APPENDIX B

BIOLOGICAL ASSESSMENT AND MSHCP CONSISTENCY ANALYSIS

RIVERSIDE COUNTY FIRE STATION #77
EXPANSION PROJECT

Lake Riverside Community, Riverside County, California

COUNTY OF RIVERSIDE
EDA
ECONOMIC DEVELOPMENT AGENCY

November 2017

DUDEK

3544 UNIVERSITY AVENUE
RIVERSIDE, CALIFORNIA 92501
T 951.300.2100 F 951.300.2105

October 27, 2017 10715

Michael Sullivan
Riverside County Economic Development Agency
3403 10th Street, Suite 400
Riverside, California 92501

Subject: ***Western Riverside County Multiple Species Habitat Conservation Plan Consistency Analysis Report for the Lake Riverside Fire Station #77 Improvements Project, Town of Aguanga, Riverside County, California***

Dear Mr. Michael Sullivan:

Dudek has prepared this Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) consistency analysis letter report for the Riverside County Economic Development Agency (EDA) in support of improvements to the Lake Riverside Fire Station #77 Improvements Project (Fire Station), Town of Aguanga, Riverside County, California (project or project site). The project site is not located within a Western Riverside Multiple-Species Habitat Conservation Plan (MHSCP) Criteria Cell, but does fall within a survey area for Los Angeles pocket mouse (*Perognathus longimembris brevinasus*; LAPM).

This letter report is intended to: (1) describe the existing conditions of biological resources within the project site in terms of vegetation, flora, wildlife, and wildlife habitats; (2) provide results of a habitat assessment for LAPM in accordance with MSHCP requirements; (3) discuss potential constraints to development of the project site; and (4) cover a MSHCP consistency determination for the following requirements (relevant MSHCP sections are provided in parentheses):

- Riparian/Riverine, Vernal Pool, and Fairy Shrimp Requirements (Section 6.1.2)
- Species Survey Requirements (Sections 6.1.3 and 6.3.2)
- Urban/Wildlife interface Guidelines (Section 6.1.4)

1 PROJECT LOCATION

The approximately 2.65-acre project site is located at the southeastern corner of Roundup Drive and Comanche Court within the Town of Aguanga, California (Figure 1; all figures are provided in Attachment A). It is comprised of one Assessor's Parcel Number (APNs), 580-240-022, situated in Section 3 of Township 7 South, Range 2 East of the Cahuilla Mountain 7.5-minute

U.S. Geological Survey (USGS) quadrangle. The project site is located within the plan area for the MSHCP, but is not within a Criteria Cell (County of Riverside 2003) (Figure 2).

2 METHODS

2.1 Literature Reviewed

For purposes of this report, special-status species are those plant or wildlife species that are listed or candidates for listing as threatened or endangered by either the California or federal Endangered Species Act. Special-status plants include species with a California Rare Plant Rank (CRPR) of 1–3 by the California Native Plant Society (CNPS). Special-status wildlife species include Fully Protected or Species of Special Concern. All plant and wildlife species covered by the MSHCP are also considered special status for this project.

Other special-status biological resources include sensitive plant communities; wetlands, including riparian habitat; and wildlife corridors. Sensitive plant communities are those that are considered to support unique vegetation communities that have a rank of S1–S3 on the CDFW List of Terrestrial Communities, or considered locally important by a local planning document such as the County of Riverside General Plan or the MSHCP.

Special-status biological resources present or potentially present on site were identified through a literature search using the following sources: U.S. Fish and Wildlife Service, Carlsbad species occurrence database (USFWS 2017a), and the CNPS Inventory of Rare and Endangered Plants of California (CNPS 2017). The California Natural Diversity Database (CNDDB) (CDFW 2017) was also reviewed to identify special-status species possibly occurring within five miles of the project site.

General information regarding wildlife species present in the region was obtained from Sibley (2000) for birds, Zeiner et al. (1990) for mammals, and Stebbins for reptiles (2003) and amphibians (1985). General information regarding vegetation communities and plant species was obtained from the Vegetation Alliances of Western Riverside County (Klein and Evens 2006). A previous biological report for a nearby property was also reviewed (County of Riverside 2009).

2.2 Survey Methodology

2.2.1 Reconnaissance Survey

On October 17, 2017 Dudek biologists Phil Behrends and Anna Cassady conducted a general reconnaissance survey, vegetation mapping, and focused habitat assessment for LAPM of the project site and its 100-foot buffer (study area). The survey began at 08:00 a.m. and concluded by 09:30 a.m. Temperatures ranged from 65 to 80 degrees Fahrenheit; there was no cloud cover, winds were calm, and the soil was dry. The general biological resources assessment was conducted on foot, and the survey area was walked thoroughly to complete the resource inventory. The survey buffer was surveyed visually, as access was not granted to these parcels.

Vegetation communities and land uses within the survey area were mapped in the field directly onto a 300-foot-scale (1 inch = 300 feet) aerial photograph–based field map. Following completion of the fieldwork, all vegetation polygons were digitized using ArcGIS, and GIS coverage was created. Once in ArcGIS, the acreage of each vegetation community and land cover present was determined.

The survey area was also surveyed for the following types of features:

- Waters of the United States, including wetlands, under the jurisdiction of the U.S. Army Corps of Engineers (ACOE), pursuant to Section 404 of the federal Clean Water Act.
- Waters of the state under the jurisdiction of the California Regional Water Quality Control Board (RWQCB), pursuant to Section 401 of the federal Clean Water Act and the Porter–Cologne Act as wetlands or drainages.
- Streambeds under the jurisdiction of CDFW, pursuant to Section 1602 of the California Fish and Game Code.

2.2.2 LAPM Habitat Assessment

To meet requirements in the MSHCP, a habitat assessment was conducted to identify suitable habitat for Los Angeles pocket mouse. The assessment was conducted by Dudek biologist Phil Behrends, Ph.D. Dr. Behrends is a recognized experts on heteromyid rodents (kangaroo rats and pocket mice) and has conducted numerous special-status mammal assessments and live-trapping studies in southern California since 1989, including for LAPM and the endangered Stephens' kangaroo rat (*Dipodomys stephensi*; SKR), San Bernardino kangaroo rat (*D. merriami parvus;*

SBKR), and Pacific pocket mouse (*P. longimembris pacificus*). Dr. Behrends also authored the LAPM species account for the Western Riverside County MSHCP.

The habitat assessment entailed a 100% walkover survey of the project site for suitable habitat for LAPM. Unlike surveys for kangaroo rats (SKR, SBKR) which can largely rely on diagnostic surface sign such as burrows, scat (fecal pellets), tracks, tail drags, runways, and dust bowls. LAPM do not leave similar detectable diagnostic surface sign, primarily because of their very small size (8-10 grams). Therefore habitat assessments for LAPM must rely on presence of suitable habitat, primarily certain vegetation and soil conditions, as described further in this report. If suitable habitat is absent, then LAPM is highly unlikely to be present. If suitable habitat is present, presence or absence can only be confirmed by live-trapping.

3 RESULTS

3.1 Land Use

The project site is located in the Town of Aguanga, which is situated in the Cahuilla Valley with the Cahuilla Mountain to the northwest and the Cahuilla Indian Reservation to the southeast. The site is relatively flat, gradually sloping west to east with an elevation of 3,460 feet to 3,470 feet above mean sea level (amsl).

The general vicinity surrounding the project site is vacant land with rural residential uses. The project site is disturbed with evidence of previous disking and mowing. Roadways are paved with dirt and were actively being levelled during the time of the site visit.

3.2 Topography/Hydrology

The study area contains several drainage features that appear to be man-made, depicted in Figure 3. There are inlet and outlet structures that funnel flows through the property to prevent flooding of the existing fire station. These features culminate in a swale that runs along the western side of the property before crossing beneath Roundup Drive through a culvert. On the west side of Roundup Drive the feature passes over ungrouted riprap, presumably for erosion control, before dissipating out in a vacant lost west of Roundup Drive. While an earthen channel lies approximately 0.3 mile southwest of the study area, the swale feature on the project site does not demonstrate any connectivity to this feature and appears to be for flood protection only. This feature is considered non-jurisdictional by the ACOE, RWQCB, and CDFW.

3.3 Soils

The following soils are mapped within the project site (USDA 2017): Bull Trail sandy loam, 8% to 15% slopes, eroded; Bull Trail sandy loam, 8% to 25% slopes, eroded; and Calpine sandy loam, 2% to 8% slopes, eroded.

3.4 Vegetation Communities

Four vegetation communities/land covers were mapped within the project survey area: California annual grassland, Eucalyptus alliance, disturbed land, and developed land. They are depicted on Figure 3 and described in the following discussion; representative photos are provided in Attachment B.

The majority of the project site is California annual grassland. There are portions of the disturbed habitat where the vegetation was unidentifiable because the site had been recently mowed. Other areas less recently disturbed had some identifiable annual weedy species present including, but not limited to, shortpod mustard (*Hirschfeldia incana*), common ragweed (*Ambrosia artemisiifolia*), and Russian thistle (*Salsola australis*).

The study area also has several disturbed areas made up of dirt roads and dirt driveways. Developed structures, including the existing fire house, also exist on the project site. Finally, a small swath of Eucalyptus (*Eucalyptus* sp.) trees occupies a small area off-site, but within the project buffer in the northwestern portion of the study area.

3.5 Plant Species Observed

A total of 11 plant species—6 native (or naturalized) plants (55%) and 5 non-native plants (45%)—were recorded during the survey, representing 7 plant families. The relatively high proportion of non-native plants indicates this site contains disturbed areas. The common plant species that were identified within the vegetation communities are provided in the Plant Compendium in Attachment C.

3.6 Wildlife Species Observed

A total of 3 mammals, 5 birds, and 1 reptile species were observed during the surveys (Attachment D), and included California ground squirrel (*Spermophilus beecheyi)*, desert cottontail rabbit *(Sylvilagus audubonii),* side blotched lizard (*Uta stansburiana*), killdeer (*Charadrius vociferus*), and house finch (*Tyrannus verticalis*).

3.8 Special-Status Plant Species

No special-status plant species were identified within this site during the reconnaissance survey. Furthermore, there is no USFWS-designated critical habitat for listed plant species within the project area (USFWS 2017b).

3.9 Special-Status Wildlife Species

There is no USFWS-designated critical habitat for listed wildlife species within the study area (USFWS 2017b).

Potential desiccated SKR scat was observed within the project site. Take of this species is fully covered under the MSHCP.

3.9.1 Los Angeles Pocket Mouse

The LAPM historically was confined to the coastal basins of Los Angeles, San Bernardino, Riverside counties. The project site falls within the recent known LAPM geographic range in western Riverside County, which includes occurrences in the Anza Valley and Temecula Creek regions (Western Riverside County MSHCP Biological Monitoring Program 2011, 2012). One California Natural Diversity Database (CNDDB) occurrence record is located approximately 2 miles southwest of the project site (CDFW 2017). In addition, Dr. Behrends trapped one LAPM along a sandy dirt road on Silverado Ranch approximately 4-5 miles east of the site in 1998 as part of a broad trapping effort for SKR (Behrends, unpubl. data). Therefore, LAPM is expected to occur in suitable habitat in locations scattered throughout the Anza Valley region.

