PRELIMINARY FOUNDATION REPORT

OSUNA TRAIL BRIDGE
AT SAN DIEGUITO RIVER
OSUNA SEGMENT OF COAST TO CREST TRAIL PROJECT
SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

KIMLEY-HORN AND ASSOCIATES, INC.
SAN DIEGO, CALIFORNIA

JULY 27, 2021
PROJECT NO. G2680-22-01

Project No. G2680-22-01
July 27, 2021

Kimley-Horn and Associates, Inc.
401 B Street, Suite 600
San Diego, California 92101

Attention: Ms. Marie Santos

Subject: PRELIMINARY FOUNDATION REPORT
OSUNA TRAIL BRIDGE AT SAN DIEGUITO RIVER
OSUNA SEGMENT OF COAST TO CREST TRAIL PROJECT
SAN DIEGO, CALIFORNIA

Dear Ms. Santo:

In accordance with your request, we herein submit our Preliminary Foundation Report (PFR) for the subject Osuna Trail Bridge at San Dieguito River in San Diego, California. The accompanying report presents the findings and conclusions from our study.

We appreciate the opportunity to work with you on this project. Should you have questions concerning the contents of this report, or if Geocon may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Yong Wang
GE 2775

Joseph J. Vettel
GE 2401

YW:JJV:arm

(e-mail) Addressee

TABLE OF CONTENTS

PRELIMINARY FOUNDATION REPORT

1. INTRODUCTION

This Preliminary Foundation Report (PFR) presents the results of a geotechnical study for the proposed Osuna Trail Bridge at San Dieguito River in San Diego, California. The purpose of this study was to document the available data regarding the subsurface condition at the proposed bridge site, provide preliminary site-specific seismic recommendations, provide preliminary foundation recommendations, and identify the need for an additional field investigation and study.

Our scope of work included:

- Reviewing published geologic maps, aerial photographs, in-house documents, and other literature pertaining to the site to aid in the evaluation of geologic conditions and hazards that may be present.
- Reviewing currently available project information regarding the proposed Osuna Trail Bridge.
- Performing a field reconnaissance to note the general existing conditions of the project site and surrounding areas.
- Performing engineering analyses to evaluate site liquefaction potential, seismic design criteria, and foundation design criteria.
- Preparing this PFR in general accordance with the Caltrans *Foundation Reports for Bridges* (January 2021).

2. PROJECT DESCRIPTION

Preliminary project plans regarding the proposed bridge are being developed at the time of preparing this PFR. Based on the currently available project information and *Osuna Valley Trail Bridge Feasibility Study*, prepared by Kleinfelder, dated August 2015, the proposed Osuna Trail Bridge site is located approximately 1,700 feet east of Via De La Valle, and within the northern limits of the City of San Diego south of the County of San Diego, as shown on the *Vicinity Map* (see Figure 1). The Osuna Trail Bridge will span over the San Dieguito River (US Waters) at the downstream side of the existing golf cart bridge of the Morgan Run Club and Resort. For the purpose of this PFR, the approximate site coordinates used for the bridge are 32.98536° (latitude) and -117.21156° (longitude).

The general configuration of the project site is shown on Figure 2 (*Site Plan*). We understand from the current available project information that a single-span, prefabricated steel bridge is being considered for the proposed crossing to provide an elevated boardwalk connecting the trail along the adjacent wetland and riparian areas. We further understand that shallow and deep foundations are being considered for the support of the proposed bridge.

The existing surface elevations of the project site are generally ranging between 15 to 25 feet (NAVD88). The project vertical datum is based on NAVD 88.

3. EXCEPTION TO POLICES AND PROCEDURES

Unless otherwise stated in this PFR, this study and the preliminary recommendations contained herein are in general conformance with current Caltrans specification and policy.

4. GEOTECHNICAL INVESTIGATION

Geotechnical investigation for this proposed bridge has not been performed at this time. For the purposes of this PFR, we have reviewed the available log of one adjacent boring drilled in 2018. The boring was drilled for a then proposed recycled water line of Olivenhain Municipal Water District (OMWD) installed beneath the San Dieguito River via horizontal directional drilling (HDD). The boring log, limited details of the exploration, and associated project plans are included in Appendices A and C of this PFR.

