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Dockets Unit
California Energy Commission
1516 Ninth Street, MS 4
Sacramento, CA 95814

DOCKET	
07-AFC-3	
DATE	AUG 22 2008
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RE: CPV Sentinel Energy Project
Application for Certification 07-AFC-3

On behalf of CPV Sentinel, LLC, a limited liability company and the applicant for the above-referenced CPV Sentinel Energy Project, we are pleased to submit five print copies and one CD of the December 2007 Geological/Seismic Hazards Evaluation for the Proposed CPV Sentinel Energy Project. This document was referenced in the Comments on the Preliminary Staff Assessment submitted to Dockets yesterday via email.

This document is being submitted to the CEC for docketing.

URS Corporation

Dale Shileikis
Vice President

Enclosures

**GEOLOGICAL/SEISMIC HAZARDS EVALUATION
PROPOSED *CPV SENTINEL ENERGY PROJECT*
NORTH PALM SPRINGS, RIVERSIDE COUNTY, CALIFORNIA**

FOR CPV SENTINEL, LLC

DECEMBER 5, 2007

URS PROJECT NO. 28067340

TABLE OF CONTENTS

Section	Page No.
1.0 INTRODUCTION.....	1
2.0 PROPOSED DEVELOPMENT	2
3.0 PURPOSE AND SCOPE OF SERVICES	3
4.0 FIELD EXPLORATION PROGRAM.....	5
5.0 LABORATORY TESTING	6
6.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS	8
6.1 REGIONAL GEOLOGY	8
6.2 LOCAL GEOLOGY	8
6.3 FAULTING AND SEISMICITY	9
7.0 GENERAL SITE CONDITIONS	12
7.1 SURFACE CONDITIONS	12
7.2 SUBSURFACE CONDITIONS	12
7.3 GROUNDWATER	12
8.0 GEOLOGY AND SEISMIC HAZARDS	13
8.1 GEOLOGICAL AND SEISMIC HAZARDS.....	13
8.2 GEOLOGIC HAZARDS	13
8.3 SEISMIC HAZARDS	13
9.0 DISCUSSIONS AND RECOMMENDATIONS	16
9.1 GENERAL.....	16
9.2 EARTHWORK.....	16
9.2.1 SITE PREPARATION.....	16
9.2.2 OVEREXCAVATION	17
9.2.3 FILL PLACEMENT AND COMPACTION	17
9.3 TEMPORARY EXCAVATIONS.....	19
9.4 SEISMIC DESIGN CONSIDERATIONS	19
9.5 FOUNDATION DESIGN.....	20
9.5.1 ALLOWABLE BEARING CAPACITY	20
9.5.2 SETTLEMENT.....	21
9.5.3 LATERAL RESISTANCE	21
9.6 SLABS-ON-GRADE.....	21
9.7 CORROSIVITY.....	22
9.8 PAVEMENT.....	23

TABLE OF CONTENTS
(Continued)

Section	Page No.
9.9 PERCOLATION TESTS	24
10.0 DESIGN REVIEW	25
11.0 CONSTRUCTION MONITORING.....	26
12.0 LIMITATIONS	27
13.0 REFERENCES	28

FIGURES

Figure 1 – Project Location Map
Figure 2 – Local Geology Map
Figure 3 – Boring Location Map
Figure 4 – Regional Seismicity Map

APPENDICES

Appendix A – Logs of Exploratory Borings
Appendix B – Laboratory Test Standards and Results



**REPORT OF
GEOTECHNICAL INVESTIGATION AND
GEOLOGICAL/SEISMIC HAZARDS EVALUATION
PROPOSED *CPV SENTINEL ENERGY PROJECT*
NORTH PALM SPRINGS, RIVERSIDE COUNTY, CALIFORNIA
FOR CPV SENTINEL LLC
URS PROJECT NO. 28067340**

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation and geological/seismic hazards evaluation performed by URS Corporation (URS) for the proposed CPV Sentinel Energy Power Plant Project, generally located East of Highway 62 and north of Interstate 10. The L-shaped site is specifically bounded on the south by Powerline Road, on the west by undeveloped land and an Edison substation, on the north by undeveloped land, and on the east by a homestead and property that has been developed for electricity generating windmills in North Palm Springs, California. We have performed the geotechnical investigation and geological/seismic hazards evaluation as requested and authorized by CPV Sentinel, LLC based on an authorization agreement dated August 11, 2007. The location of the site relative to existing topographic features is shown in the Project Location Map, Figure 1.

This report includes the results of a geological/seismic hazards study and our geotechnical recommendations for design and construction of the project. Conclusions and recommendations presented in this report are based on our review of existing data in our file as well as the subsurface conditions encountered at the location of our exploratory boring. Soil conditions were interpreted at the exploration locations only and should not be extrapolated to other areas without prior review of the Geotechnical Engineer of Record.

This investigation did not include any assessment for the potential of soil and/or groundwater contamination.

2.0 PROPOSED DEVELOPMENT

The development is a new 850 megawatt electrical generating facility power plant that will consist of cooling towers, fuel compressor building, combustion turbine units, switchyards, storage tanks, and a stormwater pond. This project will also include related parking, driveways, and underground utilities. We understand that the grading for the project may consist of maximum cuts and fills to depths of approximately 22 and 23 feet, respectively. A layout of the site showing the location of the current investigation is shown on the Boring Location Map, Figure 3.

Structural loads have not been provided at the of this memo preparation, although we understand that the cooling towers are typically the heaviest loads for this type of project. The overexcavation and footing design should be reassessed when the loading conditions are provided by the structural engineer. The project is expected to use standard construction for the foundations, tanks and towers. Information on total dead and live loads for the proposed development is not available. However, for the purpose of developing recommendations contained herein, we have assumed column loads to be on the order of 200 kips and wall loads to be on the order of 2- kips per foot.

3.0 PURPOSE AND SCOPE OF SERVICES

The purpose of our investigation was to explore and evaluate the subsurface conditions at the site, identify the key geotechnical and geologic/seismic issues that could potentially impact the proposed project and develop geotechnical recommendations for design and construction of the project. Our scope of services was performed in general accordance with our proposal dated June 27, 2007, and included performing the following tasks:

- Review geological and geotechnical data in our files pertinent to the project site;
- Review and analyze geological and seismic information for the project site;
- Conduct a site reconnaissance by a field geologist to observe the existing conditions and to lay out the location of proposed boring;
- Utilize a private subsurface utilities locator company to identify subsurface utilities and obtain clearance for drilling at the site;
- Explore the subsurface conditions at the site by drilling and sampling eighteen (18) geotechnical boring to depths of 50 feet;
- Perform laboratory tests on selected soil samples obtained from the borings to evaluate index properties of the soils;
- Perform engineering analyses to develop geotechnical recommendations for design and construction of the proposed project; and
- Prepare this report that includes:
 - A brief description of the project;
 - Description of field exploration and laboratory testing procedures;
 - Logs and location of soil borings, including depth of groundwater if encountered;
 - Laboratory test results;
 - Regional and local geology and results of the aerial photograph review;
 - An evaluation of subsurface conditions and controlling engineering properties of the subsurface soils at the site;
 - Potential seismic and geologic hazards, including settlement, expansive soil, liquefaction, lateral spreading, seismic shaking, etc.;
 - Recommended type and depth of foundations for structural support;
 - Geotechnical parameters for design of building foundations, including the allowable bearing capacity and estimated settlement (initial and after one (1) year) for structural design purposes;
 - Seismic shaking design parameters, including the Seismic Design Parameters (IBC, Chapter 16)
 - Site Class (A, B, C...)
 - Short Period Maximum Spectral Response Acceleration, S_s
 - One Second Period Maximum Spectral Response Acceleration, S_1
 - Recommendations for design of slabs-on-grade including the Modulus of subgrade reaction (psi/in per inch);

- Pavement design for various loading criteria (paved and unpaved);
- Lateral earth pressures and resistance to lateral loads, including coefficients of sliding friction and passive earth pressures. Active pressure and friction resistance for retaining structures are also be included;
- Recommendations concerning any unusual soil conditions encountered;
- Earthwork recommendations, including preparation for support of foundations and floor slabs, compaction requirements, and comments on suitability of on site materials for use as backfill;
- Specific general site and earthwork recommendations will also include:
 - Clearing and grubbing requirements
 - Soil excavation limits and slopes
 - Shrink/swell factors to apply to the cut/fill
 - Depth and lateral limits of over-excavation to remove unsuitable materials
 - Subsidence factors
 - Temporary and permanent slope protection requirements for slopes in excess of 3:1 (H:V) (localized reaches of 2:1 and a limited length of 1.7:1)
 - Rock excavation requirements
- Corrosion potential and sulfate attack on concrete;
- Suggested items to include in specifications for earthwork and foundation construction, including Construction recommendations for 1) on-site and/or import fill, 2) excavation and compaction equipment, 3) fill material moisture conditioning, placement, and compaction, and 4) proof-rolling, in-place density testing, and other quality control measures;
- Percolation tests/results/design criteria for the leach field (B-17) and retention pond (B-18) areas.

4.0 FIELD EXPLORATION PROGRAM

The field exploration program was performed from September 24 through September 27, 2007, under the technical supervision of an engineer from our Rancho Cucamonga office. The subsurface conditions at the site were explored by drilling and sampling eighteen borings to a maximum total depth of about 50 feet below the existing grades using a truck-mounted drilling rig, equipped with 8-inch diameter hollow-stem augers. The locations of the borings are shown on the Boring Location Map, Figure 3.

Test pits were excavated on November 12, 2007 in the areas of the proposed project site where drilling refusal was encountered prior to reaching proposed footing depths. A total of 5 test pits were excavated, logged and then backfilled.

Relatively undisturbed soil samples were obtained using a Modified California Split-spoon Sampler in the borings at a 10-foot interval. The sampler was driven 18 inches into the subsurface soils using a 140-pound hammer falling 30 inches. Standard Penetration Tests (SPTs) were also performed (per ASTM D 1586) between drive samples for the boring. All blow counts were recorded at 6-inch intervals. The number of blows required to drive the sampler the final 12 inches is recorded on the logs of boring. Upon completion of the drilling activities, all boreholes were backfilled with soil cuttings. Our representative maintained logs of the borings and classified the soils encountered according to the Unified Soil Classification System. A Key to the Log of Boring and description of the Unified Soil Classification System is presented in Figure A-0 of Appendix A. The logs of exploratory borings and the test pits are presented in Appendix A.

5.0 LABORATORY TESTING

Soil samples obtained from the boring were packaged and sealed in the field to prevent moisture loss and disturbance and transported to our Los Angeles laboratory where they were further examined and classified. Descriptions of the laboratory tests performed are provided below.

Moisture contents and density tests were performed on twenty –one selected soil samples in accordance with ASTM Test Methods D 2216 and D 2937, respectively. The results of these tests are presented on the Logs of Borings.

Percent passing No. 200 sieve tests (per ASTM D 1140) were performed on fifteen samples to aid in classification of the samples and in correlation with other properties. The results of these tests are presented in Table 1 of Appendix B.

Ten particle size analyses (ASTM D 42 and D 1140) were performed to aid in classification of the samples and in correlation with other properties. The results are presented as Figures 1 through 10 of Appendix B.

Two, one-dimensional (saturated) collapse tests (ASTM D-5333) were performed on undisturbed samples to evaluate the collapsibility characteristics of the on-site soils. The results of the tests are presented as Figures 11 and 12 of Appendix B.

Two direct shears and two remolded direct shear tests were performed on both in-situ and remolded samples respectively. A direct shear test determines the soils shear strength parameters of the soils sample in accordance with ASTM D-3080. The sample was soaked to near saturation prior to testing. The results are presented on Figures 13 through 16 of Appendix B.

One expansion index test (ASTM D4829-07 Standard Test Method for Expansion Index of Soils) was performed on a bulk soil sample. The expansive characteristics of the soils are determined after saturation. The results are presented in Table 2 of Appendix B.

Two maximum density tests (ASTM D1557-00) were performed on bulk soil samples to determine the maximum dry unit weight and optimum moisture content to determine relative compaction. The results are presented in Table 3 of Appendix B.

Furthermore, a suite of soil corrosivity tests (Chemical (Corrosion) Test (Resistivity, Sulfate, pH and Chloride) (California Test Methods 417, 422, 532, and 643)) were performed on five soil samples obtained from our field exploration. The test results are discussed in Section 9 of this report and are presented in Table 4 of Appendix B.

Lastly, one R-values test (per ASTM D 2844/California Test Method 301) was performed on a bulk sample collected during the geotechnical investigation. The result of the test is presented in Table 5 of Appendix B.

6.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

6.1 REGIONAL GEOLOGY

The site lies at the boundary of the San Gorgonio Pass to the west, and the Coachella Valley to the east. The Desert Hot Springs area is in the upper Coachella Valley at the juncture of three natural geomorphic provinces of California—the Transverse Ranges, the Peninsular Ranges, and the Colorado Desert. The San Gorgonio Pass forms the boundary between the Transverse Ranges geomorphic province to the north, and the Peninsular Ranges province to the south. The Transverse Ranges are characterized by east-west trending mountain ranges which include the San Bernardino Mountains, located to the north of the site. The Peninsular Ranges are characterized by northwest-southeast trending mountain ranges and valleys. The San Jacinto Mountains to the south of the site are part of the Peninsular Ranges province. The Coachella Valley is located immediately to the east of the site. The Coachella Valley is part of the tectonically active Salton Trough, which is an internally draining basin that extends from the San Gorgonio Pass southeast to the Colorado River delta near the Mexican border. The project site is located about 100 miles east of Los Angeles and is principally in north central Riverside County (Proctor, 1968).

The foothills of the San Bernardino mountains, including the vicinity of the site, are underlain by alluvial deposits of various ages, ranging from recent stream channel deposits, to Pleistocene and older alluvium, to Tertiary sandstones and conglomerates. All unmetamorphosed sedimentary and igneous deposits are late Cenozoic in age, ranging from Late Miocene fanglomerate and basalts to recent alluvium and sand accumulations. Only the lower Pliocene Imperial Formation is marine; it affords the best clues to the ages of the unconformably underlying Coachella/Split Mountain Formation and the conformably overlying Palm Springs and Canebrake/Painted Hill Formations. Unconformably above these last-named rock units are the upper Pleistocene Cabezón Fanglomerate/Ocotillo Conglomerate.

The San Andreas Fault Zone is the most significant potential seismic source in the vicinity of the proposed project. In the eastern San Gorgonio Pass and the upper portion of the Coachella Valley, the San Andreas Fault Zone is comprised of the Garnet Hill, the Banning, and the Mission Creek Faults. The Garnet Hill Fault is the least well understood of these faults. It is located along the base of Whitewater Hill just south of the site. All of these branches of the San Andreas Fault are included within the Alquist-Priolo Earthquake Fault Zones (A-P Zones) as established by the California Geological Survey.

6.2 LOCAL GEOLOGY

The proposed CPV Sentinel Energy Project site is covered by a thin layer of recent sand and silt, underlain by Pleistocene alluvium, overlying the Pleistocene Cabezon Conglomerate at an assumed depth of 80 to 100 feet, north and south of the Banning Fault (Figure 4). The uplifted alluvial and terrace deposits are derived from the erosion of the San Bernardino Mountains to the north of the sites and consist of fine- to coarse-grained sand with gravel, cobbles, and some boulders. Depth to groundwater is estimated to be greater than 160 feet north of the Banning Fault (RCS, 2000) and greater than 300 feet south of it (Rasmussen, 1981). The encountered sediments range in size from fine sand to large boulders and include unweathered sands, silts, and gravel. The local geology is depicted in Figure 3.

6.3 FAULTING AND SEISMICITY

The site is located within an active seismic area. According to the California Geological Survey, the site is not currently located within a designated Alquist-Priolo Earthquake Fault Zone (Hart, 1997). However, several active faults have been mapped within the vicinity of the site.

There have been approximately 56 historical earthquakes of M 5.5 or greater in the Southern California region. Historically, there have also been several major earthquakes in the region such as the 1857 Mw 7.9 Fort Tejon and the 1982 Mw 7.8 Imperial Valley earthquakes. Earthquakes of this magnitude can pose significant ground-shaking hazard to the project area. A review of historic earthquake activity indicates significant earthquakes of MW 6.0 or greater near the site. Several significant earthquakes include following:

The Mw 7.1 Hector Mine Earthquake occurred on October 16, 1999. The Hector Mine, an open pit quarry 14 miles (22 km) northwest of the epicenter is the largest earthquake to strike the area since the M 7.3 Landers earthquake of June 28, 1992. Location: 34° 36' N, 116° 16' W (SCEC, 2007).

The January 17, 1994 Mw 6.7 Northridge Earthquake occurred on a blind thrust fault (Northridge Thrust –also known as Pico Thrust), and produced the strongest ground motions ever instrumentally recorded in an urban setting in North America. Damage was wide-spread, sections of major freeways collapsed, parking structures and office buildings collapsed, and numerous apartment buildings suffered irreparable damage. Location 34° 12.80' N, 118° 32.22' W (SCEC, 2007)

The June 28, 1992, Landers Earthquake was a Mw 7.3 quake that was preceded a few months earlier by the Joshua Tree M6.3 earthquake on April 22 and followed by the Big Bear M6.4 earthquake at 8:05 a.m. later that day. Three items of notable interest came out regarding this quake: 1) the quake ruptured disconnected surface traces of several known faults (Johnson Valley, Landers, Homestead Valley, Emerson, and Camp Rock) and several other unknown faults

for a distance of 53 miles; 2) the displacement was two to three times larger than generally anticipated for these faults, with maximum horizontal offsets of 15–20 feet across a zone 30–60 feet wide; and as a consequence, 3) the magnitude was much larger for these individual faults than envisioned by seismologists and geologists. Location 34° 13' N, 116° 26' W (SCEC, 2007)

While technically an "aftershock" of the Landers earthquake (indeed, the largest aftershock), the June 28, 1992, Mw 6.4 Big Bear Earthquake occurred over 40 km west of the Landers rupture, on a fault with a different orientation and sense of slip than those involved in the main shock — an orientation and slip which could be considered "conjugate" to the faults which slipped in the Landers rupture. Location 34° 12' N, 116° 49.6' W (SCEC, 2007)

Preceded by a magnitude 4.6 foreshock, the April 22, 1992 the Mw 6.1, Joshua Tree Earthquake Joshua Tree earthquake raised some alarms due to its proximity to the San Andreas Fault. Location 33°57.6' N, 116°19' W (SCEC, 2007)

The Regional Fault and Epicenter Map is presented on Figure 4.

Intense shaking from earthquakes generated on nearby faults poses the greatest seismic risk to the site. A short list of several nearby faults is presented in the table below:

Fault	Estimated Closest Distance from Site (mi)	Fault Type	Maximum Credible Earthquake (Mw)
San Andreas - Southern (Banning)	.26	Strike-Slip	7.4
San Jacinto	23	Strike-Slip	7.5
Elsinore	45	Stike-Slip	7.4
Imperial	56	Strike-Slip	7.4

Fault listing based on reference URS, 2007.

The potential for a major earthquake occurring in Southern California exists which may result in loss of life, injury, or displacement of many thousands of persons. The precise time of such an event cannot be accurately predicted. Four fault systems that could affect the site include the San Andreas, Imperial, San Jacinto and Elsinore. The proposed project is located approximately 1 mile (1.7 km) from the mapped surface trace of the Banning segment of the San Andreas Fault as characterized by Jennings (1992) and the Alquist-Priolo Earthquake Fault Zones Desert Hot Springs map (CDMG, 1980). This fault last ruptured on July 8, 1986 during the North Palm Springs earthquake (M 6.0). Relocation of aftershocks from this earthquake indicated that the section of the fault that ruptured, dips to the northeast at about 45 degrees (Magistrale and Sanders, 1996). Based on the fault geometry, the proposed project site is located on the foot wall of the fault. The aftershocks were limited to a depth range of about 3 to 9 miles (5 to 15 km),

which corresponds to the range of significant subsurface strike-slip motion determined from inversions of the recorded strong ground motion time histories (Mendoza and Hartzell, 1988). Surface cracking and fractures were mapped after the earthquake in the epicentral region. A zone of surface fracturing was mapped along the surface trace of the Banning Fault from Whitewater Canyon to the intersection of Dillon Road and the Banning Fault. However, these surface fractures were not continuous over this entire 5.6-mile (9-km) length. The largest fracture exhibited 0.35 inch (9 mm) of right lateral displacement (Sharp et al., 1986). Other secondary ground fractures were noted for this earthquake along with other earthquakes in the region (Williams et al., 1988). Additional information concerning this fault can be found the report, “Application for Certification for CPV Sentinel Energy Project, Riverside County, California, June 25, 2007”. Specifically the Section 7-15, “Geologic Hazards and Resources”.

7.0 GENERAL SITE CONDITIONS

7.1 SURFACE CONDITIONS

The center of the property has a coordinate of West -116 34' 20.09" degrees for longitude and North 33 56' 11.87" degrees for latitude.

The site has a surface elevation of ranging between approximately 1,045 and 1,125 feet above mean sea level (MSL). The site is relatively flat at the southern end however is gradually increasing in slope towards the northern end. Denser subgrade materials (outcrops) were also encountered within the northern portion of the project site. The local topographic gradient is approximately 2 percent towards the southwest.

Within the site area, there are no water features. However, within the local vicinity there are many mapped named and unnamed "washes". The site is located between the named Garnet and Palm Springs Washes.

7.2 SUBSURFACE CONDITIONS

Based on our field explorations and testing, the near surface soil at the site mostly consists of interlayered Silty Sands (SM), Sands (SP), Gravelly Sands (SP-GP) with cobbles and boulders to a depth of approximately 51 feet (depth of deepest boring). There are also localized lenses of finer grained materials within the upper 10 feet of subgrade. There are large cobbles (3 inches to 12 inches in diameter) and boulders (greater than 12 inches in diameter) encountered to the full depth of the borings.

7.3 GROUNDWATER

Historically deep water conditions (greater than 40 feet depth) have existed in the area. Groundwater was not encountered 50 feet below ground surface within the exploratory hollow-stem auger borings advanced during our subsurface investigation. In some areas, especially near the front of the San Bernardino mountains, ground-water pumping is limited by the depth to water which commonly approaches 100 m and may exceed 300 m. We understand from conversation with Mission Springs Water District that their closest wells are at depths of greater than 300 feet.

8.0 GEOLOGY AND SEISMIC HAZARDS

8.1 GEOLOGICAL AND SEISMIC HAZARDS

Geological and seismic hazards are those hazards that could impact a site due to the surrounding geologic and seismic conditions. Geological hazards include landsliding, erosion, subsidence, volcanic eruptions, and poor soil conditions. Seismic hazards include phenomena that occur during an earthquake such as ground shaking, ground rupture, and liquefaction. The potential impact of these hazards to the site has been assessed and is summarized in the following sections. Our assessment of these hazards was based on guidelines established by the California Division of Mines and Geology (1986 and 1997), and outlined in CDMG Special Publication 117 and Note 48. The former California Division of Mines and Geology is currently the California Geological Survey.

8.2 GEOLOGIC HAZARDS

Geologic hazards such as landslides, erosion, subsidence, poor soil conditions and volcanic eruptions have a very low potential of impacting the site. No significant slopes are planned for the subject site, nor is there any slope directly adjacent to the described site. As such, there is minimal risk for landslides under normal conditions. Most of the proposed site will be covered with asphalt or concrete or will be graded and will not be readily susceptible to erosion. Subsidence beneath proposed site due to groundwater withdrawal is unlikely to occur because this phenomenon has not been documented within the vicinity within the historic past, and an increase in such activities is not anticipated for the future.

8.3 SEISMIC HAZARDS

Seismic hazards are those hazards associated with earthquakes such as ground shaking, ground rupture, liquefaction, differential compaction or seismic settlement, lateral spread, and other phenomena. The proposed project site, like most sites in southern California, is most susceptible to ground shaking generated during earthquakes on nearby faults. The intensity of ground shaking, or strong ground motion, is highly dependent upon on the distance of the fault to the site, the magnitude of the earthquake, and the underlying soil conditions.

Primary Ground Rupture

Primary ground rupture is ground deformation that occurs along the surface trace of the causative fault during an earthquake. Based on our review of historic aerial photographs of the site and the

available geologic data, there is no evidence suggesting that active faults cross through the site. The site is not located within an Alquist-Priolo Earthquake Fault Zone (Hart and Bryant, 1997). Therefore, primary ground rupture is not a significant concern.

