Appendix D-1

Geotechnical Investigation Report, Proposed Residential Development, APN 040725112, 15629 Smoke Tree Street, Hesperia, California

GeoBoden, Inc

May 30, 2022

GEOTECHNICAL INVESTIGATION REPORT
PROPOSED RESIDENTIAL DEVELOPMENT
APN: 040725112
15639 SMOKE TREE STREET

Hesperia, California

Prepared for:
MAZI, HOSSEIN TRUST

Prepared by:
GEOBODEN INC.
Irvine, CA 92620

May 30, 2022

Project No. Smoke Tree-1-01

GEOTECHNICAL INVESTIGATION REPORT
PROPOSED RESIDENTIAL DEVELOPMENT
APN: 040725112
15639 SMOKE TREE STREET
HESPERIA, CALIFORNIA

MAZI, HOSSEIN TRUST

Prepared by:

GEOBODEN INC.
5 Hodgenville
Irvine, California 92620

May 30, 2022

JOB NO. Smoke Tree-1-01

GEOBODEN, INC.
Geotechnical Consultants

May 30, 2022 Project No. Smoke Tree-1-01

Attention: MAZI, HOSSEIN TRUST

Subject: Geotechnical Investigation Report
Proposed Residential Development
APN: 040725112
15639 Smoke Tree Street
Hesperia, California

GeoBoden, Inc. (GeoBoden) is pleased to submit herewith our geotechnical investigation report for the Proposed Residential Development to be constructed at APN: 040725112 in the city of Hesperia, California.

This report presents the results of our field investigation, laboratory testing and our engineering judgment, opinions, conclusions and recommendations pertaining to geotechnical design aspects of the proposed development.

It has been a pleasure to be of service to you on this project. Should you have any questions regarding the contents of this report, or should you require additional information, please do not hesitate to contact us.

Respectfully submitted,
GEOBODEN, INC.

REGISTERED PROFESSIONAL ENGINEER
SHAHROKH E. RADVAR
2742
GEOTECHNICAL
STATE OF CALIFORNIA

Shahrokh (Cyrus) E Radvar,
Principal Engineer, G.E. 2742

Copies: 2/Addressee

GEOTECHNICAL INVESTIGATION REPORT

PROPOSED RESIDENTIAL DEVELOPMENT
APN: 040725112
15639 SMOKE TREE STREET
HESPERIA, CALIFORNIA

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PROPOSED RESIDENTIAL DEVELOPMENT
APN: 040725112
15639 SMOKE TREE STREET
Hesperia, California

1.0 INTRODUCTION

This report presents the results of our geotechnical investigation performed by GeoBoden, Inc. (GeoBoden) for the Proposed AutoZone to be located at 15639 Smoke Tree street in Hesperia, California. The general location of the project is shown on Figure 1.

The purposes of this investigation were to determine the geotechnical properties of subsurface soil conditions, to evaluate their in-place characteristics, evaluate site seismicity, and to provide geotechnical recommendations with respect to site grading and for design and construction of proposed foundations and other site improvements.

The scope of the authorized investigation included performing a site reconnaissance, conducting field exploration and laboratory testing programs, performing engineering analyses, and preparing this Geotechnical Investigation Report. Evaluation of environmental issues or the potential presence of hazardous materials was not within the scope of services provided.

This report has been prepared for MAZI, HOSSEIN TRUST and their other project team members, to be used solely in the development of facilities described herein. This report may not contain sufficient information for other uses or the purposes of other parties.

2.0 SITE LOCATION AND PROJECT DESCRIPTION

The site is located in Hesperia, California. The subject property is presently occupied by a vacant land.

The maximum column load for the new buildings will be about 75 kips, and the line load will be about 3 kips per lineal feet. Currently, it is our understanding that the proposed buildings will consist of masonry construction with slab on-grade.

3.0 GEOTECHNICAL INVESTIGATION

Our geotechnical investigation included a field exploration program and a laboratory testing programs. These programs were performed in accordance with our scope of services. The field exploration and laboratory testing programs are briefly described below. A more detailed description of the field exploration and laboratory testing programs is provided in Appendix A and Appendix B, respectively.

3.1 FIELD EXPLORATION PROGRAM

The field exploration program was initiated under the supervision of an engineer. Five (5) exploratory borings were drilled using a truck-mounted drilling rig equipped with 8-inch diameter hollow stem augers. The borings were advanced to depths of ranging from 11.5 to 31.5 feet (below ground surface). The approximate locations of exploratory borings are shown on Figure 2.

Logs of subsurface conditions encountered in the borings were prepared in the field by a representative of our firm. Soil samples consisting of relatively undisturbed brass ring samples and Standard Penetration Tests (SPT) samples were collected at approximately 5-foot depth intervals and were returned to the laboratory for testing. The SPTs were performed in accordance with ASTM D 1586. Final boring logs were prepared from the field logs and are presented in Appendix A.

3.2 LABORATORY TESTING

Selected samples collected during drilling activities were tested in the laboratory to assist in evaluating controlling engineering properties of subsurface materials at the site. Physical tests performed included moisture and density determination, consolidation, expansion index, No. 200 Sieve, direct shear, and corrosion. The results of laboratory are presented in Appendix B.

4.0 DISCUSSION OF FINDINGS

The following discussion of findings for the site is based on the results of the field exploration and laboratory testing programs.

4.1 SITE AND SUBSURFACE CONDITIONS

Observed subsurface native soils consisted of sand with silt and silty sand and sandy clay to the maximum explored depth of 31.5 feet below ground surface (bgs).

Based on blow counts recorded during sampling, the sandy soils encountered within borings were found to be medium dense to very dense. The clayey soils were found very stiff to hard. For a more detailed description of the subsurface materials refer to the boring logs included in Appendix A of this report.

4.2 GROUNDWATER CONDITIONS

Groundwater was not encountered within our exploratory borings to the maximum explored depth of 31.5 feet (below ground surface). Based on information from the Department of Water Resources, Water Data Library, ground water level in the site vicinity is at a depth of greater than 50 feet beneath the existing ground surface.

Fluctuations of the groundwater table, localized zones of perched water, and rise in soil moisture content should be anticipated during the rainy season. Irrigation of landscaped areas can also lead to an increase in soil moisture content and fluctuations of intermittent shallow perched groundwater levels.

4.3 SOIL ENGINEERING PROPERTIES

Physical tests were performed on the relatively undisturbed samples to characterize the engineering properties of the native soils. Moisture content determination was performed on the samples to evaluate the in-situ moisture content. Moisture content and dry unit weight results are included in Appendix B.

4.4 CONSOLIDATION CHARACTERISTICS

Consolidation tests were performed on samples of the existing overburden soils recovered from the boring. Results of the consolidation tests indicate that the overburden material will have low compressibility under the anticipated loads. These characteristics are compatible with the allowable bearing capacity values and corresponding settlement estimates presented in Foundations Section of our report.

