Appendix D – Soils Report (if applicable)

DISTRICT PRELIMINARY GEOTECHNICAL REPORT
TEMESCAL CANYON ROAD PROJECT
LAKE ELSINORE, CA

Federal-Aid Project No. BRLO-5074 (015)

Submitted to

City of Lake Elsinore
and
CALTRANS District 8

Prepared for

AGUILAR CONSULTING, INC.
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Prepared by

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GDC Project No. IR-617
April 4, 2016

GROUP DELTA

April 4, 2016

AGUILAR CONSULTING, INC.
2155 Chicago Avenue, Suite 301
Riverside, CA 92507

Attention: Ceazar Aguilar, PE
President

Subject: District Preliminary Geotechnical Report
Temescal Canyon Road Project
Lake Elsinore, California
GDC Project No. IR-617

Dear Ceazar:

Group Delta is pleased to submit this District Preliminary Geotechnical Report (DPGR) for the subject project. The DPGR provides preliminary recommendations to Project Engineers in Design and Planning, and Environmental Planners to develop the Project Initiation Documents, Environmental Documents, and Project Reports. This report is prepared to document anticipated geotechnical conditions based upon site reconnaissance and available data for the various project alternatives under consideration.

We appreciate the opportunity to assist you on this important project. Should you have any questions, please call us at (949) 450-2100.

Sincerely,
GROUP DELTA CONSULTANTS, INC.

Curt Scheyhing, PE, GE
Principal Geotechnical Engineer

Sathis Kumar, PE
Project Engineer

Terry Otis, P.G.
Senior Geologist

Distribution: Addressee (PDF file to Aguilar Consulting, Inc.)

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LAKE ELSINORE, CALIFORNIA
GDC PROJECT NO. IR-617

1.0 EXECUTIVE SUMMARY

The City of Lake Elsinore (City) proposes to realign a portion of Temescal Canyon Road between Lake Street and Bernard Street to the west, and to construct a new bridge over Temescal Wash. The existing 2-lane Temescal Canyon Road and existing bridge over Temescal Wash will be abandoned and replaced by a new 2-lane roadway and bridge. The bridge structure will be constructed to accommodate the ultimate 4-lane roadway section. The length of the roadway realignment is approximately 3,457 feet, and the bridge will be a 3-span structure, 306 feet long and 97 feet wide. The majority of the realigned roadway will be constructed on embankment fills. Fill heights up to about 25 feet will be placed near the abutment approaches.

The purpose of this District Preliminary Geotechnical Report (DPGR) is to provide preliminary recommendations to Project Engineers in Design and Planning, and Environmental Planners, to develop the Project Approval/Environmental Document (PA/ED) phase Environmental Document and Project Report. This DPGR is prepared to document anticipated geotechnical conditions based upon site reconnaissance and available data for the various project alternatives under consideration.

No existing subsurface exploration data are available within the proposed realignment of Temescal Canyon Road. Review of available information in the project vicinity and site reconnaissance along the proposed alignment indicate that the site consists of shallow fill over alluvial soils, which are underlain by bedrock. Due to close proximity of Temescal Wash, groundwater is expected to be relatively shallow, and the site is subject to periodic flooding. It is anticipated that imported soil will be required for embankment construction. Bridge supports are expected to be supported on deep foundations. The primary potential seismic and geologic hazards at the site include strong ground shaking due to nearby faults, liquefaction and its effects, seismic embankment stability and lateral spreading, amount and time rate of embankment settlements due to consolidation, and flooding. Surface fault rupture, tsunamis, and landslide hazards are not significant. Subgrade preparation requirements, grading recommendations, embankment settlement evaluation, foundation design, pavement design, and quantification of geologic hazards will require subsurface exploration at a later stage of the project. Actual depth to groundwater is unknown, but may have a significant construction impact in the event that dewatering and/or cofferdams are required for bridge pier construction excavations. Accurate groundwater depth should be defined by subsurface exploration.

The proposed project is considered feasible from a geotechnical perspective, provided that appropriate measures are taken in planning, design, and construction.

2.0 INTRODUCTION

The project is needed to improve traffic and safety, and to create an all-weather crossing of Temescal Canyon Road over Temescal Wash. Improvements include a new 2-lane roadway realignment and a new bridge structure which will be constructed to accommodate the ultimate 4-lane roadway section. The site vicinity, site location map and aerial photograph, and the United States Geological Survey (USGS) 7.5-minute quadrangle map overlaid on Google Earth are shown in Figures 1A, 1B, and 1C, respectively.

3.0 PERTINENT REPORTS AND INVESTIGATIONS

The project is currently at the PA/ED stage. The information presented in the DPGR is from surficial walk through and photographic reconnaissance along the proposed alignment, literature study, and available geologic and geotechnical information. The site reconnaissance photographs are presented in Appendix A. No subsurface exploration was performed for this stage of the project. The following published data were reviewed:

- Topographic maps
- Geologic Maps
- Aerial Photographs
- As-built data from nearby Lake Street Bridge over Temescal Wash (previously known as Temescal Wash Bridge on as-built plans)
- Caltrans online Fault Map and data
- Fault Rupture Special Studies Zones Map
- Soil Survey Maps
- Flood Hazard Maps
- Limited geotechnical data from the adjacent Clay Pits site (Geomatrix, 09/10/99, see Appendix B)

In addition, Group Delta will submit under separate cover a Preliminary Foundation Report (PFR) for Bridge Type Selection, and a Hazardous Waste Initial Site Assessment (ISA).

4.0 DESCRIPTION OF PROJECT ALTERNATIVES AND EXISTING FACILITIES

4.1 Project Alternatives

We understand that in addition to no-build, two build alternatives were considered: 1) New roadway with 2-span bridge over Temescal Wash, and 2) New roadway with 3-span bridge over Temescal Wash. The preferred alternative is a 3-span bridge, as shown in the preliminary Geometric Approval Drawing (GAD) Exhibit (See Figure 2A). The roadway realignment and profile for both alternatives is similar. Grading is primarily fill, with roadway elevations ranging from at or near existing grade to as much as about 25 feet above existing grades. The realignment is shown on an aerial photograph and on the USGS 7.5-minute Quadrangle topographic map in

Figures 1B and 1C, respectively, and the detailed preliminary plan and profile are shown in Figures 2A and 2B.

4.2 Existing Facilities

The site is fairly level and mostly undeveloped. Existing trees and vegetation have been cleared from most of the site, except for isolated areas and within the Temescal Wash channel. Existing facilities at the site include:

- I-15 freeway to the north, and I-15/Lake Street Undercrossing (UC) to the northeast
- Lake Street to the east, and Lake Street Bridge over Temescal Wash
- Bernard Street to the west, and a small bridge over Temescal Wash
- Existing Temescal Canyon Road (portion to be abandoned)
- Existing bridge carrying Temescal Canyon Road over Temescal Wash (to be abandoned), 2-span cast-in-place reinforced concrete T-girder with pier wall and closed end strutted abutments, all on spread footings
- Pacific Clay Brick Products facility to the southwest (clay mine, part of Alberhill Clay Pits), including industrial buildings and outdoor storage areas
- Temescal Wash stream channel (riparian, sensitive habitat)
- Various overhead and buried utilities
- Existing pavements along existing Temescal Canyon Road are in fair to poor condition, with significant transverse and longitudinal cracking, and localized rutting and alligator cracking

Existing improvements are shown in Figures 1B, 1C, and 2.

5.0 PHYSICAL SETTING

5.1 Climate

Climate data for Lake Elsinore is available from www.usclimatedata.com. These records indicate that average annual precipitation is about 12.5 inches per year, with about 90% of rainfall occurring between November and April. Maximum monthly average rainfall is 3 inches in January, and minimum average is 0 inches in August. The average monthly high temperature ranges from 65°F in December to 99°F in August. Average monthly low temperature ranges from 38°F in December to 63°F in August. Extreme temperatures can approach 110°F in the summer and about 20°F in winter months. No annual mean snowfall is reported. From the available climate data, soil freeze/thaw and frost heave conditions are not expected to exist within the project site.

5.2 Topography and Drainage

The project site is relatively level, and located in alluvial valley and floodplain of Temescal Wash. Regional topography is illustrated in Figure 1C, and project site topography and alignment profile are shown in Figure 2A. The preliminary channel and drainage plan including Water Quality Management Plan (WQMP) basins and selected sections are shown in Figures 2C and 2D. Natural ground within the Temescal Wash channel and floodplain zone range from about El. 1225 feet on the east side to El. 1205 feet on the west side of the project area. Existing ground elevations along the proposed realignment range from about El. 1228 feet at the Lake Street intersection, to a low of about El. 1200 feet in the bottom of Temescal Wash channel, to about El. 1210 feet where the realignment re-joins existing Temescal Canyon Road. The I-15 freeway to the north of the site is on embankment, with freeway elevations ranging from about El. 1225 feet adjacent to the west end of the proposed Temescal Canyon Road realignment, to El. 1255 feet near Lake Street. Lake Street is on embankment near El. 1230 feet where it crosses Temescal Wash on a bridge structure.

The primary drainage in the area is Temescal Wash, which flows through the site towards the west-northwest. The surrounding areas drain by sheet flow into storm drains or the Temescal Wash channel. The new roadway will be constructed near the original grades at the beginning and end of the alignment, and elevated on embankments up to about 25 feet above original grades on approach to the proposed new bridge crossing Temescal Wash. No major hills or ridges are present within the site, and no significant permanent cuts or cut slopes are proposed for roadway grading. Minor channel realignment and other channel improvements (such as slope protection, levees, etc.) may be required as part of the project in coordination with adjacent land developers. The current 100-year flood plain is illustrated in blue shading on Figures 2A and 2B. The 100-year floodplain elevations associated with Temescal Wash from Bernard Street up to Lake Street range from 1214 to 1224 feet.

5.3 Prior Land Use

Much of the site area is within the Temescal Wash and floodplain, and has historical aerial photographs dating back to the early 1900's indicate that the site has been mostly undeveloped other than the existing roadway and a former railroad line. Lake Street and the I-15 freeway form the east and northern site boundaries, respectively. The area south of the site is part of the Alberhill Clay Pits, and has been used commercially for mining clay for use in production of brick and other products. Based on review of an existing report (Geomatrix, 1999) the adjacent clay pit site has a history of leaking underground storage tanks and hydrocarbon contamination. Group Delta will prepare and submit an Initial Site Assessment (ISA) under a separate cover. No major environmental concerns that would preclude the proposed project have been identified at this time.

5.4 Man-Made / Natural Features of Engineering & Construction Significance

The project is mostly within undeveloped areas and is not expected to have major impacts to the surrounding areas and facilities. Existing facilities will be relocated or protected in place, as needed. The following man-made or natural features of engineering and construction significance are present within or closely adjacent to the construction site that should be considered during design and construction:

- Existing freeway and surface streets, and local vehicle/truck traffic to be maintained
- Existing Temescal Canyon Road bridge and portion of roadway to be abandoned
- Existing buildings, undocumented fills, and outdoor storage areas within the proposed realignment area to be removed
- Existing trees and vegetation to be removed or protected in place
- Existing buried and overhead utilities
- Existing Temescal Wash channel to be realigned or modified
- Riparian / sensitive habitat in the wash channel areas
- Potential shallow groundwater (especially near the wash) and its impact on temporary construction excavations required for bridge foundation construction

6.0 GEOLOGY

6.1 Regional Geology

The project site is located within the Peninsular Ranges geomorphic province of Southern California, as shown in Figure 3A. It is located near the western margin of the Perris Block, which is an internally unfaulted, structurally stable eroded mass of Cretaceous and older granitic and metasedimentary basement rocks located between the Elsinore and San Jacinto Fault Zones. A regional geologic map showing the site along with these major fault zones and the Perris Block is presented in Figure 3B.

The project site is located in an alluvial valley and flood plain associated with Temescal Wash. Mountainous terrain is present to the north and south of the site. Localized outcroppings of basement rock are present within the alluvial valley. The basement rock in the area is overlain locally by Tertiary sedimentary formations, and in most areas by very old to young alluvial fan deposits and alluvium. Very young wash deposits are present within the active stream channels. The regional geology with respect to the proposed project is overlaid on a Google Earth base map at two different scales in Figures 3C and 3D.

Depth to bedrock in the project vicinity varies. Rock is exposed at the surface in the mountainous areas, and in localized outcroppings in the valley areas (see Figure 3D). Basement bedrock in most of the valley area is buried below alluvial soils. Based on the Log of Test Borings (LOTB) for the Lake Street Bridge shown in Figure 4A, the depth to weathered igneous / meta-volcanic bedrock at this location is about 40 to 45 feet below natural site grades. The boring was able to penetrate to a depth of about 60 feet below ground, which is about 15 feet into weathered rock. The weathered rock is described as highly weathered to a depth of 58 feet, becoming moderately weathered below 58 feet. Elsewhere the depth to rock may vary significantly.

6.2 Site Geology

Site geology was interpreted from regional geologic mapping (Figures 3B through 3D, USGS 2016b), review of LOTB from Lake Street Bridge, review of limited data from geotechnical reports for the Alberhill Clay Pits area to the south, and our site observations. As shown in Figures 3C and 3D, the proposed realignment is mostly underlain at the surface by Holocene and late Pleistocene young axial channel deposits (Qya) and young alluvial fan deposits (Qyf). Within the active channel of Temescal Wash, the soils are mapped as young Holocene and late Pleistocene wash deposits (Qyw_a). The surrounding areas have outcrops of Cretaceous Santiago Peak Volcanics (Kvsp) and Estelle Mountain Volcanics (Kvem), and localized outcrops of undifferentiated Mesozoic metasedimentary rocks (M_zu). Tertiary sedimentary rock formations including Silverado Formation (Tsi) are exposed in the areas to the south. The Tsi unit is the source of much of the clay that has been historically mined from the Alberhill Clay Pits.

