CHRISTIAN WHEELER
ENGINEERING

June 10, 2020

Pat and Paula Broe
8423 El Paseo Grande
La Jolla, California 92037

CWE 2200064.02

Subject: **Cycle 2 LDR-Geology Review of Documents, City Project Nbr. 661815, Proposed Broe Residence, 8423 El Paseo Grande, La Jolla, California**

References:
1) City of San Diego, 2 LDR-Geology Cycle Review Memorandum, Project Nbr. 661815, prepared by Patrick Thomas, CEG, dated May 21, 2020
2) Landmark Consulting, Grading & Drainage Plan, 8423 El Paseo Grande, La Jolla, California, dated February 12, 2020
3) Christian Wheeler Engineering, 2016, Report of Preliminary Geotechnical Investigation, Proposed Broe Residence, 8423 El Paseo Grande, La Jolla, California, dated March 11, 2020, CWE Report No. 2200064.1R

Dear Mr. and Mrs. Broe:

At your request, we have prepared this report to present additional information required by the City of San Diego regarding the geotechnical issues at the site. The comments in the City Review Memorandum within our purview and our responses to the comments in the referenced memorandum are presented below.

City Comment No. 4: Submit an addendum geotechnical document.

CWE Response: This report, which addresses the referenced plans, has been prepared as an addendum to our referenced geotechnical report. Based on our review of the referenced plan, it is our opinion that all the recommendations contained in our previous geotechnical report for the proposed project remain applicable.

City Comment No. 5: The geotechnical consultant must comment whether or not the proposed site development as recommended will measurably destabilize neighboring properties or induce the settlement of adjacent structures.

CWE Response: Provided the recommendations presented in our referenced geotechnical report are incorporated into the proposed project's design and construction and that sound construction practices are

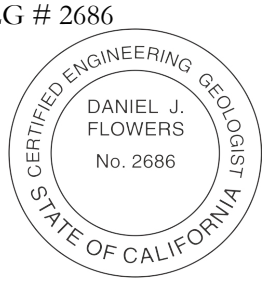
followed, the proposed site development as recommended should not measurably destabilize neighboring properties or induce the settlement of adjacent structures.

If you have any questions regarding this report, please do not hesitate to contact this office. Christian Wheeler Engineering appreciates this opportunity of providing professional services for you for the subject project.

Respectfully submitted,
CHRISTIAN WHEELER ENGINEERING

Daniel B. Adler, RCE #36037

Daniel J. Flowers, CEG # 2686



DBA:dba
ec: PBroe@broe.com
paulabroe@yahoo.com
aking@broe.com
tshah@broe.com
hduke@islandarch.com
nwilson@islandarch.com

CHRISTIAN WHEELER
ENGINEERING

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

PROPOSED BROE RESIDENCE
8423 EL PASEO GRANDE
LA JOLLA, CALIFORNIA

SUBMITTED TO

8423 EL PASEO GRANDE, LLC
8423 EL PASEO GRANDE
LA JOLLA, CALIFORNIA 92037

PREPARED BY

CHRISTIAN WHEELER ENGINEERING
3980 HOME AVENUE
SAN DIEGO, CALIFORNIA 92105

CHRISTIAN WHEELER
ENGINEERING

March 11, 2020

Pat and Paula Broe
8423 El Paseo Grande
La Jolla, California 92037

CWE 2200064.01R

Subject: Report of Preliminary Geotechnical Investigation
Proposed Broe Residence, 8423 El Paseo Grande, La Jolla, California

Dear Mr. and Mrs. Broe:

In accordance with your request and our proposal dated January 21, 2020, we have completed a preliminary geotechnical investigation for the proposed residential structure project to be constructed at the subject site. Our findings and recommendations are provided in the attached report.

In general, our findings indicate that, from a geologic and geotechnical perspective, the subject property is suitable for the proposed construction provided the recommendations presented in the attached report are implemented.

If you have any questions after reviewing this report, please do not hesitate to contact our office. This opportunity to be of professional service is sincerely appreciated.

Respectfully submitted,

CHRISTIAN WHEELER ENGINEERING

Daniel B. Adler, RCE # 36037
DBA:djf
ec: PBroe@broe.com
paulabroe@yahoo.com
aking@broe.com
tshah@broe.com
hduke@islandarch.com
nwilson@islandarch.com

REGISTERED PROFESSIONAL ENGINEER
DANIEL B. ADLER
No. 36037
Exp. 6-30-20
CIVIL
STATE OF CALIFORNIA

Daniel J. Flowers, CEG # 2686

CERTIFIED ENGINEERING GEOLOGIST
DANIEL J. FLOWERS
No. 2686
STATE OF CALIFORNIA

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

ATTACHMENTS

TABLES

FIGURES

PLATES

APPENDICES

CHRISTIAN WHEELER
ENGINEERING

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

PROPOSED BROE RESIDENCE
8423 EL PASEO GRANDE
LA JOLLA, CALIFORNIA

INTRODUCTION AND PROJECT DESCRIPTION

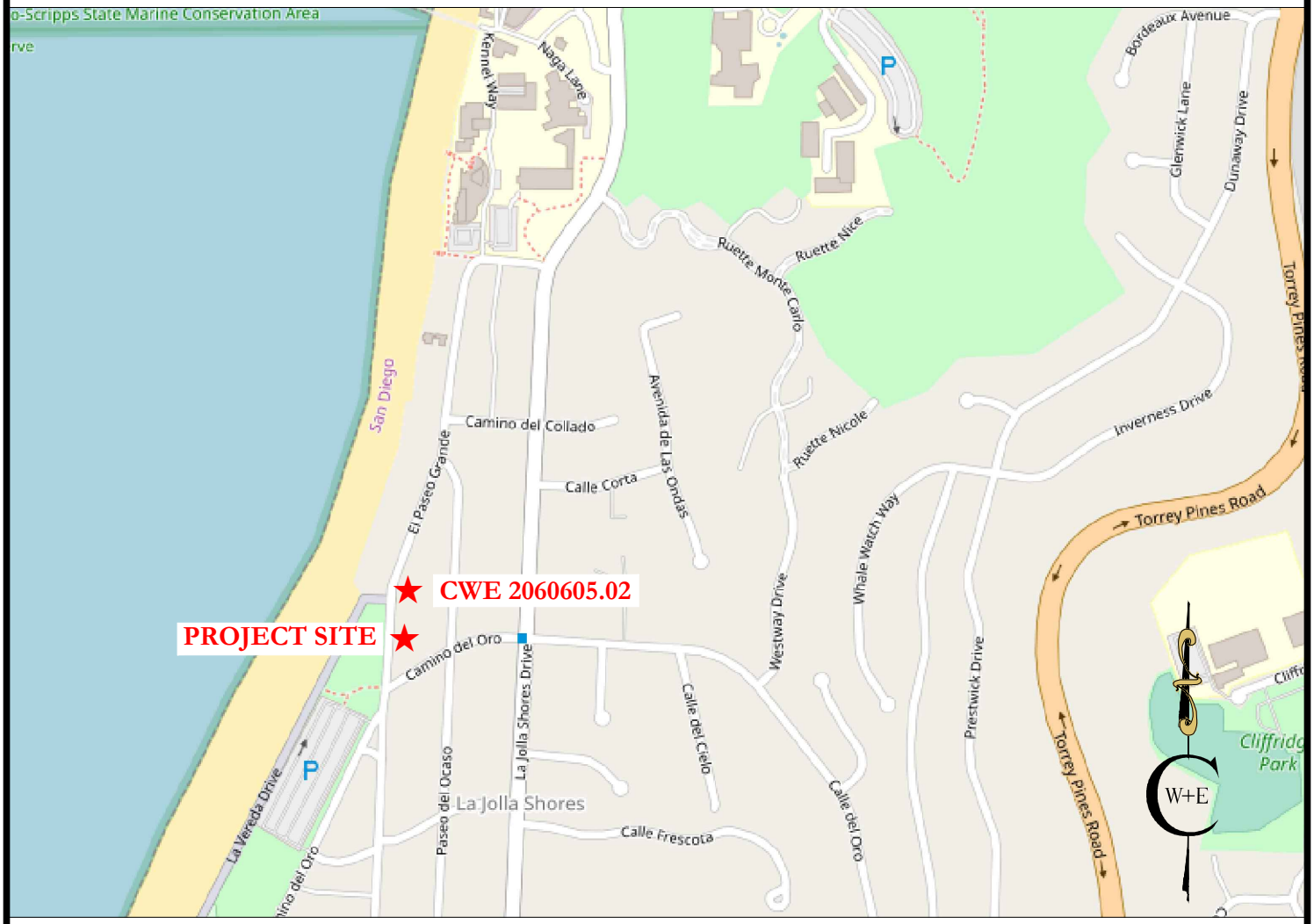
This report presents the results of our geotechnical investigation for the proposed residential structure to be constructed at 8423 El Paseo Grande, La Jolla, California. The location of the project site is shown on the following Figure Number 1.

We understand that the existing improvements will be demolished and subject project will consist of the construction of a two-story residential structure. It is anticipated that the proposed structure will be of wood-frame construction and will be supported by a structural mat foundation. Grading to accommodate the proposed construction is expected to consist of cuts and fills up to about a foot from existing grades.

To assist in the preparation of this report, we were provided with we have been provided with miscellaneous plans prepared by Island Architects, February, 2, 2020, and a coastal development grading and drainage plan prepared by Landmark Consulting, dated February 12, 2020. The coastal development permit plan was used as a base map for our Site Plan and Geologic Map included herein as Plate No. 1. We have also included a copy of the building section by Island Architects, modified to depict the site geology, and included herein as Plate No. 2. In addition, to assist in the preparation of this report we have reviewed a geotechnical report prepared by our firm for a nearby property (CWE 2060605.02). Data from this report is included in Appendix E.

This report has been prepared for the exclusive use of 8423 El Paseo Grande, LLC, and its design consultants for specific application to the project described herein. Should the project be modified, the conclusions and recommendations presented in this report should be reviewed by Christian Wheeler Engineering for conformance with our recommendations and to determine if any additional subsurface investigation, laboratory testing and/or recommendations are necessary. Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, express or implied.

SITE VICINITY



PROPOSED BROE RESIDENCE
8423 EL PASEO GRANDE
LA JOLLA, CALIFORNIA

DATE:	MARCH 2020	JOB NO.:	2200064.01R
BY:	SRD	FIGURE NO.:	1

CHRISTIAN WHEELER
ENGINEERING

PROJECT SCOPE

Our preliminary geotechnical investigation consisted of surface reconnaissance, subsurface exploration, obtaining representative soil samples, laboratory testing, analysis of the field and laboratory data, and review of relevant geologic literature. Our scope of service did not include assessment of hazardous substance contamination, recommendations to prevent floor slab moisture intrusion or the formation of mold within the structure, evaluation or design of storm water infiltration facilities, or any other services not specifically described in the scope of services presented below. Specifically, the intent of our proposed investigation is to:

- Excavate 2 test pits to explore the existing soil conditions and collect representative soil samples.
- Backfill the test pits with the removed soil. It should be noted that the soil will not be compacted and will have to be removed and replaced as compacted fill during the future site grading.
- Evaluate, by laboratory tests and our past experience with similar soil types, the engineering properties of the various soil strata that may influence the proposed construction, including bearing capacities, expansive characteristics and settlement potential.
- Describe the general geology at the site including possible geologic hazards that could have an effect on the proposed construction, and provide the seismic design parameters in accordance with the 2019 edition of the California Building Code.
- Discuss potential construction difficulties that may be encountered due to soil conditions, groundwater or geologic hazards, and provide geotechnical recommendations to mitigate identified construction difficulties.
- Provide site preparation and grading recommendations for the anticipated work.
- Provide foundation recommendations for the type of construction anticipated and develop soil engineering design criteria for the recommended foundation designs.
- Provide a preliminary geotechnical report presenting the results of our investigation, including a plot plan showing the location of our subsurface explorations, excavation logs, laboratory test results, and our conclusions and recommendations for the proposed project. The report will be provided as an electronic document in Portable Document Format (PDF).

Although a test for the presence of soluble sulfates within the soils that may be in contact with reinforced concrete was performed as part of the scope of our services, it should be understood Christian Wheeler Engineering does not practice corrosion engineering. If a corrosivity analysis is considered necessary, we recommend that the client retain an engineering firm that specializes in this field to consult with them on this matter. The results of our sulfate testing should only be used as a guideline to determine if additional testing and analysis is necessary.

