EXHIBIT 'B'

John R. Byerly
INCORPORATED

GEOTECHNICAL INVESTIGATION

BLOOMINGTON HIGH SCHOOL

STADIUM AND BASEBALL FIELD RENOVATIONS

BLOOMINGTON, CALIFORNIA

COLTON JOINT UNIFIED SCHOOL DISTRICT

GEOTECHNICAL ENGINEERS • TESTING AND INSPECTION
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JUNE 12, 2015

BLOOMINGTON HIGH SCHOOL
STADIUM AND BASEBALL FIELD RENOVATIONS

10750 LAUREL AVENUE
BLOOMINGTON, CALIFORNIA

CLIENT:
COLTON JOINT UNIFIED SCHOOL DISTRICT
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COLTON, CALIFORNIA 92324
ATTENTION: OWEN CHANG, FACILITIES, PLANNING, AND CONSTRUCTION

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INTRODUCTION

During April and May of 2015, an investigation of the soil conditions underlying the area of the proposed stadium and baseball field renovations at the existing Bloomington High School was conducted by this firm. The purpose of our investigation was to evaluate the surface and subsurface conditions at the site with respect to safe and economical foundation types, vertical and lateral bearing values, liquefaction and seismic settlement potential, support of concrete slabs-on-grade, and site preparation. Included in the recommendations are the seismic design parameters as required by the 2013 edition of the California Building Code and the ASCE Standard 7-10. Recommendations are also provided for design of asphalt concrete and portland cement concrete pavement for a new parking lot and drive area. The geologic conditions attendant to the site have been evaluated by our consulting engineering geologist, Gary S. Rasmussen and Associates, Inc., as required by the California Geological Survey. The engineering geology investigation report is presented herewith as Enclosure 9. Our soils investigation, together with our conclusions and recommendations, is discussed in detail in the following report.

This report has been prepared for the exclusive use of the Colton Joint Unified School District and their design consultants for specific application to the project described herein. Should the project be modified, the conclusions and recommendations presented in this report should reviewed by the geotechnical engineer. Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, express or implied.

PROJECT DESCRIPTION

For the preparation of this report, we reviewed the project site plan prepared by HMC Architects. We understand that planned improvements to the existing Bloomington High School will consist of a 2,700-seat-capacity home bleacher and press box, a 800-seat-capacity visitor bleacher, a shared ticket/concession building, and home and visitor team rooms. The proposed structures will be permanent buildings incorporating concrete slab-on-grade floors. Relatively light foundation loads are anticipated. We also understand that the improvements will include stadium lighting poles. The referenced site plan illustrates the construction of dugouts at the varsity baseball field, junior varsity baseball field, and junior varsity softball ball field and backstops and a batting cage. Lastly, we understand that a new parking lot and drive area are planned immediately northwest of the stadium. The sites for the proposed improvements appear to be at the approximate desired grade, and no significant additional cuts and fills seem likely. The site configuration and proposed development are illustrated on Enclosure 1.

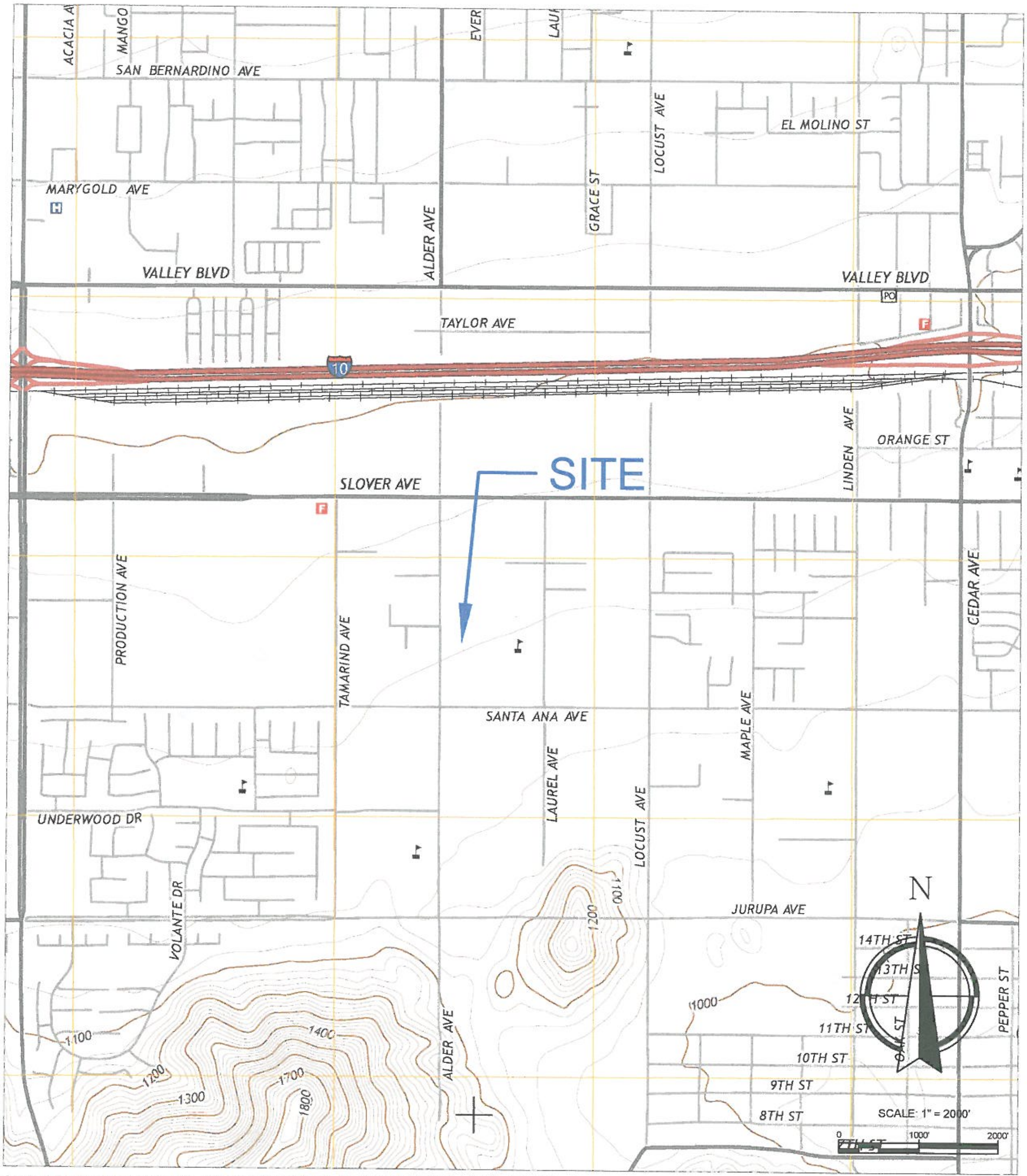
SITE CONDITIONS

The existing Bloomington High School is located on the northwest corner of Laurel Avenue and Santa Ana Avenue in the city of Bloomington. An Index Map showing the general vicinity of the site is presented on the following page. The coordinates of the site are latitude 34.0581° N and longitude 117.4173° W utilizing the North American Datum (NAD) from 1983. The current high school campus is active and is occupied by existing buildings and associated parking areas, driveways, ball fields, hardscape, and landscape areas. The locations of the shared ticket/ concession building and home and visitor team rooms are currently grass- and dirt-covered. The adjacent surrounding properties are occupied by single-family residences. The area topography is generally flat, and the site slopes downward to the southeast at an average gradient of about 1 percent.

FIELD AND LABORATORY INVESTIGATION

The soils underlying the proposed stadium and baseball field renovation areas were explored by means of 13 test borings drilled with a limited-access track-mounted flight-auger to depths of up to 51 feet below the existing ground surface. The approximate locations of the explorations are indicated on Enclosure 1. The soils encountered were examined and visually classified by one of our field engineers. A summary of the soil classifications appears as Enclosure 2. The exploration logs show subsurface conditions at the dates and locations indicated, and may not be representative of other locations and times. The stratification lines presented on the logs represent the approximate boundaries between soil types, and the transitions may be gradual. A hollow-stem auger with an outside diameter of 8.5 inches was utilized. The inside diameter of the auger was 4.5 inches.

INDEX MAP



SOURCE DOCUMENTS: USGS FONTANA QUADRANGLE, CALIFORNIA, 7.5 MINUTE SERIES, 2015

TOWNSHIP AND RANGE: SECTION 28, T1S, R5W

LATITUDE: 34.0581° N

LONGITUDE: 117.4173° W

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Bulk and relatively undisturbed samples were obtained at selected levels within the explorations and returned to our laboratory for testing and evaluation. The driving energy or blow counts required to advance the sampler at each sample interval were also noted. Relatively undisturbed soil samples were recovered at various intervals in the borings with a California sampler. The California sampler was a 2.9-inch outside diameter, 2.5-inch inside diameter, split-barrel sampler lined with brass tubes. The sampler was 18 inches long. The sampler conformed to the requirements of ASTM D 3550. A 140-pound automatic trip hammer was lifted hydraulically and was dropped 30 inches for each blow. Standard penetration tests were performed as Boring 4 was advanced. The standard penetration test blow counts are shown on the log for Boring 4. Standard penetration testing was performed with a 2.0-inch outside diameter, 1.5-inch inside diameter, split-barrel sampler. The sampler was 18 inches long. The inside diameter of the sampler shoe was 1.4 inches. The sampler was unlined. The sampler conformed to the requirements of ASTM D 1586. A 140-pound automatic trip hammer was lifted hydraulically and was dropped 30 inches for each blow. An efficiency value of 1.0 was assumed for the automatic trip hammer.

Included in our laboratory testing were moisture/density determinations on all undisturbed samples. Optimum moisture content/maximum dry density relationships were established for typical soil types so that the relative compaction of the subsoils could be determined. Consolidation testing was conducted to evaluate the compressibility characteristics of the soil. Direct shear testing was conducted on selected samples to determine their strength parameters. Samples of potential subgrade soil were tested for gradation, sand equivalent, and "R" value for pavement design purposes. The moisture/density data are presented on the boring logs, Enclosure 2. Maximum density test data appear on Enclosure 3. The results of the consolidation and direct shear testing are shown on Enclosures 4 and 5, respectively. Subgrade soil test data are summarized on Enclosure 6. Chemical testing, comprised of pH, soluble sulfate, chloride, redox potential, and resistivity testing, was also performed. The chemical test results are presented in the "Chemical Test Results" section of this report.

SOIL CONDITIONS

With the exception of Borings 9 and 10, artificial fill consisting of loose to medium dense silty sands, silty sands with varying amounts of gravel, and sands with gravel was encountered in our explorations to depths ranging from 2.5 feet to 7.0 feet. The fill appears to be associated with previous grading at the site. The natural soils immediately underlying the fill consisted of medium dense to dense silty sands, sands, sands with gravel, and gravelly sands. The upper natural soil encountered in Borings 9 and 10 was loose to depths of up to 1 foot and 3 feet, respectively. All other underlying natural soils encountered in our test borings generally consisted of medium dense to very dense silty sands, silty sands with gravel, sands, sands with gravel, and gravelly sands. Consolidation test results show hydroconsolidation ranging from 2.6 percent to 5.6 percent. Based on published geologic reports for this area, dense alluvial soil is considered to extend to a depth of at least 100 feet beneath the site. Neither bedrock nor ground water was encountered at our exploration locations. The depths of fill are itemized on the following table:

Boring Number	**Depth of Fill (ft.)**
B-1	3.0
B-2	2.5
B-3	4.0
B-4	2.5
B-5	2.5
B-6	4.0
B-7	3.0
B-8	4.5
B-9	NA
B-10	NA
B-11	5.0
B-12	7.0
B-13	6.0

The near-surface soils encountered in our test borings are granular and non-plastic and are considered to have a very low expansion potential in accordance with ASTM D 4829.

LIQUEFACTION AND DYNAMIC SETTLEMENT

Liquefaction is a phenomenon that occurs when a soil undergoes a transformation from a solid state to a liquefied condition due to the effects of increased pore-water pressure. Loose saturated soils with particle sizes in the medium sand to silt range are particularly susceptible to liquefaction when subjected to seismic groundshaking. Affected soils lose all strength during liquefaction, and foundation failure can occur.

Free ground water was not encountered at our boring locations. Based on ground water data, our consulting engineering geologist estimates that the historic high ground water level was at a depth of 241 feet below existing grade. Due to the great depth to ground water, we conclude that the potential for liquefaction is low.

It is anticipated that major earthquake ground shaking will occur during the lifetime of the proposed development from the seismically active San Jacinto fault located approximately 6 miles northeast of the site. This fault would create the most significant earthshaking event. Based on an earthquake magnitude of 7.4, a peak horizontal ground acceleration of 0.553g is assigned to the site. To evaluate the potential for seismically induced settlement of the subsoils, the soils were analyzed for relative density. The most effective measurement of relative density of sands with respect to seismic settlement potential is standard penetration resistance. Standard penetration tests were performed as Boring 4 was advanced to a depth of 51 feet. In addition, the California sampler blow count data were also evaluated. Equivalent standard penetration test blow counts were estimated for Borings 2 and 8, which were drilled to maximum depths of 31 feet. To convert the number of blow counts obtained from the California sampler to equivalent standard penetration test blow counts, the California sampler blow counts were multiplied by a factor of 0.7.

The standard penetration data provided input for the LiquefyPro Version 4.3 program for liquefaction potential and seismically induced settlement. As indicated in Special Publication 117A (Revised) Release, "Guidelines for Evaluating and Mitigating Seismic Hazards in California, March 2009," a safety factor of 1.3 was used in this analysis. The results of this evaluation are shown on Enclosure 8. Our analysis assumed that the existing loose soils will be overexcavated and recompacted to a depth of 3 feet. The engineered fill was assumed to have an "N" value of 30. Our estimate of the potential dynamic settlement in each boring is summarized in the following table.

Boring No.	**2**	**4**	**8**
Estimated total dynamic settlement (inches)	4.9	5.1	5.3

The total depths of Borings 2 and 8 were 31 feet. To allow comparison of the dynamic settlement potential calculated for Borings 2 and 8 with that calculated for Boring 4, the total settlement of that portion of the soil column below a depth of 31 feet in Boring 4 (3.69 inches) was added to the settlement computed for Borings 2 and 8. The analysis and the soil classifications and other properties indicate uniform soil conditions with respect to dynamic settlement and suggest a potential for minimal differential dynamic settlement.

CONCLUSIONS

The artificial fill is non-uniform and undocumented. In addition, portions of the upper natural soil are loose. All artificial fill and loose natural soils should be overexcavated within the new structure areas and replaced as engineered fill. The existing artificial fill should also be overexcavated in the areas of the planned Musco poles. Complete stabilization of the existing artificial fill under pavement areas would require removal and recompaction of the existing artificial fill. The cost of complete removal and recompaction of the existing fill within pavement areas does not appear to be warranted. Substantial stabilization can be obtained by removal and recompaction of the upper 3 feet of artificial fill. Recommendations for foundation design and slabs-on-grade are provided below for a very low (Expansion Index of 0 to 20) expansion potential. Subsequent to grading, the permanent buildings may be safely founded on conventional continuous and pad footings. The light poles will be supported on precast prestress piers placed in drilled or excavated holes and grouted into place. Detailed recommendations are provided below.

RECOMMENDATIONS

SHALLOW FOUNDATION DESIGN

Where the site is prepared as recommended, the proposed permanent buildings may be founded on conventional continuous and pad footings. These footings should be at least 12 inches wide, should be placed at least 12 inches below the lowest final adjacent grade, and should be designed for a maximum safe soil bearing pressure of 2,000 pounds per square foot for dead plus live loads. This value may be increased by one-third for wind and seismic loading.

The continuous footings should be reinforced with at least four No. 5 bars, two placed near the top and two near the bottom of the footings. This recommendation for foundation reinforcement is based on geotechnical considerations. Structural design may require additional foundation reinforcement.

FOUNDATION DESIGN FOR LIGHT STANDARDS

Musco field lighting poles utilize precast and prestress pier footing elements. It is our understanding that a pier diameter of 30 inches is preferred. For piers with an embedment depth of 16 feet, an allowable average skin friction of 375 pounds per square foot may be assumed. This pier capacity may be increased by one-third for wind or seismic loading. Lateral load capacity of the pier footings may be computed using any accepted pole footing formula assuming an allowable lateral earth pressure of 350 pounds per square foot per foot of depth to a maximum of 3,000 pounds per square foot. Where the precast pier footing is deepened to provide at least a 5-foot horizontal clear distance between the edge of the footing and the face of an adjacent descending slope, no reduction in the allowable passive pressure is needed.

SEISMIC DESIGN PARAMETERS

The development of the seismic ground motion parameters is described in detail in the engineering geology investigation report performed in our behalf by Gary S. Rasmussen and Associates, Inc. (Enclosure 9). In summary, the 2013 California Building Code and the ASCE Standard 7-10 coefficients and factors are provided in the following table:

Factor or Coefficient	***Value***
Latitude	34.0581° N
Longitude	117.4173° W
Mapped S_S	1.500g
Mapped S_1	0.604g
F_a	1.0
F_v	1.5
Final S_{MS}	1.500g

Factor or Coefficient	Value
Final S_{M1}	0.907g
Final S_{DS}	1.000g
Final S_{D1}	0.604g
PGA	0.553g
T_L	12 seconds
Site Class	D

LATERAL LOADING

Resistance to lateral loads will be provided by passive earth pressure and basal friction. For footings bearing against compacted fill, passive earth pressure may be considered to develop at a rate of 350 pounds per square foot per foot of depth. Basal friction may be computed at 0.4 times the normal dead load. The resistance from basal friction and passive earth pressure may be combined directly without reduction. The allowable lateral resistance may be increased by one-third for wind and seismic loading.

SLABS-ON-GRADE

Concrete slab-on-grade design recommendations are listed below. The slab-on-grade recommendations assume underlying utility trench backfills and pad subgrade soils have been densified to a relative compaction of at least 90 percent (ASTM D 1557).

1. It is our opinion that the existing compacted fill soils will provide adequate support for concrete slabs-on-grade without the use of a gravel base. The final pad surface should be rolled to provide a smooth dense surface upon which to place the concrete.

2. The slab-on-grade floors should be at least 4 inches thick – structural considerations may require a thicker slab. The concrete slab-on-grade may be designed using a modulus of subgrade reaction of 250 pounds per cubic inch.

3. The concrete slabs-on-grade should be reinforced with No. 3 bars at 18 inches each way. All slab reinforcement should be supported by chairs or precast concrete blocks to ensure positioning of the reinforcement within the middle third of the slab. Lifting of unsupported reinforcement during concrete placement should not be allowed.

4. Slabs to receive moisture-sensitive floor coverings should be underlain with a moisture vapor retardant membrane, such as 10-mil Stego Wrap or equivalent. The moisture vapor retardant membrane should conform to ASTM E 1745-97 (Standard Specification for Plastic Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs). The moisture vapor retardant membrane should be lapped into the footing excavation to provide full coverage of the subgrade soils. Punctures and/or holes cut for plumbing should be taped to minimize moisture emissions through the membrane. The project superintendent and/or a representative of the geotechnical engineer should inspect the placement of the moisture vapor retardant membrane prior to covering. Installation of the moisture vapor retardant membrane should be performed in accordance with ASTM E 1643-94 (Standard Practice of Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs).

5. A 2-inch layer of clean sand (SE>30, no more than 7 percent passing the No. 200 sieve) should be placed over the moisture vapor retardant membrane to promote uniform setting of the concrete. An additional 2-inch layer of sand over compacted fill soils should underlie the 10-mil moisture vapor retardant membrane. Concrete should be placed on the sand blanket when the sand is damp. Excess moisture should not be allowed to accumulate within the sand blanket prior to concrete placement. At the time of concrete placement, the moisture content of the sand blanket above the moisture vapor retardant membrane should not exceed 2 percent <u>below</u> the optimum moisture content.

6. In lieu of placing the sand blanket described above and to further minimize future moisture vapor emissions through the slabs-on-grade, the slab concrete may be placed directly on the moisture vapor retardant membrane. Placing concrete directly on the moisture vapor retardant membrane will increase shrinkage and curling forces and make finishing more difficult. To accommodate these concerns, the structural engineer should provide

appropriate mix design criteria for concrete placed directly on the moisture vapor retardant membrane.

7. We recommend a maximum water-cement ratio of 0.50 for all building slab concrete. Architectural or structural considerations may require the utilization of a lower water-cement ratio. Where slab concrete is placed directly on the moisture vapor retardant membrane without the presence of an intervening layer of absorptive sand, a lower maximum water-cement ratio may be needed.

8. Preparation of the concrete floor slabs should conform to ASTM F 710-98 (Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring) and the manufacturer's recommendations. Moisture vapor emission tests should be performed to verify acceptable moisture emission rates prior to flooring installation.

SITE PREPARATION

We assume that the site will be prepared in accordance with the California Building Code and the current City of Bloomington Grading Ordinance. The recommendations presented below are to establish additional grading criteria. These recommendations should be considered preliminary and are subject to modification or expansion based on a geotechnical review of the project foundation and grading plans.

- All areas to be graded should be stripped of organic matter, man-made obstructions, and other deleterious materials. Underground utilities should be removed and relocated or abandoned. All cavities created during site clearing should be cleaned of loose and disturbed soil, shaped to provide access for construction equipment, and backfilled with fill placed and compacted as described below.

- Existing artificial fill should be removed from all building areas, the bleacher areas, and from the areas of the planned Musco field lighting poles. The depth of existing artificial fill encountered in our borings ranged from 2.5 feet to 7.0 feet. The existing artificial fill may extend to greater depths in areas not explored. The removals should extend beyond the building and bleacher areas and beyond the field lighting pole locations a horizontal distance at least equal to the depth of removal or 5 feet, whichever distance is greater. The existing artificial fill should be removed to a minimum depth of 3 feet within proposed pavement areas. Organic matter and other unsuitable debris should be separated from the removed fill and hauled from the site. The removed artificial fill should be stockpiled pending replacement or be placed in areas previously prepared.

- Overexcavation

  - Building and bleacher areas and Musco field lighting pole areas – The natural soil encountered in a majority of the test borings immediately underlying the existing artificial fill was medium dense and is considered competent. Should removal of the existing artificial fill expose natural soil exhibiting a relative compaction of less than 85 percent (ASTM D 1557), the loose natural soil should be overexcavated until undisturbed soil exhibiting a relative compaction of at least 85 percent is encountered. When competent natural soil is encountered, the overexcavation can be terminated at that depth as long as there is at least 24 inches of compacted fill below all building or bleacher footings. Competent natural soil is defined as undisturbed material exhibiting a relative compaction of at least 85 percent (ASTM D 1557). The overexcavation should extend beyond the building and bleacher areas and pole locations a horizontal distance at least equal to the depth of overexcavation below the final ground surface or 5 feet, whichever distance is greater. A representative of this firm should observe the bottom of all excavations.

  - Pavement and hardscape areas – Should natural soil be encountered at a depth of less than 3 feet below asphalt concrete pavement and portland cement concrete areas, the soils exposed in the subexcavated surface should be scarified to a minimum depth of 12 inches below existing grade or 12 inches below proposed finished grade, whichever is deeper. Finished grade is defined as the elevation of the top of the subgrade.

- Approved subexcavated surfaces and all other surfaces to receive fill should be scarified to a minimum depth of 8 inches, moisture conditioned to near the optimum moisture content, and densified to a minimum relative compaction of 90 percent (ASTM D 1557).

- The on-site soils should provide adequate quality fill material provided they are free from significant organic matter and other deleterious materials and are at acceptable moisture contents. Any asphalt and portland cement concrete removed during site clearing may be pulverized into fragments not exceeding 3 inches in greatest dimension and incorporated into the fill at all levels in the building areas. Pulverized asphalt and concrete should not be placed at the planned field lighting pole locations. Import fill should be inorganic, granular, non-expansive soil free from rocks or lumps greater than 8 inches in maximum dimension and should exhibit a very low expansion potential (expansion index less than 21), negligible sulfate content (less than 1,000 ppm soluble sulfate by weight), and low corrosion potential. Prior to bringing import fill to the site, the contractor should obtain certification to verify that the proposed import meets the State of California Department of Toxic Substance Control (DTSC) environmental standards. Proposed import should be sampled at the source and tested by this firm for expansion index, soluble sulfate content, and corrosion potential.

- All fill should be placed in 8-inch or less lifts, moisture conditioned to near the optimum moisture content, and densified to a minimum relative compaction of 90 percent (ASTM D 1557).

- The surface of the site should be graded to provide positive drainage away from the structures. Drainage should be directed to established swales and then to appropriate drainage structures to minimize the possibility of erosion. Water should not be allowed to pond adjacent to footings.

SHRINKAGE AND SUBSIDENCE

Volume change in going from cut to fill conditions is anticipated where near-surface grading will occur. Assuming the fill will be compacted to an average relative compaction of 93 percent, an average cut-fill shrinkage of 10 percent is estimated. Further volume loss will occur through subsidence during preparation of the natural ground surface. Although the contractor's methods and equipment utilized in preparing the natural ground will have a significant effect on the amount of natural ground subsidence that will occur, our experience indicates as much as 0.10 foot of subsidence in areas prepared to receive fill should be anticipated. These values are exclusive of losses due to stripping or removal of subsurface obstructions.

ASPHALT CONCRETE AND PORTLAND CEMENT CONCRETE PAVEMENT

Representative samples of upper soils at the site have been tested for relevant subgrade properties. A Traffic Index of 5.0 was assumed for interior parking and driveway areas for conventional vehicular traffic and fire lanes, and a Traffic Index of 6.0 was assumed where heavier truck and bus traffic will be accommodated. It is our understanding that the maximum weight of a tandem-axle fire truck is 68 kips. It is anticipated that a single fire truck will visit the site approximately twice a year. In conjunction with the test data shown on Enclosure 6, we believe the sections presented on the following table should provide durable pavement.

Location	**TI**	**"R" Value**	**Thickness (Inches)** **Asphalt Concrete**	 **Aggregate Base**
Pavement areas for conventional passenger cars, light trucks, and fire lanes	5.0	69	2.5	4.0
Pavement areas for bus and heavier trucks	6.0	69	3.0	4.0

Location	**TI**	**"R" Value**	**Thickness (Inches) Portland Cement Concrete**
Pavement areas for conventional passenger cars and light trucks	5.0	69	4.5
Pavement areas for bus and heavier trucks	6.0	69	6.5

The foregoing thickness is for unreinforced concrete placed directly on the compacted subgrade soil. Aggregate base is not geotechnically required for the PCC pavement sections; however, if aggregate base is to be utilized for the PCC pavement, we recommend a minimum of 4 inches of aggregate base placed over the 12 inches of compacted subgrade soil. The design engineer may wish to provide some level of reinforcement to minimize the width of shrinkage cracks.

Prior to the placement of concrete, we recommend that the final subgrade surface be scarified to a depth of at least 12 inches, moisture conditioned to near the optimum moisture content, and compacted to a relative compaction of at least 90 percent (ASTM D 1557). Concrete should be proportioned for a maximum slump of 4.0 inches and to achieve a minimum compressive strength of 3,000 psi at 28 days. If additional workability is desired, a plasticizing or water-reducing admixture should be utilized in lieu of increasing the water content. Control joints for the 4.5-inch-thick pavement should be spaced no more than 13.5 feet on-center each way. The control joints for the 6.5-inch-thick pavement should be spaced no more than 19.5 feet on-center each way. Control joints should be established either by hand groovers, plastic inserts, or saw-cutting as soon as the concrete can be cut without dislodging aggregate. Cutting the control joints the day after the concrete pour will likely result in uncontrolled shrinkage cracks. Concrete should not be placed in hot and windy weather. Water curing should commence immediately after the final finishing and should continue for at least 7 days.

The above designs are preliminary and for estimating purposes only. We recommend that during the process of rough grading, observation and additional testing of the actual subgrade soils should be performed. Final pavement design sections can then be determined. The foregoing pavement sections assume that utility trench backfill below all proposed pavement areas will be compacted to at least 90 percent relative compaction. The upper 12 inches of subgrade below asphalt concrete pavement areas should be compacted to at least 90 percent relative compaction. Aggregate base should be densified to at least 95 percent relative compaction. Suggested specifications for aggregate base material are presented on Enclosure 7.

CHEMICAL TEST RESULTS

The chemical test results from a sample taken from Boring 6 between the ground surface and a depth of 3 feet are shown on the following table:

Analysis	Result	Units
Saturated Resistivity	8000	ohm-cm
Chloride	ND (Not Detected)	ppm
Sulfate	30	ppm
pH	7.2	pH units
Redox Potential	224	mV

The chemical test results from a sample taken from Boring 12 between the ground surface and a depth of 3 feet are shown on the following table:

Analysis	Result	Units
Saturated Resistivity	11200	ohm-cm
Chloride	ND (Not Detected)	ppm
Sulfate	ND (Not Detected)	ppm
pH	7.4	pH units
Redox Potential	207	mV

The soil tested in Borings 6 and 12 exhibited negligible soluble sulfate content; therefore, sulfate-resistant concrete will not be required for this project. In addition, the results of the corrosivity testing indicate that the soil tested is not detrimentally corrosive to ferrous-metal pipes.

FOUNDATION AND GRADING PLAN REVIEW

The project foundation and grading plans should be reviewed by the geotechnical engineer. Additional recommendations may be required at that time.

CONSTRUCTION OBSERVATIONS

All grading operations, including the preparation of the natural ground surface, should be observed and compaction tests performed by this firm. No fill should be placed on any prepared surface until that surface has been evaluated by the representative of the geotechnical engineer. The footing excavations for the buildings and bleachers should be evaluated by a representative of the geotechnical engineer. A representative of the geotechnical engineer should be present during the excavation of the lighting pole footings to verify embedment depths and to observe the bottom of all excavations prior to placement of the precast piers.

The conclusions and recommendations presented in this report are based upon the field and laboratory investigation described herein and represent our best engineering judgment. Should conditions be encountered in the field that appear different from those described in this report, we should be contacted immediately in order that appropriate recommendations might be prepared.

Respectfully submitted,

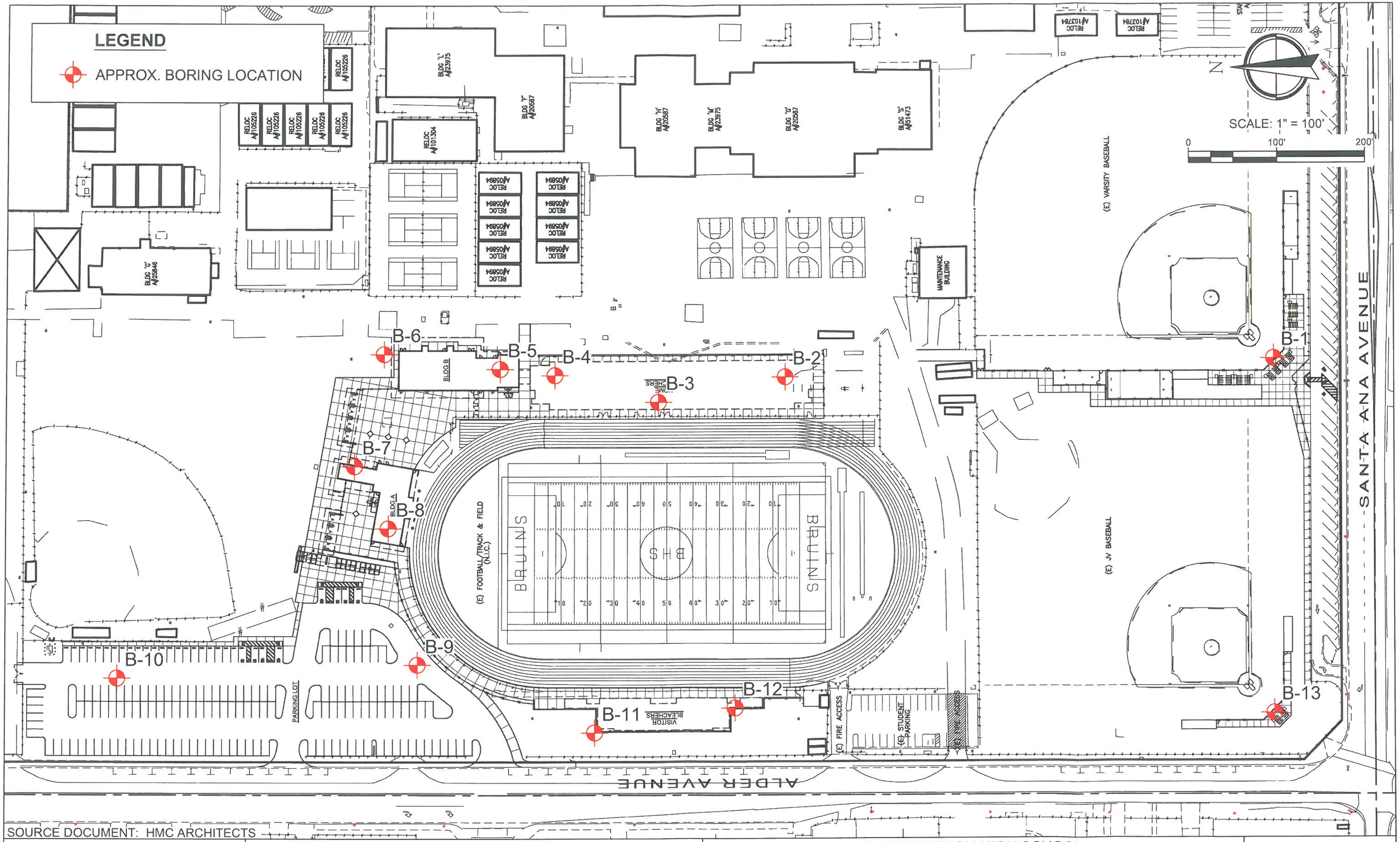
JOHN R. BYERLY, INC.

