

**GEOTECHNICAL ENGINEERING
INVESTIGATION REPORT
for the
NORTH STATE GROCERY COLUSA CENTER
PHOTOVOLTAIC INSTALLATION
1017 Bridge Street, Colusa, California**

Prepared for:
Bright Power, Inc.
PO Box 10637
Napa, California 94581
Phone (866) 214-9304

Prepared by:
HOLDREGE & KULL
48 Bellarmine Court, Suite 40
Chico, California, 95928
Phone: (530) 894-2487
Fax: (530) 894-2437

Project No. 70589-04
May 31, 2016



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Project No.: 70589-04

Mr. Kevin Berryhill
Bright Power, Inc.
PO Box 10637
Napa, California 94581
kevin@bpi-power.com

REFERENCE: *North State Grocery Colusa Center Photovoltaic Installation*
1017 Bridge Street
Colusa, Colusa County, California

SUBJECT: *Geotechnical Engineering Investigation Report*

Dear Mr. Berryhill,

Holdrege & Kull (H&K) is pleased to provide geotechnical engineering services for the proposed photovoltaic arrays on the North State Grocery, Colusa Center at the above referenced address.

H&K understands that the photovoltaic arrays will include carport type shade canopy installations within the parking lot. The findings, conclusions, and recommendations presented in this report are based on H&K's literature review, surface observations, subsurface exploration, and our experience with similar projects and sites and conditions in the area. It is our opinion that the site is suitable for the proposed construction provided the geotechnical engineering recommendations presented in this report are incorporated into the proposed improvements.

H&K appreciates the opportunity to provide geotechnical engineering services for this project. If you have questions or need additional information, please do not hesitate to contact the undersigned below at 530-894-2487.

Sincerely,

HOLDREGE & KULL



Shane D. Cummings, CEG 2492
Principal Engineering Geologist



Donald M. Olsen, P.E. 49514
Principal Engineer

Copies To: Addressee (1 electronic version via email)

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Appendices:

- Appendix A, Professional Services Statement of Work for Geotechnical Engineering Services, North State Grocery, Colusa Center, Photovoltaic Installations (excluding fee and contract sections)
- Appendix B, Important Information About Your Geotechnical Investigation Report (Included with permission of ASFE, Copyright 2004).
- Appendix C, Exploratory Boring Logs.
- Appendix D, Soil Laboratory Results

1 INTRODUCTION

Holdrege & Kull (H&K) performed a geotechnical engineering investigation of the proposed photovoltaic (PV) array sites to be located at the North State Grocery, Colusa Center (NSG2 Colusa), 1017 Bridge Street, in Colusa, California. The work performed is consistent with the scope of services presented in the proposed scope of work and contract agreement executed on April 21, 2016. A copy of the scope of work, excluding the fee and contract sections, is included in Appendix A.

For your review, Appendix B presents a document prepared by ASFE entitled "*Important Information About Your Geotechnical Engineering Report.*" This document summarizes project specific factors, limitations, content interpretation, responsibilities, and other pertinent information. Please read this document carefully.

1.1 SCOPE-OF-SERVICES

H&K performed a specific scope-of-services to develop geotechnical engineering design recommendations for earthwork and structural improvements and to identify potential conditions that may negatively impact the site and require design mitigation. Brief descriptions of each work scope task performed for the geotechnical engineering investigation are presented below. A detailed description of each work scope task is presented in Section 2 (Site Investigation) of this report.

- **Task 1, Site Investigation:** H&K performed a site investigation to characterize the existing surface and subsurface soil, rock, and groundwater conditions encountered to the maximum depth drilled and explored. H&K's field engineer made observations, collected representative soil samples, and performed field tests at a limited number of subsurface exploratory locations. H&K performed laboratory tests on selected soil samples to evaluate their geotechnical engineering material properties.
- **Task 2, Data Analysis and Engineering Design:** H&K evaluated the field and laboratory data, reviewed the proposed site improvements, and used this information to develop geotechnical engineering design recommendations for the proposed improvements.
- **Task 3, Report Preparation:** H&K prepared this report to present our findings, conclusions and recommendations for the proposed improvements.

1.2 SITE LOCATION AND DESCRIPTION

The NSG2 Colusa site is located at 1017 Bridge Street, in Colusa, California. The site is centered at approximately latitude 39.205° North and longitude -122.003° and an elevation of approximately 55 feet above mean sea level. Figure 1 shows the site location and near vicinity. The property is a generally rectangular shaped parcel developed with a shopping center and grocery store. Bridge Street is situated along

the western property boundary, Carson Street is situated along the northern property boundary, and the east and south property boundaries have mixed commercial and residential properties.

At the time that our site investigation was performed on May 9, 2016 the site conditions and improvements consisted of a flat lying parking lot with flat lying topography surrounding the shopping center and grocery store buildings. Existing surface improvements at the proposed NSG2 Colusa PV installation site includes an asphalt concrete (AC) paved parking lot and delivery truck drive route.

1.3 PROPOSED IMPROVEMENTS

The photovoltaic arrays will be constructed using pier foundations with design dimensions depending on the subsurface soil and rock conditions encountered at the site. Based on our experience with similar projects, we anticipate that the critical design loading for the structures will result from transient wind loading. Based on past experience with similar PV shade structures, H&K understands that the carport shade canopy PV arrays will be supported by cast-in-drill-hole (CIDH) concrete piers with hollow structural shape (HSS) steel columns and cantilevered beams. H&K assumes the proposed carport array will utilize a T-style array with a center column and cantilevered beams that support the purlin and PV modules.

1.4 INVESTIGATION PURPOSE

The purpose of our investigation was to obtain information about the soil, rock and groundwater conditions likely to be encountered at the site to allow us to prepare geotechnical engineering design recommendations for the proposed improvements. H&K did not evaluate the site for the presence of hazardous waste, mold, asbestos, and radon gas. Therefore, the presence and removal of these materials are not discussed in this report.

2 SITE INVESTIGATION

H&K performed a site investigation to characterize the existing subsurface conditions beneath the proposed NSG2 Colusa to develop geotechnical engineering recommendations for earthwork and structural improvements. Each component of our site investigation is presented below.

2.1 LITERATURE REVIEW

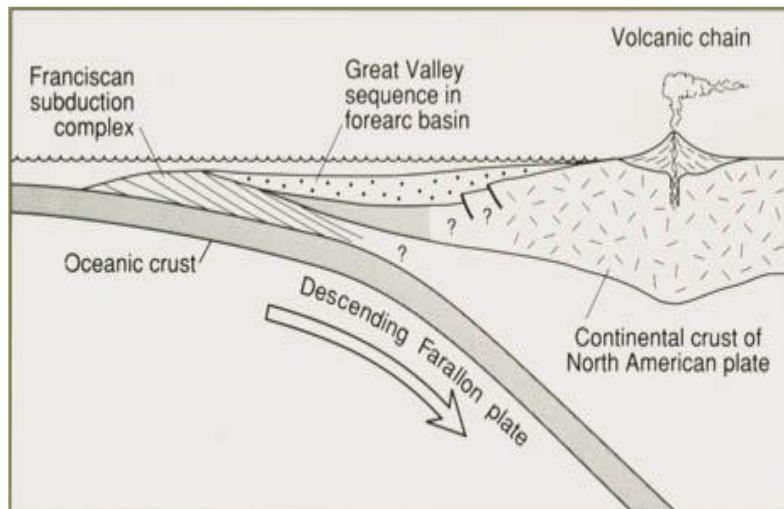
H&K performed a limited review of available literature that was pertinent to the project site. The following summarizes our findings.

2.1.1 Site Improvement Plan Review

The site improvement plans were not available at the time this report was prepared. Prior to implementing grading and site improvements, H&K should be allowed to review the final plans to determine whether our recommendations have been implemented, and if necessary, to provide additional and/or modified recommendations.

2.1.2 Geologic Setting and Regional Faulting

The subject property is situated in the northern Sacramento Valley within the Great Valley geologic province west of the boundary with the Cascade geologic province and east of the boundary of the Coast Range geologic province. The Great Valley geologic province is characterized as an asymmetrical synclinal trough filled with sequences of up to 80,000 feet thick of Jurassic age (138 to 205 million years before present [mybp]) and Eocene age (38 to 55 mybp) marine sedimentary units deposited during periods of inundation, and Pliocene age (2 to 5 mybp) to recent



Holocene age (present to 11,000 years before present) terrestrial sediments originating from the Sierra Nevada, Cascade, and Coast Mountain Ranges during sea recession and periods of mountain uplift. The inset figure shows a generalized geologic cross-section of the ancient Great Valley depositional environment consisting of a forearc basin situated where the Farallon Oceanic Plate plunges beneath the North American Continental Plate.

In the central part of the Sacramento Valley, a mantle of Tertiary age (2 to 63 mybp) and Quaternary age (present to 2 mybp) detrital continental deposits overlie the Great Valley sequence; these deposits, which are derived from the Coast Range mountains to the west, grade eastward into coeval volcanic materials derived from the Cascade Range province (Blake, et al, 2009).

The *Geologic Map of California* published by the California Geological Survey, indicates that the geology immediately underlying the subject site consists of non-marine (continental) sedimentary alluvial deposits which were deposited during the Pleistocene to Holocene Epoch (1.5 Million Years to 11,000 before present). (Jennings, Charles W., 1977).

Regional faulting is associated with the northern extent of the Foothill Fault System and the northern section of the Great Valley Fault Zone. The 1997 edition of California Geological Survey Special Publication 43, *Fault Rupture Hazard Zones in California*, describes active faults and fault zones (activity within 11,000 years), as part of the Alquist-Priolo Earthquake Fault Zoning Act. This map and document indicates that the site is not located within an Alquist-Priolo active fault zone.

H&K reviewed the Official Maps of Earthquake Fault Zones delineated by the California Geological Survey through December 2010, on the internet at http://www.quake.ca.gov/gmaps/ap/ap_maps.htm. These maps are updates to Special Publication 42, Interim Revision 2007 edition *Fault Rupture Hazard Zones in California*, which describes active faults and fault zones, as part of the Alquist-Priolo Earthquake Fault Zoning Act. Special Publication 42 and the 2010 on-line update indicate that the site is not located within an Alquist-Priolo active fault zone. Currently there are no proposed earthquake fault zone maps in the immediate area of Colusa, California.

The 2010 Fault Activity Map of California by the California Geological Survey, Geologic Data Map No. 6 (<http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html#>) shows the nearest known active faults with surface displacement within Holocene time (about the last 11,000 years). The Dunnigan Hill Fault, located approximately 30 miles south of the subject site and the Bartlett Springs Fault, located approximately 40 miles west of the subject site show evidence of Holocene faulting, and the Cleveland Hills Fault, located approximately 20 miles to the east-southeast of the subject site, is associated with ground surface rupture during the 1975 Oroville earthquake.

The nearest fault without documented Quaternary displacement is an unnamed fault associated with the Sutter Buttes approximately 8 miles east-southeast.

2.2 FIELD INVESTIGATION

H&K performed a field investigation of the site on May 9, 2016. H&K's Field Engineer described the surface and subsurface soil, rock, and groundwater conditions observed at the site using the procedures cited in the American Society for Testing and Materials (ASTM), Volume 04.08, "Soil and Rock; Dimension Stone; and Geosynthetics" as general guidelines for our field and laboratory procedures. The Field Engineer described the soil color using the general guideline procedures presented in the Munsell Soil Color Chart. Engineering judgment was used to extrapolate the observed surface and subsurface soil, rock, and groundwater conditions to areas located between and beyond our subsurface exploratory locations. The surface, subsurface, and groundwater conditions observed during our field investigation are summarized below.

2.2.1 Surface Conditions

H&K observed the following surface conditions during our field investigation of the property. Figure 2 shows the project site boundaries and our subsurface exploration location. The site asphalt concrete parking lot is generally flat lying with minor grade breaks to accommodate storm water drainage. The asphalt was in good conditions with no signs of subgrade distress, failure, or settlement. There were no surface conditions of concern identified during our site investigation.

2.2.2 Subsurface Conditions

The subsurface soil, rock and groundwater conditions were investigated by drilling exploratory borings and performing a seismic refraction microtremor (ReMi) survey at the site. The subsurface information obtained from these investigation methods are described herein.

2.2.2.1 Exploratory Boring Information

H&K provided engineering oversight for the advancement of two exploratory soil borings at the project site with a truck mounted CME 75; drill rig equipped with 7.25-inch-outside diameter, hollow stem augers (boring B16-1) and 6-inch-outside diameter solid stem augers (boring B16-2). Figure 2 shows the approximate location of the subsurface exploratory borings. The borings were advanced to a depth of 18 feet below ground surface (bgs). Engineering judgment was used to extrapolate the observed soil, rock, and groundwater conditions to areas located between and beyond our subsurface exploratory borings.