Soil type appears to be an important habitat component for LAPM, with the subspecies typically occurring in open ground with fine sandy composition that typically are associated washes or are of aeolian (windblown) origin, such as dunes (see MSHCP Los Angeles Pocket Mouse Species Account, http://rctlma.org/Portals/0/mshcp/volume2/mammals.html.) LAPM generally is associated with lower elevation grasslands and the California buckwheat, California-white sage, and scale broom scrub shrubland alliances, which commonly occur in channels and washes supporting sandy soils. These three vegetation alliances encompass several vegetation communities, including coastal sage scrub, Riversidean alluvial fan sage scrub, and Riversidean sage scrub. Vegetation structure is probably important for LAPM and, like other heteromyid rodents, probably prefers more sparsely vegetated habitats. Focused trapping studies for LAPM in western Riverside County found that ground cover at sites occupied by the subspecies was mainly bare ground (60% of total ground cover) and litter (33%), with relatively little thatch (7%)

(Western Riverside County MSHCP Biological Monitoring Program 2011). The vegetative cover at occupied sites included non-native grasses (19%), native and non-native forbs (18%), and native shrubs (7%), with scalebroom (*Lepidospartum squamatum*), Wright's eriogonum (*Eriogonum wrightii*), coyote willow (*Salix exigua*), red-shank chamise (*Adenostoma sparsifolium*) and California buckwheat (*Eriogonum fasciculatum*) as the dominant shrubs. In contrast, unoccupied sites had less bare ground (15% of total ground cover) and relatively more litter (50%) and thatch (32%) (Western Riverside County MSHCP Biological Monitoring Program 2011).

Vegetation on the project site is mostly annual grassland, with patches of weedy species such as Russian thistle and shortpod mustard and native annual forbs such tarweed, doveweed, cudweed aster, ragweed, and slender buckwheat. The site appears to be regularly mowed to keep the vegetation down, as evidenced by thatch and litter comprised of cut grasses and forbs on the majority of the site. Vegetative cover, including cut thatch and litter, ranges from fairly open to almost 100% depending on the area of the project site. Soils on the site include Bull Trail sandy loam (BsD2) and Calpine sandy loam (CcC2), both of which formed from alluvial fans and terraces (USDA 2017). The site supports support high rodent activity, including abundant Botta's pocket gopher (*Thomomys bottae*) and California ground squirrel (*Spermophilus beecheyi*) burrows. The site also supports numerous smaller burrows, and small rodents expected to occur include North American deermouse (*Peromyscus maniculatus*), cactus mouse (*P. eremicus*), and possibly western harvest mouse (*Reithrodontomys megalotis*).

The site has very low potential to support LAPM, which typically occurs on fine sandy soils associated with washes and aeolian sources. The sandy loam soils on site are too coarse and heavy for LAPM (Calpine soils derive from granitic rocks). In addition, much of the site supports high vegetative cover, including grasses, forbs, thatch and litter, that is too dense for LAPM. Areas with lower vegetative cover and openings tend to be associated with thin, compacted soils unsuitable for rodent burrowing, or occur where there are abundant pocket gopher and ground squirrel burrows and diggings. In more than 20 years of trapping experience in southern California, Dr. Behrends has never trapped LAPM in the habitat conditions present on the project site.

3.9.2 Nesting Birds

The entire site provides suitable habitat for nesting birds. The disturbed habitat, in addition to the presence of several California ground squirrel burrows, contains suitable burrows for burrowing owl, and the ground surface is suitable nesting habitat for killdeer.

4 WESTERN RIVERSIDE COUNTY MSHCP CONSISTENCY ANALYSIS

The project site is located in the MSHCP Plan area, but is not within an MSHCP Criteria Cell or Special Linkage Area (Figure 2). Therefore, no Reserve Assembly requirements would apply to the project site. The project site is within a survey area for LAPM.

4.1 Riparian/Riverine

The MSHCP defines riparian/riverine areas as "lands which contain habitat dominated by trees, shrubs, persistent emergent, or emergent mosses and lichens, which occur close to or which depend upon soil moisture from a nearby fresh water source; or areas with fresh water flow during all or a portion of the year" (County of Riverside 2003). The MSHCP further clarifies those areas "demonstrating characteristics as described above which are artificially created are not included in these definitions."

The project site does not have any riparian resources and only has riverine resources in the form of on-site swale that does not display downstream connectivity. This feature is not suitable for riparian/riverine associated species.

4.1.1 Vernal Pool and Fairy Shrimp Habitat

No indicators of ponding or vernal pool plant species were observed during the site visit. Historic aerials and topographic maps were reviewed for signatures of ponding. No topographic low points or indicators of ponding are present on historic aerials or topographic maps. The soils present within the project site are not typically associated with vernal pools. Furthermore, upon surveying, there are no areas that would likely hold water for an extended amount of time, and therefore the site does not support any vernal pools or potential fairy shrimp habitat.

This riparian/riverine assessment satisfied Section 6.1.2 of the MSHCP.

4.2 Narrow Endemic Plant Species

The project site does not require surveys are narrow endemic plant species and the reconnaissance survey resulted in the presence of no special-status plant species; therefore, this assessment satisfied Section 6.1.3 of the MSHCP.

4.3 Urban/Wildlife Interface Guidelines

According to the MSHCP, the Urban/Wildlands Interface Guidelines are intended to address indirect effects associated with locating development in proximity to the MSHCP Conservation

Area (MSHCP, p. 6-42). The project site is not within the vicinity of any conserved areas and the Urban/Wildlife Interface Guidelines are not applicable. This assessment satisfies Section 6.1.4 of the MSHCP.

4.4 Other Criteria Area Species Surveys

The MSHCP establishes habitat assessment requirements for certain species of plants, birds, mammals, and amphibians. The project site is only in a required survey area for LAPM. The habitat assessment indicated that the project site has low suitability to support LAPM and there are no documented occurrences within the immediate vicinity; therefore, focused surveys are not recommended. No other species surveys are required for this project site; therefore, this assessment satisfied Section 6.2.3 of the MSHCP.

5 RECOMMENDATIONS

5.1 Burrowing Owl Preconstruction Survey

The project site is not in an area that requires a habitat assessment for burrowing owl; however, the project site demonstrated marginally suitable habitat for burrowing owl and therefore it is recommended that a preconstruction survey is conducted within 30 days prior to ground-disturbance activities, or no less than 14 days prior to ground-disturbance activities. A minimum of one survey site visit within the described time frame prior to disturbance is required to document/confirm presence or absence of owls on the site. Preconstruction surveys are to be conducted by a qualified biologist.

If surveys confirm occupied burrowing owl habitat is located in or adjoining the project area, an impact assessment and avoidance measures will be implemented. The biologist will assess each occupied burrow to determine if the impact of the project activities will directly or substantially indirectly impact the burrow, ultimately causing death of a burrowing owl. These burrows will be monitored regularly to confirm avoidance and status of the burrow.

5.2 Nesting Birds

The entire project site provides suitable habitat for nesting birds. Direct impacts to migratory birds must be avoided in accordance with the. If ground-disturbance activities occur during the avian nesting season, and if nesting birds are present, preconstruction survey and avoidance measures must be conducted.

Preconstruction Nesting Bird Survey

To maintain compliance with the Migratory Bird Treaty Act and Fish and Game Code, a preconstruction nesting bird survey will be conducted if construction activities are scheduled to occur during the avian nesting season (from February 1 – August 30). Surveys will be conducted within 3 days of activity and will be conducted between dawn and noon.

If an active nest is detected during the nesting bird survey, avoidance buffers will be implemented. The buffer will be of a distance to ensure avoidance of adverse effects to the nesting bird, by accounting for topography, ambient conditions, species, nest location, and activity type. Appropriate buffers around nests will be determined by a qualified biologist. For nests with reduced buffers, monitoring will take place daily until it is confirmed the buffer is adequate to avoid effects to the nest. All nests will be monitored until nestlings have fledged and dispersed or it is confirmed that the nest has been unsuccessful or abandoned.

6 CONCLUSION

With preparation a preconstruction burrowing owl survey and nesting bird survey (if applicable), the project will be fully compliant with the MSHCP and fully covered for impacts to covered species with payment of the MSHCP development mitigation fee.

Should you have any questions regarding this biological assessment, please do not hesitate to contact me at 760.479.4254 or at bortega@dudek.com.

Sincerely,

Brock Ortega
Senior Biologist

Att.: A: Figures 1–3
B: Photo Documentation
C: Plant Compendium
D: Wildlife Compendium

7 REFERENCES

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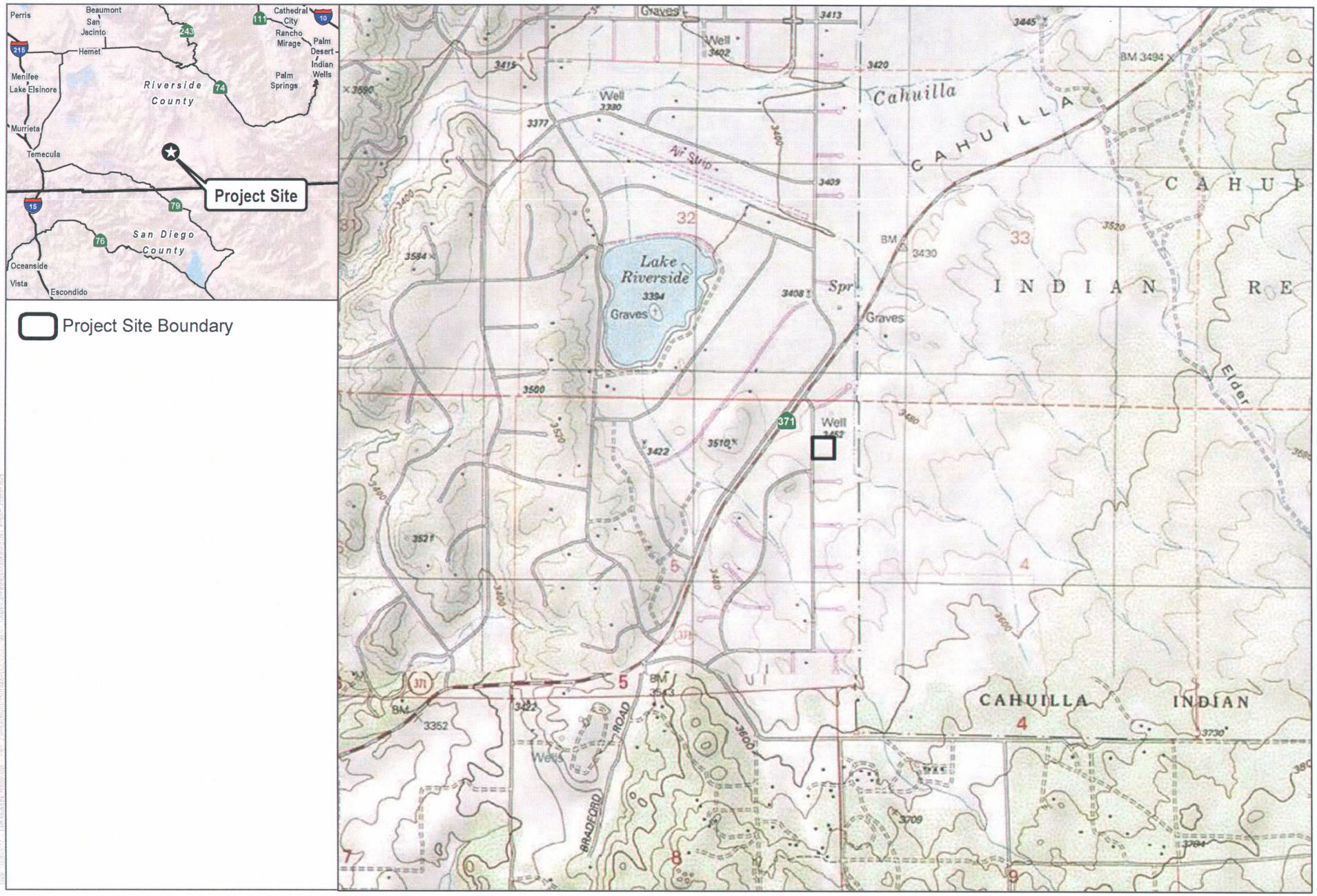
ATTACHMENT A