JOHN R. BYERLY
No. GE000179
Exp. Date 6-30-15

John R. Byerly, Geotechnical Engineer
President

JRB:MLL:mh

Enclosures:
- (1) Plot Plan
- (2) Test Boring Logs
- (3) Maximum Density Determinations
- (4) Consolidation Test Results
- (5) Direct Shear Test Results
- (6) Subgrade Soil Tests
- (7) Specifications for Aggregate Base
- (8) Liquefaction and Dynamic Settlement Analysis
- (9) Engineering Geology Investigation



SOURCE DOCUMENT: HMC ARCHITECTS

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GEOTECHNICAL INVESTIGATION

BLOOMINGTON HIGH SCHOOL
10750 LAUREL AVENUE
BLOOMINGTON, CALIFORNIA

Enclosure 1
Rpt. No.: 3058
File No.: S-13636

Boring 1

Depth
Std. Pen. "N" Value
CA Sampler Blows (Ft)
Dry Density (PCF)
Moisture Content (%)
Rel. Compaction (%)
Water Table

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger

0
5
10
15
20
25
30
35

GWT not encountered

SM	Brown silty fine sand with some gravel, dry and loose to medium dense (FILL)
SP	Gray fine sand, dry and medium dense to dense (ORIGINAL GROUND)
SP	Gray-brown gravelly sand, dry and dense
END	Total Depth at 15.0 Feet No Free Groundwater Encountered

LOG OF BORING

Boring 2

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger

Depth	Std. Pen. "N" Value	CA Sampler Blows (Ft)	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						GWT not encountered
		27	---	---	---	
		40	---	---	---	
5		43	---	---	---	
		50	131	2.3	94	
10		35	125	1.9	92	
15		34	111	7.2	91	
20		50/11"	121	2.3	93	
25		26	110	9.1	90	
30		47	115	9.2	94	
35						

SM	Light gray-brown silty fine to coarse sand with gravel, dry and medium dense (FILL)
SP	Gray gravelly sand, dry and dense (ORIGINAL GROUND)
SP	Gray fine to coarse sand with gravel, dry and dense
SM	Brown silty fine sand, moist and dense
SM	Gray-brown silty fine to coarse sand with gravel, dry and dense
SM	Brown silty fine sand, moist and dense
END	Total Depth at 31.0 Feet No Free Groundwater Encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\S-13636 (Rpt. No. 3058).log Date: 6/9/2015

LOG OF BORING

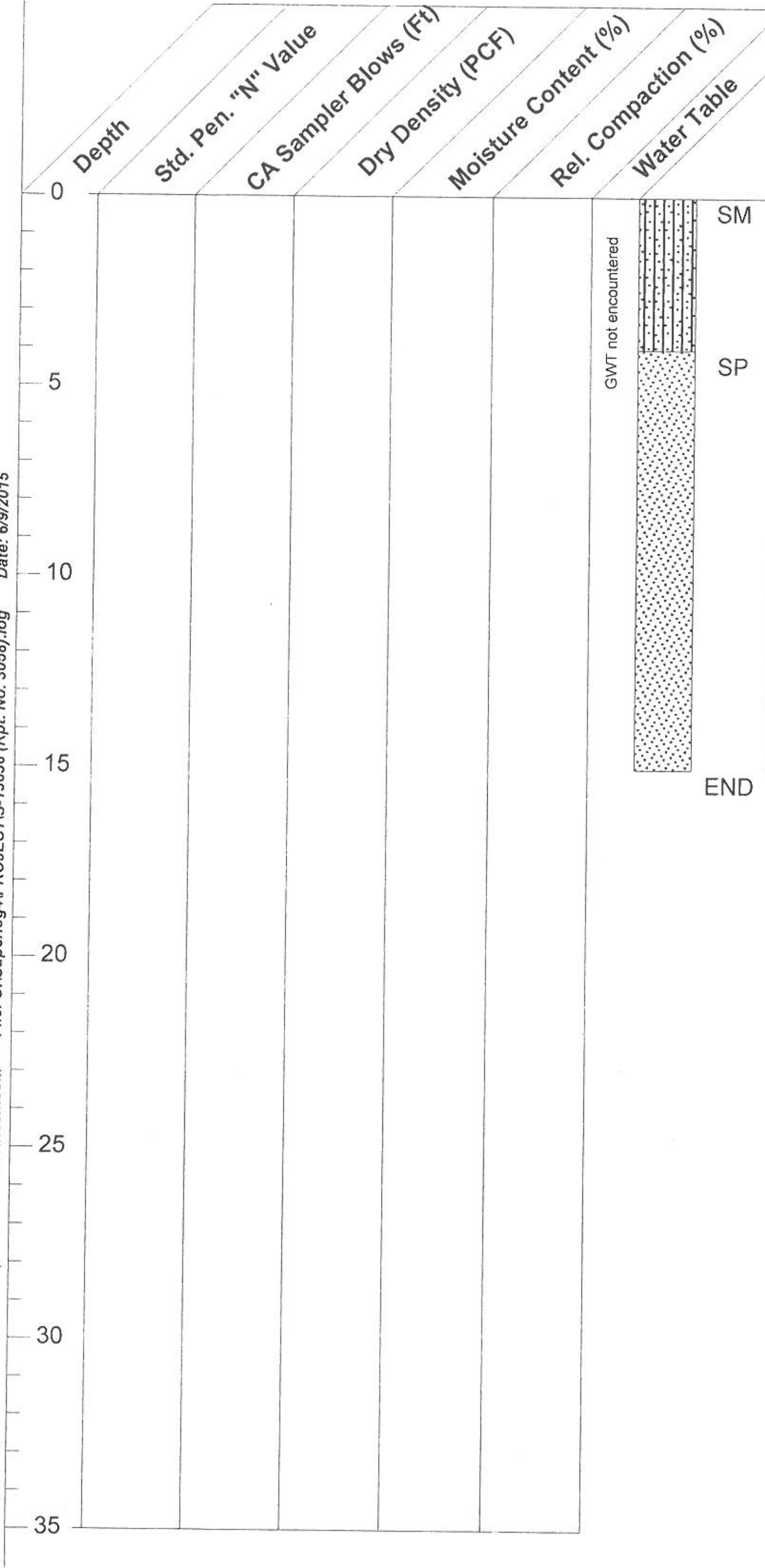
John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Enclosure 2, Page 2
Rpt. No.: 3058
File No.: S_13636

Boring 3

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger



SM	Brown silty fine to coarse sand with some gravel, dry and loose to medium dense (FILL)
SP	Gray-brown fine to coarse sand with gravel, dry and medium dense to dense (ORIGINAL GROUND)
END	Total Depth at 15.0 Feet No Free Groundwater Encountered

LOG OF BORING

John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Enclosure 2, Page 3
Rpt. No.: 3058
File No.: S-13636

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECTS-13636 (Rpt. No. 3058).log Date: 6/9/2015

Boring 4

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger

Depth	Std. Pen. "N" Value	CA Sampler Blows (Ft)	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0		37	115	2.6	88	GWT not encountered
		49	---	---	---	
	28	25	119	2.1	87	
10	42	50/11"	127	3.0	93	
	36	50	111	3.5	91	
20	16	19	105	6.5	86	
	37	47	113	8.3	92	
30	16	23	110	7.7	90	
	20					
40	20					
	19					
50	21					
60						
70						

SM	Gray-brown silty fine to coarse sand with gravel, dry and medium dense (FILL)
SP	Light gray-brown fine to coarse sand with gravel, dry and medium dense (ORIGINAL GROUND) - with less gravel at 5.0 feet
SP	Gray fine to coarse sand with gravel, dry and dense
SM	Brown silty fine sand, damp and dense
SM	Gray-brown silty fine sand, damp and medium dense
SM	Red-brown silty fine sand with some medium sand, moist and dense
SM	Gray-brown silty fine sand, moist and medium dense
SP	Gray fine to medium sand, damp and medium dense
SM	Gray-brown silty fine sand, moist and medium dense
END	Total Depth at 51.0 Feet No Free Groundwater Encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECTS\S-13636 (Rpt. No. 3058).log Date: 6/9/2015

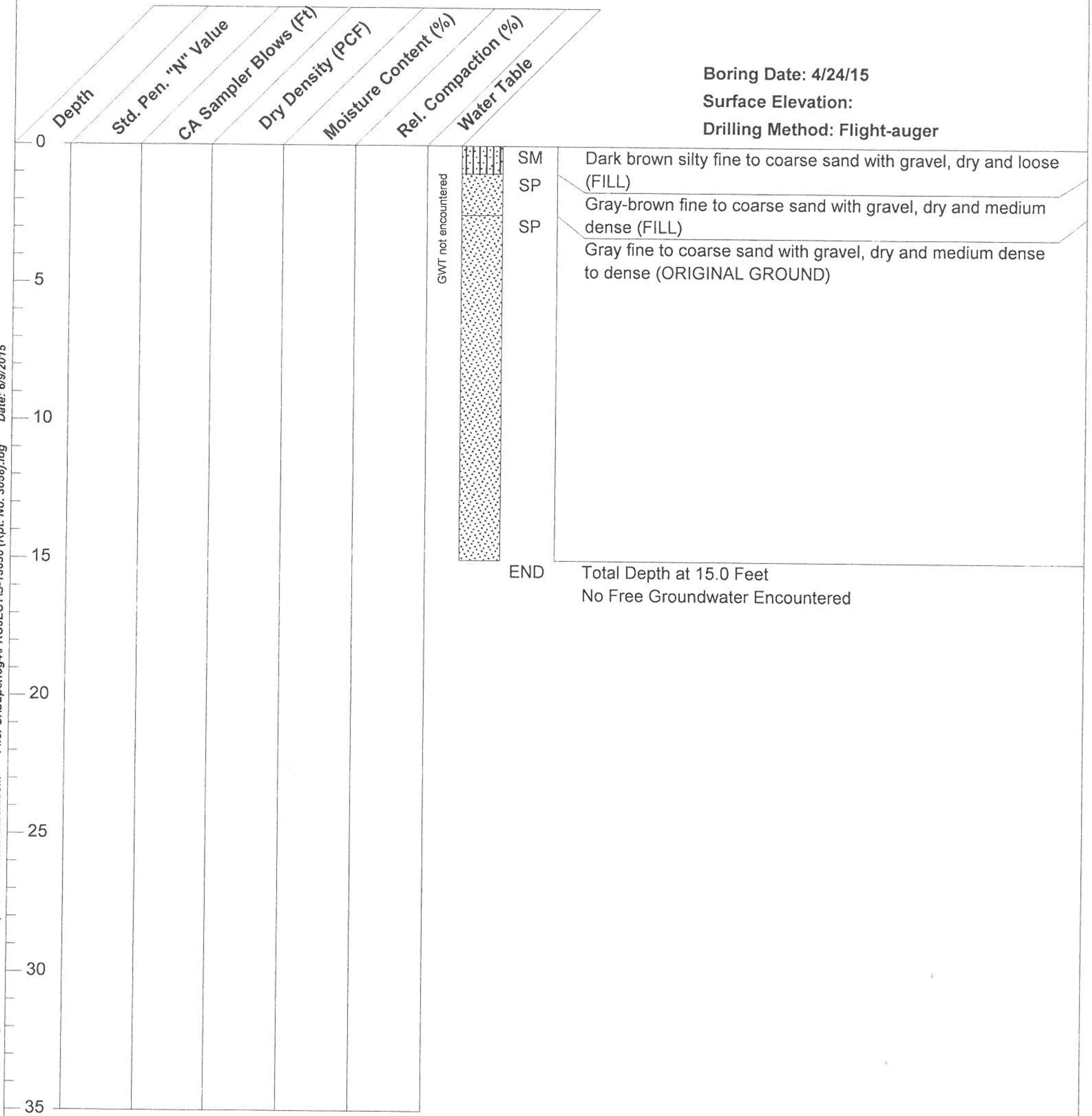
LOG OF BORING

John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Boring 5

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger



Dark brown silty fine to coarse sand with gravel, dry and loose (FILL)

Gray-brown fine to coarse sand with gravel, dry and medium dense (FILL)

Gray fine to coarse sand with gravel, dry and medium dense to dense (ORIGINAL GROUND)

Total Depth at 15.0 Feet
No Free Groundwater Encountered

LOG OF BORING

John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Enclosure 2, Page 5
Rpt. No.: 3058
File No.: S-13636

Boring 6

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger

Depth	Std. Pen. "N" Value	CA Sampler Blows (Ft)	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						GWT not encountered
		14	105	2.4	83	
		29	112	1.5	86	
5		19	---	---	---	
		50	128	0.9	94	
10		40	118	1.8	91	
15		50/9"	121	1.4	93	
20		25	109	6.8	88	
25						
30						
35						

SM	Light gray-brown silty fine to medium sand with gravel, dry and loose (FILL)
SM	Gray-brown silty fine to coarse sand with gravel, dry and medium dense (FILL)
SP	Gray fine to coarse sand with gravel, dry and medium dense (ORIGINAL GROUND)
SP	Gray gravelly sand, dry and dense
SM	Gray-brown silty fine to coarse sand with gravel, dry and dense
SM	Brown silty fine sand, damp and medium dense
END	Total Depth at 21.0 Feet No Free Groundwater Encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\S-13636 (Rpt. No. 3058).log Date: 6/9/2015

LOG OF BORING

John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Enclosure 2, Page 6
Rpt. No.: 3058
File No.: S-13636

Boring 7

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger

Depth	Std. Pen. "N" Value	CA Sampler Blows (Ft)	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
						GWT not encountered

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35

SM	Dark brown silty fine to coarse sand with gravel, dry and loose (FILL)
SM	Gray-brown silty fine to coarse sand with gravel, dry and medium dense (FILL)
SP	Gray fine to coarse sand with gravel, dry and medium dense to dense (ORIGINAL GROUND)
END	Total Depth at 15.0 Feet No Free Groundwater Encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\S-13636 (Rpt. No. 3058).log Date: 6/9/2015

LOG OF BORING

John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Enclosure 2, Page 7
Rpt. No.: 3058
File No.: S-13636

Boring 8

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger

Depth	Std. Pen. "N" Value	CA Sampler Blows (Ft)	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0		20	109	2.3	87	GWT not encountered	SM	Gray-brown silty fine to medium sand, dry and medium dense (FILL)
		18	107	3.9	85		SM	Gray-brown silty fine sand with some medium sand, damp and medium dense (FILL)
5		34	120	1.6	88		SP	Gray fine to coarse sand with gravel, dry and medium dense (ORIGINAL GROUND)
		50/10"	127	2.2	93			- becoming dense at 7.0 feet
10		50/11"	126	2.5	92		SP	Gray-brown fine to coarse sand with gravel, dry and dense
15		46	110	8.2	90		SM	Brown silty fine sand, moist and dense
20		22	105	10.1	86			- becoming medium dense at 20.0 feet
25		34	111	4.4	91		SM	Gray-brown silty fine sand, damp and dense
30		27	108	11.9	88		SM	Red-brown silty fine sand, moist and medium dense
							END	Total Depth at 31.0 Feet No Free Groundwater Encountered
35								

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECTS\S-13636 (Rpt. No. 3058).log Date: 6/10/2015

LOG OF BORING

John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Enclosure 2, Page 8
Rpt. No.: 3058
File No.: S-13636

Boring 9

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger

Depth	Std. Pen. "N" Value	CA Sampler Blows (Ft)	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table			
0						GWT not encountered	▨	SP	Gray-brown fine to coarse sand with gravel, dry and dense (ORIGINAL GROUND)
		44	119	1.5	91				
		34	117	1.9	90				
5		50/10"	121	1.3	93				
								END	Total Depth at 6.0 Feet No Free Groundwater Encountered
10									
15									
20									
25									
30									
35									

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECTS-13636 (Rpt. No. 3058).log Date: 6/9/2015

LOG OF BORING

John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Boring 10

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger

Depth	Std. Pen. "N" Value	CA Sampler Blows (Ft)	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						GWT not encountered
		14	107	2.1	82	
		25	114	2.6	87	
5		23	112	2.3	86	
10						
15						
20						
25						
30						
35						

SM Gray-brown silty fine to coarse sand with gravel, dry and loose (ORIGINAL GROUND)

- with less gravel and becoming medium dense at 3.0 feet

END Total Depth at 6.0 Feet
No Free Groundwater Encountered

LOG OF BORING

John R. Byerly, Inc.	Bloomington High School Bloomington, California	Enclosure 2, Page 10 Rpt. No.: 3058 File No.: S-13636

Boring 11

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger

Depth	Std. Pen. "N" Value	CA Sampler Blows (Ft)	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0						GWT not encountered	SM	Gray-brown silty fine to coarse sand with some gravel, damp and medium dense (FILL)
		27	115	3.6	88			
		14	105	5.9	83		SM	Brown silty fine to medium sand, damp and loose (FILL)
5		18	117	2.8	86		SP	Gray-brown fine to coarse sand with gravel, dry and medium dense (ORIGINAL GROUND)
		40	127	1.7	93			- becoming dense at 7.0 feet
10		50/6"	130	2.2	95			- becoming very dense at 10.0 feet
15		50/10"	128	2.5	94		SP	Dark gray-brown gravelly sand, dry and dense
20		43	126	2.9	92		SM	Brown silty fine sand, dry and dense
							END	Total Depth at 21.0 Feet No Free Groundwater Encountered
25								
30								
35								

LOG OF BORING

John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Enclosure 2, Page 11
Rpt. No.: 3058
File No.: S-13636

Boring 12

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger

Depth	Std. Pen. "N" Value	CA Sampler Blows (Ft)	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0						GWT not encountered	SM	Brown silty fine sand with some gravel, damp and loose (FILL)
		12	102	4.4	81			
		9	100	6.2	80			
5		18	107	5.3	85			- becoming medium dense at 5.0 feet
		18	119	10.5	87		SP	Brown fine to coarse sand with gravel, moist and medium dense (ORIGINAL GROUND)
10		15	117	9.6	86			
							SP	Gray-brown gravelly sand, dry and dense
15		50/11"	127	2.8	93			
20		19	108	7.5	88		SM	Gray-brown silty fine sand, moist and medium dense
25		25	111	9.7	91			- becoming dense at 25.0 feet
							SP	Gray-brown fine to coarse sand, dry and dense
30		35	128	3.9	94			
							END	Total Depth at 31.0 Feet No Free Groundwater Encountered
35								

LOG OF BORING

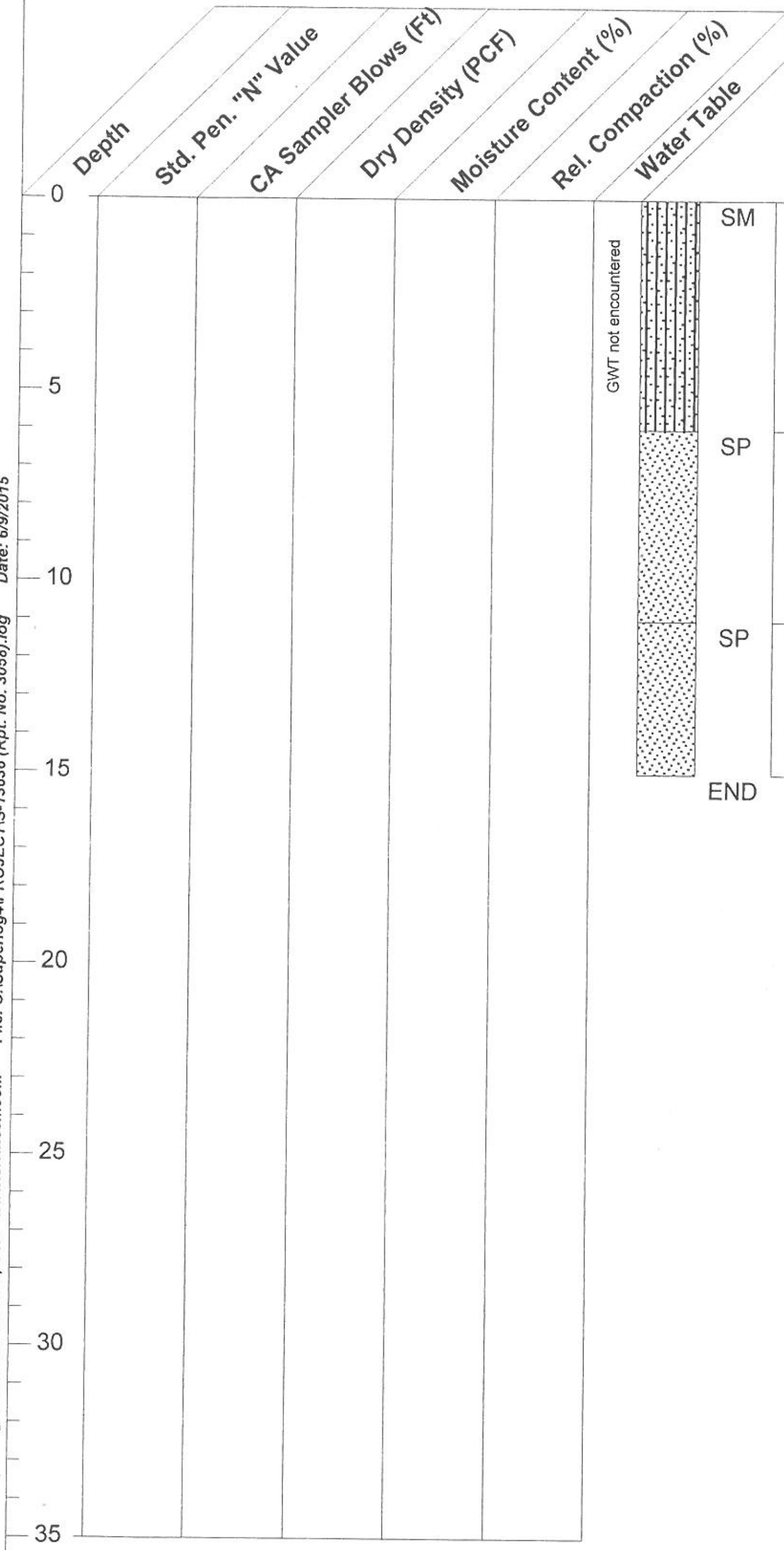
John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Enclosure 2, Page 12
Rpt. No.: 3058
File No.: S-13636

Boring 13

Boring Date: 4/24/15
Surface Elevation:
Drilling Method: Flight-auger



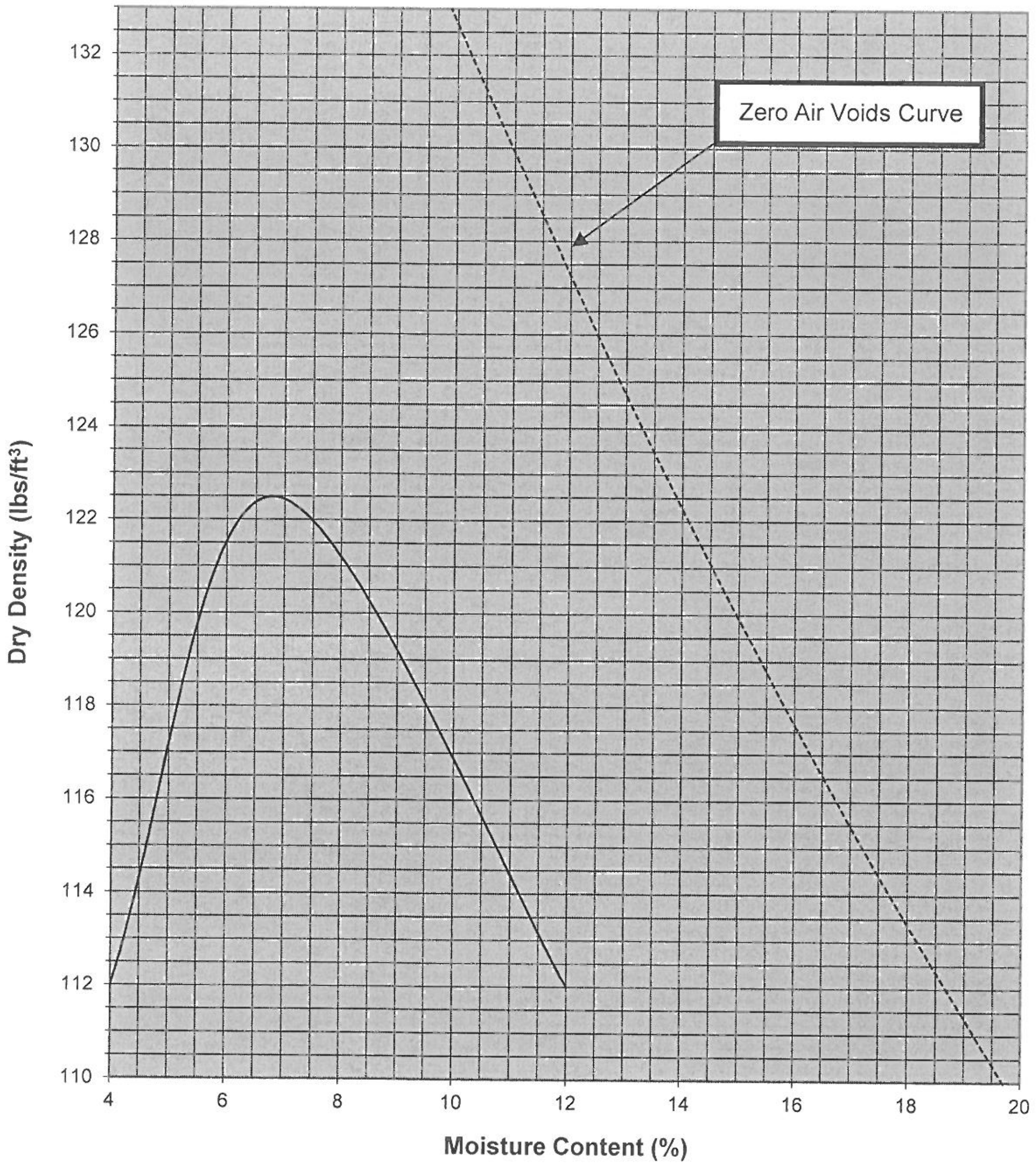
SM	Dark brown silty fine sand with some gravel, dry and loose to medium dense (FILL)
SP	Dark gray-brown fine sand, dry and medium dense to dense (ORIGINAL GROUND)
SP	Gray-brown gravelly sand, dry and dense
END	Total Depth at 15.0 Feet No Free Groundwater Encountered

LOG OF BORING

John R. Byerly, Inc.

Bloomington High School
Bloomington, California

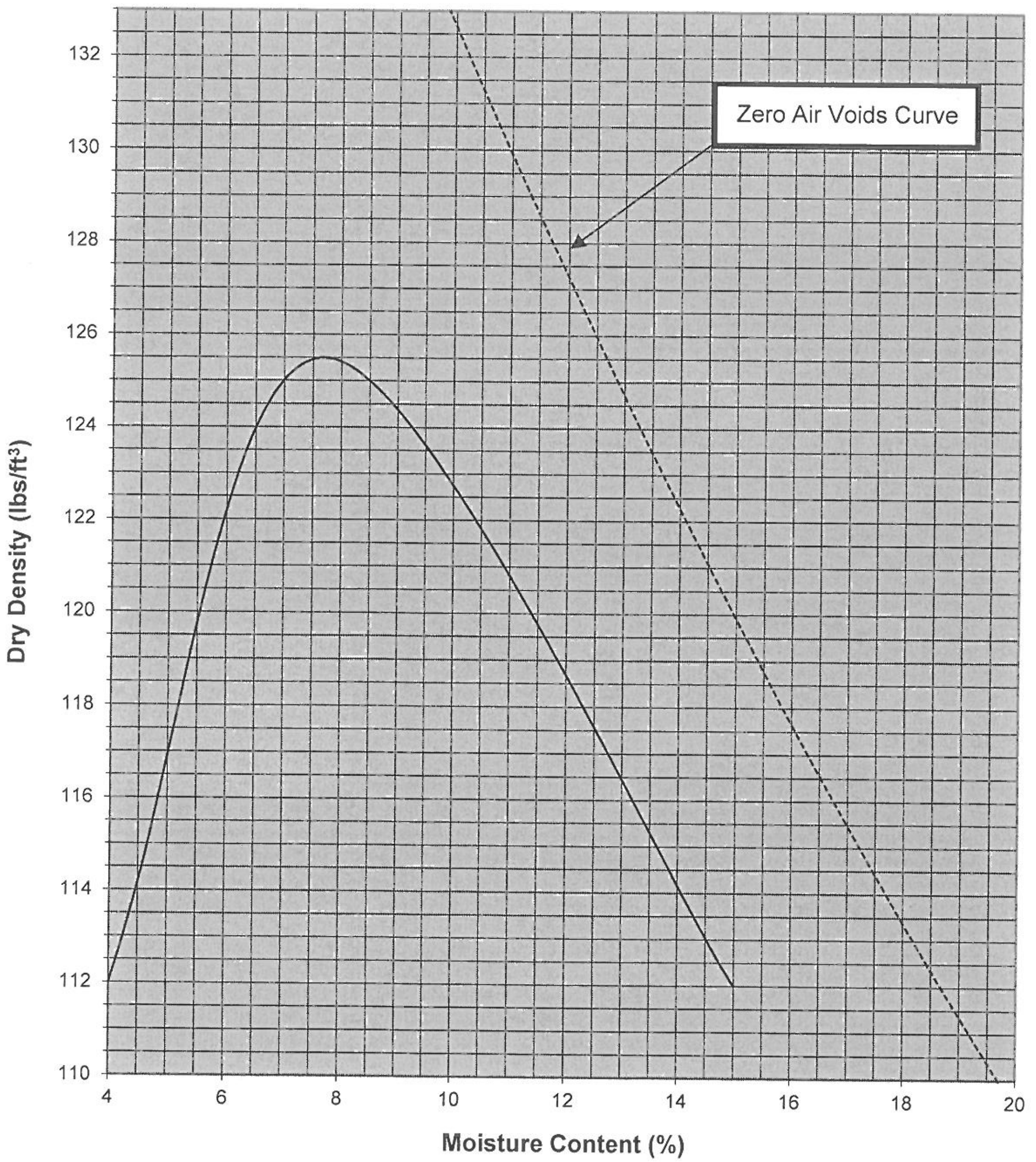
Moisture/Density Relationship
ASTM D-1557



Boring No.	B-4 (Sample ID No. 1)
Depth (ft.)	17.0
Optimum Moisture (%)	6.8
Maximum Dry Density (pcf)	122.5
Soil Classification	Brown silty fine sand (SM)

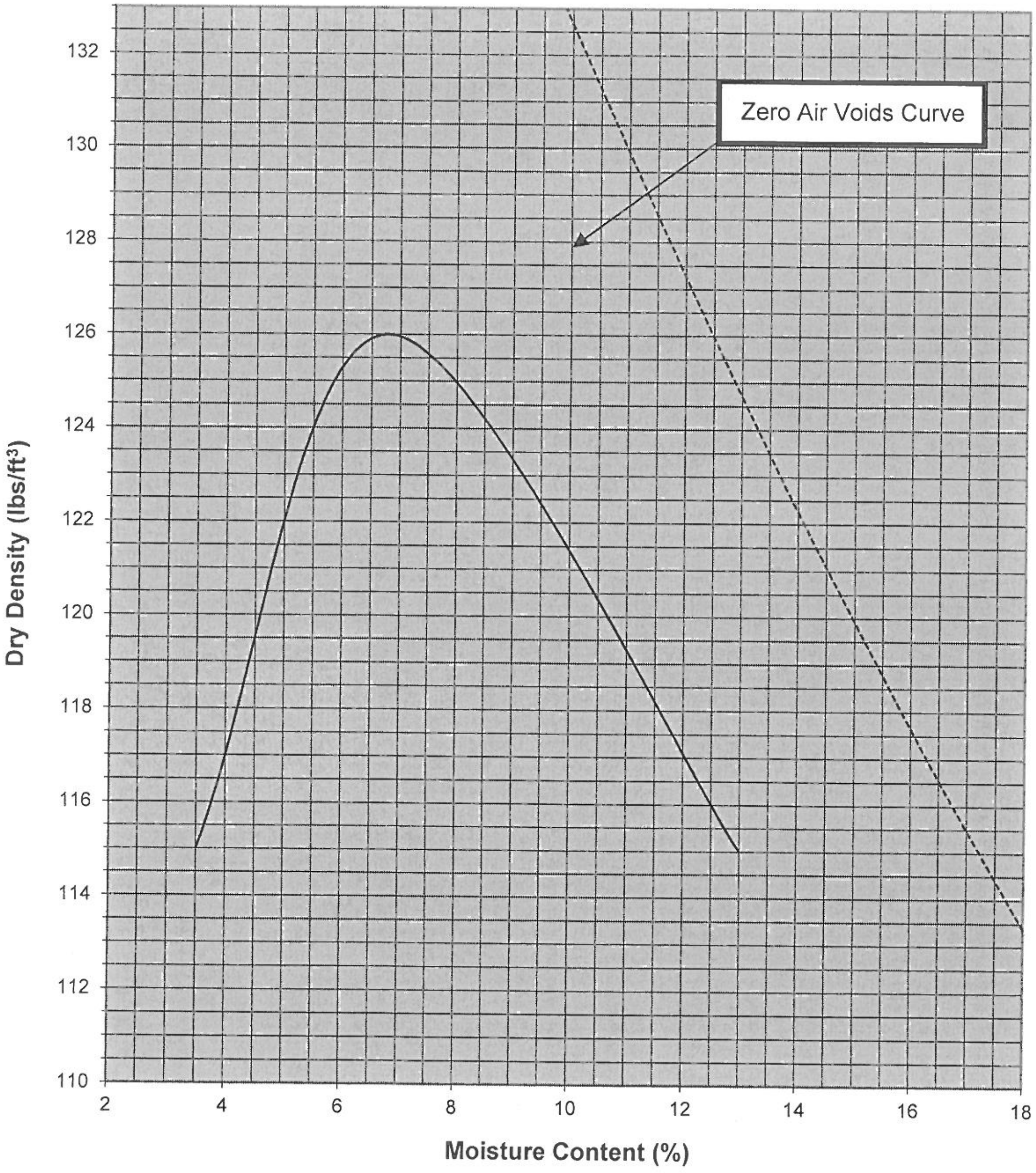
Bloomington High School Bloomington, California	Enclosure 3, Page 1 Rpt. No.: 3058 File No.: S-13636

