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September 14, 2015

County of San Bernardino
Architecture and Engineering Department
385 North Arrowhead Avenue, Third Floor
San Bernardino, California 92415-0184
Attention: Mr. Paul DeArmond

Job No. G15-028-3

Dear Mr. DeArmond:

This letter transmits six copies of the Geotechnical Investigation report prepared for the West Valley Regional Training Center (A&E Project 5P45), located at 9478 Etiwanda Avenue, Rancho Cucamonga, California.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact us at your convenience.

Respectfully submitted,
C.H.J., INCORPORATED

George Battey III

George Battey III, P.E.
President

GB:lb

Distribution: County of San Bernardino (6 and email)

GEOTECHNICAL INVESTIGATION
WEST VALLEY REGIONAL TRAINING CENTER
(A&E PROJECT 5P45)
RANCHO CUCAMONGA, CALIFORNIA
PREPARED FOR
COUNTY OF SAN BERNARDINO
ARCHITECTURE & ENGINEERING DEPARTMENT
JOB NO. G15-028-3

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Attention: Mr. Paul DeArmond

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Dear Mr. DeArmond:

Attached herewith is the Geotechnical Investigation report prepared for the West Valley Regional Training Center (A&E Project 5P45), located at 9478 Etiwanda Avenue, Rancho Cucamonga, California.

This report was based upon a scope of services generally outlined in our proposal, dated August 4, 2015, and other written and verbal communications.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,
C.H.J., INCORPORATED

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INTRODUCTION

During August and September 2015, a geotechnical investigation for the West Valley Regional Training Center (A&E Project 5P45), located at 9478 Etiwanda Avenue, Rancho Cucamonga, California, was performed by this firm. The purposes of this investigation were to explore and evaluate the geotechnical engineering conditions at the subject site and to provide appropriate geotechnical engineering recommendations for design and construction of the proposed structure and associated improvements.

The approximate location of the site is shown on the attached Index Map (Enclosure "A-1"). Google Earth imagery was reviewed and utilized as a base map for our Site Plan (Enclosure "A-2").

The results of our investigation, together with our conclusions and recommendations, are presented in this report.

SCOPE OF SERVICES

The scope of services provided during this geotechnical investigation included the following:

- Review of published and unpublished literature and maps
- Examination of stereoscopic aerial imagery dated between 1938 and 2014
- A geologic field reconnaissance of the site and surrounding area
- Logging and sampling of four exploratory borings for testing and evaluation
- Laboratory testing on selected samples

- Evaluation of the geotechnical engineering/geologic data to develop site-specific recommendations for site grading, foundation design, preliminary pavement structural section design and mitigation of potential geologic constraints

- Preparation of this report summarizing our findings, professional opinions and recommendations for the geotechnical aspects of project design and construction

PROJECT CONSIDERATIONS

Information furnished to this office indicates that a new training facility to support the County of San Bernardino's Probation Department in field and tactical training is to be developed at the subject site. The improvements will include an agility test course, K-9 agility training center, a shooting range and modification to an existing parking lot. Our field investigation included exploratory borings selectively located with the intent to encompass possible building locations. Due to the presence of numerous underground utilities and limited access, no boring was placed within the area of the proposed RAC House. We anticipate that the buildings will be supported on shallow foundations. Light to moderate foundations loads are typical for structures of the type proposed.

A project grading plan was not available at the time of our investigation. However, observation of site topography and of adjacent improvements indicates that development of this site will entail minimal cuts and fills. The final project grading plan should be reviewed by the geotechnical engineer to confirm that recommendations provided in this report have been properly implemented.

SITE DESCRIPTION

The site is located in Rancho Cucamonga, California, west of Etiwanda Avenue and halfway between San Bernardino Avenue to the south and Sixth Street to the north. The site consists of grass fields and dirt roads within an existing detention center facility and associated parking lots. Undeveloped lots were located to the east and south of the site, and industrial buildings were located to the north.

At the time of our investigation the site was relatively flat and planar, with slight slopes away from existing buildings.

Buried utilities are present within the site.

Examination of aerial imagery indicates that the site was developed for agricultural use from 1938 to 1994. The adjacent parcel to the west was developed with the detention center in 1996. In the 2002 aerial image, the site was under construction, which was completed by the time of the 2003 aerial image. Evidence of geologic hazards or flooding was not noted in the aerial imagery examined.

FIELD INVESTIGATION

The soil conditions underlying the subject site were explored by means of four exploratory borings drilled to a maximum depth of 51-1/2 feet below the existing ground surface (bgs) with a truck-mounted CME 55 drill rig equipped for soil sampling. The approximate locations of our exploratory borings are indicated on the attached Site Plan (Enclosure"A-2").

Continuous logs of the subsurface conditions, as encountered within the exploratory borings, were recorded at the time of drilling by a staff geologist from this firm. Both a standard penetration test (SPT) sampler (2-inch outer diameter and 1-3/8-inch inner diameter) and a ring sampler (3-inch outer diameter and 2-3/8-inch inner diameter) were utilized in our investigation. The penetration resistance was recorded on the boring logs as the number of hammer blows used to advance the sampler in 6-inch increments (or less if noted). The samplers were driven with an automatic hammer that drops a 140-pound weight 30 inches for each blow. After the required seating, samplers are advanced up to 18 inches, providing up to three sets of blowcounts at each sampling interval. The recorded blows are raw numbers without any corrections for hammer type (automatic vs. manual cathead) or sampler size (ring sampler vs. standard penetration test sampler). Both relatively undisturbed and bulk samples of typical soil types obtained were returned to the laboratory in sealed containers for testing and evaluation.

The exploratory boring logs, together with the uncorrected blowcount data and in-place density data, are presented in Appendix "B". The stratification lines presented on the boring logs represent approximate boundaries between soil types, which may include gradual transitions.

At the completion of drilling, all borings were backfilled to the initial grade of the boring with soil boring cuttings and tamped using the drilling equipment augers. This backfilling operation is expected to compact the boring to a density approximating that of the existing soils. If backfill material in addition to the excavated material was necessary to complete the backfill then such material was secured and utilized in the backfilling operation. It is possible that some settlement of the backfilled material may occur. Our firm does not monitor boring locations for settlement. This is deemed to be, and is accepted to be, the responsibility of our client. If the client observes settlement, then this firm should be notified.

LABORATORY INVESTIGATION

Included in our laboratory testing program were field moisture content tests on all samples returned to the laboratory and field dry density tests on all relatively undisturbed samples. The results are included on the boring logs.

An optimum moisture content - maximum dry density relationship was established for typical soil type in order for the relative compaction of the subsoils to be evaluated during construction and to estimate compaction shrinkage. Remolded direct shear testing and relatively undisturbed consolidation tests were performed to provide shear strength and consolidation parameters for bearing capacity, earth pressure and hydroconsolidation settlement evaluations. Sieve analysis and No. 200 wash were performed for soil classification purposes. R-value and sand equivalent testing was performed on representative soils for preliminary pavement design. A selected sample of material was delivered to HDR Inc. for preliminary corrosivity analysis.

Laboratory test results appear in Appendix "C". Soil classifications provided in our geotechnical investigation are in general accordance with the Unified Soil Classification System (USCS).

SITE GEOLOGY AND SUBSURFACE SOIL CONDITIONS

The site is located on the Cucamonga Plain in the west-central portion of the San Bernardino Valley, a structural basin within the Peninsular Ranges Geomorphic Province. This portion of the valley is bounded on the north by the San Gabriel Mountains of the Transverse Ranges and on the south by Jurupa Hills of the Perris Block. The Cucamonga Plain is formed by coalesced alluvial fans emanating from the San Gabriel Mountains. Published geologic mapping by Morton & Miller (2006) show the site is underlain by young alluvial fan. As encountered in our borings, the native sediments consist primarily of interlayered silty sand (SM), and sand (SP-SM) with silt with few layers of sandy silts (ML) to the maximum depth of the borings. The native sediments are mantled by up to 4 feet of fill consisting of silty sand. Refusal to advancement of the augers was not encountered.

Bedrock and groundwater were not encountered within the exploratory borings to the maximum depth of approximately 51-1/2 feet bgs.

Caving was not observed within the exploratory borings upon removal of the augers.

More detailed descriptions of the subsurface soil conditions encountered are included within the exploratory boring logs (Appendix "B").

FAULT RUPTURE HAZARD

The site is not located within an Alquist-Priolo (AP) Earthquake Fault Zone established by the State of California to mitigate fault rupture hazard to human-occupancy structures. The closest AP zone, established for the Cucamonga fault, is located approximately 6 miles north of the site. The potential for surface faulting to occur within the site is considered low.

2013 CALIFORNIA BUILDING CODE - SEISMIC PARAMETERS

Based on the geologic setting and anticipated earthwork for construction of the proposed project, the soils underlying the site are classified as Site Class "D, stiff soil profile", according to the 2013 California Building Code (CBC). The seismic parameters according to the 2013 CBC are summarized in the following table.

2013 CBC - Seismic Parameters	
Mapped Spectral Acceleration Parameters	S_s = 1.50 and S_1 = 0.60
Site Coefficients	F_a = 1.0 and F_v = 1.5
Adjusted Maximum Considered Earthquake Spectral Response Parameters	S_{MS} = 1.50 and S_{M1} =0.90
Design Spectral Acceleration Parameters	S_{DS} = 1.00 and S_{D1} = 0.60
PGA_m	0.50g

GROUNDWATER

Groundwater data were reviewed in order to estimate the historic groundwater conditions for the site. Depth to groundwater available from the California Department of Water Resources (DWR, 2015) and other regional groundwater contour mapping is summarized in the following table:

Summary of Groundwater Data					
Well ID	**Measuring Point Elevation (feet)**	**Date**	**Depth to Water (feet)**	**Location**	**Data Source**
01S06W25C001S	1,050	4/3/1919	238	3-1/2 mile SE	DWR, 2015
		10/3/1978	321		
		11/22/1988	295		
		10/20/1998	308		
		10/20/2008	334		
01S07W23M001S	981	4/15/2008	360	3-1/2 mile SW	
		11/15/2009	358		
		5/15/2010	356		
Groundwater Contour Mapping	N/A	2006	400	N/A	Wildermuth Environmental, 2007

Groundwater was not encountered within the depth of the current borings. A historic high groundwater level for the site is estimated as 238 feet bgs.