Figures 1–3



SOURCE: USGS 7.5-Minute Series Aguanga Quadrangle
Township 8S; Range 2E; Section 5

DUDEK

0 1,000 2,000 Feet

FIGURE 1

Project Location

MSHCP Consistency Analysis for the Lake Riverside Fire Station #77 Improvements Project

SOURCE: Bing Maps (Accessed 2017)

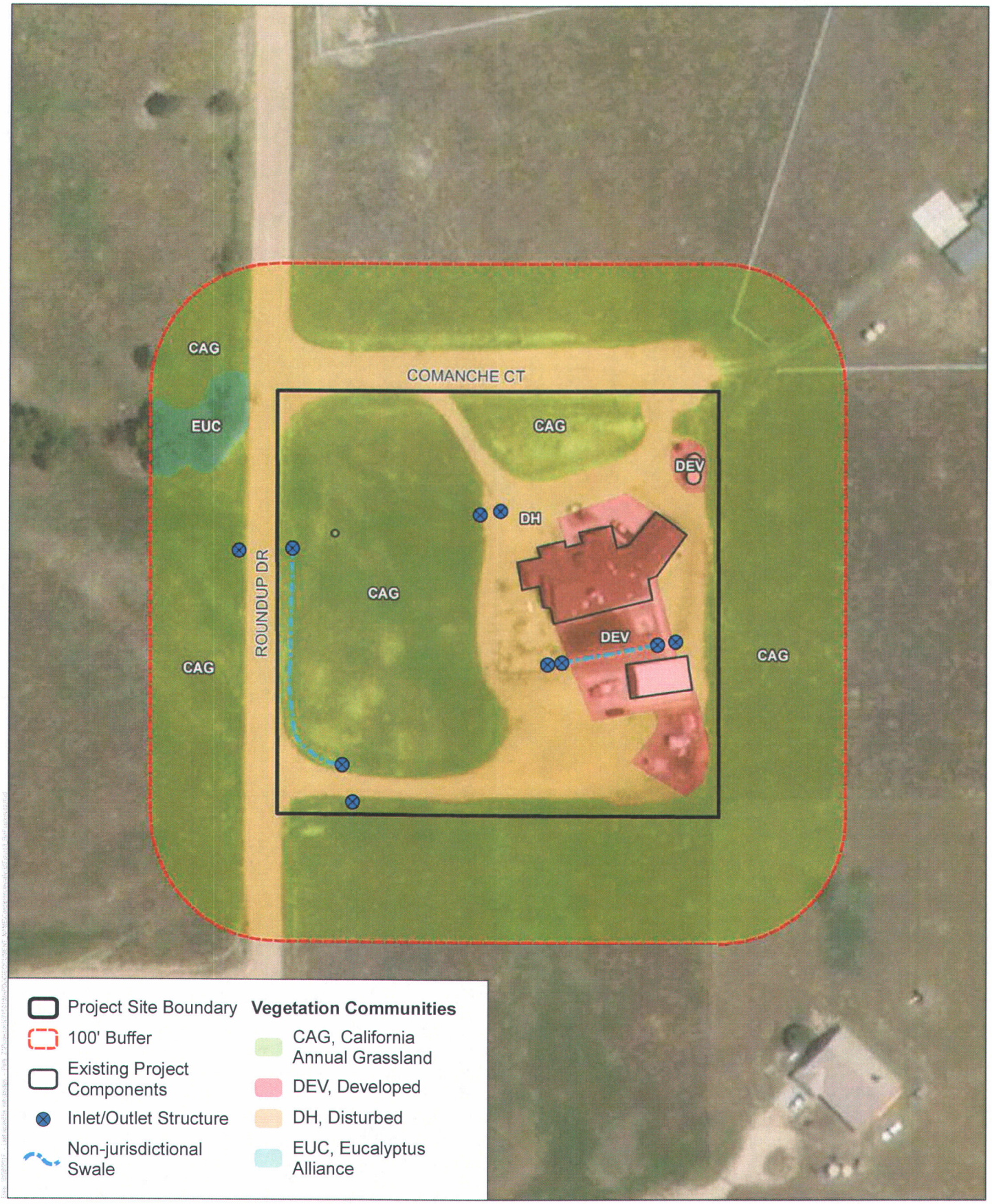
DUDEK

0 26,500 53,000 Feet

FIGURE 2

MSHCP Overview

MSHCP Consistency Analysis for the Lake Riverside Fire Station #77 Improvements Project



SOURCE: Bing Maps (Accessed 2017)

DUDEK

0 50 100 Feet

FIGURE 3

Biological Resources

MSHCP Consistency Analysis for the Lake Riverside Fire Station #77 Improvements Project

ATTACHMENT B

Photo Documentation

ATTACHMENT B
Photo Documentation

Location 1: Recently mowed California annual grassland, facing northwest from the southwestern corner of the project site.

Location 2: The existing fire station that id slated for improvement, northeast from the southwestern border of the project site.

Location 3: Non-jurisdictional swale along the western border of the project site. Facing north.

Location 4: California annual grassland behind the fire station, facing south from the northeastern portion of the project site.

Location 5: Facing east into the project buffer from behind the existing fire station.

Location 6: Non-jurisdictional swale between the fire station and the garage. Facing west.

Location 7: Sparse vegetation behind the fire station, facing east.

Location 8: Example of California ground squirrel burrows found on the project site.

ATTACHMENT C

Plant Compendium

ATTACHMENT C
Plant Compendium

VASCULAR SPECIES

EUDICOTS

ANACARDIACEAE—SUMAC OR CASHEW FAMILY

* *Schinus molle*—Peruvian peppertree

ASTERACEAE—SUNFLOWER FAMILY

Centromadia pungens ssp. *pungens*—common tarweed
Corethrogyne filaginifolia—common sandaster
* *Ambrosia artemisiifolia*—annual ragweed
Gutierrezia californica—California match weed

BRASSICACEAE—MUSTARD FAMILY

* *Hirschfeldia incana*—shortpod mustard

CHENOPODIACEAE—GOOSEFOOT FAMILY

* *Salsola australis*—Russian thistle

EUPHORBIACEAE—SPURGE FAMILY

Euphorbia albomarginata—whitemargin sandmat
Croton setiger—dove weed

MYRTACEAE MYRTLE FAMILY

Eucalyptus sp.—Eucalyptus Species

POLYGONACEAE—BUCKWHEAT FAMILY

Eriogonum microthecum—slender buckwheat

* signifies introduced (non-native) species

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ATTACHMENT D

Wildlife Compendium

ATTACHMENT D
Wildlife Compendium

BIRD

BLACKBIRDS, ORIOLES AND ALLIES

ICTERIDAE—BLACKBIRDS

Euphagus cyanocephalus—Brewer's blackbird

Quiscalus mexicanus—great-tailed grackle

FINCHES

FRINGILLIDAE—FRINGILLINE AND CARDUELINE FINCHES AND ALLIES

Haemorhous mexicanus—house finch

HUMMINGBIRDS

TROCHILIDAE—HUMMINGBIRDS

Calypte anna—Anna's hummingbird

SHOREBIRDS

CHARADRIIDAE—LAPWINGS AND PLOVERS

Charadrius vociferus—killdeer

MAMMAL

HARES AND RABBITS

LEPORIDAE—HARES AND RABBITS

Sylvilagus audubonii—desert cottontail

POCKET GOPHERS

GEOMYIDAE—POCKET GOPHERS

Thomomys bottae—Botta's pocket gopher

SQUIRRELS

SCIURIDAE—SQUIRRELS

Spermophilus (Otospermophilus) beecheyi—California ground squirrel

REPTILE

LIZARDS

PHRYNOSOMATIDAE—IGUANID LIZARDS

Uta stanburiana—common side-blotched lizard

APPENDIX C

GEOTECHNICAL REPORT

RIVERSIDE COUNTY FIRE STATION #77
EXPANSION PROJECT

Lake Riverside Community, Riverside County,
California

COUNTY OF RIVERSIDE
EDA
ECONOMIC DEVELOPMENT AGENCY

November 2017

PRELIMINARY GEOTECHNICAL REPORT
NEW APPARATUS BAY, FIRE STATION 77
49937 COMANCHE COURT
AGUANGA, CALIFORNIA

PREPARED FOR:

CAL FIRE/ Riverside County Fire Department
Strategic Planning Division
210 W. San Jacinto Avenue
Perris, California 92570

PREPARED BY:

INLAND FOUNDATION ENGINEERING, INC.
P. O. Box 937
San Jacinto, California 92581-0937

March 29, 2017
Project No. R007-046

INLAND FOUNDATION ENGINEERING, INC.
Consulting Geotechnical Engineers and Geologists
www.inlandfoundation.com
P. O. Box 937, San Jacinto, CA 92581-0937

March 29, 2017
Project No. R007-046

Attention: Dexter Galang, Fire Facilities Planner
CAL FIRE/ Riverside County Fire Department
Strategic Planning Division
210 W. San Jacinto Avenue
Perris, California 92570

Subject: Preliminary Geotechnical Report
New Apparatus Bay, Fire Station 77
49937 Comanche Court, Aguanga, California
APN: 580-240-022

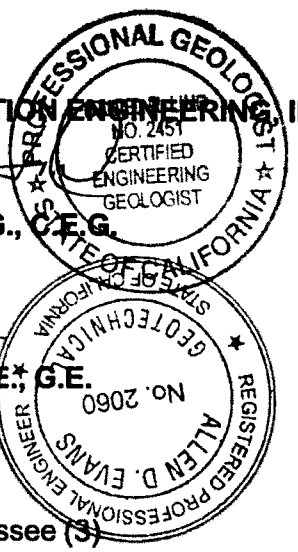
Dear Mr. Galang:

We are pleased to submit this preliminary geotechnical report prepared for the above subject project. The subject site is located at 49937 Comanche Court in the Aguanga area of Riverside County, California.