4.5 COLLAPSE POTENTIALS

Results of consolidation tests on samples of native soil indicate that the native soils will have low collapse potential. Removal and recompaction of the surficial soils is expected to reduce the anticipated amount of total differential settlement within the site.

4.6 EXPANSIVE SOILS

Preliminary laboratory testing of representative sample of onsite soils indicate that these materials exhibit VERY LOW expansion potential. We anticipate that the design and performance of the proposed new buildings will not be affected by expansion of onsite soils.

4.7 STRENGTH CHARACTERISTICS

Strength tests were performed on select samples of the existing native overburden soils recovered from the boring. Results of these strength tests generally indicate high friction angle with little cohesion. These characteristics are compatible with the allowable bearing capacity recommendations presented in section 7.7 (Foundations).

5.0 STRONG GROUND MOTION POTENTIAL

The project site is located in a seismically active area typical of Southern California and likely to be subjected to a strong ground shaking due to earthquakes on nearby faults.

5.1 CBC DESIGN PARAMETERS

The site is located at approximately 34.4283 Latitude and -117.3220 Longitude. Site spectral accelerations (Sa and S1), for 0.2 and 1.0 second periods and 2 percent probability of exceedance in 50 years (MCE) for a Class "D" site, was determined from the USGS Website, Earthquake Hazards Program, Interpolated Probabilistic Ground Motion for the Conterminous 48 States by Latitude/Longitude, 2002 Data. The results are presented in the following table:

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_a	1.408g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.544g
Site Coefficient for Site Class "D", F_a	1.2
Site Coefficient for Site Class "D", F_v	1.756
Maximum Considered Earthquake Spectral Response Acceleration Parameter at 0.2 Second, S_{MS}	1.689g
Maximum Considered Earthquake Spectral Response Acceleration Parameter at 1 second, S_{M1}	0.955g
Design Spectral Response Acceleration Parameter for 0.2 Second, S_{DS}	1.126g
Design Spectral Response Acceleration Parameter for 1.0 Second, S_{D1}	0.637g

The actual method of seismic design should be determined by the Structural Engineer.

6.0 LIQUEFACTION POTENTIAL

For liquefaction to occur, all of three key ingredients are required: liquefaction-susceptible soils, groundwater within a depth of 50 feet or less, and strong earthquake shaking. Soils susceptible to liquefaction are generally saturated loose to medium dense sands and non-plastic silt deposits below the water table.

The site is underlain by dense native soil materials. Groundwater was not encountered within our borings. Historic high groundwater is in excess of 50 feet below ground surface. Soils susceptible to liquefaction are not present on site. Accordingly, it is our opinion the potential for liquefaction at the site is remote.

7.0 DESIGN RECOMMENDATIONS

Based upon the results of our investigation, the proposed development is considered geotechnically feasible provided the recommendations presented herein are incorporated into the design and construction. If changes in the design of the structure are made or variations or changed conditions are encountered during construction, GeoBoden should be contacted to evaluate their effects on these recommendations. The following geotechnical engineering recommendations for the proposed buildings are based on observations from the field investigation program and the physical test results.

7.1 EARTHWORK

All earthworks, including excavation, backfill and preparation of subgrade, should be performed in accordance with the geotechnical recommendations presented in this report and applicable portions of the grading code of local regulatory agencies. All earthwork should be performed under the observation and testing of a qualified geotechnical engineer.

7.2 SITE AND FOUNDATION PREPARATION

All site preparation should be observed by experienced personnel reporting to the project Geotechnical Engineer. Our field monitoring services are an essential continuation of our prior studies to confirm and correlate the findings and our prior recommendations with the actual subsurface conditions exposed during construction, and to confirm that suitable fill soils are placed and properly compacted.

Earthwork is expected to consist of subgrade preparation for construction of the buildings pad and surface parking. Minimal site preparation will provide satisfactory support for the new footings, floor slab and the new pavement. We recommend that the upper 3 feet of existing soils within the site be removed and recompacted. If loose, disturbed, or otherwise unsuitable materials are encountered at the bottom of excavation, removal of unsuitable soils will be required until firm soils are encountered.

Excavations below the final grade level should be properly backfilled using lean concrete or approved fill material compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM Test Method D1557. The backfill and any additional fill should be placed in loose lifts less than 8 inches thick, moisture conditioned to near optimum moisture content, and compacted to 90 percent. Fill materials should be free of construction debris, roots, organic matter, rubble, contaminated soils, and any other unsuitable or deleterious material as determined by the Geotechnical Engineer. The on-site soils are suitable for use as compacted fill, provided the soil is free of any deleterious substance. All import fill material should be approved by the Geotechnical Engineer prior to importing to the site for use as compacted fill.

7.3 FILL PLACEMENT AND COMPACTION REQUIREMENTS

Material for engineered fill should be select free of organic material, debris, and other deleterious substances, and should not contain fragments greater than 3 inches in maximum dimension. On-site excavated soils that meet these requirements may be used to backfill the excavated buildings pad area.

All fill should be placed in 6-inch-thick maximum lifts, watered or air dried as necessary to near optimum moisture content, and then compacted in place to a maximum relative compaction of 90 percent. The laboratory maximum dry density and optimum moisture content for each change in soil type should be determined in accordance with Test Method ASTM D 1557. A representative of the project consultant should be present on-site during grading operations to verify proper placement and compaction of all fill, as well as to verify compliance with the other geotechnical recommendations presented herein.

Imported soils, if any, should consist of clean materials exhibiting a VERY LOW expansion potential (Expansion Index less than 20). Soils to be imported should be approved by the project geotechnical consultant prior to importation.

7.4 VOLUMETRIC CHANGES

Volumetric changes in earth quantities will occur when excavated onsite soil materials are replaced as properly compacted fill. It is anticipated that shrinkage due to recompaction of existing soils will range from 3 to 5 percent. The actual shrinkage or bulking that will occur during grading will depend on the average degree of relative compaction achieved.

A subsidence estimate at 0.10 to 0.15 feet may be anticipated as a result of the scarification and recompaction of the exposed ground surfaces within the removal areas.

The above estimates of shrinkage and subsidence are intended for use by the project planners in determining earthwork quantities and should not be considered absolute values. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and subsidence that will occur during grading.

7.5 GEOTECHNICAL OBSERVATIONS

Exposed bottom surfaces in each removal area should be observed and approved by the project geotechnical consultant prior to placing fill. No fill should be placed without prior approval from the geotechnical consultant.

The project geotechnical consultant should be present on site during grading operations to verify proper placement and compaction of fill, as well as to verify compliance with the recommendations presented herein.

7.6 UTILITY TRENCH BACKFIL

All utility trench backfill should be compacted to a minimum relative compaction of 90 percent. Trench backfill materials should be placed in lifts no greater than approximately 6 inches in thickness, watered or air-dried as necessary to near optimum moisture content, and then mechanically compacted in place to a minimum relative compaction of 90 percent. A representative of the project geotechnical consultant should probe and test the backfills to verify adequate compaction.