Since bedrock is located below a fairly thick cover of alluvial soils, geologic structure is not a design consideration. No naturally occurring hazardous formations or fossil bearing units are known to be present within the site. Localized undocumented fills are likely to be present within the site, particularly in the disturbed Clay Pit areas.

The mapped geology is consistent with the LOTB from Lake Street Bridge (Figure 4A), which shows about 40 to 45 feet of mixed sandy and clayey alluvium over weathered igneous/meta-volcanic rock. A boring performed by Geomatrix Consultants (1999) in Pacific Clay Brick Products facility, just south of the alignment, indicated the presence of clay and silt alluvium to a depth of 21.5 feet, the maximum depth of the boring.

6.3 Soils

6.3.1 Data from Existing LOTB

No on-site subsurface data are currently available. Based on the nearby LOTB at Lake Street Bridge, the natural soil over the bedrock surface consists of young alluvium, which in turn overlies Cretaceous and older igneous/meta-volcanic rock. The nearby Geomatrix boring indicated clay and silt alluvium to a depth of 21.5 feet. For purposes of this report, we have assumed that soil conditions versus depth within the project site are generally similar to those disclosed by the LOTB of the Lake Street Bridge over Temescal Wash. Group Delta's interpretation of the soil conditions from the LOTB as shown in Figure 4A is as follows:

- Alluvium (Upper 45 feet)
  - 0-10 feet : Very loose to medium dense Silty Sand (SM) and Clayey Sand (SC)
  - 10-15 feet : Loose / medium stiff Sandy Clayey Silt (ML)
  - 15-20 feet : Loose to medium dense Clayey Sand (SC)
  - 20-33 feet : Soft to medium stiff Sandy Clay (CL) and Sandy Silt (ML)
  - 33-38 feet : Stiff to very stiff Sandy Clay (CL)
  - 38-45 feet : Medium dense to dense Well Graded Sand with Gravel (SW)
- Igneous/Meta-volcanic Bedrock (Below 45 feet)
  - 45-58 feet : Highly weathered/decomposed
  - > 58 feet : Moderately weathered

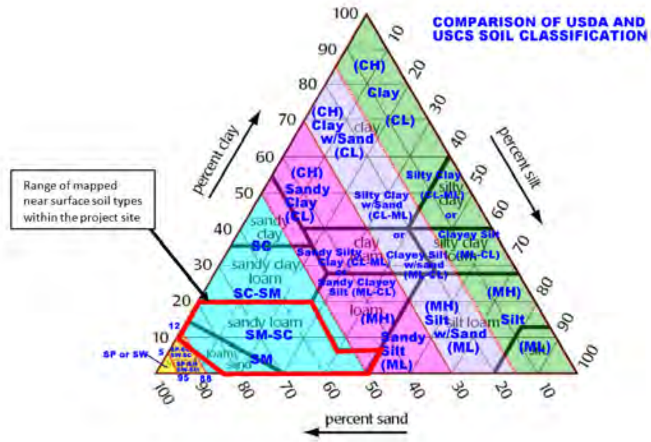
Soil and bedrock conditions at the site should be expected to vary to some degree from those disclosed by the nearby LOTB and boring log.

6.3.2 NRCS Hydrologic Soil Group

National Resource Conservation Services (NRCS) Hydrologic Soil Group classifications are used in assessing runoff potential and for evaluation of Infiltration practices that may be employed as part of storm water Best Management Practices (BMPs). Soil Survey Maps from NRCS in the vicinity were reviewed, as shown in Figure 4B. The predominant mapped soil units within and adjacent to the project site, in decreasing order of total area, are as follows:

- Within the Site:
  - GhC – Gorgonio loamy sand (0 to 8% slopes)
  - HnC – Honcut sandy loam (2 to 8% slopes)
- Adjacent to the Site:
  - CP – Clay Pits
  - TwC – Tujunga gravelly loamy sand (0 to 8% slopes)
  - TbF2 – Temescal rocky loam (bedrock topsoil, 15 to 50% slope)

The chart below relates Unified Soil Classification System (USCS) classifications to the United States Department of Agriculture (USDA) textural classifications:



The soil types within the project site (Loamy Sand and Sandy Loam by USDA system) generally are Silty Sand (SM) and Clayey Sand (SC) by the USCS soil classification system, which is consistent with the Lake Street Bridge LOTB. Nearby soil groups include Clay Pits (likely Clay (CL or CH) per USCS), Gravelly Loamy Sand (likely Silty and/or Clayey Sand with Gravel (SM and/or SC) per USCS), and Rocky Loam (sandy Clay and/or Silt with Gravel (CL and/or ML) per USCS). The following table presents minimum estimated infiltration rates and hydrologic soil group based on the textural triangle:

Method for Designing Infiltration Structures

Hydrologic Soil Properties Classified by Soil Texture*

Texture Class	Effective Water Capacity (C_w) (inch per inch)	Minimum Infiltration Rate (f) (inches per hour)	Hydrologic Soil Grouping
Sand	0.35	8.27	A
Loamy Sand	0.31	2.41	A
Sandy Loam	0.25	1.02	A
Loam	0.19	0.52	B
Silt Loam	0.17	0.27	B
Sandy Clay Loam	0.14	0.17	C
Clay Loam	0.14	0.09	D
Silty Clay Loam	0.11	0.06	D
Sandy Clay	0.09	0.05	D
Silty Clay	0.09	0.04	D
Clay	0.08	0.02	D

* Source: Rawls, Brakensiek and Saxton, 1982

Based on the soil textural classes and the corresponding minimum infiltration rates, a restriction is established to eliminate unsuitable soil conditions. Soil textures with minimum infiltration rates less than 0.52 inches per hour are not suitable for usage of infiltration practices. These include soils that have a 30 percent clay content, making these soils susceptible to frost heaving and structurally unstable, in addition to having a poor capacity to percolate runoff. Soil textures that are recommended for infiltration systems include those soils with infiltration rates of 0.52 inches per hour or greater, which include loam, sandy loam, loamy sand, and sand.

Reference: Standards and Specifications for Infiltration Practices, Maryland Department of Natural Resources, 1987

The mapped site surface soils appear to be in Hydrologic Soil Group A or B, which have a minimum estimated infiltration rate (f) on the order of 1 to 8 inches per hour, whereas the deeper subsurface soil layers indicated on the LOTB contain less pervious materials such as clay, silty clay, sandy clay, silty clay loam, and silt loam. The actual infiltration rate depends on the nature and layering of the material present within any planned infiltration areas. The minimum generally acceptable design rate for infiltration design is 0.52 in/hr. Based on soil survey sheets and LOTB it appears that most of the on-site near-surface soils may meet this minimum criterion. However, deeper subsurface layers of lower permeability, as indicated in the LOTB, will limit the infiltration capacity. According to the Caltrans Storm Water Quality Handbook, Project Planning and Design Guide (July, 2010), if the combined clay/silt content of the subgrade soils is greater than 40%, the subgrade is not acceptable for infiltration. It is possible that the on-site near-surface loamy sand and sandy loam have greater than 40% combined clay and silt, in which case on site infiltration may not be feasible. In addition, due to potentially shallow water table, infiltration may also not be feasible as infiltration is normally not permitted within 10 feet of the groundwater.

6.4 Faulting and Seismicity

The site is in a seismically active area, and strong shaking should be expected in the life of the proposed improvement. Major active faults in the project area based on the latest Caltrans Fault Database are shown on the Regional Fault Map in Figure 5A, along with their site to fault rupture plane distances (R_{rup}) obtained from Caltrans Acceleration Response Spectra (ARS) Online tool. The fault data for the 10 nearest faults is summarized in Table 1. The closest major active fault is Elsinore (Glen Ivy) at a distance of about 2.6 km. Other major active faults having a major impact on site seismicity are the San Jacinto and San Andreas Fault Zones.

There are no known active faults capable of fault rupture that pass through the site. The site is not in an Alquist-Priolo Special Studies Zone (see Figure 5B), and is not within 1000 feet of any known fault listed in the Caltrans Fault Database.

The controlling Peak Ground Acceleration (PGA) was estimated following the latest Caltrans Seismic Design Criteria (SDC) and Caltrans ARS Online methodology, which uses the upper bound envelope of probabilistic (975-year return period) and mean deterministic spectra for seismic design. Site subsurface conditions were included in the analysis based on an estimated average shear wave velocity in the upper 30 meters [V_{S30}] of 270 m/s, based on estimated undrained shear strength and standard penetration test (SPT) results and depth to bedrock from nearby LOTB. Near fault factors were applied to both the deterministic and probabilistic spectra. No basin factor was applied since the site is not in a deep sedimentary basin. Note that for this site the probabilistic analysis governs the estimated PGA, which is 0.66g. Controlling moment magnitude ($\mathbf{M_w}$) from probabilistic deaggregation analysis (higher of mean and mode) is 6.9.

7.0 GEOTECHNICAL CONDITIONS

7.1 Groundwater

7.1.1 Groundwater Regime

A California Geological Survey (CGS) Seismic Hazard Zone Report or Map documenting historically highest groundwater has not yet been prepared for this site. The northern portion of the project site is located within the 100-year flood plain of Temescal Wash (Figure 6), and the proposed roadway realignment will be elevated on embankment and cross Temescal Wash on a bridge structure, as shown in Figures 2A and 2B. Where Lake Street crosses Temescal Wash, groundwater level was reported on the LOTB (Figure 4A) in 1974 at a depth of about 38 feet (Elevation 1182 feet) below the original grade. This may not be a stabilized groundwater level, due to presence of significant layers of clay above the reported groundwater level. Groundwater (or “wet” soil) was recorded at a depth of about 9 feet (El.1201 feet) in the monitoring well (MW-1) in 1999 installed at Pacific Clay Brick Products facility, which is close to the Temescal Wash channel bed elevation. Geomatrix also reported that during excavation for an underground storage tank (UST) where site elevation was near 1200 feet, groundwater seeped into the excavation and stabilized at a depth of 7 feet (El. 1193 feet). This indicates that permanent shallower groundwater table and/or perched groundwater is likely to be present at or slightly below the channel bed. Groundwater levels may be lower further from the creek. Groundwater level may vary during rainy seasons and it locally may be as high as the ground surface within and adjacent to flooded areas during flood conditions.

7.1.2 Groundwater Regime Effects

The groundwater table was reported at a depth of about 38 feet (El. 1182 feet) on the LOTB (Figure 4A) in 1974. Groundwater (or wet soil) was recorded at a depth of about 9 feet (El.1201 feet) in the monitoring well (MW-1) in 1999 installed at Pacific Clay Brick Products facility, and During UST excavation seepage and stabilized groundwater level was reported at a depth of 7 feet (El. 1193 feet). No other monitoring well data were found in close proximity to the project. Permanent stabilized groundwater may be present at or within a few feet of the Temescal Wash channel bed, and potential for perched groundwater at higher elevations near the creek, and during and following floods, is considered high.

Based on preliminary plans in Figure 2A (Section A-A), temporary construction excavations to about El. 1190 feet are proposed to construct foundation piles and slope paving / cutoff walls for scour protection within the channel. Based on existing data, it is uncertain exactly where the groundwater level might be at the time of construction. The groundwater level could be as high as the channel bed elevation (near El. 1200 feet), or could be at or below El. 1190 feet. The groundwater level is likely to vary seasonally and with distance from the Temescal Wash channel. If the groundwater is present at elevations above El. 1190 feet during construction then dewatering and/or cofferdams may be required for the temporary excavations. This is a major construction concern and affects the cost and permitting for the project; therefore, site-specific groundwater information should be collected by installation of a groundwater monitoring well in the final design investigation to evaluate constructability and temporary dewatering requirements.

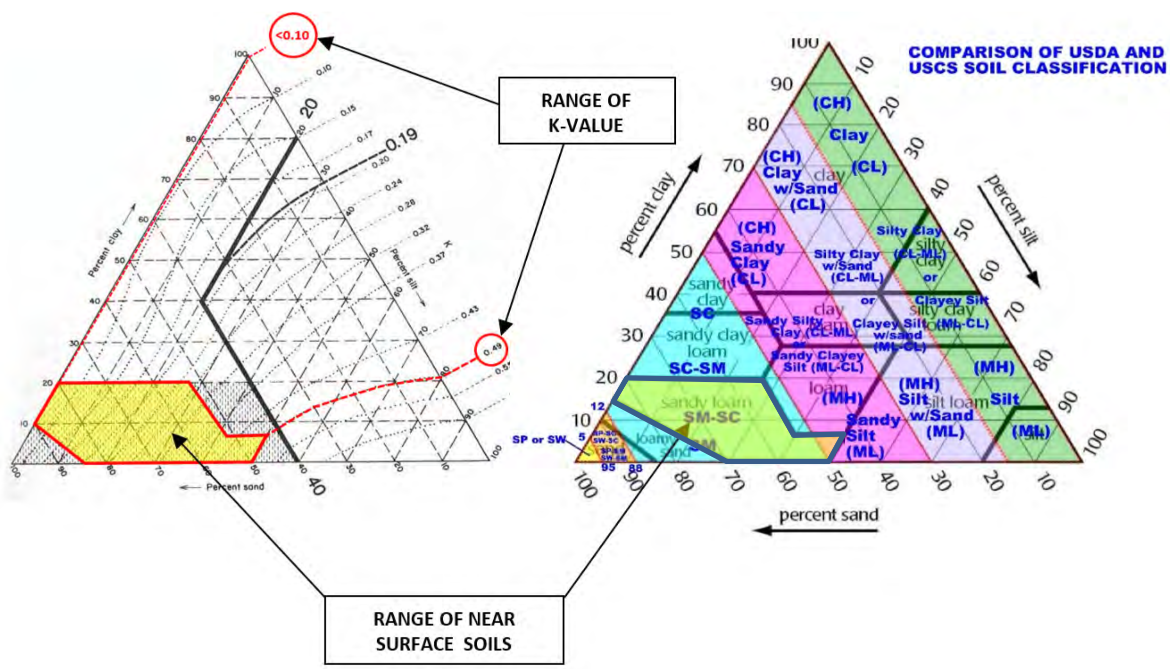
7.2 Erosion

7.2.1 Erosion of Existing Slopes

Natural grades within the project site are relatively flat and mildly sloping toward the west (Figure 1C). There are no significant cut slopes or natural slopes in the project limits. The only significant nearby slopes are graded fill slopes surrounding the perimeter of the project area with a general inclination of 2h:1v (Horizontal:Vertical) or flatter, and a maximum height of 35 feet for the I-15 embankment north of the site. No signs of excessive erosion were observed on slopes in the project area during visual site reconnaissance.

