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Preliminary Geotechnical Investigation (Phase 1)

SODA MOUNTAIN SOLAR PROJECT

BLM Case Number - CACA49584

Proposed Caithness Soda Mountain Solar Facility Near Baker,
San Bernardino County, California

March 1, 2011

Prepared for:

United States Department of the Interior
Bureau of Land Management
California Desert District Office
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

Submitted by:

Caithness Soda Mountain, LLC
565 Fifth Avenue, 29th Floor
New York, NY 10017

Prepared by:

Diaz ● Yourman & Associates
1616 East 17th Street
Santa Ana, CA 92705

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Diaz ● Yourman & Associates
1616 East 17th Street
Santa Ana, CA 92705
(714) 245-2920

DIAZ • YOURMAN
& ASSOCIATES
Geotechnical Services

A Report Prepared for:

RMT Inc.
4 West Fourth Avenue, Suite 303
San Mateo, CA 94402

PRELIMINARY GEOTECHNICAL INVESTIGATION (PHASE 1A)
CAITHNESS SODA MOUNTAIN SOLAR FACILITY PROJECT
BAKER, SAN BERNARDINO COUNTY, CALIFORNIA

Project No. 2010-024

by

Matt Dennerline
Civil Engineer 70975

REGISTERED PROFESSIONAL ENGINEER
MATTHEW R. DENNERLINE
C 70975
EXP 06-30-11
CIVIL
STATE OF CALIFORNIA

Gerald M. Diaz
Geotechnical Engineer 269

REGISTERED PROFESSIONAL ENGINEER
GERALD M. DIAZ
269
EXP
GEOTECHNICAL
STATE OF CALIFORNIA

Diaz•Yourman & Associates
1616 East 17th Street
Santa Ana, CA 92705-8509
(714) 245-2920

December 7, 2010

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This report presents the results of the Preliminary Geotechnical Investigation performed by Diaz•Yourman & Associates (DYA) for the proposed Caithness Soda Mountain Solar Facility near Baker, San Bernardino County, California. RMT, Inc. (RMT) authorized this work on July 22, 2010.

Engineering Geology and Geophysical Investigations (Phase1A) performed by Wilson Geosciences, Inc. and Terraphysics, respectively, together with this Preliminary Geotechnical Investigation (Phase 1B), make up Phase 1 of the Geotechnical Program reviewed by the Bureau of Land Management (BLM) for conformance to their land use regulations. A primary objective of Phase 1 is to increase the effective areal extent of the geologic and geophysical data, while reducing the amount of land disturbance during the investigations. Following project approval, a Phase 2 detailed geotechnical investigation will be performed based on the final design plans and specifications. Phase 3 will be construction monitoring and geotechnical compliance documentation.

Environmental hazard evaluation at the site was not within scope of these investigations.

1.1 PROJECT DESCRIPTION

The Soda Mountain Solar Facility will be located along Interstate (I) 15 between Rasor Road and Zyzzx Road, south of Baker, California, as shown on the Vicinity Map, Figure 1. The proposed project will consist of a solar power plant within a 2,200-acre site on both sides of I-15 as shown on the Site Plan, Figure 2. Much of the site will contain photovoltaic (PV) panel arrays and access roads. We understand the preferred foundations for the PV arrays are vibrated or driven steel posts/piles which will support the arrays approximately four feet above grade. The arrays will be spaced approximately 16 feet on center. We understand that the pile loads may be in the following ranges: axial-350 to 550 pounds (lbs), uplift-700 to 900 lbs, lateral-300 to 1,100 lbs, maximum moments approximately 15,000 foot-lbs. Additional structures may include transmission lines, substations, switch yards, laydown areas, water tanks, and an operations and maintenance building. Locations and foundation loads of the proposed structures are not known at this time and will be evaluated in detail in Phase 2. The proposed grades will be near existing grades.

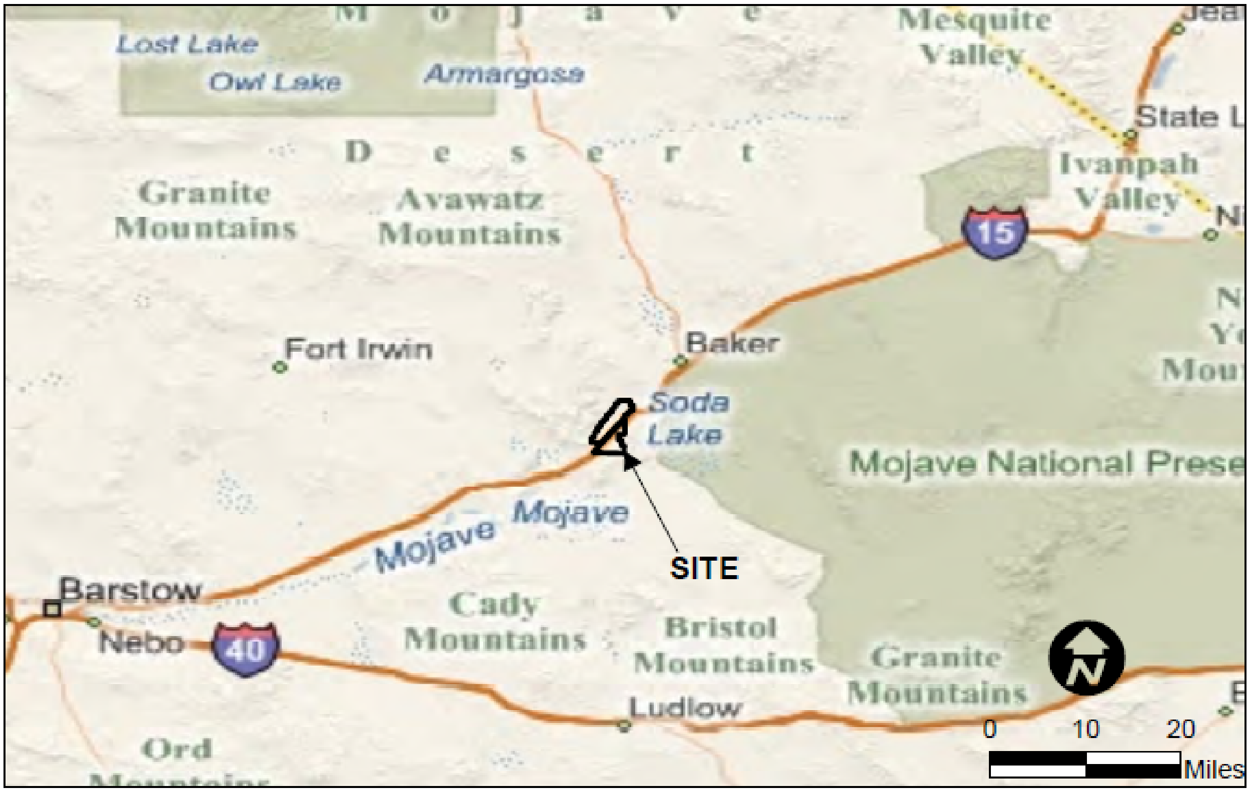
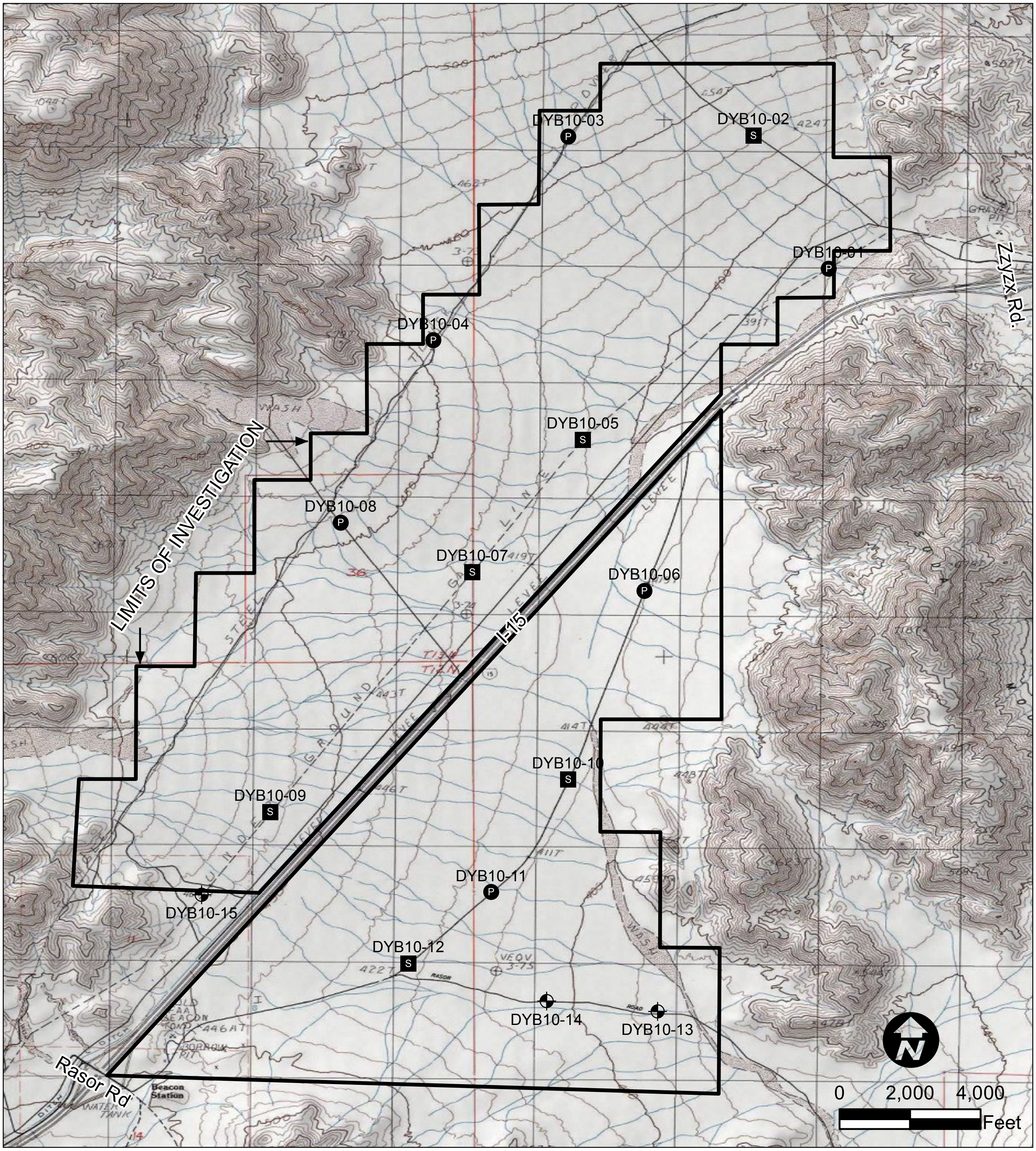


Figure 1 - VICINITY MAP



Refrence: ESRI, National Geographic Society, 2009

Legend

- **Boring locations**
- S **Boring locations with down-hole seismic testing**
- P **Boring locatins with in-hole permeability testing**

Figure 2 - SITE PLAN

The purpose of DYA's investigation and analysis was to provide geotechnical input for the preliminary design of the proposed project, for support of constraints/opportunities analysis and the project EIR/EIS (Environmental Impact Report/Environmental Impact Statement). The scope of our services consisted of the following tasks:

- Reviewing data.
- Conducting a field investigation.
- Performing geotechnical laboratory tests on selected samples.
- Performing surficial soil testing on selected samples for use in soil fertility analysis.
- Performing engineering analyses to develop preliminary conclusions and recommendations regarding the following:
  - Seismic hazards
  - Site preparation and grading
  - Slope stability
  - Foundation type and design criteria
    - Vertical capacity
    - Settlements
    - Resistance to lateral loads
    - Lateral earth pressures
  - Percolation
  - Soil corrosion potential
- Preparing this report.

2.0 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 FIELD INVESTIGATION

The field investigation, conducted August 30, 2010, through September 2, 2010, consisted of drilling 14 shallow soil borings and one deep soil boring. Six borings were converted to down-hole seismic tests and six borings were prepared for in-hole permeability tests at the locations shown on Figure 2. The boring locations were chosen to minimize the amount of land disturbed while still gathering enough information to adequately characterize the geologic units of the site. The boring depths, ranging from approximately 14 to 21 feet for shallow borings and 100 feet for the deep boring, were selected to extend to the depth of significant influence of the proposed loads. Groundwater was not encountered during the field investigation. Details of the field investigation, including sampling procedures and boring logs, are presented in Appendix A.

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, grain-size distribution, percent passing the No. 200 sieve, specific gravity, sand equivalent, compaction characteristics, and corrosion potential (pH, electrical resistivity, soluble chlorides, and soluble sulfates). The presence of gravel and cobbles larger than standard sampling and testing equipment prevented meaningful insitu density tests, shear strength tests, consolidation tests, and laboratory permeability tests from being performed. Expansion index tests were not performed because the surface soils were visually classified as nonexpansive. The soil samples tested are identified on the boring logs. Laboratory test data are summarized on the boring logs in Appendix A and presented on individual test reports in Appendix B.

Additional surface samples were tested by Wallace Laboratories, LLC for essential and nonessential elements to understand the potential of surficial soils for supporting plants to offset plants taken off the site. The complete results of the soil fertility analysis are presented in the Wallace report in Appendix C.

Other samples taken at depths of 3 to 5 feet below grade were provided to RMT in sealed 5-gallon buckets to perform thermal resistivity testing in a future phase of work.

3.0 SITE CONDITIONS

3.1 SURFACE CONDITIONS

The site is located in the Mojave Desert along the I-15 freeway between Rasor Road and Zzyzx Road. Unpaved roads including Rasor Road, Arrowhead Trail, and unnamed access and recreational roads traverse the site. Many of these roads are not maintained and difficult to drive with standard highway vehicles. Overhead power lines run north-south along the west side of the site. An underground Kinder-Morgan gas line and various communication lines run north-south in the center of the site, west of I-15. The project site is mostly undeveloped.

The site is primarily a relatively flat alluvial valley generally covered by minor desert vegetation (see sample pictures in Appendix A), flanked by segments of the Soda Mountains on the west and east. Alluvial fans emanate from the mountains and are joined in the valley. Outflow washes diverge on the fan shields, and rejoin in main drainage ways. The surface is generally covered with sandy soils, with gravels, cobbles, and boulders. Most of the boulders observed were less than 3 feet in diameter. At the margins of the site, bedrock is exposed. The existing ground surface elevation ranged from approximately 1,250 to 1,525 feet above mean sea level (MSL).

A complete description of the geologic units within the site is included in Wilson Geosciences report (Phase 1A).

3.2 SUBSURFACE CONDITIONS

The soils encountered in the all of the borings were sandy and gravelly alluvial deposits. The percentage of gravel-size and larger particles ranged from approximately 10 to 50 percent. The percentage of fine-grained silts or clays ranged from 5 to 20 percent.

Conventional shear strength tests, such as direct shear or triaxial tests, were not feasible throughout most of the site due to the high percentages of gravel-size and larger particles. Shear strength correlations with the standard penetration tests (SPT) are also poor because the larger particles increase the driving resistance by becoming stuck in the sampler tip or barrel. Shear strengths of the sands and gravels were estimated from calculations based on correlations (Duncan, 2004) with gradation, relative density, and confining pressure. Assuming a loose state of packing at the surface and increasing slightly with depth, an angle of internal friction of 40 degrees was used for preliminary design for all soils identified in the borings.

Groundwater was not encountered during DYA's drilling operations.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on geotechnical considerations, the site is generally well suited for the proposed project. The sandy soils will provide very good foundation and roadway support, make excellent fill, produce stable cut and fill slopes at moderate inclinations, and should drain well. The primary geotechnical considerations are:

- The presence of the larger gravel, cobbles, and possibly boulders that will adversely affect the ability to drive or vibrate the piles.
- Bedrock might be encountered near the margins of the site.
- Where driving/vibrating refusal is met before the required depth to resist uplift or lateral loads, alternative installation methods, foundation configuration or anchoring may be required.

4.1 SEISMIC/GEOLOGIC HAZARDS

The site, like most of Southern California, will be subject to strong ground shaking during major earthquakes. Seismic design criteria are listed in Table 1 in accordance with both the 2005 and 2010 versions of *Minimum Design Loads for Buildings and Other Structures*, Standard ASCE 7-05 and ASCE 7-10, respectively. The criteria obtained from ASCE 7-05 is applicable to the current California Building Code (ICC, 2010). Due to the uncertainty of when the project design will be completed, RMT also requested seismic criteria in accordance with ASCE 7-10, which is anticipated to be included in the 2012 International Building Code. The ASCE 7-10 criteria should be considered preliminary at this time, and re-evaluated if the new standard is incorporated into the applicable building codes.

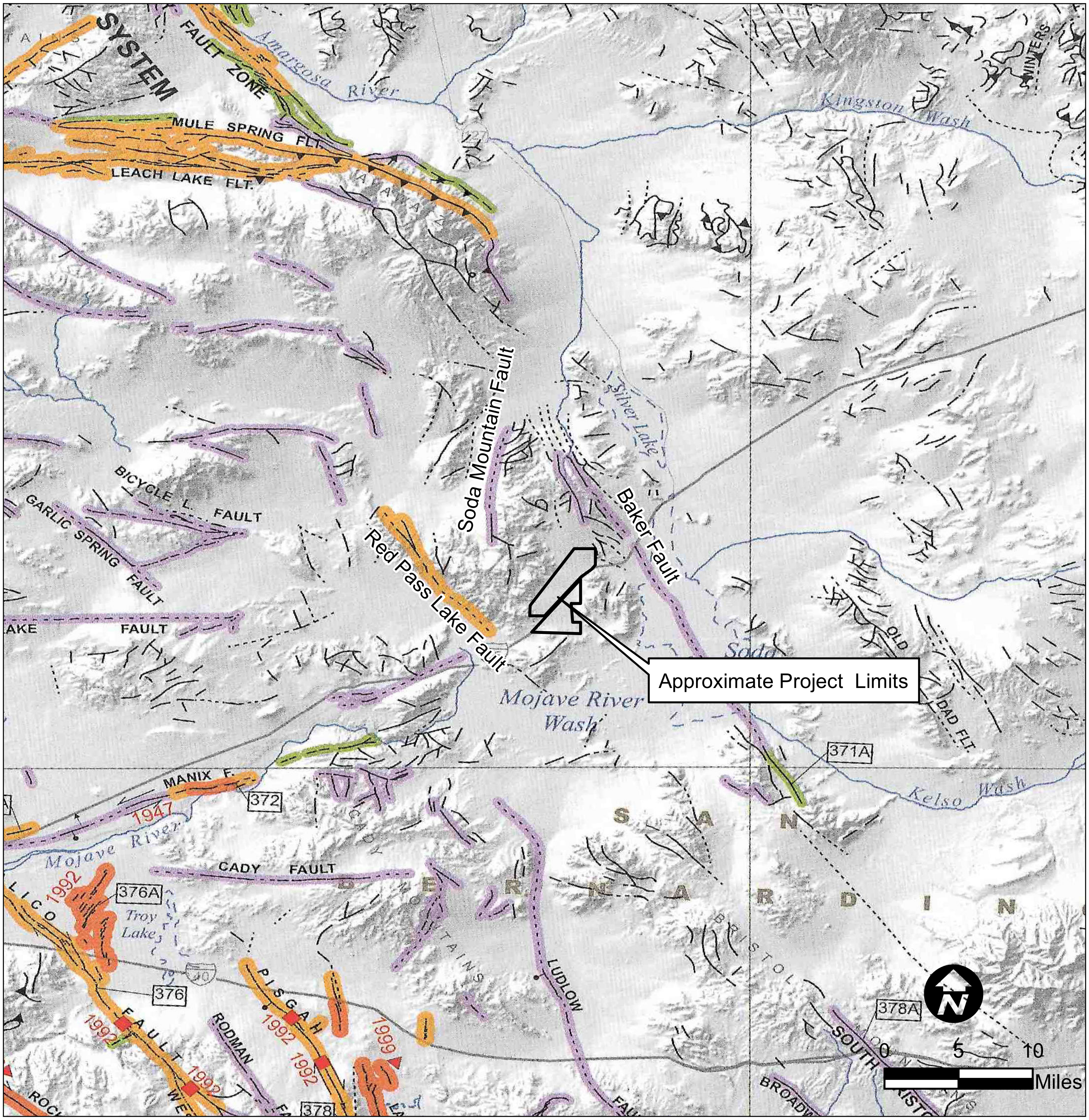
Both of the design criteria in Table 1 are based on mapped and gridded values included within the standards. The fault activity map (Jennings and Bryant, 2010) presented on Figure 3 indicates the nature and proximity of active, potentially active, and non-active faults with respect to the project area.

