APPENDIX C

PRELIMINARY GEOTECHNICAL IINVESTIGATION REPORT

PRELIMINARY
GEOTECHNICAL INVESTIGATION REPORT
VICTORVILLE 2 HYBRID POWER PROJECT
CITY OF VICTORVILLE
SAN BERNARDINO COUNTY, CALIFORNIA

June 26, 2006

June 26, 2006
File No. 66815

Mr. Arrie Bachrach
Program Manager
ENSR
1220 Avenida Acaso
Camarillo, California 93012

Subject: Preliminary Geotechnical Investigation Report
Victorville 2 Hybrid Power Project
Victorville, California

Dear Mr. Bachrach:

Kleinfelder, Inc. is pleased to present this report summarizing the findings of our preliminary geotechnical investigation for the referenced project. The project site is located north of the Southern California Logistics Airport in Victorville, California.

The purpose of our preliminary geotechnical investigation was to evaluate the suitability of the subsurface conditions for construction of the proposed Victorville 2 (VV2) Hybrid Power Project. Based on the results of our subsurface investigation, laboratory testing, geotechnical analyses conducted for this investigation, and our current understanding of the project, it is our professional opinion that the proposed site is geotechnically suitable for construction of the proposed project, provided the recommendations presented in this report are incorporated into the project design and construction. The conclusions and recommendations presented in this report are subject to the limitations presented in Section 6.

We appreciate the opportunity to be of service on this project. Please do not hesitate to contact the undersigned if you have any questions, comments, or require additional information.

Respectfully submitted,

KLEINFELDER, INC.

Khaled Chowdhury, PE
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
KHALED H. CHOWDHURY
No. C67823
Exp. 6/30/07
CIVIL
STATE OF CALIFORNIA

Richard F. Escandon, PG, CEG
Senior Project Manager

PROFESSIONAL GEOLOGIST
RICHARD F. ESCANDON
No. 1213
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

KC:edg

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EXECUTIVE SUMMARY

This report presents the results of our geotechnical investigation program for the proposed Victorville 2 Hybrid Power Project (VV2 Project or Project) located in Victorville, California. The purposes of this investigation were to evaluate the general subsurface soil conditions, seismicity and other geologic hazards for the site, and to provide recommendations for design and construction of the foundations for the proposed VV2 Project facilities.

Subsurface conditions at the locations for the proposed Combined Cycle and Solar components of the Project were explored by excavating 21 test borings. We performed a laboratory testing program on selected representative soil samples obtained from the borings to assess the geotechnical and corrosivity characteristics of the subsurface soils.

Based on the results of our subsurface investigation, the project site is underlain by alluvial deposits, generally comprised of alternating layers of sand, silty sand, and sand with silt. No groundwater was encountered within the limiting depths of the borings ranging from 21.5 feet to 76.5 feet below the existing ground surface. The depth to groundwater is anticipated to be on the order of 150 feet or deeper.

The proposed project site does not lie within an Alquist-Priolo Special Studies Zone (CDMG, 1997). No active faults are known to transect the proposed project site. The nearest fault is the Helendale fault, which is located at a distance of approximately 14.8 kilometers from the site based on Maps of Active Fault Near Source Zones in California and Nevada (Uniform Building Code, 1997). Based on subsurface information and groundwater data, the potential for liquefaction and liquefaction induced settlement at the site is considered low.

The site is located within the seismically active Southern California region. The primary seismic hazard at the site is a potential for moderate to severe shaking. California Seismic Shaking Hazard Maps (2003) obtained from California Geologic Survey (CGS) website, indicates a Peak Horizontal Ground Acceleration (PGA) with 10% probability of exceedance in 50 years of 0.35g for the site. We recommend that the proposed structures be designed and constructed in accordance with the requirements of the

California Building Code (2001) for seismic zone 4. Our recommendations for seismic design parameters are presented in Section 4.3, Seismic Design Recommendations.

We understand that at this stage of the project, information regarding structural loads is not available. However, based on anticipated loads from similar projects, we recommend that the proposed structures can be founded on shallow foundations. Our preliminary foundation recommendations include recommendations for both shallow and deep foundations. Our recommendations for foundation design are presented in Section 4.4, Preliminary Foundation Recommendation and Section 4.5, Soil Parameter Recommendations. Recommendations for retaining wall and below grade structures are presented in Section 4.6, Recommendations for Retaining Walls and Below Grade Structures.

Alluvial soil in arid and semi arid regions present a potential for collapsible conditions upon increase in moisture content. Collapse potential tests on 11 samples collected from 5 feet to 20 feet below the existing ground surface indicated a low to moderate collapse potential. To reduce the potential for collapse and excessive settlement, the site should be prepared in accordance with our recommendations presented in Section 4.8, Site Preparation.

There is a potential for presence of septic tanks, cesspools and leachate as several residential houses are currently located within the Project site. Recommendations for overexcavation of such areas are presented in Section 4.8.2, Overexcavation.

We anticipate the on-site soils encountered during our investigation, excluding organics, debris, and/or other deleterious materials, are considered suitable for use as engineered fill.

The executive summary presented herein briefly summarizes the results of our geotechnical investigation for the subject project and should be used only in conjunction with recommendations presented in the attached report.

1.0 INTRODUCTION

1.1 GENERAL

The Victorville 2 Hybrid Power Project includes construction of a hybrid (natural gas-fired combined-cycle and solar) power generating facility north of the Southern California Logistics Airport (SCLA) in Victorville, California. Kleinfelder, Inc. (Kleinfelder), was retained by ENSR Corporation to provide preliminary geotechnical engineering services for the proposed project. The location of the proposed power plant site is shown on Plate 1, Site Vicinity Map. The scope of our services was presented in a proposal entitled 'Proposal to Conduct Geotechnical Engineering Investigation, Victorville Power Plant Project, Victorville, San Bernardino County, California', dated October 19, 2005. Ms. Dodie Reed of ENSR Corporation authorized the proposed investigation on December 21, 2005.

1.2 PROJECT DESCRIPTION

The proposed site for the Victorville 2 (VV2) facilities is located north of the SCLA, east of Helendale Road and south of Desert Flower Road. The proposed hybrid power plant will generate approximately 550 Megawatts of electrical power. Approximately 500 Megawatts will be generated using natural gas-fired, combined-cycle equipment and approximately 50 Megawatts will be generated using solar thermal technology. The combined-cycle equipment will utilize up to approximately 50 acres, while the solar array will utilize approximately 250 acres. Based on the plot plan prepared by Bibb and Associates (dated November 21, 2005), the major structures in the combined-cycle area will include two combustion turbines, one heat recovery steam generator, one steam turbine generator, one 230 kV switchyard, one cooling tower, one water treatment building, several tanks including clarifier tanks, storage tanks, settling tanks, one administrative and control building and one warehouse. The design loads of the proposed structures were not available during preparation of this report.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of this preliminary geotechnical investigation program was to explore the subsurface conditions at the proposed site and to provide evaluations and recommendations for design and construction of the proposed power generating facilities. Kleinfelder's scope of services for this project consisted of:

Task 1 – Literature Review and Utility Clearance

- Reviewed available flood hazard map on the Federal Emergency Management Agency website.
- Reviewed soil and geologic data including fault and geologic maps prepared by the California Geological Survey, the U.S. Geological Survey, the County of San Bernardino, and other governmental agencies.
- Reviewed previous geotechnical engineering investigation reports prepared for the existing High Desert Power Plant (HDPP), approximately four miles south of the proposed VV2 site.
- Contacted Underground Service Alert (USA) to identify potential conflicts between planned geotechnical boring locations and existing underground utilities.

Task 2 – Field Exploration

- Retained a drilling subcontractor to perform hollow stem auger borings. Approximate boring locations for the combined-cycle and solar areas of the site are shown on Plate 2 and 3, respectively.
- Provided full time controlled inspection and supervision of the drilling operation by a Kleinfelder staff engineer. The Kleinfelder Inspector maintained logs of subsurface materials encountered and obtained samples for visual classification and laboratory testing.

Task 3 – Laboratory Testing

- Laboratory testing was performed on selected representative samples to evaluate the geotechnical characteristics and corrosion potentials of the subsurface materials encountered during subsurface exploration.

Task 4 – Analysis and Report

Conducted an engineering evaluation and prepared this report, which includes the following:

- A general description of the project.
- Discussion of the regional geologic settings, geologic features and hazards including potential of ground rupture due to surface faulting, liquefaction potential, and seismically induced settlement.
- Description of the subsurface investigation program and laboratory testing program, subsurface soil conditions, and groundwater conditions.
- Discussion of the potential for collapsible soil conditions at the site and proposed mitigation measures.
- Evaluation of the seismic hazard conditions and recommendations for seismic design parameters based on 2001 California Building Code.
- Preliminary foundation recommendations for shallow and deep foundations and static and dynamic soil parameters for vibrating machine foundations.
- Preliminary recommendations for retaining walls and below grade structures.
- Recommendations for earthwork including site preparation, engineered fill, anticipated post-construction settlement, guidelines for temporary excavations, pipe bedding and trench backfill, shrinkage and subsidence, stockpiling of excess materials.
- Recommendations for asphalt concrete pavement.
- Presentation of corrosion test results.
- Limitations and References.
- Plates including Site Vicinity Map and Boring Location Plans for Combined Cycle area and Solar area.
- Appendices including boring logs and laboratory testing results.

2.0 GEOLOGIC CONDITIONS

2.1 REGIONAL GEOLOGY

The site is located in the Mojave Desert Geomorphic Province of California. The Mojave Desert Province occupies approximately 25,000 square miles and consists of broad alluvial basins, in-filled by approximately 3,500 feet of alluvial deposits from the nearby San Gabriel and San Bernardino Mountains. In the vicinity of the site, older crystalline bedrock materials consisting of Cretaceous or Jurassic age quartz monzonite are buried beneath the thick younger (Quarternary age) alluvial deposits. Throughout the province, scattered older crystalline bedrock outcrops exists, that rise topographically above the alluvial plain. The Geologic map of the Project site and surrounding areas is shown on Plate 4, Geologic Map.

The Mojave Desert is bounded on the south-southwest by the San Andreas fault and the Transverse Ranges, on the north and northeast by the Garlock fault and the Tehachapi Mountains, and on the east by the Basin and Range Geomorphic Province. The major drainage feature in the Mojave Desert is the Mojave River. The Mojave River flows in a northerly direction and typically flows intermittently during seasonal rainfall conditions. Generally, surface flow in the Mojave River occurs at 'gaps', where shallow bedrock or other barriers to subsurface flow exist.

2.2 FAULTING AND SEISMICITY

The project site is located in a seismically-active region within the influence of several fault systems that are considered active or potentially active. An active fault is defined by the State of California as a 'sufficiently active and well defined fault that has exhibited surface displacement within the Holocene time (the last 11,000 years)'. A potentially active fault is defined by the State as a 'fault with history of movement within Pleistocene time (between 11,000 and 1.6 million years ago)'. These active and potentially active faults are capable of producing seismic shaking at the site that could potentially be damaging to building and non-building structures. There is a potential that the proposed structures may experience one or more moderate to severe ground shaking events during the design life of the project. A map showing historic seismicity for the period 1977-2005 is shown on Plate 5 – Historic Seismicity Map.

According to the California Building Code (CBC) 2001 (volume 2), faults are classified as Seismic Source Type A, B, and C based on Maximum Moment Magnitude (M) and Slip Rate (SR). Generally, a 'Type A' fault has M $\geq$ 7.0 and SR $\geq$ 5 mm/year, a 'Type B' fault has M $\geq$ 7.0 and SR < 5 mm/year *or* M < 7.0 and SR > 2 mm/year *or* M $\geq$ 6.5 and SR < 2 mm/year, a 'Type C' fault has M < 6.5 and SR $\leq$ 2 mm/year. Both maximum moment magnitude and slip rate conditions must be satisfied concurrently when determining the seismic source type.

Based on a list of significant California earthquakes prepared by the California Geological Survey, a chronology of significant earthquakes that occurred within 62 miles (100 kilometers) radius of the site between 1800 and 2001 is presented in Table 1, Significant Earthquakes (M $\geq$ 6.5) Near Project Vicinity. The distances between the epicenters of these earthquakes and the proposed project site are estimated using the software EQSEARCH version 3b (Blake, 2000). The search of historic earthquakes by EQSEARCH version 3b also indicated that 415 earthquakes with Magnitude equal or greater than 4 occurred within 62 miles of the project site between 1800 and 2000.

Table 1: Significant Earthquakes (M $\geq$ 6.5) Near Project Vicinity

Date	Magnitude	Location	Approximate Distance from the Site (mile)
1812, December 8	7.3	Wrightwood	24
1899, July 22	6.4	Wrightwood	24
1992, June 28	7.3	Landers	43
1992, June 28	6.5	Big Bear	61

The nearest fault is the Helendale fault, which is located at a distance of approximately 9.2 miles (14.8 kilometers) northeast of the VV2 site based on Maps of Active Fault Near Source Zones in California and Adjacent Portions of Nevada (Uniform Building Code, 1987). According to these maps, the Helendale fault (also known as Helendale-South Lockhart fault) is capable of generating an earthquake with Maximum Moment Magnitude of 7.3. The Slip Rate of the fault is 0.6 mm/year. The Helendale fault is considered a Type B fault. Results of our search using the software EQFAULT Version 3.0 (Blake, 2000), identified thirty-four faults within a radius of 62 miles (100 kilometers) of the proposed VV2 site. The data file in EQFAULT Version 3.0 includes the faults that are identified by the California Geological Survey. Table 2, Significant Faults Near Project Vicinity, presents a list of 10 significant faults within the search radius of the proposed project site that, in our opinion, will have the greatest impact on the site. Other active faults without surface expression (blind faults) that are capable of generating an earthquake, or other potentially active seismic sources may be present that are not currently zoned.

Table 2: Significant Faults Near Project Vicinity

Fault Name	Approximate Distance from Site (miles)	Maximum Moment Magnitude	Slip Rate (mm/yr)	Seismic Source Type
Helendale-South Lockhardt	9.2	7.1	0.6	B
North Frontal Fault Zone	18	6.7-7	0.5-1	B
Cleghorn	23	6.5	3	B
Lenwood-Lockhard-Old Woman Spring	23	7.3	0.6	B
San Andreas – 1857 Rupture (Mojave)	24	7.8	34	A
San Andreas -- Southern (San Bernardino)	24	7.4	24	A
Cucamonga	25	7	5	A
San Jacinto – San Bernardino	28	6.7	12	B
Gravel Hills – Harper Lake	29	6.9	0.6	B
Landers	32	7.3	0.6	B

The proposed VV2 site does not lie within an Alquist-Priolo Special Studies Zone (CDMG, 1997). No active faults are known to transect the proposed VV2 site. Therefore, the possibility of primary surface rupture or deformation at the site is considered low. While fault rupture would most likely occur along previously established fault traces, future fault rupture could occur at other locations.

2.3 OTHER GEOLOGIC HAZARDS

Collapsible soils deposits generally exist in regions of moisture deficiency. Collapsible soils are generally defined as soils that have potential to suddenly decrease in volume upon increase in moisture content even without increase in external loads. Soils susceptible to collapse include loess, weakly cemented sands and silts where the cementing agent is soluble (e.g. soluble gypsum, halite), valley alluvial deposits within semi-arid to arid climate, and certain granite residual soils. Collapse potential tests on 11 samples collected from 5 feet to 20 feet below the existing ground surface indicated a low to moderate collapse potential. Provided that the mitigation measures for subgrade improvements are implemented in accordance with our recommendations presented in Section 4.8, Site Preparation, potential for damage due to collapsible soils is considered low at the proposed VV2 site.

Based on the Flood Hazard Maps provided by Federal Emergency Management Agency (FEMA), the proposed VV2 site is not located within 100-year or 500-year flood zones. A 100-year flood is defined as the flood elevation that has 1 percent probability of being equaled or exceeded each year and a 500-year flood is defined as the flood elevation that has 0.2 percent probability of being equaled or exceeded each year.

Based on the United States Geological Survey (USGS) topographic map for the Victorville Quadrangle and our site reconnaissance, the ground surface within the combined-cycle area is generally flat. The potential for landsliding within the combined-cycle area is considered low. The solar array area is also generally flat except for the eastern portion of the site where the ground slopes to the east at an overall 5:1 (horizontal:vertical) gradient towards an unnamed ravine. Slopes bordering the ravine are locally as steep as approximately 2:1 (horizontal:vertical). The remaining solar array area is generally flat. The Potential for landsliding within the solar array area is considered low. Future structures planned in areas adjacent to the ravine require additional consideration. The location of the structures in the Project site should follow the setback requirements for sloping conditions in accordance with the CBC 2001, Figure 18-I-1.

Liquefaction is a phenomenon that may occur because of earthquake shaking at locations where loose sandy soils are present and groundwater levels are shallow. Potential liquefaction hazards are estimated to be limited to areas where shallow groundwater and loose sandy soils are anticipated. Based on the subsurface investigation program, the proposed site is generally underlain by dense to very dense sand and silty sand deposits except the upper strata of potentially collapsible soils. During the subsurface investigation program, groundwater was not encountered within limiting depths of the borings ranging from 21.5 feet to 76.5 feet below the existing ground surface. Therefore, the potential for liquefaction is considered low. A general discussion and proposed mitigation measures for collapsible soil conditions are presented in Section 4 of this report.

Seismically induced settlement occurs where earthquake shaking causes densification of relatively loose sediments. Sediments that are sufficiently loose are subject to such densification, which can cause surface settlement and damage to surface and near-surface structures. Provided that the mitigation measures for subgrade improvements are implemented as recommended in Section 4, the potential for damage due to seismically induced settlement is considered low at the proposed site.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 GENERAL

The proposed VV2 Project site is rectangular in shape, mostly undeveloped, and occupies approximately 300 acres. The site is located north of the SCLA, east of Helendale Road and south of Desert Flower Road. Shady Hill Road, starting at Helendale Road ends within the southern portion of the site. The site is relatively flat. A brief summary of our field investigation program, laboratory testing program, and groundwater conditions are presented in this Section of the report.

3.2 FIELD INVESTIGATION PROGRAM

Drilling was performed between April 17, 2006 through April 19, 2006, by California Pacific Drilling of Calimesa, California under contract to Kleinfelder. All drilling and sampling operations were inspected during this period by Kleinfelder staff engineer Mr. Max Quach. A total of 21 test borings, identified as B-1 through B-21 were advanced, including 17 borings within the proposed combined cycle area and the remaining 4 borings within the proposed solar array area. The test borings were performed using a truck mounted Mobil B-61 drill rig utilizing an 8-inch diameter hollow stem auger to final depths ranging from 21.5 feet to 76.5 feet below the existing ground surface. The locations of the test borings are shown on Plate 2, Boring Location Plan for Combined Cycle Area, and Plate 3, Boring Location Plan for Solar Area.

Soil samples were obtained from the borings using techniques and equipment in general accordance with the American Society for Testing and Materials (ASTM) Standard Specification D1586-Standard Penetration Test (SPT) and D3550-Standard Practice for Thick Walled, Ring Lined, Split Barrel, Drive Sampling of Soils. The SPT consists of driving a 2-inch O.D. split spoon sampler with repeated blows of a 140-lbs. hammer free falling a distance of 30-inches. The Standard Penetration, or N-value, is determined as the number of blows required advancing the sampler the next 12-inches after an initial 6-inch penetration. California Sampling consists of driving a 3–inch O.D. sampler consisting of 2.38-inch I.D. rings with repeated blows of a 140-lbs. hammer free falling a distance of 30-inches. Soil samples were obtained at a maximum interval of 5 feet utilizing SPT and California samplers alternately. Each soil sample was classified in accordance with the Unified Soil Classification (USCS) system. Rock was not encountered in any of the borings. Logs of the borings are attached in Appendix A, Field Exploration.

3.3 LABORATORY TESTING PROGRAM

Laboratory testing of selected soil samples obtained from the test borings was performed at Kleinfelder Soil and Material Testing Laboratory in Redlands, California. Corrosion testing on two samples were performed at AP Engineering and Testing, Pomona, California. The purpose of the testing was to verify the field visual classifications and obtain information for subsequent engineering evaluations. The results of the laboratory testing program are attached in Appendix B, Laboratory Testing.