Moisture/Density Relationship
ASTM D-1557



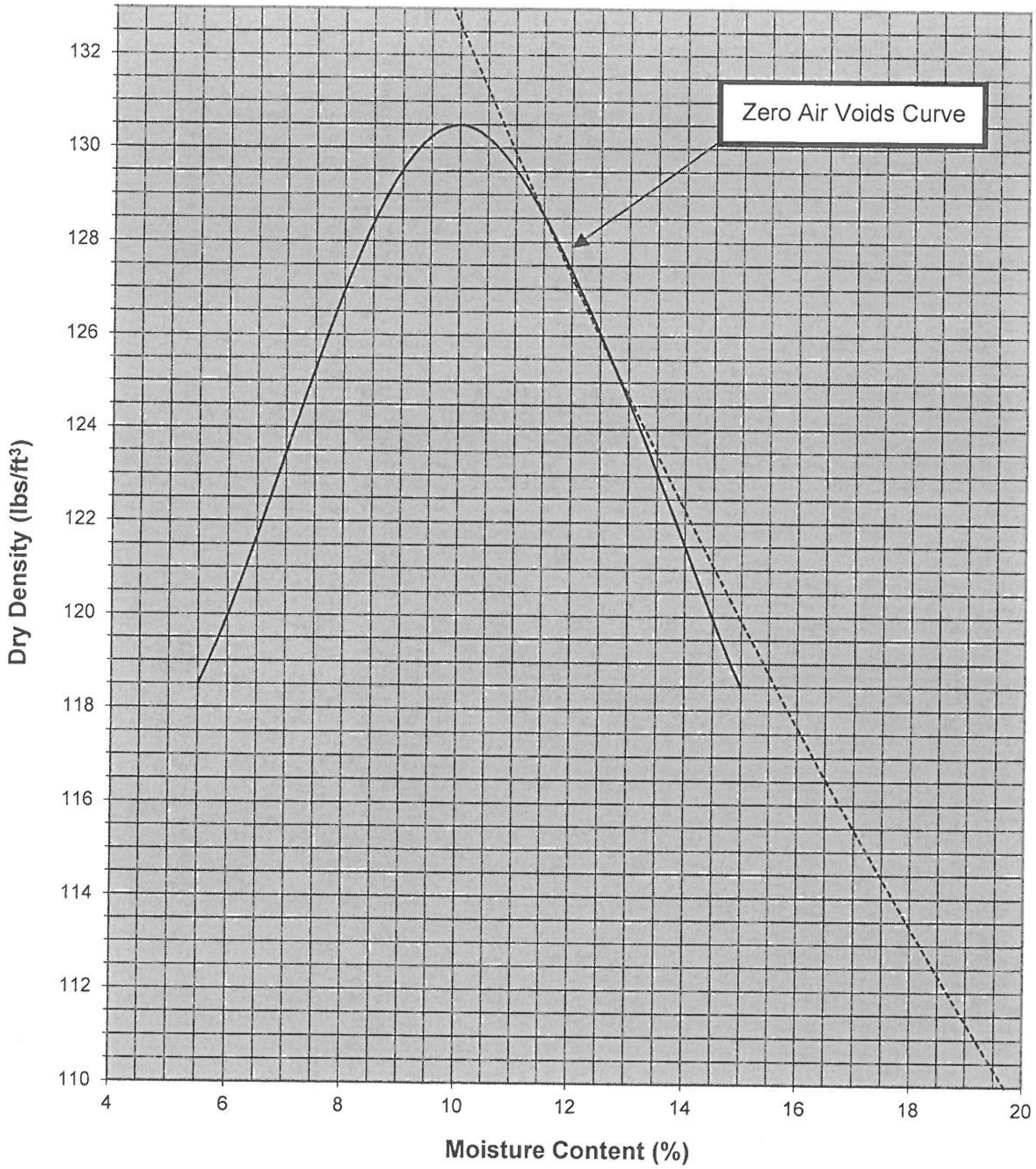
Boring No.	B-12 (Sample ID No. 2)
Depth (ft.)	3.0
Optimum Moisture (%)	7.7
Maximum Dry Density (pcf)	125.5
Soil Classification	Brown silty fine sand with some gravel (SM)

Moisture/Density Relationship
ASTM D-1557



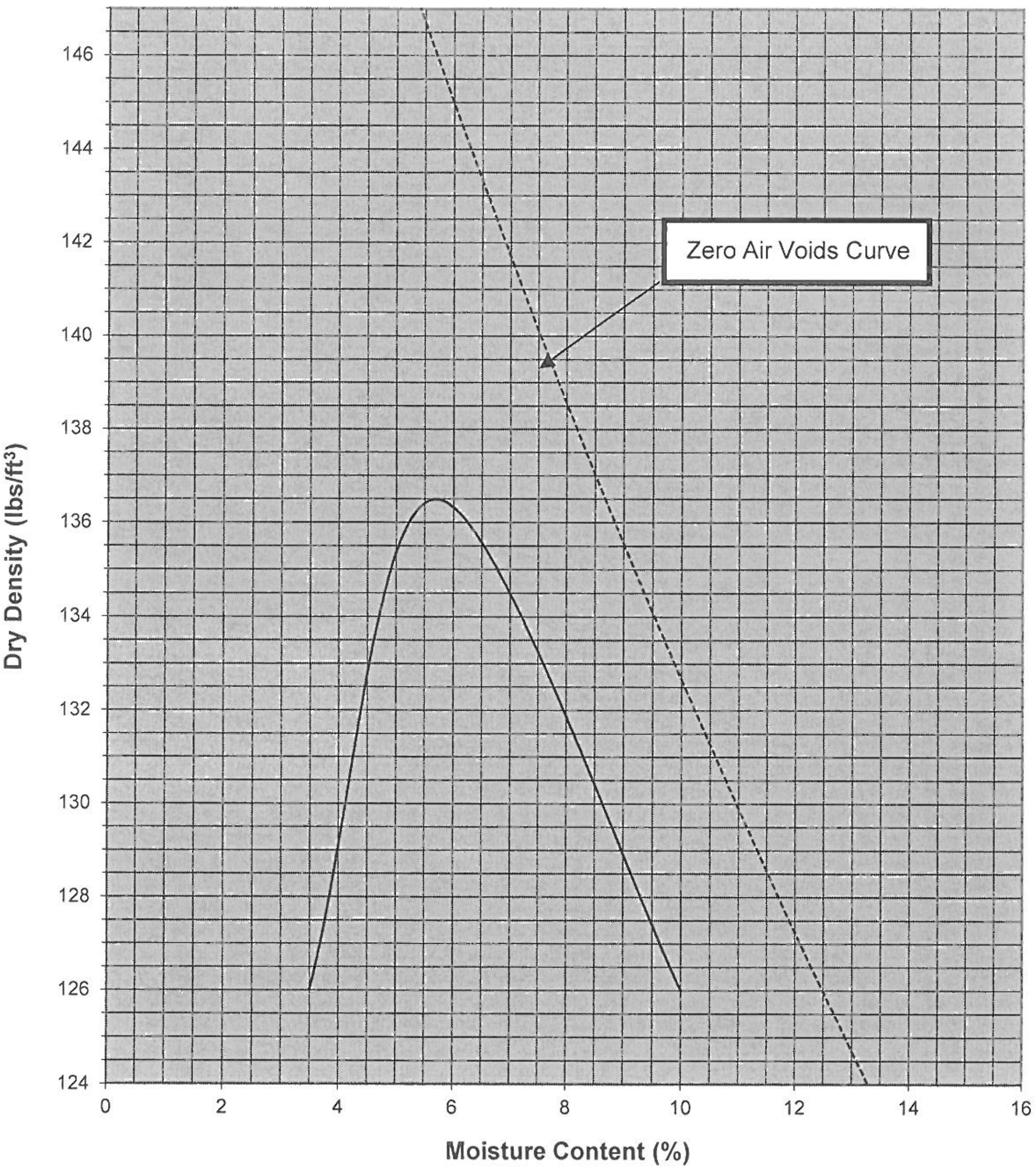
Boring No.	B-6 (Sample ID No. 3)
Depth (ft.)	2.0
Optimum Moisture (%)	6.8
Maximum Dry Density (pcf)	126.0
Soil Classification	Light gray-brown silty fine to medium sand with gravel (SM)

Moisture/Density Relationship
ASTM D-1557



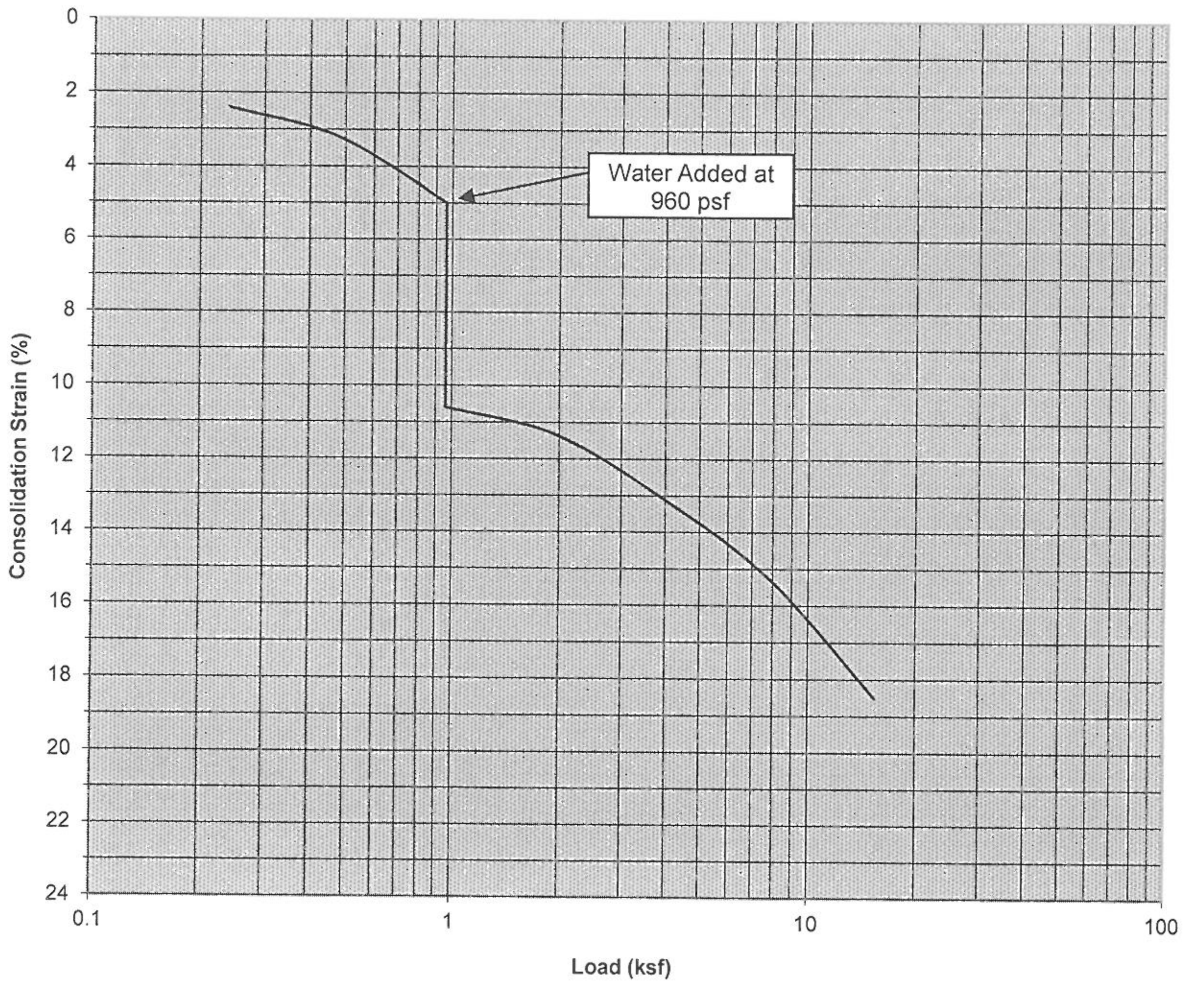
Boring No.	B-10 (Sample ID No. 4)
Depth (ft.)	2.0
Optimum Moisture (%)	10.0
Maximum Dry Density (pcf)	130.5
Soil Classification	Gray-brown silty fine to coarse sand with gravel (SM)

Moisture/Density Relationship
ASTM D-1557



Boring No.	B-4 (Sample ID No. 5)
Depth (ft.)	11.0
Optimum Moisture (%)	5.7
Maximum Dry Density (pcf)	136.5
Soil Classification	Gray fine to coarse sand with gravel (SP)

Consolidation Test Results

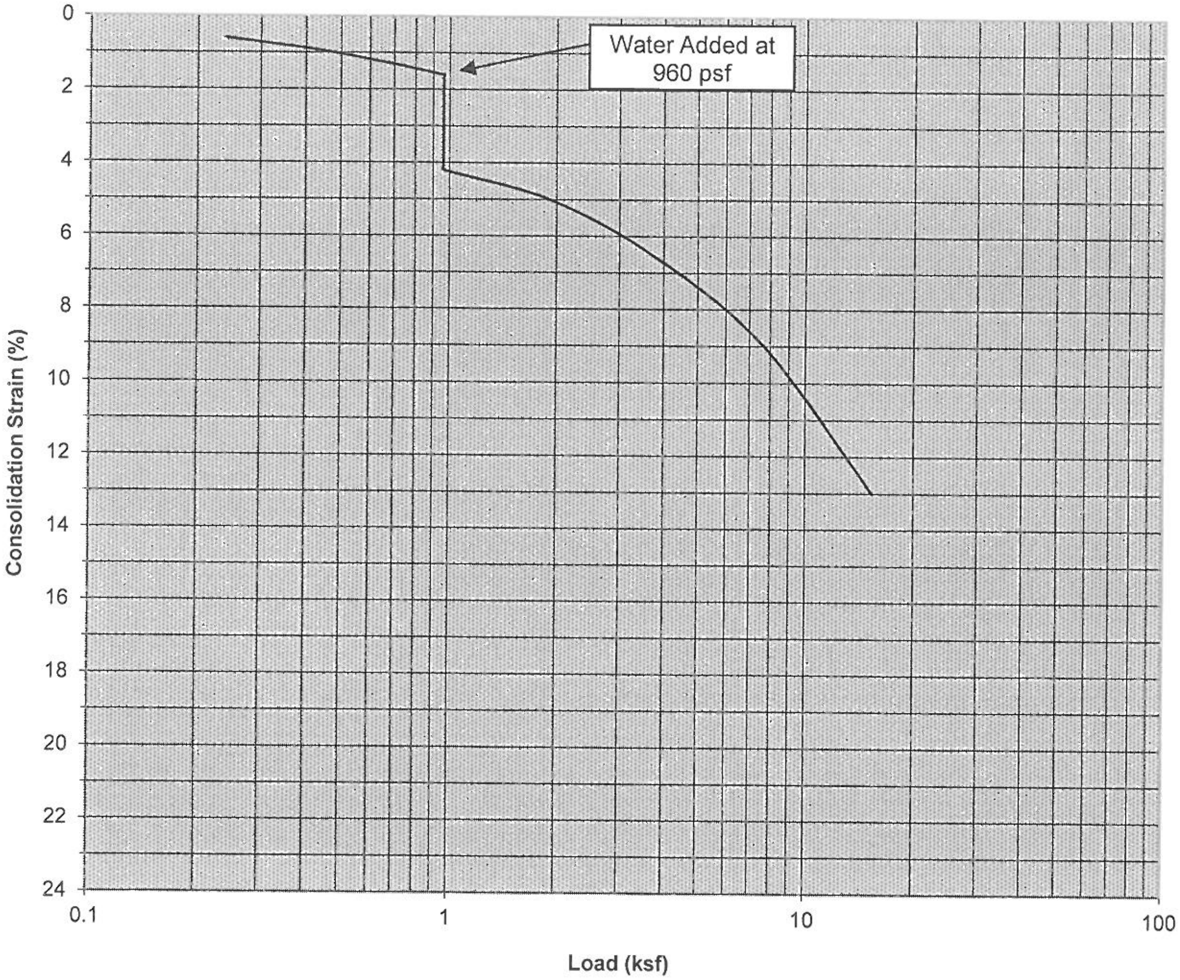


Classification: SM

Boring Number:	B-12	Initial Moisture Content (%)	6.2
Depth (ft)	3.0	Final Moisture Content (%)	17.6
Specimen Diameter (in)	2.4	Initial Dry Density (pcf)	100
Specimen Thickness (in)	1.0		

Enclosure 4, Page 1
Rpt. No.: 3058
File No.: S-13636

Consolidation Test Results



Classification: SP

Boring Number:	B-12
Depth (ft)	7.0
Specimen Diameter (in)	2.4
Specimen Thickness (in)	1.0

Initial Moisture Content (%)	10.5
Final Moisture Content (%)	16.1
Initial Dry Density (pcf)	119

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Rpt. No.: 3058
File No.: S-13636

DIRECT SHEAR TESTS

Test Boring No.	Depth of Sample (Ft.)	Angle of Internal Friction (°)	Cohesion (PSF)
B-11	3.0	32	100
B-12	15.0	38	0

Enclosure 5
Rpt. No.: 3058
File No.: S-13636

RESULTS OF SUBGRADE SOIL TESTS

California Department of Transportation Test Methods 202, 217, & 301
ASTM Designations C136 and D2419

PROJECT: Bloomington High School

		Percent Passing Sieve Size:															
Sample No.	**Location**	**3"**	**2½"**	**2"**	**1½"**	**1"**	**3/4"**	**1/2"**	**3/8"**	**No. 4**	**No. 8**	**No. 16**	**No. 30**	**No. 50**	**No. 100**	**No. 200**	**Sand Equiv.**
	B-9 at 0.5'-5.0'					100	88	80	76	67	59	52	43	32	20	11	42

STABILOMETER "R" VALUE

Sample No.		1	
Moisture Content (%)	7.4	7.8	8.2
Dry Density (lbs./cu. ft.)	126.7	125.9	124.8
Exudation Pressure (psi)	709	484	171
Expansion Pressure (psf)	0.000	0.000	0.000
"R" Value	79	74	65
"R" Value at 300 PSI Exudation		69	

Enclosure 6
Rpt. No.: 3058
File No.: S-13636

John R. Byerly
INCORPORATED

SUGGESTED SPECIFICATIONS FOR CLASS II BASE

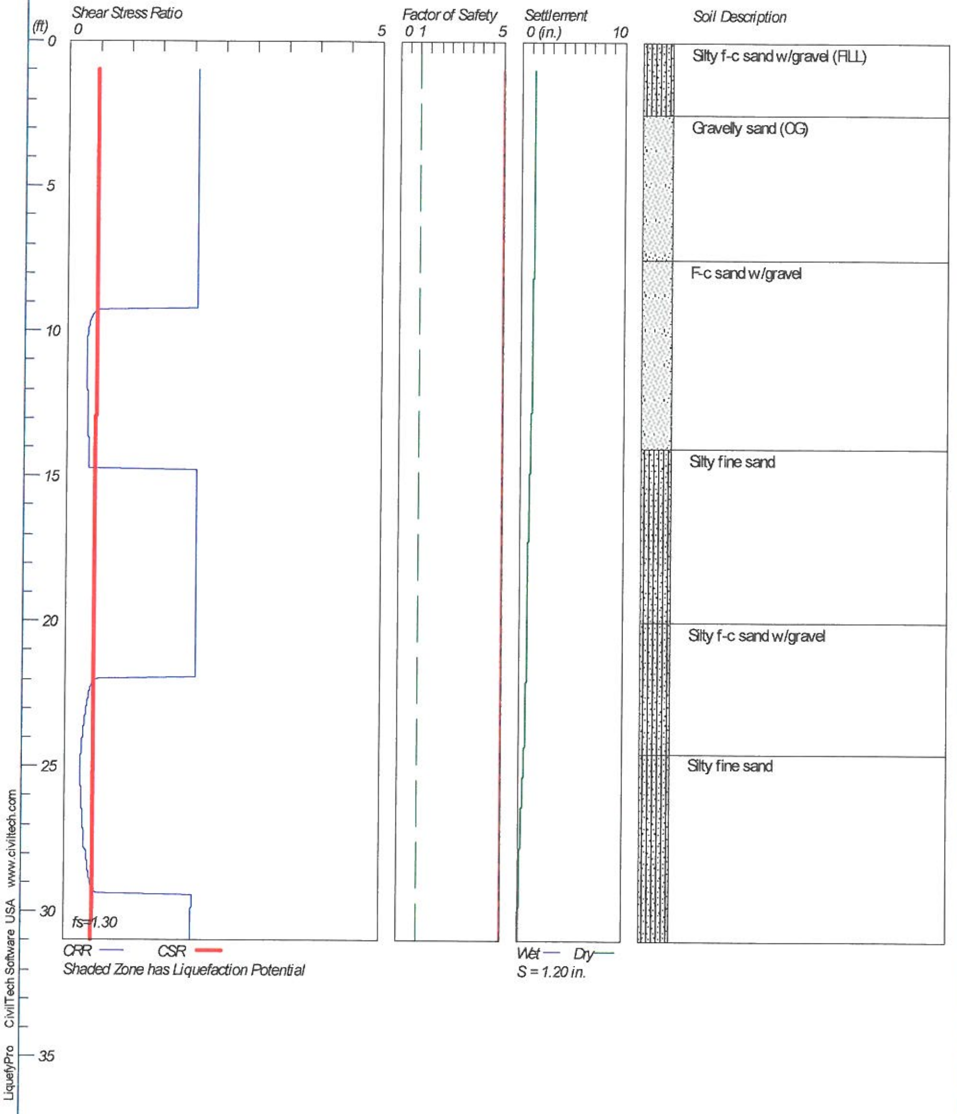
Sieve Size	**Percent Finer Than**
1 Inch	100
3/4 Inch	90 - 100
No. 4	35 - 60
No. 30	10 - 30
No. 200	2 - 9
Sand Equivalent (Minimum)	25
"R" Value (minimum) at 300 psi Exudation	78

Enclosure 7
Rpt. No.: 3058
File No.: S-13636

LIQUEFACTION ANALYSIS

COLTON JUSD - STADIUM & BASEBALL FIELD RENOVATIONS

Hole No.=B-2 Water Depth=241.0 ft Surface Elev.=1057 feet above MSL Magnitude=7.4
Acceleration=0.553g



John R. Byerly, Inc. **S-13636**

```
*************************************************************************************************
              LIQUEFACTION ANALYSIS CALCULATION SHEET
                            Version 4.3
                  Copyright by CivilTech Software
                         www.civiltech.com
                (425) 453-6488  Fax (425) 453-5848
*************************************************************************************************
        Licensed to Glenn Fraser, John R. Byerly, Inc.        6/12/2015 8:41:07 AM

        Input File Name: C:\Liquefy4\S-13636.2.liq
        Title:  COLTON JUSD - STADIUM & BASEBALL FIELD RENOVATIONS
        Subtitle:  S-13636

        Surface Elev.=1057 feet above MSL
        Hole No.=B-2
        Depth of Hole= 31.0 ft
        Water Table during Earthquake= 241.0 ft
        Water Table during In-Situ Testing= 241.0 ft
        Max. Acceleration= 0.55 g
        Earthquake Magnitude= 7.4
        User defined factor of safty (applied to CSR)       User fs=1.3
        fs=user,  Plot one CSR (fs=user)

        Hammer Energy Ratio, Ce=1
        Borehole Diameter, Cb=1
        Sampeling Method, Cs=1
        SPT Fines Correction Method: Stark/Olson et al.*
        Settlement Analysis Method: Ishihara / Yoshimine*
        Fines Correction for Liquefaction: Stark/Olson et al.*
        Fine Correction for Settlement: Post-Liq. Correction *
        Average Input Data: Smooth*
        * Recommended Options

Input Data:
        Depth     SPT       Gamma     Fines
        ft                  pcf       %
        ____________________________________
        1.0       30.0      130.0     25.0
        3.0       30.0      130.0     1.0
        5.0       30.0      130.0     1.0
        7.0       35.0      134.0     1.0
        10.0      25.0      127.4     1.0
        15.0      24.0      119.0     35.0
        20.0      38.0      123.8     25.0
        25.0      18.0      120.0     35.0
        30.0      33.0      125.6     35.0
        ____________________________________

Output Results:
        Settlement of saturated sands=0.00 in.
        Settlement of dry sands=1.20 in.
        Total settlement of saturated and dry sands=1.20 in.
        Differential Settlement=0.601 to 0.793 in.

        Depth     CRRm      CSRfs     F.S.      S_sat.    S_dry     S_all
        ft                  w/fs                in.       in.       in.
        _____________________________________________________________________
        1.00      2.07      0.46      5.00      0.00      1.20      1.20
        2.00      2.07      0.46      5.00      0.00      1.20      1.20
        3.00      2.07      0.46      5.00      0.00      1.20      1.20
        4.00      2.07      0.46      5.00      0.00      1.19      1.19
        5.00      2.07      0.46      5.00      0.00      1.19      1.19
        6.00      2.07      0.46      5.00      0.00      1.19      1.19
```

```
 7.00    2.07    0.46    5.00    0.00    1.18    1.18
 8.00    2.07    0.46    5.00    0.00    1.17    1.17
 9.00    2.07    0.45    5.00    0.00    1.15    1.15
10.00    0.32    0.45    5.00    0.00    1.14    1.14
11.00    0.30    0.45    5.00    0.00    1.11    1.11
12.00    0.31    0.45    5.00    0.00    1.07    1.07
13.00    0.32    0.45    5.00    0.00    1.03    1.03
14.00    0.34    0.45    5.00    0.00    0.97    0.97
15.00    2.07    0.45    5.00    0.00    0.91    0.91
16.00    2.07    0.45    5.00    0.00    0.86    0.86
17.00    2.07    0.45    5.00    0.00    0.81    0.81
18.00    2.07    0.45    5.00    0.00    0.76    0.76
19.00    2.07    0.44    5.00    0.00    0.74    0.74
20.00    2.07    0.44    5.00    0.00    0.72    0.72
21.00    2.07    0.44    5.00    0.00    0.70    0.70
22.00    0.46    0.44    5.00    0.00    0.68    0.68
23.00    0.33    0.44    5.00    0.00    0.64    0.64
24.00    0.27    0.44    5.00    0.00    0.57    0.57
25.00    0.23    0.44    5.00    0.00    0.47    0.47
26.00    0.26    0.44    5.00    0.00    0.35    0.35
27.00    0.29    0.44    5.00    0.00    0.25    0.25
28.00    0.34    0.43    5.00    0.00    0.17    0.17
29.00    0.40    0.43    5.00    0.00    0.11    0.11
30.00    2.01    0.43    5.00    0.00    0.05    0.05
31.00    2.00    0.43    5.00    0.00    0.00    0.00
-------------------------------------------------------
* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5,  CRR is limited to 2,  CSR is limited to 2)

Units            Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.
---------------------------------------------------------------------------------------------
CRRm             Cyclic resistance ratio from soils
CSRfs            Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.             Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat            Settlement from saturated sands
S_dry            Settlement from dry sands
S_all            Total settlement from saturated and dry sands
NoLiq            No-Liquefy Soils
```

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**********************************************************************************************
                LIQUEFACTION ANALYSIS CALCULATION SHEET
                            Version 4.3
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**********************************************************************************************
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        Input File Name: C:\Liquefy4\S-13636.2.liq
        Title:  COLTON JUSD - STADIUM & BASEBALL FIELD RENOVATIONS
        Subtitle:  S-13636

Input Data:

        Surface Elev.=1057 feet above MSL
        Hole No.=B-2
        Depth of Hole=31.0 ft
        Water Table during Earthquake= 241.0 ft
        Water Table during In-Situ Testing= 241.0 ft
        Max. Acceleration=0.55 g
        Earthquake Magnitude=7.4
        User defined factor of safty (applied to CSR)      User fs=1.3
        fs=user,  Plot one CSR (fs=user)

        Hammer Energy Ratio, Ce=1
        Borehole Diameter, Cb=1
        Sampeling Method, Cs=1
        SPT Fines Correction Method: Stark/Olson et al.*
        Settlement Analysis Method: Ishihara / Yoshimine*
        Fines Correction for Liquefaction: Stark/Olson et al.*
        Fine Correction for Settlement: Post-Liq. Correction *
        Average Input Data: Smooth*
        * Recommended Options

        Depth     SPT       Gamma     Fines
        ft                  pcf       %
        ____________________________________
        1.0       30.0      130.0     25.0
        3.0       30.0      130.0     1.0
        5.0       30.0      130.0     1.0
        7.0       35.0      134.0     1.0
        10.0      25.0      127.4     1.0
        15.0      24.0      119.0     35.0
        20.0      38.0      123.8     25.0
        25.0      18.0      120.0     35.0
        30.0      33.0      125.6     35.0
        ____________________________________

Output Results:       (Interval = 1.00 ft)