LIQUEFACTION POTENTIAL AND SEISMIC SETTLEMENT

According to the County of San Bernardino General Plan (2010), the site is not located within an area identified as having a potential for liquefaction.

Liquefaction is a process in which strong ground shaking causes saturated soils to lose shear strength and behave as a fluid, potentially resulting in near-surface and surface ground failure. Ground failure associated with liquefaction can result in severe damage to structures. The geologic conditions for increased susceptibility to liquefaction are: 1) the presence of shallow groundwater (generally less than 50 feet in depth), 2) the presence of unconsolidated sandy alluvium, typically Holocene age, and 3) strong ground shaking. All three of these conditions must be present for liquefaction to occur. Based on our preliminary analysis and modern groundwater conditions, the potential for liquefaction to occur at the site is considered low.

Severe seismic shaking may cause dry and non-saturated sands to densify, resulting in settlement expressed at the ground surface. Seismic settlement in dry soils generally occurs in loose sands and silty sands, with cohesive soils being less prone to significant settlement.

The subsurface soils generally consist of fine to coarse-grained silty sands (SM), sand with silt (SP-SM), and sandy silts (ML). Blowcounts and density testing performed on relatively undisturbed samples indicate that the soils encountered were generally in a medium dense to very dense state.

The seismic settlement was evaluated for a representative soil profile using Exploratory Boring No. 1. Using the method outlined by Pradel (1998), calculations were performed to estimate the maximum and the differential settlement to be anticipated as a result of a major seismic event. As input into our calculations, a deaggregated modal moment magnitude of 6.5 and an acceleration of 0.50g were utilized. The results indicate that the anticipated seismic settlement will be less than 1/4 inch. It is our opinion that seismic settlement will not be a hazard for the subject site.

HYDROCONSOLIDATION

To evaluate the potential settlement that may be caused by water-induced collapse, hydroconsolidation testing was performed on selected samples. The results are presented in Appendix "C".

Consolidation testing of Exploratory Boring No. 2 at a depth of 10 feet bgs exhibits a slight hydroconsolidation strain (0.3 percent). According to Yi (1991), a collapse potential (hydroconsolidation strain) of less than 1 percent indicates "no problem" regarding the severity of collapse.

SLOPE STABILITY

No significant slopes are planned or currently exist at the site; therefore, slope stability is not considered to pose a hazard at this site.

EXPANSION POTENTIAL

Since all materials encountered during this investigation were generally granular and considered to be non-critically expansive, specialized construction procedures to specifically resist expansive soil forces are not anticipated at this time. Requirements for reinforcing steel to satisfy structural criteria are not affected by this recommendation. Additional evaluation of soils for expansion potential should be conducted by the geotechnical engineer during the grading operation.

CONCLUSIONS

On the basis of our field and laboratory investigations, it is the opinion of this firm that the proposed improvement is feasible from geotechnical engineering and engineering geologic standpoints, provided the recommendations contained in this report are implemented during grading and construction.

The site is not located within an Alquist-Priolo Earthquake Fault Zone established by the State of California to mitigate fault rupture hazard to human-occupancy structures.

Severe seismic shaking can be expected at the site.

Groundwater was not encountered within the exploratory borings at the site. The potential for liquefaction is considered low at the site.

Due to the relatively dense on-site soils, settlement resulting from seismic shaking and hydroconsolidation is insignificant for the subject site.

The subsurface soils generally consist of fine to coarse-grained silty sands (SM), sand with silt (SP-SM), and sandy silts (ML). Undocumented fill was encountered to depths ranging from 3 to 4 feet bgs.

Neither bedrock nor refusal was encountered within any of the exploratory borings utilized for this investigation.

Caving was not experienced within the exploratory borings utilized for this investigation. However, trenches, larger-diameter borings or excavations that remain open for longer periods of time may be subject to caving.

The relatively planar topography at the site precludes the potential for slope instability at the site.

Based upon our field investigation and test data, it is our opinion that the upper undocumented fills and/or native soils will not, in their present condition, provide uniform or adequate support for the proposed structures. Blowcounts and density testing performed on relatively undisturbed samples indicate that the soils encountered were generally in a medium dense to very dense state. Site clearing can be expected to further aggravate the settlement-prone conditions.

Because of site conditions, our recommendation is to remove the upper 3 feet of existing soil in all areas to be graded. Further subexcavation may be necessary depending on the densities of the underlying soils. To provide adequate support for the proposed structures, it is our recommendation that the building areas be further subexcavated as necessary and recompacted to provide a compacted fill mat beneath footings and slabs. A compacted fill mat will provide a dense, uniform, high-strength soil layer to distribute the foundation loads over the underlying soils. Conventional spread foundations, either individual spread footings and/or continuous wall footings, may be utilized in conjunction with a compacted fill mat.

The on-site materials are generally granular and are considered to be non-critically expansive.

Based on the classification, density and lack of significant soil cementation encountered in exploratory borings placed throughout the site, site grading and utility trenching are expected to be feasible with conventional heavy grading and trenching equipment, respectively.

RECOMMENDATIONS

GENERAL SITE GRADING:

It is imperative that no clearing and/or grading operations be performed without the presence of a representative of the geotechnical engineer. An on-site pre-job meeting with County personnel, the contractor and the geotechnical engineer should occur prior to all grading-related operations. Operations undertaken at the site without the geotechnical engineer present may result in exclusions of affected areas from the final compaction report for the project.

Grading of the subject site should be performed, at a minimum, in accordance with these recommendations and with applicable portions of the current CBC. The following recommendations are presented for your assistance in establishing proper grading criteria.

INITIAL SITE PREPARATION:

All areas to be graded should be stripped or cleaned of significant vegetation, rocks greater than 8 inches in largest dimension and other deleterious materials. These materials should be removed from the site for disposal. The cleaned soils may be reused as properly compacted fill. If encountered, existing utility lines should be traced, removed and rerouted from areas to be graded.

All areas to be graded should have at least the upper 3 feet of existing soils removed and the open excavation bottoms observed by our engineering geologist to verify and document in writing that all undocumented fill or loose native soils is removed prior to refilling with properly tested and documented compacted fill. The removed and cleaned soils may be reused as properly compacted fill.

Further subexcavation may be necessary depending on the conditions of the underlying soils. The actual depth of removal should be determined at the time of grading by the project geotechnical engineer/geologist. The determination will be based on soil conditions exposed within the excavations.

Compaction tests may be taken in the removal bottom areas where appropriate to provide in-place moisture/density data for potential relative compaction evaluations and to help support and document the engineering geologist's decision. As such, all areas to be graded should have any loose native soils, undocumented fill, topsoil or other unsuitable materials removed and replaced with properly compacted fill.

Cavities created by removal of subsurface obstructions such as structures, individual effluent disposal systems and trees should be thoroughly cleaned of loose soil, organic matter and other deleterious materials, shaped to provide access for construction equipment and backfilled as recommended for site fill.

PREPARATION OF FILL AREAS:

Prior to placing fill, and after the mandatory subexcavation operation with all loose native and/or undocumented fill removed, the surfaces of all areas to receive fill should be scarified to a depth of 6 inches or more. The scarified soils should be brought to near optimum moisture content and recompacted to a minimum relative compaction of 90 percent in accordance with ASTM D1557.

PREPARATION OF FOOTING AREAS:

All footings should rest upon at least 24 inches of properly compacted fill material. In areas where the required thickness of compacted fill is not accomplished by site rough grading, mandatory subexcavation operation and the undocumented fill removal, the footing areas should be further subexcavated to a depth of 24 inches or more below the proposed footing base grade. The required overexcavation should extend at least 5 feet laterally beyond the footing lines, where possible. The bottom of this excavation should then be scarified to a depth of at least 6 inches, brought to near optimum moisture content and recompacted to a minimum of 90 percent relative compaction in accordance with ASTM D1557 prior to refilling the excavation to the required grade as properly compacted fill.

Foundation concrete should be placed in neat excavations with vertical sides, or the concrete should be formed and the excavations properly backfilled as recommended for compacted fill.

COMPACTED FILLS:

The on-site soils should provide adequate quality fill material provided they are free from organic matter and other deleterious materials. Unless approved by the geotechnical engineer, rock or similar irreducible material with a maximum dimension greater than 8 inches should not be buried or placed in fills.

If utilized, import fill should be inorganic, non-expansive, granular soil free from rocks or lumps greater than 6 inches in maximum dimension. The contractor shall notify the geotechnical engineer of import sources sufficiently ahead of their use so that the sources can be observed and approved as to the physical characteristic of the import material. For all import material, the contractor shall also submit current verified reports from a recognized analytical laboratory indicating that the import has a "not applicable" (Class S0) potential for sulfate attack based upon current American Concrete Institute (ACI) criteria and is not corrosive to ferrous metal and copper. The reports shall be accompanied by a written statement from the contractor that the laboratory test results are representative of all import material that will be brought to the job.

Fill should be spread in near-horizontal layers, approximately 8 inches thick. Thicker lifts may be approved by the geotechnical engineer if testing indicates that the grading procedures are adequate to achieve the required compaction. Each lift should be spread evenly, thoroughly mixed during spreading to attain uniformity of the material and moisture in each layer, brought to near optimum moisture content and compacted to a minimum relative compaction of 90 percent in accordance with ASTM D1557.

It is crucial that the geotechnical engineer or representative be present to observe the grading operations. Further recommendations may be made in the field, depending on the actual conditions encountered.

SHRINKAGE AND SUBSIDENCE:

Based upon the relative compaction of the existing soils tested during this investigation and the relative compaction anticipated for compacted fill soils, we estimate compaction shrinkage of approximately 5 to 10 percent. Therefore, 1.05 to 1.10 cubic yards of in-place soil material would be necessary to yield 1 cubic yard of properly compacted fill material. In addition, we would anticipate subsidence of approximately 0.1 foot. These values are exclusive of losses due to stripping, tree removal or the removal of other subsurface obstructions, if encountered, and may vary due to differing conditions within the project boundaries and the limitations of this investigation.

