GEOTECHNICAL ENGINEERING INVESTIGATION
BESSIE OWENS INTERMEDIATE SCHOOL MODERNIZATION
BAKERSFIELD, CALIFORNIA

BSK PROJECT G18-268-11B

PREPARED FOR:

BAKERSFIELD CITY SCHOOL DISTRICT
1300 BAKER STREET
BAKERSFIELD, CA 93305

November 26, 2018

GEOTECHNICAL ENGINEERING INVESTIGATION REPORT
BESSIE OWENS INTERMEDIATE SCHOOL MODERNIZATION
BAKERSFIELD, CALIFORNIA

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November 26, 2018

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1. INTRODUCTION

This report presents the results of a Geotechnical Engineering Investigation Report conducted by BSK Associates (BSK), for the proposed modernization for Bessie Owens Intermediate School in Bakersfield, California (Site). The Site is located at the existing Bessie Owens Intermediate School at 815 Eureka Street, Bakersfield, California, as shown on the Site Vicinity Map, Figure A-1. The geotechnical engineering investigation was conducted in accordance with BSK Proposal GB18-17397, dated October 5, 2018.

This report provides a description of the geotechnical conditions at the Site and provides specific recommendations for earthwork and foundation design with respect to the planned facility. In the event that changes occur in the design of the project, this report's conclusions and recommendations will not be considered valid unless the changes are reviewed with BSK and the conclusions and recommendations are modified or verified in writing. Examples of such changes would include location, size of structures, foundation loads, etc.

1.1. Planned Construction

Based on information provided in an electronic transmittal from you (October 3, 2018), we understand that a preliminary grading plan is not available for review. Based on the site plan views you provided, BSK understands that Bakersfield City School District (BCSD) plans to expand Bessie Owens Intermediate School into the adjacent property across King Street. The existing campus is located at 815 Eureka Street in Bakersfield, California. The campus modernization includes:

1. Demolition or removal of buildings, relocatables, and the parking lot,
2. A new administration building,
3. New modular rooms,
4. Relocating the track and grass play areas, and
5. Creating a hardcourt play area

BSK also understands that the foundations for the relocatables (pre-fabricated modular units) will consist of stem wall foundations. Anticipated foundations loads are expected to be relatively light.

In the event that significant changes occur in the design of the proposed improvements, this report's conclusions and recommendations will not be considered valid unless the changes are reviewed with BSK and the conclusions and recommendations are modified or verified in writing.

1.2. Purpose and Scope of Services

The objective of this geotechnical investigation was to characterize the subsurface conditions in the areas of the proposed structure, and provide geotechnical engineering recommendations for the preparation of plans and specifications and bearing and lateral earth pressure conditions. The scope of the investigation included a field exploration, laboratory testing, engineering analyses, and preparation of this report and a Geologic/Seismic Hazards Evaluation.

2. FIELD INVESTIGATION AND LABORATORY TESTING

2.1. Field Exploration

The field exploration for this investigation was conducted under the oversight of a BSK staff member. One (1) boring was drilled to a depth of 43.5 feet, and eight (8) borings were drilled to depths of 6.5 to 16.5 feet using a Mobile B-61 Drill Rig provided by Dave's Drilling on November 12, 2018. Two (2) borings were not drilled due to access restrictions.

The soil materials encountered in the Borings were visually classified in the field, and the logs were recorded during the drilling and sampling operations. Visual classifications of the materials encountered in the borings were made in general accordance with the Unified Soil Classification System (ASTM D 2488). A soil classification chart is presented in Appendix A.

Boring logs are presented in Appendix A and should be consulted for more details concerning subsurface conditions. Stratification lines were approximated by the field staff based on observations made at the time of drilling, while the actual boundaries between soil types may be gradual and soil conditions may vary at other locations.

2.2 Laboratory Testing

Laboratory tests were performed on selected soil samples to evaluate moisture content, dry density, shear strength, consolidation/collapse potential, expansion potential, fines content, and corrosion characteristics. A description of the laboratory test methods and results are presented in Appendix B.

3. SITE AND GEOLOGY/SEISMICITY CONDITIONS

The following sections address the Site descriptions and surface conditions, regional geology and seismic hazards, subsurface conditions, and groundwater conditions at the Site. This information is based on BSK's field exploration and published maps and reports.

3.1 Site Description and Surface Conditions

The Site currently exists at Bessie Owens Intermediate School in Bakersfield, California. The location of the additional buildings and structures are throughout the entire school campus. There are asphalt pavement parking lots with landscaping and concrete sidewalks, as well as grass fields with trees, and sprinklers.

The Site is located in the southwest quarter of the southeast quarter of Section 29, Township 29 South, and Range 28 East of the Mount Diablo Meridian. The NAD 83 GPS coordinates for the center of the Site are 35.3711 degrees North latitude and 118.9924 degrees West longitude.

3.2 Regional Geology and Seismic Hazards Assessment

Our Scope of services included a review of published maps and reports to assess the regional geology and potential for seismic hazards.

3.2.1 Regional Geology

The Site is located in the transitional area of the Great Valley geomorphic province and the Sierra Nevada geomorphic province. The Site is located in the structural region identified by the U.S.G.S. (Bartow, 1991) as the San Joaquin Valley portion of the southern Sierran block. This area forms a broad syncline with deposits of marine and overlying continental sediments, Jurassic to Holocene in age. The thickness of the sediments increases to the west and reach a thickness of as much as 20,000-feet on the west side of the San Joaquin Valley syncline. Northeast of the Site, the relatively flat geomorphology transitions into the foothills of Sierra Nevada, which generally consist of pre-Cretaceous metamorphic rocks, Mesozoic ultramafic rocks, and Mesozoic granitic rocks.

As shown on Figure C-3, the Site is located on the contact of alluvial fan deposits and alluvial valley deposits.

Nearby significant active faults include the White Wolf Fault located approximately 18 miles southeast of the site, the Garlock Fault located approximately 36 miles south of the Site, and the San Andreas Fault located approximately 38 miles southwest of the Site.

3.2.2 Seismic Hazards Assessment

The types of geologic and seismic hazards assessed include surface ground fault rupture, liquefaction, seismically induced settlement, slope failure, flood hazards and inundation hazards.

The purpose of the Alquist-Priolo Geologic Hazards Zones Act, as summarized in CDMG Special Publication 42 (SP 42), is to "prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." As indicated by SP 42, "the State Geologist is required to delineate "earthquake fault zones" (EFZs) along known active faults in California. Cities and counties affected by the zones must regulate certain development 'projects' within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting.

As shown on Figure C-6, the Site is not located in a Fault-Rupture Hazard Zone. The closest Fault-Rupture Hazard Zone is associated with the Kern Front Fault located approximately 6 miles northwest of the Site.

Zones of Required Investigation referred to as "Seismic Hazard Zones" in CCR Article 10, Section 3722, are areas shown on Seismic Hazard Zone Maps where site investigations are required to determine the need for mitigation of potential liquefaction and/or earthquake-induced landslide ground displacements. The site is within the Lamont 7.5 Minute Quadrangle and there are no mapped areas that have Seismic Hazard Zones in the project area.

3.3 Subsurface Conditions

The subsurface material generally consisted of loose to medium dense, fine to coarse grained sand and silty sand to depths of approximately 15 feet with layers of sandy silt to silty clay between 2 and 10 feet below ground surface (bgs). Then, in Boring B-1, the material below 15 feet bgs consisted generally of silts and sand to silty sand to the maximum depth of exploration.

Based on the results of the consolidation tests, the on-site soils below 5 feet are considered to have a low potential for hydrocompaction. The upper 5 feet of on-site soil is considered to have a low expansion potential with an expansion index of seven (7) at Boring B-6.

The boring logs in Appendix A provide a more detailed description of the materials encountered, including the applicable Unified Soil Classification System symbols.

3.4 Groundwater Conditions

Groundwater was not encountered in the soil borings on November 12, 2018. Based on the groundwater elevation data from the California Department of Water Resources (DWR), the historic high groundwater depth in the vicinity was recorded to be 74 feet bgs on December 27, 1950 from State Well 29S28E29R001M located 0.2 miles east from the site.

Please note that the groundwater level may fluctuate both seasonally and from year to year due to variations in rainfall, temperature, pumping from wells and possibly as the result of other factors such as irrigation, that were not evident at the time of our investigation.

4. CONCLUSIONS AND RECOMMENDATIONS

Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that the soil conditions would not preclude the construction of the proposed improvements.

The proposed improvements may be supported on shallow foundations if the recommendations presented herein are incorporated into the design and construction of the project.

4.1 Seismic Design Criteria

Based on Section 1613.3.2 of the 2016 California Building Code (CBC), the Site shall be classified as Site Class A, B, C, D, E or F based on the Site soil properties and in accordance with Chapter 20 of ASCE 7-10. Based on the “N” values from our soil Borings, as per Table 20.3-1 of ASCE 7-10, the Site is Class D ($15 \leq N \leq 50$).

The 2016 California Building Code (CBC) utilizes ground motion based on the Risk-Targeted Maximum Considered Earthquake (MCER) that is defined in the 2016 CBC as the most severe earthquake effects considered by this code, determined for the orientation that results in the largest maximum response to horizontal ground motions and with adjustment for targeted risk. Ground motion parameters in the 2016 CBC are based on ASCE 7-10, Chapter 11.

The United States Geologic Survey (USGS) has prepared maps presenting the Risk-Targeted MCE spectral acceleration (5 percent damping) for periods of 0.2 seconds (S_S) and 1.0 seconds (S_1). The values of S_S and S_1 can be obtained from the USGS Ground Motion Parameter Application available at: https://geohazards.usgs.gov/designmaps/us/application.php.

The USGS Ground Motion Parameter Application and Chapter 16 of the 2016 CBC based on ASCE 7-10 produced the spectral acceleration parameters risk targeted maximum considered earthquake values in Table 1 based on Site Class D conditions.

As per Section 1803.5.12 of the CBC, peak ground acceleration (PGA) utilized for dynamic lateral earth pressures and liquefaction, shall be based on a site specific study (ASCE 7-10, Section 21.5) or ASCE 7-10, Section 11.8.3. The USGS Ground Motion Parameter Application and based on ASCE 7-10, Section 11.8.3 produced the Geometric Mean PGA value in Table 1 based on Site Class D conditions.

Table 1: Seismic Design Parameters

Seismic Design Parameter	2016 CBC Value		Reference
MCE Mapped Spectral Acceleration (g)	$S_S = 1.086$	$S_1 = 0.400$	USGS Mapped Value
Amplification Factors (Site Class D)	$F_a = 1.066$	$F_v = 1.600$	Table 1613.3.3
Site Adjusted MCE Spectral Acceleration (g)	$S_{MS} = 1.157$	$S_{M1} = 0.640$	Equations 16-37, 38
Design Spectral Acceleration (g)	$S_{DS} = 0.771$	$S_{D1} = 0.427$	Equations 16-39, 40
Geometric Mean PGA (g)	PGA = 0.449		ASCE Equations 11.8-1

As shown above, the short period design spectral response acceleration coefficient, S_{DS}, is greater than 0.50, therefore the Site lies in Seismic Design Category D as specified in Section 1613.3.4 of the 2016 CBC. The long period design spectral response acceleration coefficient, S_{D1}, is greater than 0.2, therefore the Site lies in Seismic Design Category D as specified in Section 1613.3.4 of the 2016 CBC. The MCE mapped spectral acceleration coefficient, S_1, is less than 0.75, therefore the Site lies in Seismic Design Category D as specified in Section 1613.3.5 of the 2016 CBC. In accordance with the 2016 CBC, each structure shall be assigned to the more severe seismic design category in accordance with Table 1613.3.5(1) or 1613.3.5(2), irrespective of the fundamental period of vibration of the structure.

4.2 Soil Corrosivity

A surface soil sample obtained from the Site was tested to provide a preliminary screening of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts. The test results are presented in Appendix B.

The corrosivity evaluation was performed by BSK on a soil sample obtained at the time of drilling. The soil was evaluated for minimum resistivity (ASTM G57), pH (ASTM D4972), and soluble sulfate and chlorides (CT 417 and CT 422). At Boring B-6, the minimum resistivity was 900 ohm-cm, pH was 8.18, and sulfate and chloride were not detected.

The water-soluble sulfate content severity class is considered not severe to concrete (Exposure Category S0 per Table 19.3.1.1 of ACI 318-14). A representative sample of the Site soil has a minimum resistivity of 900 ohm-cm which is considered severely corrosive to buried metal conduit. Therefore, buried metal conduits, ferrous metal pipes, and exposed steel should have a protective coating in accordance with the manufacturer's specification.

4.3 Site Preparation Recommendations

The following procedures must be implemented during Site preparation for the proposed Site improvements. References to maximum dry density, optimum moisture content, and relative compaction are based on ASTM D 1557 (latest test revision) laboratory test procedures.

1. The areas of proposed improvements must be cleared of surface vegetation and debris. Materials resulting from the clearing and stripping operations must be removed and properly disposed of off-site. In addition, all undocumented fills should be removed where encountered and where fills or structural improvements will be placed. BSK recommends at the proposed structures, the exposed ground surface should be overexcavated to 3 feet below the existing grade or 1 foot below the footing, whichever is greater. Over excavation should extend a minimum of five feet outside exterior footing lines. Yielding areas should be observed by the geotechnical consultant and removed and recompacted if necessary.
2. After overexcavation, the bottom of the exposed soil should be scarified 8 inches, moisturized to optimum moisture content, and compacted to 90 percent of ASTM D1557.
3. Following the required stripping and overexcavation, the exposed ground surface must be inspected by the Geotechnical Engineer to evaluate if loose or soft zones are present that will require over excavation.
4. Imported soil or native excavated soils, free of organic materials or deleterious substances, may be placed as compacted engineered fill. The material must be free of oversized fragments greater than 3-inches in greatest dimension. Engineered fill underneath and extending 5 feet beyond the building foundation and must be placed in uniform layers not exceeding 8-inches in loose thickness, moisture conditioned to within 2 to 4 percent above optimum moisture content, and compacted to at least 90 percent relative compaction. Engineered fill placed on fill slopes must be placed in uniform layers not exceeding 8-inches in loose thickness, moisture conditioned to within 2 percent of optimum moisture content, and compacted to at least 90 percent of relative compaction.
5. BSK must be called to the site to verify the import material properties through laboratory testing.
6. If possible, earthwork operations should be scheduled during a dry, warm period of the year. Should these operations be performed during or shortly following periods of inclement weather,

unstable soil conditions may result in the soils exhibiting a “pumping” condition. This condition is caused by excess moisture in combination with moving construction equipment, resulting in saturation and zero air voids in the soils. If this condition occurs, the adverse soils will need to be over-excavated to the depth at which stable soils are encountered, and replaced with suitable soils compacted as engineered fill. Alternatively, the Contractor may proceed with grading operations after utilizing a method to stabilize the soil subgrade, which should be subject to review and approval by BSK prior to implementation.

7. Import fill materials must be free from organic materials or deleterious substances. The project specifications must require the contractor to contact BSK to review the proposed import fill materials for conformance with these recommendations at least one week prior to importing to the Site, whether from on-site or off-site borrow areas. Imported fill soils must be non-hazardous and derived from a single, consistent soil type source conforming to the following criteria:

Plasticity Index:	< 12
Expansion Index:	< 20 (Very Low Expansion Potential)
Maximum Particle Size:	3 inches
Percent Passing #4 Sieve:	65 - 100
Percent Passing #200 Sieve:	20 - 45
Low Corrosion Potential:	Soluble Sulfates < 1,500 ppm
	Soluble Chlorides < 150 ppm
	Minimum Resistivity > 3,000 ohm-cm

4.4 Foundations

Provided the recommendations contained in this report are implemented during design and construction, it is our opinion that the structures may be supported on shallow foundations. A structural engineer should evaluate reinforcement and embedment depth of structural elements based on the requirements for the structural loadings, shrinkage and temperature stresses.

4.4.1 Shallow Foundations

Continuous and isolated spread footings must have a minimum width of 12 inches and 24 inches, respectively and a minimum depth of footing of 18 inches. Continuous and isolated spread footing foundations may be designed using a net allowable bearing pressure of 2,000 pounds per square foot (psf). The net allowable bearing pressure applies to the dead load plus live load (DL + LL) condition; it may be increased by 1/3 for wind or seismic loads. Total foundation settlements are expected to be less than 0.5 inches and differential settlements between similarly loaded (DL + LL) and sized footings are anticipated to be less than 0.25 inches. Differential settlement of continuous footings, expressed in terms of angular distortion, is estimated to be approximately 1/600. The majority of the settlement is expected to occur within a few months after the design loads are applied.