As an alternative for shallow trenches where pipe or utility lines may be damaged by mechanical compaction equipment, such as under floor slabs, imported clean sand exhibiting a sand equivalent (SE) value of 30 or greater may be utilized. The sand backfill materials should be watered to achieve near optimum moisture conditions and then tamped into place. No specific relative compaction will be required; however, observation, probing, and if deemed necessary, testing should be performed by a representative of the project geotechnical consultant to verify an adequate degree of compaction and that the backfill will not be subject to settlement.

Where utility trenches enter the footprint of the floor slabs, they should be backfilled through their entire depths with on-site fill materials, sand-cement slurry, or concrete rather than with any sand or gravel shading. This “Plug” of less- or non-permeable materials will mitigate the potential for water to migrate through the backfilled trenches from outside to the areas beneath the foundations and floor slabs.

7.7 SHALLOW FOUNDATIONS

Following the site and foundation preparation recommended above, foundation for load bearing walls and interior columns may be designed as discussed below.

7.7.1 Bearing Capacity and Settlement

Load bearing walls and interior columns may be supported on continuous spread footings and isolated spread footings, respectively, and should bear entirely upon undisturbed native or properly engineered fill. Continuous and isolated footings should have a minimum width of 18 inches and 24 inches, respectively. All footings should be embedded a minimum depth of 18 inches measured from the lowest adjacent finish grade. Continuous and isolated footings placed on such materials may be designed using an allowable (net) bearing capacity of 2,000 pounds per square foot (psf) respectively. Allowable increases of 250 psf for each additional 1 foot in width and 250 psf for each additional 6 inches in depth may be utilized, if desired. The maximum allowable bearing pressure should be 3,000 psf. The maximum bearing value applies to combined dead and sustained live loads. The allowable bearing pressure may be increased by one-third when considering transient live loads, including seismic and wind forces.

Based on the allowable bearing value recommended above, total settlement of the shallow footings are anticipated to be less than one inch, provided foundation preparations conform to the recommendations described in this report. Differential settlement is anticipated to be approximately half the total settlement for similarly loaded footings spaced up to approximately 30 feet apart.

7.7.2 Lateral Load Resistance

Lateral load resistance for the spread footings will be developed by passive soil pressure against sides of footings below grade and by friction acting at the base of the concrete footings bearing on compacted fill. An allowable passive pressure of 250 psf per foot of depth may be used for design purposes. An allowable coefficient of friction 0.30 may be used for dead and sustained live load forces to compute the frictional resistance of the footings constructed directly on compacted fill. Safety factors of 2.0 and 1.5 have been incorporated in development of allowable passive and frictional resistance values, respectively. Under seismic and wind loading conditions, the passive pressure and frictional resistance may be increased by one-third.

7.7.3 Footing Reinforcement

Reinforcement for footings should be designed by the structural engineer based on the anticipated loading conditions. Footings for structures that are supported in very low to low expansive soils should have No. 4 bars, two top and two bottom.

7.8 RETAINING WALLS AND WALLS BELOW GRADE

The project may include shallow retaining walls supporting soil materials. These wall heights are anticipated to be of maximum height of approximately 5 feet in height. Design lateral earth pressure, backfill criteria, and drainage recommendations for walls below grade are presented below.

7.8.1 Lateral Earth Pressures

The earth pressure behind retaining walls depends primarily on the allowable wall movement, wall inclination, type of backfill materials, backfill slopes, surcharges, and any hydrostatic pressure. The potential pressure components of subterranean walls include a uniform surcharge pressures for traffic or surcharges, active and restrained horizontal pressure components, and pressures from compaction effort.

Walls below grade should be designed to resist the applicable lateral earth pressures. On-site soil materials may be used as backfill behind retaining walls; however, these onsite soils are very low to low expansive. Therefore, if these materials are used as backfill, at-rest earth pressures of 60 pcf pounds per cubic foot (equivalent fluid pressures) for drained conditions should be used, all walls should be designed to support any adjacent structural surcharge loads imposed by other nearby walls or footings in addition to the above recommended active and at-rest earth pressures.

Where sufficient area exists behind the proposed walls, imported clean sand exhibiting a sand equivalent value (SE) of 30 or greater, or pea gravel or crushed rock may be used for wall backfill to reduce the lateral earth pressures provided these granular backfill materials extend behind the walls to a minimum horizontal distance equal to one-half the wall height. In addition, the sand, pea gravel or rock backfill materials should extend behind the walls to a minimum horizontal distance of 2 feet at the base of the wall or to a horizontal distance equal to the heel width of the footing, whichever is greater. For the above conditions, at-rest earth pressures equivalent to fluids having densities of 45 pcf for drained conditions are recommended for design of restrained walls supporting a level backfill. Furthermore, as with native soil backfill, the walls should be designed to support any adjacent structural surcharge loads imposed by other nearby walls or footings in addition to the above recommended active and at-rest earth pressures, if the loads fall within a 1:1 projection of wall foundations.

7.8.2 Backfill Behind Walls Below Grade

Backfill behind walls below grade should consist of non-expansive granular materials with an E.I. less than 20, as determined by the Uniform Building Code (UBC) Standard Test Number 18-2. Wall backfill should not contain organic material, rubble, debris, and rocks or cemented fragments larger than 3 inches in greatest dimension. In the case where no shoring was used, the granular backfill should extend outward from the base of the wall to ground surface at a 1:1 (horizontal:vertical) slope.

Backfill should be properly compacted to reduce settlement of the backfill. Backfill should be placed in lifts not exceeding 8 inches in thickness, moisture-conditioned to near optimum moisture content and mechanically compacted throughout to at least 90 percent of the maximum dry density as determined by ASTM D 1557. Walls below grade that are not free to deflect should be properly braced prior to placement and compaction of backfill.

Compaction of backfill adjacent to walls can produce excessive lateral pressures. Improper type and location of compaction equipment and/or compaction techniques may damage wall below grade. The use of heavy compaction equipment should not be permitted within a horizontal distance of 5 feet from the wall. Only hand-held compactors should be permitted to compact backfill within the recommended 5-foot zone.

7.8.3 Drainage and Waterproofing

If walls are designed for drained earth pressures, adequate drainage should be provided behind the walls. This can be accomplished by installing subdrains at the base of the walls. Wall backdrains should consist of a system of filter material and perforated pipe and should be approved by GeoBoden. The perforated pipe system should consist of 4-inch diameter, schedule 40, PVC pipe or equivalent, embedded in 1 cubic foot of Class II Permeable Material (CALTRANS Standard Specifications, latest edition) or equivalent per lineal foot of pipe. Alternatively, ¾-inch open graded gravel or crushed rock enveloped in Mirafi 140 geofabric or equivalent may be used instead of the Class II Permeable Material. The pipe should be placed at the base of the wall, have a gradient of approximately 2 percent, and should be connected to the subdrains and then routed to a suitable area for discharge of accumulated water.

