Appendix F – Geotechnical Investigation

GEOTECHNICAL FEASIBILITY STUDY
PROPOSED INDUSTRIAL DEVELOPMENT

South of Highway 60, West of Potrero Boulevard
Beaumont, California
for
ASM Beaumont, LLC

SoCalGeo

SOUTHERN
CALIFORNIA
GEOTECHNICAL
A California Corporation

October 30, 2018

SOUTHERN CALIFORNIA GEOTECHNICAL

A California Corporation

ASM Beaumont, LLC
3990 Westerly Place, Suite 140
Newport Beach, California 92660

Attention: Mr. Courtland Armour
Development Manager

Project No.: **18G180-1**

Subject: **Geotechnical Feasibility Study**
Proposed Industrial Development
South of Highway 60, West of Potrero Boulevard
Beaumont, California

Gentlemen:

In accordance with your request, we have conducted a geotechnical feasibility study at the subject site. We are pleased to present this report summarizing the conclusions and recommendations developed from our investigation.

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

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1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of this investigation. Since this summary is not all inclusive, it should be read in complete context with the entire report.

It should be noted that this investigation was focused on determining the geotechnical feasibility of the proposed development. It was not intended to be a design-level investigation. Future studies will be necessary to further characterize the proposed development area and to refine the preliminary design parameters that are presented within this current report.

Geotechnical Design Considerations

- Significant grading will be necessary at this site. Based on the existing site topography and the elevations of adjacent streets, we estimate that cuts and fill on the order of 30 to 40± feet will be necessary to achieve the proposed site grades. Deeper fills may be necessary in the southwest-draining erosional canyon in the southern portion of the site, depending upon the proposed site grades.
- The materials encountered at the boring locations generally consist of native alluvium and weathered bedrock. Younger native alluvial soils were encountered at three (3) of the boring locations, extending to depths of 12 to 22± feet below existing site grades. The younger alluvial soils were encountered in the southwest-draining canyon as well as in the northeastern portion if the site. Older alluvial soils, possessing higher strengths and relative densities were encountered at all of the borings, either below the younger alluvial soils, or at the ground surface at two of the borings in the northwest and central portions of the site.
- The younger alluvial soils possess low relative densities, relatively low strengths, and some porosity. The results of laboratory testing indicate that the younger alluvium is compressible when loaded and collapsible when inundated with water.
- Remedial grading is considered warranted to remove the younger alluvium from the proposed development area in its entirety.
- The older alluvium and weathered bedrock materials possess relatively high strengths and high relative densities. These materials are generally considered to be suitable for the support of new fill soils and site improvements.
- Recently graded fill embankments are present along the east and south property lines. These fill soils support the unpaved streets bordering the subject site. A report documenting the compaction and placement of these fill soils was not provided to our office. If these existing fill soils are planned to support any new improvements or fill materials, a report documenting the compaction and placement of these soils should be provided to our office and/or additional subsurface exploration should be performed in the new fill areas in order to evaluate the suitability of these fill materials to support new improvements or fill.
- Based on the anticipated site grading, we expect that significant slopes and/or retaining walls with heights on the order of 30± feet will be necessary in order to facilitate the proposed building pad grade(s).
- A zone of perched groundwater was identified at one of the borings at depths of 16 to 20± feet below the existing site grade in the western portion of the southwest-draining canyon. The groundwater table was encountered at a depth of 49± feet below the existing site grades at one boring in the eastern portion of the southwest-draining canyon.

- The site is located within a mapped zone of low to moderate liquefaction susceptibility. However, the site is generally underlain by older alluvium and dense to very dense bedrock materials. Based on the recommended remedial grading recommendations, the loose, younger alluvial sediments that may be susceptible to liquefaction will be removed and replaced as compacted structural fill. Therefore, liquefaction is not considered to be a design concern for this project.
- The proposed development is considered to be feasible with respect to the geotechnical conditions encountered at the boring locations at the site. As discussed above, remedial grading will be necessary in order to support the proposed structures on conventional shallow foundation systems.
- Additional geotechnical investigation is recommended in order to provide detailed recommendations for site grading and the design of foundations, floor slabs, retaining walls and site pavements. In order to further characterize the subsurface conditions at this site., additional subsurface exploration should include borings and test trenches. The number and depth of additional borings and trenches will depend upon the location and number buildings, construction type and design loads of the structure(s), and the proposed site grading.

Preliminary Site Preparation Recommendations

- Initial site stripping should include removal of any surficial vegetation. This should include any weeds, grasses, shrubs, and trees. These materials should be disposed of offsite.
- Remedial grading will be necessary in the proposed development area to remove the younger alluvium in its entirety. These materials extend to depths of 12 to 22± feet at borings performed in the southwest-draining erosional canyon and to a depth of 12± feet in the northeast portion of the site. Some overexcavation of the existing older alluvium and bedrock materials will likely be necessary in order mitigate cut/fill transitions, and benching into these materials will also be necessary to flatten steep transitions between new fill and existing soil/rock materials.
- Fill soils placed at depths greater than 20 feet below proposed pad grade within the building pad(s) should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density.

Preliminary Foundation Design Parameters

- Based on the assumed construction we anticipate that the new structure(s) will be supported on conventional shallow spread footing foundations, supported in newly placed structural fill soils.
- Maximum, net allowable soil bearing pressure: 2,000 to 3,000 lbs/ft^2.
- The estimated allowable bearing pressure provided above should be refined during the design level geotechnical investigation, based on actual design loads and detailed settlement analyses.

Preliminary Building Floor Slab Recommendations

- Conventional Slab(s)-on-Grade, minimum 5 to 6 inches thick
- Some reinforcement may be necessary due to the presence of low expansive soils at the site. Further geotechnical study should more thoroughly characterize the expansive potential of the soils at this site.
- The actual thickness and reinforcement of the floor slabs should be determined by the structural engineer.

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 18P310, dated July 9, 2018. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory geotechnical testing, and geotechnical engineering analysis to determine the geotechnical feasibility of the proposed development. This report also contains preliminary design criteria for building foundations, and building floor slabs. The evaluation of the environmental aspects of this site was beyond the scope of services for this feasibility study.