        CSR Calculation:
        Depth     gamma     sigma     gamma'    sigma'    rd        CSR       fs        CSRfs
        ft        pcf       tsf       pcf       tsf                           (user)    w/fs
        ________________________________________________________________________________________
        1.00      130.0     0.065     130.0     0.065     1.00      0.36      1.3       0.46
        2.00      130.0     0.130     130.0     0.130     1.00      0.36      1.3       0.46
        3.00      130.0     0.195     130.0     0.195     0.99      0.35      1.3       0.46
        4.00      130.0     0.260     130.0     0.260     0.99      0.35      1.3       0.46
        5.00      130.0     0.325     130.0     0.325     0.99      0.35      1.3       0.46
        6.00      132.0     0.390     132.0     0.390     0.99      0.35      1.3       0.46
        7.00      134.0     0.457     134.0     0.457     0.98      0.35      1.3       0.46
```

8.00	131.8	0.523	131.8	0.523	0.98	0.35	1.3	0.46
9.00	129.6	0.589	129.6	0.589	0.98	0.35	1.3	0.45
10.00	127.4	0.653	127.4	0.653	0.98	0.35	1.3	0.45
11.00	125.7	0.716	125.7	0.716	0.97	0.35	1.3	0.45
12.00	124.0	0.779	124.0	0.779	0.97	0.35	1.3	0.45
13.00	122.4	0.840	122.4	0.840	0.97	0.35	1.3	0.45
14.00	120.7	0.901	120.7	0.901	0.97	0.35	1.3	0.45
15.00	119.0	0.961	119.0	0.961	0.97	0.34	1.3	0.45
16.00	120.0	1.021	120.0	1.021	0.96	0.34	1.3	0.45
17.00	120.9	1.081	120.9	1.081	0.96	0.34	1.3	0.45
18.00	121.9	1.142	121.9	1.142	0.96	0.34	1.3	0.45
19.00	122.8	1.203	122.8	1.203	0.96	0.34	1.3	0.44
20.00	123.8	1.265	123.8	1.265	0.95	0.34	1.3	0.44
21.00	123.0	1.326	123.0	1.326	0.95	0.34	1.3	0.44
22.00	122.3	1.388	122.3	1.388	0.95	0.34	1.3	0.44
23.00	121.5	1.449	121.5	1.449	0.95	0.34	1.3	0.44
24.00	120.8	1.509	120.8	1.509	0.94	0.34	1.3	0.44
25.00	120.0	1.569	120.0	1.569	0.94	0.34	1.3	0.44
26.00	121.1	1.630	121.1	1.630	0.94	0.34	1.3	0.44
27.00	122.2	1.691	122.2	1.691	0.94	0.33	1.3	0.44
28.00	123.4	1.752	123.4	1.752	0.93	0.33	1.3	0.43
29.00	124.5	1.814	124.5	1.814	0.93	0.33	1.3	0.43
30.00	125.6	1.876	125.6	1.876	0.93	0.33	1.3	0.43
31.00	125.6	1.939	125.6	1.939	0.92	0.33	1.3	0.43

CSR is based on water table at 241.0 during earthquake

CRR Calculation from SPT or BPT data:

Depth ft	SPT	Cebs	Cr	sigma'	Cn	(N1)60	Fines %	d(N1)60	(N1)60f	CRR7.5
1.00	30.00	1.00	0.75	0.065	1.70	38.25	25.0	4.80	43.05	2.00
2.00	30.00	1.00	0.75	0.130	1.70	38.25	13.0	1.92	40.17	2.00
3.00	30.00	1.00	0.75	0.195	1.70	38.25	1.0	0.00	38.25	2.00
4.00	30.00	1.00	0.75	0.260	1.70	38.25	1.0	0.00	38.25	2.00
5.00	30.00	1.00	0.75	0.325	1.70	38.25	1.0	0.00	38.25	2.00
6.00	32.50	1.00	0.75	0.390	1.60	39.01	1.0	0.00	39.01	2.00
7.00	35.00	1.00	0.75	0.457	1.48	38.83	1.0	0.00	38.83	2.00
8.00	31.67	1.00	0.75	0.523	1.38	32.83	1.0	0.00	32.83	2.00
9.00	28.33	1.00	0.85	0.589	1.30	31.39	1.0	0.00	31.39	2.00
10.00	25.00	1.00	0.85	0.653	1.24	26.30	1.0	0.00	26.30	0.31
11.00	24.80	1.00	0.85	0.716	1.18	24.91	7.8	0.67	25.58	0.29
12.00	24.60	1.00	0.85	0.779	1.13	23.69	14.6	2.30	26.00	0.30
13.00	24.40	1.00	0.85	0.840	1.09	22.62	21.4	3.94	26.56	0.31
14.00	24.20	1.00	0.85	0.901	1.05	21.67	28.2	5.57	27.24	0.32
15.00	24.00	1.00	0.95	0.961	1.02	23.26	35.0	7.20	30.46	2.00
16.00	26.80	1.00	0.95	1.021	0.99	25.20	33.0	6.72	31.92	2.00
17.00	29.60	1.00	0.95	1.081	0.96	27.04	31.0	6.24	33.28	2.00
18.00	32.40	1.00	0.95	1.142	0.94	28.81	29.0	5.76	34.57	2.00
19.00	35.20	1.00	0.95	1.203	0.91	30.49	27.0	5.28	35.77	2.00
20.00	38.00	1.00	0.95	1.265	0.89	32.10	25.0	4.80	36.90	2.00
21.00	34.00	1.00	0.95	1.326	0.87	28.05	27.0	5.28	33.33	2.00
22.00	30.00	1.00	0.95	1.388	0.85	24.19	29.0	5.76	29.95	0.45
23.00	26.00	1.00	0.95	1.449	0.83	20.52	31.0	6.24	26.76	0.31
24.00	22.00	1.00	0.95	1.509	0.81	17.01	33.0	6.72	23.73	0.26
25.00	18.00	1.00	0.95	1.569	0.80	13.65	35.0	7.20	20.85	0.23
26.00	21.00	1.00	0.95	1.630	0.78	15.63	35.0	7.20	22.83	0.25
27.00	24.00	1.00	0.95	1.691	0.77	17.54	35.0	7.20	24.74	0.28
28.00	27.00	1.00	1.00	1.752	0.76	20.40	35.0	7.20	27.60	0.33
29.00	30.00	1.00	1.00	1.814	0.74	22.27	35.0	7.20	29.47	0.40
30.00	33.00	1.00	1.00	1.876	0.73	24.09	35.0	7.20	31.29	2.00
31.00	33.00	1.00	1.00	1.939	0.72	23.70	35.0	7.20	30.90	2.00

CRR is based on water table at 241.0 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 7.4:

Depth ft	sigC' tsf	CRR7.5 tsf	Ksigma	CRRv	MSF	CRRm	CSRfs w/fs	F.S. CRRm/CSRfs
1.00	0.04	2.00	1.00	2.00	1.03	2.07	0.46	5.00
2.00	0.08	2.00	1.00	2.00	1.03	2.07	0.46	5.00
3.00	0.13	2.00	1.00	2.00	1.03	2.07	0.46	5.00
4.00	0.17	2.00	1.00	2.00	1.03	2.07	0.46	5.00
5.00	0.21	2.00	1.00	2.00	1.03	2.07	0.46	5.00
6.00	0.25	2.00	1.00	2.00	1.03	2.07	0.46	5.00
7.00	0.30	2.00	1.00	2.00	1.03	2.07	0.46	5.00
8.00	0.34	2.00	1.00	2.00	1.03	2.07	0.46	5.00
9.00	0.38	2.00	1.00	2.00	1.03	2.07	0.45	5.00
10.00	0.42	0.31	1.00	0.31	1.03	0.32	0.45	5.00
11.00	0.47	0.29	1.00	0.29	1.03	0.30	0.45	5.00
12.00	0.51	0.30	1.00	0.30	1.03	0.31	0.45	5.00
13.00	0.55	0.31	1.00	0.31	1.03	0.32	0.45	5.00
14.00	0.59	0.32	1.00	0.32	1.03	0.34	0.45	5.00
15.00	0.62	2.00	1.00	2.00	1.03	2.07	0.45	5.00
16.00	0.66	2.00	1.00	2.00	1.03	2.07	0.45	5.00
17.00	0.70	2.00	1.00	2.00	1.03	2.07	0.45	5.00
18.00	0.74	2.00	1.00	2.00	1.03	2.07	0.45	5.00
19.00	0.78	2.00	1.00	2.00	1.03	2.07	0.44	5.00
20.00	0.82	2.00	1.00	2.00	1.03	2.07	0.44	5.00
21.00	0.86	2.00	1.00	2.00	1.03	2.07	0.44	5.00
22.00	0.90	0.45	1.00	0.45	1.03	0.46	0.44	5.00
23.00	0.94	0.31	1.00	0.31	1.03	0.33	0.44	5.00
24.00	0.98	0.26	1.00	0.26	1.03	0.27	0.44	5.00
25.00	1.02	0.23	1.00	0.23	1.03	0.23	0.44	5.00
26.00	1.06	0.25	1.00	0.25	1.03	0.26	0.44	5.00
27.00	1.10	0.28	0.99	0.28	1.03	0.29	0.44	5.00
28.00	1.14	0.33	0.98	0.33	1.03	0.34	0.43	5.00
29.00	1.18	0.40	0.98	0.39	1.03	0.40	0.43	5.00
30.00	1.22	2.00	0.97	1.94	1.03	2.01	0.43	5.00
31.00	1.26	2.00	0.97	1.93	1.03	2.00	0.43	5.00

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 tsf	(N1)60	Fines %	d(N1)60	(N1)60s
1.00	-	-	-	38.25	25.0	2.19	40.44
2.00	-	-	-	38.25	13.0	1.20	39.45
3.00	-	-	-	38.25	1.0	0.10	38.35
4.00	-	-	-	38.25	1.0	0.10	38.35
5.00	-	-	-	38.25	1.0	0.10	38.35
6.00	-	-	-	39.01	1.0	0.10	39.10
7.00	-	-	-	38.83	1.0	0.10	38.93
8.00	-	-	-	32.83	1.0	0.10	32.92
9.00	-	-	-	31.39	1.0	0.10	31.48
10.00	-	-	-	26.30	1.0	0.10	26.39
11.00	-	-	-	24.91	7.8	0.74	25.64
12.00	-	-	-	23.69	14.6	1.34	25.03
13.00	-	-	-	22.62	21.4	1.90	24.52
14.00	-	-	-	21.67	28.2	2.43	24.10
15.00	-	-	-	23.26	35.0	2.92	26.17
16.00	-	-	-	25.20	33.0	2.78	27.98

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          17.00    -       -       -       27.04   31.0    2.64    29.68
          18.00    -       -       -       28.81   29.0    2.49    31.29
          19.00    -       -       -       30.49   27.0    2.34    32.83
          20.00    -       -       -       32.10   25.0    2.19    34.29
          21.00    -       -       -       28.05   27.0    2.34    30.38
          22.00    -       -       -       24.19   29.0    2.49    26.68
          23.00    -       -       -       20.52   31.0    2.64    23.16
          24.00    -       -       -       17.01   33.0    2.78    19.79
          25.00    -       -       -       13.65   35.0    2.92    16.57
          26.00    -       -       -       15.63   35.0    2.92    18.55
          27.00    -       -       -       17.54   35.0    2.92    20.45
          28.00    -       -       -       20.40   35.0    2.92    23.32
          29.00    -       -       -       22.27   35.0    2.92    25.19
          30.00    -       -       -       24.09   35.0    2.92    27.01
          31.00    -       -       -       23.70   35.0    2.92    26.62
          _____________________________________________________________


          Settlement of Saturated Sands:
          Settlement Analysis Method: Ishihara / Yoshimine*
          Depth   CSRfs   F.S.    Fines   (N1)60s  Dr      ec      dsz     dsv     S
          ft      w/fs            %                %       %       in.     in.     in.
          __________________________________________________________________________
          __________________________________________________________________________
          Settlement of Saturated Sands=0.000 in.
          dsz is per each segment: dz=0.05 ft
          dsv is per each print interval: dv=1 ft
          S is cumulated settlement at this depth

          Settlement of Dry Sands:
          Depth   sigma'  sigC'   (N1)60s  CSRfs   Gmax   g*Ge/Gm  g_eff   ec7.5   Cec     ec
dsz       dsv     S
          ft      tsf     tsf              w/fs    tsf                     %               %
in.       in.     in.

______________________________________________________________________________________________
_______
          30.95   1.94    1.26    26.64    0.43    1496.6  5.5E-4  0.3221  0.2175  1.03    0.2246
2.7E-3    0.003   0.003
          30.00   1.88    1.22    27.01    0.43    1480.2  5.5E-4  0.3074  0.2036  1.03    0.2102
2.5E-3    0.049   0.052
          29.00   1.81    1.18    25.19    0.43    1422.0  5.5E-4  0.3182  0.2317  1.03    0.2392
2.9E-3    0.054   0.106
          28.00   1.75    1.14    23.32    0.43    1362.0  5.6E-4  0.3326  0.2682  1.03    0.2769
3.3E-3    0.062   0.168
          27.00   1.69    1.10    20.45    0.44    1280.8  5.7E-4  0.3743  0.3579  1.03    0.3696
4.4E-3    0.081   0.249
          26.00   1.63    1.06    18.55    0.44    1217.2  5.8E-4  0.4025  0.4372  1.03    0.4515
5.4E-3    0.098   0.347
          25.00   1.57    1.02    16.57    0.44    1150.5  6.0E-4  0.4426  0.5565  1.03    0.5747
6.9E-3    0.123   0.470
          24.00   1.51    0.98    19.79    0.44    1196.9  5.5E-4  0.3193  0.3188  1.03    0.3292
4.0E-3    0.103   0.574
          23.00   1.45    0.94    23.16    0.44    1235.6  5.2E-4  0.2445  0.1989  1.03    0.2055
2.5E-3    0.062   0.636
          22.00   1.39    0.90    26.68    0.44    1267.8  4.8E-4  0.1948  0.1312  1.03    0.1355
1.6E-3    0.040   0.675
          21.00   1.33    0.86    30.38    0.44    1294.3  4.5E-4  0.1596  0.0891  1.03    0.0920
1.1E-3    0.027   0.702
          20.00   1.26    0.82    34.29    0.44    1315.7  4.3E-4  0.1334  0.0605  1.03    0.0625
7.5E-4    0.018   0.720
          19.00   1.20    0.78    32.83    0.44    1264.8  4.2E-4  0.1304  0.0641  1.03    0.0662
7.9E-4    0.015   0.736
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          18.00    1.14    0.74    31.29    0.45    1212.7    4.2E-4    0.3585    0.1909    1.03    0.1972
 2.4E-3   0.022    0.758
          17.00    1.08    0.70    29.68    0.45    1159.4    4.2E-4    0.3450    0.1996    1.03    0.2061
 2.5E-3   0.048    0.806
          16.00    1.02    0.66    27.98    0.45    1104.7    4.1E-4    0.3333    0.2102    1.03    0.2171
 2.6E-3   0.051    0.857
          15.00    0.96    0.62    26.17    0.45    1048.4    4.1E-4    0.3239    0.2239    1.03    0.2313
 2.8E-3   0.054    0.911
          14.00    0.90    0.59    24.10    0.45     987.6    4.1E-4    0.3201    0.2472    1.03    0.2553
 3.1E-3   0.064    0.975
          13.00    0.84    0.55    24.52    0.45     959.3    3.9E-4    0.2641    0.1992    1.03    0.2058
 2.5E-3   0.055    1.030
          12.00    0.78    0.51    25.03    0.45     929.8    3.8E-4    0.2160    0.1586    1.03    0.1638
 2.0E-3   0.044    1.074
          11.00    0.72    0.47    25.64    0.45     898.9    3.6E-4    0.1750    0.1244    1.03    0.1285
 1.5E-3   0.035    1.109
          10.00    0.65    0.42    26.39    0.45     866.6    3.4E-4    0.1405    0.0960    1.03    0.0992
 1.2E-3   0.027    1.136
          9.00     0.59    0.38    31.48    0.45     872.6    3.1E-4    0.0947    0.0500    1.03    0.0516
 6.2E-4   0.017    1.153
          8.00     0.52    0.34    32.92    0.46     835.1    2.9E-4    0.2049    0.1002    1.03    0.1035
 1.2E-3   0.014    1.167
          7.00     0.46    0.30    38.93    0.46     825.0    2.5E-4    0.0805    0.0274    1.03    0.0283
 3.4E-4   0.013    1.180
          6.00     0.39    0.25    39.10    0.46     763.8    2.3E-4    0.0564    0.0190    1.03    0.0196
 2.3E-4   0.006    1.186
          5.00     0.33    0.21    38.35    0.46     692.3    2.2E-4    0.0444    0.0157    1.03    0.0162
 1.9E-4   0.004    1.190
          4.00     0.26    0.17    38.35    0.46     619.2    1.9E-4    0.0378    0.0134    1.03    0.0138
 1.7E-4   0.004    1.194
          3.00     0.20    0.13    38.35    0.46     536.3    1.7E-4    0.0363    0.0129    1.03    0.0133
 1.6E-4   0.003    1.197
          2.00     0.13    0.08    39.45    0.46     442.0    1.4E-4    0.0254    0.0083    1.03    0.0086
 1.0E-4   0.003    1.199
          1.00     0.07    0.04    40.44    0.46     315.1    9.6E-5    0.0186    0.0059    1.03    0.0061
 7.3E-5   0.002    1.201

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          Settlement of Dry Sands=1.201 in.
          dsz is per each segment: dz=0.05 ft
          dsv is per each print interval: dv=1 ft
          S is cumulated settlement at this depth

          Total Settlement of Saturated and Dry Sands=1.201 in.
          Differential Settlement=0.601 to 0.793 in.

          Units               Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

-------------------------------------------------------------------------------------------------------------
          SPT                 Field data from Standard Penetration Test (SPT)
          BPT                 Field data from Becker Penetration Test (BPT)
          qc                  Field data from Cone Penetration Test (CPT)
          fc                  Friction from CPT testing
          Gamma               Total unit weight of soil
          Gamma'              Effective unit weight of soil
          Fines               Fines content [%]
          D50                 Mean grain size
          Dr                  Relative Density
          sigma               Total vertical stress [tsf]
          sigma'              Effective vertical stress [tsf]
          sigC'               Effective confining pressure [tsf]
          rd                  Stress reduction coefficient
```

CSR	Cyclic stress ratio induced by earthquake
fs	User request factor of safety, apply to CSR
w/fs	With user request factor of safety inside
CSRfs	CSR with User request factor of safety
CRR7.5	Cyclic resistance ratio (M=7.5)
Ksigma	Overburden stress correction factor for CRR7.5
CRRv	CRR after overburden stress correction, CRRv=CRR7.5 * Ksigma
MSF	Magnitude scaling factor for CRR (M=7.5)
CRRm	After magnitude scaling correction CRRm=CRRv * MSF
F.S.	Factor of Safety against liquefaction F.S.=CRRm/CSRfs
Cebs	Energy Ratio, Borehole Dia., and Sample Method Corrections
Cr	Rod Length Corrections
Cn	Overburden Pressure Correction
(N1)60	SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
d(N1)60	Fines correction of SPT
(N1)60f	(N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
Cq	Overburden stress correction factor
qc1	CPT after Overburden stress correction
dqc1	Fines correction of CPT
qc1f	CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n	CPT after normalization in Robertson's method
Kc	Fine correction factor in Robertson's Method
qc1f	CPT after Fines correction in Robertson's Method
Ic	Soil type index in Suzuki's and Robertson's Methods
(N1)60s	(N1)60 after seattlement fines corrections
ec	Volumetric strain for saturated sands
ds	Settlement in each Segment dz
dz	Segment for calculation, dz=0.050 ft
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio
ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for dry sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

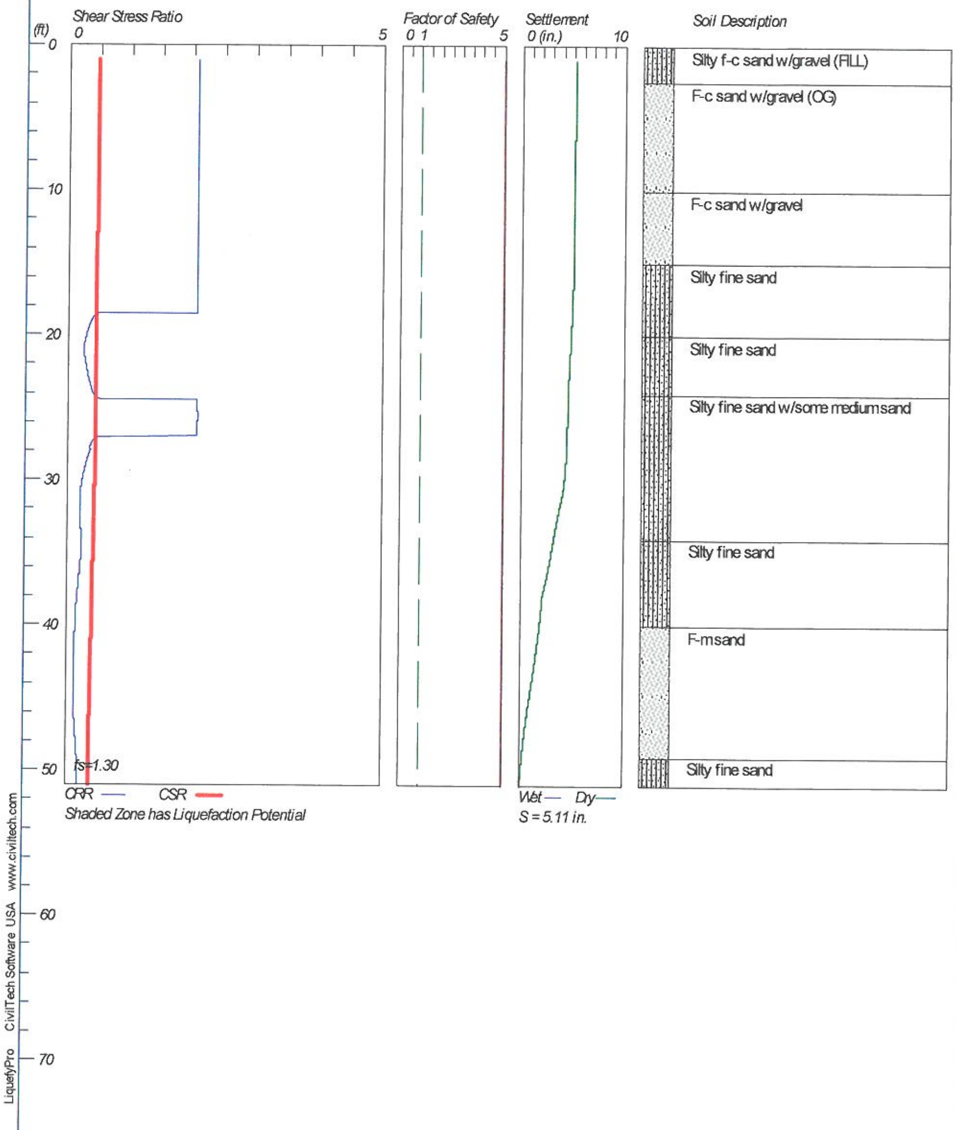
NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

LIQUEFACTION ANALYSIS

COLTON JUSD - STADIUM & BASEBALL FIELD RENOVATIONS

Hole No.=B-4 Water Depth=241.0 ft Surface Elev.=1059 feet above MSL Magnitude=7.4
Acceleration=0.553g



John R. Byerly, Inc. S-13636

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****************************************************************************************************
                  LIQUEFACTION ANALYSIS CALCULATION SHEET
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****************************************************************************************************
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        Input File Name: C:\Liquefy4\S-13636.4.liq
        Title:  COLTON JUSD - STADIUM & BASEBALL FIELD RENOVATIONS
        Subtitle:  S-13636

        Surface Elev.=1059 feet above MSL
        Hole No.=B-4
        Depth of Hole= 51.0 ft
        Water Table during Earthquake= 241.0 ft
        Water Table during In-Situ Testing= 241.0 ft
        Max. Acceleration= 0.55 g
        Earthquake Magnitude= 7.4
        User defined factor of safty (applied to CSR)       User fs=1.3
        fs=user,  Plot one CSR (fs=user)

        Hammer Energy Ratio, Ce=1
        Borehole Diameter, Cb=1
        Sampeling Method, Cs=1
        SPT Fines Correction Method: Stark/Olson et al.*
        Settlement Analysis Method: Ishihara / Yoshimine*
        Fines Correction for Liquefaction: Stark/Olson et al.*
        Fine Correction for Settlement: Post-Liq. Correction *
        Average Input Data: Smooth*
        * Recommended Options

Input Data:
        Depth    SPT      Gamma    Fines
        ft                pcf      %
        ____________________________________
        1.0      30.0     130.0    25.0
        3.0      30.0     130.0    1.0
        6.0      28.0     121.5    1.0
        11.0     42.0     130.8    1.0
        16.0     36.0     114.9    35.0
        21.0     16.0     111.8    35.0
        26.0     37.0     122.4    30.0
        31.0     16.0     118.5    30.0
        35.0     20.0     125.0    35.0
        40.0     20.0     125.0    1.0
        45.0     19.0     125.0    1.0
        50.0     21.0     125.0    35.0
        ____________________________________

Output Results:
        Settlement of saturated sands=0.00 in.
        Settlement of dry sands=5.11 in.
        Total settlement of saturated and dry sands=5.11 in.
        Differential Settlement=2.553 to 3.370 in.

        Depth    CRRm     CSRfs    F.S.     S_sat.   S_dry    S_all
        ft                w/fs              in.      in.      in.
        _________________________________________________________
        1.00     2.07     0.46     5.00     0.00     5.11     5.11
        2.00     2.07     0.46     5.00     0.00     5.10     5.10
        3.00     2.07     0.46     5.00     0.00     5.10     5.10
```

```
  4.00     2.07     0.46     5.00     0.00     5.10     5.10
  5.00     2.07     0.46     5.00     0.00     5.09     5.09
  6.00     2.07     0.46     5.00     0.00     5.09     5.09
  7.00     2.07     0.46     5.00     0.00     5.08     5.08
  8.00     2.07     0.46     5.00     0.00     5.07     5.07
  9.00     2.07     0.45     5.00     0.00     5.06     5.06
 10.00     2.07     0.45     5.00     0.00     5.05     5.05
 11.00     2.07     0.45     5.00     0.00     5.05     5.05
 12.00     2.07     0.45     5.00     0.00     5.04     5.04
 13.00     2.07     0.45     5.00     0.00     5.03     5.03
 14.00     2.07     0.45     5.00     0.00     5.02     5.02
 15.00     2.07     0.45     5.00     0.00     5.00     5.00
 16.00     2.07     0.45     5.00     0.00     4.98     4.98
 17.00     2.07     0.45     5.00     0.00     4.96     4.96
 18.00     2.07     0.45     5.00     0.00     4.91     4.91
 19.00     0.36     0.44     5.00     0.00     4.85     4.85
 20.00     0.28     0.44     5.00     0.00     4.81     4.81
 21.00     0.23     0.44     5.00     0.00     4.73     4.73
 22.00     0.27     0.44     5.00     0.00     4.65     4.65
 23.00     0.32     0.44     5.00     0.00     4.59     4.59
 24.00     0.39     0.44     5.00     0.00     4.55     4.55
 25.00     2.07     0.44     5.00     0.00     4.51     4.51
 26.00     2.07     0.44     5.00     0.00     4.48     4.48
 27.00     2.06     0.44     5.00     0.00     4.45     4.45
 28.00     0.35     0.43     5.00     0.00     4.40     4.40
 29.00     0.28     0.43     5.00     0.00     4.33     4.33
 30.00     0.23     0.43     5.00     0.00     4.21     4.21
 31.00     0.19     0.43     5.00     0.00     3.99     3.99
 32.00     0.20     0.42     5.00     0.00     3.69     3.69
 33.00     0.21     0.42     5.00     0.00     3.42     3.42
 34.00     0.21     0.42     5.00     0.00     3.18     3.18
 35.00     0.22     0.41     5.00     0.00     2.95     2.95
 36.00     0.20     0.41     5.00     0.00     2.71     2.71
 37.00     0.18     0.41     5.00     0.00     2.43     2.43
 38.00     0.16     0.40     5.00     0.00     2.12     2.12
 39.00     0.14     0.40     5.00     0.00     2.00     2.00
 40.00     0.13     0.39     5.00     0.00     1.85     1.85
 41.00     0.13     0.39     5.00     0.00     1.68     1.68
 42.00     0.12     0.39     5.00     0.00     1.51     1.51
 43.00     0.12     0.38     5.00     0.00     1.32     1.32
 44.00     0.12     0.38     5.00     0.00     1.12     1.12
 45.00     0.11     0.38     5.00     0.00     0.91     0.91
 46.00     0.12     0.37     5.00     0.00     0.71     0.71
 47.00     0.14     0.37     5.00     0.00     0.54     0.54
 48.00     0.15     0.36     5.00     0.00     0.38     0.38
 49.00     0.17     0.36     5.00     0.00     0.24     0.24
 50.00     0.19     0.36     5.00     0.00     0.12     0.12
 51.00     0.18     0.35     5.00     0.00     0.00     0.00
_____________________________________________________________
* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5,  CRR is limited to 2,  CSR is limited to 2)

Units          Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.
_______________________________________________________________________________________
CRRm           Cyclic resistance ratio from soils
CSRfs          Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.           Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat          Settlement from saturated sands
S_dry          Settlement from dry sands
S_all          Total settlement from saturated and dry sands
NoLiq          No-Liquefy Soils
```

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*****************************************************************************************************
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        Input File Name: C:\Liquefy4\S-13636.4.liq
        Title:  COLTON JUSD - STADIUM & BASEBALL FIELD RENOVATIONS
        Subtitle:  S-13636

Input Data:

        Surface Elev.=1059 feet above MSL
        Hole No.=B-4
        Depth of Hole=51.0 ft
        Water Table during Earthquake= 241.0 ft
        Water Table during In-Situ Testing= 241.0 ft
        Max. Acceleration=0.55 g
        Earthquake Magnitude=7.4
        User defined factor of safty (applied to CSR)       User fs=1.3
        fs=user,  Plot one CSR (fs=user)

        Hammer Energy Ratio, Ce=1
        Borehole Diameter, Cb=1
        Sampeling Method, Cs=1
        SPT Fines Correction Method: Stark/Olson et al.*
        Settlement Analysis Method: Ishihara / Yoshimine*
        Fines Correction for Liquefaction: Stark/Olson et al.*
        Fine Correction for Settlement: Post-Liq. Correction *
        Average Input Data: Smooth*
        * Recommended Options

        Depth      SPT       Gamma     Fines
        ft                   pcf       %
        ________________________________________
        1.0        30.0      130.0     25.0
        3.0        30.0      130.0     1.0
        6.0        28.0      121.5     1.0
        11.0       42.0      130.8     1.0
        16.0       36.0      114.9     35.0
        21.0       16.0      111.8     35.0
        26.0       37.0      122.4     30.0
        31.0       16.0      118.5     30.0
        35.0       20.0      125.0     35.0
        40.0       20.0      125.0     1.0
        45.0       19.0      125.0     1.0
        50.0       21.0      125.0     35.0
        ________________________________________

Output Results:       (Interval = 1.00 ft)

        CSR Calculation:
        Depth     gamma     sigma     gamma'    sigma'    rd        CSR       fs        CSRfs
        ft        pcf       tsf       pcf       tsf                           (user)    w/fs
        ______________________________________________________________________________________
        1.00      130.0     0.065     130.0     0.065     1.00      0.36      1.3       0.46
        2.00      130.0     0.130     130.0     0.130     1.00      0.36      1.3       0.46
        3.00      130.0     0.195     130.0     0.195     0.99      0.35      1.3       0.46
        4.00      127.2     0.259     127.2     0.259     0.99      0.35      1.3       0.46
```

5.00	124.3	0.322	124.3	0.322	0.99	0.35	1.3	0.46
6.00	121.5	0.384	121.5	0.384	0.99	0.35	1.3	0.46
7.00	123.4	0.445	123.4	0.445	0.98	0.35	1.3	0.46
8.00	125.2	0.507	125.2	0.507	0.98	0.35	1.3	0.46
9.00	127.1	0.570	127.1	0.570	0.98	0.35	1.3	0.45
10.00	128.9	0.634	128.9	0.634	0.98	0.35	1.3	0.45
11.00	130.8	0.699	130.8	0.699	0.97	0.35	1.3	0.45
12.00	127.6	0.764	127.6	0.764	0.97	0.35	1.3	0.45
13.00	124.4	0.827	124.4	0.827	0.97	0.35	1.3	0.45
14.00	121.3	0.888	121.3	0.888	0.97	0.35	1.3	0.45
15.00	118.1	0.948	118.1	0.948	0.97	0.34	1.3	0.45
16.00	114.9	1.006	114.9	1.006	0.96	0.34	1.3	0.45
17.00	114.3	1.064	114.3	1.064	0.96	0.34	1.3	0.45
18.00	113.7	1.121	113.7	1.121	0.96	0.34	1.3	0.45
19.00	113.0	1.177	113.0	1.177	0.96	0.34	1.3	0.44
20.00	112.4	1.234	112.4	1.234	0.95	0.34	1.3	0.44
21.00	111.8	1.290	111.8	1.290	0.95	0.34	1.3	0.44
22.00	113.9	1.346	113.9	1.346	0.95	0.34	1.3	0.44
23.00	116.0	1.404	116.0	1.404	0.95	0.34	1.3	0.44
24.00	118.2	1.462	118.2	1.462	0.94	0.34	1.3	0.44
25.00	120.3	1.522	120.3	1.522	0.94	0.34	1.3	0.44
26.00	122.4	1.582	122.4	1.582	0.94	0.34	1.3	0.44
27.00	121.6	1.643	121.6	1.643	0.94	0.33	1.3	0.44
28.00	120.8	1.704	120.8	1.704	0.93	0.33	1.3	0.43
29.00	120.1	1.764	120.1	1.764	0.93	0.33	1.3	0.43
30.00	119.3	1.824	119.3	1.824	0.93	0.33	1.3	0.43
31.00	118.5	1.884	118.5	1.884	0.92	0.33	1.3	0.43
32.00	120.1	1.943	120.1	1.943	0.91	0.33	1.3	0.42
33.00	121.7	2.004	121.7	2.004	0.91	0.32	1.3	0.42
34.00	123.4	2.065	123.4	2.065	0.90	0.32	1.3	0.42
35.00	125.0	2.127	125.0	2.127	0.89	0.32	1.3	0.41
36.00	125.0	2.189	125.0	2.189	0.88	0.31	1.3	0.41
37.00	125.0	2.252	125.0	2.252	0.87	0.31	1.3	0.41
38.00	125.0	2.314	125.0	2.314	0.86	0.31	1.3	0.40
39.00	125.0	2.377	125.0	2.377	0.86	0.31	1.3	0.40
40.00	125.0	2.439	125.0	2.439	0.85	0.30	1.3	0.39
41.00	125.0	2.502	125.0	2.502	0.84	0.30	1.3	0.39
42.00	125.0	2.564	125.0	2.564	0.83	0.30	1.3	0.39
43.00	125.0	2.627	125.0	2.627	0.82	0.29	1.3	0.38
44.00	125.0	2.689	125.0	2.689	0.82	0.29	1.3	0.38
45.00	125.0	2.752	125.0	2.752	0.81	0.29	1.3	0.38
46.00	125.0	2.814	125.0	2.814	0.80	0.29	1.3	0.37
47.00	125.0	2.877	125.0	2.877	0.79	0.28	1.3	0.37
48.00	125.0	2.939	125.0	2.939	0.78	0.28	1.3	0.36
49.00	125.0	3.002	125.0	3.002	0.78	0.28	1.3	0.36
50.00	125.0	3.064	125.0	3.064	0.77	0.27	1.3	0.36
51.00	125.0	3.127	125.0	3.127	0.76	0.27	1.3	0.35

CSR is based on water table at 241.0 during earthquake

CRR Calculation from SPT or BPT data:

Depth ft	SPT	Cebs	Cr	sigma'	Cn	(N1)60	Fines %	d(N1)60	(N1)60f	CRR7.5
1.00	30.00	1.00	0.75	0.065	1.70	38.25	25.0	4.80	43.05	2.00
2.00	30.00	1.00	0.75	0.130	1.70	38.25	13.0	1.92	40.17	2.00
3.00	30.00	1.00	0.75	0.195	1.70	38.25	1.0	0.00	38.25	2.00
4.00	29.33	1.00	0.75	0.259	1.70	37.40	1.0	0.00	37.40	2.00
5.00	28.67	1.00	0.75	0.322	1.70	36.55	1.0	0.00	36.55	2.00
6.00	28.00	1.00	0.75	0.384	1.61	33.90	1.0	0.00	33.90	2.00
7.00	30.80	1.00	0.75	0.445	1.50	34.63	1.0	0.00	34.63	2.00
8.00	33.60	1.00	0.75	0.507	1.40	35.39	1.0	0.00	35.39	2.00
9.00	36.40	1.00	0.85	0.570	1.32	40.98	1.0	0.00	40.98	2.00