H&K's Field Engineer logged each exploratory boring using the Unified Soils Classification System (USCS) as guidelines for soil descriptions and the American Geophysical Union guidelines for rock descriptions. Representative relatively undisturbed soil samples were collected at 2.5 feet bgs then 5 feet bgs and continued at 5-foot-depth intervals bgs for the entire depth of the exploratory borings. Relatively undisturbed soil samples were collected with a 2.5-inch-inside-diameter, split-spoon

sampler equipped with steel liner sample tubes and with an unlined standard penetration test (SPT) split barrel sampler. The samplers were driven into the soil using a 140 pound automatic trip hammer with a 30-inch-free fall. The steel liner tube samples were sealed with end-caps, labeled and transported to our soil laboratory facility.

Selected soil samples were tested in H&K's laboratory to determine their engineering material properties which included: natural moisture content, density and particle size gradation. These soil engineering material properties were used to develop the geotechnical engineering recommendations that are presented herein for: foundation.

Detailed descriptions of the soil, rock, and groundwater conditions that were encountered in each subsurface exploratory location are presented on the exploratory boring logs included in Appendix C. The soil and rock descriptions are based on visual field estimates of the particle size percentages (by dry weight), color, relative density or consistency, moisture content, and cementation that comprise each soil material encountered.

A generalized profile of the soil, rock, and groundwater conditions encountered to the maximum depth drilled (18 feet) for the proposed PV array area is presented below. The soil and/or rock units encountered in our subsurface exploratory borings were generally stratigraphically continuous across the site; however, the units may vary slightly in thickness. The units encountered in general stratigraphic sequence during our subsurface investigation of the site are described below.

- **ML, Low Plasticity Silt Soil:** This soil consists of the following field estimated particle size percentages 40 percent fine to medium sand, and 60 percent low plasticity clay and silt size particles. This soil is predominantly brown with a Munsel Color Chart designation of (7.5YR 4/3). This soil was medium stiff and damp at the time of our subsurface investigation.
- **CL, Low Plasticity Clay Soil:** This soil consists of the following field estimated particle size percentages 20 percent fine sand, and 80 percent low to medium plasticity clay and silt size particles. This soil is predominantly brown with a Munsel Color Chart designation of (7.5YR 4/4). This soil was soft to medium stiff and damp to wet at the time of our subsurface investigation.

2.2.2.2 Seismic Refraction Survey

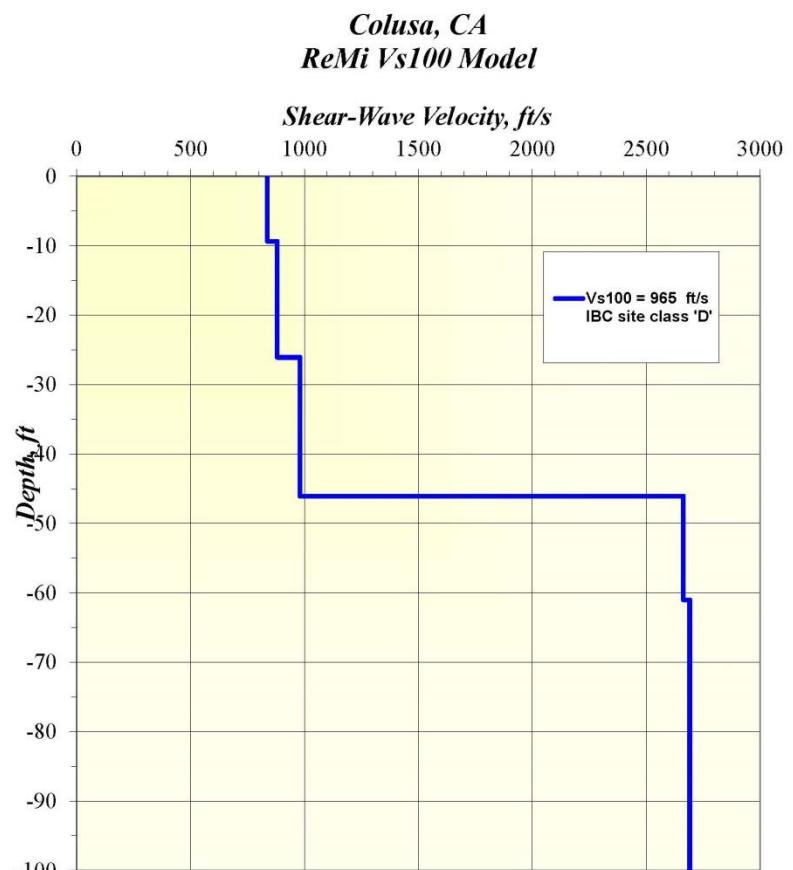
H&K performed a seismic refraction microtremor survey in the City of Colusa, California. The survey is located in southern Colusa, approximately 5,000 feet west and southwest of the solar array and within the same geologic units. The refraction survey was performed on the site using the SeisOpt® ReMi™ Vs30 method to determine the in-situ shear-wave (S-wave) velocity profile of the first 100 feet of soil beneath the site.

SeisOpt® ReMi™ Vs30 method was used to determine the 2013 California Building Code (CBC) Site Class in accordance with Chapter 16, Section 1613.3.2 and Chapter 20 of ASCE 7-10. The seismic refraction survey was performed at the surface using conventional seismograph and vertical P-wave geophones used for refraction surveys. The seismic source consists of ambient seismic microtremors which were constantly being generated by cultural and natural noise in the area. H&K recorded the seismic vibrations generated by vehicle traffic along Highway 20 and other roadways, and industrial operations in the area during the site investigation. The data was collected during a series of 20 recording periods that were each 30 seconds in duration. The Vs Model (depicted on this page) shows the subsurface shear-wave velocity profile that was developed for the site from the SeisOpt® ReMi™ data.

The resulting subsurface shear wave model for the site indicates that the harmonic mean seismic shear wave velocity for the upper 100 feet of the subsurface was 965 feet per second (ft/s). This weighted shear wave velocity corresponds to the upper range of Site Class D which represents stiff soil profiles.

2.2.2.3 Groundwater Conditions

Groundwater was encountered at depths of approximately 13.5 and 14.4 feet bgs in the exploratory borings drilled at the site, respectively. Seasonal fluctuations in the local groundwater table at the project site and vicinity are unknown at this time;



however it is generally understood that the groundwater table elevation is highest at the end of the winter rainy season and lowest at the end of the summer dry season. Based on a review of shallow groundwater data from monitoring wells situated northwest of the subject site at the northeast corner of the intersection of Bridge Street and Carson Street, approximately 200 feet away, indicates that the groundwater level ranged from approximately 11 to 18 feet below ground surface and the flow direction is generally to the southeast.

3 LABORATORY TESTING

H&K performed laboratory tests on selected soil samples taken from the subsurface exploratory borings to determine their engineering material properties. These engineering material properties were used to develop geotechnical engineering design recommendations for earthwork and structural improvements. The following laboratory tests were performed using the cited American Society for Testing and Materials (ASTM) and Caltrans Test Method (CTM) guideline procedures:

- ASTM D422, Particle Size Gradation (Sieve and Hydrometer Methods)
- ASTM D2216, Moisture Content
- ASTM D2487, Soil Classification by the USCS
- ASTM D2488, Soil Description (Visual Manual Method)
- ASTM D2937, Density
- ASTM D4318, Atterberg Indices
- ASTM D2166, Unconfined Compressive Strength

Table 3-1 presents a summary of the laboratory test results. Appendix D presents the laboratory test data sheets.

Table 3-1. Laboratory Test Results

Results										
ASTM No.			D2487 D2488	D2216	D2937	D422		D4318		D2166
Boring No.	Sample No.	Sample Depth (feet)	USCS (sym)	Moisture Content (%)	Dry Density (pcf)	Passing No. 4 (%)	Passing No. 200 (%)	Plasticity Index	Liquid Limit (%)	Unconfined Compression (psf)
B16-1	L1-1-2	2.5	CL-ML			100	70.5	5	23	
B16-1	L2-1-2	5.5	CL	19.5	108					2,908
B16-1	L3-1-2	10	CL	22.9	103.5					4,925
B16-1	L3-2-2	10	CL			100	98.5	18	3.7	
B16-1	L4-1-2	15	CL	34.2	88.9					
B16-2	L2-1-2	5	CL	25.2	101.1					
B16-2	L3-1-2	10	CL	22.7	106.1					

Notes:
ASTM = American Society for Testing and Materials
CTM = Caltrans Test Method
dim = dimensionless units

No. = number
pcf = pounds per cubic foot
sym = symbol
% = percent

4 CONCLUSIONS

The conclusions presented below are based on information developed from our field and laboratory investigations.

1. It is our opinion that the site is suitable for the proposed construction improvements provided that the geotechnical engineering design recommendations presented in this report are incorporated into the earthwork and structural improvement project plans.
2. Prior to construction, H&K should be allowed to review the proposed final earthwork grading plan and structural improvement plans to determine if our geotechnical engineering recommendations are applicable or need modifications.
3. Based on the site geology, the observations of our exploratory borings, and the SeisOpt ReMi Vs30 shear-wave profile analysis, the site soil profile can be modeled, according to the 2010 CBC, Chapter 16A, Table 1613A.5.2, and Section 1613A.5.5, as a Site Class D (stiff soil profile) designation for the purposes of establishing seismic design loads for the proposed improvements.
4. Based on our literature review and knowledge of the geology in the Colusa, California area, no active or potentially active faults are known to underlie the site.
5. Based on the subsurface exploratory boring sampler blow counts, field data, and literature review, H&K believes that the site soil and groundwater conditions makes the probability of liquefaction occurring during a nearby earthquake to be low.
6. At the time of our investigation the site consisted of a relatively flat lying asphalt concrete parking lot for a shopping complex and grocery store. The surrounding land use is mixed commercial and residential.
7. The soil conditions observed to a maximum depth of 18 feet below the existing ground surface in our subsurface exploratory borings generally consisted of (described relative to the existing ground surface): brown, soft, damp, sandy silty (ML), and brown, firm damp to wet, sandy clay (CL).
8. The field and laboratory test data indicates that the soil underlying the project site generally consists of the following geotechnical engineering material properties: firm, damp, and moderate skin friction and lateral bearing capacity, moderate lateral resistance, with very low expansion potential (volume change).
9. At the time of our subsurface site investigation, groundwater was encountered at a depth of approximately 13 to 14 feet bgs.

5 RECOMMENDATIONS

The following geotechnical engineering recommendations are based on our understanding of the project as currently proposed, our field observations, the results of our laboratory testing program, engineering analysis, and our experience in the area. Because excavation, fill placement, and the construction of occupied structures are not proposed as a part of this project, we are not providing detailed geotechnical recommendations addressing aspects of construction typically addressed, such as stripping and grubbing, the placement of fills or recommendations regarding asphalt placement, concrete slab-on-grade construction, or similar topics typically included in geotechnical reports. We can provide recommendations addressing these topics, if requested.

5.1 GRADING

Because the site improvements will be mainly limited to the AC parking lot, our grading recommendations presented herein are limited to underground utility trenches, construction de-dewatering, subsurface drainage, review of construction plans, and construction quality assurance/quality control (QA/QC) monitoring. Our grading recommendations are presented below.

5.1.1 Temporary Excavations

All temporary excavations must comply with applicable local, state and federal safety regulations, including the current Occupational Safety and Hazards Administration (OSHA) excavation and trench safety standards. Construction site safety is the responsibility of the contractor, who is solely responsible for the means, methods, and sequencing of construction operations. Under no circumstances should the findings, conclusions and recommendations presented herein be inferred to mean that H&K is assuming any responsibility for temporary excavations, or for the design, installation, maintenance, and performance of any temporary shoring, bracing, underpinning or other similar systems. H&K can provide observation of the subsurface conditions revealed in temporary excavations and recommendations for shoring systems, if requested.