7.2.2 Soil Erodibility

Soil erodibility assessment is required for a National Pollutant Discharge Elimination System (NPDES) permit where disturbance area is greater than 1 acre. The K-factor for use in the Revised Uniform Soil Loss Equation (RUSLE) was estimated by using the nomograph method based on particle size ranges for the types of near surface soils indicated in the Soil Survey Sheets (Figure 4B), which include loamy sand and sandy loam in accordance with USDA classification. No data on embankment are available, but they may be similar to the natural soils. The range of soil types and K-value are illustrated in the figure below:



The USDA agricultural classification sandy loam to loamy sand covers a fairly wide range of USCS soil types including Silty Sand (SM), Clayey Sand (SC), and Sandy Silt (ML), with percent sand ranging from 45 to 90, percent clay ranging from 0 to 20, and percent silt ranging from 0 to 50. The K-value has a wide range with values from < 0.1 to 0.49. In general, soils with higher silt content, lower clay content, and lower sand content have higher K values.

7.3 Seismic Hazards

The primary seismic hazard at the site is strong shaking, fault rupture potential is remote, and the risk of secondary seismic hazards exists, as described in the following sections.

7.3.1 Primary Seismic Hazards

7.3.1.1 Fault Rupture

The site is not located in an Alquist- Priolo Fault Special Studies Zone, it is not within 1000 feet of any fault in the current Caltrans Fault Database, and no faults considered capable of producing surface rupture are mapped as crossing the site or projecting towards the site (Figures 5A and 5B). Therefore, the potential for ground surface fault rupture within the project site is considered remote.

7.3.1.2 Seismic Shaking

The site is located within the zone of influence of the highly active strike-slip faults of the Elsinore, San Jacinto, and San Andreas. A number of other less significant strike-slip and reverse faults also contribute to the seismic risk at the site. The faults are illustrated in Figures 5A and 5B, and fault parameters are summarized in Table 1. Based on the estimated V_{S30} of 270 m/s and ARS Online tool, the preliminary PGA at the site is controlled by probabilistic analysis (average return period of 975 years) and is estimated as 0.66g, with a probabilistic $\mathbf{M_w}$ of 6.9 (based on USGS 2008 deaggregation tool).

During final design, borings with Standard Penetration Testing and Seismic Cone Penetration Tests (SCPTs) with shear wave velocity measurements should be conducted to better estimate $V_{S30.}$ Final design ARS curve should be developed using the estimated V_{s30} and Caltrans ARS Online tool.

7.3.2 Secondary Seismic Hazards

Potential secondary seismic hazards at any site include liquefaction settlement and lateral spreading, seismically-induced (dry) settlement, seismically-induced slope failure, rock fall and landslides, and dam failure / seiches / tsunamis.

7.3.2.1 Liquefaction, Seismic Settlement, and Lateral Spreading

Soil liquefaction is the sudden loss in strength of a saturated, cohesionless soil caused by the build-up of pore water pressure during cyclic loading, such as produced by an earthquake, and where it occurs its effects can include vertical and lateral ground displacements, slope instability and lateral spreading, and bearing failure. For liquefaction to occur, all of the following must be present:

- Liquefaction susceptible soils (loose to medium dense cohesionless soils);
- Groundwater within 50 feet of the surface;
- Strong shaking, such as caused by an earthquake.

Due to groundwater shallower than 50 feet and presence of poorly consolidated alluvium containing granular cohesionless soil layers, liquefaction potential exists, but the magnitude of the hazard will depend on actual groundwater levels and the distribution of liquefiable soil types and their relative density. Preliminary data suggest the alluvial soil profile consists of a variety of soil layers including non-liquefiable soil types (plastic clays and silty clays), liquefiable soils (cohesionless sands, silty sands, and sandy silts), and marginally liquefiable soils (clayey sands, sandy / clayey silts).

The Riverside County Safety Element maps the area as having no groundwater data available, but having susceptible sediments, and a "moderate" liquefaction susceptibility. Liquefaction potential, seismically-induced liquefaction and dry sand settlement, and potential for ground and embankment instability or displacement due to liquefaction should be quantified in final design by conducting borings with Standard Penetration Testing and Cone Penetration Testing (CPT), measuring stabilized groundwater levels, and performing detailed liquefaction analysis. If final design studies indicate it is required, mitigation measures could include structural solutions such as use of longer piles to mitigate settlement and/or lateral displacements of structures, or ground improvement solutions to reduce liquefaction potential and its impacts.

7.3.2.2 Seismic Slope Stability

Due to low natural relief, lack of natural slopes, the fact that the only slopes are compacted fill slopes of modest height and inclination, potential for seismically-induced slope failure, rock fall, and landslides is considered negligible to low, other than possibly liquefaction induced lateral spreading as described above.

7.3.2.3 Tsunamis, Seiches, and Dam Failure

A Tsunami is a long period high sea wave caused by an earthquake, submarine landslide, or other disturbance. Due to high elevations at the site (greater than 1200 feet above sea level) and distance from the coastline, the potential for tsunamis to impact the site is remote. A Seiche is a wave created by a temporary disturbance or oscillation in the water level of a lake or partially enclosed body of water. No major bodies of enclosed water are present nearby, so potential for seiches is considered negligible. The Riverside County Safety Element indicates the site is not mapped in a Dam Failure Hazard Zone.

7.4 Slope Stability and Rockfall

No natural or cut slopes of any kind are present at the site. Therefore, potential for landslides or rockfalls is nonexistent. The site is entirely underlain by alluvium, and therefore geologic structure and its effect on slope stability is not an issue. The only slopes adjacent to the site and proposed within the site are embankment fills with maximum heights of about 25 feet and inclinations of 2h: 1v, except at the bridge abutment area where the inclination is 1.5:1. This steeper slope inclination will be paved with concrete with the cutoff wall extended to the computed scour depth. Existing and proposed properly compacted fill slopes of this height and inclination are expected to be globally stable under static conditions. Fill slopes may experience shallow sloughing in a major seismic event. In addition, based on preliminary available nearby LOTB, embankment foundation soils may contain cohesive layers that are “soft” and potentially liquefiable soils; therefore, the potential for seismic slope instability should be investigated as described above.

7.5 Excavation Characteristics

Earth materials at the site are Holocene to late Pleistocene age alluvial soils and fill materials. These materials can be readily excavated using conventional heavy duty grading equipment. Large quantities of oversized cobbles and boulders are not known to exist at the site, but these materials could be encountered locally. No need for special excavation techniques such as mechanical breaking or blasting is anticipated.

7.6 Embankments

7.6.1 Embankment Foundations

The existing I-15 freeway and Lake Street, both adjacent to the project site, are on embankment fill with heights up to a maximum of about 35 feet above original ground. No signs of excessive settlement or instability were noted during site reconnaissance. No data on previous embankment settlement in the area was available for review. Based on available LOTB at Lake Street Bridge over Temescal Wash, the subsurface profile contains cohesionless soil layers described as “loose” and cohesive soil layers described as “soft”. Therefore, significant settlements should be anticipated due to embankment placement. A significant continuous thickness of soils described as sandy clay, silty clay, and clayey silt are indicated on the LOTB from a depth of 20 to 38 feet. This suggests that some long-term consolidation settlement is likely due to embankment placement. Preliminary rough estimates based on very limited data indicate that settlements on the order of 9 to 15 inches may occur due to placement of up to 25 feet of fill, and that time to complete 90% of this settlement could be on the order of 4 to 8 months. The magnitude and time rate of settlement depend on a number of factors including thickness, compressibility, and degree of overconsolidation of the soil strata, plasticity of cohesive layers, drainage condition of cohesive soils subject to consolidation (single versus double drainage), and others. A settlement waiting period and settlement monitoring should be anticipated during construction. Settlement could be accelerated by placement of additional surcharge, use of wick drains, or other ground improvement techniques, if settlement period is critical to the project schedule.

7.6.2 Embankment Materials

The project will require imported fills. No potential borrow sites have been identified at this stage. For planning purposes, in order to avoid import of expansive or otherwise problematic materials, it is advisable that all imported soils have "Low" expansion potential (expansion index less than 50), have less than 40% passing No. 200 sieve, have maximum particle size of 3 inches, and be non-corrosive in accordance with Caltrans criteria.

7.7 Volumetric Stability of Embankment and Subgrade Materials

Based on limited existing data and site observations, no distress has been identified that can be conclusively associated with any specific type of soils prone to volume change (such as expansive or collapsible soils). The only observed distress was in existing pavements on existing Temescal Canyon Road, which are locally in poor condition and exhibit longitudinal and transverse cracking, alligator cracking, and rutting. This could be a result of poor subgrade / expansive soils, or pavements that have reached the end of their design life, or other causes.

Lake Street Bridge over Temescal Wash LOTB and soil survey sheets suggest that surface soils within the project site consist of mostly silty sand and clayey sand, which would generally be expected to have low to medium expansion potential. However, due to presence of the Clay Pits immediately adjacent to the south side of the project site, the presence of moderately to highly expansive clays in the near surface cannot be ruled out.

Certain soils deposited in an alluvial fan environment can be subject to "collapse", which is the sudden reduction in volume when soils get wet, which can result in substantial ground settlements. Such soils are typically characterized by low dry density combined with low plasticity clayey fines that create a water-soluble bond between the loosely packed particles following deposition. Due to the inter-particle bonding these soils behave very stiff when dry, but they suddenly "collapse" upon wetting when the inter-particle bonds are dissolved. There is no evidence indicating the presence of this type of soil at this time.

No laboratory data are available to quantify expansion or collapse potential. Soil borings and laboratory testing should be performed during final design to screen for potentially volumetrically unstable materials and need for any mitigation. Typical tests would include

Atterberg Limits, Moisture Content and Dry Density, Expansion Index, and One-dimensional Swell / Collapse consolidation tests.

7.8 Other Potential Geologic Hazards

Adverse geologic structure is not an issue since no bedrock or formational materials are exposed at the site. Scour potential will need to be evaluated for improvements in the channel and flood inundation area of Temescal Wash. No other geologic hazards or concerns (such as naturally occurring asbestos, avalanches, petrology, or geothermal activity) have been identified at the site.

8.0 HAZARDOUS WASTE POTENTIAL

An Initial Site Assessment is currently being prepared by Group Delta. A leaking UST and hydrocarbon soil and groundwater contamination have been reported in the past at the Clay Pits adjacent to the site. No major environmental concerns that would preclude the proposed project have been identified at this time.

9.0 PRELIMINARY RECOMMENDATIONS AND CONCLUSIONS

9.1 Future Exploration and Investigations

The DPGR and PFR for the bridge structure are being prepared at the current PA/ED stage. During Plans, Specifications and Estimate (PS&E) stage subsurface conditions for the pavements, embankment, bridge structure, and other improvements must be based on site specific explorations following the latest Caltrans guidelines. The results of the PS&E geotechnical investigations would be presented in separate reports as follows:

- Geotechnical Design Report (GDR) for general project grading (cuts, fills), standard design earth retaining systems, sound walls, standard signs, and conventional culverts;
- Update (if required) of the Preliminary Foundation Report (PFR) for type selection of the bridge structure and any special design walls or other structures:
- Foundation Reports (FRs) for the bridge and any other special design structures:
- Materials Report (MR): required for Corrosion, culvert material selection, and pavement structural sections recommendations.

Additional studies may include Aerially Deposited Lead (ADL) or other environmental investigations.

An adequate number of borings, test pits, geophysical tests, and/or CPTs should be performed and should be advanced to sufficient depth to meet Caltrans requirements as outline in the latest versions of:

- American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications with Caltrans Amendments;
- Caltrans Guidelines for Structures Foundation Reports;
- Caltrans Foundation Report Preparation for Bridge Foundations;
- Caltrans Guidelines for Preparing Geotechnical Design Reports;
- Caltrans Guidelines for the Preparation Of Geotechnical Design Reports for Earth Retaining Systems; and
- Caltrans Geotechnical Manual.

A groundwater monitoring well is highly recommended at the proposed Temescal Wash crossing to determine groundwater levels for evaluation of temporary construction excavations and need for dewatering. Specific requirements for minimum number of explorations points, location of exploration points, and depth of explorations should follow Section 10.4.2 and Table 10.4.2-1 of the LRFD guidelines. An exploration plan showing the location of proposed explorations should be developed by the geotechnical designer at PS&E stage. The number, depth, and type of explorations and laboratory tests should be selected based on the details of the final planned improvements. Schedule should consider permit lead time, right of entry and access constraints, environmental requirements, number of explorations, traffic control, and other relevant factors.

9.2 Embankments

Based on available data, it is likely that embankment construction may be performed without the need for special ground improvement. Subgrade preparation and stabilization requirements should be developed after performing subsurface explorations. As a minimum, after clearing and grubbing, the bottom to receive embankment should be prepared in accordance with the Standard Specifications, and any additional recommendations in the final geotechnical reports. If unsuitable soils are encountered at foundation level, they may require additional overexcavation and recompaction. Magnitude and time rate of settlement, settlement waiting period, subgrade preparation, and need for ground improvement should be addressed based on site specific subsurface data after completion of the investigation.