5. LABORATORY TESTING PROGRAM

No laboratory testing program and data are available for review at the time of preparing this report.

6. GEOTECHNICAL CONDITIONS

6.1 Geology

Geologic Map of The San Diego 30' x 60' Quadrangle shows that the site is underlain by young alluvial flood-plain deposits (Holocene and late Pleistocene) and the San Dieguito River channel is filled with wash deposits (late Holocene). The *Regional Geologic Map* is shown on Figure 3.

6.2 Surface Conditions

The San Dieguito River is a 100-yr floodway per FEMA Map. The adjacent riparian area and wetland are located within the 100-yr floodplain that is generally covered with dense brush and trees. The existing site topography generally consists of flat to sloping terrains. The open water within the San Dieguito River channel is collected from the upstream watershed areas and flows downstream southwestward. Based on the project plans in Appendix C, the approximate elevations of the water surface and the river channel bottom are expected to be around 14.3 feet (NAVD 88) and 9.6 feet (NAVD 88), respectively.

The project site is located within the City of San Diego and near the boundary line of County of San Diego at the north. An existing golf cart bridge is located on the upstream side of the site. In addition, an 8-inch-diameter recycled water line is installed beneath the San Dieguito River at approximate 50 feet deep via trenchless construction method. Besides the floodplain and the potential for seismic induced liquefaction and/or lateral spreading, no other geologic hazards have been identified at this time.

6.3 Subsurface Conditions

Based on a review of the previous boring log (Appendix A) for the adjacent recycled water line project and our experiences in the area, the subject site is likely underlain by thick young alluvial deposits in the San Dieguito River Basin overlying Eocene-age Torrey Sandstone.

The alluvial soil generally consists of very loose to loose, poorly-graded sand and silty sand with varying amounts of gravel, and interbeds of soft clay and silt with sand. The alluvium encountered in the previous boring extended approximately 120 feet below the grade. Besides the potential for liquefaction and lateral spreading as discussed in Section 11, the fine portions of the alluvium would be compressible and could result in consolidation settlement under additional loading condition. The Torrey Sandstone generally consists of weathered sandstone and mudstone.

The depth to rock-like materials in the proposed bridge area is expected to be on the order of 120 to 130 feet below the existing grade.

7. GROUNDWATER

Groundwater was depicted on the log of the previous drilled boring for the recycled water line project in 2018. Assuming the approximate ground surface elevation of 25 feet (NAVD 88) at the previous boring location, the groundwater level encountered in the boring was 13 feet below the grade, or at the approximate elevation of 12 feet (NAVD 88). In the zone adjacent to the river channel, the groundwater level may be near the water level in the open channel. Therefore, groundwater in the project area is likely between elevations of 12 and 14 feet (NAVD 88).

8. AS-BUILT DATA

There is no existing bridge at the subject site. Therefore As-Built data is not applicable for this PFR.

9. SCOUR DATA

The site is located within the tributary drainage channel margins (San Dieguito River). The scour evaluation should refer to the project hydraulic/hydrologic report. The bridge supports should be founded below the maximum anticipated depth of scour at channel crossings.

10. CORROSION EVALUATION

According to Caltrans Corrosion Guidelines (Version 3.2, May 2021), a site is considered corrosive to structural elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site: chloride concentration is 500 ppm or greater, sulfate concentration is 1500 ppm or greater, or the pH is 5.5 or less. Caltrans LRFD Memo to Designer 3-1 (MTD 3-1, June 2014) provides the similar criteria with an additional condition that the soil has a minimal resistivity of 1000 ohm-centimeters or less.

Historical corrosion data is not available for this site. The preliminary evaluation of the corrosion potential of onsite soil should be incorporated into the scope of future geotechnical investigation for this project.