It is our opinion that the proposed development is feasible from a geotechnical engineering standpoint. Our report includes design recommendations along with the field and laboratory data. We have also included recommendations for site grading.

We appreciate being of service to you on this project. If you have any questions, please contact our office.

Respectfully,
INLAND FOUNDATION ENGINEERING, INC.



Daniel R. Lind, P.G., C.E.G.
Principal Geologist

Allen D. Evans, P.E., G.E.
Principal

DRL:ADE:es
Distribution: Addressee (3)

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INTRODUCTION

This report presents the results of the preliminary geotechnical investigation conducted at the proposed site of a new apparatus bay for Riverside County Fire Station 77, located at 49937 Comanche Court in the Aguanga area of Riverside County, California. The Assessor Parcel No. of the site is 580-240-022. The following references were provided for our use during this investigation:

- Plans entitled "Fire Station 77 Apparatus Bay Addition, 49937 Comanche Court, Aguanga, California, APN: 580-240-022", dated December 3, 2015, prepared by RVC Fire Strategic Planning Division.
- A plan set entitled "Site Plan, New Home, Single Family Residence, Lot 473/Tract 3925, A.P.N. 580-240-022", dated September 14, 2007, prepared by SouthWest Design Group.
- A plan entitled "Field Topo Exhibit, Cal-Fire, County of Riverside Fire Station 77 Apparatus Bay Addition", dated March 1, 2017, prepared by Cozad & Fox, Inc.

This report provides preliminary geotechnical design parameters that may be applied to the proposed project.

SCOPE OF SERVICE

The purpose of this preliminary geotechnical investigation is to provide geotechnical parameters for design and construction of the proposed project. The scope of the geotechnical services included:

- *Review of the general geologic conditions and specific subsurface conditions of the project site.*
- *Geological and seismicity (seismic hazards) evaluation of the site.*
- *Evaluation of the engineering and geologic data collected for the project site.*
- *Preparation of this report with geotechnical conclusions and recommendations for design and construction.*

The tasks performed to achieve these objectives included:

- *Collection and review of new and existing data relative to the site.*
- *Subsurface exploration to evaluate the nature and stratigraphy of the subsurface soils and to obtain representative samples for laboratory testing.*

- *Visual reconnaissance of the site and surrounding area to ascertain the existence of unstable or adverse geologic conditions.*

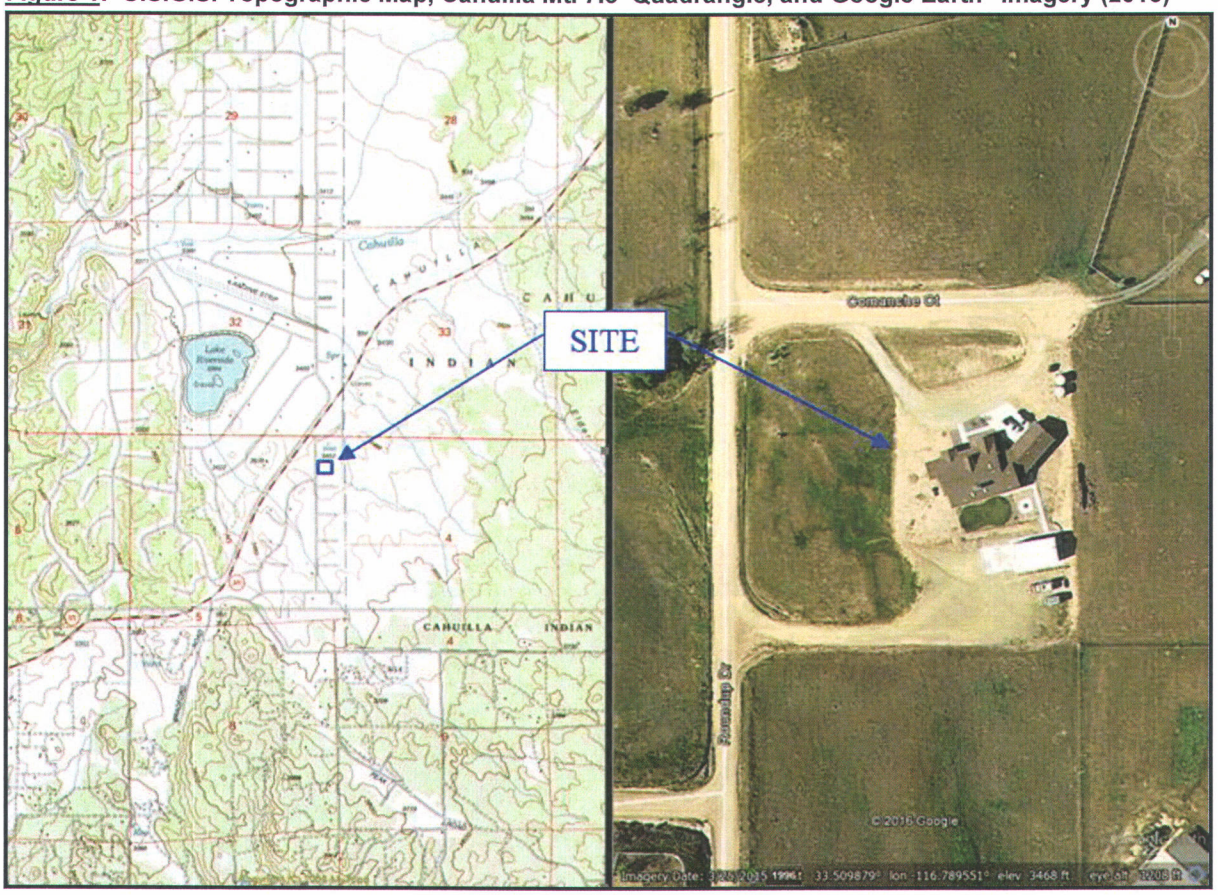
- *Laboratory testing of representative samples to evaluate the classification and engineering properties of the soils.*

- *Analysis of the data collected and the preparation of this report presenting our geotechnical conclusions and recommendations.*

SITE AND PROJECT DESCRIPTION

The fire station site lies within the northeasterly portion of Section 5, Township 8 South, Range 2 East, S.B.B.&M. Fire Station 77 is located at 49937 Comanche Court in the Aguanga area of Riverside County, California. The location of Fire Station No. 77 is shown on Figure 1 below.

Figure 1: U.S.G.S. Topographic Map, Cahuilla Mt. 7.5' Quadrangle, and Google Earth© Imagery (2015)



The site is currently ocupied by an existing fire house and apparatus bay. The topography is relatively planar with a slight gradient to the northwest. Based on U.S.G.S. topographic mapping (1996), the existing ground surface elevation in the vicinity of the proposed building site is approximately 3,453 feet above mean sea level

(msl). Elevations across the site range from approximately 3,465 to 3,453 feet above msl on the northwest corner. A light growth of seasonal weeds and grasses was present on the site at the time of our investigation.

The proposed new fire apparatus bay will be located to the west of the existing fire house. We understand that the apparatus bay will be a single story structure encompassing 3,124 square feet. We anticipate that foundations for the new structure will consist of shallow spread and continuous footings with a concrete slab-on-grade floor.

Grading is expected to consist of preparation of the building pad area for the proposed structure as well as pavement and landscape areas. We assume that rough cuts and fills on the order of four feet or less will be required to achieve final site grades (not including any remedial over-excavation).

ENGINEERING GEOLOGY REVIEW

The engineering geology and seismicity review has been prepared utilizing the suggested "Checklist for the Review of Geologic/Seismic Reports for California Public Schools, Hospitals and Essential Services Buildings" (California Geologic Survey, Note No. 48, 2013). The scope of services provided for this evaluation included:

- Review of available published and unpublished geologic and geotechnical data in our files pertinent to the site, including photogeologic analysis of aerial photographs;
- Geologic field reconnaissance of the site and adjacent areas by a State of California Certified Engineering Geologist;
- Preparation of this report presenting our findings, conclusions and recommendations, from an engineering geologic standpoint.

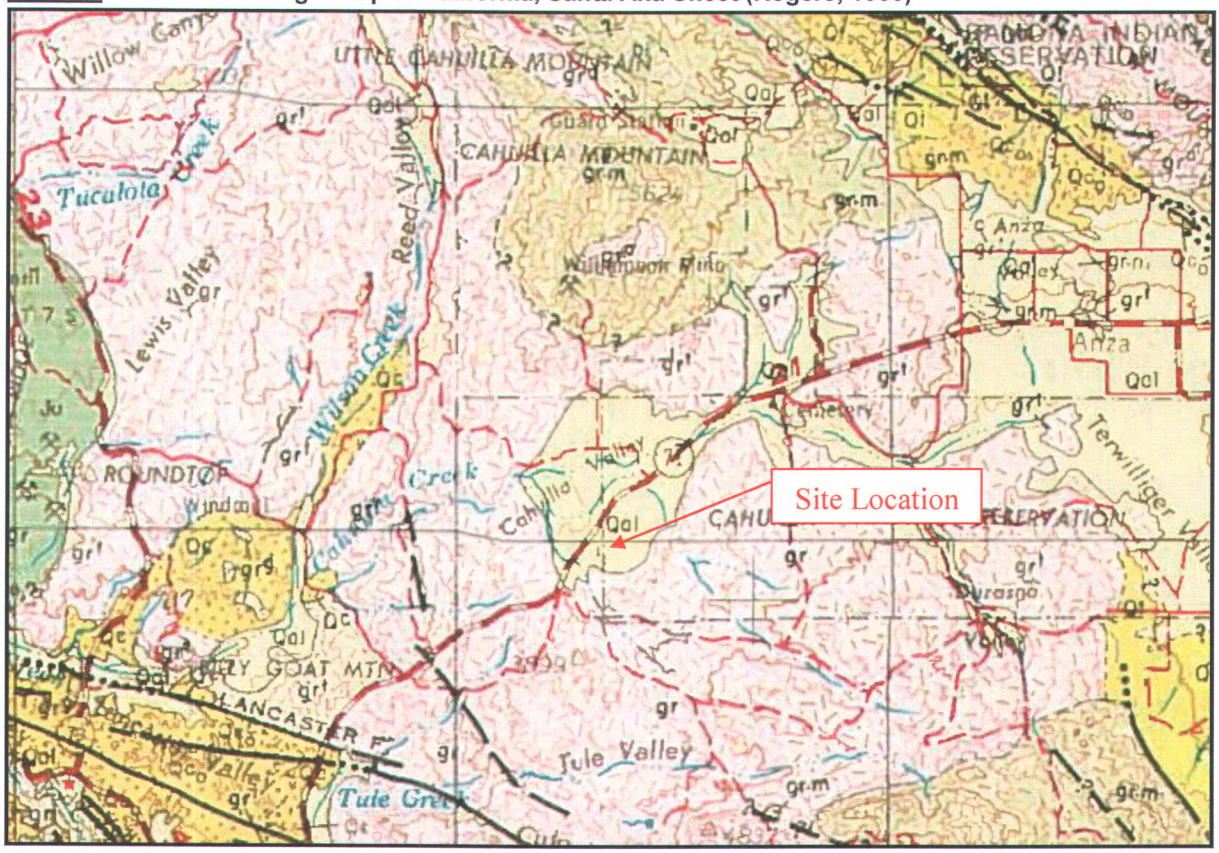
GEOLOGIC SETTING

Regional Geology: The subject site is situated within a natural geomorphic province in southwestern California known as the Peninsular Ranges, which is characterized by steep, elongated ranges and valleys that trend northwesterly. This geomorphic province encompasses an area that extends 125 miles, from the Transverse Ranges and the Los Angeles Basin, south to the Mexican border, and beyond another 795 miles to the tip of Baja California (Norris & Webb, 1990; Harden, 1998). This province is believed to have originated as a thick accumulation of predominantly marine sedimentary and volcanic rocks during the late Paleozoic and early Mesozoic. Following this accumulation, in mid-Cretaceous time, the province underwent a pronounced episode of mountain building. The accumulated rocks were then

complexly metamorphosed and intruded by igneous rocks, known locally as the Southern California Batholith. A period of erosion followed the mountain building, and during the late Cretaceous and Cenozoic time, sedimentary and subordinate volcanic rocks were deposited upon the eroded surfaces of the batholithic and pre-batholithic rocks.