All permanent embankment slopes should be sloped at 4h:1v, wherever possible, but in no case should they be steeper than 2h:1v, with the possible exception of paved slopes below a bridge abutment, which may have maximum 1.5h:1v slopes. Slopes steeper than 4h:1v typically require a Caltrans design exception, and must have an erosion control plan prepared or approved by the District Landscape Architect.

9.3 Excavations

Some permanent cuts are required at the location of the proposed WQMP basins and channels (See Figure 2C). All permanent cuts subject to periodic inundation (basin) should be sloped at

4h:1v, wherever possible, but in no case should they be steeper than 3h:1v while earthen channels may be sloped at 2h:1v or flatter unless protected by established vegetation or rigid material such as concrete and riprap lining, etc. Site-specific slope stability analyses will need to be performed during final design phase.

9.4 Retaining Wall Alternatives

No retaining walls are currently indicated in the plans, other than bridge wing walls, and these walls would likely be supported on piles along with the bridge foundations. Wall type selection for other walls (if needed) should consider site soil and seismic conditions, bearing capacity, settlement, overall stability, and economics. In general, cast-in-place (CIP) concrete (Type 1 or similar) or Mechanically Stabilized Earth (MSE) walls are considered feasible. The height of CIP walls may be limited by bearing capacity or settlement considerations. MSE walls may be preferable for higher walls since they are generally more economical for taller walls, are more flexible and tolerant of settlement, and require lower factor of safety on bearing capacity.

It should be noted that Caltrans memorandum (06-13-13) “Seismic Design and Selection of Standard Retaining Walls” states that:

“According to standard plan sheets dated April 2012, the seismic criteria threshold for standard retaining walls are; Coefficient of Horizontal Acceleration, k_h = 0.2 and Coefficient of Vertical Acceleration k_y = 0.0, except for concrete retaining walls supporting soundwalls where k_h = 0.3 and k_y = 0.0 are used. The k_h = 0.2 is roughly based on using 1/3 Peak Ground Acceleration (PGA), therefore, at sites where the PGA is equal to or less than 0.6g, the retaining walls shown in the Standard Plans are applicable. For sites with PGA greater than 0.6g, the standard plans are not applicable, and DES/Structure Design should design the retaining walls as special design walls.”

Since the site has PGA greater than 0.6g, a special design would be required for Standard Plan walls. The special design would require designing for a pseudo-static acceleration coefficient of k_h = 0.22, which is 1/3 of the PGA of 0.66g. In accordance with Caltrans requirements, a Foundation Report (FR) that is separate from the Geotechnical Design Report will be required for any special design walls during PS&E stage. Note that XS sheet designs for soundwall on retaining wall are designed for 0.3g and therefore, if used, would not require a special design.

9.5 Groundwater Control

The only anticipated significant excavations for the project include temporary excavations to install bridge pier foundations and slope paving/cutoff walls. As shown in Figure 2A, it is proposed to grade the channel with a soft bottom and a central low-flow trapezoidal channel, and to extend the abutment slope paving and pier foundation cut-off level below expected scour depth to about El. 1192 feet, or roughly 10 feet below existing grade. Based on available groundwater data as discussed in Section 7.1, it is anticipated that the proposed excavation may require de watering. Management of surface flow in the channel should be planned prior to construction.

9.6 Other Considerations

No other considerations have been identified at this time.

10.0 LIMITATIONS

The conclusions and recommendations contained in this report are professional opinions, intended for the use of Aguilar Consulting, Inc. and their design consultants. This report has been prepared solely for the preliminary design of the improvements described herein, and may not contain sufficient information for other uses. The recommendations should not be extrapolated to areas not covered by this report, or used for other facilities without the review and approval of GDC.

Our investigation and evaluations were performed in accordance with generally accepted local standards using that degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical consultants practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional advice included in this report.

11.0 REFERENCES

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Tables

TABLE 1
SUMMARY OF NEARBY FAULTS

Fault Name	Closest Distance from Site to Fault Rupture Plane, km (Rrup)	Fault ID Number (FID)	Maximum Moment Magnitude (Mmax)	Style of Faulting (STYLE)	Dip Angle (DIP)	Dip Direction (DIP DIR)	Depth to Top of Rupture Plane, km (TOPRUP)	Depth to Bottom of Rupture Plane, km (BOTRUP)	Age of Most Recent Activity (AGE)	Average Slip Rate, mm/yr (SLIP RATE)	Slip Rate Reference (SR ref)
Elsinore (Glen Ivy) rev	2.60	365	7.7	SS	90	V	0	13.0	H	5.0	86
Elsinore (Temecula)	6.67	378	7.7	SS	90	V	0	14.0	H	5.0	86
San Jacinto (Anza)	31.96	362	7.7	SS	90	V	0	17.0	H	18.0	86
San Jacinto (San Jacinto Valley)	33.82	356	7.7	SS	90	V	0	16.0	H	18.0	86
San Jacinto (San Bernardino Valley section)	34.19	310	7.7	SS	90	V	0	15.0	H	6.0	86
San Jacinto (San Bernardino)	34.85	336	7.7	SS	90	V	0	16.0	H	6.0	86
San Andreas (San Bernardino S)	49.15	325	7.9	SS	90	V	0	12.8	H	13.0	86
San Jacinto (San Jacinto Valley - so.ext)	43.11	417	7.7	SS	90	V	0	16.0	H	18.0	86
San Joaquin Hills	29.58	376	7.0	R	23	W	2	12.5	LQ	0.6	86
Elsinore fault zone (Chino section)	20.77	355	6.6	SS	50	SW	0	9.2	H	1.0	86

NOTES

Rrup: Distance between site and fault rupture plane from ARS Online

FID: Caltrans fault identification number

M_{Max}: Maximum moment magnitude, or largest earthquake a fault is capable of generating. Caltrans MMax is commonly taken to have approximately a 1000 yr return period.

STYLE: N- normal, R- reverse, SS- strike-slip

DIP, DIP DIR: dip angle (relative to horizontal), dip direction (V=vertical, N=north, S=south, E=east, W=west)

TOPRUP: depth below ground surface to top of fault rupture plane (kilometers)

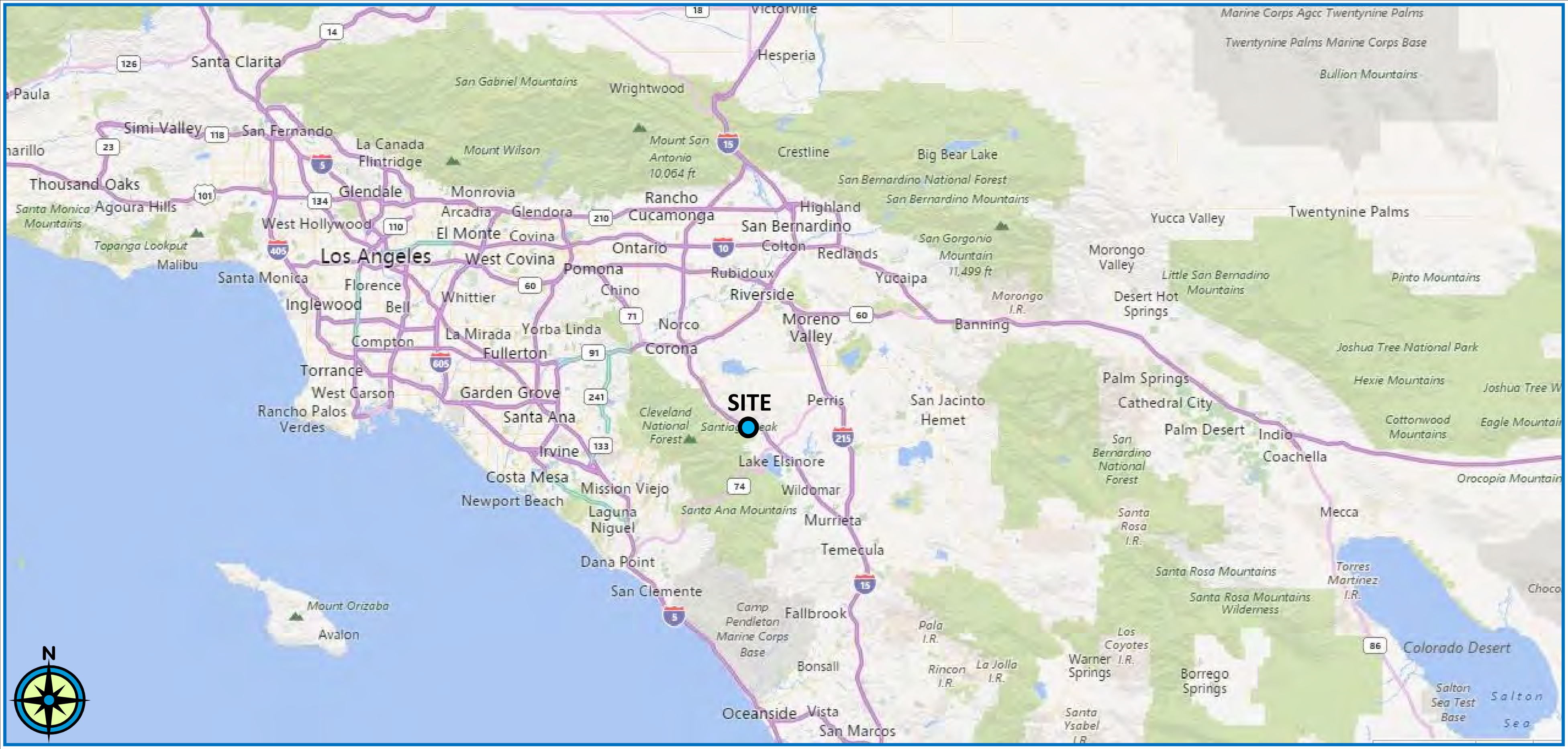
BOTRUP: depth below ground surface to bottom of fault rupture plane (kilometers)

AGE (youngest observed): H (Historic, Holocene or latest Pleistocene; 15,000 years or younger); LQ=late Quaternary (750,000 years or younger)

SLIP RATE: mm/yr

SR ref: Slip Rate Reference (86=Dawson and Weldon, 2012)

