GEOTECHNICAL ENGINEERING INVESTIGATION
JACUMBA SITE
OLD HIGHWAY 80
JACUMBA, CALIFORNIA

KA PROJECT NO. 022-11039
MAY 5, 2011

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INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the proposed Jacumba Site, to be located south of Old Highway 80, in Jacumba, California. Discussions regarding site conditions are presented herein, together with conclusions and recommendations pertaining to site preparation, Engineered Fill, utility trench backfill, drainage and landscaping, foundations, and retaining walls.

A site plan showing the approximate boring locations is presented following the text of this report. A description of the field investigation, boring logs, and the boring logs legend are presented in Appendix A. Appendix A contains a description of the laboratory testing phase of this study, along with the laboratory test results. Appendix B contains a guide to earthwork specifications. When conflicts in the text of the report occur with the general specifications in the appendices, the recommendations in the text of the report have precedence.

PURPOSE AND SCOPE

This investigation was conducted to evaluate the soil and groundwater conditions at the site, to make geotechnical engineering recommendations for use in design of specific construction elements, and to provide criteria for site preparation and Engineered Fill construction.

Our scope of services was outlined in our proposal dated January 14, 2011 (KA Proposal No. P022-11) and included the following:

- A site reconnaissance by a member of our engineering staff to evaluate the surface conditions at the project site.
- A field investigation consisting of drilling 18 borings to depths ranging from approximately 8 to 20 feet below site grades for evaluation of the subsurface conditions at the project site.
- Performing laboratory tests on representative soil samples obtained from the borings to evaluate the physical and index properties of the subsurface soils.

- Evaluation of the data obtained from the investigation and an engineering analysis to provide recommendations for use in the project design and preparation of construction specifications.

- Preparation of this report summarizing the results, conclusions, recommendations, and findings of our investigation.

PROPOSED CONSTRUCTION

We understand that design of the proposed development is currently underway. It is understood that the development will include the construction, installation and operation of solar panels and associated equipment pads for operation of the site. The proposed development will occupy approximately 170 acres. Preliminary design indicates the structures will be supported on conventional shallow foundation systems. The solar units will likely be supported on drilled piers or driven pipe piles extending approximately 10 feet below site grade. Some structures may utilize concrete slab-on-grade construction. Foundation loads are anticipated to be light to moderate. Asphalt and concrete pavements are not anticipated as part of the proposed development.

In the event, these structural or grading details are inconsistent with the final design criteria, the Soils Engineer should be notified so that we may update this writing as applicable.

SITE LOCATION AND SITE DESCRIPTION

The site is irregular in shape and encompasses approximately 170 acres. The site is located south of Old Highway 80 in the city of Jacumba, San Diego County, California. The site is bound to the south by the Mexican border fence, to the north by Old Highway 80, and to the east and west by undeveloped land. The subject site and surrounding areas are vacant, native land.

Presently, the site consists of vacant land. It appears as though localized portions of the site are occasionally used by campers. Dirt access roads trend throughout the site and along the edges of the site. Shallow natural drainages are located throughout the site. The site is covered by a sparse to moderate weed and brush growth and the surface soils have a loose consistency. Large rock outcrops and boulders are located throughout the west and northwest portion of the site. The site consists of gently rolling terrain with a general slope toward the northeast.

GEOLOGIC SETTING

The site is located within the Peninsular Ranges Geomorphic Province of Southern California. This province is typified by northwest to southeast trending mountain ranges approximately parallel to the San Andreas and related regional fault system. The Peninsular Ranges are generally characterized by granitic rocks ranging in the Peninsular Ranges batholith and associated metamorphic rocks. Sedimentary rocks ranging in age from Cretaceous to Pleistocene form the San Diego embayment and coastal terraces west of the batholith.

Geologic Hazards – Fault Rupture Hazard Zones

The Alquist-Priolo Geologic Hazards Zones Act went into affect in March, 1973. Since that time, the act has been amended 10 times (Hart, 1994). The purpose of the Act, as provided in DMG Special Publication 42 (SP 42), is to "prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." The act was renamed the Alquist-Priolo Earthquake Fault Zoning Act in 1994, and at that time, the originally designated "Special Studies Zones" was renamed the "Earthquake Fault Zones."

A Fault Rupture Hazard Zones Map for the Jacumba area has not been prepared to date. As such, the subject site is not located within a Fault-Rupture Hazard Zone as defined by the State of California.

Geologic Hazards – Seismic Hazard Zones

In 1990, the California State Legislature passed the Seismic Hazard Mapping Act to protect public safety from the effects of strong shaking, liquefaction, landslides, or other ground failure, and other hazards caused by earthquakes. The Act requires that the State Geologist delineate various seismic hazards zones on Seismic Hazards Zones Maps. Specifically, the maps identify areas where soil liquefaction and earthquake-induced landslides are most likely to occur. A site-specific geotechnical evaluation is required prior to permitting most urban developments within the mapped zones. The Act also requires sellers of real property within the zones to disclose this fact to potential buyers. The area of the subject site is not included on any of the maps released to date. It is not known whether the subject site will be within a seismic hazard zone on a future map.

FIELD AND LABORATORY INVESTIGATIONS

Subsurface soil conditions were explored by drilling eighteen (18) borings to depths of approximately 8 to 20 feet below existing site grade, using a truck-mounted drill rig. The approximate boring locations are shown on the site plan. During drilling operations, penetration tests were performed at regular intervals to evaluate the soil consistency and to obtain information regarding the engineering properties of the subsurface soils. Soil samples were retained for laboratory testing. The soils encountered were continuously examined and visually classified in accordance with the Unified Soil Classification System. A more detailed description of the field investigation is presented in Appendix A.

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory testing program was formulated with emphasis on the evaluation of natural moisture, density, gradation, shear strength, consolidation potential, and moisture-density relationships of the materials encountered. In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal. Details of the laboratory test program and results of the laboratory tests are summarized in Appendix A. This information, along with the field observations, was used to prepare the final boring logs in Appendix A.

SOIL PROFILE AND SUBSURFACE CONDITIONS

Based on our findings, the subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the upper soils consisted of approximately 18 to 24 inches of very loose silty sand, and sand with trace fines. These soils are disturbed, have low strength characteristics, and are highly compressible when saturated.

Below the very loose surface soils, medium dense to very dense alluvium consisting of sand and silty sand with varying gravel content were encountered to depths ranging from 4 to 20 feet below existing site grades. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. Penetration resistance ranged from 15 to over 50 blows per foot. Dry densities ranged from 114.8 to 126.4 pcf. Representative soil samples consolidated approximately 0.8 to 1.5 percent under a 2 ksf load when saturated. Representative soil samples had angles of internal friction ranging from 32 to 34 degrees.

Weathered sandstone bedrock was encountered below the medium dense to very dense sands and silty sands. Auger refusal was encountered at several of the boring locations at depths ranging from 8 to 18 feet below the existing site grades.

For additional information about the soils encountered, please refer to the logs of borings in Appendix A.

GROUNDWATER

Test boring locations were checked for the presence of groundwater during and immediately following the drilling operations. Free groundwater was not encountered in any of the boring locations. Information obtained from the State of California Department of Water Resources indicates that groundwater has been encountered at depths of 75 to 80 feet below existing site grade within the project vicinity. Information was obtained from readings taken in groundwater monitoring wells located southwest of the subject site in December 2010.

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use and climatic conditions, as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

SOIL LIQUEFACTION

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. However, liquefaction has occurred in soils other than clean sand. Liquefaction usually occurs under vibratory conditions such as those induced by seismic event.

To evaluate the liquefaction potential of the site, the following items were evaluated:

1) Soil type

2) Groundwater depth

3) Relative density

4) Initial confining pressure

5) Intensity and duration of groundshaking

The soils encountered within the project site predominately consist of very dense silty sands, sands with silt, and sandstone. Groundwater was not encountered within the soil borings advanced during subsurface exploration. Available groundwater data, as well as our experience in the area, indicates that historically groundwater has been located at depths greater than 75 feet within the project site vicinity. Based on our findings, it is our opinion that the potential for soil liquefaction within the project site is very low. Therefore, measures to mitigate seismic-induced liquefaction are not necessary.

SEISMIC SETTLEMENT

One of the most common phenomena during seismic shaking accompanying any earthquake is the induced settlement of loose unconsolidated soils. Based on the nature of the relatively dense subsurface materials, the plan to excavate and recompact the upper soils and any loose fill soils within the proposed structure areas, and although there is a potential for relatively moderate to high seismicity within the region, we would not expect seismic settlement to represent a significant geologic hazard to the site provided that the recommendations of our referenced Geotechnical Engineering Investigation are followed.

One of the most common phenomena during seismic shaking accompanying any earthquake is the induced settlement of loose unconsolidated soils. Based on the nature of the subsurface materials, and the relatively moderate seismicity of the region, we would not expect seismic settlement or lateral spread to represent a significant geologic hazard to the site.

The Consolidated Settlement (under static load of specific structures) and Differential Settlement (per specified length in building area) are indicated in the Foundations section of this report.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of our field and laboratory investigations, along with previous geotechnical experience in the project area, the following is a summary of our evaluations, conclusions, and recommendations.

Administrative Summary

In brief, the subject site and soil conditions, with the exception of the loose surface soils, and localized rock outcrops, appear to be conducive to the development of the project. Up to 2 feet of loose and disturbed surficial material was encountered throughout the subject site. The thickness and extent of the loose surficial soil was determined based on limited test borings and visual observation. The surficial soils were found to have varying strength characteristics ranging from loose to medium dense. Therefore, it is recommended that these soils be excavated and recompacted as necessary.

In areas where structures or equipment will be supported by conventional shallow foundations are anticipated, mitigation measures are recommended to reduce the potential for excessive total and differential soil settlements. It is recommended that, following stripping and fill removal operations, and any required demolition activities, the upper 2 feet of the native soils within the proposed structure and equipment areas be excavated, worked until uniform and free from large clods, moisture-conditioned as necessary, and recompacted to a minimum of 90 percent of the maximum density based on ASTM Test Method D1557. Over-excavation should extend to a minimum of 5 feet beyond proposed footing lines. In addition, it is recommended that proposed structural elements be supported by a minimum of 12 inches of Engineered Fill. Prior to backfilling, the exposed subgrade soils should be scarified to a depth of 6 inches, moisture-conditioned as necessary, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. The excavation should then be backfilled with Engineered Fill, compacted to a minimum of 90 percent of the maximum density based on ASTM Test Method D1557. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation. Prior to fill placement Krazan & Associates, Inc. should inspect the bottom of the excavation to verify no additional removal will be required.

Sandy soil conditions were encountered at the site. These cohesionless soils have a tendency to cave in trench wall excavations. Shoring or sloping back trench sidewalls may be required within these sandy soils.

After completion of the recommended site preparation and over-excavation, the site should be suitable for shallow footing support. The proposed structure footings may be designed utilizing conventional footings or mat foundations with allowable bearing pressures of 2,600 and 1,800 psf, respectively, for dead-plus-live loads. Conventional footings, if utilized, should have a minimum embedment of 18 inches. Alternatively, the proposed structures may be supported on drilled caissons/piers or driven pipe piles. If drilled piers or driven pipe piles extending to a minimum depth of 8 feet below existing grade will be utilized, over-excavation of the fill material and native soils in the area of the structures supported on these deep foundations will not be required. Recommendations regarding drilled caissons/piers and driven pipe piles are also provided in the Foundation section of this report.

Groundwater Influence on Structures/Construction

Based on our findings and historical records, it is not anticipated that groundwater will rise within the zone of structural influence or affect the construction of foundations and pavements for the project. However, if earthwork is performed during or soon after periods of precipitation, the subgrade soils may become saturated, "pump," or not respond to densification techniques. Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material; or mixing the soil with an approved lime or cement product. Our firm should be consulted prior to implementing remedial measures to observe the unstable subgrade conditions and provide appropriate recommendations.

Site Preparation

General site clearing should include removal of vegetation; asphaltic concrete; existing utilities; structures including foundations; basement walls and floors; existing stockpiled soil; trees and associated root systems; rubble; rubbish; and any loose and/or saturated materials. Site stripping should extend to a minimum depth of 2 to 4 inches, or until all organics in excess of 3 percent by volume are removed. Deeper stripping may be required in localized areas. These materials will not be suitable for reuse as Engineered Fill. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas.

Up to 2 feet of loose and disturbed surficial material was encountered throughout the subject site. The thickness and extent of the loose surficial soil was determined based on limited test borings and visual observation. The surficial soils were found to have varying strength characteristics ranging from loose to medium dense. Therefore, it is recommended that these soils be excavated and recompacted as necessary.

In areas where structures or equipment will be supported by conventional shallow foundations, mitigation measures are recommended to reduce the potential for excessive total and differential soil settlements. It is recommended that, following stripping and fill removal operations, and any required demolition activities, the upper 2 feet of the native soils within the proposed structure and equipment areas be excavated, worked until uniform and free from large clods, moisture-conditioned as necessary, and recompacted to a minimum of 90 percent of the maximum density based on ASTM Test Method D1557. Over-excavation should extend to a minimum of 5 feet beyond proposed footing lines. In addition, it is recommended that proposed structural elements be supported by a minimum of 12 inches of Engineered Fill. Prior to backfilling, the exposed subgrade soils should be scarified to a depth of 6 inches, moisture-conditioned as necessary, and recompacted to a minimum of 90 percent of the maximum density based on ASTM Test Method D1557. The excavation should then be backfilled with Engineered Fill, compacted to a minimum of 90 percent of the maximum density based on ASTM Test Method D1557. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation. Prior to fill placement Krazan & Associates, Inc. should inspect the bottom of the excavation to verify no additional removal will be required.

Sandy soil conditions were encountered at the site. These cohesionless soils have a tendency to cave in trench wall excavations. Shoring or sloping back trench sidewalls may be required within these sandy soils.

Following stripping, fill removal, and demolition activities, the exposed subgrade in pavement areas should be excavated/scarified to a depth of at least 12 inches, worked until uniform and free from large clods, moisture-conditioned as necessary and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation.