Shallow groundwater and loose sandy soils were not encountered during the subsurface investigation. A liquefaction analysis was not performed for this project. Some dry sand settlement should be expected during high ground shaking.

Table 1 - SEISMIC/GEOLOGIC DESIGN CRITERIA

CHARACTERISTIC	ASCE 7-05	ASCE 7-10 (Preliminary)
Site Class[1]	C	C
S_s - mapped maximum considered earthquake spectral acceleration at short periods (g)[1,2]	0.745	0.792
S_1 - mapped maximum considered earthquake spectral acceleration at 1-second period (g) [1,2]	0.269	0.314
F_a - site coefficient[1]	1.102	1.083
F_v - site coefficient[1]	1.531	1.486
F_{PGA} - site coefficient[5]	--	1.084
S_{MS} - adjusted maximum considered earthquake spectral acceleration at short periods (g)[1]	0.821	0.858
S_{M1} - adjusted maximum considered earthquake spectral acceleration at 1-second period (g)[1]	0.412	0.466
Design Peak Ground Acceleration, g (PGA)[3]	0.22	0.23
Mapped maximum considered earthquake geometric mean peak ground acceleration, g (PGA)[4]	0.33	0.32
Peak Ground Acceleration adjusted for site class effects, g (PGA_M)[5]	--	0.34
T_L - mapped long-period transition period[2]	8	8
Alquist-Priolo Special Study Zone Act[6]	Site outside special study zone	
California Seismic Hazards Mapping Act, Liquefaction Zone[7]	Site not mapped	
California Seismic Hazards Mapping Act, Landslide Zone[7]	Site not mapped	

Notes:
1. California Building Code (CBC) Section 1613.
2. ASCE 7-05 mapped values based on Earthquake Ground Motion Parameters (U.S. Geological Survey [USGS], 2009).
3. ASCE 7 Section 11.4.5 (S_{DS} *0.4).
4. ASCE 7 Section 11.4.6.
5. ASCE 7-10 Section 11.8.3 for seismic design categories D through F; $PGA_M = F_{PGA}$ PGA.
6. California Division of Mines and Geology (CDMG; 1994).
7. California Geological Survey (CGS; 2009).



Refrence: California Geological Survey Fault Activity Map, 2010.

Legend

- Fault along which historic displacement (last 200 years) has occured.
- Holocene fault displacement (during past 11,700 years) without historic record.
- Late Quaternatry fault displacement (during past 700,000 years).
- Quaternary fault (age undifferentiated)
- Pre-Quaternary Fault

Figure 3 - FAULT ACTIVITY MAP

4.2 EARTHWORK

Minor earthwork (cuts and fills less than 5 feet) will be required to grade access roads, provide drainage, and prepare the building pads, and provide compacted soil beneath shallow spread footings and concrete flatwork, and backfill behind retaining walls.

4.2.1 Site Preparation and Grading

Prior to the start of construction, the following should be performed:

- All utilities should be located in the field and rerouted, removed, abandoned, or protected.
- Areas to be graded should be stripped of vegetation and debris, and the material removed from the site.

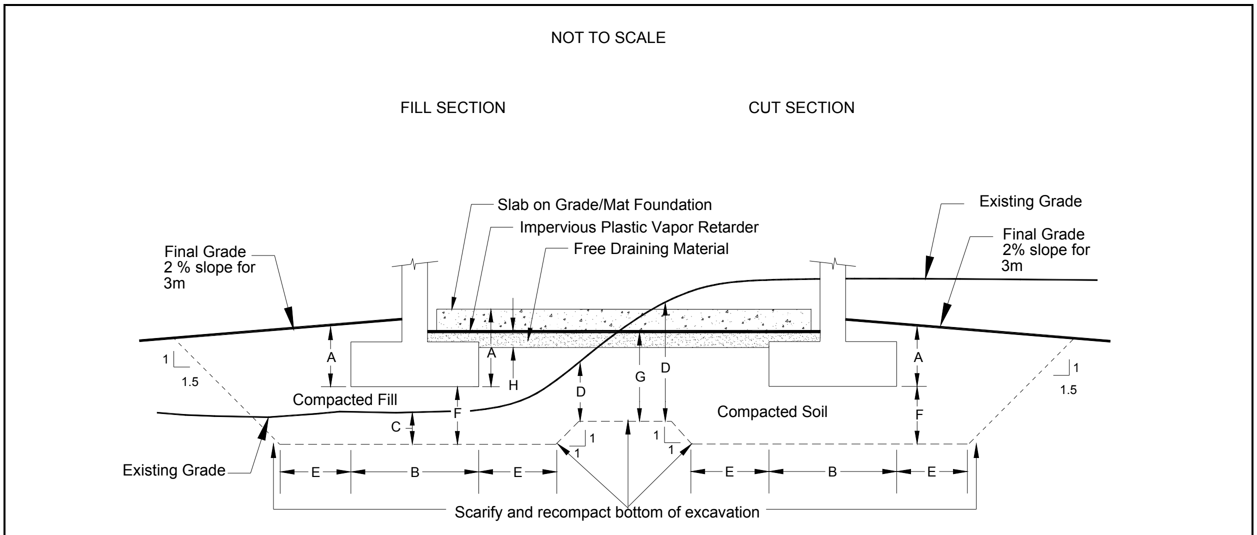
For preliminary planning purposes, where buildings are to be placed, it should be anticipated that the upper soil should be over excavated and replaced with compacted fill approximately as shown on Figure 4.

In general, except for oversize material, the on site soils will be suitable for general fill. Oversize material can be selectively placed in deeper fills, crushed and reused for road base or aggregate, or used for velocity dissipation and erosion control in drainage ways. Specific recommendations for separating and selective use of oversize material will be provided in Phase 2.

Prior to placing fill, surface exposed by stripping or over excavation should be:

- Scarified to a depth of 8 inches.
- Moisture-conditioned to above-optimum moisture content.
- Compacted to at least 90 percent relative compaction[1].

[1] Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, as determined by the American Society for Testing Materials (ASTM) D1557-09 test method. Optimum moisture content is the moisture content corresponding to the maximum dry density, as determined by the ASTM D1557-09 test method.



LOCATION	MINIMUM DIMENSIONS (feet)
A. Footing Embedment Below Subgrade	1.5
B. Footing Width	1
C. Excavation Below Existing Grade (Footing)[1]	2
D. Excavation Below Existing Grade (Slab)[1]	2
E. Excavation Beyond Footing	5
F. Compacted Soil/Fill Below Footing	1
G. Compacted Soil/Fill Below Slab	1
H. Free-Draining Material	0.5
PRESSURE (psf)	
Static (net) Allowable Bearing Capacity (FS≥3)	3,000
Increase per Foot of Depth	1,300
Increase per Foot of Width	1,000
Maximum Static Bearing Capacity (FS≥3)	6,000
Maximum Transient Bearing Capacity (FS≥2)[2]	8,000

Notes:
1. Excavation extents can be waived where bedrock is present.
2. The static bearing capacity may be increased by 33 percent to calculate the transient bearing capacity.

Figure 4 - GRADING/FOUNDATION DETAILS

Where the soils at the bottom of the excavation preclude compaction, they should be excavated to a sufficient depth such that a firm and unyielding surface is achieved at the planned bottom of excavation or the base of fill. Generally, an overexcavation depth of 1 to 2 feet is sufficient. Fill and backfill should be compacted by:

- Placing in loose layers less than 8 inches thick.
- Moisture-conditioning to above-optimum moisture content.
- Compacting to at least 90 percent relative compaction.

The compacted subgrade soils should be firm, hard, and unyielding.

Slabs-on-grade should be underlain by a minimum of 12 inches of soil compacted to at least 90 percent relative compaction.

The project is not expected to need significant import or export of soil. If required, import materials for fill and select backfill should meet the criteria in Table 2. Select backfill is material placed within a horizontal distance of 5 feet or one-half of the wall height, whichever is greater, behind retaining/basement walls.

Table 2 - IMPORT FILL AND SELECT BACKFILL CRITERIA

CRITERIA	IMPORT FILL	SELECT BACKFILL
Maximum particle size (inches)	4	1
Maximum liquid limit (%)	10	5
Maximum plasticity index (%)	5	0
Maximum percentage passing the No. 200 sieve (%)	40	30
Minimum sand equivalent	20	20

The soils encountered in the borings are not expected to meet the above criteria for select backfill due to the presence of large particles. If the large particles are removed, the onsite soils would be expected to meet the criteria for select backfill.

Site grading in the alluvial deposits covered by this investigation may be accomplished with conventional heavy-duty construction equipment. The fill should be compacted using soil compactors, designed for compaction, or a vibratory padded drum roller, as defined by the Caterpillar Performance Handbook (2008), or equivalent. However, to avoid overstressing retaining walls, backfill should be compacted using lightweight compaction equipment or the walls should be braced. If the buildings or other areas with significant grading are to be located where there is bedrock at the surface, the strength and rippability of that rock should be evaluated in the second phase of the geotechnical program.

4.2.2 Excavations and Temporary and Permanent Slopes

The stability of temporary excavations is a function of several factors, including the total time the excavation is exposed, moisture condition, soil type and consistency, and contractor's operations. The contractor is responsible for excavation safety. As a guideline, temporary construction excavations should be planned with slopes no steeper than 1.5H:1V (horizontal to vertical). For steeper temporary construction slopes or deeper excavations, shoring should be provided for stability and protection. The contractor should strictly adhere to applicable health and safety regulations, including the Occupational Safety and Health Administration (OSHA).

Permanent compacted fill slopes should be planned no steeper than 2H:1V. The slopes should be paved or covered with vegetation to reduce surface erosion.

4.2.3 Drainage

General site drainage criteria are outlined on Figure 4. Roof water should be collected by roof gutters and downspouts and directed away from structures into a closed drainage system or onto landscape or infiltration areas. Landscaped areas should be designed to not seep below building foundations or slabs-on-grade. Exterior grades should be no higher than the interior plastic vapor retarder. Best management practices (BMP) should be employed.

In-hole permeability tests were performed in general accordance with methods prescribed in the United States Bureau of Reclamation (USBR) Groundwater Manual and USBR Procedure 7310-89. Test locations were selected that are representative of each of the soil types encountered in this investigation. The tests were performed at a depth of approximately 5 feet. Details of the test procedure are described in Appendix A. The results of the tests are summarized in Table 3.

Table 3 - SOIL TYPES AND HYDRAULIC CONDUCTIVITY - INSITU TESTS

BORING NO.	SOIL TYPE (USCS)	APPROXIMATE HSG CLASSIFICATION[1]	PERMEABILITY/ HYDRAULIC CONDUCTIVITY[2] (inch/hour)
DYB10-01	Poorly Graded Sand with Silt and Gravel	A	> 2.5 [3]
DYB10-03	Well Graded Sand with Silt and Gravel	A	> 2.5 [3]
DYB10-04	Well Graded Gravel with Silt and Sand	A	> 2.5 [3]
DYB10-06	Poorly Graded Sand with Silt and Gravel	B	0.3
DYB10-08	Well Graded Sand with Silt and Gravel	A	1.4
DYB10-11	Silty Sand with Gravel	B	0.8

Notes:

1. Hydrologic soil group (HSG) determination is based on minimum infiltration rates calculated. Group A soils have low runoff potential; Group B soils have moderately low runoff potential (USDA, 2007).
2. Insitu hydraulic conductivity measured from constant head gravity tests in accordance with United States Bureau of Reclamation (USBR) 7310-89.
3. Discharge rate of water for steady-state condition exceeded equipment capacity.

- USCS = unified soil classification system.

In addition to the insitu tests, the permeability of the soils was estimated based on particle size analysis and the Kozeny-Carman equation (Chapuis and Aubertin, 2003). While the insitu tests are the preferred method for measuring permeability, using the prediction model allows for a greater number of locations to be evaluated; these results are shown in Table 4.

Table 4 - SOIL TYPES AND HYDRAULIC CONDUCTIVITY - PREDICTION MODEL

BORING NO.	BORING DEPTH (feet)	PREDOMINANT SOIL TYPE (USCS)	APPROXIMATE HSG CLASSIFICATION	PREDICTED PERMEABILITY[1] (inch/hour)
DYB10-01	3.5	Poorly graded Sand with Silt and Gravel	A	3.1
DYB10-02	5	Well graded Sand with Silt and Gravel	A	4.6
DYB10-03	3.5	Well graded Sand with Silt and Gravel	A	6.0
DYB10-04	11.5	Well graded Gravel with Silt and Sand	A	7.9
DYB10-05	5.5	Poorly graded Sand with Silt and Gravel	A	4.3
DYB10-06	0.5	Poorly graded Sand with Silt and Gravel	A	3.3
DYB10-07	2.5	Poorly graded Sand with Silt and Gravel	A	5.8
DYB10-07	7.5	Well graded Sand with Silt and Gravel	A	4.8
DYB10-08	5.5	Well graded Sand with Silt and Gravel	A	3.1
DYB10-09	9	Poorly graded Sand with Silt and Gravel	A	5.7
DYB10-09	14	Well graded Sand with Silt and Gravel	A	9.7
DYB10-10	1.5	Poorly graded Sand with Silt and Gravel	A	5.1
DYB10-10	9	Well graded Sand with Silt and Gravel	A	2.9
DYB10-11	6	Poorly graded Sand with Silt and Gravel	A	5.4
DYB10-12	12.5	Poorly graded Sand with Silt and Gravel	A	2.7
DYB10-13	0.5	Poorly graded Sand with Silt and Gravel	A	5.6
DYB10-13	18	Silty Sand with Gravel	A	2.2
DYB10-14	2.5	Poorly graded Sand with Silt and Gravel	A	6.7
DYB10-14	20	Poorly graded Sand with Silt	A	3.7
DYB10-15	0.5	Well graded Sand with Silt and Gravel	A	7.4

Notes:
1. Predicted permeability based on Kozeny-Carman equation.
- USCS = unified soil classification system.

4.3 FOUNDATION DESIGN

The specific locations and loading conditions for the proposed structures are not known at this time. These foundation recommendations should be considered preliminary and re-evaluated in Phase 2 of this geotechnical program when the loading conditions are known and access to the site is not limited.

4.3.1 Miscellaneous Structures

The proposed buildings, tanks, and other lightly-loaded structures can be supported on shallow foundations placed on a layer of compacted fill as shown on Figure 4. The static and temporary allowable bearing capacities include factors of safety (FS) of at least 3 and 2, respectively, against shear failure. Some total and differential static settlement is expected and magnitudes should be calculated when the loading conditions are known. The static settlements are expected to occur as the loads are applied or shortly thereafter.

4.3.2 PV Arrays

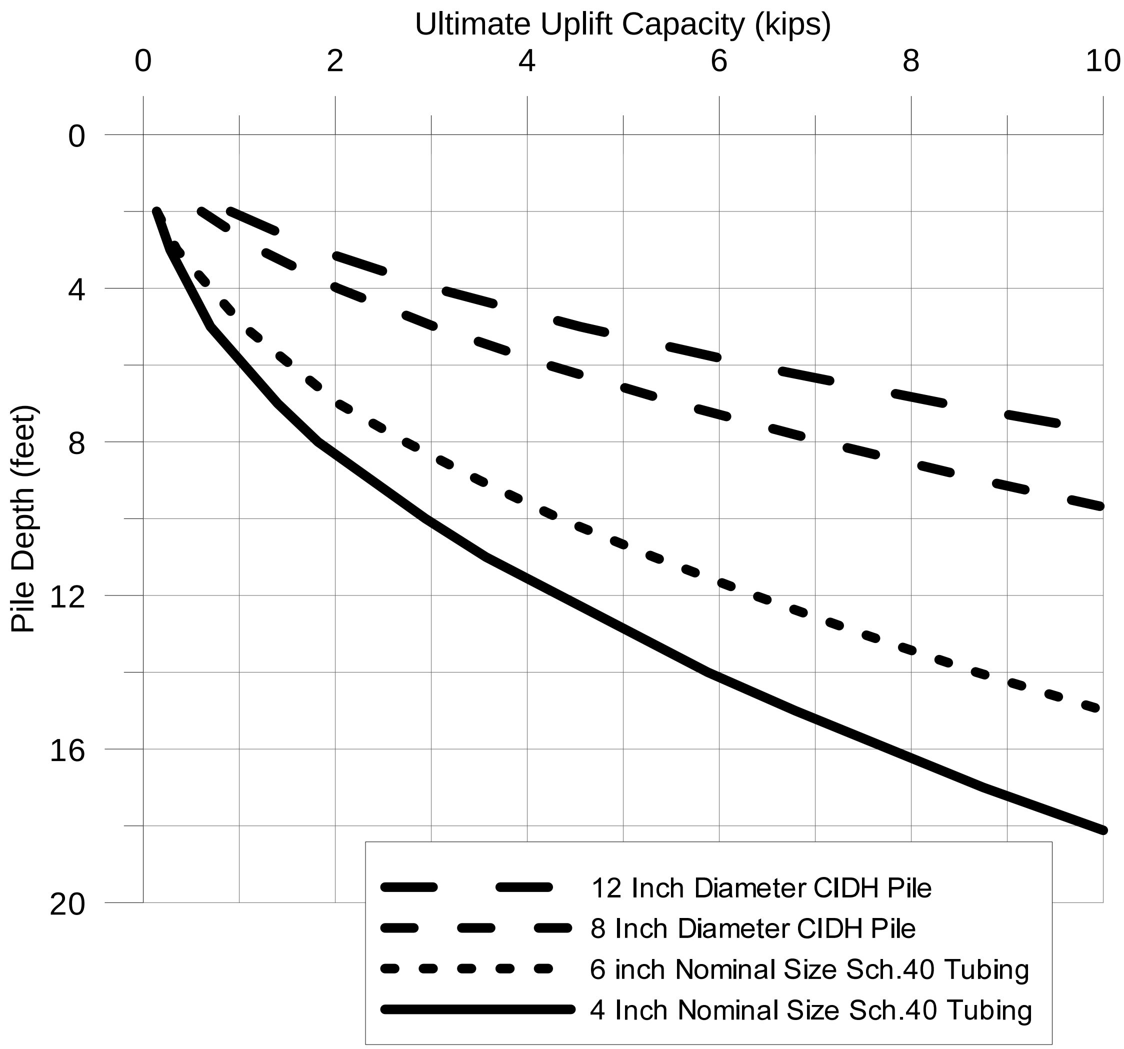
4.3.2.1 Vibrated or Driven Piles

We understand the desired foundation type for the PV arrays is planned to be 4- or 6-inch-diameter steel pipe piles installed with vibratory equipment or by driving. Due to large wind loads, the depth of the pipe required to resist the loads is expected to be controlled by either uplift or lateral loads. Approximate uplift capacities calculated using the computer program APILE 5.0 (Ensoft, 2008) are shown on Figure 5. A lateral pile analysis was performed using the computer program LPILE ^{PLUS} 5.0 for Windows (Ensoft, 2010). Based on an assumed loading condition of 1 kip shear force and a 15 kip-foot moment at the ground surface, the pile will require approximately 10 feet of embedment to anchor the toe against rotations. This depth should be re-evaluated when actual foundation loads are known.

Based on the strength of the soils encountered at the site, planned foundation type can support the likely loads imposed by the PV arrays. However, installation of these piles within required tolerances may not be feasible due to the presence or cobbles and boulders at the site. The extent of boulders and cobbles at the site should be further evaluated in Phase 2 of this geotechnical program with test trenches and a pile drivability test program where the panel arrays will be located.

Test installations should be planned in different areas of the project representative of a range of different anticipated conditions.

- If vibratory installation is not feasible, driving may prove more effective.
- For either alternative, pilot holes, advanced with an air percussion drill, could be effective to help achieve the required depth and position accuracy.
- Additional piles transversely offset from the planned alignment and interconnected would require less penetration and allow alignment adjustment.