Strong Ground Motion

The proposed project will be subjected to periodic seismic shaking. Strong ground motion occurs as energy is released during an earthquake. The intensity of ground motion is dependent upon the distance between the site and the earthquake, the magnitude of the earthquake, and the geologic conditions underlying and surrounding the site. Earthquakes occurring on faults closest to the site would most likely generate the largest ground motions.

As part of our investigation, the seismic design considerations have been presented for the proposed site. The results of this assessment are presented in Section 9.4 of this report.

Liquefaction Potential

Liquefaction is a phenomenon whereby saturated granular (coarse-grained) materials lose their inherent shear strength due to increased pore water pressures, which may be induced by cyclic loading such as that caused by an earthquake. A low relative density of the granular materials, shallow groundwater, long duration and high acceleration of seismic shaking are some of the factors favorable to cause liquefaction.

Groundwater at the site is historically deep (greater than 40 feet below ground surface). Groundwater was not reported in the boreholes within 50 feet of the ground surface. Based on the historically deep groundwater, the liquefaction susceptibility at this location is rated as low.

Historic liquefaction has not been reported in the site vicinity, nor has evidence been observed of paleo-seismic liquefaction. Accordingly, the site area is not zoned for potential liquefaction hazard by the State of California as an area where conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Lateral Spread Displacement

According to publications by Bartlett and Youd, 1999, conditions such as free-face, sloping ground surface and liquefiable layers are factors contributing to lateral spread displacement of the ground during strong motion events. The ground surface at the site is relatively level, therefore, risk of lateral spread displacement is low.

Seismically-Induced Settlement and Differential Compaction

Seismically induced settlement and differential compaction occurs when relatively soft or loose soils experience a reduction in strength caused by strong ground motion. Soil conditions subject to these hazards include porous, poorly-cemented soils, or areas where weak soils of variable thickness overlie firm soil or bedrock. The site is underlain by mostly dense to very dense native soils that are not prone to significant settlement under earthquake loading conditions. The magnitude of seismically-induced settlement is estimated to be on the order of about one inch, under the loading of upper-bound peak ground acceleration.

Earthquake Induced Flooding

Earthquake induced flooding occurs when nearby water retaining structures, such as dams or storage tanks, are breached or damaged during an earthquake. According to General Plan Hazard Overlays of the San Bernardino County Land Use Plan, the site is not within close proximity to a designated dam inundation hazard zone resulting from the potential failure of retaining structures upstream of the site.

Other Seismic Hazards

Other seismic hazards include tsunamis, seiches, and earthquake-induced landslides. These hazards do not exist at the site due to the site's distance from the Pacific Ocean and the absence of reservoirs or lakes within the vicinity of the site.

Other Hazards

According to the FIRM Flood Insurance Rate Map (Panel # 0602450900D) this site is located within Zone C which is designated by FEMA as being within an area of minimal flooding. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk. The site is specifically not located within a designated year flood zone. Additionally, the site area is subject to local flash flooding. Subsidence beneath proposed site due to oil or groundwater withdrawal is unlikely to occur because this phenomenon has not been documented within the vicinity within the historic past, and an increase in such activities is not anticipated for the future.

9.0 DISCUSSIONS AND RECOMMENDATIONS

9.1 GENERAL

Based on the results of our geotechnical investigation and our understanding of the project requirements, the site can be developed for its intended purpose provided the recommendations in this report are incorporated in the design and implemented during earthwork and construction of the project.

With respect to geological and seismic hazards, no faults are known to exist within the project site; accordingly, the possibility of surface rupture of the site due to faulting is remote. Although the site could be subject to significant ground shaking in the event of a major earthquake, this hazard is common to Southern California, and possible damage caused by the shaking can be reduced by proper structural design and construction. The possibility of liquefaction occurring within the underlying soil is considered remote.

The proposed structures may be supported on spread footings. During the current investigation, the near-surface soils (upper 10 feet of subgrade soils) were found to be mostly medium dense to dense with isolated locations of loose soils. These soils have a low compressible potential when subjected to structural loads. Groundwater is well below the depth of footings and influence zone and is not anticipated within the planned excavation. Dewatering should not be required during construction.

Recommendations for earthwork, foundation design, seismic design and retaining structure design, floor slab support, pavement design, and corrosion protection considerations are presented below.

9.2 EARTHWORK

9.2.1 Site Preparation

Prior to site grading, any debris, organic materials, deleterious materials, loose native soil and uncertified fills should be removed and disposed of outside the construction limits under observation by the Geotechnical Engineer of Record. All existing foundation elements, if any, should be removed. All active utilities within the construction areas should be identified, marked and relocated, while abandoned utility lines should be removed or backfilled.

9.2.2 Overexcavation

In order to provide adequate support for proposed foundation and limit foundation settlement, the building areas should be overexcavated five (5) feet below the bottom of the proposed footings. The overexcavation should extend at least five (5) feet outside the perimeter of the buildings' footprints. In general, the bottom surfaces of all excavations should be scarified to a depth of at least twelve (12) inches, moisture conditioned, if necessary, and compacted to 95 percent relative compaction (as per ASTM Standard D1557) at near-optimum moisture condition prior to placing compacted fills. Following the scarification process, the subgrade should be observed, proofrolled, probed and tested as appropriate. Proofrolling should involve making several passes over the subgrade with heavy, rubber tired equipment. All identified loose or soft zones should be compacted in-place or excavated and replaced with properly compacted backfill to the satisfaction of the Geotechnical Engineer of Record in order to establish a competent subgrade on which to place compacted fill. The fill should be prepared and placed in accordance with the following recommendations in this section.

Subgrade underlying proposed surface pavement and hardscape area should be processed by in-place removal and recompaction to a minimum depth of 12 inches. The subgrade should be proof-rolled and probed after excavation, and localized loose or soft zones should also be removed and filled with compacted fill. The standard of relative compaction is recommended to be 95 percent.

Localized loose or soft zones should also be removed and filled with compacted fill.

9.2.3 Fill Placement and Compaction

Building pad fill, general area fills, and utility trench backfills may be placed during construction of this project. All fills placed within building pad areas and for support of structural loads should be placed in loose lifts not exceeding 8 inches in thickness, brought to within ± 3 percent of the optimum moisture content in-place, and compacted to at least 95 percent of the maximum dry density per ASTM D 1557 using mechanical compaction equipment. Densification by flooding or jetting should not be allowed. All compacted fills should be tested by a representative from the office of the Geotechnical Engineer of Record, and the results of tests should be presented in a fill compaction report.

The on-site soils within the top 5 feet as encountered in the exploratory borings are predominantly sands and silts, with a low expansion potential. From a geotechnical standpoint,

these on-site soils are re-usable as structural fill for the project. Any oversized materials greater than 6 inches, should be removed from the fill or placed in windrows.

If import soil is needed, the import materials should be predominantly granular and non-expansive, less than 6 inches in any dimension and be free of hazardous, organic and inorganic debris. All import soils should be observed and tested by the Geotechnical Engineer of Record prior to their use in order to evaluate their suitability. All imported soils should be inspected and approved at the borrow site by the Geotechnical Engineer of Record and tested prior to its import.

According to the available proposed grading information, there will be significant slopes along the northern portion of the project site. During construction, efforts should be made to protect the slopes from excessive watering and disturbance. Large equipment should not be parked or mobilized along the top of the slopes. It is also recommended that a brow ditch is constructed along the top of the slope to direct water flows. When the final grading design is completed, it is recommended that the Geotechnical Engineer review the plans to provide specific slope construction recommendations.

9.2.3.1 Oversized Materials

Oversized materials were encountered during the exploration drilling. As previously stated, material over 6 inches should be removed from the engineered fill. Depending on the final grading plan, there may be locations within the grading section, especially within the areas of the cuts, where significant larger materials will be encountered. Rock fragments or rocks greater than 6 inches should be placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. Acceptable methods typically include windrows. Oversized materials should not be placed within the range of excavation for foundations, utilities or paving. Rock placement should be kept away from slopes at a minimum distance of 15 feet, to facilitate compaction near the slope.

9.2.3.1 Shrinkage/Swell

The shrinkage factor for earthwork is expected to range from 10 to 20 percent for the upper excavated or scarified site soils. This estimate is based on compactive effort to achieve an average relative compaction of about 92% and may vary with contactor methods. The greatest factor in this estimate is the quantity of oversized materials that will be encountered. Subsidence is estimated to be less than 0.2 feet. Losses from site clearing and removal of existing site improvements may affect earthwork quantity calculations and should be considered.

9.3 TEMPORARY EXCAVATIONS

All temporary excavations should comply with the current California and Federal OSHA requirements, as applicable. Due to the low-cohesion nature of some of the on-site soils, we anticipate sloughing and/or caving for any vertical excavations greater than 4 feet. Therefore, all cuts greater than 4 feet in depth should be sloped and/or shored. For shoring utility trench excavations, the subsurface soils should be classified as Type C in accordance with OSHA regulations. The following table summarizes the excavation slopes for various excavation depths.

Excavation Depth (feet)	Required Excavation Support
Less than 4	Vertical
4 to 20	1:1 slopes
Over 20	1.5:1 slopes or shoring Required

Trenches in 95 percent compacted fill may be cut vertically up to 5 feet. This should be confirmed in the compaction report.

During wet weather, runoff water should be prevented from entering the excavation, and collected and disposed of outside the construction limits. To prevent runoff from adjacent areas from entering the excavation, a perimeter berm should be constructed at the top of the slope. Heavy construction equipment, building materials, excavated soil stockpiles and vehicle traffic should not be allowed near the top of the slope within a horizontal distance equal to the depth of the excavation.

9.4 SEISMIC DESIGN CONSIDERATIONS

The most significant geologic hazard at the proposed project site is strong ground shaking due to an earthquake. The site has experienced at least moderate ground motions in the past and will in the future. Blake (2004) estimates that the ground shaking of an M 7.4 earthquake along the San Andreas fault could produce a peak bedrock acceleration of up to 0.70 g (rounded up, g = acceleration due to gravity) in the vicinity of the proposed project site. This is the maximum considered earthquake (MCE) event with ground motions associated with a 2,500-year mean return period or a 2 percent probability of exceedance in 50 years. This would affect the plant site. Frisk (Blake 2000) was also performed resulting in the following:

- CBC (2001), Short Period Maximum Spectral Acceleration = 1.5g
- One Second Maximum Spectral Acceleration = 1.12g

Based upon the subsurface information at this site, the soil profile corresponds to a site profile type S_D in accordance with Table No. 16-J of the 2001 California Building Code (CBC). According to the Maps of Known Active Fault Source Zone Map (sheet O-33) prepared by the California Department of Conservation Division of Mines and Geology (1998), the site is located approximately .36 km (.22 miles) from the San Andreas (Banning) fault zone, which is a Type A fault. The San Andreas is a Type A fault zone. Based on the location of this site to the San Andreas, a seismic source Type A should be used for the site when selecting a near source factor from Tables 16-S and 16-T of the 2001 CBC and 1997 Uniform Building Code (UBC). In summary, based on our review of the available geotechnical and geological data, the seismic parameters for the site, according to 2001 CBC and 1997 UBC, are presented in the table below:

SEISMIC PARAMETERS	
Site Soil Profile Type	S_D
Fault Type	A
Distance to Fault ¹	0. km
Seismic Zone Factor (Z)	0.40
Seismic Coefficient (C_a)	0.60
Seismic Coefficient (C_v)	0.56
Near-Source Factor (N_a)	1.5
Near-Source Factor (N_v)	2.0

Notes: ¹Distance shown represents distance to seismic sources at depth and does not always represent distance to projections of fault planes at ground surface.

9.5 FOUNDATION DESIGN

9.5.1 Allowable Bearing Capacity

Heavily reinforced spread footings established on the compacted fill blanket as recommended in the previous section may be used for support of the project. Another option would be to design a mat foundation with thickened edges. An allowable bearing value of 4,000 pounds per square foot (psf) is recommended for a minimum of 24-inch wide footings placed at a depth of 18 inches below the lowest adjacent grade and may be increased by 10 percent for each additional foot of width or depth to a maximum value of 6,000 psf. This allowable bearing value is for dead plus live loads used in working stress design, and has included a safety factor of 3. It may be increased by one-third for momentary wind or seismic loads. The bearing capacity given is net allowable value, and the weight of the concrete may be neglected in computing dead loads. Edge pressure for any eccentrically loaded footing should not exceed the allowable bearing values given for permanent and temporary loads.

9.5.2. Settlement

Static Loads

Total static settlements of individual foundations will vary depending on the width of the foundation and the actual load supported. Based on an approximate maximum column load of 200 kips and an approximate wall load of 2 kips/ft, the total static settlements of spread footings designed and constructed in accordance with the preceding recommendations are anticipated to be on the order of one inch. Differential settlements between similarly loaded adjacent footings may be assumed to be half of the total settlement.

Static settlements will primarily be due to elastic compression of the foundation subgrade materials. Settlements of the foundations are generally expected to occur immediately after initial application of the design loads. As a precaution, structural and utility connections to new construction supported on shallow foundations should be deferred until after the majority of the dead loads have been applied.

Seismic Settlement

Based on the liquefaction analysis, the total seismic settlement of spread footings designed and constructed in accordance with the preceding recommendations are anticipated to be on the order of two inches. Differential settlements between similarly loaded adjacent footings may be assumed to be 1.3 inches.

9.5.3 Lateral Resistance

Resistance to lateral loads may be provided by frictional resistance between the bottom of concrete footings and the underlying soils and by passive soil pressure against the sides of the footings. The allowable coefficient of friction between poured-in-place concrete footings and the underlying soils may be taken as 0.4. Allowable passive pressure available in compacted fill may be taken as equivalent to the pressure exerted by a fluid weighing 250 pounds per cubic foot (pcf). The above-recommended values include a factor of safety of at least 1.5; therefore, frictional and passive pressure resistance may be used in combination without reduction.

9.6 SLABS-ON-GRADE

All site preparation and earthwork below the slab should be performed in accordance with the preceding recommendations. All floor slabs founded on compacted fill should be least 6 inches thick and should be reinforced with a minimum of ½-inch diameter (#4) deformed reinforcing

bars spaced a maximum of 24 inches each way, while the final design of slab and reinforcement should be determined by the project structural engineer. As a general requirement, all slabs-on-grade should be supported on a minimum twenty -four inches of fill with very low expansion potential compacted to 95 percent of the maximum dry density per ASTM D 1557. As discussed in the preceding sections of this report, on-site materials should be suitable for this purpose. A moisture barrier is recommended under all floor slabs to be overlain by moisture-sensitive floor covering or equipment. A plastic or vinyl membrane may be used for this purpose and should be placed between two layers of moist sand, each at least 2 inches thick, to promote uniform curing of the concrete and to protect the membrane during construction. For design of slabs and rigid pavements and estimating their deflections, a modulus of subgrade reaction (k) of 100 pounds per square inch per inch deflection (pci) may be used.

9.7 CORROSIVITY

Preliminary testing for soluble sulfate for the site indicates a NEGLIGIBLE (2001 CBC Table 19-A-A-4) exposure to sulfate attack. As such, we anticipate that concrete in contact with site soils may be constructed with Portland Cement Type II. Appropriate testing should be performed at the completion of rough grading to confirm the type of cement required for concrete to be placed in contact with onsite soils.

The hydrogen-ion concentration (pH), indicating the degree of alkalinity or acidity, of the on-site soils was tested on a representative soil sample. The pH value of the selected soil samples were 8.6 and 7.8. Result of the laboratory chloride content tests performed indicate that the near-surface site soils have a chloride content of 45 and 105 ppm.

A laboratory electrical resistivity test was performed on two bulk soil samples and the results are 6,300 and 12,000 ohm-cm. A commonly accepted correlation between electrical resistivity and potential corrosivity toward ferrous metals is presented as follows:

Below 1,000 ohm-cm	Severely corrosive
1,000 to 2,000 ohm-cm	corrosive
2,000 to 10,000 ohm-cm	moderately corrosive
over 10,000 ohm-cm	mildly corrosive

Moderately corrosive site soils should be assumed in estimating the service life of the underground utility lines and for metal in contact with on-site soils. We recommend that a corrosion engineer be consulted to determine the most appropriate corrosion protection measures at the site.

The summary of corrosivity test result is provided in Appendix B.

9.8 PAVEMENT

The test result for R-value of the on-site soil is greater than 60, which is considered a high test value. The recommended pavement sections were calculated using this R-value. We recommend additional testing be conducted during construction to verify this value and the pavement recommendations. The traffic index (TI) assumed for each type of traffic loading condition should be verified by the project design engineers and updated recommendations will be needed if different TI's are considered more appropriate.

Loading Type	TI	Asphaltic Concrete/Aggregate Base (inches)
Passenger vehicle – Parking Area	4.0	3"/3.5"
Service Lanes – Trash and Fire	6.0	3"/4"
Heavy Use Driveways	9.0	4.0"/5.0"

The aggregate base should meet the requirement for Caltrans Class 2 Base with a minimum R-value of 78. The aggregate base should be compacted to at least 95 percent of the maximum dry density in accordance with ASTM D1557.

Pavement adjacent to the structures should be sloped away from the structures in all directions and ponding of water should not be allowed. Asphalt should be graded to direct surface water toward the street or, preferably, toward suitable catchment devices, which should be appropriately designed and maintained.

It should be noted that the above recommendations apply to parking lot, driveway and street areas only. Service pad and trash enclosures should be paved with portland cement concrete pavement. We recommend that the section consist of a minimum of 6 inches of reinforced portland cement concrete over 4 inches of Caltrans Class 2 Base with a minimum R-value of 78. The base should be compacted to at least 95 percent of the maximum dry density per ASTM D-1557.

The following table presents the recommended sections for unpaved pavements:

Loading Type	TI	Aggregate Base (inches)/Compacted Native(inches)
Passenger vehicle – Parking Area	4.0	4"/6"
Service Lanes – Trash and Fire	6.0	6"/6"
Heavy Use Driveways	9.0	9"/12"

9.9 PERCOLATION TESTS

Percolation tests were performed on two of the borings (B-17 and B-18). Boring B-17 was drilled to a total depth of 50-feet, eleven inches. Boring B-18 was drilled to a depth of 25 feet. The purpose of the percolation testing is to assist with the design of the required on-site stormwater runoff best management practice (BMP) which is expected to be a retention pond (infiltration basin). In each trial, the entire water column percolated into the surrounding subgrade. A total of approximately 50,000 gallons of water was utilized for the tests. Based on this information and the general soil classification, the permeability factor (k) for this site is described as follows:

Rate	Feet/minute
High (in-situ)	2.0

Value from Army Corp of Engineers Permeability Table

The two in-situ field test results show high rates of permeability at those locations. Depending on the grading performed on this project, it is possible that the rate could decrease if fine-grained import soils are brought onto the site for engineered fill. It is also recommended that minimal grading occur in the area of the infiltration pond in order to maintain maximum rates.

10.0 DESIGN REVIEW

The geotechnical aspects of the project should be reviewed by the Geotechnical Engineer of Record during the design process. The scope of services may include assistance to the design team in providing specific recommendations for special cases, reviewing the foundation design and evaluating the overall applicability of the recommendations presented in this report, reviewing the geotechnical portions of the project for possible cost savings through alternative approaches and reviewing the proposed construction techniques to evaluate if they satisfy the intent of the recommendations presented in this report.

11.0 CONSTRUCTION MONITORING

All earthwork and foundation construction should be monitored by a qualified engineer/technician under the supervision of a licensed Geotechnical Engineer of Record, including:

- Site preparation - site stripping, removal of subsurface structures, overexcavation, bottom observation, and recompaction;
- Placement of all compacted fills and backfills;
- All foundation excavations;
- Construction of slab and pavement subgrades.
- Shoring construction (if any);

The Geotechnical Engineer should be present to observe the soil conditions encountered during construction, to evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and to recommend appropriate changes in design or construction if conditions differ from those described herein.

12.0 LIMITATIONS

URS warrants that our services have been performed within the limits prescribed by our clients, with the usual thoroughness and competence of the geotechnical engineering profession in southern California at this time. No other warranty or representation, either expressed or implied, is included or intended in this report.

—o0o—

It has been a pleasure to assist you with this project. We look forward to being of further assistance as the project develops. Should you have any questions, please contact us.

Respectfully submitted:



Cynthia Gabaldon, P.E.

H. Rice, C.E.G.
Senior Engineer



Raymond

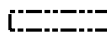





Senior Geologist

13.0 REFERENCES

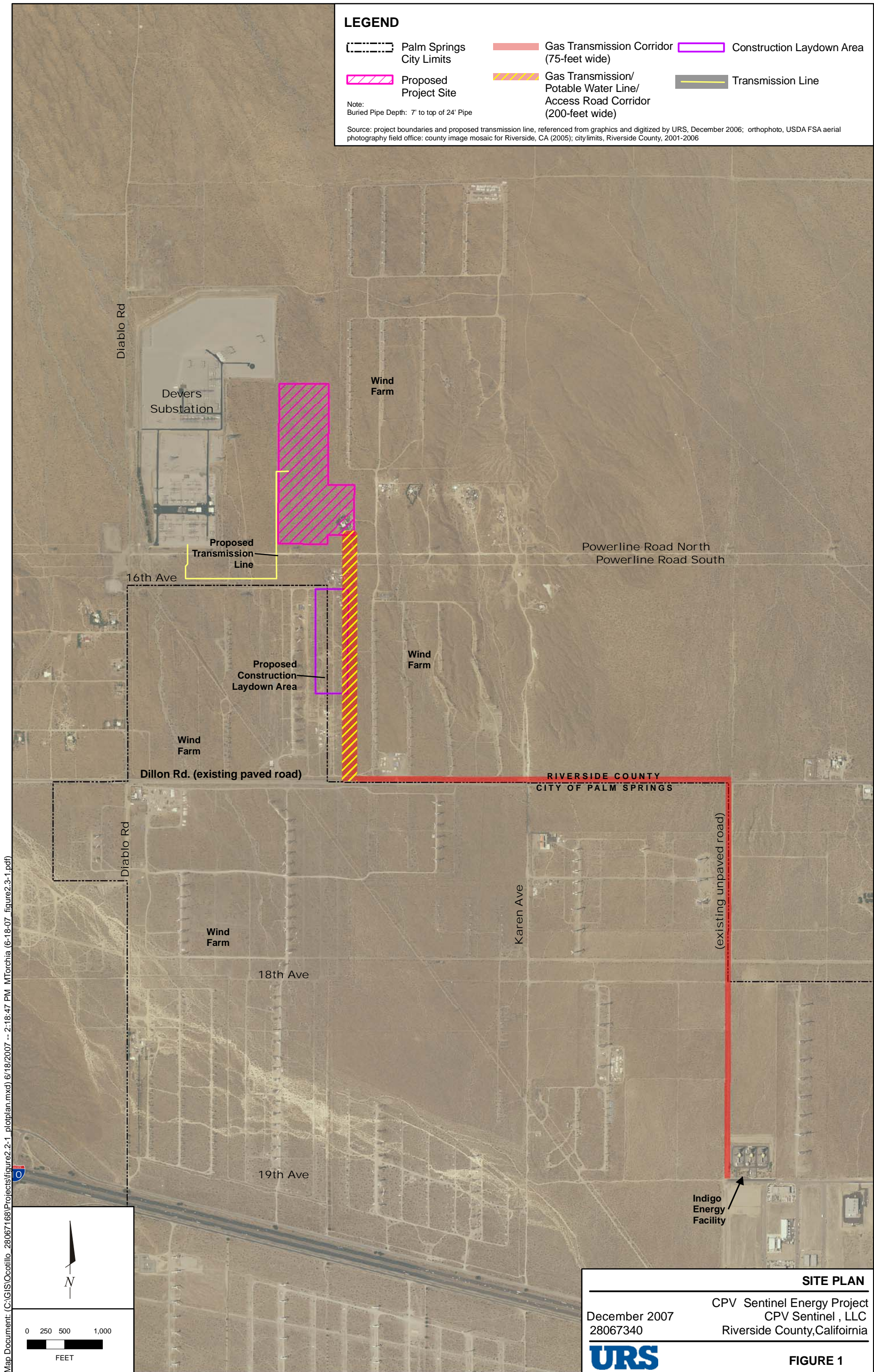
- Blake, T.F. 2004. EQFAULT, A Computer Program for the Deterministic Prediction of Peak Horizontal Acceleration from Digitized California Faults.
- California Department of Conservation Division of Mines and Geology (CDMG) and International Conference of Building Officials (ICBO), 1998, Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, To be used with the 1997 Uniform Building Code, Sheet O-33.
- Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C.J., 2003, The Revised 2002 California Probabilistic Seismic Hazard Maps. California Department of Conservation Division of Mines and Geology.
- Hart, E. W., and Bryant, W. A., 1997, "Earthquake Hazard Zones in California" California Division of Mines and Geology Special Publication 42.
- Jennings, C.W., 1994, "Fault Activity Map of California and Adjacent Areas" CDMG Open-File Report 92-03, Scale = 1:750,000
- Norris, R.M, Webb, R.M., 1990. Geology of California, John Wiley and Sons, Inc., New York, New York, USA
- URS Corporation, 2007, Application for Certification for CPV Sentinel Energy Project, Riverside County, California, June 25, 2007. Specifically "Section 7-15: Geologic Hazards and Resources".