FINDINGS

SITE DESCRIPTION

The subject site consists of a rectangular-shaped lot located at 8423 El Paseo Grande, La Jolla, California. The site presently supports a single-family residential structure with a detached garage. The property is bounded on the west by El Paseo Grande and is otherwise bounded by residential properties. Topographically, the lot is near flat-lying. According to grading and drainage plan, the site elevation is about 12 feet.

GENERAL GEOLOGY AND SUBSURFACE CONDITIONS

GEOLOGIC SETTING AND SOIL DESCRIPTION: The project site is located in the Coastal Plains Physiographic Province of San Diego County and is primarily underlain by younger alluvium, old paralic deposits, and Ardath Shale. The geologic units that underlie the subject property are described below in order of increasing age:

YOUNGER ALLUVIUM (Qyal): Younger alluvium was encountered in the test pits and is expected to extend to a depth of about 11 feet below existing site grades. The younger alluvium generally consisted of grayish-brown and light brown, moist to saturated, medium stiff and medium stiff to stiff, silty clay with sand. The younger alluvium was found to possess a medium to expansion potential (EI=67 and 78).

OLD PARALIC DEPOSITS (Qop): Old paralic deposits were encountered underlying the younger alluvium to the maximum exploration depth of about 10½ feet below existing grade (test pit P-2); however, based on our nearby boring (B-1, CWE2060605.02) the old paralic deposits are anticipated to extend to a depth of about 25 feet below existing grade. The old paralic deposits exposed in the test pit were found to consist of dark reddish-brown, moist to saturated, medium dense, silty sand (SM). The old paralic deposits were judged to possess a low expansion index (EI between 21 and 50).

ARDATH SHALE (Ta): Based on our investigation for a nearby site (CWE 2060605.02), it is assumed that Tertiary-age Ardath Shale underlies the old paralic deposits at depth. The formational soils previously encountered consisted of light grayish-brown and light brown, moist, hard, silty clay (CL).

GROUNDWATER: Groundwater was encountered in test pits P-1 and P-2 at a depth of about 8 feet and 10 feet below existing site grade, respectively. Due to the site's proximity to the Pacific Ocean, relatively small variations in the local groundwater table may be expected. Based on the proposed site development plans, it is our opinion that groundwater is not expected to present any problems to the site during or after the completion of the proposed construction; however, deep utility trenches excavated on-site may encounter groundwater. As such, a limited de-watering operation may be required if deep utility trenches are planned.

TECTONIC SETTING: No active or potentially active faults are known to traverse the subject site. However, it should be noted that much of Southern California, including the San Diego County area, is characterized by a series of Quaternary-age fault zones that consist of several individual, en echelon faults that generally strike in a northerly to northwesterly direction. Some of these fault zones (and the individual faults within the zone) are classified as "active" according to the criteria of the California Division of Mines and Geology. Active fault zones are those that have shown conclusive evidence of faulting during the Holocene Epoch (the most recent 11,000 years). The Division of Mines and Geology used the term "potentially active" on Earthquake Fault Zone maps until 1988 to refer to all Quaternary-age (last 1.6 million years) faults for the purpose of evaluation for possible zonation in accordance with the Alquist-Priolo Earthquake Fault Zoning Act and identified all Quaternary-age faults as "potentially active" except for certain faults that were presumed to be inactive based on direct geologic evidence of inactivity during all of Holocene time or longer. Some faults considered to be "potentially active" would be considered to be "active" but lack specific criteria used by the State Geologist, such as *sufficiently active* and *well-defined*. Faults older than Quaternary-age are not specifically defined in Special Publication 42, Fault Rupture Hazard Zones in California, published by the California Division of Mines and Geology. However, it is generally accepted that faults showing no movement during the Quaternary period may be considered to be "inactive".

The active Rose Canyon Fault Zone is located approximately 0.6 miles south of the subject site. Other active fault zones in the region that could possibly affect the site include the Coronado Bank, San Diego Trough and San Clemente Fault Zones to the west, the Newport-Inglewood and Palos Verdes Fault Zones to the northwest, and the Elsinore, Earthquake Valley, San Jacinto, and San Andreas Fault Zones to the northeast.

GEOLOGIC HAZARDS

GENERAL: A review of the City of San Diego Seismic Safety Study (Sheet 29) indicated that the site is located in Geologic Hazards Category 52. Hazard Category 52 is assigned to level, gently sloping to steep terrain with favorable geologic structure, where the risks are also classified as low. Although not mapped as

such, the site is located within an area that possesses a low to moderate potential for soil liquefaction due to such factors as shallow groundwater, and the presence of loose to medium dense, cohesionless sediments.

Other than the potentials for seismically induced ground shaking, soil liquefaction and the subsequent seismic induced settlements, as described herein, the site should be safe from geologic hazards at the conclusion of construction, provided the recommendations contained herein are implemented and sound construction practices are followed. It is our professional opinion that the site is suitable for the proposed development. The client should realize that the site preparation and foundation recommendations presented herein are intended to provide a life safety level such that the proposed residence will not collapse during a major seismic event, which could result in loss of life. The recommendations will not necessarily prevent the residence from sustaining structural damage, even to the extent that it becomes uninhabitable. The foundations for the residence should, however, perform in a normally expected manner under static loading conditions for the anticipated life of the structure of 50 to 75 years.

LIQUEFACTION: The subject site is in an area considered susceptible to liquefaction. In order to be subject to liquefaction, three general conditions must be present: loose, sandy and silty deposits of a specified plasticity; shallow groundwater; and earthquake shaking of sufficient magnitude and duration. Based on our site-specific study, it appears that shallow groundwater is present at the site and strong earthquake shaking may affect the site. Information extrapolated from a nearby geotechnical investigation (Figure 2) was used in our evaluation of the liquefaction potential. Data from this report (CWE 2060605.02) is included in Appendix E. As encountered in the nearby geotechnical investigation, the materials of the old paralic deposits below the water table contain poorly graded sands with silt (SP-SM) which are expected to possess consistencies and gradations (soil behavior types) conducive to liquefaction.

It should be noted that our analysis is in no way a guarantee that the analyses will accurately predict the liquefaction potential at the site. The analysis provides general information only on the site liquefaction potential. It should again be noted that many of the parameters used in liquefaction evaluations are subjective and open to interpretation, and that much is yet unknown about both the seismicity of the San Diego area and the phenomenon of liquefaction. The site preparation and foundation recommendations contained in this report are intended to address this situation and provide a life-safety performance level for the proposed structures. Our recommendations do not, however, preclude the possibility of structural damage and settlement of the proposed addition occurring, even to the extent that it become uninhabitable, as a result of a major seismic event, regardless of the mitigation measures taken.

LIQUEFACTION INDUCED SETTLEMENTS: The analyses for a project located 100 feet north of the subject site (CWE 2060605.02) indicates that the potential for up to approximately 2.2 inches of seismically-induced, total settlement may be expected at the site as the result of soil liquefaction caused by a 7.2 Magnitude seismic event along the nearest portion of the Rose Canyon Fault Zone. As described in the referenced CDMG Special Publication 117, considerable difficulty exists in trying to "reliably estimate" the amount of differential settlement at a site caused by soil liquefaction (CDMG, 1997). As such, the Recommended Procedures for the Implementation of Special Publication 117 suggests that conservative estimates of differential settlement at any given site can be assumed to be one-half to two-thirds of the total liquefaction-induced settlement (CDMG, 1999). It is further suggested that differential settlement estimates for a given site be used as representative of the minimum differential settlements between adjacent structural supports (CDMG, 1999). As such, it is our professional opinion and judgment that, based on the site preparation and foundation recommendations contained herein, a conservative estimate of differential settlement across the proposed building pad at the subject site be taken as one-half of the total settlement estimated. Therefore, the proposed structure at the subject site may be assumed to be subject to up to approximately 1.1 inches of seismically-induced, differential settlement.

The above analyses are in no way a guarantee that the analyses will accurately predict the liquefaction potential at the site. The analyses provide general information only on the site liquefaction potential. It should be noted that many of the parameters used in liquefaction evaluations are subjective and open to interpretation, and that much is yet unknown about both the seismicity of the San Diego area and the phenomenon of liquefaction.

LATERAL GROUND SPREADING: Another concern is the possible lateral ground spreading that could occur at the site. Lateral ground spreading can occur when the viscous liquefied soils flow downslope, usually towards a river channel or shoreline. The project area is located within 350 feet of the Pacific Ocean and is gently sloping. Based on this condition, the relatively level hydraulic gradient that is expected across the project area, and the shallow depth of the Ocean shelf, it is our opinion that if liquefaction were to occur during an earthquake, the site will likely experience only minor lateral movement towards the Pacific Ocean.

SURFACE RUPTURE: No active or potentially active faults are known to underlie the subject site. As such, the site is not considered subject to surface rupture.

SLOPE STABILITY: As part of this investigation we reviewed the publication, "Landslide Hazards in the Southern Part of the San Diego Metropolitan Area" by Tan, 1995. This reference is a comprehensive study that classifies San Diego County into areas of relative landslide susceptibility. The subject site is located in Area

2, which is considered to be "marginally susceptible" to slope failures. Based on our findings and the relatively level terrain of the site, it is our opinion that the likelihood of slope stability related problems at the site is very low.

FLOODING: As delineated on the referenced Flood Insurance Rate Map (FIRM), map # 06073C1582H prepared by the Federal Emergency Management Agency, the site is located in Zone X. Zone X is considered to be an "area of minimal flood hazard." Areas of minimal flood hazards are located outside of the boundaries of both the 100-year and 500-year flood zones.

TSUNAMIS: Tsunamis are great sea waves produced by a submarine earthquake or volcanic eruption. Historically, the San Diego area has been free of tsunami-related hazards and tsunamis reaching San Diego have generally been well within the normal tidal range. It is thought that the wide continental margin off the coast acts to diffuse and reflect the wave energy of remotely generated tsunamis. The largest historical tsunami to reach San Diego's coast was 4.6 feet high, generated by the 1960 earthquake in Chile. A lack of knowledge about the offshore fault systems makes it difficult to assess the risk due to locally generated tsunamis.

According to the Tsunami Inundation Map for Emergency Planning (CEMA, 2009) the westerly edge of the site is located on the tsunami inundation line. Given this information and the site's location, the risk associated with tsunamis at the site is considered to be moderate. The City of San Diego have developed a tsunami alert and evacuation plan. The City has posted signs throughout the community showing routes of evacuation in the event of a tsunami warning, evacuation center locations, and the limits of tsunami hazard areas. The property owner should have an evacuation plan in place in the event of a tsunami warning.

SEICHES: Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays or reservoirs. Due to the site's location, it is considered to have a negligible risk potential for seiches.

CONCLUSIONS

In general, it is our opinion that, from a geologic and geotechnical perspective, the subject property is suitable to receive the proposed residential structure, provided the recommendations presented herein are implemented.

Based on our investigation, we have determined that the site is underlain by potentially compressible younger alluvium and old paralic deposits. In addition, the findings of our investigation for a nearby property

(CWE206605.02) indicate that portions of the old paralic deposits are potentially liquefiable. These conditions will require special foundation consideration as described hereinafter. Good engineering practice requires that where liquefaction is likely, the hazards that might reasonably be caused by liquefaction that could result in the collapse of a structure and/or loss of life be mitigated. The client should realize that the foundation recommendations presented herein are intended to provide this level of life safety. These recommendations, however, will not necessarily prevent the building from sustaining structural damage, even to the extent that it may become uninhabitable in the event of a major, proximal earthquake. To fully mitigate the liquefaction potential at the site would require supporting the structure on pile foundations or altering the existing soils such that they are resistant to liquefaction through the use of extensive deep ground modification techniques. Since it will not be practical to remove or densify all of the potentially compressible/potentially liquefiable soils underlying the site, it is our opinion that the proposed structure should be supported by a concrete mat foundation and that the allowable bearing capacity of the mat foundation system should be limited to the values presented hereinafter.

The prevailing foundation soils were found to have a medium expansion potential (EI=67 and 78). The recommended mat foundation will also mitigate this condition. It should be recognized that the intent of this report is to provide cost-effective foundation recommendations to mitigate the potential detrimental effect of the on-site expansive soils on the proposed structure. However, soils with medium expansion potential may detrimentally affect light-weight exterior improvements such as site walls, sidewalks, and driveways. Select grading consisting of replacing the expansive soils with a soil that has a low expansive potential (EI between 21 and 50) is one of the best ways to mitigate for expansive soil conditions. However, this may be cost prohibitive for the subject project. If select grading is unfeasible, consideration should be given to utilizing materials that are tolerant to movement, implementing drought tolerant landscaping, providing positive drainage away from exterior improvements, and providing concrete surfaces with appropriate weakened plane joints. Regardless of these or other similar measures, some distress to exterior improvements requiring future maintenance or even replacement should be anticipated due to expansive soils. The recommendations contained in this report assume that select grading will not be performed.