Values presented for shrinkage and subsidence are estimates only. Final grades should be adjusted and/or contingency plans to import or export material should be made to accommodate possible variations in actual quantities during site grading.

FOUNDATION DESIGN:

If the site is prepared as recommended, the proposed development may be safely founded on conventional spread foundations, either individual spread footings and/or continuous wall footings, bearing on a minimum of 24 inches of compacted fill. Footings should be a minimum of 12 inches wide and should be established at a minimum depth of 12 inches below lowest adjacent final subgrade level. For the minimum width and depth, footings may be designed for a maximum safe soil bearing pressure of 2,300 pounds per square foot (psf) for dead plus live loads. This allowable bearing pressure may be increased by 400 psf for each additional foot of width and by 700 psf for each additional foot of depth to a maximum safe soil bearing pressure of 4,500 psf for dead plus live loads. These bearing values may be increased by one-third for wind or seismic loading.

For footings thus designed and constructed, we would anticipate a maximum static settlement of less than 1/2 inch. Differential static settlement between similarly loaded adjacent footings is expected to be approximately half the total settlement. Static settlement is expected to occur during construction or shortly after.

LATERAL LOADING:

Resistance to lateral loads will be provided by passive earth pressure and base friction. For footings bearing against compacted fill, passive earth pressure may be considered to be developed at a rate of 430 psf per foot of depth. Base friction may be computed at 0.40 times the normal load. Base friction and passive earth pressure may be combined without reduction. Foundation concrete should be placed in neat excavations with vertical sides, or the concrete should be formed and the excavations properly backfilled as recommended for compacted fill.

Other than conservative soil modeling, the lateral passive earth pressure and base friction values recommended do not include factors of safety. If the design is to be based on allowable lateral resistance values, we recommend that minimum factors of safety of 1.5 and 2.0 be applied to the friction coefficient and passive lateral earth pressure, respectively. The resulting allowable lateral resistance values are:

Allowable Lateral Resistance Values			
	Ultimate	**Allowable**	**Factor of Safety**
Passive Lateral Earth Pressure (psf/ft)	430	215	2.0
Base Friction Coefficient	0.40	0.26	1.5

For preliminary design purposes, a lateral active earth pressure developed at a rate of 38 psf per foot of depth should be utilized for unrestrained conditions.

For restrained conditions, an at-rest earth pressure of 58 psf per foot of depth should be utilized.

The "at-rest" condition applies toward braced walls that are not free to tilt. The "active" condition applies toward unrestrained cantilevered walls where wall movement is anticipated. The structural designer should use judgment in determining the wall fixity and may utilize values interpolated between the "at-rest" and "active" conditions where appropriate.

These values are based on backfills with on-site materials compacted to 90 percent of relative compaction and should be verified prior to construction. These values are applicable only to level, properly drained backfill with no additional surcharge loadings and do not include a factor of safety other than conservative modeling of the soil strength parameters. *If inclined backfills are proposed, this firm should be contacted to develop appropriate active earth pressure parameters*. If import material is to be utilized for backfill, an engineer from this firm should verify the backfill has equivalent or superior strength values.

RETAINING WALL BACKFILL:

Backfill behind retaining walls should consist of a soil of sufficient granularity that the backfill will properly drain. The granular soil should be classified per the USCS as GW, GP, SW, SP, SW-SM or

SP-SM. Surface drainage should be provided to prevent ponding of water behind walls. A drainage system should be installed behind all retaining walls consisting of either of the following:

1. A 4-inch-diameter perforated PVC (Schedule 40) pipe or equivalent at the base of the stem encased in 2 cubic feet of granular drain material per linear foot of pipe or

2. Synthetic drains such as Enkadrain, Miradrain, Hydraway 300 or equivalent.

Perforations in the PVC pipe should be 3/8 inch in diameter. Granular drain material should be wrapped with filter cloth such as Mirafi 140 or equivalent to prevent clogging of the drains with fines. Walls should be waterproofed to prevent nuisance seepage. Water should outlet to an approved drain.

SLABS-ON-GRADE:

To provide adequate support, concrete slabs-on-grade should bear on a minimum of 24 inches of compacted soil. Concrete slabs-on-grade should be a minimum of 4 inches in thickness. The soil should be compacted to 90 percent relative compaction. The final soil pad surfaces should be rolled to provide smooth, dense surfaces.

Slabs to receive moisture-sensitive coverings should be provided with a moisture vapor retarder. We recommend that a vapor retarder be designed and constructed according to the American Concrete Institute 302.1R, Concrete Floor and Slab Construction, which addresses moisture vapor retarder construction. At a minimum, the vapor retarder/barrier should comply with ASTM E1745 and have a nominal thickness of at least 10 mils. The vapor retarder/barrier should be properly sealed, per the manufacturer's recommendations, and protected from punctures and other damage. Per the Portland Cement Association (www.cement.org/tech/cct_con_vapor_retarders.asp), for slabs with vapor-sensitive coverings, a layer of dry, granular material (sand) should be placed under the vapor retarder/barrier. For slabs in humidity-controlled areas, a layer of dry, granular material (sand) should be placed above the vapor retarder/barrier.

Concrete building slabs subjected to heavy loads, such as materials storage and/or forklift traffic, should be designed by a registered civil engineer competent in concrete design. A modulus of vertical subgrade reaction of 200 pounds per cubic inch can be utilized in the design of slabs-on-grade for the proposed project.

POTENTIAL EROSION AND DRAINAGE:

The potential for erosion should be mitigated by proper drainage design. The site should be graded in such a way that surface water flows away from structures. Water should not be allowed to flow over graded areas or natural areas so as to cause erosion. Graded areas should be planted or otherwise protected from erosion by wind or water.

PRELIMINARY FLEXIBLE PAVEMENT DESIGN:

The following recommended structural sections were calculated based on traffic indices (TIs) provided in the Caltrans Highway Design Manual, "Minimum TIs for Safety Roadside Rest Areas", Table 613.5B (Caltrans, 2012)[1]. The structural sections tabulated below should be confirmed during construction when the actual subgrade soils are exposed.

Preliminary Flexible Pavement Design			
Usage	**TI**	**R-Value**	**Recommended Structural Section**
Auto Parking Areas	5.0	50	0.25' HMA/0.35' Class 2 AB
Auto Roads	5.5	50	0.25' HMA/0.35' Class 2 AB
Truck Parking Areas	6.0	50	0.30' HMA/0.35' Class 2 AB
Truck Ramps and Roads	8.0	50	0.40' HMA/0.45' Class 2 AB

HMA = hot mix asphalt AB = aggregate base

[1] As per the Caltrans Highway Design Manual, Section 614.3, a design subgrade maximum R-value of 50 for the soil was utilized in performing the pavement section calculations.

The above structural sections are predicated upon proper compaction of the utility trench backfills and the subgrade soils, with the upper 6 inches of subgrade soils and all aggregate base material brought to a minimum relative compaction of 95 percent in accordance with ASTM D1557 prior to paving. The aggregate base should meet Caltrans requirements for Class 2 base.

It should be noted that the above pavement designs were based upon preliminary R-value testing and should be verified by additional sampling and testing during construction when the actual subgrade soils are exposed.

C.H.J., Incorporated does not practice traffic engineering. The TIs used to develop the recommended pavement sections are typical for projects of this type. We recommend that the project civil engineer or traffic engineer verify that the TIs are appropriate for this project.

PRELIMINARY RIGID PAVEMENT DESIGN:

Based on an R-value of 50, we recommend the following Portland cement concrete (PCC) pavement designs. The designs are based on the ACI "Guide for the Design and Construction of Concrete Parking Lots" (ACI 330R-08).

Preliminary Rigid Pavement Design	
Design Area	**Recommended Section**
Car Parking and Access Lanes ADTT = 1 (Category A)	4.0" PCC/Compacted Soil
Truck Parking Areas Multiple Units ADTT = 300 (Category B)	6.0" PCC/Compacted Soil

ADTT = Average Daily Truck Traffic

The above recommended concrete sections are based on a design life of 20 years, with integral curbs or thickened edges. In addition, the above structural sections are predicated upon proper compaction of the utility trench backfills and the subgrade soils, with the upper 12 inches of subgrade soils brought to a uniform relative compaction of 95 percent (ASTM D1557).

Slab edges that will be subject to vehicle loading should be thickened at least 2 inches at the outside edge and tapered to 36 inches back from the edge. Typical details are given in the ACI "Guide for the Design and Construction of Concrete Parking Lots" (ACI 330R-08). Alternatively, slab edges subject to vehicle loading should be designed with dowels or other load transfer mechanism. Thickened edges or dowels are not necessary where new pavement will abut areas of curb and gutter, buildings or other structures preventing through-vehicle traffic and associated traffic loads.

The concrete sections may be placed directly over a compacted subgrade prepared as described above. The concrete to be utilized for the concrete pavement should have a minimum modulus of rupture of 590 pounds per square inch. This approximates a 28-day compressive strength of 3,500 pounds per square inch. However, the design strength should be based upon the modulus of rupture and not the compressive strength. Contraction joints should be sawcut in the pavement at maximum spacing of 30 times the thickness of the slab, up to a maximum of 15 feet. Sawcutting in the pavement should be performed within 12 hours of concrete placement, or preferably sooner.

Sawcut depths should be equal to approximately one-quarter of the slab thickness for conventional saws or 1 inch when early-entry saws are utilized on slabs 9 inches thick or less. The use of plastic strips for formation of jointing is not recommended. The use of expansion joints is not recommended, except where the pavement will adjoin structures. Construction joints should be constructed such that adjacent sections butt directly against each other and are keyed into each other or the joints are properly doweled with smooth dowels. It should be noted that distributed steel reinforcement (welded wire fabric) is not necessary, nor will any decrease in section thickness result from its inclusion.