3.4 SUBSURFACE SOIL CONDITIONS

The subsurface soil encountered in the test borings consisted of alluvial deposits of sand, silty sand, and sand with silt. Alluvium soil was encountered to the maximum explored depth of 76.5 feet below the existing ground surface in boring B-16. An approximately 10 foot thick stratum of clay and silt was also encountered in boring B-16 at a depth of 65 feet. The SPT N-values in the borings varied from 4 to 87, with an average value SPT N-value of 36. The SPT N-values in the borings indicate a dense soil condition with the exception of occasional upper 5 feet of loose soil (SPT N-values less than 10). Based on the laboratory test results, the dry unit weight of the soil varies from 97.1 pounds per cubic foot (pcf) to 121.3 pcf at water contents from 0.7 to 23.2 percent.

3.5 GROUNDWATER

At the time of our investigation, groundwater was not encountered within the exploratory borings ranging in depths from 21.5 feet to 76.5 feet below the existing ground surface. Based on Kleinfelder's experience with other projects in the City of Victorville and review of a subsurface geologic report in the SCLA area, we anticipate the depth to groundwater to be on the order of 150 feet or deeper. However, seasonal fluctuation of shallow perched groundwater and/or surficial sheet flow should be expected during periods of intense rainfall.

4.0 PRELIMINARY EVALUATIONS AND RECOMMENDATIONS

4.1 GENERAL

Based on the results of our subsurface investigations, laboratory testing, geotechnical analyses, and our current understanding of the Project, it is our opinion that the proposed site is geotechnically feasible for construction of the proposed electrical generating facilities, provided the recommendations presented in this report are incorporated into the Project design and construction. In general, the primary geotechnical constraint for development of this site as identified by our preliminary investigation, is the potential for partial collapse of the alluvial soil within approximately 10 to 20 feet of the existing ground surface. Our preliminary evaluations and recommendations based on the subsurface investigation program and our current understanding of the proposed VV2 Project are presented in the following sections of this report.

4.2 COLLAPSIBLE SOIL CONDITIONS

The degree of collapse of a soil is defined by the Collapse Potential (CP) value, which is expressed as a percent of collapse of the total sample using the Collapse Potential Test (ASTM Standard Test Method D 5333). Based on Naval Facilities Engineering Command (NAVFAC) Design Manual 7.1, the severity of collapse potential is commonly evaluated by the following Table 3, Collapse Potential Values.

Table 3: Collapse Potential Values

Collapse Potential Value	Severity of Problem
0-1%	No Problem
1-5%	Moderate Problem
5-10%	Trouble
10-20%	Severe Trouble
> 20%	Very Severe Trouble

Table 3 can be combined with other factors such as the probability of ground wetting to occur on-site and the extent or depth of potential collapsible soil zone to evaluate the potential hazard by collapsible soil at a specific site. A hazard ranking system associated with collapsible soil as developed by Hunt (1984) is presented in Table 4, Collapsible Soil Hazard Ranking System.

Table 4: Collapsible Soil Hazard Ranking System

Degree of Hazard	Definition of Hazard
No Hazard	No hazard exists where the potential collapse magnitudes are non-existent under any condition of ground wetting.
Low Hazard	Low hazards exist where the potential collapse magnitudes are small (CP values 0-1%) and tolerable or the probability of significant ground wetting is low.
Moderate Hazard	Moderate hazards exist where the potential collapse magnitudes are undesirable (CP values 1-5%) or the probability of substantial ground wetting is low, or the occurrence of the collapsible unit is limited.
High Hazard	High hazard exist where potential collapse magnitudes are undesirably high (CP values 5-20%) and the probability of occurrence is high.

The proposed Project site is located in a geologic environment, where potential of collapsible soil exists. The results of collapse potential tests performed on 14 selected samples from different depths within 20 feet below the existing ground surface indicated a range of collapse potential values from 0% to 2.6% at applied vertical stress of 2000 psf.

Based on our laboratory test results and geotechnical analyses conducted for the site, it is our opinion that the site generally has a low to moderate potential for collapsible soil conditions. We recommend overexcavation within the structural areas to competent soils below the bottom of the proposed shallow foundations or the lowest adjacent grade to reduce the potential for collapsible soil conditions at the site. Our recommendations for overexcavation and compaction are discussed in Section 4.8, Site Preparation.

Since the introduction of water into the soils can initiate collapse, proper measures should be taken to reduce potential for future pipe leakage and/or water from landscape irrigation to enter the soils within the specific locations of the proposed equipment and other Project structures. It is very important that storm water runoff be directed from roofs and other improvements to appropriate storm water collection systems. Diligent efforts should be made to provide an efficient means of transport of runoff water to collection devices, preventing runoff water from infiltrating soils within approximately 30 feet of the structures.

4.3 SEISMIC DESIGN RECOMMENDATIONS

The site is located within seismically active Southern California region and will likely be subjected to ground shaking from movement along one or more of the active or potentially active faults in the region. We anticipate that the primary seismic hazard to the project site is a potential for moderate to severe shaking.

Based on the California Seismic Shaking Hazard Maps (2003) obtained from the California Geologic Survey (CGS) website, the Peak Horizontal Ground Acceleration (PGA) at the site with 10% probability of exceedance in 50 years is 0.35g for alluvial soil condition. The California Seismic Hazard Maps are based on USGS/CGS seismic hazards assessment (PSHA) model 2002 (revised in April, 2003). In accordance with the California Building Code 2001 (CBC), the proposed site is located within seismic zone 4. The seismic design parameters for the proposed structures in accordance with the CBC, are presented in the following Table 5, Seismic Design Parameters.

Table 5: Seismic Design Parameters

Seismic Design Parameter	Value
Seismic Zone Factor (Table 16A-I)	0.40
Soil Profile Type (Table 16A-J)	S_D
Seismic Source Type (Table 16A-U)	B
Near Source Factor – N_a (Table 16A-S)	1.0
Near Source Factor – N_v (Table 16A-T)	1.0
Seismic Coefficient – C_a (Table 16A-Q)	0.44
Seismic Coefficient – C_v (Table 16A-Q)	0.64

4.4 PRELIMINARY FOUNDATION RECOMMENDATIONS

4.4.1 General

We understand that at this stage of the project, detailed information regarding structural loads is not available. Based on our experience with similar projects, we anticipate that the proposed structures will be supported on shallow foundations. Our preliminary foundation recommendations include recommendations for both shallow and deep foundations in the event that deep foundations are selected for the proposed structures.

4.4.2 Conventional Shallow Foundations

The proposed structures can be supported on conventional continuous strip footings and isolated spread footings. Footings should have a minimum width of 12 inches and a minimum embedment depth of 18 inches below the lowest adjacent final grade and underlain by at least 3 feet of engineered fill prepared as discussed in Section 4.8 of this report. Shallow foundations constructed in accordance with the recommendations stated in this report may be designed using a maximum allowable soil bearing pressure of 2000 pounds per square foot (psf). The allowable bearing pressure provided above is a net value; therefore, the weight of the foundation (which extends below grade) may be neglected when computing dead loads. The allowable bearing pressure may be increased by 1/3 for short term loading due to wind or seismic loads.

The total settlement of an individual foundation will vary, depending on the depth of fill materials, the plan dimensions of the foundation and the actual load supported. Based on the anticipated foundation dimensions and loads, we estimate that the total settlement of foundations designed and constructed in accordance with the recommendations stated in this report should be on the order of one inch or less. Differential settlement between similarly loaded, adjacent footings is expected to be less than ½ inch, provided footings are founded on similar materials. Differential settlement of footings founded on dissimilar materials may approach the maximum estimated settlement of one inch. In the event that the foundation soils become saturated, settlement greater than one inch could occur due to the presence of isolated collapsible soils.

Footings may experience an overall loss of bearing capacity or an increased potential to settlement where located in close proximity to existing or future utility trenches. Furthermore, stresses imposed by the footings on the utility lines may cause cracking, collapse, and/or a loss of serviceability. To reduce this risk, footings should extend below a 1:1 plane projected upward from the closest bottom corner of the trench.

At the completion of grading, representative samples of the subgrade materials at footing grade should be evaluated for expansion potential and corrosivity.

4.4.3 Slab-On-Grade

Concrete slab-on-grade should be placed on compacted engineered fill that is uniform in composition and at least 2-feet thick. Concrete floor slabs should be reinforced as required by the structural engineer. The structural engineer should design all slabs for any specific loading, settlement, or expansive soil conditions.

We anticipate that most of the proposed floor slabs will be covered with moisture-sensitive floor coverings. Thus, we recommend that interior concrete slabs supported-on-grade be underlain by a capillary break to reduce the potential for soil moisture migrating upwards toward the slab.

Within areas where moisture-sensitive flooring will be placed, we recommend the placement of an impermeable membrane such as visqueen (or equivalent), to act as a vapor barrier to reduce the potential for upward migration of water vapor through the slab. The vapor barrier should have a thickness of at least 10 millimeters. To promote uniform curing of the slab and provide protection of the membrane during construction, clean, fine to medium grained sand, 2 inches thick, should be placed on top of and below the membrane, for a 4-inch thick sand blanket, prior to the placement of concrete. This sand should be moistened immediately prior to concrete placement.

Clean sand should conform to the specifications for concrete sand in the Standard Specifications for Public Works Construction (Green Book, 2000). Generally, the gradation range of clean sand should consist of 100% passing the No. 4 sieve to less than 5% passing the No. 200 sieve. In general, the on-site soils do not appear to meet this requirement. All areas adjacent to the building, including planters, should be designed to drain away from the structure to avoid an accumulation of water beneath the slab.

Concrete should not be placed if sand overlying the vapor barrier has been allowed to become wet (due to precipitation or excessive moistening) or if standing water is present above membrane. Excessive water beneath interior floor slabs could result in significant vapor transmission through the slab, adversely affecting moisture-sensitive floor coverings.

Although vapor barrier systems are currently the industry standard, this system may not be completely effective in preventing floor slab moisture problems. These systems typically will not necessarily ensure that floor slab moisture transmission rates will meet floor-covering manufacturer standards or that indoor humidity levels will be appropriate to inhibit mold growth. In many cases, floor moisture problems are the results of either improper curing of floor slabs or improper application of flooring adhesives.

Our evaluations have not included services to address the influence of moisture vapor transmission through building floor slabs. Slab and flooring system design experts should be retained to provide design recommendations consistent with the maximum allowable moisture transmission rate as it may affect flooring performance and indoor humidity levels.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking, or curling of the slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of concrete. We recommend that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI). At the completion of grading, representative samples of the materials at pad grade should be evaluated for expansion potential and corrosivity.

4.4.4 Mat Foundations

Mat foundations may be considered as an alternative foundation system for the proposed Project structures. The proposed mat foundations should be underlain by a minimum of 2 feet of compacted engineered backfill. The compacted fill blanket should extend at least 5 feet beyond the mat foundation perimeter. Mat foundations constructed in accordance with the recommendations stated in this report may be designed using a maximum net allowable soil bearing pressure of 2000 psf and modulus of subgrade reaction of 150 pci.

The modulus of subgrade reaction presented above is appropriate for foundation design considering static loading and elastic settlement. The settlement of a mat foundation designed using the criteria recommended above is expected to be on the order of 1-inch or less. Differential settlement or 'mat rotation' should be negligible, assuming that structural loads are uniformly distributed over the entire structure footprint area. The allowable bearing pressure may be increased by 1/3 for short term loading due to wind or seismic loads.

4.4.5 Footing, Slab-On-Grade and Mat Foundation Observation

Prior to placing steel and concrete, footing excavations should be cleaned of all debris, loose or soft soil, and water. All footing excavations should be observed by a qualified geotechnical engineer just prior to placing steel or concrete to verify that the recommendations contained herein are implemented during construction. Subgrade soils beneath slab-on-grade or mat foundation should also be observed during pre-moistening operations to verify that the recommendations contained herein are implemented during construction.

4.4.6 Deep Foundations

As mentioned previously, deep foundations may be required based on the structural load requirements of the proposed Project. If a deep foundation alternative is selected, we recommend Cast-In-Drilled-Hole (CIDH) piles or driven piles to support the proposed structures. Analysis and design of deep foundation systems is not included in the scope of Kleinfelder's services at this stage of the Project.

4.5 SOIL PARAMETER RECOMMENDATIONS

4.5.1 Physical Soil Characteristics

Our recommendations for soil strength parameters and unit weight are presented in the following Table 6, Physical Soil Parameters:

Table 6: Physical Soil Parameters

Soil Type	Total Unit Weight (pcf)	Angle of Internal Friction (degrees)	Cohesion (psf)
Silty SAND/SAND	110	33	0

4.5.2 Static and Dynamic Soil Parameters for Vibrating Machine Foundations

Our recommendations for static and dynamic soil parameters for vibrating machine foundations are presented in the following Table 7, Static and Dynamic Soil Parameters for Vibrating Machine Foundations:

Table 7: Static and Dynamic Soil Parameters for Vibrating Machine Foundations

Soil Type	Poisson's Ratio, □	Maximum Shear Modulus, G_{max} (psi)	Material Damping Ratio	Static Horizontal Subgrade Modulus, K_h (pci)	Static Vertical Subgrade Modulus, K_v (pci)
Silty SAND	0.4	20000	0.02 (for shear strain 10^{-3} %) to 0.05 for shear strain 10^{-5} %)	100	150

4.6 RECOMMENDATIONS FOR RETAINING WALLS AND BELOW GRADE STRUCTURES

We recommend that soil pressure values for calculating active lateral earth pressures developed from horizontal backfills behind retaining walls or below grade structures that are free to rotate at least 0.1 percent of the wall height use an equivalent fluid pressure of 35 pounds per cubic foot (pcf). Walls that are restrained against movement or rotation at the top should be designed for an at-rest equivalent fluid pressure 55 pcf. The above values are applicable if the on-site soils are used for level backfill behind the walls. The recommended values do not include compaction or truck-induced wall pressures.

We recommend a coefficient of sliding resistance value of 0.35 for sliding stability analysis. This value is applicable for friction between cast-in-place concrete foundations and underlying soil. Passive pressure available in engineered fill may be taken as equivalent fluid pressure of 325 pcf, not to exceed 3000 psf.

Based on Caltrans Bridge Design Specifications (2004), seismic loading for gravity and semi gravity walls can be analyzed by the Monobe-Okabe (M-O) method. The M-O analysis is also recommended for below grade structures. We recommend a horizontal seismic acceleration coefficient, k_h value of 0.12 and corresponding equivalent fluid pressure of 45 pcf for seismic force applied on retaining walls or below grade structures with horizontal backfill. The seismic pressure should be applied as an inverted triangular shape pressure distribution. The vertical seismic acceleration coefficient, k_v can be considered as zero for the analysis.

In case of traffic coming closer than one half of the height of the wall, we recommend a live load surcharge pressure equal to not less than 2 feet of soil surcharge with an average unit weight of 125 pcf.

Care must be taken during the compaction operations not to overstress the walls. Heavy construction equipment should be maintained a distance of at least 3 feet away from the walls while the backfill soils are being placed. Hand-operated compaction equipment should be used to compact the backfill soils within a 3-foot-wide zone adjacent to the walls. This zone should be free of materials greater than 3 inches in diameter.

The recommended lateral earth pressures assume that drainage is provided behind the walls to prevent the accumulation of hydrostatic pressures. Walls should be provided with backdrains to reduce the potential for the accumulation of hydrostatic pressures. Backdrains may consist of a 1 foot wide zone of Caltrans Class 2 permeable material located immediately behind the wall, extending to within 1 foot of the ground surface. Weep holes should be installed in the wall or a perforated pipe (Schedule 40 PVC) wrapped in filter fabric should be installed at the base of the backdrain and sloped to discharge to a suitable collection facility. A proprietary drainage board, approved by the geotechnical engineer, may also be used in lieu of drainage material (Class 2 permeable base material). If sufficient drainage is not provided, walls should be designed to resist equivalent fluid pressures of 95 pcf and 110 pcf for the active and at rest cases, respectively.

4.7 CORROSIVITY

Chemical analyses were performed on two samples of near surface soils (1-5 feet below the ground surface) to estimate pH, resistivity, soluble sulfate, and chloride contents in general accordance with Caltrans Standard Test Methods 532 (pH), 643 (resistivity), 417 (sulfates), and 422 (chlorides). The results of the corrosivity testing indicated a minimum resistivity of 1900 ohm-cm, pH values from 8.6 to 9.15, sulfate contents from 6 ppm to 59 ppm, and chloride contents from 63 ppm to 126 ppm. The corrosivity test results are presented in attachment B, Laboratory Testing. These tests are only an indicator of potential soil corrosivity for the samples tested. Other soils found on the site may be more, less, or of a similar corrosive nature.

Kleinfelder does not practice corrosion engineering. We recommend that a competent corrosion engineer be retained to evaluate the corrosion potential of the site to the proposed project, to recommend further testing as required, and to provide specific corrosion mitigation methods appropriate for the project. In general, the soil samples tested are normally considered as having a low corrosion potential towards concrete and a low corrosion potential towards ferrous metal. We recommend that specific testing be performed once site-grading activities are near completion to provide a better assessment of the actual soils present in the areas of interest.

4.8 SITE PREPARATION

4.8.1 Stripping and Grubbing

Prior to general site grading, existing vegetation, weeds, organic matter, and debris should be stripped and disposed outside the construction limits. We estimate the average depth of stripping to be approximately six inches over most portions of the site. Deeper stripping and grubbing may be required where higher concentrations of organic soils or vegetations are encountered. Areas where there are concentrations of tree roots and in the vicinity of natural drainage areas are two examples of areas requiring deeper stripping and grubbing. Stripped topsoil (less any debris and organic matter) may be stockpiled and reused for landscape purposes; however, this material should not be incorporated into any engineered structural fill.

4.8.2 Overexcavation

Overexcavation and recompaction are recommended beneath the structures founded on the shallow foundation system and beneath pavement (e.g. parking lot) to improve the existing soil and to reduce the potential for soil collapse or excessive settlements. Care should be taken during overexcavation operations to maintain sidewall stability and personal safety. In addition, the grading should result in the overexcavation of soils beyond the perimeter of foundations to a minimum of 5 feet.

There is a potential for presence of septic tanks, cesspools, and leachate as several residential houses are currently located within the Project site. These septic tanks, cesspools, and leachate should be removed in accordance with the Federal and State laws and regulations prior to site preparation for foundations. The excavated bottom should be verified by the project geotechnical engineer or project geologist for suitability to receive compacted backfill. Upon removal of the septic tanks, cesspools and leachate, the excavated area should be backfilled and compacted in accordance with the recommendations of this Section.

All overexcavations should extend to a depth where competent soils are encountered and the project geotechnical engineer or project geologist has deemed the exposed soils as being suitable for receiving compacted fill. Kleinfelder's general recommendations for overexcavation are as follows:

- Fill: Prior to placing any additional fills, the area to receive fill should be overexcavated a minimum of 36 inches below the existing ground surface.

- Shallow Foundations: Shallow footing areas should be overexcavated at least 36 inches below the bottom of the proposed footings.

- Slab-on-Grade/Mat Foundation: Slab-on-grade and mat foundation areas should be overexcavated at least 24 inches below the bottom of the proposed foundations.

- Pavement and Miscellaneous Improvements: Pavement and other miscellaneous improvement (e.g., sidewalks, parking lot) areas should be overexcavated at least 18 inches below the bottom of the proposed sections.

The overexcavation depths may be modified once final grading plans are prepared for the proposed improvements and reviewed by qualified professionals.

Borings were advanced using a truck-mounted, hollow-stem auger drill rig with little to moderate effort through the existing soil deposits. Conventional earth moving equipment is expected to be capable of performing the excavations required for site preparation.

4.8.3 Scarification and Compaction

Following site stripping and any required grubbing and/or overexcavation, we recommend all areas to receive engineered fill or to be used for support of structures, concrete slabs, and pavements be scarified to a minimum depth of 8 inches, uniformly moisture-conditioned to near optimum moisture content, and compacted to at least 90 percent of the maximum dry density obtained using ASTM (American Society for Testing and Materials) Test Method D 1557.

4.8.4 Engineered Fill

The on-site soils encountered during our investigation, excluding organics, debris, and/or other deleterious materials, are considered suitable for use as engineered fill. When adequately compacted at an appropriate moisture content, the materials can be expected to possess suitable bearing and settlement characteristics for the proposed

Project. If potentially expansive soils are encountered near ground surface during grading, the project geotechnical engineer or project geologist should be notified so that proper mitigation measures can be taken, such as blending with low expansive soils or placement outside of buildings and pavement areas.