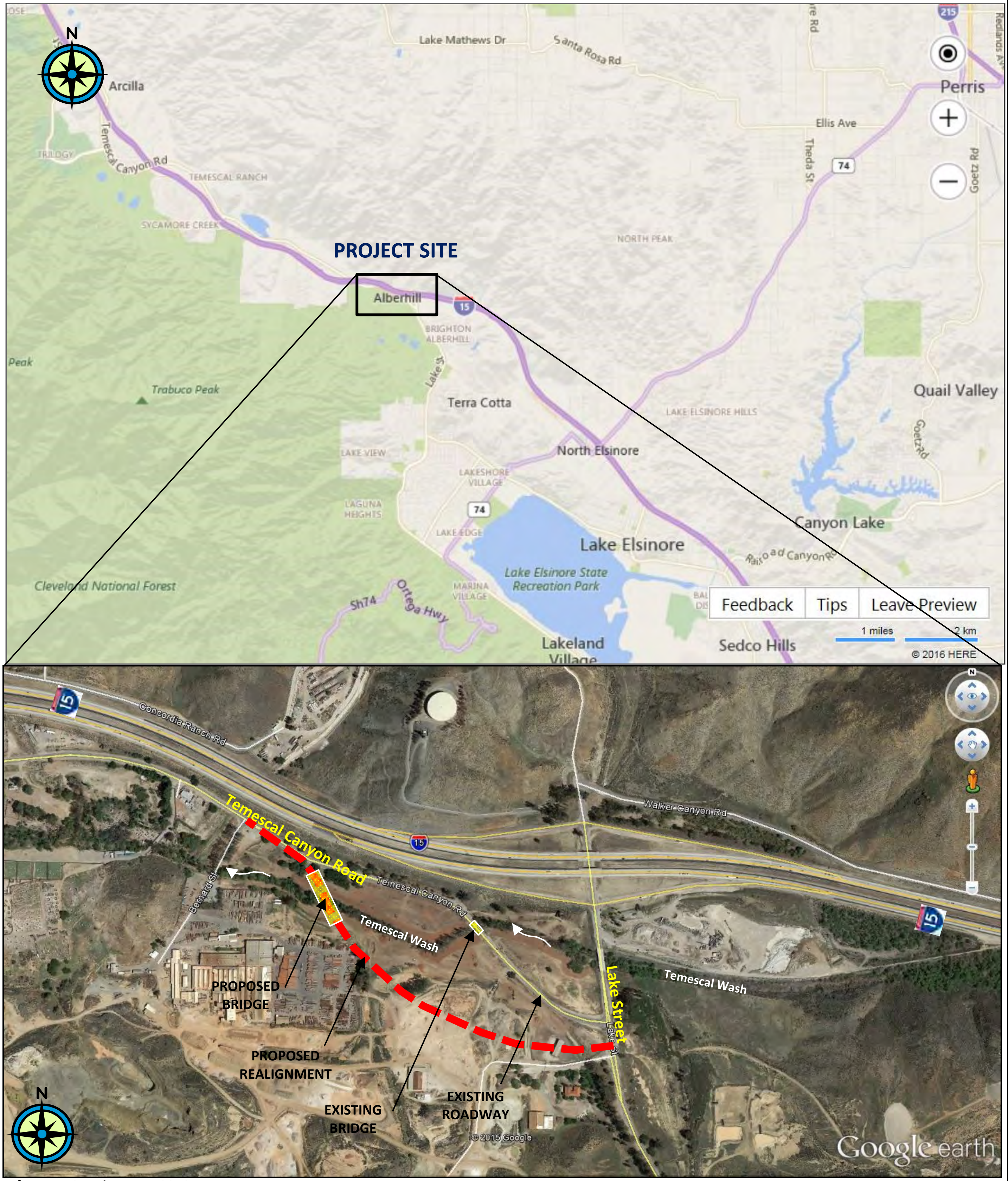
Figures



NOT TO SCALE

Reference: Bing Maps, 2016

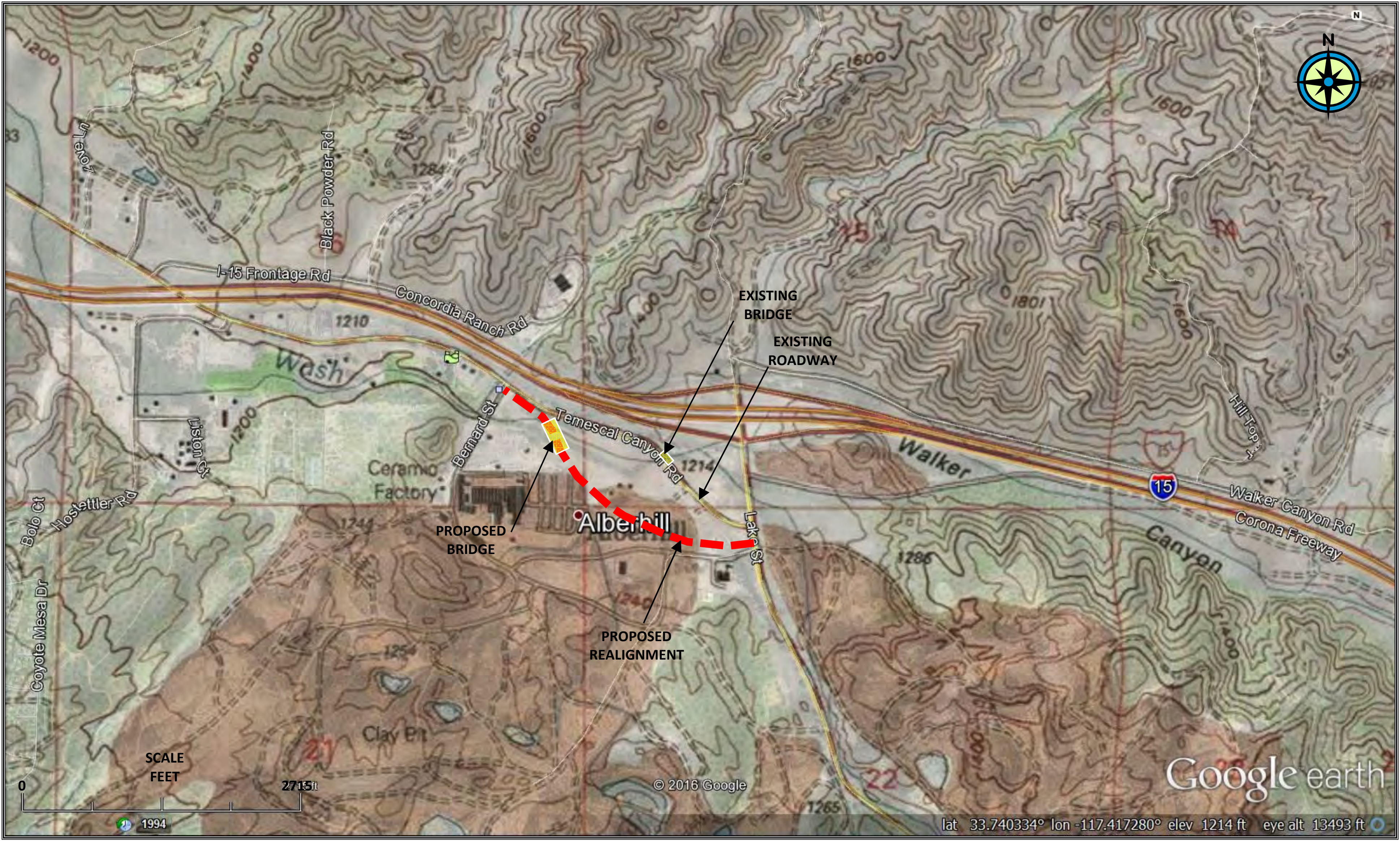
GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 1A
	Project Location: Temescal Canyon Road Bridge, Lake Elsinore, CA	Project Number: IR 617
	VICINITY MAP	



Reference: Google Maps, 2016

NOT TO SCALE

GROUP DELTA	**GROUP DELTA CONSULTANTS, INC.** ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 1B
	Project Location: Temescal Canyon Road Bridge, Lake Elsinore, CA	Project Number: IR 617
	LOCATION MAP & AERIAL PHOTO	

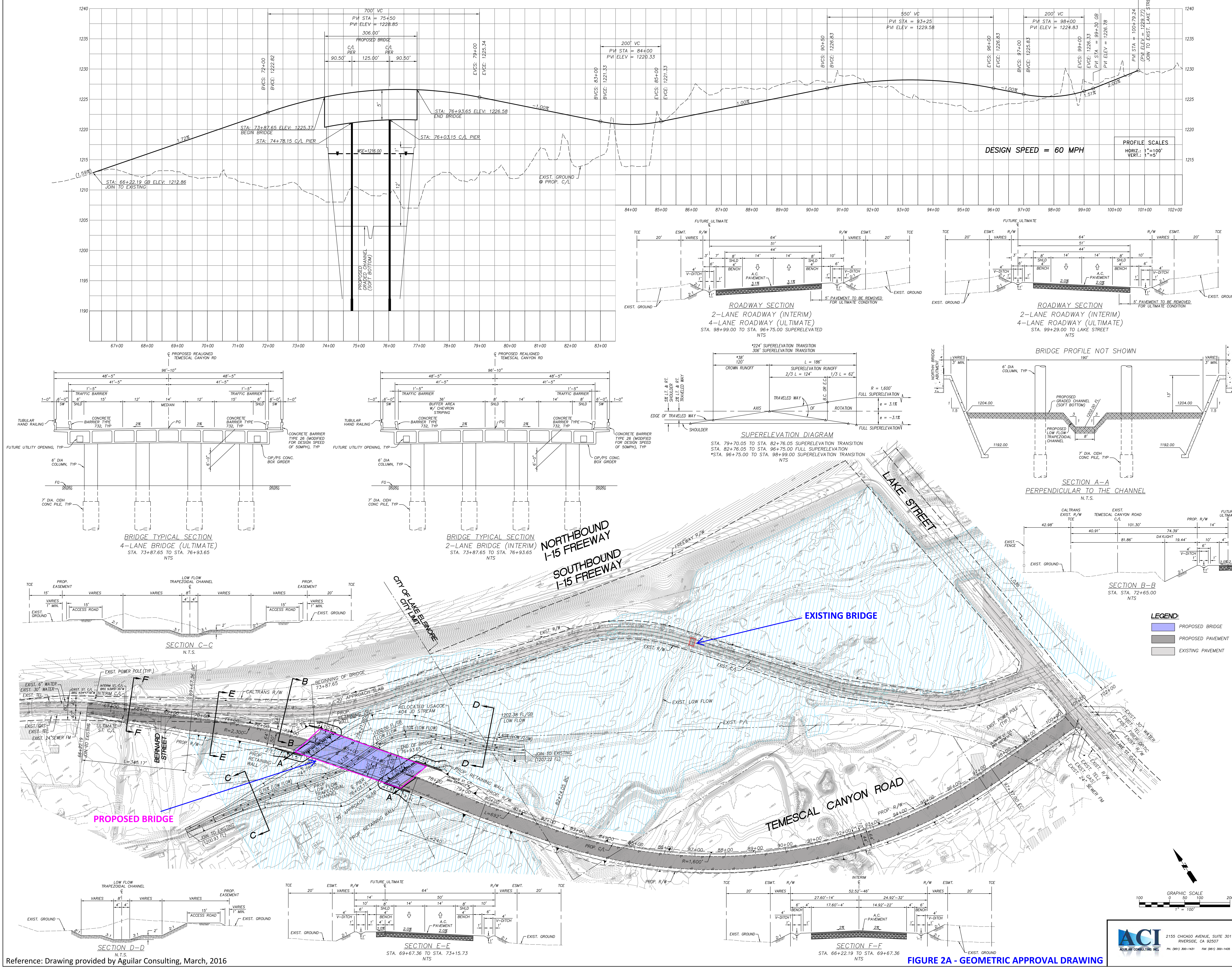


Reference: Google Earth with USGS 7.5-Minute Overlay

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 1C
	Project Location: Temescal Canyon Road Bridge, Lake Elsinore, CA	Project Number: IR 617
	USGS 7.5' GOOGLE EARTH OVERLAY	

TEMESCAL CANYON ROAD GAD (OPTION 4)

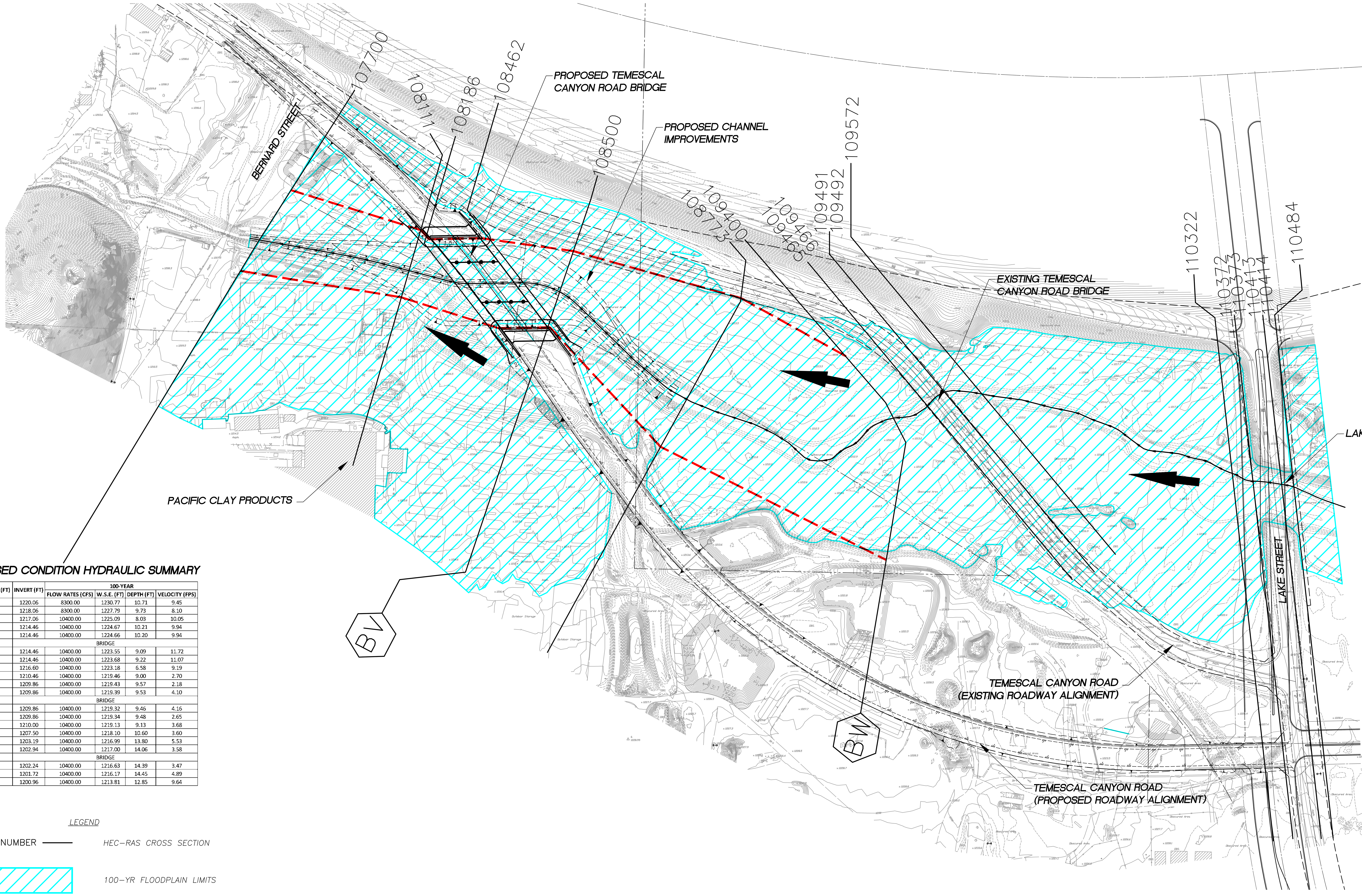
2,300 AND 1,600-FOOT RADIUS, 2-LANE (INTERIM), 64' R/W (INTERIM), 4-LANE (ULTIMATE), 100' R/W (ULTIMATE)



Reference: Drawing provided by Aguilar Consulting, March, 2016

FIGURE 2A - GEOMETRIC APPROVAL DRAWING

EXHIBIT B: 100-YEAR FLOODPLAIN EXHIBIT FOR TEMESCAL WASH BASED ON PROPOSED CONDITION IN THE VICINITY OF THE TEMESCAL CANYON ROAD BRIDGE



PROPOSED CONDITION HYDRAULIC SUMMARY

RIVER STATION (FT)	INVERT (FT)	100-YEAR			
		FLOW RATES (CFS)	W.S.E. (FT)	DEPTH (FT)	VELOCITY (FPS)
112034	1220.06	8300.00	1230.77	10.71	9.45
111034	1218.06	8300.00	1227.79	9.73	8.10
110484	1217.06	10400.00	1225.09	8.03	10.05
110414	1214.46	10400.00	1224.67	10.21	9.94
110413	1214.46	10400.00	1224.66	10.20	9.94
110393	BRIDGE				
110373	1214.46	10400.00	1223.55	9.09	11.72
110372	1214.46	10400.00	1223.68	9.22	11.07
110322	1216.60	10400.00	1223.18	6.58	9.19
109572	1210.46	10400.00	1219.46	9.00	2.70
109492	1209.86	10400.00	1219.43	9.57	2.18
109491	1209.86	10400.00	1219.39	9.53	4.10
109479	BRIDGE				
109466	1209.86	10400.00	1219.32	9.46	4.16
109465	1209.86	10400.00	1219.34	9.48	2.65
109400	1210.00	10400.00	1219.13	9.13	3.68
108773	1207.50	10400.00	1218.10	10.60	3.60
108500	1203.19	10400.00	1216.99	13.80	5.53
108462	1202.94	10400.00	1217.00	14.06	3.58
108324	BRIDGE				
108186	1202.24	10400.00	1216.63	14.39	3.47
108111	1201.72	10400.00	1216.17	14.45	4.89
107700	1200.96	10400.00	1213.81	12.85	9.64