11. SEISMIC INFORMATION

11.1 Ground Motion Hazard

A design response spectrum for the proposed structure at the site was developed in accordance with the probabilistic data generated by the Caltrans *ARS Online* application (Version 3.0.2) and Appendix B of Seismic Design Criteria (Version 2.0). Site-specific information used in the procedure included the latitude of 32.9854° and the longitude of -117.2116°. The site is not located within a deep sedimentary basin per Caltrans *ARS Online*. The recommended ground motion parameters are listed in Table 11.1 below:

TABLE 11.1
RECOMMENDED GROUND MOTION PARAMETERS FOR GEOTECHNICAL DESIGN

Site Parameters			**Design Ground Motion Parameters (Return Period = 975 years)**		
Locations		Shear-Wave Velocity Vs30, m/sec	Horizontal Peak Ground Acceleration (HPGA) [1], g	Mean Earthquake [2] M, Moment Magnitude	Mean Site-to-Fault/Rupture Surface Distance [2] Rrup, km
Latitude, degrees	Longitude, degrees				
32.9854	-117.2116	180	0.37	6.6	36.5

1. Based on the Caltrans web tool ARS Online (Version v3.0.2).

2. Based on hazard de-aggregation analysis for the design of HPGA using the web based USGS Uniform Hazard Tool (Edition: Dynamic: Conterminous U.S. 2014 (Updated) (V4.2.0)).

The soil profile below the bridge foundation is generally expected to consist of granular soils with potential for liquefaction, lateral spreading, or scour. The fine portions of the alluvium (silts and clays) would be compressible and result in consolidation settlements under additional loads. The characteristics of the onsite soils are not expect to meet the criteria for competent soils (Class S1) per

Seismic Design Criteria (Version 2.0) with respect to the standard penetration test data and shear wave velocity. We recommend the onsite soil profile be classified as the non-competent, marginal soils (Class S2). For a preliminary estimate of the site controlling horizontal peak ground acceleration (HPGA), a shear wave velocity, Vs30 of approximately 180 m/sec is considered appropriate for the soil profile based on the subsurface conditions encountered in the previous exploratory boring (Appendix A) near the subject site. Some details associated with the previous boring such as the type of drill rig used, drilling methods, and the energy ratio of the hammer used for the Standard Penetration Test (SPT) are not available at this time. For the purpose of this PFR, some assumptions were made based on the lithology descriptions provided by the boring log.

The *Design Response Spectrum* developed from Caltrans *ARS Online* application (Version 3.0.2) based on the USGS Seismic Hazard Map (2014) for the 5% in 50 years probability of exceedance (or 975-year return period) is included in Appendix B of this PFR. The HPGA generated by the design spectrum is 0.37g (where "g" represents the acceleration due to gravity). The seismic design date obtained from Caltrans *ARS Online (Version 3.0.2)* is also included in Appendix B.

The preliminary data included in this PFR will be verified during the pending investigation for the project Foundation Report (FR).

11.2 Other Seismic Hazards

The site is not located within an Alquist-Priolo Earthquake Fault Zone or 1000 feet from any Holocene or younger age fault. Therefore, per MTD 20-10, the proposed structure is not considered susceptible to surface fault rupture hazards.

Due to the presence of loose and soft alluvial materials and shallow groundwater beneath the site, the potential for soil liquefaction is present at the site. The liquefiable zone at the site extends from approximate elevation of 12 feet NAVD 88 (groundwater level) to approximate elevation of -97 feet NAVD 88 (bottom of alluvium). The liquefaction-induced settlement of the ground surface is expected on the order of 30 inches.

There is a potential for lateral spreading of the embankment slope towards the river channel due to the presence of liquefiable soils at this site. Further evaluation would be performed during the pending geotechnical investigation for FR, when the general configuration of the proposed embankments and specific geotechnical data become available.

Planned earthwork may include fill slopes along portions of the approach embankments or abutments. Assuming that fill materials meet Caltrans' specifications for structural backfill of 2:1 (horizontal:vertical), we expect the proposed abutment slopes should have adequate factors of safety

against deep-seated and shallow failures under the static and pseudo-static (seismic) loading (a horizontal seismic load of 1/3 HPGA up to 0.20g). The further analysis together with the potential for seismically induced horizontal deformations/displacements would be evaluated (based on the recommended design parameters including the HPGA of 0.37g and earthquake magnitude (moment) of 6.6) during the pending geotechnical investigation for FR, when the general configuration of the proposed embankments and specific geotechnical data become available.

A tsunami is a series of long period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The site is not located within the tsunami inundation area shown on *California Official Tsunami Inundation Map for Emergency Planning, County of San Diego County, Del Mar Quadrangle (June 1, 2009)*. Based on the above information and per MTD 20-13, a the potential for tsunami does not exist at the site.