FIGURES

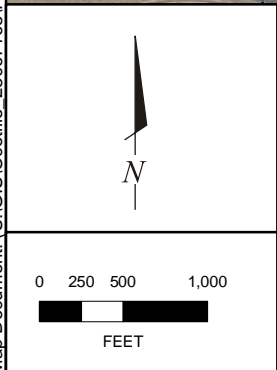
LEGEND

-  Palm Springs City Limits
-  Proposed Project Site
- Note:
Buried Pipe Depth: 7' to top of 24' Pipe
-  Gas Transmission Corridor (75-feet wide)
-  Gas Transmission/ Potable Water Line/ Access Road Corridor (200-feet wide)
-  Construction Laydown Area
-  Transmission Line

Source: project boundaries and proposed transmission line, referenced from graphics and digitized by URS, December 2006; orthophoto, USDA FSA aerial photography field office: county image mosaic for Riverside, CA (2005); city limits, Riverside County, 2001-2006



Map Document: C:\GIS\Ocotillo_28067168\Projects\figure2.2-1_plotplan.mxd) 6/18/2007 -- 2:18:47 PM MTorchia (6-18-07_figure2.3-1.pdf)



SITE PLAN

December 2007
28067340

CPV Sentinel Energy Project
CPV Sentinel , LLC
Riverside County, California


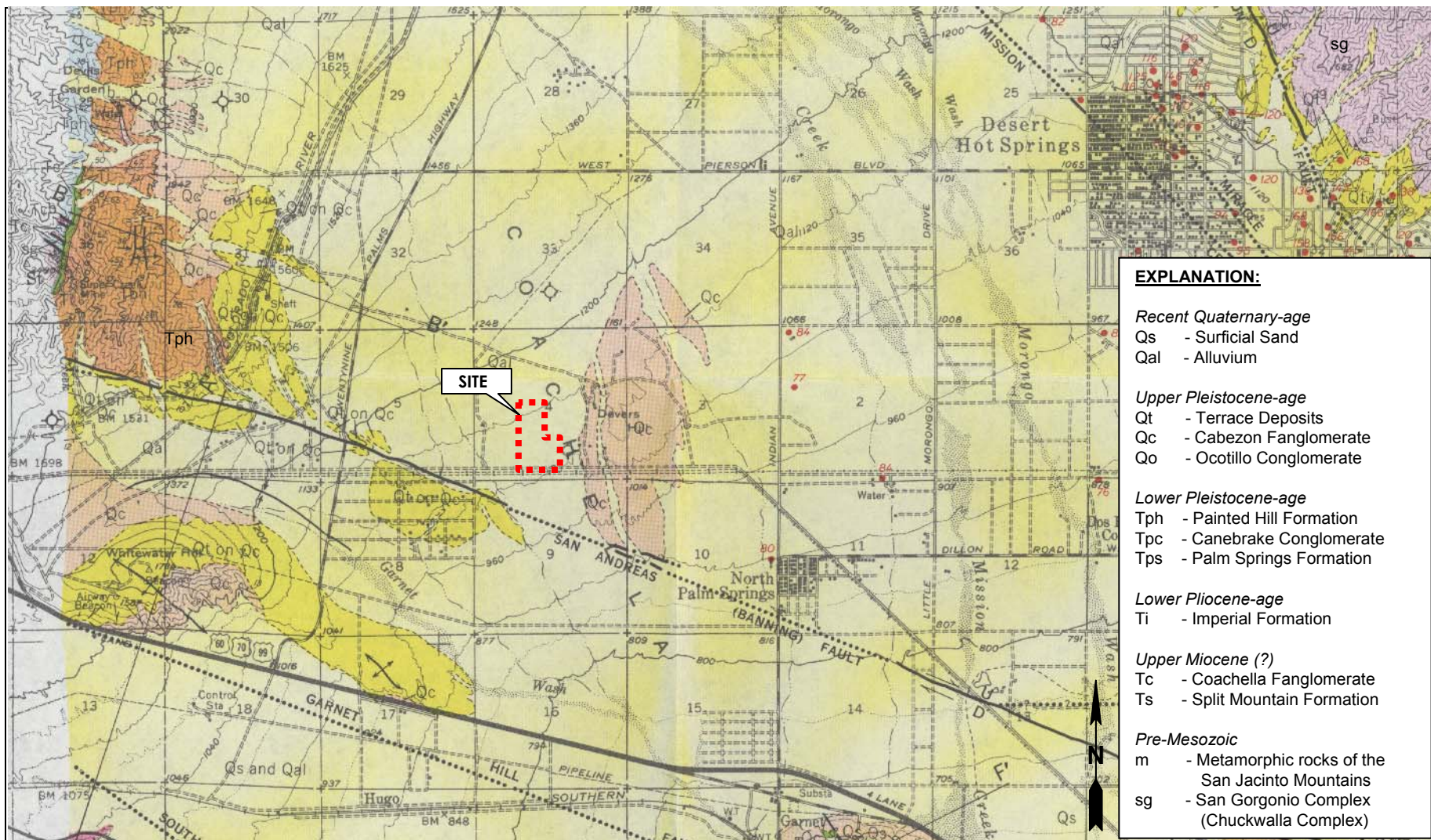


FIGURE 1



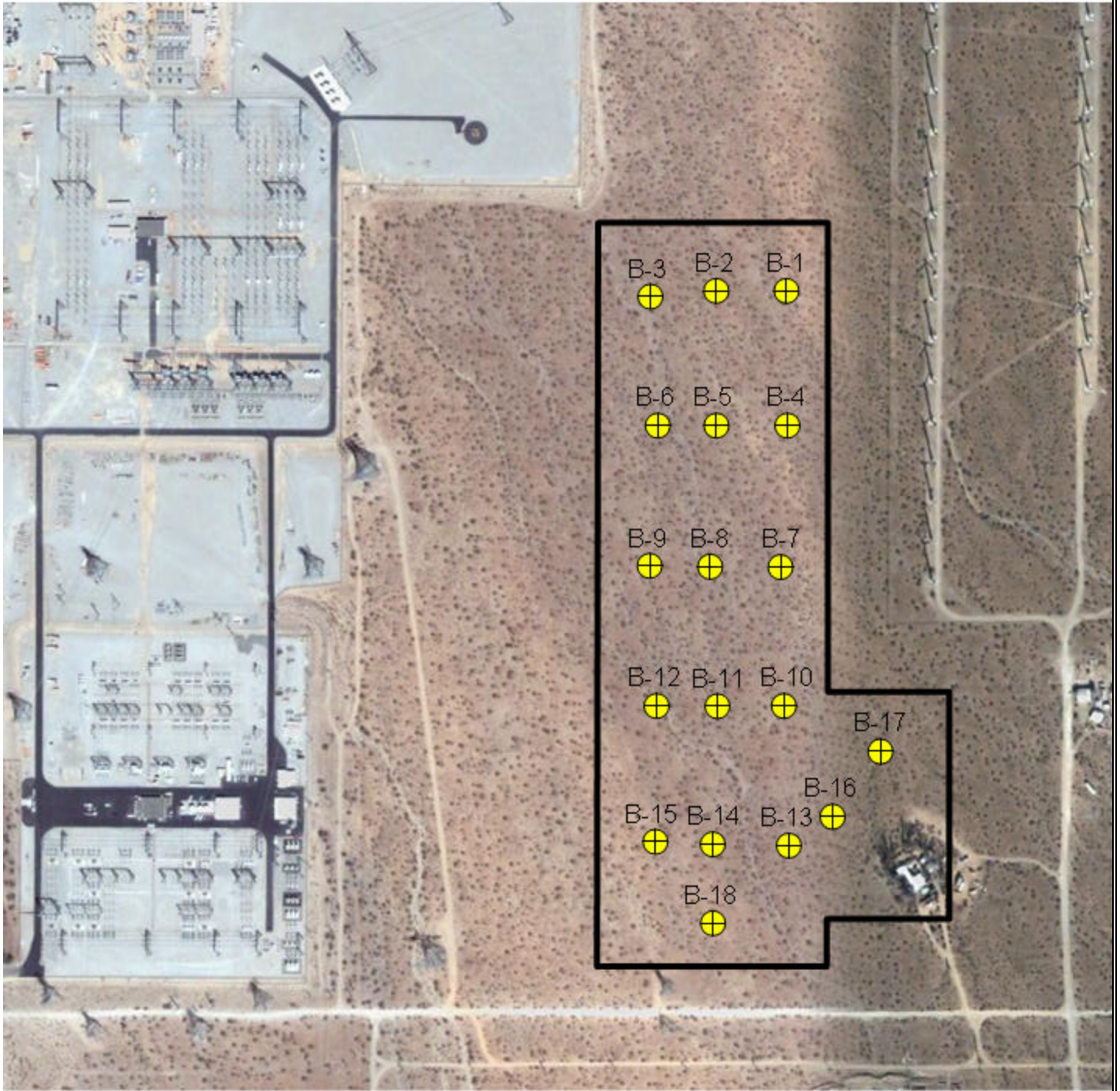
Basemap modified from: Proctor, Richard J., Geologic Map and Sections of the Desert Hot Springs Area, Riverside County, California, CDMG, 1968, Special Report 94, Scale= 1:62,500.

SCALE: 0 3000 6000 9000 12000 feet
 1:62,000

GEOLOGIC MAP
 DECEMBER 2007 CPV Sentinel Energy Project
 28067340 CPV Sentinel, LLC
 Riverside County, California

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FIGURE 2



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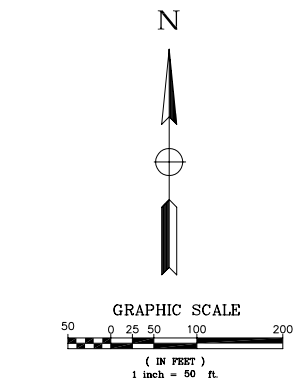
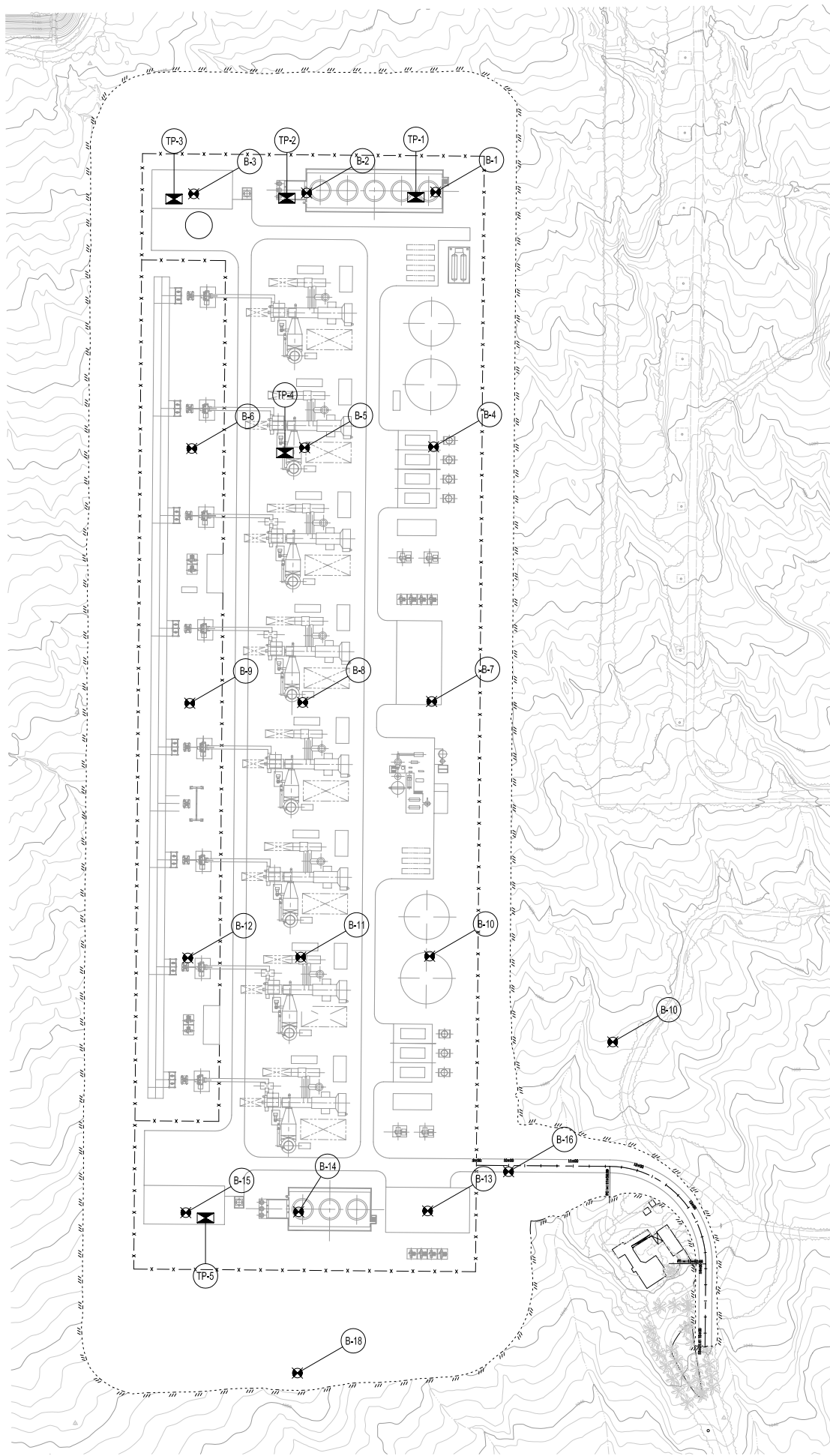
BORING LOCATION MAP

December 2007
28067340

CPV Sentinel Energy Project
CPV Sentinel, LLC
Riverside County, California

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Figure 3



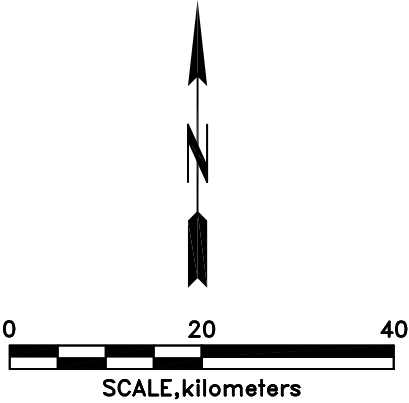
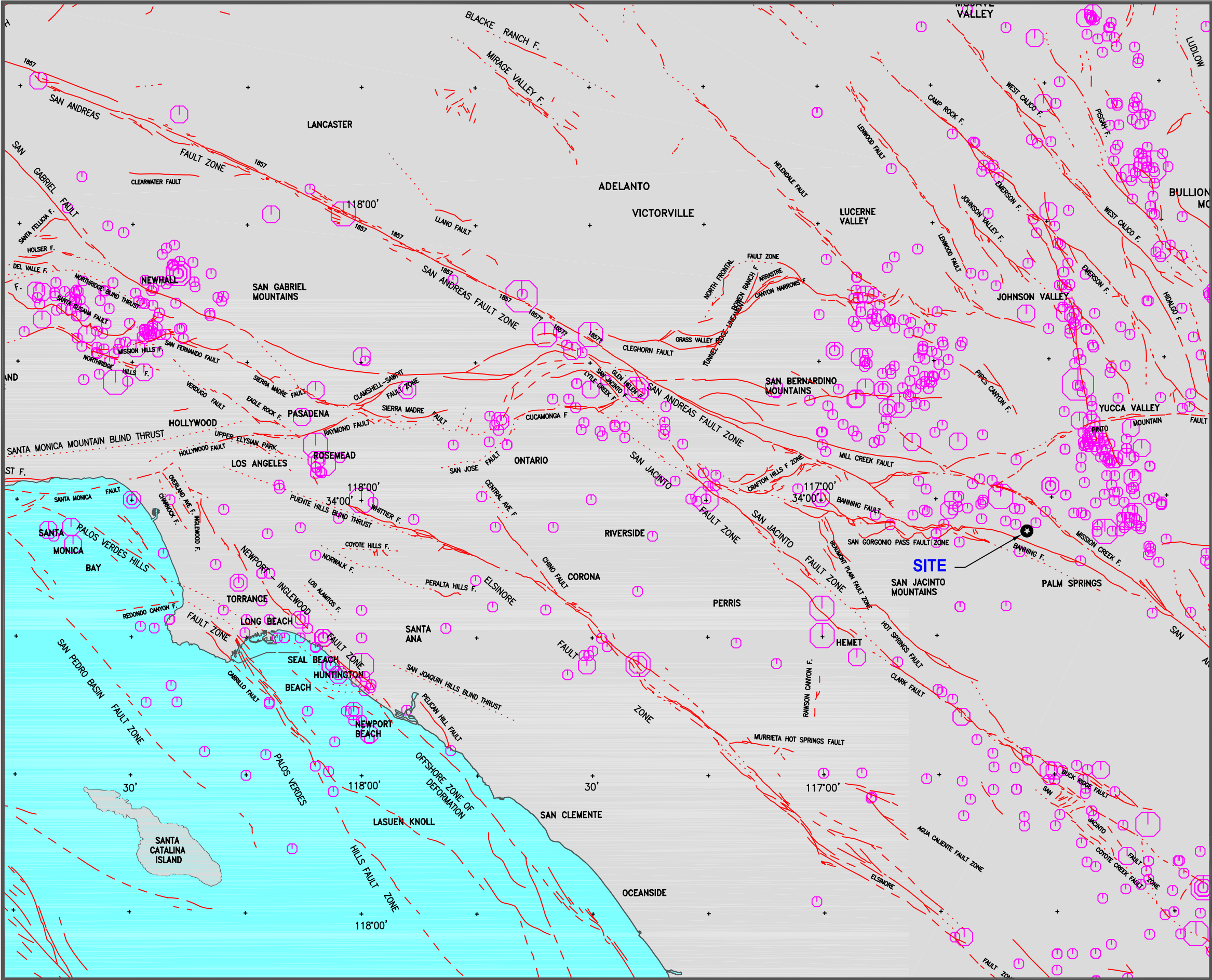
BORING LOCATION MAP

CPV Sentinel Energy Project
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Riverside County, California

December 2007
28067340

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Figure 3



- LEGEND
- REPORTED EARTHQUAKE MAGNITUDES.
 - 4.0 TO 4.9
 - 5.0 TO 5.9
 - 6.0 TO 6.9
 - 7.0 AND GREATER

SOUTH OF LATITUDE 35°N, EPICENTER AND MAGNITUDE DATA ARE FROM THE CALIFORNIA GEOLOGICAL SURVEY (2001) EARTHQUAKE CATALOG FOR THE PERIOD FROM 1769 TO 2000. ONLY EARTHQUAKES OF MAGNITUDE 4.0 AND LARGER ARE SHOWN. AFTERSHOCKS ARE NOT INCLUDED.

APPROXIMATE LOCATION OF HOLOCENE AND PLEISTOCENE FAULTS, DOTTED WHERE CONCEALED, QUERIED WHERE CONJECTURAL. FAULT LOCATIONS BASED ON: ZIONY AND JONES, 1989; CDMG GEOLOGIC MAP SERIES OF CALIFORNIA, 1977–1986 (1:250,000 SCALE); CDMG GEOLOGIC MAP SERIES, CALIFORNIA CONTINENTAL MARGIN, 1987 (1:250,000 SCALE); HAUSSON, 1990; SHAW AND SHEARER, 1999; WRIGHT, 1991; GRANT ET AL. 1999.

REGIONAL FAULT AND EPICENTER MAP

CPV Sentinel Energy Project
DECEMBER 2007
28067340
CPV Sentinel, LLC
Riverside County, California

APPENDIX A

Logs of Exploratory Borings

Description

This appendix describes the exploration program conducted by URS. The exploratory locations for soil borings were first marked in the field, and then checked through a private utility clearance company for potential conflicts with the underground utilities. When necessary, the marked locations were adjusted in order to avoid encountering underground utilities.

Subsurface exploration included drilling and sampling 18 borings to approximate depths ranging from 10 to 50 feet below the existing ground surface using a truck-mounted, 8-inch diameter, hollow stem auger drill rig. The approximate locations of the borings are shown in Figure 3.

A URS representative from our Santa Ana office maintained a log for each boring in the field, recording sampler blow counts, soil characteristics, observations, sample locations, and other pertinent drilling and sampling information. The subsurface materials were characterized by visual inspection of the samples and soil cuttings returned to the surface during the drilling operation. The behavior of the drill rig, such as variations penetration rate, was also considered in material characterization. Soils were classified according to the Unified Soil Classification System (ASTM D 2488). The boring logs were modified to reflect the results of laboratory observations and testing of the samples. A key to notations on the boring logs is included.

Relatively undisturbed samples were obtained using a Dames & Moore Type U sampler (2.42-inch I.D.) driven 18 inches using a 140-pound hammer with 30-inch drop. The number of blows required to drive the sampler was recorded for each 6-inch interval of penetration. The first 6-inch increment of penetration is considered to be a "seating interval" in potentially highly disturbed soils at the base of the borehole, and is therefore not included in the final log notation unless refusal was met within the seating interval. The total number of blows for the 12 inches of penetration beyond the seating interval, or the distance driven before refusal, is normally recorded on the log.

Relatively undisturbed and disturbed samples from the sampling activities were placed in plastic bags to preserve the water content of the soil and transported to our geotechnical laboratory in Los Angeles for testing.

Standard Penetration Tests (SPT) were also performed at selected depths per ASTM D-1586. The sampler was driven 18 inches using a 140-pound hammer with 30-inch drop. The blow count for the final 12 inches of sampler penetration is commonly referred to as the "N-value". This value generally reflects the resistance to penetration of the soil at the sample depth. The degree of relative density of granular soils and the degree of consistency of cohesive soils are generally described on the boring logs according to the conventional correlation presented below:

GRANULAR SOILS			COHESIVE SOILS	
SPT Blow Count	Description		SPT Blow Count	Description
< 4	Very Loose		< 2	Very Soft
4 - 10	Loose		2 – 4	Soft
10 - 30	Medium Dense		4 – 8	Medium Stiff
30 - 50	Dense		8 – 15	Stiff
> 50	Very Dense		15 – 30	Very Stiff
			> 30	Hard

The relative density and consistency descriptions on the attached boring logs are based on adjusted blow counts recorded in the field. These numbers are considered to be useful in providing an estimate of the soils relative density or consistency. The relative density and consistency descriptions on the logs may deviate from the correlation for a number of reasons, including reliance on other test results or the engineer's judgment based on manual manipulation of the sample.

It is widely accepted that the above-listed SPT blow count correlation is overly simplistic. For most applications in non-gravelly soils, the blow count is usually adjusted for the effective vertical pressure at the sampling depth and for other sampling system parameters such as the efficiency of the sampling system or/and sampling techniques used. In gravelly soil, it is recognized that the blow counts are higher than would be expected in non-gravelly soil of similar density or consistency. This occurs because the sampler tends to push larger gravel clasts ahead of it. The area of the gravel clast may be significantly greater than that of the sampler, causing increased resistance and higher blow counts.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		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
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GP	POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
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 SANDY OR SILTY SOILS, ELASTIC SILTS	
				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 gravels or sand with 5-12% fines and soils with fines classifying as CL-ML. Symbols separated by a slash indicate borderline soil classifications.

Rock Material Symbols (examples)



Puente Formation

Sampler and Symbol Descriptions



Dames & Moore Type-U sample



Modified California sample



No Recovery



Bulk sample



Disturbed Type-U Sample



Pitcher Tube Sample



Shelby Tube Sample



Rock Core Sample



Approximate depth of perched water or groundwater



Approximate depth of seepage encountered in boring

Note: Number of blows required to advance driven sample 12" (or length noted) is recorded; blow count recorded for seating interval (initial 6" of drive) is indicated by an asterisk.