5.1.2 Underground Utility Trenches

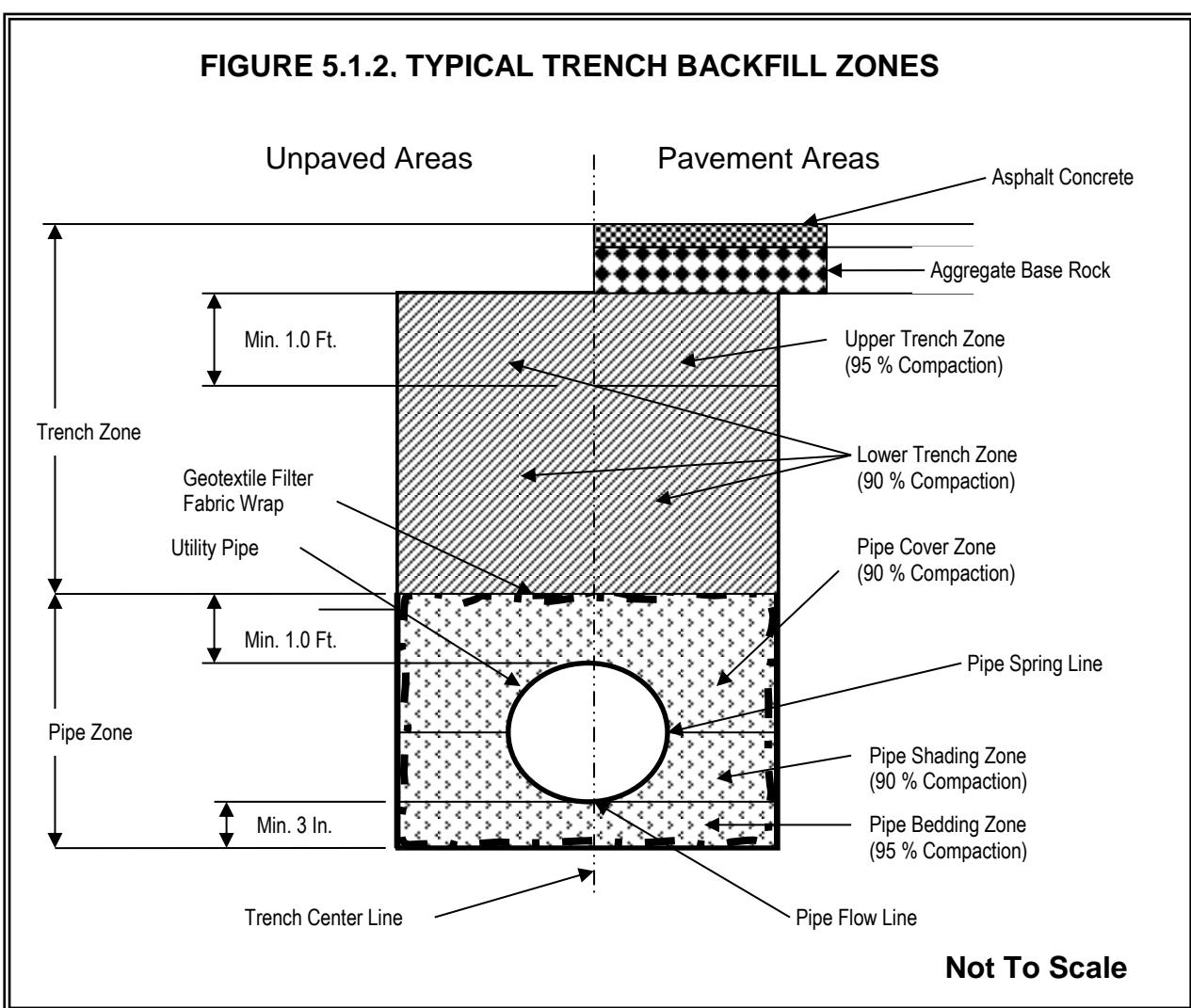
Underground utility trenches should be excavated and backfilled as described below for each trench zone as shown in the figure below.

1. **Trench Excavation Equipment:** H&K anticipate that the contractor will be able to excavate shallow (up to 3 feet bgs) underground utility trenches with a Case 580 Backhoe or equivalent, however, deeper utility trenches (6-feet or greater) may require larger equipment.
2. **Trench Shoring:** All utility trenches that are excavated deeper than 4 feet below the surrounding ground surface are required by the California Occupational Safety

and Health Administration (OSHA) to be shored with bracing equipment or sloped back to an appropriate slope gradient prior to being entered by any individuals.

3. **Trench Dewatering:** H&K does not anticipate that the proposed shallow underground utility trenches will encounter shallow groundwater. However, if the utility trenches are excavated during the winter rainy season, then shallow or perched ground water may be encountered. The earthwork contractor may need to employ de-watering methods as discussed in Section 5.1.3 in order to excavate, place and compact the trench backfill materials.
4. **Pipe Zone Backfill Type and Compaction Requirements:** The backfill material type and compaction requirements for the pipe zone which includes the bedding zone, shading zone and cover zone as shown in the Figure 5.1.2 are described below.

FIGURE 5.1.2. TYPICAL TRENCH BACKFILL ZONES



- **Pipe Zone Backfill Material Type:** Trench backfill used within the pipe zone which includes the bedding zone, shading zone and cover zone should consist of $\frac{3}{4}$ -inch minus, washed, and crushed rock. The crushed rock particle size gradation should meet the following requirements (percents are expressed as dry weights using ASTM D422 test method): 100 percent passing the $\frac{3}{4}$ inch sieve, 80 to 100 percent passing the $\frac{1}{2}$ inch sieve, 60 to 100 percent passing the $\frac{3}{8}$ inch sieve, 0 to 30 percent passing the No. 4 sieve, 0 to 10 percent passing the No. 8 sieve, and 0 to 3 percent passing the No. 200 sieve. If ground water is encountered within the trench during construction or if it is expected to rise during the rainy season to a elevation that will infiltrate the pipe zone within the trench, then the pipe zone material should be wrapped with a minimum 6 ounce per square yard, non-woven, geotextile filter fabric such as Mirafi 140 or equivalent should be used.. The geotextile seam should be located along the trench centerline and have a minimum 1-foot overlap.
 - **Pipe Bedding Zone Compaction:** Trench backfill soil placed in the pipe bedding zone (beneath the utilities) should be a minimum 3-inches thick, moisture conditioned to within ± 3 percentage points of the ASTM D1557 optimum moisture content and compacted to achieve a minimum relative compaction of 95 percent of the ASTM D1557 maximum dry density.
 - **Pipe Shading Zone Compaction:** Trench backfill soil placed within the pipe-shading zone (above the bedding zone and to a height of one pipe radius length above the pipe spring line) should be moisture conditioned to within ± 3 percentage points of the ASTM D1557 optimum moisture content and compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density. The pipe shading zone backfill material should be shovel sliced to remove voids and to promote compaction.
 - **Pipe Cover Zone Compaction:** Trench backfill soil placed within the pipe cover zone (above the pipe shading zone to one foot over the pipe top surface) should be moisture conditioned to within ± 3 percentage points of the ASTM D1557 optimum moisture content and compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.
5. **Trench Zone Backfill And Compaction Requirements:** The trench zone backfill materials consists of both lower and upper zones as discussed below.
- **Trench Zone Backfill Material Type:** Soil used as trench backfill within the lower and upper intermediate zones as shown on the preceding figure should consist of non-expansive soil with a plasticity index (PI) of less than or equal to 15 ($PI \leq 15$) based on ASTM D4318 and should not contain rocks greater than 3 inches in greatest dimension.
 - **Lower Trench Zone Compaction:** Soil used to construct the lower trench zone backfills should be uniformly moisture conditioned to within

0 to 4 percentage points of the ASTM D1557 optimum moisture content, placed in maximum 12-inch-thick loose lifts (layers) prior to compacting and compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.

- **Upper Trench Zone Compaction (Road And Parking Lot Areas):** Soil used to construct the upper trench zone backfills should be uniformly moisture conditioned to within 0 to 4 percentage points greater than the ASTM D1557 optimum moisture content, placed in maximum 8-inch-thick loose lifts (layers) prior to compacting and compacted to achieve a minimum relative compaction of 95 percent of the ASTM D1557 maximum dry density.
 - **Upper Trench Zone Compaction (Non-Road And Non Parking Lot Areas):** Soil used to construct the upper trench zone backfills should be uniformly moisture conditioned to within 0 to 2 percentage points greater than the ASTM D1557 optimum moisture content, placed in maximum 6-inch-thick loose lifts (layers) prior to compacting and compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.
6. **CQA Testing And Observation Engineering Services:** The moisture content, dry density, and relative percent compaction of all engineered utility trench backfills should be tested by project engineer's field representative during construction to evaluate whether the compacted trench backfill material meet or exceed the minimum compaction and moisture content requirements presented in this report. The earthwork contractor shall assist the project engineer's field representative by excavating test pads with the on-site earth moving equipment.
- **Compaction Testing Frequencies:** The field and laboratory CQA tests should be performed consistent with the testing frequencies presented in Table 5.1.2 or as modified by the project engineer to better suit the site conditions.

Table 5.1.2, Minimum Testing Frequencies For Utility Trench Backfill

ASTM No.	Test Description	Minimum Test Frequency ⁽¹⁾
D1557	Modified Proctor Compaction Curve	1 per 500 CY ⁽¹⁾ Or Material Change ⁽²⁾
D2922	Nuclear Moisture Content	1 per 100 LF per 12-Inch-Thick Compacted Backfill Layer ⁽³⁾ The maximum loose lift thickness shall not exceed 12-inches prior to compacting.
D3017	Nuclear Density	1 per 100 LF per 12-Inch-Thick Compacted Backfill Layer ⁽³⁾ The maximum loose lift thickness shall not exceed 12-inches prior to compacting.

Notes:

(1) These are minimum testing frequencies that may be increased or decreased at the project engineer's discretion on the basis of the site conditions encountered during grading.

(2) CY = cubic yards.

(3) Whichever criteria provide the greatest number of tests

5.1.3 Utility Trench Construction De-watering

H&K does not anticipate the need to perform de-watering of the site during utility installation, but could encounter groundwater during deep foundation construction. The earthwork contractor should be prepared to de-water the drilled foundation excavations and any other excavations if perched water or the groundwater table are encountered during construction and prior to placement of concrete.

5.1.4 Soil Corrosion Potential

The selected materials used for constructing underground utilities should be evaluated by a corrosion engineer for compatibility with the onsite soil and groundwater conditions. H&K perform minimal testing to determine the corrosion potential of the shallow soils in Colusa that are anticipated to be in contact with the underground pipes and concrete structures associated with the improvements. Based on these limited tests (i.e., Redox, pH, resistivity, chloride, and sulfate) it is our opinion that the corrosion potential of the soil is corrosive. Buried iron and steel materials should be properly protected against corrosion depending on the critical nature of the structure. H&K recommends that the owner contract with a corrosion engineer to evaluate the corrosion potential of the soil relative to the materials to be used to construct the associated underground utilities.

5.1.5 Subsurface Groundwater Drainage

The contractor should expect to encounter groundwater in deep foundations (greater than 11 feet bgs) and during the wet weather season construction. The contractor may need to dewater the deep foundations prior to placing concrete, or pump the concrete using a tremie pipe set at the bottom of the deep foundation excavation to displace the water as the concrete is placed. If necessary, H&K could observe the conditions and provide site-specific de-watering recommendations.

5.1.6 Project Plan Review and Construction Monitoring

Construction quality assurance includes review of plans and specifications and performing construction monitoring as described below.

1. H&K should be allowed to review the final earthwork grading improvement plans prior to commencement of construction to determine whether our recommendations have been implemented, and if necessary, to provide additional and/or modified recommendations.
2. H&K should be allowed to perform CQA monitoring of all earthwork grading performed by the contractor to determine whether our recommendations have been implemented, and if necessary, to provide additional and/or modified recommendations.
3. Our experience, and that of our engineering profession, clearly indicates that during the construction phase of a project the risks of costly design, construction

and maintenance problems can be significantly reduced by retaining the design geotechnical engineering firm to review the project plans and specifications and to provide geotechnical engineering CQA observation and testing services. If H&K is not retained to provide geotechnical engineering CQA services during the construction phase of the project, then H&K will not be responsible for geotechnical engineering CQA services provided by others nor any aspect of the project that fails to meet your or a third party's expectations in the future.

5.2 STRUCTURAL IMPROVEMENTS

H&K's structural improvement design criteria recommendations include: seismic design parameters, and CIDH pier foundations.. These recommendations are presented here after.

5.2.1 Seismic Design Parameters

H&K developed the code-based seismic design parameters in accordance with Section 1613 and 1614 of the 2013 CBC and the USGS, *U.S. Seismic "DesignMaps" Web Application, Version 3.1.0*. The internet based application can be found at (<https://geohazards.usgs.gov/secure/designmaps/us/>) and is used for determining seismic design values from ASCE/SEI-7-10 (erratum released July, 2013), the 2012 International Building Code (2013 CBC). The spectral acceleration, site class, site coefficients and adjusted maximum considered earthquake (MCE) spectral response acceleration, and design spectral acceleration parameters are presented in the following Table 5.2.1.