All import soils should be free from deleterious material and debris. In general, well graded mixtures of gravel, sand, and non plastic silt are suitable for use as engineered fill. Import materials, if required, should have a low expansion potential, i.e. have an expansion index of less than 20 in accordance with UBC Standard 18-2. All imported fill should be compacted to the general recommendations provided for engineered fill.

4.8.5 Pipe Bedding and Trench Backfill

Pipe zone backfill (i.e. material beneath and in the immediate vicinity of the pipe) should consist of sand or similar material having a minimum sand equivalency of 30. Sand equivalent tests on 4 samples indicated a sand equivalency value of less than 30 in 3 tests. Therefore, we recommend that imported soil or screened on-site soil with a minimum sand equivalency of 30 be used as pipe zone backfill. If screening of on-site soil is performed, we recommend that a Sand Equivalent Test be performed on screened soil before using it as pipe zone backfill material. Trench zone backfill (i.e. material placed between the pipe zone backfill and finished subgrade) may consist of native or import soil, which meets the requirements for engineered fill provided in Section 4.8.4.

If imported material is used for pipe or trench zone backfill, we recommend it consist of fine-grained sand with a sand equivalency of 30. In general, coarse grained sand and/or gravel should not be used for pipe or trench zone backfill due to the potential for soil migration into the relatively large void spaces present in this type of material and water seepage along trenches backfilled with coarse-grained sand and/or gravel.

Recommendations provided above for pipe zone backfill are minimum requirements only. More stringent material specifications may be required to fulfill local building requirements and/or bedding requirements for specific types of pipes. We recommend the Project Civil Engineer develop these material specifications based on planned pipe types, bedding conditions, and other factors beyond the scope of this study.

4.8.6 Compaction Criteria

All fill soils, either native or imported, required to bring the sites to final grade should be compacted as engineered fill. Native or imported soils intended for engineered fill should be uniformly moisture-conditioned to near moisture content, placed in horizontal lifts no greater than 8 inches in loose thickness, and compacted to at least 90 percent of relative compaction, based on ASTM D1557. The upper 12 inches of subgrade soil within pavement areas should be compacted to a minimum of 95 percent relative compaction (ASTM D1557). Additional fill lifts should not be placed if the previous lift did not meet the required dry unit weight or if soil conditions are not stable.

The pipe bedding material should be compacted to a minimum of 90 percent relative compaction (ASTM D1557). Trench backfill above pipe bedding should be native or imported soils intended for engineered fill, moisture conditioned to near moisture content, placed in horizontal lifts no greater than 8 inches in loose thickness, and compacted to at least 90 percent of relative compaction (ASTM D1557).

The post-construction settlement of fills following site preparation and fill construction, is estimated to be approximately 0.2 percent of the fill thickness for fills compacted to 90 percent of the maximum dry density at moisture contents at or slightly above optimum moisture content.

4.9 TEMPORARY EXCAVATIONS

4.9.1 General

All excavations must comply with applicable local, state, and federal safety regulations including the current the Occupational Safety & Health Administration (OSHA) Excavation and Trench Safety Standards. Construction site safety generally is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing the information below solely as a service to our client. Under no circumstances should the information provided be interpreted to mean that Kleinfelder is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

4.9.2 Temporary Slopes

Near-surface soils encountered during our field investigation consisted predominantly of sand and silty sand. In our opinion, these soils would be considered as a Type C soil with regard to OSHA regulations. According to OSHA regulations, the maximum allowable slopes for type C soil is 1.5:1 (horizonal:vertical) for excavations less than 20 feet deep. Steeper cut slopes may be utilized for excavations less than 5 feet deep, depending on strength, moisture content, and homogeneity of the soils as observed during construction.

4.9.3 Shoring

Shoring may be required where space or other restrictions do not allow a sloped excavation. A braced or cantilevered shoring system maybe used. A temporary cantilevered shoring system should be designed to resist an active earth pressure equivalent to a fluid weighing 36 pounds per cubic foot (pcf). Braced excavations should be designed to resist a uniform horizontal soil pressure of 20H psf, where 'H' is the excavation depth in feet. The values provided above assume a level ground surface adjacent to the top of the shoring.

Fifty percent of an areal surcharge placed adjacent to the shoring may be assumed to act as a uniform horizontal pressure against the shoring. Special cases such as combinations of slopes and shoring or other surcharge loads (not specified above) may require an increase in the design values recommended above. These conditions should be evaluated by the project geotechnical engineer on a case-by-case basis.

Cantilevered shoring must extend to a sufficient depth below the excavation bottom to provide the required lateral resistance. We recommend that required embedment depths be determined using methods for evaluating sheet pile walls and based on the principles of force and moment equilibrium. For this method, the allowable passive pressure against shoring, which extends below the level of excavation, may be assumed to be equivalent to fluid weighing 300 pcf. Isolated shafts spaced at a distance less than 3D, where 'D' is the width of the shaft, may be designed for an allowable passive pressure equivalent to a fluid weighing 600 pcf. Additionally, we recommend a factor of safety of 1.2 be applied to the calculated embedment depth and that passive pressure is limited to 2000 psf. The Contractor should be responsible for the structural design and safety of all temporary shoring systems.

4.10 PRELIMINARY PAVEMENT SECTIONS

The appropriate pavement design sections for on-site roadways depends primarily on the shear strength of the subgrade soil exposed after grading and anticipated traffic over the design life of the pavement. Flexible pavement sections (i.e. asphalt concrete pavement section) are recommended in the following section, is based on the soil conditions encountered during our field investigation, laboratory testing, and anticipated design traffic indexes. We recommend representative roadway subgrade samples be obtained during grading and R-Value tests be performed. Should the results of these tests indicate a significant difference, the design pavement sections provided below may need to be revised.

To reduce potential settlement, excess soil material, and/or fill material removed during any footing or utility trench excavation, should not be spread or placed over compacted finished grade soils unless subsequently compacted to at least 95 percent of the maximum dry unit weight, as evaluated by ASTM D1557 test procedure, and at or near optimum moisture content, if placed under areas designated for pavement.

Our pavement design recommendations are not based on any heavy construction traffic on the finished pavement sections.

4.10.1 Asphalt Concrete Pavement

Our recommendations for the asphalt pavement sections were prepared in accordance with the Caltrans Highway Design Manual (2004). We performed two R-Value tests on samples recovered during our subsurface investigation and selected the lower of the two test results (a R-Value of 18) for design purposes. The following Table 8, Recommended Asphalt Concrete Pavement Sections presents the recommended pavement sections for a range of anticipated traffic indices (T.I.'s) between 5 and 10. We recommend that the project civil engineer evaluate appropriateness of the T.I.'s used for the anticipated traffic.

Table 8: Recommended Asphalt Concrete Sections

Traffic Index	Asphalt Concrete Thickness (inch)	Class 2 Aggregate Base Thickness (inch)
5	3.0	7.5
6	3.5	10.0
7	4.0	12.5
8	5.0	14.0
9	5.5	16.5
10	6.5	18.5

Pavement sections provided above are contingent on the following recommendations being implemented during construction.

- Asphalt concrete and base materials should be underlain by at least 18 inches of engineered fill compacted to at least 95 percent relative compaction (ASTM D1557).
- Subgrade soils should be in a stable, non-pumping condition at the time aggregate base materials are placed and compacted.
- Asphalt concrete paving, aggregate base materials, and placement methods should conform to the latest edition of the Standard Specification for Public Works, referred to as the Green Book.
- Aggregate base materials should be compacted to at least 95 percent relative compaction (ASTM D1557).
- Within the structural pavement section areas, positive drainage (both surface and subsurface) should be provided. In no instance should water be allowed to pond on the pavement. Roadway performance depends greatly on how well runoff water drains from the site. This drainage should be maintained both during construction and over the entire life of the Project.

5.0 ADDITIONAL GEOTECHNICAL INVESTIGATIONS

5.1 PLANS AND SPECIFICATION REVIEW

We recommend Kleinfelder, Inc., be retained to review preliminary foundation and earthwork plans and specifications. It has been our experience that this service provides an opportunity to review whether or not our recommendations have been properly interpreted and to correct possible misunderstandings of our recommendations prior to the start of construction. In the event Kleinfelder is not retained to perform this recommended review, we will assume no responsibility for misinterpretation of our recommendations.

5.2 CONSTRUCTION OBSERVATION AND TESTING

We recommend that Kleinfelder, Inc., be retained to provide observation and testing services during site earthwork and construction of foundations. This will allow us the opportunity to compare actual subsurface soil conditions with those encountered during our field exploration and, if necessary, to provide supplemental recommendations, if warranted due to unanticipated subsurface conditions.

6.0 LIMITATIONS

Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory tests, and our present knowledge of the proposed construction. It is possible that soil conditions vary between or beyond the points explored. If soil or groundwater conditions are encountered during construction that differ from those described herein, we should be notified immediately in order that a review may be made and any supplemental recommendations provided. If the scope of the proposed construction, including structural locations, changes from that described in this report, our recommendations should also be reviewed. We have not reviewed the final grading plans or foundation plans for the Project.

Our corrosion recommendations are preliminary. Kleinfelder is not a corrosion engineering consultant. Specific recommendations for corrosion protection should be obtained from a corrosion specialist.

Our evaluation of subsurface conditions at the site has considered subgrade soil and groundwater conditions present at the time of our investigation. The influence(s) of post-construction changes to these conditions such as introduction of water into the subsurface will likely influence future performance of the proposed VV2 Project. Whereas our scope of services addresses present groundwater conditions; future irrigation, broken water pipelines, etc. may adversely influence the Project and should be addressed and mitigated, as needed, by specialized slab and flooring system designers having local knowledge.

Other standards or documents referenced in any given standard cited in this report, or otherwise relied upon by the authors of this report, are only mentioned in the given standard; they are not incorporated into it or "included by reference", as the latter term is used relative to contracts or other matters of law.

We have strived to present the findings, conclusions and recommendations in this report in a manner consistent with the standards of care and skill ordinarily exercised by members of this profession practicing under similar conditions in San Bernardino County, California, and at the time the services were performed. No warranty, express or implied, is made. The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by Kleinfelder during Project construction in order to evaluate compliance with our recommendations and/or to provide supplemental recommendations, as needed, if anticipated subsurface conditions are encountered.

This report may be used only by the client and only for the purposes stated, within a reasonable time from its issuance, but in no event later than one year from the date of the report. Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party, and client agrees to defend, indemnify, and hold harmless Kleinfelder from any claim or liability associated with such unauthorized use or non-compliance.

The scope of our geotechnical services did not include any environmental site assessment for the presence or absence of hazardous/toxic materials. Kleinfelder will assume no responsibility or liability whatsoever for any claim, damage, or injury which results from pre-existing hazardous materials being encountered or present on the project site, or from the discovery of such hazardous materials.

7.0 REFERENCES

Arya, O'Neill, Pincus, 1979, Design of Structures and Foundations for Vibrating Machines, Gulf Publishing Company.

Blake, Thomas F., 2000, EQFAULT: "A Computer Program for the Deterministic Prediction of Peak Horizontal Accelerations from Digitized California Faults."

Blake, Thomas F., 2000, EQSEARCH: A Computer Program for Windows.

California Building Standards Commission, 2001 California Building Code.

California Geological Survey, 2006, Seismic Shaking Hazards in California, www.consrv.ca.gov/CGS/rghm/pshamap.

Caltrans, 2006, Guidelines for Structures Foundation Reports, Version 2.0, Division of Engineering Services, Geotechnical Services.

Caltrans, 2004, Bridge Design Specifications, Division of Engineering Services.

Caltrans, 2003, Corrosion Guidelines version 1.0, Division of Engineering Services, Material Engineering and Testing Services, Corrosion Technology Branch

Dibblee, Thomas W., Jr., 1967, Aerial Geology of the Western Mojave Desert, California, U.S. Geological Survey Professional Paper 522.

FEMA/ESRI Hazard Information and Awareness (web site).

Hart, Earl W., and Bryant William A., 1997, Fault Rupture Hazard Zones in California, Division of Mines and Geology, Special Publication 42.

International Conference of Building Officials, 1997, Uniform Building Code, Volume 2.

International Conference of Building Officials, 1998, Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada for the 1997 UBC.

Jennings, Charles W., 1994, Fault Activity Map of California and Adjacent Areas, California Division of Mines and Geology, Geologic Data Map No. 6.

Kramer, 1996, Geotechnical Earthquake Engineering, Prentice Hall, Upper Saddle River, New Jersey 07458.

Kleinfelder, 2001, Report of Geotechnical Investigation – Proposed High Desert Power Project, Victorville, California, Project No. 56-2085-01.

LPILE 5.0 Manual, Ensoft, Austin, Texas.

NAVFAC Design Manual 7.1, 1986, Naval Facilities Engineering Command, Alexandria, Virginia.

Occupational Safety and Health Standards - Excavations, Final Pub., 1989.

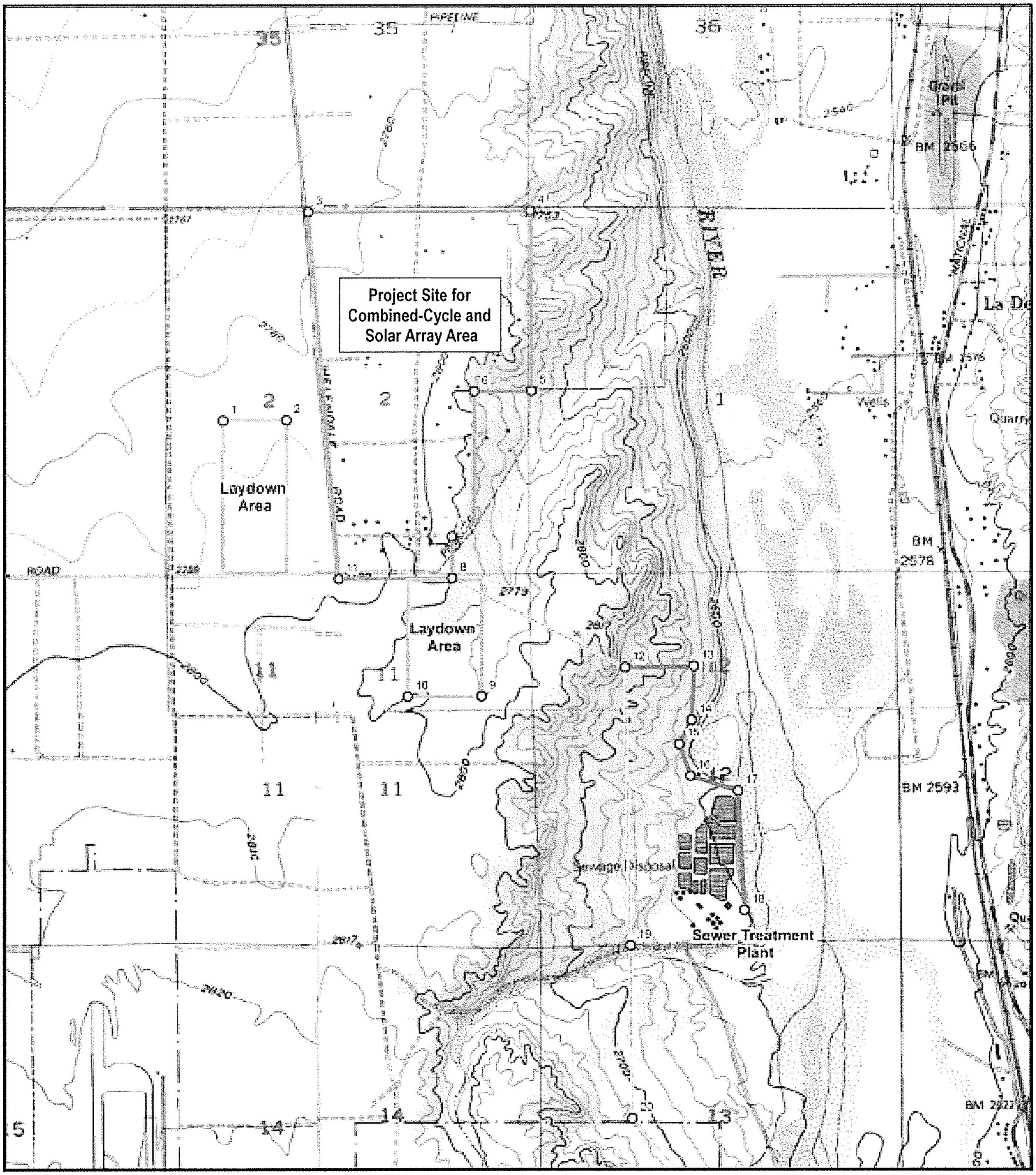
Petersen, Mark D, et al., 1999, "Seismic Shaking Hazard Maps of California," Division of Mines and Geology Map Sheet 48.

Petersen, Mark D., et al., 1996, Probabilistic Seismic Hazard Assessment for the State of California, California Geological Survey, Open File Report 96-08.

Standard Specifications for Public Works Construction, 2000 Edition.

United States Geological Survey, 1998, Regional Water Table (1998) and Ground Water Level Changes in the Mojave River and the Morongo Ground Water Basins, San Bernardino County, California, by Gregory R. Smith and M. Isabel Pimentel.

PLATES



Legend

Laydown Area
Project Site
Transmission Line Route
Transmission and Water Line Route
GPS Point

Base Imagery USGS 24K Topo Quadrangle(s)
Victorville NW Helendale & Victorville

Scale 1:24,000 0 1,000 2,000 4,000 Feet

Source of Site Vicinity Map

Inland Energy, Inc.