12. GEOTECHNICAL RECOMMENDATIONS

The proposed trail bridge is located within the wetland and riparian areas of San Dieguito River. The thick alluvial deposits underlying the site are loose and soft and therefore provide relatively low bearing resistance. Settlement would be expected for structures supported by the onsite alluvium under additional loads. In the event of a major earthquake, liquefaction-induced settlement and the potential for lateral spreading should be expected at the site.

A trail bridge is a structure that is typically designed for the traffic of pedestrian, bike, equestrian, and occasional service vehicle. The risk category associated with a trail bridge would be relatively low as compared with critical and/or essential facilities. It is our opinion that site mitigation for the potential liquefaction and/or lateral spreading via deep foundation and/or ground improvement are technically feasible but not likely economical for the proposed trail bridge.

A site specific geotechnical investigation for the proposed bridge has not been performed and the preliminary project plans are not available at this time. A specific geotechnical investigation and laboratory testing program for the bridge FR should be performed in general accordance with Caltrans guidelines. The future investigation should include at least one boring at each proposed abutment location and extending into the underlying formation. For the purpose of this PFR, we have assumed that the finished grade elevation and the groundwater level in the proposed abutment areas would be approximately 25 feet (NAVD 88) and 14 feet (NAVD 88), respectively. Our preliminary foundation recommendations are provided in the following sections.

12.1 Shallow Foundations

We recommend spread footings for the support of the proposed bridge abutments. The alluvial deposits in their present condition are not suitable for the support of additional structural fill soils and/or settlement-sensitive improvements: therefore, the alluvial deposits above groundwater should be removed (where practical) and recompacted. To provide a relatively uniform support, the upper 3 feet of soil below the proposed abutment footings should be replaced with structure fill and/or slurry. Excavation bottom stabilization with a geotextile fabric and crushed rock blanket maybe necessary. Surcharge should also be considered to mitigate the settlement of the foundation soil.

The following tables provide the preliminary foundation recommendations. Permissible settlement of 1.5 inches is estimated based on the assumed footing dimensions under the net contact stress of 1.2 kips per square foot (ksf). The differential settlement would be 50 percent of the estimated total settlement.

TABLE 12.1.1
FOUNDATION DATA

Support Location	Finished Grade Elevation (ft)	Bottom of Footing Elevation (ft)	Footing Dimensions (ft)		Permissible Settlement under Service Load (in)*
			B	L	
Abutment 1	25	20	20	20	1.5
Abutment 2	25	20	20	20	1.5

* Based on Caltrans' current practice, the total permissible settlement of one inch for multi-span structures with continuous spans or multi-column bents, one inch for single span structures with diaphragm abutments, and two inches for single span structures with seat abutments. Different permissible settlement under services loads may be allowed if structure analysis verifies that required level of serviceability is met. The permissible settlement of 1.5 inches is assumed for this PFR.

TABLE 12.1.2
PRELIMINARY FOUNDATION DATA FOR ABUTMENTS

Support Location	Effective Footing Width B' (ft)	Gross Nominal Bearing Resistance q_n (ksf)	Permissible Net Contact Stress (Settlement) q_{pn} (ksf)	Factored Gross Nominal Bearing Resistance (Strength) qR (ksf)
Abutment 1	20	2.7	1.2	1.2
Abutment 2	20	2.7	1.2	1.2

Foundation Location: Soil; Friction Angle: 28°; permissible Settlement: 1.5 inches; Resistance factor (Strength) - φb: 0.45; Resistance Factor (Seismic) - φb: 1.0; Based on L' = 20 ft.

TABLE 12.1.3
FOUNDATION DESIGN RECOMMENDATIONS FOR SPREAD FOOTING

Support Location	Footing Size (ft)		Bottom of Footing Elevation (ft)	Minimum Footing Embedment Depth (ft)	Total Permissible Support Settlement (in)	Service Limit State	Strength Limit State (φ_b = 0.45)	Extreme Event Limit State (φ_b = 1.0)
	B	L				Permissible Net Contact Stress (ksf)	Factored Gross Nominal Bearing Resistance (ksf)	Factored Gross Nominal Bearing Resistance (ksf)
Abut 1	20	20	20	5	1.5	1.2	1.2	N/A
Abut 2	20	20	20	5	1.5	1.2	1.2	N/A

Foundation Location: Soil; Friction Angle: 28°; permissible Settlement: 1.5 inches; Resistance factor (Strength) - φb: 0.45; Resistance Factor (Seismic) - φb: 1.0; Based on L' = 20 ft.