Table 5.2.1-1 2013 CBC Seismic Design Parameters

Description	Value	Reference
Latitude	39.205 deg	Google Earth
Longitude	-122.003 deg	Google Earth
Site Coefficient, F_A	1.183	2013 CBC, Table 1613.5.3(1), USGS, USSDM, v 3.1.0, 2013
Site Coefficient, F_V	1.738	2013 CBC, Table 1613.5.3(2), USGS, USSDM, v 3.1.0, 2013
Site Class (Stiff Soil Profile)	D	2013 CBC, Section 1613.5.2, Table 1613.5.2
Short (0.2 sec) Spectral Response, S_S	0.792 g	2013 CBC, Figure 1613.5(3), USGS, USSDM, v 3.1.0, 2013
Long (1.0 sec) Spectral Response, S_1	0.331 g	2013 CBC, Figure 1613.5(4), USGS, USSDM, v 3.1.0, 2013
Short (0.2 sec) MCE Spectral Response, S_{MS}	0.937 g	2013 CBC, Section 1613.5.3, USGS, USSDM, v 3.1.0, 2013
Long (1.0 sec) MCE Spectral Response, S_{M1}	0.575 g	2013 CBC, Section 1613.5.3, USGS, USSDM, v 3.1.0, 2013
Short (0.2 sec) Design Spectral Response, S_{DS}	0.625g	2013 CBC, Section 1613.5.4, USGS, USSDM, v 3.1.0, 2013
Long (1.0 sec) Design Spectral Response, S_{D1}	0.383 g	2013 CBC, Section 1613.5.4, USGS, USSDM, v 3.1.0, 2013
deg = degrees	sec = second	
CBC = California Building Code	USSDM = U.S. Seismic Design Maps	
MCE = Maximum Considered Earthquake	USGS = United States Geological Survey	

5.2.1 CIDH Pier Foundation Systems

H&K recommends that the foundation systems for the proposed PV structures utilize CIDH piers. Based on the soft sandy silt (ML) and sandy clay (CL) soils encountered in the borings, H&K recommends the following.

1. H&K recommends for design of the CIDH piers that the soil conditions onsite be modeled as consisting of an approximate 5-foot-thick layer of soft sandy silt possessing an in place wet unit weight of 120 pounds per cubic foot (pcf), an internal friction angle of 28 degrees, and a cohesion of 1,500 pounds per square foot (psf). Below this depth, we recommend that the soil be modeled as sandy clay (CL) possessing an in place wet unit weight of 125 pcf, an internal friction angle of 26 degrees, and a cohesion of 2,000 psf. At the option of the designer, the cohesion of the soil profile may be considered when resisting short duration, transient loads such as wind and seismic.
2. H&K recommends that the upper two feet of soil be ignored for design of both axial bearing and uplift CIDH pier capacities and for design of lateral resistance capacities of the CIDH piers. However, the weight of the upper 2 feet of soil can be considered when calculating the friction and lateral resistance of the soil below depths of 2 feet.
3. H&K recommends for CIDH pier design methods employing lateral bearing approaches, such as the traditional CBC approach for constrained or non-constrained foundations, that an allowable lateral bearing (passive) pressure of 200 pounds per square foot, per foot of depth below the ground surface, be used for long-duration loads. For short term, dynamic loading such as would result from wind or seismic events, an allowable lateral bearing (active) pressure of 400 pounds per square foot, per foot of depth may be used. The use of this relatively high value assumes that the proposed PV structures would not be adversely impacted by an approximate $\frac{1}{2}$ -inch displacement at the ground surface due to short term lateral loads. If this magnitude of displacement is considered excessive for the proposed installation, then the recommended values above should be reduced by 50 percent or a more detailed foundation analysis including evaluation of lateral deflection should be performed.
4. H&K's experience has revealed that the CBC constrained and non-constrained equations are often conservative for CIDH piers and drilled shafts, and do not provide an estimate of pier deflection under lateral loading. H&K can provide a more detailed review of pier performance under lateral loading, including an estimate of deflection, if requested, once pier reactions and design has been established.
5. For depths greater than 6 feet below the ground surface, we recommend that an allowable end bearing capacity of 3,000 pounds per square foot be used for CIDH pier design. This value may be increased by a factor of 1.33 for transient or dynamic loads such as wind or seismic loads. In order to utilize end bearing

values for CIDH pier design, the excavations must be cleaned thoroughly with a spin bucket capable of removing loose material from the bottom of the shaft. If end bearing is used for the design, skin friction should be considered as an additional factor of safety.

6. The structural engineer of record should design the pier dimension, reinforcing steel, and connections between the foundation system and the structure.

6 REFERENCES

The following presents the references cited in this report:

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7 LIMITATIONS

The following limitations apply to the findings, conclusions and recommendations presented in this report:

1. This report was prepared to provide information to BPi for design purposes.
2. This report should not be relied upon without review by H&K if a period of 24 months elapses between the issuance report date shown on the signature and stamp page of this report and the date when construction commences.
3. Our professional services were performed consistent with the generally accepted geotechnical engineering principles and practices employed in northern California. No warranty is either expressed or implied.
4. H&K provided engineering services for the site project consistent with the work scope and contract agreement presented in our proposal and agreed to by our client. The findings, conclusions and recommendations presented in this report apply to the conditions existing when H&K performed our services and are intended only for our client, purposes, locations, time frames, and project parameters described herein. H&K is not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to completing our services. H&K does not warrant the accuracy of information supplied by others, or the use of segregated portions of this report. This report is solely for the use of our client unless noted otherwise. Any reliance on this report by a third party is at the party's sole risk.
5. If changes are made to the nature or design of the project as described in this report, then the conclusions and recommendations presented in this report should be considered invalid by all parties. The validity of the conclusions and recommendations presented in this report can only be made by H&K; therefore, H&K should be allowed to review all project changes and prepare written responses with regards to their impacts on the conclusions and recommendations presented in this report. However, additional fieldwork and laboratory testing may be required for H&K to develop any modifications to the recommendations presented in this report. The cost to review project changes and perform additional fieldwork and laboratory testing necessary to modify the recommendations presented in this report is beyond the scope-of-services presented in this report. Any additional work will be performed only after receipt of an approved scope-of-work, budget, and written authorization to proceed.
6. The analyses, conclusions and recommendations presented in this report are based on the site conditions as they existed at the time H&K performed the surface and subsurface field investigations. H&K assumed that the subsurface soil and groundwater conditions encountered at the location of the exploratory borings are generally representative of the subsurface conditions throughout the entire project site. However, if the actual subsurface conditions encountered

during construction are different than those described in this report, then H&K should be notified immediately so that an H&K representative can review these differences and, if necessary, modify the recommendations presented in this report.

7. The elevation or depth to the groundwater table underlying the project site may differ with time and location. Therefore, the depth to the groundwater table encountered in our exploratory borings is only representative of the specific time and location where it was observed.
8. The project site map shows the approximate locations of the H&K exploratory borings and/or trenches as determined by pacing distances from identifiable site features; therefore, their locations should not be relied upon as being exact nor located with the accuracy of a California licensed land surveyor.
9. Our geotechnical investigation scope-of-services did not include an evaluation of the project site for the presence of hazardous materials. Although, H&K did not observe the presence of hazardous materials at the time of our field investigation all project personnel should be careful and take the necessary precautions should hazardous materials be encountered during construction.
10. Our geotechnical investigation scope-of-services did not include an evaluation of the project site for the presence of mold nor for the future potential development of mold at the project site. If an evaluation of the presence of mold and/or for the future potential development of mold at the site is desired, then the property owner should contact a consulting firm specializing in these types of investigations. Holdrege & Kull does not perform mold evaluation investigations.
11. Our experience and that of the civil engineering profession clearly indicates that during the construction phase of a project the risks of costly design, construction and maintenance problems can be significantly reduced by retaining the design geotechnical engineering firm to review the project plans and specifications and to provide geotechnical engineering CQA observation and testing services. Upon your request H&K will prepare a CQA geotechnical engineering services proposal that will present a work scope, tentative schedule and fee estimate for your consideration and authorization. If H&K is not retained to provide geotechnical engineering CQA services during the construction phase of the project, then H&K will not be responsible for geotechnical engineering CQA services provided by others.

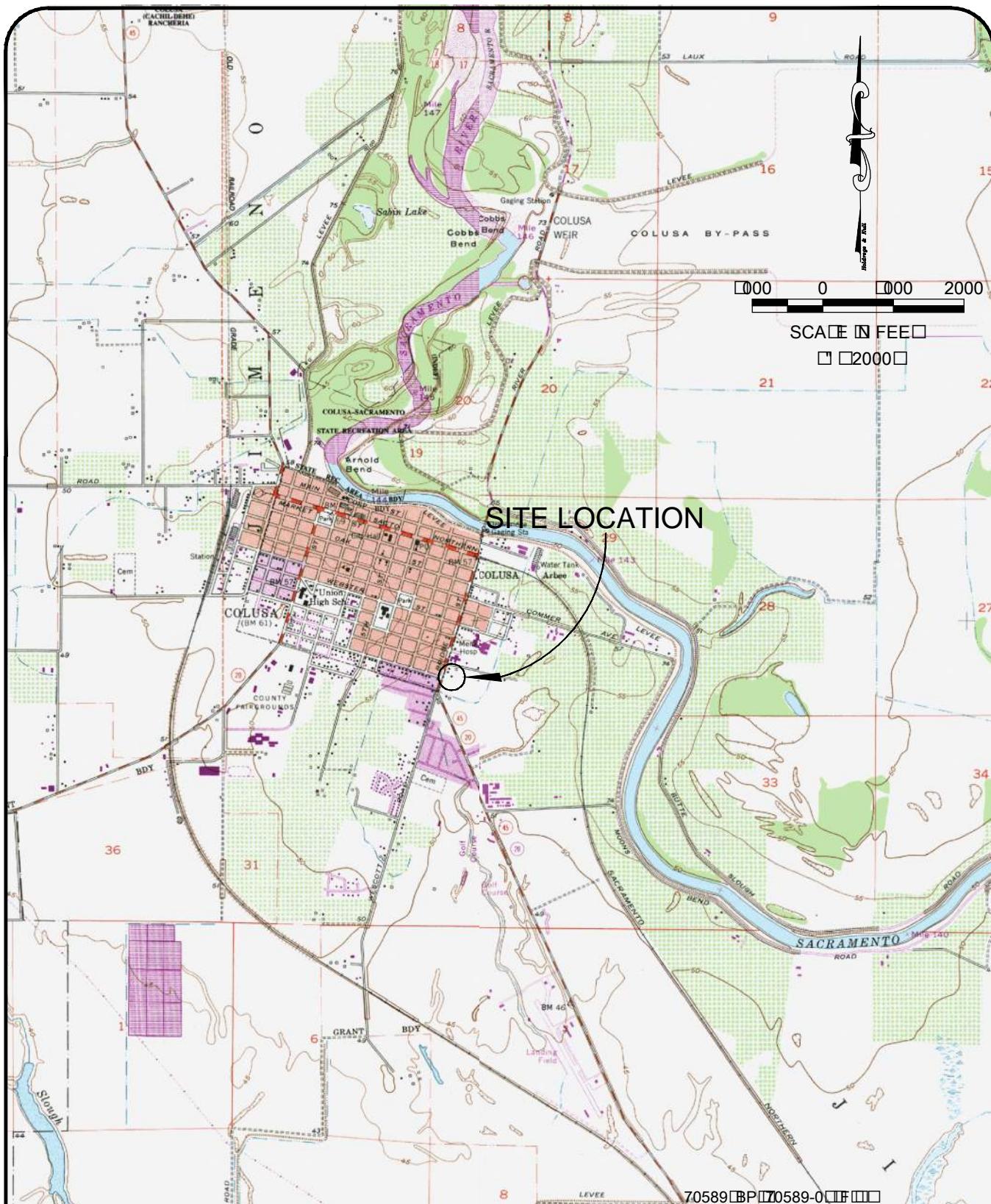
FIGURES:

Figure 1

Site Location Map

Figure 2

Site Plan and Exploratory Boring Location Map



HK HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

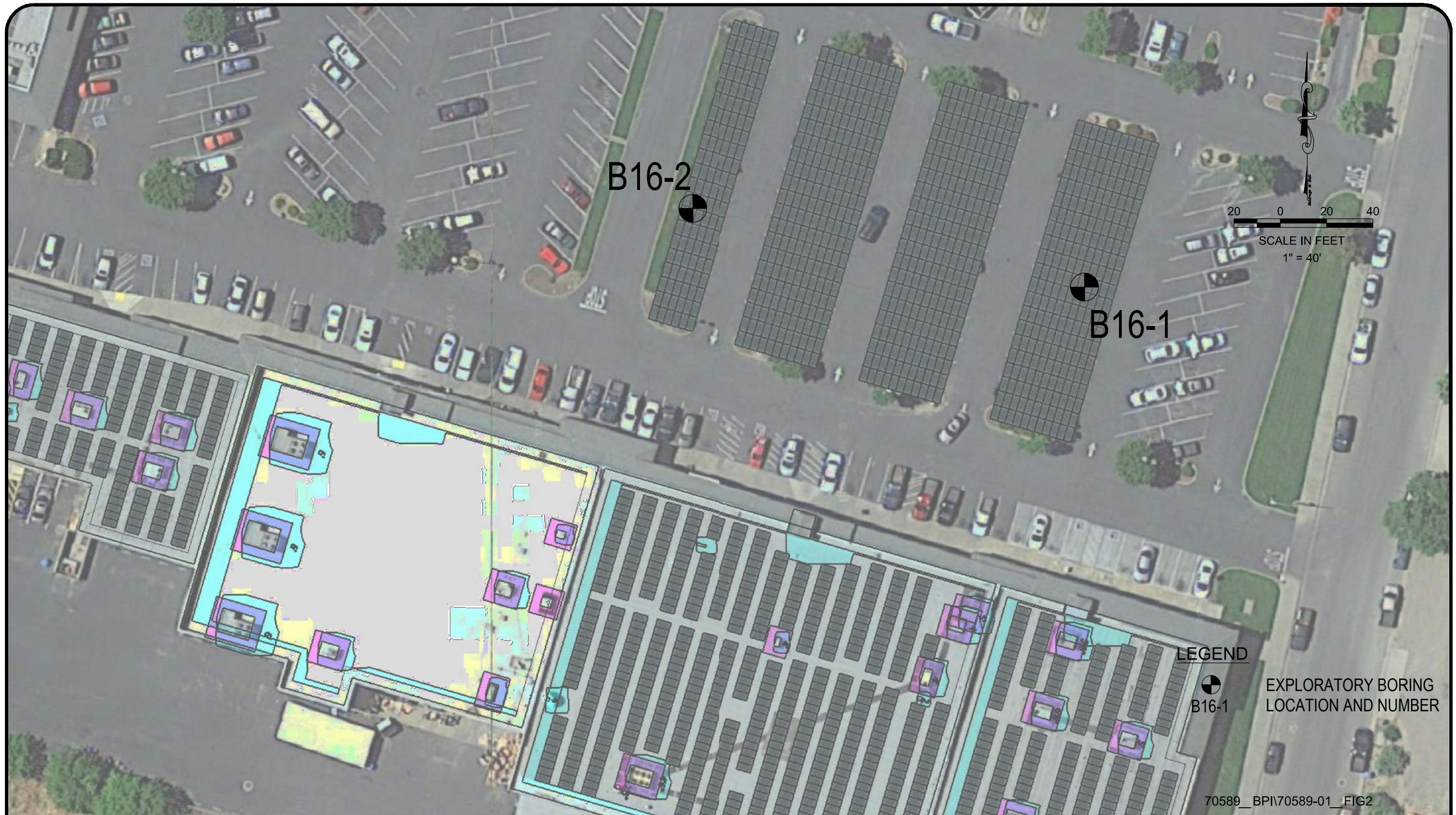
48 BROADMEAD COURT #40
CHICO, CA 95928
530-894-2487 FAX 894-2437

SITE LOCATION MAP
NORTH SCAPEGOAT CREEK CONSERVATION
COLUSA, COLUSA COUNTY, CALIFORNIA

PROJ NO.: 70589-04

DATE: MAY 2000

FIGURE NO.:



HK HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
48 BELLARMINE COURT, SUITE 40
CHICO, CA 95928
530-894-2487 FAX 894-2437

SITE SKETCH AND EXPLORATORY BORING LOCATIONS
NORTH STATE GROCERY COLUSA CENTER
COLUSA, COLUSA COUNTY, CALIFORNIA

DRAWN BY: SDC
CHECKED BY: SDC
PROJECT NO.: 70589-04
DATE: MAY, 2016

FIGURE NO.:
2

APPENDIX A:

**Proposal for Geotechnical Engineering Services for the North State
Grocery, Colusa, Photovoltaic Installation (fee and contract agreement
sections excluded)**



MASTER AGREEMENT ON CONSULTING ENGINEER SERVICES

WORK ORDER No.: 16-071

This Work Order is issued to Holdrege & Kull (Engineer) for the services requested by Bright Power, Inc. dba BPI, Contractor (Contractor). All terms in this project specific Work Order shall be in accordance with the Master Agreement on Consulting Engineer Services No.: 16-033 executed on March 21, 2016. Engineer shall provide the professional engineering Services (Services) scope of work as outlined below.

Project Name and Project No.:	NSG2 Colusa C15-700.1
Project Owner:	VSF Blue Sky Portfolio I LLC
Date Services Requested:	4/22/16
Fix Fee Amount:	\$7,678.50 (seven thousand six hundred and seventy-eight dollars and fifty cents)
Special Payment Terms:	None
Project Specific Scope of Services:	Scope of work as per Proposal No.: PC16.079 attached.

SERVICES SCOPE OF WORK: Engineer shall provide the following professional engineering Services as outlined in the Scope of work below for the above referenced project. Consult shall provide .DWG files in addition to the PDF files.

To provide geotechnical engineering investigation and consulting services for the development of the above referenced proposed photovoltaic (PV) carport canopy installation at the North State Grocery (NSG) Colusa facility, at the above referenced address.

1. PROJECT DESCRIPTION

H&K assumes the proposed carport array will utilize a T-style array with a center column and cantilevered beams that support the purlin and PV modules. Based on previous PV carport projects, H&K assumes a standardized foundation plan utilizing cast-in-drilled hole (CIDH) has been prepared that requires confirmation of the subsurface soil conditions. The CIDH piers will support tube steel columns and the canopy. As such H&K will perform a subsurface drilling investigation to classify the soil encountered below the proposed pier and pile locations.

2. SCOPE OF SERVICES

H&K proposes to perform the following tasks as basic services with no other additional services included: Task 1 Site Investigation and Laboratory Testing, Task 2 Data Analysis, Task 3 Report Preparation. As per scope of work in Proposal No.: PC16.079 attached.

3. SCHEDULE

H&K's proposed work schedule is based on our present and expected workload. H&K is prepared to commence work on this project following receipt of a signed contract and notice to proceed. H&K can provide verbal preliminary design recommendations immediately following the site investigation based on the field investigation data; however, the final recommendations will be developed from both the field and laboratory data. Therefore, the final recommendations will govern the design. H&K estimates that the final report can be completed within 3 weeks following receipt of the signed contract and a notice to proceed, weather and site access permitting.

The time required to complete our geological investigation field work may be increased as a result of encountering unforeseen subsurface conditions, adverse weather conditions, soil stability, property access problems, or scheduling



Bright Power, Inc.

Job No.: C15-700.1

Master Contract No.: 16-033

Work Order No.: 16-071

CC: 601.04



of exploratory equipment.

4. COST ESTIMATE

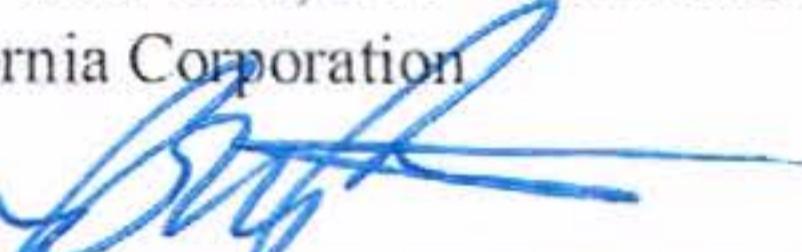
4.0 COST ESTIMATE

H&K proposes to perform the geological and geotechnical investigations and prepare the reports on a fixed cost lump sum basis of \$7,678.50, in accordance with the professional services agreement task order. This fee includes the cost of a drill rig and operator. Invoices will be generated on a monthly basis; terms of payment are net 30 days. Full payment is due upon completion of the work and issuance of the report. This cost associated with this scope of service is valid for a period of 60 days from the date of this proposal.

This cost estimate may require modification if unusual or unexpected site conditions are encountered which significantly change the work scope and increase the associated costs, if the client requests an expansion of the work scope, or if Colusa County or the City of Colusa requires the purchase of any additional permits in order to complete the site investigation. H&K will not perform additional work outside the scope of services presented above until a written authorization to proceed and an approved budget augmentation is received.

Bright Power Inc., BPi "Contractor"

A California Corporation

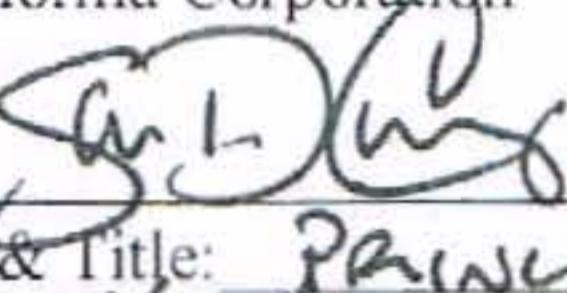
By: 

Name & Title: Brian Peterson - President

Date: 5/9/16

Holdrege & Kull "Engineer"

A California Corporation

By: 

Name & Title: Principal

Date: 4/25/16

APPENDIX B:

Important Information About Your Geotechnical Engineering Investigation Report (Presented with permission of ASFE, Copyright 2004)

Important Information About Your Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one—not even you—should apply the report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overly rely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but preface it with a clearly written letter of transmittal.* In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time to perform additional study.* Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geo-environmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



8811 Colesville Road/Suite G106, Silver Spring, MD 20910

Telephone: 301/565-2733 Facsimile: 301/589-2017

e-mail: info@asfe.org www.asfe.org

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*Project No.: 70589-04
May 31, 2016*

*North State Grocery, Colusa PV Installation
1017 Bridge Street, Colusa, California
Geotechnical Engineering Investigation Report*

APPENDIX C:

Exploratory Boring Logs

Project Name: NORTH STATE GROCERY PHOTOVOLTAIC

Project No.: 70589-04

Task: 01

Date Start: 05-09-16

Location: COLUSA, CALIFORNIA

Ground Elev. (Ft. AMSL):
Date Finish: 05-09-16

Logged By: CHAD DIEZ

Drilling Cmpny: PC EXPLORATION

Drill Rig Type: GEFCO SS15

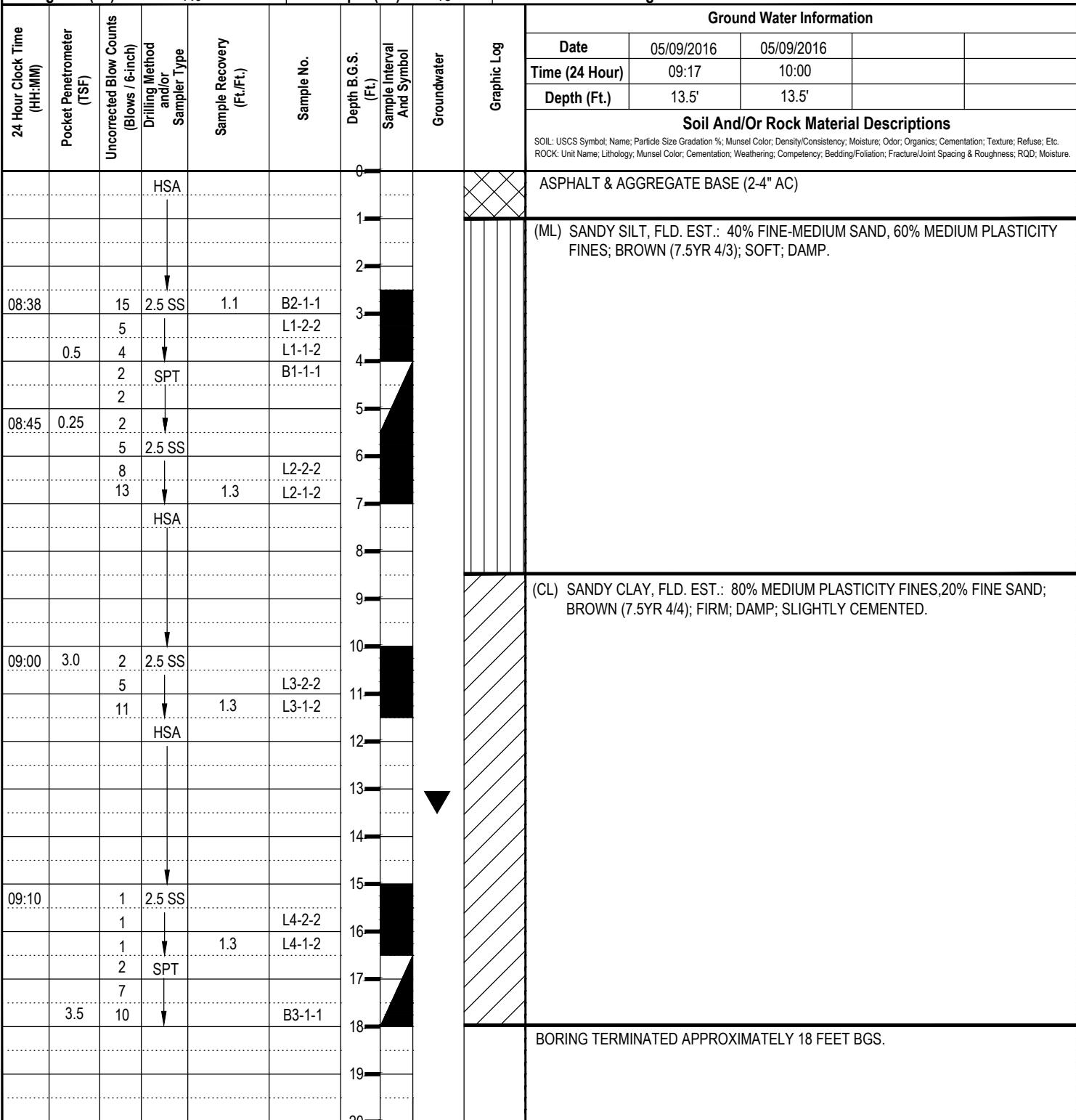
Driller: NATE

Drilling Method: HOLLOW STEM AUGER (HSA)

Hammer Type: 140 lbf. Automatic Trip Hammer

Boring Dia. (In.): 7.0

Total Depth (Ft.): 18

Backfill or Well Casing: SOIL

NOTES:



HOLDREGE & KULL

CONSULTING ENGINEERS • GEOLOGISTS

EXPLORATORY BORING LOG

48 Bellarmine Court, Suite 40 Chico, CA 95928
PHONE: 530-894-2487, FAX: 530-894-2437

Boring No.