It should be noted that additional subsurface exploration, laboratory testing and engineering analysis will be necessary to provide a design level geotechnical investigation with specific foundation, floor slab, and grading recommendations.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located on the south side of Highway 60, approximately 4300 feet east of Jack Rabbit Trail, in Beaumont, California. The site is bounded to the north by the Highway 60 public right of way, to the east by an unpaved and unnamed public street (located within the alignment of the existing Potrero Boulevard, if projected south of Highway 60), to the south by the unpaved alignment of 4th Street, and to the west by undeveloped parcels.

The site consists of two contiguous irregularly shaped parcels identified as APN 424-010-005 and APN 242-010-009, which together are about 32½± acres in size. The site is vacant and undeveloped, with the exception of recently-placed embankment fills along the eastern and southern property lines. These fill soils were presumably placed to support the unpaved, unnamed street along the east property line, and the unpaved alignment of 4th Street along the southern property line. A subdrain or culvert extends through the embankment on the east side of the property and outlets into a shallow basin located near the bottom of the embankment fill. This shallow basin drains into an existing stream located at the bottom of the southwest-draining canyon. The stream was dry at the time of subsurface exploration. The remainder of the site is characterized as hilly with a southwest-draining canyon that extends from the existing drain outlet at the embankment fill to near the southwest corner of the site.

Topographic information for the subject site was obtained from an ALTA survey prepared by ATLAS Geospatial, dated October 18, 2018. Based on this survey, site elevations range between a maximum grade of El. 2452± feet meal sea level (msl) in the northeast property corner to a minimum grade of El. 2367± feet msl at the southwest property corner. As discussed above, the major topographic features of the site are the southwest-draining canyon in the central to the southern portion of the site, generally hilly topography, and embankment fills located along the southern and eastern property lines. Based on the ALTA survey, the fill embankments along the east property line possess heights of up to 30± feet with inclinations ranging between 4h:1v and 2h:1v. Along the south property line, the fill slope possesses heights of up to 27± feet with an inclination of about 2h:1v.

3.2 Proposed Development

Based on a conceptual site plan provided by the client, the subject site will be developed with one (1) commercial/industrial building. However, we understand that the proposed development, including the location, number, and size of the building(s) is subject to change. Based on the current plan, the proposed building will have a footprint of 637,000± ft^2, located within the central portion of the site. The building will be constructed with dock-high doors along the north and south sides of the building. Based on our experience with similar commercial/industrial developments, we expect that the building will be surrounded by asphaltic concrete pavements in parking areas and drive lanes and with Portland cement concrete pavements for the truck loading areas. Landscape planters and concrete flatwork may also be included throughout the site.

Detailed structural information for the proposed building has not been provided. For the purposes of this feasibility study we assume that the new building will be of concrete tilt-up construction, supported on a conventional shallow foundation system, with a concrete slab-on-grade floor. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

Grading plans were not available at the time of this report. Based on the existing site grades, we assume that cuts and fills on the order of 30 to 40± feet will be necessary in order to achieve the proposed site grades. Deeper fills may be necessary in the western portion of the southwest-draining canyon depending upon the proposed site grades. Based on the preliminary site plan, no significant amounts of below grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Additionally, we anticipate that some significant retaining walls and/or slopes will be necessary, especially in the southwest portion of the site, in order to achieve the proposed site grades.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of five (5) borings advanced to depths of 25 to 50± feet below the existing site grades. All of the borings were logged during drilling by a member of our staff.

The borings were advanced with hollow-stem augers, by a conventional truck-mounted drilling rig. Representative bulk and relatively undisturbed soil samples were taken during drilling. Relatively undisturbed soil samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. This sampling method is described in ASTM Test Method D-3550. Samples were also taken using a 1.4± inch inside diameter split spoon sampler, in general accordance with ASTM D-1586. Both of these samplers are driven into the ground with successive blows of a 140-pound weight falling 30 inches. The blow counts obtained during driving are recorded for further analysis. Bulk samples were collected in plastic bags to retain their original moisture content. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory.

The approximate locations of the borings are indicated on the Geotechnical Map, included as Plate 2 in Appendix A of this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included in Appendix B. The elevations reported on the Boring Logs were interpolated from the ALTA survey provided by the client. The boring locations were not surveyed.

4.2 Geotechnical Conditions

The materials encountered at the boring locations generally consist of native alluvium and weathered bedrock. The native alluvial soils were classified as younger alluvium and older alluvium depending upon their apparent age, strengths, and relative densities. A description of the soil and bedrock materials encountered at the boring locations is presented below.

Although not encountered at the boring locations, some artificial fill soils were observed in the embankment areas for proposed streets along the east and south property lines. No description of the fill materials is available at this time because no borings were performed within these embankment areas.

Younger Alluvium

Soils classified as younger alluvium were encountered at the ground surface at the Boring Nos. B-3 and B-4, drilled within the southwest-draining canyon, and at Boring No. B-2 which was performed in the northeast portion of the site. The younger alluvium encountered at these borings generally consists of very loose to medium dense silty fine sands and fine sands with occasional trace to little clay content, loose clayey fine to coarse sands, and very stiff fine sandy clays. Some of the younger alluvial soils possess appreciable porosity and calcareous cementation. The younger alluvium was encountered to depths of 12 to 22± feet in the southwest-draining canyon area at Boring Nos. B-4 and B-3, respectively, and to a depth of 12 ± feet at Boring No. B-2 in the northeast portion of the site. Occasional traces of fine gravel were encountered in some of the younger alluvial strata.

Older Alluvium

Soils classified as older alluvium were encountered at the ground surface at Boring Nos. B-1 and B-5 and beneath the younger alluvium at all of the remaining borings. The older alluvial soils generally consist of medium dense to very dense silty fine sands, fine to medium sands, clayey sands, fine sandy silts, and hard silty clays and fine sandy clays. The older alluvium generally possesses relatively high strengths and medium dense to very dense relative densities. Some of the recovered samples of the older alluvial materials are weakly cemented. Occasional traces of fine gravel were encountered throughout the older alluvial materials. The older alluvial soils generally extended to depths of 17 to 27± feet at the boring locations. Boring No. B-3 was terminated in older alluvium at a depth of 25 ± feet.