LEGEND

SECTION NUMBER — HEC-RAS CROSS SECTION

100-YR FLOODPLAIN LIMITS

CHANNEL FLOWLINE

EFFECTIVE FLOW BOUNDARY

BV — APPROXIMATE LOCATION OF FEMA FLOOD INSURANCE RATE MAP CROSS SECTION

GRAPHIC SCALE 100 0 50 100 200
1" = 100'

FIGURE 2B - FLOODPLAIN MAP EXHIBIT

ACI AGUILAR CONSULTING INC.
2155 CHICAGO AVENUE, SUITE 301
RIVERSIDE, CA 92507
PH: (951) 300-1431 FAX (951) 300-1435

Reference: Preliminary Floodplain map provided by Aguilar Consulting, March, 2016

EXHIBIT E - TEMESCAL CANYON ROAD
PRELIMINARY DRAINAGE FACILITIES PLAN

ACI
AGUILAR CONSULTING INC.
2155 CHICAGO AVENUE, SUITE 301
RIVERSIDE, CA 92507
PH. (951) 300-1431 FAX (951) 300-1435

FIGURE 2C - PRELIMINARY CHANNEL AND DRAINAGE PLAN

SHEET 1 OF 2

Reference: Preliminary channel and drainage plans provided by Aguilar Consulting, March, 2016

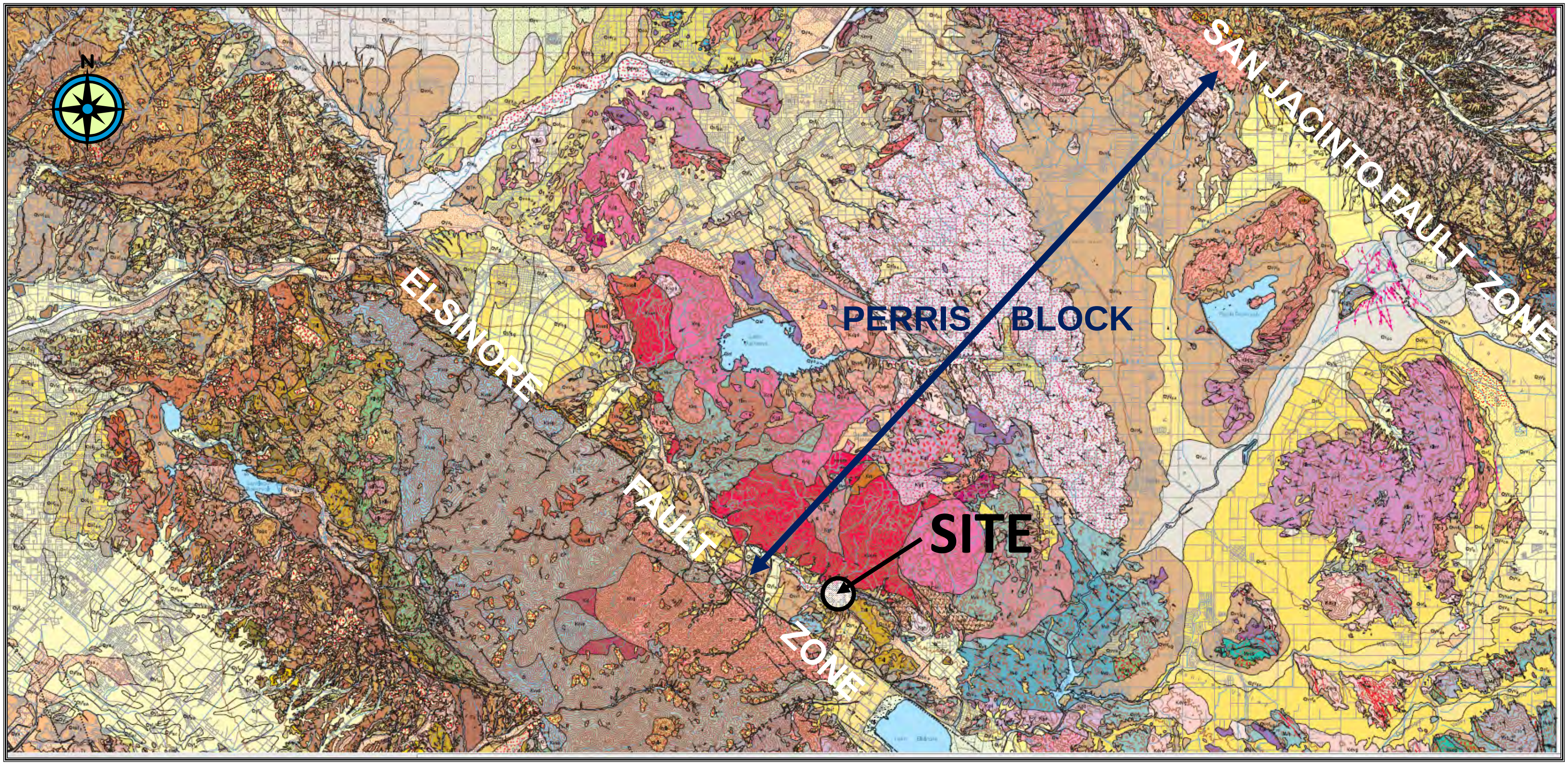
EXHIBIT E - TEMESCAL CANYON ROAD
PRELIMINARY DRAINAGE FACILITIES PLAN

FIGURE 2D - PRELIMINARY CHANNEL AND DRAINAGE PLAN

ACI
AGUILAR CONSULTING INC.
2155 CHICAGO AVENUE, SUITE 301
RIVERSIDE, CA 92507
PH. (951) 300-1431 FAX (951) 300-1435

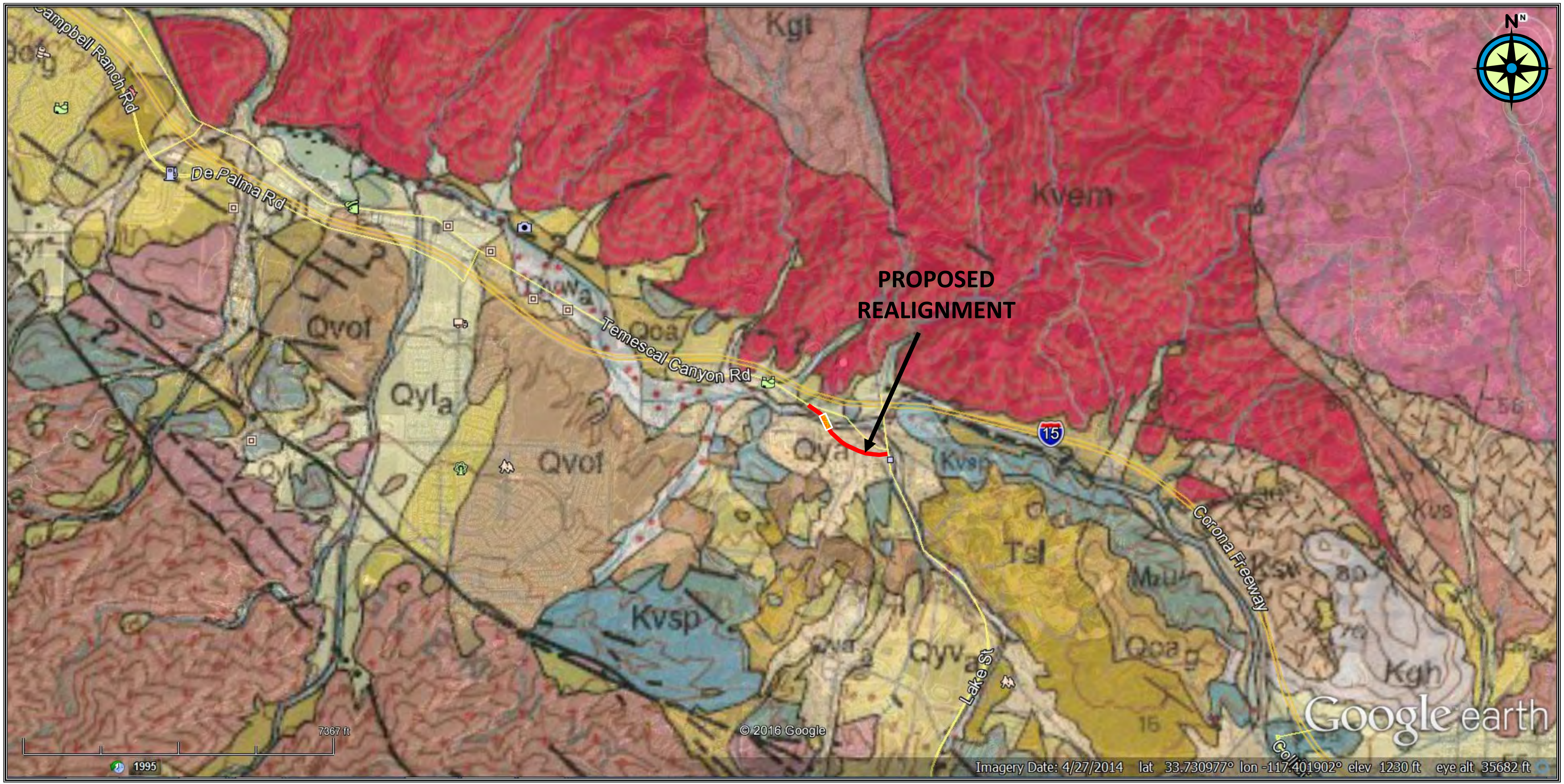
Reference: Preliminary channel and drainage plans provided by Aguilar Consulting, March, 2016

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 3A
	Project Location: Temescal Canyon Road Bridge, Lake Elsinore, CA	Project Number: IR 617
	GEOMORPHIC PROVINCES	



Reference: Geologic Map of Santa Ana 30x60' Quadrangle Overlay

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 3B
	Project Location: Temescal Canyon Road Bridge, Lake Elsinore, CA	Project Number: IR 617
	REGIONAL GEOLOGIC MAP	



Reference: Google Earth with Geologic Map of Santa Ana 30x60' Quadrangle Overlay

Description of Map Units

Qyw_a – Young wash deposits (Holocene and late Pleistocene), Sand

Qya – Young axial-channel deposits (Holocene and late Pleistocene)

Qoa – Old axial-channel deposits (late to middle Pleistocene)

Qvof – Very old alluvial-fan deposits (middle to early Pleistocene)

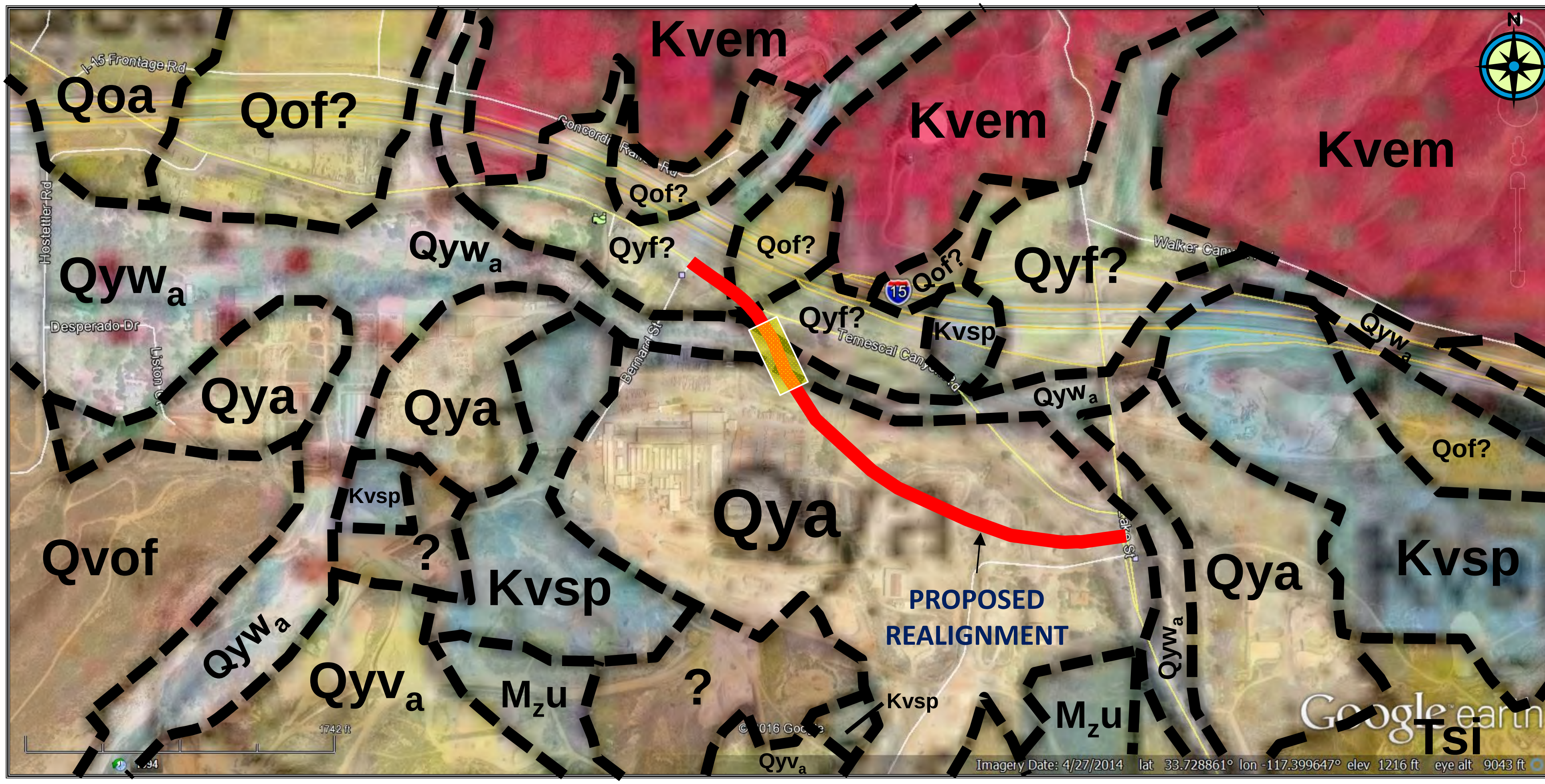
Tsi – Silverado Formation (Paleocene)