B16-2

Sheet: 1 Of 1

Project Name: NORTH STATE GROCERY PHOTOVOLTAIC

Project No.: 70589-04

Task: 01 | Date Start: 05-09-16

Location: COLUSA, CALIFORNIA

Ground Elev. (Ft. AMSL):

date Finish: 05-09-16

Logged By: CHAD DIEZ

Drilling Cmpny: PC EXPLORATION

Drill Rig Type: GEFCO SS15

Driller: NATE

Drilling Method: HOLLOW STEM AUGER (HSA)

Hammer Type: 140 lbf. Automatic Trip Hammer

Boring Dia. (In.):

Total Depth (Ft.): 18 **Backfill or Well Casing:** SOIL

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JOURNAL OF CLIMATE

Table 1. Summary of results

NOTES:

APPENDIX D:

Laboratory Test Sheets

**Holdrege & Kull Laboratory
Cerco Analytical Laboratory**

8 May 2015

Job No. 1505012
Cust. No. 12277

Mr. Don Olsen
Holdrege & Kull
792 Searls Avenue
Nevada City, CA 95959

Subject: Project No.: 70508-01
Project Name: Boring B15-6 @ 10'
Corrosivity Analysis – ASTM Test Methods with Brief Evaluation

Dear Mr. Olsen:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on May 04, 2015. Based on the analytical results, a brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurement, the sample is classified as "corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentration is 16 mg/kg. Because the chloride ion concentration is less than 300 mg/kg, it is determined to be insufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentration is 47 mg/kg and is determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations.

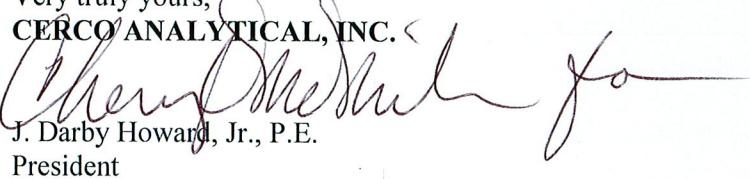
The pH of the soil is 8.90 which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,

CERCO ANALYTICAL, INC.



J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure



California State Certified Laboratory No. 2153

Client:	Holdrege & Kull
Client's Project No.:	70508-01
Client's Project Name:	Boring B15-6 @ 10'
Date Sampled:	Not Indicated
Date Received:	4-May-15
Matrix:	Soil
Authorization:	Signed Chain of Cust

Date of Report: 8-May-2015

00 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax: 925 462 2775
www.cerroanahysical.com

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Detection Limit:	-	-	10	-	50	15	15
Date Analyzed:	6-May-2015	-	-	5-May-2015	-	6-May-2015	6-May-2015

* Results Reported on "As Received" Basis
ND - None Detected

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

1505012

Colusa Waste Water Project Chain of Custody



1100 Willow Pass Court
Concord, CA 94520-1006
925 462 2771
Fax: 925 462 2775

Colusa Waste Water Project

Page
of

Package	Generic COC		Schedule	Date Sampled	Date Due
Job No.	70508-01	CU# <u>12277</u>	Analyte	3-12-15	
Full Name	NOTES:				
Don Olsen					
Company					
Holdrege and Kull, 8 Seville Ct, Ste 100, Chico, CA 95928					
Sample Source Boring B15-6 at 10 feet below ground surface					
ANALYSIS					
Lab No.	Sample I.D.	Date	Time	Matrix	Contain.
001	B2-1-1			S	Preserv.
					Qty.
Soil Electrical Resistivity					
AS7M 651					
Soil pH					
ATM 657					
Soil Superficial					
CTM 417					
Soil Characteristics					
CTM 422					
Dri-Et Ecol.					
DRIVE ECOL.					
SAMPLE RECEIPT					
Temp. at Lab °C _____					
Total No. of Containers _____					
Rec'd Good Cond/Cold _____					
Conforms to Record _____					
Sampler CT					
MATRIX					
DW - Drinking Water					
GW - Ground Water					
SW - Surface Water					
WW - Waste Water					
Water					
SL - Sludge					
S - Soil					
ABBREVIATIONS					
HB - Hosebib					
PV - Petcock Valve					
PT - Pressure Tank					
PH - Pump House					
RR - Restroom					
GL - Glass					
PL - Plastic					
ST - Sterile					
Relinquished By: <u>Amy Brown</u>					
Date <u>5-1-15</u>					
Site Mgr. _____					
Site Mgr.Tel# _____					
Cell# _____					
Site Access _____					
Emer. Name 1 _____ Emer. Phone 1 _____					
Emer. Name 2 _____ Emer. Phone 2 _____					
Emer. Name 3 _____ Emer. Phone 3 _____					
Emer. Name 4 _____ Emer. Phone 4 _____					
Emer. Name 5 *See file EDT					
Agency _____ Agency # _____ Fax# _____					

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 ASTM D4318

DSA File No.: n/a

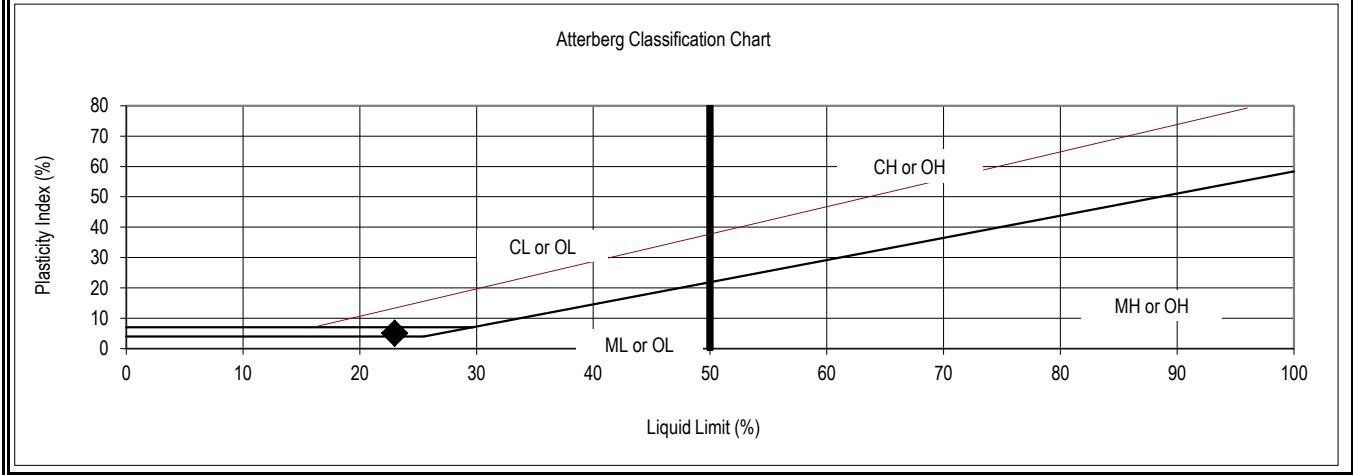
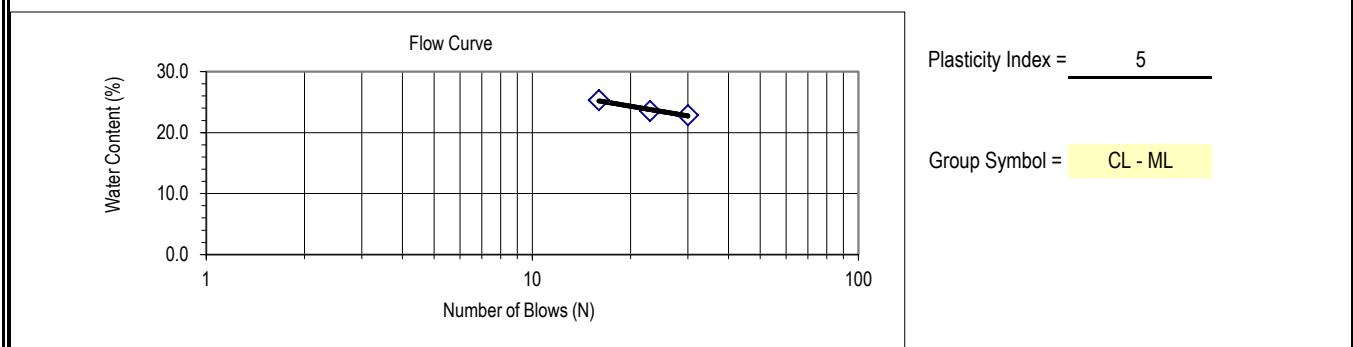
DSA App No.: n/a

Project No.:	70589-04	Project Name:	BPI - NSG Colusa	Date:	05/19/16
Sample No.:	L1-1-2	Boring/Trench:	B16-1	Depth, (ft.):	2.5
Description:	(CL - ML) Silty Clay; Lab Data; Very Dark Greyish Brown (10YR 3/2)	Tested By:	CHB	Checked By:	SDC
Sample Location:		Lab. No.:	C16-038		

Estimated % of Sample Retained on No. 40 Sieve: 100 Sample Air Dried: yes

Test Method A or B: A

LIQUID LIMIT:					PLASTIC LIMIT:			
Sample No.:	1	2	3	4	5	1	2	3
Pan ID:	A1	B1	C1			D1	E1	
Wt. Pan (gr)	18.49	18.60	18.72			18.57	17.05	
Wt. Wet Soil + Pan (gr)	31.60	31.35	31.40			26.44	24.90	
Wt. Dry Soil + Pan (gr)	29.16	28.92	28.84			25.22	23.68	
Wt. Water (gr)	2.44	2.43	2.56			1.22	1.22	
Wt. Dry Soil (gr)	10.67	10.32	10.12			6.65	6.63	
Water Content (%)	22.9	23.5	25.3			18.3	18.4	
Number of Blows, N	30	23	16					
					LIQUID LIMIT = <u>23</u>	PLASTIC LIMIT = <u>18</u>		





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PARTICLE SIZE DISTRIBUTION TEST WORK SHEET

ASTM D422, C136

DSA File No.: n/a
DSA App No.: n/a

Sieve Only Analysis Worksheet						
Project No.:	70589-04	Project Name:	BPI - NSG Colusa	Date:	05/19/16	
Sample No.:	L1-1-2	Boring/Trench:	B16-1	Depth, (ft.):	2.5	Tested By: CHB
Description:	(CL - ML) Silty Clay; Lab Data; Very Dark Greyish Brown (10YR 3/2)			Checked By:	SDC	
Sample Location:				Lab. No.:	C16-038	

Moisture Content Data:			Total Material Sample Data:			
Pan ID	ZZ7	Pan ID	G11			
Pan Weight	171.30	Pan Weight	765.10	(gm)		
Wet Soil + Pan	222.80	Wet Soil + Pan Wt.	1,277.00	(gm)		
Dry Soil + Pan	221.50	Total Wet Weight	511.90	(gm)		
Water Weight	1.30	Total Dry Weight	498.98	(gm)		
Dry Soil Weight	50.20	Total Dry Wt. >#10 Sieve	0.00	(gm)		
Moisture Content	2.6	Total Dry Wt. <#10 Sieve	498.98	(gm)		
	(%)	Total Dry Wt. <#200 Sieve	351.98	(gm)		
		Total Percent <#200 Sieve	70.54	(%)		

GRAVEL PORTION SIEVE ANALYSIS (Portion Retained On > #4 Sieve)

Sieve Size	Particle Diameter		Wet Weight Retained On Sieve (gm)	Dry Weight		
	Inches (in.)	Millimeter (mm)		Retained On Sieve (gm)	Accum. On Sieve (gm)	Passing Sieve (gm)
6 Inch	6.0000	152.40			0.00	498.98
3 Inch	3.0000	76.20			0.00	498.98
2 Inch	2.0000	50.80			0.00	498.98
1.5 Inch	1.5000	38.10			0.00	498.98
1.0 Inch	1.0000	25.40		0.00	0.00	498.98
3/4 Inch	0.7500	19.05		0.00	0.00	498.98
1/2 Inch	0.5000	12.70		0.00	0.00	498.98
3/8 Inch	0.3750	9.53		0.00	0.00	498.98
#4	0.1870	4.75		0.00	0.00	498.98
#10	0.079	2.000	0.00	0.00	0.00	498.98
			511.90	498.98	0.00	498.98