The upper soils, during wet winter months, become very moist due to the absorptive characteristics of the soil. Earthwork operations performed during winter months may encounter very moist unstable soils, which may require removal to grade a stable building foundation. Project site winterization consisting of placement of aggregate base and protecting exposed soils during the construction phase should be performed.

A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service, as acceptance of earthwork construction is dependent upon compaction and stability of the material. The Soils Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section and the Engineered Fill section.

Engineered Fill

The upper, on-site native fill soils are predominately silty sand, sand with trace silt, and sand with gravel. These soils will be suitable for reuse as Engineered Fill, provided they are cleansed of excessive organics, debris and fragments larger than 4 inches in dimension.

The preferred materials specified for Engineered Fill is suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since he has complete control of the project site at that time.

Imported Fill material should be predominately non-expansive granular material with a plasticity index less than 10 and an expansion index less than 15. Imported Fill should be free from rocks and clods greater than 4 inches in maximum dimension. All Imported Fill material should be submitted to the Soils Engineer for approval at least 48 hours prior to delivery at the site.

Fill soils should be placed in lifts approximately 6 inches thick, moisture-conditioned as necessary, and compacted to achieve at least 90 percent maximum density based on ASTM Test Method D1557. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

Drainage and Landscaping

The ground surface should slope away from building pads and pavement areas toward appropriate drop inlets or other surface drainage devices. In accordance with Section 1804 of the 2010 California Building Code, it is recommended that the ground surface adjacent to foundations be sloped a minimum of 5 percent for a minimum distance of 10 feet away from structures, or to an approved alternative means of drainage conveyance. Swales used for conveyance of drainage and located within 10 feet of foundations should be sloped a minimum of 2 percent. Impervious surfaces, such as pavement and exterior concrete flatwork, within 10 feet of building foundations should be sloped a minimum of 2 percent away from the structure. Drainage gradients should be maintained to carry all surface water to collection facilities and off-site. These grades should be maintained for the life of the project.

Utility Trench Backfill

Utility trenches should be excavated according to accepted engineering practice following OSHA (Occupational Safety and Health Administration) standards by a Contractor experienced in such work. The responsibility for the safety of open trenches should be borne by the Contractor. Traffic and vibration adjacent to trench walls should be minimized; cyclic wetting and drying of excavation side slopes should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced; especially during or following periods of precipitation.

Sandy and gravelly soil conditions were encountered at the site. These cohesionless soils have a tendency to cave in trench wall excavations. Shoring or sloping back trench sidewalls may be required within these sandy and gravelly soils.

Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 90 percent of maximum density based on ASTM Test Method D1557. Utility trench backfill placed in pavement areas should be compacted to at least 90 percent of the maximum density based on ASTM Test Method D1557. Pipe bedding should be in accordance with pipe manufacturer's recommendations.

The Contractor is responsible for removing all water-sensitive soils from the trench regardless of the backfill location and compaction requirements. The Contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

Pipe Bedding and Envelope

Proper bedding and envelope should be provided for the proposed pipes. The bedding surface should be smooth and true to the design grade. At least 12 inches of compacted cohesionless soil bedding (100 percent passing the No. 4 Sieve and not more than 8 percent passing and No. 200 Sieve) should be provided below the pipes. An envelope of sandy backfill material should be placed along the sides of the pipe and a minimum depth of 12 inches or ⅛ H over the top of pipe (H is the height of soil backfill above the top of the pipe).

Pipe bedding and envelope should be brought to near optimum moisture content, placed in loose lifts not more than 6 inches in thickness, and compacted to achieve at least 90 percent of maximum density based on ASTM Test Method D1557. Due to space limitations, a hand compactor may be required.

Foundations – Conventional

After completion of the recommended site preparation and over-excavation, the site should be suitable for shallow footing support. The proposed structures may be supported on a shallow foundation system bearing on a minimum of 12 inches of Engineered Fill. Spread or continuous footings can be designed for the following maximum allowable soil bearing pressures:

Load	Allowable Loading
Dead Load Only	2,000 psf
Dead-Plus-Live Load	2,600 psf
Total Load, including wind or seismic loads	3,325 psf

Footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Footings should have a minimum width of 12 inches, regardless of load. Ultimate design of foundations and reinforcement should be performed by the project Structural Engineer.

The total settlement is not expected to exceed 1 inch. Differential settlement should be less than ½ inch. Most of the settlement is expected to occur during construction, as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.35 acting between the base of foundations and the supporting subgrade. Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 300 pounds per cubic foot acting against the appropriate vertical footing faces. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. A ⅓ increase in the value above may be used for short duration, wind, or seismic loads. All of the above earth pressures are unfactored and are, therefore, not inclusive of factors of safety.

Mat Foundations

The proposed structures may be supported on a mat foundation system, bearing on a minimum of 12 inches of Engineered Fill. The mat foundations may be designed for the following maximum allowable soil bearing pressure:

Load	Allowable Loading
Dead Load Only	1,350 psf
Dead-Plus-Live Load	1,800 psf
Total Load, including wind or seismic loads	2,400 psf

The total settlement of the mat is not expected to exceed 1 inch. The differential settlement should be less than ¾ inch. The mat should have a minimum thickness of 18 inches. Ultimate design of foundations and reinforcement should be performed by the project Structural Engineer.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.35 acting between the base of foundations and the supporting subgrade. Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 300 pounds per cubic foot acting against the appropriate vertical footing faces. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. A ⅓ increase in the above value may be used for short duration, wind, or seismic loads. All of the above earth pressures are unfactored and are, therefore, not inclusive of factors of safety.

Foundations—Drilled Caissons or Driven Pipe Piles

The proposed structures can be supported on caissons or driven piles, using an allowable sidewall friction of 300 psf. This value is for dead-plus-live loads. This value may be increased ⅓ for short duration loads, such as wind or seismic. The upper 2 feet should be neglected from friction calculations. Uplift loads can be resisted by caissons using an allowable sidewall friction of 175 psf of the surface area plus the weight of the pier. Caissons should have a minimum embedment depth of 8 feet. The total and differential settlements of the piers are not expected to exceed ½ inch. Most of the settlement is expected to occur during construction as the loads are applied. If drilled piers will be utilized, no over-excavation of the fill material and native soils will be required.

Caissons may be designed using a lateral bearing capacity of 200 psf/ft using the applicable formula for nonconstrained or constrained conditions in Sections 1807.3.2.1 and 1807.3.2.2 of the 2010 California Building Code. Nonconstrained or flexible cap conditions apply to isolated piers, and constrained or rigid cap (fixed against rotation) conditions apply to piers with a rigid connection to a pile cap, or where lateral constraint is provided at the ground surface.

Sandy and gravelly soils were encountered at the site. These sandy soils may be subject to caving during drilling operations. Accordingly, cased caissons may be required. The drilled holes should be left open for as short of time as possible and should be protected from run-off.

Excavation Stability

Temporary excavations planned for the construction of structures associated with the proposed construction may be excavated, according to the accepted engineering practices following Occupational Safety and Health Administration (OSHA) standards by a Contractor experienced in such work. Open, unbraced excavations in undisturbed soils should be made according to the table below.

Recommended Excavation Slopes	
Depth of Excavation (ft)	**Slope (Horizontal:Vertical)**
	Temporary
0-5	1:1
5-10	1½:1
10-20	2:1

If, due to space limitation, excavation near existing structures or roads is performed in a vertical position, braced shoring or shields may be used for supporting vertical excavations. Therefore, in order to comply with the local and state safety regulations, a properly designed and installed shoring system would be required to accomplish planned excavation and installation. A specialty Shoring Contractor should be responsible for the design and installation of such a shoring system during construction. The lateral pressures provided below may be used in the design of a braced-type shoring system.

Recommended Lateral Earth Pressure for Braced Shoring	
Depth of Excavation Below Ground Surface (feet)	**Lateral Soil Pressure (psf)**
0	0
0.25 H	35 H
H	35 H
Where H is the total depth of the excavation in feet.	

The foregoing does not include excess hydrostatic pressure or surcharge loading. Fifty percent of any surcharge load, such as construction equipment weight, should be added to the lateral load given above. Since the Contractor has the ultimate responsibility for excavation stability, he may design a different shoring system for the excavation.

The excavation/shoring recommendations provided herein are based on soil characteristics derived from the limited test borings drilled within the site. Variations in soil conditions will likely be encountered during the excavations. Krazan & Associates, Inc. should be afforded the opportunity to provide field review to evaluate the actual conditions and account for field condition variations not otherwise anticipated in the preparation of this recommendation.

Lateral Earth Pressures and Retaining Walls

Walls retaining horizontal backfill and capable of deflecting a minimum of 0.1 percent of its height at the top may be designed using an equivalent fluid active pressure of 31 pounds per square foot per foot of depth. Walls that are incapable of this deflection or walls that are fully constrained against deflection may be designed for an equivalent fluid at-rest pressure of 52 pounds per square foot per foot per depth. Expansive soils should not be used for backfill against walls. The wedge of non-expansive backfill material should extend from the bottom of each retaining wall outward and upward at a slope of 2:1 (horizontal to vertical) or flatter. The stated lateral earth pressures do not include the effects of hydrostatic water pressures generated by infiltrating surface water that may accumulate behind the retaining walls; or loads imposed by construction equipment, foundations, or roadways. All of the above earth pressures are unfactored and are, therefore, not inclusive of factors of safety.

Retaining and/or below grade walls should be drained with either perforated pipe encased in free-draining gravel or a prefabricated drainage system. The gravel zone should have a minimum width of 12 inches wide and should extend upward to within 12 inches of the top of the wall. The upper 12 inches of backfill should consist of native soils, concrete, asphaltic concrete, or other suitable backfill to minimize surface drainage into the wall drain system. The aggregate should conform to Class II permeable materials graded in accordance with Section 68-1.025 of the CalTrans Standard Specifications (May 2006). Prefabricated drainage systems, such as Miradrain®, Enkadrain®, or an equivalent substitute, are acceptable alternatives in lieu of gravel provided they are installed in accordance with the manufacturer's recommendations. If a prefabricated drainage system is proposed, our firm should review the system for final acceptance prior to installation.

Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements. The pipes should be placed no higher than 6-inches above the heel of the wall, in the center line of the drainage blanket and should have a minimum diameter of four inches. Collector pipes may be either slotted or perforated. Slots should be no wider than ⅛ inch, while perforations should be no more than ¼ inch in diameter. If retaining walls are less than 6 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 4-inch diameter holes (concrete walls) or unmortared head joints (masonry walls) and not be higher than 18 inches above the lowest adjacent grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to Section 88-1.03 of the CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

During grading and backfilling operations adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall, or within a lateral distance equal to the wall height, whichever is greater, to avoid developing excessive lateral pressures. Within this zone, only hand operated equipment ("whackers," vibratory plates, or pneumatic compactors) should be used to compact the backfill soils.

Seismic Parameters – 2010 California Building Code

The Site Class per Table 1613.5.2, of the 2010 California Building Code (2010 CBC) is based upon the site soil conditions. It is our opinion that Site Class D is most consistent with the subject site soil conditions. For seismic design of the structures based on the seismic provisions of the 2010 CBC, we recommend the following parameters:

Seismic Item	Value	CBC Reference
Site Class	D	Table 1613.5.2
Site Coefficient F_a	1.00	Table 1613.5.3 (1)
S_s	1.24	Figure 1613.5 (3)
S_{MS}	1.24	Section 1613.5.3
S_{DS}	0.83	Section 1613.5.4
Site Coefficient F_v	1.50	Table 1613.5.3 (2)
S_1	0.43	Figure 1613.5 (4)
S_{M1}	0.68	Section 1613.5.3
S_{D1}	0.45	Section 1613.5.4

Compacted Material Acceptance

Compaction specifications are not the only criteria for acceptance of the site grading or other such activities. However, the compaction test is the most universally recognized test method for assessing the performance of the Grading Contractor. The numerical test results from the compaction test cannot be used to predict the engineering performance of the compacted material. Therefore, the acceptance of compacted materials will also be dependent on the stability of that material. The Soils Engineer has the option of rejecting any compacted material regardless of the degree of compaction if that material is considered to be unstable or if future instability is suspected. A specific example of rejection of fill material passing the required percent compaction is a fill which has been compacted with an in situ moisture content significantly less than optimum moisture. This type of dry fill (brittle fill) is susceptible to future settlement if it becomes saturated or flooded.

Testing and Inspection

A representative of Krazan & Associates, Inc. should be present at the site during the earthwork activities to confirm that actual subsurface conditions are consistent with the exploratory fieldwork. This activity is an integral part of our service, as acceptance of earthwork construction is dependent upon compaction testing and stability of the material. This representative can also verify that the intent of these recommendations is incorporated into the project design and construction. Krazan & Associates, Inc. will not be responsible for grades or staking, since this is the responsibility of the Prime Contractor.

LIMITATIONS

Soils Engineering is one of the newest divisions of Civil Engineering. This branch of Civil Engineering is constantly improving as new technologies and understanding of earth sciences advance. Although your site was analyzed using the most appropriate and most current techniques and methods, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to advancements in the field of Soils Engineering, physical changes in the site, either due to excavation or fill placement, new agency regulations, or possible changes in the proposed structure after the soils report is completed may require the soils report to be professionally reviewed. In light of this, the Owner should be aware that there is a practical limit to the usefulness of this report without critical review. Although the time limit for this review is strictly arbitrary, it is suggested that 2 years be considered a reasonable time for the usefulness of this report.

Foundation and earthwork construction is characterized by the presence of a calculated risk that soil and groundwater conditions have been fully revealed by the original foundation investigation. This risk is derived from the practical necessity of basing interpretations and design conclusions on limited sampling of the earth. The recommendations made in this report are based on the assumption that soil conditions do not vary significantly from those disclosed during our field investigation. If any variations or undesirable conditions are encountered during construction, the Soils Engineer should be notified so that supplemental recommendations may be made.

The conclusions of this report are based on the information provided regarding the proposed construction. If the proposed construction is relocated or redesigned, the conclusions in this report may not be valid. The Soils Engineer should be notified of any changes so the recommendations may be reviewed and re-evaluated.