4.4.2 Mat Foundations

We understand that the structures may be supported on a concrete mat foundation. The mat foundation may be designed to impose a maximum allowable pressure of 3,000 psf due to dead plus live loads. This value may be increased by one-third for transient loads such as seismic or wind. The concrete mat foundation should be embedded at least 8 inches below the lowest adjacent grade.

Settlements: Based on the results of our laboratory tests and analyses, total static settlements of the mat foundation under the allowable bearing pressure are expected to be approximately 1 inch, and maximum differential settlements are expected to be about 0.5 inches.

4.5 Lateral Earth Pressures and Frictional Resistance

Provided the Site is prepared as recommended above, the following earth pressure parameters for footings may be used for design purposes. The parameters shown in the table below are for drained conditions of select engineered fill or undisturbed native soil.

Table 2: Recommended Static Lateral Earth Pressures for Footings

Lateral Pressure Condition	Equivalent Fluid Density (pcf) Drained Condition
Active Pressure	40
At Rest Pressure	60
Passive Pressure	380

The lateral earth pressures listed herein are obtained by the conventional equation for active, at rest, and passive conditions assuming level backfill and a bulk unit weight of 120 pcf for the Site soils. A coefficient of friction of 0.30 may be used between soil sub-grade and the bottom of footings.

The coefficient of friction and passive earth pressure values given above represent ultimate soil strength values. BSK recommends that a safety factor consistent with the design conditions be included in their usage in accordance with Sections 1806.3.1 through 1806.3.3 of the 2016 CBC. For stability against lateral sliding that is resisted solely by the passive earth pressure against footings or friction along the bottom of footings, a minimum safety factor of 1.5 is recommended. For stability against lateral sliding that is resisted by combined passive pressure and frictional resistance, a minimum safety factor of 2.0 is recommended. For lateral stability against seismic loading conditions, a minimum safety factor of 1.2 is recommended.

4.6 Excavation Stability

Soils encountered within the depth explored are generally classified as Type C soils in accordance with OSHA (Occupational Safety and Health Administration). The slopes surrounding or along temporary excavations may be vertical for excavations that are less than five feet deep and exhibit no indication of potential caving, but should be no steeper than 1.5H:1V for excavations that are deeper than five feet, up to a maximum depth of 15 feet. Certified trench shields or boxes may also be used to protect workers during construction in excavations that have vertical sidewalls and are greater than 5 feet deep. Temporary excavations for the project construction should be left open for as short a time as possible and should be protected from water runoff. In addition, equipment and/or soil stockpiles must be maintained at least 10 feet away from the top of the excavations. Because of variability in soils, BSK must be afforded the opportunity to observe and document sloping and shoring conditions at the time of construction. Slope height, slope inclination, and excavation depths (including utility trench excavations) must in no case exceed those specified in local, state, or federal safety regulations, (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations).

4.7 Trench Backfill and Compaction

Processed on-Site soils, which are free of organic material, are suitable for use as general trench backfill above the pipe envelope. Native soil with particles less than three inches in the greatest dimension may be incorporated into the backfill and compacted as specified above, provided they are properly mixed into a matrix of friable soils. The backfill must be placed in thin layers not exceeding 12 inches in loose thickness, be well-blended and consistent texture, moisture conditioned to at least optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined by the ASTM D1557. The uppermost 12 inches of trench backfill below pavement sections must be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. Moisture content within two percent of optimum must be maintained while compacting this upper 12 inch trench backfill zone.

We recommend that trench backfill be tested for compliance with the recommended Relative Compaction and moisture conditions. Field density testing should conform to ASTM Test Methods D1556 or D6938. We recommend that field density tests be performed in the utility trench bedding, envelope and backfill for every vertical lift, at an approximate longitudinal spacing of not greater than 150 feet. Backfill that does not conform to the criteria specified in this section should be removed or reworked, as applicable over the trench length represented by the failing test so as to conform to BSK recommendations.

4.8 Concrete Slabs on Grade

Non-structural concrete slab-on-grade floors must be a minimum of 4-inches thick and must be supported on a compacted subgrade prepared in accordance with Section 4.3. In order to regulate cracking of the slabs, construction joints and/or control joints must be provided in each direction at a maximum spacing of 10 feet along with steel reinforcement as recommended by the Project Structural Engineer. Control joints must have a minimum depth of one-quarter of the slab thickness. Due to the difficulty of installing and maintaining woven or welded wire mesh (WWM) in the middle of concrete slabs-on-grade during construction, it is recommended that any steel reinforcement used in concrete slabs-on-grade consist of steel rebar. Structural concrete slabs-on-grade may be designed using a modulus of subgrade reaction equal to 180 pci.

Interior concrete slabs must be successively underlain by: 1-½ inches of washed concrete sand; a durable vapor barrier; and a smooth, compacted subgrade surface. The vapor barrier must meet the requirements of ASTM E 1745 Class A and have a water vapor transmission rate (WVTR) of less than or equal to 0.012 Perms as tested by ASTM E 96. Examples of acceptable vapor barrier products include: Stego Wrap (15-mil) Vapor Barrier by STEGO INDUSTRIES LLC; W.R. Meadows Premoulded Membrane with Plasmatic Core; and Zero-Perm by Alumiseal. Because of the importance of the vapor barrier, joints must be carefully spliced and taped. If migration of subgrade moisture through the slab is not a concern, then the vapor barrier and overlying sand may be deleted. The building subgrade must be kept in a moist condition until the vapor barrier or concrete slab is placed. A representative from BSK must be called to the Site to review soil and moisture conditions immediately prior to placing the vapor barrier or concrete slab.

As indicated in the recent PCA Engineering Bulletin 119, Concrete Floors and Moisture, and applicable ACI Committee reports (see ACI 360R-06, Design of Slabs-on-Ground, dated October 2006 and ACI 302.1R-04, Guide for Concrete Floor and Slab Construction, dated June 2004), the sand layer between the vapor barrier and concrete floor slab may be omitted. This must reduce the amount of moisture that can be transmitted through the slab (especially if the sand layer becomes very moist or wet prior to placing the concrete); however, the risk of slab “curling” is much greater. The “curling” may result from a sharp contrast in moisture-drying conditions between the exposed slab surface and the surface in contact with the membrane. As recommended in the referenced ACI Committee reports, measures must be taken to reduce the risk of “curling” such as reducing the joint spacing, using a low shrinkage mix design, and reinforcing the concrete slab. In order to regulate cracking of the slab, we recommend that full depth construction joints and control joints be provided in each direction with slab thickness and steel reinforcing recommended by the structural engineer.

Excessive landscape water or leaking utility lines could create elevated moisture conditions under concrete slabs, which could result in adverse moisture or mildew conditions in floor slabs or walls.

Accordingly, care must be taken to avoid excess irrigation around the structures, as well as to periodically monitor for leaking utility lines. Likewise, positive surface drainage must be provided around the perimeter of the structures.

As indicated above, the control of the deleterious effects of moisture vapor transmission on flooring materials can be substantially improved by the use of a low porosity concrete. This can be achieved by specifying a low water: cement ratio (0.45 or less by weight), 4,000 psi compressive strength at 28 days and a minimum of 7 days wet-curing.

4.9 Drainage Considerations

The control surface drainage in the project areas is an important design consideration. BSK recommends that final grading around shallow foundations must provide for positive and enduring drainage away from the structures, and ponding of water must not be allowed around, or near the shallow foundations. Ground surface profiles next to the shallow foundations must have at least a 2 percent gradient away from the structures.

5. PLANS AND SPECIFICATIONS REVIEW

BSK recommends that it be retained to review the draft plans and specifications for the project, with regard to foundations and earthwork, prior to their being finalized and issued for construction bidding.

6. CONSTRUCTION TESTING AND OBSERVATIONS

Geotechnical testing and observation during construction is a vital extension of this geotechnical investigation. BSK recommends that it be retained for those services. Field review during Site preparation and grading allows for evaluation of the exposed soil conditions and confirmation or revision of the assumptions and extrapolations made in formulating the design parameters and recommendations. BSK's observations must be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. BSK must also be called to the Site to observe foundation excavations, prior to placement of reinforcing steel or concrete, in order to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report. BSK must also be called to the Site to observe placement of foundation and slab concrete.

If a firm other than BSK is retained for these services during construction, then that firm must notify the owner, project designers, governmental building officials, and BSK that the firm has assumed the responsibility for all phases (i.e., both design and construction) of the project within the purview of the geotechnical engineer. Notification must indicate that the firm has reviewed this report and any subsequent addenda, and that it either agrees with BSK's conclusions and recommendations, or that it will provide independent recommendations.

7. LIMITATIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the Borings performed at the locations shown on the Boring Location Map, Figure A-2. The report does not reflect variations which may occur between or beyond the Borings. The nature and extent of such variations may not become evident until construction is initiated. If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-Site observations during the excavation period and noting the characteristics of the variations.

The validity of the recommendations contained in this report is also dependent upon an adequate testing and observation program during the construction phase. BSK assumes no responsibility for construction compliance with the design concepts or recommendations unless it has been retained to perform the testing and observation services during construction as described above.

The findings of this report are valid as of the present. However, changes in the conditions of the Site can occur with the passage of time, whether caused by natural processes or the work of man, on this property or adjacent property. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, governmental policy or the broadening of knowledge.

BSK has prepared this report for the exclusive use of the Client and members of the project design team. The report has been prepared in accordance with generally accepted geotechnical engineering practices which existed in Kern County at the time the report was written. No other warranties either expressed or implied are made as to the professional advice provided under the terms of BSK's agreement with Client and included in this report.

8. REFERENCES

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APPENDIX A

FIELD EXPLORATION

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FIELD EXPLORATION

The field exploration for this investigation was conducted under the oversight of a BSK staff member. One (1) boring was drilled to a depth of 43.5 feet, and eight (8) borings were drilled to depths of 6.5 to 16.5 feet using a Mobile B-61 Drill Rig provided by Dave's Drilling on November 12, 2018. Two (2) borings were not drilled due to access restrictions.

The soil materials encountered in the test borings were visually classified in the field, and the logs were recorded during the drilling and sampling operations. Visual classification of the materials encountered in the test borings was made in general accordance with the Unified Soil Classification System (ASTM D 2488). A soil classification chart is presented herein. Boring logs are presented herein and should be consulted for more details concerning subsurface conditions. Stratification lines were approximated by the field staff based on observations made at the time of drilling, while the actual boundaries between soil types may be gradual and soil conditions may vary at other locations.

Subsurface samples were obtained at the successive depths shown on the boring logs by driving samplers which consisted of a 2.5-inch inside diameter (I.D.) California Sampler and a 1.4-inch I.D. Standard Penetration Test (SPT) Sampler. The samplers were driven 18 inches using a 140-pound hammer dropped from a height of 30 inches by means of either an automatic hammer or a down-hole safety hammer. The number of blows required to drive the last 12 inches was recorded as the blow count (blows/foot) on the boring logs. The relatively undisturbed soil core samples were capped at both ends to preserve the samples at their natural moisture content. Soil samples were also obtained using the SPT Sampler lined with metal tubes or unlined in which case the samples were placed and sealed in polyethylene bags. At the completion of the field exploration, the test borings were backfilled with the excavated soil cuttings.

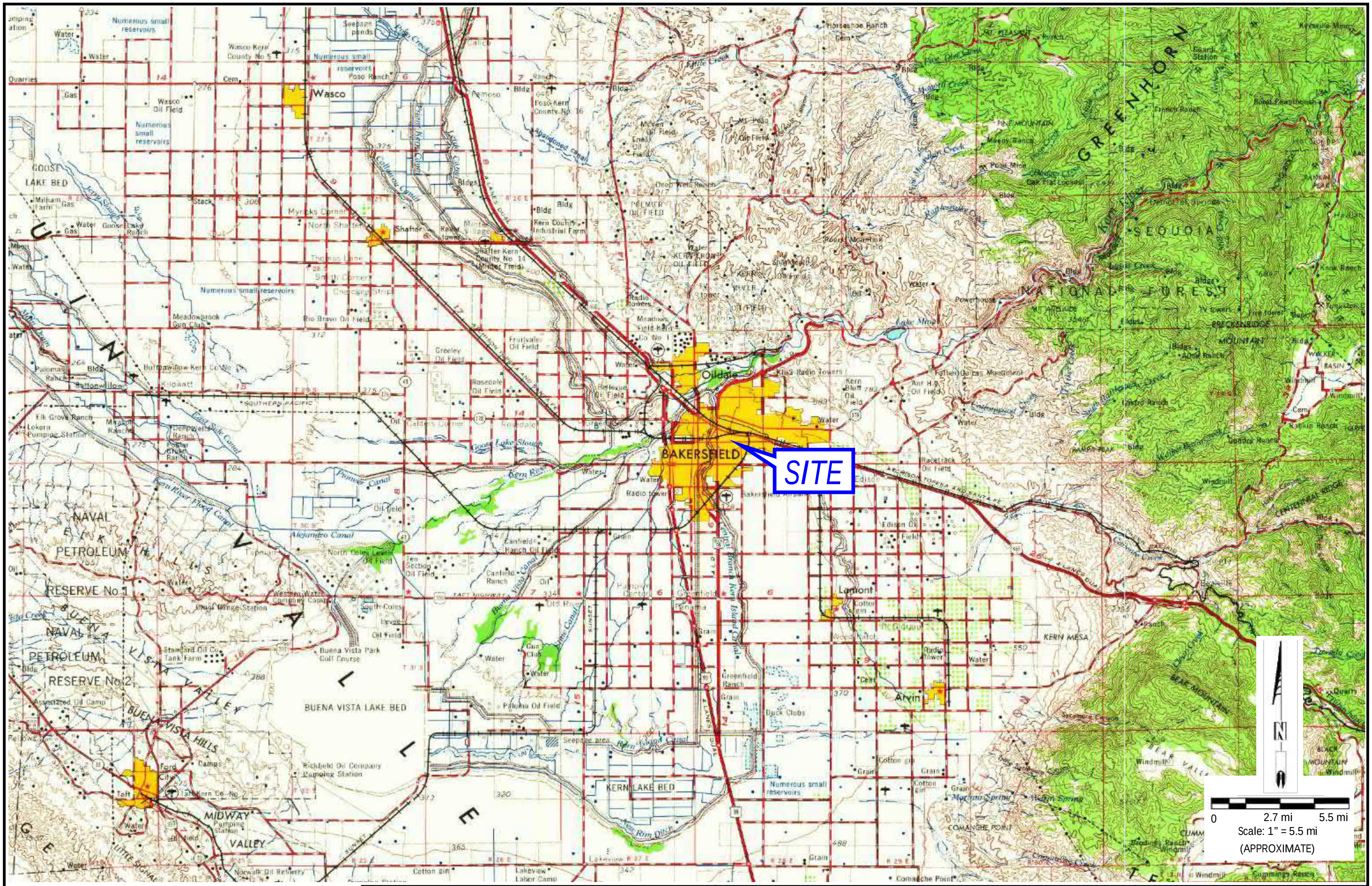
It should be noted that the use of terms such as "loose", "medium dense", "dense" or "very dense" to describe the consistency of a soil is based on sampler blow count and is not necessarily reflective of the in-place density or unit weight of the soils being sampled. The relationship between sampler blow count and consistency is provided in the following Tables A-1 and A-2 for coarse-grained (sandy and gravelly) soils and fine grained (silty and clayey) soils, respectively.