Figure No. 2 shows a portion of the C.D.M.G. Geologic Map of California, Santa Ana Sheet, (Scale 1: 250,000), Southern California (Rogers, 1965) depicting the approximate location of the project site:

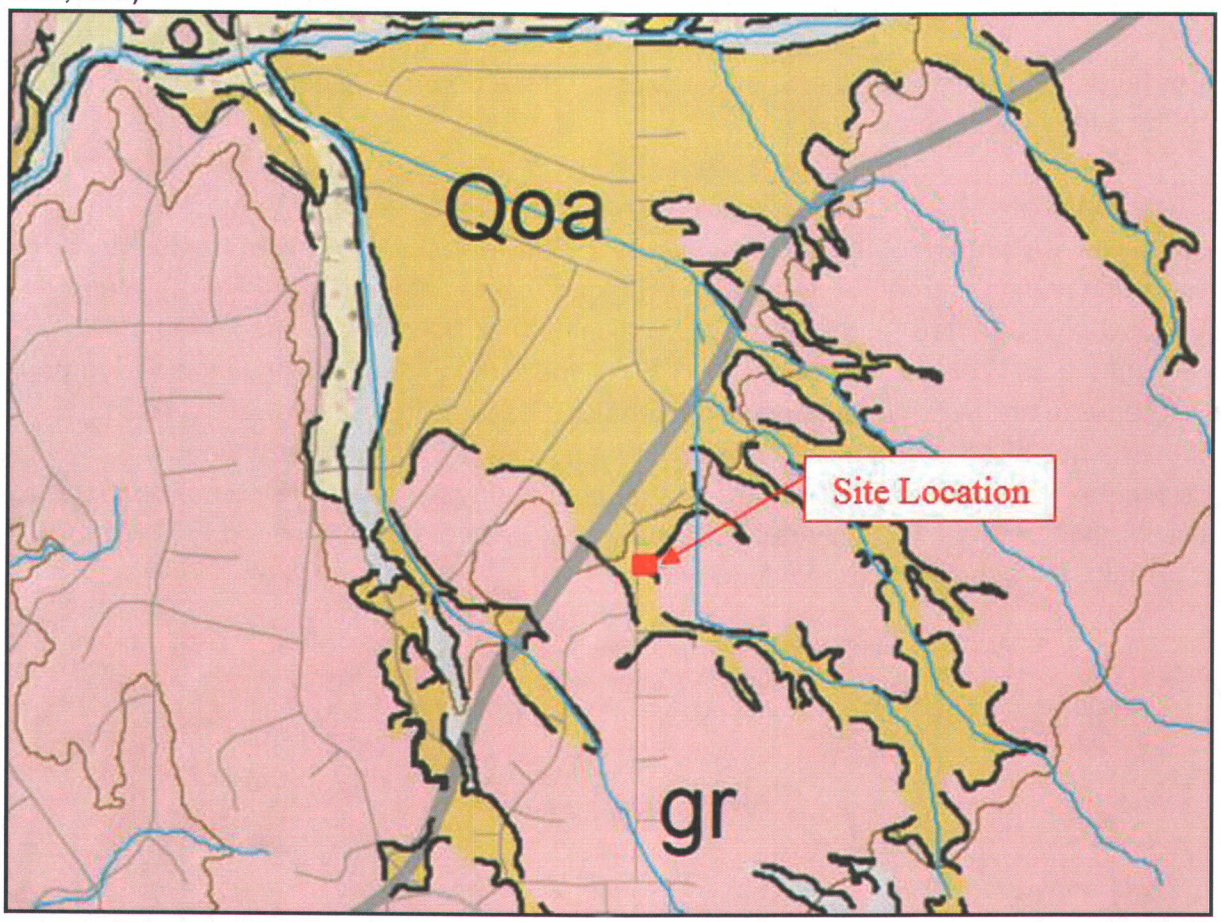
Figure 2: C.D.M.G. Geologic Map of California, Santa Ana Sheet (Rogers, 1965)



Local Geology: Locally, as mapped by Lancaster, et al., (2012), the site is shown to be mantled by old alluvial fan deposits (map symbol Qal) generally described as consisting of slightly to moderately consolidated, moderately dissected clay, silt, sand, and gravel.

Figure No. 3 shows a portion of the CGS Preliminary Geologic Map of Quaternary Surficial Deposits in Southern California, Palm Springs 30' x 60' Quadrangle (Lancaster, et al, 2012) depicting the mapped geologic units in the vicinity of the site.

Figure 3: CGS Preliminary Geologic Map Quadrangle Palm Springs 30' x 60' Quadrangle (Lancaster, et al., 2012)



Qoa — **Old Alluvial Valley Deposits** - slightly to moderately consolidated, moderately dissected clay, silt, sand, and gravel along stream valleys and alluvial flats of larger rivers

gr — **Granitic and other intrusive crystalline rocks of all ages**

Groundwater: Groundwater was encountered within our exploratory boring B-01 (March 2016) at a depth of approximately 43 feet. Records compiled by the California Department of Water Resources (DWR) indicated one well (State Well 08S02E05A001S) located approximately 570 feet to the north of the subject site. On October 1, 1969, the depth to groundwater at this location was 26.0 feet below the existing ground surface. Records compiled in a report entitled "Hydrogeologic Evaluation and Water Resources Analysis of the Anza-Terwilliger Area, Riverside County, California", dated October 1990 and prepared by Ground Water Systems, Inc. includes groundwater monitoring records for two nearby wells. State Well No. 08S02E05B01, located approximately 1,800 feet to the west of the subject site was monitored on November 22, 1985. At that time, the depth to groundwater was 53.4 feet below the existing ground surface. State Well 08S02E04P01, located approximately

3,700 feet to the southeast of the site, was monitored on April 7, 1986. At that time, the depth to groundwater was 89.2 feet below the existing ground surface.

For purposes of our analysis, we have estimated the depth to historic high groundwater at the site to be 25 feet.

Surface Water: A very shallow seasonal drainage swale traverses through the southwesterly portion of the site, draining to the northwest. A review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), Map No. 06065C2800G, dated August 28, 2008, indicates that the site is located in an area designated as "Zone D". According to FEMA, the Zone D designation is used for areas where there are possible but undetermined flood hazards, as no analysis of flood hazards has been conducted. The designation of Zone D is also used when a community incorporates portions of another community's area where no map has been prepared (FEMA, 2015). Figure No. 4 shows a portion of the referenced FIRM Map indicating the site and mapped flood zone:

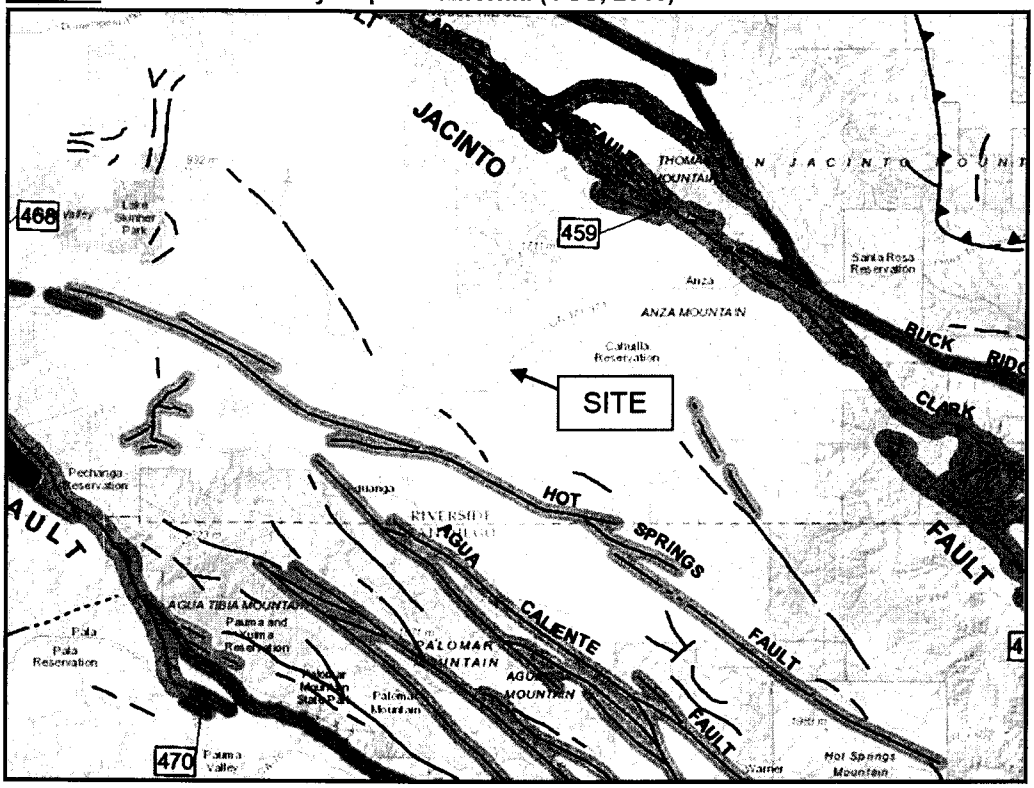
Figure 4: FEMA Flood Insurance Rate Map (FIRM), Map No. 06065C2800G, dated August 28, 2008

Faulting: There are at least 51 major late Quaternary active/potentially active faults that are within a 100-kilometer radius of the site (Blake, 2000). Of these, there are no faults known to traverse the site, based on published literature, nor were there any photogeologic or surficial geomorphic evidence suggestive of faulting on the site. In addition, the site is not located within a State of California "Alquist-Priolo Earthquake Fault Zone" for fault rupture hazard (Hart and Bryant, 2007) or within a mapped County of Riverside fault zone.