Notes:
1. A minimum factor of safety of 3 should be applied for allowable uplift capacity.
2. Compression capacity can be estimated by increasing the chart values by 50%. A minimum factor of safety of 2.5 should be used for compression.

Figure 5 - PILE UPLIFT CAPACITY

4.3.2.2 Cast-in-Drilled-Hole (CIDH) Concrete Piles

CIDH concrete piles may be considered as an alternative foundation type.

- Suitably large diameters could allow removal of cobbles and small boulders
- Air percussion hammers/drills could break up larger particles as needed for removal
- Short penetration depths could be offset by grouted anchors

The CIDH method is probably least desirable from cost and environmental standpoints.

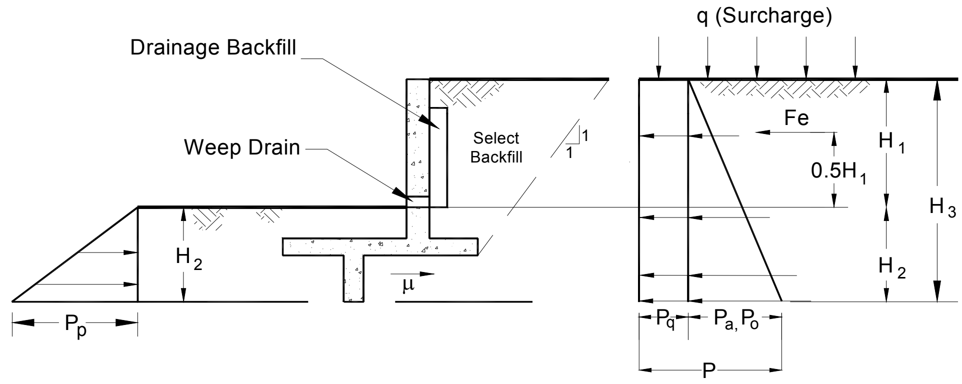
- Added construction traffic
- Drill spoil disposal
- Concrete production and transportation
- Pile reinforcing and post anchoring

Uplift capacities for 8- and 12-inch CIDH piles calculated using the computer program SHAFT 6.0 (Ensoft, 2007) are shown on Figure 5. A lateral pile analysis similar to that performed for the pipe piles indicated the CIDH piles would also require approximately 10 feet of pile embedment to anchor the toe against rotations.

4.4 RESISTANCE TO LATERAL LOADS AND LATERAL EARTH PRESSURES

The lateral resistance may be calculated using the minimum of the following: 50 percent of passive resistance plus 50 percent of base friction, 100 percent passive resistance only, or 100 percent of the base friction only. Lateral loads can be resisted by an allowable passive soil pressure and base friction, as outlined on Figure 6 for compacted fill, applied against below-grade walls and foundation elements.

Retaining and subterranean walls should be designed to resist lateral earth pressures with the equivalent fluid pressures as illustrated on Figure 6. Lateral earth pressures are presented for walls free to rotate and restrained walls. At-rest earth pressures (restrained walls) should be used for basement walls and where the top of the wall is not expected to move laterally more than 0.001 H_1 (see Figure 6). The lateral earth pressures on Figure 6 are based on the backfill material noted in Table 2 or natural onsite recompacted soils. See Figure 7 for typical sections of wall drains.

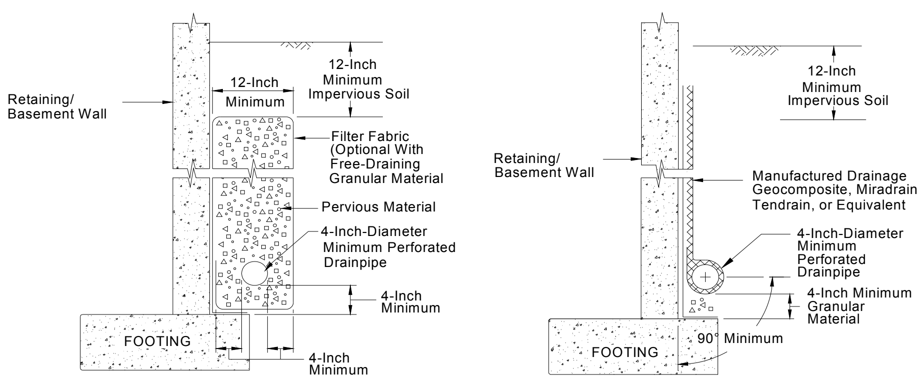


$P_p = 400\ H_2 \leq 4{,}000$ psf $\mu = 0.4$	Cantilever Walls $P = P_a + P_q = 35\ H_3 + 0.4q$ $Fe = 6\ H_1^2$	Restrained Walls $P = P_o + P_q = 50\ H_3 + 0.5q$ $Fe = 10\ H_1^2$

Notes:

- All values of height (H) in feet, pressure (P), and surcharge (q) in pounds per square foot (psf) and force (F) in pounds.
- P_p, P_a, and P_o are the passive, active, and at-rest earth pressures, respectively; Fe is the incremental seismic force.
- P_q is the incremental surcharge pressure; μ is the allowable friction coefficient applied to dead normal loads. Fe is in addition to the active and at-rest pressures. All pressures assume no groundwater.
- For 2H:1V (horizontal to vertical) slopes above the wall, increase the active and at-rest pressures by 50 percent; for 1.5H:1V slope, increase the active and at-rest pressures by 100 percent.
- Neglect the upper 1 foot for passive pressure unless the surface is contained by a pavement or slab.
- Peak ground acceleration (PGA) was used to calculate Fe, 50 percent of the PGA for cantilever walls and 75 percent of PGA for restrained walls was used. PGA based on ASCE 7-10 as shown in Table 1.
- See Figure 7 for drainage details.

Figure 6 - LATERAL EARTH PRESSURES



MATERIAL	CALTRANS SPECIFICATIONS	GREENBOOK SPECIFICATIONS
Free-Draining Granular Material	68-1.025 (Class 2)	300-3.5.2
Geotextile Filter Fabric	68-1.03	300-8
Perforated Pipe	68-1.02	207-13.4

Notes:

- Drainpipe should drain to an outlet.
- Filter fabric wraps completely around perforated drainpipe and pervious materials.

Figure 7 - RETAINING OR BASEMENT WALL DRAINAGE

4.5 SLABS-ON-GRADE AND CONCRETE FLATWORK

Slabs-on-grade should be underlain by compacted free-draining granular materials as outlined on Figure 4. The free-draining granular material should contain less than 5 percent fines (passing the No. 200 sieve) and should be placed immediately below the slab-on-grade.

Moisture vapor will tend to migrate through the slab-on-grade. A waterproofing specialist should be consulted. To reduce vapor migration through the floor building slab, the following should be considered:

- Minimum 10-millimeter-thick plastic vapor barrier with joints overlapped by at least 6 inches and taped.
- Sealing the plastic vapor barrier around plumbing, electrical, and other conducts.
- No sand above the plastic vapor barrier.
- Minimum 7-day wet cure with no curing compounds.
- Two-month drying period before floor coverings are placed.
- Concrete mix design, materials, placement, curing, and finishing in conformance with the Greenbook and the American Concrete Institute (ACI; 1996, 1997).

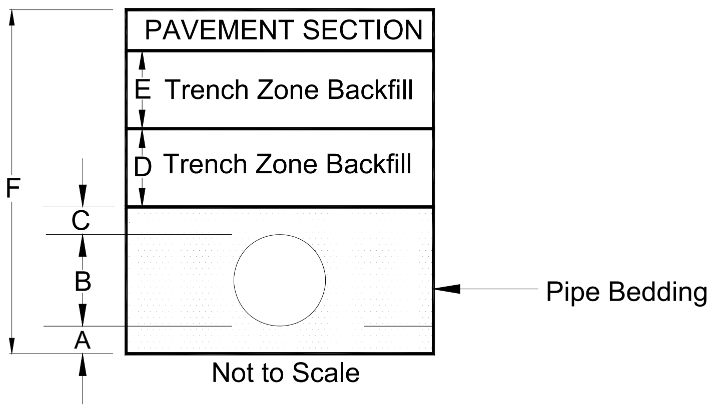
The plastic vapor barrier should satisfy the requirements of ASTM E 1745 (Class “A”). ACI 302.1R-96 defines a vapor barrier as having a water vapor transmission rate (WVTR) of 0.00, plus a testing tolerance generally of a WVTR of 0.008 or less when tested in accordance with ASTM E 96. Note that commonly used “poly” or "visqueen” does not meet ASTM E 1745 requirements. Vapor barriers should be installed in accordance with ASTM E 1643. Care should be taken to seal the plastic vapor barrier and avoid puncturing the plastic vapor barrier during construction.

4.6 UTILITY TRENCHES

Utility trenches (either open or backfilled) that parallel structures, pavement, or flatwork should be planned so that they do not extend below a plane with a downward slope of 1.5H:1V from the bottom edge of footings, pavement, or flatwork. Temporary shoring to provide footing, pavement, flatwork, or utility support is recommended unless localized settlements on the order of 1 percent of the trench depth can be tolerated.

All excavations should comply with appropriate safety standards outlined in Section 4.2.2.

Utility pipes should be placed on the bottom of a neatly cut trench on a layer of bedding as outlined on Figure 8 or according to the manufacturer's recommendations, whichever is greater. Jetting should not be allowed for compaction purposes. We anticipate that the near-surface soils will be suitable for use as bedding materials if oversized particles are removed.



MATERIAL	MINIMUM THICKNESS (feet)	MINIMUM RELATIVE COMPACTION[1] (%)	BACKFILL SPECIFICATIONS	
			Caltrans Specifications	Greenbook Specifications
Pipe Bedding	A = 0.33 or B/4	--	19-3.025B	306-1.2.1
Pipe Zone	C = 1	--	19-3.025B	306-1.2.1
Trench Zone	D varies	90[2]	--	--
Trench Zone[3]	E = 2	95	--	--

Notes:

1. Based on ASTM D1557.
2. To reduce settlement, use 95 percent relative compaction.
3. E = 0 if no pavement or settlement-sensitive structures at surface.

- Minimum values; use manufacturer's recommendations if greater.

Figure 8 - PIPELINE BACKFILL SCHEMATIC

4.7 PAVEMENT THICKNESS DESIGN

Access roads are proposed throughout the site for maintenance vehicles with AASHTO H-20 loadings. These roads may or may not be paved with hot mix asphalt. At this phase of the project, the volume of traffic, desired design life, and maintenance concerns have not been evaluated. The onsite soils have good pavement supporting characteristics and can support a properly designed pavement section when the design parameters are determined.

4.8 SOIL CORROSION POTENTIAL

Analytical chemical results from six tests performed during this investigation indicated 38 to 88 parts per million (ppm) soluble sulfate concentrations in the near-surface soils. Based on these test results, Type II cement can be used in accordance with California Building Code (CBC) 1904.3.

Six soil samples were tested for pH, soluble chloride and soluble sulfate, and soil electrical resistivity to check for corrosion potential. The range of test values is summarized in Table 5. Caltrans (2003) corrosion criteria are also presented. The corrosion potential test results from each boring location are presented in Appendix B. Based on Caltrans standards and other published correlations and the chemical test results, the tested soils are classified as non-corrosive. Additional corrosion testing should be performed in the second phase of this investigation when additional areas of the site become accessible.

Table 5 - CORROSION POTENTIAL

TEST	CALTRANS CRITERIA FOR CORROSIVE MATERIALS	RANGE OF VALUES
pH	<5.5	7.1 to 8.1
Soluble sulfate content (ppm)	>2,000	38 to 88
Soluble chloride content (ppm)	>500	30 to 40
Electrical resistivity (ohm-cm)	<1,000	4,300 to 10,900
Note: • ppm = parts per million		

4.9 SOIL FERTILITY

As stated in the Wallace report in Appendix C, "*The soils are alkaline with pH's ranging from 7.52 to 8.05. The majority of the samples have low to moderate salinity values. Sample DYB10-11 has a high salinity with a value of 4.28 millimho/cm. Nitrogen is low in all the samples except for Sample DYB10-06 and Sample DYB10-11 which have high nitrogen. Phosphorus is low across the board. Potassium ranges from modest to moderate, with Sample DYB10-11 having the highest at 180 parts per million. Iron, magnesium, zinc, and copper are low in all the samples. Sodium is low except for Samples DYB10-09 and DYB10-11. Sample DYB10-09 has a moderate amount of sodium. Sample DYB10-11 has high sodium at over 400 parts per million. Chloride is also high in Sample DYB10-11 at over 800 parts per million. Limestone is present in all the samples which may cause iron deficiency in acid loving plants. Boron is elevated in DYB10-11 at 0.84 parts per million in the saturation extract.*"

We understand the results of the soil fertility analysis, and recommendations for soil amendments in the Wallace report, together with the soil grain size distribution drainage characteristics contained in this report will be used by RMT or others to evaluate the applicability of the site soils for use as a growing medium.

5.0 PHASE 2 ADDITIONAL FIELD WORK AND LABORATORY TESTING

The results of this Phase 1 B investigation should be integrated with the results of the Phase 1 A geologic and geophysical investigations, and the preliminary project design and layout to define the requirements of the Phase 2 Geotechnical investigation.

Additional field investigation and analysis should be performed by DYA as will be required for final design of the project (Phase 2). Additional borings should be drilled in locations that were inaccessible during this phase of the investigation. Test trenches should be performed to better evaluate the extent of cobbles and boulders where deep foundations are proposed. Detailed analysis should be performed for the designs for the final foundation locations and loading conditions.

6.0 PHASE 3, PLAN REVIEW, CONSTRUCTION OBSERVATION, AND TESTING

In Phase 3, the finished grading earthwork and foundation plans and specifications should be reviewed by DYA for conformance with the intent of our recommendations. The review will enable DYA to modify the recommendations if final design conditions are different than presently understood.

During early stage test foundation installation, and throughout construction, DYA should provide field observation and testing to check that the site preparation, excavation, foundation installation, and finished grading conform to the intent of these recommendations, project plans, and specifications. This would allow DYA to develop supplemental recommendations as appropriate for the actual soil conditions encountered and the specific construction techniques used by the contractor.

As needed during construction, DYA should be retained to consult on geotechnical questions, construction problems, and unanticipated site conditions.

7.0 LIMITATIONS

This 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 analyses and recommendations contained in this report are preliminary and based on the literature review, field investigation, and laboratory testing conducted in the area. 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. Although subsurface conditions have been explored as part of the investigation, we have not conducted chemical laboratory testing on samples obtained or evaluated the site with respect to the presence or potential presence of contaminated soil or groundwater conditions.

The validity of our recommendations is based in part on assumptions about the stratigraphy. Observations during construction can help confirm such assumptions. If subsurface conditions different from those described are noted during construction, recommendations in this report must be re-evaluated. DYA should be retained to observe earthwork construction in order to help confirm that our assumptions and recommendations are valid or to modify them accordingly. In accordance with CBC Chapter 17 Section 1704, DYA cannot assume responsibility or liability for the adequacy of recommendations if we do not observe construction.

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, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by DYA. We are not responsible for any claims, damages, or liability associated with the interpretation of subsurface data or reuse of the subsurface data or engineering analyses without our express written authorization.

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APPENDIX A
FIELD INVESTIGATION

APPENDIX A - FIELD INVESTIGATION

The field investigation for the proposed project consisted of drilling 14 shallow borings (DYB10-01 through DYB10-13, and DYB10-15) to depths ranging from 14 to 21 feet and one deep boring (DYB10-14) to a depth of 100.5 feet, converting six shallow borings to down-hole seismic tests, and preparing six 5-foot deep holes for percolation (in-hole permeability) tests. The percolation test holes were drilled adjacent (5 to 7 feet from the borings along the trail) to the selected shallow borings. The details of the geotechnical field investigation are summarized in Table A1.

Table A1 - SUMMARY OF FIELD INVESTIGATION

BORING ID	DEPTH (feet)	BOREHOLE SIZE (inches)	DATE OF PERFORMANCE	PURPOSE
DYB10-01	19	8[1] / 10[2]	9/2/2010	Soil profile and in-hole permeability test
DYB10-02	21	10[3]	8/31/2010	Soil profile and down-hole seismic test
DYB10-03	19.5	8 / 10	8/31/2010	Soil profile and in-hole permeability test
DYB10-04	17.5	8 / 10	8/31/2010	Soil profile and in-hole permeability test
DYB10-05	18	10	9/2/2010	Soil profile and down-hole seismic test
DYB10-06	18.5	8 / 10	8/30/2010	Soil profile and in-hole permeability test
DYB10-07	21	10	9/2/2010	Soil profile and down-hole seismic test
DYB10-08	19	8 / 10	8/31/2010	Soil profile and in-hole permeability test
DYB10-09	17.5	10	9/2/2010	Soil profile and down-hole seismic test
DYB10-10	18.5	10	8/30/2010	Soil profile and down-hole seismic test
DYB10-11	19.5	8 / 10	8/30/2010	Soil profile and in-hole permeability test
DYB10-12	20.5	10	8/30/2010	Soil profile and down-hole seismic test
DYB10-13	19.5	8	9/1/2010	Soil profile
DYB10-14	100.5	8	9/1/2010	Soil profile
DYB10-15	14	8	9/2/2010	Soil profile

Notes:
1. The hole size of 8 inches is for soil profile.
2. The hole size of 10 inches is for in-hole permeability test.
3. The hole size of 10 inches is for both soil profile and down-hole seismic test.

The boring locations were selected to minimize the amount of land disturbed while still gathering enough information to adequately characterize the geologic units of the site, and approximate boring locations are shown on Figure 2. Prior to drilling the borings, the field investigation locations were marked in the field and Underground Service Alert (USA) was notified.

The borings were drilled by Tri-County Drilling, Inc. between August 30 and September 2, 2010, with a Diedrich D120 all terrain drill rig using hollow-stem auger drilling techniques. All borings were drilled along existing roads and care was taken not to impact undisturbed areas. A representative from Kinder-Morgan was present when borings DYB10-01, DYB10-05, DYB10-07, DYB10-09, and DYB10-15 were drilled in the vicinity of their petroleum pipeline. 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 steel tubes/rings 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.

The hammer 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). 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. An equivalent SPT blow count was then calculated by multiplying the sampler blow count (usually 50 blows) by the ratio of 6 inches divided by the actual sampler penetration in inches. 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 boring were classified in general accordance with the ASTM Soil Classification System (ASTM D2487 and 2488), which is summarized on Plate A1. The boring log presented on Plates A2 through A18 was prepared from visual examination of the samples, cuttings obtained during drilling operations, and results of laboratory tests.

Six shallow borings were prepared for down-hole seismic tests at the end of drilling. A 4-inch-diameter open-ended solid pipe with a secure cap at the bottom was installed in the borehole while the hollow-stem auger was in place. The pipe top was covered with a temporary cap and grouting was placed annulus (between the pipe and the hollow-stem auger) using a tremie pipe. The auger was continuously lifted and removed while grouting was placed to the top. Water was added into the pipe to keep it in place before removing the augers. The pipe top was covered with tape at the end of grouting. The seismic testing was performed by Terraphysics at a later date.

In-hole hydraulic conductivity tests were performed on September 1 and September 2, 2010, in general accordance with methods prescribed in the United States Bureau of Reclamation (USBR) Groundwater Manual and USBR Procedure 7310-89. Six 5-foot-deep borings were drilled at the selected locations and prepared for in-hole permeability tests. Approximately ¾-inch size gravel was placed at the bottom of the boring to a height of 4 inches. A 4-inch-diameter open-ended slotted pipe was installed in the borehole while the hollow-stem auger was in place. Gravel was placed within the annulus (between the pipe and the hollow-stem auger) to the top while auger was continuously lifted and removed. The pipe top was covered with duct tape until in-hole permeability test was performed.

A 60-gallon reservoir equipped with a flow totalizer was used to fill the well with water. The flow from the reservoir was controlled to maintain a constant height of water in the well. Time and flow measurements were used to obtain a discharge rate from the well for steady-state condition. This rate was used with the formulas from USBR 7300-89 to calculate the hydraulic conductivity. The results from the field tests are presented in Table 3 of this report.

Groundwater was not encountered during the field investigation. The borings were backfilled with soil cuttings for regular borings and gravel for in-hole permeability test holes.