Table A-1: Consistency of Coarse-Grained Soil by Sampler Blow Count

Consistency Descriptor	SPT Blow Count (#Blows / Foot)	2.5” I.D. California Sampler Blow Count (#Blows / Foot)
Very Loose	<4	<6
Loose	4 – 10	6 – 15
Medium Dense	10 – 30	15 – 45
Dense	30 – 50	45 – 80
Very Dense	>50	>80

Table A-2: Consistency of Fine-Grained Soil by Sampler Blow Count

Consistency Descriptor	SPT Blow Count (#Blows / Foot)	2.5” I.D. California Sampler Blow Count (#Blows / Foot)
Very Soft	<2	<3
Soft	2 – 4	3 – 6
Medium Stiff	4 – 8	6 – 12
Stiff	8 – 15	12 – 24
Very Stiff	15 – 30	24 – 45
Hard	>30	>45



REFERENCE IMAGE: USGS Topo

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Tel. (661) 327-0671

SITE VICINITY MAP

Bessie Owens Intermediate Modernization
815 Eureka Street
Bakersfield, California

FIGURE A-1

JOB NO. G18-268-11B
DATE November 21, 2018

DR. BY CG
CH. BY OML
SCALE AS SHOWN

SHEET NO. 1
OF 1 SHEETS

SITE CAPACITY

(4) SP. NEEDS CLSRMS @ 12	= 48
(10) 6TH GRADE CLSRMS@ 28	= 280
(24) 7-8 CLSRMS @ 29	= 696
TOTAL STUDENT CAPACITY:	1,024

+(2) P.E. CLSRMS
+(2) SCIENCE LABS
+ BAND / CHOIR ROOM

LEGEND

🟥 EXISTING BUILDINGS

🟦 PROPOSED BUILDINGS

Scale: 1" = 85'
(APPROXIMATE)

LEGEND:

B-1 ◐ APPROXIMATE BORING LOCATIONS

B-1 ◐ PLANNED BORING LOCATIONS WHEN PROPERTY IS ATTAINED

REFERENCE IMAGE: Google Earth 2018

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BORING LOCATION MAP

Bessie Owens Intermediate Modernization
815 Eureta Street
Bakersfield, California

FIGURE A-2

JOB NO. G18-268-11B
DATE November 21,2018
DR. BY CG
CH. BY OML
SCALE AS SHOWN
SHEET NO. 1
OF 1 SHEETS

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS More than Half >#200	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES
		GRAVELS WITH OVER 15% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 15% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS More than Half <#200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS , MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

Note: Dual symbols are used to indicate borderline soil classifications.

⧗	Pushed Shelby Tube	RV	R-Value
☒	Standard Penetration Test	SA	Sieve Analysis
■	Modified California	SW	Swell Test
◧	Auger Cuttings	TC	Cyclic Triaxial
✋	Grab Sample	TX	Unconsolidated Undrained Triaxial
■	Sample Attempt with No Recovery	TV	Torvane Shear
CA	Chemical Analysis	UC	Unconfined Compression
CN	Consolidation	(1.2)	(Shear Strength, ksf)
CP	Compaction	WA	Wash Analysis
DS	Direct Shear	(20)	(with % Passing No. 200 Sieve)
PM	Permeability	∇	Water Level at Time of Drilling
PP	Pocket Penetrometer	▼	Water Level after Drilling (with date measured)

SOIL CLASSIFICATION CHART AND KEY TO TEST DATA
Unified Soil Classification System

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PLATE: Figure A-3

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LOG OF BORING NO. B-1

Project Name: **Bessie Owens Intermediate Modernization**
Project Number: **G18-268-11B**
Project Location: **815 Eureka Street, Bakersfield, California**
Logged by: **V. Simental**
Checked by: **O. Lau**

Surface El.:
Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
	■	**Surface: ASPHALT CONCRETE:** AC = 4 inches										
		SM: SILTY SAND: dark yellowish brown, moist, loose, fine to coarse grained, trace fine subangular gravel	✋				46					
		high silt content	■		5			103	12			
5		**SP: POORLY GRADED SAND:** yellowish brown, dry, loose, fine to coarse grained, trace silt	■		8			112	3			
10		with fine to coarse subangular gravel	■		25		2					
15		**ML: SILT:** yellowish brown, moist, hard										
		dark yellowish brown, trace fine to medium grained sand	☒		26				21			
20		**SANDY SILT:** olive brown, moist, very firm, fine grained sand	■		22		54	95	10			
		SILT: olive brown, moist, very firm										
25												

Completion Depth: 43.5
Date Started: 11/12/18
Date Completed: 11/12/18
California Sampler: 2.4 inch inner diameter
SPT Sampler: 1.4 inch inner diameter

Drilling Equipment: Mobile B-61 with auto hammer
Drilling Method: Hollow Stem Auger
Drive Weight: 140 pounds
Hole Diameter: 8 inches
Drop: 30 inches
Remarks: Borings backfilled with soil cuttings.

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LOG OF BORING NO. B-1

Project Name: **Bessie Owens Intermediate Modernization**
Project Number: **G18-268-11B**
Project Location: **815 Eureka Street, Bakersfield, California**
Logged by: **V. Simental**
Checked by: **O. Lau**

Surface El.:
Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		SP: POORLY GRADED SAND: yellowish brown, dry, medium dense, fine to coarse grained, trace silt	⊠		14				11			
		CL: SILTY CLAY: olive brown with dark brown mottling, very moist, firm										
30		**SM: SILTY SAND:** yellowish brown, moist, medium dense, fine to coarse grained, trace fine to coarse subangular gravel	■		35		16					
35		fine to medium grained	⊠		19				13			
		ML: SANDY SILT: olive brown, moist, hard, fine to medium grained sand										
40		olive brown	■		32		64					
		SP: POORLY GRADED SAND: olive brown, slightly moist, medium dense, fine to coarse grained										
		End of boring. Auger refusal due to very hard/dense material.										
45												
50												

Completion Depth: 43.5
Date Started: 11/12/18
Date Completed: 11/12/18
California Sampler: 2.4 inch inner diameter
SPT Sampler: 1.4 inch inner diameter

Drilling Equipment: Mobile B-61 with auto hammer
Drilling Method: Hollow Stem Auger
Drive Weight: 140 pounds
Hole Diameter: 8 inches
Drop: 30 inches
Remarks: Borings backfilled with soil cuttings.

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LOG OF BORING NO. B-2

Project Name: **Bessie Owens Intermediate Modernization**
Project Number: **G18-268-11B**
Project Location: **815 Eureka Street, Bakersfield, California**
Logged by: **V. Simental**
Checked by: **O. Lau**

Surface El.:
Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetro-meter, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		Surface: Grass										
		SM: SILTY SAND: yellowish brown, moist, fine to coarse grained										
		ML: CLAYEY SILT: light olive brown, moist, soft, trace of fine to coarse grained sand	■		6			106	10			
		SM: SILTY SAND: yellowish brown, moist, loose, fine to coarse grained										
5		**SP: POORLY GRADED SAND:** yellowish brown, slightly moist, fine to coarse grained	■		14			105	4			
10		medium dense, with fine subangular gravel	■		24			105	9			
15		trace fine subangular gravel	☒		18							
		End of boring.										
20												
25												

Completion Depth: 16.5
Date Started: 11/12/18
Date Completed: 11/12/18
California Sampler: 2.4 inch inner diameter
SPT Sampler: 1.4 inch inner diameter

Drilling Equipment: Mobile B-61 with auto hammer
Drilling Method: Hollow Stem Auger
Drive Weight: 140 pounds
Hole Diameter: 8 inches
Drop: 30 inches
Remarks: Borings backfilled with soil cuttings.

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LOG OF BORING NO. B-3

Project Name: **Bessie Owens Intermediate Modernization**
Project Number: **G18-268-11B**
Project Location: **815 Eureka Street, Bakersfield, California**
Logged by: **V. Simental**
Checked by: **O. Lau**

Surface El.:
Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		Surface: Grass										
		SM: SILTY SAND: yellowish brown, moist, loose, fine to coarse grained										
			■		7			110	9			
5		**SP: POORLY GRADED SAND:** yellowish brown, slightly moist, medium dense, fine to coarse grained	■		17			113	6			
10		trace fine to coarse subangular gravel	■		23				1			
15		no gravel	☒		15							
		End of boring.										
20												
25												

Completion Depth: 16.5
Date Started: 11/12/18
Date Completed: 11/12/18
California Sampler: 2.4 inch inner diameter
SPT Sampler: 1.4 inch inner diameter

Drilling Equipment: Mobile B-61 with auto hammer
Drilling Method: Hollow Stem Auger
Drive Weight: 140 pounds
Hole Diameter: 8 inches
Drop: 30 inches
Remarks: Borings backfilled with soil cuttings.

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LOG OF BORING NO. B-4

Project Name: **Bessie Owens Intermediate Modernization**
Project Number: **G18-268-11B**
Project Location: **815 Eureka Street, Bakersfield, California**
Logged by: **V. Simental**
Checked by: **O. Lau**

Surface El.:
Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetro-meter, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		Surface: Grass										
		SM: SILTY SAND: yellowish brown, moist, very loose, fine to coarse grained, organics	✋				37					
			■		4			112	11			
5		looser, no organics	■		2			104	11			
10		**SP: POORLY GRADED SAND:** yellowish brown, slightly moist, medium dense, fine to coarse grained	■		20			108	3			
15		no gravel	☒		16							
		ML: SILT: olive brown, moist, hard										
		End of boring.										
20												
25												

Completion Depth: 16.5
Date Started: 11/12/18
Date Completed: 11/12/18
California Sampler: 2.4 inch inner diameter
SPT Sampler: 1.4 inch inner diameter

Drilling Equipment: Mobile B-61 with auto hammer
Drilling Method: Hollow Stem Auger
Drive Weight: 140 pounds
Hole Diameter: 8 inches
Drop: 30 inches
Remarks: Borings backfilled with soil cuttings.

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LOG OF BORING NO. B-5

Project Name:	**Bessie Owens Intermediate Modernization**
Project Number:	**G18-268-11B**
Project Location:	**815 Eureka Street, Bakersfield, California**
Logged by:	**V. Simental**
Checked by:	**O. Lau**

Surface El.:
Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
	■	**Surface: ASPHALT CONCRETE:** AC = 4 inches										
	░	**SM: SILTY SAND:** dark yellowish brown with trace white mottling, moist, loose, fine to coarse grained										
	░		■		8			100	16			
5	░	**SP: POORLY GRADED SAND w/ GRAVEL:** yellowish brown, slightly moist, loose, fine to coarse grained, subangular gravel	■		10			115	3			
10	░	light yellowish brown, trace fine subanular gravel	■		14			103	2			
15	░	yellowish brown, medium dense	☒		14							
		End of boring.										
20												
25												

Completion Depth:	16.5	**Drilling Equipment:**	Mobile B-61 with auto hammer
Date Started:	11/12/18	**Drilling Method:**	Hollow Stem Auger
Date Completed:	11/12/18	**Drive Weight:**	140 pounds
California Sampler:	2.4 inch inner diameter	**Hole Diameter:**	8 inches
SPT Sampler:	1.4 inch inner diameter	**Drop:**	30 inches
		Remarks:	Borings backfilled with soil cuttings.

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LOG OF BORING NO. B-6

Project Name: **Bessie Owens Intermediate Modernization**
Project Number: **G18-268-11B**
Project Location: **815 Eureka Street, Bakersfield, California**
Logged by: **V. Simental**
Checked by: **O. Lau**

Surface El.:
Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
	■	**Surface: ASPHALT CONCRETE:** AC = 4 inches										
		SM: SILTY SAND: dark yellowish brown with trace white mottling, moist, loose, fine to coarse grained	✋				41					
			■		32							
	▨	**CL: SILTY CLAY w/ SAND:** dark yellowish brown, moist, medium dense, fine to medium grained										
5												
		with white mottling, dense, less sand	■		47							
		SM: SILTY SAND: dark yellowish brown, moist, loose, fine to medium grained	■									
		End of boring.										
10												
15												
20												
25												

Completion Depth:	6.5	**Drilling Equipment:**	Mobile B-61 with auto hammer
Date Started:	11/12/18	**Drilling Method:**	Hollow Stem Auger
Date Completed:	11/12/18	**Drive Weight:**	140 pounds
California Sampler:	2.4 inch inner diameter	**Hole Diameter:**	8 inches
SPT Sampler:	1.4 inch inner diameter	**Drop:**	30 inches
		Remarks:	Borings backfilled with soil cuttings.

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LOG OF BORING NO. B-7

Project Name: **Bessie Owens Intermediate Modernization**
Project Number: **G18-268-11B**
Project Location: **815 Eureka Street, Bakersfield, California**
Logged by: **V. Simental**
Checked by: **O. Lau**

Surface El.:
Location:

Depth, feet	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
	Surface: ASPHALT CONCRETE: AC = 4.5 inches										
	SM: SILTY SAND: dark yellowish brown, moist, loose, fine to coarse grained	✋				38					
		■		7			110	9			
5	**CL-ML: CLAYEY SILT:** dark yellowish brown with light brown, moist, soft with white mottling, dense, less sand	■		7			114	11			
	SM: SILTY SAND: dark yellowish brown, moist, loose, fine to coarse grained										
	End of boring.										
10											
15											
20											
25											

Completion Depth: 6.5
Date Started: 11/12/18
Date Completed: 11/12/18
California Sampler: 2.4 inch inner diameter
SPT Sampler: 1.4 inch inner diameter

Drilling Equipment: Mobile B-61 with auto hammer
Drilling Method: Hollow Stem Auger
Drive Weight: 140 pounds
Hole Diameter: 8 inches
Drop: 30 inches
Remarks: Borings backfilled with soil cuttings.

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LOG OF BORING NO. B-8

Project Name:	**Bessie Owens Intermediate Modernization**
Project Number:	**G18-268-11B**
Project Location:	**815 Eureka Street, Bakersfield, California**
Logged by:	**V. Simental**
Checked by:	**O. Lau**

Surface El.:
Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		Surface: Grass										
		SM: SILTY SAND: dark yellowish brown, moist, loose, fine to coarse grained, trace clay	✋				38					
			■		6			100	12			
		no clay										
5			■		11			110	9			
		ML: SANDY SILT: dark yellowish brown, moist, firm, fine to coarse grained sand										
10		**SP: POORLY GRADED SAND:** light yellowish brown, slightly moist, medium dense, fine to coarse grained	■		16			109	3			
		End of boring.										
15												
20												
25												

Completion Depth:	11.5	**Drilling Equipment:**	Mobile B-61 with auto hammer
Date Started:	11/12/18	**Drilling Method:**	Hollow Stem Auger
Date Completed:	11/12/18	**Drive Weight:**	140 pounds
California Sampler:	2.4 inch inner diameter	**Hole Diameter:**	8 inches
SPT Sampler:	1.4 inch inner diameter	**Drop:**	30 inches
		Remarks:	Borings backfilled with soil cuttings.

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LOG OF BORING NO. B-9

Project Name: **Bessie Owens Intermediate Modernization**
Project Number: **G18-268-11B**
Project Location: **815 Eureka Street, Bakersfield, California**
Logged by: **V. Simental**
Checked by: **O. Lau**

Depth, feet	Graphic Log	Surface El.: Location: MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetro-meter, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		Surface: Grass										
		SM: SILTY SAND: dark yellowish brown, moist, loose, fine to coarse grained, trace fine subangular gravel	✋				34					
			■		7			107	17			
		trace clay and debris, no gravel										
5			■		12			114	14			
		no clay and debris										
10			■									
		SP: POORLY GRADED SAND: light yellowish brown, slightly moist, medium dense, fine to coarse grained, trace fine subangular gravel			20			108	4			
15		moist	☒		14				3			
		End of boring.										
20												
25												

Completion Depth:	16.5	**Drilling Equipment:**	Mobile B-61 with auto hammer
Date Started:	11/12/18	**Drilling Method:**	Hollow Stem Auger
Date Completed:	11/12/18	**Drive Weight:**	140 pounds
California Sampler:	2.4 inch inner diameter	**Hole Diameter:**	8 inches
SPT Sampler:	1.4 inch inner diameter	**Drop:**	30 inches
		Remarks:	Borings backfilled with soil cuttings.

APPENDIX B

LABORATORY TESTING RESULTS

APPENDIX B
LABORATORY TESTING

Moisture-Density Tests

The field moisture content, as a percentage of dry weight of the soils, was determined by weighing the samples before and after oven drying in accordance with ASTM D 2216 test procedures. Dry densities, in pounds per cubic foot, were also determined for undisturbed core samples in general accordance with ASTM D 2937 test procedures. Test results are presented on the boring logs in Appendix A.

Direct Shear Test

Two (2) Direct Shear Tests were performed on relatively undisturbed soil samples obtained at the time of drilling in the area of planned construction. The tests were conducted to determine the soil strength characteristics. The standard test method is ASTM D3080, Direct Shear Test for Soil under Consolidated Drained Conditions. The direct shear test results are presented graphically on Figures B-1 and B-2.

Consolidation Test

Two (2) Consolidation Tests were performed on relatively undisturbed soil samples obtained at the time of drilling in the area of planned construction to evaluate compressibility and collapse potential characteristics. The samples were initially loaded under as-received moisture content to a selected stress level, were then saturated, and then incrementally loaded up to a maximum load of 5200 psf. The tests were performed in general accordance with ASTM D2435. The test results are presented on Figures B-3 and B-4.