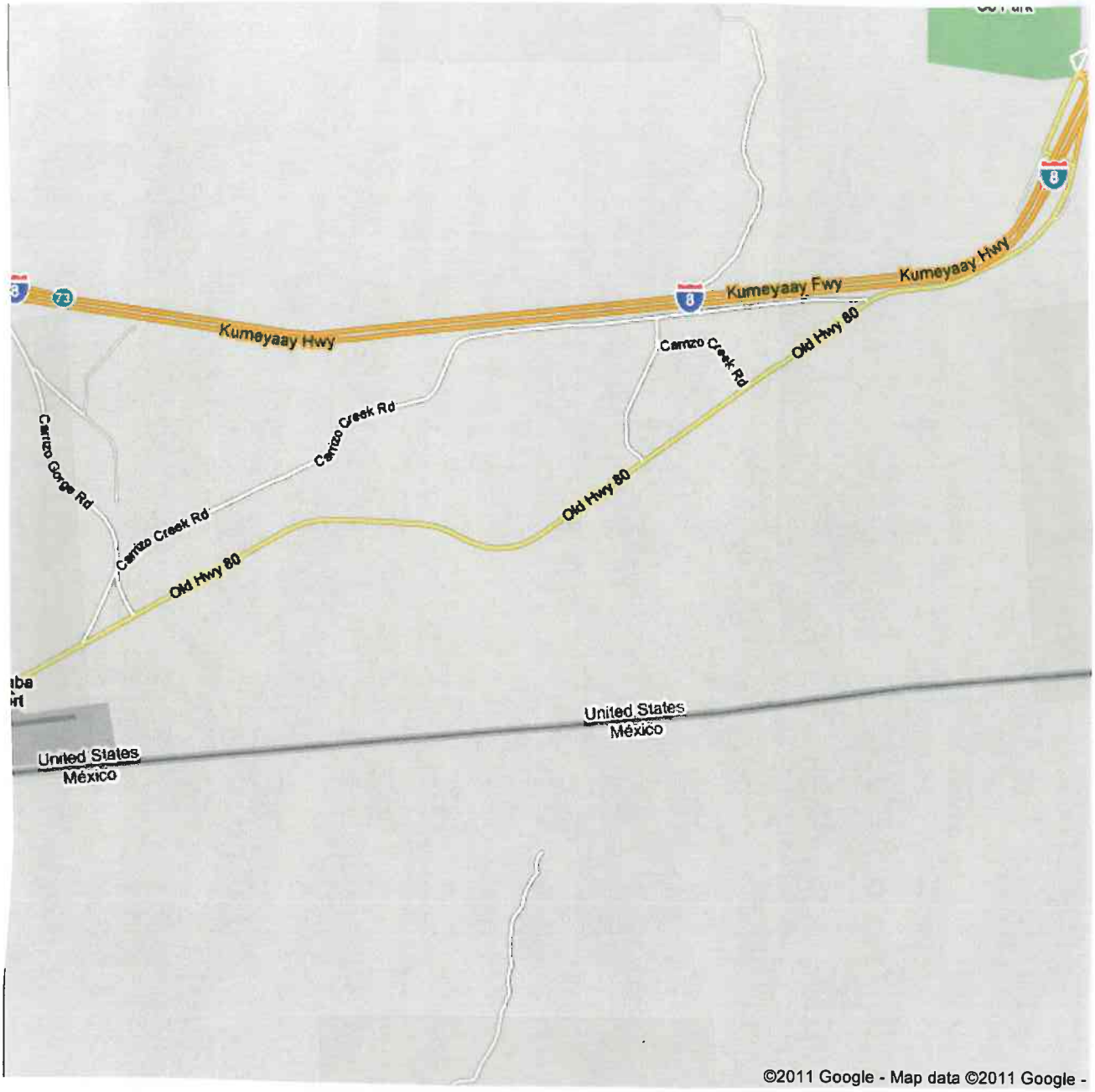
This report is a Geotechnical Engineering Investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our services did not include any Environmental Site Assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater, or atmosphere; or the presence of wetlands. Any statements, or absence of statements, in this report or on any boring log regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment.

The geotechnical engineering information presented herein is based upon professional interpretation utilizing standard engineering practices and a degree of conservatism deemed proper for this project. It is not warranted that such information and interpretation cannot be superseded by future geotechnical engineering developments. We emphasize that this report is valid for the project outlined above and should not be used for any other sites.

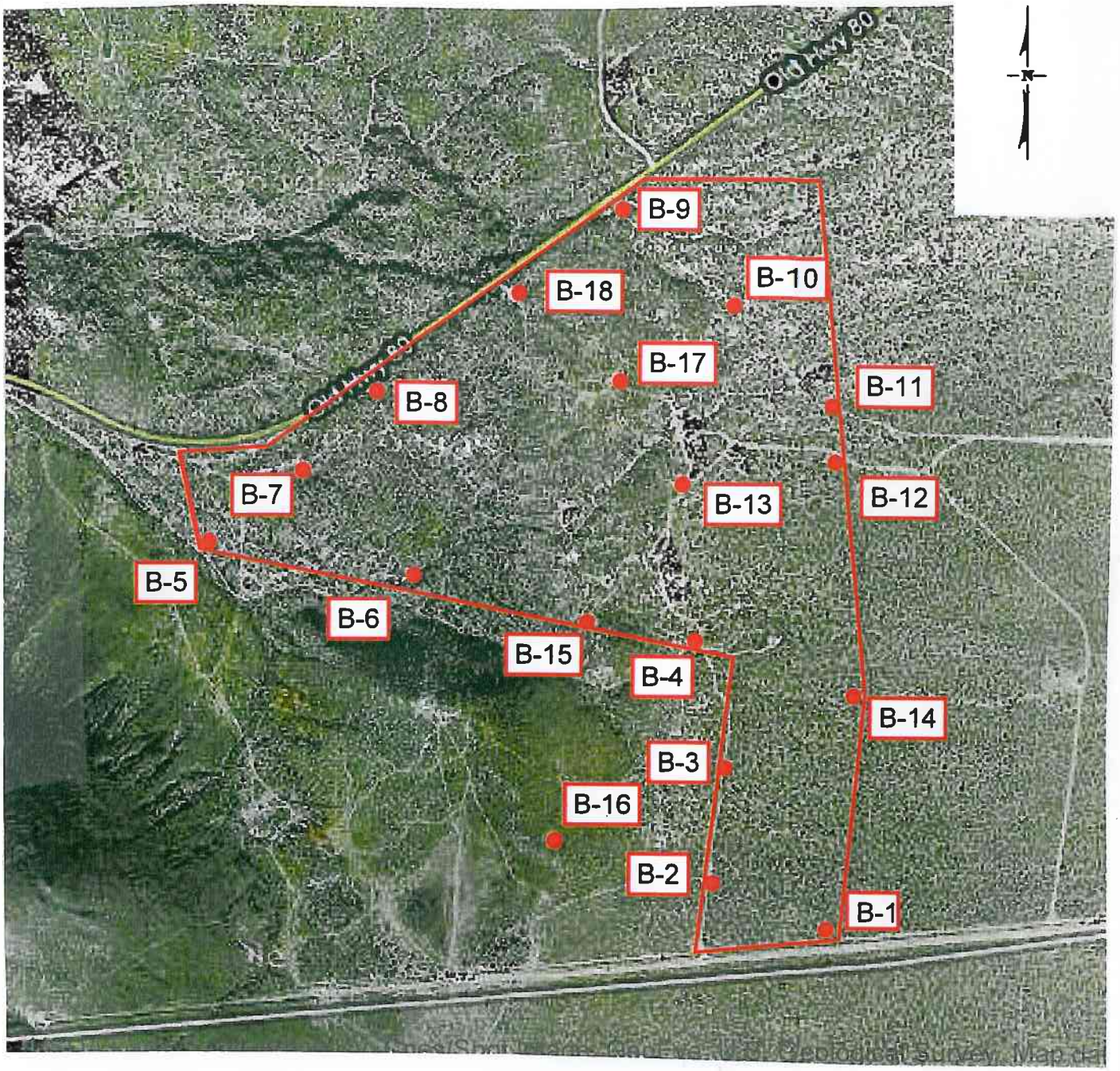
If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (951) 273-1011.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

James M. Kellogg
Managing Engineer
RGE No. 2902/RCE No. 65092



GEOTECHNICAL ENGINEERING INVESTIGATION **PROPOSED JACUMBA SITE** **OLD HIGHWAY 80** **JACUMBA, CALIFORNIA**	Scale: *NTS*	Date: *MAY 5, 2011*	Krazan SITE DEVELOPMENT ENGINEERS Offices Serving the Western United States
	Drawn by: *JMK*	Approved by: *JMK*	
VICINITY MAP	Project No. *022-11039*	Figure No. *1*	



LEGEND

APPROXIMATE BORING LOCATION

GEOTECHNICAL ENGINEERING INVESTIGATION *PROPOSED JACUMBA SITE* *OLD HIGHWAY 80* *JACUMBA, CALIFORNIA*	Scale: *NTS*	Date: *MAY 5, 2011*	Krazan *SITE DEVELOPMENT ENGINEERS*
	Drawn by: *JMK*	Approved by: *JMK*	
SITE PLAN	Project No. *022-11039*	Figure No. *2*	*Offices Serving the Western United States*

Appendix A

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Eighteen (18) 4½-inch diameter exploratory borings were advanced. The boring locations are shown on the attached site plan.

The soils encountered were logged in the field during the exploration and with supplementary laboratory test data are described in accordance with the Unified Soil Classification System.

Modified standard penetration tests were performed at selected depths. These tests represent the resistance to driving a 2½-inch diameter split barrel sampler. The driving energy was provided by a hammer weighing 140 pounds, falling 30 inches. Relatively undisturbed soil samples were obtained while performing this test. Bag samples of the disturbed soil were obtained from the auger cuttings. All samples were returned to our Fresno laboratory for evaluation.

Laboratory Investigation

The laboratory investigation was programmed to determine the physical and mechanical properties of the foundation soil underlying the site. Test results were used as criteria for determining the engineering suitability of the surface and subsurface materials encountered.

In-situ moisture content, dry density, consolidation, direct shear, and sieve analysis tests were completed for the undisturbed samples representative of the subsurface material. Expansion index and R-value tests were completed for select bag samples obtained from the auger cuttings. These tests, supplemented by visual observation, comprised the basis for our evaluation of the site material.

The logs of the exploratory borings and laboratory determinations are presented in this Appendix.

Log of Boring B1

Project: Jacumba Site (170 Acres)

Project No: 022-11039

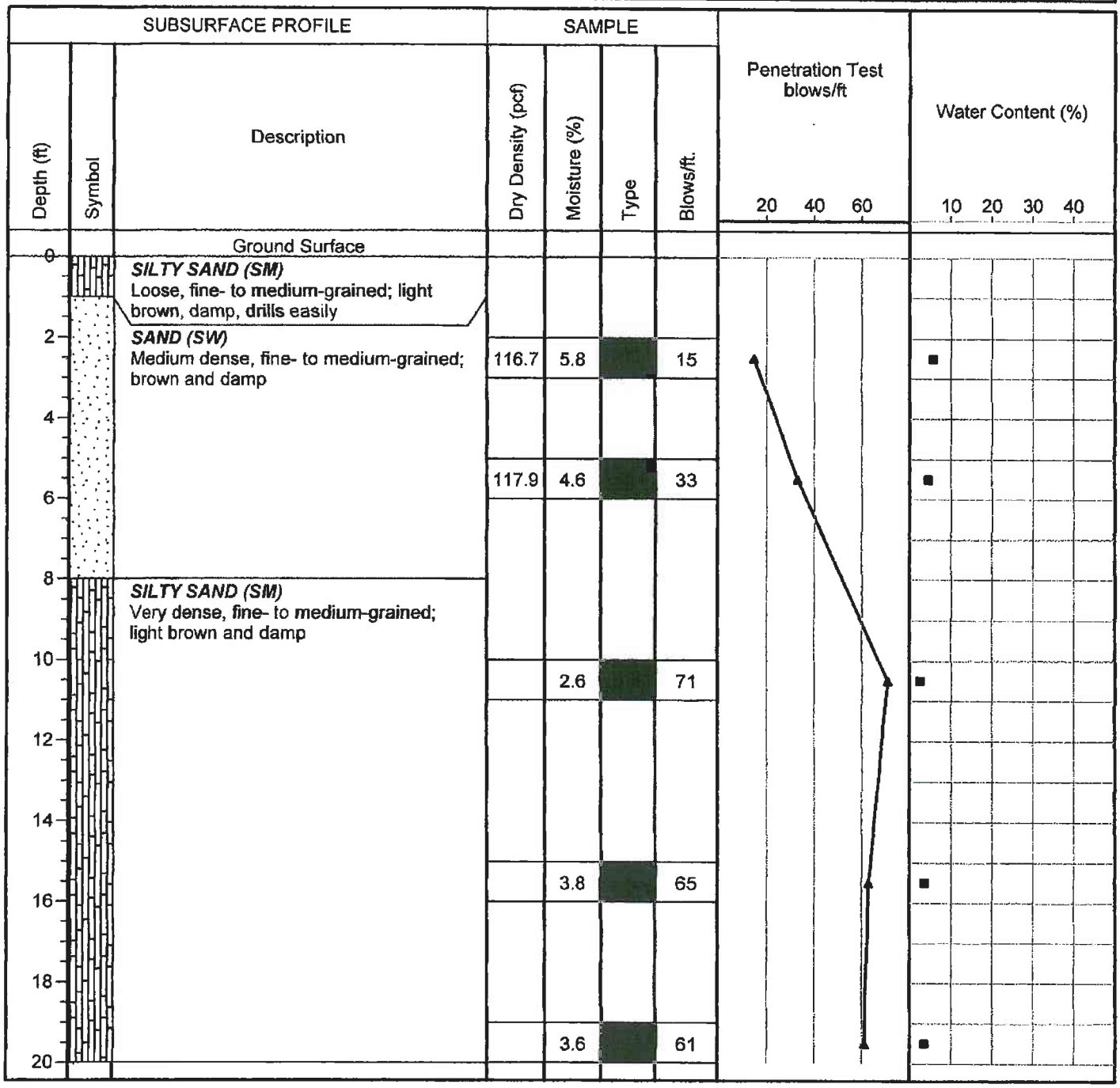
Client: Bakersfield Fuel and Oil Company