The nearest known active fault is the San Jacinto Fault (Anza segment), located approximately 8± miles to the northeast. The Anza segment of the San Jacinto Fault has an estimated maximum moment magnitude (Mw) earthquake of Mw7.2 and an associated slip-rate of 12.0 ±6.0 mm/year. The San Jacinto Fault Zone is not a continuous fault, but rather a series of complex fault zones overlapping strike-slip fault segments, steps and bends that traverse over a length of 210± kilometers extending from the northern San Bernardino Valley to the Mexican border. It is considered to be the most seismically active fault zone in southern California. Other known regional active faults that could affect the site include the Elsinore Fault (Temecula and Julian segments), and the San Andreas Fault.

Figure 5 shows a portion of the 2010 Fault Activity Map of California (CGS, 2010) depicting the site location and mapped faults in the vicinity. This map indicates that no active faults are present on the site, or trend toward the site.

Figure 5: 2010 Fault Activity Map of California (CGS, 2010)



Fault along which historic (last 200 years) displacement has occurred

Holocene fault displacement (during past 11,700 years) without historic record.

Late Quaternary fault displacement (during past 700,000 years).

Quaternary fault (age undifferentiated).

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement.

According to the U.S.G.S. 2008 National Seismic Hazard Maps - Source Parameters (USGS, 2008) and computer program EQSEARCH (Blake, 1989-2000b), the major faults influencing the site, approximate distances and model values for maximum earthquake magnitudes and slip rates are presented in Table 1.

Table 1: Fault Zone, Distances and Maximum Earthquake Magnitudes

Fault Zone	Approximate Distance (km)	Modal Earthquake Magnitude (M_w)	Modal Slip Rate (mm/yr)
San Jacinto-Anza	13.2	7.3	9
Elsinore-Julian	24.8	7.3	3
Elsinore-Temecula	25.6	6.5	5
San Jacinto-Coyote Creek	26.7	7.0	4
San Jacinto-San Jacinto Valley	28.2	7.0	18

Our evaluation of the potential for surface fault rupture at this site included an examination of two non-stereo and six stereo pairs of vertical black and white aerial photographs dating from 1974 to 2014 (see References for a listing) to aid in assessing the geologic and geomorphic characteristics with respect to the site and vicinity. The photogeologic analysis did not reveal indicators suggestive of active fault-related features. This included the lack of photolineations and/or no consistent tonal variations across the site, or trending toward the site.

Our review indicates that no documented active faults traverse toward the subject site, based on published literature. No surficial indications or geomorphic features were observed within the aerial photographs or field reconnaissance that are suggestive of active faulting.

Historic Seismic Activity: A computerized historical seismicity search, based on the ANSS composite catalog, accessed through the Northern California Earthquake Data Center (NCEDC, 2016), and using the computer program EQSEARCH (Blake, 1989-2000b) has been performed. The following table and discussion summarizes the known historic seismic events (≥M4.0) that have been estimated and/or recorded during the time period of 1800 to April 2016, within a 100-kilometer (62 mile) radius of the site

TABLE 2 - HISTORIC SEISMIC EVENTS; 1800-2016 (100 Kilometer Radius)

Richter Magnitude	No. of Events
4.0 - 4.9	441
5.0 - 5.9	38
6.0 - 6.9	7
7.0 - 7.9	1
8.0+	0

It should be noted that pre-instrumental seismic events (generally before 1932) have been estimated from isoseismal maps (Toppozada, et al., 1981 and 1982). These data

have been compiled generally based on the reported intensities throughout the region, thus focusing in on the most likely epicentral location. Instrumentation since 1932 has greatly increased the accuracy of locating earthquake epicenters. A summary of the historic earthquake data is as follows:

- The nearest estimated significant (≥M5.0) historic earthquake epicenter (pre-1932) was approximately 20 miles northwest of the site (April 21, 1918, M6.8).
- The largest estimated historical earthquake magnitude (pre-1932) is the December 8, 1812, M7.5 event, the epicenter thought to have occurred on the San Andreas Fault near Wrightwood, approximately 75 miles to the northwest.
- The largest recorded historical earthquake magnitude is the M7.3 Landers event that occurred on January 17, 1994, located approximately 58 miles to the northeast.

Seismic Parameters: The site coordinates (WGS 84) are 33.5097°N / -116.7895°W. On the bases of the subsurface conditions and local fault characteristics, the 2016 California Building Code provides the following seismic design parameters as presented in Table 3.

Table 3: 2016 CBC Seismic Design Parameters

Seismic Parameter	2016 CBC / ASCE 7-10 Reference	Value
Site Class	- - - / Table 20.3-1	D
S_s - Mapped Spectral Acceleration for Short Period	Fig. 1613.3.1(1) / Figure 22-1	1.500 g
S_1 - Mapped Spectral Acceleration for 1-sec Period	Fig. 1613.3.1(2) / Figure 22-2	0.600 g
F_a – Short Period Site Coefficient	Table 1613.3.3(1) / Table 11.4-1	1.0
F_V – Long Period Site Coefficient	Table 1613.3.3(2) / Table 11.4-2	1.5
S_{MS} – Maximum Considered Earthquake Spectral Response Acceleration, 5% damped, 0.2-sec period, adjusted for Site Class	Eq. 16-37 / Eq. 11.4-1	1.500 g
S_{M1} - Maximum Considered Earthquake Spectral Response Acceleration, 5% damped, 1-sec period, adjusted for Site Class	Eq. 16-38 / Eq. 11.4-2	0.900 g
S_{DS} - Design Earthquake Spectral Response Acceleration, 5% damped, 0.2-sec period	Eq. 16-39 / Eq. 11.4-3	1.000 g
S_{D1} - Design Earthquake Spectral Response Acceleration, 5% damped, 1-sec period	Eq. 16-40 / Eq. 11.4-4	0.600 g
MCE_G PGA – Maximum Considered Earthquake Geometric Mean for Site Class B	- - - / Figure 22-7	0.500
PGA_M – MCE_GPGA adjusted for Site Class	- - - / Eq. 11.8-1	0.5 g
Seismic Design Category	Sect. 1613A.3.5	D

All structures should be designed to at least meet the current California Building Code provisions; however, it should be noted that the building code is intended as a minimum design condition and is often the maximum level to which structures are designed. Structures that are built to minimum code requirements are designed to remain standing after an earthquake in order for occupants to safely evacuate, but then may have to ultimately be demolished (Larson and Slosson, 1992).

It is the responsibility of both the property owner and project structural engineer to determine the risk factors with respect to using CBC minimum design values for the subject project. The previously-outlined CBC seismic classifications and data have been provided for use by the project structural engineer, to aid in evaluating design criteria, if needed. This information should be used to help select the appropriate seismic parameters, as outlined in the California Building Code (CBC, 2016). In addition, a site-specific seismic shear-wave study could also be performed to properly evaluate the soil profile type for site classification and seismic design purposes.

Secondary Seismic Hazards: The primary geologic hazard affecting the project is that of ground shaking. Secondary permanent or transient seismic hazards generally associated with severe ground shaking during an earthquake include, but are not necessarily limited to; ground rupture, liquefaction, seiches or tsunamis, landsliding, rockfalls, and seismically-induced settlement. These are discussed below:

Ground Rupture: Ground rupture is generally considered most likely to occur along pre-existing faults. Since there are no faults that are known to traverse the site, the potential for ground rupture is considered to be low.

Liquefaction and Seismically-Induced Settlement: In general, liquefaction is a phenomenon that occurs where there is a loss of strength or stiffness in the soils that can result in the settlement of buildings, ground failures, or other hazards. The main factors contributing to this phenomenon are: 1) cohesionless, granular soils having relatively low density (usually of Holocene age); 2) shallow ground water (generally less than 50 feet); and 3) moderate to high seismic ground shaking.

Due to the presence of medium dense to very dense older alluvial soils at the site (refer to SUBSURFACE CONDITIONS section), the results of our analysis indicate that the potential for liquefaction and seismically induced settlement is negligible.

Seiches/Tsunamis: A seiche is a standing wave in an enclosed or partially enclosed body of water. In order for a seiche to form, the body of water needs to be at least partially bounded, allowing the formation of the standing wave.

Tsunamis are very large ocean waves that are caused by an underwater earthquake or volcanic eruption, often causing extreme destruction when they strike land.

There are no bodies of water on or adjacent to the project site. Based on the distance to large, open bodies of water and the elevation of the site with respect to sea level, it is our opinion that the potential for seiches/tsunamis does not present a hazard to this project.

Landsliding: Due to the relatively low-lying relief of the site and adjacent areas, the potential for landsliding due to seismic shaking is considered very low.

Rockfalls: Since no large rock outcrops are present at or adjacent to the site, the possibility of rockfalls during seismic shaking is nil.

Debris Flows: Debris flows are composed of a slurry-like mass of liquefied debris (ranging up to boulder size) that moves downhill under the force of gravity. Such slurries are dense enough to support very large particles but not solid enough to resist flowing downhill. Debris flows are most common in steep mountain canyons when a mass of mud and debris becomes saturated during a heavy rainstorm and suddenly begins to flow down the canyons (Prothero & Schwab, 1996). Based on the location of the site and the relatively planar topography of the property up-gradient of site, it is our opinion that the hazard of debris flow should be considered low.

Erosion: With the exception of the minor drainage swale traversing the southwesterly portion of the site, no indication of wind or water surface erosion was observed on the site or adjacent properties at the time of our study. It is our opinion that the hazard of erosion at this site should be considered low.

Other Geologic Hazards: There are other geologic hazards not necessarily associated with seismic activity that occur statewide. These hazards include; natural hazardous materials (methane gas, hydrogen-sulfide gas, tar seeps); Radon-222 Gas; regional subsidence, and naturally occurring asbestos. Of these hazards, there are none that appear to impact the site.

SUBSURFACE CONDITIONS

The field and laboratory exploration and testing indicate that the site is underlain by older alluvial soils typically consisting of fine- to medium-grained silty sand with variable amounts of clay (SM), fine- to coarse-grained sand with clay (SW-SC), fine- to medium-grained clayey sand (SC) and sand with silt (SW-SM). Approximately 2.5 feet of

artificial fill consisting of silty sand (SM) was encountered in our exploratory boring B-02. The artificial fill appears to be isolated to the easterly portion of the proposed building site and related to the grading for the existing fire house pad.

In general, the native alluvial soils encountered were medium dense to very dense, with field sampler penetration blow counts (N-values) ranging from 16 to more than 80.

Groundwater was encountered within our exploratory boring B-01 at a depth of approximately 43 feet. We have assumed a historic high groundwater depth of 25 feet in our analysis.

Laboratory testing indicates that the near surface on-site soils are expansive. Expansion index (EI) values of 41 and 49 were indicated by our laboratory testing

Consolidation testing of the native alluvial soil indicates that it is normally-consolidated. This testing also indicates that the soil is not subject to saturation collapse.