ENSR | AECOM

Date May 2006

KLEINFELDER

KLEINFELDER, INC
1220 RESEARCH DRIVE, SUITE B
REDLANDS, CALIFORNIA 92374

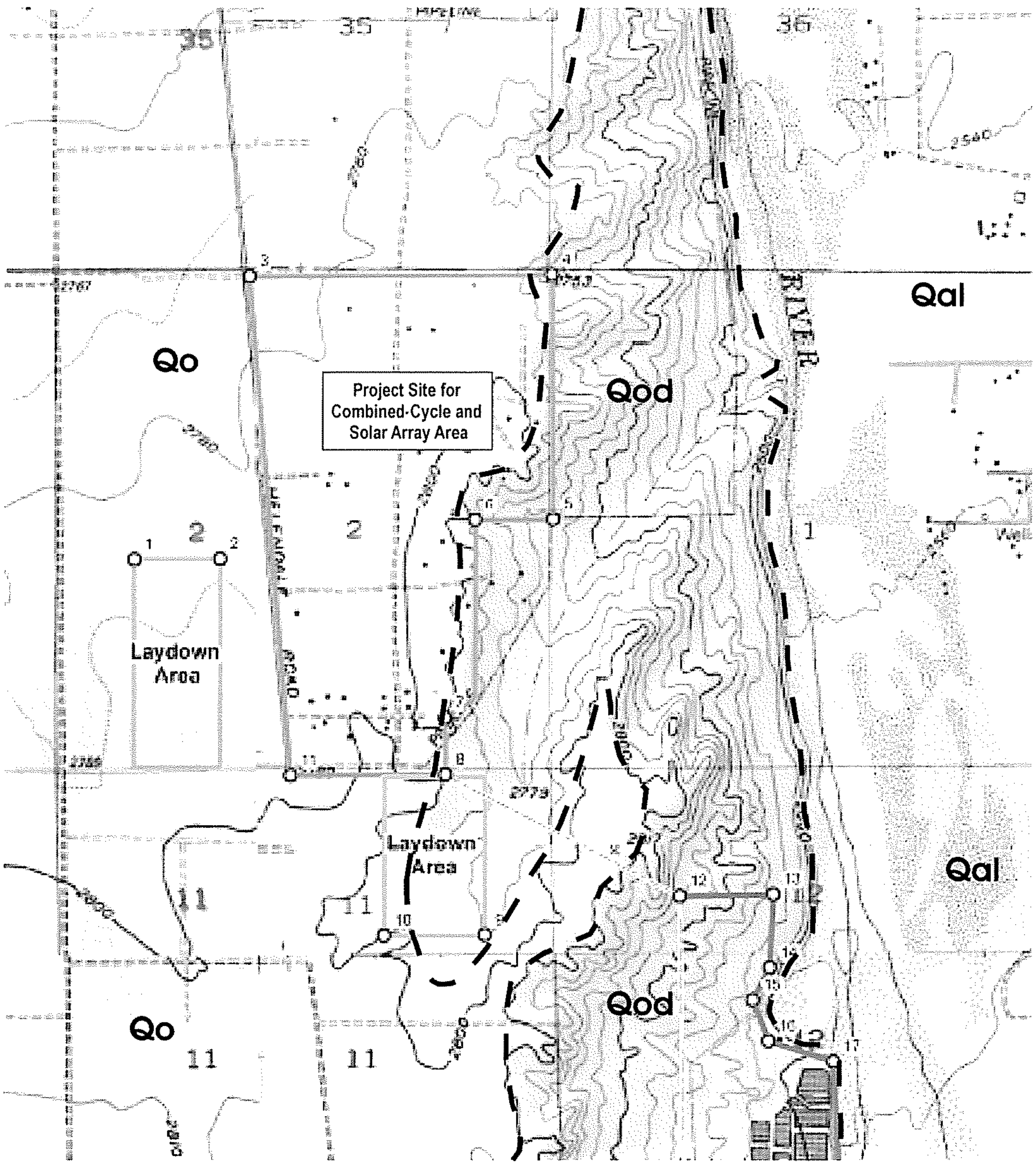
PROJECT: 66815 JUNE 2006

SITE VICINITY MAP

VICTORVILLE 2 HYBRID POWER PROJECT
VICTORVILLE, CALIFORNIA

PLATE

1



EXPLANATION

Qal	-	Alluvium
Qo	-	Older alluvium
Qod	-	Older alluvium, well dissected
(dashed line)	-	Approximate geologic contact

Reference: Bortugno-Spittler, 1998, CGS

Legend

Laydown Area
Project Site
Transmission Line Route
Transmission and Water Line Route
GPS Point

N

Base Imagery: USGS 24K Topo Quadrangle(s)
Victorville NW Helendale & Victorville

Scale: 1:24,000 0 1,000 2,000 4,000 Feet

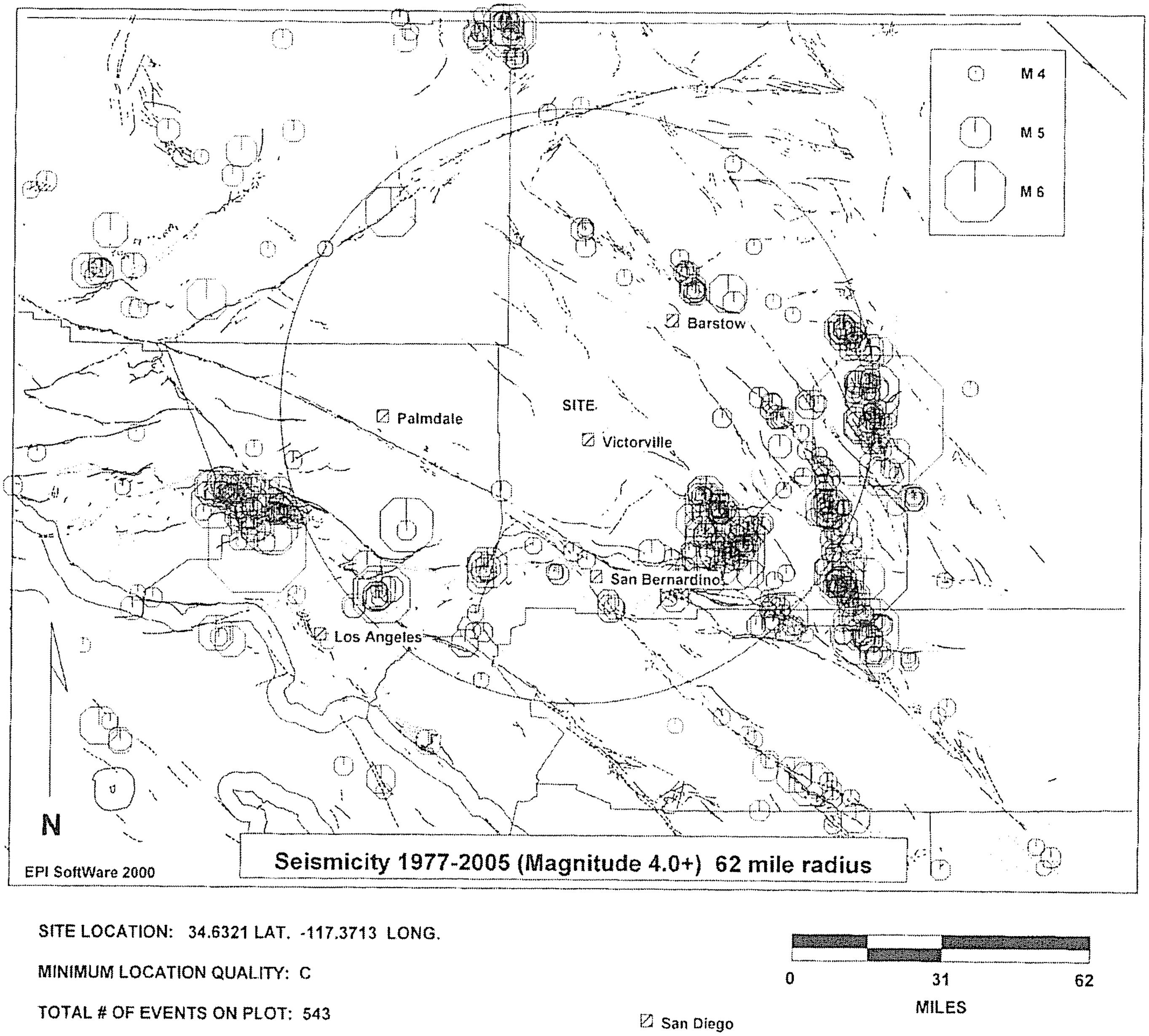
Inland Energy, Inc. ENSR | AECOM

KLEINFELDER

KLEINFELDER, INC
1220 RESEARCH DRIVE, SUITE B
REDLANDS, CALIFORNIA 92374
PROJECT: 66815 June 2006

GEOLOGIC MAP
VICTORVILLE 2 HYBRID POWER PROJECT
VICTORVILLE, CALIFORNIA

PLATE
4



SITE LOCATION: 34.6321 LAT. -117.3713 LONG.

MINIMUM LOCATION QUALITY: C

TOTAL # OF EVENTS ON PLOT: 543

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 249

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:

4.0- 4.9 : 225
5.0- 5.9 : 22
6.0- 6.9 : 1
7.0- 7.9 : 1
8.0- 8.9 : 0

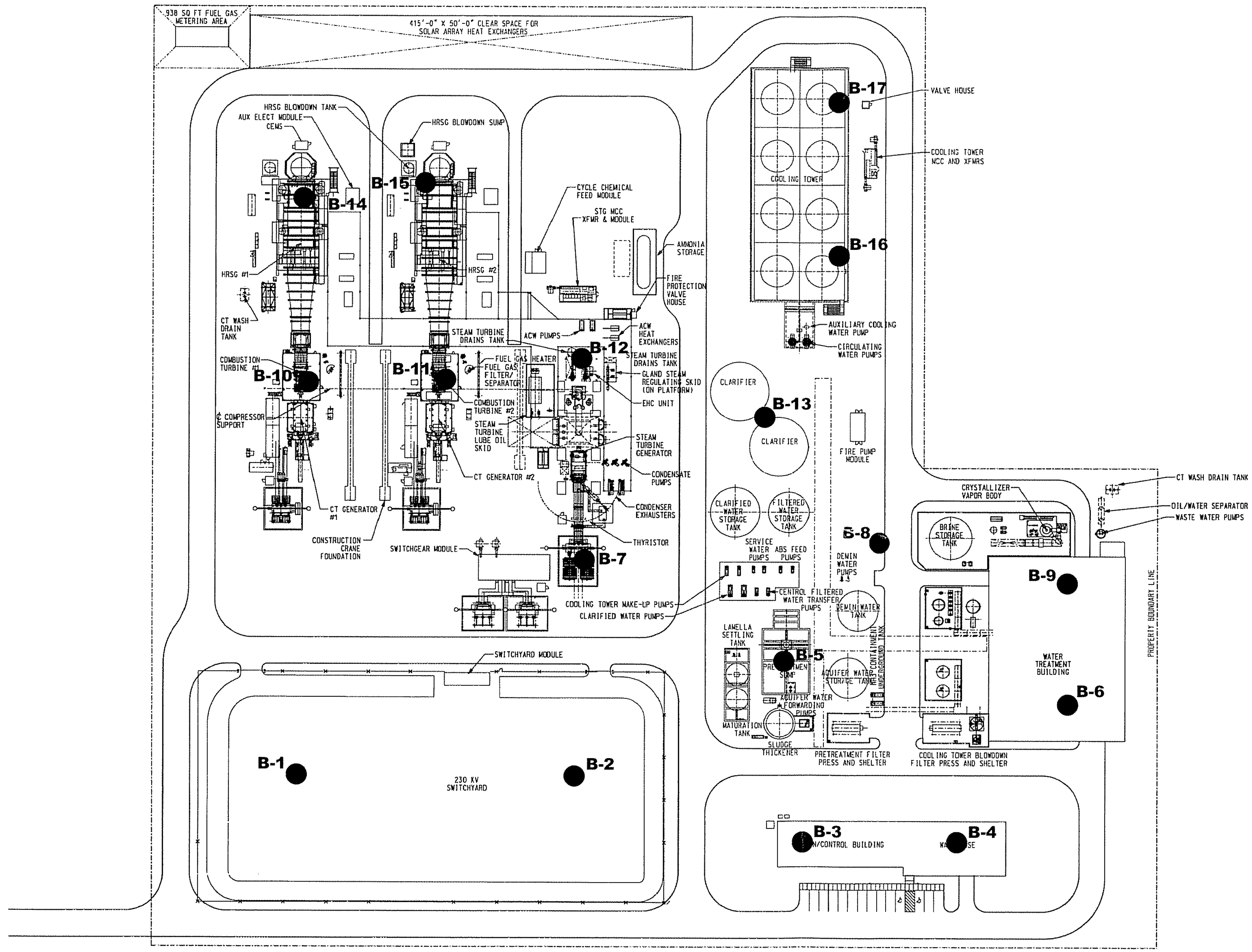
CLOSEST EVENT: 4.4 ON THURSDAY, AUGUST 20, 1998 LOCATED APPROX. 24 MILES SOUTHWEST OF THE SITE

LARGEST 5 EVENTS:

7.3 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 61 MILES SOUTHEAST OF THE SITE
6.4 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 42 MILES SOUTHEAST OF THE SITE
5.9 ON THURSDAY, OCTOBER 01, 1987 LOCATED APPROX. 56 MILES SOUTHWEST OF THE SITE
5.8 ON SATURDAY, OCTOBER 16, 1999 LOCATED APPROX. 61 MILES EAST OF THE SITE
5.8 ON FRIDAY, JUNE 28, 1991 LOCATED APPROX. 43 MILES SOUTHWEST OF THE SITE

N

KLEINFELDER	KLEINFELDER, INC. 1220 RESEARCH DRIVE, SUITE B REDLANDS, CALIFORNIA 92374 PROJECT: 66815 JUNE 2006	HISTORIC SEISMICITY MAP VICTORVILLE 2 HYBRID POWER PROJECT VICTORVILLE, CALIFORNIA	PLATE 5



NOTES:

1. BORING LOCATIONS SHOWN WITH RESPECT TO EQUIPMENT
2. EQUIPMENT PLAN SOURCE: BIBB AND ASSOCIATES
   8455 LEZANA DRIVE
   LEZANA, KANSAS 66214

- PRELIMINARY -
NOT FOR CONSTRUCTION

CONFIDENTIAL

A	PRELIMINARY	CED	RSG	CKB	09-28-05
REV	DESCRIPTION	DWN	CHK	APP	DATE

KIEWIT INDUSTRIAL CO.
A Kiewit Company

INLAND ENERGY

VICTORVILLE HYBRID COMBINED CYCLE · SOLAR POWER PROJECT

Bibb and associates
8455 Lenexa Drive
Lenexa Kansas 66214

PLOT PLAN

	by	date
DESIGNED	CKB	09-21-05
DRAWN	CED	09-23-05
CHECKED	---	----
APPROVED	---	----

DRAWING NUMBER: 2005-038-PP-001

LEGEND

B-17 ● APPROXIMATE BORING LOCATION

N

40 0 40 80
SCALE IN FEET
SCALE: 1" = 40'-0"

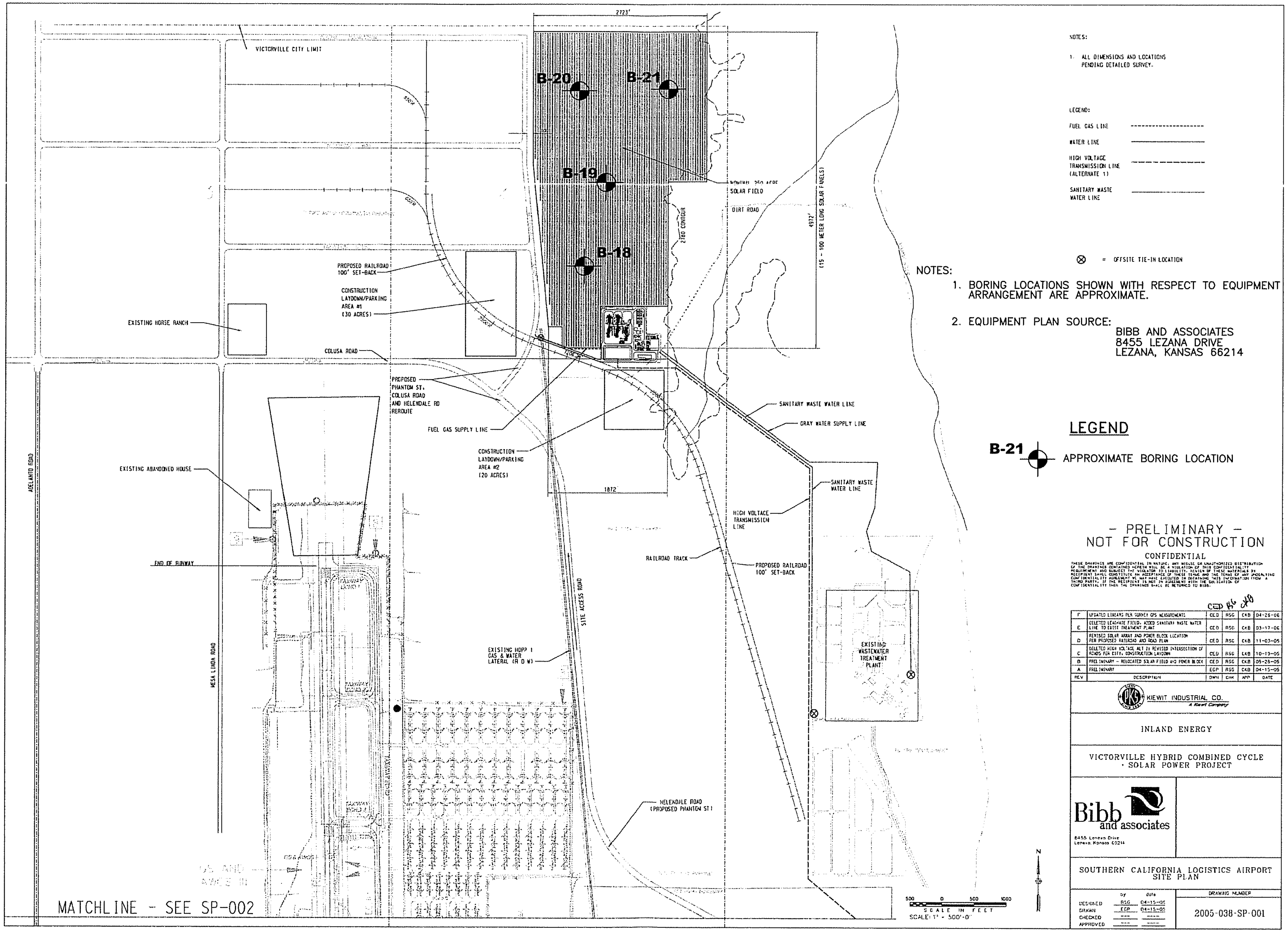
KLEINFELDER

KLEINFELDER, INC.
1220 RESEARCH DRIVE, SUITE B
REDLANDS, CALIFORNIA 92374
PROJECT: 66815 MAY 2006

BORING LOCATION PLAN FOR COMBINED CYCLE AREA

VICTORVILLE 2 HYBRID POWER PROJECT
VICTORVILLE, CALIFORNIA

PLATE
2



BORING LOCATION PLAN FOR SOLAR AREA

VICTORVILLE 2 HYBRID POWER PROJECT
VICTORVILLE, CALIFORNIA

PLATE 3

KLEINFELDER, INC.
1220 RESEARCH DRIVE, SUITE B
REDLANDS, CALIFORNIA 92374

PROJECT: 66815

MAY 2006

KLEINFELDER

APPENDIX A

FIELD EXPLORATION

APPENDIX A
FIELD EXPLORATION

The subsurface exploration program consisted of excavating and logging 21 hollow-stem auger borings that extended to depths ranging from approximately 21.5 to 76.5 feet below existing grades. The exploratory borings were advanced using a Mobile B-61, truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers and an automatic hammer. Plates 2 and 3 show the approximate locations of the exploratory borings.

A legend to the logs is presented as Plate A-1. The logs of borings are presented as Plates A-2 through A-22. The logs of the borings describe the earth materials encountered, indicate the locations of the samples obtained, and show field and laboratory tests performed. The excavations were logged by a staff engineer from this firm using methods outlined in the Unified Soil Classification System (USCS) and general procedures established in ASTM D 2488. The boundaries between soil types shown on the logs are approximate because the transition between different soil layers may be gradual. Bulk and in-place samples of representative earth materials were obtained from the borings.

In-place soil samples were obtained from the borings using either a Standard Penetration (SPT) or California-type Sampler driven a total of 18-inches (or until practical refusal) into the undisturbed soil at the bottom of the boring. The soil sampled by the SPT (2-inch O.D., 1.5 inches I.D.) or California-type sampler (3-inch O.D., 2.4 inches I.D.) was returned to our laboratory for testing. The samplers were driven using an autohammer with a 140-pound weight falling 30 inches. The total number of hammer blows required to drive the sampler the final 12 inches is termed the blow count and is recorded on the Logs of Borings. Bulk samples of the surface soils were retrieved directly from the auger blades. All borings were backfilled using the soil from cuttings.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISION		LTR	ID	DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW		Well-graded gravels, gravel-sand mixtures
		GP		Poorly-graded gravels, gravel-sand mixtures
		GM		Silty gravels, gravel-sand-silt mixtures
		GC		Clayey gravels, gravel-sand-clay mixtures
	SAND AND SANDY SOILS	SW		Well-graded sands, gravelly sands
		SP		Poorly-graded sands and gravelly sands
		SM		Silty sands, sand-silt mixture
		SC		Clayey sands, sand-clay mixture

MAJOR DIVISION		LTR	ID	DESCRIPTION
FINE GRAINED SOILS	SILTS AND CLAYS LL < 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands
		CL		Inorganic clays of low to medium plasticity; gravelly clays silty clays,sandy clays, lean clays
		OL		Organic silts and organic silt-clays of low plasticity
	SILTS AND CLAYS LL > 50	MH		Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
		CH		Inorganic clays of medium to high plasticity
		OH		Organic clays of medium to high plasticity
	HIGHLY ORGANIC SOILS	Pt		Peat, muck and other highly organic soils

▼ Approximate water level observed in boring following drilling

SOIL SAMPLE

Bulk Sample

Drive Sample - California Sample

Shelby Tube Sample

Standard Penetration Test (SPT) Sample

ADDITIONAL TESTS

CN	-	Consolidation
COR	-	Corrosion Potential
CP	-	Collapse Potential
DS	-	Direct Shear
EI	-	Expansion Potential
MAX	-	Maximum Dry Density
SG	-	Specific Gravity
PI	-	Plasticity Index
RV	-	R-Value
SE	-	Sand Equivalent
GS	-	Grain Size Distribution

NOTES:

Blow counts represent the number of blows of a 140-pound hammer falling 30 inches required to drive a sampler through the last 12 inches of an 18-inch penetration, unless otherwise noted.

The lines separating strata on the logs represent approximate boundaries only. The actual transition may be gradual. No warranty is provided as to the continuity of soil strata between borings. Logs represent the soil section observed at the boring location on the date of drilling only.