The groundwater table was found at a depth of approximately 8 feet below existing site grade and is anticipated to fluctuate to within 6 feet of existing site grade. As such, any proposed deep utility trenches may extend below the water table. If such deep utilities are proposed, dewatering may be necessary during the excavation and backfilling of the utility trenches.

RECOMMENDATIONS

GRADING AND EARTHWORK

GENERAL: All grading should conform to the guidelines presented in the current edition of the California Building Code, the minimum requirements of the City of San Diego, and the recommended Grading Specifications and Special Provisions attached hereto, except where specifically superseded in the text of this report.

PREGRADE MEETING: It is recommended that a pregrade meeting including the grading contractor and a representative from Christian Wheeler Engineering be held, to discuss the recommendations of this report and address any issues that may affect grading operations.

OBSERVATION OF GRADING: Continuous observation by the Geotechnical Consultant is essential during the grading operation to confirm conditions anticipated by our investigation, to allow adjustments in design criteria to reflect actual field conditions exposed, and to determine that the grading proceeds in general accordance with the recommendations contained herein.

CLEARING AND GRUBBING: Site preparation should begin with the removal of any existing improvements designated for demolition, any vegetation, and other deleterious materials. These removals should include all foundations, floor slabs, utilities, and all significant root material. The resulting materials should be disposed of in an appropriate off-site facility.

SITE PREPARATION: It is recommended that existing surficial soils be removed to a minimum depth of 1 foot below existing or finish pad grade, whichever is more. The removals should extend 3 feet outside of the footprint of all settlement sensitive improvements. No removals are recommended beyond property lines.

PROCESSING OF FILL AREAS: Prior to placing any new fill soils or constructing any new improvements in areas that have been cleaned out to receive fill, the exposed soils should be scarified to a depth of 12 inches, moisture conditioned, and compacted to at least 90 percent relative compaction. This recommendation applies to the area of the site outside the perimeter of the proposed main residence.

COMPACTION AND METHOD OF FILLING: All structural fill placed at the site should be compacted to a relative compaction of at least 90 percent of maximum dry density as determined by ASTM Laboratory Test D1557. Fills should be placed at or slightly above optimum moisture content, in lifts six to

eight inches thick, with each lift compacted by mechanical means. Fills should consist of approved earth material, free of trash or debris, roots, vegetation, or other materials determined to be unsuitable by our soil technicians or project geologist. Fill material should be free of rocks or lumps of soil in excess of six inches in maximum dimension. Based on our subsurface observations and laboratory testing, we anticipate the removed fill will be suitable for use as structural fill. All utility trenches should be compacted to a minimum of 90 percent of its maximum dry density.

SURFACE DRAINAGE: The ground around the proposed structure should be graded so that surface water flows rapidly away from the structure without ponding. In general, we recommend that the ground adjacent to structure slope away at a gradient of at least 2 percent. Densely vegetated areas where runoff can be impaired should have a minimum gradient of 5 percent within the first 5 feet from the structure. Pervious hardscape surfaces adjacent to structures should be similarly graded. Rain gutters with downspouts that discharge runoff away from the structure into controlled drainage devices are also recommended.

FOUNDATIONS

GENERAL: Based on our findings and engineering judgment, the proposed structure may be supported by a mat foundation. Conventional shallow continuous and isolated spread footings may be used to support associated exterior improvements. The following recommendations are considered the minimum based on the anticipated soil conditions. All foundations should be designed by a qualified professional.

STRUCTURAL MAT FOUNDATION

A structurally reinforced concrete mat foundation is recommended for support of the proposed structure. Thickness and reinforcement requirements of the mat foundation should be in accordance with the recommendations of the project structural engineer. To reduce potential consolidation settlements, the mat should be designed using an allowable bearing capacity of no more than 1,000 pounds per square foot. The recommended allowable bearing capacity may be increased by up to one-third when considering loads of a short duration such as wind or seismic forces.

Mat foundations typically experience some deflection due to loads placed on the mat and the reaction of the soils underlying the mat. A design coefficient of subgrade reaction, K_{v1}, of 100 pounds per cubic inch (pci) may be used for evaluating such deflections at the site. This value is based on the soil conditions encountered in our exploratory excavations and is considered as applied to a unit square

foot area. The value should be adjusted for the design mat size. The coefficient of subgrade reaction K_b for a mat of a specific width may be evaluated using the following equation:

$$\mathbf{K_b = K_{v1}\,[(b+1)/2b]^2}$$

Where **b** is the least width of the foundation

Based on our preliminary evaluation, the anticipated total static settlement for mat foundation should be less than approximately 1 inch. Anticipated maximum differential settlements of approximately 50 percent of the total settlements may occur between the center of the base of the structure and the structure corners. Also, total settlement on the order of 2.2 inches and differential settlements on the order of 1.1 inch are possible as a result of liquefaction during a major, proximal seismic event.

Lateral forces may be resisted by passive pressure resistance. For passive pressure design, an allowable equivalent fluid pressure of 250 pounds per cubic foot (pcf) may be assumed.

SHALLOW FOUNDATIONS

DIMENSIONS: Spread footings supporting the proposed exterior associate improvements should be embedded at least 24 inches below finish grade and should have minimum width of 12 inches. Isolated footings should have a minimum width of 24 inches and should be connected by tie beams as recommend by the project structural engineer.

BEARING CAPACITY: Spread footings with the above minimum dimensions may be designed for an allowable soil bearing pressure of 1,500 pounds per square foot. This value may be increased by one-third for combinations of temporary loads such as those due to wind or seismic loads.

LATERAL LOAD RESISTANCE: Lateral loads against foundations may be resisted by friction between the bottom of the footing and the supporting soil, and by the passive pressure against the footing. The coefficient of friction between concrete and fill material may be considered to be 0.25. The passive resistance for the fill may be considered to be equal to an equivalent fluid weight of 250 pounds per cubic foot. These values are based on the assumption that the footings are poured tight against undisturbed soil. If a combination of the passive pressure and friction is used, the friction value should be reduced by one-third.

REINFORCEMENT: Footing reinforcement should be specified by the project structural engineer. However, based on soil conditions, we recommend that the minimum reinforcing for continuous footings should consist of at least 2 No. 5 bars positioned 2 inches above the bottom of the footing and 2 No. 5 bars positioned 2 inches below the top of the footing.

SETTLEMENT CHARACTERISTICS: The anticipated total and differential footing static settlement is expected to be less than about 1 inch and 1 inch in 40 feet, respectively, provided the recommendations presented in this report are followed. It should be recognized that minor cracks normally occur in concrete slabs and foundations due to concrete shrinkage during curing or redistribution of stresses, therefore some cracks should be anticipated. Such cracks are not necessarily an indication of excessive vertical movements. In addition, total and differential settlements on the order of 2.2 inches and 1.1 inch, respectively, are possible as a result of liquefaction during a major, proximal seismic event.

EXPANSIVE CHARACTERISTICS: The anticipated prevailing foundation soils are anticipated to have a medium expansion potential (EI between 51 and 90). The recommendations presented in this report reflect this condition.

SOLUBLE SULFATES: : The water-soluble sulfate content of a selected soil sample from the site was determined in accordance with California Test Method 417. The test results indicate that the soil sample had a soluble sulfate content of 0.012 percent. Soils with a soluble sulfate content of less than 0.1 percent are considered to be negligible. However, it should be recognized that the sulfate content of surficial soils may increase with time due to soluble sulfate in the irrigation water or fertilized use.

FOUNDATION PLAN REVIEW: The final foundation plan and accompanying details and notes should be submitted to this office for review. The intent of our review will be to verify that the plans used for construction reflect the minimum dimensioning and reinforcing criteria presented in this section and that no additional criteria are required due to changes in the foundation type or layout. It is not our intent to review structural plans, notes, details, or calculations to verify that the design engineer has correctly applied the geotechnical design values. It is the responsibility of the design engineer to properly design/specify the foundations and other structural elements based on the requirements of the structure and considering the information presented in this report.

FOUNDATION EXCAVATION OBSERVATION: All foundation excavations should be observed by the Geotechnical Consultant prior to constructing forms or placing reinforcing steel to determine if the

foundation recommendations presented herein are complied with. All footing excavations should be excavated neat, level and square. All loose or unsuitable material should be removed prior to the placement of concrete.

SEISMIC DESIGN FACTORS

A likely geologic hazard to affect the site is ground shaking as a result of movement along one of the major active fault zones mentioned in the "Tectonic Setting" section of this report. Seismic design parameters were determined in accordance with Chapter 16 of the *2019 California Building Code (CBC)* and the applicable sections of *ASCE/SEI 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures*. For the subject site, field blow counts measured/estimated in the referenced boring B-1 indicate that the upper 100 feet of geologic subgrade has a N_{S30} value of 38 blows per foot and can be characterized as Soil Site Class D.

In accordance with Section 11.4.8 of ASCE/SEI 7-16, structures on Soil Site Class D or E sites that have a mapped MCE_R spectral response acceleration parameter (S_1) value greater than or equal to 0.2 require a site-specific ground motion hazard analysis or the seismic response coefficient (C_S) must be adjusted to adequately characterize the site response (Exception 2). The following Table I presents the seismic design parameters based on Exception 2 in Section 11.4.8.

TABLE I: CBC 2019/ASCE 7-16 – SEISMIC DESIGN PARAMETERS

CBC – Chapter 16 Section	Seismic Design Parameter	Recommended Value
Section 1613.2.2	Soil Site Class	D
Figure 1613.2.1 (1)	MCE_R Acceleration for Short Periods (0.2 sec), S_s	1.470 g
Figure 1613.2.1 (2)	MCE_R Acceleration for 1.0 Sec Periods (1.0 sec), S_1	0.505 g
Table 1613.2.3 (1)	Site Coefficient, F_a	1.000
Table 1613.3.3 (2)	Site Coefficient, F_v	1.795
Section 1613.2.3	S_{MS} = MCE_R Spectral Response at 0.2 sec. = $(S_s)(F_a)$	1.470 g
Section 1613.2.3	S_{M1} = MCE_R Spectral Response at 1.0 sec. = $(S_1)(F_v)$	0.906 g
Section 1613.2.4	S_{DS} = Design Spectral Response at 0.2 sec. = $2/3(S_{MS})$	0.980 g
Section 1613.2.4	S_{D1} = Design Spectral Response at 1.0 sec. = $2/3(S_{M1})$	0.604 g
Section 1613.2.5	Seismic Design Category	D
ASCE 7-16 Fig. 22-14	Mapped Long-Period Transition Period, T_L	8 sec
ASCE 7-16 Eq 12.8-3	Adjustment to Seismic Response Coefficient, C_S	Multiply by 1.5
Section 1803.2.12	PGA_M per Section 11.8.3 of ASCE 7	0.74 g

It can be noted that sites underlain by liquefaction-susceptible soils should be designated as Soil Site Class F, requiring a site response analysis. However, as discussed in Section 20.3.1 of ASCE/SEI 7-16, for structures having fundamental periods of vibration equal to or less than 0.5 second, it is not required to perform a site

response analysis. We understand that the proposed structure will have fundamental periods less than 0.5 second and can therefore be designed using Soil Site Class D as described above.

EXTERIOR CONCRETE FLATWORK

Exterior concrete slabs on grade should have a minimum thickness of 5 inches and be reinforced with at least No.4 bars placed at 18 inches on center each way (ocew). Driveway slabs should have a minimum thickness of 5 inches and be reinforced with at least No. 4 bars placed at 12 inches ocew. Driveway slabs should be provided with a thickened edge a least 12 inches deep and 6 inches wide. All slabs should be provided with weakened plane joints in accordance with the American Concrete Institute (ACI) guidelines. Special attention should be paid to the method of concrete curing to reduce the potential for excessive shrinkage cracking. It should be recognized that minor cracks occur normally in concrete slabs due to shrinkage. Some shrinkage cracks should be expected and are not necessarily an indication of excessive movement or structural distress.

PERMEABLE PAVERS

Pavers should be installed per manufacturer specifications. The suitability of the pavers to support traffic loads should be confirmed by others. Prior to placing the base material, the subgrade soils should be scarified to a depth of 12 inches, moisture-conditioned and compacted to at least 95 percent of its maximum dry density as determined in accordance to ASTM D 1557. Geogrid material such as Tensar TX130S or equivalent is recommended under the crushed rock portion of the paver section. Filter fabric is not recommended. Instead, we recommend a sand layer above a rock choker layer (similar to AASHTO #8) be used if open-graded rock (similar to AASHTO #57) is designed for the reservoir zone. A raised concrete curb or zero height curb should be constructed around the perimeter of the paver section. The curb should extend a minimum of 30 inches below proposed grade.