The above pavement designs were based on preliminary R-value testing and should be verified by additional sampling and testing during construction when the actual subgrade soils are exposed.

C.H.J., Incorporated does not practice traffic engineering. The ADTT values used to develop the recommended PCC pavement sections are typical for projects of this type. We recommend that the project civil engineer or traffic engineer verify that ADTT values are appropriate for this project.

CHEMICAL/CORROSIVITY TESTING:

Selected samples of materials were delivered to HDR, Inc. for soil corrosivity testing. Laboratory testing consisted of pH, resistivity and major soluble salts commonly found in soils. The results of the laboratory tests performed by HDR, Inc. appear in Appendix "C".

These tests have been performed to screen the site for potentially corrosive soils. Values from the soil tested are considered potentially "mildly" and "moderately" corrosive to ferrous metals at as-received and saturated conditions, respectively. Specific corrosion control measures, such as coating of the pipe with non-corrosive material or alternative non-metallic pipe material, will be needed if there is a potential of saturation.

Ammonium and nitrate levels did not indicate a concern as to corrosion of buried copper.

Results of the soluble sulfate testing indicate a "not applicable" (Class S0) anticipated exposure to sulfate attack. Based on the criteria from Table 4.3.1. of the American Concrete Institute Manual of Concrete Practice (2011), no special measures, such as specific cement types or water-cement ratios, will be needed for this "not applicable" exposure to sulfate attack.

The soluble chloride content of the soils tested was not at levels high enough to be of concern with respect to corrosion of reinforcing steel. The results should be considered in combination with the soluble chloride content of the hardened concrete in determining the effect of chloride on the corrosion of reinforcing steel.

C.H.J., Incorporated does not practice corrosion engineering. If further information concerning the corrosion characteristics, or interpretation of the results submitted herein, is required, then a competent corrosion engineer could be consulted.

CONSTRUCTION OBSERVATION:

All grading operations, including site clearing and stripping, should be observed by a representative of the geotechnical engineer. The geotechnical engineer's field representative will be present to provide observation and field testing and will not supervise or direct any of the actual work of the contractor, his employees or agents. Neither the presence of the geotechnical engineer's field representative nor the observations and testing by the geotechnical engineer shall excuse the contractor in any way for defects discovered in his work. It is understood that the geotechnical engineer will not be responsible for job or site safety on this project, which will be the sole responsibility of the contractor.

LIMITATIONS

C.H.J., Incorporated has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable geotechnical engineers and engineering geologists practicing under similar circumstances. No other representation, express or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the testing conducted on the site as the site existed during the investigation, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested at the time of the subject investigation, and the findings of this report may be invalidated fully or partially by changes outside of the control of C.H.J., Incorporated. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions that appear different than those described herein be encountered in the field by the client or any firm performing services for the client or the client's assign, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this investigation are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this office.

REGISTERED GEOLOGIST
JOHN S. McKEOWN
NO. 2396
CERTIFIED ENGINEERING GEOLOGIST
Exp. 06-30-17
STATE OF CALIFORNIA

Respectfully submitted,

C.H.J., INCORPORATED

John S. McKeown

John S. McKeown, C.E.G. 2396
Consulting Geologist

REGISTERED PROFESSIONAL ENGINEER
FENG YI
No. 2967
Exp. 06-30-17
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Fred Yi, Ph.D., G.E. 2967
Consulting Chief Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
JAMES F. COOKE
No. 3012
Exp. 12-31-15
GEOTECHNICAL
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Date: 2015.09.15 14:01:14 -07'00'

James F. Cooke, G.E. 3012
Consulting Managing Engineer

George Battey III

George Battey III, P.E.
President

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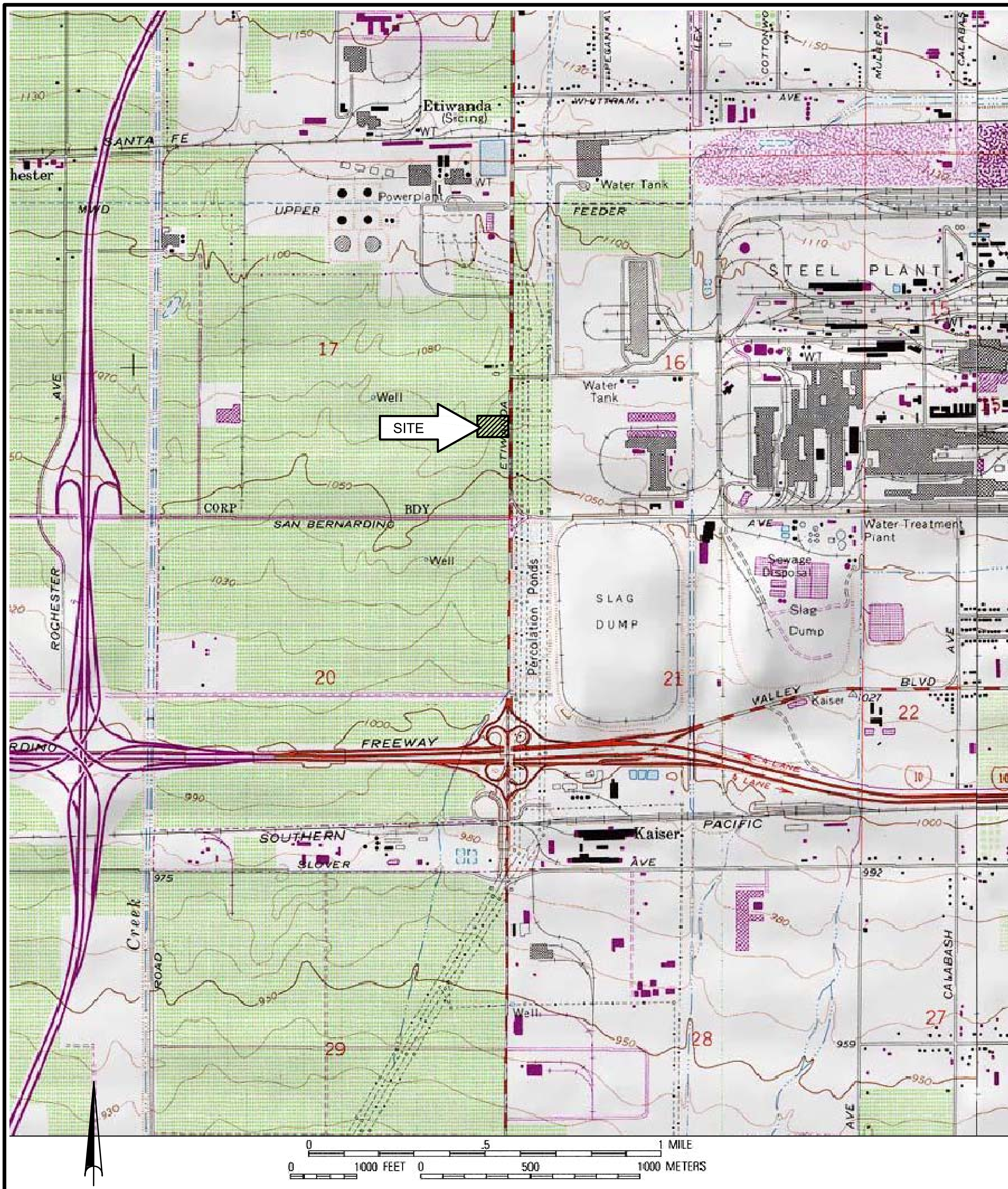
APPENDIX "A"

MAPS



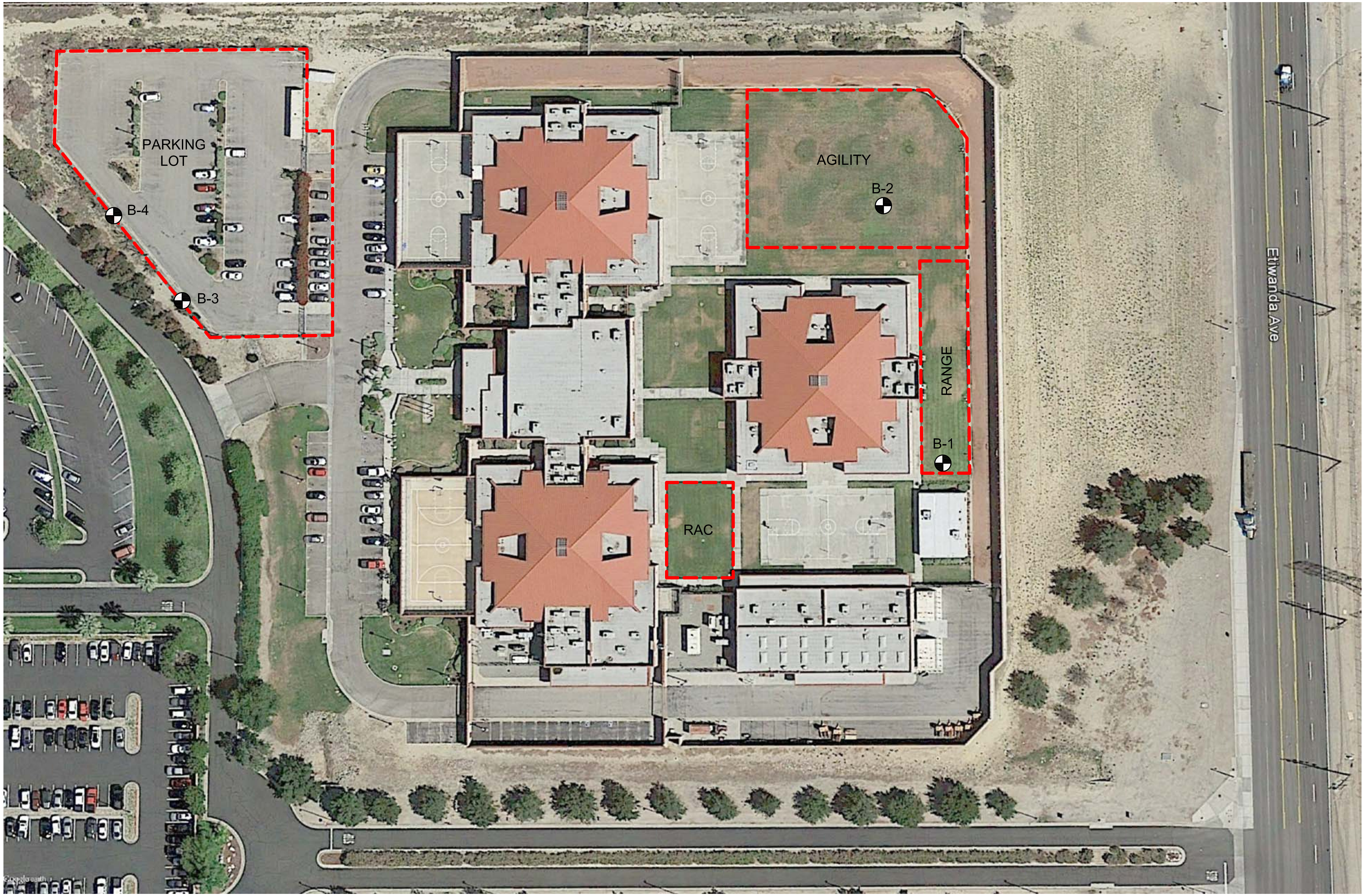
N

SCALE: 1" = 2000'