5.00	124.3	0.322	124.3	0.322	0.99	0.35	1.3	0.46
6.00	121.5	0.384	121.5	0.384	0.99	0.35	1.3	0.46
7.00	123.4	0.445	123.4	0.445	0.98	0.35	1.3	0.46
8.00	125.2	0.507	125.2	0.507	0.98	0.35	1.3	0.46
9.00	127.1	0.570	127.1	0.570	0.98	0.35	1.3	0.45
10.00	128.9	0.634	128.9	0.634	0.98	0.35	1.3	0.45
11.00	130.8	0.699	130.8	0.699	0.97	0.35	1.3	0.45
12.00	127.6	0.764	127.6	0.764	0.97	0.35	1.3	0.45
13.00	124.4	0.827	124.4	0.827	0.97	0.35	1.3	0.45
14.00	121.3	0.888	121.3	0.888	0.97	0.35	1.3	0.45
15.00	118.1	0.948	118.1	0.948	0.97	0.34	1.3	0.45
16.00	114.9	1.006	114.9	1.006	0.96	0.34	1.3	0.45
17.00	114.3	1.064	114.3	1.064	0.96	0.34	1.3	0.45
18.00	113.7	1.121	113.7	1.121	0.96	0.34	1.3	0.45
19.00	113.0	1.177	113.0	1.177	0.96	0.34	1.3	0.44
20.00	112.4	1.234	112.4	1.234	0.95	0.34	1.3	0.44
21.00	111.8	1.290	111.8	1.290	0.95	0.34	1.3	0.44
22.00	113.9	1.346	113.9	1.346	0.95	0.34	1.3	0.44
23.00	116.0	1.404	116.0	1.404	0.95	0.34	1.3	0.44
24.00	118.2	1.462	118.2	1.462	0.94	0.34	1.3	0.44
25.00	120.3	1.522	120.3	1.522	0.94	0.34	1.3	0.44
26.00	122.4	1.582	122.4	1.582	0.94	0.34	1.3	0.44
27.00	121.6	1.643	121.6	1.643	0.94	0.33	1.3	0.44
28.00	120.8	1.704	120.8	1.704	0.93	0.33	1.3	0.43
29.00	120.1	1.764	120.1	1.764	0.93	0.33	1.3	0.43
30.00	119.3	1.824	119.3	1.824	0.93	0.33	1.3	0.43
31.00	118.5	1.884	118.5	1.884	0.92	0.33	1.3	0.43
32.00	120.1	1.943	120.1	1.943	0.91	0.33	1.3	0.42
33.00	121.7	2.004	121.7	2.004	0.91	0.32	1.3	0.42
34.00	123.4	2.065	123.4	2.065	0.90	0.32	1.3	0.42
35.00	125.0	2.127	125.0	2.127	0.89	0.32	1.3	0.41
36.00	125.0	2.189	125.0	2.189	0.88	0.31	1.3	0.41
37.00	125.0	2.252	125.0	2.252	0.87	0.31	1.3	0.41
38.00	125.0	2.314	125.0	2.314	0.86	0.31	1.3	0.40
39.00	125.0	2.377	125.0	2.377	0.86	0.31	1.3	0.40
40.00	125.0	2.439	125.0	2.439	0.85	0.30	1.3	0.39
41.00	125.0	2.502	125.0	2.502	0.84	0.30	1.3	0.39
42.00	125.0	2.564	125.0	2.564	0.83	0.30	1.3	0.39
43.00	125.0	2.627	125.0	2.627	0.82	0.29	1.3	0.38
44.00	125.0	2.689	125.0	2.689	0.82	0.29	1.3	0.38
45.00	125.0	2.752	125.0	2.752	0.81	0.29	1.3	0.38
46.00	125.0	2.814	125.0	2.814	0.80	0.29	1.3	0.37
47.00	125.0	2.877	125.0	2.877	0.79	0.28	1.3	0.37
48.00	125.0	2.939	125.0	2.939	0.78	0.28	1.3	0.36
49.00	125.0	3.002	125.0	3.002	0.78	0.28	1.3	0.36
50.00	125.0	3.064	125.0	3.064	0.77	0.27	1.3	0.36
51.00	125.0	3.127	125.0	3.127	0.76	0.27	1.3	0.35

CSR is based on water table at 241.0 during earthquake

CRR Calculation from SPT or BPT data:

Depth ft	SPT	Cebs	Cr	sigma'	Cn	(N1)60	Fines %	d(N1)60	(N1)60f	CRR7.5
1.00	30.00	1.00	0.75	0.065	1.70	38.25	25.0	4.80	43.05	2.00
2.00	30.00	1.00	0.75	0.130	1.70	38.25	13.0	1.92	40.17	2.00
3.00	30.00	1.00	0.75	0.195	1.70	38.25	1.0	0.00	38.25	2.00
4.00	29.33	1.00	0.75	0.259	1.70	37.40	1.0	0.00	37.40	2.00
5.00	28.67	1.00	0.75	0.322	1.70	36.55	1.0	0.00	36.55	2.00
6.00	28.00	1.00	0.75	0.384	1.61	33.90	1.0	0.00	33.90	2.00
7.00	30.80	1.00	0.75	0.445	1.50	34.63	1.0	0.00	34.63	2.00
8.00	33.60	1.00	0.75	0.507	1.40	35.39	1.0	0.00	35.39	2.00
9.00	36.40	1.00	0.85	0.570	1.32	40.98	1.0	0.00	40.98	2.00

10.00	39.20	1.00	0.85	0.634	1.26	41.84	1.0	0.00	41.84	2.00
11.00	42.00	1.00	0.85	0.699	1.20	42.70	1.0	0.00	42.70	2.00
12.00	40.80	1.00	0.85	0.764	1.14	39.69	7.8	0.67	40.36	2.00
13.00	39.60	1.00	0.85	0.827	1.10	37.02	14.6	2.30	39.32	2.00
14.00	38.40	1.00	0.85	0.888	1.06	34.63	21.4	3.94	38.57	2.00
15.00	37.20	1.00	0.95	0.948	1.03	36.30	28.2	5.57	41.86	2.00
16.00	36.00	1.00	0.95	1.006	1.00	34.09	35.0	7.20	41.29	2.00
17.00	32.00	1.00	0.95	1.064	0.97	29.48	35.0	7.20	36.68	2.00
18.00	28.00	1.00	0.95	1.121	0.94	25.13	35.0	7.20	32.33	2.00
19.00	24.00	1.00	0.95	1.177	0.92	21.01	35.0	7.20	28.21	0.35
20.00	20.00	1.00	0.95	1.234	0.90	17.11	35.0	7.20	24.31	0.27
21.00	16.00	1.00	0.95	1.290	0.88	13.38	35.0	7.20	20.58	0.22
22.00	20.20	1.00	0.95	1.346	0.86	16.54	34.0	6.96	23.50	0.26
23.00	24.40	1.00	0.95	1.404	0.84	19.57	33.0	6.72	26.29	0.31
24.00	28.60	1.00	0.95	1.462	0.83	22.47	32.0	6.48	28.95	0.37
25.00	32.80	1.00	0.95	1.522	0.81	25.26	31.0	6.24	31.50	2.00
26.00	37.00	1.00	0.95	1.582	0.79	27.94	30.0	6.00	33.94	2.00
27.00	32.80	1.00	0.95	1.643	0.78	24.31	30.0	6.00	30.31	2.00
28.00	28.60	1.00	1.00	1.704	0.77	21.91	30.0	6.00	27.91	0.34
29.00	24.40	1.00	1.00	1.764	0.75	18.37	30.0	6.00	24.37	0.27
30.00	20.20	1.00	1.00	1.824	0.74	14.96	30.0	6.00	20.96	0.23
31.00	16.00	1.00	1.00	1.884	0.73	11.66	30.0	6.00	17.66	0.19
32.00	17.00	1.00	1.00	1.943	0.72	12.20	31.2	6.30	18.50	0.20
33.00	18.00	1.00	1.00	2.004	0.71	12.72	32.5	6.60	19.32	0.21
34.00	19.00	1.00	1.00	2.065	0.70	13.22	33.7	6.90	20.12	0.22
35.00	20.00	1.00	1.00	2.127	0.69	13.71	35.0	7.20	20.91	0.23
36.00	20.00	1.00	1.00	2.189	0.68	13.52	28.2	5.57	19.08	0.21
37.00	20.00	1.00	1.00	2.252	0.67	13.33	21.4	3.94	17.26	0.19
38.00	20.00	1.00	1.00	2.314	0.66	13.15	14.6	2.30	15.45	0.17
39.00	20.00	1.00	1.00	2.377	0.65	12.97	7.8	0.67	13.64	0.15
40.00	20.00	1.00	1.00	2.439	0.64	12.81	1.0	0.00	12.81	0.14
41.00	19.80	1.00	1.00	2.502	0.63	12.52	1.0	0.00	12.52	0.14
42.00	19.60	1.00	1.00	2.564	0.62	12.24	1.0	0.00	12.24	0.13
43.00	19.40	1.00	1.00	2.627	0.62	11.97	1.0	0.00	11.97	0.13
44.00	19.20	1.00	1.00	2.689	0.61	11.71	1.0	0.00	11.71	0.13
45.00	19.00	1.00	1.00	2.752	0.60	11.45	1.0	0.00	11.45	0.12
46.00	19.40	1.00	1.00	2.814	0.60	11.56	7.8	0.67	12.24	0.13
47.00	19.80	1.00	1.00	2.877	0.59	11.67	14.6	2.30	13.98	0.15
48.00	20.20	1.00	1.00	2.939	0.58	11.78	21.4	3.94	15.72	0.17
49.00	20.60	1.00	1.00	3.002	0.58	11.89	28.2	5.57	17.46	0.19
50.00	21.00	1.00	1.00	3.064	0.57	12.00	35.0	7.20	19.20	0.21
51.00	21.00	1.00	1.00	3.127	0.57	11.88	35.0	7.20	19.08	0.21

CRR is based on water table at 241.0 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 7.4:

Depth ft	sigC' tsf	CRR7.5 tsf	Ksigma	CRRv	MSF	CRRm	CSRfs w/fs	F.S. CRRm/CSRfs
1.00	0.04	2.00	1.00	2.00	1.03	2.07	0.46	5.00
2.00	0.08	2.00	1.00	2.00	1.03	2.07	0.46	5.00
3.00	0.13	2.00	1.00	2.00	1.03	2.07	0.46	5.00
4.00	0.17	2.00	1.00	2.00	1.03	2.07	0.46	5.00
5.00	0.21	2.00	1.00	2.00	1.03	2.07	0.46	5.00
6.00	0.25	2.00	1.00	2.00	1.03	2.07	0.46	5.00
7.00	0.29	2.00	1.00	2.00	1.03	2.07	0.46	5.00
8.00	0.33	2.00	1.00	2.00	1.03	2.07	0.46	5.00
9.00	0.37	2.00	1.00	2.00	1.03	2.07	0.45	5.00
10.00	0.41	2.00	1.00	2.00	1.03	2.07	0.45	5.00
11.00	0.45	2.00	1.00	2.00	1.03	2.07	0.45	5.00
12.00	0.50	2.00	1.00	2.00	1.03	2.07	0.45	5.00
13.00	0.54	2.00	1.00	2.00	1.03	2.07	0.45	5.00
14.00	0.58	2.00	1.00	2.00	1.03	2.07	0.45	5.00

15.00	0.62	2.00	1.00	2.00	1.03	2.07	0.45	5.00
16.00	0.65	2.00	1.00	2.00	1.03	2.07	0.45	5.00
17.00	0.69	2.00	1.00	2.00	1.03	2.07	0.45	5.00
18.00	0.73	2.00	1.00	2.00	1.03	2.07	0.45	5.00
19.00	0.77	0.35	1.00	0.35	1.03	0.36	0.44	5.00
20.00	0.80	0.27	1.00	0.27	1.03	0.28	0.44	5.00
21.00	0.84	0.22	1.00	0.22	1.03	0.23	0.44	5.00
22.00	0.87	0.26	1.00	0.26	1.03	0.27	0.44	5.00
23.00	0.91	0.31	1.00	0.31	1.03	0.32	0.44	5.00
24.00	0.95	0.37	1.00	0.37	1.03	0.39	0.44	5.00
25.00	0.99	2.00	1.00	2.00	1.03	2.07	0.44	5.00
26.00	1.03	2.00	1.00	2.00	1.03	2.07	0.44	5.00
27.00	1.07	2.00	1.00	1.99	1.03	2.06	0.44	5.00
28.00	1.11	0.34	0.99	0.34	1.03	0.35	0.43	5.00
29.00	1.15	0.27	0.98	0.27	1.03	0.28	0.43	5.00
30.00	1.19	0.23	0.98	0.22	1.03	0.23	0.43	5.00
31.00	1.22	0.19	0.97	0.19	1.03	0.19	0.43	5.00
32.00	1.26	0.20	0.97	0.19	1.03	0.20	0.42	5.00
33.00	1.30	0.21	0.96	0.20	1.03	0.21	0.42	5.00
34.00	1.34	0.22	0.95	0.21	1.03	0.21	0.42	5.00
35.00	1.38	0.23	0.95	0.22	1.03	0.22	0.41	5.00
36.00	1.42	0.21	0.94	0.19	1.03	0.20	0.41	5.00
37.00	1.46	0.19	0.94	0.17	1.03	0.18	0.41	5.00
38.00	1.50	0.17	0.93	0.16	1.03	0.16	0.40	5.00
39.00	1.55	0.15	0.93	0.14	1.03	0.14	0.40	5.00
40.00	1.59	0.14	0.92	0.13	1.03	0.13	0.39	5.00
41.00	1.63	0.14	0.92	0.12	1.03	0.13	0.39	5.00
42.00	1.67	0.13	0.91	0.12	1.03	0.12	0.39	5.00
43.00	1.71	0.13	0.91	0.12	1.03	0.12	0.38	5.00
44.00	1.75	0.13	0.90	0.11	1.03	0.12	0.38	5.00
45.00	1.79	0.12	0.90	0.11	1.03	0.11	0.38	5.00
46.00	1.83	0.13	0.89	0.12	1.03	0.12	0.37	5.00
47.00	1.87	0.15	0.89	0.13	1.03	0.14	0.37	5.00
48.00	1.91	0.17	0.88	0.15	1.03	0.15	0.36	5.00
49.00	1.95	0.19	0.88	0.17	1.03	0.17	0.36	5.00
50.00	1.99	0.21	0.87	0.18	1.03	0.19	0.36	5.00
51.00	2.03	0.21	0.87	0.18	1.03	0.18	0.35	5.00

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 tsf	(N1)60	Fines %	d(N1)60	(N1)60s
1.00	-	-	-	38.25	25.0	2.19	40.44
2.00	-	-	-	38.25	13.0	1.20	39.45
3.00	-	-	-	38.25	1.0	0.10	38.35
4.00	-	-	-	37.40	1.0	0.10	37.50
5.00	-	-	-	36.55	1.0	0.10	36.65
6.00	-	-	-	33.90	1.0	0.10	34.00
7.00	-	-	-	34.63	1.0	0.10	34.73
8.00	-	-	-	35.39	1.0	0.10	35.49
9.00	-	-	-	40.98	1.0	0.10	41.07
10.00	-	-	-	41.84	1.0	0.10	41.94
11.00	-	-	-	42.70	1.0	0.10	42.80
12.00	-	-	-	39.69	7.8	0.74	40.42
13.00	-	-	-	37.02	14.6	1.34	38.36
14.00	-	-	-	34.63	21.4	1.90	36.54
15.00	-	-	-	36.30	28.2	2.43	38.72
16.00	-	-	-	34.09	35.0	2.92	37.01

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        17.00    -      -      -      29.48   35.0    2.92    32.40
        18.00    -      -      -      25.13   35.0    2.92    28.05
        19.00    -      -      -      21.01   35.0    2.92    23.93
        20.00    -      -      -      17.11   35.0    2.92    20.03
        21.00    -      -      -      13.38   35.0    2.92    16.30
        22.00    -      -      -      16.54   34.0    2.85    19.39
        23.00    -      -      -      19.57   33.0    2.78    22.34
        24.00    -      -      -      22.47   32.0    2.71    25.18
        25.00    -      -      -      25.26   31.0    2.64    27.89
        26.00    -      -      -      27.94   30.0    2.56    30.50
        27.00    -      -      -      24.31   30.0    2.56    26.87
        28.00    -      -      -      21.91   30.0    2.56    24.47
        29.00    -      -      -      18.37   30.0    2.56    20.93
        30.00    -      -      -      14.96   30.0    2.56    17.52
        31.00    -      -      -      11.66   30.0    2.56    14.22
        32.00    -      -      -      12.20   31.2    2.65    14.85
        33.00    -      -      -      12.72   32.5    2.74    15.46
        34.00    -      -      -      13.22   33.7    2.83    16.05
        35.00    -      -      -      13.71   35.0    2.92    16.63
        36.00    -      -      -      13.52   28.2    2.43    15.95
        37.00    -      -      -      13.33   21.4    1.90    15.23
        38.00    -      -      -      13.15   14.6    1.34    14.48
        39.00    -      -      -      12.97   7.8     0.74    13.71
        40.00    -      -      -      12.81   1.0     0.10    12.90
        41.00    -      -      -      12.52   1.0     0.10    12.61
        42.00    -      -      -      12.24   1.0     0.10    12.34
        43.00    -      -      -      11.97   1.0     0.10    12.07
        44.00    -      -      -      11.71   1.0     0.10    11.80
        45.00    -      -      -      11.45   1.0     0.10    11.55
        46.00    -      -      -      11.56   7.8     0.74    12.30
        47.00    -      -      -      11.67   14.6    1.34    13.01
        48.00    -      -      -      11.78   21.4    1.90    13.68
        49.00    -      -      -      11.89   28.2    2.43    14.32
        50.00    -      -      -      12.00   35.0    2.92    14.91
        51.00    -      -      -      11.88   35.0    2.92    14.79
        ______________________________________________________________


        Settlement of Saturated Sands:
        Settlement Analysis Method: Ishihara / Yoshimine*
        Depth    CSRfs    F.S.    Fines    (N1)60s   Dr     ec     dsz     dsv     S
        ft       w/fs             %                  %      %      in.     in.     in.
        _____________________________________________________________________________
        _____________________________________________________________________________
        Settlement of Saturated Sands=0.000 in.
        dsz is per each segment: dz=0.05 ft
        dsv is per each print interval: dv=1 ft
        S is cumulated settlement at this depth

        Settlement of Dry Sands:
        Depth    sigma'   sigC'    (N1)60s  CSRfs    Gmax    g*Ge/Gm  g_eff    ec7.5    Cec    ec
dsz     dsv      S
        ft       tsf      tsf               w/fs     tsf                       %               %
in.     in.      in.
_____________________________________________________________________________________________________
________
        50.95    3.12     2.03     14.80    0.35     1563.2  7.1E-4   0.3348   0.4870   1.03   0.5030
6.0E-3  0.006    0.006
        50.00    3.06     1.99     14.91    0.36     1552.2  7.0E-4   0.3326   0.4791   1.03   0.4948
5.9E-3  0.114    0.120
        49.00    3.00     1.95     14.32    0.36     1515.6  7.1E-4   0.3477   0.5279   1.03   0.5451
6.5E-3  0.125    0.245
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          48.00     2.94      1.91      13.68     0.36      1477.2    7.2E-4    0.3651    0.5873    1.03      0.6065
 7.3E-3   0.138     0.383
          47.00     2.88      1.87      13.01     0.37      1437.1    7.4E-4    0.3854    0.6606    1.03      0.6822
 8.2E-3   0.155     0.538
          46.00     2.81      1.83      12.30     0.37      1395.1    7.5E-4    0.4092    0.7524    1.03      0.7771
 9.3E-3   0.175     0.713
          45.00     2.75      1.79      11.55     0.38      1350.9    7.6E-4    0.4376    0.8693    1.03      0.8978
 1.1E-2   0.201     0.914
          44.00     2.69      1.75      11.80     0.38      1345.2    7.6E-4    0.4248    0.8217    1.03      0.8486
 1.0E-2   0.209     1.123
          43.00     2.63      1.71      12.07     0.38      1339.3    7.5E-4    0.4119    0.7755    1.03      0.8009
 9.6E-3   0.198     1.321
          42.00     2.56      1.67      12.34     0.39      1333.0    7.4E-4    0.3989    0.7307    1.03      0.7546
 9.1E-3   0.186     1.507
          41.00     2.50      1.63      12.61     0.39      1326.5    7.4E-4    0.3858    0.6873    1.03      0.7098
 8.5E-3   0.175     1.683
          40.00     2.44      1.59      12.90     0.39      1319.7    7.3E-4    0.3726    0.6454    1.03      0.6665
 8.0E-3   0.165     1.848
          39.00     2.38      1.55      13.71     0.40      1329.2    7.1E-4    0.3450    0.5536    1.03      0.5718
 6.9E-3   0.148     1.995
          38.00     2.31      1.50      14.48     0.40      1335.9    7.0E-4    0.3214    0.4808    1.03      0.4965
 6.0E-3   0.127     2.123
          37.00     2.25      1.46      15.23     0.41      1339.9    6.8E-4    0.8803    1.2344    1.03      1.2748
 1.5E-2   0.310     2.433
          36.00     2.19      1.42      15.95     0.41      1341.6    6.7E-4    0.7841    1.0362    1.03      1.0701
 1.3E-2   0.279     2.712
          35.00     2.13      1.38      16.63     0.41      1341.0    6.6E-4    0.7045    0.8815    1.03      0.9104
 1.1E-2   0.236     2.948
          34.00     2.06      1.34      16.05     0.42      1305.8    6.6E-4    0.7284    0.9541    1.03      0.9854
 1.2E-2   0.228     3.176
          33.00     2.00      1.30      15.46     0.42      1270.2    6.6E-4    0.7552    1.0387    1.03      1.0727
 1.3E-2   0.247     3.423
          32.00     1.94      1.26      14.85     0.42      1234.2    6.7E-4    0.7857    1.1382    1.03      1.1755
 1.4E-2   0.270     3.693
          31.00     1.88      1.22      14.22     0.43      1197.8    6.7E-4    0.8207    1.2566    1.03      1.2977
 1.6E-2   0.297     3.990
          30.00     1.82      1.19      17.52     0.43      1263.5    6.2E-4    0.5460    0.6386    1.03      0.6595
 7.9E-3   0.219     4.209
          29.00     1.76      1.15      20.93     0.43      1318.5    5.8E-4    0.3885    0.3605    1.03      0.3723
 4.5E-3   0.118     4.327
          28.00     1.70      1.11      24.47     0.43      1365.0    5.4E-4    0.2952    0.2233    1.03      0.2307
 2.8E-3   0.070     4.397
          27.00     1.64      1.07      26.87     0.44      1382.9    5.2E-4    0.2477    0.1653    1.03      0.1707
 2.0E-3   0.050     4.446
          26.00     1.58      1.03      30.50     0.44      1415.5    4.9E-4    0.2021    0.1121    1.03      0.1158
 1.4E-3   0.034     4.480
          25.00     1.52      0.99      27.89     0.44      1347.4    4.9E-4    0.2110    0.1336    1.03      0.1379
 1.7E-3   0.030     4.510
          24.00     1.46      0.95      25.18     0.44      1276.4    5.0E-4    0.2233    0.1627    1.03      0.1680
 2.0E-3   0.037     4.547
          23.00     1.40      0.91      22.34     0.44      1201.9    5.1E-4    0.2411    0.2056    1.03      0.2123
 2.5E-3   0.046     4.593
          22.00     1.35      0.87      19.39     0.44      1122.7    5.3E-4    0.2679    0.2746    1.03      0.2836
 3.4E-3   0.059     4.652
          21.00     1.29      0.84      16.30     0.44      1037.3    5.5E-4    0.3110    0.3993    1.03      0.4124
 4.9E-3   0.083     4.734
          20.00     1.23      0.80      20.03     0.44      1086.4    5.0E-4    0.2242    0.2204    1.03      0.2276
 2.7E-3   0.073     4.807
          19.00     1.18      0.77      23.93     0.44      1126.2    4.6E-4    0.1722    0.1342    1.03      0.1386
 1.7E-3   0.042     4.849
          18.00     1.12      0.73      28.05     0.45      1158.4    4.3E-4    0.4153    0.2609    1.03      0.2694
 3.2E-3   0.058     4.908
          17.00     1.06      0.69      32.40     0.45      1184.0    4.0E-4    0.2849    0.1433    1.03      0.1479
```

```
1.8E-3   0.048    4.956
         16.00    1.01     0.65     37.01    0.45     1203.9   3.7E-4   0.2047   0.0790   1.03     0.0816
9.8E-4   0.026    4.982
         15.00    0.95     0.62     38.72    0.45     1186.3   3.6E-4   0.1700   0.0587   1.03     0.0606
7.3E-4   0.017    4.999
         14.00    0.89     0.58     36.54    0.45     1126.2   3.5E-4   0.1624   0.0646   1.03     0.0667
8.0E-4   0.017    5.016
         13.00    0.83     0.54     38.36    0.45     1104.2   3.4E-4   0.1331   0.0471   1.03     0.0486
5.8E-4   0.014    5.030
         12.00    0.76     0.50     40.42    0.45     1080.0   3.2E-4   0.1086   0.0343   1.03     0.0355
4.3E-4   0.010    5.040
         11.00    0.70     0.45     42.80    0.45     1053.1   3.0E-4   0.0883   0.0279   1.03     0.0288
3.5E-4   0.008    5.047
         10.00    0.63     0.41     41.94    0.45     996.3    2.9E-4   0.0780   0.0247   1.03     0.0255
3.1E-4   0.006    5.054
         9.00     0.57     0.37     41.07    0.45     938.1    2.8E-4   0.0685   0.0217   1.03     0.0224
2.7E-4   0.006    5.059
         8.00     0.51     0.33     35.49    0.46     842.7    2.7E-4   0.1405   0.0595   1.03     0.0615
7.4E-4   0.009    5.068
         7.00     0.44     0.29     34.73    0.46     783.7    2.6E-4   0.0933   0.0413   1.03     0.0426
5.1E-4   0.012    5.081
         6.00     0.38     0.25     34.00    0.46     722.7    2.4E-4   0.0658   0.0303   1.03     0.0313
3.8E-4   0.009    5.089
         5.00     0.32     0.21     36.65    0.46     679.0    2.2E-4   0.0455   0.0180   1.03     0.0186
2.2E-4   0.006    5.095
         4.00     0.26     0.17     37.50    0.46     613.8    1.9E-4   0.0381   0.0143   1.03     0.0147
1.8E-4   0.004    5.099
         3.00     0.20     0.13     38.35    0.46     536.3    1.7E-4   0.0363   0.0129   1.03     0.0133
1.6E-4   0.003    5.102
         2.00     0.13     0.08     39.45    0.46     442.0    1.4E-4   0.0254   0.0083   1.03     0.0086
1.0E-4   0.003    5.105
         1.00     0.07     0.04     40.44    0.46     315.1    9.6E-5   0.0186   0.0059   1.03     0.0061
7.3E-5   0.002    5.107

_______________________________________________________________________________________________________
____________
         Settlement of Dry Sands=5.107 in.
         dsz is per each segment: dz=0.05 ft
         dsv is per each print interval: dv=1 ft
         S is cumulated settlement at this depth

         Total Settlement of Saturated and Dry Sands=5.107 in.
         Differential Settlement=2.553 to 3.370 in.

         Units               Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

_______________________________________________________________________________________________________
         SPT                 Field data from Standard Penetration Test (SPT)
         BPT                 Field data from Becker Penetration Test (BPT)
         qc                  Field data from Cone Penetration Test (CPT)
         fc                  Friction from CPT testing
         Gamma               Total unit weight of soil
         Gamma'              Effective unit weight of soil
         Fines               Fines content [%]
         D50                 Mean grain size
         Dr                  Relative Density
         sigma               Total vertical stress [tsf]
         sigma'              Effective vertical stress [tsf]
         sigC'               Effective confining pressure [tsf]
         rd                  Stress reduction coefficient
         CSR                 Cyclic stress ratio induced by earthquake
         fs                  User request factor of safety, apply to CSR
         w/fs                With user request factor of safety inside
```

CSRfs	CSR with User request factor of safety
CRR7.5	Cyclic resistance ratio (M=7.5)
Ksigma	Overburden stress correction factor for CRR7.5
CRRv	CRR after overburden stress correction, CRRv=CRR7.5 * Ksigma
MSF	Magnitude scaling factor for CRR (M=7.5)
CRRm	After magnitude scaling correction CRRm=CRRv * MSF
F.S.	Factor of Safety against liquefaction F.S.=CRRm/CSRfs
Cebs	Energy Ratio, Borehole Dia., and Sample Method Corrections
Cr	Rod Length Corrections
Cn	Overburden Pressure Correction
(N1)60	SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
d(N1)60	Fines correction of SPT
(N1)60f	(N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
Cq	Overburden stress correction factor
qc1	CPT after Overburden stress correction
dqc1	Fines correction of CPT
qc1f	CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n	CPT after normalization in Robertson's method
Kc	Fine correction factor in Robertson's Method
qc1f	CPT after Fines correction in Robertson's Method
Ic	Soil type index in Suzuki's and Robertson's Methods
(N1)60s	(N1)60 after seattlement fines corrections
ec	Volumetric strain for saturated sands
ds	Settlement in each Segment dz
dz	Segment for calculation, dz=0.050 ft
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio
ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for dry sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

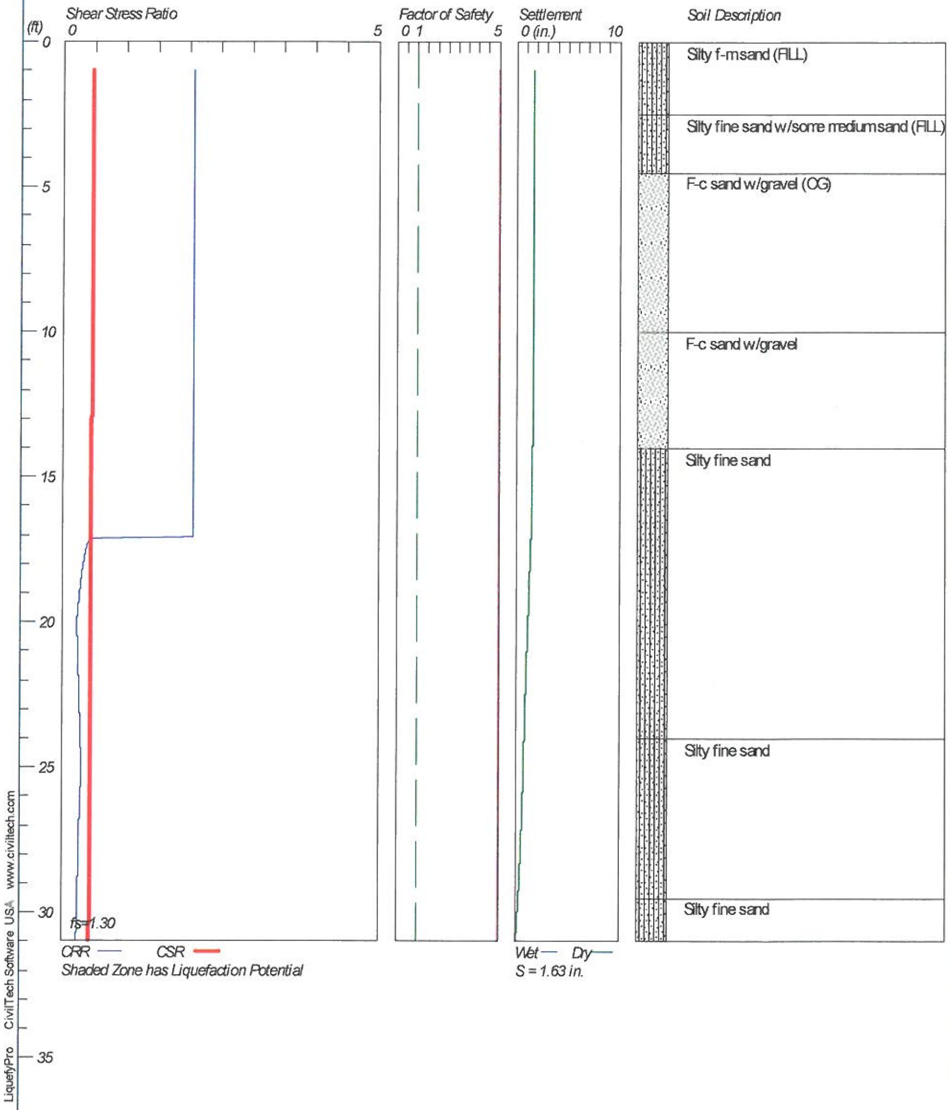
NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

LIQUEFACTION ANALYSIS

COLTON JUSD - STADIUM & BASEBALL FIELD RENOVATIONS

Hole No.=B-8 Water Depth=241.0 ft Surface Elev.=1064 feet above MSL Magnitude=7.4
Acceleration=0.553g



John R. Byerly, Inc. **S-13636**

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*************************************************************************************************************
                      LIQUEFACTION ANALYSIS CALCULATION SHEET
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          Input File Name: C:\Liquefy4\S-13636.8.liq
          Title:  COLTON JUSD - STADIUM & BASEBALL FIELD RENOVATIONS
          Subtitle:  S-13636

          Surface Elev.=1064 feet above MSL
          Hole No.=B-8
          Depth of Hole= 31.0 ft
          Water Table during Earthquake= 241.0 ft
          Water Table during In-Situ Testing= 241.0 ft
          Max. Acceleration= 0.55 g
          Earthquake Magnitude= 7.4
          User defined factor of safty (applied to CSR)       User fs=1.3
          fs=user,  Plot one CSR (fs=user)

          Hammer Energy Ratio, Ce=1
          Borehole Diameter, Cb=1
          Sampeling Method, Cs=1
          SPT Fines Correction Method: Stark/Olson et al.*
          Settlement Analysis Method: Ishihara / Yoshimine*
          Fines Correction for Liquefaction: Stark/Olson et al.*
          Fine Correction for Settlement: Post-Liq. Correction *
          Average Input Data: Smooth*
          * Recommended Options

Input Data:
          Depth     SPT       Gamma     Fines
          ft                  pcf       %
          ________________________________________
          1.0       30.0      130.0     25.0
          3.0       30.0      130.0     1.0
          5.0       24.0      121.9     1.0
          7.0       42.0      129.8     1.0
          10.0      38.0      129.2     1.0
          15.0      32.0      119.0     35.0
          20.0      15.0      115.6     35.0
          25.0      24.0      115.9     35.0
          30.0      19.0      120.9     35.0
          ________________________________________

Output Results:
          Settlement of saturated sands=0.00 in.
          Settlement of dry sands=1.63 in.
          Total settlement of saturated and dry sands=1.63 in.
          Differential Settlement=0.813 to 1.073 in.

          Depth     CRRm      CSRfs     F.S.      S_sat.    S_dry     S_all
          ft                  w/fs                in.       in.       in.
          ____________________________________________________________________
          1.00      2.07      0.46      5.00      0.00      1.63      1.63
          2.00      2.07      0.46      5.00      0.00      1.62      1.62
          3.00      2.07      0.46      5.00      0.00      1.62      1.62
          4.00      2.07      0.46      5.00      0.00      1.62      1.62
          5.00      2.07      0.46      5.00      0.00      1.61      1.61
          6.00      2.07      0.46      5.00      0.00      1.61      1.61
```

```
7.00     2.07     0.46     5.00     0.00     1.60     1.60
8.00     2.07     0.46     5.00     0.00     1.60     1.60
9.00     2.07     0.45     5.00     0.00     1.59     1.59
10.00    2.07     0.45     5.00     0.00     1.58     1.58
11.00    2.07     0.45     5.00     0.00     1.58     1.58
12.00    2.07     0.45     5.00     0.00     1.57     1.57
13.00    2.07     0.45     5.00     0.00     1.55     1.55
14.00    2.07     0.45     5.00     0.00     1.53     1.53
15.00    2.07     0.45     5.00     0.00     1.50     1.50
16.00    2.07     0.45     5.00     0.00     1.47     1.47
17.00    2.07     0.45     5.00     0.00     1.42     1.42
18.00    0.32     0.45     5.00     0.00     1.32     1.32
19.00    0.27     0.44     5.00     0.00     1.22     1.22
20.00    0.22     0.44     5.00     0.00     1.14     1.14
21.00    0.24     0.44     5.00     0.00     1.04     1.04
22.00    0.25     0.44     5.00     0.00     0.96     0.96
23.00    0.27     0.44     5.00     0.00     0.88     0.88
24.00    0.29     0.44     5.00     0.00     0.80     0.80
25.00    0.30     0.44     5.00     0.00     0.73     0.73
26.00    0.28     0.44     5.00     0.00     0.66     0.66
27.00    0.27     0.44     5.00     0.00     0.57     0.57
28.00    0.26     0.43     5.00     0.00     0.46     0.46
29.00    0.25     0.43     5.00     0.00     0.34     0.34
30.00    0.23     0.43     5.00     0.00     0.18     0.18
31.00    0.23     0.43     5.00     0.00     0.00     0.00
----------------------------------------------------------------
* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5,  CRR is limited to 2,  CSR is limited to 2)

Units           Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.
--------------------------------------------------------------------------------------------
CRRm            Cyclic resistance ratio from soils
CSRfs           Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.            Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat           Settlement from saturated sands
S_dry           Settlement from dry sands
S_all           Total settlement from saturated and dry sands
NoLiq           No-Liquefy Soils
```

```
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         Input File Name: C:\Liquefy4\S-13636.8.liq
         Title:  COLTON JUSD - STADIUM & BASEBALL FIELD RENOVATIONS
         Subtitle:  S-13636

Input Data:

         Surface Elev.=1064 feet above MSL
         Hole No.=B-8
         Depth of Hole=31.0 ft
         Water Table during Earthquake= 241.0 ft
         Water Table during In-Situ Testing= 241.0 ft
         Max. Acceleration=0.55 g
         Earthquake Magnitude=7.4
         User defined factor of safty (applied to CSR)       User fs=1.3
         fs=user,  Plot one CSR (fs=user)

         Hammer Energy Ratio, Ce=1
         Borehole Diameter, Cb=1
         Sampeling Method, Cs=1
         SPT Fines Correction Method: Stark/Olson et al.*
         Settlement Analysis Method: Ishihara / Yoshimine*
         Fines Correction for Liquefaction: Stark/Olson et al.*
         Fine Correction for Settlement: Post-Liq. Correction *
         Average Input Data: Smooth*
         * Recommended Options

         Depth     SPT      Gamma    Fines
         ft                 pcf      %
         ______________________________________
         1.0       30.0     130.0    25.0
         3.0       30.0     130.0    1.0
         5.0       24.0     121.9    1.0
         7.0       42.0     129.8    1.0
         10.0      38.0     129.2    1.0
         15.0      32.0     119.0    35.0
         20.0      15.0     115.6    35.0
         25.0      24.0     115.9    35.0
         30.0      19.0     120.9    35.0
         ______________________________________

Output Results:      (Interval = 1.00 ft)

         CSR Calculation:
         Depth     gamma    sigma    gamma'   sigma'   rd       CSR      fs       CSRfs
         ft        pcf      tsf      pcf      tsf                        (user)   w/fs
         _____________________________________________________________________________
         1.00      130.0    0.065    130.0    0.065    1.00     0.36     1.3      0.46
         2.00      130.0    0.130    130.0    0.130    1.00     0.36     1.3      0.46
         3.00      130.0    0.195    130.0    0.195    0.99     0.35     1.3      0.46
         4.00      126.0    0.259    126.0    0.259    0.99     0.35     1.3      0.46
         5.00      121.9    0.321    121.9    0.321    0.99     0.35     1.3      0.46
         6.00      125.9    0.383    125.9    0.383    0.99     0.35     1.3      0.46
         7.00      129.8    0.447    129.8    0.447    0.98     0.35     1.3      0.46
```