Laboratory and Field Test Abbreviations

CBR	California Bearing Ratio Test
COL	Collapse Potential test (test result in parentheses)
COMP	Compaction test
CON	Consolidation test
CORR	Corrosivity test
DSCD	Consolidated drained direct shear test (normal pressure and shear strength results shown)
EI	Expansion Index test (test result in parentheses)
LL=29	Liquid limit (Atterberg limits test)
PI=11	Plasticity Index (Atterberg limits test)
PP	Pocket Penetrometer test (test result in parentheses)
R-Value	Resistance Value test
SA	Sieve Analysis (-200 result in parentheses)
SE	Sand Equivalent test (test result in parentheses)
SWELL	Swell Load test (test result in parentheses)
TV	Torvane test (test result in parentheses)
-200	Percent passing #200 sieve (test result in parentheses)

KEY TO LOG OF BORING

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-1

Sheet 1 of 1

Date(s) Drilled	09/25/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	25.1 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	SPT, 2.4" modCal	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-4, 200' east of B-2		

Elevation, feet	Depth, feet	SAMPLES			MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
0					Holocene-age Younger Alluvium (Qal):			
1110					- GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
		B-1-1	22		- Silty SAND with GRAVEL (SM) light brown, medium dense, dry; 10-20% coarse to fine, subrounded, elongated GRAVEL; medium to fine SAND; no cementation, no apparent bedding	0.8	117	GSD
5		B-1-2	82		- becomes weakly cemented; sampled through decomposed COBBLE > 3" in diameter			
1105		B-1-3	36		- becomes dense, with no cementation, and trace iron oxide stained nodules			
10		B-1-4	505'		- becomes very dense; 20-30% GRAVEL			@10'- poor recovery
1100								
15		B-1-5	66		- becomes weakly bedded	1.5		#200 Wash
1095								
20		B-1-6	505'		- no change; recovered COBBLE fragment wedged in sand catcher			
1090								
25		B-1-7	504"		- no recovery			
1085					- Used sand catcher with 2.4" modCal sampler Total Depth: 25.1' bgs (refusal based on blow counts) Did not encounter groundwater Backfilled with soil cuttings			Figure A-1
30								

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-2

Sheet 1 of 1

Date(s) Drilled	09/25/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	12.0 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	2.4" modCal, SPT	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	200' west of B-1, 175' east of B-3		

Elevation, feet	Depth, feet	SAMPLES			MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
	0				Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
	1110	B-1-1	40		- Silty SAND with GRAVEL (SM) gray, medium dense, dry; 30% coarse to fine, subangular to subrounded, elongated to spherical GRAVEL; coarse to fine SAND; no cementation	0.5	112	
	5	B-1-2	39		- becomes light brown, dense, with 15-20% fine GRAVEL, and medium to fine SAND; recovered coarse GRAVEL wedged in shoe; poor recovery			
		B-1-3	502'		- no recovery			
	1105							
	10	B-1-4	505'		- Silty SAND (SM) light brown, very dense, dry; trace fine GRAVEL; medium to fine SAND; no cementation			
					- rig chatter; difficulty drilling; no progress - Used sand catcher with 2.4" modCal sampler			
	1100				Total Depth: 12' bgs (refusal based on difficulty in drilling) Did not encounter groundwater Backfilled with soil cuttings			
	15							
	1095							
	20							
	1090							
	25							
	1085							
	30							

Figure A-2

URS

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-3

Sheet 1 of 1

Date(s) Drilled	09/27/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	19.5 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	Bulk, SPT, 2.4" modCal	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-6, 175' west of B-2		

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number					
0					Holocene-age Younger Alluvium (Qal):			
1115		B-3-1A			- GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
		B-3-1	22		- Silty SAND with GRAVEL (SM) light brown, medium dense, dry; 25-35% coarse to fine, subangular to subrounded GRAVEL; coarse to fine SAND; no cementation	0.9		Chem B #200 Wash
5		B-3-2	56		- becomes dense			
1110								
10		B-3-3	35		- no change			GSD
1105								
15		B-3-4	50.5"		- no recovery			
1100								
20					- rig chatter on rock			
1095					- Used sand catcher with 2.4" modCal sampler Total Depth: 19.5' bgs (refusal on very hard rock) Did not encounter groundwater Backfilled with soil cuttings			
25								
1090								
30								

Figure A-3

URS

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-4

Sheet 1 of 1

Date(s) Drilled	09/25/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	15.0 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	SPT, 2.4" modCal	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-7, 200' east of B-5		

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
0					Holocene-age Younger Alluvium (Qal):			
1095					- GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented	1.2		#200 Wash
		B-4-1	23		- Silty SAND (SM) brown, medium dense, dry; trace fine GRAVEL; coarse to fine SAND; no cementation			
5					- SAND with GRAVEL (SP) grayish brown, dense, dry, poorly graded; 40% coarse to fine, subangular to subrounded GRAVEL; coarse to medium SAND	0.5		
1090		B-4-2	64					
		B-4-3	32		- Silty SAND with GRAVEL (SM) brown, dense, dry; 20-30% coarse to fine, subrounded GRAVEL; coarse to fine SAND; weakly bedded			
10					- SAND with GRAVEL (SP) brownish gray, very dense, dry, poorly graded; 20-30% coarse to fine, subangular to subrounded GRAVEL; coarse to medium SAND; no cementation	1.1		DS COLL
1085		B-4-4	909'		- rig chatter			
15					- auger encounters very hard rock, boulder, or hard pan; rig begins to bounce; cannot drill past 15'			
1080					- Used sand catcher with 2.4" modCal sampler			
					Total Depth: 15' bgs (refusal on very hard rock, boulder, or hardpan) Did not encounter groundwater Backfilled with soil cuttings rear hydraulic pads keep sinking into ground; driller attempts to bridge with cobbles; cobbles disappear into alluvium; driller repeats process until borehole sampling is completed			
20								
1075								
25								
1070								
30								

Figure A-4

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-5

Sheet 1 of 1

Date(s) Drilled	09/25/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	8.0 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	2.4" modCal, SPT	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-8, 175' east of B-8		

Elevation, feet	Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot					
1100	0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented - GRAVEL with SILT and SAND (GP-GM) light brown, very dense, dry, poorly graded; 80% coarse, subangular GRAVEL; coarse to fine SAND; no cementation; recovered coarse to fine GRAVEL wedged in shoe			
		B-5-1	503"						
1095	5					- Silty SAND with GRAVEL (SM) light brown, dense, dry; 5-15% coarse to fine GRAVEL; medium to fine SAND; no cementation; trace rock fragments	0.8		#200 Wash
		B-5-2	40						
		B-5-3	503"			- no recovery - rig chatter; auger encounters very hard rock, boulder, or hard pan; rig begins to bounce; cannot drill past 8' - Used sand catcher with 2.4" modCal sampler			
1090	10					Total Depth: 8' bgs (refusal on very hard rock, boulder, or hard pan) Did not encounter groundwater Backfilled with soil cuttings			
1085	15								
1080	20								
1075	25								
1070	30								

Figure A-5

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-6

Sheet 1 of 1

Date(s) Drilled	09/27/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	25.5 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	2.4" modCal, SPT	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-9, 175' west of B-5		

Elevation, feet	Depth, feet	SAMPLES			MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
1100		B-6-1	55		- Silty SAND with GRAVEL (SM) light brown, very dense, dry; 30-40% coarse to fine, subangular GRAVEL; coarse to fine SAND; trace calcium carbonate stringers	0.8	108	
5		B-6-2	40		- becomes dense			
1095		B-6-3	50 5/8"		- becomes very dense, less fines	0.7	97	#200 Wash
10		B-6-4	60		- becomes less than 10% GRAVEL			
1090								
15		B-6-5	50 1/4"		- no recovery			
1085								
20		B-6-6	50 6/8"		- becomes 20-30% GRAVEL			
1080					- brief rig chatter; thin layer of GRAVEL			
25		B-6-7	50 6/8"		- no change			
1075					- Used sand catcher with 2.4" modCal sampler Total Depth: 25.5 bgs (refusal based on blow counts) Did not encounter groundwater Backfilled with soil cuttings			
30								Figure A-6

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-7

Sheet 1 of 1

Date(s) Drilled	09/25/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	25.1 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	2.4" modCal, SPT	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-10, 200' east of B-8		

Elevation, feet	Depth, feet	SAMPLES			MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented - no recovery			
1080		B-7-1		50/1"				
5		B-7-2		45	- Silty SAND (SM) light brown, dense, moist; trace coarse to fine GRAVEL; medium to coarse SAND; no cementation			GSD CHEM
1075		B-7-3		50/5"	- Silty SAND with GRAVEL (SM) light brown, very dense, moist; 20-30% coarse to fine, angular to subrounded GRAVEL; medium to fine SAND; no cementation			
10		B-7-4		83	- Silty SAND (SM) light brown, very dense, moist; trace fine GRAVEL; medium to fine SAND; no cementation			
1070								
15		B-7-5		50/2"	- no change; recovered 80% coarse to fine GRAVEL in sand catcher and only SAND in sample rings - rig chatter for 5 seconds; thin GRAVEL layer	1.1	96	
1065								
20		B-7-6		50/3"	- Silty SAND with GRAVEL (SM) brown, very dense, moist; 20-30% coarse to fine, subangular to subrounded GRAVEL; coarse to fine SAND; no cementation			
1060								
25		B-7-7		50/1"	- no recovery			
1055					- Used sand catcher with 2.4" modCal sampler Total Depth: 27.1' bgs (refusal based on blow counts) Did not encounter groundwater Backfilled with soil cuttings			Figure A-7
30								

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-8

Sheet 1 of 1

Date(s) Drilled	09/27/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	24.0 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	SPT, 2.4" modCal	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-11, 175' east of B-9		

Elevation, feet	Depth, feet	SAMPLES			MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
1085	0				Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
		B-8-1	22		- Silty SAND (SM) light brown, medium dense, dry; trace fine GRAVEL; coarse to fine SAND; no cementation; trace rock fragments	0.9		#200 Wash
1080	5	B-8-2	504"		- Silty SAND with GRAVEL (SM) light brown, very dense, dry; less than 10% rounded COBBLES; 20-30% coarse to fine, subangular GRAVEL; coarse to fine SAND; no cementation	0.7	115	
		B-8-3	46		- becomes dense			
1075	10	B-8-4	503"		- becomes very dense; recovered rock fragment wedged in shoe and lower 1" of sample			GSD
1070	15	B-8-5	506"		- no change			
1065	20	B-8-6	506"		- no recovery			
1060	25				- rig chatter; difficulty drilling; cannot drill past 24' - Used sand catcher with 2.4" modCal sampler Total Depth: 24' bgs (refusal on very hard rock) Did not encounter groundwater Backfilled with soil cuttings			
1055	30							Figure A-8

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-9

Sheet 1 of 1

Date(s) Drilled	09/27/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	18.0 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	SPT, 2.4" modCal	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-12, 175' west of B-8		

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
1085			B-9-1		- SAND with GRAVEL (SP) brown, very dense, dry, poorly graded; 30-35% coarse to fine, subangular to subrounded GRAVEL; coarse to fine SAND; no cementation to weakly cemented			
	5		B-9-2		- no change	0.8	97	
1080			B-9-3		- no change			
	10		B-9-4	506"	- no change			
1075								
	15		B-9-5	74	- becomes 30-40% GRAVEL, and weakly cemented			
1070								
	20				- observed COBBLES to coarse GRAVEL appear in soil cuttings - Used sand catcher with 2.4" modCal sampler Total Depth: 18' bgs (refusal on cobble layer) Did not encounter groundwater Backfilled with soil cuttings			
1065								
	25							
1060								
	30							

Figure A-9

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-10

Sheet 1 of 2

Date(s) Drilled	09/24/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	51.5 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	SPT, 2.4" modCal	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-13, 200' east of B-11		

Elevation, feet	Depth, feet	SAMPLES			MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
1070		B-10-1	17		- Silty SAND with GRAVEL (SM) light brown, medium dense, dry; less than 10% coarse to fine, subrounded, elongated to spherical GRAVEL; medium to fine SAND; no cementation			GSD
5		B-10-2	36		- no change	0.8	116	
1065		B-10-3	60		- becomes very dense; good recovery			
10		B-10-4	503"		- no recovery			
1060								
15		B-10-5	73		- becomes 30% GRAVEL; recovered rock fragments in shoe	0.7		#200 Wash
1055		B-10-6	503"		- no recovery			
1050								
25		B-10-7	879"		- becomes 30% subangular to subrounded GRAVEL, with trace rock fragments; good recovery			
1045								
30								

URS

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-10

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES			MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
30		B-10-8		505'	- SAND with GRAVEL (SP) gray, very dense, dry, poorly graded; 40% coarse to fine, subangular GRAVEL; coarse to medium SAND; weakly cemented			
1040								
35		B-10-9		505'	- SAND with Silt (SP) gray, very dense, dry, poorly graded; trace fine GRAVEL; coarse to medium SAND; weakly cemented			GSD
1035								
40		B-10-10		505'	- becomes 10-15% elongated to spherical GRAVEL, with trace rock fragments	1.1		#200 Wash
1030								
45		B-10-11		504'	- no change			
1025								
50		B-10-12		66	- no change			
1020					- Sand catcher was not used with 2.4" modCal sampler Total Depth: 51.5 lgs (maximum planned depth) Did not encounter groundwater Backfilled with soil cuttings			
55								
1015								
60								
1010								
65								Figure A-10

Project: CPV Sentinel Energy Project/Geotechnical Investigation

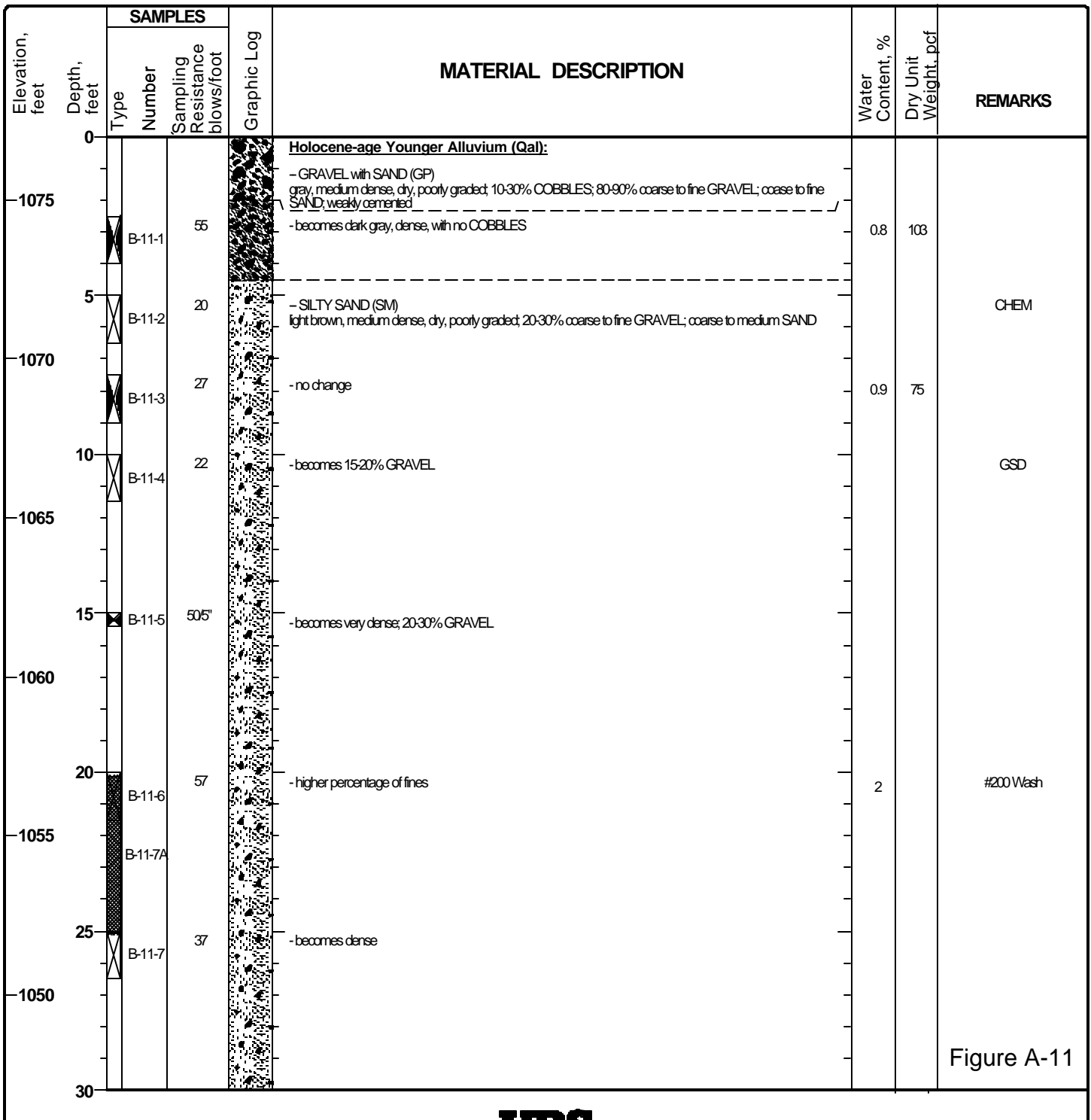
Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-11

Sheet 1 of 2

Date(s) Drilled	09/27/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	41.0 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	2.4" modCal, SPT, Bulk	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-14, 175' east of B-12		



Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-11

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number Sampling Resistance blows/foot					
30		X	B-11-8	505'	- SAND with GRAVEL (SP) grayish brown, very dense, moist, poorly graded, 15-20% coarse to fine GRAVEL; coarse to medium SAND			
1045								
35		X	B-11-9	505'	- becomes dry; recovered coarse to fine GRAVEL in shoe			
1040								
40		X	B-11-10	506'	- no change			
1035					- Used sand catcher with 24" modCal sampler Total Depth: 41' bgs (refusal based on blow counts) Did not encounter groundwater Backfilled with soil cuttings			
45								
1030								
50								
1025								
55								
1020								
60								
1015								
65								

Figure A-11a

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-12

Sheet 1 of 1

Date(s) Drilled	09/27/07	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	25.6 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	2.4" modCal, SPT	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' north of B-15, 175 west of B-11		

Elevation, feet	Depth, feet	SAMPLES			MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
		B-12-1	63		- Silty SAND with GRAVEL (SM) brown, dense, dry; 30-40% coarse to fine, subangular GRAVEL; coarse to fine SAND; weakly cemented			#200 Wash
-1075	5	B-12-2	53		- becomes very dense	1.3		
		B-12-3	502'		- no recovery			
-1070	10	B-12-4	49		- becomes dense			
-1065	15	B-12-5	506"		- becomes very dense	0.9	111	
-1060	20	B-12-6	90		- no change			
-1055	25	B-12-7	501"		- no change	0.8	94	
-1050	30				- Used sand catcher with 2.4" modCal sampler Total Depth: 27.6' bgs (refusal based on blow counts) Did not encounter groundwater Backfilled with soil cuttings			Figure A-12

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-13

Sheet 1 of 1

Date(s) Drilled	09/24/07	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	25.4 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	Bulk, 2.4" modCal, SPT	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' south of B-10, 200' east of B-14		

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number					
1055	0				Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			Remolded DS
		B-13-1A	32		- Silty SAND with GRAVEL (SM) light gray, medium dense, dry; 20-25% coarse to fine, subangular to subrounded, elongated to spherical GRAVEL; coarse to fine SAND; no cementation; recovered COBBLE in shoe and lower 2' of sample			
1050	5				- Silty SAND (SM) light brown, medium dense, dry; trace fine GRAVEL; medium to fine SAND; no cementation; recovered GRAVEL wedged in shoe; poor recovery	0.8		#200 Wash
		B-13-2	20					
		B-13-3	506"		- no recovery			
1045	10				- Silty SAND with GRAVEL (SM) light brown, very dense, dry; less than 10% coarse to fine, subangular to subrounded, elongated to spherical GRAVEL; medium to fine SAND; no cementation			CHEM
		B-13-4	52					
1040	15				- no recovery			
		B-13-5	505"					
1035	20				- becomes trace fine, subrounded, spherical GRAVEL; recovered rock fragments in shoe - from 20.75-25'- top of auger drifts during drilling			
		B-13-6	503"					
1030	25				- no recovery			
		B-13-7	505"					
					- Sand catcher was not used with 2.4" modCal sampler Total Depth: 25.4' bgs (refusal based on blow counts) Did not encounter groundwater Backfilled with soil cuttings			Figure A-13
1025	30							

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-14

Sheet 1 of 2

Date(s) Drilled	09/27/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	45.5 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	SPT, 2.4" modCal	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' south of B11, 175' east of B-15		

Elevation, feet	Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot					
1060	0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented - Silty SAND with GRAVEL (SM) light brown, very dense, dry; 15-20% fine, subangular GRAVEL; medium to fine SAND; no cementation; recovered gravel in shoe			
		B-14-1		59					
1055	5	B-14-2		50/3'		- becomes 20-25% GRAVEL			
		B-14-3		72/11"		- becomes 15-20% fine GRAVEL, with trace calcium carbonate stringers			
1050	10	B-14-4		50/5'		- no recovery			
1045	15	B-14-5		56		- becomes 20-25% fine GRAVEL, coarse to medium SAND, and weakly cemented	1.2		#200 Wash
1040	20	B-14-6		50/4"		- no recovery			
1035	25	B-14-7		50/6'		- becomes 10% fine GRAVEL, medium to fine SAND, with no cementation			
1030	30								

Figure A-14

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-14

Sheet 2 of 2





Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number Sampling Resistance blows/foot					
1030	30	B-14-8	504'		- Silty SAND with GRAVEL (SM) light brown, very dense, dry; 10-15% coarse to fine, subangular GRAVEL; medium to fine SAND; no cementation	1.1		#200 Wash
1025	35	B-14-9	506'		- no change			
1020	40	B-14-10	506'		- SAND with GRAVEL (SP) light brown, very dense, dry, poorly graded; 30-35% coarse to fine GRAVEL; coarse to medium SAND; some calcium carbonate stringers			
1015	45	B-14-11	506'		- Silty SAND (SM) light brown, very dense, dry; medium to fine SAND; no cementation; recovered completely sheared COBBLE or coarse GRAVEL in shoe - Used sand catcher with 2.4" modCal sampler Total Depth: 45.5 bgs (refusal based on blow counts) Did not encounter groundwater Backfilled with soil cuttings			
1010	50							
1005	55							
1000	60							
995	65							

Figure A-14a

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-15

Sheet 1 of 1

Date(s) Drilled	09/27/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	6.0 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	SPT, 2.4" modCal	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	395' south of B-12, 175' west of B-14		

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
1060		B-15-1	27		- Silty SAND with GRAVEL (SM) light brown, medium dense, dry; 30-40% coarse to fine, angular to subrounded GRAVEL; coarse to fine SAND; no cementation			Chem
5		B-15-2	506'		- becomes very dense; sampler bounced on rock	0.5	83	#200 Wash
1055					- from 5.5' to 6'- observed COBBLES 3-5" in length coming up in soil cuttings; difficulty drilling; no progress after 6' bgs - Used sand catcher with 2.4" modCal sampler Total Depth: 6' bgs (refusal on hard COBBLE layer) Did not encounter groundwater Backfilled with soil cuttings			
10								
1050								
15								
1045								
20								
1040								
25								
1035								
30								

Figure A-15

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-16

Sheet 1 of 1

Date(s) Drilled	09/28/2007	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	25.7 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	SPT, 2.4" modCal	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	70' north and 125' east of B-13		

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
		B-16-1		17	- SAND (SP) brown, medium dense, dry, poorly graded; trace fine, subangular GRAVEL < 3/4" in length; coarse to medium SAND			
5		B-16-2		55	- SAND with SILT and GRAVEL (SP-SM) brown, dense, dry, poorly graded; 30-40% GRAVEL; weakly cemented; moderate calcium carbonate stringers			GSD
		B-16-3		55	- becomes very dense			
10		B-16-4		506"	- no change	0.8	99	
15		B-16-5		92/11"	- no change - from 16.5' to 20'- slight rig chatter; auger drilled through GRAVEL			
20		B-16-6		504"	- no recovery			
25		B-16-7		502'	- no change			
					- Used sand catcher with 2.4" modCal sampler Total Depth: 25.6' bgs (refusal based on blow counts) Did not encounter groundwater Backfilled with soil cuttings			
30								Figure A-16

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-17

Sheet 1 of 2

Date(s) Drilled	09/25/07	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	50.9 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	2.4" modCal, SPT	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	270' north and 285' east of B-13		