Bedrock

Weathered bedrock materials were encountered beneath the older alluvium at all of the boring locations with the exception of Boring No. B-3, which was terminated in older alluvium at a depth of 25± feet. The weathered bedrock materials generally consist of dense to very dense fine to coarse grained sandstones, fine-grained sandstones, silty sandstones, and clayey sandstones. The bedrock materials were generally weakly to moderately cemented and friable. The weathered silty fine-grained sandstone bedrock extended to the maximum depth explored of 50± feet below the existing site grade at Boring No. B-4.

Groundwater

Free water was encountered at a depth of 49± feet at during the drilling of Boring No. B-4. This depth corresponds to an elevation of about 2341± feet. Additionally, very moist soils were encountered at Boring No. B-3, between depths of 16 and 20± feet. The obtained from these depths possess moisture contents of 13 and 27 percent, and possessed a very moist to wet appearance. Based on their moisture contents and appearance, a perched groundwater table may be present between depths of 16 and 20± feet at this location, although no seepage was observed in the borehole during or at the completion of drilling. The underlying older alluvial soils encountered at a depth of 24 to 25± feet at Boring No. B-3 possessed a moisture content of 12 percent and possessed a "moist" appearance, in contrast to the "very moist to wet" overlying soils.

Based on these considerations, the static groundwater table is expected to have been present at a depth of about 49± feet below the existing site grades at Boring No. B-4 at the time of subsurface exploration. Shallower zones of perched ground water may also be present, especially in within the southwest-draining canyon.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the groundwater depths in this area is the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well is located approximately 2.1 miles southeast of the site. Water level readings within these monitoring wells indicate high groundwater levels of 58± feet (Fall 2017).

4.3 Geologic Conditions

The general geologic conditions of the subject site were determined by review of available geologic literature. The primary available reference applicable to the subject site is the Geologic Map of the El Casco and Beaumont Quadrangle published by the Dibblee Foundation, 2003. This map indicates that the site and general area is underlain by Quaternary alluvial deposits identified as younger alluvium and older alluvium, represented by map symbols Qa and Qoa, respectively. Younger alluvial soils are generally located within the southwest-draining erosional canyon and in the northeastern portion of the site, as identified at the boring locations. The geologic conditions at the ground surface in the areas of higher elevations generally consist of older alluvium, as identified in our exploratory borings and trenches. Weathered bedrock/formational materials were encountered beneath the older alluvial soils at most of the boring locations and appear to be consistent with the San Timoteo formation.

5.0 LABORATORY TESTING

The soil samples recovered from the subsurface exploration were returned to our laboratory for further testing to determine selected physical and engineering properties of the soils. The tests are briefly discussed below. It should be noted that the test results are specific to the actual samples tested, and variations could be expected at other locations and depths.

Classification

All recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. Field identifications were then supplemented with additional visual classifications and/or by laboratory testing. The USCS classifications are shown on the Boring Logs and are periodically referenced throughout this report.

Density and Moisture Content

The density has been determined for selected relatively undisturbed ring samples. These densities were determined in general accordance with the method presented in ASTM D-2937. The results are recorded as dry unit weight in pounds per cubic foot. The moisture contents are determined in accordance with ASTM D-2216, and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Consolidation

Selected soil samples have been tested to determine their consolidation potential, in accordance with ASTM D-2435. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. Each sample is then loaded incrementally in a geometric progression and the resulting deflection is recorded at selected time intervals. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The samples are typically inundated with water at an intermediate load to determine their potential for collapse or heave. The results of the consolidation testing are plotted on Plates C-1 through C-11 in Appendix C of this report.

Soluble Sulfates

Representative samples of the near-surface soils were submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in soils, and if the concentration is high enough, can result in degradation of concrete which comes into contact with these soils. The result of the soluble sulfate testing is presented below, and is discussed further in a subsequent section of this report.

Sample Identification	**Soluble Sulfates (%)**	**ACI Classification**
B-2 @ 0 to 5 feet	< 0.001	Not Applicable (S0)
B-3 @ 0 to 5 feet	< 0.001	Not Applicable (S0)

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample was tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557 and are presented on Sheet C-12 in Appendix C of this report. These tests are generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil types or soil mixes may be necessary at a later date.

Expansion Index

The expansion potential of the on-site soils was determined in general accordance with ASTM D-4829. The testing apparatus is designed to accept a 4-inch diameter, 1-in high, remolded sample. The sample is initially remolded to 50± 1 percent saturation and then loaded with a surcharge equivalent to 144 pounds per square foot. The sample is then inundated with water, and allowed to swell against the surcharge. The resultant swell or consolidation is recorded after a 24-hour period. The results of the EI testing are as follows:

Sample Identification	**Expansion Index**	**Expansion Potential**
B-1 @ 0 to 5 feet	3	Very Low
B-2 @ 0 to 5 feet	35	Low
B-3 @ 0 to 5 feet	0	Very Low

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing, and geotechnical analysis, the proposed development, which will consist of a new commercial/industrial development. The recommendations contained in this report should be taken into the design, construction, and grading considerations. The recommendations are contingent upon all grading and foundation construction activities being monitored by the geotechnical engineer of record.

Based on the preliminary nature of this investigation, further geotechnical investigation will be required prior to construction of the proposed development. The Grading Guide Specifications, included as Appendix D, should be considered part of this report, and should be incorporated into the project specifications. The contractor and/or owner of the development should bring to the attention of the geotechnical engineer any conditions that differ from those stated in this report, or which may be detrimental for the development.