8.00	129.6	0.512	129.6	0.512	0.98	0.35	1.3	0.46
9.00	129.4	0.576	129.4	0.576	0.98	0.35	1.3	0.45
10.00	129.2	0.641	129.2	0.641	0.98	0.35	1.3	0.45
11.00	127.2	0.705	127.2	0.705	0.97	0.35	1.3	0.45
12.00	125.1	0.768	125.1	0.768	0.97	0.35	1.3	0.45
13.00	123.1	0.830	123.1	0.830	0.97	0.35	1.3	0.45
14.00	121.0	0.891	121.0	0.891	0.97	0.35	1.3	0.45
15.00	119.0	0.951	119.0	0.951	0.97	0.34	1.3	0.45
16.00	118.3	1.011	118.3	1.011	0.96	0.34	1.3	0.45
17.00	117.6	1.070	117.6	1.070	0.96	0.34	1.3	0.45
18.00	117.0	1.128	117.0	1.128	0.96	0.34	1.3	0.45
19.00	116.3	1.187	116.3	1.187	0.96	0.34	1.3	0.44
20.00	115.6	1.245	115.6	1.245	0.95	0.34	1.3	0.44
21.00	115.7	1.303	115.7	1.303	0.95	0.34	1.3	0.44
22.00	115.7	1.360	115.7	1.360	0.95	0.34	1.3	0.44
23.00	115.8	1.418	115.8	1.418	0.95	0.34	1.3	0.44
24.00	115.8	1.476	115.8	1.476	0.94	0.34	1.3	0.44
25.00	115.9	1.534	115.9	1.534	0.94	0.34	1.3	0.44
26.00	116.9	1.592	116.9	1.592	0.94	0.34	1.3	0.44
27.00	117.9	1.651	117.9	1.651	0.94	0.33	1.3	0.44
28.00	118.9	1.710	118.9	1.710	0.93	0.33	1.3	0.43
29.00	119.9	1.770	119.9	1.770	0.93	0.33	1.3	0.43
30.00	120.9	1.830	120.9	1.830	0.93	0.33	1.3	0.43
31.00	120.9	1.890	120.9	1.890	0.92	0.33	1.3	0.43

CSR is based on water table at 241.0 during earthquake

CRR Calculation from SPT or BPT data:

Depth ft	SPT	Cebs	Cr	sigma'	Cn	(N1)60	Fines %	d(N1)60	(N1)60f	CRR7.5
1.00	30.00	1.00	0.75	0.065	1.70	38.25	25.0	4.80	43.05	2.00
2.00	30.00	1.00	0.75	0.130	1.70	38.25	13.0	1.92	40.17	2.00
3.00	30.00	1.00	0.75	0.195	1.70	38.25	1.0	0.00	38.25	2.00
4.00	27.00	1.00	0.75	0.259	1.70	34.43	1.0	0.00	34.43	2.00
5.00	24.00	1.00	0.75	0.321	1.70	30.60	1.0	0.00	30.60	2.00
6.00	33.00	1.00	0.75	0.383	1.62	40.00	1.0	0.00	40.00	2.00
7.00	42.00	1.00	0.75	0.447	1.50	47.13	1.0	0.00	47.13	2.00
8.00	40.67	1.00	0.75	0.512	1.40	42.64	1.0	0.00	42.64	2.00
9.00	39.33	1.00	0.85	0.576	1.32	44.04	1.0	0.00	44.04	2.00
10.00	38.00	1.00	0.85	0.641	1.25	40.34	1.0	0.00	40.34	2.00
11.00	36.80	1.00	0.85	0.705	1.19	37.25	7.8	0.67	37.92	2.00
12.00	35.60	1.00	0.85	0.768	1.14	34.52	14.6	2.30	36.83	2.00
13.00	34.40	1.00	0.85	0.830	1.10	32.09	21.4	3.94	36.02	2.00
14.00	33.20	1.00	0.85	0.891	1.06	29.89	28.2	5.57	35.46	2.00
15.00	32.00	1.00	0.95	0.951	1.03	31.17	35.0	7.20	38.37	2.00
16.00	28.60	1.00	0.95	1.011	0.99	27.02	35.0	7.20	34.22	2.00
17.00	25.20	1.00	0.95	1.070	0.97	23.15	35.0	7.20	30.35	2.00
18.00	21.80	1.00	0.95	1.128	0.94	19.50	35.0	7.20	26.70	0.31
19.00	18.40	1.00	0.95	1.187	0.92	16.05	35.0	7.20	23.25	0.26
20.00	15.00	1.00	0.95	1.245	0.90	12.77	35.0	7.20	19.97	0.22
21.00	16.80	1.00	0.95	1.303	0.88	13.98	35.0	7.20	21.18	0.23
22.00	18.60	1.00	0.95	1.360	0.86	15.15	35.0	7.20	22.35	0.24
23.00	20.40	1.00	0.95	1.418	0.84	16.27	35.0	7.20	23.47	0.26
24.00	22.20	1.00	0.95	1.476	0.82	17.36	35.0	7.20	24.56	0.28
25.00	24.00	1.00	0.95	1.534	0.81	18.41	35.0	7.20	25.61	0.29
26.00	23.00	1.00	0.95	1.592	0.79	17.32	35.0	7.20	24.52	0.27
27.00	22.00	1.00	0.95	1.651	0.78	16.27	35.0	7.20	23.47	0.26
28.00	21.00	1.00	1.00	1.710	0.76	16.06	35.0	7.20	23.26	0.26
29.00	20.00	1.00	1.00	1.770	0.75	15.03	35.0	7.20	22.23	0.24
30.00	19.00	1.00	1.00	1.830	0.74	14.05	35.0	7.20	21.25	0.23
31.00	19.00	1.00	1.00	1.890	0.73	13.82	35.0	7.20	21.02	0.23

CRR is based on water table at 241.0 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 7.4:

Depth ft	sigC' tsf	CRR7.5 tsf	Ksigma	CRRv	MSF	CRRm	CSRfs w/fs	F.S. CRRm/CSRfs
1.00	0.04	2.00	1.00	2.00	1.03	2.07	0.46	5.00
2.00	0.08	2.00	1.00	2.00	1.03	2.07	0.46	5.00
3.00	0.13	2.00	1.00	2.00	1.03	2.07	0.46	5.00
4.00	0.17	2.00	1.00	2.00	1.03	2.07	0.46	5.00
5.00	0.21	2.00	1.00	2.00	1.03	2.07	0.46	5.00
6.00	0.25	2.00	1.00	2.00	1.03	2.07	0.46	5.00
7.00	0.29	2.00	1.00	2.00	1.03	2.07	0.46	5.00
8.00	0.33	2.00	1.00	2.00	1.03	2.07	0.46	5.00
9.00	0.37	2.00	1.00	2.00	1.03	2.07	0.45	5.00
10.00	0.42	2.00	1.00	2.00	1.03	2.07	0.45	5.00
11.00	0.46	2.00	1.00	2.00	1.03	2.07	0.45	5.00
12.00	0.50	2.00	1.00	2.00	1.03	2.07	0.45	5.00
13.00	0.54	2.00	1.00	2.00	1.03	2.07	0.45	5.00
14.00	0.58	2.00	1.00	2.00	1.03	2.07	0.45	5.00
15.00	0.62	2.00	1.00	2.00	1.03	2.07	0.45	5.00
16.00	0.66	2.00	1.00	2.00	1.03	2.07	0.45	5.00
17.00	0.70	2.00	1.00	2.00	1.03	2.07	0.45	5.00
18.00	0.73	0.31	1.00	0.31	1.03	0.32	0.45	5.00
19.00	0.77	0.26	1.00	0.26	1.03	0.27	0.44	5.00
20.00	0.81	0.22	1.00	0.22	1.03	0.22	0.44	5.00
21.00	0.85	0.23	1.00	0.23	1.03	0.24	0.44	5.00
22.00	0.88	0.24	1.00	0.24	1.03	0.25	0.44	5.00
23.00	0.92	0.26	1.00	0.26	1.03	0.27	0.44	5.00
24.00	0.96	0.28	1.00	0.28	1.03	0.29	0.44	5.00
25.00	1.00	0.29	1.00	0.29	1.03	0.30	0.44	5.00
26.00	1.03	0.27	1.00	0.28	1.03	0.28	0.44	5.00
27.00	1.07	0.26	0.99	0.26	1.03	0.27	0.44	5.00
28.00	1.11	0.26	0.99	0.25	1.03	0.26	0.43	5.00
29.00	1.15	0.24	0.98	0.24	1.03	0.25	0.43	5.00
30.00	1.19	0.23	0.98	0.23	1.03	0.23	0.43	5.00
31.00	1.23	0.23	0.97	0.22	1.03	0.23	0.43	5.00

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 tsf	(N1)60	Fines %	d(N1)60	(N1)60s
1.00	-	-	-	38.25	25.0	2.19	40.44
2.00	-	-	-	38.25	13.0	1.20	39.45
3.00	-	-	-	38.25	1.0	0.10	38.35
4.00	-	-	-	34.43	1.0	0.10	34.52
5.00	-	-	-	30.60	1.0	0.10	30.70
6.00	-	-	-	40.00	1.0	0.10	40.09
7.00	-	-	-	47.13	1.0	0.10	47.22
8.00	-	-	-	42.64	1.0	0.10	42.74
9.00	-	-	-	44.04	1.0	0.10	44.13
10.00	-	-	-	40.34	1.0	0.10	40.44
11.00	-	-	-	37.25	7.8	0.74	37.98
12.00	-	-	-	34.52	14.6	1.34	35.86
13.00	-	-	-	32.09	21.4	1.90	33.99
14.00	-	-	-	29.89	28.2	2.43	32.32
15.00	-	-	-	31.17	35.0	2.92	34.08
16.00	-	-	-	27.02	35.0	2.92	29.94

```
        17.00    -       -       -      23.15   35.0    2.92    26.06
        18.00    -       -       -      19.50   35.0    2.92    22.41
        19.00    -       -       -      16.05   35.0    2.92    18.96
        20.00    -       -       -      12.77   35.0    2.92    15.69
        21.00    -       -       -      13.98   35.0    2.92    16.90
        22.00    -       -       -      15.15   35.0    2.92    18.07
        23.00    -       -       -      16.27   35.0    2.92    19.19
        24.00    -       -       -      17.36   35.0    2.92    20.28
        25.00    -       -       -      18.41   35.0    2.92    21.33
        26.00    -       -       -      17.32   35.0    2.92    20.23
        27.00    -       -       -      16.27   35.0    2.92    19.18
        28.00    -       -       -      16.06   35.0    2.92    18.98
        29.00    -       -       -      15.03   35.0    2.92    17.95
        30.00    -       -       -      14.05   35.0    2.92    16.96
        31.00    -       -       -      13.82   35.0    2.92    16.74
        _______________________________________________________________


        Settlement of Saturated Sands:
        Settlement Analysis Method: Ishihara / Yoshimine*
        Depth   CSRfs   F.S.    Fines   (N1)60s Dr      ec      dsz     dsv     S
        ft      w/fs            %               %       %       in.     in.     in.
        ___________________________________________________________________________

        ___________________________________________________________________________
        Settlement of Saturated Sands=0.000 in.
        dsz is per each segment: dz=0.05 ft
        dsv is per each print interval: dv=1 ft
        S is cumulated settlement at this depth

        Settlement of Dry Sands:
        Depth   sigma'  sigC'   (N1)60s CSRfs   Gmax    g*Ge/Gm g_eff   ec7.5   Cec     ec
dsz     dsv     S
        ft      tsf     tsf             w/fs    tsf                     %               %
in.     in.     in.

________________________________________________________________________________________________
________
        30.95   1.89    1.23    16.75   0.43    1266.2  6.4E-4  0.6149  0.7625  1.03    0.7875
9.4E-3  0.009   0.009
        30.00   1.83    1.19    16.96   0.43    1252.1  6.3E-4  0.5808  0.7083  1.03    0.7315
8.8E-3  0.173   0.182
        29.00   1.77    1.15    17.95   0.43    1254.8  6.1E-4  0.4937  0.5594  1.03    0.5777
6.9E-3  0.155   0.337
        28.00   1.71    1.11    18.98   0.43    1256.4  5.9E-4  0.4236  0.4465  1.03    0.4611
5.5E-3  0.123   0.461
        27.00   1.65    1.07    19.18   0.44    1239.0  5.8E-4  0.3899  0.4053  1.03    0.4185
5.0E-3  0.110   0.571
        26.00   1.59    1.03    20.23   0.44    1238.5  5.6E-4  0.3387  0.3285  1.03    0.3392
4.1E-3  0.090   0.661
        25.00   1.53    1.00    21.33   0.44    1237.2  5.4E-4  0.2960  0.2682  1.03    0.2770
3.3E-3  0.073   0.734
        24.00   1.48    0.96    20.28   0.44    1193.4  5.4E-4  0.2961  0.2864  1.03    0.2958
3.5E-3  0.069   0.803
        23.00   1.42    0.92    19.19   0.44    1148.5  5.4E-4  0.2970  0.3085  1.03    0.3186
3.8E-3  0.074   0.877
        22.00   1.36    0.88    18.07   0.44    1102.5  5.4E-4  0.2990  0.3359  1.03    0.3469
4.2E-3  0.080   0.957
        21.00   1.30    0.85    16.90   0.44    1055.1  5.5E-4  0.3024  0.3705  1.03    0.3827
4.6E-3  0.088   1.044
        20.00   1.24    0.81    15.69   0.44    1006.2  5.5E-4  0.3078  0.4153  1.03    0.4289
5.1E-3  0.097   1.142
        19.00   1.19    0.77    18.96   0.44    1046.4  5.0E-4  0.2251  0.2375  1.03    0.2453
2.9E-3  0.077   1.219
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           18.00     1.13     0.73     22.41     0.45      1078.8    4.7E-4    0.6555    0.5565    1.03       0.5747
6.9E-3     0.100     1.318
           17.00     1.07     0.70     26.06     0.45      1104.5    4.3E-4    0.4237    0.2946    1.03       0.3043
3.7E-3     0.100     1.418
           16.00     1.01     0.66     29.94     0.45      1124.4    4.0E-4    0.2894    0.1652    1.03       0.1706
2.0E-3     0.054     1.473
           15.00     0.95     0.62     34.08     0.45      1139.0    3.7E-4    0.2064    0.0947    1.03       0.0978
1.2E-3     0.031     1.504
           14.00     0.89     0.58     32.32     0.45      1083.1    3.7E-4    0.1952    0.0985    1.03       0.1018
1.2E-3     0.026     1.530
           13.00     0.83     0.54     33.99     0.45      1063.0    3.5E-4    0.1577    0.0727    1.03       0.0751
9.0E-4     0.021     1.551
           12.00     0.77     0.50     35.86     0.45      1040.9    3.3E-4    0.1272    0.0527    1.03       0.0544
6.5E-4     0.015     1.566
           11.00     0.71     0.46     37.98     0.45      1016.6    3.1E-4    0.1024    0.0371    1.03       0.0384
4.6E-4     0.011     1.577
           10.00     0.64     0.42     40.44     0.45      989.7     2.9E-4    0.0823    0.0260    1.03       0.0269
3.2E-4     0.008     1.585
           9.00      0.58     0.37     44.13     0.45      966.2     2.7E-4    0.0651    0.0206    1.03       0.0212
2.5E-4     0.006     1.591
           8.00      0.51     0.33     42.74     0.46      900.6     2.6E-4    0.0923    0.0292    1.03       0.0302
3.6E-4     0.006     1.596
           7.00      0.45     0.29     47.22     0.46      870.0     2.3E-4    0.0568    0.0180    1.03       0.0186
2.2E-4     0.006     1.602
           6.00      0.38     0.25     40.09     0.46      762.7     2.3E-4    0.0529    0.0167    1.03       0.0173
2.1E-4     0.004     1.606
           5.00      0.32     0.21     30.70     0.46      638.9     2.3E-4    0.0535    0.0294    1.03       0.0303
3.6E-4     0.005     1.612
           4.00      0.26     0.17     34.52     0.46      596.8     2.0E-4    0.0387    0.0173    1.03       0.0179
2.1E-4     0.005     1.617
           3.00      0.20     0.13     38.35     0.46      536.3     1.7E-4    0.0363    0.0129    1.03       0.0133
1.6E-4     0.004     1.621
           2.00      0.13     0.08     39.45     0.46      442.0     1.4E-4    0.0254    0.0083    1.03       0.0086
1.0E-4     0.003     1.624
           1.00      0.07     0.04     40.44     0.46      315.1     9.6E-5    0.0186    0.0059    1.03       0.0061
7.3E-5     0.002     1.626
______________________________________________________________________________________________________________________
_____________
           Settlement of Dry Sands=1.626 in.
           dsz is per each segment: dz=0.05 ft
           dsv is per each print interval: dv=1 ft
           S is cumulated settlement at this depth

           Total Settlement of Saturated and Dry Sands=1.626 in.
           Differential Settlement=0.813 to 1.073 in.

           Units               Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

______________________________________________________________________________________________________________________
           SPT                 Field data from Standard Penetration Test (SPT)
           BPT                 Field data from Becker Penetration Test (BPT)
           qc                  Field data from Cone Penetration Test (CPT)
           fc                  Friction from CPT testing
           Gamma               Total unit weight of soil
           Gamma'              Effective unit weight of soil
           Fines               Fines content [%]
           D50                 Mean grain size
           Dr                  Relative Density
           sigma               Total vertical stress [tsf]
           sigma'              Effective vertical stress [tsf]
           sigC'               Effective confining pressure [tsf]
           rd                  Stress reduction coefficient
```

CSR	Cyclic stress ratio induced by earthquake
fs	User request factor of safety, apply to CSR
w/fs	With user request factor of safety inside
CSRfs	CSR with User request factor of safety
CRR7.5	Cyclic resistance ratio (M=7.5)
Ksigma	Overburden stress correction factor for CRR7.5
CRRv	CRR after overburden stress correction, CRRv=CRR7.5 * Ksigma
MSF	Magnitude scaling factor for CRR (M=7.5)
CRRm	After magnitude scaling correction CRRm=CRRv * MSF
F.S.	Factor of Safety against liquefaction F.S.=CRRm/CSRfs
Cebs	Energy Ratio, Borehole Dia., and Sample Method Corrections
Cr	Rod Length Corrections
Cn	Overburden Pressure Correction
(N1)60	SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
d(N1)60	Fines correction of SPT
(N1)60f	(N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
Cq	Overburden stress correction factor
qc1	CPT after Overburden stress correction
dqc1	Fines correction of CPT
qc1f	CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n	CPT after normalization in Robertson's method
Kc	Fine correction factor in Robertson's Method
qc1f	CPT after Fines correction in Robertson's Method
Ic	Soil type index in Suzuki's and Robertson's Methods
(N1)60s	(N1)60 after seattlement fines corrections
ec	Volumetric strain for saturated sands
ds	Settlement in each Segment dz
dz	Segment for calculation, dz=0.050 ft
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio
ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for dry sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

GARY S. RASMUSSEN & ASSOCIATES, INC. /*ENGINEERING GEOLOGY*

P.O. BOX 10575 • SEDONA, ARIZONA 86339 • (909) 229-9415

May 9, 2015

John R. Byerly, Inc.
2257 So. Lilac Avenue
Bloomington, California 92316

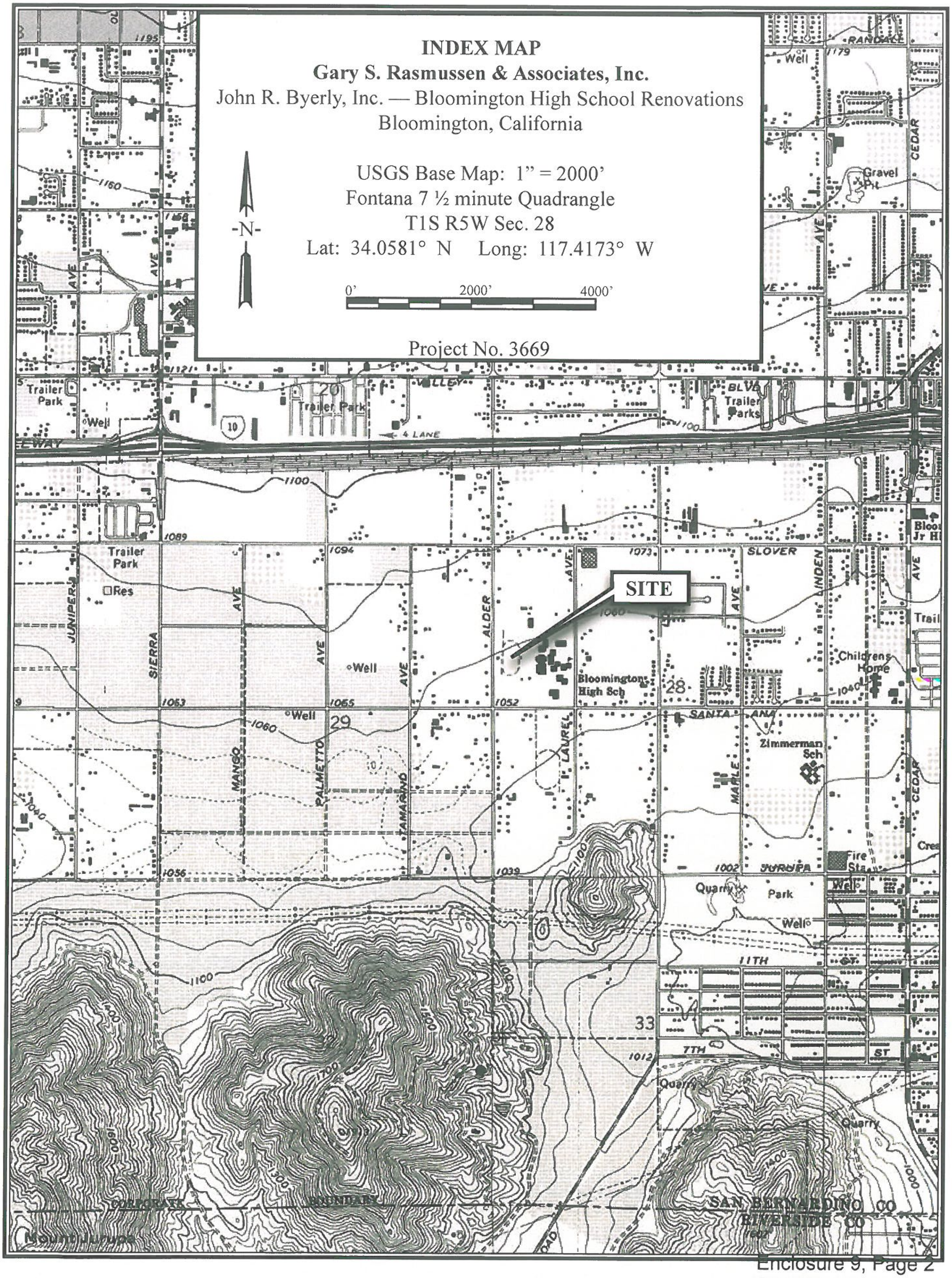
Project No. 3669

Attention: Mike Lozano

Subject: Engineering Geology Investigation, Bloomington High School, Stadium and Baseball Field Renovations, 10750 Laurel Avenue, Bloomington, California.

An engineering geology investigation of the proposed 2,700-seat capacity home bleacher and press box, a 800-seat capacity visitor bleacher, a shared ticket/concession building, and home and visitor team rooms to the existing Bloomington High School has been conducted in accordance with your request. Additional improvements will include stadium lighting poles and dugouts at the varsity baseball, junior varsity baseball, and junior varsity softball fields. The overall school is located east of Alder Avenue and north of Santa Ana Avenue in the Bloomington area of San Bernardino County, California. The proposed improvements are located immediately east of Alder Avenue. The purpose of our investigation was to relate general geologic conditions of the site to future placement of these improvements. A site plan prepared by HMC Architects was used in our investigation. The general location of the proposed improvements is shown on the index map on page 2.

No grading plans were available at the time of our investigation. However, the existing high school has previously been graded. An existing stadium and ball fields are located at the location of the proposed improvements. The original topography prior to grading sloped downward to the southeast at approximately 1 percent. No additional grading is anticipated to be associated with placement of the improvements.



INDEX MAP

Gary S. Rasmussen & Associates, Inc.

John R. Byerly, Inc. — Bloomington High School Renovations
Bloomington, California

USGS Base Map: 1” = 2000’
Fontana 7 ½ minute Quadrangle
T1S R5W Sec. 28
Lat: 34.0581° N Long: 117.4173° W

Project No. 3669

Enclosure 9, Page 2
Rpt. No.: 3058
File No.: S-13636

SITE INVESTIGATION

A geologic field reconnaissance of the site and surrounding area was conducted during April, 2015. In addition, our investigation included review of stereoscopic black and white aerial photographs flown in 1967 and 1968, and stereoscopic color infrared aerial photographs flown in 1973 and 1985; review of pertinent geologic literature and maps, including reports in our files on nearby projects; and review of significant seismic information, including historic seismic activity. A list of aerial photographs reviewed and references cited in this report is included in Enclosure 1.

SITE DESCRIPTION

The overall school site was in existence on the 1967 aerial photographs. One and two-story buildings are currently located on the site. An existing stadium and grass-covered ball fields are in existence at the location of the proposed improvements.

The original ground surface at the location of the proposed improvements sloped downward to the southeast at a rate of approximately 1percent. The natural topography of the site occupied a relatively flat geomorphic surface that sloped gently away from San Gabriel Mountains, 8 miles (13 kilometers [km]) north of the school.

SITE GEOLOGY

The site is located on a large structural block of land known as the Perris Block. The Perris Block is part of the Peninsular Ranges Geomorphic Province. The Peninsular Ranges Geomorphic Province extends north to the base of the San Gabriel Mountains and south into Mexico to the tip of Baja California. The Perris Block is bounded on the northeast by the

San Jacinto fault, on the north by the Cucamonga fault and the San Gabriel Mountains, and on the southwest by the Elsinore fault and the Santa Ana Mountains. It is considered to be relatively stable compared to the subsiding San Bernardino Valley Block, which is bounded by the San Andreas and San Jacinto faults.

Morton (2003) mapped the site as being located on younger alluvium. Jennings, *et al.* (2010b) mapped the site as containing Quaternary alluvium. Exploratory soil test borings placed on the site by John R. Byerly, Inc. during April, 2015 revealed that the site is underlain by gray-brown, silty fine to medium and silty fine to coarse sands with occasional gravel to a maximum depth of 51 feet (15½ meters [m]). Groundwater was not encountered in any of their borings. A geologic index map is included as Enclosure 2.

The geologic subsurface materials underlying the site are considered to be characterized by stiff soil. For purposes of the California Building Code (International Conference of Building Officials, 2013) the soils under the site are considered to be Type D to a depth of at least 100 feet (30 m) below the ground surface, based on published geologic data, geologic field reconnaissance and exploratory soil borings placed on the site by John R. Byerly, Inc.

SEISMIC SETTING

The site does not lie within or immediately adjacent to an Earthquake Fault Zone (formerly Special Studies Zone) as defined by the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 1999). The closest A-P earthquake fault zone is along the San Jacinto fault zone, 6 miles (10 kilometers) northeast of the site (California Geological Survey (CGS) (2003).

The site does not lie within a Seismic Hazard Zone as published by the California Geological Survey (CGS).

Dutcher and Garrett (1963) and Morton (1974) showed a groundwater barrier (Barrier J) located approximately 4 miles (6 km) northwest of the site. Barrier J (also known as the Fontana groundwater barrier) is a northeast-trending feature which may be fault related. Microseismic activity has been attributed to this suspected fault by Hadley and Combs (1974). The Fontana groundwater barrier may truncate the Rialto-Colton fault (Dutcher and Garrett, 1963) and, therefore, may be a younger tectonic feature. However, Fife (1974) showed the two features as intersecting. Trenching in Holocene-age alluvium across the mapped location of the Fontana groundwater barrier did not reveal evidence of faulting (Rasmussen, August 1, 1985)

A second trend of northeast-trending microseismic activity was identified by Hadley and Combs (1974) located approximately 5 miles (8 km) northwest of the site, northwest of, and parallel to, Barrier J. Hadley and Combs indicated that a composite first-motion plot of microearthquakes in the Fontana area suggests that the Fontana microearthquake zone represents a left-lateral strike-slip fault. This microearthquake zone has also been referred to as the Fontana Seismic zone. The Fontana Seismic zone is inclined steeply to the northwest (Margaret Gooding, Simon Fraser University, presentation to Inland Geological Society, 2013). Ziony and Jones (1989) showed both the Fontana groundwater barrier and Fontana microearthquake zone as potentially active faults. Morton (1978) did not show the Fontana Seismic zone. Jennings and Bryant (2010a) showed the trend as a late Quaternary fault. Bortugno (1986) did not show either feature.