Wall backfill should be protected against infiltration of surface water. Backfill adjacent to walls should be sloped so that surface water drains freely away from the wall and will not pond. Waterproofing of walls below grade is recommended.

7.9 CONCRETE SLAB ON-GRADE

Concrete slabs will be placed on undisturbed natural soils or properly compacted fill as outlined in Section 7.2. Moisture content of subgrade soils should be maintained near the optimum moisture content.

At the time of the concrete pour, subgrade soils should be firm and relatively unyielding. Any disturbed soils should be excavated and then replaced and compacted to a minimum of 90 percent relative compaction. Slabs should be designed to accommodate very low to low expansive fill soils. The structural engineer should determine the minimum slab thickness and reinforcing depending upon the expansive soil condition intended use. Slabs placed on very low to low expansive soils should be at least 4 inches thick and have minimum reinforcement of No. 4 bars placed at mid-height of the slabs and spaced 18 inches on centers, in both directions. The structural engineer may require thicker slabs with more reinforcement depending on the anticipated slab loading conditions.

If moisture-sensitive floor covering is planned, a layer of open-graded gravel, at least 4 inches thick, should be placed below the concrete slab to form a capillary break. Alternately, moisture-proof membrane (such as 10-mil) may be utilized. The vapor barrier should be placed between sand layers (2 inches above and below) to protect the membrane from damage during construction. Gravel for use under a concrete floor slab should be clean, crushed rock that meets the gradation requirements presented below.

Sieve Size	Percentage
1 inch	100
¾ inch	90-100
No. 4	0-10

7.10 PRELIMINARY PAVEMENT DESIGN

Pavement design should be confirmed at the completion of site grading when the subgrade soils are in-place. This should include sampling and R-Value testing of the actual subgrade soils and an analysis based upon the anticipated traffic loading.

For a preliminary pavement design, recommendations for pavement design section of asphalt parking areas are provided below. These values are based on R-value of 48.

For pavement design, Traffic indexes (TI) of 4.0 and 5.5 were used for the parking areas and auto driveways, respectively. The preliminary flexible pavement layer thickness is as follows:

RECOMMMENDED ASPHALT PAVEMENT SECTION LAYER THICKNESS

Pavement Material	Recommended Thickness		
	TI = 4.0	TI = 5.5	TI = 10
Asphalt Concrete Surface Course	3 inches	4 inches	7 inches
Class II Aggregate Base Course	6 inches	8 inches	8 inches
Compacted Subgrade Soils	12 inches	12 inches	12 inches

Asphalt concrete should conform to Sections 203 and 302 of the latest edition of the Standard Specifications for Public Works Construction ("Greenbook").

Portland cement concrete paving sections were determined in accordance with procedures developed by the Portland Cement Association. Concrete paving sections for three Traffic

Indices are presented below. We have assumed that the portland cement concrete will have a compressive strength of at least 3,000 pounds per square inch.

Assumed Traffic Index	PCC Paving (Inches)	Base Course (Inches)
4½ (Automobile Parking)	6	4
6½ (Roadways and Heavy Truck Traffic)	8	4

Class II aggregate base should conform to Section 26 of the Caltrans Standard Specifications, latest edition. The aggregate base course should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Method D 1557.

7.11 SOLUBLE SULFATES AND SOIL CORROSIVITY

The soluble sulfate, pH, and chloride concentration tests were performed on a sample of the on-site soils. Corrosion test results are presented in Appendix B. Results of the minimum resistivity tests indicate that on-site soils have mildly corrosive potential when in contact with ferrous materials. Typical recommendations for mitigation of the corrosive potential of the soil in contact with buildings materials are the following:

- Below grade ferrous metals should be given a high quality protective coating, such as an 18 mil plastic tape, extruded polyethylene, coal tar enamel, or Portland cement mortar.

- Below grade ferrous metals should be electrically insulated (isolated) from above grade ferrous metals and other dissimilar metals, by means of dielectric fittings in utilities and exposed metal structures breaking grade.

- Steel and wire reinforcement within concrete in contact with the site soils should have at least two inches of concrete cover.

If ferrous buildings materials are expected to be placed in contact with site soils, it may be desirable to consult a corrosion specialist regarding chosen construction materials, and/or protection design for the proposed facility.

Corrosion test results also indicate that the surficial soils at the site have negligible sulfate attack potential on concrete. No sulfate-resistant cement will be necessary for concrete placed in contact with the on-site soils.

8.0 CONSTRUCTION CONSIDERATIONS

Based on our field exploration program, earthwork can be performed with conventional construction equipment.

8.1 TEMPORARY DEWATERING

Groundwater was not encountered in borings to the maximum explored depth of 31.5 feet below ground surface. Based on the anticipated excavation depths, the need for temporary dewatering is considered low.

8.2 CONSTRUCTION SLOPES

Excavations during construction should be conducted so that slope failure and excessive ground movement will not occur. The short-term stability of excavation depends on many factors, including slope angle, engineering characteristics of the subsoils, height of the excavation and length of time the excavation remains unsupported and exposed to equipment vibrations, rainfall and desiccation.

Where space permits, and providing that adjacent facilities are adequately supported, open excavations may be considered. In general, unsupported slopes for temporary construction excavations should not be expected to stand at an inclination steeper than 1:1 (horizontal:vertical). The temporary excavation side walls may be cut vertically to a height of 3 feet and then laid back at a 1:1 slope ratio above a height of 3 feet.

Surcharge loads should be kept away from the top of temporary excavations a horizontal distance equal to at least one-half the depth of excavation. Surface drainage should be controlled along the top of temporary excavations to preclude wetting of the soils and erosion of the excavation faces. Even with the implementation of the above recommendations, sloughing of the surface of the temporary excavations may still occur, and workmen should be adequately protected from such sloughing.

If site conditions do not provide sufficient space for sloped excavations at the project site, slot cutting techniques in a repeating "ABC" sequence may be required. First, all the slots designated as "A" should be excavated, backfilled and recompacted. The procedure should continue with the "B" slots and end with the "C" slots. The width of each slot should not exceed 6 feet. If any evidence of potential instability is observed, revised recommendations such as narrower slot cuts may be necessary. All slot excavation and backfilling procedures should be performed under the observation and testing of a qualified geotechnical engineer.

8.3 TEMPORARY SHORING

Soldier piles and lagging could be considered for shoring the temporary excavation sidewalls; however, this method of shoring may not be economically feasible since the shoring would significantly increase construction costs and could possibly double the cost of performing overexcavations along the property lines. If shoring is considered, we should be notified in order to provide appropriate design parameters.

9.0 POST INVESTIGATION SERVICES

Final project plans and specifications should be reviewed prior to construction to confirm that the full intent of the recommendations presented herein have been applied to design and construction. Following review of plans and specifications, observation should be performed by the geotechnical engineer during construction to document that foundation elements are founded on/or penetrate onto the recommended soils, and that suitable backfill soils are placed upon competent materials and properly compacted at the recommended moisture content.