Figure No.: A-1

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B2

Project: Jacumba Site (170 Acres)

Project No: 022-11039

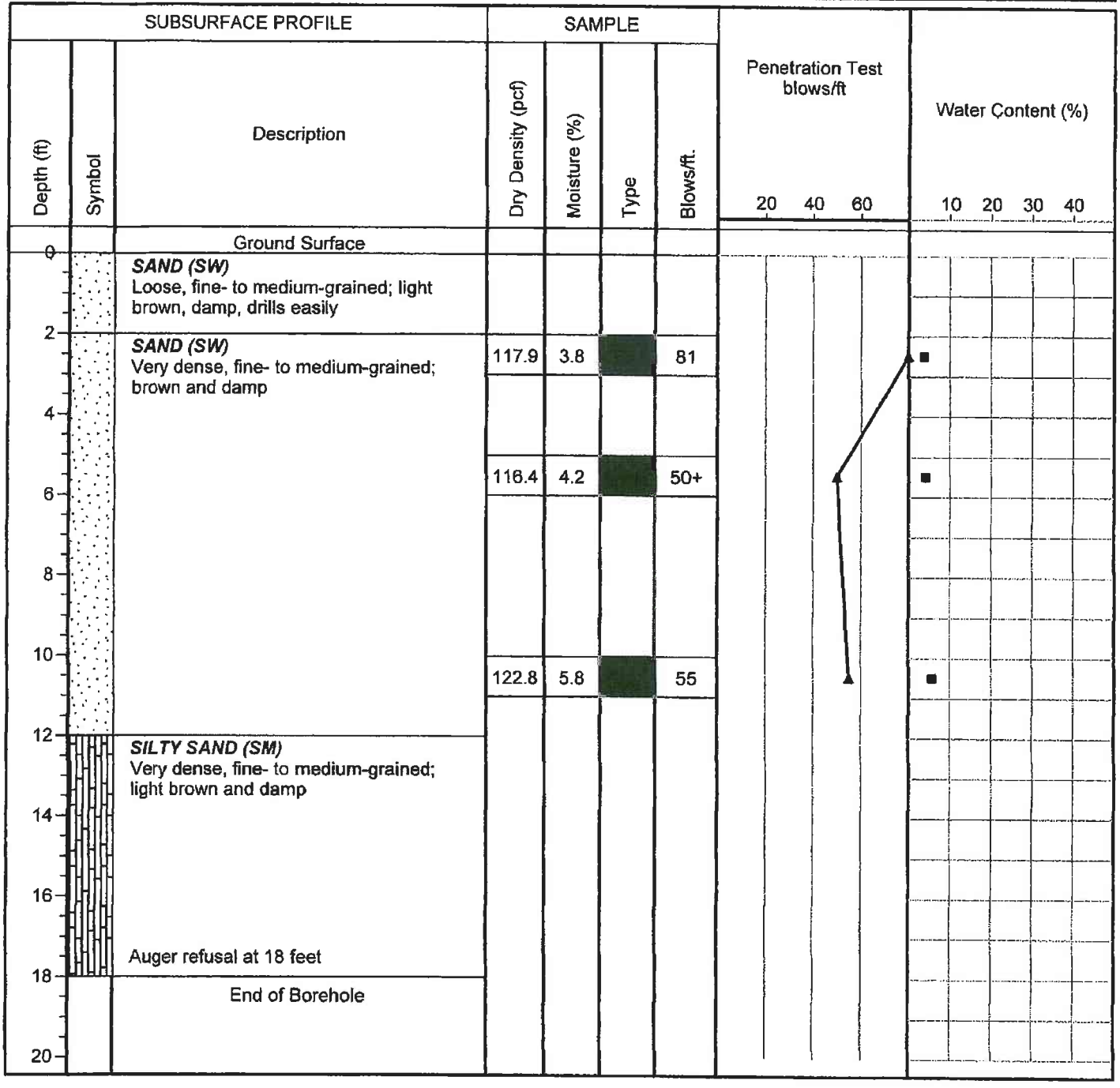
Client: Bakersfield Fuel and Oil Company

Figure No.: A-2

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 18 Feet

Sheet: 1 of 1

Log of Boring B3

Project: Jacumba Site (170 Acres)

Project No: 022-11039

Client: Bakersfield Fuel and Oil Company

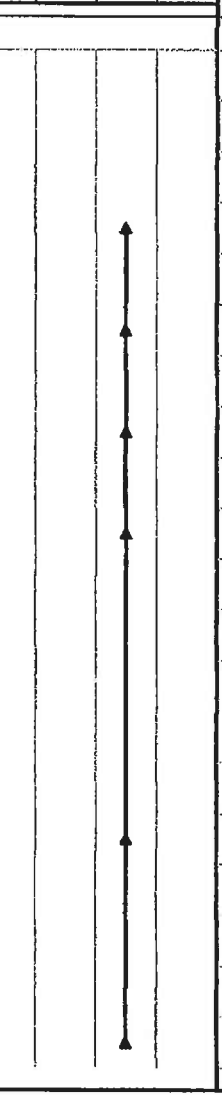
Figure No.: A-3

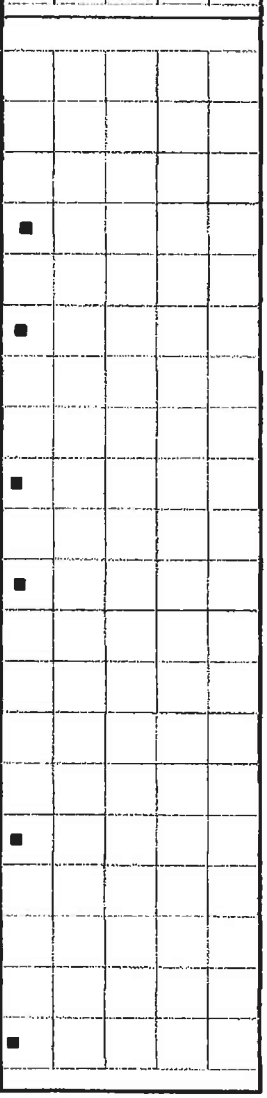
Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained; light brown, damp, and drills easily				
2		***SILTY SAND (SM)*** Very dense, fine- to medium-grained; light brown and damp				
4			116.2	4.9		50+
6			121.8	3.9		50+
8			119.6	3.2		50+
10				3.8		50+
12						
14						
16				3.1		50+
18						
20				2.6		50+





Drill Method: Hollow Stem Auger

Drill Rig: CME 75

Driller: Baja

Krazan and Associates

Drill Date: 4-19-11

Hole Size: 4½ Inches

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B4

Project: Jacumba Site (170 Acres)

Project No: 022-11039

Client: Bakersfield Fuel and Oil Company

Figure No.: A-4

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
		SILTY SAND (SM) Loose, fine- to medium-grained; light brown, damp, drills easily				
2		***SILTY SAND (SM)*** Very dense, fine- to medium-grained; light brown and damp				
4			114.8	4.1		50+
		SILTY SAND (SM) Very dense, fine- to medium-grained; brown and damp	118.2	5.3		50+
6						
8		***SILTY SAND (SM)*** Very dense, fine- to medium-grained; white and damp	122.6	3.6		50+
10		***SANDSTONE*** Very dense, highly weathered; light brown and damp		3.8		50+
12		Auger refusal at 13 feet				
		End of Borehole				
14						
16						
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Hollow Stem Auger

Drill Rig: CME 75

Driller: Baja

Krazan and Associates

Drill Date: 4-19-11

Hole Size: 4½ Inches

Elevation: 13 Feet

Sheet: 1 of 1

Log of Boring B5

Project: Jacumba Site (170 Acres)

Project No: 022-11039

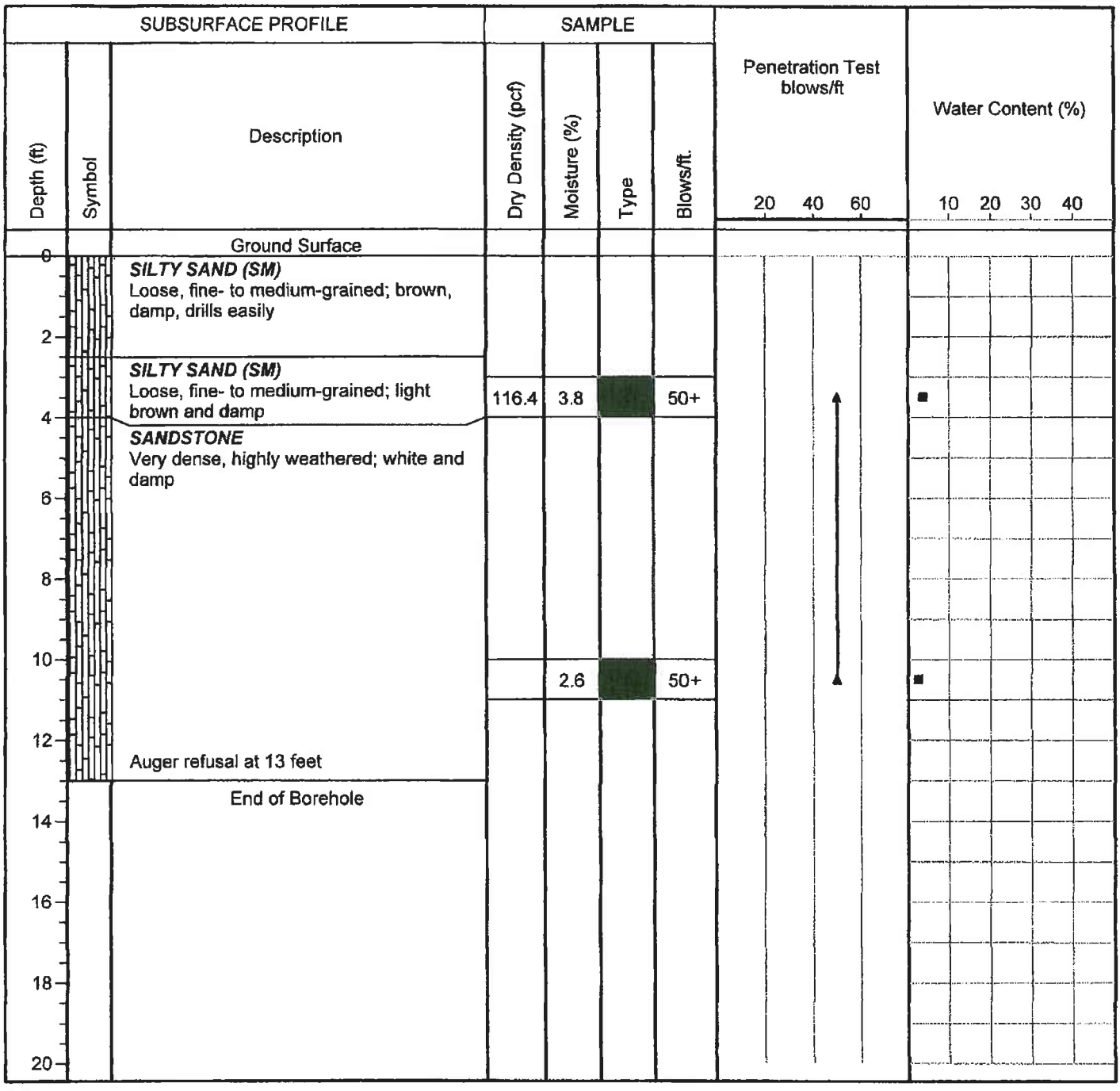
Client: Bakersfield Fuel and Oil Company

Figure No.: A-5

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 13 Feet

Sheet: 1 of 1

Log of Boring B6

Project: Jacumba Site (170 Acres)

Project No: 022-11039

Client: Bakersfield Fuel and Oil Company

Figure No.: A-6

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water>

Initial: None

At Completion: None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, drills easily				
2		***SAND (SP)*** Loose, fine- to medium-grained with GRAVEL; light brown and damp				
4		***SANDSTONE*** Very dense, highly weathered; white and damp	116..8	4.8		40
6			114.2	3.6		69
8		Auger refusal at 9 feet				
		End of Borehole				
10						
12						
14						
16						
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 9 Feet

Sheet: 1 of 1

Log of Boring B7

Project: Jacumba Site (170 Acres)

Project No: 022-11039

Client: Bakersfield Fuel and Oil Company

Figure No.: A-7

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained; white, damp, drills easily				
4			115.9	3.1		16
6		***SANDSTONE*** Medium dense, weathered, light brown and damp	121.8	4.2		32
10				4.6		50+
16		End of Borehole				

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 15 Feet

Sheet: 1 of 1

Log of Boring B8

Project: Jacumba Site (170 Acres)

Project No: 022-11039

Client: Bakersfield Fuel and Oil Company

Figure No.: A-8

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained with GRAVEL; light brown, damp, drills easily				
2		***SANDSTONE*** Very dense, highly weathered; white and damp				
4				3.2	■	50+
6				3.6	■	50+
		Auger refusal at 8 feet				
8		End of Borehole				
10						
12						
14						
16						
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Hollow Stem Auger

Drill Rig: CME 75

Driller: Baja

Krazan and Associates

Drill Date: 4-19-11

Hole Size: 4½ Inches

Elevation: 8 Feet

Sheet: 1 of 1

Log of Boring B9

Project: Jacumba Site (170 Acres)

Project No: 022-11039

Client: Bakersfield Fuel and Oil Company

Figure No.: A-9

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine-grained; light brown, damp, drills easily				
2		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; brown and damp		2.8		43
4		***SANDSTONE*** Very dense, highly weathered; white and damp		3.6		50+
6		Auger refusal at 8 feet				
8		End of Borehole				
10						
12						
14						
16						
18						
20						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Hollow Stem Auger