Expansion Index Test

One (1) Expansion Index Test was performed on a bulk soil sample obtained at the time of drilling in the area of planned construction to determine the expansion characteristics of the sample. The test was performed in general accordance with ASTM Test Method D4829. The test results are presented on Figure B-5.

Soil Corrosivity

One (1) Corrosivity Evaluation was performed on a bulk soil sample obtained at the time of drilling in the area of planned construction. The soil was evaluated for minimum resistivity (ASTM G57), sulfate ion concentration (CT 417), chloride ion concentration (CT 422), and pH of soil (ASTM D4972). The test results are presented in Table B-1.

Table B-1: Summary of Corrosion Test Results

Sample Location	pH	Sulfate, ppm	Chloride, ppm	Minimum Resistivity, ohm-cm
B-6 @ 0-5 feet bgs	8.18	Not Detected	Not Detected	900

Minus #200 Wash Test

Ten (10) #200 Wash Tests were performed on selected soil samples obtained at the time of drilling in the area of planned construction. The tests were performed to determine the amount of fine material present in the subsurface material. The tests were performed in general accordance with ASTM Test Method D1140. The test results are presented in Table B-2 and the boring logs in Appendix A.

Table B-2: Summary of Minus #200 Wash Test Results

Test Location	Percent Fines
B-1 @ 0-5 feet bgs	46
B-4 @ 0-5 feet bgs	37
B-6 @ 0-5 feet bgs	41
B-7 @ 0-5 feet bgs	38
B-8 @ 0-5 feet bgs	38
B-9 @ 0-5 feet bgs	34
B-1 @ 10 feet bgs	2
B-1 @ 20 feet bgs	54
B-1 @ 30 feet bgs	16
B-1 @ 40 feet bgs	64

BSK ASSOCIATES

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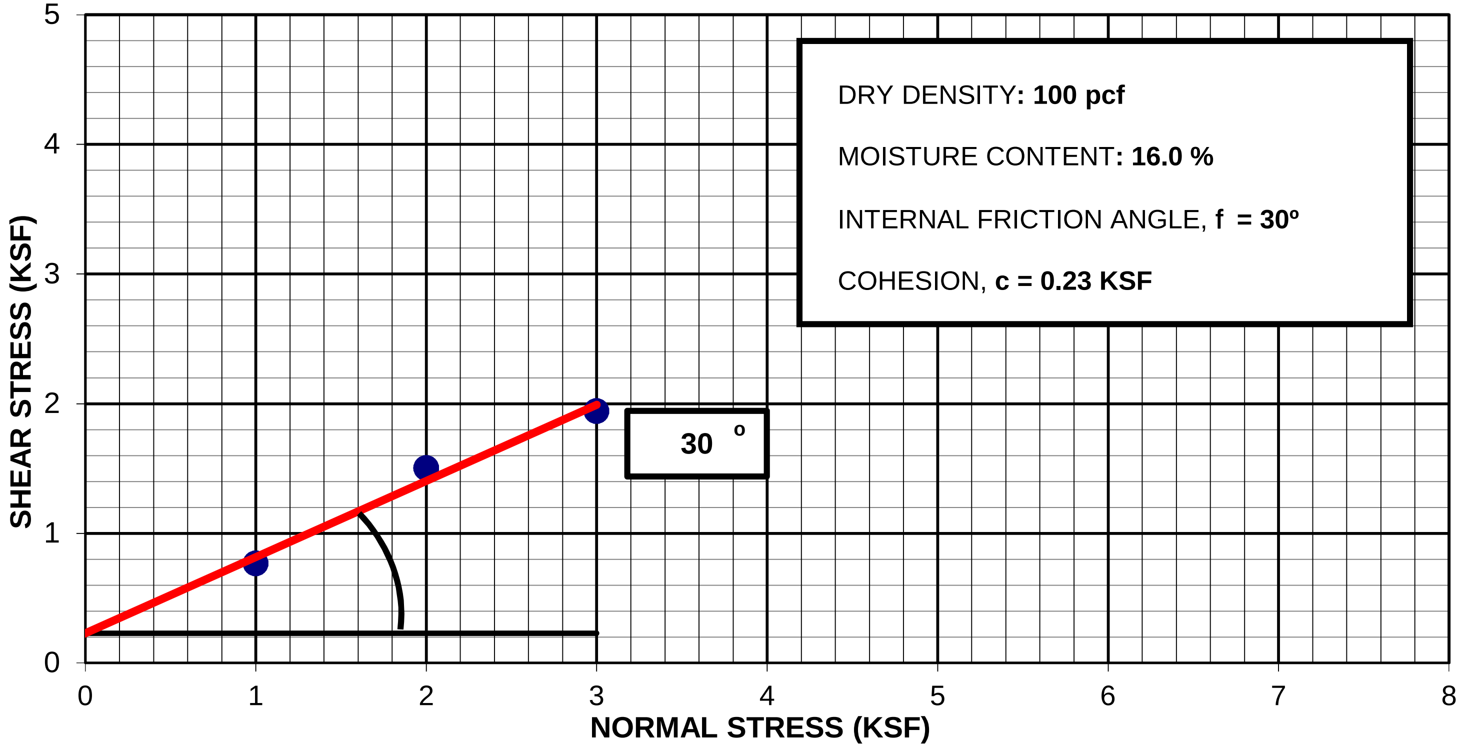
Direct Shear Test

ASTM D 3080

Project Name: BCSD Bessie Owens IS Modernization
Project Number: G18-268-11B
Lab Tracking ID: B18-418
Sample Location: B-5 @ 3.0-3.5 feet bgs
Sample Description: SM: Silty Sand: dark yellowish brown, fine to coarse grained, moist

Sample Date: 11/12/2018
Test Date: 11/12/2018
Report Date: 11/21/2018
Sampled By: V. Simental
Tested By: E. Lopez

SHEAR STRENGTH DIAGRAM



DRY DENSITY**: 100 pcf**

MOISTURE CONTENT**: 16.0 %**

INTERNAL FRICTION ANGLE, **f = 30º**

COHESION, **c = 0.23 KSF**

Figure B-1

Reviewed by: *Daisy Elizondo*

ASSOCIATES

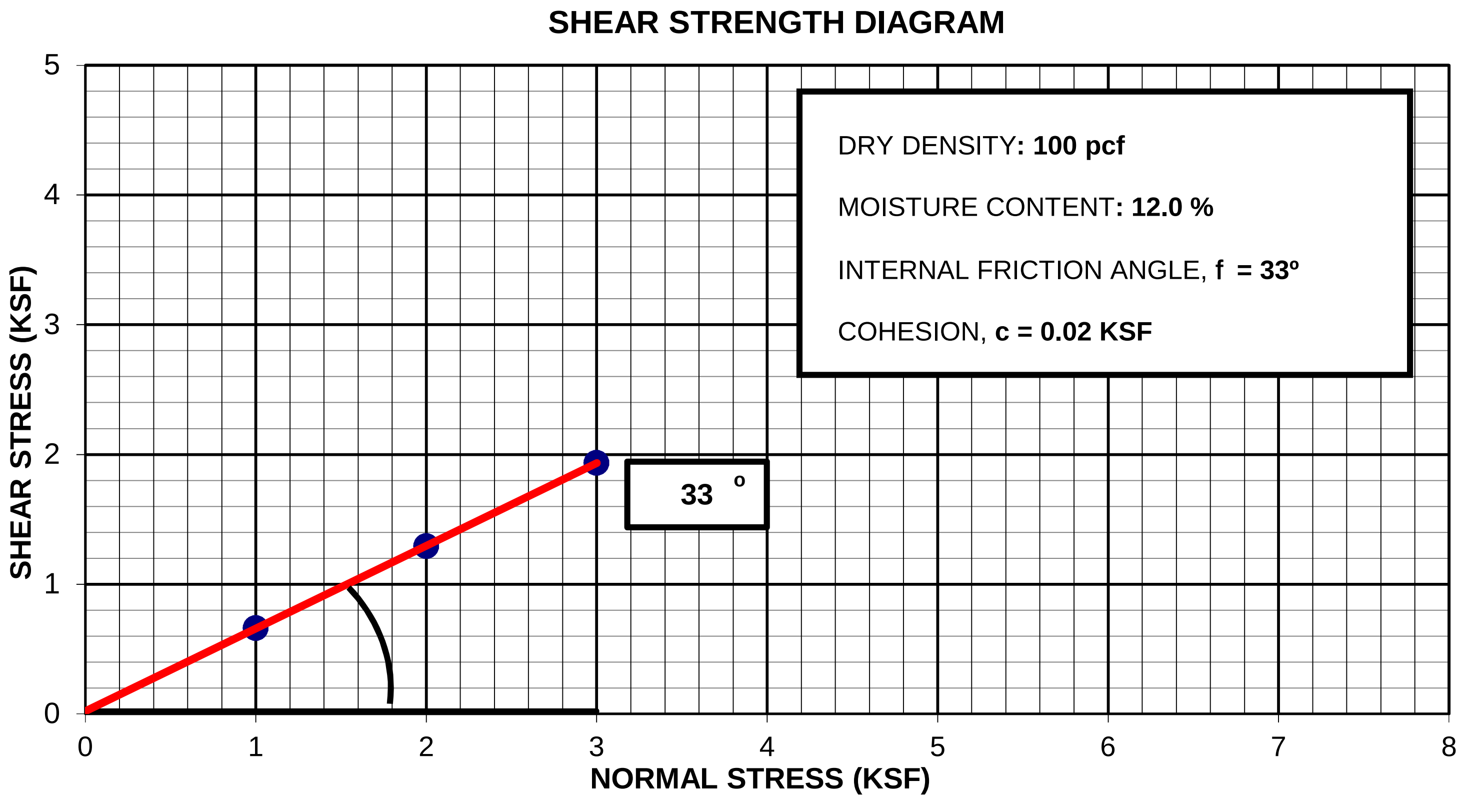
Direct Shear Test

ASTM D 3080

700 22nd St
Bakersfield, CA
Ph: (661) 327-0671
Fax: (661) 324-4218

Project Name: BCSD-Bessie Owens IS Modernization
Project Number: G18-268-11B
Lab Tracking ID: B18-418
Sample Location: B-8 @ 6.0-6.5 feet bgs
Sample Description: SM: Silty Sand: dark yellowis brown, fine to coarse grained, moist

Sample Date: 11/12/2018
Test Date: 11/12/2018
Report Date: 11/21/2018
Sampled By: V. Simental
Tested By: E. Lopez



DRY DENSITY: **100 pcf**

MOISTURE CONTENT: **12.0 %**

INTERNAL FRICTION ANGLE, **f = 33º**

COHESION, **c = 0.02 KSF**

Figure B-2

Reviewed by: *Daisy Elizondo*

BSK ASSOCIATES

Consolidation Test

ASTM D 2435, One-Dimensional Analysis

700 22nd St
Bakersfield, CA
Ph: (661) 327-0671
Fax: (661) 324-4218

Project Name: BCSD-Bessie Owens IS Modernization
Project Number: G18-268-11B
Sample Location: B-2 @ 11.0-11.5 feet bgs
Sample Description: SP: Poorly Graded Sand: yellowish brown, fine to coarse grained, moist

Sample Date: 11/12/2018
Test Date: 11/13/2018
Sampled By: V. Simental
Tested By: I.L.T.Remotigue

Collapse Potential: 0.01 percent collapse at 1300 psf
Peak Load (psf): 5200

Dry Density (pcf): 105
Initial Moisture Content (%): 9

CONSOLIDATION PROPERTIES

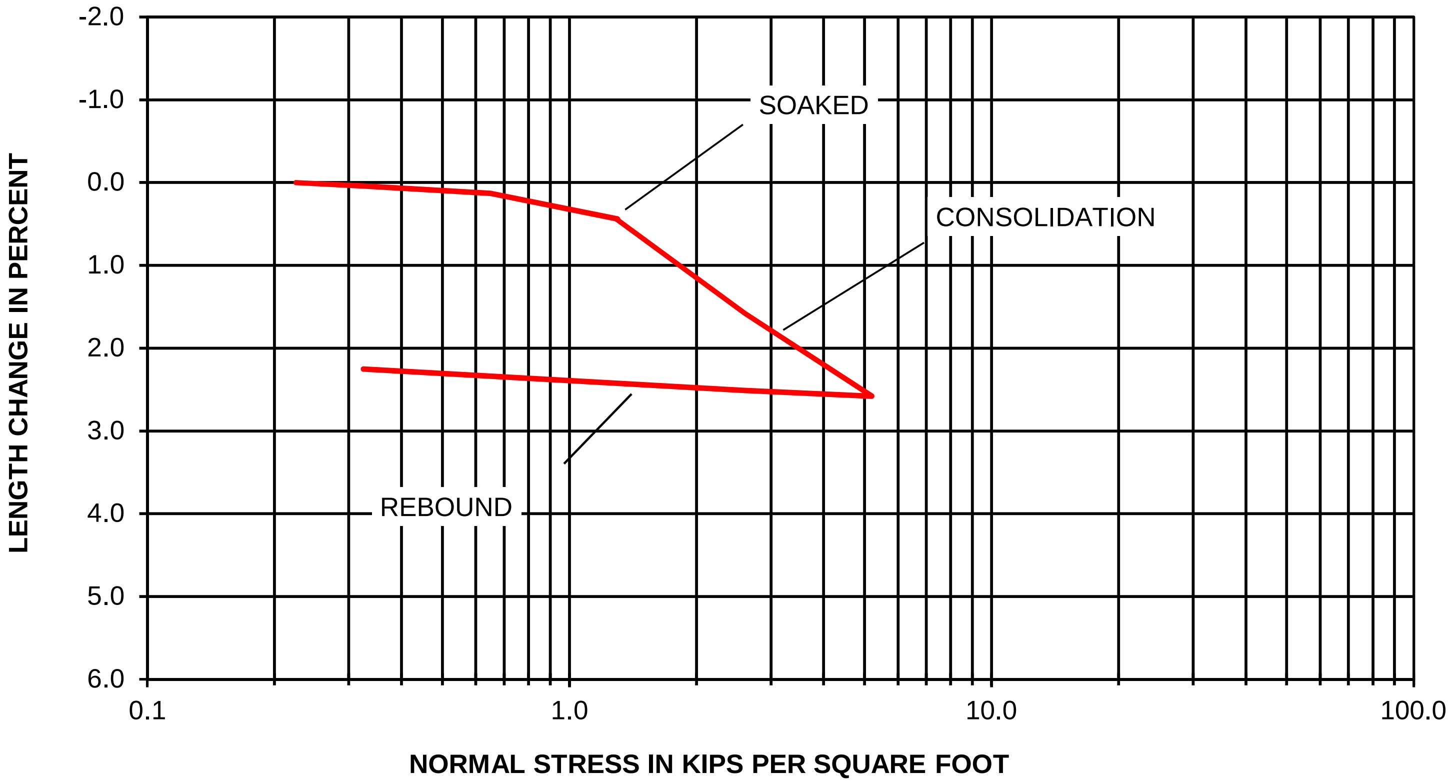


Figure B-3

700 22nd St
Bakersfield, CA
Ph: (661) 327-0671
Fax: (661) 324-4218

Consolidation Test

ASTM D 2435, One-Dimensional Analysis

Project Name: BCSD-Bessie Owens IS Modernization
Project Number: G18-268-11B
Sample Location: B-9 @ 11.0-11.5 feet bgs
Sample Description: SP: Poorly Graded Sand: lt. yellowish brown, sl. moist, fine to coarse

Sample Date: 11/12/2018
Test Date: 11/13/2018
Sampled By: V. Simental
Tested By: I.L.T.Remotigue