6.1 Seismic Design Considerations

The subject site is located in an area which is subject to strong ground motions due to earthquakes. The performance of a site specific seismic hazards analysis was beyond the scope of this investigation. However, numerous faults capable of producing significant ground motions are located near the subject site. Due to economic considerations, it is not generally considered reasonable to design a structure that is not susceptible to earthquake damage. Therefore, significant damage to structures may be unavoidable during large earthquakes. The proposed structure should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Faulting, Seismicity, and Geologic Hazards

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. The Riverside County RCIT GIS website indicates that the subject site is not located within a county fault zone. Therefore, the possibility of significant fault rupture on the site is considered to be low.

The nearest mapped active fault is the San Jacinto Fault, located approximately 5.2± miles southwest of the subject site. Due to the proximity of this and other faults, significant seismic shaking could impact the site within the design life of the proposed development. Other known regionally active faults that could affect the site include Elsinore-Glen Ivy, Whittier, San Andreas, Cucamonga, Puente Hills Thrust, and San Jose faults.

It should also be noted that some of the parcels located within ½ mile to the east and north of the subject area are located within a Riverside county fault zone. Additionally, based on our knowledge of other projects in the vicinity of the site, we understand that evidence of inactive faults was observed with the San Timoteo formation bedrock materials on other project sites located ½ to 1 mile west of the subject site. Based on the presence of an earthquake fault zone located east of the subject site, and evidence of faulting found west of the site, it is possible that some unmapped faults are present within the subject site. Based on the fact that there are no mapped fault zones within the subject area of this report, we do not expect that any active faults are present at the subject site. We recommend that as part of the future subsurface exploration performed at this site, the soils exposed in trench sidewalls should be examined for evidence of active faulting. **Some trenches should also be performed perpendicular to known fault strike directions in order to increase the likelihood of identifying evidence of faulting.**

Based on the preliminary remedial grading recommendations provided in a subsequent section of this report, the loose and potentially compressible and collapsible younger alluvial soil will be removed and replaced as compacted structural fill. Therefore, the potential for other geologic hazards such as seismically induced settlement, lateral spreading, and subsidence affecting the site is considered low.

The potential for hazards such as tsunamis, inundation and seiches is considered to be very low, because no significant bodies of water are present within several miles of the subject site. Significant flooding is considered unlikely because the ALTA survey referenced in Section 3.2 indicates that the site is "outside the 0.2% annual floodplain, per the FEMA website."

Seismic Design Parameters

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2016 edition of the California Building Code (CBC). The CBC provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

The 2016 CBC Seismic Design Parameters have been generated using U.S. Seismic Design Maps, a web-based software application developed by the United States Geological Survey. This software application, available at the USGS web site, calculates seismic design parameters in accordance with the 2016 CBC, utilizing a database of deterministic site accelerations at 0.01 degree intervals. The table below is a compilation of the data provided by the USGS application. A copy of the output generated from this program is included in Appendix E of this report. A copy of the Design Response Spectrum, as generated by the USGS application is also included in Appendix E. Based on this output, the following parameters may be utilized for the subject site:

2016 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1649
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.717
Site Class	---	C
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.649
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.932
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.099
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.622

Liquefaction

Liquefaction is the loss of strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and plasticity characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Non-sensitive clayey (cohesive) soils which possess a plasticity index of at least 18 (Bray and Sancio, 2006) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

The Riverside County GIS website indicates that the subject site is located within a zone of low to moderate liquefaction susceptibility. However, the soil conditions encountered at the boring locations are not considered to be conducive to liquefaction. These conditions consist of surficial younger alluvial sediments underlain by medium dense to very dense older alluvium and dense to very dense weathered bedrock. In their existing condition, some of the younger alluvial soils may be susceptible to liquefaction. However, the preliminary remedial grading recommendations presented in this report indicate that the younger alluvium should be removed in its entirety and replaced as compacted structural fill prior to construction. Therefore, any younger alluvium which may be presently susceptible to liquefaction will be mitigated as a part of the recommended remedial grading. Based on these considerations, liquefaction is not considered to be a design concern for this project.

6.2 Geotechnical Design Considerations

General

Significant grading will be required at this site in order to facilitate the proposed development. Although no grading plans are presently available for the subject site, we estimate that maximum cuts and fills of 30 to 40± feet from existing site grades will be necessary. The areas of maximum fill are expected to be located in the southwest-draining canyon, which corresponds to the southern portion of the conceptual building location. Deeper fills may be necessary in this area, depending on the proposed building pad grade(s). Significant cuts are expected to be necessary within the northwestern and northeastern corners of the conceptual building area, with minor cuts in the central portion of the conceptual building area. Relatively large cuts may also be necessary in the southeastern portion of the site, south of the southwest-draining canyon and in the northern portion of the site, north of the conceptual building area. The actual cut and fill depths are not known at this time because no grading plan is presently available. We also understand that the conceptual building location, size, and number of buildings are subject to change.

The younger alluvial soils encountered at the boring locations possess relatively low strengths and low relative densities. These materials were observed to be porous. Based on the results of laboratory testing, some of these soils are subject to consolidation settlement upon loading and significant collapse when inundated with water. Based on these considerations, the younger alluvium, in its present condition, is not considered suitable for the support of new fill soils or any new improvements. **Therefore, significant remedial grading will be necessary in order to remove the younger alluvial soils and replace these materials as compacted structural fill.** Based on conditions encountered at the boring locations, these overexcavations may extend to depths of up to 25± feet. The underlying older alluvium and bedrock materials possess greater strengths and relative densities and are considered to be suitable to support new structural fill and improvements.

Based on the overall topographic relief across the site, and the elevations of the recently graded unpaved streets to the east and south of the site, **we expect that some new slopes and/or retaining walls will be necessary to achieve the proposed site grades.** Based on the conceptual site plan, we expect that retaining walls and/or slopes on the order of 25 to 30± feet or more in height would likely be necessary to facilitate the grading and construction of a new development similar to that indicated on the conceptual site plan. Subject to a detailed slope stability analysis, which should be performed at the time of the design-level geotechnical investigation, new fill slopes should not exceed an inclination of 2h:1v. Based on the requirements of the 2016 CBC, any new retaining wall supporting more than 6± feet of soils should be designed to withstand seismic lateral earth pressures.