LIMITATIONS

REVIEW, OBSERVATION AND TESTING

The recommendations presented in this report are contingent upon our review of final plans and specifications. Such plans and specifications should be made available to the Geotechnical Engineer and Engineering Geologist so that they may review and verify their compliance with this report and with the California Building Code.

It is recommended that Christian Wheeler Engineering be retained to provide continuous soil engineering services during the earthwork operations. This is to verify compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

UNIFORMITY OF CONDITIONS

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on an evaluation of the subsurface soil conditions encountered at the subsurface exploration locations and on the assumption that the soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the foundations and/or cut and fill slopes may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the Geotechnical Engineer so that he may make modifications if necessary.

CHANGE IN SCOPE

This office should be advised of any changes in the project scope or proposed site grading so that we may determine if the recommendations contained herein are appropriate. It should be verified in writing if the recommendations are found to be appropriate for the proposed changes or our recommendations should be modified by a written addendum.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they are due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Government Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a period of two years without a review by us verifying the suitability of the conclusions and recommendations.

PROFESSIONAL STANDARD

In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the locations where our borings, surveys, and explorations are made, and that our data, interpretations, and recommendations are based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for the interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

CLIENT'S RESPONSIBILITY

It is the responsibility of the client, or his representatives, to ensure that the information and recommendations contained herein are brought to the attention of the structural engineer for the project and incorporated into the project's plans and specifications. It is further their responsibility to take the necessary measures to insure that the contractor and his subcontractors carry out such recommendations during construction.

FIELD EXPLORATIONS

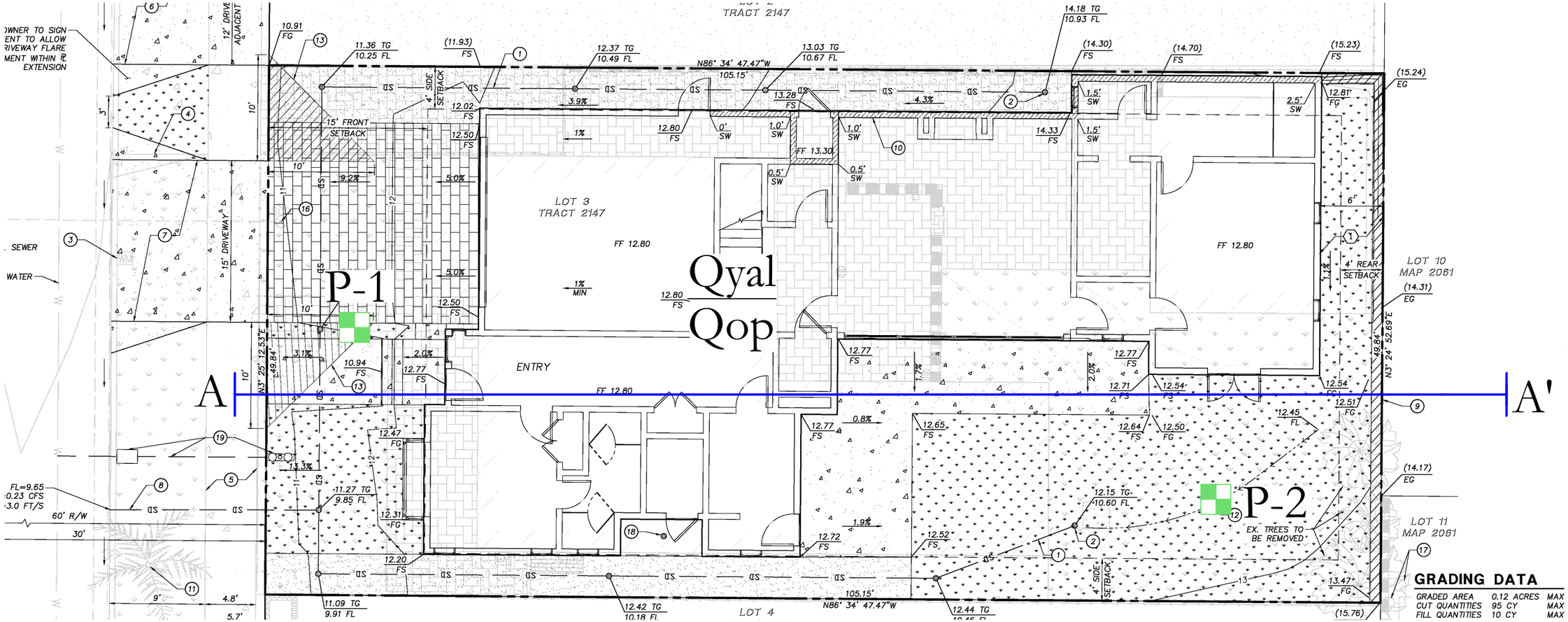
Two subsurface explorations were made at the locations indicated on the attached Plate Number 1 on February 13, 2020. These explorations consisted of hand-dug test pits. The fieldwork was conducted under the observation of our engineering geology personnel.

The explorations were carefully logged when made. The logs are presented on Appendix A. The soils are described in accordance with the Unified Soils Classification. In addition, a verbal textural description, the wet color, the apparent moisture, and the density or consistency is provided. The density of granular soils is given as very loose, loose, medium dense, dense or very dense. The consistency of silts or clays is given as either very soft, soft, medium stiff, stiff, very stiff, or hard.

Relatively undisturbed chunk and drive samples, and bulk samples of the earth materials encountered were collected and transported to our laboratory for testing.

LABORATORY TESTING

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. A brief description of the tests performed and the subsequent results are presented in Appendix B.



SCALE: 1" = 10'

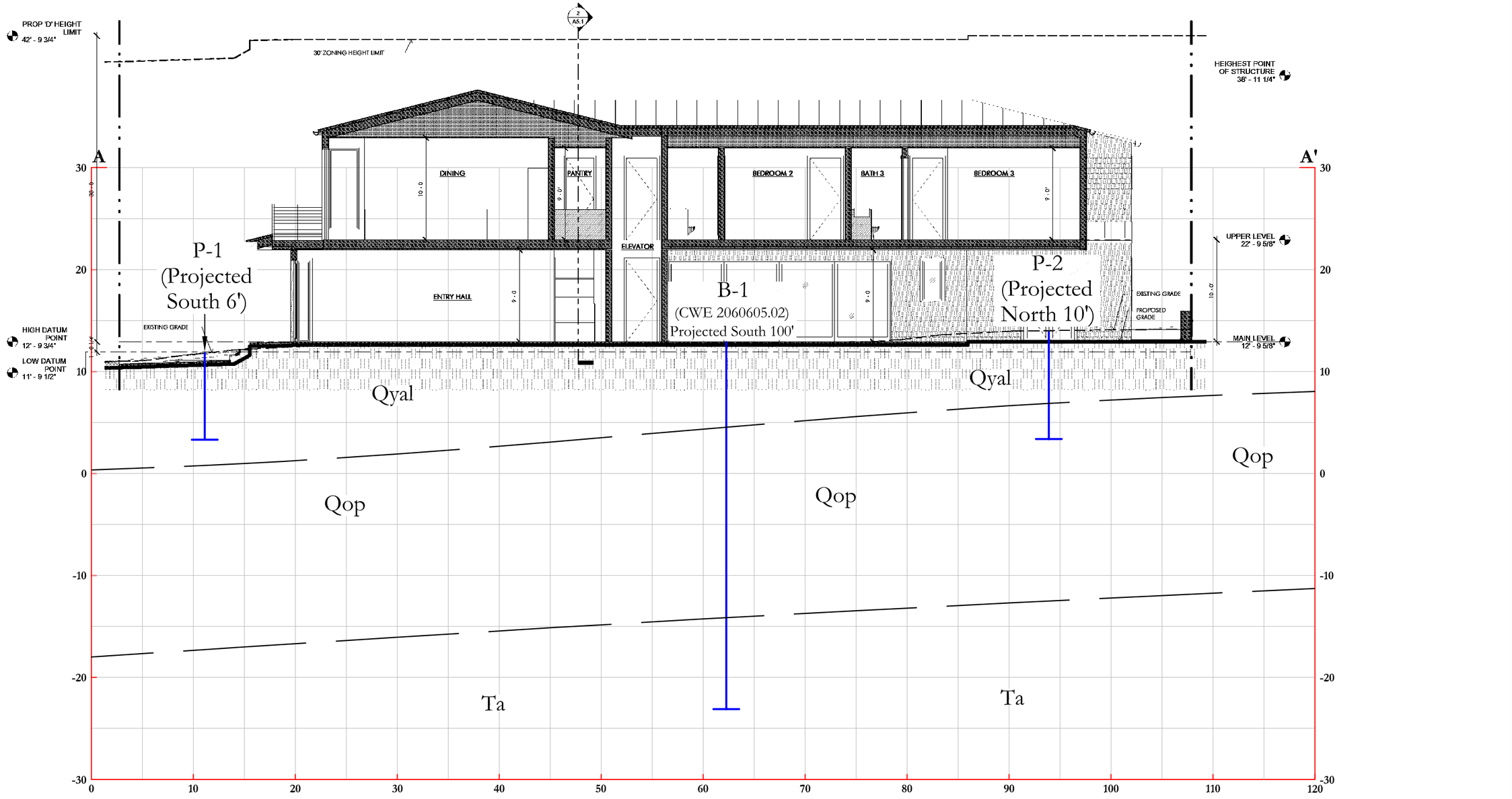
CWE LEGEND	
P-2	Approximate Test Pit Location
Qyal / Qop	Young Alluvium over Old Paralic Deposits
	Geologic Cross Section

SITE PLAN AND GEOTECHNICAL MAP

PROPOSED BROE RESIDENCE
8423 EL PASEO GRANDE
LA JOLLA, CALIFORNIA

DATE:	MARCH 2020	JOB NO.:	2200064.01R
BY:	SRD	PLATE NO.:	1

CHRISTIAN WHEELER ENGINEERING



CWE LEGEND	
Qyal	Younger Alluvium
Qop	Old Paralic Deposits
Ta	Ardath Shale

0 10' 20'

SCALE: 1" = 10'

GEOLOGIC CROSS SECTION A-A'

PROPOSED BROE RESIDENCE
8423 EL PASEO GRANDE
LA JOLLA, CALIFORNIA

DATE:	MARCH 2020	JOB NO.:	2200064.01R
BY:	SD	PLATE NO.:	2

CHRISTIAN WHEELER
ENGINEERING

Appendix A

Subsurface Explorations

LOG OF TEST PIT P-1

Date Logged:	2/13/20	Equipment:	Hand tools
Logged By:	WEB	Auger Type:	N/A
Existing Elevation:	±12'	Bucket:	N/A
Finish Elevation:	±12'	Depth to Water:	8'

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0				Upper 6" disturbed landscaping.							
1			CL	**Young Alluvium (Qyal):** Grayish-brown, moist, medium stiff, very fine- to fine-grained, SILTY CLAY with sand.							
2						CK					
3			CL	Light brown, very moist, medium stiff to stiff, very fine- to fine-grained, SILTY CLAY with sand.		Cal		22.4	99.4		Con
4											
5						Cal					
6											
7											
8	▼			Groundwater at 8'. Saturated.							
9				Test pit terminated at 8.5 feet. Groundwater encountered at 8 feet.							
10											
11											
12											
13											
14											
15											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ❞ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED BROE RESIDENCE
8423 EL PASEO GRANDE
LA JOLLA, CALIFORNIA

DATE:	MARCH 2020	JOB NO.:	2200064.01R
BY:	SRD	APPENDIX:	A-1

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST PIT P-2

Date Logged:	2/13/20	Equipment:	Hand tools
Logged By:	WEB	Auger Type:	N/A
Existing Elevation:	±13'	Bucket:	N/A
Finish Elevation:	±12'	Depth to Water:	10'

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0		Upper 12" disturbed landscaping.							
1	CL	**Young Alluvium (Qyal):** Grayish-brown, moist, medium stiff, SILTY CLAY with sand.							SA EI
2				CK					MD PI SO4 DS
3	CL	Light brown, very moist, medium stiff to stiff, SILTY CLAY with sand.							SA EI
4				Cal		23.0	97.8		SD
5				Cal		21.2	101.1		SD
6									
7	SM	**Old Paralic Deposits (Qop):** Dark reddish-brown, moist, medium dense, very fine- to coarse-grained, SILTY SAND.							
8				Cal		12.1	121.9		
9		Very moist.							
10		Groundwater at 10'. Saturated.							
11		Test pit terminated at 10.5 feet. Groundwater encountered at 10 feet.							
12									
13									
14									
15									