Drill Rig: CME 75

Driller: Baja

Krazan and Associates

Drill Date: 4-19-11

Hole Size: 4½ Inches

Elevation: 8 Feet

Sheet: 1 of 1

Log of Boring B10

Project: Jacumba Site (170 Acres)

Project No: 022-11039

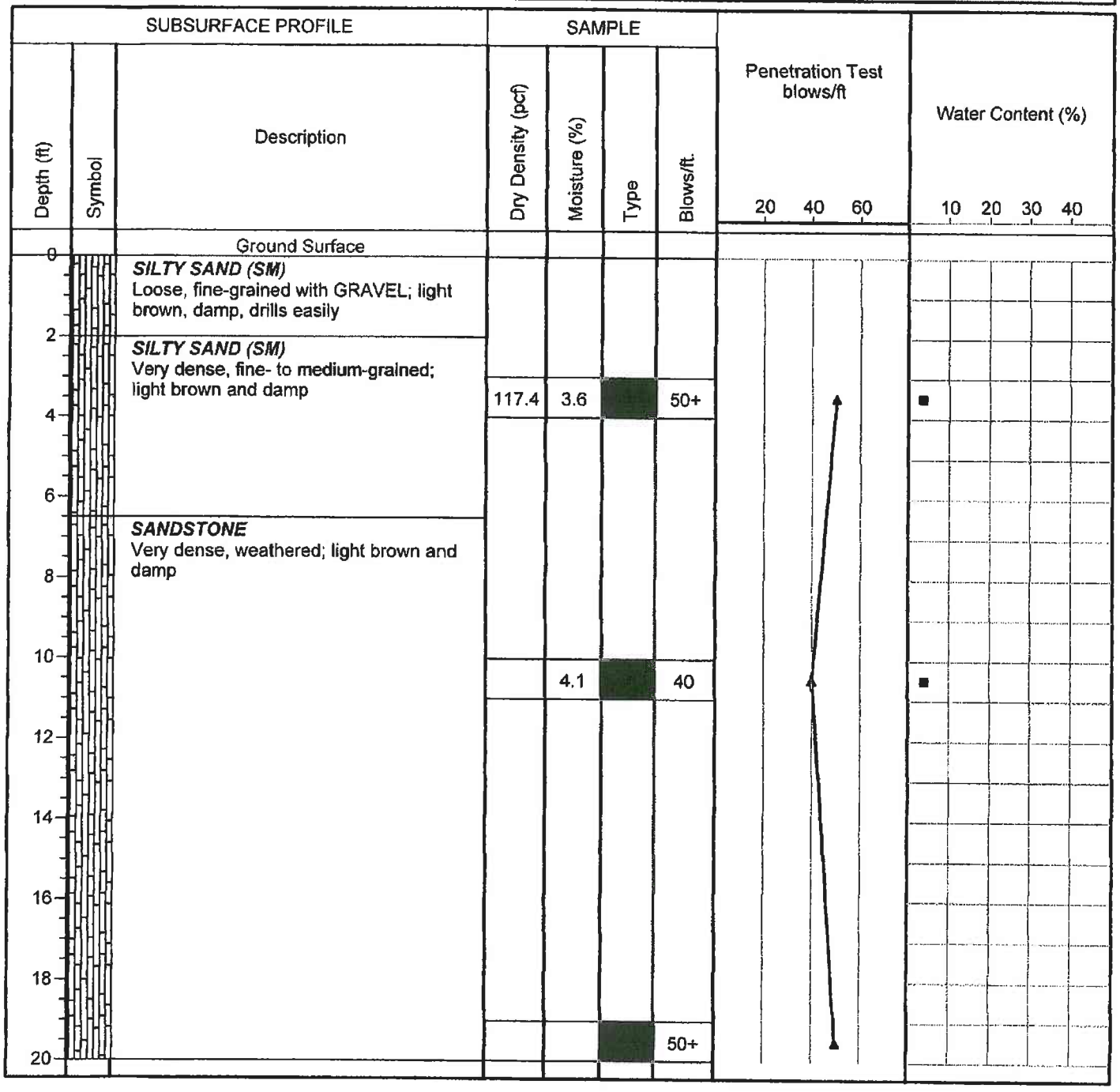
Client: Bakersfield Fuel and Oil Company

Figure No.: A-10

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B11

Project: Jacumba Site (170 Acres)

Project No: 022-11039

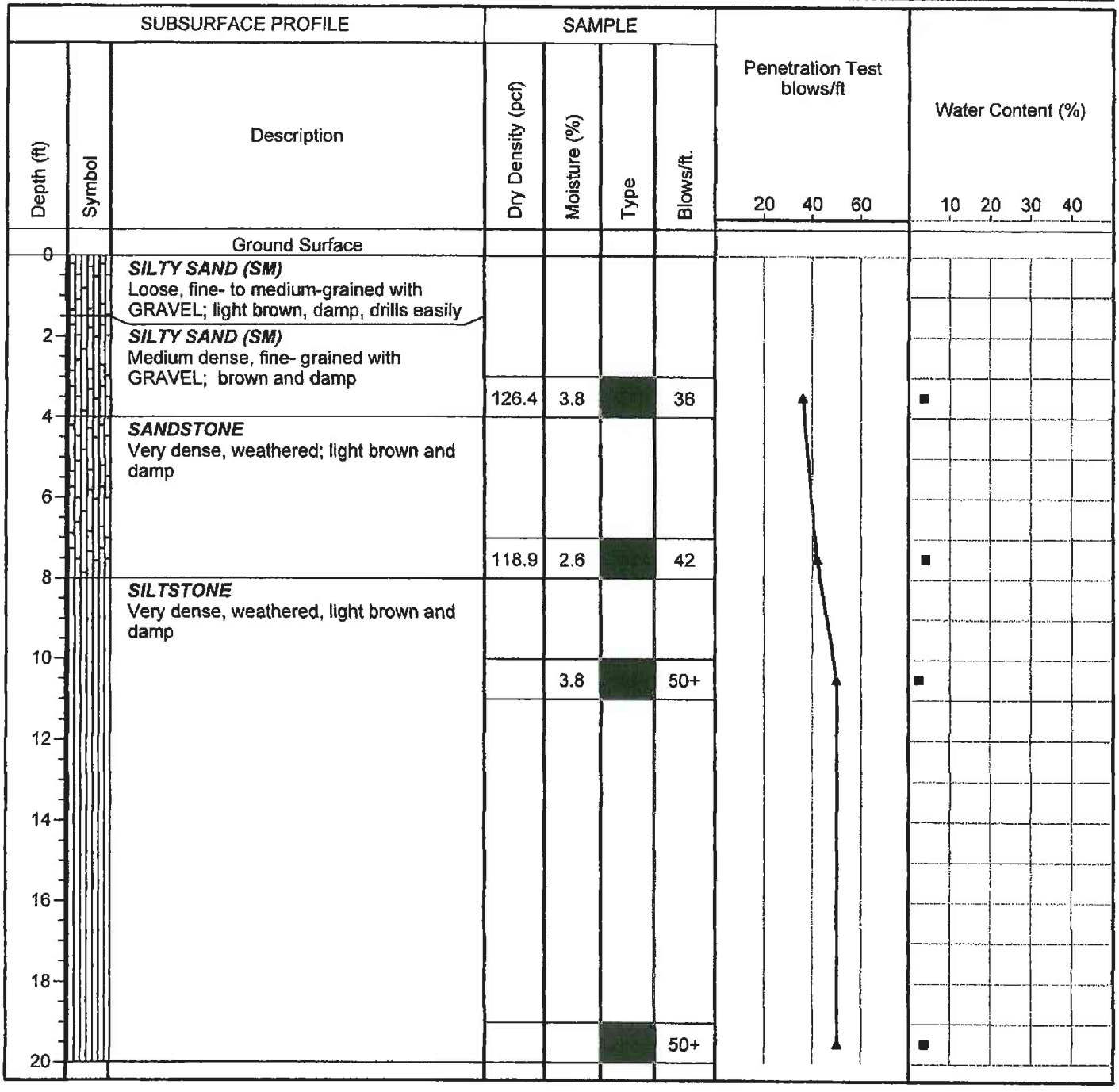
Client: Bakersfield Fuel and Oil Company

Figure No.: A-11

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B12

Project: Jacumba Site (170 Acres)

Project No: 022-11039

Client: Bakersfield Fuel and Oil Company

Figure No.: A-12

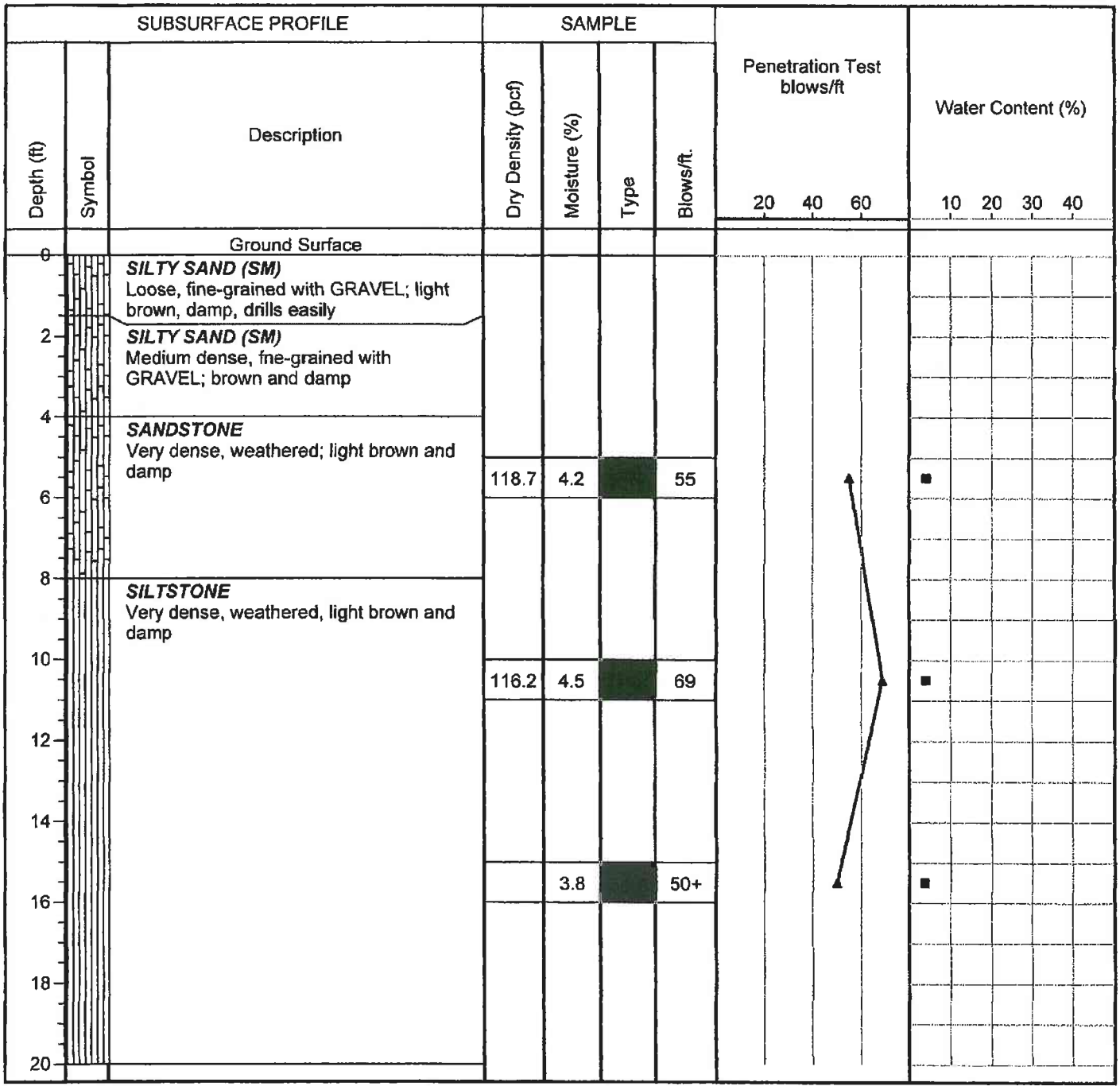
Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water>

Initial: None

At Completion: None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B13

Project: Jacumba Site (170 Acres)