INDEX MAP

FOR: COUNTY OF SAN BERNARDINO ARCHITECTURE AND ENGINEERING DEPARTMENT	GEOTECHNICAL INVESTIGATION WEST VALLEY REGIONAL TRAINING CENTER (A&E PROJECT 5P45) 9478 ETIWANDA AVENUE RANCHO CUCAMONGA, CALIFORNIA	ENCLOSURE "A-1"
DATE: AUGUST 2015		JOB NUMBER G15-028-3

C.H.J. Incorporated



-N-

SCALE: 1" = APPROX. 80'

LEGEND:

B-4 EXPLORATORY BORING

PROJECT BOUNDARIES

SITE PLAN

FOR: COUNTY OF SAN BERNARDINO ARCHITECTURE AND ENGINEERING DEPARTMENT

DATE: AUGUST 2015

GEOTECHNICAL INVESTIGATION
WEST VALLEY REGIONAL TRAINING CENTER
(A&E PROJECT 5P45)
9478 ETIWANDA AVENUE
RANCHO CUCAMONGA, CALIFORNIA

ENCLOSURE "A-2"

JOB NUMBER G15-028-3

C.H.J. Incorporated

APPENDIX "B"

EXPLORATORY LOGS

KEY TO LOGS

LEGEND OF LAB/FIELD TESTS:

Blows	A measure of the penetration resistance of soil expressed as the number of hammer blows required to advance the indicated sampler 6 inches (or less if noted). Samplers are driven with an automatic hammer that drops a 140-pound weight 30 inches for each blow. After the required seating, samplers are advanced up to 18 inches ahead of the boring, providing up to three sets of blows per drive.
Bulk	Indicates Disturbed or Bulk Sample
Consol.	Consolidation Test (ASTM D2435)
Cor.	Chemical/Corrosivity Tests (ASTM G187, D4327, D4972)
DS	Direct Shear Test (ASTM D3080)
MDC	Maximum Density Optimum Moisture Test (ASTM D1557)
Pass #200	Washed through #200 Screen (ASTM D422)
Ring	Indicates Relatively Undisturbed Ring Sample. The number of blows per 6 inches required to drive a "California Sampler" (3" O.D. and 2-3/8" I.D.) 18 inches using a 140-pound weight falling 30 inches was recorded.
RV	R- Value Test (CT 301)
SA	Sieve Analysis (ASTM D422)
SE	Sand Equivalent Test (ASTM D2419)
SPT	Indicates Standard Penetration Test. The number of blows per 6 inches required to drive an unlined SPT sampler (2" O.D. and 1 3/8" I.D). 18 inches using a 140-pound weight falling 30 inches was recorded.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size)		
		Clean Gravels (Less than 5% fines)
GRAVELS More than 50% of coarse fraction larger than No.4 sieve size	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		Gravels with fines (More than 12% fines)
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
		Clean Sands (Less than 5% fines)
SANDS 50% or more of coarse fraction smaller than No.4 sieve size	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
		Sands with fines (More than 12% fines)
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

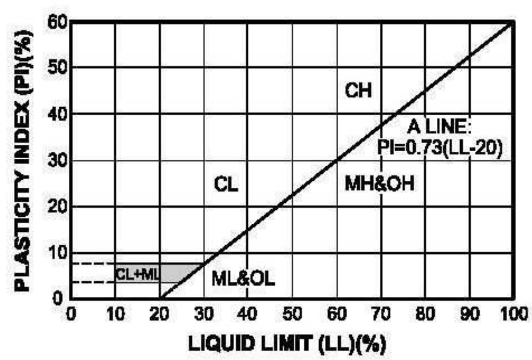
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size). Coarse-grained soils are classified as follows:

Less than 5 percent..GW, GP, SW, SP
More than 12 percent..GM, GC, SM, SC
5 to 12 percent..............................Borderline cases requiring dual symbols

PLASTICITY CHART



EXPLORATORY BORING NO. 1

Date Drilled: 8/26/15
Client: County of San Bernardino
Equipment: CME55 Truck Rig
Driving Weight / Drop / Sampler Size: 140lbs./30in./2.0" O.D.
Surface Elevation(ft): N/A
Logged by: VJR
Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
0		(SM) Silty Sand, fine to medium, with gravel to 3", light brown	Fill						
~3					X		6.3		Cor.
~3		(SP-SM) Sand, fine to coarse, with silt and gravel to 3", brown	Native						
5				X		10 13 18			Pass #200, SPT
~7			Auger Chatter						
10				X		18 30 27			Pass #200, SPT
~12					X		4.0		
15				X		8 11 14			Pass #200, SPT
20		(SM) Silty Sand, fine with medium, yellowish brown		X		7 10 11			Pass #200, SPT
25			Silt Lenses	X		8 10 11			Pass #200, SPT
~27			Smoky Auger Added Water						
30				X		9 10 9			SPT

10331-3 15408-3.GPJ CHJ.GDT 9/8/15

CHJ

WEST VALLEY REGIONAL TRAINING CENTER
RANCHO CUCAMONGA, CALIFORNIA

Job No. G15-028-3

Enclosure B-1a

EXPLORATORY BORING NO. 1

Date Drilled: 8/26/15

Client: County of San Bernardino

Equipment: CME55 Truck Rig

Driving Weight / Drop / Sampler Size: 140lbs./30in./2.0" O.D.

Surface Elevation(ft): N/A

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		(ML) Sandy Silt, fine to medium, with clay and few gravel to 1", brown	Added Water	X		11 15 21			SPT
40			Added Water	X		11 11 16			SPT
45		(SM) Silty Sand, fine to medium, few clay, brown	Added Water	X		9 14 19			SPT
50				X		14 21 25			SPT
		END OF BORING NO REFUSAL, NO BEDROCK NO GROUNDWATER NO CAVING, FILL TO 3'							
55									
60									
65									

10331-3 15408-3.GPJ CHJ.GDT 9/8/15

EXPLORATORY BORING NO. 2

Date Drilled: 8/26/15
Client: County of San Bernardino
Equipment: CME55 Truck Rig
Driving Weight / Drop / Sampler Size: 140lbs./30in./3.0" O.D.
Surface Elevation(ft): N/A
Logged by: VJR
Measured Depth to Water(ft): N/A

DEPTH (ft)	VISUAL CLASSIFICATION	REMARKS	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
0	(SM) Silty Sand, fine to medium, light brown	Fill						
1				X		3.6		DS, MDC
4	(SM) Silty Sand, fine to coarse, with gravel to 3", brown	Native, Auger Chatter						
5			X		26 41 37	3.8	129	Ring
7				X		4.6		
10			X		43 50	5.6	116	Consol., Ring
12	(SM) Silty Sand, fine with medium, brown	Easier Drilling						
15			X		14 18 23	16.3	114	Ring
16				X		9.9		
20			X		14 23 40	10.0	130	Ring
25			X		13 18 23	10.6	120	Ring
26.5	END OF BORING NO REFUSAL, NO BEDROCK NO GROUNDWATER NO CAVING, FILL TO 4'							

10331-3 15408-3.GPJ CHJ.GDT 9/8/15

EXPLORATORY BORING NO. 3

Date Drilled: 8/26/15

Client: County of San Bernardino

Equipment: CME55 Truck Rig

Driving Weight / Drop / Sampler Size: 140lbs./30in.

Surface Elevation(ft): N/A

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
0–5		(SM) Silty Sand, fine to coarse, with gravel to 3", brown	Native						
					☒		2.5		SA, SE
5		END OF BORING NO REFUSAL, NO BEDROCK NO GROUNDWATER NO CAVING, NO FILL							
10									
15									
20									
25									
30									

10331-3 15408-3.GPJ CHJ.GDT 9/8/15

EXPLORATORY BORING NO. 4

Date Drilled: 8/26/15

Client: County of San Bernardino

Equipment: CME55 Truck Rig

Driving Weight / Drop / Sampler Size: 140lbs./30in.