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED BROE RESIDENCE
8423 EL PASEO GRANDE
LA JOLLA, CALIFORNIA

DATE:	MARCH 2020	JOB NO.:	2200064.01R
BY:	SRD	APPENDIX:	A-2

CHRISTIAN WHEELER ENGINEERING

Appendix B

Laboratory Test Results

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. Brief descriptions of the tests performed are presented below:

a) **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System and are presented on the exploration logs in Appendix A.

b) **MOISTURE-DENSITY: MOISTURE-DENSITY:** In-place moisture contents and dry densities were determined for selected soil samples in accordance with ATM D2937. The results are summarized in the subsurface exploration logs presented in Appendix A.

c) **MAXIMUM DRY DENSITY AND OPTIUM MOISTURE CONTENT TEST:** The maximum dry density and optimum moisture content of a selected soil sample were determined in the laboratory in accordance with ASTM D 1557, Method A.

d) **DIRECT SHEAR:** Direct shear tests were performed on selected samples of the on-site soils in accordance with ASTM D 3080.

e) **EXPANSION INDEX TEST:** An expansion index test was performed on a selected remolded soil sample was performed in accordance with ASTM D 4829.

f) **GRAIN SIZE DISTRIBUTION:** The grain size distribution of a selected sample was determined in accordance with ASTM C136 and/or ASTM D 422.

g) **ATTERBERG LIMITS:** The Liquid Limit, Plastic Limit and Plastic Index of a selected soil sample was determined in accordance with ASTM D424.

h) **SOLUBLE SULFATES:** The soluble sulfate content of a selected soil sample was determined in accordance with California Test Method 417.

i) **CONSOLIDATION TEST:** A consolidation test was performed on selected a undisturbed sample in accordance with ASTM D 2435.

LABORATORY TEST RESULTS

PROPOSED BROE RESIDENCE

8423 EL PASEO GRANDE

SAN DIEGO, CALIFORNIA

MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT (ASTM D1557)

Sample Location	**Pit P-2 @ 1'-2½'**
Sample Description	Grayish-Brown Silty Clay with Sand (CL)
Maximum Density	140.5 pcf
Optimum Moisture	12.7 %

DIRECT SHEAR (ASTM D3080)

Sample Location	**Pit P-2 @ 1'-2½'**
Sample Type	Remolded to 90%
Friction Angle	15°
Cohesion	450 psf

EXPANSION INDEX TESTS (ASTM D4829)

Sample Location	**Pit P-2 @ 1'-2½'**	**Pit P-2 @ 2½' -4'**
Initial Moisture:	11.9 %	12.5 %
Initial Dry Density	101.3 pcf	99.5 pcf
Final Moisture:	26.1 %	27.7 %
Expansion Index:	67 (Medium)	78 (Medium)

GRAIN SIZE DISTRIBUTION (ASTM D422)

Sample Location	**Pit P-2 @ 1'-2½'**	**Pit P-2 @ 2½'-4'**
Sieve Size	*Percent Passing*	*Percent Passing*
#16	100	100
#30	99	99
#50	96	97
#100	91	94
#200	82	87
0.05 mm	76	82
0.005 mm	36	42
0.001 mm	21	21

ATTERBERG LIMITS (ASTM D424)

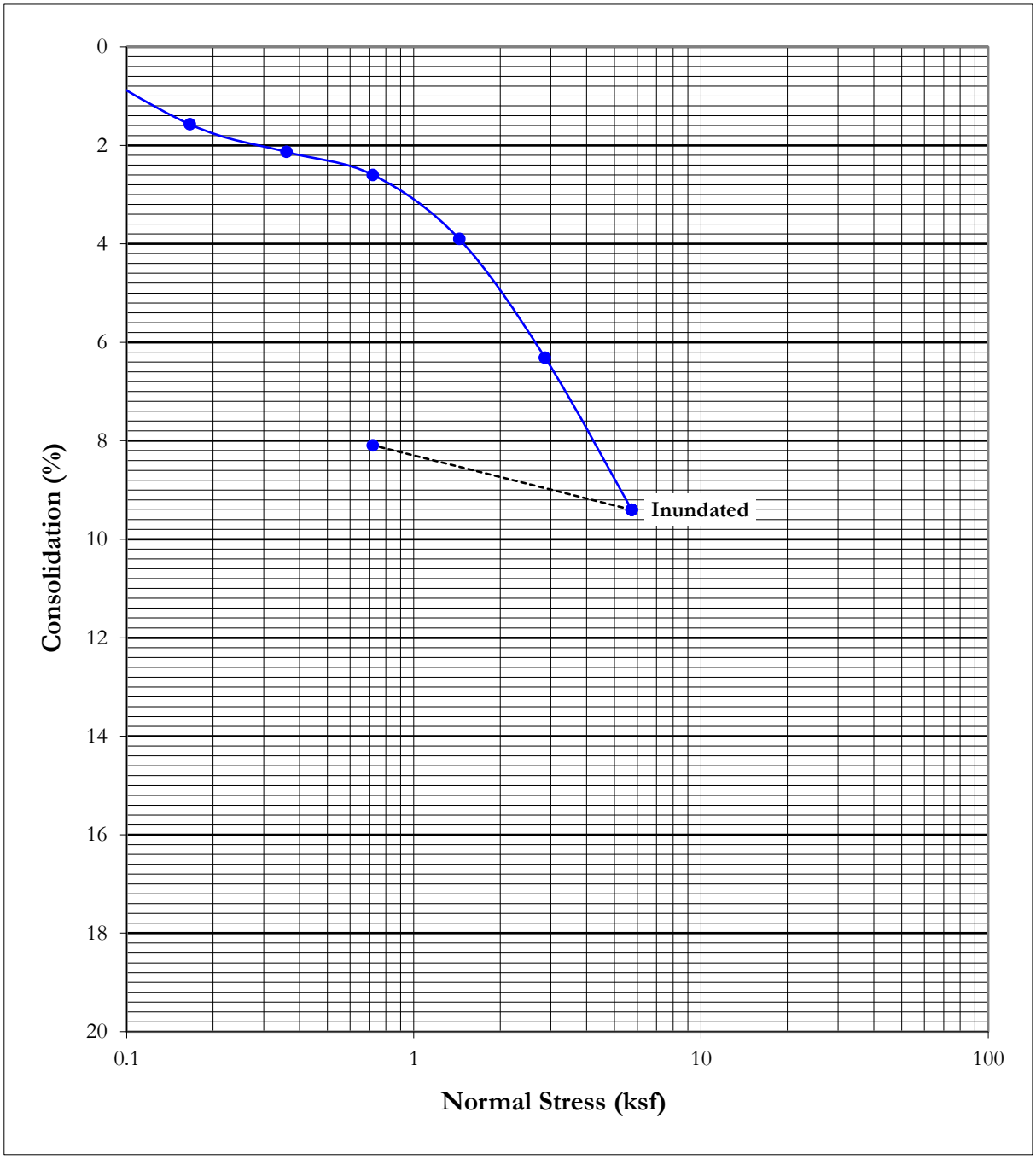
Sample Location	**Pit P-2 @ 1'-2½'**
Liquid Limit	38
Plastic Limit	17
Plasticity Index	21 (CL)

SOLUBLE SULFATES (CALIFORNIA TEST 417)

Sample Location	**Pit P-2 @ 1'-2½'**
Soluble Sulfate	0.012 % (SO_4)

CONSOLIDATION TEST

ASTM D2435



CHRISTIAN WHEELER ENGINEERING	PROPOSED BROE RESIDENCE 8423 El PASEO GRANDE, LA JOLLA, CALIFORNIA			P-1 @ 3½'
	BY: DBA	DATE: March 2020	REPORT NO.:2200064.01R	PLATE NO.: B-3

Appendix C

References

REFERENCES

Anderson, J.G.; Rockwell, R.K. and Agnew, D.C., 1989, Past and Possible Future Earthquakes of Significance to the San Diego Region, Earthquake Spectra, Volume 5, No. 2, 1989.

American Society of Civil Engineers, ASCE 7 Hazard Tool, https://asce7hazardtool.online

Bartlett, S.F. and Youd, T.L., 1995, Empirical Prediction of Liquefaction-Induced Lateral Spread, American Society of Civil Engineers, Journal of Geotechnical Engineers, v. 121, no. 4, p. 316-329.

Blake, T.F., 2000, EQFAULT, A Computer Program for the Estimation of Peak Horizontal Acceleration from 3-D Fault Sources, Version 3.0, Thomas F. Blake Computer Services and Software, Thousand Oaks, California.

Blake, T. F., 2000, Documentation for FRISKSP Version 4.00, Thomas F. Blake Computer Services and Software.

Boore, David M., Joyner, William B., and Fumal, Thomas E., 1997, "Empirical Near-Source Attenuation Relationships for Horizontal and Vertical Components of Peak Ground Acceleration, Peak Ground Velocity, and Pseudo-Absolute Acceleration Response Spectra", in Seismological Research Letters, Volume 68, Number 1, January/February 1997.

Bryant, W. A. (compiler), 2005, Digital Database of Quaternary and Younger Faults from the Fault Activity Map of California, version 2.0: California Geological Survey Web Page, http://www.consrv.ca.gov/CGS/information/publications/QuaternaryFaults_ver2.htm

California Division of Mines and Geology, 1999, Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction Hazards in California, organized through the Southern California Earthquake Center, University of Southern California.

California Emergency Management Agency – California Geological Society – University of Southern California, 2009, Tsunami Inundation Map for Emergency Planning, La Jolla Quadrangle, scale 1:24,000, dated June 1, 2009.

City of San Diego, 2008, Seismic Hazard Study, Geologic Hazards and Faults, Sheet 29.

Christian Wheeler Engineering, 2008, Report of Preliminary Geotechnical Investigation, Proposed Single-Family Home, 8449 El Paseo Grande, La Jolla, California, Report No. 2060605.02, dated January 17, 2008

Federal Emergency Management Agency, 2012, San Diego County, California and Incorporated Areas Flood Insurance Rate Map, Map # 06073C1582H.

Historic Aerials, NETR Online, historicaerials.com

Idriss, I. M. and Boulanger, R. W., 2008, Soil Liquefaction During Earthquakes, Oakland, CA: Earthquake Engineering Research Institute.

Ishihara, K., 1985, "Stability of Natural Deposits During Earthquakes," Theme Lecture, Proceeding of the XI ICSMFE, Vol. 2, pp. 321-376

Island Architects, Architectural Plans, 8423 El Paseo Grande, La Jolla, CA, dated February 2, 2020.

Jennings, C.W. and Bryant, W. A., 2010, Fault Activity Map, California Geological Survey, Geologic Data Map No. 6, http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html

Kennedy, Michael P. and Tan, Siang S., 2008, Geologic Map of the San Diego 30'x60' Quadrangle, California, California Geologic Survey, Map No. 3.

Landmark Consulting, Coastal Development Permit, Grading and Drainage Plan, 8423 El Paseo Grande, dated February 12, 2020.

Seed et al, 2003, Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework, Keynote Presentation, 26th Annual ASCE Los Angeles Geotechnical Spring Seminar, Long Beach, CA.

Tan, S.S., 1995, Landslide Hazards in the Southern Part of the San Diego Metropolitan Area, San Diego County, California, California Division of Mines and Geology Open-File Report 95-03.

U.S. Geological Survey, Quaternary Faults in Google Earth, http://earthquake.usgs.gov/hazards/qfaults/google.php

Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Finn, W.D.L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J., Liao, S., Marcuson III, W.F., Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R., and Stokoe, K.H., Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 127, October, pp 817-833.

Zhang, G., Robertson. P.K., Brachman, R., 2004, Estimating Liquefaction Induced Lateral Displacements using the SPT and CPT, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 130, No. 8, 861-871.

TOPOGRAPHIC MAPS

City of San Diego, 1963, Topographic Map Sheet 250-1689; Scale: 1 inch = 200 feet.

City of San Diego, 1979, Ortho-Topographic Map Sheet 250-1689; Scale: 1 inch = 200 feet.

PHOTOGRAPHS

Lenska's Aerial Atlas, 1994, The Thomas Guide, Sheet 1227.

San Diego County, 1928, Photographs 52C1 and 52C2, Scale: 1 inch = 1000 feet (approximate).

San Diego County, 1970, Flight 4, Photographs 3 and 4; Scale: 1 inch= 1000 feet (approximate).