The Rialto-Colton fault (groundwater barrier) has been mapped approximately 5 miles (8 km) northeast of the site (Dutcher and Garrett, 1963; Carson and Matti, 1982; Gosling, 1966, 1967; Morton, 1974). This fault was originally mapped as a groundwater barrier by Eckis (1934) and named the Rialto-Colton fault. Dutcher and Garrett (1963) enlarged on Eckis' original work and stated: "Its position is approximately located, largely on hydrologic evidence but partly on subsurface geologic evidence." The Rialto-Colton fault disrupts the normal flow of ground water in the area and diverts the flow southeast along the north side of the fault. Bortugno (1986), Ziony and Jones (1989), and Jennings (1994) showed the Rialto-Colton fault as a potentially active fault. However, the Rialto-Colton fault is not considered to be an active fault, as trenching across the fault has shown that it does not offset the upper 5 to 7 feet (1½-2 m) of Pleistocene-age alluvium (Rasmussen, January 9, 1981).

The San Bernardino Valley segment of the San Jacinto fault is located approximately 6 miles (10 km) northeast of the site. The San Jacinto fault is considered to be the most active fault in southern California (Allen *et al.*, 1965). Trenching in very young alluvium across the San Jacinto fault has confirmed very recent episodes of fault rupture. The San Jacinto fault is characterized by right-lateral, strike-slip movement. The San Jacinto fault is included within an Alquist-Priolo Earthquake Fault Zone designated by the State of California.

The Cucamonga fault is an east-trending fault located approximately 8 miles (13 km) north of the site (Morton, 1974, 1976; Morton and Matti, 1987, 1991a, 1991b; Matti *et al.*, 1982, 1992; Bortugno and Spittler, 1986; Herber, 1976; Dibblee, 1970; Ziony and Jones, 1989; Ziony *et al.*, 1974; Jennings and Bryant, 2010a). This fault zone is characterized by reverse movement. The Cucamonga fault zone is the eastward extension of the Sierra Madre fault zone, which was responsible for the M6.4 earthquake of 1971 in the San Fernando Valley. The Cucamonga fault zone is included within an Alquist-Priolo Earthquake Fault Zone designated by the State of California to include traces of suspected Holocene faulting.

The active, northwest-trending San Andreas fault is located approximately 11 miles (18 km) northeast of the site. The location of the main, active trace of the San Andreas fault is evidenced by vegetation lineaments, fault scarps, springs, linear ridges, and offset drainages. Although the San Andreas fault is characterized overall by right-lateral, strike-slip movement, the San Bernardino Mountains have been uplifted along its trace.

The Cleghorn fault, located approximately 16 miles (26 km) northeast of the site, is a left-lateral strike-slip fault with a significant dip-slip component. This fault is considered active by Weldon *et al.* (1981), as evidenced by scarps, stream offsets and disrupted terrace remnants. The Cleghorn fault may merge with the east-trending Tunnel Ridge fault (Meisling and Weldon, 1989; Ziony and Jones, 1989). The Tunnel Ridge fault is located approximately 26 miles (42 km) northeast of the site. The motion of the Cleghorn fault may be transferred along the Tunnel Ridge fault to the North Frontal fault zone of the San Bernardino Mountains (Ziony and Jones, 1989). Both the Cleghorn and the Tunnel Ridge faults are shown as late Quaternary faults on the Fault Activity Map of California (Jennings and Bryant, 2010a).

The San Jose fault is a northeast trending, strike-slip fault located approximately 16 miles (26 km) northwest of the site. The San Jose fault is only exposed at the surface in the bedrock areas of the San Jose Hills. The San Jose fault forms a ground-water barrier in alluvium in the Pomona area. Shelton (1955) mapped the San Jose fault as a normal fault. However, Cramer and Harrington (1987) and Real (1987) showed that microseismic activity associated with this fault displays left-lateral, strike-slip motion. The San Jose fault is considered to be a late Quaternary fault (Bortugno, 1986; Ziony and Jones, 1989; Jennings and Bryant, 2010a; Los Angeles County, 1990). The San Jose fault may have been responsible for the M5.2 Upland earthquake that occurred in 1990 (Dreger and Helmberger, 1991).

The northwest-trending Chino fault, located approximately 17 miles (27 km) southwest of the site, is considered to be a late Quaternary fault, as evidenced by laterally deflected drainages; low, east-facing, modified fault scarps; offset of Pleistocene-age or younger(?) alluvium; warping of paleosols; and the presence of a strong vegetational lineament coincident with the suspected trace of the fault within Holocene-age sediments as observed on aerial photographs taken prior to the construction of Prado Dam (Weber, 1977; Heath *et al.*, 1982). The Chino fault is considered to be a right-lateral fault which is inclined steeply towards the southwest (Durham and Yerkes, 1964). The Chino fault is part of the Elsinore fault system.

The Elsinore fault zone is located approximately 18 miles (29 km) southwest of the site. The Elsinore fault zone extends southeast into Mexico (Biehler *et al.*, 1964). The Elsinore fault separates the Santa Ana Mountains from the Temescal Basin on the Perris Block. Subsurface investigations by Rockwell *et al.* (1986) have shown that the Elsinore fault is active and may have a recurrence interval of approximately 250 years for large earthquakes. Bergmann and Rockwell (1996) and Vaughan *et al.* (1999) found additional evidence of active faulting associated with the Elsinore fault. Ziony *et al.* (1974), Ziony and Jones (1989) and Jennings and Bryant (2010a) showed portions of the Elsinore fault zone to be Holocene in age. The State included portions of the Elsinore fault zone within Alquist-Priolo Earthquake Fault Zones.

The west to northwest trending Sierra Madre fault zone is located approximately19 miles (31 km) north of the site. This fault zone is characterized by reverse movement. The San Gabriel Mountains have been uplifted along its trace. Rubin *et al.* (1998) recognized evidence for a M7.2 to M7.6 earthquake along the central portion of the Sierra Madre fault during the past 10,000 years. Tucker and Dolan (2001) suggested that a M7.0 to 7.8 earthquake occurred along the eastern portion of the Sierra Madre fault zone during latest Pleistocene to early Holocene time. The Sierra Madre fault zone was responsible for the M_w6.6 earthquake of 1971 in the San Fernando Valley (Goter *et al.*, 1994).

A set of discontinuous south-dipping reverse faults referred to as the North Frontal fault zone (Bortugno and Spittler, 1986) is located approximately 20 miles (32 km) north-northeast of the site along the northern flank of the San Bernardino Mountains. Several of the faults place pre-Cenozoic basement rocks over Quaternary alluvium (Dibblee, 1973; Miller, 1987). Dibblee and Miller also mapped thrusting and folding within Quaternary alluvium. The youthful fault scarps developed in the alluvial units suggest that the North Frontal fault zone is an active fault (Miller, 1987). Portions of the fault zone are sufficiently well defined according to fault hazard criteria established by the State of California to be included within Alquist-Priolo Earthquake Fault Zones.

The Whittier fault is a northwest trending, right-lateral, reverse(?) fault located approximately 22 miles (35 km) west of the site. The Whittier fault displays evidence of probable Holocene offset (Hannan and Lung, 1979; Gath, 1992; Gath *et al.*, 1988, 1992a, b) and microseismicity (Lamar, 1972; Lamar and Stewart, 1973; Ziony and Yerkes, 1985). Los Angeles County (1990) and Jennings and Bryant (2010a) showed the Whittier fault to be a Holocene fault in the Whittier and La Habra areas. The California Division of Mines and Geology (1998) considered the Whittier fault to be a segment of the Elsinore fault zone. The Whittier fault is included within an Aqluist-Priolo Earthquake Fault Zone by the State.

The northeast trending Clamshell-Sawpit fault is located approximately 28 miles (45 km) north of the site. The Clamshell-Sawpit fault is considered to be a splay of the Sierra Madre fault (Hauksson, 1994; Ma and Kanamori, 1994). The Clamshell-Sawpit fault was responsible for the June 28th, 1991, Sierra Madre earthquake (Dreger and Helmberger, 1991; Ma and Kanamori, 1994; Hauksson, 1994). Based on the hypocentral location plotted for the Sierra Madre earthquake, the Clamshell-Sawpit fault is considered to intercept and displace the San Gabriel fault at depth in the vicinity of that earthquake (Hauksson, 1994). Bortugno (1986), Ziony and Jones (1989), Los Angeles County (1990) and Jennings (1994) showed the Clamshell-Sawpit fault as a potentially active fault.

The northwest trending Puente Hills Blind Thrust-Elysian Park Blind Thrust fault is located approximately 28 miles (45 km) northwest of the site. The Elysian Park thrust fault is considered to be responsible for the uplift of the Santa Monica Mountains (Davis *et al.*, 1989) and the Montebello, Repetto and Puente Hills (Dolan *et al.*, 1995). The southeast projection of the Elysian Park blind thrust fault may extend to the Santa Ana River (Shaw and Suppe, 1996). The M5.9 Whittier Narrows earthquake of October 1, 1987, was attributed to the Elysian Park blind thrust fault (Jones and Hauksson, 1988; Hauksson and Jones, 1989). However, Shaw *et al.* (2002) revised the source of the Whittier Narrows earthquake to the Puente Hills blind thrust fault. The Elysian Park and Puente Hills blind thrust faults are postulated to be associated with the Compton-Los Alamitos fault trend (Dolan *et al.*, 1995; Shaw and Suppe, 1996).

The northeast trending Raymond fault is located approximately 34 miles (55 km) west of the site (Real, 1987). Jones *et al.* (1990) indicated that movement along the Raymond fault is left-lateral, oblique slip and may transfer movement from the Sierra Madre fault zone to the Verdugo fault. Weaver and Dolan (2000) documented the most recent earthquake that ruptured the ground surface along the Raymond fault as having occurred within the last 2,400 years. The Raymond fault is considered to be an active fault and is included within an Alquist-Priolo Earthquake Fault Zone designated by the State of California.

Mueller *et al.* (1998), Grant and Ballenger (1999), Grant *et al.* (1999, 2000, 2002) and Rivero *et al.* (2000) identified a blind thrust fault underlying the San Joaquin Hills, inclined approximately 20° to 30° to the southwest, and called this feature the San Joaquin Hills Blind Thrust fault. Grant and Ballenger (1999) and Grant *et al.* (1999) considered uplifted marine terraces along the southwest flank of the Laguna Hills to be the result of uplift along the San Joaquin Hills Blind Thrust fault. Rivero *et al.* (2000) partitioned this uplift to both the San Joaquin Hills Blind Thrust fault and the deeper Oceanside blind thrust fault. The exact northwest and southeast extent of the San Joaquin Hills thrust fault are not confirmed at this time, but the fault is at least coincident with the San Joaquin Hills (Grant *et al.*, 1999, 2002). The uplift of Newport Mesa, previously attributed to the Newport-Inglewood fault zone, is also attributed to the San Joaquin Hills Blind Thrust fault (Grant *et al.*, 1999, 2002; Rivero *et al.*, 2000). The San Joaquin Hills Blind Thrust fault is shown as occurring southwest of the site but is only defined at the surfaced as uplift of the San Joaquin Hills. No surface faulting exists so its precise location is not known but is suggested to be about 34 miles (55 km) southwest of the site.

Other active or potentially active faults are located within the general region, but because of their greater distance from the site and/or lower expected maximum magnitude earthquakes, they are considered less important to the site. A summary of significant faults within a 62 mile (100 km) radius of the site is tabulated on Enclosure 3. A regional fault map showing significant faults within a 62 mile (100 km) radius of the site is included as Enclosure 4.

SEISMIC HISTORY

The accuracy of locating earthquake epicenters is not always sufficient to determine which fault they are associated with. Estimates of magnitude and epicenter locations for earthquakes prior to implementation of recording instruments were based on descriptions of the earthquakes by individuals in different areas. Seismic instrumentation did not become available until about 1932, and these earlier instruments were imprecise. An earthquake epicenter map showing earthquake epicenters within 62 miles (100 km) of the site is included as Enclosure 5 (EPI SoftWare, 2000, Southern California Earthquake Center, 2015). The earthquake locations shown on the earthquake epicenter map are based on instrument locations (Southern California Earthquake Center, 2015). The site is expected to have undergone significant seismic shaking due to several active faults in the general region.

Magnitudes reported for earthquakes usually fall in a range of values depending on the recorded strength and frequency of the strong ground motion, type of seismometer recording the ground motion, location of the seismometer with respect to the earthquake, subsurface conditions at the seismometer location, and the scale used to classify the magnitude. Common scales used to classify earthquake magnitudes include the familiar Richter or "local" magnitude (M_L), moment magnitude (M_W) derived from the seismic moment (M_O), body-wave magnitude (M_b) and surface-wave magnitude (M_S). Estimates of earthquake size utilizing the moment magnitude and the seismic moment are preferred due to limitations associated with other measurement scales, including variations among distant recording locations, frequency response of geologic materials, and saturation (or response) of the recording seismometers (Wells and Coppersmith, 1994).

The northeast-trending Fontana Seismic zone has had several hundred micro-earthquakes along it, ranging from M_w 1.0 to 3.5. A northwest dip along a northeasterly trend has been shown by Gooding (2013) for micro-earthquakes along this zone. No large earthquakes have occurred historically along this zone and there is no apparent surface expression for any potential faults along this zone. However, Jordan (2002) has suggested that there are lineaments observable on aerial photographs along this zone.

The San Jacinto fault has been the most seismically active fault in southern California (Allen *et al.*, 1965). Between 1899 and 1995, eight earthquakes of M6.0 or greater have occurred somewhere along the San Jacinto fault between the San Gabriel Mountains and Mexico (Lamar *et al.*, 1973; Kahle *et al.*, 1988). A summary of the dates of these earthquakes, their approximate locations, and their estimated magnitude is presented in the following table:

DATE	LOCATION	MAGNITUDE
July 22, 1899	Lytle Creek	(estimated) 6.5
December 25, 1899	Anza Valley	(estimated) 7.1
April 21, 1918	San Jacinto Valley	(estimated) 6.9
July 22, 1923	South of Loma Linda	(estimated) 6.3
March 25, 1937	Southeast of Anza	6.0
October 21, 1942	Fish Creek Mountains	6.5
March 19, 1954	East of Borrego	6.2
April 9, 1968	Borrego Mountain	6.5
November 24, 1987	Superstition Hills	6.6

Since 1899, earthquakes on the San Jacinto fault of magnitude 6.0 or greater have occurred every 5 to 19 years. The earthquakes in 1899, 1918 and 1923 occurred along the northern portion of the San Jacinto fault; the earthquake in 1937 occurred along the middle reach of the San Jacinto fault; and the earthquakes in 1942, 1954, 1968 and 1987 occurred along the southern portion of the San Jacinto fault (Lamar *et al.*, 1973; Kahle *et al.*, 1988).

Documented evidence for large earthquakes along the Cucamonga fault has only recently been found. This fault is part of the Sierra Madre-Cucamonga fault system which ruptured during the M_W6.6 San Fernando earthquake in 1971 (Oakeshott, 1975; Goter *et al.*, 1994). This fault system was also responsible for the M_L5.8 Sierra Madre earthquake which occurred on June 28, 1991 (Hauksson, 1994). Subsurface investigations by this firm have documented evidence of Holocene activity along the Cucamonga fault (Rasmussen, December 29, 1989; April 18, 1990).

No large earthquakes have occurred along the San Andreas fault in the southern California area in recent time. This fault has a pattern of almost no movement for long periods of time (131 years, Sieh, 1984), followed by a sudden release of energy. The last major earthquake along it in this area was the great earthquake of January 9, 1857, which was centered at Fort Tejon, north of Gorman. The Fort Tejon earthquake had an estimated magnitude of approximately M8.0, comparable to the 1906 San Francisco earthquake (Wood, 1955). A large earthquake that occurred on December 8, 1812, affected a wide area of southern California and is now attributed to the San Andreas fault in the San Bernardino area (Jacoby, *et al.*, 1988; Fumal, *et al.*, 1993). The magnitude of the 1812 earthquake is estimated to have been approximately M7.5 (Petersen and Wesnousky, 1994). On December 4, 1948, a large earthquake occurred in the Desert Hot Springs area. This earthquake was originally assigned a magnitude of M_L6.5 and attributed to the Mission Creek fault (north branch of the San Andreas fault in this area) by Richter *et al.* (1958). An evaluation of this earthquake by Nicholson (1996) placed the Desert Hot Springs earthquake on the Banning fault (south branch of the San Andreas fault) and revised the earthquake to M_L6.3 (M_W6.2). An earthquake of M_L6.0 (M_W6.1) occurred along the Banning fault on July 8, 1986, northwest of the 1948 earthquake (Jones *et al.*, 1986; Nicholson, 1996). Field reconnaissance by our firm found evidence for surface ground rupture associated with the 1986 earthquake. Other smaller earthquakes have occurred along the San Andreas fault northwest and southeast of these two locations.

The Cleghorn fault is considered to be a Type B fault (CGS, 2008). It shows evidence of late Quaternary offset and possible Holocene movement (Morton and Miller, 2003). Jennings and Bryant (2010a) show it to exhibit late Quaternary movement. No significant earthquakes have been associated with this fault.

No large earthquakes have been documented along the San Jose fault. The 1988 M4.6 and the 1990 M5.2 Upland earthquakes are considered to have occurred along the San Jose fault at depth (Dreger and Helmberger, 1991; Hauksson and Jones, 1991).

The Chino-Central Avenue fault is a north-trending offshoot of the Elsinore fault zone in the Chino area. No large historic earthquakes have been assigned to it. Micro-seismicity appears to be related to this fault. A slip rate of 1 mm per year has been assigned to this fault (CGS, 2013, USGS, 2013 and 2014, Petersen *et al.*, 2014) and it has been considered in the ground motion design parameters.

Several earthquakes with estimated magnitudes between 6.0 and 6.5 have been located along the Elsinore fault zone between the Santa Ana River and the Gulf of California during historic time. In 1910, a moderately large earthquake (~M6) occurred in the Temescal Valley area, probably along the Glen Ivy North fault. In 1956 an earthquake of approximately Richter magnitude 4.7 occurred in the Temescal Valley area causing rock slides. A magnitude 7.0 earthquake occurred on the Laguna Salada strand of the Elsinore fault zone in northern Mexico in 1892 (Townley and Allen, 1939). However, no earthquakes of this magnitude or greater have been recorded along the northern end of the fault since 1910 (Lamar *et al.*, 1973).

Documented evidence for large earthquakes along the Sierra Madre fault has only recently been found. The San Fernando fault of the Sierra Madre fault system ruptured during the M_W6.6 San Fernando earthquake in 1971 (Goter *et al.*, 1994). This fault system was also responsible for the M5.8 Sierra Madre earthquake which occurred on June 28, 1991. Tucker and Dolan (2001) determined that approximately 46 feet (15 m) of ground surface rupturing reverse slip occurred along the eastern portion of the Sierra Madre fault zone between 24,000 and 8,000 years ago. Rubin *et al.* (1998) concluded that approximately 34 feet (11 m*)* of surface rupturing reverse slip involving two large earthquakes occurred along the central portion of the Sierra Madre fault zone during the past 18,000 years, and that one of the earthquakes occurred during Holocene time. Subsurface investigations by this firm have documented evidence of Holocene activity along the Cucamonga portion of the fault zone (Rasmussen, December 29, 1989; April 18, 1990).

No large earthquakes have been recorded along the Whittier fault. However, numerous microseismic events with Richter magnitudes less than 3.0 have been measured along the Whittier fault in the Puente Hills (Lamar, 1972, 1973; Lamar and Stewart, 1973). The Whittier fault is considered to be a segment of the Elsinore fault zone and capable of producing a significant earthquake (California Geological Survey, 2013, Petersen *et al.*, 2014).

Numerous earthquakes of magnitudes greater than 4.0 have occurred in the area surrounding the intersection of the Helendale-South Lockhart fault and the North Frontal fault zone along the north side of the San Bernardino Mountains (Southern California Earthquake Center, 2015). The locations of these epicenters are not precise enough to exactly correlate the earthquakes with these two faults. It is possible that these earthquakes are related to both faults. Earthquake activity apparently becomes less frequent and epicenter locations less closely spaced away from the intersection of these two faults. The latest sequence of small earthquakes included a M5.1 earthquake in March, 2003, along the south branch of the Helendale-South Lockhart fault near Cushenbury Springs.

The 1987 M5.9 Whittier earthquake was originally assigned to the northwest-trending Elysian Park blind thrust fault (Jones and Hauksson, 1988; Hauksson and Jones, 1989). However, Shaw *et al.* (2002) attributed the Whittier earthquake to the Santa Fe Springs segment of the Puente Hills blind thrust fault. The upper and lower Elysian Park faults, along with the Puente Hills fault, are considered responsible for uplift of the Repetto, Montebello, Whittier, Puente, Chino and Coyote Hills. The Elysian Park-Puente Hills thrust fault system may be a "blind" fault system that extends across the northeast portion of the Los Angeles basin (Davis *et al.*, 1989; Shaw *et al.*, 2002).

No large earthquakes have occurred along the Raymond fault zone during historic times. Soil stratigraphic evidence indicates at least one movement in the last 8,400 years (Borchardt and Hill, 1979). Weaver and Dolan (2000) isolated the most recent earthquake to rupture the ground surface along the fault as probably a M_w6.7 that occurred approximately 955 to 2,400 years ago. Existing evidence indicates the recurrence interval along the Raymond fault may be of the order of thousands of years and/or movement may have occurred along one or more strands of the fault (Borchardt and Hill, 1979; Crook *et al.*, 1987). Weaver and Dolan (2000) documented at least five earthquakes that ruptured the ground surface during late Pleistocene time and determined an average recurrence interval for the fault of less than 3,300 years. The Raymond fault is considered to be an active fault and is included within an Alquist-Priolo Earthquake Fault Zone designated by the State of California. The Raymond fault is suspected to be responsible for the M4.9 Pasadena earthquake in 1988 (Jones *et al.*, 1990).

No large earthquakes are known to have occurred along the San Joaquin Hills Blind Thrust. The precise location of the blind thrust fault is not known, nor the exact depths to it at various locations in the area. However, the recent M_w3.9 earthquake of April 23, 2012 has been suggested by the California Geological Survey to have occurred along this fault. The earthquake had a focal depth of 13.1 kilometers and the epicenter was located approximately 26 miles (42 km) southwest of the site (SCEC, 2012). First motion analysis of the earthquake is suggestive of a thrust fault mechanism.

The following table presents a summary of the most significant historic earthquakes that may have affected the site, based on data presented by Townley and Allen (1939), Richter (1958), Proctor (1973), Real *et al.* (1978), Goter (1988, 1992), and Goter *et al.* (1994):

Date	Earthquake Epicenter Location	Magnitude (M_w)	Distance from Site mi. (km)	Direction
May 15, 1910	Temescal Valley	6.0	10 (16)	Southwest
July 22, 1923	Loma Linda	~6.3	14 (23)	Northeast
July 22, 1899	Cajon Pass	~6.5	23 (37)	North
October 1, 1987	Whittier	5.9	26 (42)	Northwest
September 19,1907	Running Springs	~6.0	29 (47)	Northeast
April 21, 1918	San Jacinto	~6.9	30 (48)	Northeast
December 8, 1812	San Bernardino	~7.5	31(50)	Northwest
June 28, 1992	Big Bear	6.4	36(58)	Northeast
March 10, 1933	Long Beach	6.4	40 (64)	West
July 6, 1986	North Palm Springs	6.1	49 (79)	East
December 25, 1899	Anza	~7.1	50 (81)	Southeast
February 9, 1971	San Fernando	6.6	55 (89)	West
January 17, 1994	Northridge	6.7	56 (90)	West
December 4, 1948	Desert Hot Springs	6.2	59 (95)	East
June 28, 1992	Landers	7.3	62 (100)	East
January 9, 1857	Fort Tejon	~8.25	126 (202)	Northwest

SEISMIC ANALYSIS

The site does not lie within a Seismic Hazard Zone as published by the California Geological Survey (CGS).

The Seismic Design Parameters in accordance with the 2013 California Building Code and the ASCE Standard 7-10 are provided below to assist the structural engineer. The site soils are considered to be Site Class D. S_1 is less than 0.75g.

Factor or Coefficient	Value
Latitude	34.0581
Longitude	117.4173
Mapped S_s	1.500g
Mapped S_1	0.604g
F_a	1.0
F_v	1.5
S_{ms}	1.500g
S_{m1}	0.907g
S_{DS}	1.000g
S_{D1}	0.604g
PGA	0.553g
T_L	12 seconds

The Fontana Seismic trend is not considered in the current fault modeling for ground motion design. The fault is not considered to have ruptured Holocene age materials and is not considered to be an active fault as defined by the State. However, the numerous micro-seismicity along it is likely to continue in the future. It has produced numerous earthquakes up to M_w 4.0.

Significant earthquakes affecting the site may occur on the San Jacinto or San Andreas faults during the lifetime of the proposed educational facilities. These faults are considered to be the most important faults to the site from a seismic shaking standpoint due to their proximity to the site, style of faulting, and recurrence interval. A M_w7.4 earthquake may occur along the San Jacinto fault and a M_w8.1 earthquake along the San Andreas fault and are the maximum considered earthquakes. The San Jacinto fault has been assigned a slip rate of 8-18 millimeters (mm) per year and the San Andreas fault 29 mm per year by the 2007 Working Group on California Earthquake Probabilities (WGCEP) and Wills, et al., (2008) as well as CGS Fault Model (Cao, 2002, 2004). The Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3), USGS (2013, 2014) suggested variable rates for both faults, depending on the amount of cascading.

Recurrence intervals for large earthquakes cannot yet be precisely determined from a statistical standpoint, because recorded information on seismic activity does not encompass a sufficient span of time. Large earthquakes could occur on other faults in the general area, but because of their greater distance and/or lower probability of occurrence, they are less important to the site from a seismic shaking standpoint. Other significant faults within a 62-mile (100 km) radius of the site were also evaluated and data are included as Enclosure 3.

SLOPE STABILITY

The State of California has not conducted seismic hazards mapping for the Fontana 7½ minute quadrangle and did not include the site within a Seismic Hazard Earthquake-Induced Landslide Zone as defined by the Seismic Hazards Mapping Act (California Division of Mines and Geology, 1997). San Bernardino County (2007) did not show the site within an area susceptible to landsliding.

No evidence for landsliding was observed on or in the immediate vicinity of the site in the field or on the aerial photographs reviewed. The closest slope is along the north flank of a series of hills 2,00 feet (884 m) south of the site. Due to the lack of significant topography close to the site, landsliding is not expected on the site.

GROUNDWATER

Current depth to groundwater data are not available in the immediate vicinity of the site from the California Department of Water Resources (2005). Data from a well located approximately 1,000 feet (305 m) north of the site (State Well No. 1S5W29A013) indicates that the depth to groundwater at that location was at its shallowest at 241 feet (73 m) in January, 1994 and at its deepest at 294 feet (90 m) in April, 2004 (Western Municipal Water District, 2004). Data from a well located approximately 1½ miles (2.4 km) northwest of the site (State Well No. 01S05W20D001S) indicates that the depth to groundwater at that location was at its shallowest at 283 feet (86 m) in February, 1964, and was at its deepest at 392 feet (119 m) in June, 1992 (California Department of Water Resources, 2005). Groundwater was not encountered in the borings placed on the site to a maximum depth of 51 feet (15½ m). The historic high groundwater depth was 241 feet (73 m).

The State of California has not conducted seismic hazards mapping for the Fontana 7½ minute quadrangle and the site is not included within a Seismic Hazard Liquefaction Zone as defined by the Seismic Hazards Mapping Act (California Division of Mines and Geology, 1997). San Bernardino County (2007) does not show the site as being within a high potential liquefaction area. The depth to groundwater of over 250 feet (76 m) should preclude liquefaction from occurring from a geological standpoint. Davis *et al.* (1982) did not show the site within a potential liquefaction area, (Enclosure 6).

Youd and Perkins (1978) and Youd *et al.* (1978) listed the parameters for increased liquefaction susceptibility as: 1) high groundwater (less than 33 feet below the surface); 2) sandy sedimentary deposits; 3) recent age of material; and 4) close proximity to an active fault. The materials encountered on the site marginally do not fall into only the category of high groundwater. Therefore, the subsurface materials on the site are not considered to be susceptible to liquefaction from a geologic standpoint. John R. Byerly, Inc. is evaluating the soils for potential liquefaction.

SUBSIDENCE

Subsidence of the ground surface has occurred in the Antelope, San Bernardino, San Jacinto and Murrieta Valleys. The primary cause of non-tectonic subsidence in these areas has been the removal of large quantities of groundwater from their respective ground-water basins. Static groundwater levels in the immediate vicinity of the site have been relatively consistent. No evidence for significant static groundwater level declines beneath the site was observed in the depth to groundwater data as the levels are currently only 53 feet (16 m) deeper than the shallowest historic level. San Bernardino County (20007 does not show the site as being within a zone subject to subsidence. Subsidence is not considered to be a potential hazard to the site.

FLOODING

The site does not lie within a 100-year flood plain as shown by San Bernardino County (2007). The Federal Emergency Management Agency has not published a flood panel for this site (2008). No evidence of recent flooding on the site was observed during the geologic field reconnaissance or on the aerial photographs reviewed.

SEICHES

Seiching consists of the periodic oscillation of a body of water which often occurs during, and following, an earthquake. As there are no large bodies of water on the site or in the immediate vicinity, seiching is not considered to be a potential hazard to the site.

SEISMIC SETTLEMENT AND DIFFERENTIAL COMPACTION

Seismic settlement occurs when relatively loose natural materials undergo compaction due to seismic shaking. This results in settlement of the natural ground surface. Differential compaction of natural materials may occur across a site if significant geologic features (i.e. faults, bedrock contacts, landslide contacts, etc.) result in different thicknesses or different densities of materials across a site.

Seismic settlement or differential compaction on the site are not expected as no unusual geologic conditions or structures are known to exist at shallow depth under the site. The geotechnical engineer is addressing the potential for dry settlement.

TSUNAMIS

Due to the inland distance of the site from the Pacific Ocean, tsunamis are not considered to be a potential hazard to the site.

VOLCANIC ACTIVITY

Jennings (1994) did not show recent volcanic eruptions in the vicinity of the site. Due to the lack of significant volcanic source in the vicinity of the site, volcanism is not considered to be a potential hazard during the lifetime of the proposed building.

MISCELLANEOUS

The San Bernardino County General Plan (2007) was reviewed and geologic hazards to the site have been addressed.

CONCLUSIONS

The site does not lie within an Earthquake Fault Zone as defined by the Alquist-Priolo Earthquake Fault Zoning Act.

No known faults cross the site and no indicators of fault movement on the site were observed during the geologic field reconnaissance or on the aerial photographs reviewed. Ground rupture on the site from surface faulting is not expected during the lifetime of the proposed improvements.

Moderate seismic shaking of the site can be expected within the lifetime of the proposed facilities from an earthquake along the San Jacinto or San Andreas faults.

The San Jacinto fault is located approximately 6 miles (10 km) northeast of the site and the San Andreas fault is located approximately 11 miles (18 km) northeast of the site. These faults are the most likely to produce a strong earthquake affecting the site. The USGS design ground motion parameters from ASCE 7-10 are provided in the Seismic Analysis section.

The closest slope is along the north flank of a series of hills 2,900 feet (884 m) south of the site. Landsliding is not expected to affect the site.

Subsidence is not considered to be a potential hazard to the site.

The site does not lie within, or adjacent to, a 100-year flood plain as shown on the San Bernardino County General Plan or FEMA flood maps.

No above ground reservoirs are located topographically higher than the site in the immediate vicinity of the site.

Seismic settlement and differential compaction are not considered to be potential hazards to the proposed educational facilities on the site. The geotechnical engineer is addressing the potential for dry settlement.

The State of California has not conducted seismic hazards mapping for the Fontana 7½ minute quadrangles and the site is not included within a Seismic Hazard Liquefaction Zone as defined by the Seismic Hazards Mapping Act. San Bernardino County does not show the site within a potential liquefaction area. Davis *et al.* did not show the site within a potential liquefaction area. The materials encountered on the site do not fall into the category of high groundwater (greater than 73 m). Therefore, the subsurface materials on the site are not considered to be susceptible to liquefaction from a geologic standpoint.

Static groundwater levels in the vicinity of the site are expected to have been relatively consistent. The historic high groundwater level below the site was 241 feet (73 m) below the surface.

The site is not located within a dam inundation area. No large water storage reservoirs are located topographically higher than the site in the immediate vicinity of the site; therefore, seismically induced flooding is not considered to be a potential hazard to the proposed educational facility at this time.

Seiching, seismic settlement and differential compaction are not expected to be potential hazards to the proposed educational facilities.

The San Bernardino County General Plan was reviewed and geologic hazards to the site have been addressed.

RECOMMENDATIONS

A maximum earthquake of $M_w 7.4$ may occur along the San Jacinto fault or a M_w 8.1 earthquake along the San Andreas fault, located approximately 6 and 11 miles (10 and 18 km) from the site. The ground motion parameters outlined in the Seismic Analysis section should be considered.