Analytical testing indicates the concentration of sulfates in the soil is less than 0.01 percent which is considered to be negligible with respect to sulfate attack on concrete. Chloride concentrations are less than 500 parts per million. The soil is slightly alkaline with a pH values of 7.8 and 8.4. The saturated minimum resistivity value ranged from 1,860 to 11,300 ohm-cm indicates that the site soils are potentially corrosive to buried metal. This should be addressed by a qualified corrosion engineer for elements of construction that may be subject to corrosion.

CONCLUSIONS AND RECOMMENDATIONS

On the basis of our field and laboratory exploration and testing, it is our opinion that the proposed construction is feasible from a geotechnical engineering standpoint. Existing site soils should be suitable for providing foundation support with appropriate recompaction, as recommended herein.

The primary issues requiring mitigation are the removal and recompaction of undocumented artificial fill and the presence of expansive soils. Expansive soil design criteria are recommended for concrete slabs-on-grade.

Analytical testing indicates that sulfate concentrations are very low. Per ACI 318, Table 4.2.1, the soil can be classified as Class S0 with respect to sulfate exposure. Chloride concentrations are also low. However, saturated resistivity values indicate that the site soils may be corrosive with respect to buried metal. This should be addressed by a qualified corrosion engineer for elements of construction that may be subject to corrosion.

Groundwater was encountered within our exploratory boring B-01 at a depth of approximately 43 feet. Data suggests that historical high groundwater elevations are on the order of 25 feet below the existing ground surface.

The following paragraphs present more detailed design criteria which have been developed on the basis of our field and laboratory exploration and testing.

Foundation Design: Foundations for the proposed fire station may consist of shallow spread footings with a slab-on-grade floor. For design, we recommend an allowable soil bearing capacity of 2,500 pounds per square foot. This value may be increased by ⅓ for short-term transient wind and seismic loads.

Conventional spread footings should have a minimum width of 12 inches and should be founded a minimum depth of 24 inches beneath the lowest adjacent final grade. Building footings should be supported by compacted fill over suitably dense alluvial soils. The fill thickness below footings should be at least equal to the footing width, or 12 inches, whichever is greater. Conditions encountered in our exploratory borings indicate that suitably dense native alluvial soil is present at a depth of approximately five feet below existing grades.

Static settlement of foundations properly designed and constructed as recommended herein is expected to be less than one inch total. Differential settlement between foundations of similar size and load is expected to be less than ½-inch in 40 feet.

The site is underlain by expansive soil. The 2016 CBC requires that slab-on-grade foundations on expansive soils be designed in accordance with WRI/CRSI Design of Slab-on-Ground Foundations (1981) or PTI Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils (2012). Recommended design parameters for use with these methods are presented in the "Concrete Slabs-on-Grade" section of this report.

If conventional slabs-on grade are utilized, they should be supported by at least four feet of imported non-expansive soil.

Lateral Design: Resistance to lateral loads will be provided by a combination of friction acting at the base of the slab or foundation and passive earth pressure. A coefficient of friction of 0.40 between soil and concrete may be used with dead load forces only. A passive earth pressure of 250 pounds per square foot, per foot of depth, may be used for the sides of footings poured against recompacted or dense native material. These values may be increased by ⅓ to provide for lateral loads of short duration such as those caused by wind or seismic forces. Passive earth pressure should be ignored within the upper one foot except where confined as beneath a floor slab, for example.

Trench Wall Stability: Significant caving did not occur within our exploratory borings. All excavations should be configured per the requirements of CalOSHA. We would classify the soils as Type C, per CalOSHA criteria. The classification of the soil and the shoring and/or slope configuration should be the responsibility of the contractor on the basis of the trench depth and the soil encountered. The contractor should have a "competent person" on-site for the purpose of assuring safety within and about all construction excavations.

Retaining Walls: Retaining walls may be necessary during construction and/or landscaping. For on-site soils, retaining walls should be designed for an active earth pressure equivalent to that exerted by a fluid weighing not less than 40 pounds per cubic foot (pcf).

For walls that are restrained, an "at-rest" lateral equivalent fluid pressure of 65 pounds per cubic foot is recommended, with the resultant applied at mid-height of the wall.

Any applicable construction and seismic surcharges should be added to the above pressures. Figure 6 presents a typical retaining profile.

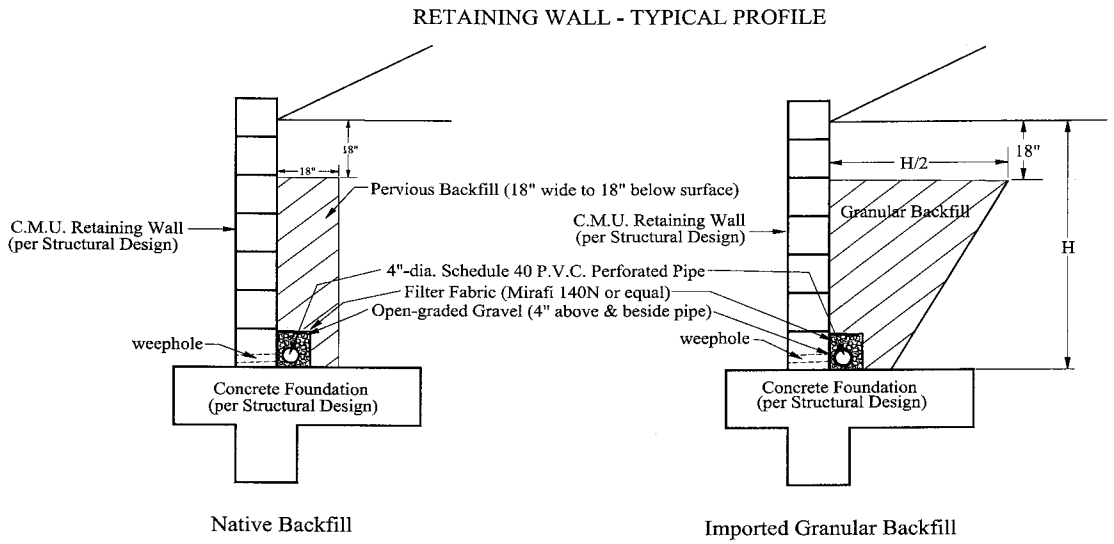


Figure 6: Typical Retaining Wall Profile

At least 12 inches of granular material should be used in the backfill behind the walls and water pressure should not be permitted to build up behind retaining walls. The upper 12 to 18 inches of the backfill should consist of soil having a low permeability (less than 10^{-6} cm/sec). All backfill should be non-expansive. A subdrain should be constructed along the base of the backfill. Typical recommended retaining wall backfill and drainage details are shown in the detail above.

Concrete Slabs-on-Grade: Our exploratory borings and laboratory testing indicate that potentially expansive soils are present throughout the project site and that expansive soil design criteria should be implemented for foundations and concrete slabs-on-grade. *If conventional slabs-on grade are utilized, they should be supported by at least four feet of imported non-expansive soil.*

The 2016 CBC requires that slab-on-grade foundations on expansive soils be designed in accordance with ***WRI/CRSI Design of Slab-on-Ground Foundations (1981)*** or ***PTI Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils (2012)***. The following table presents the design parameters for the WRI method:

Table 4: WRI Parameters

Parameter	Reference	Value
C_O	WRI Figure 5	2.0
C_S	WRI Figure 4	1.0
C_W	WRI Figure 14	15
Effective PI	minimum	15
1-C	WRI Figure 15	0.0

PTI design criteria for the design of post-tensioned slabs are presented in the following table:

Table 5: PTI Parameters

Parameter	Reference	Value
pF	Figure 5.11	4.0
Thornthwaite Index	Figure A3	-30
e_m edge lift	Section 5.10	4.5 ft.
y_m edge lift	Table 5.2 (a)	0.8 in.
e_m center lift	Section 5.10	9.0 ft.
y_m center lift	Table 5.2 (a)	0.2 in.

All concrete slabs-on-grade should have a minimum thickness of four inches. During final grading and prior to the placement of concrete, all surfaces to receive concrete slabs-on-grade should be compacted to maintain a minimum compacted fill thickness of 12 inches.

Load bearing slabs may be designed using a modulus of subgrade reaction not exceeding 125 pounds per square inch per inch.

Slabs that are designed and constructed per the provisions of the American Concrete Institute (ACI) as a minimum will perform much better and will be more pleasing in appearance. Shrinkage of concrete should be anticipated. This will result in cracks in all concrete slabs-on-grade. Shrinkage cracks may be directed to saw-cut "control joints" spaced on the basis of slab thickness and reinforcement. ACI typically recommends control joint spacing in unreinforced concrete at maximum intervals equal to the slab thickness times 24. A level subgrade is also an important element in achieving some "control" in the locations of shrinkage cracks. Control joints should be cut immediately following the finishing process and prior to the placement of the curing cover or membrane. Control joints that are cut on the day following the concrete placement are generally ineffective. The placement of reinforcing steel will help in reducing crack width and propagation as-well-as providing for an increase in the control joint spacing. The use of welded wire mesh has typically been observed to be of limited value due to difficulties and lack of care in maintaining the level of the steel in the concrete during placement. The addition of water to the mix to enhance placement and workability frequently results in an excessive water-cement ratio that weakens the concrete, increases drying times and results in more cracking due to concrete shrinkage during the initial cure.

Where slabs are to receive moisture sensitive floor coverings, we recommend the use of a vapor retarder. There are various products manufactured for this purpose. ASTM currently provides a standard water vapor permeance of 0.3 perms. Such materials would allow up to 18 gallons of water per week in a 50,000-square foot area. Therefore, it should be understood that these materials are not vapor "barriers". Some flooring applications may require more effective retarders. Therefore, the selection of the vapor retarder should be based upon the type of flooring material and is not considered to be a geotechnical engineering design parameter.

Vapor retarders should have a minimum thickness of 10-mil unless otherwise specified. It is possible that the retarders will be exposed to equipment loads such as ready-mix trucks, buggies, laser screeds, etc. In such cases, the thickness should be increased to at least 15-mil. Vapor retarders should be placed between two 2-inch thick layers of sand to reduce the potential of punctures and to aid in the curing process. In lieu of this, the concrete may be placed directly upon the vapor retarder but should be designed with reinforcement to offset additional curling stresses. Seams and holes made for underground utilities should be properly sealed per the recommendations of the manufacturer.

The vapor retarder recommended in the preceding paragraphs is a common method of reducing the migration of moisture through the slab. It will not prevent all moisture migration through the slab nor will it prohibit the formation of mold or other moisture related problems. For moisture sensitive floor coverings, an expert in that field should be consulted to properly design a vapor retarder suitable for the specific application.

If concrete is to be placed on a dry absorptive subgrade in hot and dry weather, the subgrade should be dampened but not to a point that there is freestanding water prior to placement. The formwork and reinforcement should also be dampened.

Concrete Pavement Design: We recommend that all surfaces that will support fire apparatus be paved with Portland cement concrete (PCC). All surfaces to receive concrete paving should be underlain by a minimum compacted fill thickness of 12 inches (excluding aggregate base).