KLEINFELDER
1220 Research Drive, Suite B
Redlands, California
Project No. 46995

LEGEND TO LOGS

PLATE
A-1

Date Drilled	4/17/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SP-SM	**Sand with Silt:** Light brown to yellowish brown, dry, fine to medium sand			
2795	5	1	9				-- light brown, loose			GS
2790	10	2	26				-- medium dense, fine to medium sand	94.5	0.7	CP
2785	15	3	31				-- dense, fine to coarse sand, trace caliche veining			
						SP	**Sand:** Light brown, dry, very dense, medium to coarse sand			
2780	20	4	81							

Boring terminated at 21.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.

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PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-1

PLATE A-2

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/17/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
							Sand: Yellowish brown, dry, fine sand			
		1								MAX, SE
2795	5	2	10			SP	-- loose, fine to coarse sand, trace fine gravel	105.6	1.9	CP
2790	10	3	68			SM	**Silty Sand:** Dark yellowish brown, slightly moist, very dense, trace voids (2-3%), trace caliche veining			GS
2785	15	4	58			SP	**Sand:** Yellowish brown, dry, dense, coarse sand			
2780	20	5	37				-- medium to coarse sand			

Boring terminated at 21.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

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PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-2

PLATE A-3

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/17/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SP	**Sand:** Light brown, dry, fine to medium sand			
2795	5	1	20			SP-SM	**Sand with Silt:** Light brown to red-brown, slightly moist, medium dense, medium to coarse sand			
2790	10	2	45			SM	**Silty Sand:** Light brown, dry, dense, fine to coarse sand, trace caliche veining			GS
2785	15	3	41							
2780	20	4	76			SP-SM	**Sand with Silt:** Light brown, dry, very dense, fine sand			
2775	25	5	55			SP	**Sand:** Light brown, dry, very dense, fine sand			
							Boring terminated at 26.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

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Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-3

PLATE

A-4

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/17/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
				SP	**Sand:** Light brown, dry, fine to medium sand			
2795	5	1	75	SP-SM	**Sand with Silt:** Light brown, dry, very dense, medium to coarse sand			
2790	10	2	46	SM	**Silty Sand:** light brown to red-brown, dense, fine to coarse sand			GS
2785	15	3	41	SP	**Sand:** Light brown, dry, dense, fine to medium sand			
2780	20	4	41		-- fine to coarse sand, trace gravel			
2775	25	5	50		-- no gravel, increase fine sand			
					Boring terminated at 26.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

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Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-4

PLATE A-5

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/18/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SP	**Sand:** Light brown, dry, fine to medium sand			
2795	5	1	16				-- slightly moist, medium dense, fine to coarse sand			
2790	10	2	23				-- fine to medium sand			
2785	15	3	88				-- fine to coarse sand, decrease moisture content, very dense	108.6	0.9	CP
2780	20	4	20, 50 - 5"			SM	**Silty Sand:** Light brown, slightly moist to dry, very dense, fine sand			
2775	25	5	27, 50 - 5"				-- increase moisture content, fine to medium sand			
2770	30	6	22, 50 - 5"				-- fine to coarse sand			
							Boring terminated at 31 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

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PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-5

PLATE A-6

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/17/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
		1				SP	**Sand:** Light brown, dry, fine to coarse sand			
2795	5	2	62			SP-SM	**Sand with Silt:** Light brown, dry, dense, fine to coarse sand			
2790	10	3	46			SP	**Sand:** Light brown, dry dense, medium to coarse sand	115.8	2.2	CN
2785	15	4	36			SP-SM	**Sand with Silt:** Light brown, slightly moist, dense, fine to medium sand			
2780	20	5	51				-- medium to coarse sand			
2775	25	6	38			SP	**Sand:** Light brown, dry, dense, medium to coarse sand, trace gravel			

Broing terminated at 31 feet. Groundwater was not encountered. Boring backfilled with cuttings.

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PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-6

PLATE A-7

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/18/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SM	**Silty Sand:** Light brown, slightly moist to dry, fine sand			
2795	5	1	26				--medium dense, trace caliche veining			
2790	10	2	43			SP	**Sand:** Light brown, slightly moist to dry, dense, fine to coarse sand			
2785	15	3	54			SM	**Silty Sand:** Light bown, slightly moist, very dense, fine to medium sand			GS
2780	20	4	44, 50 - 5"			SP	**Sand:** Light brown, slightly moist to dry, very dense, fine to coarse sand			
2775	25	5	70			SM	**Silty Sand:** Light brown, slightly moist to dry, very dense, fine sand			
2770	30	6	29, 50 - 5"				-- increase fine sand			
							Boring terminated at 31 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

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PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-7

PLATE A-8

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/18/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
					SP	**Sand:** Light brown, dry, fine to medium sand			
2795	5	1	16		SM	**Silty Sand:** Light brown, slightly moist, medium dense, fine to coarse sand			
2790	10	2	59		SP	**Sand:** Light brown, dry , dense, fine to coarse sand			
2785	15	3	49			**Sand:** Light brown, dry, very dense, fine to coarse sand			
2780	20	4	37, 50 - 5"			**Sand:** Light brown, dry, very dense, fine to coarse sand			
2775	25	5	42			-- trace fine gravel, increase coarse sand, dense			GS
2770	30	6	80			-- no gravel, fine to medium sand			
						Boring terminated at 31.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

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PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-8

PLATE A-9

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/17/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SP	**Sand:** Light brown, dry, fine to coarse sand			
2795	5	1	24				-- medium dense, medium to coarse sand, trace fine gravel, subrounded	103.6	2.1	CP
2790	10	2	38				-- increase fine gravel			
2785	15	3	46				-- moist, no gravel			
2780	20	4	36				-- trace fine gravel			
2775	25	5	44				-- increase coarse sand			
2770	30	6	55				-- decrease moisture content, decrease coarse sand, no fine gravel, very dense			

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-9

PLATE A-10a

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Elevation (approx.) (feet) Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION *(Continued From Previous Page)*	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
	7	71				**Sand:** Light brown, dry, fine to coarse sand *(continued)* -- trace fine gravel			
2760 40	8	54				-- increase coarse sand, increase fine gravel			
2755 45	9	32, 50 - 5"			SM	**Silty Sand:** Light brown, slightly moist to moist, very dense, fine to medium sand			
2750 50	10	31				-- dense, increase fine sand			
						Boring terminated at 51.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-9

PLATE A-10b

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/19/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SM	**Silty Sand:** Light brown, dry, fine to coarse sand			
2795	5	1	25				-- dark yellowish brown, slightly moist, medium dense, fine to medium sand, trace coarse sand, abundant caliche veining			GS
2790	10	2	32				-- medium dense, increase fine to medium sand, trace caliche veining, trace red-yellow mottling			
2785	15	3	77			SP	**Sand:** Light brown to yellow brown, slightly moist, very dense, medium to coarse sand, one 1 inch subrounded gravel			
2780	20	4	82				-- increase coarse sand, increase moisture content			
2775	25	5	20			SM	**Silty Sand:** Light brown, slightly moist, medium dense, fine to medium sand, trace caliche veining			
2770	30	6	34, 50 - 5"				-- very dense, increase fine to medium sand			
							Boring terminated at 31.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-10

PLATE A-11

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/19/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SM	**Silty Sand:** Light brown, dry to slightly moist, fine to medium sand			
2795	5	1	19				-- slightly moist to moist, medium dense, increase fine sand	107.0	4.0	CP
2790	10	2	13				-- trace coarse sand, some caliche veining			
2785	15	3	56				-- decrease in moisture content, dense, with coarse sand, no caliche	100.6		DS
2780	20	4	28				-- medium dense, increase medium sand			
2775	25	5	48				-- dense, fine to medium sand			
2770	30	6	56				-- very dense, increase fine sand			GS

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-11

PLATE

A-12a

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Elevation (approx.) (feet) Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION *(Continued From Previous Page)*	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
	7	60				**Silty Sand:** Light brown, dry to slightly moist, fine to medium sand *(continued)* -- dense			
2760 40	8	56				-- increase silt			
						Boring terminated at 41.5 feet. Groundwater was not encountered, Boring backfilled with cuttings.			

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-11

PLATE

A-12b

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/18/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet) Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
	1				SM	**Silty Sand:** Light brown, slightly moist to moist, fine sand			MAX, COR, SE
2795 5	2	27			SM-SC	-- medium dense, fine to medium sand, trace caliche veining			
2790 10	3	20			SP	**Sand:** Light brown, dry, medium dense, fine to coarse sand			
2785 15	4	73				-- very dense, increase medium sand			
2780 20	5	59			SM	**Silty Sand:** Light brown, slightly moist, very dense, fine sand			
2775 25	6	27, 50 - 5"				-- trace reddish brown iron staining, increase fine sand			
2770 30	7	87				-- increase fine sand			
						Boring terminated at 31.5 feet, Groundwater was not encountered. Boring backfilled with cuttings.			

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-12

PLATE

A-13

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/18/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
				SP	**Sand:** Light brown, dry, fine to medium sand			
2795	5	1	19		-- slightly moist to moist, medium dense, medium to coarse sand			
2790	10	2	26		-- increase moisture content, decrease coarse sand			GS
2785	15	a	35		-- moist, fine to coarse sand, trace fine gravel			
2780	20	4	36	SM	**Silty Sand:** Light brown to brown, moist, dense, fine to medium sand			
2775	25	5	75		-- very dense, increase coarse sand, increase fine gravel, trace coarse gravel			
2770	30	6	36		-- increase coarse sand, encountered 1" gravel, subrounded			

Boring terminated at 31.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-13

PLATE A-14

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/19/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SM	**Silty Sand:** Light brown, dry, fine to medium sand			
		1								RV, EI
2795	5	2	12				-- slightly moist, loose, increase fine sand			DS
2790	10	3	15				fine to coarse sand			
2785	15	4	43			SP	**Sand:** Light brown, dry, dense, fine to medium sand, trace coarse gravel			
2780	20	5	26			SM	**Silty Sand:** Light brown, slightly moist, medium dense, fine to medium sand, trace caliche veining			
2775	25	6	59				-- dense, no caliche veining, decrease medium sand			
2770	30	7	50				-- increase moisture content			
							Boring terminated at 31.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-14

PLATE

A-15

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/19/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SM	**Silty Sand:** Light brown, dry, fine to medium sand			
2795	5	1	27				-- medium dense, trace caliche veining			SE
2790	10	2	19			SP	**Sand:** Light brown, dry, medium dense, medium to coarse sand			
2785	15	3	35				-- dense, increase medium sand	109.6	1.9	
2780	20	4	49				-- increase coarse sand, trace fine gravel			
2775	25	5	26			SM	**Silty Sand:** Light brown, slightly moist, medium dense, fine to medium sand			
2770	30	6	27, 50 - 5"			SP	**Sand:** Light brown, slightly moist, very dense, medium sand			
							Boring terminated at 31.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-15

PLATE

A-16

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/17/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
					SM	**Silty Sand:** Yellowish brown, slightly moist, fine to medium sand			
2795	5	1	27			-- medium dense, heavy caliche veining	95.1	7.4	
2790	10	2	5			-- loose, fine to coarse sand, no caliche			
2785	15	3	32		SP	**Sand:** Light brown, slightly moist to dry, medium dense, medium to coarse sand			
2780	20	4	54			-- very dense, trace fine to coarse gravel			
2775	25	5	54			-- dense, no coarse gravel, increase medium sand			
2770	30	6	37			-- decrease fine gravel			

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-16

PLATE

A-17a

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Elevation (approx.) (feet) Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION *(Continued From Previous Page)*	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
	7	80				-- increase fine to medium sand, very dense			DS
2760 40	8	58				-- no fine gravel			
2755 45	9	86				-- increase medium sand			
2750 50	10	36			SP-SM	**Sand with Silt:** Light brown, slightly moist, dense, fine to medium sand			
2745 55	11	30, 50 - 4"			SM	**Silty Sand:** Light brown, slightly moist, very dense, fine sand, trace reddish brown mottling			GS
2740 60	12	59			SP	**Sand:** Light brown, dry, very dense, fine to medium sand			
2735 65	13	41			CH	**Clay:** Light brown, slightly moist, hard, trace dark brown mottling			PI
2730 70	14	38			ML	**Silt:** Light brown, slightly moist, hard, trace dark brown mottling			

KLEINFELDER

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Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-16

PLATE A-17b

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Elevation (approx.) (feet) Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION *(Continued From Previous Page)*	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
	15	54			SM	**Silty Sand:** Light yellowish brown, slightly moist, very dense, fine to medium sand			
						Boring terminated at 76.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-16

PLATE A-17c

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/17/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2800 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
		1				SP	**Sand:** Light brown, dry, fine to coarse sand with some fine gravel			
2795	5	2	4				-- loose, medium to coarse sand (determined from soil cuttings because there was no recovery)			
2790	10	3	31, 50 - 4"			SP-SM	**Sand with Silt:** Light brown, dry, very dense, very fine sand			
2785	15	4	29			SP	**Sand:** Light brown, dry, medium dense, fien to coarse sand			
2780	20	5	72				-- trcae fine gravel, subrounded	112.3	0.8	CP
2775	25	6	45				-- increase coarse sand			
2770	30	7	38, 50 - 5"				-- decrease fine gravel			

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-17

PLATE A-18a

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Elevation (approx.) (feet) Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION *(Continued From Previous Page)*	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
	8	56				-- no fine gravel			
2760 40	9	64			SM	**Silty Sand:** Light brown, slightly moist, very dense, fine sand			
2755 45	10	58				-- increase fine sand			
2750 50	11	75			SP	**Sand:** Light brown, slightly moist, very dense, fine to medium sand, trace coarse gravel			

Boring terminated at 51.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

KLEINFELDER

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Victorville 2 Hybrid Power Project
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LOG OF BORING B-17

PLATE A-18b

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/18/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2790 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SM	**Silty Sand:** Light brown, dry, fine to medium sand			
2785	5	1	17			SP	**Sand:** Light brown, moist, medium dense, fine to medium sand	103.1	1.7	CP
2780	10	2	56			SM	**Silty Sand:** Light brown, moist, very dense, fine to medium sand			
2775	15	3	87			SP	**Sand:** Light brown, slightly moist, very dense, fine to medium sand, trace coarse gravel			
2770	20	4	41				-- medium to coarse sand, with fine gravel			

Boring terminated at 21.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-18

PLATE

A-19

GEOTECH 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/18/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2790 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet) Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
					SM	**Silty Sand:** Light brown, dry, fine to coarse sand			
2785 5	1	6				-- loose, fine to medium sand			
2780 10	2	30, 50 - 5"			SM-SC	-- heavy caliche sheeting, very dense	102.8	5.2	DS, CP
2775 15	3	50			SP	**Sand with Silt:** Light brown, dry, veyr dense, fine to medium sand, trace caliche veining			
2770 20	4	61				-- medium to coarse sand, no silt			

Boring terminated at 21.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-19

PLATE

A-20

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/18/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2780 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet)	Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
						SP-SM	**Sand with Silt:** Light brown, slightly moist, fine to coarse sand, trace fine gravel			
2775	5	1	15				-- increase coarse sand, medium dense			GS
2770	10	2	40			SP	**Sand:** Light brown, dry, dense, fine sand			
2765	15	3	35				-- with silt, medium to coarse sand			
2760	20	4	52				-- medium sand, no silt			
							Goring terminated at 21.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-20

PLATE A-21

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

Date Drilled	4/18/06	Water Depth:	Not Encountered
Drilled By:	Cal Pac Drilling	Date Measured:	
Drilling Method:	8" Hollow-Stem Auger	Elevation:	2790 feet (approx.)
Logged By:	M. Quach	Datum:	MSL

Elevation (approx.) (feet) Depth	Sample Number	Blows per Foot	Sample Type	Graphic Log	USCS Description	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	Dry Unit Weight (pcf)	Moisture Content (%)	Additional Tests & Remarks
	1				SM	**Silty Sand:** Light brown, dry, fine to medium sand, trace caliche			COR, RV, SE
2785 5	2	77			SP	**Sand:** Light brown, dry, very dense, medium to coarse sand, trace fine gravel	108.3	2.3	CP
2780 10	3	34				--medium dense, increase coarse sand, no fine gravel			
2775 15	4	22, 50 - 5"				-- slightly moist, some caliche veining			
2770 20	5	36				-- increase coarse sand			
						Boring terminated at 21.5 feet. Groundwater was not encountered. Boring backfilled with cuttings.			

KLEINFELDER

PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

LOG OF BORING B-21

PLATE
A-22

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

APPENDIX B

LABORATORY TESTING

APPENDIX B
LABORATORY TESTING

Laboratory tests were performed on drive and bulk soil samples to estimate engineering characteristics of the various earth materials encountered. All laboratory tests except the corrosion tests were performed at Kleinfelder soil and materials laboratory at Redlands, California. Corrosion tests were performed by AP Engineering, Pomona, California. Testing was performed in general accordance with procedures outlined by the American Society for Testing and Materials, the California Department of Transportation, or other accepted procedures.

IN-SITU MOISTURE CONTENT AND DRY UNIT WEIGHT

In-situ moisture content and dry unit weight tests were performed on twenty two samples that could be recovered in a relatively undisturbed condition. Moisture content was evaluated in general accordance with ASTM Test Method D 2216; dry unit weight was evaluated using procedures similar to ASTM Test Method D 2937. The test results are presented in the following table.

In-situ Moisture Content and Dry Unit Weight Test Results

Location	Depth (ft)	USCS Soil Type	Dry Unit Weight (pcf)	Moisture Content (%)
B-1	10	SP	97.1	0.7
B-2	5	SP	106.9	1.9
B-5	15	SP	107.2	0.9
B-5	25	SM	109.7	2.7
B-6	10	SP	113.1	2.2
B-7	30	SM	111.7	2.0
B-9	5	SP	105.6	2.1
B-9	35	SP	116.4	1.6
B-11	5	SM	110.2	4.0
B-11	15	SM	118.8	2.0
B-12	5	SM-SC	108.7	3.2
B-14	5	SM	102.5	2.7
B-14	15	SP	111.8	1.2

Location	Depth (ft)	USCS Soil Type	Dry Unit Weight (pcf)	Moisture Content (%)
B-15	20	SP	105.0	1.6
B-16	5	SM	99.9	7.4
B-16	35	SP	109.8	1.4
B-16	55	SM	114.8	6.9
B-16	65	CL	100.9	23.2
B-17	20	SP	121.3	0.8
B-18	5	SP	107.2	1.7
B-19	10	SM-SC	106.9	5.2
B-21	5	SP	112.3	2.3

GRAIN SIZE DISTRIBUTION

Sieve analyses were performed on eleven soil samples to evaluate the gradation of the material and to aid in soil classification. Tests were performed in general accordance with ASTM Standard Test Method D 422. The results of these tests are presented on Plate B-1 through B-3.

MAXIMUM DRY UNIT WEIGHT/OPTIMUM MOISTURE CONTENT

Two maximum dry unit weight/optimum moisture content tests were performed on selected bulk samples of the on-site soils to determine compaction characteristics. The tests were performed in accordance with ASTM Standard Test Method D 1557. The test results are presented in the following table.

Maximum Unit Weight/Optimum Moisture Content Test Results

Location	Depth (ft)	USCS Soil Type	Maximum Unit Weight (ASTM D 1557) (pcf)	Optimum Moisture Content (%)
B-2	1-5	SP	116.0	10.0
B-12	1-5	SM	128.5	8.0

CORROSIVITY TESTS

Chemical analyses were performed on two samples of the near surface soil to estimate pH, resistivity, soluble sulfate, and chloride contents in general accordance with Caltrans Standard Test Methods 532 (pH), 643 (resistivity), 417 (sulfates), and 422 (chlorides). Corrosion tests were performed by AP Engineering, Pomona, California. The test results are presented in the following table.

Corrosion Test Results

Location	Depth (ft)	Minimum Resistivity (Ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
B-12	1-5	1900	8.60	59	126
B-21	1-5	1900	9.15	6	63

DIRECT SHEAR STRENGTH

Four direct shear strength tests were performed on representative drive soil samples to evaluate the drained shear strength of the soils. The samples were tested in a near-saturated condition in general accordance with ASTM Test Method D 3080 (consolidated, drained, 3 point testing). The test results are presented in the following table.