The borings were identified in the field by measuring using a hand-held differential global positioning system (GPS) unit with an estimated 6-foot horizontal accuracy. Photographs showing typical site conditions during this investigation are presented at the end of this appendix.

SOIL CLASSIFICATION SYSTEM-ASTM D2487

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

"Push" Sampler

Split Barrel "Drive" Sampler With Liner

Standard Penetration Test (SPT) Sampler

Bag Sample

Concrete/Rock Core

Groundwater Surface

SPT "N" = 0.65 x modified California blows per foot

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
[PID] Reading in ppm above background

BORING LOCATION: See Figure 2		**ELEVATION AND DATUM (feet):** 1247 MSL	
LATITUDE: 35° 11' 48.2" N		**LONGITUDE:** 116° 9' 16.6" W	
DRILLING EQUIPMENT: D 120		**DRILLING METHOD:** Hollow Stem Auger	
BORING DIAMETER (inches): 8		**BORING DEPTH (feet):** 19	
DATE STARTED: 9/2/10		**DATE COMPLETED:** 9/2/10	
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
1245				12 18 32	50		POORLY GRADED SAND with SILT and GRAVEL (SP-SM): light yellowish brown, dry, dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size up to 1.5 inches coming out of the hole; granitic, subangular, hard, no calcium carbonate coating						MD SE
	5			18 42 41	54		moist, very dense, gravel size 2 inches, drill rig chattering		1			11	SA
1240				15 39 50/5"	99		gravel size 1.5 inches, calcium carbonate coating on sides of gravel, moderately reactive						
	10			41 50/3"	100		hard drilling, calcium carbonate coating on sides of gravel, trace veining to stringers in matrix of gravel						
1235				13 24 50/6"	74		very pale brown, gravel size 2 inches, calcium carbonate coating on one side of gravel		1			8	
	15			50/4"	97								
1230				50/5"	100		some subrounded gravel, some calcium carbonate coating on gravel sides						
	20						Bottom of boring at 19 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings. Adjacent second hole was drilled to 5 feet and prepared for percolation test.						
1225													
	25												
1220													

LOG OF BORING DYB10-01

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A2

Template: DYLG1-2006; Prj ID: 2010-024.GPJ

BORING LOCATION: See Figure 2		**ELEVATION AND DATUM (feet):** 1414 MSL	
LATITUDE: 35° 12' 25.5" N		**LONGITUDE:** 116° 9' 37.6" W	
DRILLING EQUIPMENT: D 120		**DRILLING METHOD:** Hollow Stem Auger	
BORING DIAMETER (inches): 10		**BORING DEPTH (feet):** 21	
DATE STARTED: 8/31/10		**DATE COMPLETED:** 8/31/10	
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
				10 14 20	34		WELL-GRADED SAND with SILT and GRAVEL (SW-SM): light yellowish brown, dry, dense, fine- to coarse-grained sand, fine gravel, gravel size 1/2 inch, granitic, subangular to angular, very hard, slightly to entirely coated with calcium carbonate, mildly reactive						
1410				9 22 32	35		moist, fine to coarse gravel, gravel size 1.5 inches						CA
	5			5 5 9	14		medium dense, fine gravel, gravel size 1/2 inch		1			9	SA
1405				50/3"	100		very dense, no recovery						
	10			50/6"	100		hard drilling, heavy calcium carbonate coating observed on some gravel						
1400				16 50/2"	100		reduced calcium carbonate coating		2				
1395	15			30 50/2"	100								
	20			9 34 50/2"	100				2			11	
1390							Bottom of boring at 21 feet. Groundwater not encountered during drilling. Boring prepared for down hole seismic test.						
1385	25												

LOG OF BORING DYB10-02

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A3

Template: DYLG1-2006; Prj ID: 2010-024.GPJ

BORING LOCATION: See Figure 2		**ELEVATION AND DATUM (feet):** 1517 MSL	
LATITUDE: 35° 12' 25.1" N		**LONGITUDE:** 116° 10' 29.4" W	
DRILLING EQUIPMENT: D 120		**DRILLING METHOD:** Hollow Stem Auger	
BORING DIAMETER (inches): 8		**BORING DEPTH (feet):** 19.5	
DATE STARTED: 8/31/10		**DATE COMPLETED:** 8/31/10	
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
1515				20 50/6"	65		WELL-GRADED SAND with SILT and GRAVEL (SW-SM): light yellowish brown, dry, very dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 3 inches in sampler shoe, granitic, subrounded to subangular, hard to very hard, partial calcium carbonate coating, mildly reactive						
	5			6 13 15	28		moist, medium dense, fewer subrounded gravel		1			8	SA
1510				18 38 50/5"	64		very dense, gravel size 2 inches in sampler shoe						
	10			16 30 25	55		SILTY SAND with GRAVEL (SM): light yellowish brown, moist, very dense, fine- to medium-grained sand, fine to coarse gravel, gravel size 1.5 inches						
1505				22 50/3"	100		gravel size 3 inches in sampler shoe, hard drilling, little to no calcium carbonate staining						
	15			13 50/6"	100				1			13	
1500				31 50/5"	78								
	20						Bottom of boring at 19.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings. Adjacent second hole was drilled to 5 feet and prepared for percolation test.						
1495	25												
1490													

LOG OF BORING DYB10-03

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A4

Template: DYLG1-2006; Prj ID: 2010-024.GPJ

BORING LOCATION: See Figure 2		**ELEVATION AND DATUM (feet):** 1451 MSL	
LATITUDE: 35° 11' 28.2" N		**LONGITUDE:** 116° 11' 7.2" W	
DRILLING EQUIPMENT: D 120		**DRILLING METHOD:** Hollow Stem Auger	
BORING DIAMETER (inches): 8		**BORING DEPTH (feet):** 17.5	
DATE STARTED: 8/31/10		**DATE COMPLETED:** 8/31/10	
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
1450				7 11 22	33		WELL-GRADED GRAVEL with SILT and SAND (GW-GM): very pale brown, dry, dense, fine to coarse gravel, fine- to coarse-grained sand, gravel size 2 inches, granitic, subangular, hard to very hard, occasional partial coating of calcium carbonate deposits, miltely to moderately reactive very hard drilling, cobbles coming out of the hole						MD SE CA
	5			50/4"	97		very dense, no recovery						
1445				18 43 23	66		iron oxide veining in matrix of some broken gravel		0				
	10			11 28 21	49		moist, dense, gravel size 3 inches in sampler shoe, up to 1/8 inch thick calcium carbonate coating on side of occasional gravel						
1440				16 31 27	38		broken cobbles in sampler shoe		1			7	SA
	15			14 50/5"	100		very dense, drill rig chattering, little to no calcium carbonate						
1435				50/2"	100		gravel size 2 inches in sampler shoe Bottom of boring at 17.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings. Adjacent second hole was drilled to 5 feet and prepared for percolation test.						
	20												
1430													
	25												
1425													

LOG OF BORING DYB10-04

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A5

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	1346 MSL
LATITUDE:	35° 11' 0.3" N	**LONGITUDE:**	116° 10' 25.3" W
DRILLING EQUIPMENT:	D 120	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	10	**BORING DEPTH (feet):**	18
DATE STARTED:	9/2/10	**DATE COMPLETED:**	9/2/10
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
1345				15 50/5"	78		POORLY GRADED SAND with SILT and GRAVEL (SP-SM): very pale brown, dry, very dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 3 inches in sampler shoe, granitic, subrounded to angular, hard, slight to partial coating on all sides, mildly reactive, some iron oxide stringers						
				6 21 50/3"	100		moist, gravel size 2 inches						
	5						hard drilling						
1340				10 22 30	34		light yellowish brown, dense, gravel size 3 inches		1			10	SA
				11 23 24	47		no subrounded gravel						
	10												
1335				15 31 50/4"	69		very dense, broken cobbles in sampler shoe, complete calcium carbonate coating on some small gravel						
				12 20 31	51				1				
	15												
1330													
				27 50/2"	100		very pale brown					10	
							Bottom of boring at 18 feet. Groundwater not encountered during drilling. Boring prepared for down hole seismic test.						
	20												
1325													
	25												
1320													

LOG OF BORING DYB10-05

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A6

Template: DYLG1-2006; Prj ID: 2010-024.GPJ

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	1378 MSL
LATITUDE:	35° 10' 18.1" N	**LONGITUDE:**	116° 10' 8.1" W
DRILLING EQUIPMENT:	D 120	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	8	**BORING DEPTH (feet):**	18.5
DATE STARTED:	8/30/10	**DATE COMPLETED:**	8/30/10
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
				8 10 10	13		POORLY GRADED SAND with SILT and GRAVEL (SP-SM): light yellowish brown, dry, medium dense, fine- to medium-grained sand, fine to coarse gravel, gravel size 1 inch, no clasts					10	SA
1375				10 40 50/5"	100		moist, very dense, fine gravel, gravel size 3/4 inch		1				
	5												
				21 50/4"	97		light brown						
1370				19 50/6"	100		light yellowish brown, gravel has small calcium carbonate deposit						
	10												
				24 50/5"	78		fine to coarse gravel, gravel size 1.5 inches, trace iron oxide		2				
1365				50/6"	100		fine gravel, gravel size 1/2 inch						
	15												
1360				50/6"	65								
							Bottom of boring at 18.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings. Adjacent second hole was drilled to 5 feet and prepared for percolation test.						
	20												
1355													
	25												
1350													

LOG OF BORING DYB10-06

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A7

BORING LOCATION: See Figure 2	**ELEVATION AND DATUM (feet):** 1401 MSL
LATITUDE: 35° 10' 23.3" N	**LONGITUDE:** 116° 10' 56.3" W
DRILLING EQUIPMENT: D 120	**DRILLING METHOD:** Hollow Stem Auger
BORING DIAMETER (inches): 10	**BORING DEPTH (feet):** 21
DATE STARTED: 9/2/10	**DATE COMPLETED:** 9/2/10
SPT HAMMER DROP: 30 inches **WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches **WT:** 140 lbs
LOGGED BY: SS **CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)** **ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
1400				5 7 11	18		POORLY GRADED SAND with SILT and GRAVEL (SP-SM): light yellowish brown, dry, medium dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 2 inches, granitic, subangular, very hard, little to no calcium carbonate coating						
				5 16 33	32		moist, dense					8	SA MD SE CA
1395	5			9 20 22	42		increase in calcium carbonate coating on sides of gravel						
				7 20 22	27		WELL-GRADED SAND with SILT and GRAVEL (SW-SM): light yellowish brown, moist, medium dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 2 inches		1			9	SA
1390	10			6 16 18	34		dense						
				8 50/5"	78		very dense, no recovery, very hard drilling						
1385	15			7 30 50/4"	100		gravel size 1 inch						
1380	20			25 50/5"	78				1			9	
							Bottom of boring at 21 feet. Groundwater not encountered during drilling. Boring prepared for down hole seismic test.						
1375	25												

LOG OF BORING DYB10-07

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A8

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	1512 MSL
LATITUDE:	35° 10' 37.2" N	**LONGITUDE:**	116° 11' 33.0" W
DRILLING EQUIPMENT:	D 120	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	8	**BORING DEPTH (feet):**	19
DATE STARTED:	8/31/10	**DATE COMPLETED:**	8/31/10
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
				8 50/2"	100		WELL-GRADED SAND with SILT and GRAVEL (SW-SM): very pale brown, dry, very dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size upto 3 inches coming out of the hole, granitic, subangular, hard, little to no calcium carbonate coating						
				10 30 29	59		moist, gravel size 2 inches		1				
							hard drilling						
				19.26 50/5"	78							12	SA
				15 31 49	80		gravel size 2 inches in sampler shoe						
				10 35 50/4"	100				1				
				9 17 32	49		dense, gravel size 1 inch						
							very hard drilling						
				30 50/3"	100		very dense, gravel size 2 inches in sampler shoe						
							Bottom of boring at 19 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings. Adjacent second hole was drilled to 5 feet and prepared for percolation test.						

LOG OF BORING DYB10-08

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A9

BORING LOCATION: See Figure 2		**ELEVATION AND DATUM (feet):** 1519 MSL	
LATITUDE: 35° 9' 16.3" N		**LONGITUDE:** 116° 11' 52.9" W	
DRILLING EQUIPMENT: D 120		**DRILLING METHOD:** Hollow Stem Auger	
BORING DIAMETER (inches): 10		**BORING DEPTH (feet):** 17.5	
DATE STARTED: 9/2/10		**DATE COMPLETED:** 9/2/10	
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
				6 23 50/5"	83		POORLY GRADED SAND with SILT and GRAVEL (SP-SM): light yellowish brown, dry, very dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 1.5 inches, granitic, subrounded to subangular, hard to very hard, slight to moderate calcium carbonate stringers within matrix, moderately reactive, partial coating of calcium carbonate on sides of some clasts, mildly reactive						
1515	5			50/2"	100		moist, no recovery						
							hard drilling						
				12 31 28	59				1				
1510	10			10 30 44	48		dense					8	SA
				9 18 27	45		WELL-GRADED SAND with SILT and GRAVEL (SW-SM): light yellowish brown, moist, dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 1.5 inches						
1505	15			9 24 33	37		gravel size 2.5 inches, broken cobbles in sampler shoe		1			6	SA
							very hard drilling, drill rig chattering						
				50/1"	100		very dense, no recovery, sampler bounced back and possibly on boulder						
1500	20						Bottom of boring at 17.5 feet. Groundwater not encountered during drilling. Boring prepared for down hole seismic test.						
1495	25												
1490													

LOG OF BORING DYB10-09

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A10

Template: DYLG1-2006; Prj ID: 2010-024.GPJ

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	1350 MSL
LATITUDE:	35° 9' 25.3" N	**LONGITUDE:**	116° 10' 29.4" W
DRILLING EQUIPMENT:	D 120	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	10	**BORING DEPTH (feet):**	18.5
DATE STARTED:	8/30/10	**DATE COMPLETED:**	8/30/10
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
					POORLY GRADED SAND with SILT and GRAVEL (SP-SM): pale brown, dry, medium dense, fine- to coarse-grained sand, fine gravel, gravel size 3/4 inch						
		8 8 10	18							8	SA MD SE CA
1345	5	5 20 21	27		moist, fine to coarse gravel, gravel size 3 inches in sampler shoe		1				
		25 50/6"	100		POORLY GRADED GRAVEL with SILT (GP-GM): light gray, moist, very dense, fine to coarse gravel, gravel size 1.5 inches, gravel is granitic, subangular, very hard, calcium carbonate coating on side of some gravel						
					WELL-GRADED SAND with SILT and GRAVEL (SW-SM): yellowish brown, moist, very dense, fine- to coarse-grained sand, fine gravel, gravel size 3/4 inch						
1340	10	25 50/3"	100							11	SA
		33 50/3"	100								
1335	15	17 50/5"	78		fine to coarse gravel, gravel size 2 inches, occasional partial calcium carbonate coating on gravel		4				
		23 50/3"	100		fine gravel, gravel size 1/2 inch						
					Bottom of boring at 18.5 feet. Groundwater not encountered during drilling. Boring prepared for down hole seismic test.						
1330	20										
1325	25										

LOG OF BORING DYB10-10

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A11

Template: DYLG1-2006; Prj ID: 2010-024.GPJ

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	1358 MSL
LATITUDE:	35° 8' 53.8" N	**LONGITUDE:**	116° 10' 51.0" W
DRILLING EQUIPMENT:	D 120	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	8	**BORING DEPTH (feet):**	19.5
DATE STARTED:	8/30/10	**DATE COMPLETED:**	8/30/10
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
				9 19 24	28		SILTY SAND with GRAVEL (SM): pale brown to light yellowish brown, moist, medium dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 2 inches, granitic, subrounded to subangular, hard, isolated calcium carbonate stains in matrix and veins of clasts, mildly to moderately reactive, partial to moderate calcium carbonate coating on sides, mildly reactive		5			17	
1355				8 24 25	49		dense						
	5			13 20 20	26		POORLY GRADED SAND with SILT and GRAVEL (SP-SM): pale brown to light yellowish brown, moist, medium dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 2 inches, partial to significant calcium carbonate coating of some gravels, iron oxide staining on side of large gravel		5			8	SA
1350				10 14 14	28								
	10			25 50/6"	65		very dense, gravel size 3 inches in sampler shoe hard drilling drill rig chattering		2				
1345				19 50/6"	100		very pale brown						
	15						hard drilling through cobbles/boulders						
1340				30 50/4"	97		reduced calcium carbonate staining						
	20						Bottom of boring at 19.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings. Adjacent second hole was drilled to 5 feet and prepared for percolation test.						
1335													
	25												
1330													

LOG OF BORING DYB10-11

Page 1 of 1
Caithness Soda Mountain Solar Facility
Project No. 2010-024

PLATE
A12

Template: DYLG1-2006; Prj ID: 2010-024.GPJ

BORING LOCATION: See Figure 2	**ELEVATION AND DATUM (feet):** 1384 MSL
LATITUDE: 35° 8' 33.9" N	**LONGITUDE:** 116° 11' 14.1" W
DRILLING EQUIPMENT: D 120	**DRILLING METHOD:** Hollow Stem Auger
BORING DIAMETER (inches): 10	**BORING DEPTH (feet):** 20.5
DATE STARTED: 8/30/10	**DATE COMPLETED:** 8/30/10
SPT HAMMER DROP: 30 inches **WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches **WT:** 140 lbs
LOGGED BY: SS **CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches) ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
				3 8 9	17		POORLY GRADED SAND with SILT and GRAVEL (SP-SM): pale brown, moist, medium dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 2 inches, granitic, subrounded to subangular, very hard, slight calcium carbonate coating, weak reactivity		1				
				10 50/6"	65		very dense, cobbles coming out of the hole, hard drilling						
1380	5			7 14 23	37		very pale brown, dense, slight increase in calcium carbonate coating						
				8 21 23	29		medium dense						
1375	10			9 22 29	51		very dense		2				
				22 50/2"	100							12	SA
1370	15			29 50/5"	100		fine gravel, gravel size 3/4 inch						
1365	20			50/6"	65								
							Bottom of boring at 20.5 feet. Groundwater not encountered during drilling. Boring prepared for down hole seismic test.						
1360	25												
1355													

LOG OF BORING DYB10-12

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A13

BORING LOCATION: See Figure 2	**ELEVATION AND DATUM (feet):** 1267 MSL
LATITUDE: 35° 8' 20.4" N	**LONGITUDE:** 116° 10' 4.4" W
DRILLING EQUIPMENT: D 120	**DRILLING METHOD:** Hollow Stem Auger
BORING DIAMETER (inches): 8	**BORING DEPTH (feet):** 19.5
DATE STARTED: 9/1/10	**DATE COMPLETED:** 9/1/10
SPT HAMMER DROP: 30 inches **WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches **WT:** 140 lbs
LOGGED BY: SS **CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)** **ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
				15 18 17	23		POORLY GRADED SAND with SILT and GRAVEL (SP-SM): very pale brown, moist, medium dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 2.5 inches, granitic, subangular, very hard, little to no calcium carbonate coating, mildly reactive where present		2			8	SA
				24 30 44	74		brown, very dense, gravel size 1.5 inches						MD SE
				20 39 50/4"	74		some gravel is brittle with trace calcium carbonate coating, micaceous		4				
				11 30 50/4"	100		POORLY GRADED SAND with SILT (SP-SM): very pale brown, moist, very dense, fine- to coarse-grained sand, few fine gravel, gravel size 3/4 inch					10	
				16 50/6"	65		no recovery						
				23 50/4"	100		some partial calcium carbonate coating of one side of gravel						
							SILTY SAND with GRAVEL (SM): very pale brown, moist, very dense, fine- to coarse-grained sand, fine gravel, gravel size 3/4 inch						
				19 32 50/5"	92				4			13	SA
							Bottom of boring at 19.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.						