San Diego County, 1973, Flight 31, Photographs 17 and 18; Scale: 1 inch= 1000 feet (approximate).

San Diego County, 1978, Flight 17B, Photographs 53, 54, and 55; Scale: 1 inch= 1000 feet (approximate).

San Diego County, 1982, Aerial Foto-Map Book, Sheet E13.

San Diego County, 1983, Photographs 553 and 554; Scale: 1 inch= 2000 feet (approximate).

San Diego County, 1986-87, Aerial Foto-Map Book, Sheet E13.

San Diego County, 1989, Photographs 1-201; Scale: 1 inch= 2000 feet (approximate).

USDA, 1953, Flight AXN-8M, Photographs 1 and 2; Scale: 1 inch= 1700 feet (approximate).

APPENDIX D

GRADING SPECIFICATIONS

RECOMMENDED GRADING SPECIFICATIONS - GENERAL PROVISIONS

PROPOSED BROE RESIDENCE
8423 EL PASEO GRANDE
LA JOLLA, CALIFORNIA

GENERAL INTENT

The intent of these specifications is to establish procedures for clearing, compacting natural ground, preparing areas to be filled, and placing and compacting fill soils to the lines and grades shown on the accepted plans. The recommendations contained in the preliminary geotechnical investigation report and/or the attached Special Provisions are a part of the Recommended Grading Specifications and shall supersede the provisions contained hereinafter in the case of conflict. These specifications shall only be used in conjunction with the geotechnical report for which they are a part. No deviation from these specifications will be allowed, except where specified in the geotechnical report or in other written communication signed by the Geotechnical Engineer.

OBSERVATION AND TESTING

Christian Wheeler Engineering shall be retained as the Geotechnical Engineer to observe and test the earthwork in accordance with these specifications. It will be necessary that the Geotechnical Engineer or his representative provide adequate observation so that he may provide his opinion as to whether or not the work was accomplished as specified. It shall be the responsibility of the contractor to assist the Geotechnical Engineer and to keep him apprised of work schedules, changes and new information and data so that he may provide these opinions. In the event that any unusual conditions not covered by the special provisions or preliminary geotechnical report are encountered during the grading operations, the Geotechnical Engineer shall be contacted for further recommendations.

If, in the opinion of the Geotechnical Engineer, substandard conditions are encountered, such as questionable or unsuitable soil, unacceptable moisture content, inadequate compaction, adverse weather, etc., construction should be stopped until the conditions are remedied or corrected or he shall recommend rejection of this work.

Tests used to determine the degree of compaction should be performed in accordance with the following American Society for Testing and Materials test methods:

Maximum Density & Optimum Moisture Content - ASTM D1557
Density of Soil In-Place - ASTM D1556 or ASTM D6938

All densities shall be expressed in terms of Relative Compaction as determined by the foregoing ASTM testing procedures.

PREPARATION OF AREAS TO RECEIVE FILL

All vegetation, brush and debris derived from clearing operations shall be removed, and legally disposed of. All areas disturbed by site grading should be left in a neat and finished appearance, free from unsightly debris.

After clearing or benching the natural ground, the areas to be filled shall be scarified to a depth of 6 inches, brought to the proper moisture content, compacted and tested for the specified minimum degree of compaction. All loose soils in excess of 6 inches thick should be removed to firm natural ground which is defined as natural soil which possesses an in-situ density of at least 90 percent of its maximum dry density.

When the slope of the natural ground receiving fill exceeds 20 percent (5 horizontal units to 1 vertical unit), the original ground shall be stepped or benched. Benches shall be cut to a firm competent formational soil. The lower bench shall be at least 10 feet wide or 1-1/2 times the equipment width, whichever is greater, and shall be sloped back into the hillside at a gradient of not less than two (2) percent. All other benches should be at least 6 feet wide. The horizontal portion of each bench shall be compacted prior to receiving fill as specified herein for compacted natural ground. Ground slopes flatter than 20 percent shall be benched when considered necessary by the Geotechnical Engineer.

Any abandoned buried structures encountered during grading operations must be totally removed. All underground utilities to be abandoned beneath any proposed structure should be removed from within 10 feet of the structure and properly capped off. The resulting depressions from the above described procedure should be backfilled with acceptable soil that is compacted to the requirements of the Geotechnical Engineer. This includes, but is not limited to, septic tanks, fuel tanks, sewer lines or leach lines, storm drains and water lines. Any buried structures or utilities not to be abandoned should be brought to the attention of the Geotechnical Engineer so that he may determine if any special recommendation will be necessary.

All water wells which will be abandoned should be backfilled and capped in accordance to the requirements set forth by the Geotechnical Engineer. The top of the cap should be at least 4 feet below finish grade or 3

feet below the bottom of footing whichever is greater. The type of cap will depend on the diameter of the well and should be determined by the Geotechnical Engineer and/or a qualified Structural Engineer.

FILL MATERIAL

Materials to be placed in the fill shall be approved by the Geotechnical Engineer and shall be free of vegetable matter and other deleterious substances. Granular soil shall contain sufficient fine material to fill the voids. The definition and disposition of oversized rocks and expansive or detrimental soils are covered in the geotechnical report or Special Provisions. Expansive soils, soils of poor gradation, or soils with low strength characteristics may be thoroughly mixed with other soils to provide satisfactory fill material, but only with the explicit consent of the Geotechnical Engineer. Any import material shall be approved by the Geotechnical Engineer before being brought to the site.

PLACING AND COMPACTION OF FILL

Approved fill material shall be placed in areas prepared to receive fill in layers not to exceed 6 inches in compacted thickness. Each layer shall have a uniform moisture content in the range that will allow the compaction effort to be efficiently applied to achieve the specified degree of compaction. Each layer shall be uniformly compacted to the specified minimum degree of compaction with equipment of adequate size to economically compact the layer. Compaction equipment should either be specifically designed for soil compaction or of proven reliability. The minimum degree of compaction to be achieved is specified in either the Special Provisions or the recommendations contained in the preliminary geotechnical investigation report. When the structural fill material includes rocks, no rocks will be allowed to nest and all voids must be carefully filled with soil such that the minimum degree of compaction recommended in the Special Provisions is achieved. The maximum size and spacing of rock permitted in structural fills and in non-structural fills is discussed in the geotechnical report, when applicable.

Field observation and compaction tests to estimate the degree of compaction of the fill will be taken by the Geotechnical Engineer or his representative. The location and frequency of the tests shall be at the Geotechnical Engineer's discretion. When the compaction test indicates that a particular layer is at less than the required degree of compaction, the layer shall be reworked to the satisfaction of the Geotechnical Engineer and until the desired relative compaction has been obtained.

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction by sheepsfoot roller shall be at vertical intervals of not greater than four feet. In addition, fill slopes at a ratio of

two horizontal to one vertical or flatter, should be trackrolled. Steeper fill slopes shall be over-built and cut-back to finish contours after the slope has been constructed. Slope compaction operations shall result in all fill material six or more inches inward from the finished face of the slope having a relative compaction of at least 90 percent of maximum dry density or the degree of compaction specified in the Special Provisions section of this specification. The compaction operation on the slopes shall be continued until the Geotechnical Engineer is of the opinion that the slopes will be surficially stable.

Density tests in the slopes will be made by the Geotechnical Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the Contractor will be notified that day of such conditions by written communication from the Geotechnical Engineer or his representative in the form of a daily field report.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no cost to the Owner or Geotechnical Engineer.

CUT SLOPES

The Engineering Geologist shall inspect cut slopes excavated in rock or lithified formational material during the grading operations at intervals determined at his discretion. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be analyzed by the Engineering Geologist and Geotechnical Engineer to determine if mitigating measures are necessary.

Unless otherwise specified in the geotechnical report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of the controlling governmental agency.

ENGINEERING OBSERVATION

Field observation by the Geotechnical Engineer or his representative shall be made during the filling and compaction operations so that he can express his opinion regarding the conformance of the grading with acceptable standards of practice. Neither the presence of the Geotechnical Engineer or his representative or the observation and testing shall release the Grading Contractor from his duty to compact all fill material to the specified degree of compaction.

SEASON LIMITS

Fill shall not be placed during unfavorable weather conditions. When work is interrupted by heavy rain, filling operations shall not be resumed until the proper moisture content and density of the fill materials can be achieved. Damaged site conditions resulting from weather or acts of God shall be repaired before acceptance of work.

RECOMMENDED GRADING SPECIFICATIONS - SPECIAL PROVISIONS

RELATIVE COMPACTION: The minimum degree of compaction to be obtained in compacted natural ground, compacted fill, and compacted backfill shall be at least 90 percent. For street and parking lot subgrade, the upper six inches should be compacted to at least 95 percent relative compaction.

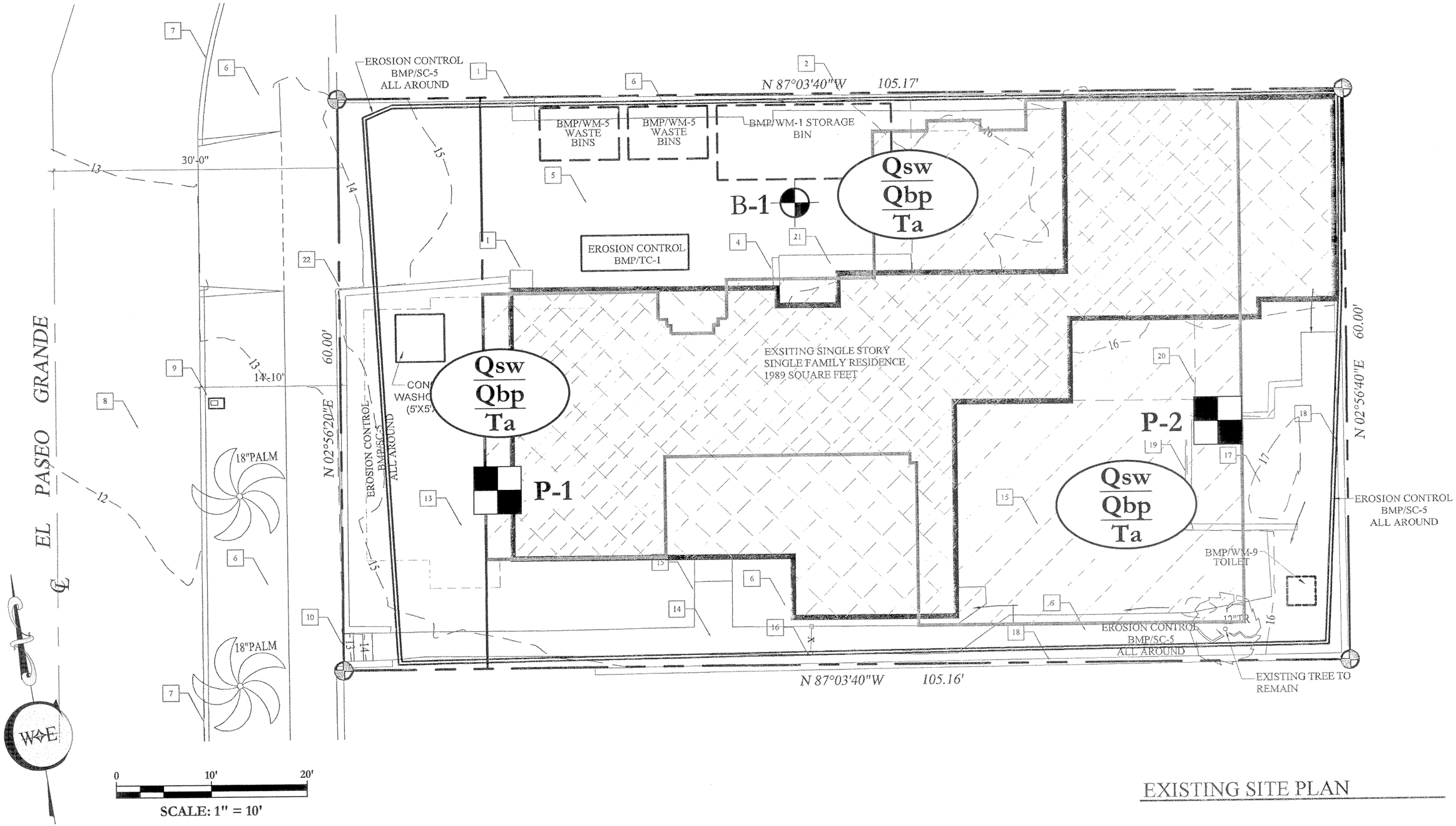
EXPANSIVE SOILS: Detrimentally expansive soil is defined as clayey soil which has an expansion index of 50 or greater when tested in accordance with the Uniform Building Code Standard 29-2.