10.0 CLOSURE

The conclusions, recommendations, and opinions presented herein are: (1) based upon our evaluation and interpretation of the limited data obtained from our field and laboratory programs; (2) based upon an interpolation of soil conditions between and beyond the borings; (3) are subject to confirmation of the actual conditions encountered during construction; and,

(4) are based upon the assumption that sufficient observation and testing will be provided during construction.

If parties other than GeoBoden are engaged to provide construction geotechnical services, they must be notified that they will be required to assume complete responsibility for the geotechnical phase of the project by concurring with the findings and recommendations in this report or providing alternate recommendations.

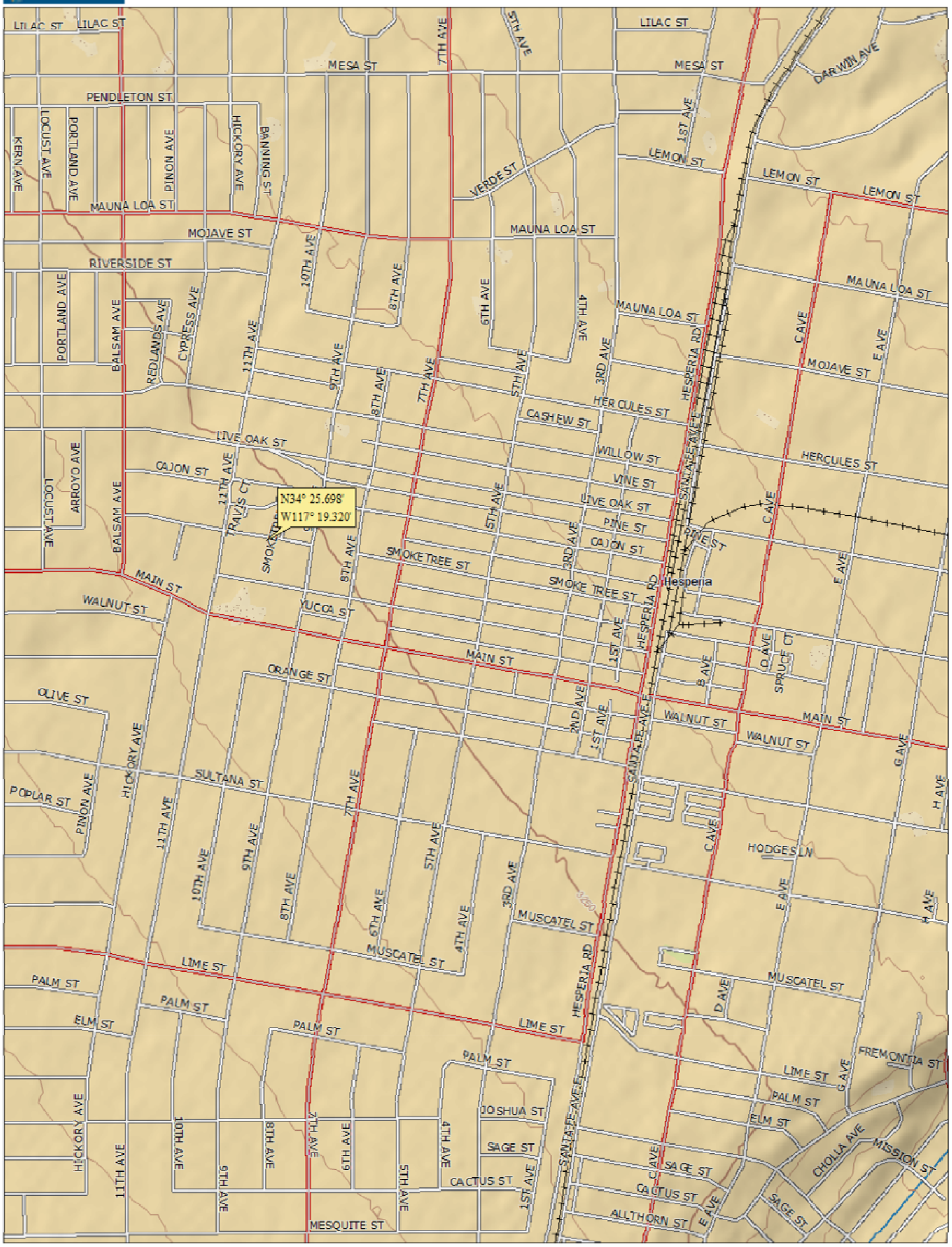
If pertinent changes are made in the project plans or conditions are encountered during construction that appear to be different than indicated by this report, please contact this office. Significant variations may necessitate a re-evaluation of the recommendations presented in this report.

11.0 REFERENCES

California Building Code, 2019 Volume 2.

FIGURES

DeLorme Topo USA® 7.0



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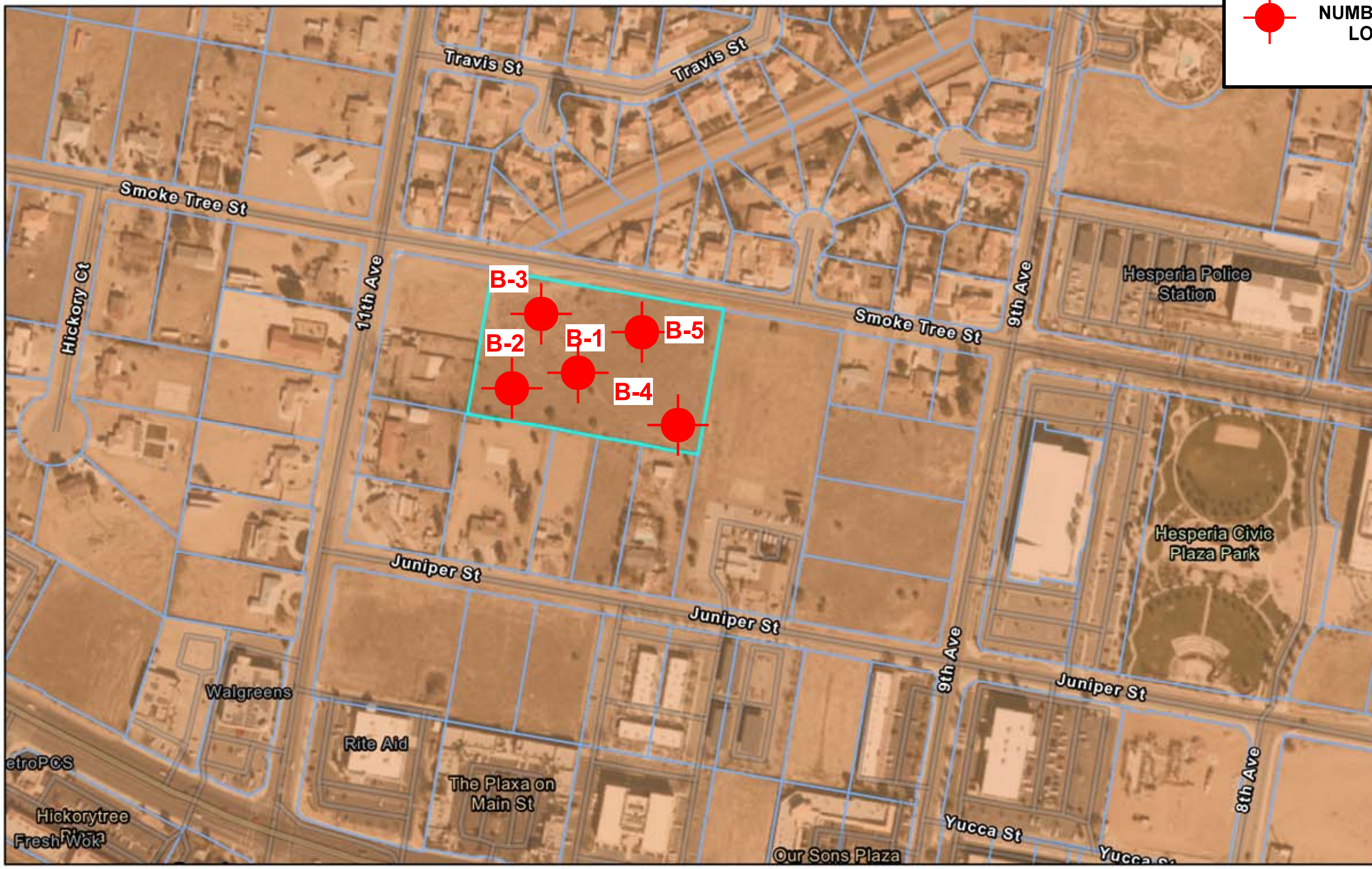
MN (11.4° E)