Collapse Potential: 0.26 percent collapse at 1300 psf
Peak Load (psf): 5200

Dry Density (pcf): 108
Initial Moisture Content (%): 4

CONSOLIDATION PROPERTIES

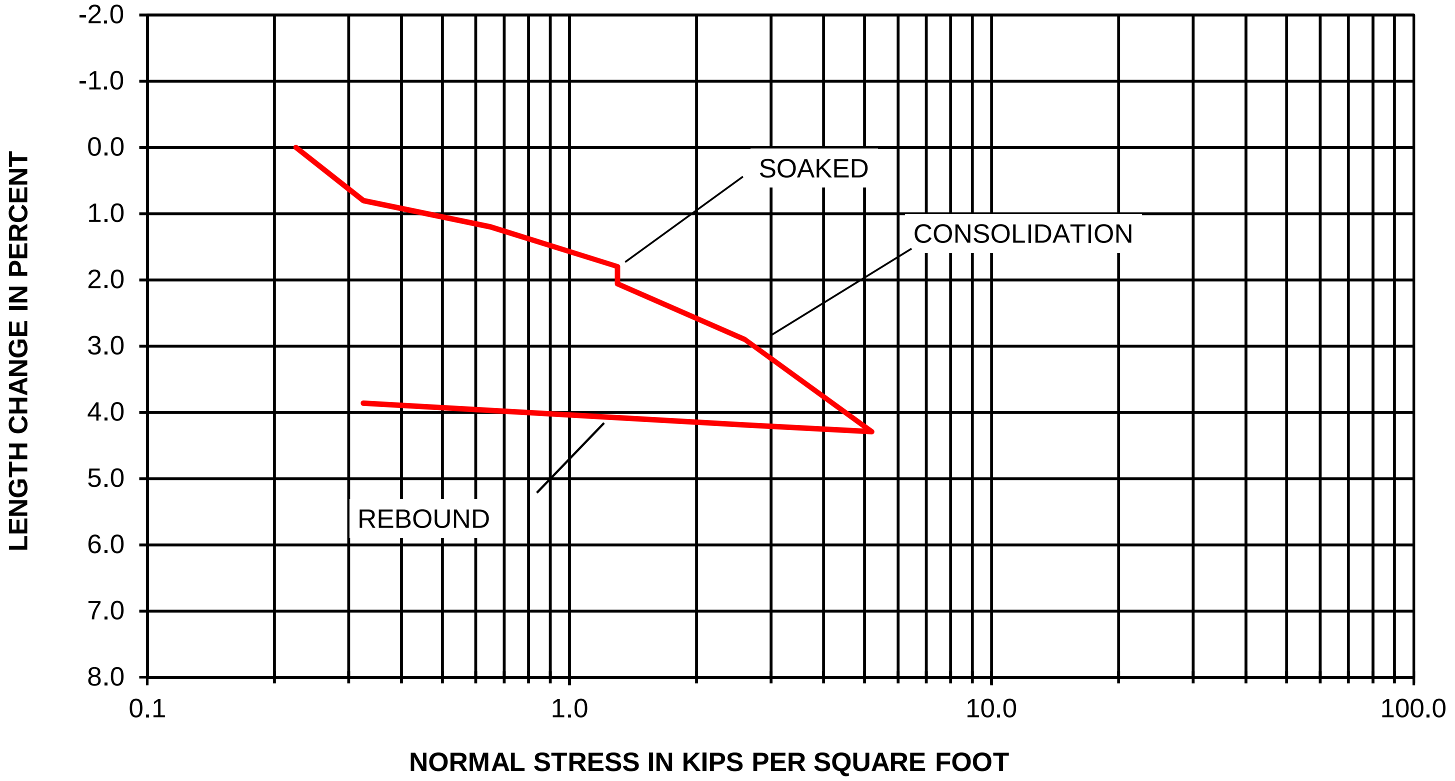


Figure B-4

EXPANSION INDEX OF SOILS

ASTM D 4829 / UBC STANDARD 18-2

700 22nd Street
Bakersfield, CA 93301
Ph: (661) 327-0671
Fax: (661) 324-4218

Project Name: BCSD - Bessie Owen IS Modernization
Project Number: G18-268-11B
Sample Date: 11/12/2018
Lab Tracking ID: B18-418
Test Date: 11/15/2018
Sample Location: B-6 @ 0-5 feet bgs
Sample Source Native
Sampled By: V. Simental
Tested By: M. Zavala II
Reviewed By: D. Elizondo

TEST DATA

INITIAL SET-UP DATA		FINAL TAKE-DOWN DATA	
Sample + Tare Weight (g)	785.7	Sample + Tare Weight (g)	812.2
Tare Weight (g)	368.2	Tare Weight (g)	368.2
Moisture Content Data		Moisture Content Data	
Wet Weight + Tare	100.0	Wet Weight + Tare	812.2
Dry Weight + Tare	92.6	Dry Weight + Tare	755.1
Tare Weight (g)	0	Tare Weight (g)	368.2
Moisture Content (%)	8.0%	Moisture Content (%)	14.8%
Initial Volume (ft^3)	0.007272	Final Volume (ft^3)	0.007327
Remolded Wet Density (pcf)	126.6	Final Wet Density (pcf)	133.6
Remolded Dry Density (pcf)	117.2	Final Dry Density (pcf)	116.4
Degree of Saturation	49.3	Degree of Saturation	89

EXPANSION READINGS

Initial Gauge Reading (in)	0.2573
Final Gauge Reading (in)	0.2649
Expansion (in)	0.0076

Expansion Index, EI	8

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Remarks: The material has a very low expansion potential

Figure B-5

APPENDIX C

GEOLOGIC AND SEISMIC HAZARDS ASSESSMENT

Table of Contents

Tables

Figures

C1.0 INTRODUCTION

This report presents the preliminary geologic and seismic hazards evaluation prepared in accordance with 2016 California Building Code (CBC), CCR Title 24, Chapters 16 and 18 requirements for a Geotechnical/Engineering Geologic Report. The evaluation was performed in conformance with California Geologic Survey Note 48 (October 2013).

C1.1 Objective and Scope of Services

The objective of the geologic and seismic hazards assessment is to provide the Client with an evaluation of potential geologic or seismic hazards that may be present at the site or due to regional influences. BSK's scope of services for this assessment included the following: a review of published geologic literature; an evaluation of the data collected; determination of site class and seismic design parameters; liquefaction and seismic settlement analyses.

C1.2 Site Location

Bessie Owens Intermediate School is located at 815 Eureka Street in Bakersfield, Kern County, California (Site). The Site coordinates of the center of the property are:

Latitude 35.37073ºN
Longitude -118.99270ºW

C1.3 Site Topography

As shown on Figure C-1, the Site and surrounding area topography is relatively flat with a ground surface elevation between of approximately 410 feet msl, USGS datum. The Site and surrounding area slopes down slightly to the south.

C1.4 Groundwater Conditions

The Site is within the Kern County Sub-Basin of the San Joaquin Valley Basin Hydrologic Study Area. This includes approximately the southern two-thirds of the Great Valley. Within the Study Area, 39 groundwater basins and areas of potential storage have been identified. The boundaries of these areas are based largely on hydrologic as well as political considerations.

At the time of the field exploration in November 2018 groundwater was not encountered in our borings completed to a depth of 43.5 feet below the ground surface (bgs) To ascertain groundwater levels for the area during other time periods, groundwater elevation data from the California Department of Water Resources (DWR) were obtained for the period 1950 to 1965. The water level hydrograph from a well in the vicinity Site are presented on Figure C-2. The hydrograph indicates that, in the vicinity of the Site, the historical shallowest depth to groundwater was approximately 71 (bgs).

C2.0 GEOLOGIC SETTING

The Site is located in the transitional area of the Great Valley geomorphic province and the Sierra Nevada geomorphic province. The Site is located in the structural region identified by the U.S.G.S. (Bartow, 1991) as the San Joaquin Valley portion of the southern Sierran block. This area forms a broad syncline with deposits of marine and overlying continental sediments, Jurassic to Holocene in age. The thickness of the sediments increases to the west and reach a thickness of as much as 20,000-feet on the west side of the San Joaquin Valley syncline. Northeast of the Site, the relatively flat geomorphology transitions into the foothills of Sierra Nevada, which generally consist of pre-Cretaceous metamorphic rocks, Mesozoic ultramafic rocks, and Mesozoic granitic rocks.

As shown on Figure C-3, the Site is located on the contact of alluvial fan deposits and alluvial valley deposits.

Nearby significant active faults include the White Wolf Fault located approximately 18 miles southeast of the site, the Garlock Fault located approximately 36 miles south of the Site, and the San Andreas Fault located approximately 38 miles southwest of the Site.

C2.1 Subsurface Soil Conditions

Subsurface conditions are described in the main body of the report. As shown on Figure C-4, the Site was the subject of a field investigation program of eight soil borings completed in November 2018. The subsurface units encountered consist of silty sand, sand and silt/sandy silt with a silty clay layer encountered at 26 feet to 30 feet bgs. Figure C-5 presents a geologic cross section showing the subsurface units encountered at the Site.

C3.0 GEOLOGIC/SEISMIC HAZARDS

The types of geologic and seismic hazards assessed include surface ground fault rupture, liquefaction, seismically induced settlement, slope failure, flood hazards and inundation hazards.

C3.1 Fault Rupture Hazard Zones in California

The purpose of the Alquist-Priolo Geologic Hazards Zones Act, as summarized in CDMG Special Publication 42 (SP 42), is to "prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." As indicated by SP 42, "the State Geologist is required to delineate "earthquake fault zones" (EFZs) along known active faults in California. Cities and counties affected by the zones must regulate certain development 'projects' within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting.

As shown on Figure C-6, the Site is not located in a Fault-Rupture Hazard Zone. The closest Fault-Rupture Hazard Zone is associated with the Kern Front Fault located approximately 6 miles northwest of the Site.

C3.2 State of California Seismic Hazard Zones (Liquefaction and Landslides)

Zones of Required Investigation referred to as "Seismic Hazard Zones" in CCR Article 10, Section 3722, are areas shown on Seismic Hazard Zone Maps where site investigations are required to determine the need for mitigation of potential liquefaction and/or earthquake-induced landslide ground displacements. The site is within the Lamont 7.5 Minute Quadrangle and there are no mapped areas that have Seismic Hazard Zones in the project area.

C3.3 Slope Stability and Potential for Slope Failure

The Site and surrounding areas are essentially flat and the potential hazard due to landslides from adjacent properties is not applicable.

C3.4 Flood and Inundation Hazards

An evaluation of flooding at the Site includes review of potential hazards from flooding during periods of heavy precipitation and flooding due to a catastrophic dam breach from up-gradient surface impoundments.

C3.4.1 Flood Hazards

Federal Emergency Management Agency (FEMA) flood hazard data was obtained to present information regarding the potential for flooding at the Site. As shown on Figure C-7, according to FEMA Flood Hazard Map Layer GIS data, NFHL_06029C, Dated 3/28/2016, the Site lies in Zone X, outside the 100-year and 500-year floodplains.

C3.4.2 Inundation Hazards – Dams

As shown on Figure C-7, according to the GIS data obtained from California Emergency Management Agency, the Site is located in the Lake Isabella Dam inundation area.

C3.5 Volcanic Hazards

According to USGS Bulletin 1847, dated 1989, the Site is not located in an area which would be subject to hazards from volcanic eruptions.

C3.6 Land Subsidence

Four types of subsidence are known to occur in the San Joaquin Valley (Galloway, 1999). In order of decreasing magnitude they are:

(1) Subsidence caused by aquifer system compaction due to the lowering of ground-water levels by sustained ground-water overdraft;

(2) Subsidence caused by the hydrocompaction of moisture-deficient deposits above the water table;

(3) Subsidence related to fluid withdrawal from oil and gas fields; and

(4) Subsidence related to crustal neotectonic movements.

The Site is not located in an area susceptible to subsidence due to petroleum withdrawal. The Site is not located in an area with historical subsidence due to groundwater withdrawal. (Borcher, 2014). The Site is not located in an area in which soils are known to be impacted by hydro-compaction.

C4.0 SEISMIC HAZARD ASSESSMENT

C4.1 Seismic Source Deaggregation

Figure C-8 presents fault maps showing the major faults that may impact the Site in the future. Seismically induced ground motion at a Site can be caused by earthquakes on any of the sources surrounding the site. Deaggregation of the seismic hazard was performed by using the USGS Interactive Deaggregation website. The deaggregation determination, at the maximum considered earthquake (MCE) hazard level, results in distance, magnitude and epsilon (ground-motion uncertainty) for each source that contributes to the hazard. Each source has a corresponding epsilon, which is the probabilistic value relative to the mean value of ground motion for that source.

Deaggregation based on a probabilistic model developed by the USGS indicates that the extreme seismic source with the highest magnitude that contributes to the peak ground acceleration (PGA) is a magnitude 7.90 earthquake from the San Andreas Fault. For liquefaction and seismic settlement, the modal magnitude (Mw) of 6.10 would be appropriate for probabilistic input parameter that is consistent with the design earthquake ground motion.

C4.2 Historical Seismicity

Table C-1 provides the location, earthquake magnitude, site to earthquake distances, dates and the resulting site peak horizontal acceleration for the period 1800 to 2016. Figure C-9 presents historical earthquake magnitudes and locations relative to the Site.

The Table C-1 shows that the Site has experienced mean plus one sigma peak horizontal acceleration up to 0.43g from an aftershock of the 1952 Kern County Earthquake on the White Wolf Fault. In general, the Site has been subjected to relatively low intensity ground motion, primarily from large earthquakes on distance faults and low magnitude earthquakes closer to the Site.

TABLE C-1
HISTORIC EARTHQUAKES WITHIN 100 MILES OF THE SITE
GROUND MOTION GREATER THAN 0.15G

File Code	Latitude (North)	Longitude (West)	Date	Depth (km)	Earthquake Magnitude	Site Acceleration (g)	Distance mi (km)
DMG	35.333	118.917	8/22/1952	0	5.8	0.43	5.0(8.0)
DMG	35.000	119.017	7/21/1952	0	7.7	0.38	25.6(41.2)
DMG	35.383	118.850	7/29/1952	0	6.1	0.38	8.1(13.0)
DMG	35.300	119.800	01/09/1857	0	7.9	0.27	45.7(73.6)
T-A	35.330	119.000	01/04/1870	0	4.3	0.25	2.8(4.6)
MGI	35.300	119.000	1/8/1903	0	4.6	0.23	4.9(7.9)
MGI	35.300	119.000	9/4/1908	0	4.6	0.23	4.9(7.9)
DMG	35.350	118.967	2/4/1954	0	4.0	0.23	2.0(3.3)
DMG	35.333	118.917	7/31/1952	0	4.5	0.22	5.0(8.0)
DMG	35.333	118.917	7/29/1952	0	4.5	0.22	5.0(8.0)
DMG	35.217	118.817	7/23/1952	0	5.7	0.20	14.5(23.3)
DMG	35.400	118.817	7/29/1952	0	5.1	0.19	10.1(16.2)
DMG	35.000	119.000	7/21/1952	0	6.4	0.19	25.6(41.2)
DMG	35.317	118.950	9/1/1952	0	4.1	0.19	4.4(7.1)
T-A	34.830	118.750	11/27/1852	0	7.0	0.19	39.8(64.0)
DMG	35.333	118.917	8/7/1952	0	4.2	0.19	5.0(8.0)
PAS	35.452	118.899	2/8/1985	11.1	4.6	0.18	7.7(12.4)
DMG	35.367	118.583	7/23/1952	0	6.1	0.18	23.1(37.1)
DMG	35.300	118.800	12/23/1905	0	5.0	0.16	11.9(19.1)
DMG	35.367	118.883	9/12/1953	0	4.1	0.16	6.2(9.9)
DMG	35.333	118.600	7/31/1952	0	5.8	0.16	22.3(35.8)

C4.3 Earthquake Ground Motion, 2016 California Building Code

C4.3.1 Site Class

Based on Section 1613A.3.2 of the 2016 California Building Code (CBC), the Site shall be classified as Site Class A, B, C, D, E or F based on the Site soil properties and in accordance with Chapter 20 of ASCE 7-10. Based on the blow counts in boring B-1, as per Table 20.3-1 of ASCE 7-10, the Site is Class D (15 ≤ N ≤50).

C4.3.2 Seismic Design Criteria

The 2016 California Building Code (CBC) utilizes ground motion based on the Risk-Targeted Maximum Considered Earthquake (MCE_R) that is define in the 2016 CBC as the most severe earthquake effects considered by this code, determined for the orientation that results in the largest maximum response to horizontal ground motions and with adjustment for targeted risk. Ground motion parameters in the 2016 CBC are based on ASCE 7-10, Chapter 11.