OVERSIZED MATERIAL: Oversized fill material is generally defined herein as rocks or lumps of soil over 6 inches in diameter. Oversized materials should not be placed in fill unless recommendations of placement of such material should be provided by the Geotechnical Engineer. At least 40 percent of the fill soils shall pass through a No. 4 U.S. Standard Sieve.

TRANSITION LOTS: Where transitions between cut and fill occur within the proposed building pad, the cut portion should be undercut a minimum of one foot below the base of the proposed footings and recompacted as structural backfill. In certain cases that would be addressed in the geotechnical report, special footing reinforcement or a combination of special footing reinforcement and undercutting may be required.

Appendix E

Data From CWE 2060605.02



EXISTING SITE PLAN

CWE LEGEND	
Qsw / Qbp / Ta	SLOPEWASH UNDERLAIN BY BAY POINT FORMATION UNDERLAIN BY ARDATH SHALE
B-1	APPROXIMATE BORING LOCATION
P-2	APPROXIMATE TEST PIT LOCATION

EXISTING SITE PLAN AND GEOTECHNICAL MAP

BENSON RESIDENCE			
DATE:	JANUARY 2008	JOB NO.:	2060605.02
BY:	CHC/WM/JDB	PLATE NO.:	1A

CHRISTIAN WHEELER ENGINEERING

(STREET TREE)
VISIBILITY TRIANGLE
PROPOSED BOSTON IVY TO GROW UP DRIVEWAY WALL
PROP "D" LOW POINT 6.52'
1'-0" SET BACK ALLOWED BY LA JOLLA SHORES PDO AS THE AVERAGE WITHIN A 300' RADIUS
NEW DRIVEWAY & CURB CUT
EXISTING LANDSCAPE
N 87°03'40"W 105.17'
4'-1" SETBACK
T.O. RETAINING WALL 14.0' 30'-0"
GRASSCRETE TO INTEGRATE THROUGHOUT DRIVEWAY
Qsw / Qbp / Ta
B-1
TRENCH DRAIN AT GARAGE PUMPED UP TO BMP FILTER FOR DISCHARGE
11'-0" SETBACK
FINISH GRADE @ P.L. 14.0'
T.O. RETAINING WALL 17.0' FRONT P.L. ELEV. 14.0'
CITY STANDARD DRIVEWAY (G14B)
VISIBILITY TRIANGLE
15'-0" SETBACK
NEW ENTRANCE WALKWAY
T.O. P BOTT
PROPOSED 18"PALM (STREET TREE)
N 02°56'20"E 60.00'
NEW SINGLE FAMILY RESIDENCE
BASEMENT: 3142 SQ.FT.
FIRST FLOOR: 2899 SQ.FT.
SECOND FLOOR: 1066 SQ.FT.
15'-2"
14'-10"
4'-6"
EXISTING WATER METER
FIRE PIT
FIN. 1ST FL. ELEV. 15.5'
Qsw / Qbp / Ta
P-2
PATIO
FIN. PATIO FL. ELEV. 15.25'
EXISTING 18"PALM (STREET TREE)
P-1
EXISTING SIDEWALK
NEW PATIO AREA
EXISTING LANDSCAPE
EL PASEO GRANDE
T.O. PATIO WALL 17.0' FRONT P.L. ELEV. 14.0'
POOL
EXISTING 18"PALM (STREET TREE)
N 87°03'40"W 105.17'
BMP FILTER
NEW FENCE AND GATE
FIRE FEATURE WITH SAND AND ROCK
NEW FENCE AND GATE
EXISTING TREE
T.O. WALL FOUNTAIN 21.25' B.O. WALL 15.43'
T.O. PERIMETER FENCE 21.25' BOTTOM OF FENCE 15.83'
W E
0 10' 20'
SCALE: 1" = 10'

PROPOSED SITE PLAN

CWE LEGEND	
Qsw / Qbp / Ta	SLOPEWASH UNDERLAIN BY BAY POINT FORMATION UNDERLAIN BY ARDATH SHALE
B-1	APPROXIMATE BORING LOCATION
P-2	APPROXIMATE TEST PIT LOCATION

PROPOSED SITE PLAN AND GEOTECHNICAL MAP

BENSON RESIDENCE			
DATE:	JANUARY 2008	JOB NO.:	2060605.02
BY:	CHC/WM/JDB	PLATE NO.:	1B

CHRISTIAN WHEELER ENGINEERING

LEGEND FOR TRENCH & BORING LOG SYMBOLS

UNIFIED SOIL CLASSIFICATION DESCRIPTIONS

SILTY GRAVELS (GM), poorly-graded gravel-sand-silt mixtures

CLAYEY GRAVELS (GC), poorly-graded gravel-sand-clay mixtures

WELL-GRADED SANDS (SW), gravelly sands, little or no fiines

POORLY-GRADED SANDS (SP), gravelly sands, little or no fines

SILTY SANDS (SM), poorly-graded sand-gravel-silt mixtures

CLAYEY SANDS (SC), poorly-graded sand-gravel-clay mixtures

INORGANIC SILTS and VERY FINE SANDS (ML), silty or clayey sands, clayey silts with slight plasticity

INORGANIC CLAYS (CL), of low to medium plasticity

INORGANIC SILTS (ML), micaceous or diatomaceous fine sand or

INORGANIC CLAYS (CH), of high plasticity, fat clays

* A dual soil classification is indicated by an alternating pattern

Ground Water

SAMPLING

Bulk or Bag sample

CK Chunk sample

Cal Modified California Sampler (penetration indicated in number of blov

SPT Standard Penetration Test (penetration indicated in number of blows

LABORATORY TESTING

SA	Sieve Analysis	MD	Maximum Density
HA	Hydrometer Analysis	ND	Natural Density for chunks and rings
SE	Sand Equivalent	SO_4	Soluble Sulfates
EI	Expansion Index	DS	Direct Shear
PI	Plasticity Index	Con	Consolidation

CHRISTIAN WHEELER
Engineering

PROPOSED SINGLE-FAMILY RESIDENCE

8449 El Paseo Grande, La Jolla, California

BY:	WM	DATE:	January 2008
JOB NO. :	2060605.02	PLATE NO.:	2

LOG OF TEST BORING NUMBER B-1

Date Excavated:	12/19/2007	Logged by:	DF
Equipment:	CME 55 Drill Rig	Project Manager:	CHC
Existing Elevation:	16 feet	Depth to Water:	15'
Finish Elevation:	5 feet	Drive Weight:	140 lbs.

DEPTH (feet)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: SAMPLE TYPE	SAMPLES: BULK	PENETRATION (blows/foot)	MOISTURE (%)	DRY UNIT WT. (pcf)	LABORATORY TESTS
		4 inches of concrete.						
2		**Slopewash (Qsw):** Medium grayish-brown, moist, medium stiff to stiff, SILTY CLAY (CL), with organics, moderatley porous. Contact at 3½ feet	Cal		15	21.0	102.3	
4		Light brown, moist, loose, CLAYEY SAND (SC), very fine to fine-grained, porous.	Cal		11	19.8	102.3	
6								
8								
10		**Bay Point Formation (Qbp):** Medium grayish-brown, moist, very stiff, SILTY CLAY (CL), with sand. Expansion Index = 36 (low).	Cal		31			SA DS E.I. SO_4
12								
14	▽	Ground water table at 15 feet. Becomes saturated.	Cal		45	14.1	120.4	
16								
18		Light brown, saturated, loose to medium dense, POORLY GRADED SAND-SILTY SAND (SP-SM), very fine to medium-grained, micaceous.						
20			Cal		12			

Boring continued on Plate No. 4.

CHRISTIAN WHEELER
Engineering

PROPOSED SINGLE-FAMILY RESIDENCE
8449 El Paseo Grande, La Jolla, California

BY:	WM	DATE:	January 2008
JOB NO. :	2060605	PLATE NO.:	3

LOG OF TEST BORING NUMBER B-1 (Continued)

Date Excavated:	12/19/2007	Logged by:	DF
Equipment:	CME 55 Drill Rig	Project Manager:	CHC
Existing Elevation:	16 feet	Depth to Water:	15'
Finish Elevation:	5 feet	Drive Weight:	140 lbs.

DEPTH (feet)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: SAMPLE TYPE	SAMPLES: BULK	PENETRATION (blows/foot)	MOISTURE (%)	DRY UNIT WT. (pcf)	LABORATORY TESTS
22		**Bay Point Formation (Qbp):** Light brown, saturated, loose to medium dense, POORLY GRADED SAND-SILTY SAND (SP-SM), very fine to medium-grained.						
24		Becomes dense at 24 feet.	SPT		41			SA
26								
28		**Ardath Shale (Ta):** Light grayish-brown to light brown, moist, hard, SILTY CLAY (CL), well bedded.						
30			SPT		49			
32								
34			SPT		59			
36			Cal		50-5"	22.4	103.5	
36		Boring terminated at 36 feet. Groundwater at 17 feet.						
38								
40								

CHRISTIAN WHEELER
Engineering

PROPOSED SINGLE-FAMILY RESIDENCE
8449 El Paseo Grande, La Jolla, California

BY:	WM	DATE:	January 2008
JOB NO. :	2060605	PLATE NO.:	4

LOG OF TEST PIT NUMBER P-1

Date Excavated:	12/19/2007	Logged by:	DF
Equipment:	CME 55 Drill Rig	Project Manager:	CHC
Existing Elevation:	15.5 feet	Depth to Water:	15'
Finish Elevation:	5 feet	Drive Weight:	140 lbs.

DEPTH (feet)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: SAMPLE TYPE	SAMPLES: BULK	PENETRATION (blows/foot)	MOISTURE (%)	DRY UNIT WT. (pcf)	LABORATORY TESTS
1		8 inches of sod and associated landscaping fill.						
2		**Slopewash (Qsw):** Medium grayish-medium, moist, medium stiff to stiff, SILTY CLAY (CL), moderatly porous, with rootlets. Expansion Index = 43 (low). Becomes light brown at 3 feet.	CK			18.6	102.7	E.I MD SO_4
3								
4								
5			CK					
6		Light brown, moist to very moist, SANDY CLAY (CL) at 5½ feet.	CK			24.6	94.9	
7		Test pit terminated at 7 feet. No groundwater or seepage.						
8								
9								
10								

CHRISTIAN WHEELER
Engineering

PROPOSED SINGLE-FAMILY RESIDENCE
8449 El Paseo Grande, La Jolla, California

BY:	WM	DATE:	January 2008
JOB NO. :	2060605	PLATE NO.:	5

LOG OF TEST PIT NUMBER P-2

Date Excavated:	12/19/2007	Logged by:	DF
Equipment:	CME 55 Drill Rig	Project Manager:	CHC
Existing Elevation:	16 feet	Depth to Water:	15'
Finish Elevation:	5 feet	Drive Weight:	140 lbs.