Test trenches should be performed in proposed slope or retaining wall areas where cuts will expose bedrock materials in order to determine the potential for out-of-slope bedding. Bedding or stratigraphy of the bedrock can serve as a potential slope failure plane if the dip angle of the bedding or geologic contacts are unfavorable.

Existing Fill Embankments

Existing fill slopes are present along the east and south property lines. No documentation of the placement and compaction of these fill materials has been provided to our office. Therefore, we are unable to determine if the existing fill materials are suitable to support new improvements or additional fill soils. SCG should be provided with a copy of the report documenting the placement and compaction of the existing fill materials and/or additional subsurface exploration should be performed within the existing fill materials if the existing fill soils are planned to support any new improvements.

Settlement

As discussed above, the younger alluvial soils are subject to significant consolidation settlement upon loading and are potentially collapsible when wetted. The underlying older alluvial soils and bedrock materials possess more favorable consolidation characteristics and no significant collapse potential. With remedial grading of the unsuitable younger alluvium, it is considered feasible to reduce the projected settlements within the building area to within tolerable limits.

Deep Fill Areas

Based on the assumed site grading, cuts and fills of more than 30± feet will be required. In order to reduce the settlement potential of the newly placed fill soils to acceptable levels and avoid excessive differential settlements, fill soils placed at depths greater than 20 feet below proposed pad grade within the building pad(s) should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. This is a preliminary estimate. The actual standard of compaction should be determined at the time of the design level investigation.

Cut/Fill Transitions

Based on the existing site topography, it is likely that cut/fill transitions will be created within the proposed building and improvement areas. The differing support conditions of the native soils/bedrock versus the newly compacted fill soils may result in excessive differential settlements if not mitigated. Due to the relatively steep inclination of the side walls of the southwest-draining canyon, the resultant cut/fill transitions will occur at steep inclinations as well. Remedial grading will be required to eliminate the cut/fill transitions which will occur at building pad and foundation bearing grade as well as to reduce the inclinations of the underlying cut/fill contacts.

Expansion

The near-surface on-site soils have been determined to possess very low to low expansion potentials (EI = 0 to 35). Based on the presence of expansive soils, adequate moisture conditioning of the subgrade soils and fill soils will be necessary during grading, and special care must be taken to maintaining moisture content of these soils at 2 to 4 percent above the Modified Proctor optimum. This will require the contractor to frequently moisture condition these soils throughout the grading process, unless grading occurs during a period of relatively wet weather.

Soluble Sulfates

The results of the soluble sulfate testing, presented in Section 5.0 of this report, indicate soluble sulfate concentrations of less than 0.001. These concentrations are considered to be negligible with respect to the American Concrete Institute (ACI) Publication 318-05 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted during the design-level geotechnical investigation and at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at the proposed building pad grades.

Existing Box Culvert

An existing box culvert is present beneath the recently graded embankment fill along the east property line. Based on the conceptual site plan, the culvert extends into the proposed building area. It may be necessary to reroute drainage from this culvert around the proposed building area or relocate the proposed structure(s) to allow the existing culvert to remain with appropriate drainage.

Additional Geotechnical Investigation

As stated above, the nature of this investigation is considered to be preliminary. We recommend that additional borings and test trenches be performed within proposed improvement areas in order to more thoroughly characterize the subsurface conditions at this site. Further site characterization, laboratory testing, and engineering analysis will be necessary in order to provide more detailed grading, foundation, floor slab, retaining wall, and pavement design recommendations. This additional exploration should be performed after a detailed site plan is developed.

We recommend that several borings be performed within the proposed building area(s), advanced to a sufficient depth to penetrate through the younger alluvial soils into the underlying older alluvial soils and/or weathered bedrock materials. Several test trenches, excavated with a backhoe or excavator, should also be performed within the proposed building area(s), in the southwest-draining erosional canyon, and in other improvement areas in order to further characterize the subsurface conditions and refine the remedial grading recommendations. As recommended in Section 6.1, above, test trenches should be examined for any evidence of active faulting in the proposed building and improvement areas on the site. The bedding and stratigraphy of the existing bedrock materials should be identified within the test trenches, wherever possible.

The number and depths of the additional borings and test trenches should be determined based on the size, location, construction type, and the anticipated structural loads of the proposed building(s) and other site improvements.

If any new improvements or fill soils will rely upon the existing embankment fills for support, additional subsurface exploration should be performed within the existing fill materials in order to determine their suitability to support new improvements or fill.

Grading and Foundation Plan Review

As discussed previously, detailed grading and foundation plans were not available at the time of this report. It is therefore recommended that we be provided with copies of the preliminary plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report and future geotechnical investigations.

6.3 Preliminary Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring locations and our understanding of the proposed development, which will consist of a new industrial development. These recommendations are general in nature, and should be confirmed as part of the design level geotechnical investigation.

Site Stripping

Initial site stripping should include removal of any surficial vegetation. This should include any weeds, grasses, trees, and shrubs. These materials should be disposed of offsite. Site stripping is expected to be minimal to moderate in the higher elevations of the site, and more substantial in the erosional canyon areas of the site. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Treatment of Existing Soils: Building Pad(s)

As discussed above, the younger alluvial soils possess relatively low strengths and are subject to collapse upon wetting and consolidation upon loading. It is therefore recommended that these soils, within the development area, be removed and replaced in order to reduce the potential for excessive settlement of the proposed improvements. **Based on conditions encountered at the boring and trench locations, the depths of unsuitable soil removals are estimated to range from 0 to 25± feet below existing grade. Greater depths of unsuitable soils may be present in unexplored areas of the site.**

The bulk of the remedial grading will be required within the southwest-draining canyon areas and other localized areas where the younger alluvial deposits exist. At three of the boring locations, younger alluvial soils extend to depths of 12 to 22± feet below existing site grades. The actual depth of removals will be determined during grading by the geotechnical engineer. Variations should be expected between the trench and boring locations.

The removals should extend to a depth of firm, competent older alluvium deposits or weathered bedrock/formational soils. The younger alluvial soils should be removed in their entirety to expose suitable older alluvial soils or weathered bedrock/materials.