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number	Sampling Resistance blows/foot				
0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
		B-17-1	41		- Silty SAND with GRAVEL (SM) light brown, medium dense, dry; 20-30% coarse to fine, subangular to subrounded GRAVEL; medium to fine SAND; no cementation	0.4	118	DS COLL
5		B-17-2	25		- no change	0.5		#200 Wash
		B-17-3	50/5"		- becomes very dense			
10		B-17-4	42		- no change			GSD
		B-17-5	83/11"		- no change; extra sample at 11.5'; driller did not drill down to 15' before pounding the sampler	0.6	118	
15		B-17-6	25		- no change			
20		B-17-7	86/8"		- becomes 30-40% GRAVEL			
25		B-17-8	80		- no change			
30								

Figure A-17

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-17

Sheet 2 of 2

Elevation, feet	SAMPLES			MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
	Type	Number	Sampling Resistance blows/foot				
30	B-17-9		77	- Silty SAND with GRAVEL (SM) light brown, very dense, dry; 30-40% coarse to fine, subangular to subrounded GRAVEL; medium to fine SAND; no cementation; weakly bedded			GSD
35	B-13-10		66	- becomes light gray, coarse to fine SAND, and weakly to moderately bedded			
40	B-13-11		50 5"	- some rig chatter - Silty SAND (SM) light gray, very dense, dry; trace coarse to fine, subangular to subrounded GRAVEL; coarse to fine SAND; no cementation; weakly to moderately bedded			
45	B-17-12		86 10"	- becomes 5-10% GRAVEL; no bedding			
50	B-17-13		50 5"	- no change; poor recovery			
55				- Used sand catcher with 2.4" modCal sampler Total Depth: 50.9 bgs (refusal based on blow counts) Did not encounter groundwater Percolation Test Installation: 47 perforated pvc casing was installed to 46' bgs and lined with gravel to the ground surface <u>NOTE:</u> Borehole belled out from ~ 2' in diameter at the surface to ~ 4' in diameter at the base of the borehole			
60							
65							

Figure A-17a

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-18

Sheet 1 of 2

Date(s) Drilled	09/26/07	Logged By	Phuong Chau	Checked By	C.G.
Drilling Method	hollow-stem auger	Drill Bit Size/Type	8" O.D., fingerbit	Total Depth of Borehole	50.0 feet
Drill Rig Type	CME-75	Drilling Contractor	WDC Drilling	Approximate Surface Elevation	
Groundwater Level and Date Measured	did not encounter	Sampling Method (s)	2.4" modCal, SPT	Hammer Data	140 lbs., 30" drop, automatic trip hammer
Borehole Backfill	soil cuttings	Location	255' south of B-14		

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Number					
0					Holocene-age Younger Alluvium (Qal): - GRAVEL with SAND (GP) gray, medium dense, dry, poorly graded; 10-30% COBBLES; 80-90% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented			
		B-18-1	60		- Silty SAND with GRAVEL (SM) light brown, dense, dry; 20-30% coarse to fine GRAVEL; medium to fine SAND; no cementation; recovered rock fragment wedged in shoe			
5		B-18-2	17		- becomes medium dense	0.7		#200 Wash
		B-18-3	73		- SAND with GRAVEL (SP) light brown, dense, dry, poorly graded; 30-40% GRAVEL; coarse to medium SAND; no cementation	1.1	111	
10		B-18-4	20		- becomes medium dense			
					Pleistocene-age Older Alluvium (Qc)- non-marine:			
15		B-18-5	78		- Silty SAND with GRAVEL (SM) reddish brown, dense, dry; 20% coarse to fine GRAVEL; coarse to fine SAND; weakly cemented; trace calcium carbonate stringers	0.8	121	
20		B-18-6	25		- becomes medium dense			
25		B-18-7	50/4"		- Silty SAND (SM) reddish brown, medium dense, dry; trace coarse to fine GRAVEL; medium to fine SAND; 20-30% rock fragments (originating from COBBLES or coarse GRAVEL > 1" in diameter)			
30								Figure A-18

Project: CPV Sentinel Energy Project/Geotechnical Investigation

Project Location: North Palm Springs, CA

Project Number: 28067340

Log of B-18

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES		MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS
		Type	Sampling Resistance blows/foot				
30				- Silty SAND with GRAVEL (SM) reddish brown, medium dense to dense, dry, < 5% to 30% GRAVEL; medium to fine SAND			
35							
40							
45							
50				- Used sand catcher with 2.4" modCal sampler Total Depth: 50' bgs (maximum planned depth) Did not encounter groundwater Percolation Test Installation: 48" perforated pvc casing was installed to 47' bgs and lined with gravel to the ground surface			
55							
60							
65							

Figure A-18a

Project: CPV Sentinel Energy Project
 Project Location: Riverside County, CA
 Project Number: 28067340

Log of Test Pit
 Sheet 1 of 1 TP-1

Date(s) Drilled	11/12/07	Logged By	PHUONG CHAU	Checked By	CG
Drilling Method	BACKHOE TESTPIT	Drill Bit Size/Type	18" BUCKET	Total Depth of Borehole	9'
Drill Rig Type	N/A	Drilling Contractor	N/A	Approx. Surface Elevation	N/A
Groundwater Level and Date Measured	N/A	Sampling Method(s)	N/A	Hammer Data	N/A
Borehole Backfill	SPOILS	Location	B-1		

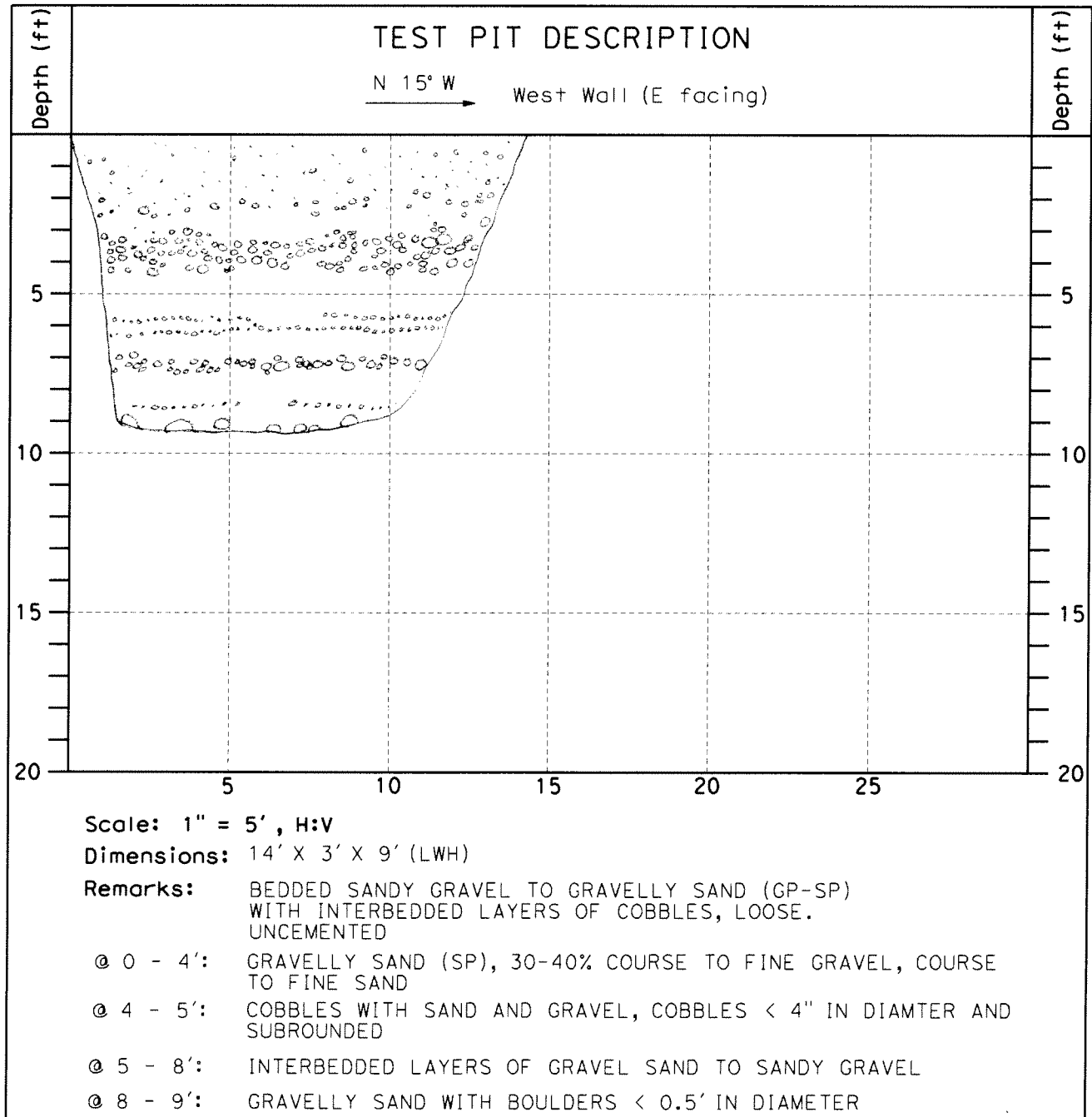


Figure A-19

Project:	CPV Sentinel Energy Project	Log of Test Pit
Project Location:	Riverside County, CA	Sheet <u>1</u> of <u>1</u> TP-2
Project Number:	28067340	

Date(s) Drilled	11/12/07	Logged By	PHUONG CHAU	Checked By	CG
Drilling Method	BACKHOE TESTPIT	Drill Bit Size/Type	18" BUCKET	Total Depth of Borehole	13'
Drill Rig Type	N/A	Drilling Contractor	N/A	Approx. Surface Elevation	N/A
Groundwater Level and Date Measured	N/A	Sampling Method(s)	N/A	Hammer Data	N/A
Borehole Backfill	SPOILS	Location	B-2		

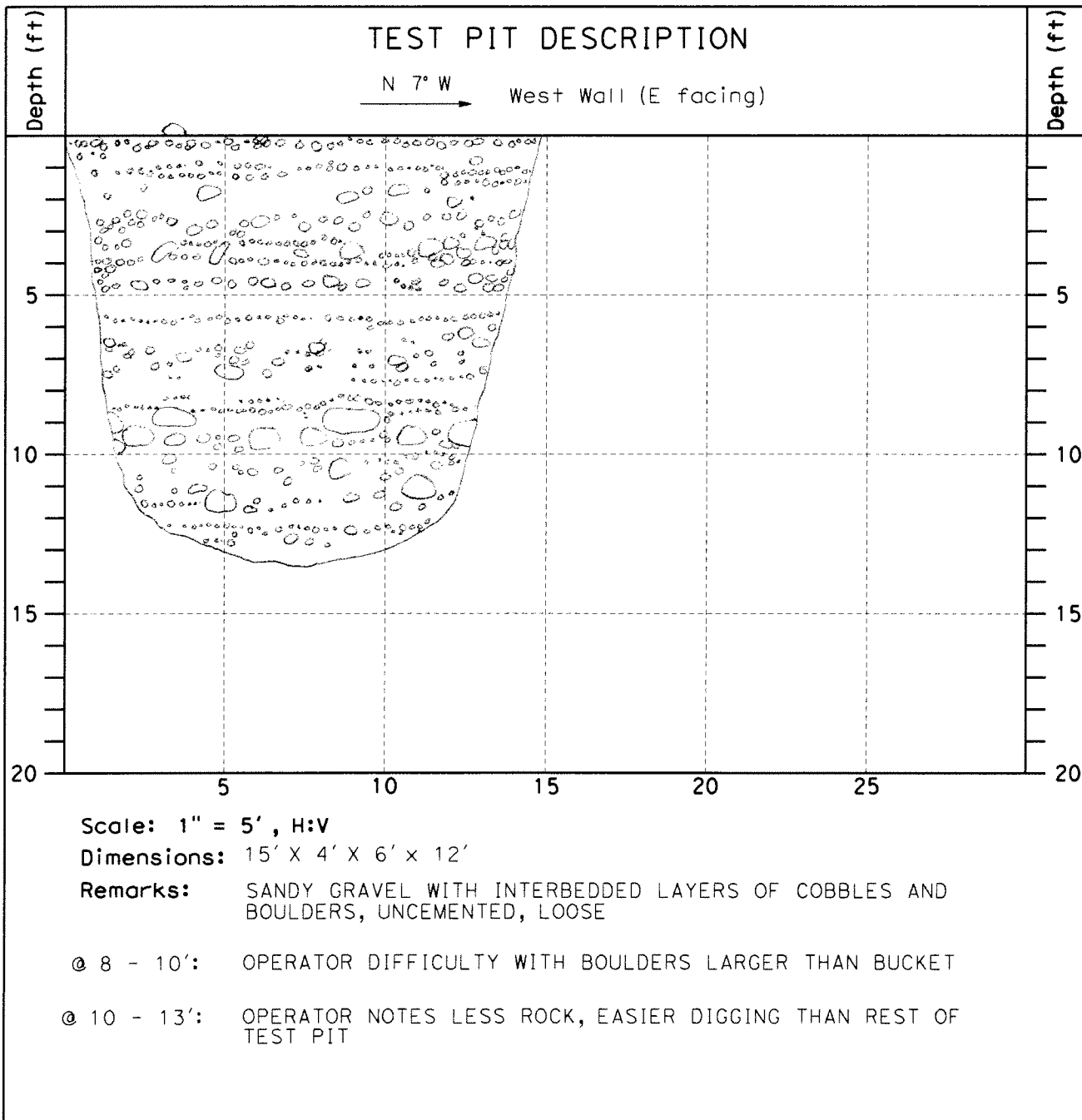


Figure A-20

Project: CPV Sentinel Energy Project
 Project Location: Riverside County, CA
 Project Number: 28067340

Log of Test Pit
 Sheet 1 of 1 TP-3

Date(s) Drilled	11/12/07	Logged By	PHUONG CHAU	Checked By	CG
Drilling Method	BACKHOE TESTPIT	Drill Bit Size/Type	18" BUCKET	Total Depth of Borehole	15'
Drill Rig Type	N/A	Drilling Contractor	N/A	Approx. Surface Elevation	N/A
Groundwater Level and Date Measured	N/A	Sampling Method(s)	N/A	Hammer Data	N/A
Borehole Backfill	SPOILS	Location	B-3		

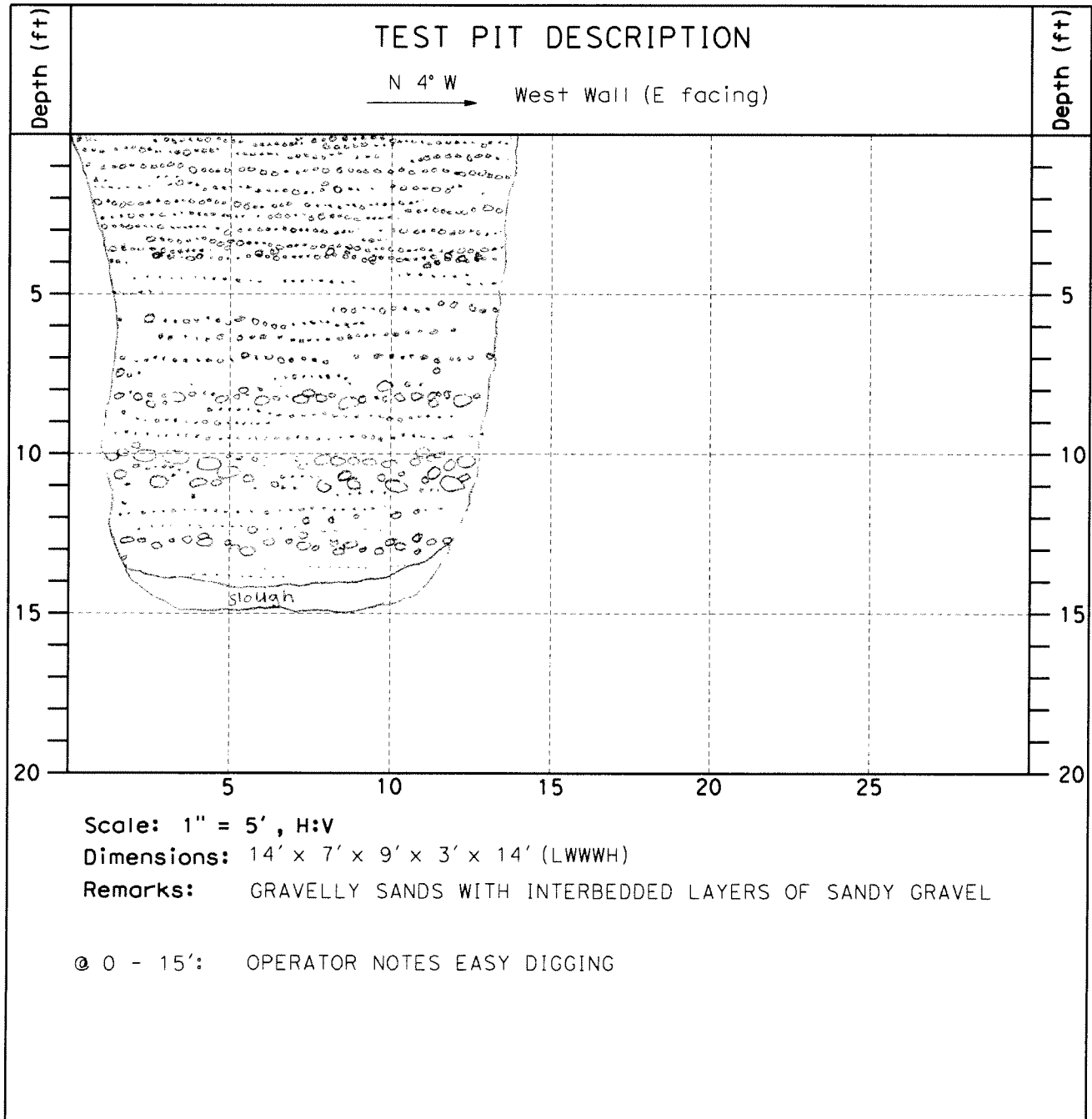


Figure A-21

Project:	CPV Sentinel Energy Project	Log of Test Pit
Project Location:	Riverside County, CA	Sheet <u>1</u> of <u>1</u>
Project Number:	28067340	TP-4

Date(s) Drilled	11/12/07	Logged By	PHUONG CHAU	Checked By	CG
Drilling Method	BACKHOE TESTPIT	Drill Bit Size/Type	18" BUCKET	Total Depth of Borehole	10'
Drill Rig Type	N/A	Drilling Contractor	N/A	Approx. Surface Elevation	N/A
Groundwater Level and Date Measured	N/A	Sampling Method(s)	N/A	Hammer Data	N/A
Borehole Backfill	SPOILS	Location	B-5		

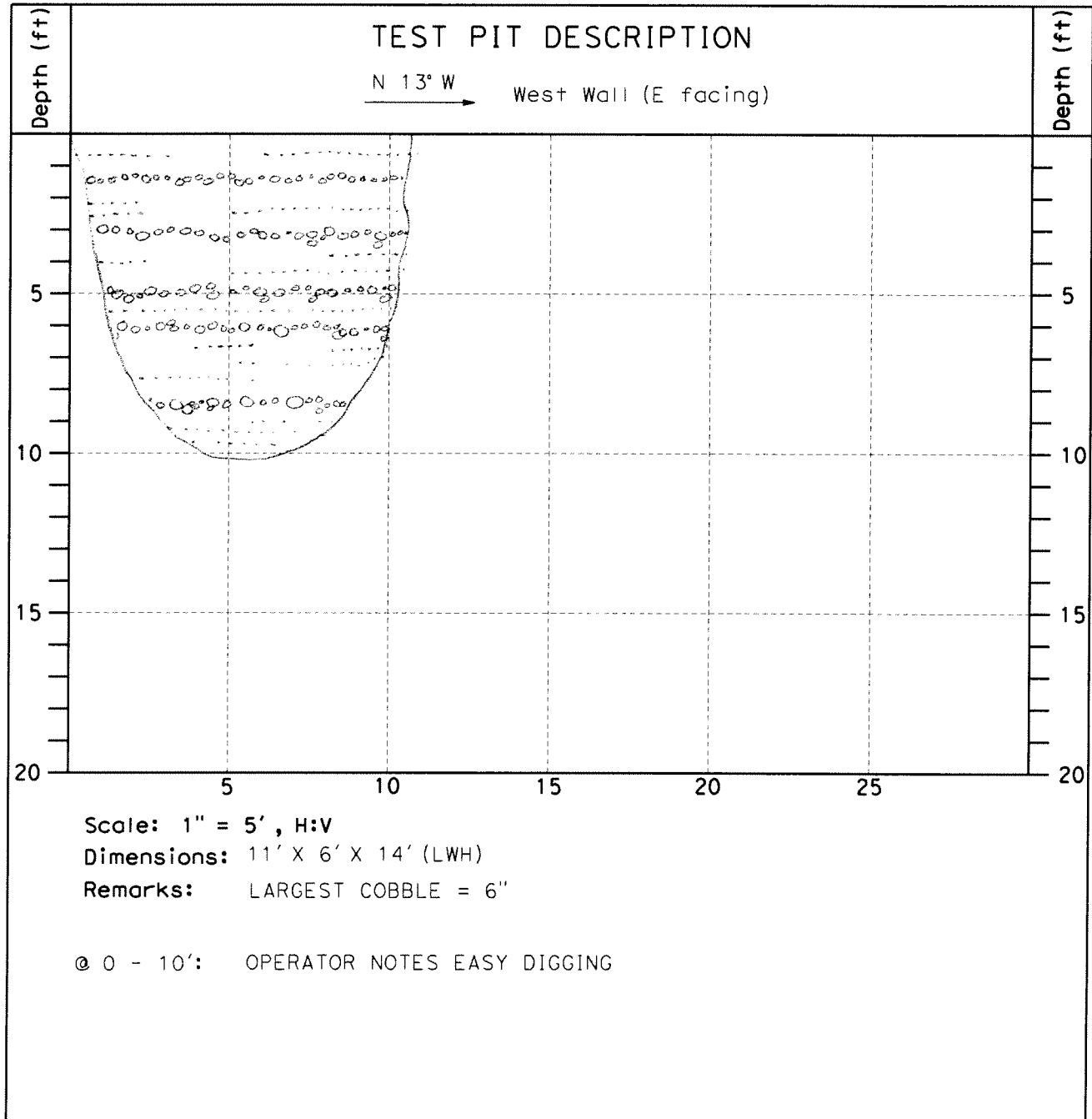


Figure A-22

Project:	CPV Sentinel Energy Project	Log of Test Pit
Project Location:	Riverside County, CA	Sheet <u>1</u> of <u>1</u>
Project Number:	28067340	TP-5

Date(s) Drilled	11/12/07	Logged By	PHUONG CHAU	Checked By	CG
Drilling Method	BACKHOE TESTPIT	Drill Bit Size/Type	18" BUCKET	Total Depth of Borehole	9'
Drill Rig Type	N/A	Drilling Contractor	N/A	Approx. Surface Elevation	N/A
Groundwater Level and Date Measured	N/A	Sampling Method(s)	N/A	Hammer Data	N/A
Borehole Backfill	SPOILS	Location	B-15		

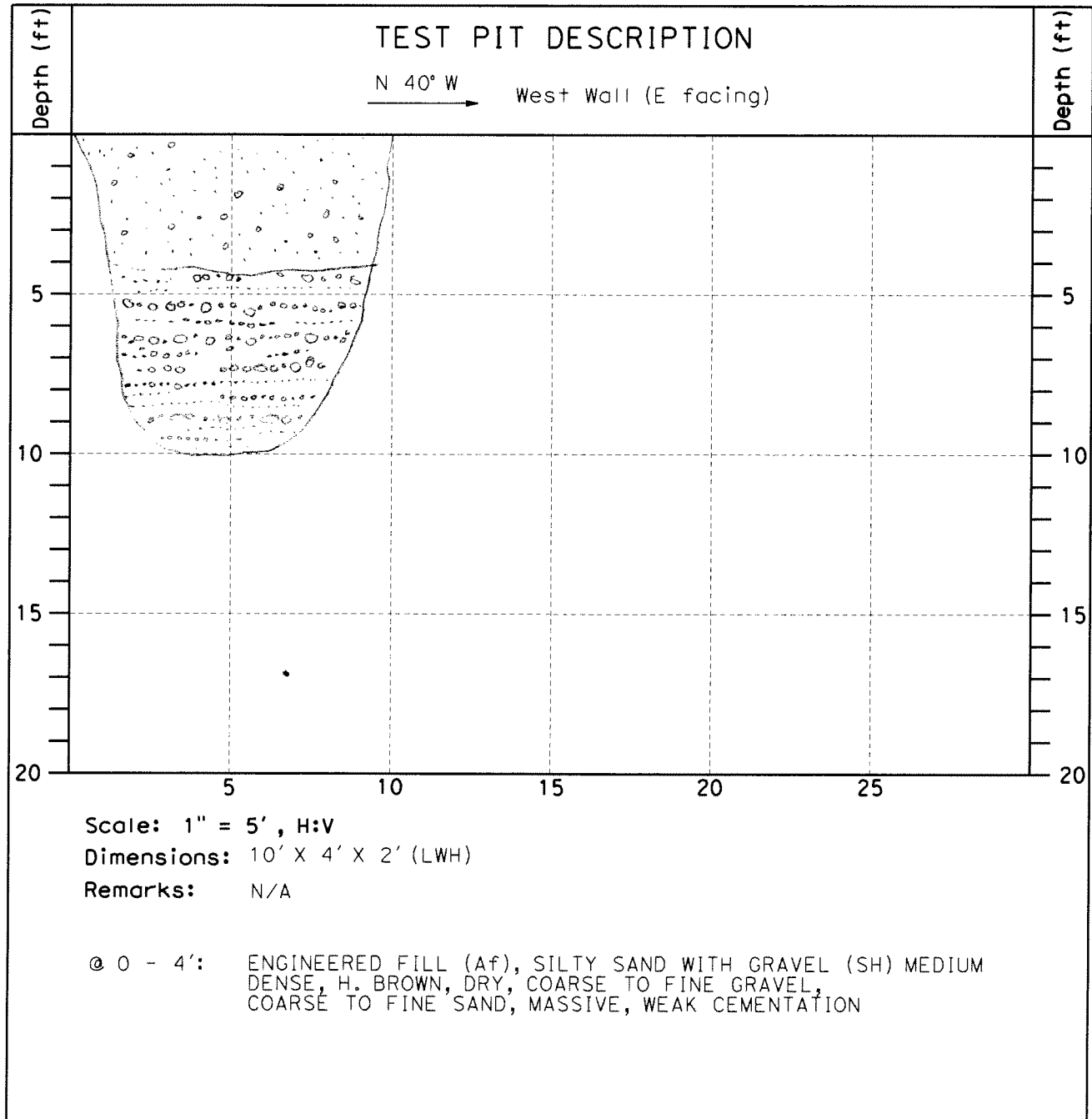


Figure A-23

APPENDIX B

Laboratory Test Standards and Results

GENERAL

Laboratory tests were performed on selected representative samples as an aid in classifying the soils and to evaluate the physical properties of the soils affecting foundation design and construction procedures. Tests performed are indicated on the Logs of Borings. A description of the laboratory testing program is presented below.