DEPTH (feet)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: SAMPLE TYPE	SAMPLES: BULK	PENETRATION (blows/foot)	MOISTURE (%)	DRY UNIT WT. (pcf)	LABORATORY TESTS
1		12 inches of landscaping fill.						
2		**Slopewash (Qsw):** Medium grayish-medium, moist, medium stiff to stiff, SILTY CLAY (CL), moderatly porous.	CK			13.4	95.9	
3			CK			13.4	90.2	
4		Light brown, moist, loose to medium dense, CLAYEY SAND (SC), very fine to fine-grained, moderatly porous.	CK			9.9	95.2	
5								
6		Test pit terminated at 5½ feet. No groundwater or seepage.						
7								
8								
9								
10								

CHRISTIAN WHEELER
Engineering

PROPOSED SINGLE-FAMILY RESIDENCE
8449 El Paseo Grande, La Jolla, California

BY:	WM	DATE:	January 2008
JOB NO. :	2060605	PLATE NO.:	6

LABORATORY TEST RESULTS

PROPOSED SINGLE-FAMILY HOME

8449 EL PASEO GRANDE

SAN DIEGO, CALIFORNIA

MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT (ASTM D1557)

Sample Location:	**Test Pit P-1 @ 1.5'-5.5'**
Sample Description:	Grayish brown, CL
Maximum Density:	119.2 pcf
Optimum Moisture:	8.9 %

DIRECT SHEAR (ASTM D3080)

Sample Location:	**Boring B-1 @ 10'**
Sample Type:	Natural
Friction Angle:	18 °
Cohesion:	1200 psf

GRAIN SIZE DISTRIBUTION (ASTM D422/C136)

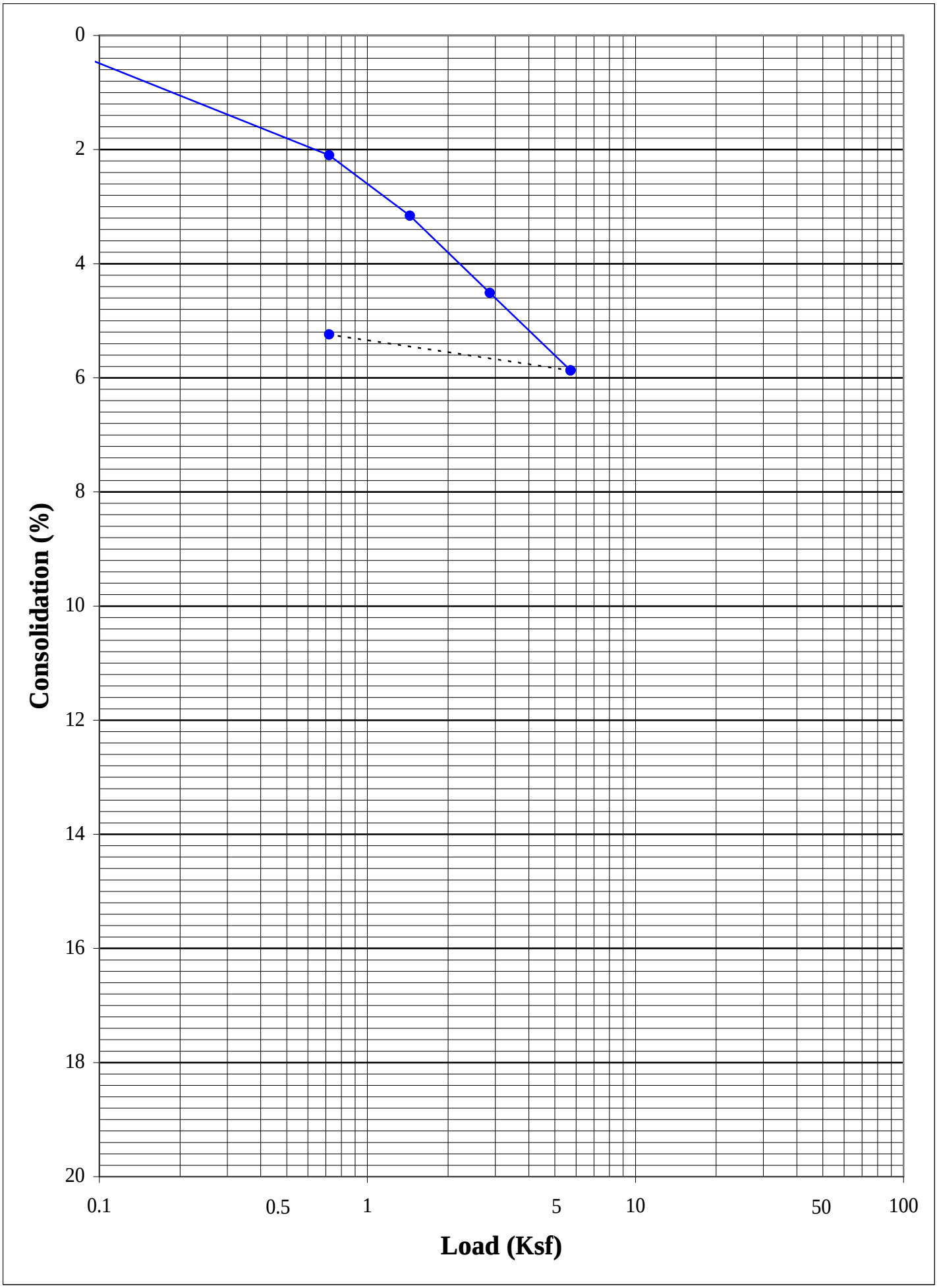
Sample Location	**Boring B-1 @ 8'-12'**	**Boring B-1 @ 24'-25'**
Sieve Size	*Percent Passing*	*Percent Passing*
#4	100	--
#8	100	100
#16	99	100
#30	95	92
#50	80	34
#100	67	12
#200	56	7
0.05 mm	50	--
0.005 mm	26	--
0.001 mm	23	--

EXPANSION INDEX (ASTM D4829)

Sample Location:	**Boring B-1 @ 8'-12'**	**Test Pit P-1 @ 1.5'-5.5'**
Initial Moisture:	9.2 %	10.5 %
Initial Dry Density:	111.1 pcf	104.9 pcf
Final Moisture:	20.4 %	23.8 %
Expansion Index:	36 (medium)	43 (medium)

SOLUBLE SULFATE

Sample Location:	**Boring B-1 @ 8'-12'**	**Test Pit P-1 @ 1.5'-5.5'**
Soluble Sulfate:	0.020 % (SO_4)	0.013 % (SO_4)


0
2
4
6
8
10
12
14
16
18
20
Consolidation (%)
0.1
0.5
1
5
10
50
100
Load (Ksf)

```
*****************************
*                           *
*      L I Q U E F Y 2      *
*                           *
*       Version 1.50        *
*                           *
*****************************
```

EMPIRICAL PREDICTION OF
EARTHQUAKE-INDUCED LIQUEFACTION POTENTIAL

JOB NUMBER: 2060605 DATE: 01-10-2008

JOB NAME: Benson

SOIL-PROFILE NAME: benson.LDW

BORING GROUNDWATER DEPTH: 15.00 ft

CALCULATION GROUNDWATER DEPTH: 15.00 ft

DESIGN EARTHQUAKE MAGNITUDE: 7.20 Mw

SITE PEAK GROUND ACCELERATION: 0.370 g

BOREHOLE DIAMETER CORRECTION FACTOR: 1.00

SAMPLER SIZE CORRECTION FACTOR: 1.00

N60 HAMMER CORRECTION FACTOR: 0.85

MAGNITUDE SCALING FACTOR METHOD: Idriss (1997, in press)

Magnitude Scaling Factor: 1.110

rd-CORRECTION METHOD: NCEER (1997)

FIELD SPT N-VALUES ARE CORRECTED FOR THE LENGTH OF THE DRIVE RODS.

Rod Stick-Up Above Ground: 3.0 ft

CN NORMALIZATION FACTOR: 1.044 tsf

MINIMUM CN VALUE: 0.6

File Name: benson.OUT

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	FC DELTA N1_60	C N	CORR. (N1)60 (B/ft)	LIQUE. RESIST RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
1	0.25	0.015	0.015	9	~	*	*	*	*	*	**
1	0.75	0.045	0.045	9	~	*	*	*	*	*	**
1	1.25	0.075	0.075	9	~	*	*	*	*	*	**
1	1.75	0.105	0.105	9	~	*	*	*	*	*	**
1	2.25	0.135	0.135	9	~	*	*	*	*	*	**
1	2.75	0.165	0.165	9	~	*	*	*	*	*	**
1	3.25	0.195	0.195	9	~	*	*	*	*	*	**
2	3.75	0.225	0.225	6	~	*	*	*	*	*	**
2	4.25	0.255	0.255	6	~	*	*	*	*	*	**
2	4.75	0.285	0.285	6	~	*	*	*	*	*	**
2	5.25	0.315	0.315	6	~	*	*	*	*	*	**
2	5.75	0.345	0.345	6	~	*	*	*	*	*	**
2	6.25	0.375	0.375	6	~	*	*	*	*	*	**
2	6.75	0.405	0.405	6	~	*	*	*	*	*	**
2	7.25	0.435	0.435	6	~	*	*	*	*	*	**
2	7.75	0.465	0.465	6	~	*	*	*	*	*	**
3	8.25	0.495	0.495	18	~	*	*	*	*	*	**
3	8.75	0.525	0.525	18	~	*	*	*	*	*	**
3	9.25	0.555	0.555	18	~	*	*	*	*	*	**
3	9.75	0.585	0.585	18	~	*	*	*	*	*	**
3	10.25	0.615	0.615	18	~	*	*	*	*	*	**
3	10.75	0.645	0.645	18	~	*	*	*	*	*	**
3	11.25	0.675	0.675	18	~	*	*	*	*	*	**
3	11.75	0.705	0.705	18	~	*	*	*	*	*	**
4	12.25	0.737	0.737	26	~	*	*	*	*	*	**
4	12.75	0.771	0.771	26	~	*	*	*	*	*	**
4	13.25	0.804	0.804	26	~	*	*	*	*	*	**
4	13.75	0.838	0.838	26	~	*	*	*	*	*	**
4	14.25	0.872	0.872	26	~	*	*	*	*	*	**
4	14.75	0.906	0.906	26	~	*	*	*	*	*	**
5	15.25	0.939	0.932	26	~	~	~	~	~	~	~~
5	15.75	0.973	0.950	26	~	~	~	~	~	~	~~
5	16.25	1.007	0.968	26	~	~	~	~	~	~	~~
5	16.75	1.041	0.986	26	~	~	~	~	~	~	~~
6	17.25	1.074	1.004	8	0.17	0.972	6.3	0.075	0.960	0.247	0.34
6	17.75	1.108	1.022	8	0.17	0.972	6.3	0.075	0.959	0.250	0.33
6	18.25	1.142	1.040	8	0.17	0.972	6.3	0.075	0.957	0.253	0.33
6	18.75	1.176	1.059	8	0.17	0.972	6.3	0.075	0.956	0.255	0.32
6	19.25	1.209	1.077	8	0.17	0.972	6.3	0.075	0.955	0.258	0.32
6	19.75	1.243	1.095	8	0.17	0.972	6.3	0.075	0.954	0.260	0.32
6	20.25	1.277	1.113	8	0.17	0.972	6.3	0.075	0.953	0.263	0.31
6	20.75	1.311	1.131	8	0.17	0.972	6.3	0.075	0.952	0.265	0.31
6	21.25	1.344	1.149	8	0.17	0.972	6.3	0.075	0.950	0.267	0.31

File Name: benson.OUT

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	FC DELTA N1_60	C N	CORR. (N1)60 (B/ft)	LIQUE. RESIST RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
6	21.75	1.378	1.168	8	0.17	0.972	6.3	0.075	0.949	0.269	0.31
7	22.25	1.412	1.186	41	0.38	0.901	31.3	Infin	0.948	0.272	NonLiq
7	22.75	1.446	1.204	41	0.38	0.901	31.3	Infin	0.947	0.273	NonLiq
7	23.25	1.479	1.222	41	0.38	0.901	31.3	Infin	0.946	0.275	NonLiq
7	23.75	1.513	1.240	41	0.38	0.901	31.3	Infin	0.945	0.277	NonLiq
7	24.25	1.547	1.258	41	0.38	0.901	31.3	Infin	0.943	0.279	NonLiq
7	24.75	1.581	1.276	41	0.38	0.901	31.3	Infin	0.942	0.281	NonLiq
7	25.25	1.614	1.295	41	0.38	0.901	31.3	Infin	0.941	0.282	NonLiq
7	25.75	1.648	1.313	41	0.38	0.901	31.3	Infin	0.940	0.284	NonLiq
7	26.25	1.682	1.331	41	0.38	0.901	31.3	Infin	0.939	0.285	NonLiq
7	26.75	1.716	1.349	41	0.38	0.901	31.3	Infin	0.938	0.287	NonLiq
8	27.25	1.748	1.366	49	~	~	~	~	~	~	~~
8	27.75	1.779	1.382	49	~	~	~	~	~	~	~~
8	28.25	1.811	1.397	49	~	~	~	~	~	~	~~
8	28.75	1.842	1.413	49	~	~	~	~	~	~	~~
8	29.25	1.873	1.429	49	~	~	~	~	~	~	~~
8	29.75	1.904	1.444	49	~	~	~	~	~	~	~~
8	30.25	1.936	1.460	49	~	~	~	~	~	~	~~
8	30.75	1.967	1.475	49	~	~	~	~	~	~	~~
8	31.25	1.998	1.491	49	~	~	~	~	~	~	~~
8	31.75	2.029	1.507	49	~	~	~	~	~	~	~~
9	32.25	2.061	1.522	59	~	~	~	~	~	~	~~
9	32.75	2.092	1.538	59	~	~	~	~	~	~	~~
9	33.25	2.123	1.554	59	~	~	~	~	~	~	~~
9	33.75	2.154	1.569	59	~	~	~	~	~	~	~~
9	34.25	2.186	1.585	59	~	~	~	~	~	~	~~
9	34.75	2.217	1.601	59	~	~	~	~	~	~	~~
9	35.25	2.248	1.616	59	~	~	~	~	~	~	~~
9	35.75	2.279	1.632	59	~	~	~	~	~	~	~~