LOG OF BORING DYB10-13

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A14

BORING LOCATION: See Figure 2	**ELEVATION AND DATUM (feet):** 1332 MSL
LATITUDE: 35° 8' 23.3" N	**LONGITUDE:** 116° 10' 35.5" W
DRILLING EQUIPMENT: D 120	**DRILLING METHOD:** Hollow Stem Auger
BORING DIAMETER (inches): 8	**BORING DEPTH (feet):** 100.5
DATE STARTED: 9/1/10	**DATE COMPLETED:** 9/1/10
SPT HAMMER DROP: 30 inches **WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches **WT:** 140 lbs
LOGGED BY: SS **CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)** **ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
				7 18 18	36		POORLY GRADED SAND with SILT and GRAVEL (SP-SM): light brown, dry, dense, fine- to coarse-grained sand, fine gravel, gravel size 1/2 inch, no large clasts, gravels are granitic, little to no calcium carbonate coating						
1330				18 25 40	42		strong brown, moist, fine to coarse gravel, gravel size 2.5 inches		5			7	SA CA
	5			10 25 27	52		very pale brown, very dense, gravel size 1.5 inches, partial calcium carbonate coating on one side of gravel					5	
1325				16 46 50/5"	69		POORLY GRADED SAND with SILT (SP-SM): light yellowish brown, moist, very dense, fine- to medium-grained sand, few fine gravel, gravel size 3/4 inch, partial calcium carbonate coating on one side of gravel		4				
	10			21 50/6"	100							7	
1320				28 50/5"	78		no recovery						
	15			17 50/4"	100		trace fine gravel, gravel size 1/2 inch		3				
1315													
	20			19 50/2"	100		few fine gravel, gravel size 3/4 inch					9	SA
1310													
	25			16 50/6"	100		trace fine gravel, gravel size 1/2 inch		4				
1305													

LOG OF BORING DYB10-14

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A15

Elevation (feet)	Depth (feet)	Sampler	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
			50/6"	65		no recovery						
1300			50/5"	78		no recovery						
						POORLY GRADED SAND with SILT and GRAVEL (SP-SM): very pale brown, moist, very dense, fine- to medium-grained sand, fine gravel, gravel size 1/2 inch						
	35		50/4"	100							9	
1295						hard drilling						
	40		50/3"	100								
1290						drill rig chattering						
	45		50/5"	100				3				
1285												
	50		50/5"	78		fine to coarse gravel, gravel size 1 inch					9	
1280												
	55		50/6"	100								
1275												
	60		50/3"	100				3				
1270												
	65		50/5"	100								
1265												
						SILTY SAND (SM): very pale brown, moist, very dense, fine- to medium-grained sand, few fine gravel, gravel size 1/2 inch						

LOG OF BORING DYB10-14

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A16

Template: DYLG1-2006; Prj ID: 2010-024.GPJ

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
		X		50/4"	100							21	SA
1260													
	75	X		50/5"	100								
1255													
	80	X		50/4"	100				3				
1250													
	85	X		50/5"	100								
1245													
	90	X		50/4"	100							19	SA
1240													
	95	X		50/3"	100								
1235													
	100	X		50/4"	100		Bottom of boring at 100.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.		3				
1230													
	105												
1225													

LOG OF BORING DYB10-14

Page 3 of 3

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A17

Template: DYLG1-2006; Prj ID: 2010-024.GPJ

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	1522 MSL
LATITUDE:	35° 8' 53.1" N	**LONGITUDE:**	116° 12' 12.0" W
DRILLING EQUIPMENT:	D 120	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	8	**BORING DEPTH (feet):**	14
DATE STARTED:	9/2/10	**DATE COMPLETED:**	9/2/10
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: SS	**CHECKED BY:** CS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
				13 27 40	44		WELL-GRADED SAND with SILT and GRAVEL (SW-SM): very pale brown, moist, dense, fine- to coarse-grained sand, fine to coarse gravel, gravel size 2.5 inches		1			7	SA
1520													
				5 18 20	38		gravel size 2 inches						MD SE CA
	5												
				22 50/3"	100		POORLY GRADED GRAVEL with SILT and SAND (GP-GM): very pale brown, moist, very dense, fine to coarse gravel, fine- to medium-grained sand, gravel size 2 inches		1				
1515													
				50/1"	100		no recovery						
							hard drilling						
	10												
				50/3"	100		no recovery, very hard drilling drill rig chattering						
1510													
				50/5"	100		refusal at 14 feet		1			12	
							Bottom of boring at 14 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.						
	15												
1505													
	20												
1500													
	25												
1495													

LOG OF BORING DYB10-15

Page 1 of 1

Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

A18

Photograph A1 - Approximately South From DYB10-01

Photograph A2 - Approximately North From DYB10-10

PLATE
A19

Photograph A3 - Approximately North From DYB10-09

Photograph A4 - Approximately South From DYB10-03

APPENDIX B

LABORATORY TESTING

APPENDIX B - LABORATORY TESTING

Diaz•Yourman & Associates (DYA) selected soil samples to be tested and the tests to be performed on the selected samples. Laboratory testing was performed by DYA and Leighton and Associates (City of Los Angeles certified testing laboratories). Laboratory data are summarized on the boring logs in Appendix A and presented on Plates B1 through B21. We have reviewed and concur with the test results and accept full responsibility. A summary of the geotechnical laboratory testing is presented in Table B1. A summary of the corrosion test results is presented in Table B2.

Table B1 - LABORATORY TESTING SUMMARY

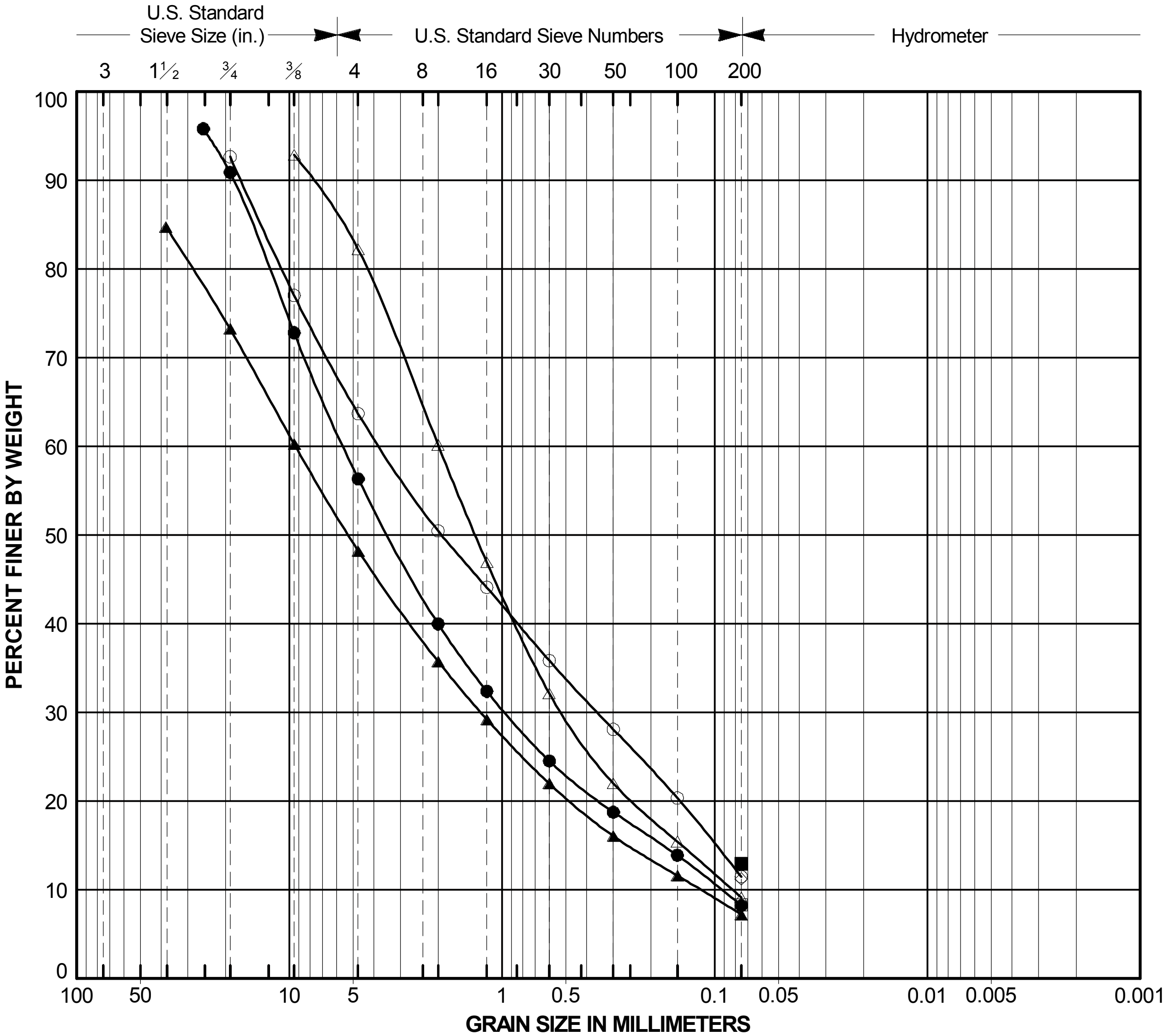
TEST NAME	PROCEDURE	PURPOSE	LOCATION
Percent Passing the No. 200 Sieve	ASTM D1140-92	Classification, index properties	Boring Logs
Moisture Content	ASTM D2216-92	Classification, index properties	Boring Logs
Grain-Size Distribution	ASTM D422-63	Classification, index properties	Plates B1 through B5
Compaction	ASTM D1557-91	Earthwork	Plates B6 and B7
Sand Equivalent	CTM 217	Earthwork	Plates B8 through B13
pH	CTM 532	Corrosion potential	Table B2 and Plates B14 through B21
Resistivity	CTM 532	Corrosion potential	Table B2 and Plates B14 through B21
Soluble Sulfates	CTM 417-B	Corrosion potential	Table B2 and Plates B14 through B21
Soluble Chlorides	CTM 422	Corrosion potential	Table B2 and Plates B14 through B21

Notes:
- ASTM = American Society for Testing and Materials
- CTM = Caltrans Test Method

Table B2 - CORROSION POTENTIAL TEST RESULTS

Boring No.	DYB10-02	DYB10-04	DYB10-07	DYB10-10	DYB10-14	DYB10-15
Depth (feet)	0 to 5	0 to 5	0 to 5	0 to 5	0 to 5	0 to 5
pH	7.1	7.9	7.4	7.5	8.1	7.3
Water Soluble Sulfate Content (ppm)	38	54	54	88	68	54
Water Soluble Chloride Content (ppm)	30	40	40	31	31	40
Minimum Resistivity/Moisture Content (ohms-cm / %)	10,900	4,300	6,225	7,000	6,180	7,600

Note:
- ppm = parts per million



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

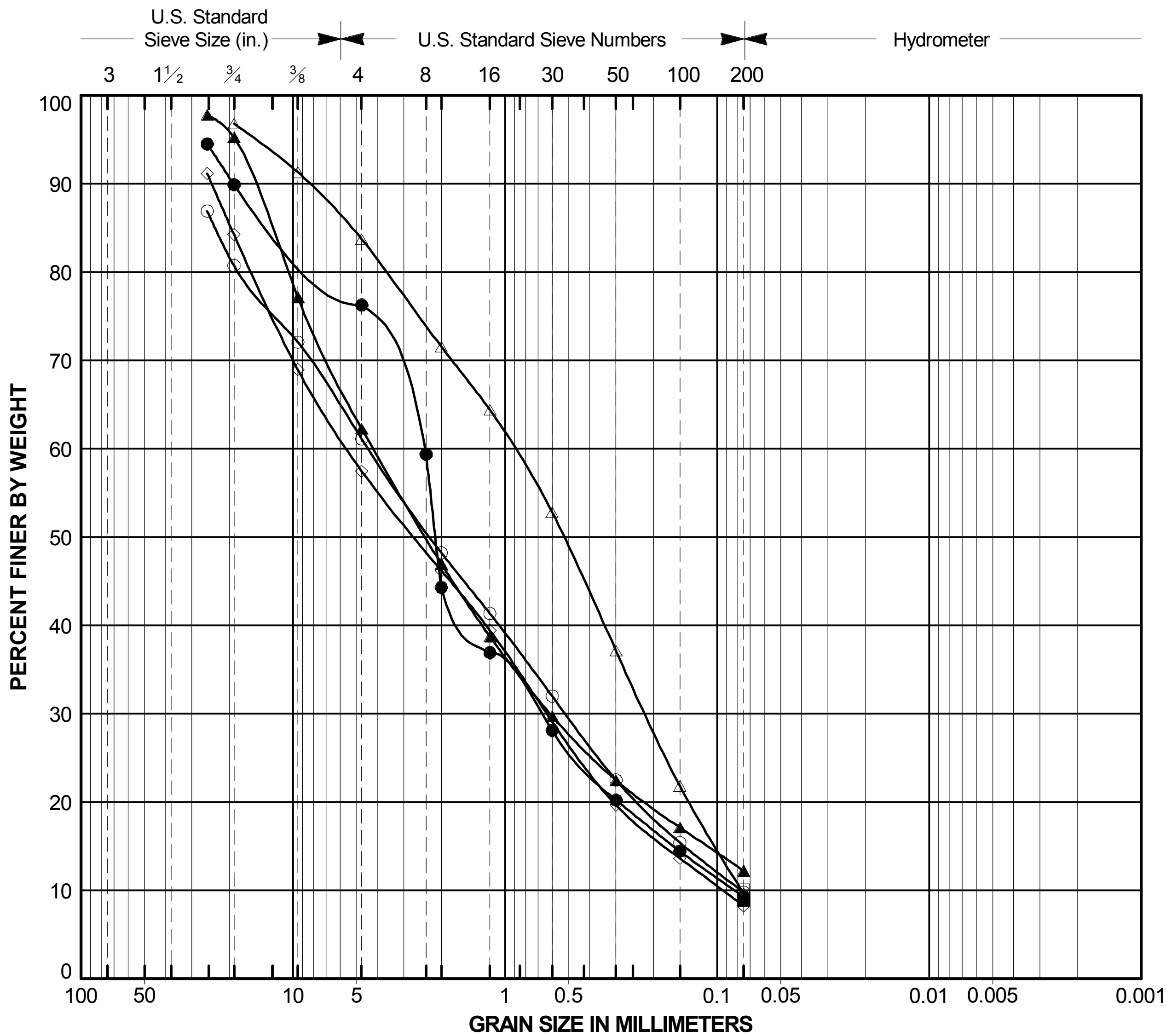
Laboratory Testing by: Diaz Yourman & Associates

Symbol	Source	Depth (feet)	Classification	Natural M. C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
○	DYB10-01	3.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	1			11
□	DYB10-01	11.0	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	1			8
△	DYB10-02	5.0	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)	1			9
◇	DYB10-02	20.0	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)	2			11
●	DYB10-03	3.5	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)	1			8
■	DYB10-03	13.5	SILTY SAND WITH GRAVEL (SM)	1			13
▲	DYB10-04	11.5	WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM)	1			7

PARTICLE SIZE ANALYSIS

Caithness Soda Mountain Solar Facility
Project No. 2010-024

PLATE
B1



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

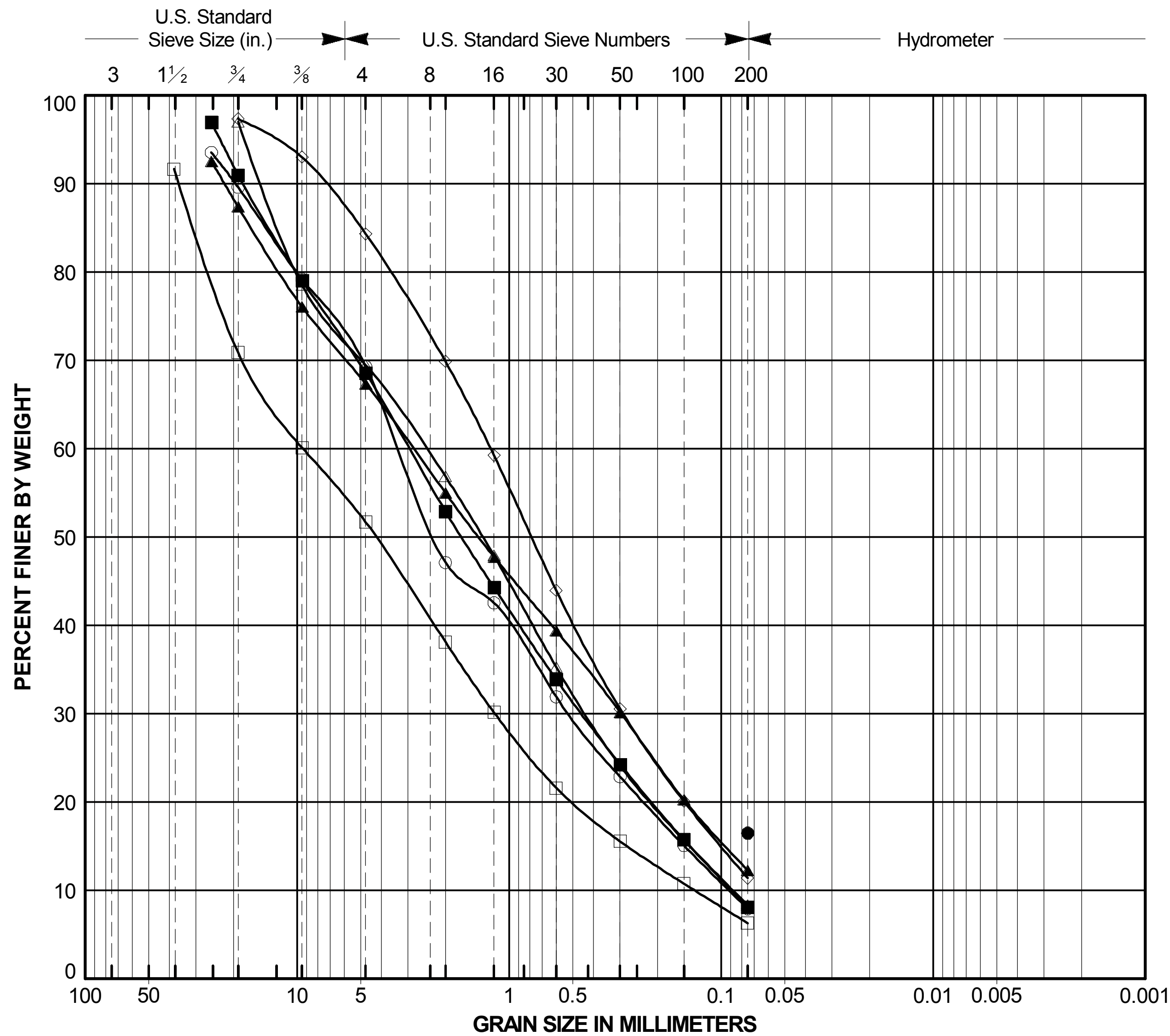
Laboratory Testing by: Diaz Yourman & Associates

Symbol	Source	Depth (feet)	Classification	Natural M. C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
○	DYB10-05	5.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	1			10
□	DYB10-05	17.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)				10
△	DYB10-06	0.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)				10
◇	DYB10-07	2.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)				8
●	DYB10-07	7.5	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)	1			9
■	DYB10-07	20.0	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)	1			9
▲	DYB10-08	5.5	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)				12

PARTICLE SIZE ANALYSIS

Caithness Soda Mountain Solar Facility
Project No. 2010-024

PLATE
B2



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Laboratory Testing by: Diaz Yourman & Associates

Symbol	Source	Depth (feet)	Classification	Natural M. C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
⊙	DYB10-09	9.0	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)				8
□	DYB10-09	14.0	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)	1			6
△	DYB10-10	1.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)				8
◇	DYB10-10	9.0	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)				11
●	DYB10-11	1.0	SILTY SAND WITH GRAVEL (SM)	5			17
■	DYB10-11	6.0	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	5			8
▲	DYB10-12	12.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)				12