12.2 Deep Foundations

Deep foundations typically consist of driven piles and/or CIDH concrete piles. Based on the currently available geotechnical data, the onsite thick alluvial deposits are loose and soft, and would not develop the adequate side and tip resistances along the piles. For appropriate load supports and settlement mitigation, the piles should be extended at least 10 or more feet into the underlying formational materials that are located approximately 120 to 130 feet below the existing grade. Therefore, we do not recommend a deep foundation system for the support of the proposed trail bridge based on the currently available data. The option of deep foundations should be furthered evaluated during the specific geotechnical investigation for the project FR.

12.3 Approach Fills

New fills are expected to establish finish grades for the proposed abutments. All grading should be performed in conformance with Caltrans Standard Specifications or equivalent. Backfill placed at and behind abutment walls should be have a low expansion potential. The extent and placement of the low-expansive soils should conform to Caltrans Standard Specifications 19-5.03. Backfill should have an Expansion Index (EI) no greater than 50, or a Sand Equivalent of 20 or greater. Ponding or jetting of backfill should not be permitted.

Backfill placed within the full width of the embankment and within 150 feet of the abutment is considered structural backfill. All structural backfill should be compacted to 95 percent of the maximum density as determined by ASTM D 1557. All compaction on the project should be based on this test method. All other backfill should be compacted to a minimum of 90 percent relative compaction. Existing undocumented fills and alluvial soils at expected abutment locations are not

adequate for the support of new fill loads, and partial removal and recompaction will be necessary prior to the placement of new structure backfill and foundation construction.

Surface settlements can be expected where substantial thicknesses of new fill will be placed. If calculated settlements will exceed allowable settlement, a waiting period or surcharge may be necessary. Further evaluation and recommendations can be provided when the specific geotechnical for the bridge FR and project plans regarding the proposed embankment configuration become available.

13. REPORT COPY LIST

This PFR is prepared for Kimley-Horn and Associates, Inc. in accordance with the project document procedure. The PFR should be forwarded to the Structural Designer of the project per Caltrans requirement.

14. CLOSURE

14.1 Foundation and Grading Plan Review

Geocon Incorporated should review the grading plans and foundation plans prior to final design submittal to determine whether additional analysis and/or recommendations are required.

14.2 Limitations and Uniformity of Conditions

The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that

supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous materials was not part of the scope of services provided by Geocon Incorporated.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

15. REFERENCES

1. California Department of Transportation, 2019, *California Amendments to AASHTO LRFD Bridge Design Specifications, 2017 (8th Edition),* dated April.

2. California Department of Transportation, 2021, *Foundation Reports for Bridges,* dated January.

3. California Department of Transportation, 2018, *Highway Design Manual (Sixth Edition).*

4. California Department of Transportation, 2015, *Memo to Designers 1-0,* dated January 26.

5. California Department of Transportation, 2012, *Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations,* dated month of November.

6. California Department of Transportation, 2018, *Standard Plans,* undated.

7. United States Geological Survey (USGS), 2009, *Unified Hazard Tool*, 5% probability of being exceeded in 50 years, accessed October 14.

8. Kennedy, M. P., and S. S. Tan, *Geologic Map of the Oceanside 30' X 60' Quadrangle, California,* 2005,

9. Tan, S. S., and D. G. Giffen, *Landslide Hazards in the Northern Part of the San Diego County, California*, California Division of Mines and Geology, Open-File Report 95-04, 1995.