0 800 1600 2400 3200 4000 ft

Data Zoom 13-0

GEOBODEN INC. Geotechnical Consultants	**SITE VICINITY MAP** **Proposed Residential Development** **APN: 040725112** **15639 Smoke Tree Street** **Hesperia, California**	Figure By S.R. Map No. XX Date 05-30-22	Project No. Smoke Tree-1-01 Figure No. 1

San Bernardino County Parcel Viewer



LEGEND

B-1 NUMBER AND APPROXIMATE LOCATION OF BORING

5/30/2022, 12:31:05 AM

Parcels

BLM National Public Land Survey - Township

City Limits

1:4,514

0 0.03 0.06 0.12 mi

0 0.05 0.1 0.2 km

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap

San Bernardino County GIS

San Bernardino County, Maxar | Compiled by the Bureau of Land Management (BLM), National Operations Center (NOC), OC-530 | Esri Community Maps Contributors, City of Hesperia, California State Parks, © OpenStreetMap, Microsoft, Esri, HERE, Garmin,

GEOBODEN INC. Geotechnical Consultants	BORING LOCATION PLAN Proposed Residential Development APN: 040725112 15639 Smoke Tree Street Hesperia, California	Figure By S.R. Map No. XX Date 05-30-22	Project No. Smoke Tree-1-01 Figure No. 2

APPENDIX A
BORING LOGS

APPENDIX A
SUBSURFACE EXPLORATION PROGRAM

PROPOSED RESIDENTIAL DEVELOPMENT
APN: 040725112
15639 SMOKE TREE STREET
HESPERIA, CALIFORNIA

Prior to drilling, the proposed borings were located in the field by measuring from existing site features.

A total of 5 exploratory borings (B-1 through B-5) were drilled using a hollow-stem auger drill rig equipped with 8-inch outside diameter (O.D.) augers. Geoboden of Irvine, California performed the drilling on February 13, 2018. The boring locations are shown on Figure 2.

Depth-discrete soil samples were collected at selected intervals from the exploratory borings using a 2 ½ -inch inside diameter (I.D.) modified California Split-barrel sampler fitted with 12 brass ring of 2 ½ inches in O.D. and 1-inch in height and one brass liner (2 ½ -inch O.D. by 6 inches long) above the brass rings. The sampler was lowered to the bottom of the boreholes and driven 18 inches into the soil with a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler the lower 12 inches is shown on the blow count column of the boring logs.

After removing the sampler from the boreholes, the sampler was opened and the brass rings and liner containing the soil were removed and observed for soil classification. Brass rings containing the soil were sealed in plastic canisters to preserve the natural moisture content of the soil. Soil samples collected from exploratory borings were labeled, and were transported for physical testing.

Standard Penetration Tests (SPTs) were also performed within the borings. The SPT consists of driving a standard sampler, as described in the ASTM 1586 Standard Method, using a 140-pound hammer falling 30 inches. The number of blows required to drive the SPT sampler the lower 12 inches of the sampling interval is recorded on the blow count column of the boring logs.

The soil classifications and descriptions on field logs were performed using the Unified Soil Classification System as described by the American Society for Testing and Materials (ASTM) D 2488-90, “Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).” The final boring logs were prepared from the field logs and are presented in this Appendix.

At the completion of the sampling and logging, the exploratory borings were backfilled with the drilled cuttings.

GEOBODEN, INC.

BORING NUMBER B-1

CLIENT Mazi, Hossein Trust
PROJECT NAME Proposed Residential Development
PROJECT NUMBER Smoke Tree1-01
PROJECT LOCATION 15639 Smoke Tree Street, Hesperia, CA
DATE STARTED 5/2/22 **COMPLETED** 5/2/22
GROUND ELEVATION **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Geoboden, Inc.
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY C.R. **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SAND (SP): light yellowish brown, moist, fine sand										
3		SILTY SAND (SM): yellowish brown, moist, fine sand										
5			MC R-1		30		108	8				18
10			SS S-2		19							
15			MC R-3		39							
20			SS S-4		19							
23		SANDY CLAY (CL): light brown, moist										
25			SS R-5		18							
30			SS S-6		19							

Bottom of borehole at 31.5 feet below ground surface. Boring was backfilled with cuttings. No groundwater was encountered at the time of drilling.

Bottom of borehole at 31.5 feet.

GEOBODEN, INC.

BORING NUMBER B-2

CLIENT Mazi, Hossein Trust	**PROJECT NAME** Proposed Residential Development
PROJECT NUMBER Smoke Tree1-01	**PROJECT LOCATION** 15639 Smoke Tree Street, Hesperia, CA
DATE STARTED 5/2/22 **COMPLETED** 5/2/22	**GROUND ELEVATION** **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Geoboden, Inc.	**GROUND WATER LEVELS:**
DRILLING METHOD HSA	**AT TIME OF DRILLING** ---
LOGGED BY C.R. **CHECKED BY**	**AT END OF DRILLING** ---
NOTES	**AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SAND w. SILT (SP-SM): light brown, dry, fine sand										
5			MC R-1		25		103	4				
10			SS S-2		23			5				
		SANDY CLAY (CL): brown, moist, fine sand										
15			MC R-3		54		112	16	46	21	25	69
20		light brown	SS S-4		22							

Bottom of borehole at 21.5 feet below ground surface. Boring was backfilled with cuttings. No groundwater was encountered at the time of drilling.