The United States Geologic Survey (USGS) has prepared maps presenting the Risk-Targeted MCE spectral acceleration (5% damping) for periods of 0.2 seconds (S_S) and 1.0 seconds (S_1). The values of S_S and S_1 can be obtained from the USGS Ground Motion Parameter Application available at: http://earthquake.usgs.gov/designmaps/us/application.php

The USGS Ground Motion Parameter Application and Chapter 16A of 2016 CBC based on ASCE 7-10 produced the following values based on Site Class D conditions:

TABLE C-2
SPECTRAL ACCELERATION PARAMETERS
RISK TARGETED MAXIMUM CONSIDERED EARTHQUAKE

Criteria	Value		Reference
MCE Mapped Spectral Acceleration (g)	$S_S = 1.086$	$S_1 = 0.400$	USGS Mapped Value
Site Coefficients (Site Class D)	Fa = 1.066	Fv = 1.600	ASCE Table 11.4
Site Adjusted MCE Spectral Acceleration (g)	$S_{MS} = 1.157$	$S_{M1} = 0.640$	ASCE Equations 11.4.1-2
Design Spectral Acceleration (g)	$S_{DS} = 0.771$	$S_{D1} = 0.427$	ASCE Equations 11.4.3-4

C4.3.3 Geometric Mean Peak Ground Acceleration

As per Section 1803A.5.12 of the CBC, peak ground acceleration (PGA) utilized for dynamic lateral earth pressures and liquefaction, shall be based on a site specific study (ASCE 7-10, Section 21.5) or ASCE 7-10, Section 11.8.3. The USGS Ground Motion Parameter Application based on ASCE 7-10, Section11.8.3 produced the values shown in Table C-3, based on Site Class D conditions.

TABLE C-3
GEOMETRIC MEAN PEAK GROUND ACCELERATION
MAXIMUM CONSIDERED EARTHQUAKE

Criteria	Value	Reference
Mapped Peak Ground Acceleration (g)	PGA = 0.414	USGS Mapped Value
Site Coefficients (Site Class D)	$F_{PGA} = 1.086$	ASCE Table 11.8-1
Geometric Mean PGA (g)	$PGA_M = 0.449$	ASCE Equations 11.8-1

For liquefaction analysis and seismic settlement calculations a PGA of 0.449g should be used.

C4.3.4 Seismic Design Category

As shown above, the short period design spectral response acceleration coefficient, SDS, is greater than 0.50, therefore the Site lies in Seismic Design Category D as specified in Section 1613A.3.5 of the 2016 CBC . The long period spectral response acceleration coefficient, S1, is less than 0.75, therefore the Site lies in Seismic Design Category D, based on Risk Category III. When S1 is greater than or equal to 0.75g, the Seismic Design Category is E for buildings in Risk Categories I, II, and III, and F for those in Risk Category IV.

C4.4 Liquefaction

Liquefaction describes a condition in which a saturated, cohesionless soil loses shear strength during earthquake shocks. Ground motion from an earthquake may induce cyclic reversals of shearing strains of large amplitude. Lateral and vertical movements of the soil mass, combined with loss of bearing strength, usually result from this phenomenon. Historically, liquefaction of soils has caused severe damage to structures, berms, levees and roads. Seed and Idriss (1971) demonstrated that liquefaction potential depends on soil type, void ratio, depth to groundwater, duration of shaking and confining pressures over the potentially liquefiable soil mass. Fine, well-sorted, loose sand, shallow groundwater, severe seismic ground motion and particularly long durations of ground shaking are conditions conducive for liquefaction.

In order for liquefaction triggering to occur due to ground shaking, it is generally accepted that four conditions will exist:

1. The subsurface soils are in a relatively loose state
2. The soils are saturated
3. The soils have low plasticity
4. Ground shaking is of sufficient intensity to act as a triggering mechanism

The historical depth to groundwater is greater than 71 feet bgs. Based on this, the liquefaction potential at the site is low.

C4.4.2 Lateral Spread

Lateral spreading is a potential hazard commonly associated with liquefaction where extensional ground cracking and settlement occur as a response to lateral migration of subsurface liquefiable material. These phenomena typically occur adjacent to free faces such as slopes and creek channels. Sloped ground or channel free-faces are not present in the area, therefore the potential for lateral spreading to take place at the site is low.

C4.4.3 Dynamic Compaction/Seismic Settlement

Another type of seismically induced ground failure, which can occur as a result of seismic shaking, is dynamic compaction, or seismic settlement. Such phenomena typically occur in unsaturated, loose granular material or uncompacted fill soils.

A seismic settlement analysis was performed using the program Liquefy Pro version 5.8k using soil boring data B-1. Input parameters for the liquefaction and settlement analysis were based upon:

- Soil densities estimated from soil boring data.
- PGA based upon the geometric mean peak ground acceleration or 0.449g.
- Magnitude 6.10 of controlling earthquake from Deaggregation of the seismic hazard.
- Assumed depth to groundwater of 71 feet bgs.
- A Factor-of-Safety of 1.3 was used for analysis.

Based on the analysis the total seismic settlement is estimated to be 1.5 inches with a differential settlement of 0.8 inch. Most of the settlement occurs in the loose sandy units present in the top ten feet.

C5.0 REFERENCES

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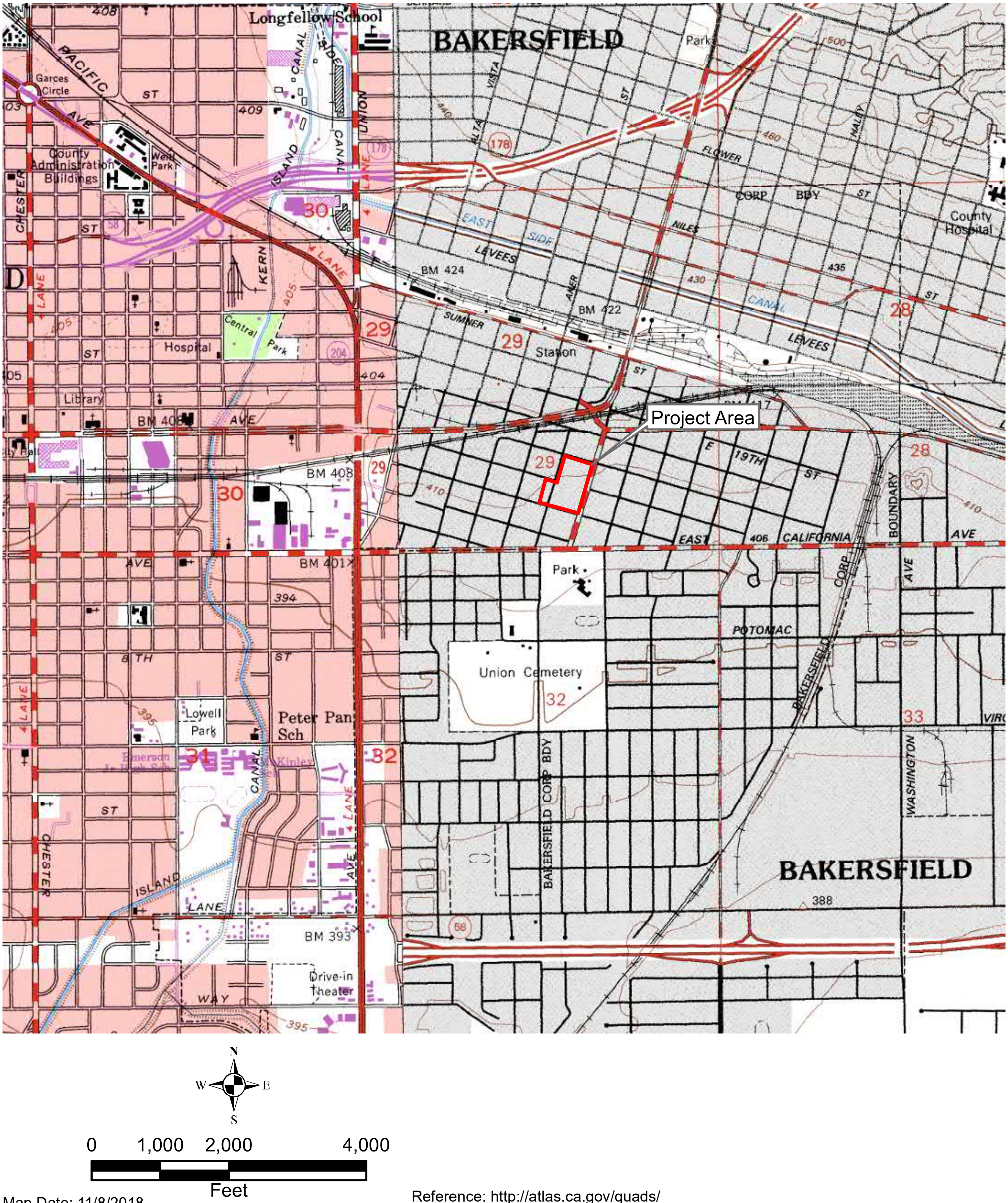


Reference: http://atlas.ca.gov/quads/

Map Date: 11/8/2018

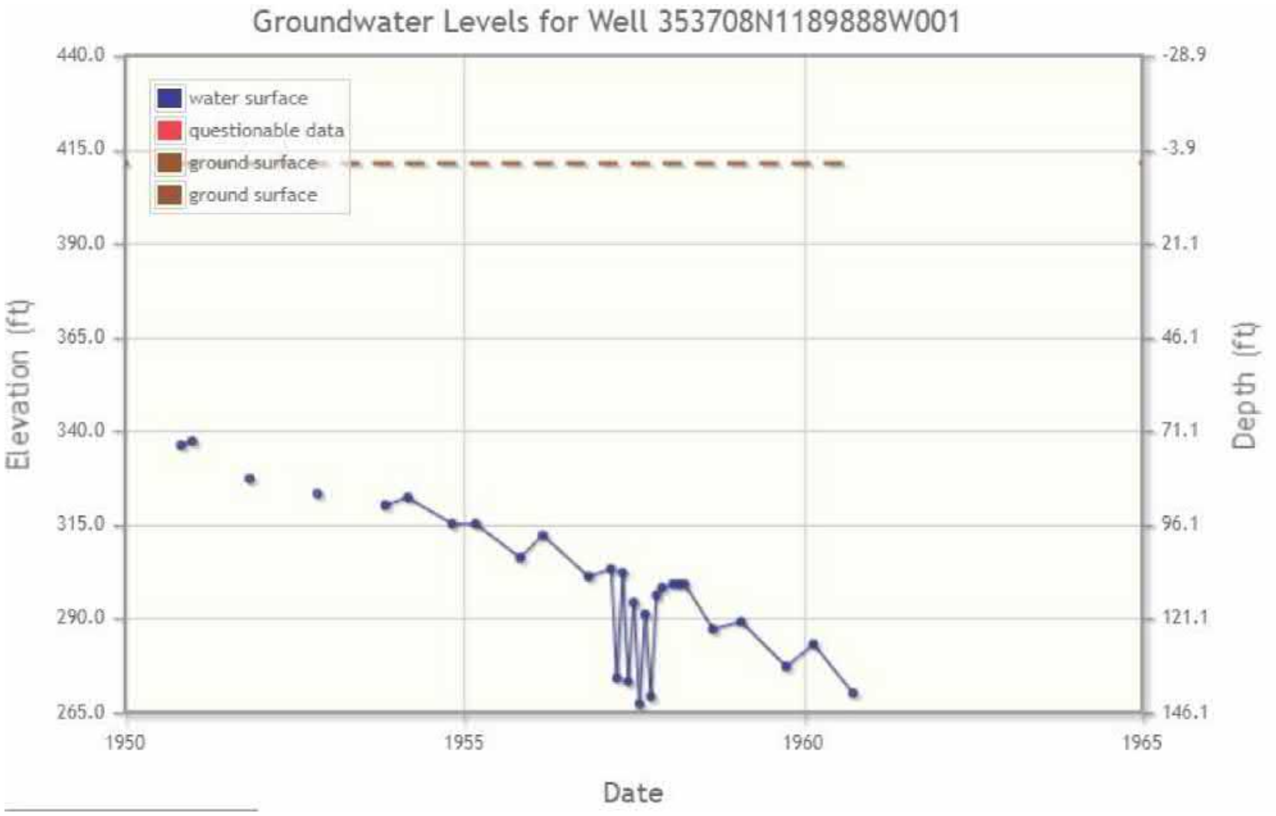
Document Path: T:\GIS-Files\Project-Files\Geotech\G1826811B - Besse Owens IS - Bakersfield\Figure C-1 Topomap.mxd

BSK ASSOCIATES

Geologic/Seismic Hazard Evaluation
Bessie Owens Intermediate School Modernization
815 Eureka Street
Bakersfield, California

Figure C-1
Topographic Map
BSK Project G1826811B

Document Path: T:\GIS-Files\Project-Files\Geotech\G1826811B - Besse Owens IS - Bakersfield\Figure C-2 hydro.mxd



State Well Number:□29S28E29R001M
Latitude (NAD83):□35.370800
Longitude (NAD83):□-118.9888
Groundwater Basin (code): Kern County (5-022.14)
Reference Point Elevation (NAVD88 ft):□411.150
Ground Surface Elevation (NAVD88 ft):□411.150

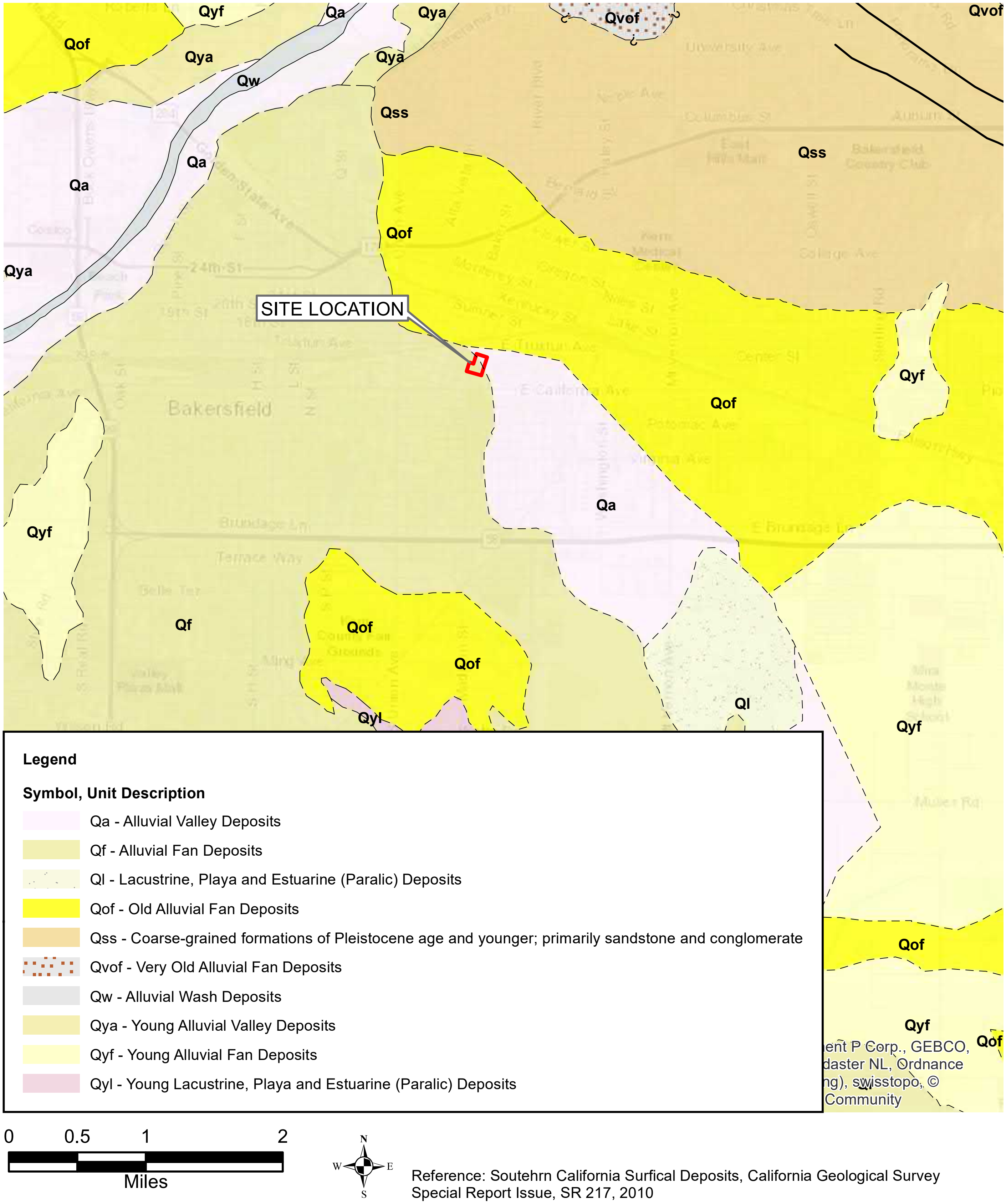
Map Date: 11/8/2018

Reference: http://www.water.ca.gov/waterdatalibrary/index.cfm

BSK ASSOCIATES

Geologic/Seismic Hazard Evaluation
Bessie Owens Intermediate School Modernization
815 Eureka Street
Bakersfield, California