MOISTURE AND DENSITY TEST

Moisture content and density tests were performed on twenty-one of samples recovered from the borings. The results of these tests were used to compute existing soil overburden pressures, to correlate strength and compressibility data from tested samples with those not tested, and to aid in evaluating soil properties. The tests were performed in accordance with ASTM Test Methods D-2937 and D-2216, respectively. The results of these tests are presented on the Logs of Borings.

200 WASH SIEVES

The percent passing #200 wash sieve of fifteen selected soil samples were performed by mechanical sieving in accordance with ASTM Standard Test Method D-1140. The test results are presented in Table 1 of Appendix B.

SIEVE ANALYSIS

Sieve analyses were performed on ten selected samples of soils encountered at the site. These tests were performed to evaluate the gradation characteristics of the soils and to aid in their classification. The tests were performed in accordance with ASTM Test Methods D-422 and D-1140, respectively. The results are presented as Figures 1 through 10 of Appendix B.

COLLAPSE TEST

Two, one-dimensional (saturated) collapse tests (ASTM D-5333) were performed on undisturbed samples to evaluate the collapsibility characteristics of the on-site soils. The results of the tests are presented as Figures 11 and 12 of Appendix B.

EXPANSION INDEX

One expansion index test (ASTM D4829-07 Standard Test Method for Expansion Index of Soils) was performed on a bulk soil sample. The expansive characteristics of the soils are determined after saturation. The results are presented in Table 2 of Appendix B.

DIRECT SHEAR

Two direct shears and two remolded direct shear tests were performed on both in-situ and remolded samples respectively. A direct shear test determines the soils shear strength parameters

of the soils sample in accordance with ASTM D-3080. The sample was soaked to near saturation prior to testing. The results are presented on Figures 13 through 16 of Appendix B.

MAXIMUM DENSITY

Two maximum density tests (ASTM D1557-00) were performed on bulk soil samples to determine the maximum dry unit weight and optimum moisture content to determine relative compaction. The results are presented in Table 3 of Appendix B.

CORRESIVITY TEST

A series of chemical tests were performed on five selected samples of the soils to estimate pH, resistivity, sulfate and chloride contents (California Test Methods 417, 422, 532, and 643). Test results may be used by a qualified corrosion engineer to evaluate the general corrosion potential with respect to construction materials. The test results are discussed in Section 9 of this report and are presented in Table 4 of Appendix B.

R-VALUE TEST

One R-values test (per ASTM D 2844/California Test Method 301) was performed on a bulk sample collected during the geotechnical investigation. The result of the test is presented in Table 5 of Appendix B.

LABORATORY TESTS RESULTS

**PROPOSED CPV SENTINEL ENERGY PROJECT
NORTH PALM SPRINGS, RIVERSIDE COUNTY, CALIFORNIA
FOR CPV SENTINEL LLC**

URS PROJECT NO. 28067340

Table 1 - #200 Wash Tests

Boring #	Sample #	Depth	Percent Passing #200 Sieve
		(ft.)	
B-1	5	15	15.8
B-3	1	2.5	13.6
B-4	1	2.5	11.5
B-5	2	5	14.9
B-6	3	7.5	8.4
B-8	1	2.5	16.0
B-10	5	15	11.0
B-10	10	40	13.4
B-11	6	20	18.2
B-12	2	5	11.7
B-13	2	5	11.0
B-14	5	15	18.4
B-14	8	30	19.9
B-15	2	5	21.0
B-17	2	5	15.5
B-18	2	5	17.6

Table 2 –Expansion Index Test

Boring #	Sample #	Depth	Soil Type	Index
		(ft.)		
B-3	1A	0-5'	Sand to Gravelly Sand	3.8

LABORATORY TESTS RESULTS

PROPOSED CPV SENTINEL ENERGY PROJECT NORTH PALM SPRINGS, RIVERSIDE COUNTY, CALIFORNIA FOR CPV SENTINEL LLC

URS PROJECT NO. 28067340

Table 3 – Maximum Density Test

Boring #	Sample #	Depth	Soil Type	Dry Unit Weight,pcf	Moisture Content, %
		(ft.)			
B-11	7A	20-25'	Sand to Gravelly Sand	138.6	6.8
B-13	1A	0-5'	Sand to Gravelly Sand	128.9	8.3

Table 4 - Corrosivity Tests

Resistivity Test and pH: California Test Methods 532 and 643

Sulfate Content: California Test Method 417

Chloride Content: California Test Method 422

Boring No.	Sample No.	Depth	Resistivity	pH	Sulfate Content	Chloride Content
		(ft.)	(ohm-cm)		(ppm)	(ppm)
B-3	BK-1	0-5	6300	8.16	14	105
B-7	2	5	8600	7.76	7	45
B-11	2	5	8400	8.28	2	75
B-13	4	10	11500	8.58	27	105
B-15	1	2.5	12000	8.42	16	75

Table 5 – R-Value Test

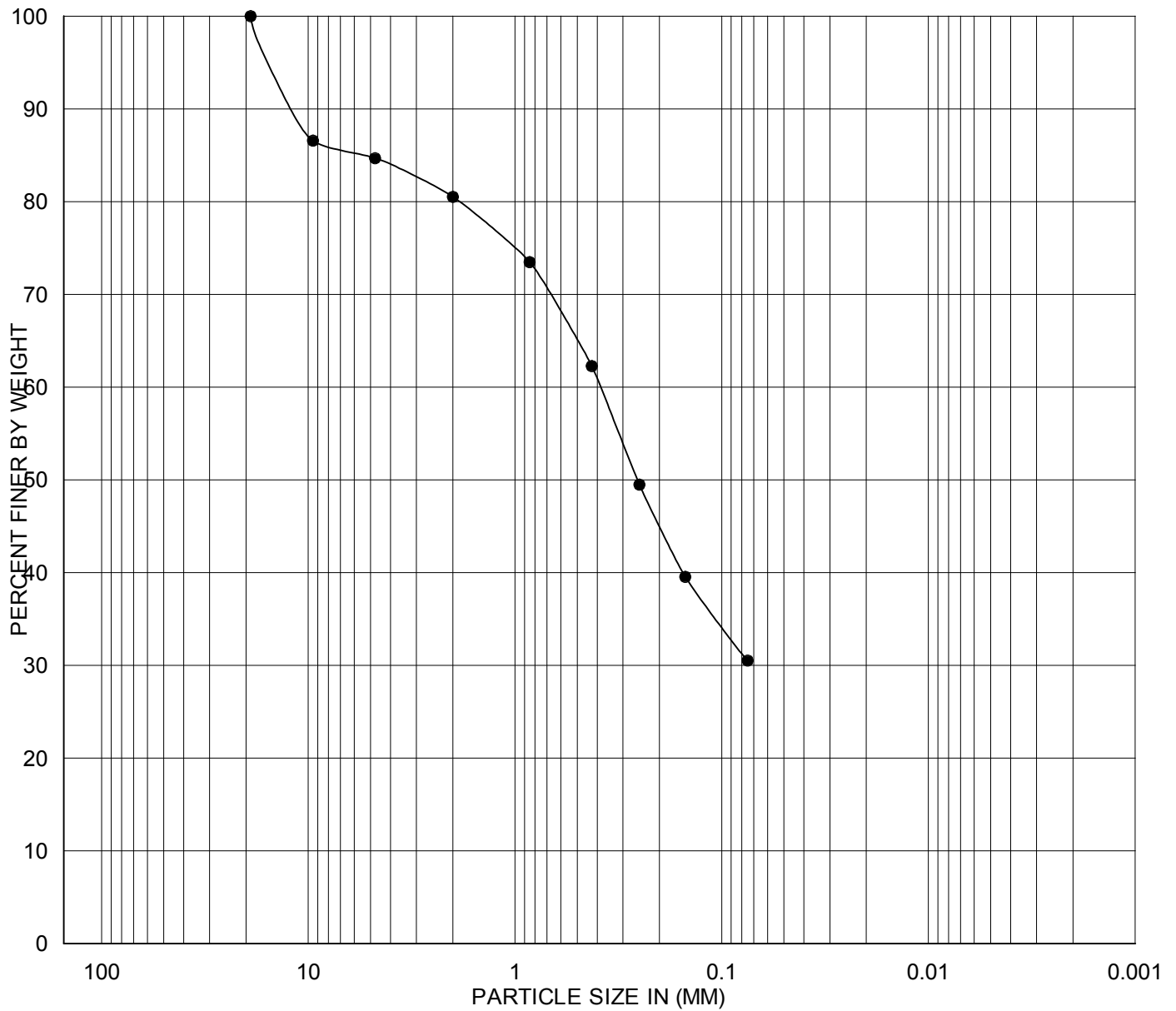
Boring #	Sample #	Depth	Soil Type	R-Value
		(ft.)		
B-11	7A	20-25'	Sand to Gravelly Sand	60

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER

6" 3" 1 1/2" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #200

HYDROMETER



Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI-CL (%)	Sample Description (USCS Symbol)
●	B-1	1	2.5	15:54:31	SILTY SAND with GRAVEL (SM)

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

URS

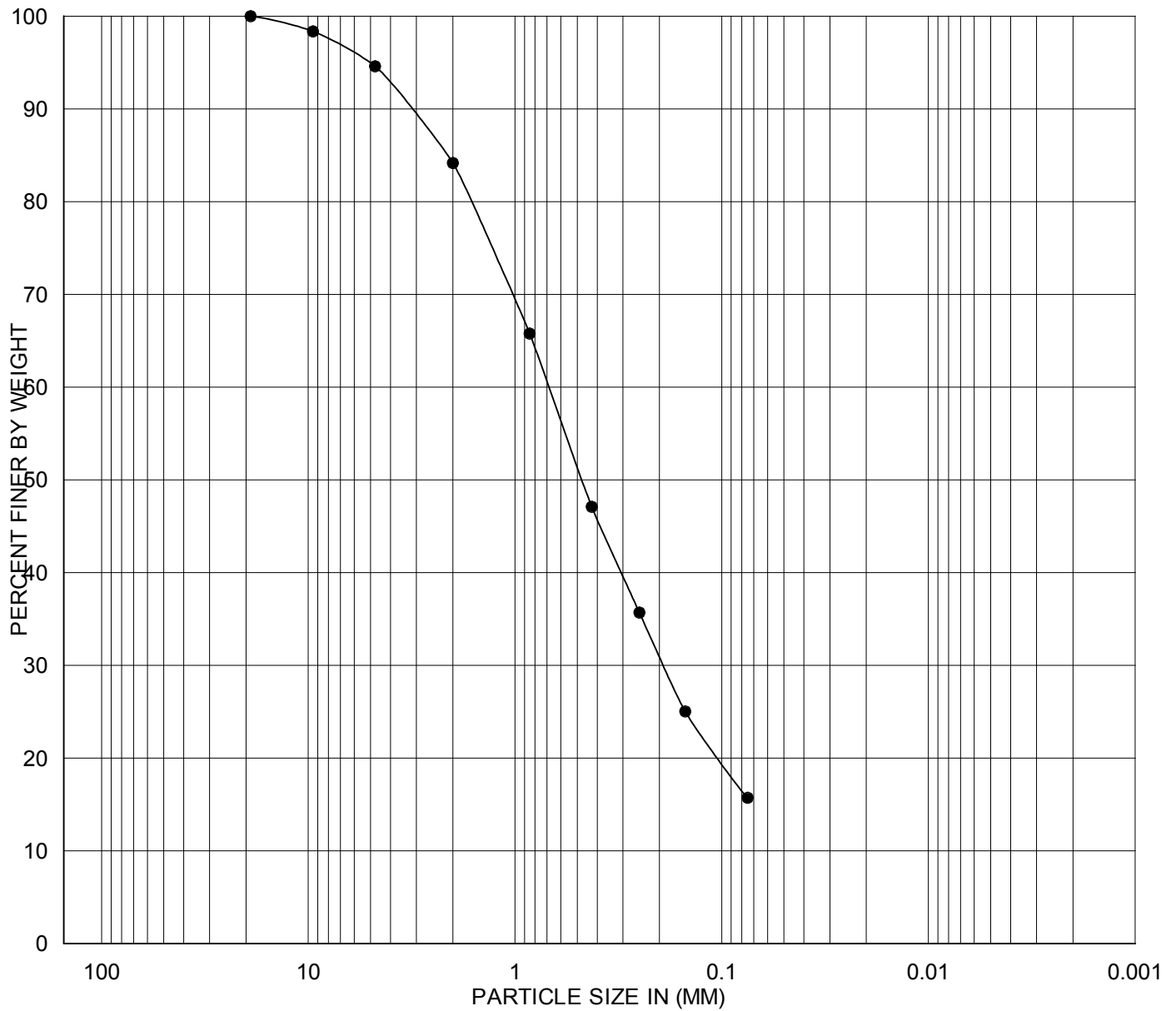
Figure B-1

GRAVEL		SAND				FINES	
COARSE	FINE	COARSE	MEDIUM	FINE		SILT	CLAY

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER

6" 3" 1 1/2" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #200

HYDROMETER



Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI-CL (%)	Sample Description (USCS Symbol)
●	B-3	3	10	5:79:16	SILTY SAND (SM)

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

URS

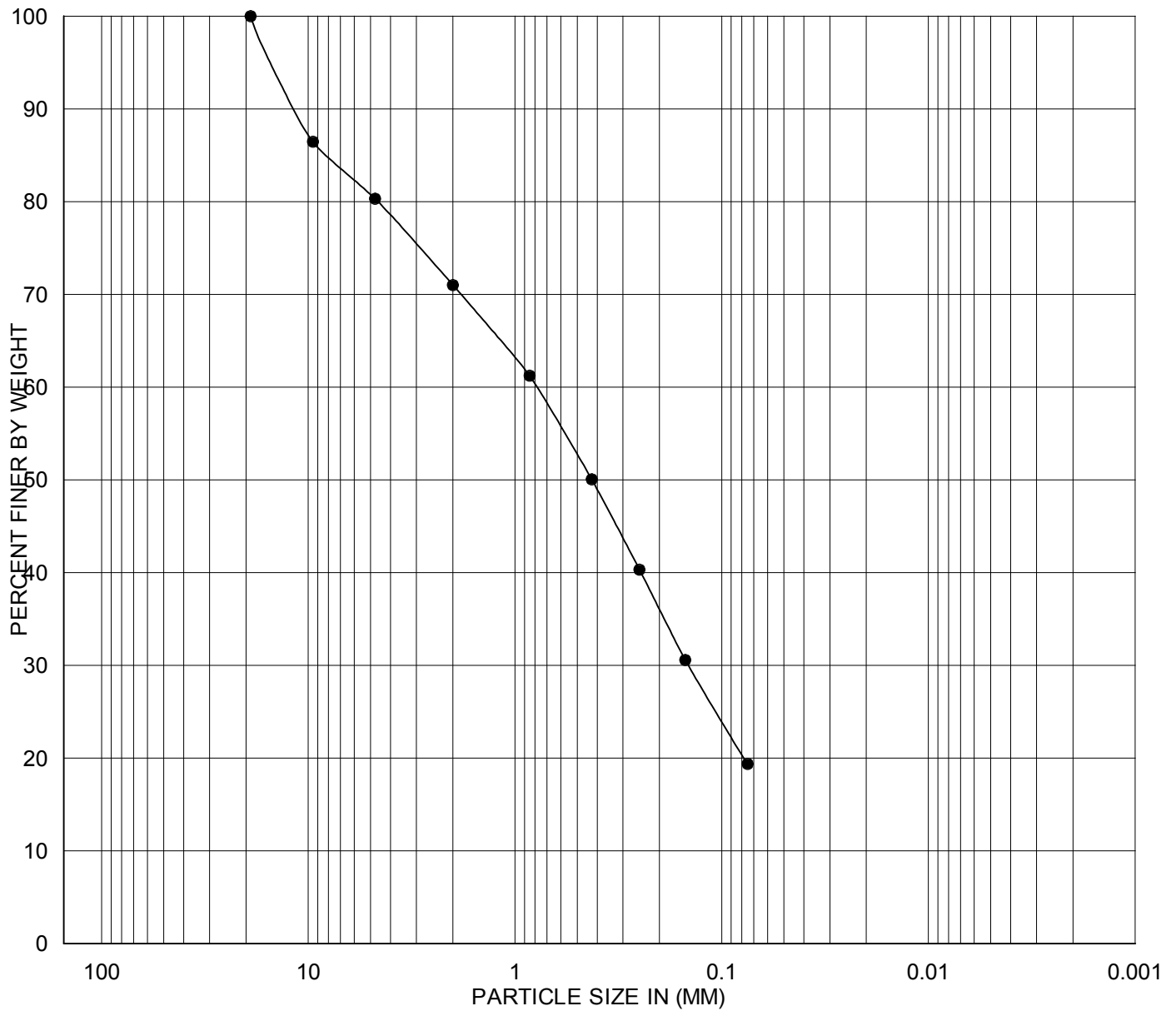
Figure B-2

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER

6" 3" 1 1/2" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #200

HYDROMETER



Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI-CL (%)	Sample Description (USCS Symbol)
●	B-7	2	5	20:61:19	SILTY SAND with GRAVEL (SM)

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

URS

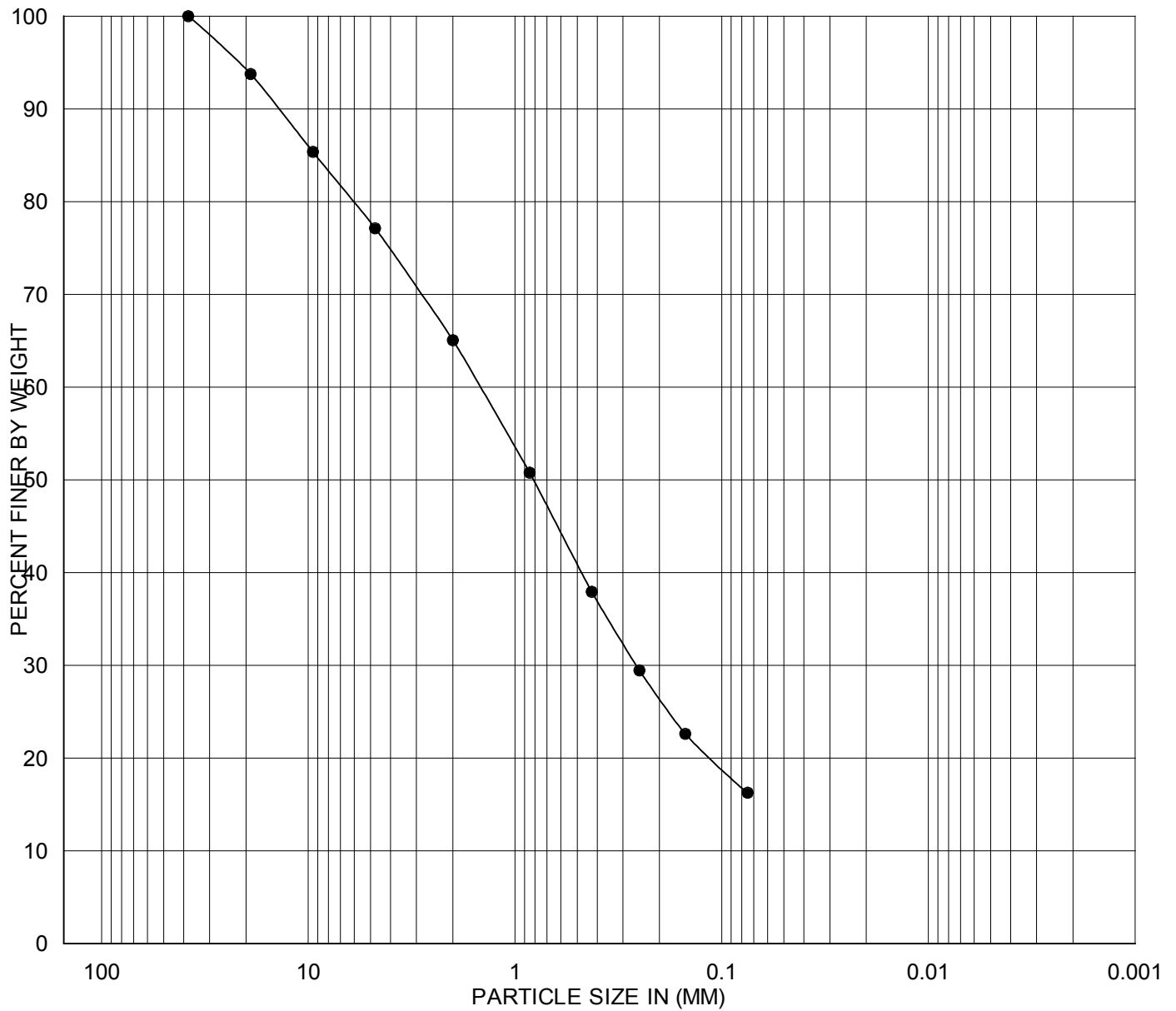
Figure B-3

GRAVEL			SAND			FINES	
COARSE	FINE		COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER

6" 3" 1 1/2" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #200

HYDROMETER



Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI-CL (%)	Sample Description (USCS Symbol)
●	B-8	4	10	23:61:16	SILTY SAND with GRAVEL (SM)