Bottom of borehole at 21.5 feet.

GEOBODEN, INC.

BORING NUMBER B-3

CLIENT Mazi, Hossein Trust
PROJECT NAME Proposed Residential Development
PROJECT NUMBER Smoke Tree1-01
PROJECT LOCATION 15639 Smoke Tree Street, Hesperia, CA
DATE STARTED 5/2/22 **COMPLETED** 5/2/22
GROUND ELEVATION **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Geoboden, Inc.
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY C.R. **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SILTY SAND (SM): brown, moist, fine sand, some clay										
5			MC R-1		32		105	8				52
		SAND (SP): light olive, moist, fine sand										
10			SS S-2		21			6				
		SAND w. SILT & GRAVEL (SP-SM): light olive brown, moist, ~15% fine subrounded gravel, ~10% fines, ~75% fine to medium sand										
15			MC R-3		41		111	7				
20												

Bottom of borehole at 21.5 feet below ground surface. Boring was backfilled with cuttings. No groundwater was encountered at the time of drilling.

Bottom of borehole at 21.5 feet.

GEOBODEN, INC.

BORING NUMBER B-4

CLIENT Mazi, Hossein Trust
PROJECT NAME Proposed Residential Development
PROJECT NUMBER Smoke Tree1-01
PROJECT LOCATION 15639 Smoke Tree Street, Hesperia, CA
DATE STARTED 5/2/22 **COMPLETED** 5/2/22
GROUND ELEVATION **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Geoboden, Inc.
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY C.R. **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SAND w. SILT (SP-SM): brown, moist, fine sand										
5			MC R-1		35		106	4				
		POORLY-GRADED SAND (SP): light brown, moist										
10			MC R-2		39		110	3				
15			MC R-3		43							

Bottom of borehole at 16.5 feet below ground surface. Boring was backfilled with cuttings. No groundwater was encountered at the time of drilling.

Bottom of borehole at 16.5 feet.

GEOBODEN, INC.

BORING NUMBER B-5

CLIENT Mazi, Hossein Trust
PROJECT NAME Proposed Residential Development
PROJECT NUMBER Smoke Tree1-01
PROJECT LOCATION 15639 Smoke Tree Street, Hesperia, CA
DATE STARTED 5/2/22 **COMPLETED** 5/2/22
GROUND ELEVATION **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Geoboden, Inc.
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY C.R. **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SILTY SAND (SM): brown, moist										
5			MC R-1		45							
10		SAND (SP): light brown, moist										
			MC R-2		47							

Bottom of borehole at 11.5 feet below ground surface. Boring was backfilled with cuttings. No groundwater was encountered at the time of drilling.

Bottom of borehole at 11.5 feet.

APPENDIX B
LABORATORY TESTING

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LABORATORY TESTING

PROPOSED RESIDENTIAL DEVELOPMENT
APN: 040725112
15639 SMOKE TREE STREET
HESPERIA, CALIFORNIA

Laboratory tests were performed on selected samples to assess the engineering properties and physical characteristics of soils at the site. The following tests were performed:

- moisture content and dry density
- No. 200 Wash sieve
- consolidation
- direct shear
- expansion potential
- corrosion

Test results are summarized on laboratory data sheets or presented in tabular form in this appendix.

Moisture Density Tests

The field moisture contents, as a percentage of the dry weight of the soils, were determined by weighing samples before and after oven drying. The dry density, in pounds per cubic foot, was also determined fir all relatively undisturbed ring samples collected. These analyses were performed in accordance with ASTM D 2937. The results of these determinations are shown on the boring logs in Appendix A.

No. 200 Wash Sieve

Quantitative determination of the percentage of soil finer than 0.075 mm was performed on selected soil samples by washing the soil through the No. 200 sieve. Test procedures were performed in accordance with ASTM Method D1140. The results of the tests are shown on the boring logs.

Consolidation

The tests were performed in accordance with ASTM Test method D 2345. The compression curves from the consolidation tests are presented in this Appendix.

Direct Shear

Direct shear tests were performed on undisturbed samples of on-site soils. A different normal stress was applied vertically to each soil sample ring which was then sheared in a horizontal direction. The resulting shear strength for the corresponding normal stress was measured at a maximum constant rate of strain of 0.005 inches per minute. The direct shear results are shown graphically on a laboratory data sheet included in this appendix.

Expansion Potential

Expansion index test was performed on a representative sample of the on-site soils in accordance with ASTM D4829. The result of the expansion test is summarized in Table B-1.

TABLE B-1 (Expansion Index Test Data)

Boring Designation	**Depth (ft)**	Expansion Index (EI)
B-1	0-5	18

Corrosion Potential

A selected soil sample was tested to determine the corrosivity of the site soil to steel and concrete. The soil sample was tested for soluble sulfate (Caltrans 417), soluble chloride (Caltrans 422), and pH and minimum resistivity (Caltrans 643). The results of corrosion tests are summarized in Table B-2.

TABLE B-2 (Corrosion Test Results)

Boring No.	**Depth (ft)**	**Chloride Content (Calif. 422)**	**Sulfate Content (Calif. 417) % by Weight**	**pH (Calif. 643)**	**Resistivity (Calif. 643) Ohm*cm**
B-1	0-5	69	0.0119	7.3	1,845