In order to reduce the potential for excessive differential settlement due to the differing support conditions provided by the native soils and the newly placed fill soils, the cut portion of the building pads should also be overexcavated. The depth of overexcavation in the cut portions of the building pad area will be dependent upon the depths of the fill and the steepness of the cut/fill transition.

Relatively steep cut/fill contacts are anticipated in the southwest-draining canyon. Mitigation of steep cut/fill contacts should include benching of the sidewalls during fill placement. Generally, the horizontal extent of the benching should be sufficient to reduce the inclination of the native fill contact to 3h:1v or flatter. This additional benching is generally not required outside the areas of the proposed building foundation influence zones.

Following completion of the overexcavation, the exposed soils should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structure(s). This evaluation should include proofrolling with a heavy rubber-tired vehicle and probing to identify any soft, loose or otherwise unstable soils that must be removed. The materials exposed at the base of overexcavations should possess a minimum relative compaction of 85 percent of the maximum dry density as determined by ASTM D-1557 maximum dry density. Some localized areas of deeper excavation may be required if loose, porous, or low-density soils are encountered at the bottom of the overexcavation. The exposed subgrade soils should then be scarified to a depth of 12 inches, moisture conditioned to 2 to 4 percent above optimum moisture content, and recompacted.

Treatment of Existing Soils: Retaining Walls and Site Walls

Retaining walls are expected to be necessary in order to facilitate the development of this site. Overexcavation will also be necessary in these areas to remove any lower-strength potentially compressible/collapsible younger alluvium.

Treatment of Existing Soils: Flatwork, Parking and Drive Areas

Based on economic considerations, overexcavation of the existing near-surface existing soils in new parking and drive areas is not considered warranted, with the exception of areas underlain by younger alluvial soils or where lower strength or otherwise unstable soils are identified by the geotechnical engineer during grading. Subgrade preparation in the new flatwork, parking and drive areas should initially consist of removal of all soils disturbed during stripping and demolition operations.

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 2 to 4 percent above the optimum moisture content, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength surficial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 2 to 4 percent above the optimum moisture content, and compacted.
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- All grading and fill placement activities should be completed in accordance with the requirements of the 2016 CBC and the grading code of the city of Beaumont.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Fill soils placed at depths greater than 20 feet below proposed pad grade within the building pad(s) should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density.

- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Utility Trench Backfill

In general, all utility trench backfill should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the city of Beaumont. All utility trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

Utility trenches which parallel a footing, and extending below a 1h:1v plane projected from the outside edge of the footing should be backfilled with structural fill soils, compacted to at least 90 percent of the ASTM D-1557 standard. Pea gravel backfill should not be used for these trenches.

6.4 Construction Considerations

Excavation Considerations

Based on the presence of predominantly granular soils near the surface, minor caving of shallow excavations may occur. Flattened excavation slopes may be sufficient to mitigate caving of shallow excavations. On a preliminary basis, temporary excavation slopes should be made no steeper than 2h:1v. Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Dense to very dense older alluvium and weathered bedrock were encountered in the exploratory borings at relatively shallow depths. These materials are expected to be rippable with heavy grading equipment. However, if areas of less weathered bedrock are encountered, use of specialized excavation equipment may be necessary.

Expansive Soils

The near-surface on-site soils have been determined to possess very low to low expansion potentials. Therefore, care should be given to proper moisture conditioning of all subgrade soils to a moisture content of 2 to 4 percent above the Modified Proctor optimum during site grading. All imported fill soils should have very low expansive (EI < 20) characteristics. In addition to adequately moisture conditioning the subgrade soils and fill soils during grading, special care must be taken to maintain the moisture content of these soils at 2 to 4 percent above the Modified Proctor optimum. This will require the contractor to frequently moisture condition these soils throughout the grading process, unless grading occurs during a period of relatively wet weather. Additional EI testing should be performed during the design level geotechnical investigation.

Due to the anticipated expansive potential of the soils at this site, provisions should be made to limit the potential for surface water to penetrate the soils immediately adjacent to the structures. These provisions should include directing surface runoff into rain gutters and area drains, reducing the extent of landscaped areas around the structure, and sloping the ground surface away from the buildings. Other provisions, as determined by the civil engineer, may also be appropriate.

Moisture Sensitive Subgrade Soils

Some of the near surface soils possess appreciable silt and clay content and may become unstable if exposed to significant moisture infiltration or disturbance by construction traffic. In addition, based on their granular content, some of the on-site soils will also be susceptible to erosion. The site should, therefore, be graded to prevent ponding of surface water and to prevent water from running into excavations.

If the construction schedule dictates that site grading will occur during a period of wet weather, allowances should be made for costs and delays associated with drying the on-site soils or import of a drier, less moisture sensitive fill material. Grading during wet or cool weather may also increase the depth of overexcavation in the pad area as well as the need for mechanical stabilization. If subgrade stability problems develop, the geotechnical engineer should be contacted to provide stabilization recommendations.

Slope Planting and Maintenance

The natural slopes and any manufactured slopes that will be created on site should be planted immediately after construction is completed, to achieve well-established and deep-rooted vegetation. The slopes should be planted with shrubs that will develop root systems to depths of 5 feet or more, such as ground acacia. Intervening areas should be planted with lightweight surface plantings with shallower root systems. Wherever possible, the selected plantings should be lightweight and drought tolerant. Due to its high weight, the use of iceplant is not recommended. It is recommended that a landscape architect be consulted to determine the actual planting materials.

All reasonable precautions should be taken to minimize deep soil moisture penetration within the slope soils. The volume of slope irrigation should be the minimum that is required to maintain plant growth. All surface water runoff from the slopes should be diverted away from the top of the proposed retaining walls. The condition of the slope must be continually maintained to reduce the potential for surficial failures. This includes maintenance of the drainage pathways, any diversion structures, maintenance of the vegetation, and repair of rodent damage.