Kvsp – Santiago Peak Volcanics (Cretaceous)

Kvem – Estelle Mountain Volcanics of Herzig (Cretaceous)

M_zu – Mesozoic metasedimentary rocks, undifferentiated (Mesozoic)

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 3C
	Project Location: Temescal Canyon Road Bridge, Lake Elsinore, CA	Project Number: IR 617
	REGIONAL GEOLOGIC MAP GOOGLE EARTH OVERLAY #1	



Reference: Google Earth with Geologic Map of Santa Ana 30x60' Quadrangle Overlay

Description of Map Units

Qyw_a – Young wash deposits (Holocene and late Pleistocene), Sand

Qya – Young axial-channel deposits (Holocene and late Pleistocene)

Qoa – Old axial-channel deposits (late to middle Pleistocene)

Qvof – Very old alluvial-fan deposits (middle to early Pleistocene)

Tsi – Silverado Formation (Paleocene)

Kvsp – Santiago Peak Volcanics (Cretaceous)

Kvem – Estelle Mountain Volcanics of Herzig (Cretaceous)

M_zu – Mesozoic metasedimentary rocks, undifferentiated (Mesozoic)

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 3D
	Project Location: Temescal Canyon Road Bridge, Lake Elsinore, CA	Project Number: IR 617
	REGIONAL GEOLOGIC MAP GOOGLE EARTH OVERLAY #2	

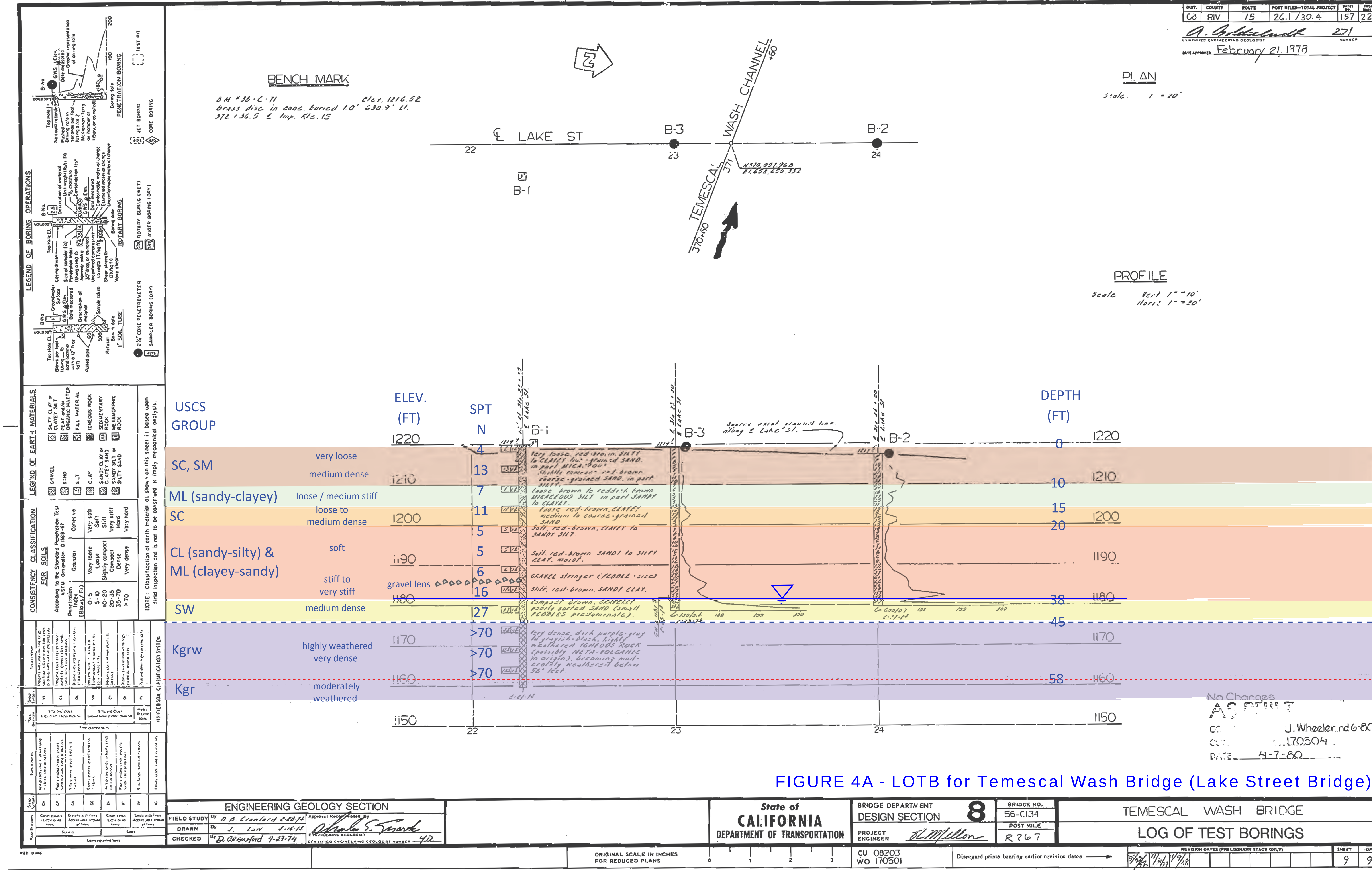
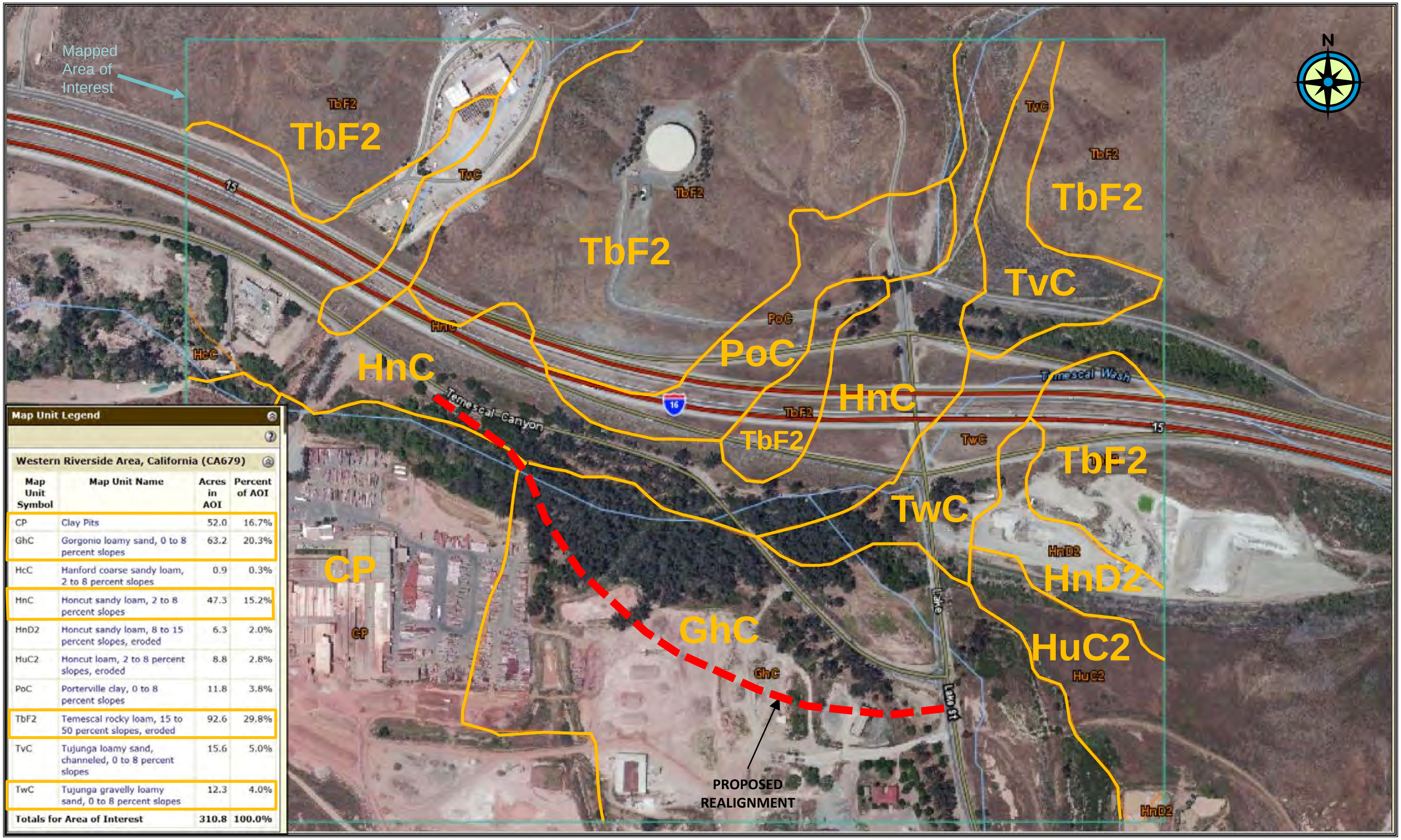


FIGURE 4A - LOTB for Temescal Wash Bridge (Lake Street Bridge)



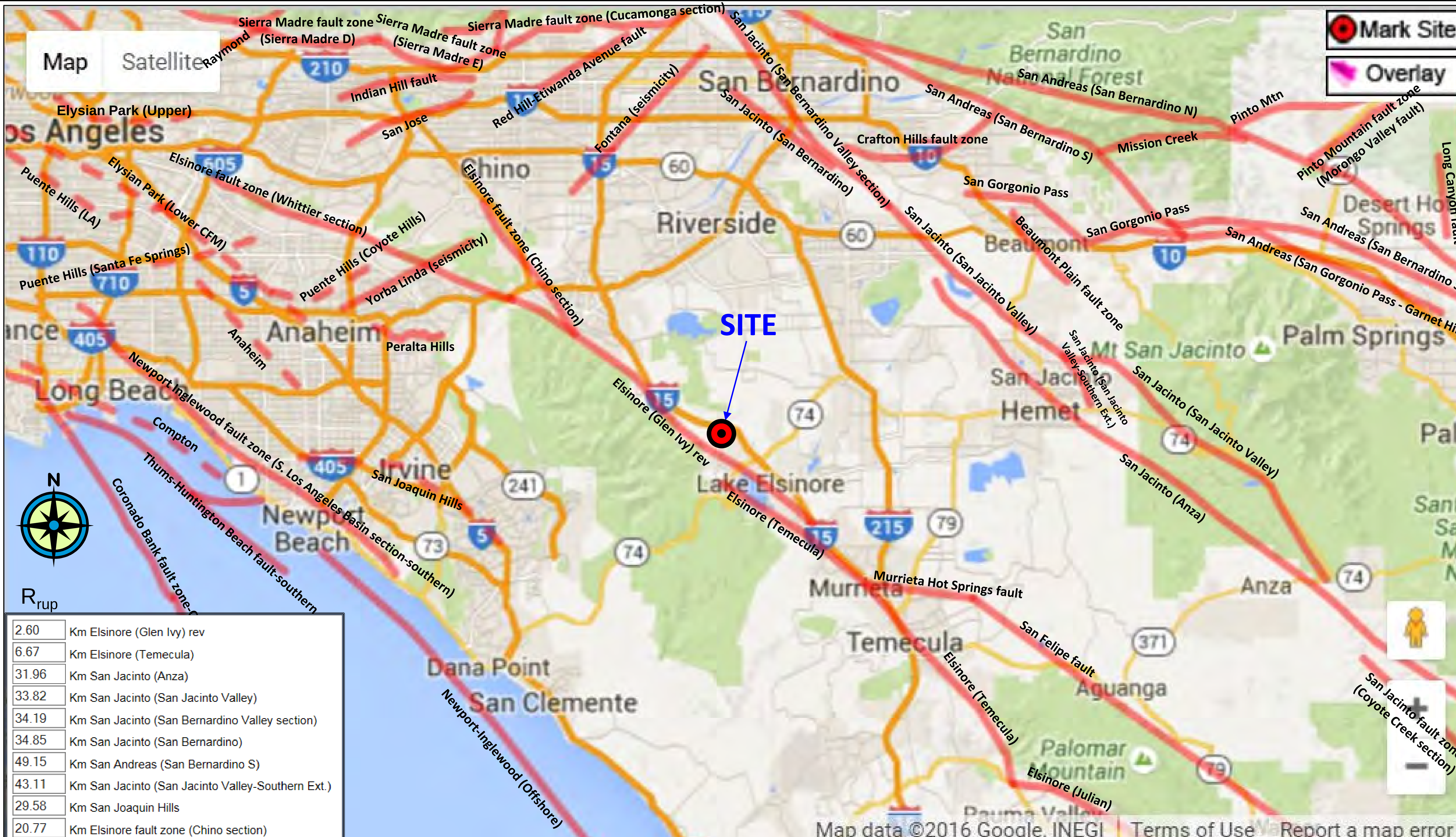
Map Unit Legend

Western Riverside Area, California (CA679)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CP	Clay Pits	52.0	16.7%
GhC	Gorgonio loamy sand, 0 to 8 percent slopes	63.2	20.3%
HcC	Hanford coarse sandy loam, 2 to 8 percent slopes	0.9	0.3%
HnC	Honcut sandy loam, 2 to 8 percent slopes	47.3	15.2%
HnD2	Honcut sandy loam, 8 to 15 percent slopes, eroded	6.3	2.0%
HuC2	Honcut loam, 2 to 8 percent slopes, eroded	8.8	2.8%
PoC	Porterville clay, 0 to 8 percent slopes	11.8	3.8%
TbF2	Temescal rocky loam, 15 to 50 percent slopes, eroded	92.6	29.8%
TvC	Tujunga loamy sand, channeled, 0 to 8 percent slopes	15.6	5.0%
TwC	Tujunga gravelly loamy sand, 0 to 8 percent slopes	12.3	4.0%
Totals for Area of Interest		**310.8**	**100.0%**