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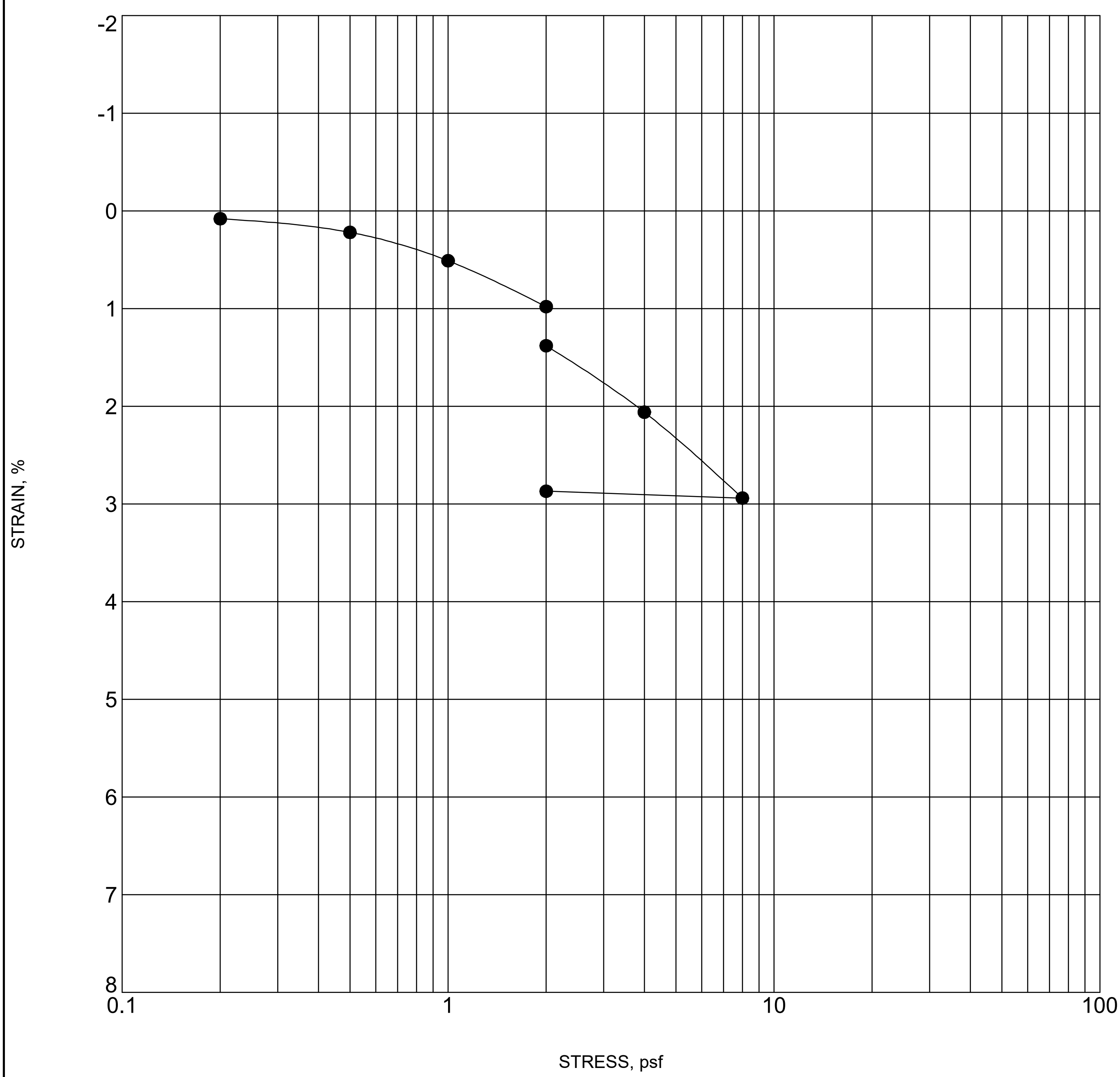
CONSOLIDATION TEST

CLIENT Mazi, Hossein Trust

PROJECT NAME Proposed Residential Development

PROJECT NUMBER Smoke Tree1-01

PROJECT LOCATION 15639 Smoke Tree Street, Hesperia, CA



	Specimen Identification		Classification	γ_d	MC%
●	**B-1**	**5.0**	**SILTY SAND (SM)**	**106**	**8**

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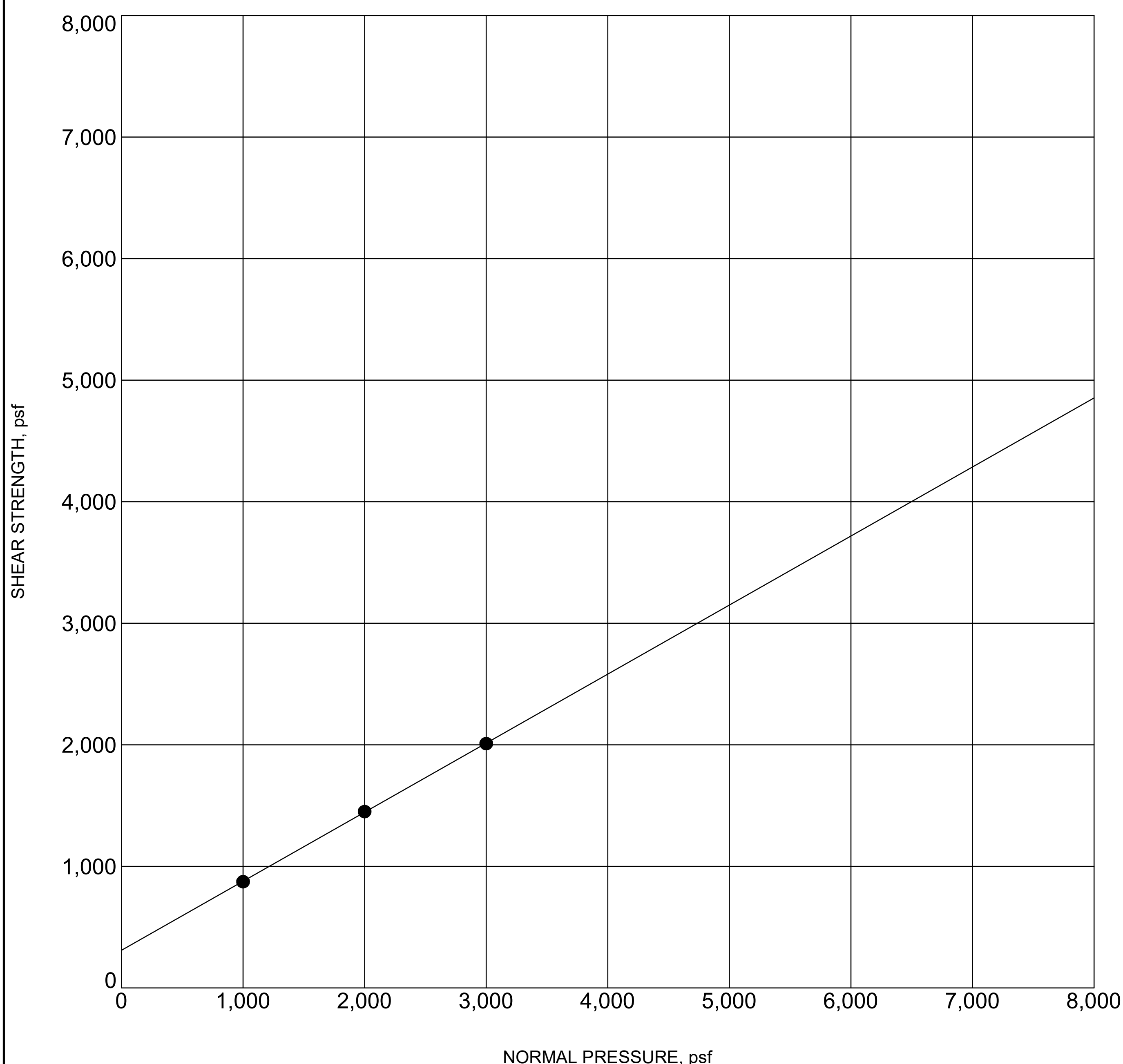
DIRECT SHEAR TEST

CLIENT Mazi, Hossein Trust
PROJECT NAME Proposed Residential Development
PROJECT NUMBER Smoke Tree1-01
PROJECT LOCATION 15639 Smoke Tree Street, Hesperia, CA



	Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	**B-3**	**5.0**	**SILTY SAND (SM)**	**105**	**8**	**309.0**	**30**