PARTICLE SIZE ANALYSIS

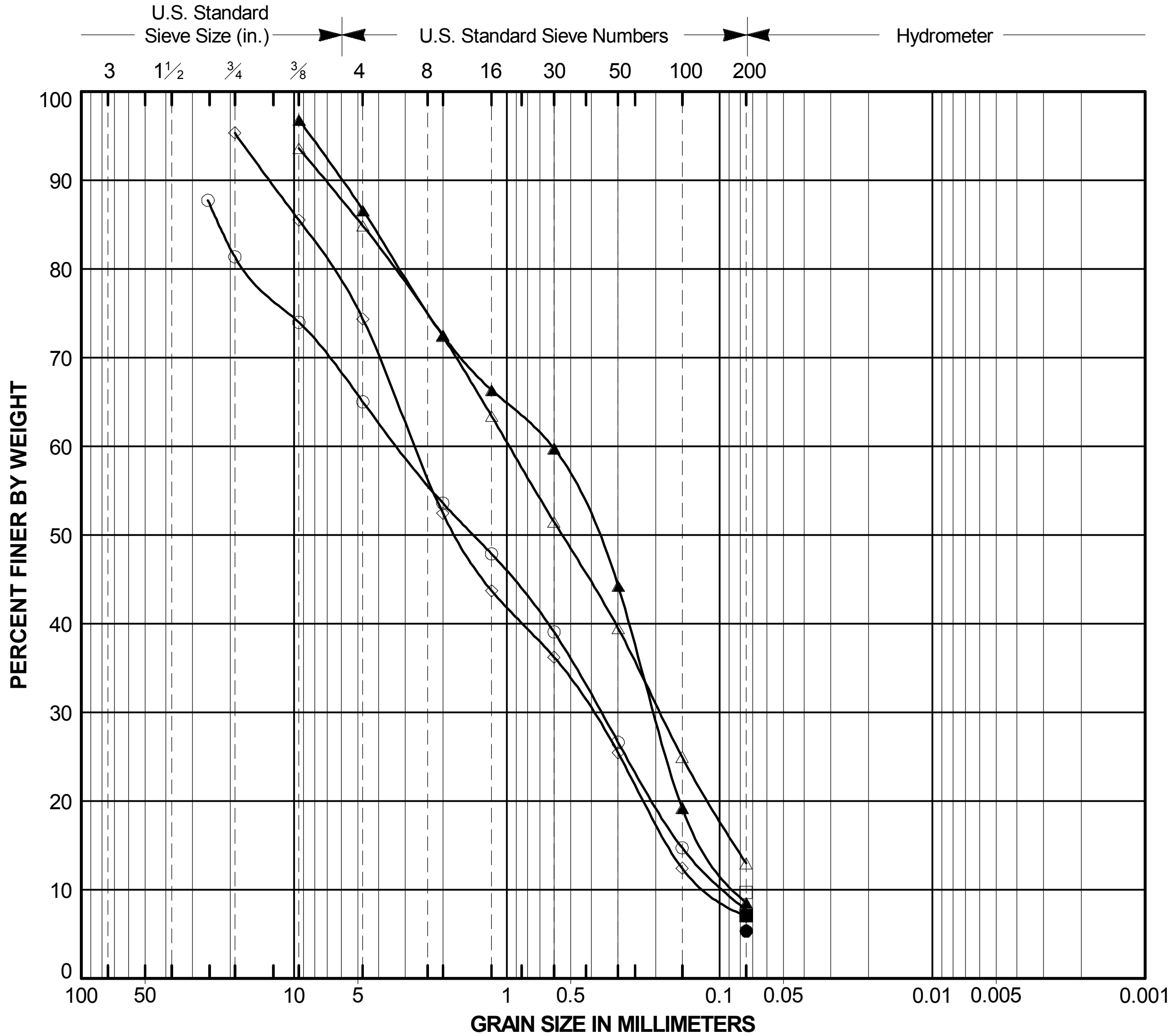
Caithness Soda Mountain Solar Facility

Project No. 2010-024

PLATE

B3

Template: DY_SIEVE_WIN



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

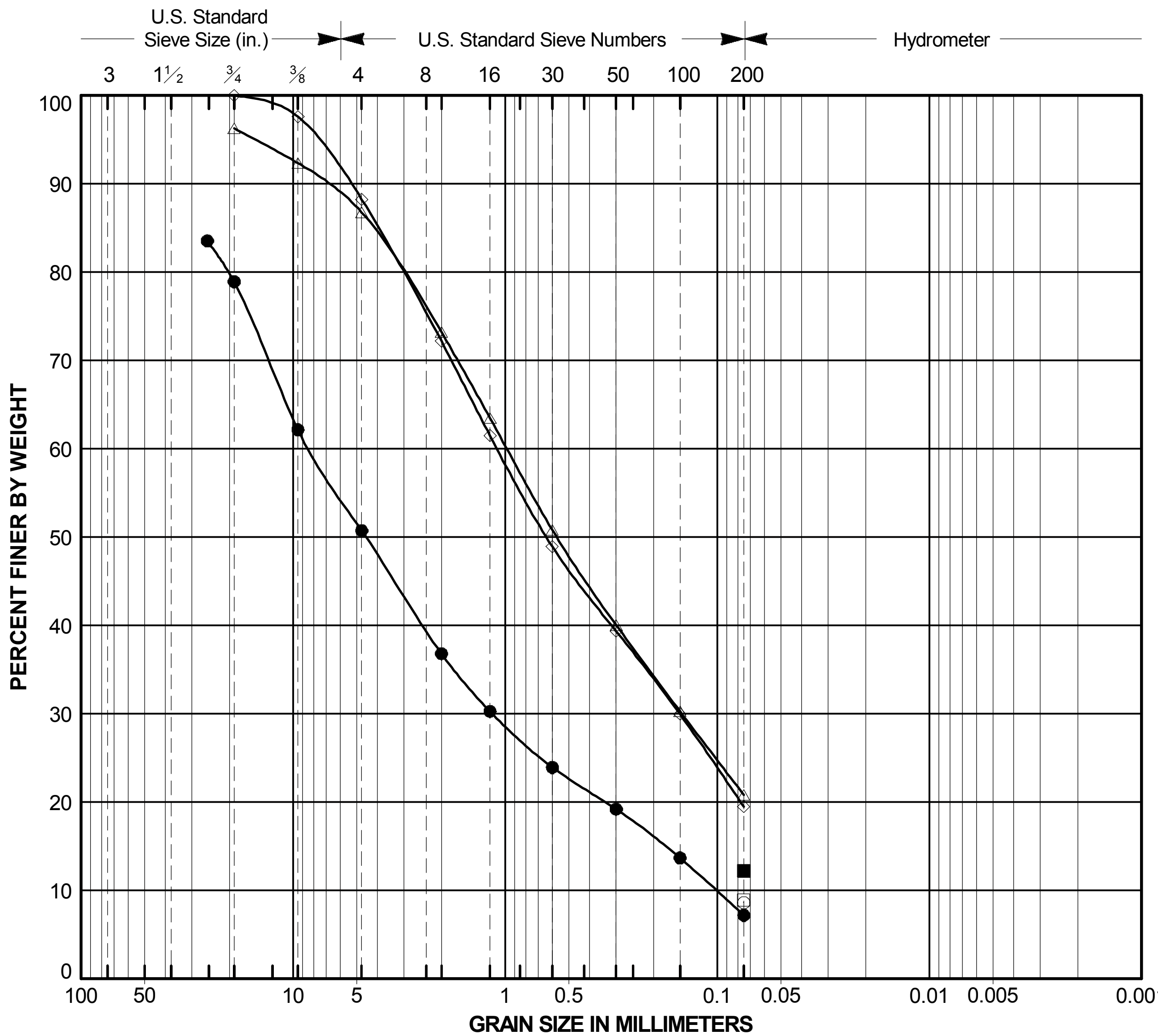
Laboratory Testing by: Diaz Yourman & Associates

Symbol	Source	Depth (feet)	Classification	Natural M. C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
○	DYB10-13	0.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	2			8
□	DYB10-13	8.0	POORLY GRADED SAND WITH SILT (SP-SM)				10
△	DYB10-13	18.0	SILTY SAND WITH GRAVEL (SM)	4			13
◇	DYB10-14	2.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	5			7
●	DYB10-14	5.0	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)				5
■	DYB10-14	10.0	POORLY GRADED SAND WITH SILT (SP-SM)				7
▲	DYB10-14	20.0	POORLY GRADED SAND WITH SILT (SP-SM)				9

PARTICLE SIZE ANALYSIS

Caithness Soda Mountain Solar Facility
Project No. 2010-024

PLATE
B4



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

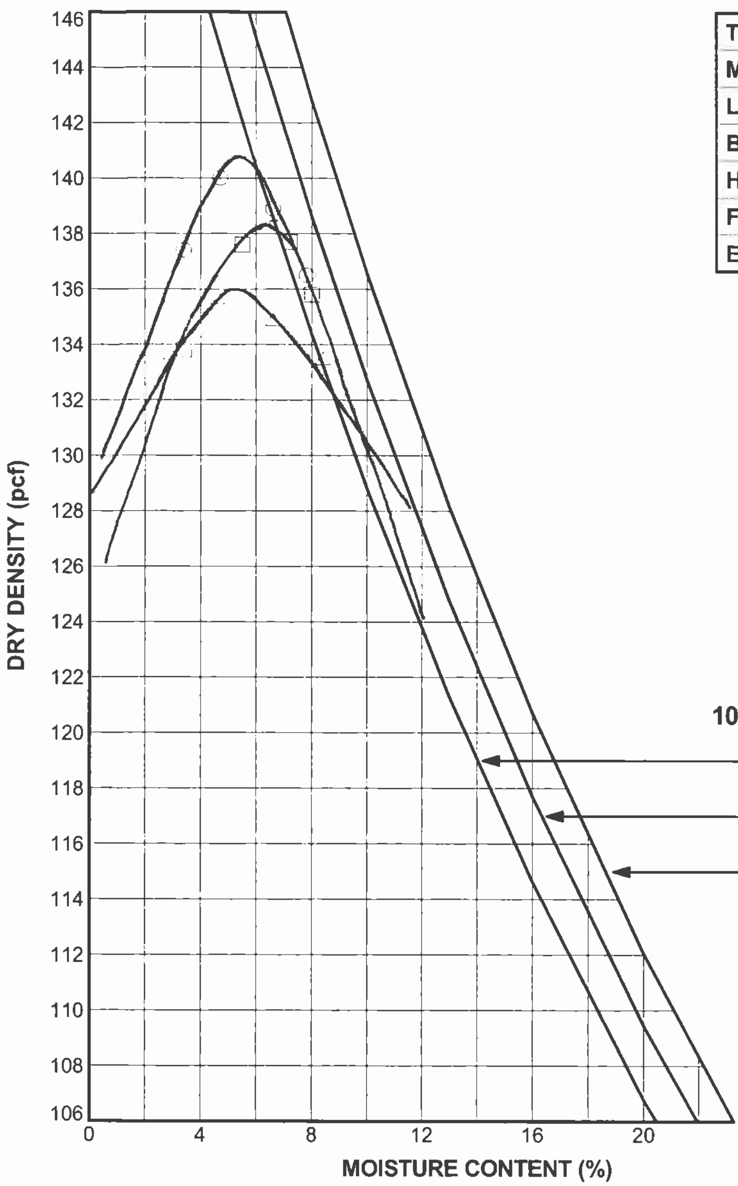
Laboratory Testing by: Diaz Yourman & Associates

Symbol	Source	Depth (feet)	Classification	Natural M. C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
⊙	DYB10-14	35.0	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)				9
□	DYB10-14	50.0	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)				9
△	DYB10-14	70.0	SILTY SAND (SM)				21
◇	DYB10-14	90.0	SILTY SAND (SM)				19
●	DYB10-15	0.5	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)	1			7
■	DYB10-15	13.0	POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)	1			12

PARTICLE SIZE ANALYSIS

Caithness Soda Mountain Solar Facility
Project No. 2010-024

PLATE
B5



Test Method:	ASTM D1557-91(C)
Mold Diameter:	6 inches
Layers:	5
Blows:	56/layer
Hammer:	10 pounds
Fall:	18 inches
Energy:	56,000 ft-lbs/cu ft

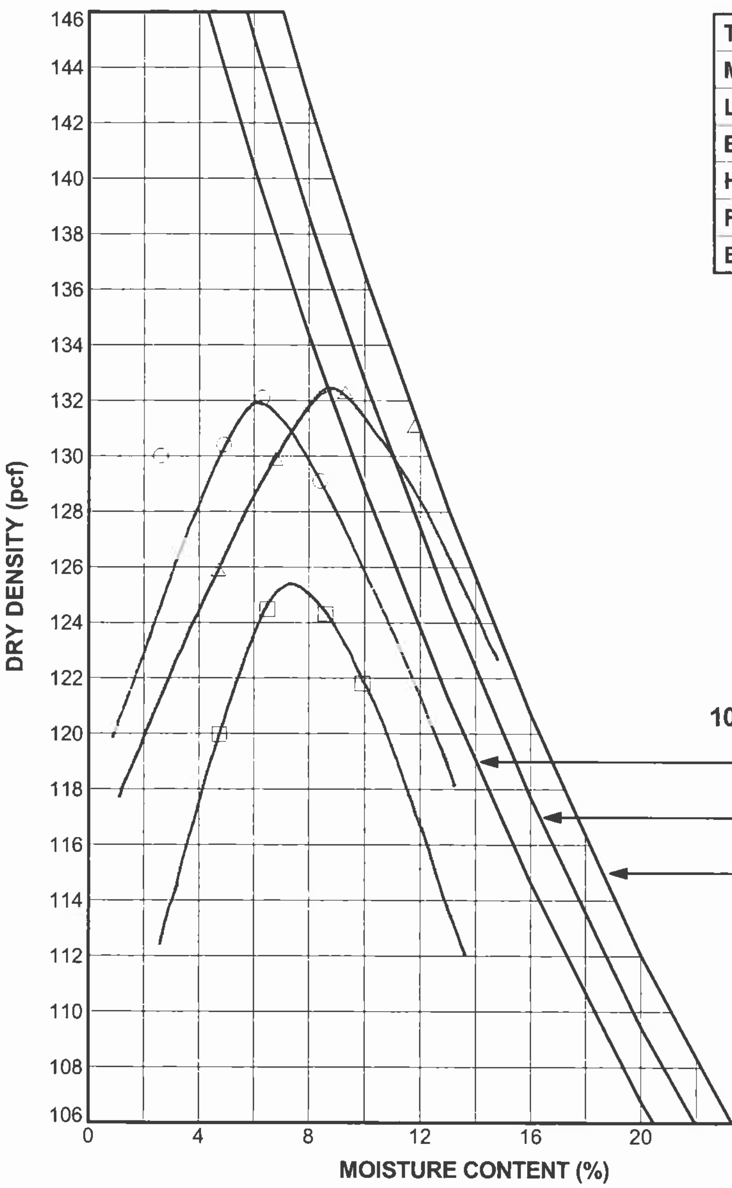
Laboratory Testing by: Diaz Yourman & Associates

Symbol	Source	Depth (feet)	Classification	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
○	DYB10-01	2.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	5	141			
□	DYB10-04	2.5	WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM)	7	138.5			
△	DYB10-07	2.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	5	136			8

COMPACTION TEST DATA

Caithness Soda Mountain Solar Facility
Project No. 2010-024

PLATE B6



Test Method:	ASTM D1557-91(C)
Mold Diameter:	6 inches
Layers:	5
Blows:	56/layer
Hammer:	10 pounds
Fall:	18 inches
Energy:	56,000 ft-lbs/cu ft

Laboratory Testing by: Diaz Yourman & Associates

Symbol	Source	Depth (feet)	Classification	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
○	DYB10-10	2.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	6	132			
□	DYB10-13	2.5	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)	7	125.5			
△	DYB10-15	2.5	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)	9	132.5			

COMPACTION TEST DATA

Caithness Soda Mountain Solar Facility
Project No. 2010-024

PLATE
B7

CALIFORNIA TEST 217 - SAND EQUIVALENT

Project No.:	2010-024	**Date Sample Tested:**	9/27/2010
Project Name:	SODA Mountain	**Sampled by:**	SS
Boring:	DYB10-01	**Tested by:**	RA
Depth (feet)	0-5 feet	**Reviewed by:**	JGS
Material Type:	Poorly graded Sand with Silt and Gravel (SP-SM)		

Trial No.	**1**	**2**
Height of Sand Reading (units)	26	33
Height of Clay Reading (units)	59	80
Sand Equivalent	45	42
Average Sand Equivalent	44	

PLATE
B8

CALIFORNIA TEST 217 - SAND EQUIVALENT

Project No.: 2010-024 **Date Sample Tested:** 9/27/2010
Project Name: SODA Mountain **Sampled by:** SS
Boring: DYB10-04 **Tested by:** RA
Depth (feet) 0-5 feet **Reviewed by:** JGS
Material Type: Well graded Gravel with Silt and Sand (GW-GM)

Trial No.	**1**	**2**
Height of Sand Reading (units)	36	34
Height of Clay Reading (units)	70	60
Sand Equivalent	52	57
Average Sand Equivalent	55	

PLATE
B9

CALIFORNIA TEST 217 - SAND EQUIVALENT

Project No.:	2010-024	**Date Sample Tested:**	9/27/2010
Project Name:	SODA Mountain	**Sampled by:**	SS
Boring:	DYB10-07	**Tested by:**	RA
Depth (feet)	0-5 feet	**Reviewed by:**	JGS
Material Type:	Poorly graded Sand with Silt and Gravel (SP-SM)		

Trial No.	**1**	**2**
Height of Sand Reading (units)	30	29
Height of Clay Reading (units)	90	81
Sand Equivalent	34	36
Average Sand Equivalent	35	

PLATE
B10

CALIFORNIA TEST 217 - SAND EQUIVALENT

Project No.: 2010-024 **Date Sample Tested:** 9/27/2010
Project Name: SODA Mountain **Sampled by:** SS
Boring: DYB10-10 **Tested by:** RA
Depth (feet) 0-5 feet **Reviewed by:** JGS
Material Type: Poorly graded Sand with Silt and Gravel (SP-SM)

Trial No.	**1**	**2**
Height of Sand Reading (units)	35	36
Height of Clay Reading (units)	59	62
Sand Equivalent	60	59
Average Sand Equivalent	60	

PLATE
B11

CALIFORNIA TEST 217 - SAND EQUIVALENT

Project No.: 2010-024 **Date Sample Tested:** 9/27/2010
Project Name: SODA Mountain **Sampled by:** SS
Boring: DYB10-13 **Tested by:** RA
Depth (feet) 0-5 feet **Reviewed by:** JGS
Material Type: Poorly graded Sand with Silt and Gravel (SP-SM)

Trial No.	**1**	**2**
Height of Sand Reading (units)	30	35
Height of Clay Reading (units)	64	70
Sand Equivalent	47	50
Average Sand Equivalent	49	

PLATE
B12

CALIFORNIA TEST 217 - SAND EQUIVALENT

Project No.:	2010-024	**Date Sample Tested:**	9/27/2010
Project Name:	SODA Mountain	**Sampled by:**	SS
Boring:	DYB10-15	**Tested by:**	RA
Depth (feet)	0-5 feet	**Reviewed by:**	JGS
Material Type:	Well graded Sand with Silt and Gravel (SW-SM)		

Trial No.	**1**	**2**
Height of Sand Reading (units)	36	36
Height of Clay Reading (units)	61	63
Sand Equivalent	60	58
Average Sand Equivalent	59	

PLATE
B13

Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name:	SODA Mountain Facility	Tested By :	V. Juliano	Date: 10/04/10
Project No. :	2010-024	Data Input By:	J. Ward	Date: 10/06/10

Boring No.	DYB10-02	DYB10-04	DYB10-07	DYB10-10
Sample No.	N/A	N/A	N/A	N/A
Sample Depth (ft)	0-5	0-5	0-5	0-5
Soil Identification:	Light yellowish brown (SW-SM)	Very pale brown (GW-GM)	Light yellowish brown (SP-SM)	Pale brown (SP-SM)
Wet Weight of Soil + Container (g)	164.20	187.10	182.80	160.30
Dry Weight of Soil + Container (g)	162.70	186.30	181.50	158.40
Weight of Container (g)	60.30	67.60	58.80	59.90
Moisture Content (%)	1.46	0.67	1.06	1.93
Weight of Soaked Soil (g)	100.80	100.30	100.20	100.60