SAND PORTION SIEVE ANALYSIS (Portion Retained On < #4 Sieves)

Representative Sample Data:							
Pan ID	G11		#200 Wash Data:				
Pan Weight	765.10	(gm)	Portion >#200 Sieve:	147.00	(gm)		
Wet Soil + Pan	1277.00	(gm)	Portion <#200 Sieve:	351.98	(gm)		
Wet Soil	511.90	(gm)	Percent <#200 Sieve	70.54	(%)		
Dry Soil	498.98	(gm)	Total Wt. <#200 Sieve	351.98	(gm)		

Sieve Size	Particle Diameter		Dry Weight Rep. Sample		Total Sample Weight Retained (gm)	Accum. Grand Total On Sieve (gm)	Total Percent Passing (%)
	Inches (in.)	Millimeter (mm)	Retained On Sieve (gm)	Percent Retained (%)			
#20	0.033	0.850	0.70	0.14	0.70	0.70	99.9
#40	0.017	0.425	0.60	0.12	0.60	1.30	99.7
#60	0.010	0.250	1.70	0.34	1.70	3.00	99.4
#100	0.006	0.150	20.00	4.01	20.00	23.00	95.4
#200	0.003	0.075	124.00	24.85	124.00	147.00	70.5
PAN			Discard				

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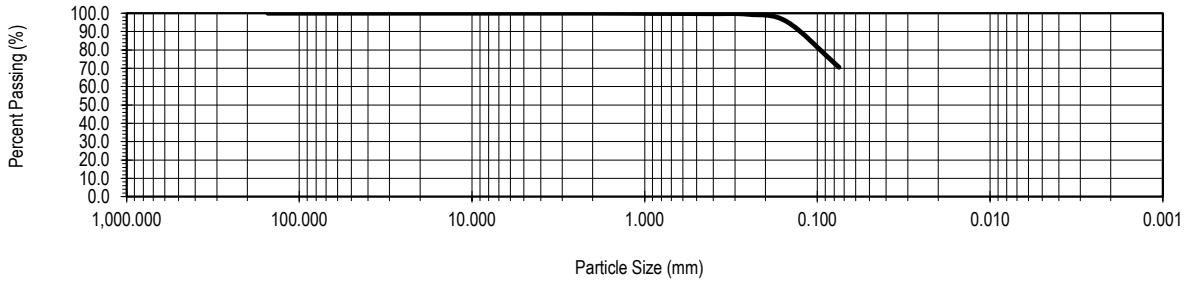
Particle Size Distribution

ASTM D422, C136

Project No.: **70589-04** Project Name: **BPI - NSG Colusa** Date: **5/19/2016**
Sample No.: **L1-1-2** Boring/Trench: **B16-1** Depth, (ft.): **2.5** Tested By: **CHB**
Description: **(CL - ML) Silty Clay; Lab Data; Very Dark Greyish Brown (10YR 3/2)** Checked By: **SDC**
Sample Location: **C16-038** Lab. No.: **C16-038**

Particle Size Gradation

Boulders	Cobble	Coarse	Gravel	Fine	Coarse	Medium	Sand	Fine		Silt	Clay
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UNCONFINED COMPRESSION

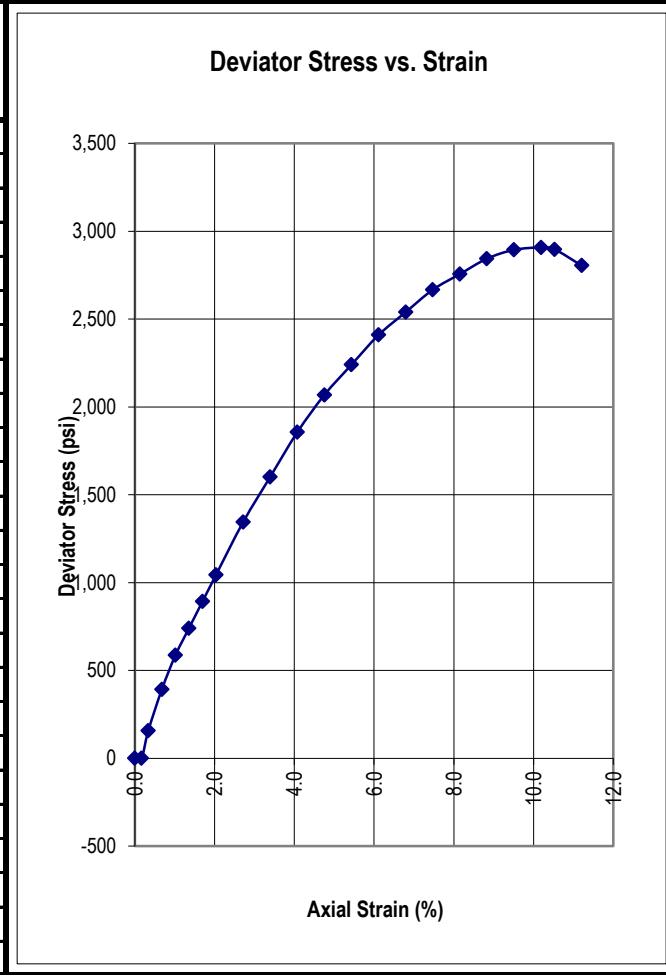
ASTM D2166

Project No.:	70589-04	Project Name:	BPI - Colusa	Date:	05/19/16
Boring/Trench No.:	B16-1	Sample No.:	L2-1-2	Depth (ft.)	5.5
Soil Description:	Clay; Vis Est; Dark Greyish Brown (10YR 4/2)			Tested By:	JFH
Sample Location:				Check By:	SDC
				Lab No.:	C16-038

Sample Data			Sample Sketch At Failure		
Tare Tube Number	I.D.	G11			
Tare Weight	(gm)	765.10			
Wet Soil + Tare	(gm)	1661.30			
Dry Soil + Tare	(gm)	1515.30			
Weight of Water	(gm)	146.00			
Dry Soil Weight	(gm)	750.20			
Moisture Content	(%)	19.46			
Soil Height	(cm)	14.96			
Sample Diameter	(cm)	6.07			
Wet Unit Weight	(pcf)	129.25			
Dry Unit Weight	(pcf)	108.19			
Specific Gravity	(dim)	2.60	Comments:		
Saturation	(%)	101.28	Maximum Shear Strength, $S_u = 1,454.1 \text{ psf} = 10.10 \text{ psi}$		
Strain Rate	(%/min.)	1.17	Maximum Unconfined Compressive Strength, $q_u = 2,908.2 \text{ psf} = 20.20 \text{ psi}$		
Proving Ring Constant	(lbs/unit)	1.230			

Elapsed Time (Sec)	Strain		Area (cm^2)	Load		Deviator Stress (psf)
	Units (0.001in/unit)	Percent (%)		Dial (units)	Force (lbs)	
0	0	0.00	0.00	0	0.00	0.0
13	10	0.17	28.99	0	0.00	0.0
22	20	0.34	29.04	4	4.92	157.4
39	40	0.68	29.14	10	12.30	392.2
54	60	1.02	29.24	15	18.45	586.3
70	80	1.36	29.34	19	23.37	740.1
86	100	1.70	29.44	23	28.29	892.8
101	120	2.04	29.54	27	33.21	1044.5
133	160	2.72	29.75	35	43.05	1344.5
184	200	3.40	29.96	42	51.66	1602.2
196	240	4.07	30.17	49	60.27	1856.1
226	280	4.75	30.38	55	67.65	2068.6
257	320	5.43	30.60	60	73.80	2240.6
288	360	6.11	30.82	65	79.95	2409.8
320	400	6.79	31.05	69	84.87	2539.6
351	440	7.47	31.27	73	89.79	2667.3
382	480	8.15	31.51	76	93.48	2756.5
413	520	8.83	31.74	79	97.17	2844.1
443	560	9.51	31.98	81	99.63	2894.4
474	600	10.19	32.22	82	100.86	2908.2
489	620	10.53	32.34	82	100.86	2897.2
520	660	11.21	32.59	80	98.40	2805.1
		0.00	0.00		0.00	0.0
		0.00	0.00		0.00	0.0
		0.00	0.00		0.00	0.0

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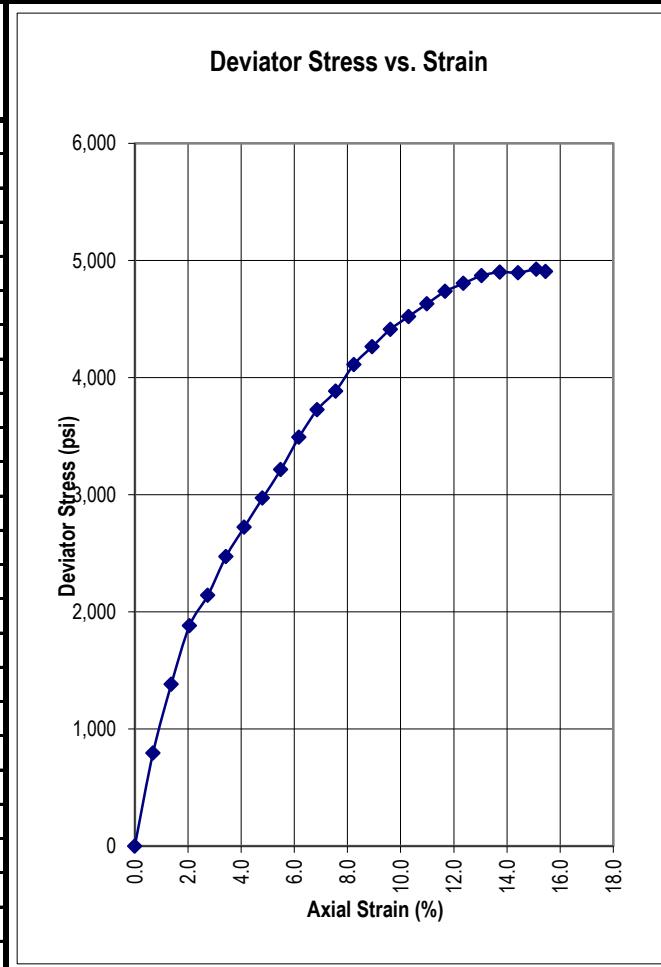
UNCONFINED COMPRESSION

ASTM D2166

Project No.:	70589-04	Project Name:	BPI - Colusa	Date:	05/19/16
Boring/Trench No.:	B16-1	Sample No.:	L3-1-2	Depth (ft.)	10
Soil Description:	Clay; Vis Est; Dark Greyish Brown (10YR 4/2)			Tested By:	JFH
Sample Location:				Check By:	SDC
				Lab No.:	C16-038

Sample Data			Sample Sketch At Failure		
Tare Tube Number	I.D.	G10			
Tare Weight	(gm)	766.70			
Wet Soil + Tare	(gm)	1628.60			
Dry Soil + Tare	(gm)	1468.00			
Weight of Water	(gm)	160.60			
Dry Soil Weight	(gm)	701.30			
Moisture Content	(%)	22.90			
Soil Height	(cm)	14.80			
Sample Diameter	(cm)	6.03			
Wet Unit Weight	(pcf)	127.32			
Dry Unit Weight	(pcf)	103.59			
Specific Gravity	(dim)	2.60	Comments:		
Saturation	(%)	105.17	Maximum Shear Strength, $S_u = 2,462.9 \text{ psf} = 17.10 \text{ psi}$		
Strain Rate	(%/min.)	1.30	Maximum Unconfined Compressive Strength, $q_u = 4,925.8 \text{ psf} = 34.21 \text{ psi}$		
Proving Ring Constant	(lbs/unit)	1.230			

Elapsed Time (Sec)	Strain		Area (cm^2)	Load		Deviator Stress (psf)
	Units (0.001in/unit)	Percent (%)		Dial (units)	Force (lbs)	
0	0	0.00	0.00	0	0.00	0.0
34	40	0.69	28.76	20	24.60	794.8
65	80	1.37	28.96	35	43.05	1381.3
97	120	2.06	29.16	48	59.04	1881.1
128	160	2.75	29.36	55	67.65	2140.3
160	200	3.43	29.57	64	78.72	2473.0
191	240	4.12	29.78	71	87.33	2724.0
222	280	4.81	30.00	78	95.94	2971.1
253	320	5.49	30.22	85	104.55	3214.4
285	360	6.18	30.44	93	114.39	3491.4
316	400	6.86	30.66	100	123.00	3726.7
347	440	7.55	30.89	105	129.15	3884.2
378	480	8.24	31.12	112	137.76	4112.4
410	520	8.92	31.36	117	143.91	4263.8
440	560	9.61	31.59	122	150.06	4412.5
472	600	10.30	31.84	126	154.98	4522.6
503	640	10.98	32.08	130	159.90	4630.4
534	680	11.67	32.33	134	164.82	4736.1
565	720	12.36	32.58	137	168.51	4804.5
595	760	13.04	32.84	140	172.20	4871.3
626	800	13.73	33.10	142	174.66	4901.9
657	840	14.42	33.37	143	175.89	4897.1
688	880	15.10	33.64	145	178.35	4925.8
719	900	15.45	33.77	145	178.35	4905.8
		0.00	0.00		0.00	0.0