Direct Shear Strength Test Results

Location	Depth (ft)	USCS Soil Type	Dry Unit Weight (pcf)	Angle of Internal Friction (degrees)	Cohesion (psf)
B-11	15	SM	110	43.5	0
B-14	5	SM	103	33.0	0
B-16	35	SP	112	41.5	300
B-19	10	SM-SC	106	34.0	400

R-VALUE

Two resistance value (R-value) tests were performed on bulk soil samples to evaluate pavement support characteristics of the near-surface on-site soils. R-value testing was performed in accordance with Caltrans Standard Test Method 301. The test results are presented in the following table.

R-Value Test Result

Location	Depth (ft)	USCS Soil Type	R-Value
B-14	1-5	SM	73
B-21	1-5	SM-SC	18

SAND EQUIVALENT TEST

Four sand equivalent tests were performed on near surface soil to determine the suitability of the onsite materials for use as engineered fill during construction. The test was performed in accordance with ASTM Standard Test Method D 2419. The test results are presented in the following table.

Sand Equivalent Test Results

Location	Depth (ft)	USCS Soil Type	Sand Equivalency
B-2	1-5	SP	31
B-12	1-5	SM	14
B-15	5-6.5	SM	20
B-21	1-5	SM-SC	16

COLLAPSE POTENTIAL

Eleven collapse potential tests were performed on selected on-site soil samples to determine collapse potential of the soils. The test was performed in accordance with ASTM Standard Test Method D 5333. The test results are presented on Plate B-4 through B-13. A summary of the collapse potential tests is presented in the following table.

Collapse Potential Test Results

Location	Depth (ft)	USCS Soil Type	Dry Unit Weight (pcf)	Moisture Content (%)	Collapse Potential (%)
B-1	10	SP	95	0.7	0.8
B-2	5	SP	106	1.9	2.3
B-5	15	SP	109	0.9	0.8
B-6 (Plate B-14)	10	SP	116	2.2	1.1
B-9	5	SP	104	2.1	2.3
B-11	5	SM	107	4.0	1.0
B-16	5	SM	95	7.4	1.8
B-17	20	SP	112	0.8	1.0
B-18	5	SP	103	1.7	0
B-19	10	SM-SC	103	5.2	1.0
B-21	5	SM-SC	108	2.3	2.6

CONSOLIDATION

One consolidation test was performed on a selected on-site materials to evaluate consolidation characteristics of soil. Consolidation testing was performed in accordance with ASTM Standard Test Method D 2435. The test results are presented on Plate B-14.

EXPANSION INDEX

Two expansion index tests were performed on drive soil sample to evaluate expansion characteristics of soil. Expansion index testing was performed in accordance with UBC Standard 18-2. The test results are presented in the following table.

Expansion Index Test Result

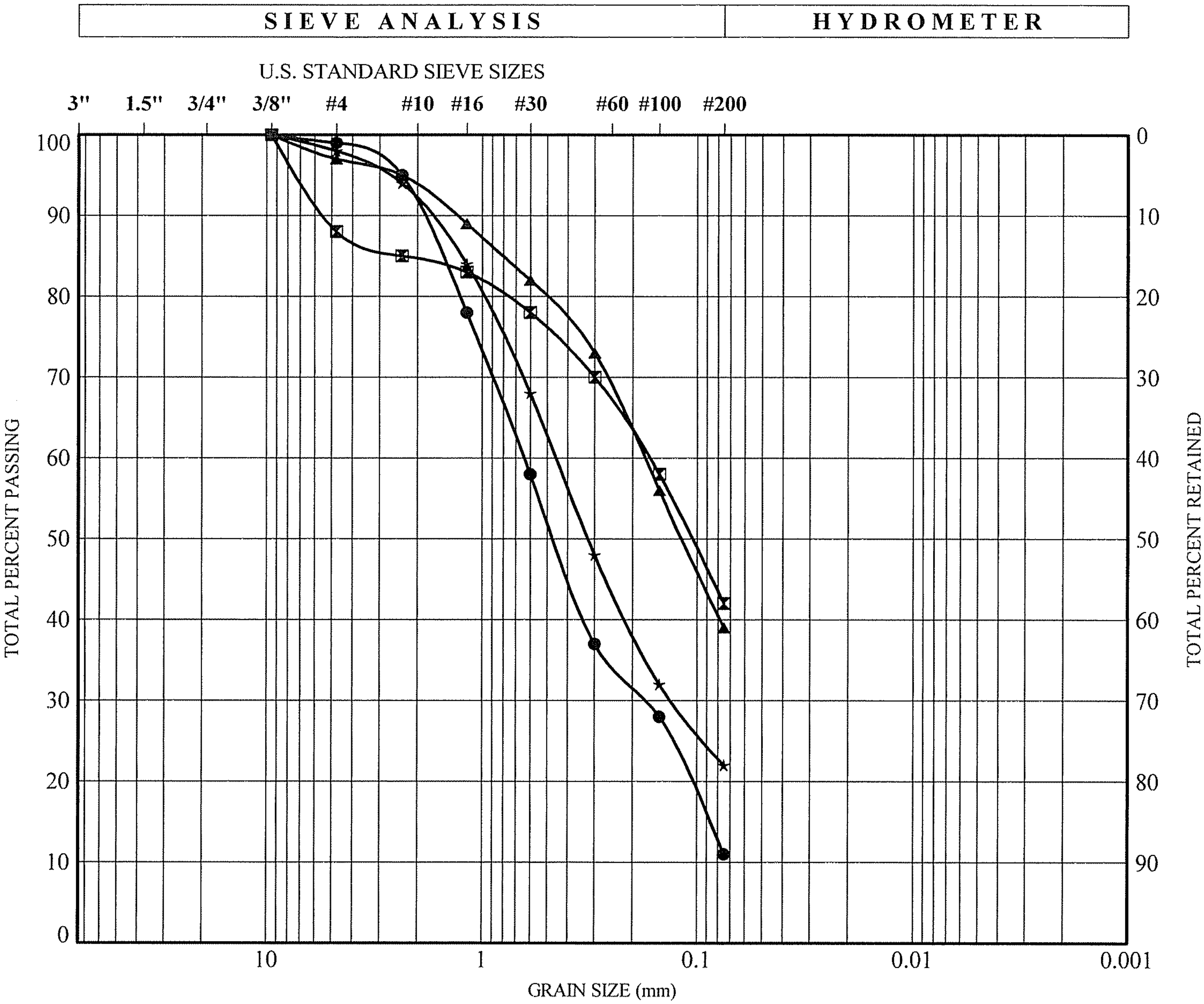
Location	Depth (ft)	USCS Soil Type	Expansion Index
B-14	1-5	SM	3
B-21	1-5	SM	20

ATTERBERG LIMITS TEST

One Atterberg Limits test was performed on drive soil sample to evaluate liquid limit and plastic limit of fine grained soil. Atterberg limits testing was performed in accordance with ASTM Standard D 4318. The test results are presented in the following table.

Atterberg Limits Test Result

Location	Depth (ft)	USCS Soil Type	Liquid Limit (LI)	Plastic Limit (PL)	Plasticity Index (PI)
B-16	65	CH	66	19	47



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

Symbol	Boring	Depth (ft)	Description	Classification
●	B-1	5	Sand with Silt	SP-SM
⊠	B-2	10	Silty Sand	SM
▲	B-3	10	Sand	SM
★	B-4	10	Silty Sand	SM

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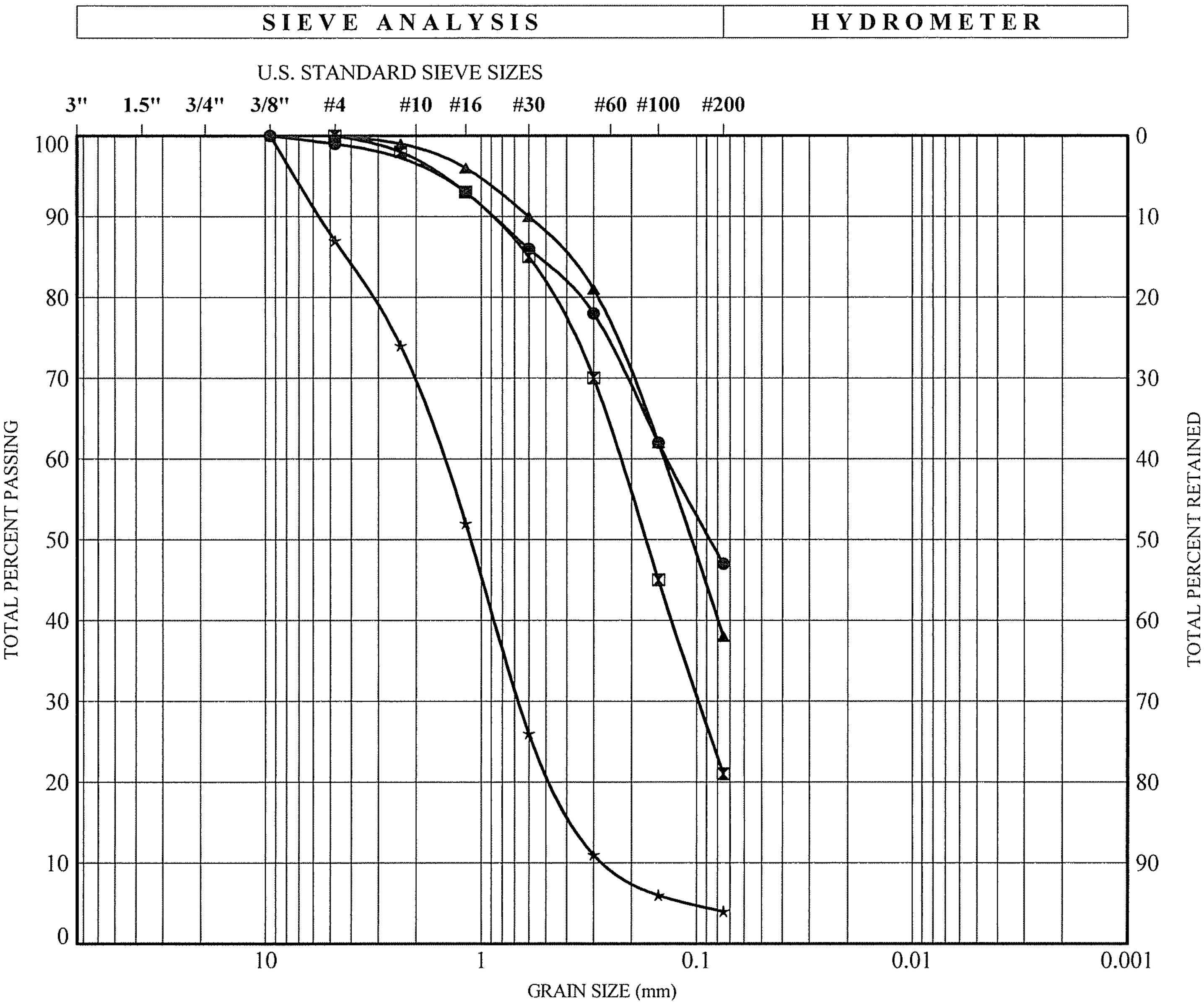
Victorville 2 Hybrid Power Project
Victorville, California

GRAIN SIZE DISTRIBUTION

PLATE

B-1

GRAIN SIZE 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

Symbol	Boring	Depth (ft)	Description	Classification
●	B-10	5	Silty Sand	SM
⊠	B-11	30	Silty Sand	SM
▲	B-7	15	Silty Sand	SM
★	B-8	25	Sand	SP

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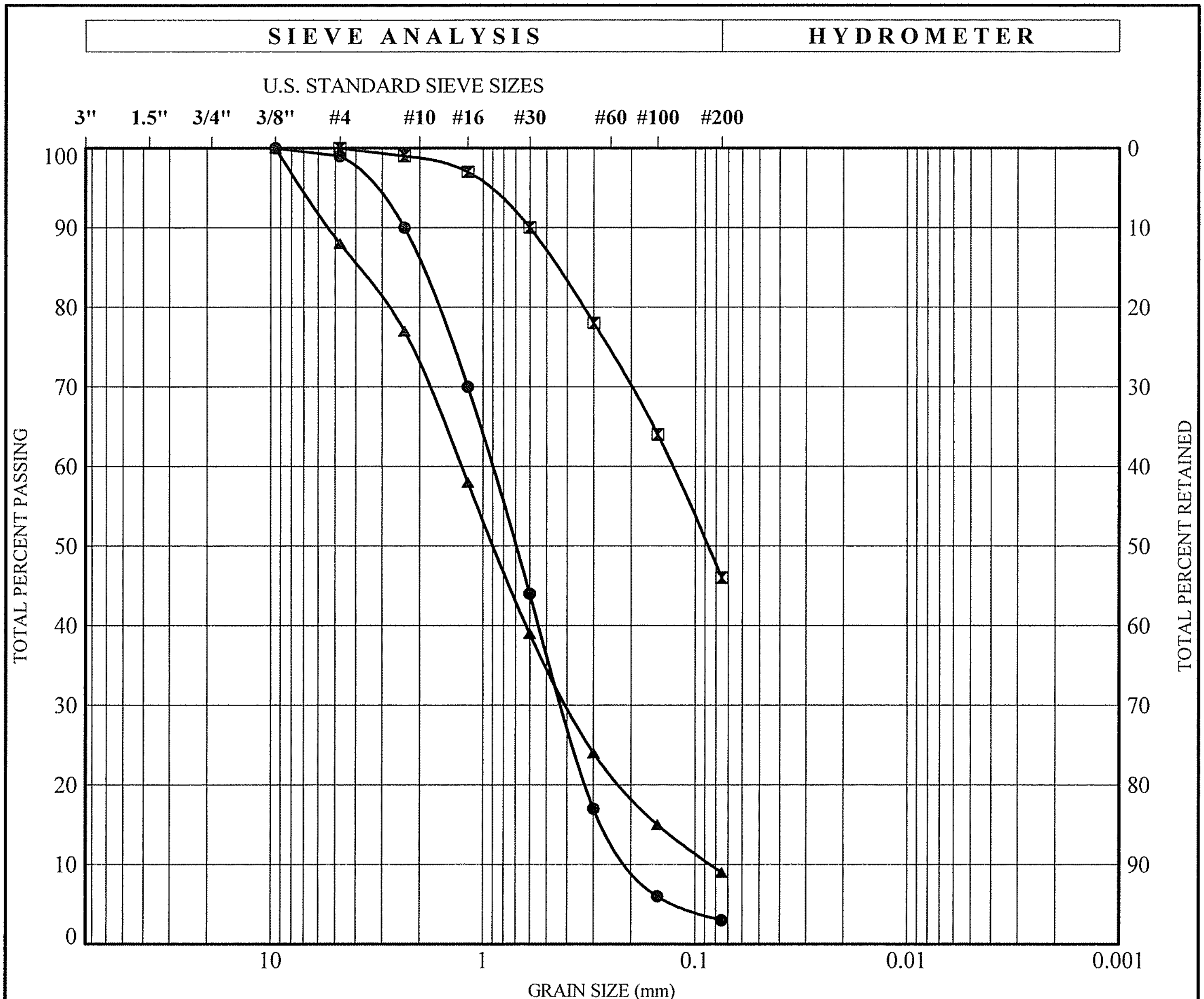
Victorville, California

GRAIN SIZE DISTRIBUTION

PLATE

B-2

GRAIN SIZE 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

Symbol	Boring	Depth (ft)	Description	Classification
●	B-13	10	Sand	SP
⧗	B-16	55	Silty Sand	SM
▲	B-20	5	Sand with Silt	SP-SM

KLEINFELDER

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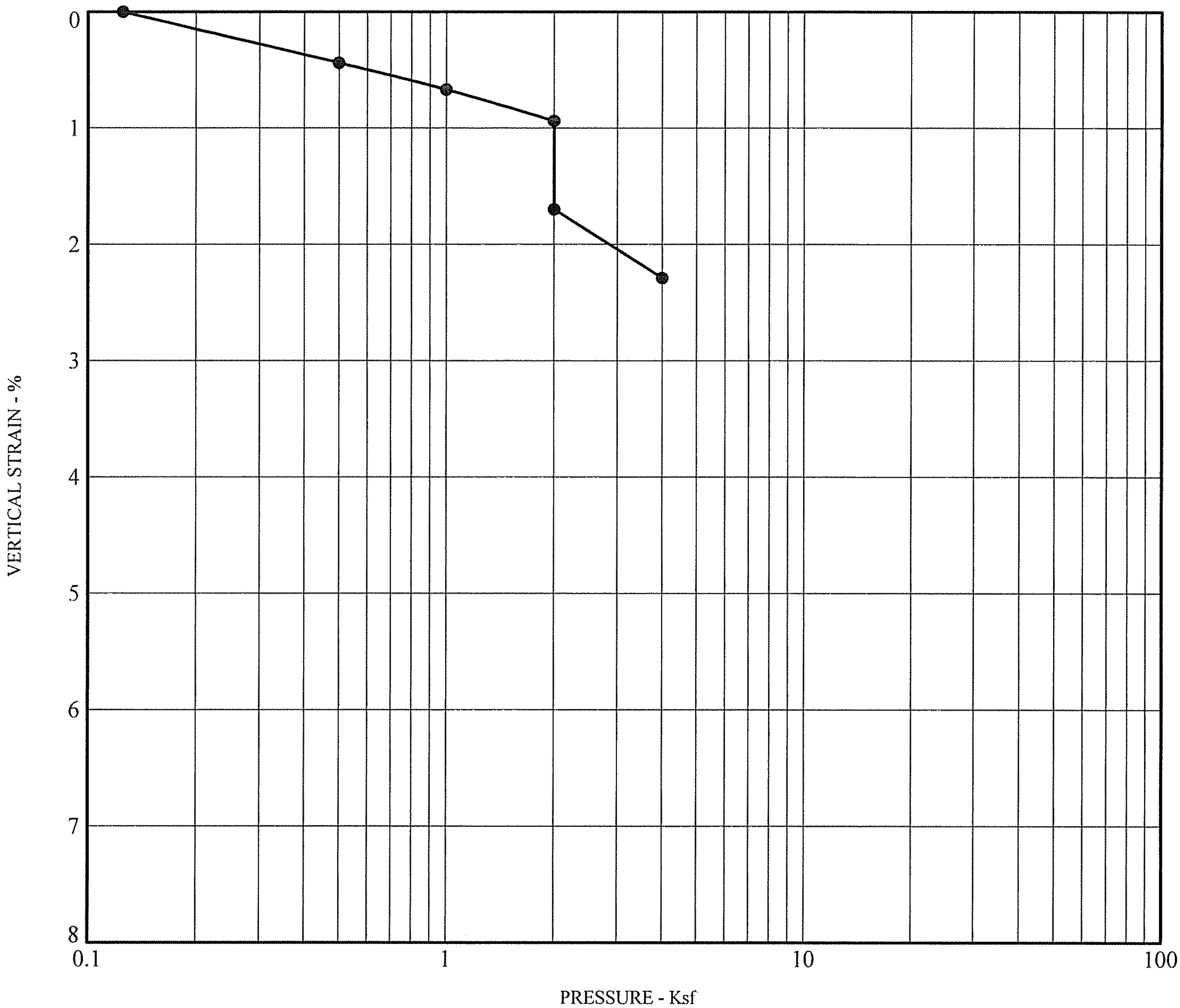
Victorville 2 Hybrid Power Project
Victorville, California