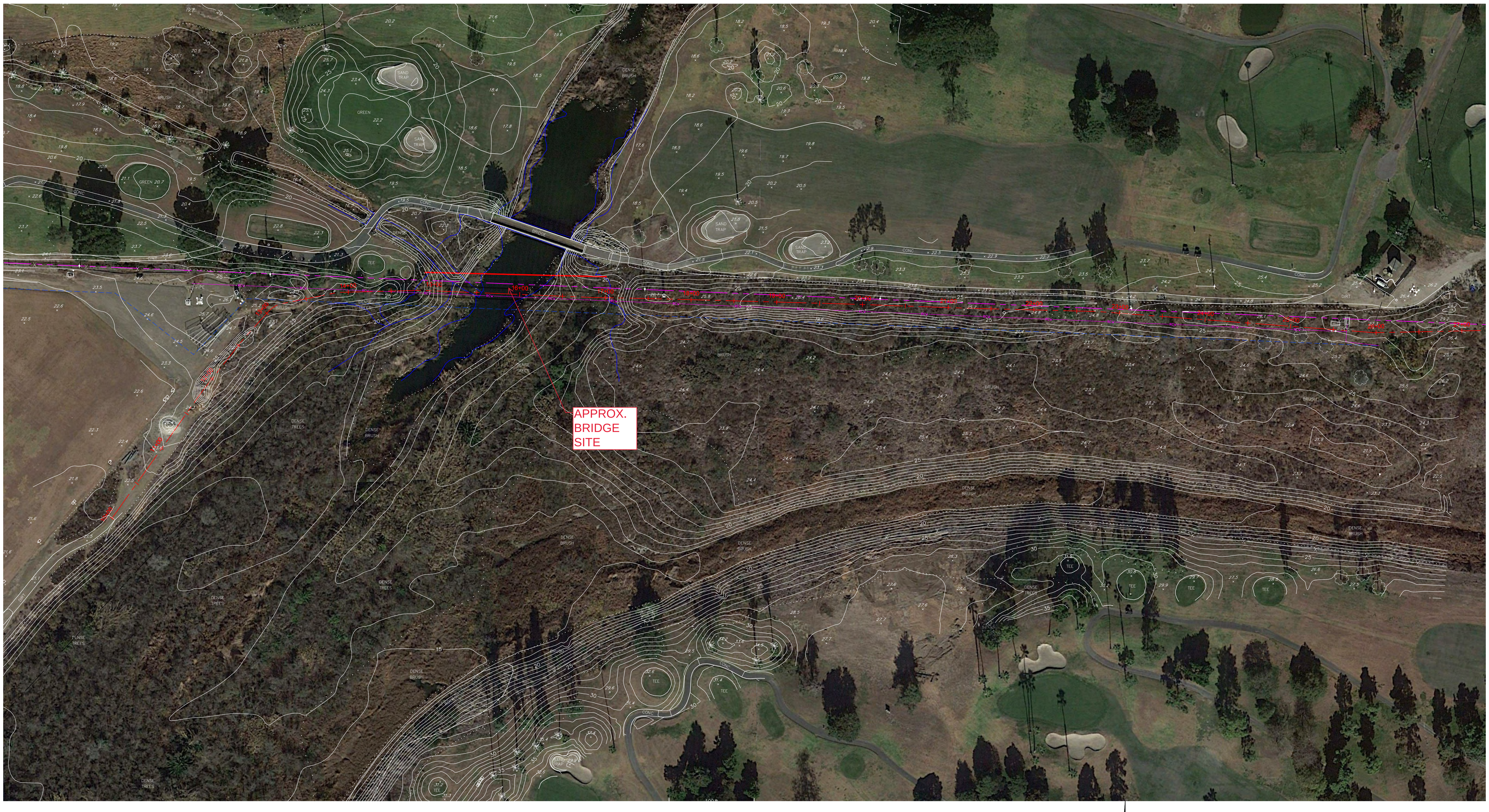
10. Unpublished reports, aerial photographs, and maps on file with Geocon Incorporated.

11. Youd, L. T., I. M. Idriss, *et al., Liquefaction Resistance of Soils: Summary Report from 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils,* Journal of Geotechnical and Geoenvironmental Engineering, October 2001.

OSUNA TRAIL BRIDGE
SAN DIEGO, CALIFORNIA

VICINITY MAP

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159
PROJECT NO. **G2680 - 22 - 01**
FIGURE **1**
DATE **07 - 27 - 2021**