Figure C-2
Area Hydrograph
BSK Project G1826811B



Reference: Soutehrn California Surfical Deposits, California Geological Survey
Special Report Issue, SR 217, 2010

Document Path: T:\GIS-Files\Project-Files\Geotech\G1826811B - Bakersfield\Figure C-3 Geology.mxd

Map Date: 11/8/2018

BSK ASSOCIATES

Geologic/Seismic Hazard Evaluation
Bessie Owens Intermediate School Modernization
815 Eureka Street
Bakersfield, California

Figure C-3
Geologic Map
BSK Project G1809111B

Document Path: T:\GIS-Files\Project-Files\Geotech\G1826811B - Besse Owens IS - Bakersfield\Figure C-4 Site Map.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map Date: 11/21/2018

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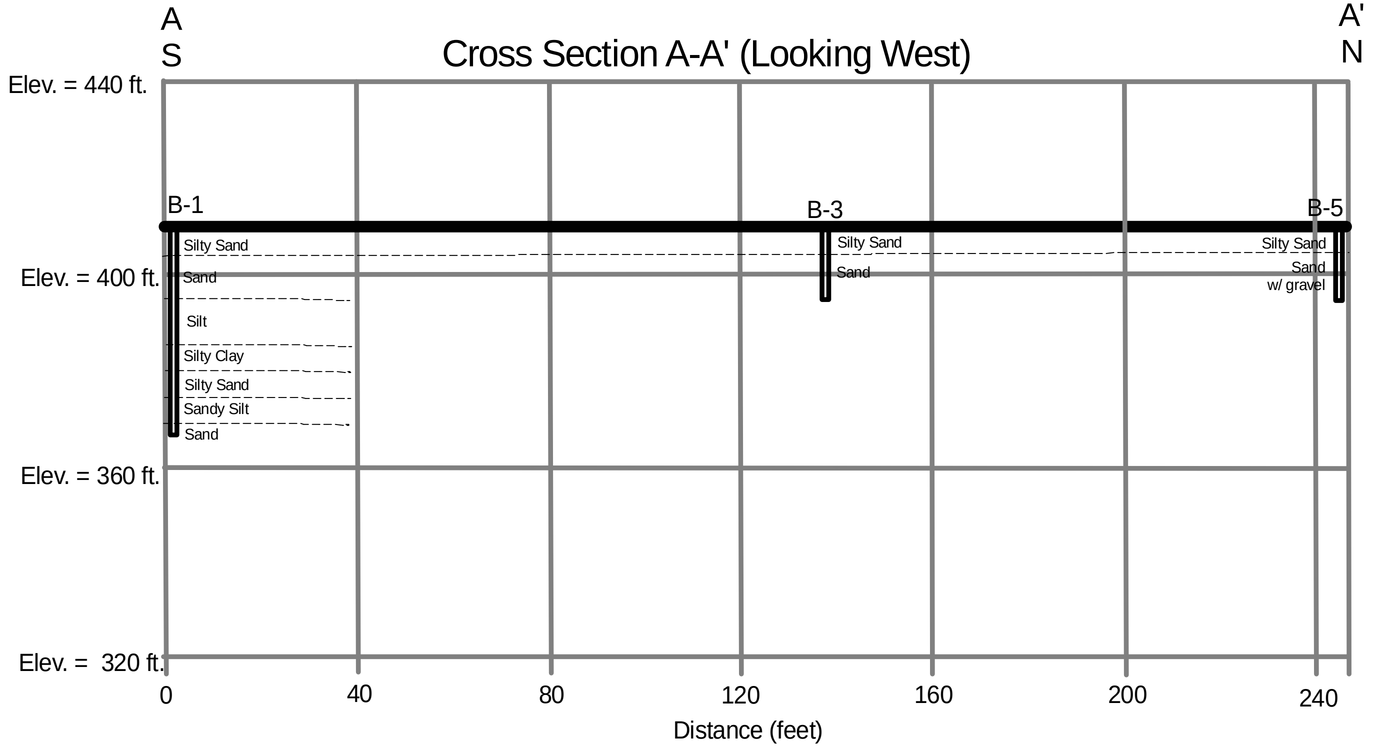
Geologic/Seismic Hazard Evaluation
Bessie Owens Intermediate School Modernization
815 Eureka Street
Bakersfield, California

Figure C-3
Site Map
BSK Project G1828611B



LEGEND

- - Unit Contact

▯ Soil Boring/CPT Location

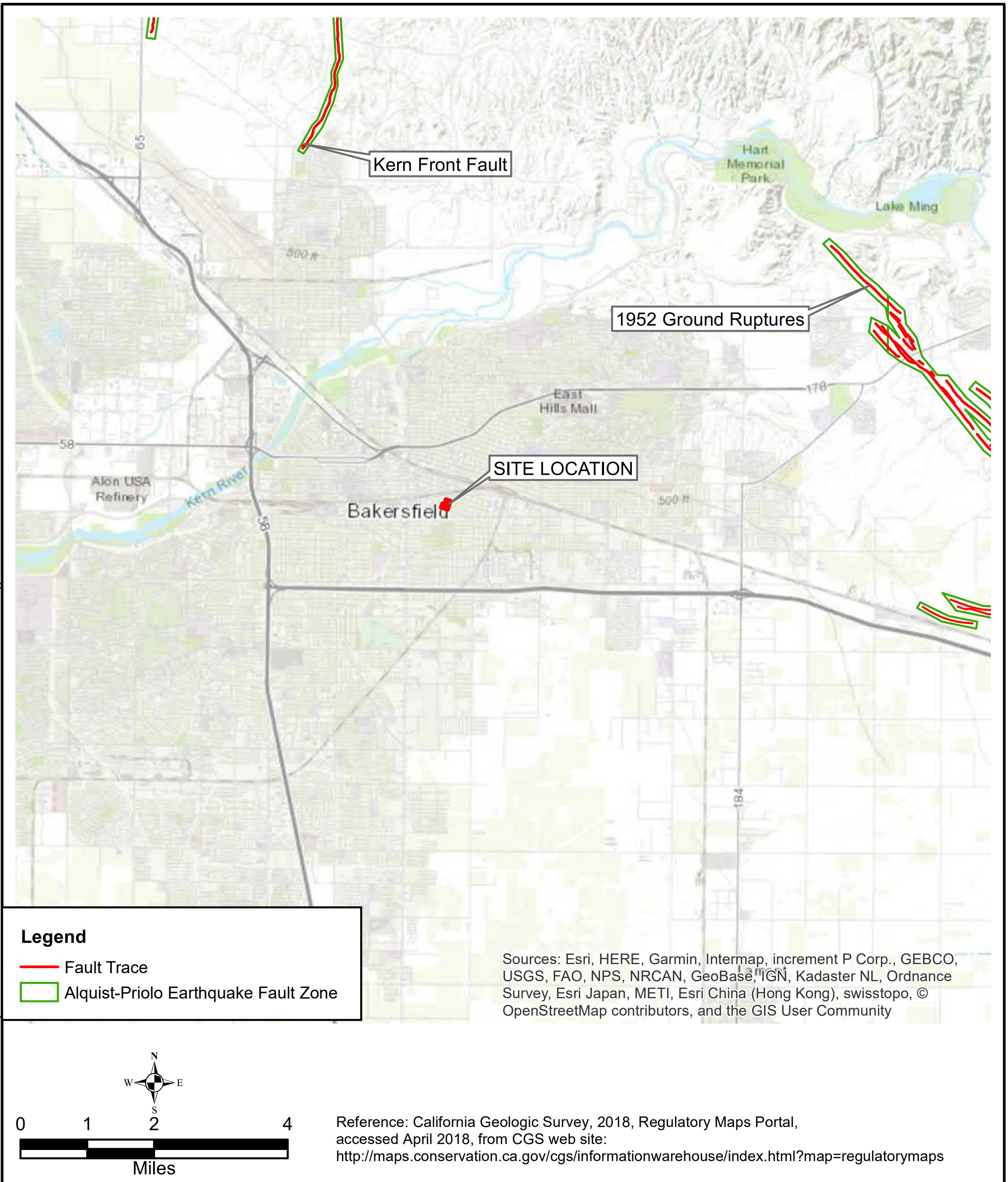
▼ Groundwater Level

NOTES:
1) Locations are Approximate.

0 40 80
Approximate Scale in Feet
Horizontal=Vertical

Geologic/Seismic Hazard Evaluation
Bessie Owens Intermediate School Modernization
815 Eureka Street
Bakersfield, California

BSK Project G1826811B
Geologic Cross Section
A-A'
Figure C-5



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Reference: California Geologic Survey, 2018, Regulatory Maps Portal, accessed April 2018, from CGS web site: http://maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps

Document Path: T:\GIS-Files\Project-Files\Geotech\G1826811B - Bakersfield\Figure C-7 AP Faults.mxd

Map Date: 11/8/2018

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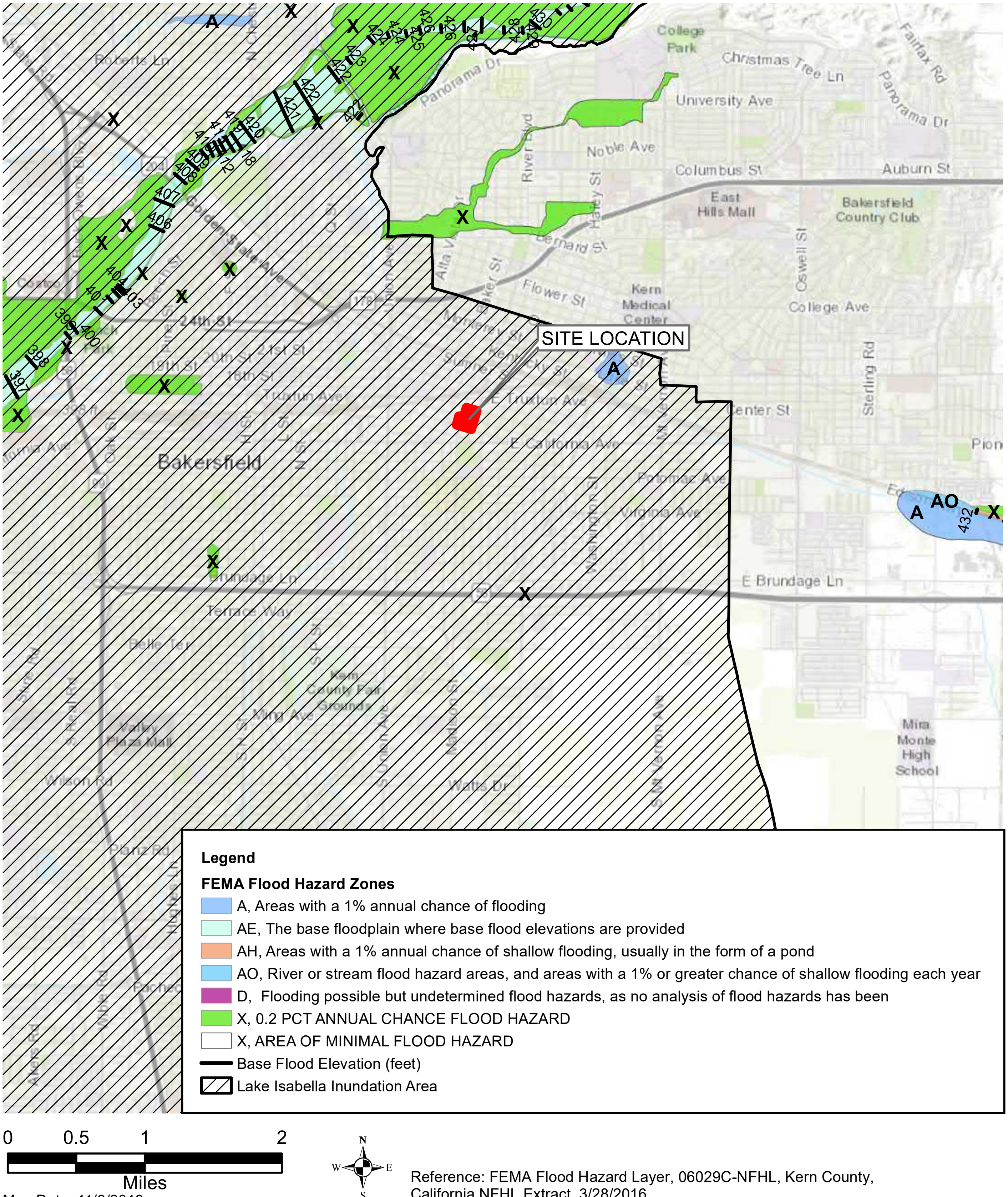
Geologic/Seismic Hazard Evaluation
Bessie Owens Intermediate School Modernization
815 Eureka Street
Bakersfield, California

Figure C-6
A-P Earthquake
Fault Zones
BSK Project G1826811B



Reference: FEMA Flood Hazard Layer, 06029C-NFHL, Kern County, California NFHL Extract, 3/28/2016

Map Date: 11/8/2018

Document Path: T:\GIS-Files\Project-Files\Geotech\G1826811B - Besse Owens IS - Bakersfield\Figure C-6 FEMA.mxd

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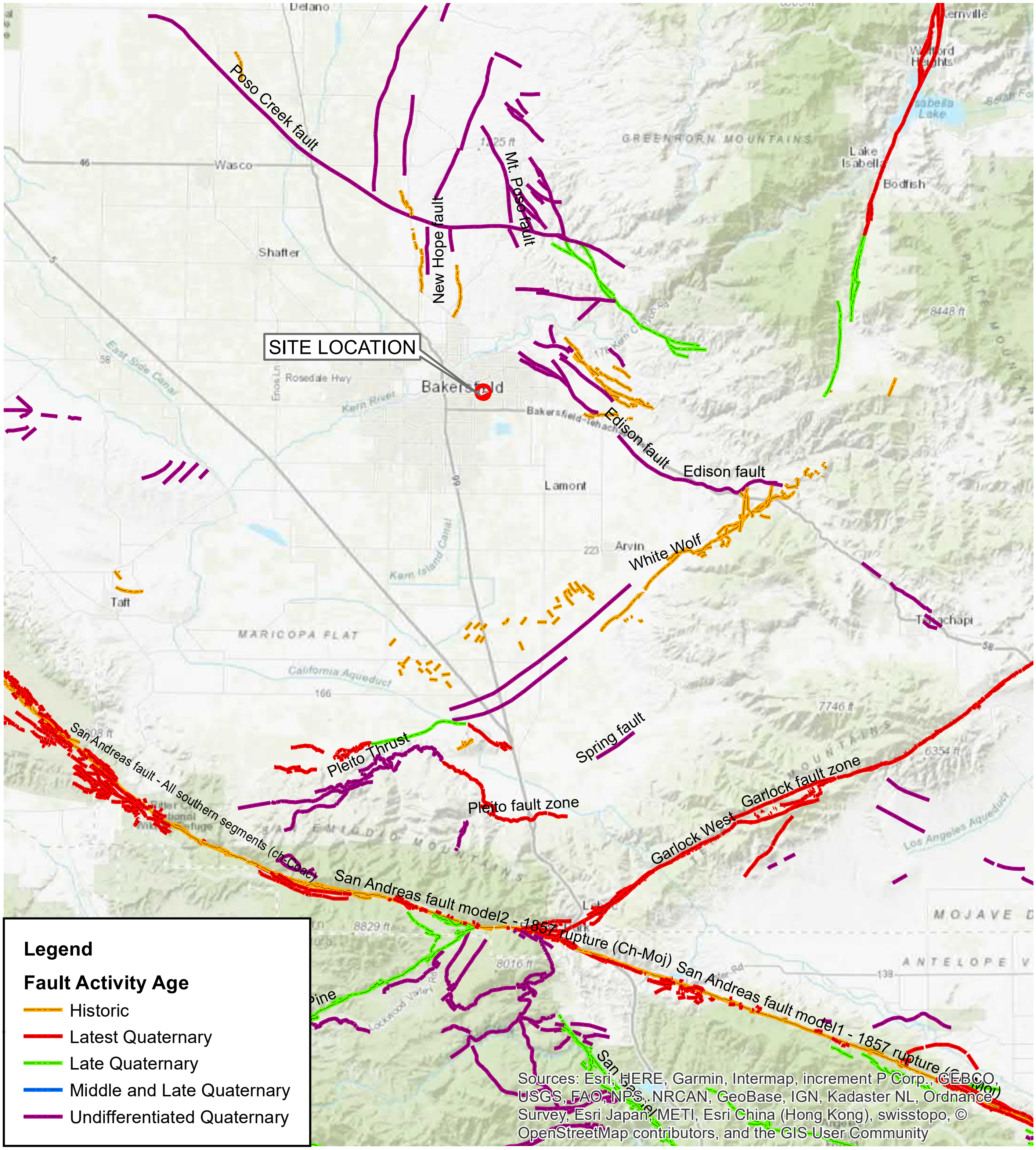
Geologic/Seismic Hazard Evaluation
Bessie Owens Intermediate School Modernization
815 Eureka Street
Bakersfield, California