Surface Elevation(ft): N/A

Logged by: VJR

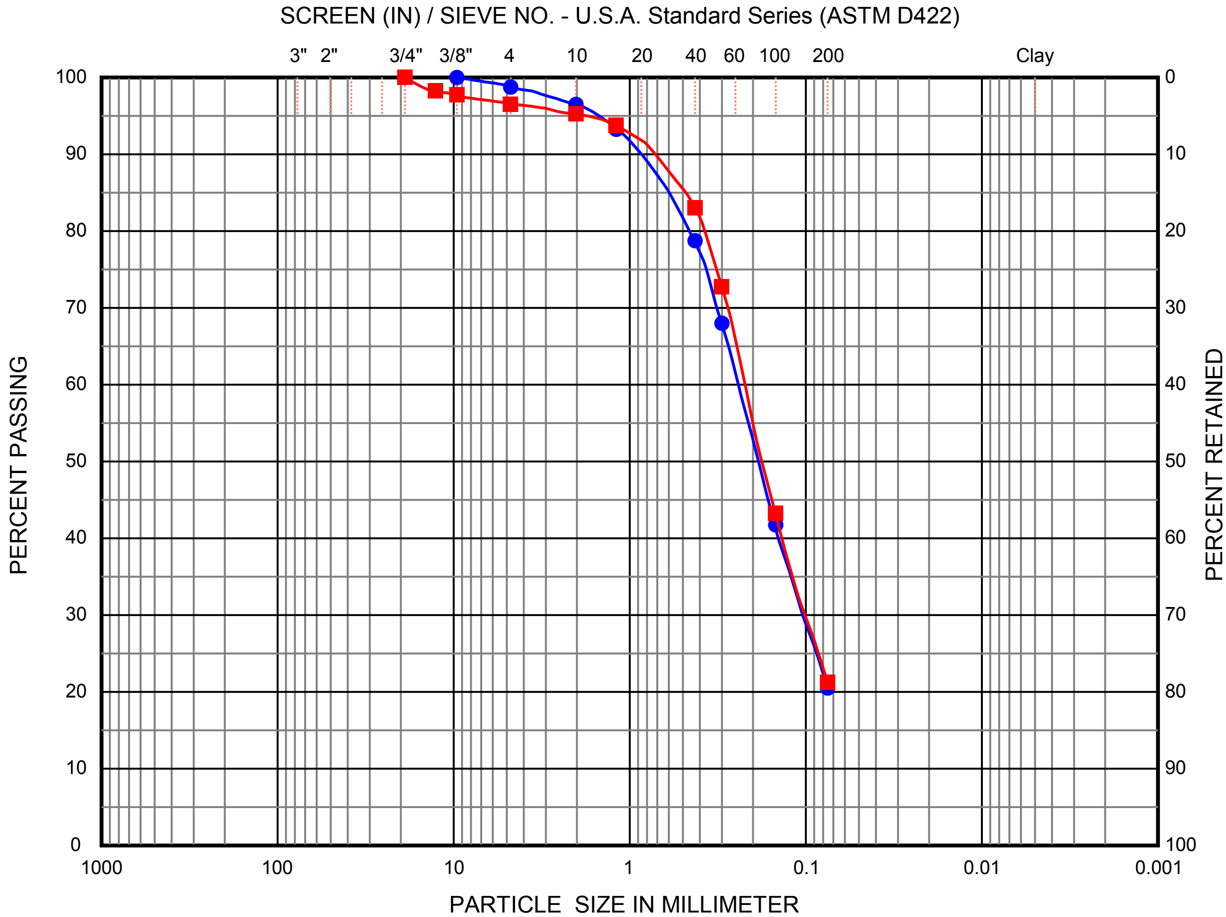
Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
0–5		(SM) Silty Sand, fine to coarse, with gravel to 2", brown	Native		X		2.9		RV, SA, SE
5		END OF BORING NO REFUSAL, NO BEDROCK NO GROUNDWATER NO CAVING, NO FILL							
10									
15									
20									
25									
30									

10331-3 15408-3.GPJ CHJ.GDT 9/8/15

APPENDIX "C"

LABORATORY TESTING



Cobbles & Boulders	Gravel		Sand			Silt	Clay
	Coarse	Fine	Coarse	Medium	Fine		

	Sample No.	Gravel	Sand	Fines	Clay	D_{10}	D_{30}	D_{50}	D_{60}	C_u	C_c
●	3A (3 - 4 ft)	1.1	78.4	20.5			0.103	0.187	0.242		
	(SM) Silty sand, fine to medium (SE=40)										
■	4A (3 - 4 ft)	3.4	75.4	21.2			0.101	0.177	0.221		
	(SM) Silty sand, fine to medium (SE=41)										

PARTICLE SIZE DISTRIBUTION (ASTM D422)

Project:	West Valley Regional Training Center (A&E Project 5P45)				
Location:	9478 Etiwanda Avenue, Rancho Cucamonga, California				
Job Number:	G15-028-3	Engineer:	fy	Enclosure:	C-1

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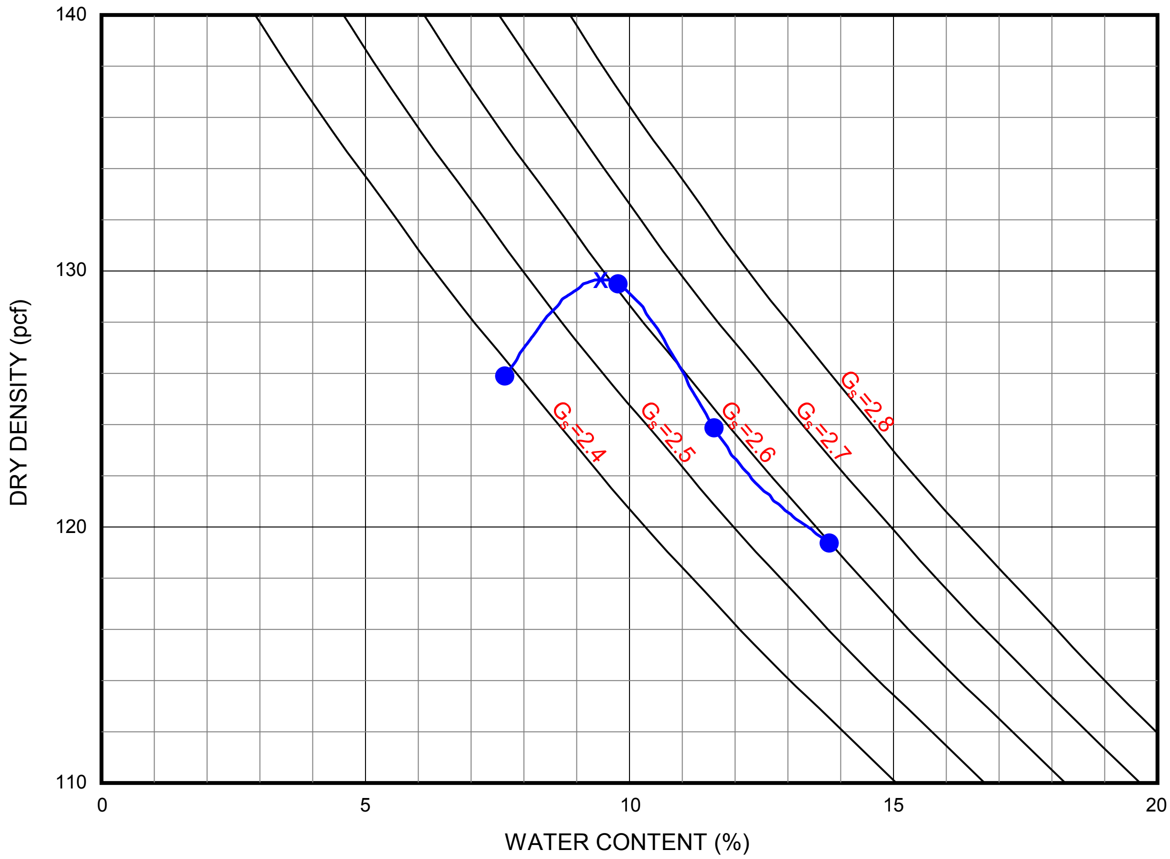

	Sample No.	USCS Classification	γ_{dmax} (pcf)	w_o (%)
●	2A (0 - 1 ft)	(SM) Silty sand, fine to medium	129.5	9.5

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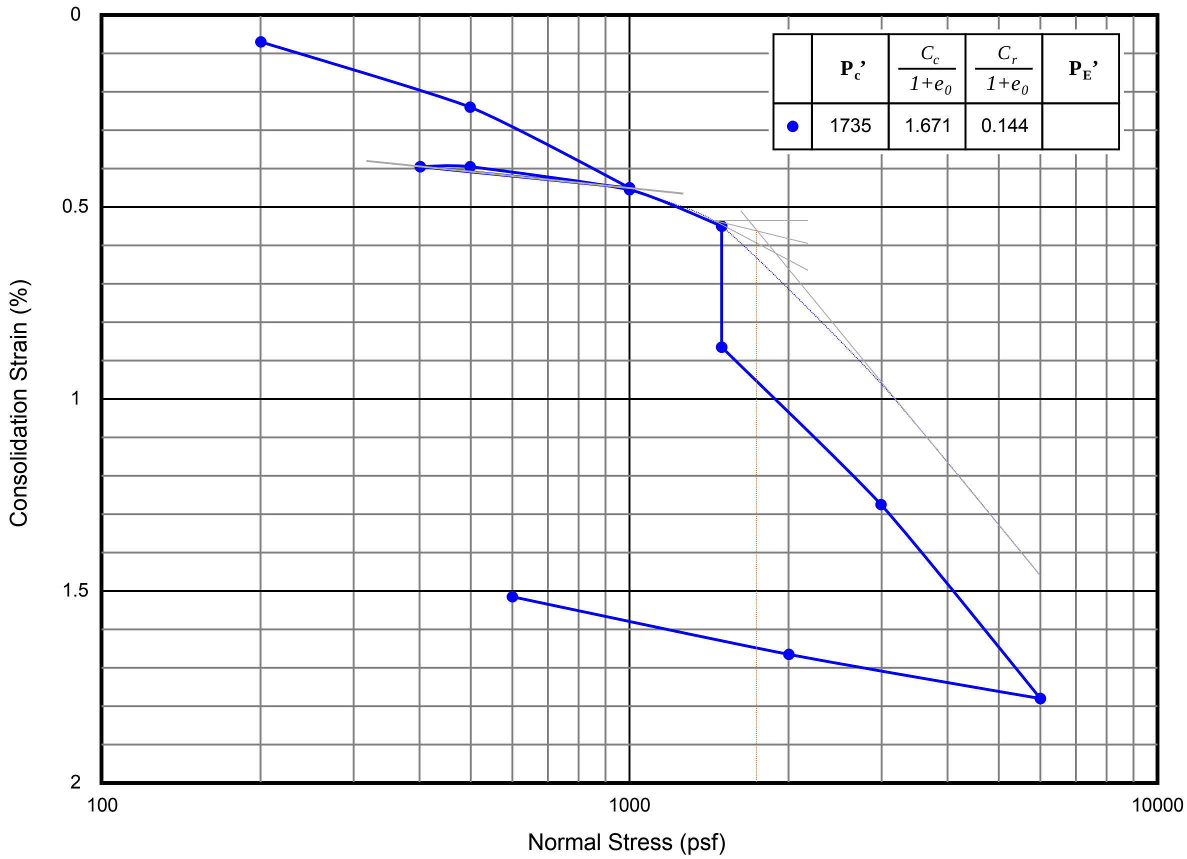
COMPACTION CURVES (ASTM D1557)