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

URS

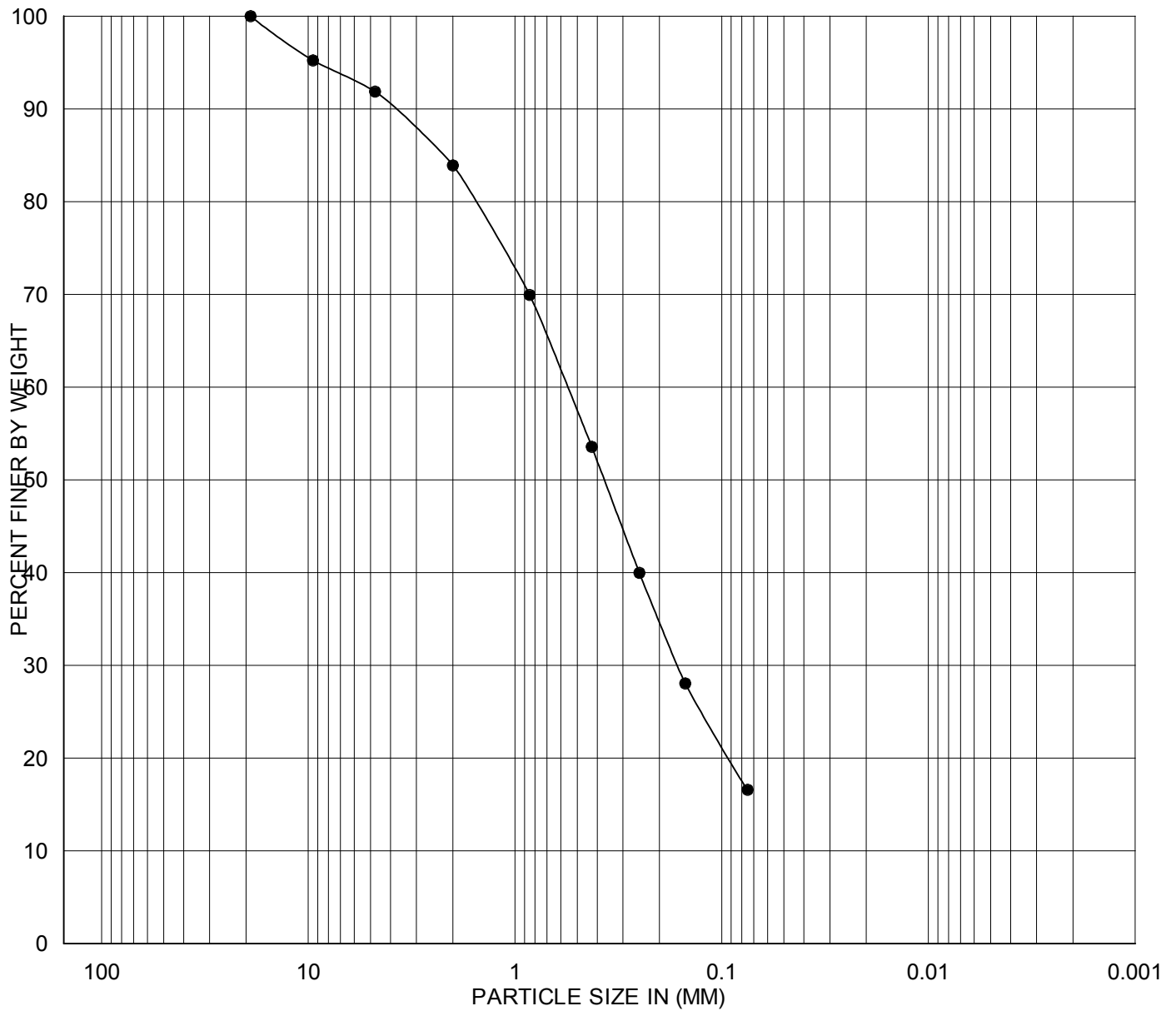
Figure B-4

GRAVEL		SAND				FINES	
COARSE	FINE	COARSE	MEDIUM	FINE		SILT	CLAY

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER

6" 3" 1 1/2" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #200

HYDROMETER



Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI-CL (%)	Sample Description (USCS Symbol)
●	B-10	1	2.5	8:75:17	SILTY SAND (SM)

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

URS

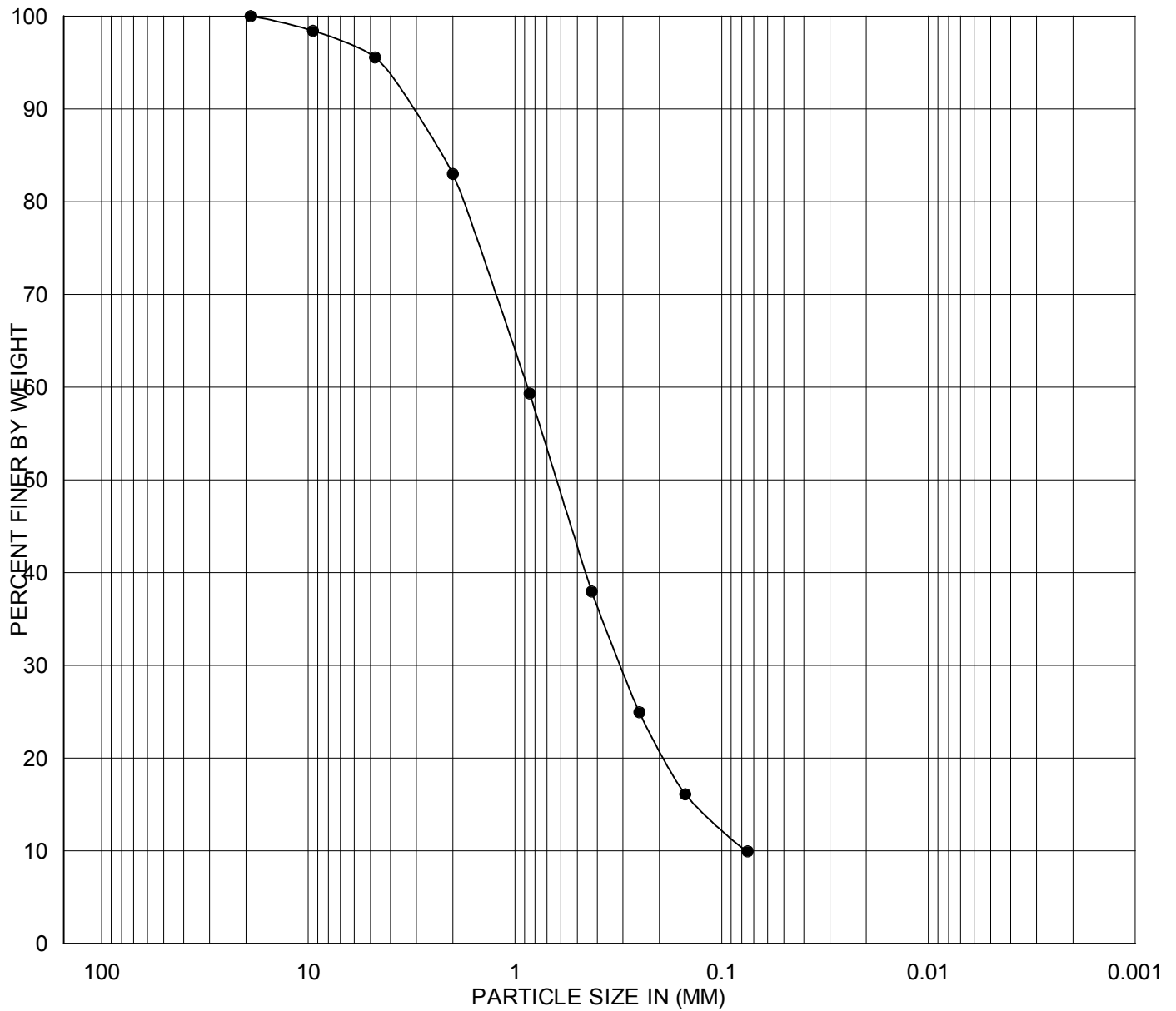
Figure B-5

GRAVEL		SAND				FINES	
COARSE	FINE	COARSE	MEDIUM	FINE		SILT	CLAY

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER

6" 3" 1 1/2" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #200

HYDROMETER



Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI-CL (%)	Sample Description (USCS Symbol)
●	B-10	9	35	4:86:10	POORLY GRADED SAND with SILT (SP-SM)

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

URS

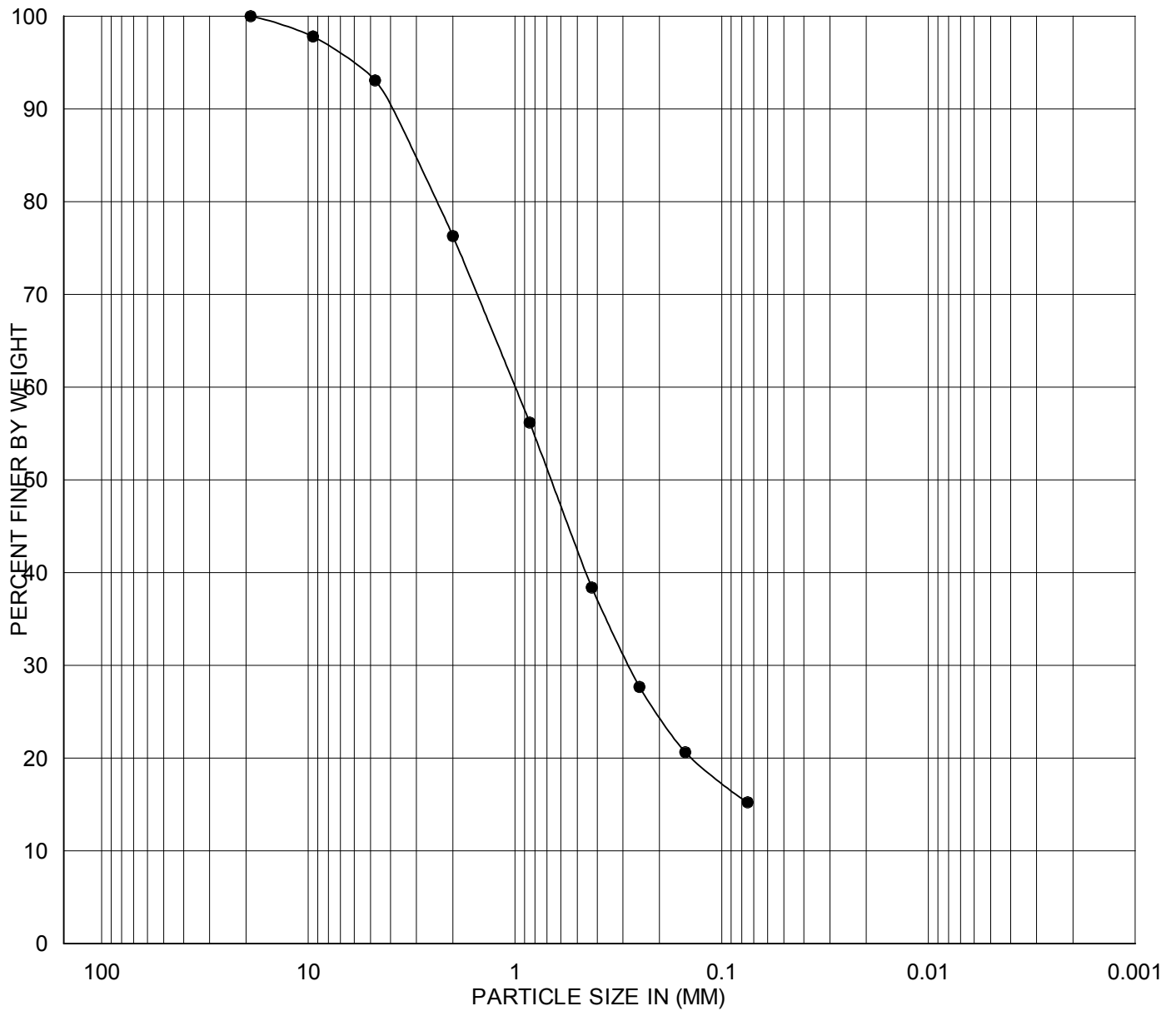
Figure B-6

GRAVEL		SAND				FINES	
COARSE	FINE	COARSE	MEDIUM	FINE		SILT	CLAY

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER

6" 3" 1 1/2" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #200

HYDROMETER



Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI-CL (%)	Sample Description (USCS Symbol)
●	B-11	4	10	7:78:15	SILTY SAND (SM)

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

URS

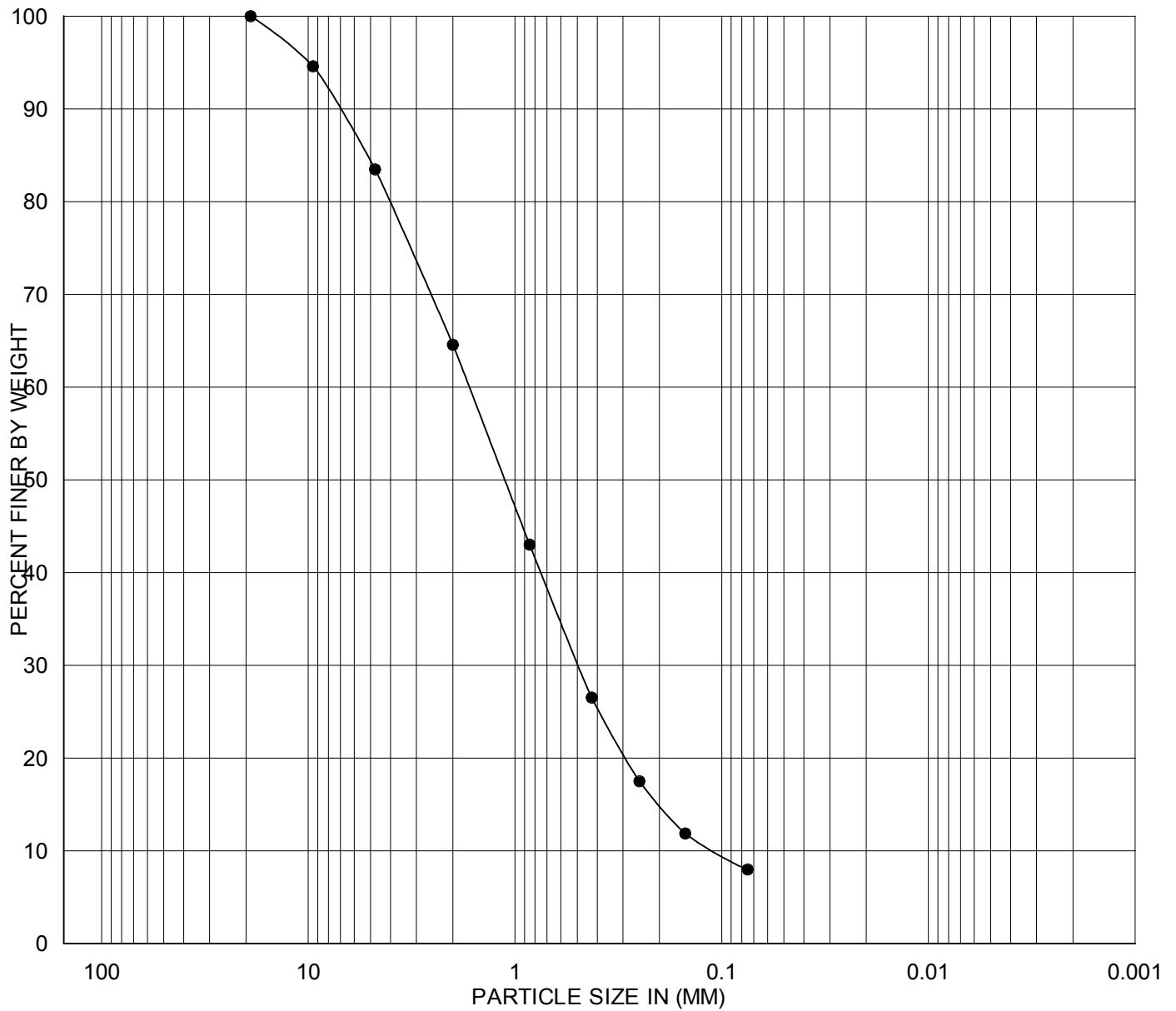
Figure B-7

GRAVEL		SAND				FINES	
COARSE	FINE	COARSE	MEDIUM	FINE		SILT	CLAY

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER

6" 3" 1 1/2" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #200

HYDROMETER



Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI-CL (%)	Sample Description (USCS Symbol)
●	B-16	3	7.5	16:76:8	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

URS

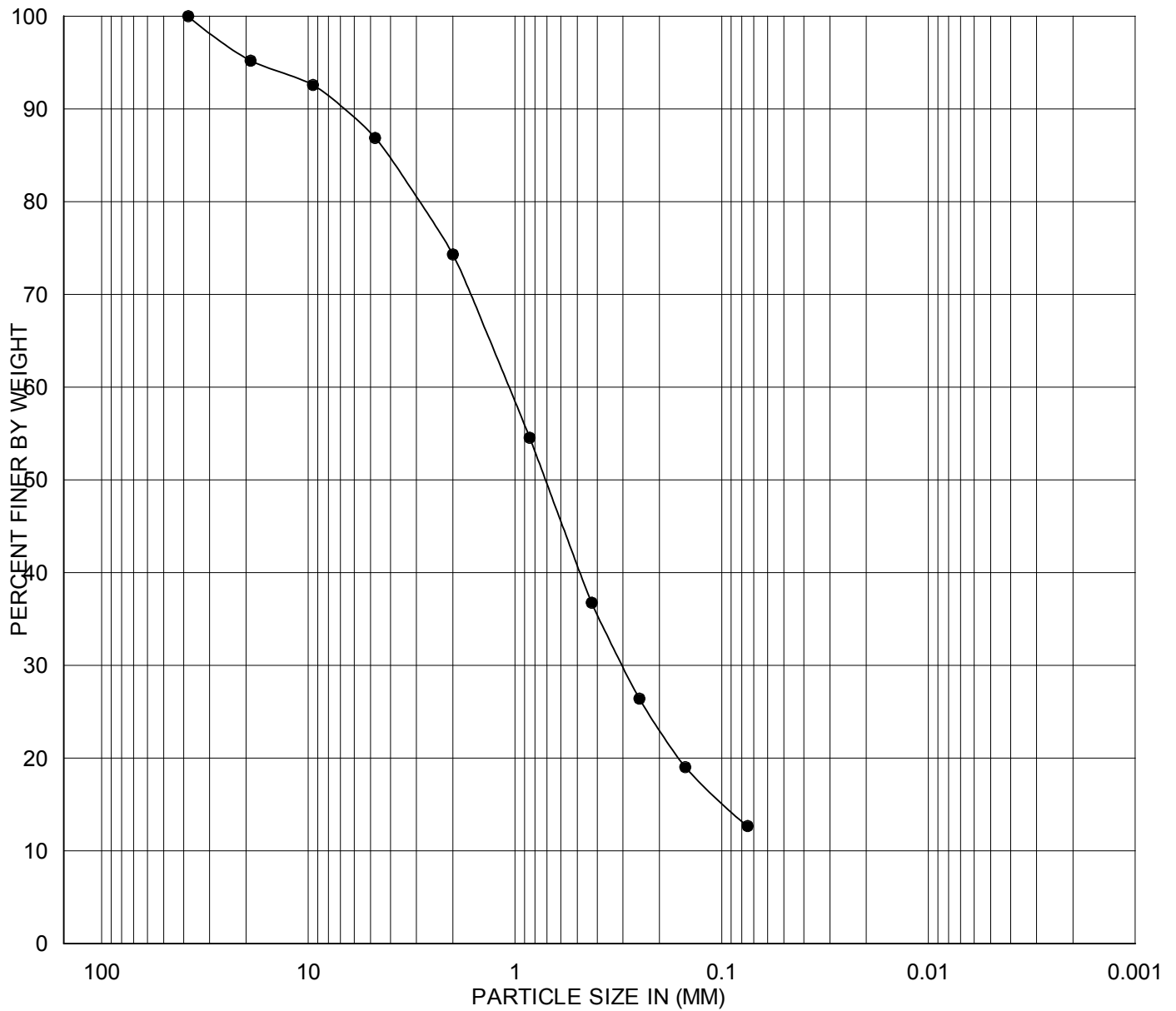
Figure B-8

GRAVEL			SAND				FINES	
COARSE	FINE		COARSE	MEDIUM	FINE		SILT	CLAY

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER

6" 3" 1 1/2" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #200

HYDROMETER



Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI-CL (%)	Sample Description (USCS Symbol)
●	B-17	4	10	13:74:13	SILTY SAND (SM)

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

URS

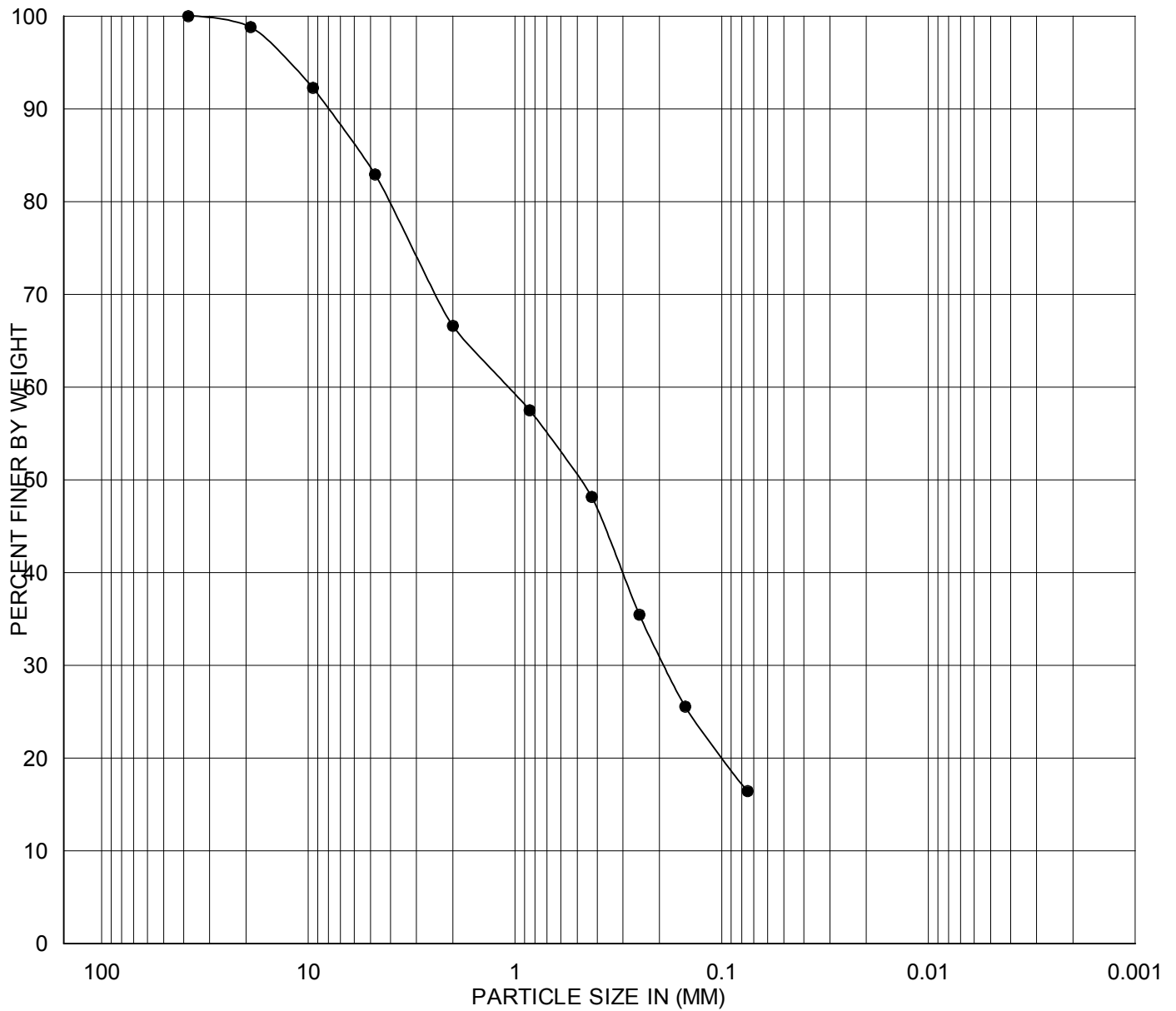
Figure B-9

GRAVEL			SAND			FINES	
COARSE		FINE	COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER