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	8	9	11	14
Crucible No.	2	3	7	15
Furnace Temperature (°C)	840	840	840	840
Time In / Time Out	7:40/8:25	7:40/8:25	7:40/8:25	7:40/8:25
Duration of Combustion (min)	45	45	45	45
Wt. of Crucible + Residue (g)	17.2669	18.5293	18.2403	20.3185
Wt. of Crucible (g)	17.2660	18.5280	18.2390	20.3164
Wt. of Residue (g) (A)	0.0009	0.0013	0.0013	0.0021
PPM of Sulfate (A) x 41150	37.04	53.50	53.50	86.41
PPM of Sulfate, Dry Weight Basis	**38**	**54**	**54**	**88**

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30	30	30
ml of AgNO3 Soln. Used in Titration (C)	0.5	0.6	0.6	0.5
PPM of Chloride (C -0.2) * 100 * 30 / B	30	40	40	30
PPM of Chloride, Dry Wt. Basis	**30**	**40**	**40**	**31**

pH TEST, DOT California Test 532/643

pH Value	**7.14**	**7.86**	**7.37**	**7.46**
Temperature °C	19.9	19.8	19.8	19.9

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Leighton

Project Name: SODA Mountain Facility | Tested By : V. Juliano | Date: 10/04/10

Project No. : 2010-024 | Data Input By: J. Ward | Date: 10/06/10

Boring No.	DYB10-14	DYB10-15		
Sample No.	N/A	N/A		
Sample Depth (ft)	0-5	0-5		
Soil Identification:	Light brown (SP-SM)	Very pale brown (SW-SM)		
Wet Weight of Soil + Container (g)	195.30	194.30		
Dry Weight of Soil + Container (g)	190.70	193.40		
Weight of Container (g)	60.50	68.30		
Moisture Content (%)	3.53	0.72		
Weight of Soaked Soil (g)	100.70	100.50		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	16	17		
Crucible No.	18	23		
Furnace Temperature (°C)	840	840		
Time In / Time Out	7:40/8:25	7:40/8:25		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	19.7381	18.4177		
Wt. of Crucible (g)	19.7365	18.4164		
Wt. of Residue (g) (A)	0.0016	0.0013		
PPM of Sulfate (A) x 41150	65.84	53.50		
PPM of Sulfate, Dry Weight Basis	**68**	**54**		

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30		
ml of AgNO3 Soln. Used in Titration (C)	0.5	0.6		
PPM of Chloride (C -0.2) * 100 * 30 / B	30	40		
PPM of Chloride, Dry Wt. Basis	**31**	**40**		

pH TEST, DOT California Test 532/643

pH Value	**8.10**	**7.28**		
Temperature °C	19.7	19.8		

PLATE
B15

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Leighton

Project Name:	SODA Mountain Facility	Tested By :	V. Juliano	Date:	10/05/10
Project No. :	2010-024	Data Input By:	J. Ward	Date:	10/06/10
Boring No.:	DYB10-02	Depth (ft.) :	0-5		
Sample No. :	N/A				

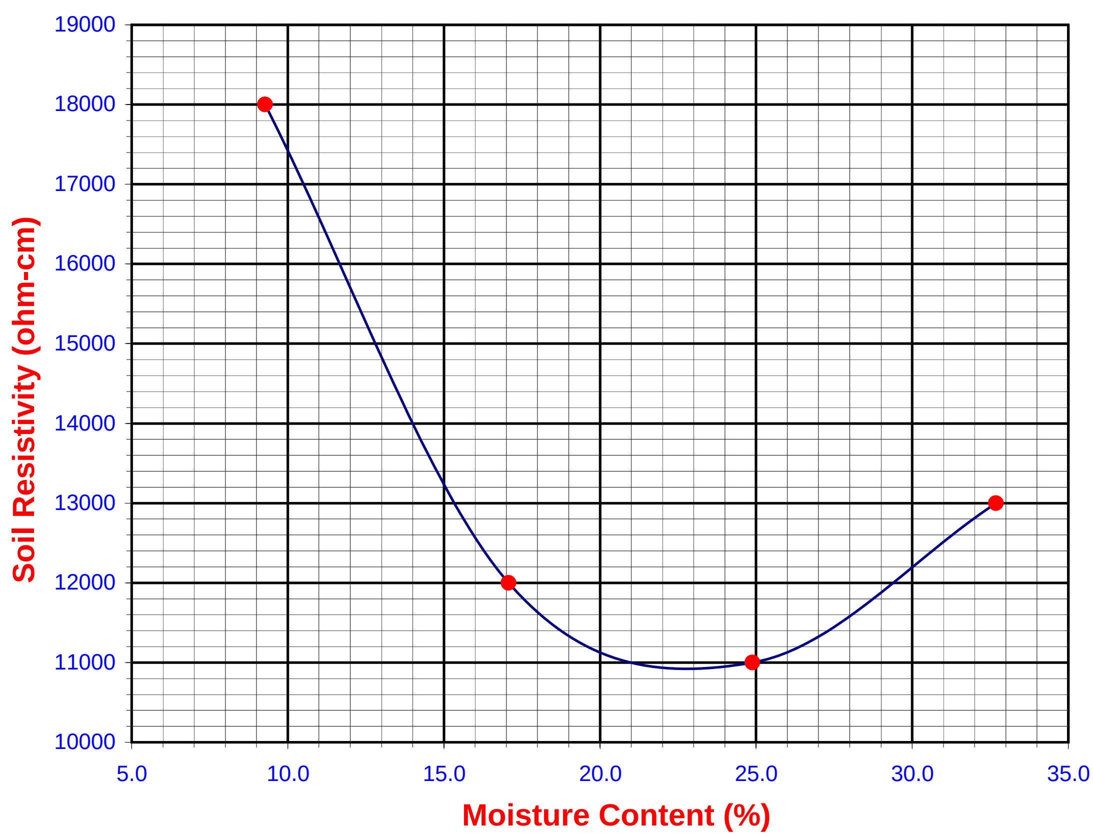
Soil Identification:* Light yellowish brown (SW-SM)

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	9.27	18000	18000
2	20	17.07	12000	12000
3	30	24.88	11000	11000
4	40	32.68	13000	13000
5				

Moisture Content (%) (MCi)	1.46
Wet Wt. of Soil + Cont. (g)	164.20
Dry Wt. of Soil + Cont. (g)	162.70
Wt. of Container (g)	60.30
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
10900	**22.8**	**38**	**30**	**7.14**	**19.9**



PLATE

B16

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Leighton

Project Name:	SODA Mountain Facility	Tested By :	V. Juliano	Date:	10/05/10
Project No. :	2010-024	Data Input By:	J. Ward	Date:	10/06/10
Boring No.:	DYB10-04	Depth (ft.) :	0-5		
Sample No. :	N/A				

Soil Identification:* Very pale brown (GW-GM)

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

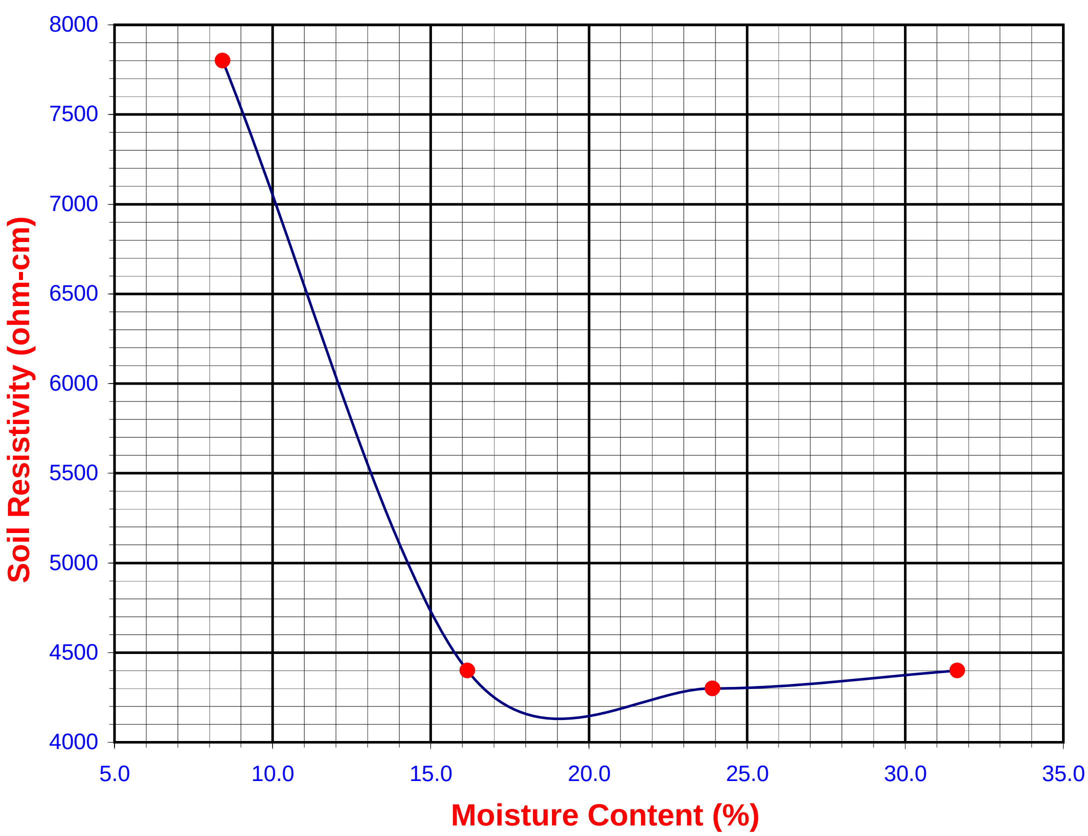
Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	8.42	7800	7800
2	20	16.16	4400	4400
3	30	23.91	4300	4300
4	40	31.65	4400	4400
5				

Moisture Content (%) (MCi)	0.67
Wet Wt. of Soil + Cont. (g)	187.10
Dry Wt. of Soil + Cont. (g)	186.30
Wt. of Container (g)	67.60
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000

MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100

Note: Lowest data point taken as minimum resistivity due to plot distortion

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
4300	**23.9**	**54**	**40**	**7.86**	**19.8**



PLATE

B17

Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name:	SODA Mountain Facility	Tested By :	V. Juliano Date: 10/05/10
Project No. :	2010-024	Data Input By:	J. Ward Date: 10/06/10
Boring No.:	DYB10-07	Depth (ft.) :	0-5
Sample No. :	N/A		

Soil Identification:* Light yellowish brown (SP-SM)

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	8.83	9600	9600
2	20	16.61	6500	6500
3	30	24.38	6400	6400
4	40	32.15	6700	6700
5				

Moisture Content (%) (MCi)	1.06
Wet Wt. of Soil + Cont. (g)	182.80
Dry Wt. of Soil + Cont. (g)	181.50
Wt. of Container (g)	58.80
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
6225	**19.6**	**54**	**40**	**7.37**	**19.8**

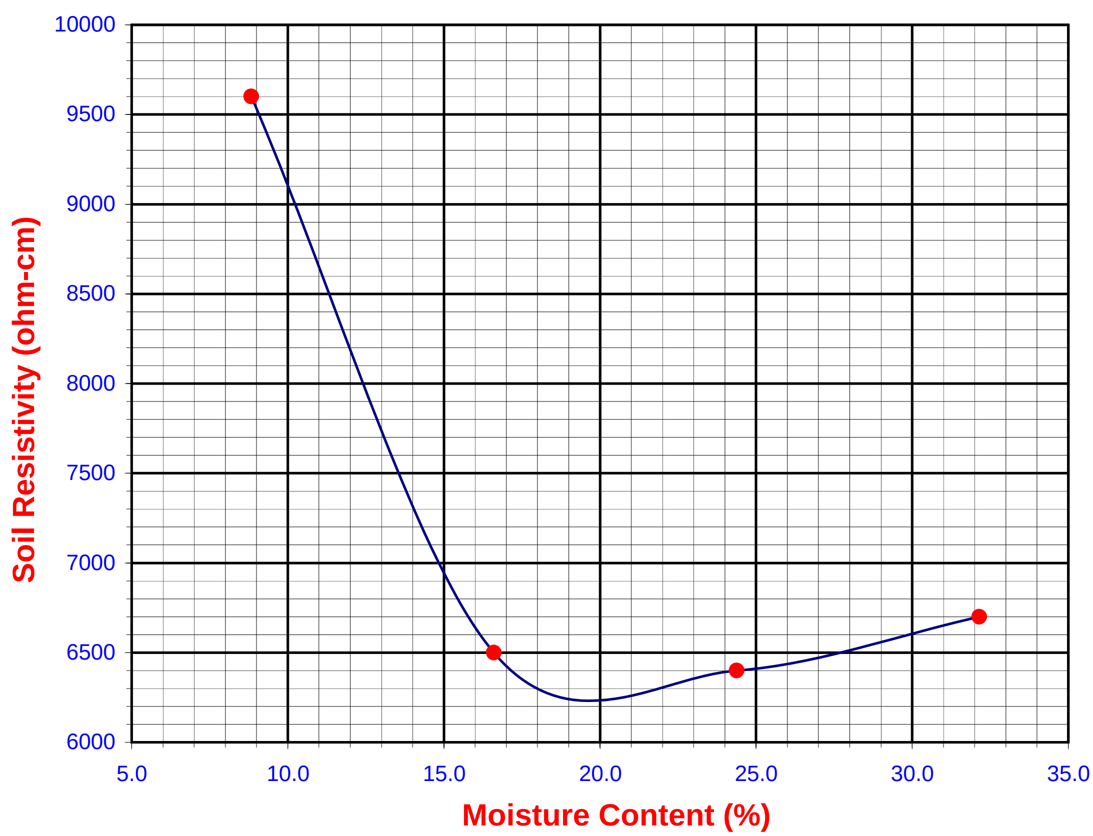


PLATE
B18

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Leighton

Project Name:	SODA Mountain Facility	Tested By :	V. Juliano Date: 10/05/10
Project No. :	2010-024	Data Input By:	J. Ward Date: 10/06/10
Boring No.:	DYB10-10	Depth (ft.) :	0-5
Sample No. :	N/A		

Soil Identification:* Pale brown (SP-SM)

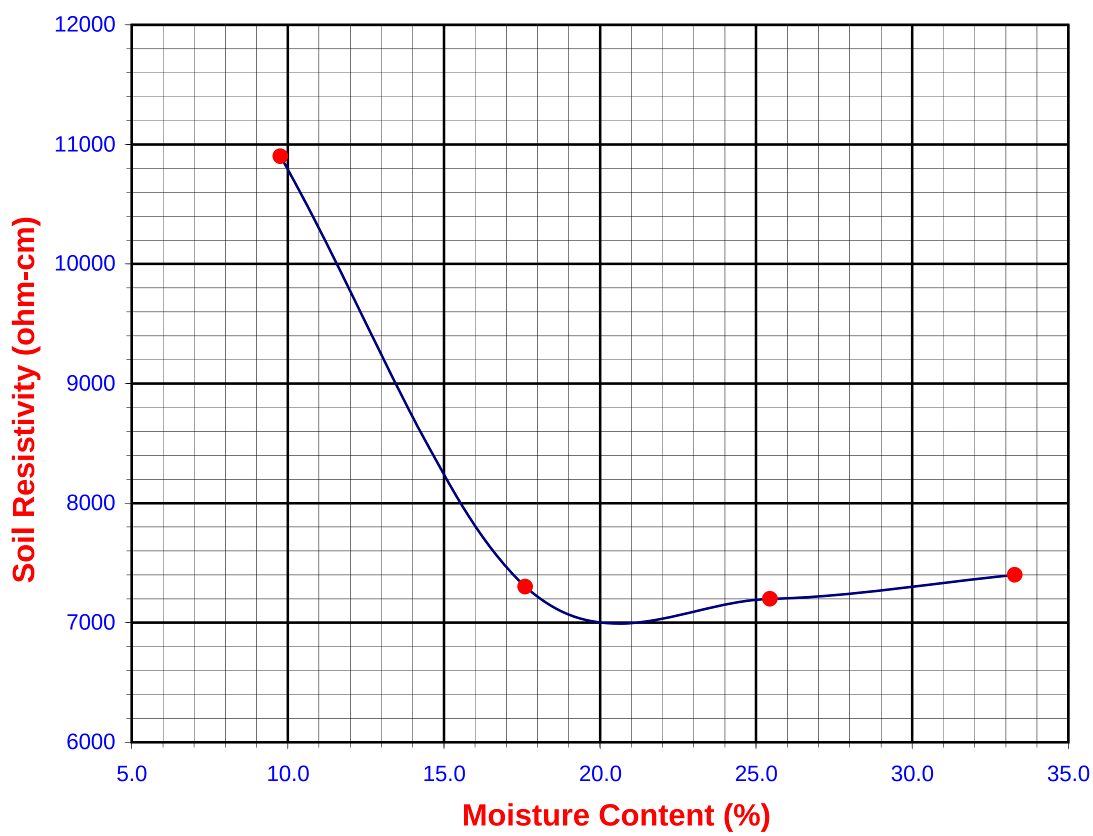
*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	9.77	10900	10900
2	20	17.61	7300	7300
3	30	25.45	7200	7200
4	40	33.29	7400	7400
5				

Moisture Content (%) (MCi)	1.93
Wet Wt. of Soil + Cont. (g)	160.30
Dry Wt. of Soil + Cont. (g)	158.40
Wt. of Container (g)	59.90
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000

MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
7000	**20.6**	**88**	**31**	**7.46**	**19.9**



PLATE

B19

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Leighton

Project Name:	SODA Mountain Facility	Tested By :	V. Juliano	Date:	10/06/10
Project No. :	2010-024	Data Input By:	J. Ward	Date:	10/06/10
Boring No.:	DYB10-14	Depth (ft.) :	0-5		
Sample No. :	N/A				

Soil Identification:* Light brown (SP-SM)

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	11.50	7500	7500
2	20	19.46	6500	6500
3	30	27.43	6200	6200
4	40	35.39	7000	7000
5				

Moisture Content (%) (MCi)	3.53
Wet Wt. of Soil + Cont. (g)	195.30
Dry Wt. of Soil + Cont. (g)	190.70
Wt. of Container (g)	60.50
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
6180	**26.0**	**68**	**31**	**8.10**	**19.7**

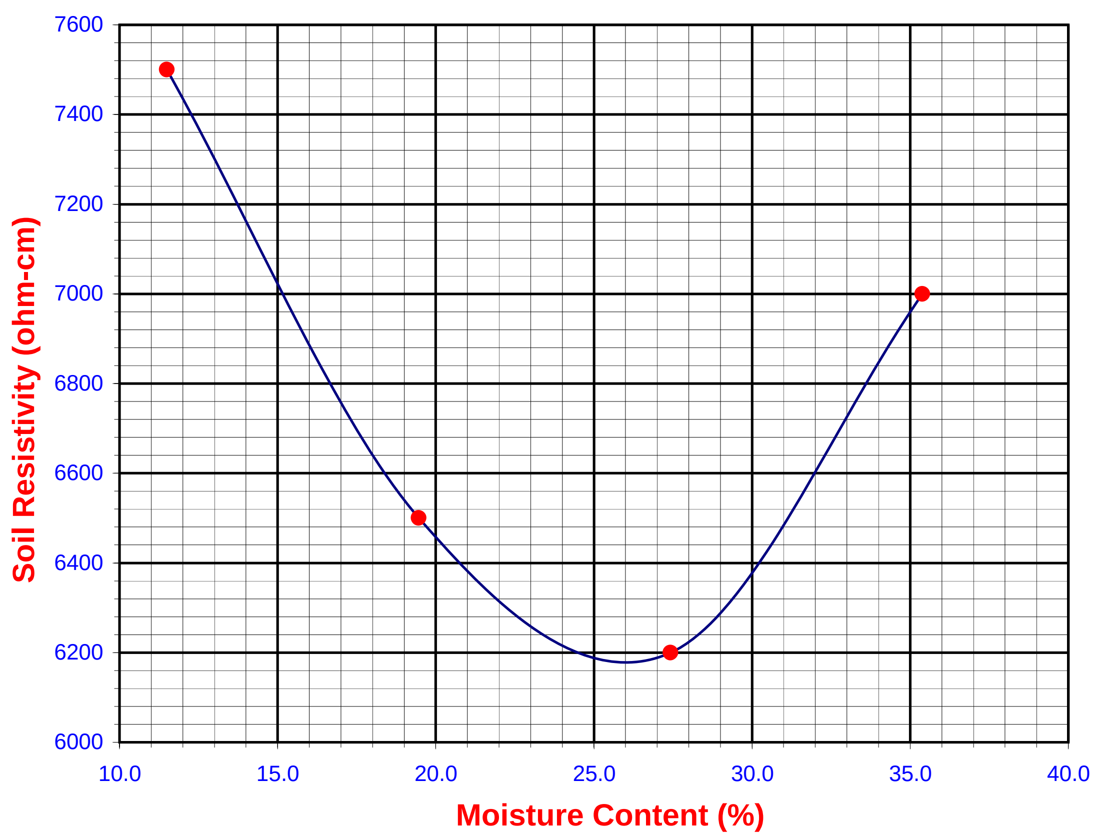


PLATE
B20

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name:	SODA Mountain Facility	Tested By :	V. Juliano Date: 10/05/10
Project No. :	2010-024	Data Input By:	J. Ward Date: 10/06/10
Boring No.:	DYB10-15	Depth (ft.) :	0-5
Sample No. :	N/A		