Project No: 022-11039

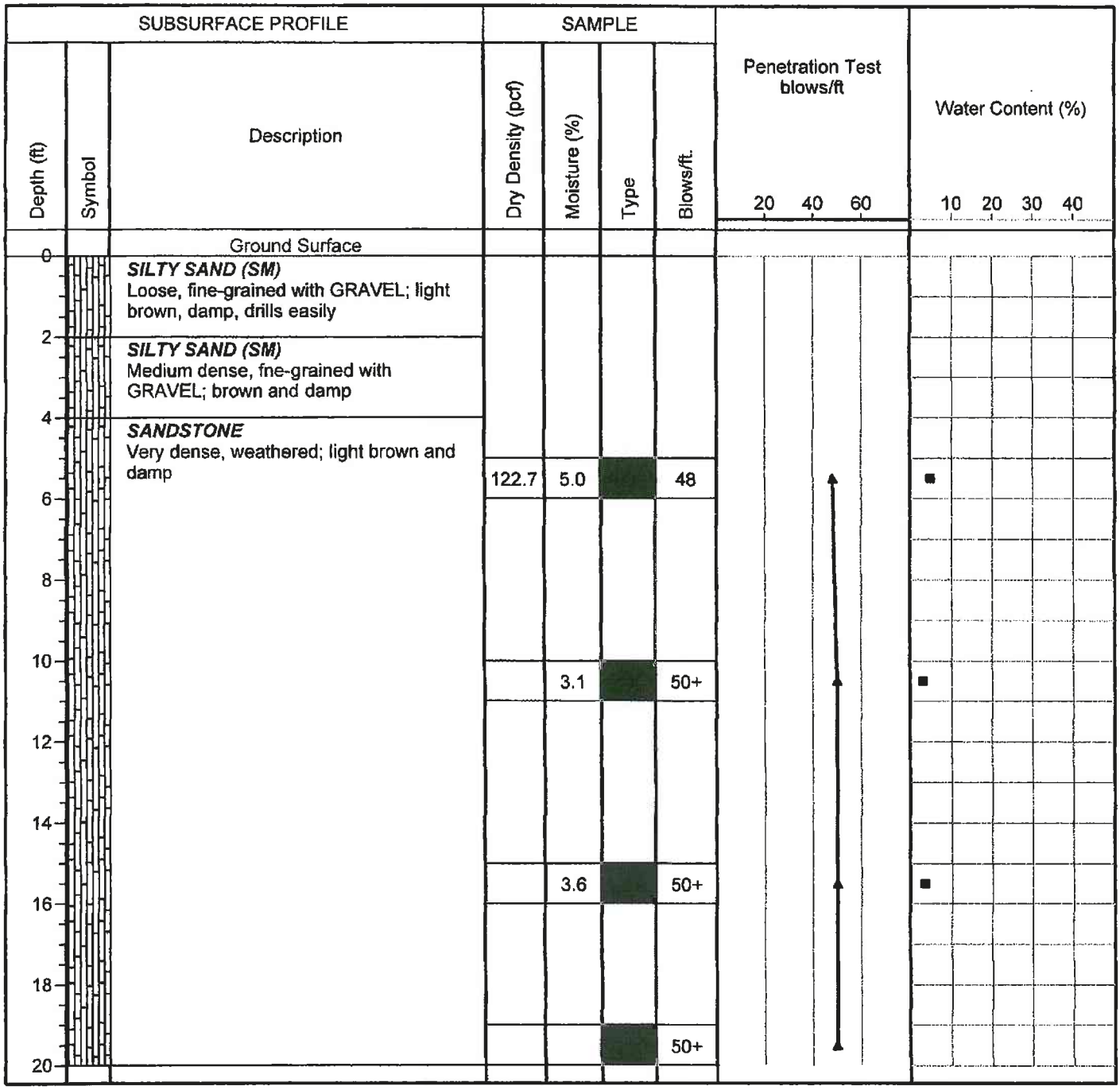
Client: Bakersfield Fuel and Oil Company

Figure No.: A-13

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 20 Feet

Sheet: 1 of 1

Log of Boring B14

Project: Jacumba Site (170 Acres)

Project No: 022-11039

Client: Bakersfield Fuel and Oil Company

Figure No.: A-14

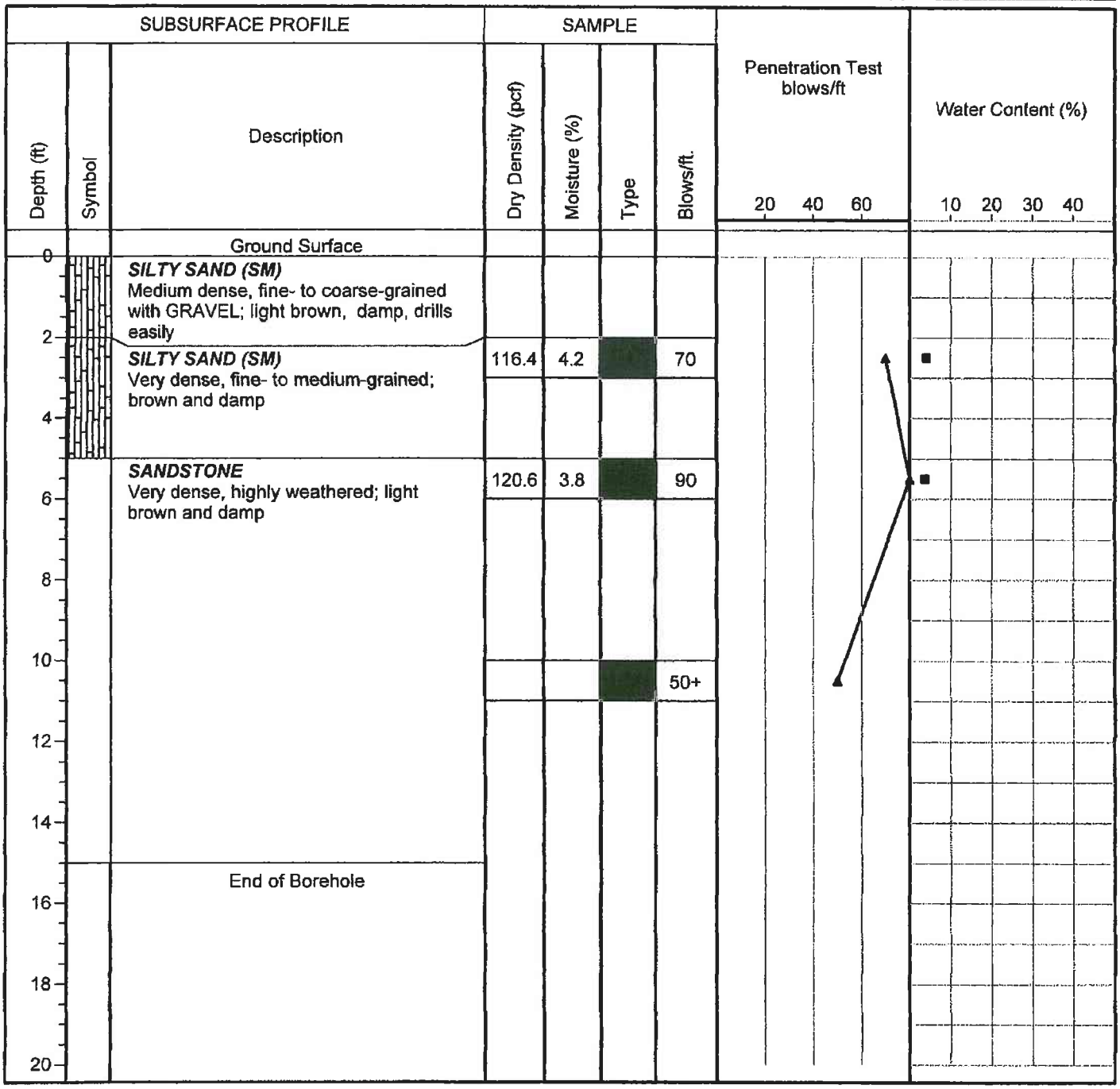
Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water>

Initial: None

At Completion: None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 15 Feet

Sheet: 1 of 1

Log of Boring B15

Project: Jacumba Site (170 Acres)

Project No: 022-11039

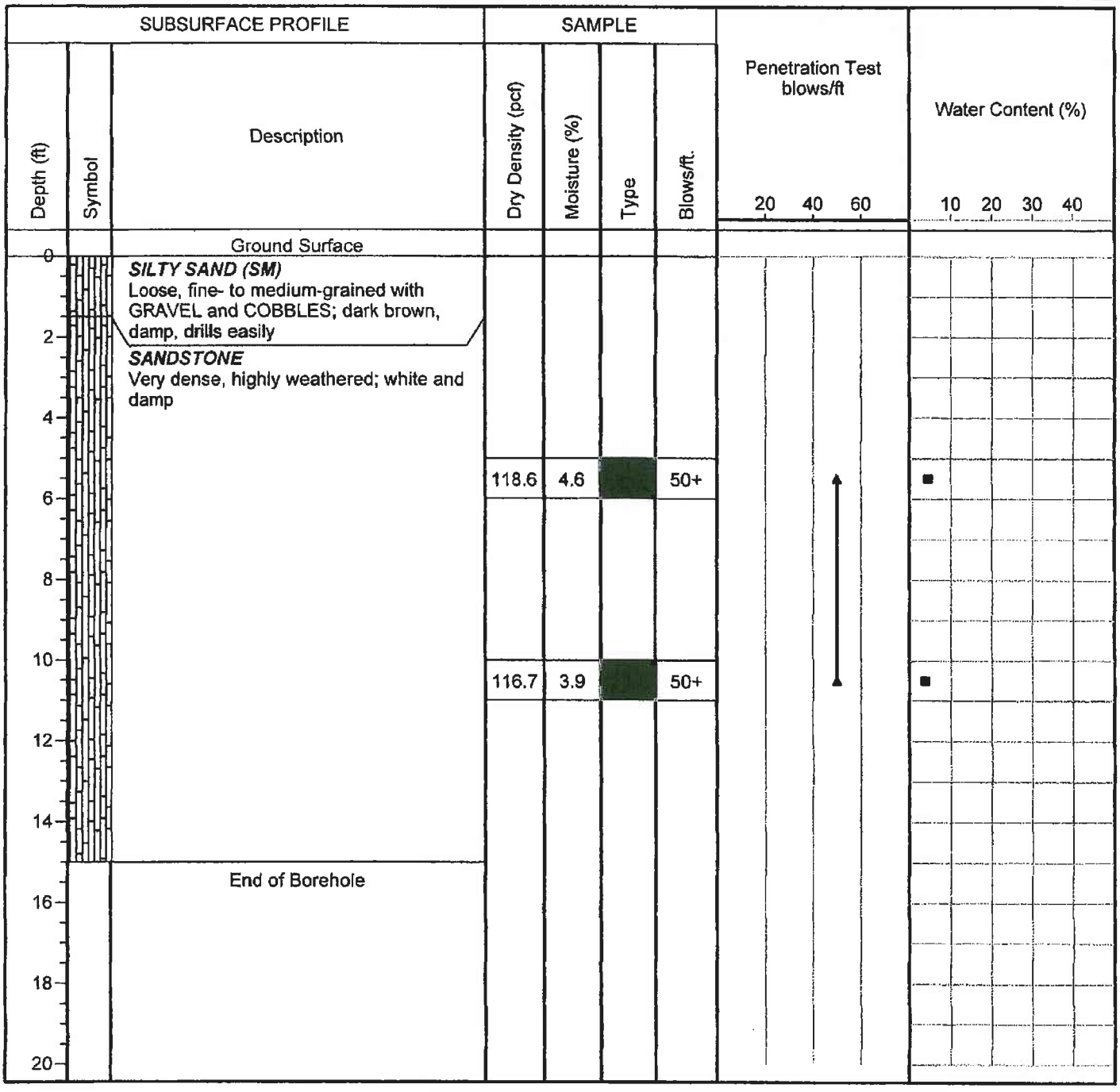
Client: Bakersfield Fuel and Oil Company

Figure No.: A-15

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 15 Feet

Sheet: 1 of 1

Log of Boring B16

Project: Jacumba Site (170 Acres)

Project No: 022-11039

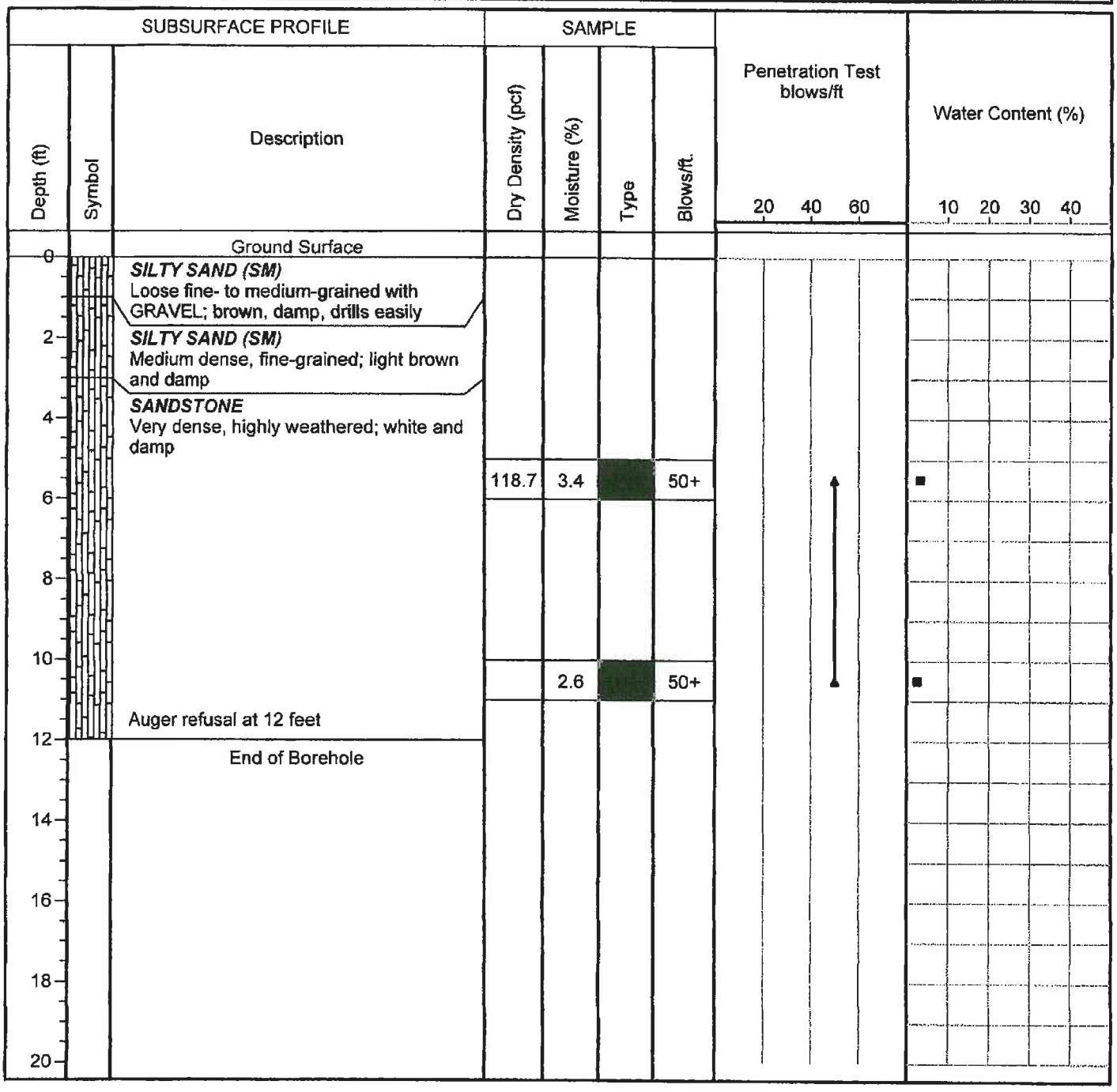
Client: Bakersfield Fuel and Oil Company