GRAIN SIZE DISTRIBUTION

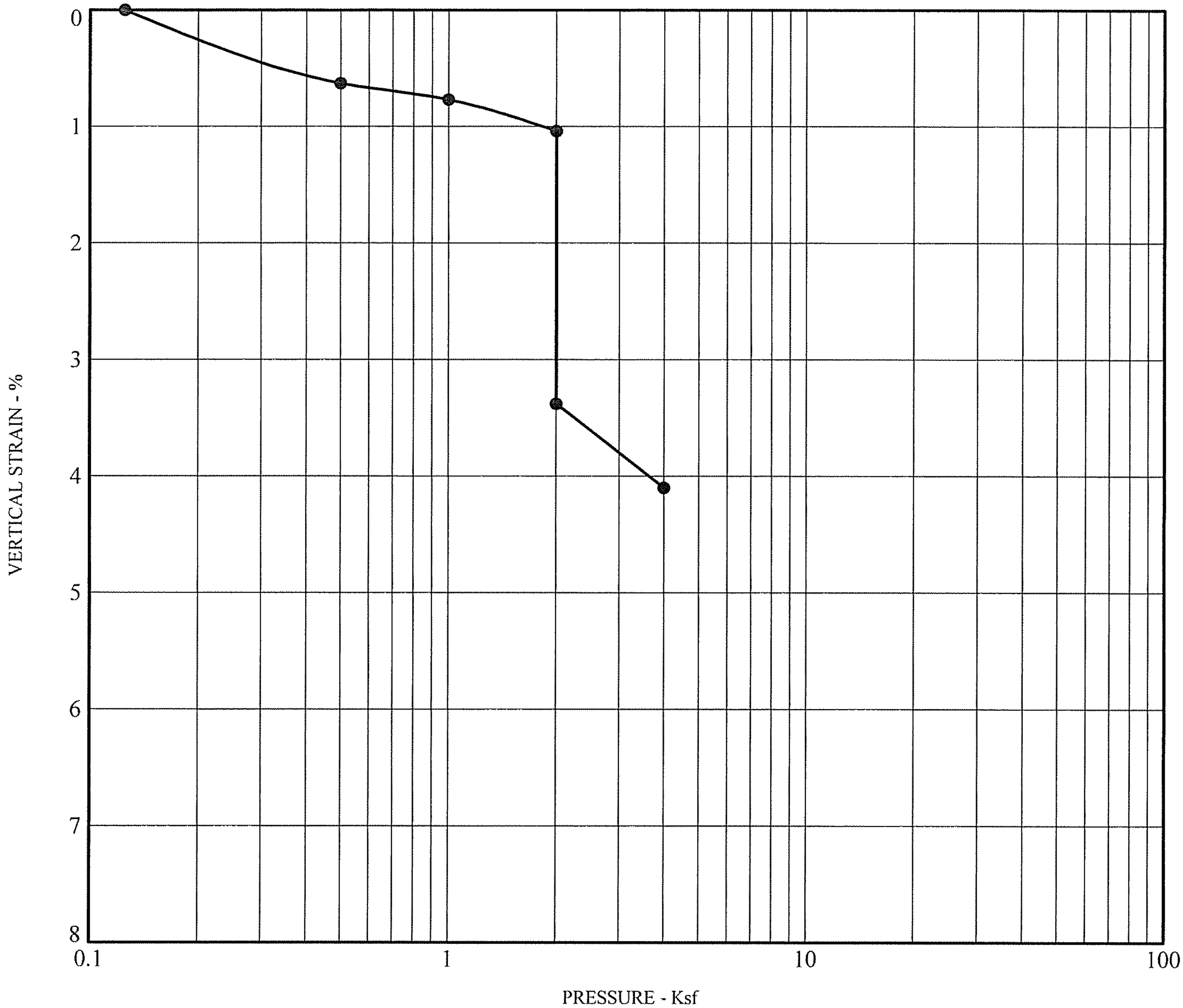
PLATE

B-3



Boring	B-1	
Depth (feet)	10	
Moisture Content (%)	0.7 Before	21.0 After
Dry Density (pcf)	94.5	
Description	Sand with Silt	
Classification	SP-SM	

NOTE : SPECIMEN FLOODED AT 2000 psf



Boring	B-2	
Depth (feet)	5	
Moisture Content (%)	1.9 Before	14.9 After
Dry Density (pcf)	105.6	
Description	Silty Sand	
Classification	SM	

NOTE : SPECIMEN FLOODED AT 2000 psf

CONSOL NO INDICIES 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

KLEINFELDER

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Victorville 2 Hybrid Power Project
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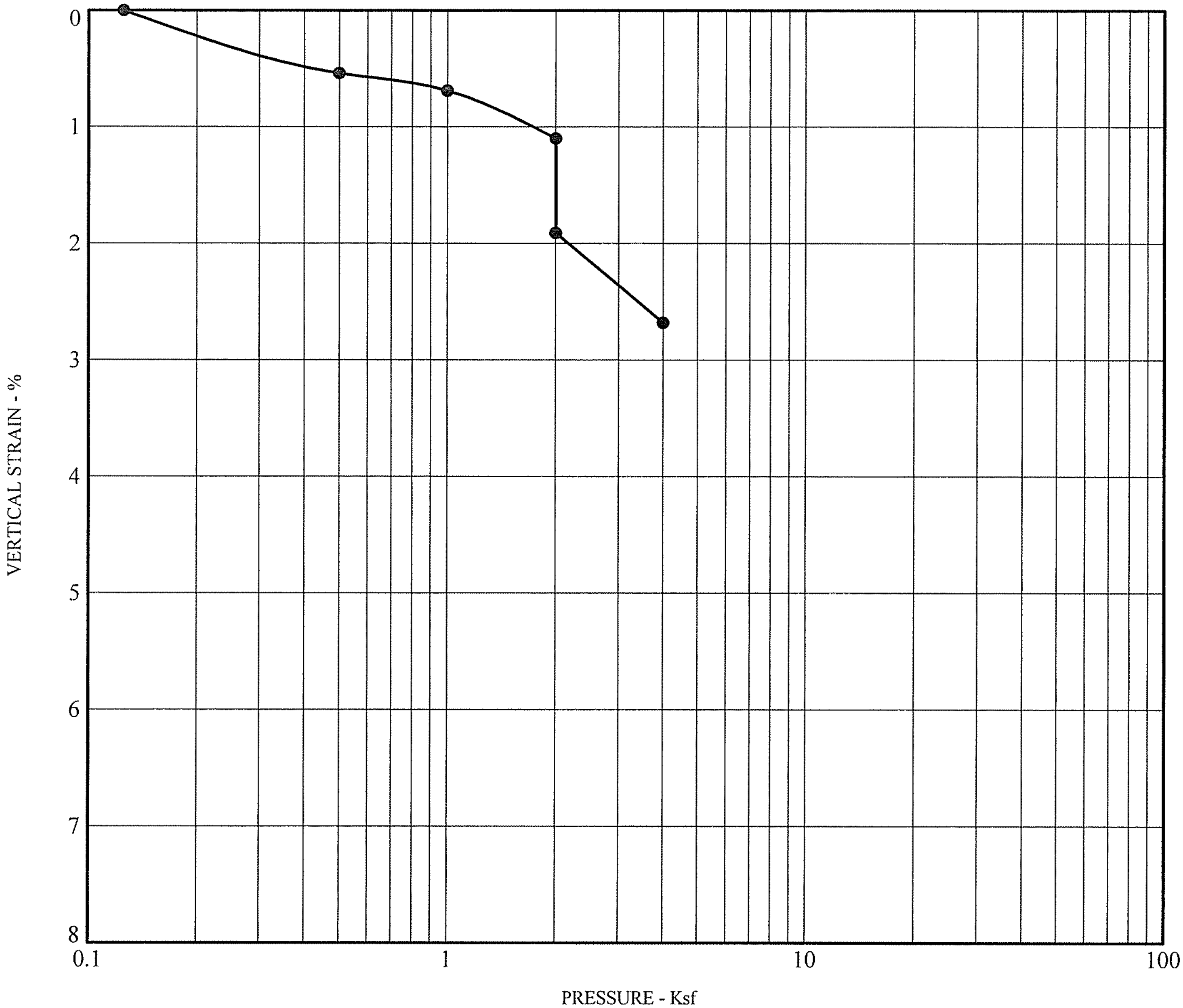
CONSOLIDATION/COLLAPSE POTENTIAL TEST

PLATE

B-5



Boring	**B-5**	
Depth (feet)	**15**	
Moisture Content (%)	**0.9 Before**	**16.7 After**
Dry Density (pcf)	**108.6**	
Description	**Sand**	
Classification	**SP**	

NOTE : SPECIMEN FLOODED AT 2000 psf

KLEINFELDER

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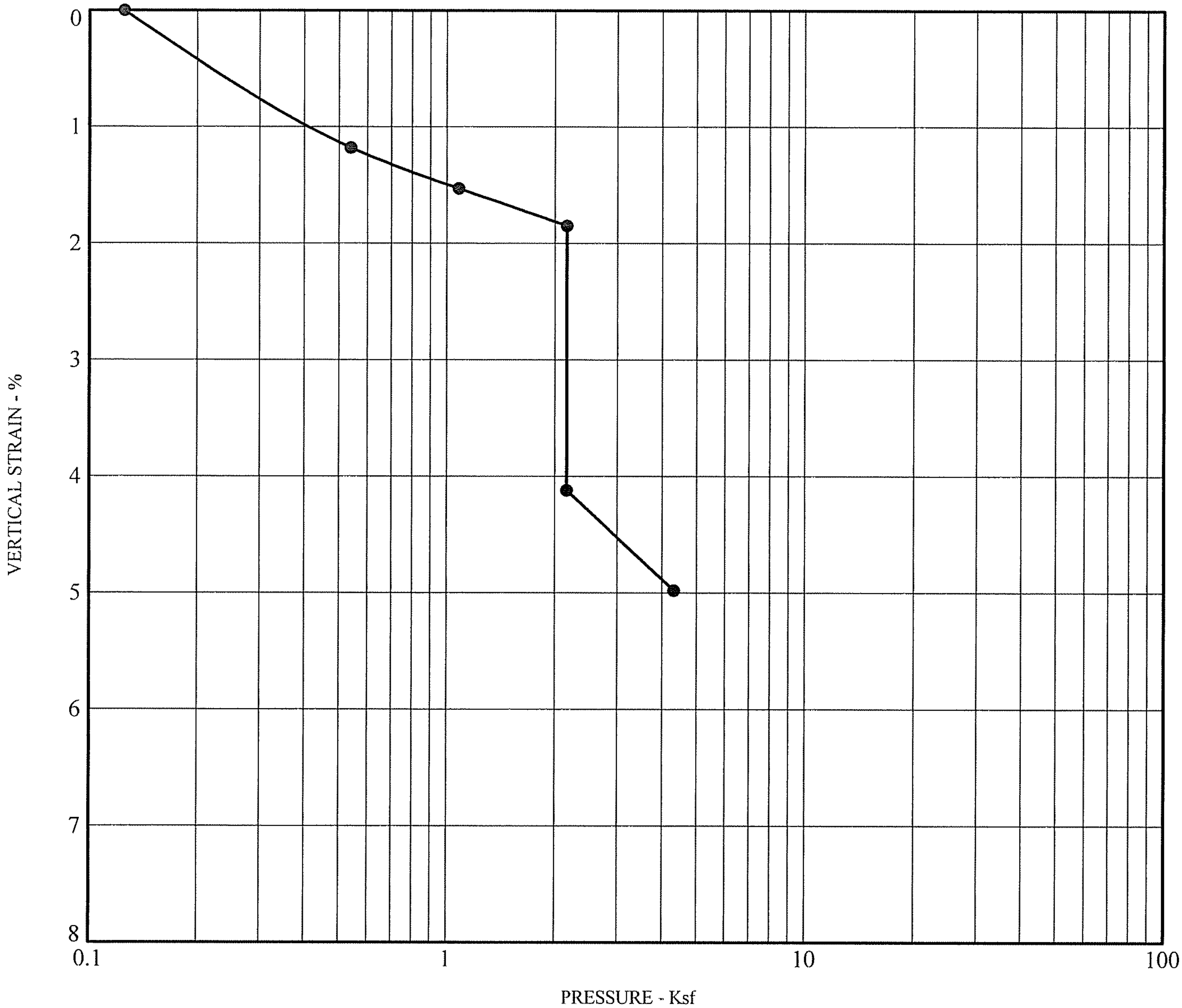
Victorville 2 Hybrid Power Project
Victorville, California

CONSOLIDATION/COLLAPSE POTENTIAL TEST

PLATE

B-6

CONSOL NO INDICIES 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06



Boring	B-9	
Depth (feet)	5	
Moisture Content (%)	2.1 Before	14.8 After
Dry Density (pcf)	103.6	
Description	Sand	
Classification	SP	

NOTE : SPECIMEN FLOODED AT 2000 psf

CONSOL NO INDICIES 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

KLEINFELDER

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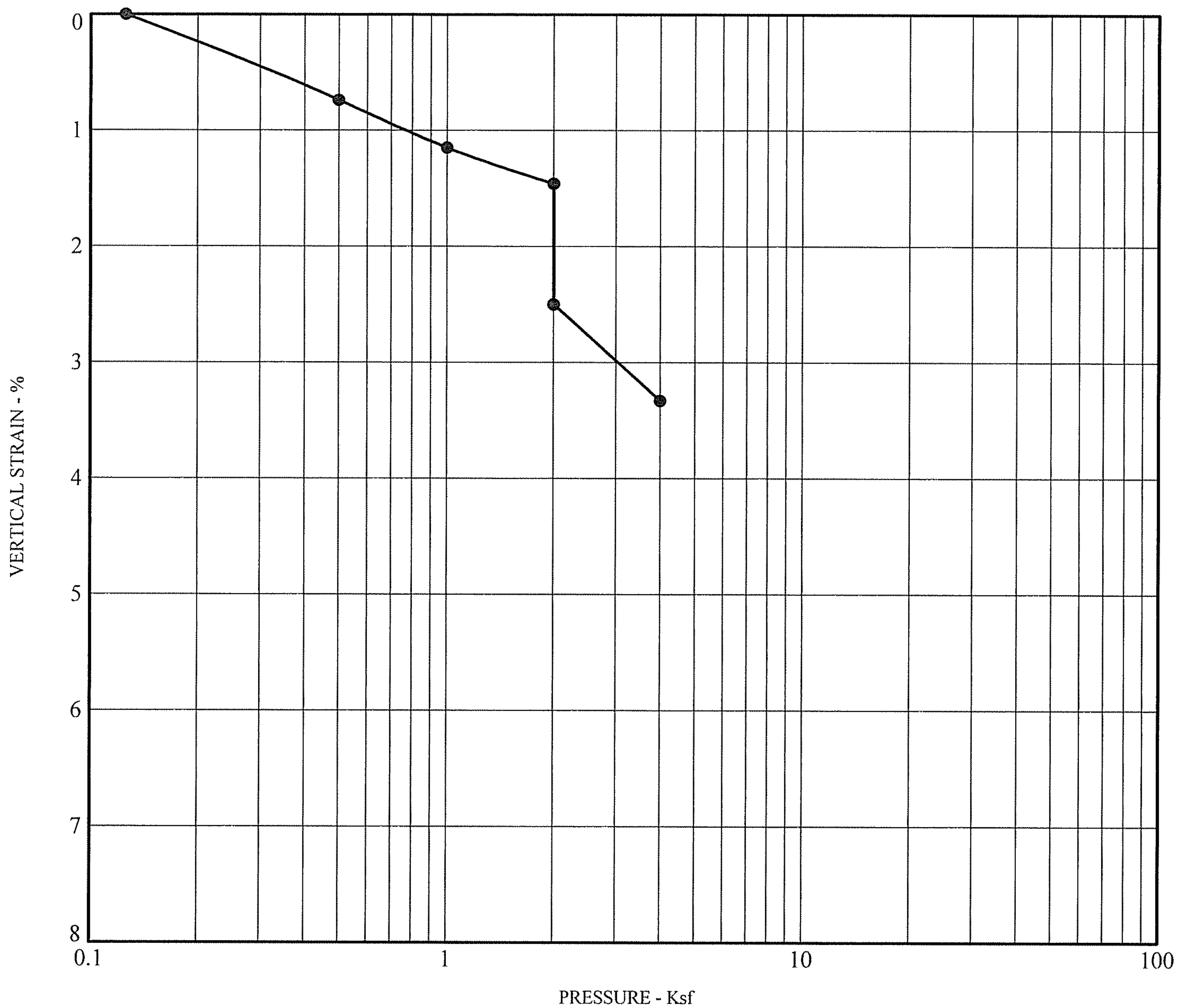
Victorville 2 Hybrid Power Project
Victorville, California

CONSOLIDATION/COLLAPSE POTENTIAL TEST

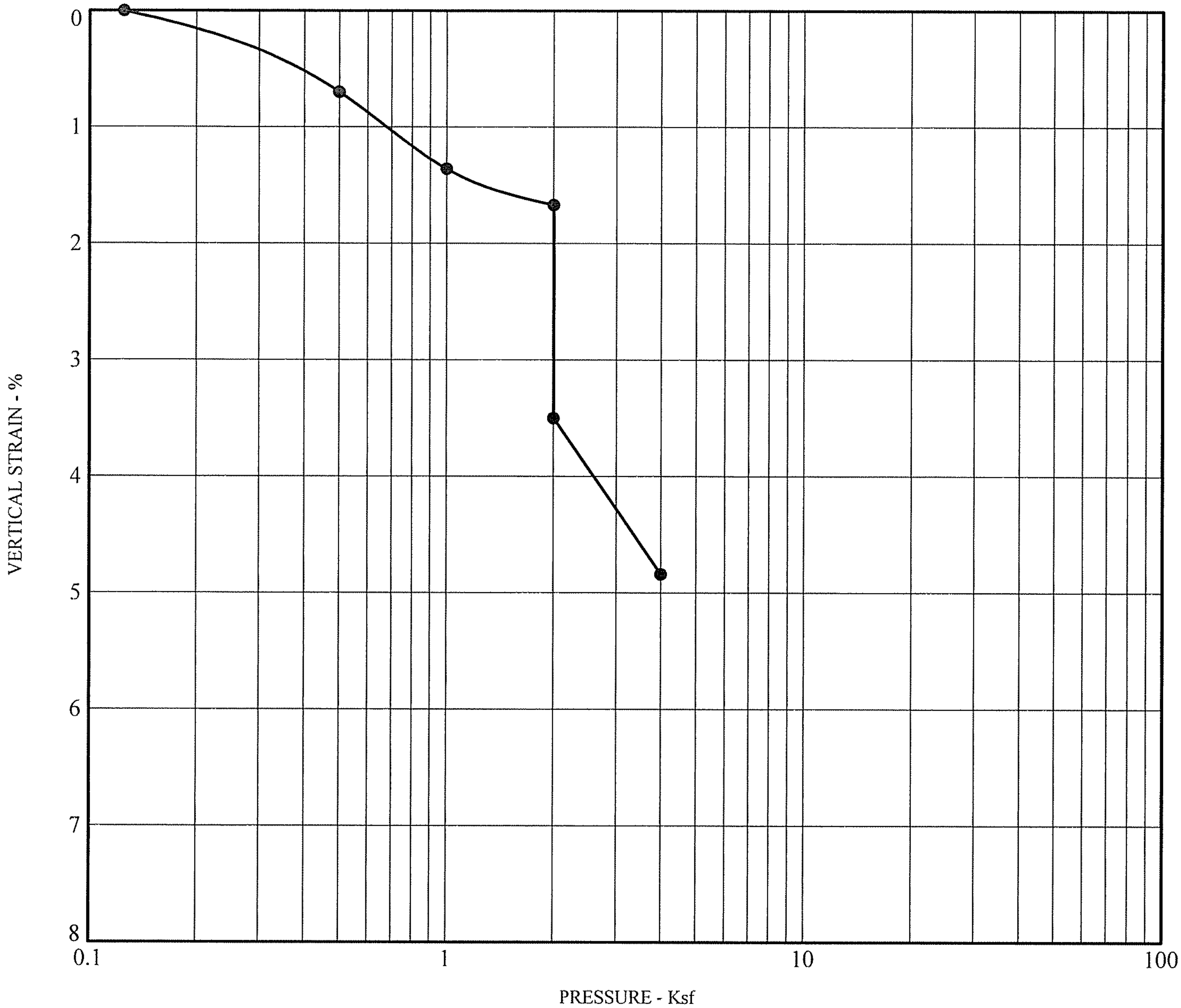
PLATE

B-7



Boring	B-11	
Depth (feet)	5	
Moisture Content (%)	4.0 Before	17.5 After
Dry Density (pcf)	107.0	
Description	Silty Sand	
Classification	SM	

NOTE : SPECIMEN FLOODED AT 2000 psf



Boring	B-16	
Depth (feet)	5	
Moisture Content (%)	7.4 Before	23.5 After
Dry Density (pcf)	95.1	
Description	Silty Sand	
Classification	SM	