Project:	West Valley Regional Training Center (A&E Project 5P45)				
Location:	9478 Etiwanda Avenue, Rancho Cucamonga, California				
Job Number:	G15-028-3	Engineer:	fy	Enclosure:	C-2

Prepared at 9/15/2015 9:28:30



	Boring No.	Depth (ft)	USCS Classification	γ_d (pcf)	w (%)	HCS (%)
●	2	10	(SM) Silty sand, fine to coarse	108.5	4.6	0.3

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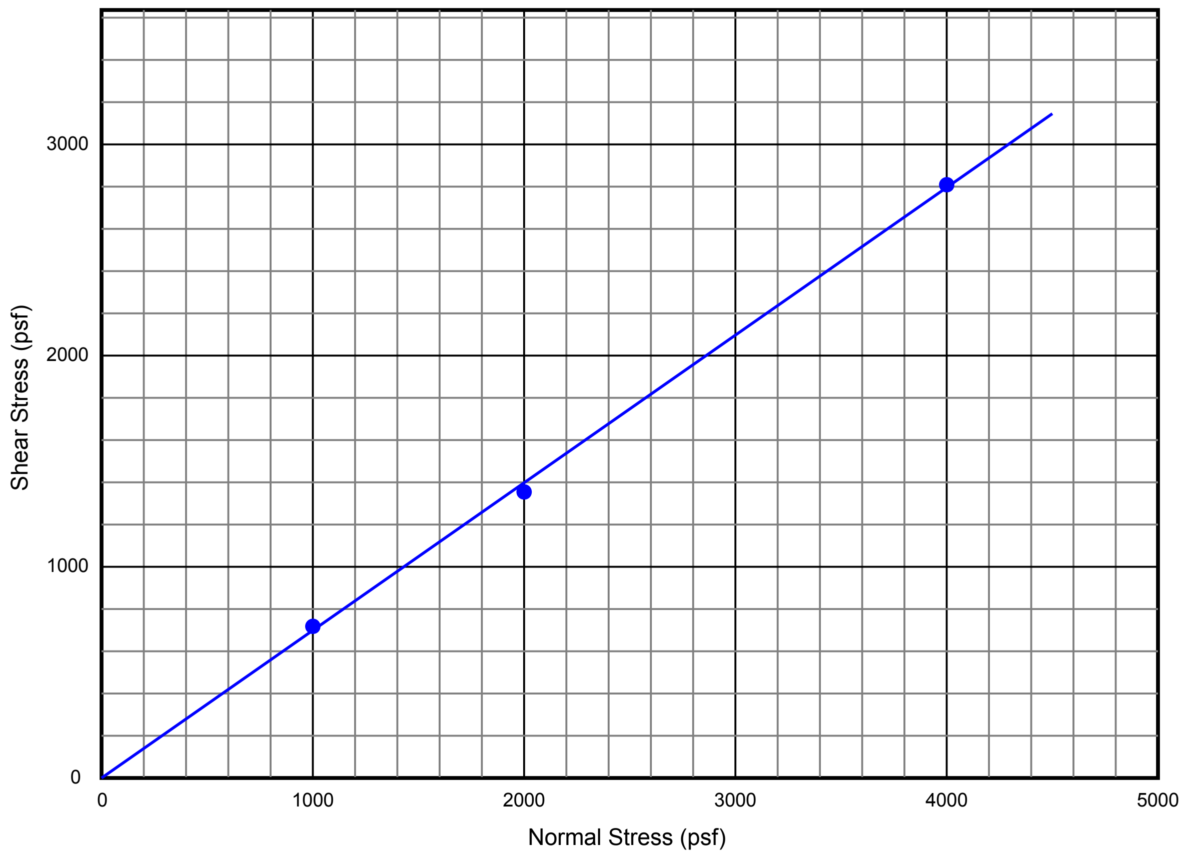
CONSOLIDATION TESTS (ASTM D2435/4546)

Project:	West Valley Regional Training Center (A&E Project 5P45)				
Location:	9478 Etiwanda Avenue, Rancho Cucamonga, California				
Job Number:	G15-028-3	Engineer:	fy	Enclosure:	C-3

Prepared at 9/15/2015 9:28:30



	Sample No.	γ_d (pcf)	w (%)	C_{pk} (psf)	ϕ_{pk} (°)	C_{rs} (psf)	ϕ_{rs} (°)
●	2A (0 - 1 ft)	116.6	10.0	76.5	34.1	0.0	35.0
	(SM) Silty sand, fine to medium / Remolded (RC=90%)						

DIRECT SHEAR TESTS (ASTM D3080)

Project:	West Valley Regional Training Center (A&E Project 5P45)				
Location:	9478 Etiwanda Avenue, Rancho Cucamonga, California				
Job Number:	G15-028-3	Engineer:	fy	Enclosure:	C-4

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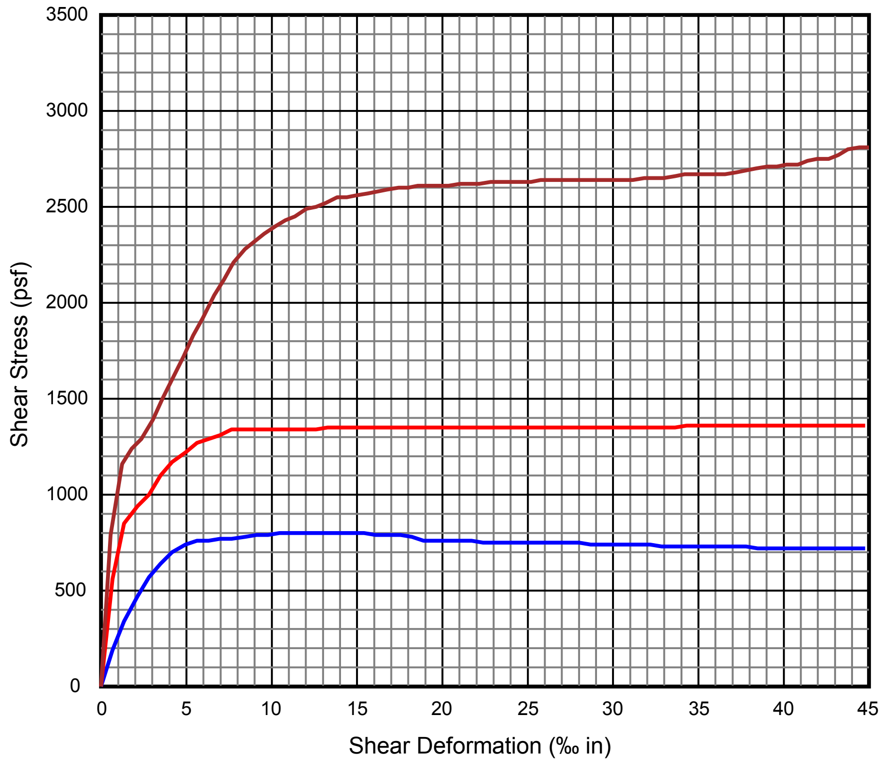

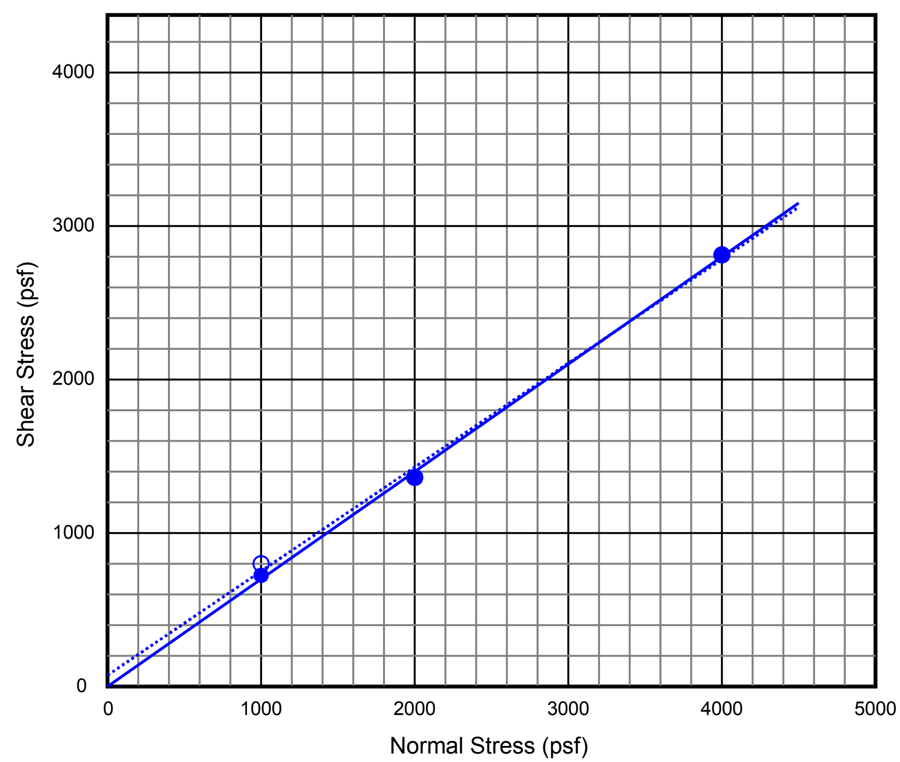

	Sample No.	USCS	γ_d (pcf)	w (%)	C_{pk} (psf)	ϕ_{pk} (°)	C_{rs} (psf)	ϕ_{rs} (°)
●	2A (0 - 1 ft)	(SM) Silty sand, fine to medium / Remolded (RC=90%)	116.6	10.0	76.5	34.1	0.0	35.0