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 ASTM D4318

DSA File No.: n/a

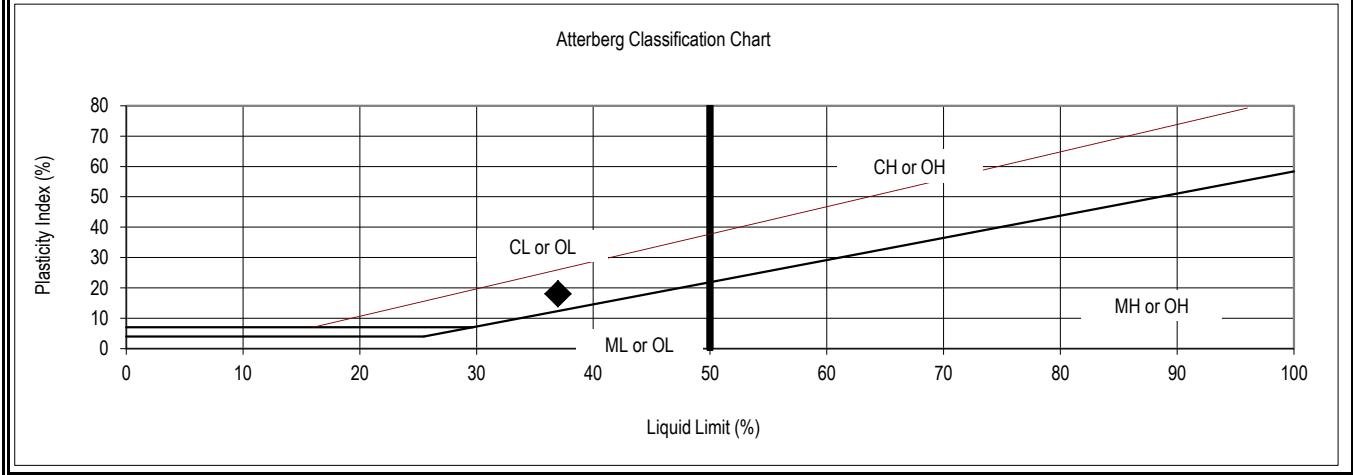
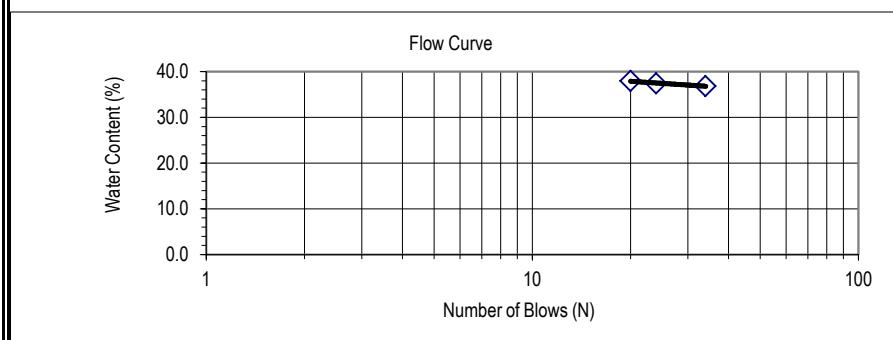
DSA App No.: n/a

Project No.:	70589-04	Project Name:	BPI - NSG Colusa	Date:	05/19/16
Sample No.:	L3-2-2	Boring/Trench:	B16-1	Depth, (ft.):	10
Description:	(CL) Lean Clay; Lab Data; Dark Brown (10YR 3/4)	Tested By:	JFH	Checked By:	SDC
Sample Location:		Lab. No.:	C16-038		

Estimated % of Sample Retained on No. 40 Sieve: 100 Sample Air Dried: yes

Test Method A or B: A

LIQUID LIMIT:					PLASTIC LIMIT:			
Sample No.:	1	2	3	4	5	1	2	3
Pan ID:	B	E	C			A	D	
Wt. Pan (gr)	38.97	36.44	38.46			38.44	38.27	
Wt. Wet Soil + Pan (gr)	56.43	52.74	56.35			46.13	49.91	
Wt. Dry Soil + Pan (gr)	51.73	48.30	51.43			44.91	48.04	
Wt. Water (gr)	4.70	4.44	4.92			1.22	1.87	
Wt. Dry Soil (gr)	12.76	11.86	12.97			6.47	9.77	
Water Content (%)	36.8	37.4	37.9			18.9	19.1	
Number of Blows, N	34	24	20					
LIQUID LIMIT = 37					PLASTIC LIMIT = 19			



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PARTICLE SIZE DISTRIBUTION TEST WORK SHEET

ASTM D422, C136

DSA File No.: n/a
DSA App No.: n/a

Sieve Only Analysis Worksheet					
Project No.:	70589-04	Project Name:	BPI - NSG Colusa	Date:	05/19/16
Sample No.:	L3-2-2	Boring/Trench:	B16-1	Depth, (ft.):	10
Description:	(CL) Lean Clay; Lab Data; Dark Brown (10YR 3/4)			Tested By:	JFH
Sample Location:				Checked By:	SDC
				Lab. No.:	C16-038

Moisture Content Data:			Total Material Sample Data:		
Pan ID	C12	Pan ID	C4		
Pan Weight	180.60	Pan Weight	178.10	(gm)	
Wet Soil + Pan	280.30	Wet Soil + Pan Wt.	395.80	(gm)	
Dry Soil + Pan	277.20	Total Wet Weight	217.70	(gm)	
Water Weight	3.10	Total Dry Weight	210.93	(gm)	
Dry Soil Weight	96.60	Total Dry Wt. >#10 Sieve	0.00	(gm)	
Moisture Content	3.2	Total Dry Wt. <#10 Sieve	210.93	(gm)	
	(%)	Total Dry Wt. <#200 Sieve	207.83	(gm)	
		Total Percent <#200 Sieve	98.53	(%)	

GRAVEL PORTION SIEVE ANALYSIS

(Portion Retained On > #4 Sieve)

Sieve Size	Particle Diameter		Wet Weight Retained On Sieve (gm)	Dry Weight		
	Inches (in.)	Millimeter (mm)		Retained On Sieve (gm)	Accum. On Sieve (gm)	Passing Sieve (gm)
6 Inch	6.0000	152.40			0.00	210.93
3 Inch	3.0000	76.20			0.00	210.93
2 Inch	2.0000	50.80			0.00	210.93
1.5 Inch	1.5000	38.10			0.00	210.93
1.0 Inch	1.0000	25.40		0.00	0.00	210.93
3/4 Inch	0.7500	19.05		0.00	0.00	210.93
1/2 Inch	0.5000	12.70		0.00	0.00	210.93
3/8 Inch	0.3750	9.53		0.00	0.00	210.93
#4	0.1870	4.75		0.00	0.00	210.93
#10	0.079	2.00	0.00	0.00	0.00	210.93
			217.70	210.93	0.00	210.93

SAND PORTION SIEVE ANALYSIS

(Portion Retained On < #4 Sieves)

Representative Sample Data:		
Pan ID	C4	#200 Wash Data:
Pan Weight	178.10	(gm)
Wet Soil + Pan	395.80	Portion >#200 Sieve: 3.10 (gm)
Wet Soil	217.70	Portion <#200 Sieve: 207.83 (gm)
Dry Soil	210.93	Percent <#200 Sieve: 98.53 (%)
		Total Wt. <#200 Sieve: 207.83 (gm)

Sieve Size	Particle Diameter		Dry Weight Rep. Sample		Total Sample Weight Retained (gm)	Accum. Grand Total On Sieve (gm)	Total Percent Passing (%)
	Inches (in.)	Millimeter (mm)	Retained On Sieve (gm)	Percent Retained (%)			
#20	0.033	0.850	0.00	0.00	0.00	0.00	100.0
#40	0.017	0.425	0.00	0.00	0.00	0.00	100.0
#60	0.010	0.250	0.20	0.09	0.20	0.20	99.9
#100	0.006	0.150	0.20	0.09	0.20	0.40	99.8
#200	0.003	0.075	2.70	1.28	2.70	3.10	98.5
PAN			Discard				

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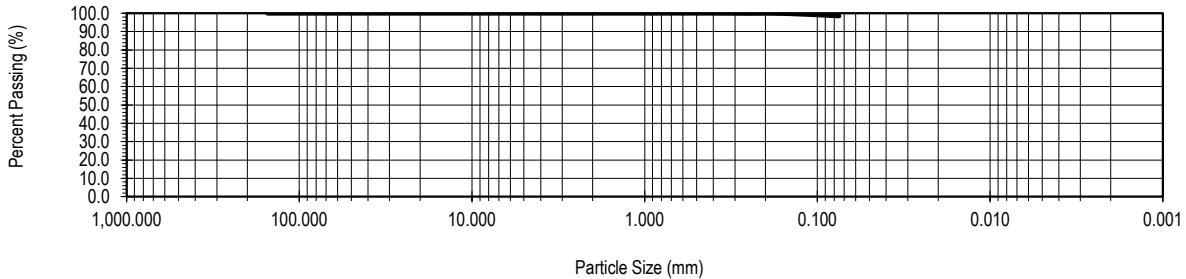
Particle Size Distribution

ASTM D422, C136

Project No.: **70589-04** Project Name: **BPI - NSG Quincy** Date: **5/19/2016**
Sample No.: **L3-2-2** Boring/Trench: **B16-1** Depth, (ft.): **10** Tested By: **JFH**
Description: **(CL) Lean Clay; Lab Data; Dark Brown (10YR 3/4)** Checked By: **SDC**
Sample Location: **C16-038**

Particle Size Gradation

Boulders	Cobble	Coarse	Gravel	Fine	Coarse	Medium	Sand	Fine		Silt	Clay
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Moisture & Density

ASTM D2216, D2937, C566

DSA File No.: n/a
DSA App No.: n/a

Project No.:	70589-04			Project Name:	BPI - NSG Colusa			Date:	05/19/16		
								Tested By:	CHB		
								Checked By:			
								Lab. No.:	C16-038		
SAMPLE LOCATION DATA											
Boring/Trench No.	Units	B16-1	B16-2	B16-2							
Sample No.		L4-1-2	L2-1-2	L3-1-2							
Depth Interval	(ft.)	15	5	10							
Sample Description		Lean Clay; Vis Est; Dark Yellowish Brown (10YR 4/4)	Lean Clay; Vis Est; Brown (10YR 4/3)	Lean Clay; Vis Est; Dark Yellowish Brown (10YR 4/4)							
USCS Symbol		CL	CL	CL							
SAMPLE DIMENSION AND WEIGHT DATA											
Sample Length	(in)	5.720	5.962	5.975							
Sample Diameter	(in)	2.391	2.384	2.386							
Sample Volume	(cf)	0.0149	0.0154	0.0155							
Wet Soil + Tube Wt.	(gr)	1080.70	1160.10	1187.80							
Tube Wt.	(gr)	276.50	276.10	274.70							
Wet Soil Wt.	(gr)	804.20	884.00	913.10							
MOISTURE CONTENT DATA											
Tare No.		ZZ1	ZZ9	C7							
Tare Wt.	(gr)	169.10	170.70	181.00							
Wet Soil + Tare Wt.	(gr)	973.40	1053.90	1093.60							
Dry Soil + Tare Wt.	(gr)	768.60	876.10	924.70							
Water Wt.	(gr)	204.80	177.80	168.90							
Dry Soil Wt.	(gr)	599.50	705.40	743.70							
Moisture Content	(%)	34.2	25.2	22.7							
TEST RESULTS											
Wet Unit Wt.	(pcf)	119.3	126.5	130.2							
Moisture Content	(%)	34.2	25.2	22.7							
Dry Unit Wt.	(pcf)	88.9	101.1	106.1							
MOISTURE CORRECTION DATA											
Gauge Moisture	(%)										
K Value Correction Factor											
COMPACTION CURVE DATA (ASTM D698, ASTM D1557, or CAL216)											
Test Method											
Curve No.											
Max Wet Unit Wt.	(pcf)										
Max Dry Unit Wt.	(pcf)										
Optimum Moisture	(%)										
Wet Relative Comp.	(%)										
Dry Relative Comp.	(%)										

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