6" 3" 1 1/2" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #200

HYDROMETER



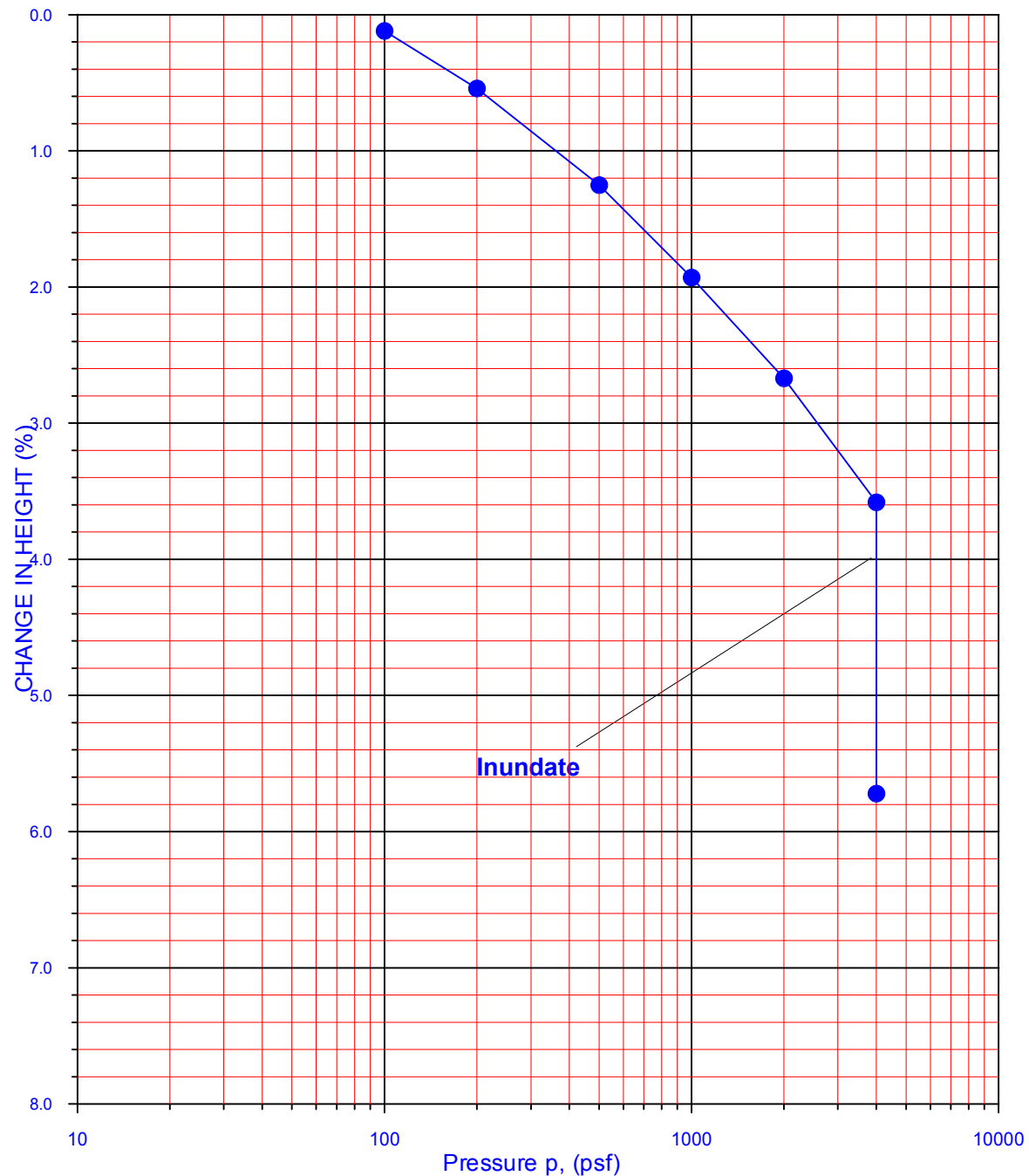
Symbol	Boring No.	Sample No.	Depth (ft.)	GR:SA:SI-CL (%)	Sample Description (USCS Symbol)
●	B-17	11	40	17:67:16	SILTY SAND with GRAVEL (SM)

PARTICLE-SIZE DISTRIBUTION CURVE
(ASTM D-422)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

URS

Figure B-10



BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%) Initial / Final	DRY DENSITY (pcf) Initial / Final	DEGREE OF SATURATION (%) Initial / Final
B-4	4	10	1 / 16.4	115 / 125	6 / 99

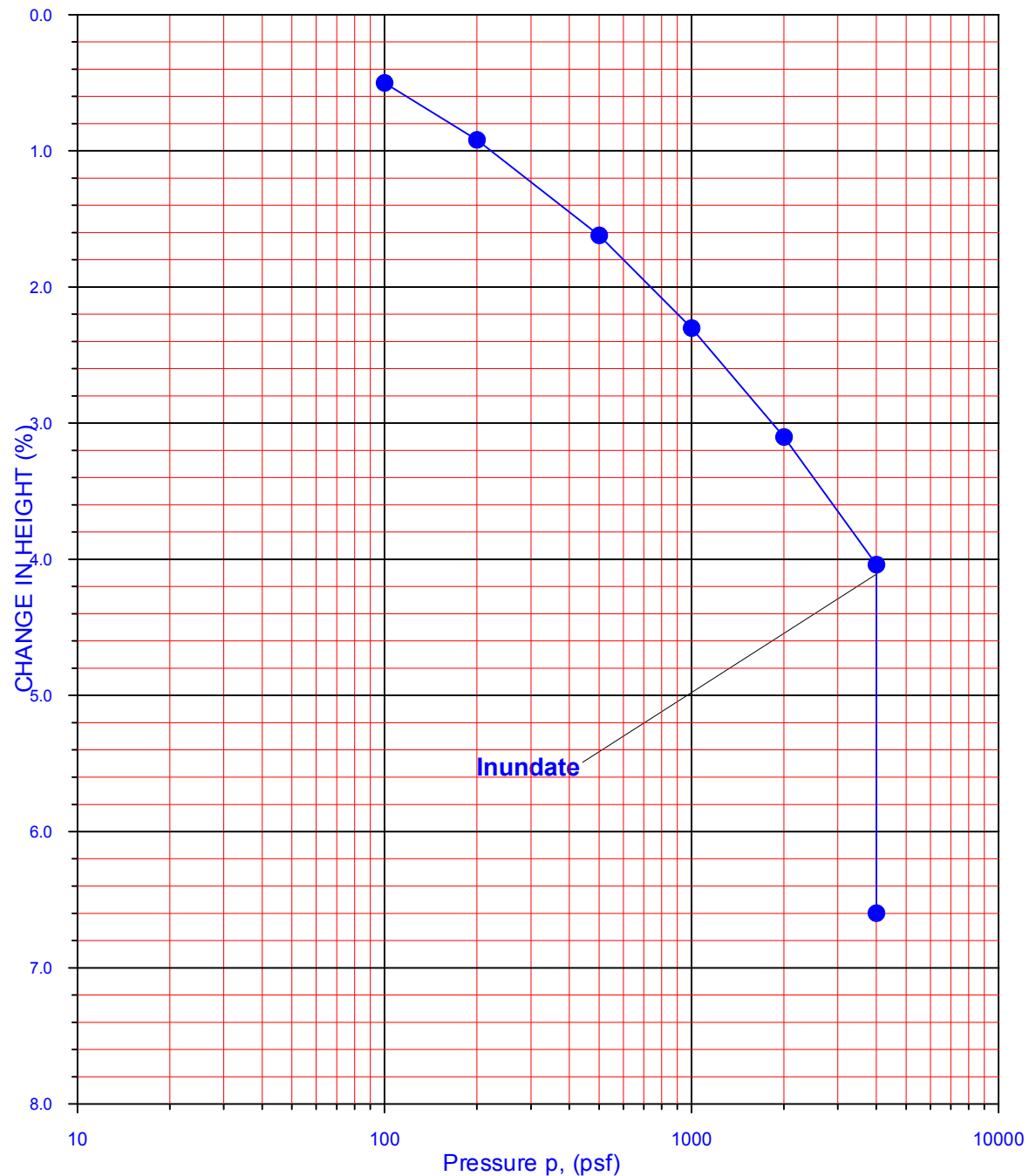
Sample Description: POORLY GRADED SAND with SILT (SP-SM), yellowish brown, fine to medium sand

COLLAPSE POTENTIAL OF SOILS (ASTM D5333)

**CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL**



Figure B-11



BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%) Initial / Final	DRY DENSITY (pcf) Initial / Final	DEGREE OF SATURATION (%) Initial / Final
B-17	1	2.5	0.4 / 10	120 / 126	3 / 99

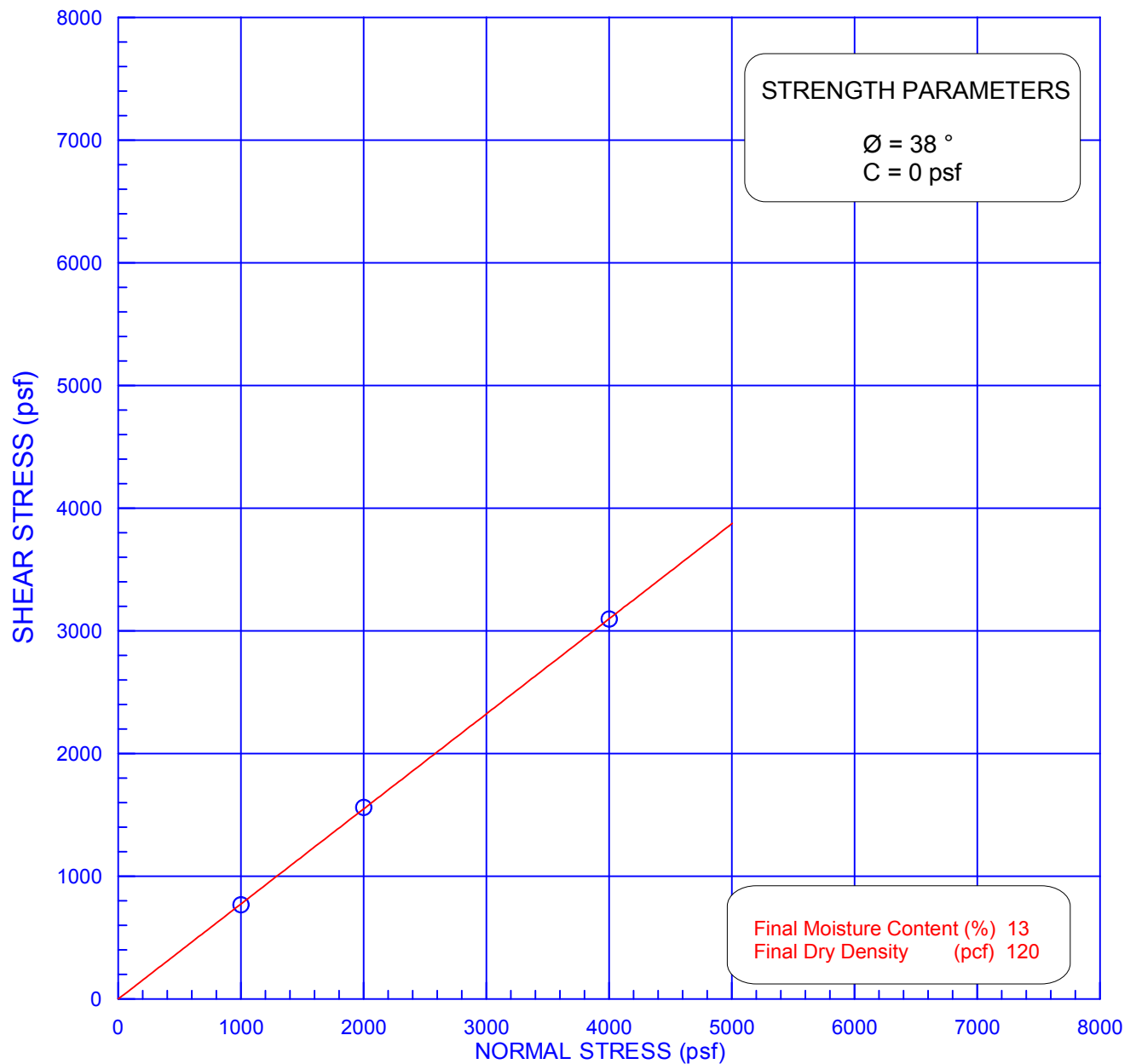
Sample Description: SILTY SAND (SM), light yellowish brown, fine to medium sand

COLLAPSE POTENTIAL OF SOILS (ASTM D5333)

**CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL**



Figure B-12

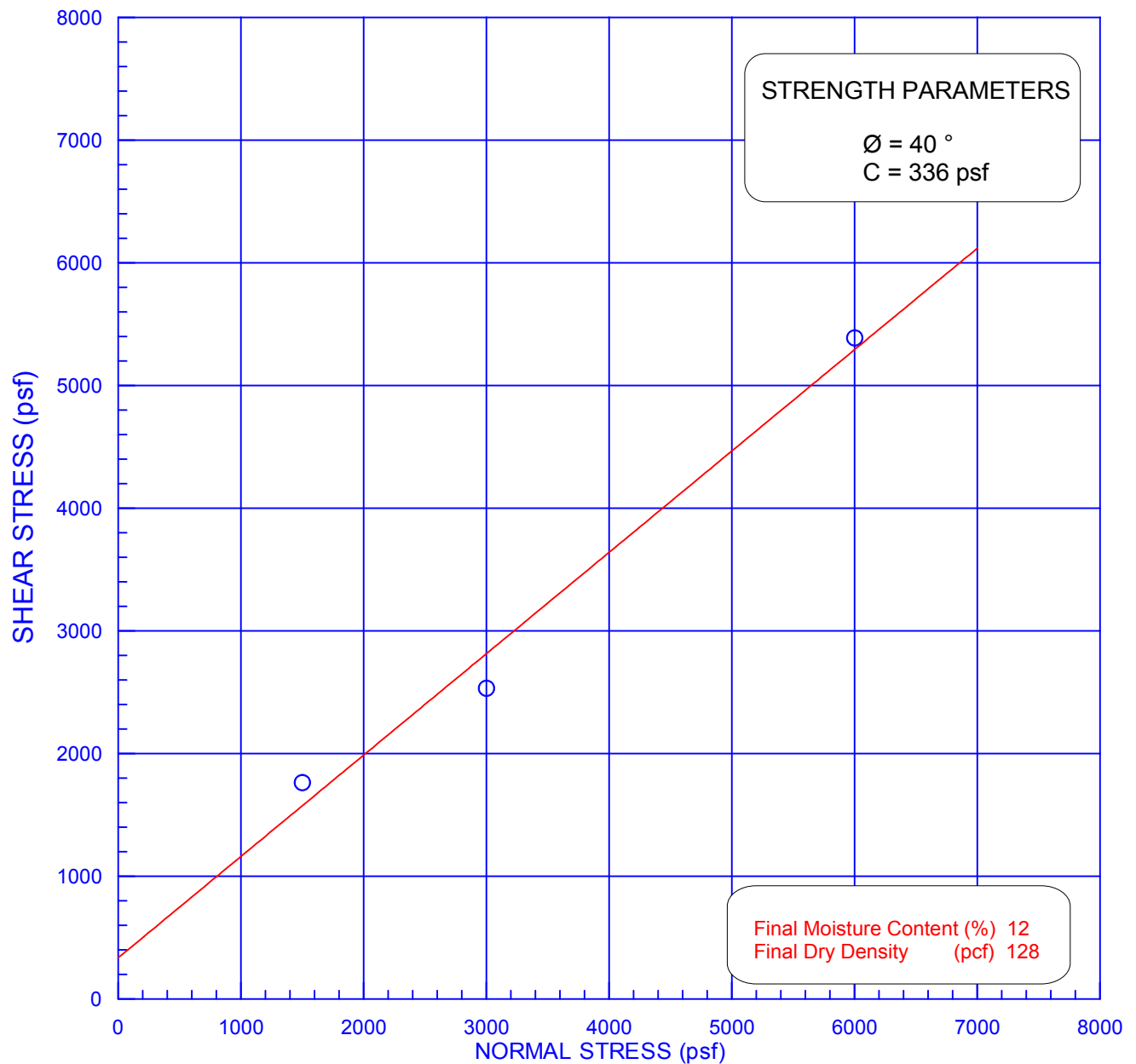


BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-4	4	10	0.010	1000	768
				2000	1560
				4000	3096

Sample Description: POORLY GRADED SAND with SILT (SP-SM), yellowish brown, fine to medium sand

DIRECT SHEAR TEST RESULTS
 CONSOLIDATED DRAINED
 ASTM D 3080

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-11	1	2.5	0.005	1500	1764
				3000	2532
				6000	5388

Sample Description: SILTY SAND (SM), yellowish brown

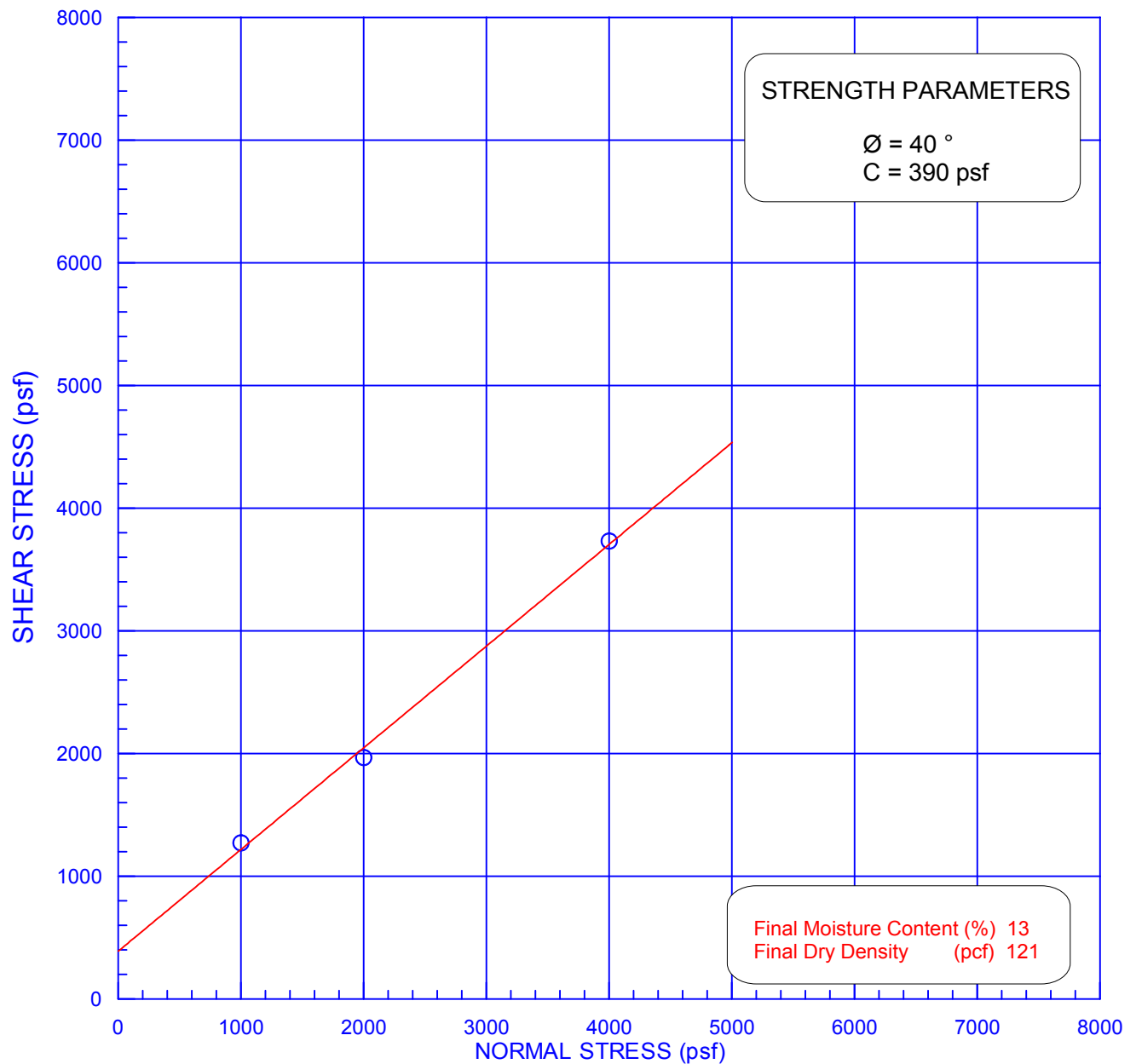
REMOLDED DIRECT SHEAR TEST RESULTS

CONSOLIDATED DRAINED

ASTM D 3080

(95% OF MODIFIED PROCTOR)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-13	1	2.5	0.005	1000	1272
				2000	1968
				4000	3732

Sample Description: SILTY SAND (SM), yellowish brown

REMOLDED DIRECT SHEAR TEST RESULTS

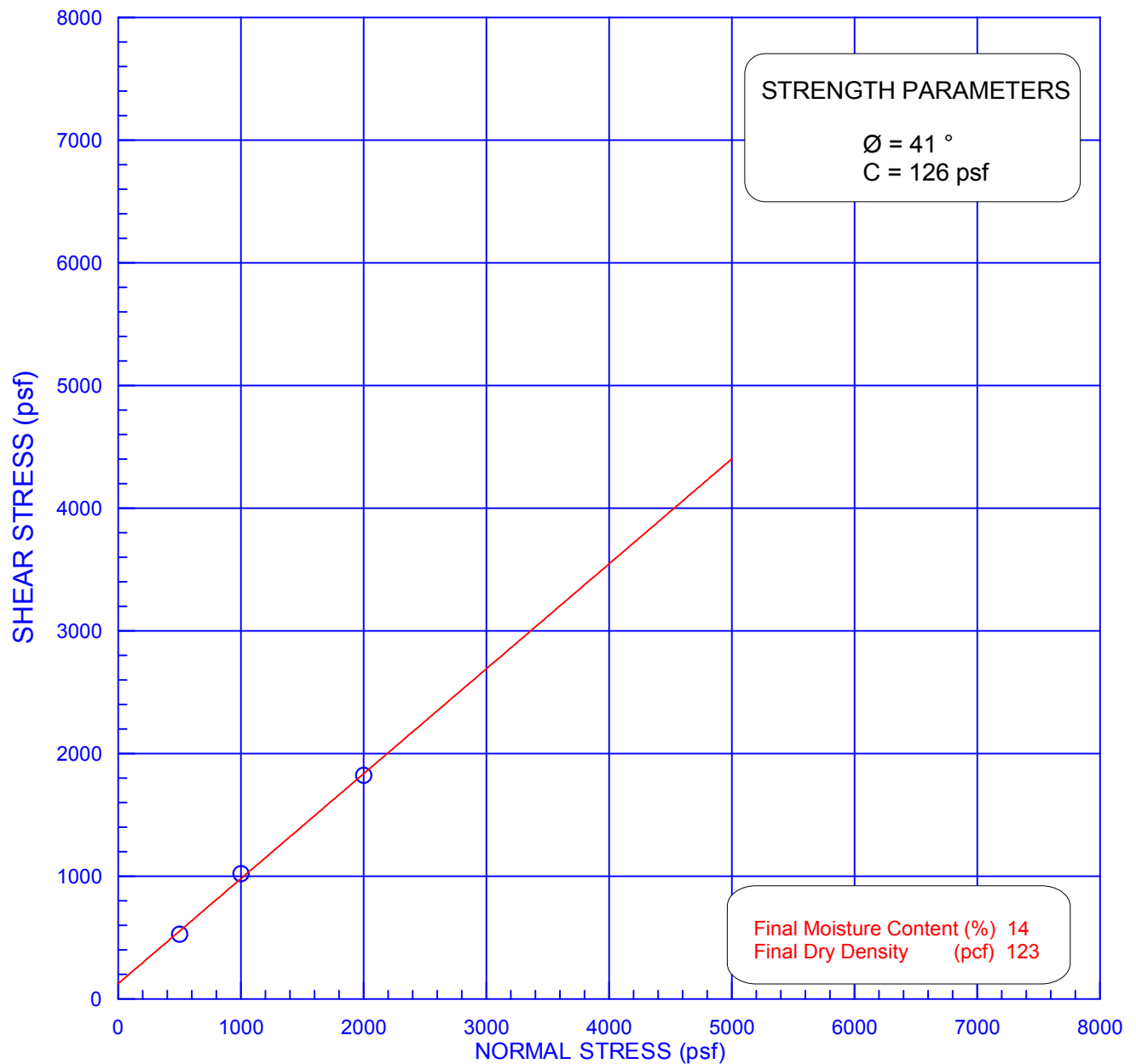
CONSOLIDATED DRAINED

ASTM D 3080

(95% OF MODIFIED PROCTOR)

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL

Figure B-15



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-17	1	2.5	0.010	500	528
				1000	852
				2000	1824

Sample Description: SILTY SAND (SM), light yellowish brown, fine to medium sand

DIRECT SHEAR TEST RESULTS
 CONSOLIDATED DRAINED
 ASTM D 3080

CPV SENTINEL ENERGY PROJECT
PALM SPRINGS, CALIFORNIA
FOR: SENTINEL