The maximum inclination of any cut slopes should be 1 ½ horizontal to 1 vertical up to a maximum height of 15 feet.

Positive drainage of the site should be provided, and water should not be allowed to pond behind or flow over any natural, cut or fill slopes. Where water is collected in a common area and discharged, protection of the native soils should be provided.

Respectfully Submitted,

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GSR/gr

Enclosure 1: References
Enclosure 2: Geologic Index Map
Enclosure 3: Fault Table
Enclosure 4: Regional Fault Location Index Map
Enclosure 5: Earthquake Epicenter Map
Enclosure 6: Seismic Hazards Index Map

Distribution: John R. Byerly, Inc. (1 Digital Copy)

ENCLOSURE 1
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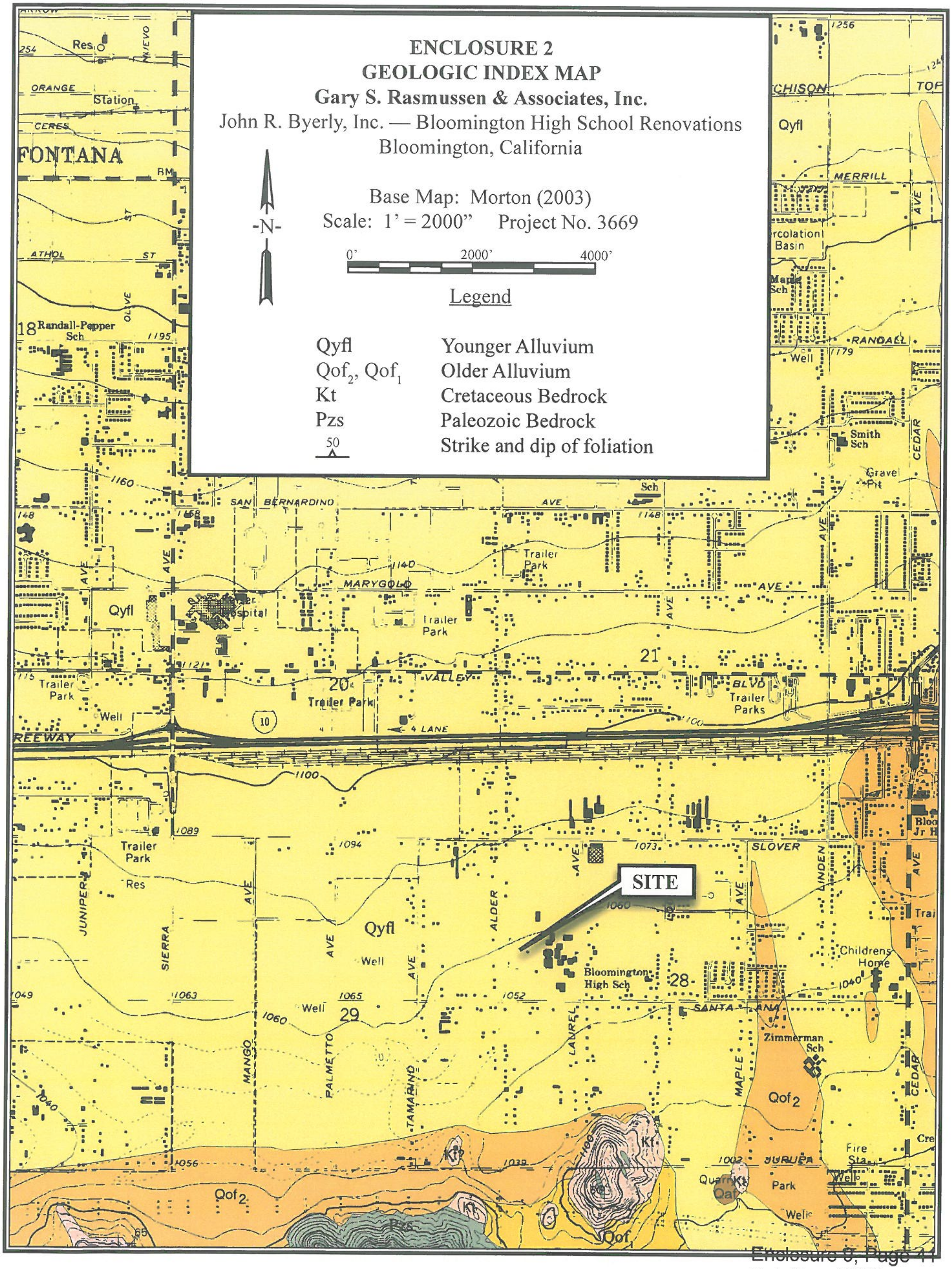


ENCLOSURE 2
GEOLOGIC INDEX MAP

Gary S. Rasmussen & Associates, Inc.

John R. Byerly, Inc. — Bloomington High School Renovations
Bloomington, California

-N-

Base Map: Morton (2003)
Scale: 1' = 2000" Project No. 3669

0' 2000' 4000'

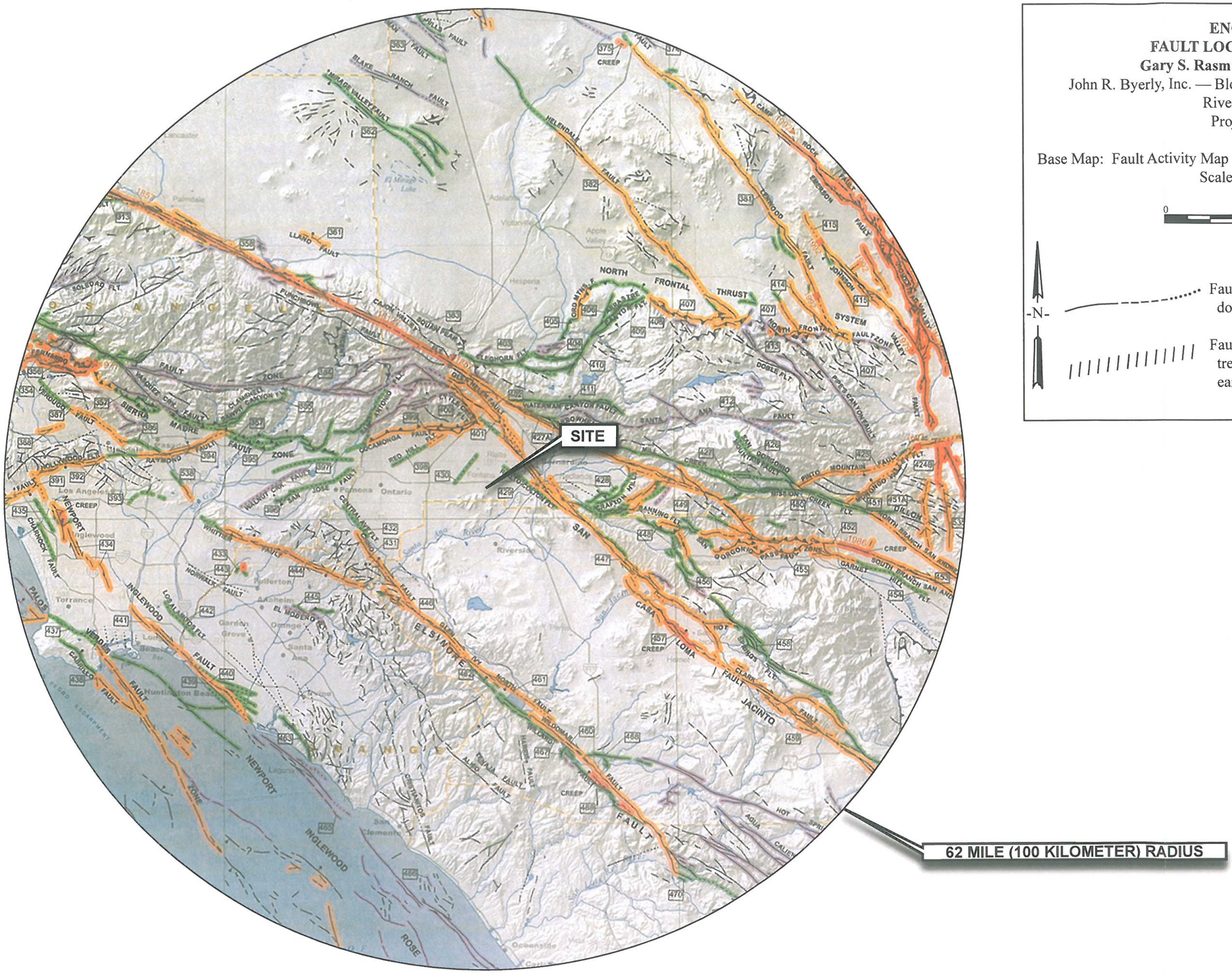
Legend

Qyfl	Younger Alluvium
Qof_2, Qof_1	Older Alluvium
Kt	Cretaceous Bedrock
Pzs	Paleozoic Bedrock
50	Strike and dip of foliation

ENCLOSURE 3
FAULT TABLE
Gary S. Rasmussen & Associates, Inc.
John R. Byerly, Inc. — Bloomington High School Improvements
Bloomington, California Project No. 3669

Fault	Fault Type	Fault Length Mi.(Km)	Distance Mi.(Km)	Direction
Rialto-Colton	Strike Slip	10 (16)	5 (8)	NE
San Jacinto Fault Zone	Strike Slip	150 (242)	6 (10)	NE
Cucamonga Fault Zone	Reverse Slip	17 (28)	8 (13)	N
San Andreas Fault Zone	Strike Slip	341 (549)		
San Bernardino	Strike Slip	213 (343)	11 (18)	NE
Mojave	Strike Slip	163 (263)	15 (24)	N
Cleghorn	Strike Slip	16 (25)	16 (26)	NE
San Jose	Strike Slip	12 (20)	16 (26)	NW
Chino-Central Avenue	Strike Slip	18 (29)	17(27)	SW
Elsinore Fault Zone	Strike Slip	150 (242)	18(29)	SW
Glen Ivy	Strike Slip			
Sierra Madre	Reverse Slip	47 (76)	19 (31)	NW
North Frontal Fault Zone	Reverse Slip	31 (50)	20 (32)	NE
Clamshell-Sawpit	Reverse	10(16)	28 (45)	NW
Puente Hills	Thrust	11 (17)	28 (45)	NW
Raymond	Strike Slip	14 (23)	34 (55)	W
San Joaquin Hills	Blind Thrust	17 (27)	34 (55)	SW
Helendale So. Lockhart	Strike Slip	71 (114)	38 (61)	NE
Elysian Park	Blind Thrust	12 (20)	39 (63)	NW
Pinto Mountain	Strike Slip	46 (74)	40 (64)	NE
Newport-Inglewood	Strike Slip	129 (208)	42 (68)	SW
Verdugo	Reverse Slip	18 (29)	43 (69)	NW
Hollywood	Strike Slip	11 (17)	47 (76)	W

Fault	Fault Type	Fault Length Mi.(Km)	Distance Mi.(Km)	Direction
Lenwood-Lockhart-Old Woman Springs	Strike Slip	90 (145)	49 (79)	NE
Santa Monica	Strike Slip	58 (93)	50 (80)	SW
San Gabriel	Strike Slip	44 (71)	53 (85)	NW
Palos Verdes	Strike Slip	177 (285)	53 (85)	W
Johnson Valley	Strike Slip	22 (35)	53 (85)	NE
Landers	Strike Slip	58 (94)	57 (92)	NE
Santa Monica	Strike Slip	58 (93)	57 (92)	W
Burnt Mountain	Strike Slip	13 (21)	58 (93)	NE
Northridge	Reverse Slip	21 (33)	58 (93)	W
Eureka Peak	Strike Slip	12 (19)	59 (95)	NE
So. Emerson-Copper Mtn	Strike Slip	34 (54)	60 (97)	NE
Coronado Bank	Strike Slip	116 (186)	61 (98)	SW



ENCLOSURE 4
FAULT LOCATION INDEX MAP

Gary S. Rasmussen & Associates, Inc.

John R. Byerly, Inc. — Bloomington High School Renovations
Riverside, California
Project No. 3669

Base Map: Fault Activity Map of California (Jennings and Bryant, 2010)
Scale: 1" = 12 miles

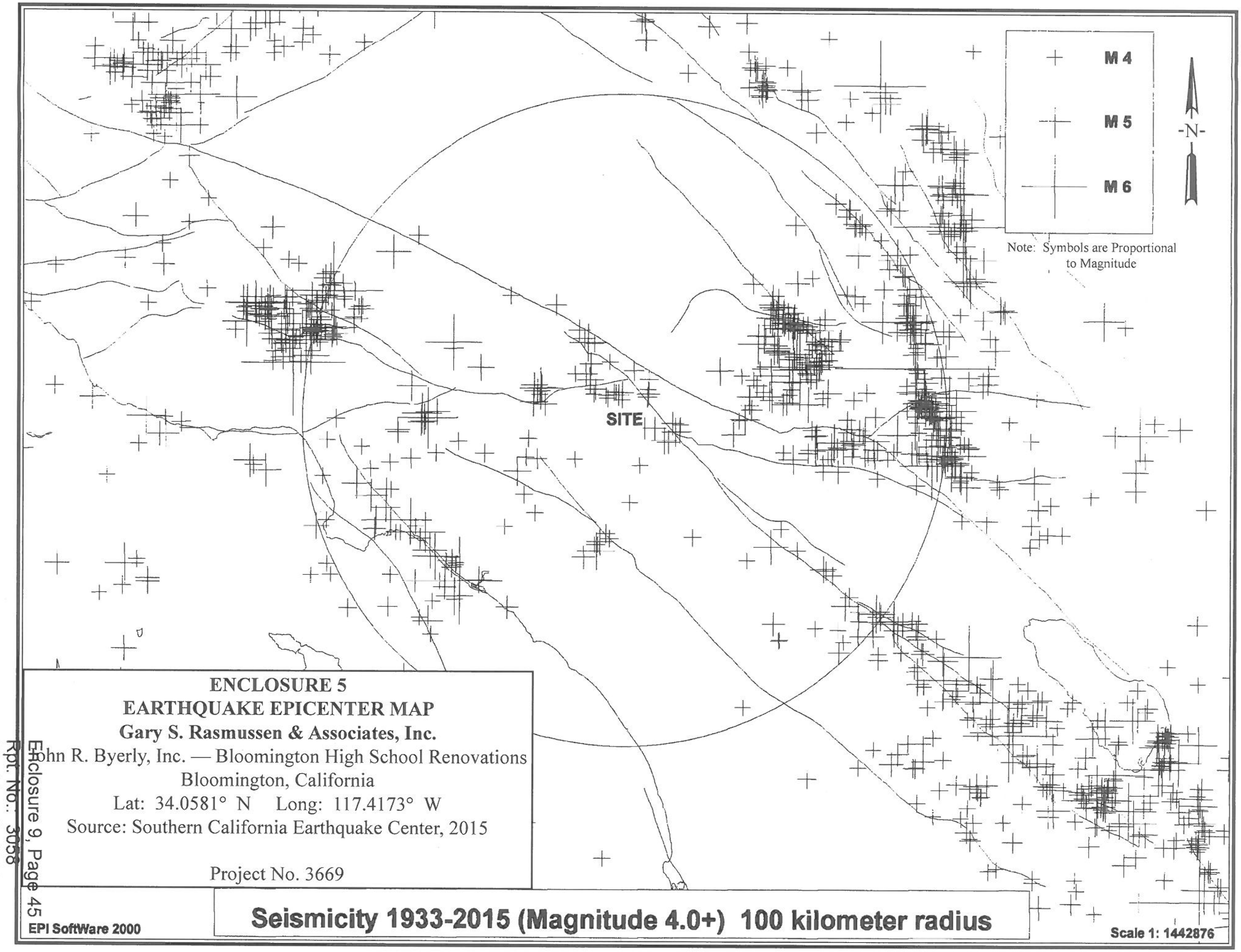
0 12 mi. 24 mi.

-N-

Legend

Fault; dashed where approximate, dotted where buried

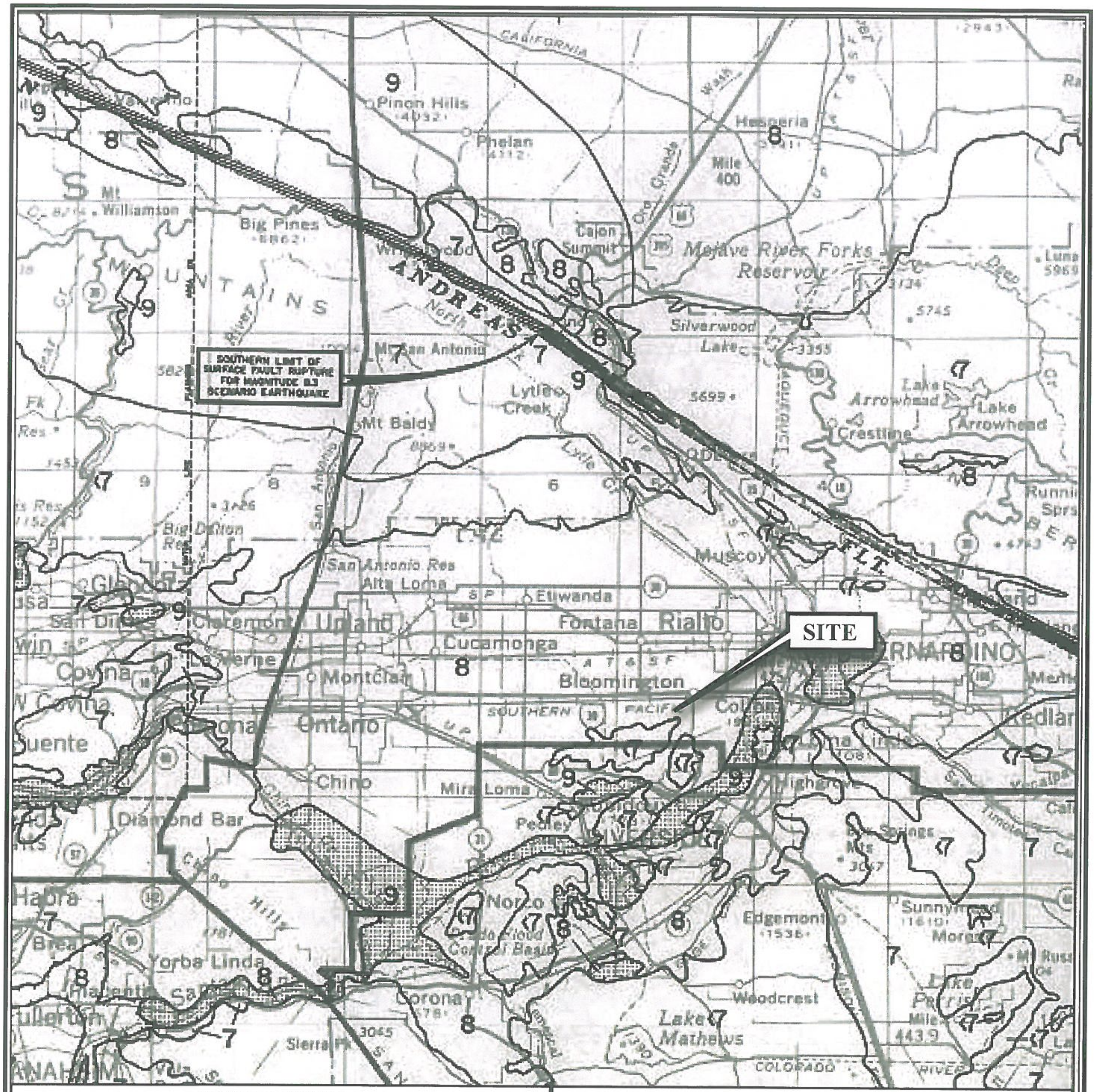
Fault segment with a significant trend of accurately located earthquake epicenters



ENCLOSURE 5
EARTHQUAKE EPICENTER MAP
Gary S. Rasmussen & Associates, Inc.
John R. Byerly, Inc. — Bloomington High School Renovations
Bloomington, California
Lat: 34.0581° N Long: 117.4173° W
Source: Southern California Earthquake Center, 2015

Project No. 3669

Seismicity 1933-2015 (Magnitude 4.0+) 100 kilometer radius



ENCLOSURE 6
SEISMIC HAZARDS INDEX MAP

Gary S. Rasmussen & Associates, Inc.

John R. Byerly, Inc. — Bloomington High School Renovations
Bloomington, California

Base Map: Davis *et al.* (1982)

-N-

Scale: 1" = 6.3 mi.

Project No. 3669

0 6 mi. 12 mi.

Legend

▨ Surface fault rupture zone

8 Earthquake shaking Intensity

▨ Liquefaction Area; High Potential

○ Liquefaction Area, Moderate or Unknown Potential

John R. Byerly
INCORPORATED

March 28, 2016

Colton Joint Unified School District
1212 Valencia Drive
Colton, California 92324

Rpt. No.: 3636
File No.: S-13636

Attention: Craig Sandifer

Project: Bloomington High School, Stadium and Baseball Field Renovations, 10750 Laurel Avenue, Bloomington, California

Subject: Infiltration Rate Study for Storm Water Disposal

References: (a) Technical Guidance Document for Water Quality Management Plans, San Bernardino County Stormwater Program, June 7, 2013

(b) Geotechnical Investigation, John R. Byerly, Inc., Rpt. No. 3058, June 12, 2015

Ladies and Gentlemen:

Improvement of the subject property will require the disposal of storm water runoff within the site. We understand that a subsurface storm water chamber system is proposed in the northwestern portion of the existing junior varsity baseball field area. The bottom of the system will be about 8 feet below the presently existing grade. During March of 2016, an investigation of the percolation characteristics of the subsoils underlying the proposed chamber system was conducted by this firm. The purpose of our investigation was to assist in the determination of a suitable infiltration rate for design of the proposed chamber system.

REVIEW OF GEOTECHNICAL REPORT

A geotechnical investigation was performed by our firm for the proposed stadium and baseball field renovations as described in Reference (b). The subsurface explorations consisted of 13 test borings drilled with a limited-access track-mounted flight-auger to depths of up to 51 feet below the existing ground surface. The exploration data from these earlier test borings were evaluated to assist in the interpretation of our percolation test results.

SITE CONDITIONS

The existing Bloomington High School is located on the northwest corner of Laurel Avenue and Santa Ana Avenue in the Bloomington area of San Bernardino County. The current high school campus is active and is occupied by existing buildings and associated parking areas, athletic fields, hardscape, and landscape areas. The location of the proposed chamber system is currently grass-covered. The area topography is generally flat, and the site slopes downward to the southeast.

FIELD INVESTIGATION

The soils underlying the areas of the proposed chamber system were explored by means of two test borings excavated with a track-mounted flight-auger to depths of up to 10.3 feet below the existing ground surface. The approximate locations of the explorations are indicated on Enclosure 1. The soils encountered were examined and visually classified by one of our field engineers. A summary of the soil classifications appears as Enclosure 2. The exploration logs show subsurface conditions at the dates and locations indicated, and may not be representative of other locations and times. The stratification lines presented on the logs represent the approximate boundaries between soil types, and the transitions may be gradual.

San Bernardino County's Technical Guidance Document for Water Quality Management Plans (Reference a) incorporates Low Impact Development (LID) Best Management Practices (BMPs) to the maximum extent practicable. Table VII.1, Appendix VII of Reference (a) provides required methods of establishing design infiltration rates. We investigated the percolation characteristics of the subsoils underlying the area designated for the infiltration system by two percolation tests using the falling-head test method. Percolation testing was performed using the deep percolation test method and following test procedures required by Reference (a).

On February 14, 2016, percolation testing was performed for the proposed infiltration system at two locations. Perforated pipe, 3 inches in diameter, was placed into each test hole to control scour. Two inches of clean gravel were then placed in the bottom of the test holes. At least 5 gallons of clear water was introduced into each test hole, and the water quickly percolated through the test hole. Water was reintroduced into the test holes, and the water was allowed to percolate into the soil. At timed intervals, the level of water was measured, and additional water was added to the test holes. The test was continued until steady-state conditions were attained. Enclosure 3 presents the field test data. Percolation rates have been corrected for the contribution of the test hole sidewall.

SOIL CONDITIONS

In both borings, less than one foot of artificial fill consisting of silty sand was encountered. The natural soils immediately underlying the fill consisted of medium dense to dense silty sands. Neither bedrock nor ground water was encountered in our borings. The underlying soils encountered are consistent with the findings of our referenced geotechnical investigation. Based on ground water data, our consulting engineering geologist estimates that the shallowest historic depth to ground water is expected to have been 241 feet below existing grade. Due to the great depth to ground water, we conclude that the potential for storm water runoff contamination of ground water at this location is low.

CONCLUSIONS AND RECOMMENDATIONS

The percolation tests yielded percolation rates of 0.2 inch per hour and 0.1 inch per hour. The percolation rates were computed utilizing the percolation rate conversion equation (Porchet Method, aka Inverse Borehole Method) provided by the San Bernardino County's Technical Guidance Document for Water Quality Management Plans (Reference a), which accommodates the contribution of the test hole sidewall to the measured percolation rate. The percolation rate conversion equation is presented below.

$$I_t = \frac{\Delta H\ (60\ \text{min./hr.})\ r}{\Delta t\ (r+2\ H_{avg})}$$

Where: I_t = *tested infiltration rate (in./hr.)*

Δt = *time interval (min.)*

r = *test hole radius (in.)*

ΔH = *change in height over the time interval (in.)*

H_{avg} = *average head height over the time interval (in.)*

The converted percolation rates are presented in the following table.

Boring Number	Depth of Test (inches)	Converted Percolation Rate (inch per hour)
P-1	122.0	0.2
P-2	123.0	0.1

A safety factor has not been applied to these design values. We note that the tests conducted yielded percolation rates generally considered slow. It is our opinion that the slow percolation rates are attributable to the high silt content and dense nature of the soil layer at the depth tested. During our geotechnical investigation, a layer of gravelly sand was encountered starting at a depth of approximately 12 feet below the existing surface. We recommend that further percolation testing be conducted in this deeper layer to determine if it could be utilized to enhance the design of the proposed storm water disposal system.

We appreciate this opportunity to be of service. Should there be questions, please feel free to contact this office.

Respectfully submitted,

JOHN R. BYERLY, INC.

John R. Byerly, Geotechnical Engineer
President

REGISTERED PROFESSIONAL ENGINEER
JOHN R. BYERLY
No. GE000179
Exp. Date 6-30-17
GEOTECHNICAL
STATE OF CALIFORNIA

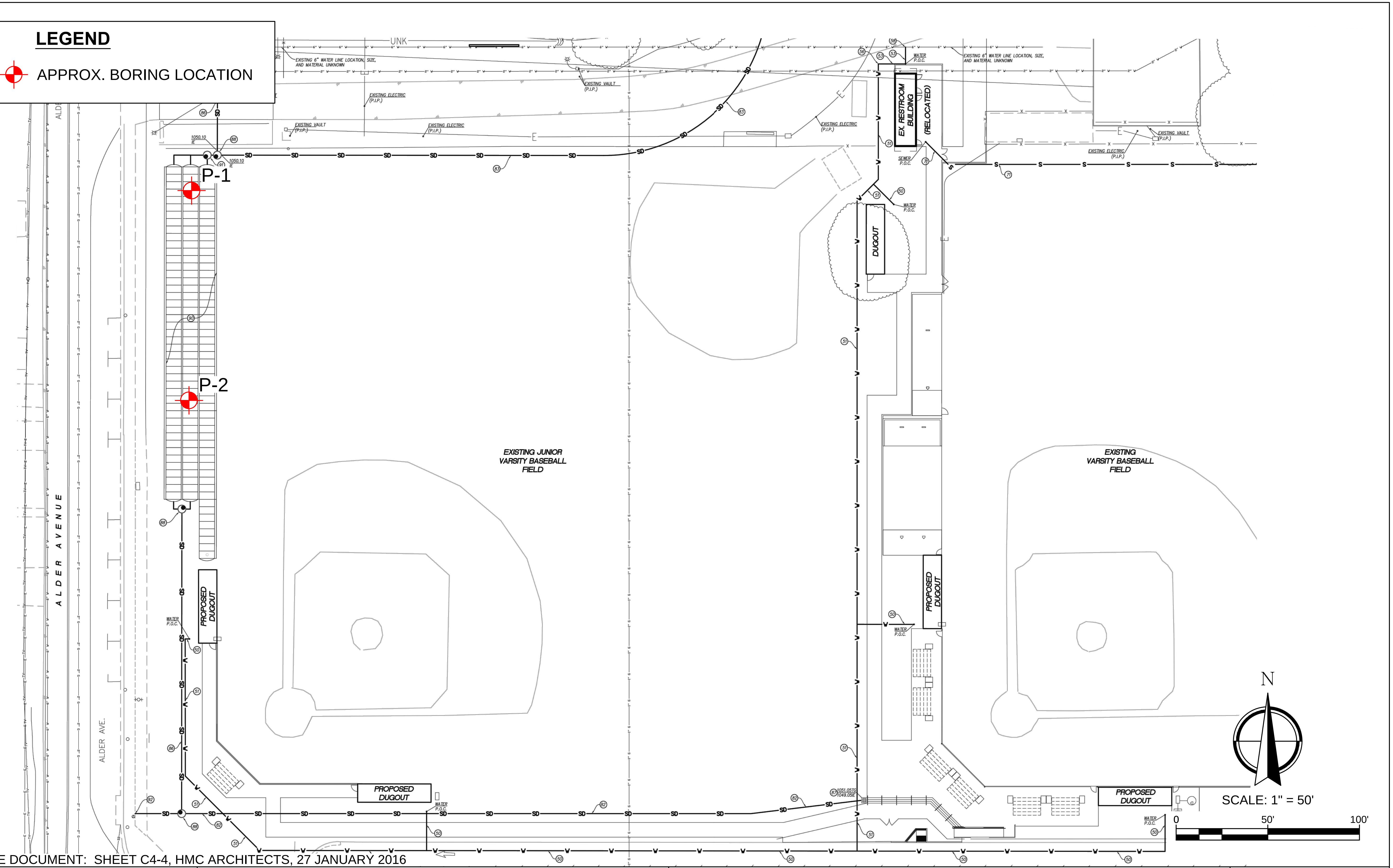
JRB:MEC:jet

Enclosures: (1) Plot Plan
(2) Exploration Logs
(3) Summary of Field Test Data

Copies: (3) Client
(1) HMC Architects
(1) Epic Engineers

LEGEND

⊕ APPROX. BORING LOCATION



SOURCE DOCUMENT: SHEET C4-4, HMC ARCHITECTS, 27 JANUARY 2016

John R. Byerly
INCORPORATED

INFILTRATION RATE STUDY

BLOOMINGTON HIGH SCHOOL
10750 LAUREL AVENUE
BLOOMINGTON, CALIFORNIA

Enclosure 1
Rpt. No.: 3636
File No.: S-13636

Boring 1

Boring Date: 3/14/16
Surface Elevation:
Drilling Method: Track-Mounted Flight-Auger

Depth	Std. Pen. "N" Value	Blows/ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						GWT not encountered
2						
4						
6						
8						
10						
12						
14						

SM	Dark gray-brown silty fine to medium sand, moist and loose (FILL)
SM	Brown silty fine to medium sand, moist and medium dense (NATURAL SOIL)
SM	Gray-brown silty fine to coarse sand with gravel, moist and dense
SM	Brown silty fine sand, moist and medium dense to dense

Total Depth at 10.2 Feet
No Free Ground Water Encountered

LOG OF BORING

Boring 2

Boring Date: 3/14/16
Surface Elevation:
Drilling Method: Track-Mounted Flight-Auger

Depth	Std. Pen. "N" Value	Blows/ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						GWT not encountered
2						
4						
6						
8						
10						
12						
14						

SM	Dark brown silty fine to medium sand, moist and loose (FILL)
SM	Gray-brown silty fine to medium sand, moist and medium dense (NATURAL SOIL)
SM	Brown silty fine to coarse sand with gravel, moist and medium dense
SM	Gray-brown silty fine sand, moist and medium dense to dense

Total Depth at 10.3 Feet
No Free Ground Water Encountered

LOG OF BORING

John R. Byerly, Inc.

Bloomington High School
Bloomington, California

Enclosure 2, Page 2
Rpt. No.: 3636
File No.: S-13636

JOHN R. BYERLY, INC.

PERCOLATION TEST DATA SHEET

Job: Bloomington High School – Stadium Modernization

Date: 3/14/16

By: JEJ

Remarks: ____

Bor. No. _P-1__ Dia. (in.) 8 __

Depth of Test: 122 inches ___

Time Read	Read. (in.)	* Rate (in/hr)
10:22	48.000	0.71
10:47	58.500	
10:48	48.000	0.48
11:13	55.250	
11:14	48.000	0.32
11:24	50.000	
11:25	48.000	0.30
11:35	49.875	
11:36	48.000	0.28
11:46	49.750	
11:47	48.000	0.28
11:57	49.750	
11:58	48.000	0.24
12:08	49.500	
12:09	48.000	0.24
12:19	49.500	

Time Read	Read. (in.)	* Rate (in/hr)

Bor. No. _P-2__ Dia. (in.) 8 __

Depth of Test: 123 inches ___

Time Read	Read. (in.)	* Rate (in/hr)
10:25	48.000	0.49
10:50	55.500	
10:51	48.000	0.39
11:16	54.000	
11:17	48.000	0.28
11:27	49.750	
11:28	48.000	0.24
11:38	49.500	
11:39	48.000	0.22
11:49	49.375	
11:50	48.000	0.20
12:00	49.250	
12:01	48.000	0.16
12:11	49.000	
12:12	48.000	0.14
12:22	48.875	

Time Read	Read. (in.)	* Rate (in/hr)

* Rate has been corrected for contribution of boring sidewall

Enclosure 3
Rpt. No.: 3636
File No.: S-13636