Figure No.: A-16

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

Driller: Baja

Elevation: 12 Feet

Sheet: 1 of 1

Log of Boring B17

Project: Jacumba Site (170 Acres)

Project No: 022-11039

Client: Bakersfield Fuel and Oil Company

Figure No.: A-17

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft (20 40 60)	Water Content (%) (10 20 30 40)
0		Ground Surface						
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained with GRAVEL; brown, damp, drills easily						
4		***SANDSTONE*** Very dense, highly weathered, grayish-white and damp						
6			120.6	4.2		50+		■
10				3.6		50+		■
14		End of Borehole						
16								
18								
20								

Drill Method: Hollow Stem Auger

Drill Rig: CME 75

Driller: Baja

Krazan and Associates

Drill Date: 4-19-11

Hole Size: 4½ Inches

Elevation: 15 Feet

Sheet: 1 of 1

Log of Boring B18

Project: Jacumba Site (170 Acres)

Project No: 022-11039

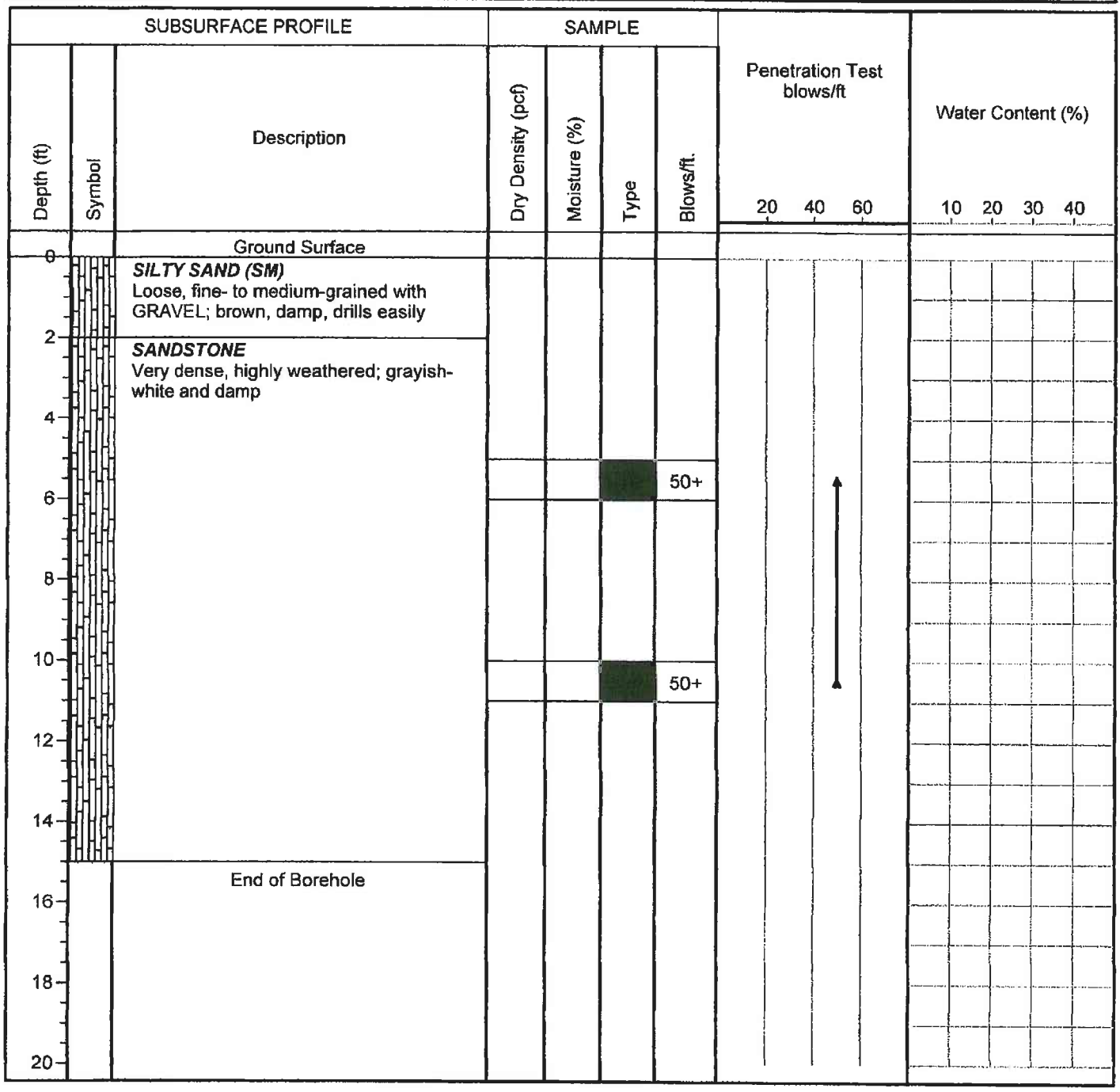
Client: Bakersfield Fuel and Oil Company

Figure No.: A-18

Location: Old Highway 80, San Diego County, California

Logged By: Jim Kellogg

Depth to Water> **Initial:** None **At Completion:** None



Drill Method: Hollow Stem Auger

Drill Date: 4-19-11

Drill Rig: CME 75

Krazan and Associates

Hole Size: 4½ Inches

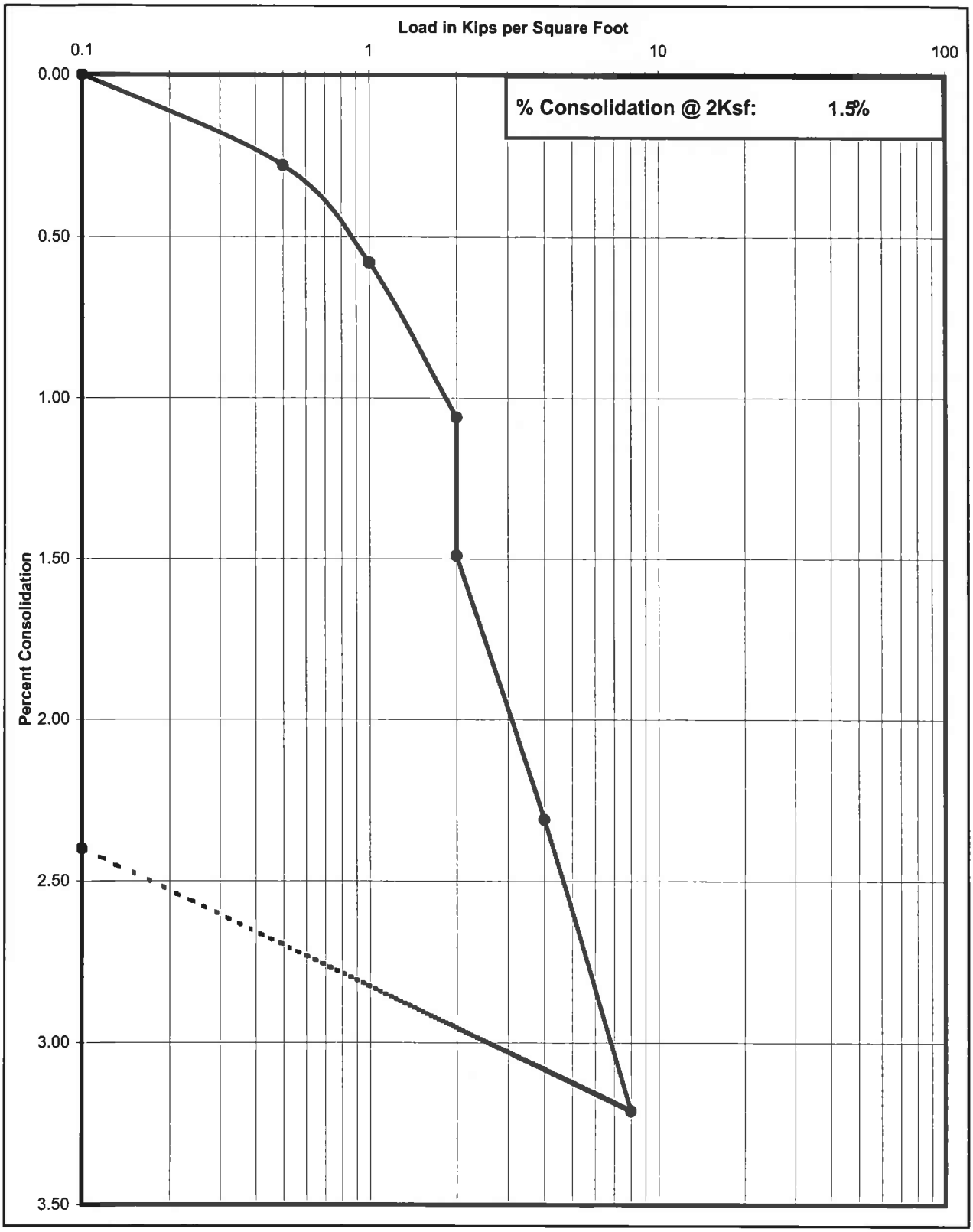
Driller: Baja

Elevation: 15 Feet

Sheet: 1 of 1

Consolidation Test

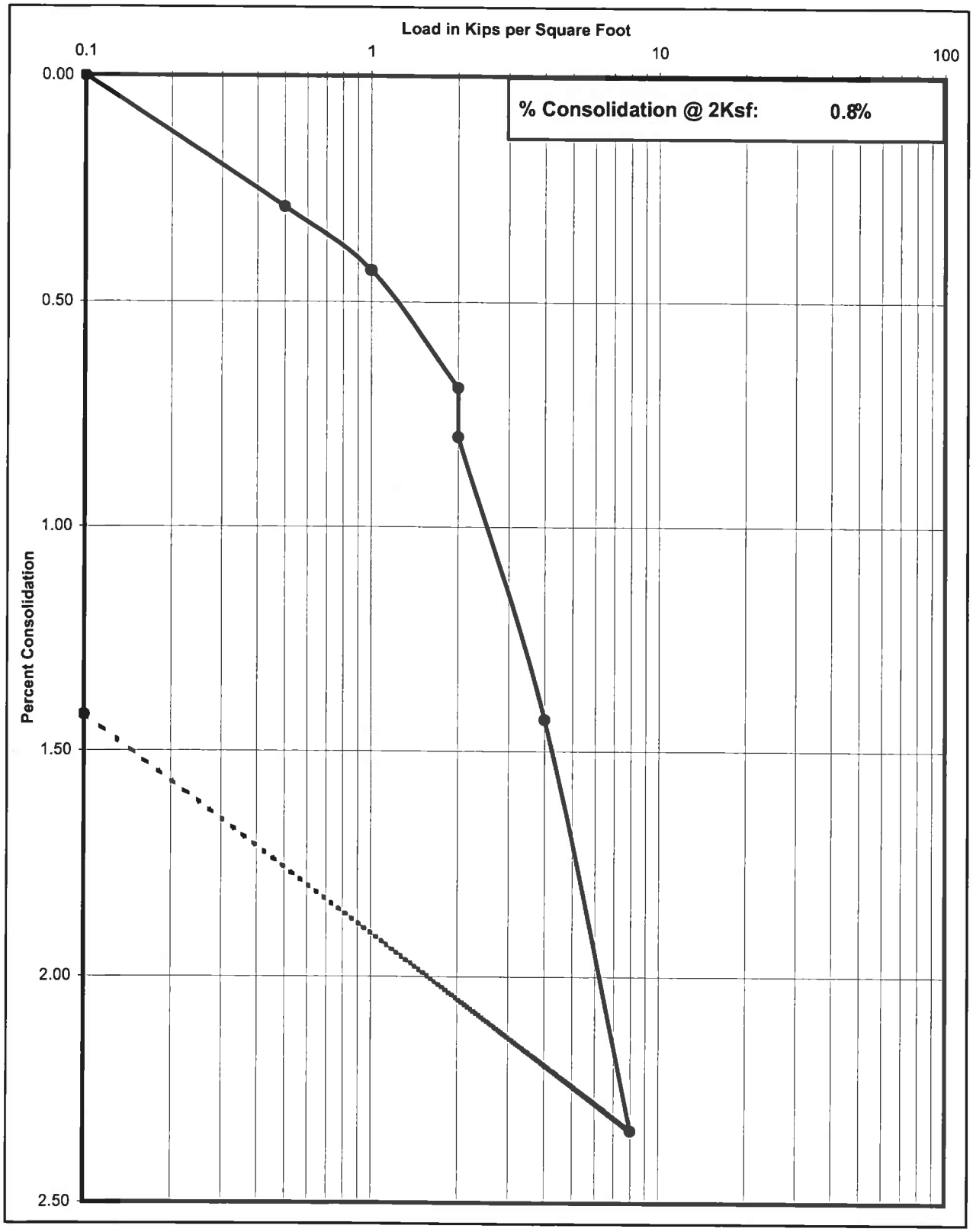
Project No	Boring No. & Depth	Date	Soil Classification
2211039	B2 @ 3-4'	4/20/2011	SM