Reference: *http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm*

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 4B
	Project Location: Temescal Canyon Road Bridge, Lake Elsinore, CA	Project Number: IR 617
	NRCS SOIL SURVEY SHEET	



R_{rup}

2.60	Km Elsinore (Glen Ivy) rev
6.67	Km Elsinore (Temecula)
31.96	Km San Jacinto (Anza)
33.82	Km San Jacinto (San Jacinto Valley)
34.19	Km San Jacinto (San Bernardino Valley section)
34.85	Km San Jacinto (San Bernardino)
49.15	Km San Andreas (San Bernardino S)
43.11	Km San Jacinto (San Jacinto Valley-Southern Ext.)
29.58	Km San Joaquin Hills
20.77	Km Elsinore fault zone (Chino section)

Reference: Caltrans ARS Online (V2.3.06), 2016

NOT TO SCALE

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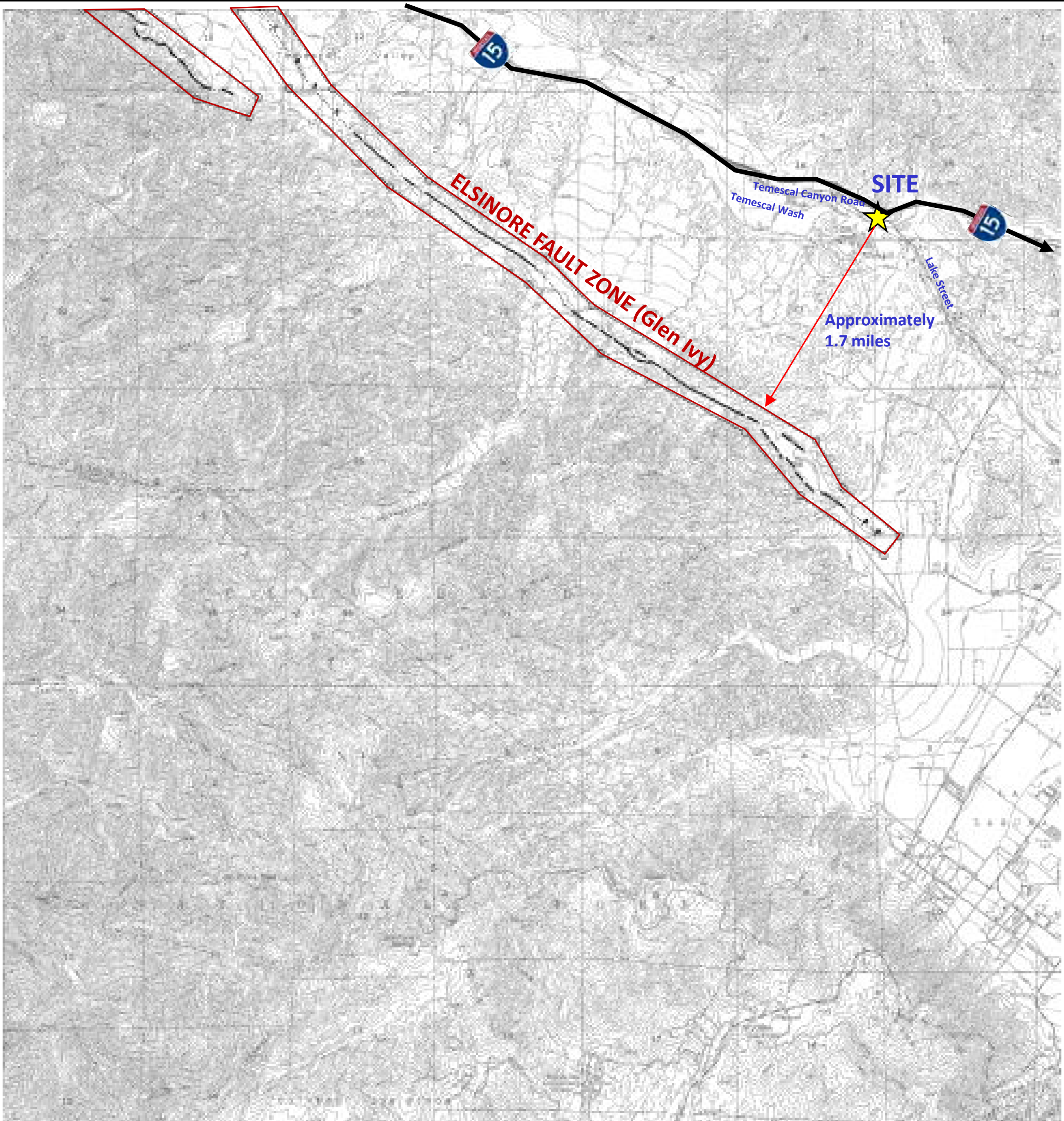
IRVINE, CA 92618 (949) 450-2100

Figure Number: 5A

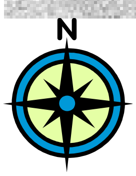
Project Name: Temescal Canyon Road Bridge, Lake Elsinore, CA

Project Number: IR 617

REGIONAL FAULT MAP



NOT TO SCALE



STATE OF CALIFORNIA
SPECIAL STUDIES ZONES
Delineated in compliance with Chapter 7.5, Division 2 of the California Public Resources Code

ALBERHILL QUADRANGLE

OFFICIAL MAP

Effective: January 1, 1980

[signature] State Geologist

Potentially Active Faults

1906 C — Faults considered to have been active during Quaternary time; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.

Aerial photo lineaments (not field checked); based on youthful geomorphic and other features believed to be the results of Quaternary faulting.

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Seaward projection of zone boundary.

REFERENCES USED TO COMPILE FAULT DATA

Alberhill Quadrangle

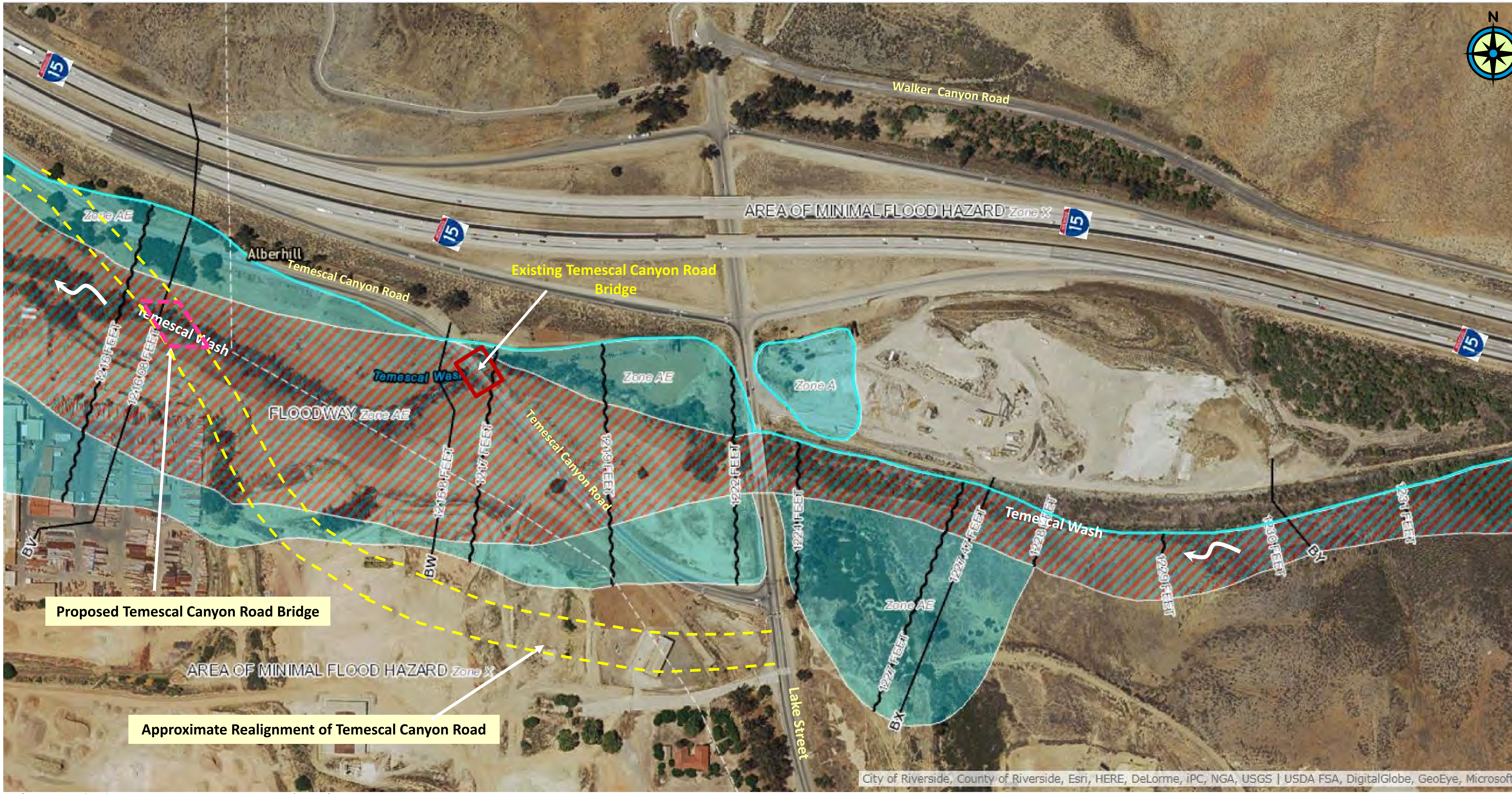
Smith, D.P., 1979, Fault Evaluation Report FER-72 (Elsinore fault zone, Prado Dam to Lake Elsinore, Riverside County): Unpublished report, California Division of Mines and Geology, 20 p. with supplement, 16 p. (see figures 4 and 5).

Weber, F.H., 1977, Seismic hazards related to geologic factors, Elsinore and Chino fault zones, northwestern Riverside County, California: California Division of Mines and Geology Open File Report 77-4 LA, 96 p., plates 2A and 2B.

IMPORTANT - PLEASE NOTE

1) *This map may not show all potentially active faults, either within the special studies zones or outside their boundaries.*
2) Faults shown are the basis for establishing the boundaries of the special studies zones.
3) The identification of these potentially active faults and the location of such fault traces are based on the best available data. Traces have been drawn as accurately as possible at this map scale; however, the quality of data used is varied.
4) Fault information on this map is not sufficient to serve as a substitute for the geologic site investigations (special studies) required under Chapter 7.5, Division 2, Section 2623 of the California Public Resources Code.

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 5B
	Project Name: Temescal Canyon Road Bridge, Lake Elsinore, CA	Project Number: IR 617
	FAULT RUPTURE SPECIAL STUDIES ZONE MAP	



Reference: Federal Emergency Management Agency (FEMA), 2016

NOT TO SCALE

EXPLANATION

Zone A : Areas within 100-year floods

Zone AE : Areas with base flood plain and base flood elevations are provided

Zone X : Areas of minimal flood hazard

GROUP DELTA

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ENGINEERS AND GEOLOGISTS
32 MAUCHLY, SUITE B
IRVINE, CA 92618 (949) 450-2100

Figure Number: 6

Project Location: Temescal Canyon Road Bridge, Lake Elsinore, CA

Project Number: IR 617

FLOOD HAZARD ZONE MAP

Appendix A

Site Reconnaissance Photographs along the Proposed Realignment

(1)

Looking North along Lake Street;
Location of the proposed tie-in of Temescal Canyon Road realignment

(2)

Looking west from Lake Street along the proposed Temescal Canyon Road realignment

NOTE: Site reconnaissance was conducted on March 23, 2016.

(3)

Looking west along the proposed Temescal Canyon Road realignment
(The realignment will require the existing storage building be demolished)

(4)

Looking west along the proposed Temescal Canyon Road realignment

(5)

Looking west along the proposed Temescal Canyon Road realignment

(6)

Looking north from the proposed Temescal Canyon Road realignment

(7)

Looking north; The existing storage building to be demolished

(8)

Looking west along north side of the storage building

(9)

Looking east towards Lake street from the existing storage building area

(10)

Looking east along the proposed Temescal Canyon Road realignment

(11)

Looking west along the proposed Temescal Canyon Road realignment

(12)

Looking east from Pacific Clay pit area

(13)

Looking east from Pacific Clay pit area

(14)

Looking south towards Pacific Clay pit area

(15)

Looking southwest towards Pacific Clay pit area

(16)

Looking southwest towards Pacific Clay pit area

(17)

Looking west from east side of Pacific Clay pit area

(18)

Looking northwest from east side of Pacific Clay pit area

(19)

Looking northwest along the proposed Temescal Canyon Road realignment

(20)

Looking at the Temescal Wash (Dry at the time of site visit)

(21)

Looking at the Temescal Wash (Dry at the time of site visit)

(22)

Looking southeast towards the Temescal Wash

(23)

Looking northwest towards the existing Temescal Canyon Road

(24)

Looking northwest towards the existing Temescal Canyon Road

(25)

Looking northwest towards the existing Temescal Canyon Road

(26)

Looking west along the existing Temescal Canyon Road near Bernard Street,
where the proposed realignment begins