Groundwater

The static groundwater table at this site is considered to exist at a depth of approximately 49 feet below the existing grade at Boring No. B-4. Therefore, the groundwater table is not expected to impact the grading or foundation construction activities. However, some zones of very moist to wet soils and perched water will likely be encountered, especially within the southwest-draining canyon. One such zone was encountered at Boring No. B-3, between depths of 16 to 20± feet.

6.5 Preliminary Foundation Design Recommendations

Based on the preceding geotechnical design considerations and preliminary grading recommendations, it is assumed that the new building(s) will be underlain by newly placed structural fill soils. Based on the assumed construction and structural loads discussed in Section 3.2 of this report, we expect the proposed structure(s) will be supported on conventional spread footing foundations.

The foundation design parameters presented below provide anticipated ranges for the allowable soil bearing pressures. These ranges should be refined during the subsequent design level geotechnical investigation.

Spread Footing Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,000 to 3,000 lbs/ft^2.

- Minimum longitudinal steel reinforcement within strip footings: Four (4) to six (6) No. 5 rebars.

General Foundation Design Recommendations

The allowable bearing pressures presented above may be increased by one-third when considering short duration wind or seismic loads. Additional reinforcement may be necessary for structural considerations. The actual design of the foundations should be determined by the structural engineer.

Estimated Foundation Settlements

Typically, foundations designed in accordance with the preliminary foundation design parameters presented above will experience total and differential static settlements of less than 1.0 and 0.5 inches, respectively. A detailed settlement analysis should be conducted as part of the design level geotechnical investigation, once detailed foundation loading information is available.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. The following friction and passive pressure may be used to resist lateral forces:

- Passive Earth Pressure: 275 - 300 lbs/ft^3
- Friction Coefficient: 0.28 to 0.30

6.6 Preliminary Floor Slab Design and Construction

Subgrades which will support new floor slabs should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the assumed construction and the anticipated grading which will occur at this site, we expect that the floors for the new structures will consist of conventional slabs-on-grade. Based on geotechnical considerations, the floor slabs may be preliminarily designed as follows:

- Minimum slab thickness: 5 to 6 inches.

- Modulus of Subgrade Reaction: k = 100 to 150 psi/in.

- Minimum slab reinforcement: Based on the low expansion potential of some of the on-site soils, reinforcement consisting of No. 3 bars placed at 18inches on center in both directions may be necessary. The actual need for reinforcement and the amount to reinforcing steel should be determined after the subsurface soils have been more thoroughly characterized through additional subsurface exploration. Additional expansion index testing should be performed to confirm this recommendation at the time of the design level investigation. Ultimately, the actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

- Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire area of the proposed slab which will incorporate such coverings. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. A polyolefin material such as Stego® Wrap Vapor Barrier or equivalent will meet these specifications. The moisture vapor barrier should be properly constructed in accordance with all applicable manufacturer specifications. Given that a rock free subgrade is anticipated and that a capillary break is not required, sand below the barrier is not required. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview. Where moisture sensitive floor coverings are not anticipated, the vapor barrier may be eliminated.

- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.

The actual design of the floor slab should be completed by the structural engineer to verify adequate thickness and reinforcement.

7.0 GENERAL COMMENTS

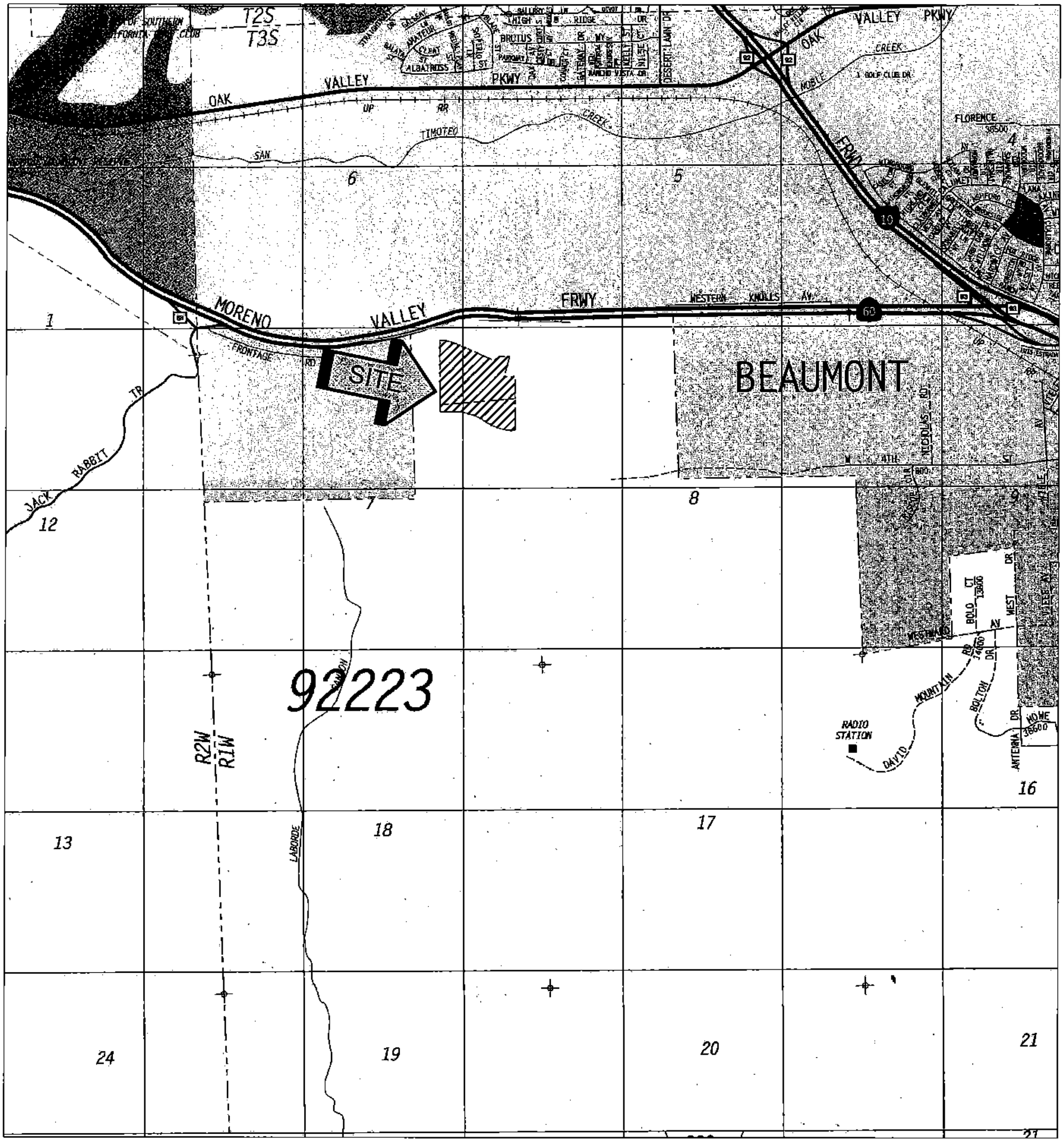
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, civil engineer, and/or structural engineer. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The client(s)' reliance upon this report is subject to the Engineering Services Agreement, incorporated into our proposal for this project.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and sample depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted.