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DIRECT SHEAR TESTS (ASTM D3080)

Project:	West Valley Regional Training Center (A&E Project 5P45)		
Location:	9478 Etiwanda Avenue, Rancho Cucamonga, California		
Job Number:	G15-028-3	Engineer:	fy
Enclosure:	C-5		

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CONSOLIDATION TESTS (ASTM D2435/4546)

Boring No.	Depth (ft)	USCS	γ_d (pcf)	w (%)	Pc' (psf)
2	10	SM	108.5	4.6	1735
Boring No.	**$C_c/(1+e_0)$(%)**	**$C_r/(1+e_0)$(%)**	**PE' (psf)**	**HCS (%)**	
2	1.671	0.144		0.3	

DIRECT SHEAR TESTS (ASTM D3080)

Sample No.	Depth (ft)	USCS	γ_d (pcf)	w (%)	C_{pk} (psf)	ϕ_{pk} (°)	C_{rs} (psf)	ϕ_{rs} (°)
2A	0 - 1	SM	116.6	10.0	76.5	34.1	0.0	35.0

FINES CONTENT (ASTM C117)

Boring No.	1A	1	1	1	1	1
Depth (ft)	3 - 4	5 - 7	10 - 12	15 - 17	20 - 22	25 - 27
Original Dry Mass	428.2	197	199.4	189.4	178.9	179.1
Dry Mass after Washing	318.2	176.6	183.2	167.2	101.3	112.2
Fine Contents (%)	25.7	10.4	8.1	11.7	43.4	37.4
Classification	SM	SP-SM	SP-SM	SP-SM	SM	SM

COMPACTION CURVES (ASTM D1557)

Sample No.	Depth (ft)	USCS	γ_{dmax} (pcf)	w_o (%)
2A	0 - 1	SM	129.5	9.5

R-VALUE (CALTRANS 301)

Sample No.	3A
Depth (ft)	3 - 4
Classification	SM
Sand Equivalent	40
R-value	60

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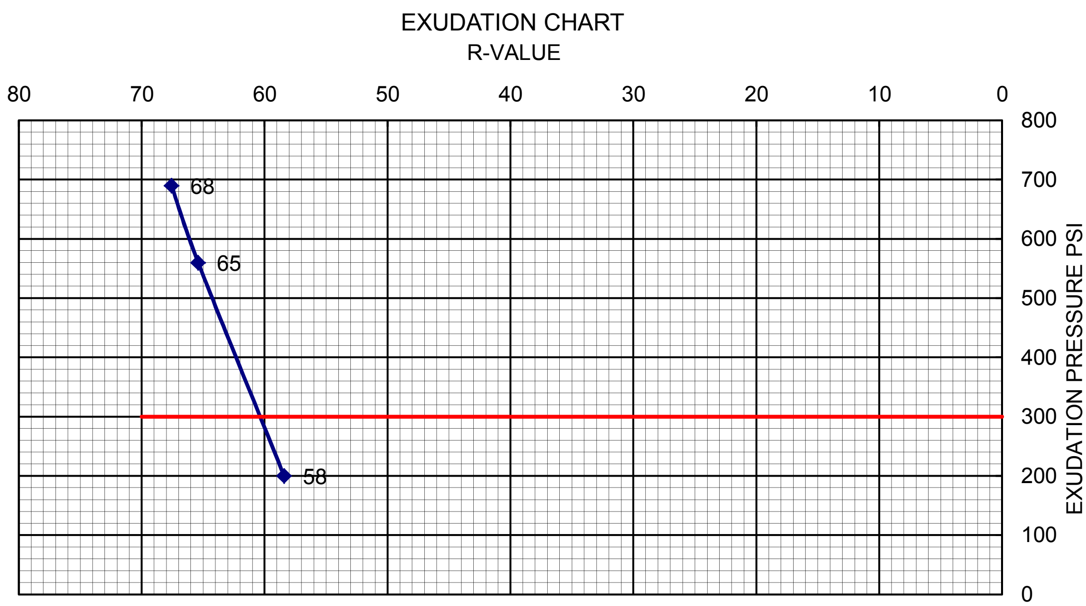
TEST DATA SUMMARY					
Project:	West Valley Regional Training Center (A&E Project 5P45)				
Location:	9478 Etiwanda Avenue, Rancho Cucamonga, California				
Job Number:	G15-028-3	Engineer:	fy	Enclosure:	C-6

Prepared at 9/15/2015 9:28:30

Traffic Index (T.I.) 5.0	A	B	C	D
COMPACTOR AIR PRESSURE P.S.I.	350	350	350	
INITIAL MOISTURE %	3.2	3.2	3.2	
WATER ADDED, ML	80	70	60	
WATER ADDED %	7.9	6.9	5.7	
MOISTURE AT COMPACTION %	11.1	10.1	8.9	
HEIGHT OF BRIQUETTE	2.49	2.48	2.55	
WET WEIGHT OF BRIQUETTE	1047	1045	1091	
DENSITY LB. PER CU.FT.	114.7	115.9	119.1	
STABILOMETER PH AT 1000 LBS.	24	20	19	
2000 LBS.	42	34	32	
DISPLACEMENT	5.00	4.90	4.80	
R-VALUE	58	65	68	
EXUDATION PRESSURE	200	560	690	
THICK. INDICATED BY STAB.	0.67	0.55	0.52	
EXPANSION PRESSURE	0	0	0	
THICK. INDICATED BY E.P.	0.00	0.00	0.00	



R-Value: 60

Sample No.	Depth (ft)	Soil/Sample Type	SE	w_0 (%)
3A	3 - 4	(SM) Silty sand	40	3.2

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R-VALUE TEST			
Project:	West Valley Regional Training Center (A&E Project 5P45)		
Location:	9478 Etiwanda Avenue, Rancho Cucamonga, California		
Job No.:	G15-028-3	Enclosure:	C-7

Prepared at 9/8/2015

ASPHALT CONCRETE STRUCTURAL SECTION DESIGN

R-Value used	50

Traffic Index (T.I.)	Recommended Street Sections	
5.00	0.25' AC / 0.35' AB Class 2	0.40' AC / Native
5.50	0.25' AC / 0.35' AB Class 2	0.45' AC / Native
6.00	0.30' AC / 0.35' AB Class 2	0.50' AC / Native
6.50	0.30' AC / 0.35' AB Class 2	0.55' AC / Native
7.00	0.35' AC / 0.35' AB Class 2	0.60' AC / Native
7.50	0.40' AC / 0.35' AB Class 2	0.65' AC / Native
8.00	0.40' AC / 0.45' AB Class 2	0.70' AC / Native
8.50	0.45' AC / 0.45' AB Class 2	0.80' AC / Native
9.00	0.45' AC / 0.55' AB Class 2	0.85' AC / Native
9.50	0.50' AC / 0.55' AB Class 2	0.90' AC / Native
10.00	0.55' AC / 0.60' AB Class 2	1.00' AC / Native
10.50	0.55' AC / 0.70' AB Class 2	1.05' AC / Native
11.00	0.60' AC / 0.70' AB Class 2	1.10' AC / Native
11.50	0.60' AC / 0.75' AB Class 2	1.15' AC / Native
12.00	0.65' AC / 0.75' AB Class 2	1.20' AC / Native

NOTE: MIN. A.C. THICKNESS IS 0.25' MIN. A.B. THICKNESS IS 0.35'
All thicknesses arerounded to the nearest 0.05 foot.
The above values may not reflect applicable county or city minimum standards.
A safety factor of 0.20 for the G.E. of the A.C. is included as per Caltrans.
The values also include a safety factor of 0.10 for A.C./ native soil.
Some agencies do not permit placing A.C. over native soil.

PARKING LOT PCC SECTION DESIGN

R-Value	Concrete Compressive Strength, f_c (psi)	Flexural Strength, M_r (psi)
60	*3500*	*592*
Traffic Category	**ADTT**	**PCC Section (in)***
A	1	4
A	10	5
B	25	5
B	300	6
C	100	6
C	300	6.5
C	700	6.5
D	700	7
Modulus of subgrade reaction, k (pci)		258.5

* Rough-textured, angular-shaped aggregates

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AC & PCC STRUCTURAL SECTION DESIGN			
Project:	West Valley Regional Training Center (A&E Project 5P45)		
Location:	9478 Etiwanda Avenue, Rancho Cucamonga, California		
Job No.:	G15-028-3	Enclosure:	C-8

Table 1 - Laboratory Tests on Soil Samples

CHJ Consultants
Co S.B. W. Valley Training Center
Your #G15-028-3, HDR Lab #15-0684LAB
28-Aug-15

Sample ID			
			1A
Resistivity		**Units**	
as-received		ohm-cm	80,000
saturated		ohm-cm	9,600
pH			7.3
Electrical Conductivity		mS/cm	0.05
Chemical Analyses			
Cations			
calcium	Ca^{2+}	mg/kg	23
magnesium	Mg^{2+}	mg/kg	3.7
sodium	Na^{1+}	mg/kg	52
potassium	K^{1+}	mg/kg	2.4
Anions			
carbonate	CO_3^{2-}	mg/kg	ND
bicarbonate	HCO_3^{1-}	mg/kg	156
fluoride	F^{1-}	mg/kg	3.4
chloride	Cl^{1-}	mg/kg	9.9
sulfate	SO_4^{2-}	mg/kg	14
phosphate	PO_4^{3-}	mg/kg	3.9
Other Tests			
ammonium	NH_4^{1+}	mg/kg	ND
nitrate	NO_3^{1-}	mg/kg	11
sulfide	S^{2-}	qual	na
Redox		mV	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

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