Krazan Testing Laboratory

Consolidation Test

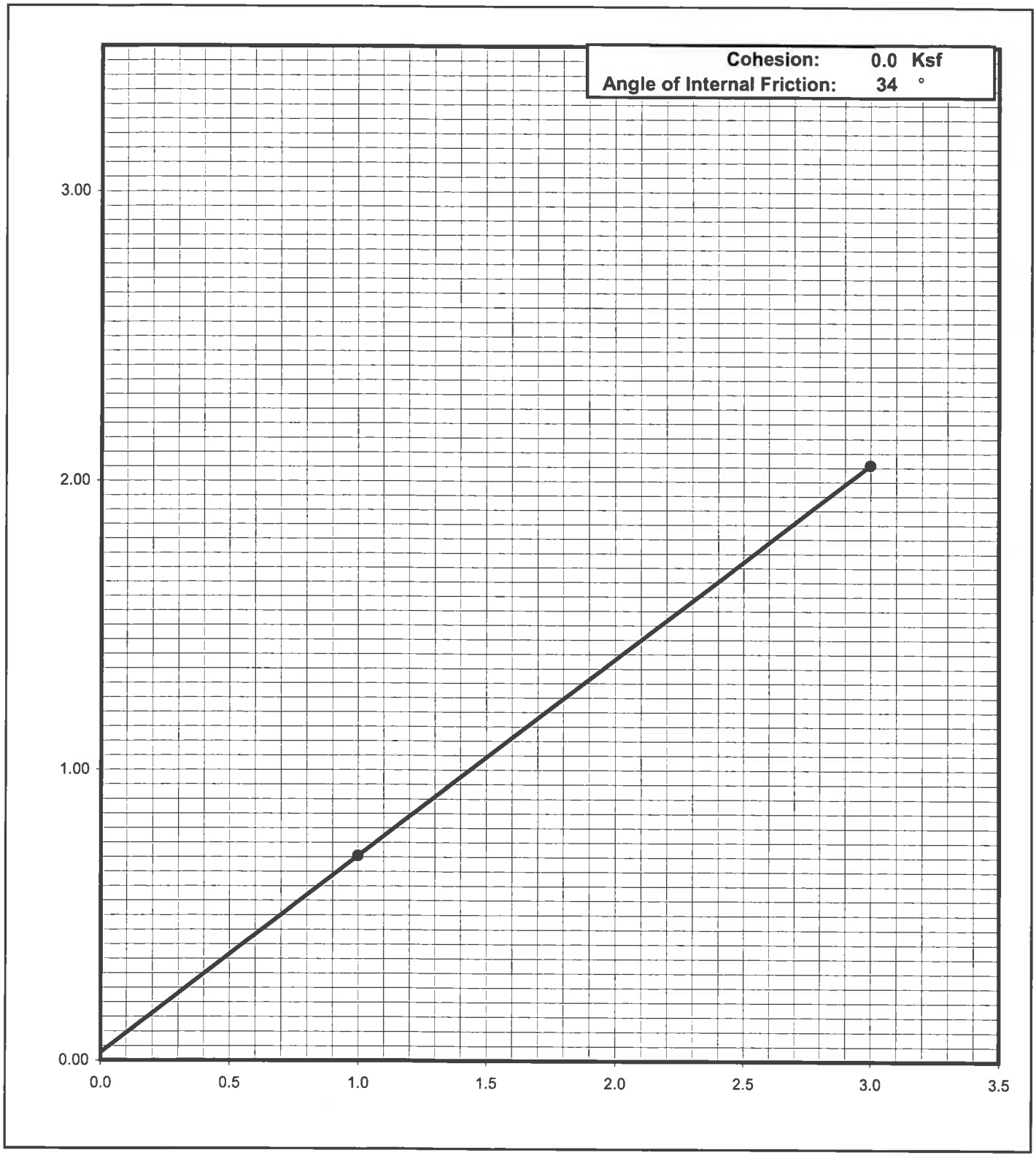
Project No	Boring No. & Depth	Date	Soil Classification
2211039	B17 @ 5-6'	4/20/2011	SP



Krazan Testing Laboratory

Shear Strength Diagram (Direct Shear)
ASTM D - 3080 / AASHTO T - 236

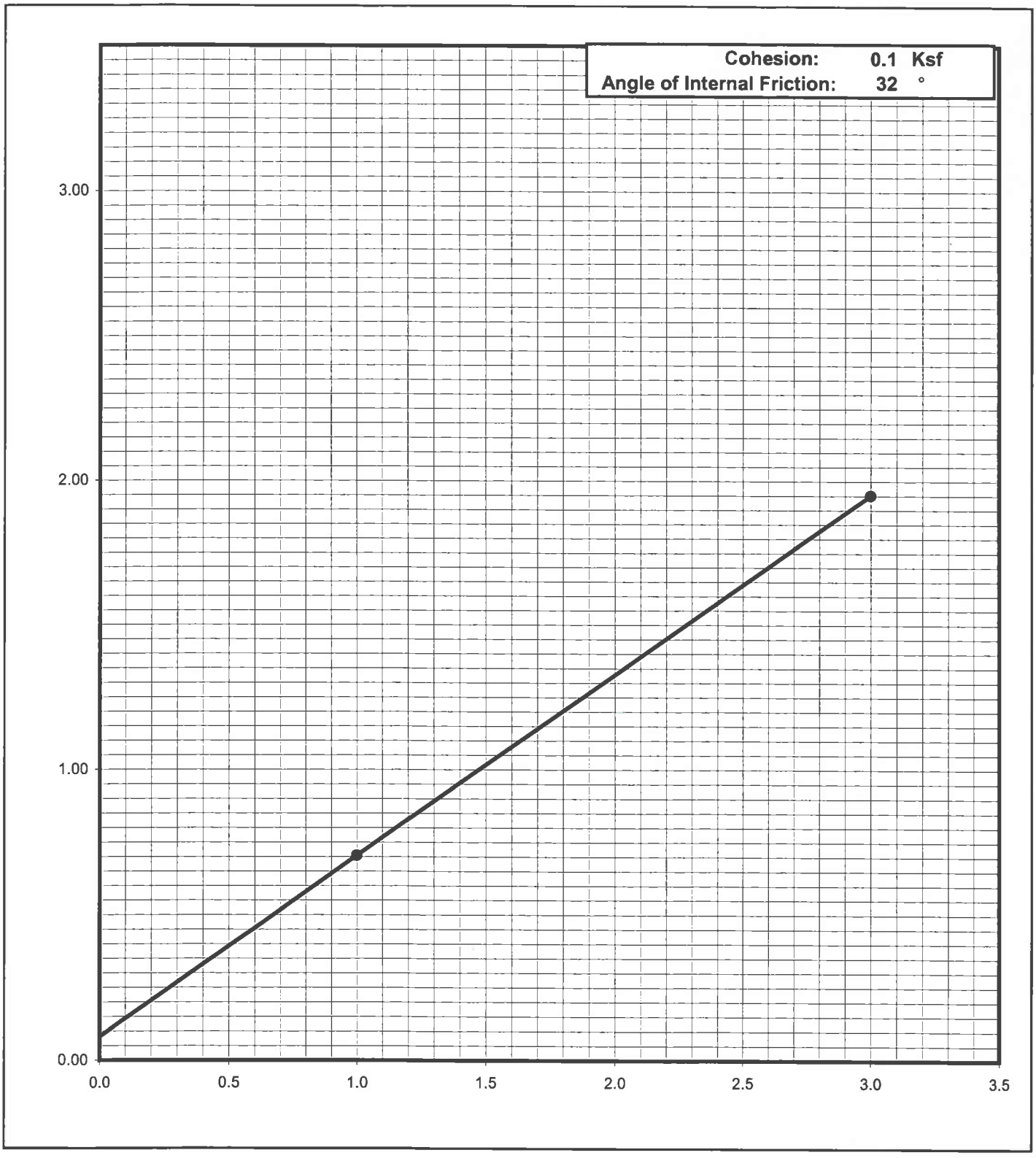
Project Number	Boring No. & Depth	Soil Type	Date
2211039	B1 @ 3-4'	SM	4/20/2011



Krazan Testing Laboratory

Shear Strength Diagram (Direct Shear)
ASTM D - 3080 / AASHTO T - 236

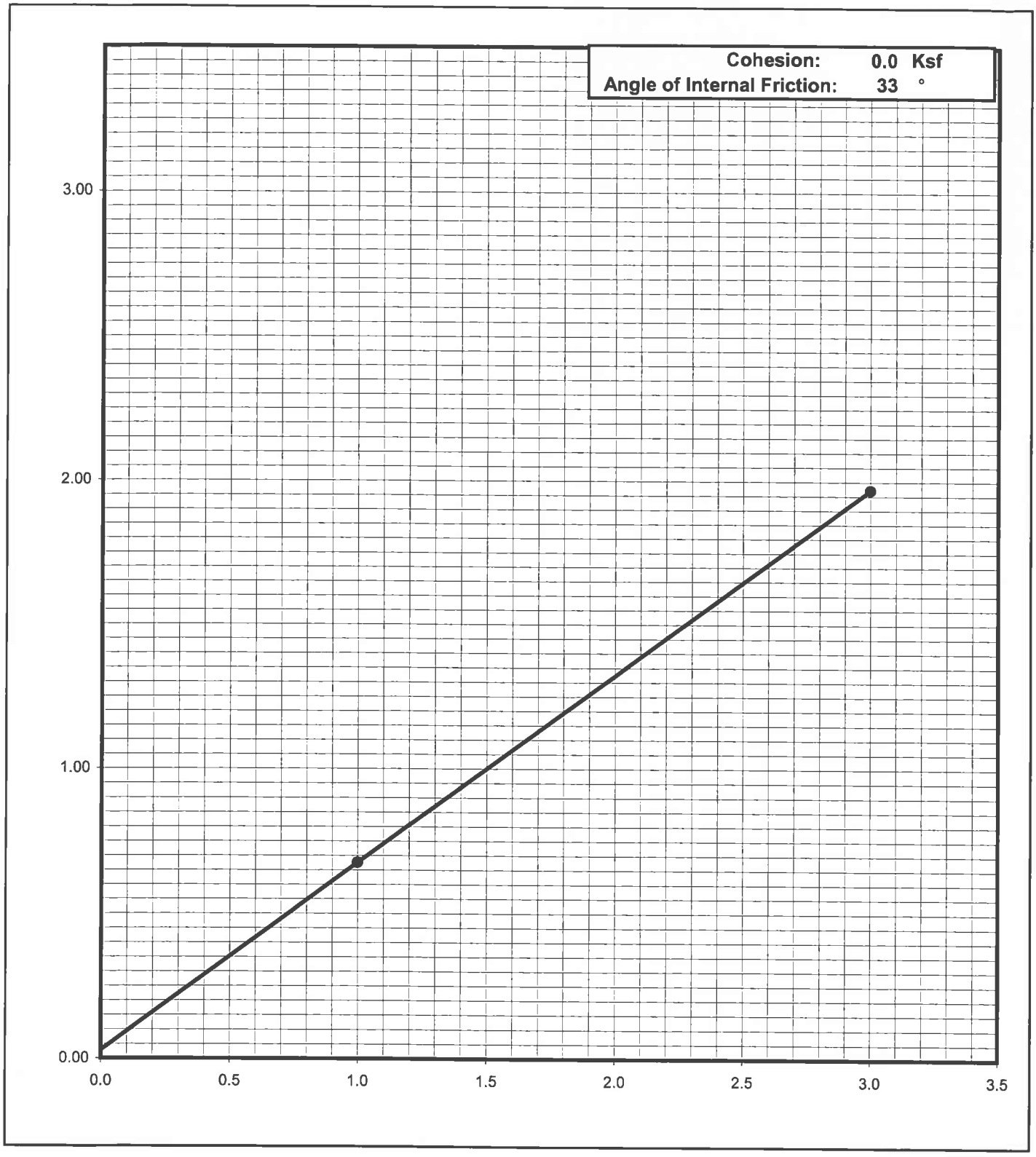
Project Number	Boring No. & Depth	Soil Type	Date
2211039	B9 @ 3-4'	SM	4/20/2011



Krazan Testing Laboratory

Shear Strength Diagram (Direct Shear)
ASTM D - 3080 / AASHTO T - 236

Project Number	Boring No. & Depth	Soil Type	Date
11039	B13 @ 5-6'''	SM	4/20/2011



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Appendix B

APPENDIX B

EARTHWORK SPECIFICATIONS

GENERAL

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including but not limited to the furnishing of all labor, tools, and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans, and disposal of excess materials.

PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of Krazan and Associates, Inc., hereinafter known as the Soils Engineer and/or Testing Agency. Attainment of design grades when achieved shall be certified by the project Civil Engineer. Both the Soils Engineer and the Civil Engineer are the Owner's representatives. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory as determined by both the Soils Engineer and the Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Soils Engineer, Civil Engineer or project Architect.

No earthwork shall be performed without the physical presence or approval of the Soils Engineer. The Contractor shall notify the Soils Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork.

The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner or the Engineers.

TECHNICAL REQUIREMENTS: All compacted materials shall be densified to a density not less than 90 percent relative compaction based on ASTM Test Method D1557 or CAL-216, as specified in the technical portion of the Soil Engineer's report. The location and frequency of field density tests shall be as determined by the Soils Engineer. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Soils Engineer.

SOILS AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the soil report.

The Contractor shall make his own interpretation of the data contained in said report, and the Contractor shall not be relieved of liability under the Contract documents for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including court costs of codefendants, for all claims related to dust or windblown materials attributable to his work.

SITE PREPARATION

Site preparation shall consist of site clearing and grubbing and the preparations of foundation materials for receiving fill.

CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter, and all other matter determined by the Soils Engineer to be deleterious or otherwise unsuitable. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed building areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots larger than 1 inch. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill of tree root excavations should not be permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

SUBGRADE PREPARATION: Surfaces to receive Engineered Fill, building or slab loads shall be prepared as outlined above, excavated/scarified to a depth of 12 inches, moisture-conditioned as necessary, and compacted to 90 percent relative compaction.

Loose soil areas, areas of uncertified fill, and/or areas of disturbed soils shall be moisture-conditioned as necessary and recompacted to 90 percent relative compaction. All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill materials. All areas which are to receive fill materials shall be approved by the Soils Engineer prior to the placement of any of the fill material.

EXCAVATION: All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over-excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence of the Soils Engineer. Material from the required site excavation may be utilized for construction site fills provided prior approval is given by the Soils Engineer. All materials utilized for constructing site fills shall be free from vegetation or other deleterious matter as determined by the Soils Engineer.

PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. However, compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Soils Engineer.

Both cut and fill areas shall be surface-compacted to the satisfaction of the Soils Engineer prior to final acceptance.

SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed fill are as specified.