NOTE : SPECIMEN FLOODED AT 2000 psf

KLEINFELDER

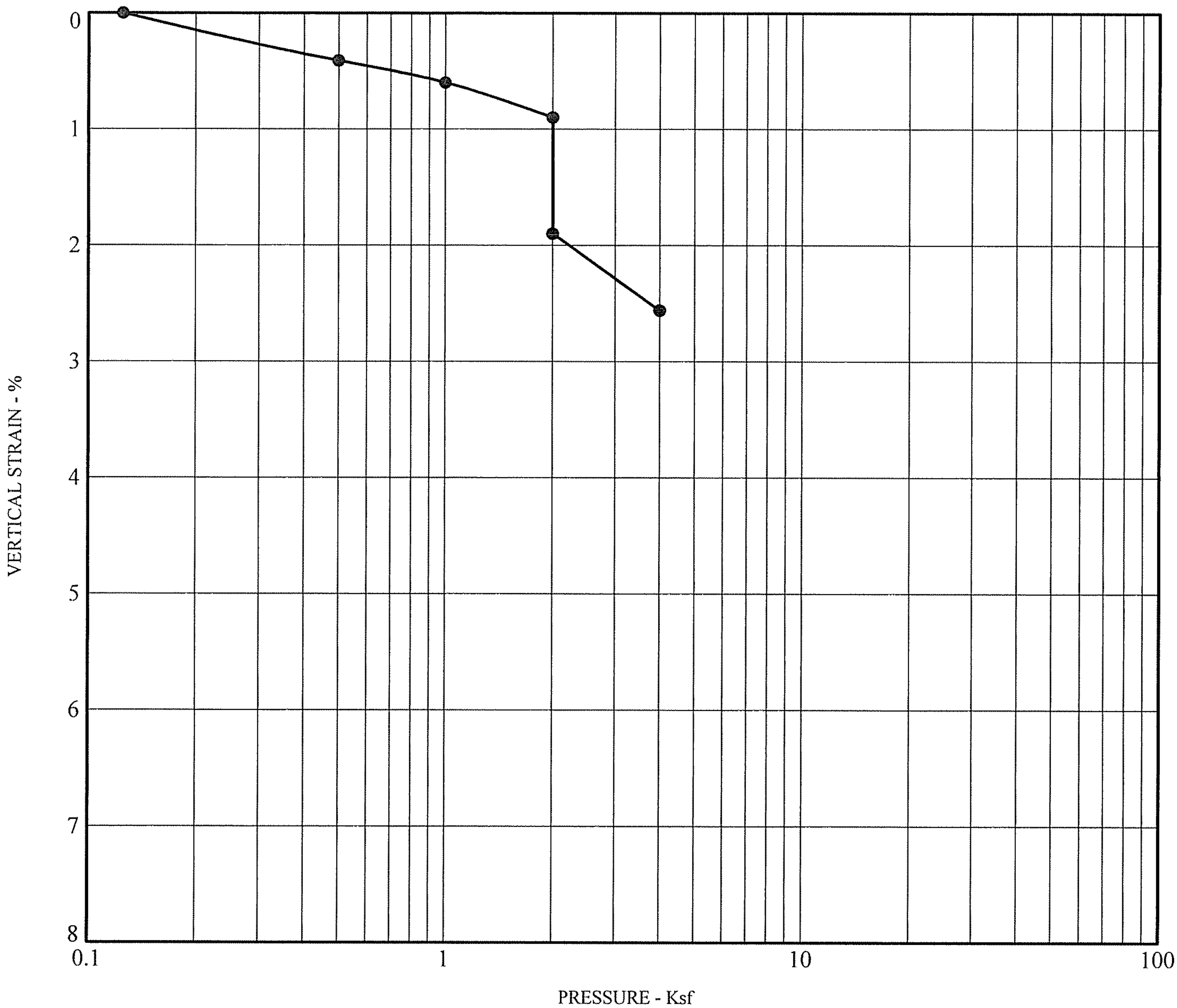
PROJECT NO. 66815

Victorville 2 Hybrid Power Project
Victorville, California

CONSOLIDATION/COLLAPSE POTENTIAL TEST

PLATE

B-9



Boring	B-17	
Depth (feet)	20	
Moisture Content (%)	0.8 Before	14.3 After
Dry Density (pcf)	112.3	
Description	Sand	
Classification	SP	

NOTE : SPECIMEN FLOODED AT 2000 psf

KLEINFELDER

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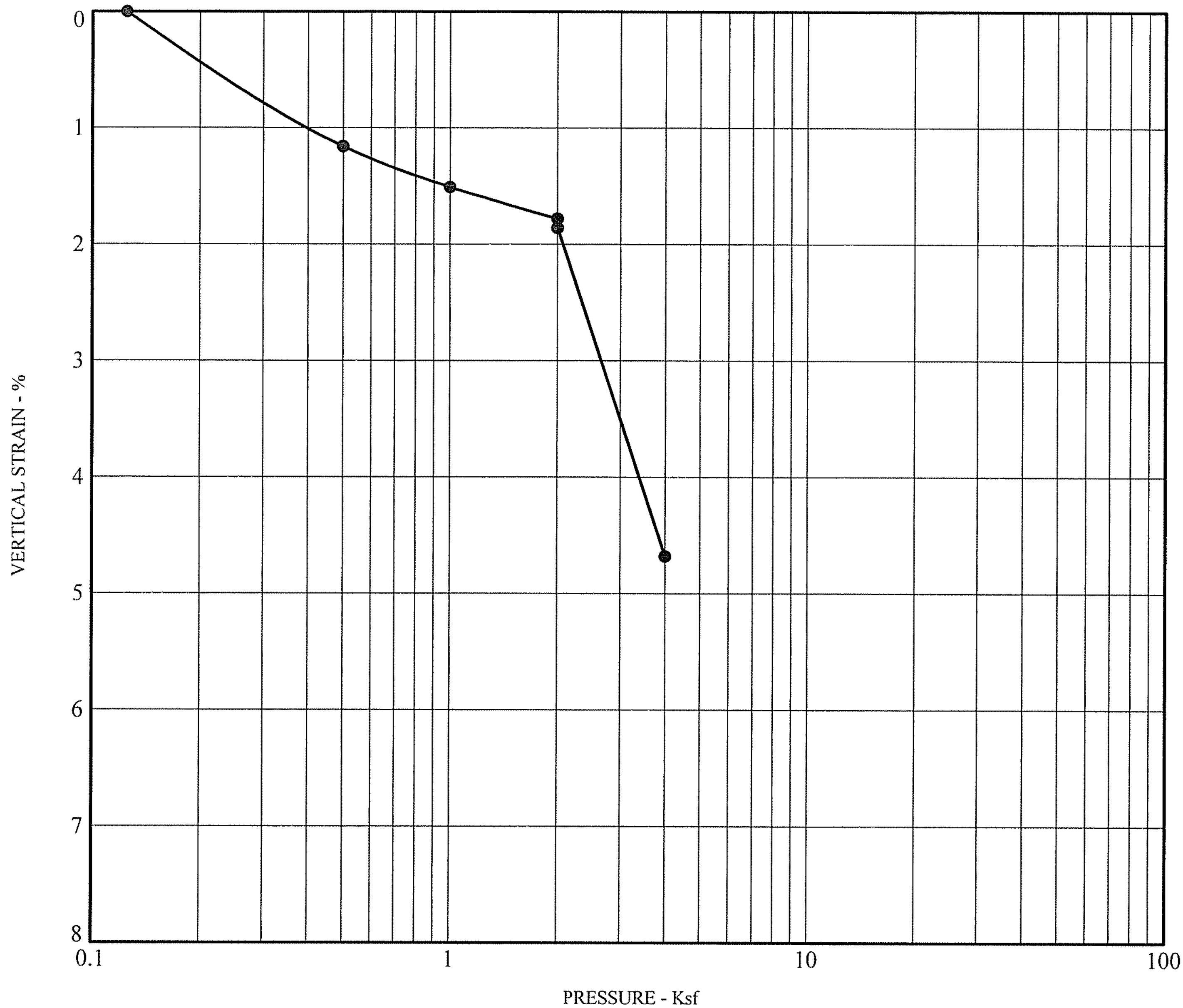
Victorville, California

CONSOLIDATION/COLLAPSE POTENTIAL TEST

PLATE

B-10



Boring	B-18	
Depth (feet)	5	
Moisture Content (%)	1.7 Before	17.6 After
Dry Density (pcf)	103.1	
Description	Sand	
Classification	SP	

NOTE : SPECIMEN FLOODED AT 2000 psf

KLEINFELDER

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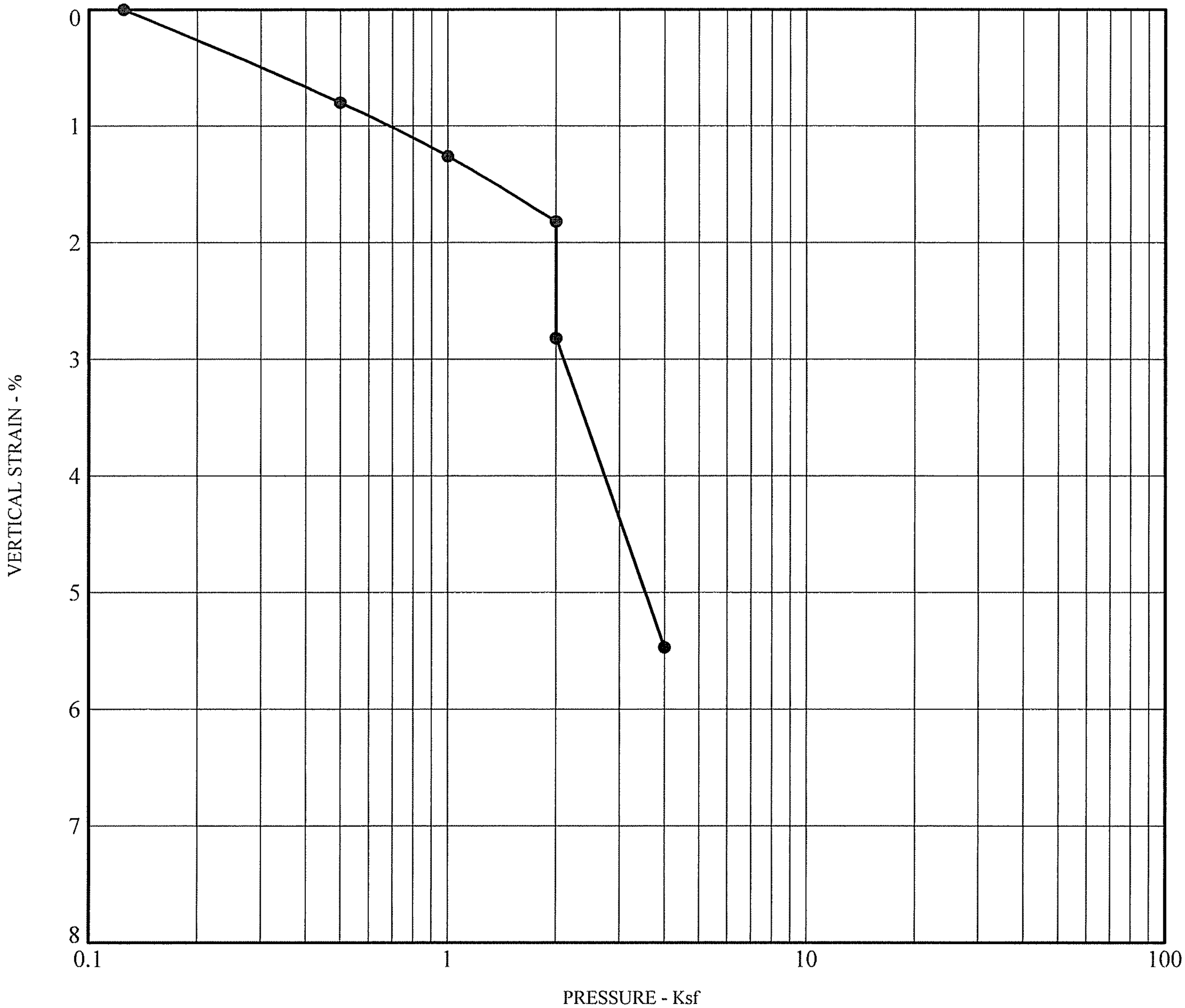
PLATE

B-11

CONSOL NO INDICIES 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06



Boring	B-19	
Depth (feet)	10	
Moisture Content (%)	5.2 Before	19.1 After
Dry Density (pcf)	102.8	
Description	Silty Sand	
Classification	SM	

NOTE : SPECIMEN FLOODED AT 2000 psf

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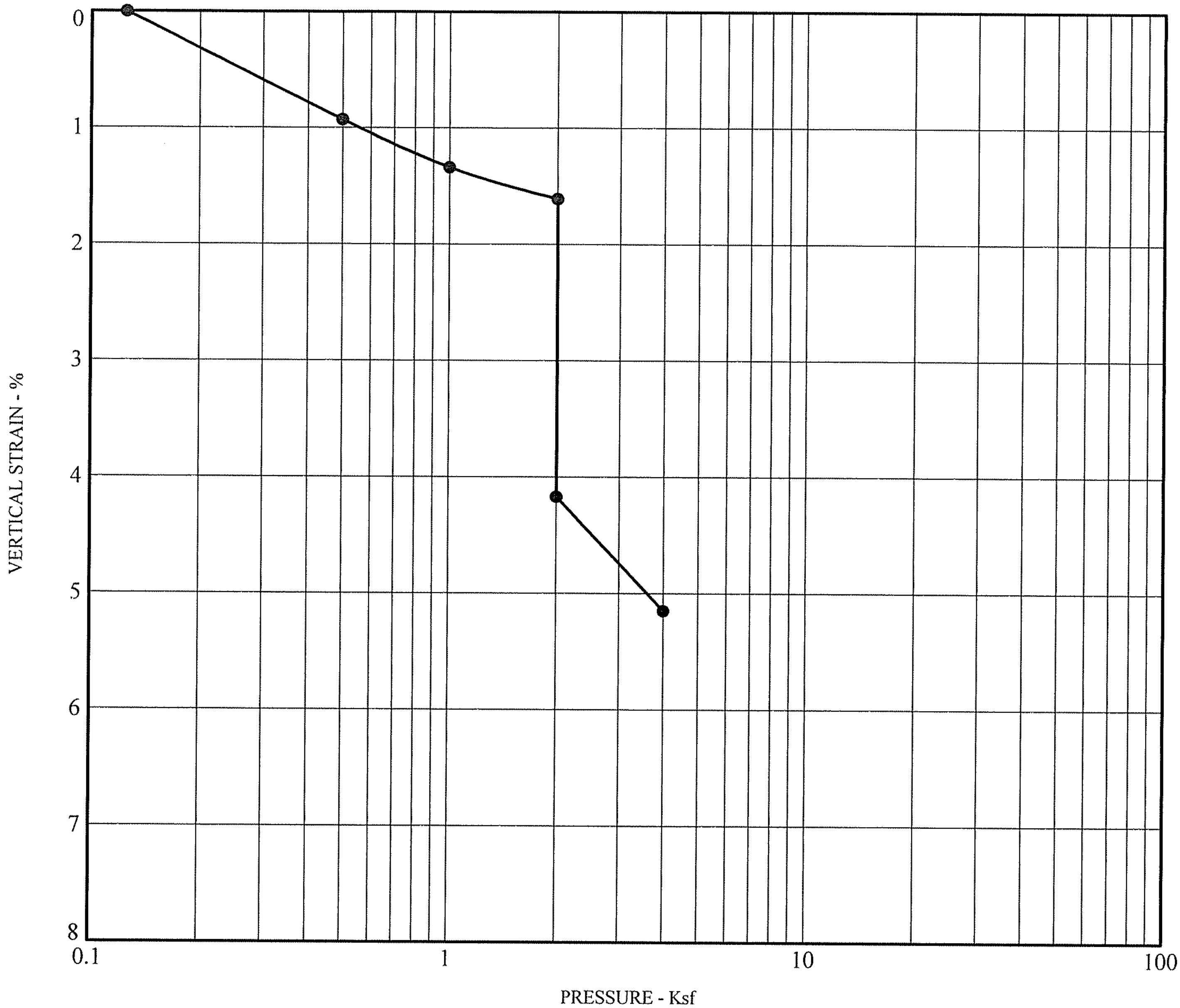
PLATE

B-12

CONSOL NO INDICIES 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06



Boring	B-21	
Depth (feet)	5	
Moisture Content (%)	2.3 Before	16.3 After
Dry Density (pcf)	108.3	
Description	Sand	
Classification	SP	

NOTE : SPECIMEN FLOODED AT 2000 psf

CONSOL NO INDICIES 66815 VICTORVILLE POWER PLANT II (TL).GPJ KA_RDLND.GDT 6/20/06

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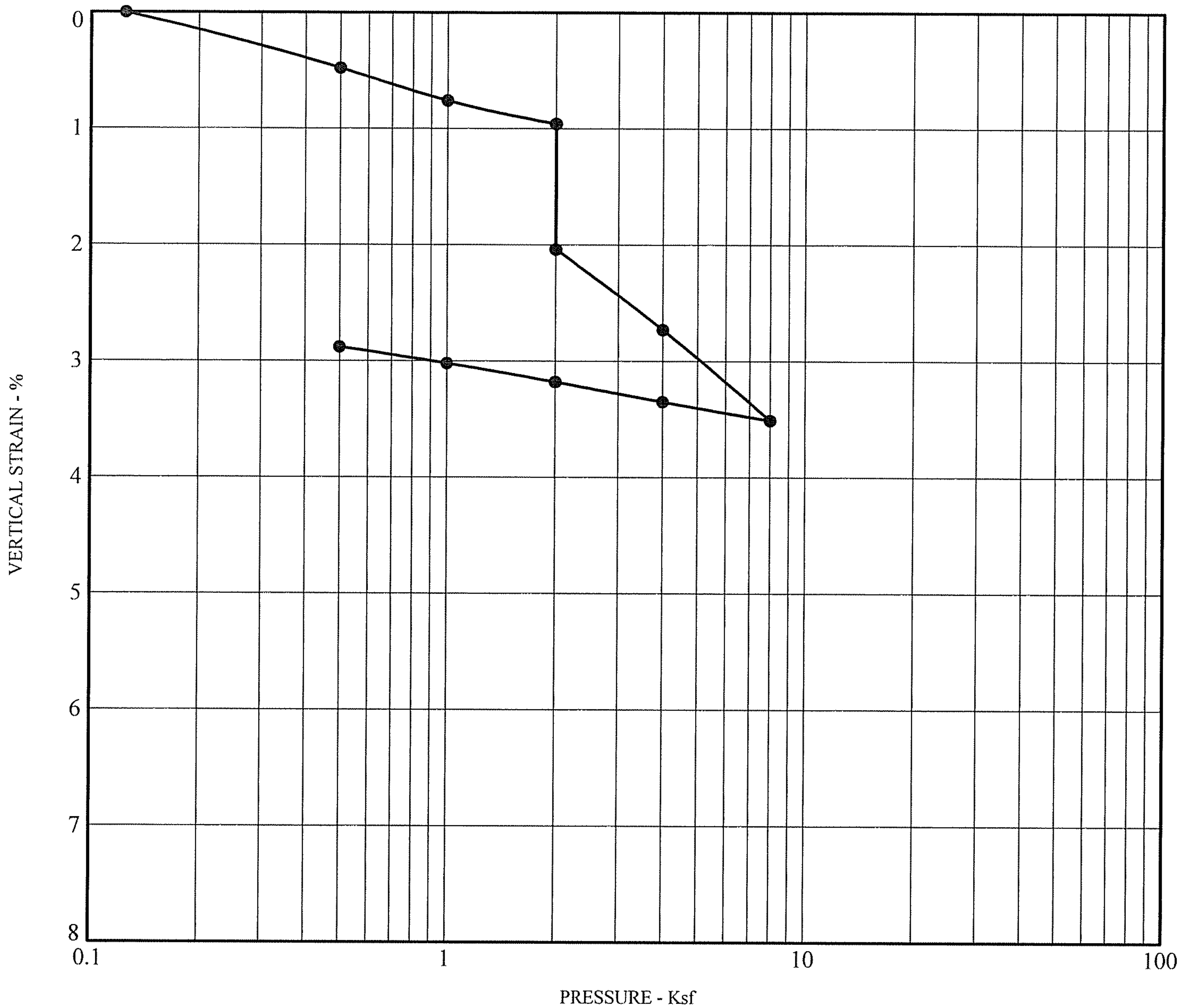
PLATE

B-13



Boring	B-6	
Depth (feet)	10	
Moisture Content (%)	2.2 Before	14.6 After
Dry Density (pcf)	115.8	
Description	Sand	
Classification	SP	

NOTE : SPECIMEN FLOODED AT 2000 psf

KLEINFELDER

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CONSOLIDATION/COLLAPSE POTENTIAL TEST

PLATE

B-14