SITE PLAN

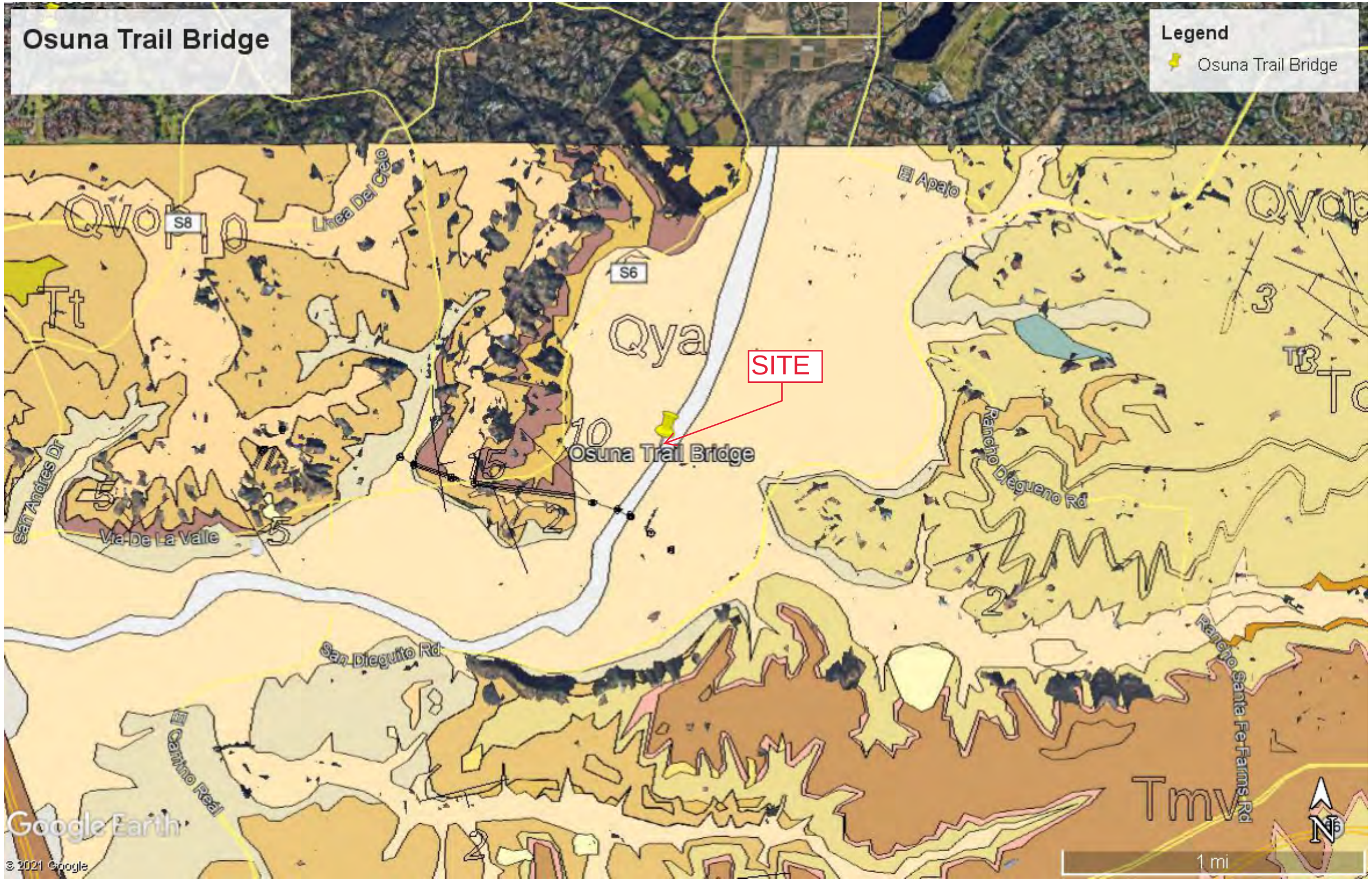
OSUNA TRAIL BRIDGE
SAN DIEGO, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE	1" = 50'	DATE	07 - 27 - 2021
PROJECT NO.	G2680 - 22 - 01	FIGURE	2
SHEET	1 OF 1		

Plotted:07/16/2021 10:32AM | By:RUBEN AGUILAR | File Location:Y:\PROJECTS\G2680-22-01 Osuna Trail Bridge\SHEETS\G2680-22-01 GeoMap-BridgeAlignment.dwg

OSUNA TRAIL BRIDGE
SAN DIEGO, CALIFORNIA



REGIONAL GEOLOGIC MAP

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159
PROJECT NO. **G2680 - 22 - 01**
FIGURE **3**
DATE **07 - 27 - 2021**