Figure C-6
Flood Hazard Map
BSK Project G1826811B



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Reference:U.S. Geological Survey and California Geologic Survey, 2018, Quaternary fault and fold database for the United States, accessed Feb 2018, from USGS web site: https://earthquake.usgs.gov/hazards/qfaults/

Document Path: T:\GIS-Files\Project-Files\Geotech\G1826811B - Bessie Owens IS - Bakersfield\Figure C-8 Faults.mxd

Map Date: 11/8/2018

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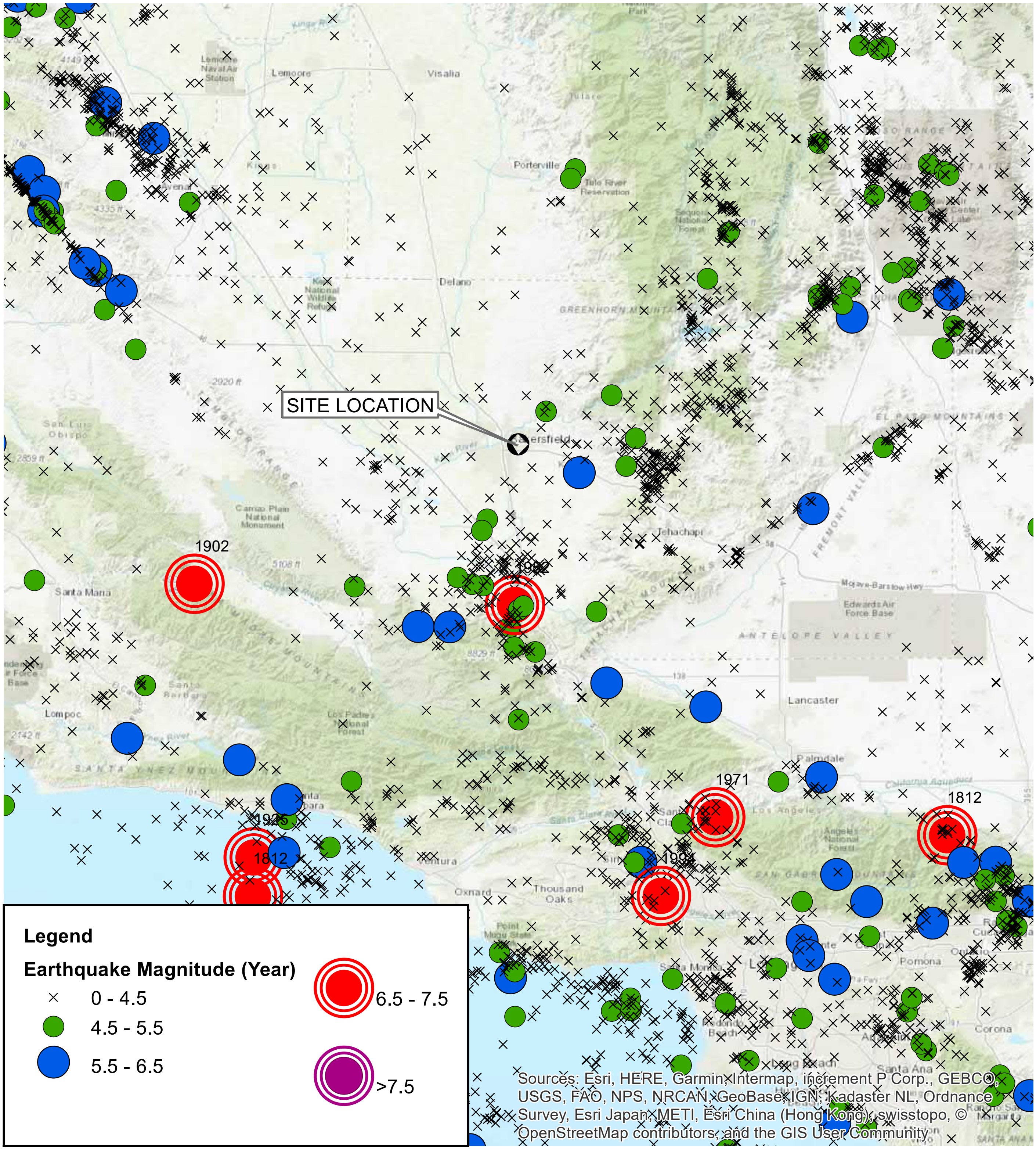
Geologic/Seismic Hazard Evaluation
Bessie Owens Intermediate School Modernization
815 Eureka Street
Bakersfield, California

Figure C-8
Area Fault Map
BSK Project G1826811B



Legend

Earthquake Magnitude (Year)

×	0 - 4.5
●	4.5 - 5.5
●	5.5 - 6.5
◎	6.5 - 7.5
◎	>7.5

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

0 12.5 25 50

Miles

N W E S

Source: National Seismic Hazard Model (NSHM) Earthquake Catalogs, 2014 NSHM Catalogs, USGS, https://github.com/usgs/nshmp-haz-catalogs

Document Path: T:\GIS-Files\Project-Files\Geotech\G1826811B - Bessie Owens IS - Bakersfield\Figure C-9 EQ-locations.mxd

Map Date: 11/8/2018

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Geologic/Seismic Hazard Evaluation
Bessie Owens Intermediate School Modernization
815 Eureka Street
Bakersfield, California

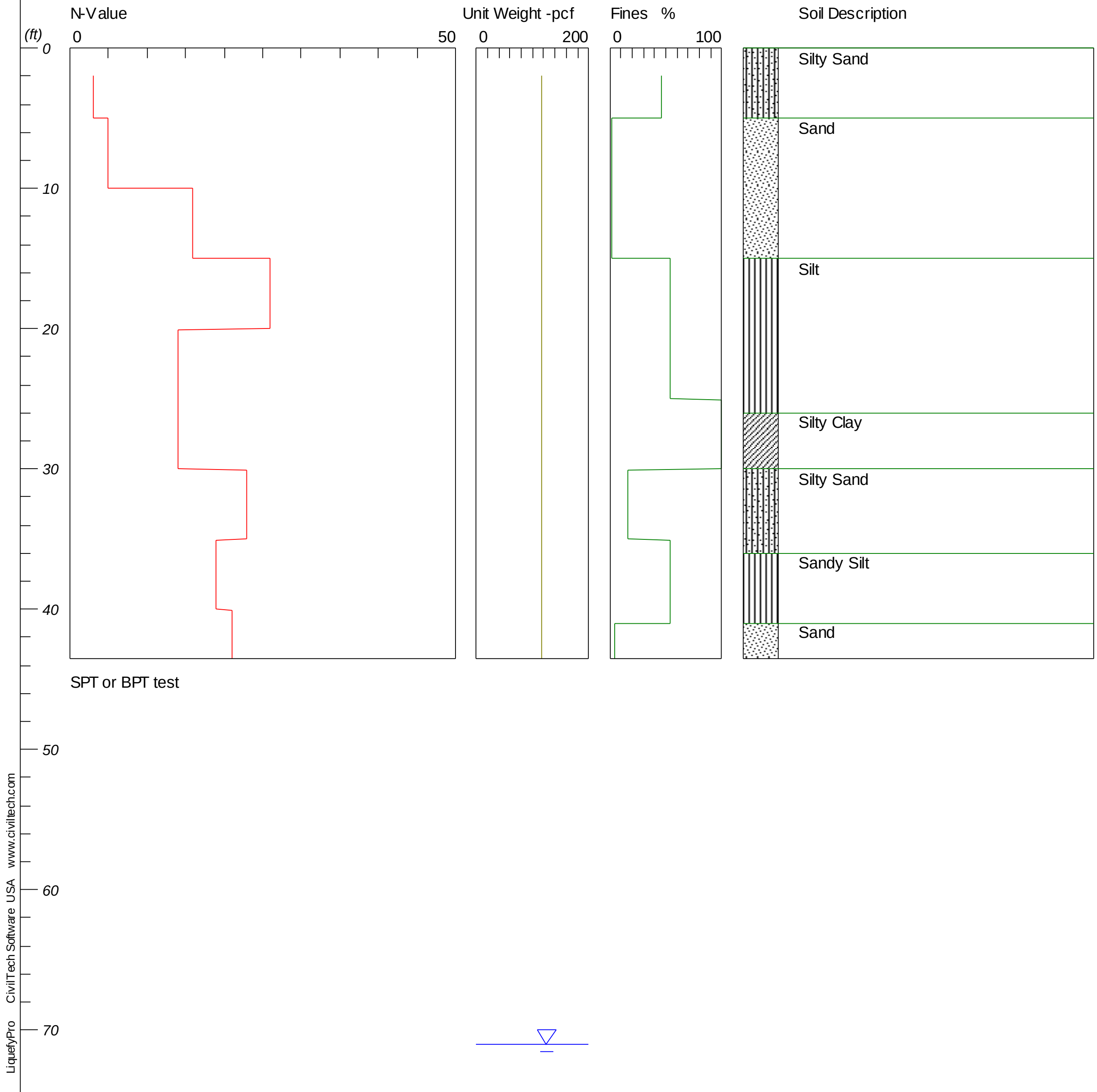
Figure C-9
Earthquake Epicenter
Map
BSK Project G1826811B

LIQUEFACTION ANALYSIS

Bessie Owens IS

Hole No.=B-1 Water Depth=71 ft

Magnitude=6.10
Acceleration=0.449g



BSK Associates

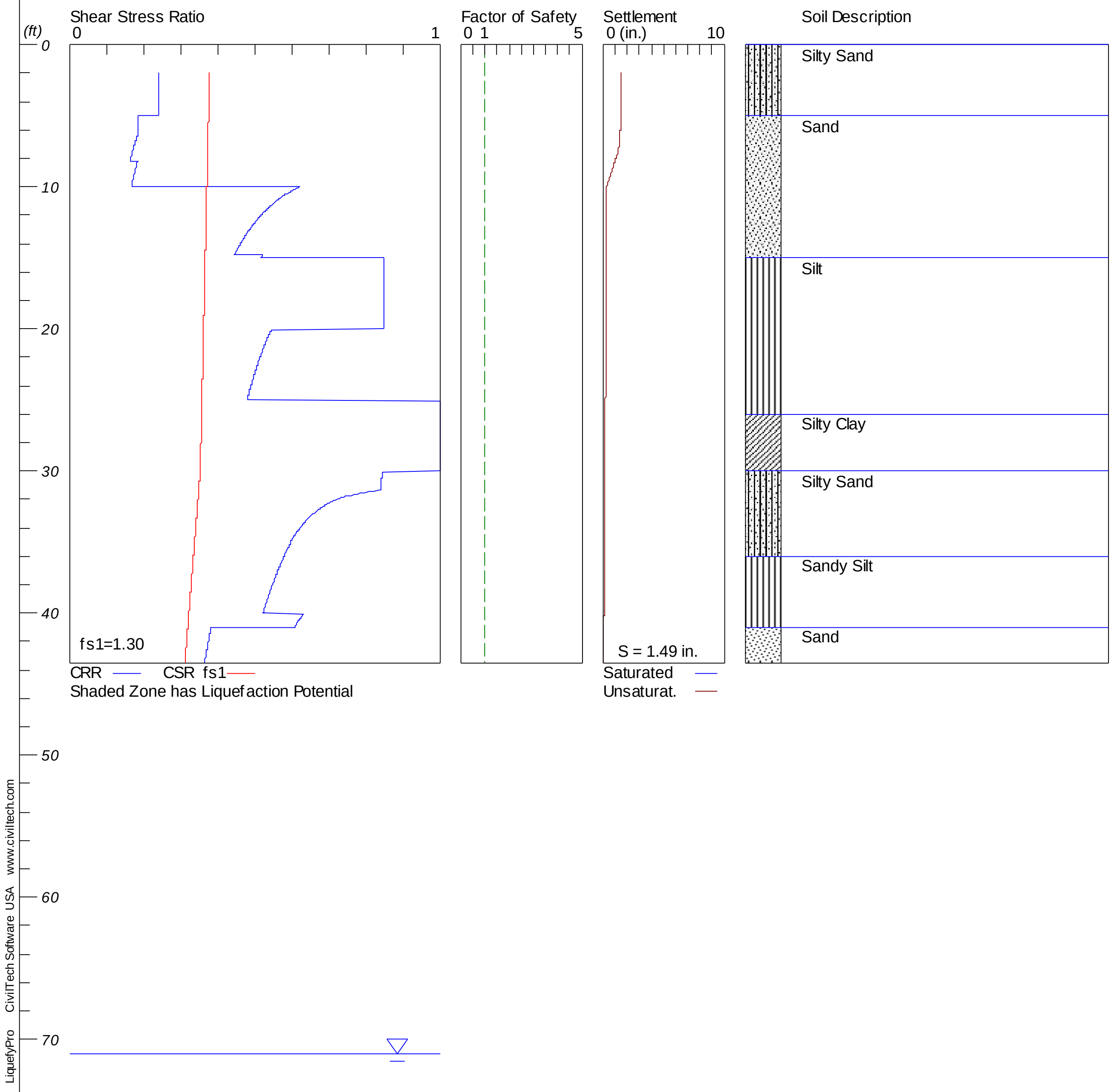
Figure C-10

LIQUEFACTION ANALYSIS

Bessie Owens IS

Hole No.=B-1   Water Depth=71 ft

Magnitude=6.10
Acceleration=0.449g



BSK Associates

Figure C-10

```
    *********************************************************************************************************
                                     LIQUEFACTION ANALYSIS SUMMARY
                                    Copyright by CivilTech Software
                                           www.civiltech.com
    *********************************************************************************************************
       Font: Courier New, Regular, Size 8 is recommended for this report.
       Licensed to ,  11/21/2018     9:42:20 AM

       Input File Name: T:\GIS-Files\Project-Files\Geotech\G1826811B - Besse Owens IS - Bakersfield\Figures\b-1.liq
       Title:  Bessie Owens IS
       Subtitle:

       Surface Elev.=
       Hole No.=B-1
       Depth of Hole= 43.50 ft
       Water Table during Earthquake= 71.00 ft
       Water Table during In-Situ Testing= 100.00 ft
       Max. Acceleration= 0.45 g
       Earthquake Magnitude= 6.10

 Input Data:
       Surface Elev.=
       Hole No.=B-1
       Depth of Hole=43.50 ft
       Water Table during Earthquake= 71.00 ft
       Water Table during In-Situ Testing= 100.00 ft
       Max. Acceleration=0.45 g
       Earthquake Magnitude=6.10
       No-Liquefiable Soils:   Based on Analysis

       1. SPT or BPT Calculation.
       2. Settlement Analysis Method: Tokimatsu, M-correction
       3. Fines Correction for Liquefaction: Stark/Olson et al.*
       4. Fine Correction for Settlement: During Liquefaction*
       5. Settlement Calculation in: All zones*
       6. Hammer Energy Ratio,                                  Ce = 1.3
       7. Borehole Diameter,                                        Cb= 1
       8. Sampling Method,                                         Cs= 1.2
       9. User request factor of safety (apply to CSR) ,   User= 1.3
          Plot one CSR curve (fs1=User)
       10. Use Curve Smoothing: No
       * Recommended Options

       In-Situ Test Data:
       Depth   SPT     gamma   Fines
       ft              pcf     %
       ____________________________________
       2.00    3.00    115.00  46.00
       5.00    5.00    115.00  2.00
       10.00   16.00   115.00  2.00
       15.00   26.00   115.00  54.00
       20.00   14.00   115.00  54.00
       25.00   14.00   115.00  NoLiq
       30.00   23.00   115.00  16.00
       35.00   19.00   115.00  54.00
       40.00   21.00   115.00  54.00
       41.00   21.00   115.00  5.00
       ____________________________________

Output Results:
       Settlement of Saturated Sands=0.00 in.
       Settlement of Unsaturated Sands=1.49 in.
       Total Settlement of Saturated and Unsaturated Sands=1.49 in.
       Differential Settlement=0.744 to 0.982 in.
```