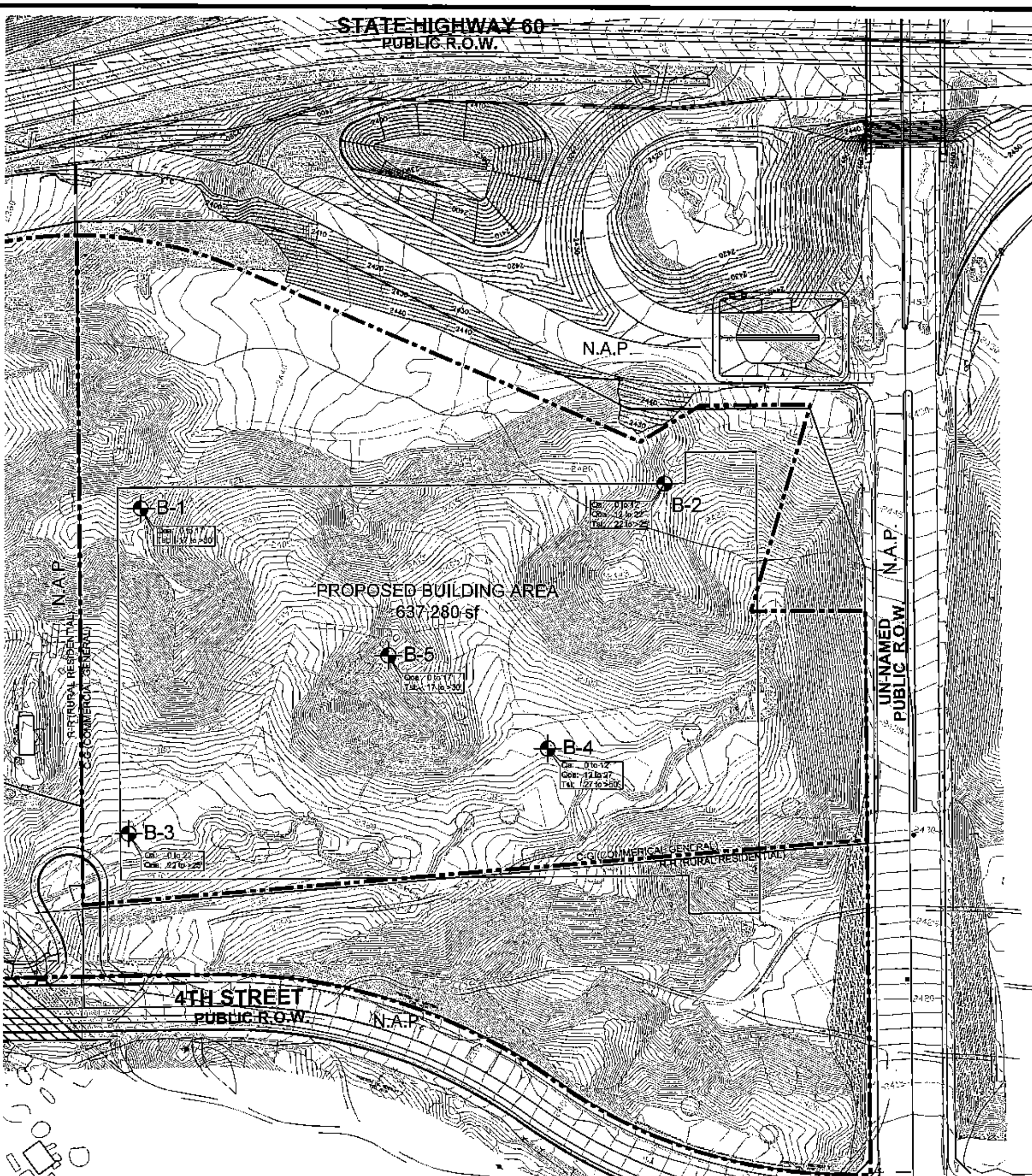
The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

APPENDIX A



SOURCE: RIVERSIDE COUNTY
THOMAS GUIDE, 2013

SITE LOCATION MAP	
PROPOSED INDUSTRIAL DEVELOPMENT	
BEAUMOUNT, CALIFORNIA	
SCALE: 1" = 2400'	SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: PM CHKD: GKM	
SCG PROJECT 18G180-1	
PLATE 1	



GEOTECHNICAL LEGEND

- APPROXIMATE BORING LOCATION
- Qa - Younger Alluvium
- Qoa - Older Alluvium
- Tst - San Timoteo Formation

NOTE: TOPOGRAPHIC INFORMATION BY ATLAS GEOSPATIAL. BASE SITE PLAN PREPARED BY DOUGLAS FRANZ ARCHITECTS, INC.

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SCALE: 1" = 80'
DRAWN: PM
CHKD: GKM
SCG PROJECT 18G180-1

GEOTECHNICAL MAP
PROPOSED INDUSTRIAL DEVELOPMENT
BEAUMONT, CALIFORNIA

PLATE 2