Soil Identification:* Very pale brown (SW-SM)

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	8.47	13000	13000
2	20	16.21	8100	8100
3	30	23.96	7800	7800
4	40	31.71	8000	8000
5				

Moisture Content (%) (MCi)	0.72
Wet Wt. of Soil + Cont. (g)	194.30
Dry Wt. of Soil + Cont. (g)	193.40
Wt. of Container (g)	68.30
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
7600	**19.6**	**54**	**40**	**7.28**	**19.8**

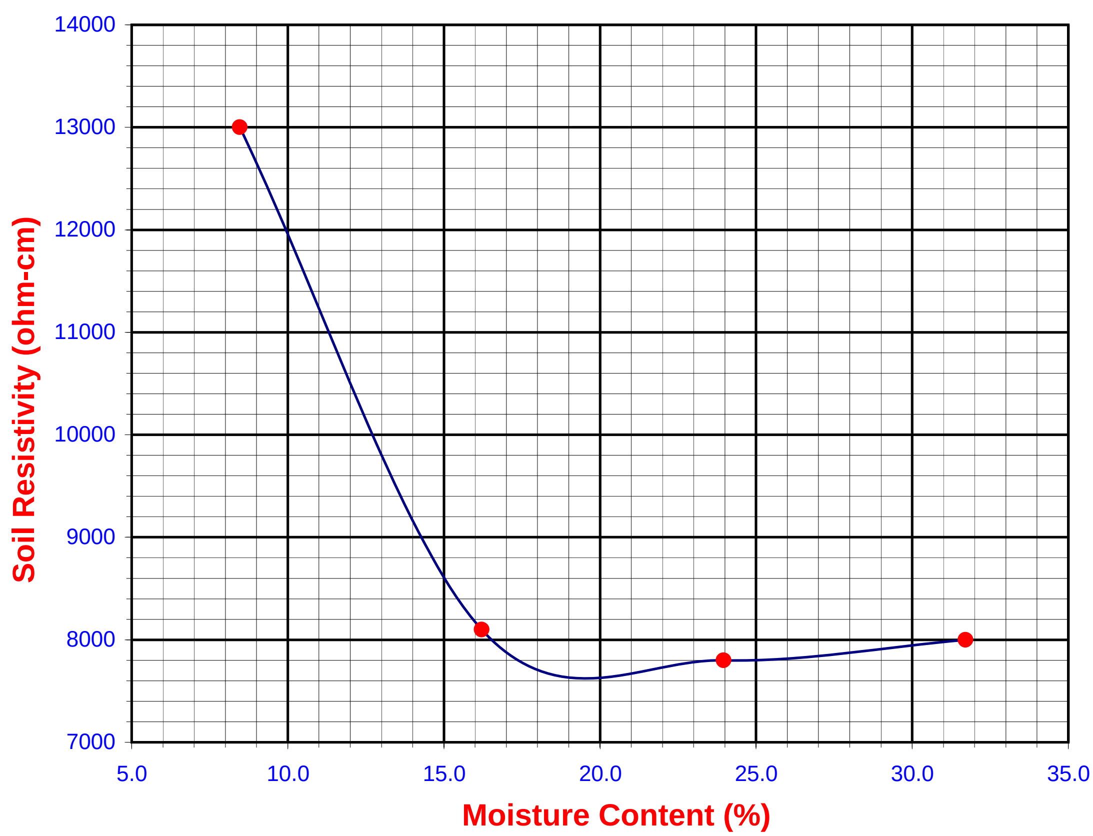


PLATE
B21

APPENDIX C

SOIL FERTILITY ANALYSIS

WALLACE LABORATORIES
365 Coral Circle
El Segundo, CA 90245
phone (310) 615-0116 fax (310) 640-6863

October 12, 2010

Diaz•Yourman & Associates
Matt Dennerline, matt@diazyourman.com
1616 East 17th Street
Santa Ana, CA 92705

RE: SODA Mountain Facility, Job No. 2010-024
Received October 11, 2010

Dear Matt,

sample ID		10-285-02	10-285-03	10-285-04	10-285-05	10-285-06	10-285-07
description	target	DYB10-02 0-5'	DYB10-04 0-5'	DYB10-06 0-5'	DYB10-07 0-5'	DYB10-09 0-5'	DYB10-11 0-5'
phosphorus	8-20	2.7	2.1	8.6	2.8	2.9	1.2
potassium	60-180	92.9	109.8	125.3	86.8	124.0	181.2
iron	4-15	1.6	3.4	3.8	2.2	2.7	1.4
manganese	0.6-3	1.4	3.2	12.3	2.3	2.3	1.6
zinc	1-3	0.2	0.9	0.6	0.5	0.2	0.3
copper	0.2-3	0.2	0.3	0.4	0.3	0.2	0.2
boron	0.2-0.5	0.2	0.2	0.2	0.1	0.3	0.5
magnesium	25-100	27.4	33.1	34.9	40.1	35.9	40.0
sodium	<200	19.4	92.3	15.3	16.3	132.3	422.8
sulfur	25-100	2.2	10.2	13.7	4.4	35.3	76.5
pH	6.5-7.9	8.05	7.52	7.52	7.93	8.02	7.63
salinity	0.5-3	0.43	0.92	1.00	0.41	1.35	4.28
chloride	<150	10.2	28.3	2.8	3.6	58.7	814.5
nitrate	20-30	3.6	16.9	54.3	4.4	8.5	55.0
Organic Matter	3-6%	0.12%	0.11%	0.64%	0.17%	0.17%	0.49%
C:N Ratio	10	3.9	2.8	9.0	3.0	5.6	10.4
SAR	<4	2.5	8.5	1.3	2.0	7.1	11.5

The soils are alkaline with pH's ranging from 7.52 to 8.05.

The majority of the samples have low to moderate salinity values. Sample DYB10-11 has a high salinity with a value of 4.28 millimho/cm.

Nitrogen is low in all the samples except for Sample DYB10-06 and Sample DYB10-11 which have high nitrogen. Phosphorus is low across the board. Potassium ranges from modest to moderate, with Sample DYB10-11 having the highest at 180 parts per million.

Iron, magnesium, zinc, and copper are low in all the samples.

Sodium is low except for Samples DYB10-09 and DYB10-11. Sample DYB10-09 has a moderate amount of sodium. Sample DYB10-11 has high sodium at over 400 parts per million. Chloride is also high in Sample DYB10-11 at over 800 parts per million.

Limestone is present in all the samples which may cause iron deficiency in acid loving plants.

Boron is elevated in DYB10-11 at 0.84 parts per million in the saturation extract.

Recommendations

General soil preparation on a square foot basis. Broadcast the following materials uniformly. The rates are per 1,000 square feet. Incorporate them homogeneously 6 inches deep. Remove rock, gravel and debris:

Ammonium sulfate (21-0-0) – 5 pounds for all except DYB10-06 & DYB10-11
Potassium sulfate (0-0-50) – 8 pounds for all except DYB10-11
Triple superphosphate (0-45-0) – 4 pounds for all
agricultural gypsum - 20 pounds for all except 40 pounds for DYB10-11
Organic soil amendment - 3 cubic yards, sufficient for 3% to 5% soil organic matter

For preparation on a volume basis, incorporate uniformly the following materials into the soil. Rates are expressed per cubic yard. Remove rock, gravel and debris:

Ammonium sulfate (21-0-0) – 1/4 pound for all except DYB10-06 & DYB10-11
Potassium sulfate (0-0-50) – 1/2 pound for all
Triple superphosphate (0-45-0) – 1/4 pound for all
agricultural gypsum – 1 pound for all except 2 pounds for DYB10-11
organic soil amendment - 15% by volume, sufficient for 3% to 5% soil organic matter

Organic soil amendment:

1. Humus material shall have an acid-soluble ash content of no less than 6% and no more than 20%. The organic matter content shall be at least 50% on a dry weight basis.
2. The pH of the material shall be between 6 and 7.5.
3. The salt content shall be less than 10 millimho/cm @ 25° C. on a saturated paste extract.
4. Boron content of the saturated extract shall be less than 1.0 parts per million.
5. Silicon content (acid-insoluble ash) shall be less than 50%.
6. Calcium carbonate shall not be present if to be applied on alkaline soils.
7. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
8. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based products are not acceptable which are based on red wood or cedar.

9. Sludge-based materials are not acceptable.
10. Carbon:nitrogen ratio is less than 25:1.
11. The compost shall be aerobic without malodorous presence of decomposition products.
12. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 screen for soil amending.

Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

arsenic	20	copper	150	selenium	50
cadmium	15	lead	200	silver	10
chromium	300	mercury	10	vanadium	500
cobalt	50	molybdenum	20	zinc	300
		nickel	100		

Higher amounts of salinity or boron may be present if the soils are to be preleached to reduce the excess or if the plant species will tolerate the salinity and/or boron.

For DYB10-11 0-5', 10-285-04, leach to reduce the sodium, chloride and alkalinity. Reduce the pH to less than 8.0 or 8.5, reduce the chloride to less than 150 parts per million, reduce the sodium to less than 150 parts per million, all depending on the tolerance of the plant palette. After leaching apply ammonium sulfate (21-0-0) at 5 pounds per 1,000 square feet where nitrogen is low.

Verify the suitability of these soils after amending and leaching.

For maintenance fertilization, apply ammonium sulfate (21-0-0) at 5 pounds per 1,000 square feet about once per quarter. Monitor the site with periodic soil testing. Correct iron deficiency if it develops with Becker Underwood Sprint 138 Fe or other FeEDDHA chelated iron.

Sincerely,

John S. Wallace
JSW:n

WALLACE LABS
365 Coral Circle
El Segundo, CA 90245
(310) 615-0116

SOILS REPORT

Print Date Oct. 12, 2010 Receive Date 10/11/10

Location: Soda Mountian Solar

Requester: Matt, Diaz Yourman & Associates

graphic interpretation: * very low, ** low, *** moderate **** high, ***** very high

ammonium bicarbonate/DTPA extractable - mg/kg soil	Sample ID Number	10-285-02		10-285-03		10-285-04	
Interpretation of data	Sample Description	DYB10-02 0-5'		DYB10-04 0-5'		DYB10-06 0-5'	
low medium high	elements		graphic		graphic		graphic
0 - 7 8-15 over 15	phosphorus	2.70	*	2.06	*	8.60	***
0-60 60 -120 121-180	potassium	92.87	***	109.85	***	125.28	****
0 - 4 4 - 10 over 10	iron	1.55	*	3.36	**	3.78	**
0- 0.5 0.6- 1 over 1	manganese	1.35	****	3.20	****	12.25	*****
0 - 1 1 - 1.5 over 1.5	zinc	0.21	*	0.94	**	0.61	**
0- 0.2 0.3- 0.5 over 0.5	copper	0.17	*	0.26	**	0.36	***
0- 0.2 0.2- 0.5 over 1	boron	0.18	**	0.21	***	0.22	***
ratio of calcium to magnesium	calcium	357.76	***	343.41	***	349.97	***
needs to be more than 2 or 3	magnesium	27.41	*	33.07	**	34.89	**
should be less than potassium	sodium	19.39	*	92.33	**	15.32	*
	sulfur	2.21	*	10.16	*	13.70	*
	molybdenum	n d	*	n d	*	n d	*
	nickel	n d	*	0.04	*	0.10	*
The following trace	aluminum	n d	*	n d	*	n d	*
elements may be toxic	arsenic	n d	*	n d	*	n d	*
The degree of toxicity	barium	1.14	*	1.00	*	1.08	*
depends upon the pH of	cadmium	n d	*	n d	*	0.03	*
the soil, soil texture,	chromium	n d	*	n d	*	n d	*
organic matter, and the	cobalt	0.01	*	0.06	*	0.05	*
concentrations of the	lead	0.32	*	0.50	*	1.01	**
individual elements as	lithium	0.07	*	0.09	*	0.07	*
well as to their interactions.	mercury	n d	*	n d	*	n d	*
	selenium	0.17	*	n d	*	n d	*
The pH optimum depends	silver	n d	*	n d	*	n d	*
upon soil organic	strontium	4.08	*	4.06	*	3.07	*
matter and clay content-	tin	n d	*	n d	*	n d	*
for clay and loam soils:	vanadium	0.11	*	0.15	*	0.09	*
under 5.2 is too acidic							
6.5 to 7 is ideal	**Saturation Extract**						
over 8 is too alkaline	pH value	8.05	****	7.52	****	7.52	****
The ECe is a measure of	ECe (milli-	0.43	**	0.92	***	1.00	***
the soil salinity:	mho/cm)		millieq/l		millieq/l		millieq/l
1-2 affects a few plants	calcium	11.6	0.6	14.8	0.7	110.9	5.5
2-4 affects some plants,	magnesium	5.8	0.5	4.7	0.4	12.7	1.1
> 4 affects many plants.	sodium	42.0	1.8	146.5	6.4	54.2	2.4
	potassium	15.2	0.4	15.5	0.4	32.4	0.8
	cation sum		3.3		7.9		9.8
problems over 150 ppm	chloride	10	0.3	28	0.8	3	0.1
	nitrate as N	4	0.3	17	1.2	54	3.9
	phosphorus as P	0.8	0.0	0.0	0.0	0.0	0.0
toxic over 800	sulfate as S	10.8	0.7	38.3	2.4	37.1	2.3
	anion sum		1.2		4.4		6.3
toxic over 1 for many plants	boron as B	0.36	**	0.38	**	0.33	**
increasing problems start at 4	SAR	2.5	**	8.5	****	1.3	*
est. gypsum requirement-lbs./1000 square feet		3		16		3	
	infiltration rate inches/hour	slow/fair		slow/fair		fair/slow	
	soil texture	gravelly sand		gravelly sand		sand	
	lime (calcium carbonate)	yes		yes		yes	
	Total nitrogen, dry weight basis	0.016%		0.020%		0.036%	
	Total carbon, dry weight basis	0.060%		0.055%		0.322%	
	carbon:nitrogen ratio	3.9		2.8		9.0	
	organic matter based on carbon	0.12%		0.11%		0.64%	
	moisture content of soil	1.6%		1.1%		1.1%	
	half saturation percentage	11.8%		10.3%		14.8%	

Elements are expressed as mg/kg dry soil or mg/l for saturation extract.

pH and ECe are measured in a saturation paste extract. nd means not detected.

Analytical data determined on soil fraction passing a 2 mm sieve.

WALLACE LABS
365 Coral Circle
El Segundo, CA 90245
(310) 615-0116

SOILS REPORT

Print Date Oct. 12, 2010 Receive Date 10/11/10
Location Soda Mountian Solar
Requester Matt, Diaz Yourman & Associates
graphic interpretation: * very low, ** low, *** moderate **** high, ***** very high

ammonium bicarbonate/DTPA extractable - mg/kg soil	Sample ID Number	10-285-05		10-285-06		10-285-07	
Interpretation of data	Sample Description	DYB10-07 0-5'		DYB10-09 0-5'		DYB10-11 0-5'	
low medium high	**elements**		graphic		graphic		graphic
0 - 7 8-15 over 15	phosphorus	2.76	*	2.91	*	1.22	*
0-60 60 -120 121-180	potassium	86.79	***	123.97	****	181.20	*****
0 - 4 4 - 10 over 10	iron	2.19	*	2.74	**	1.43	*
0- 0.5 0.6- 1 over 1	manganese	2.30	****	2.28	****	1.57	****
0 - 1 1 - 1.5 over 1.5	zinc	0.52	**	0.25	*	0.33	*
0- 0.2 0.3- 0.5 over 0.5	copper	0.30	**	0.16	*	0.16	*
0- 0.2 0.2- 0.5 over 1	boron	0.06	*	0.30	***	0.53	****
ratio of calcium to magnesium	calcium	321.48	***	366.36	***	321.70	***
needs to be more than 2 or 3	magnesium	40.08	**	35.94	**	40.03	**
should be less than potassium	sodium	16.30	*	132.27	***	422.84	*****
	sulfur	4.37	*	35.29	**	76.49	**
	molybdenum	n d	*	0.02	**	n d	*
	nickel	0.04	*	0.07	*	0.03	*
The following trace	aluminum	n d	*	n d	*	n d	*
elements may be toxic	arsenic	n d	*	n d	*	n d	*
The degree of toxicity	barium	1.42	*	1.08	*	1.00	*
depends upon the pH of	cadmium	n d	*	n d	*	n d	*
the soil, soil texture,	chromium	n d	*	n d	*	n d	*
organic matter, and the	cobalt	0.02	*	0.05	*	0.05	*
concentrations of the	lead	0.51	*	0.33	*	0.50	*
individual elements as	lithium	0.07	*	0.10	*	0.13	*
well as to their interactions.	mercury	n d	*	n d	*	n d	*
	selenium	n d	*	n d	*	0.43	*
The pH optimum depends	silver	n d	*	n d	*	n d	*
upon soil organic	strontium	2.98	*	5.60	**	6.65	**
matter and clay content-	tin	n d	*	n d	*	n d	*
for clay and loam soils:	vanadium	0.08	*	0.11	*	0.15	*
under 5.2 is too acidic							
6.5 to 7 is ideal	**Saturation Extract**						
over 8 is too alkaline	pH value	7.93	****	8.02	****	7.63	****
The ECe is a measure of	ECe (milli-	0.41	**	1.35	***	4.28	*****
the soil salinity:	mho/cm)		millieq/l		millieq/l		millieq/l
1-2 affects a few plants	calcium	26.6	1.3	46.5	2.3	177.3	8.9
2-4 affects some plants,	magnesium	3.4	0.3	5.8	0.5	12.4	1.0
> 4 affects many plants.	sodium	40.7	1.8	193.4	8.4	587.7	25.6
	potassium	9.5	0.2	15.6	0.4	25.0	0.6
	cation sum		3.6		11.6		36.1
problems over 150 ppm	chloride	4	0.1	59	1.7	814	22.9
	nitrate as N	4	0.3	8	0.6	55	3.9
	phosphorus as P	0.0	0.0	0.0	0.0	0.1	0.0
toxic over 800	sulfate as S	18.0	1.1	102.5	6.4	161.3	10.1
	anion sum		1.5		8.7		37.0
toxic over 1 for many plants	boron as B	0.13	*	0.48	***	0.84	****
increasing problems start at 4	SAR	2.0	**	7.1	****	11.5	*****
est. gypsum requirement-lbs./1000 square feet		3		22		72	
	infiltration rate inches/hour	slow		fair/slow		slow	
	soil texture	gravelly sand		gravelly sand		sand	
	lime (calcium carbonate)	yes		yes		yes	
	Total nitrogen, dry weight basis	0.029%		0.016%		0.024%	
	Total carbon, dry weight basis	0.086%		0.087%		0.246%	
	carbon:nitrogen ratio	3.0		5.6		10.4	
	organic matter based on carbon	0.17%		0.17%		0.49%	
	moisture content of soil	1.5%		1.9%		3.9%	
	half saturation percentage	11.8%		12.3%		14.5%	

Elements are expressed as mg/kg dry soil or mg/l for saturation extract.
pH and ECe are measured in a saturation paste extract. nd means not detected.
Analytical data determined on soil fraction passing a 2 mm sieve.

DISTRIBUTION

2 copies:	Mr. Brent Miyazaki RMT Inc. 4 West Fourth Avenue, Suite 303 San Mateo, CA 94402

QUALITY CONTROL REVIEWER

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

MD/GMD:cfp