On the basis of an assumed R-value of 20, we recommend a pavement section consisting of 9 inches of PCC over 12 inches of Class 2 aggregate base. The concrete should have a minimum 28-day modulus of rupture of 600 psi. This corresponds to a compressive strength of approximately 4,500 psi. The Class 2 aggregate base should comply with current Caltrans requirements. The aggregate base should be compacted to at least 95 percent relative compaction based on ASTM D1557. The upper 12 inches of pavement subgrade soil, below the aggregate base, should also be compacted to a minimum relative compaction of 95 percent.

The above recommendations are based on the assumption that the concrete pavement will be constructed with doweled joints. We have also assumed that the concrete pavement will be restrained laterally by concrete curb/gutter or building foundations and that the edges of the concrete will be protected from traffic loads by curbs or paved shoulders. If unrestrained pavement edges or non-doweled joints are desired, this firm should be contacted so that revised recommendations can be developed.

Construction joints should be sawcut in the pavement at a maximum spacing of 30 times the thickness of the slab, up to a maximum of 15 feet. Pavement sawcutting should be performed within 12 hours of concrete placement, preferably sooner. Sawcut depths should be equal to approximately ¼ of the slab thickness for conventional saws or one inch when early-entry saws are utilized on slabs nine inches thick or less. Construction joints should not be placed near flow lines. The use of plastic strips for formation of jointing is not recommended. The use of expansion joints is not recommended, except where the pavement will adjoin structures.

During site grading, R-value testing of pavement subgrade soils should be performed to confirm that the above recommended pavement section is appropriate.

General Site Grading: All grading should be performed per the applicable provisions of the 2016 California Building Code. The following specifications have been developed on the basis of our field and laboratory testing:

1. **Clearing and Grubbing:** All building, slab and pavement areas and all surfaces to receive compacted fill should be cleared of existing undocumented fill, loose soil, vegetation, debris, and other unsuitable materials. We recommend a minimum overexcavation of at least 24 inches to provide assurance of processing loose and disturbed soils. *All existing undocumented fill should be removed. The undocumented fill is suitable for reuse as compacted fill.*

   Abandoned underground utility lines should be traced out and completely removed from the site. Each end of the abandoned utility line should be securely capped at the entrance and exit to the site to prevent any water from entering the site. Soils loosened due to the removal of trees should be removed and replaced as controlled compacted fill under the direction of the geotechnical engineer.

2. **Preparation of Building Area:** The proposed fire station building area should be overexcavated to the depth necessary to provide at least 12 inches of compacted fill below footing bottoms, or to a depth equal to the footing width, whichever is deeper. The overexcavated area should extend outside of the exterior footing lines for a distance of at least five feet, where possible. Following over-excavation, the surface should be prepared as recommended below in the following section, Preparation of Surfaces to Receive Compacted Fill.

3. **Preparation of Surfaces to Receive Compacted Fill:** All surfaces to receive compacted fill should be subjected to compaction testing prior to processing. Testing should indicate a relative compaction of at least 85 percent within the unprocessed native soils. If roots or other deleterious materials are encountered or if the relative compaction fails to meet the acceptance criterion, additional overexcavation will be required until satisfactory conditions are encountered. Upon approval, surfaces to receive fill should be scarified, brought to near optimum moisture content, and compacted to a minimum of 90 percent relative compaction.

4. **Placement of Compacted Fill:** Fill materials consisting of on-site soils or approved imported granular soils should be spread in shallow lifts and compacted at near optimum moisture content to a minimum of 90 percent relative compaction. Depending on weather conditions preceding construction, the soils may be at very high moisture contents and could require drying back or

processing to achieve stability prior to and during fill placement. This should be investigated by the grading contractor prior to the commencement of site grading.

5. **Preparation of Slab and Paving Areas:** During site grading and prior to placement of aggregate base, R-value testing of the pavement subgrade soils should be performed to confirm that the pavement section recommended is appropriate. All surfaces to receive asphalt concrete paving or concrete slabs-on-grade should be processed and tested to assure compaction for a depth of at least of 12 inches. This may be accomplished by a combination of overexcavation, scarification and recompaction of the surface, and replacement of the excavated material as controlled compacted fill. Compaction of the slab areas should be to a minimum of 90 percent relative compaction. Compaction within the proposed pavement areas should be to a minimum of 95 percent relative compaction for both the subgrade and base course.

6. **Utility Trench Backfill:** Utility trench backfill consisting of the on-site soil types should be placed by mechanical compaction to a minimum of 90 percent relative compaction. This is with the exception of the upper 12 inches under pavement areas where the minimum relative compaction should be 95 percent. Jetting of the native soils is not recommended.

7. **Testing and Observation:** During grading, tests and observations should be performed by the project geotechnical engineer or his/her representative to verify that the grading is being performed per the project specifications. Field density testing should be performed per ASTM D1556 or ASTM D6938. The minimum acceptable degree of compaction should be 90 percent of the maximum dry density as obtained by the ASTM D1557 test method except where superseded by more stringent requirements, such as beneath pavement. Where testing indicates insufficient density, additional compactive effort should be applied until retesting indicates satisfactory compaction.

   Testing should also be conducted to verify that the soils will not subject concrete to sulfate attack and are not corrosive. Testing of any proposed import will be necessary prior to placement on the site. Testing of on-site soils may be done on either a selective or random basis as site conditions indicate.

GENERAL

The findings and recommendations presented in this report are based upon an interpolation of the soil conditions between boring locations. Should conditions be encountered during grading that appear to be different than those indicated by this report, this office should be notified.

This report was prepared prior to the preparation of a grading plan for the project. We recommend that a pre-job conference be held on the site prior to the initiation of site grading. The purpose of this meeting will be to assure a complete understanding of the recommendations presented in this report as they apply to the actual grading performed.

This report was prepared for the CAL FIRE/ Riverside County Fire Department for their use in the design of the proposed apparatus bay at the County of Riverside Fire Station No. 77. This report may only be used by the CAL FIRE/ Riverside County Fire Department for this purpose. The use of this report by other parties or for other purposes is not authorized without written permission by Inland Foundation Engineering, Inc. Inland Foundation Engineering, Inc. will not be liable for any projects connected with the unauthorized use of this report.

The recommendations of this report are considered to be preliminary. The final design parameters may only be determined or confirmed at the completion of site grading on the basis of observations made during the site grading operation. To this extent, this report is not considered to be complete until the completion of both the design process and the site preparation.

LIMITATIONS

The findings and recommendations of this report are based upon an interpolation of soil conditions between test locations. It is likely that conditions occur between borings that are different than those indicated in this report. Should such conditions be encountered during construction, our office should be notified in order to determine if revisions or retesting are warranted.

Evaluation of hazardous waste was not within the scope of services provided. The evaluation of seismic hazards was based upon field mapping and literature review. The information in this report represents professional opinions that have been developed 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, either expressed or implied, is made as to the professional advice included in this report.

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APPENDIX A – FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

For our field exploration, two exploratory borings were excavated by means of a truck mounted rotary auger rig at the approximate locations shown on Figure No. A-5. Logs of the materials encountered were made on the site by a staff geologist. These are presented on Figure Nos. A-3 through A-4.

Representative relatively undisturbed samples were obtained within our borings by driving an 18-inch long thin-walled steel penetration sampler (SPT) with successive 30-inch drops of a 140-pound hammer. The number of blows required to achieve each six inches of penetration were recorded on our boring logs and used for estimating the relative consistency of the subsoils. Two different samplers were used. The first sampler used was a Standard Penetration Test Sampler (SPT) for which published correlations relating the number of hammer blows to the strength of the soil are available. The second sampler type was a modified California split barrel sampler, which is larger in diameter, carrying brass sample rings having inner diameters of 2.41 inches. Relatively undisturbed samples were removed from the sampler and placed in moisture sealed containers in order to preserve the natural soil moisture content. They were then transported to our laboratory for further observations and testing.

Representative bulk samples were also obtained and returned to our laboratory for further testing and observations. The results of this testing are discussed and presented in Appendix B.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

PRIMARY DIVISIONS			GROUP SYMBOLS		SECONDARY DIVISIONS
COARSE GRAINED SOILS – MORE THAN HALF OF MATERIALS IS LARGER THAN #200 SIEVE SIZE	GRAVELS – MORE THAN HALF OF COARSE FRACTION IS LARGER THAN #4 SIEVE	CLEAN GRAVELS (LESS THAN) 5% FINES	GW		WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP		POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVEL WITH FINES	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS – MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN #4 SIEVE	CLEAN SANDS (LESS THAN) 5% FINES	SW		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP		POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM		SILTY SANDS, SAND-SILT MIXTURES
			SC		CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS – MORE THAN HALF OF MATERIALS IS SMALLER THAN #200 SIEVE SIZE	SILTS AND CLAYS – LIQUID LIMIT IS LESS THAN 50		ML		INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL		ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS – LIQUID LIMIT IS GREATER THAN 50		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
	HIGHLY ORGANIC SOILS		PT		PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS
TYPICAL FORMATIONAL MATERIALS	SANDSTONES		SS		
	SILTSTONES		SH		
	CLAYSTONES		CS		
	LIMESTONES		LS		
	SHALE		SL		

CONSISTENCY CRITERIA BASES ON FIELD TESTS

RELATIVE DENSITY – COARSE – GRAIN SOIL

RELATIVE DENSITY	SPT * (# BLOWS/FT)	RELATIVE DENSITY (%)
VERY LOOSE	<4	0-15
LOOSE	4-10	15-35
MEDIUM DENSE	10-30	35-65
DENSE	30-50	65-85
VERY DENSE	>50	85-100

CONSISTENCY – FINE-GRAIN SOIL

CONSISTENCY	SPT* (# BLOWS/FT)	TORVANE UNDRAINED SHEAR STRENGTH (tsf)	POCKET ** PENETROMETER UNCONFINED COMPRESSIVE STRENGTH (tsf)
Very Soft	<2	<0.13	<0.25
Soft	2-4	0.13-0.25	0.25-0.5
Medium Stiff	4-8	0.25-0.5	0.5-1.0
Stiff	8-15	0.5-1.0	1.0-2.0
Very Stiff	15-30	1.0-2.0	2.0-4.0
Hard	>30	>2.0	>4.0

* NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1 3/8 INCH I.D.) SPLIT BARREL SAMPLER (ASTM -1586 STANDARD PENETRATION TEST)

** UNCONFINED COMPRESSIVE STRENGTH IN TONS/SQ.FT. READ FROM POCKET PENETROMETER

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
DRY	Absence of moisture, dusty, dry to the touch
MOIST	Damp but no visible water
WET	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbled or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

LOG OF BORING B-01

Elevation:	+/- 3464	Date(s) Drilled:	3/22/16	Logged by:	DRL
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	L-10-T			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	USCS	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
	SC		■	B				
		☒		SS	8	7	100	
	SM		■	B	8			
5		☒		SS	14	8	117	
					35			
	SW SC	☒		SS	30	9	121	
				B	50/6"			
10								
	SW SC	☒		SS	22	22	108	
					42			
15	SC							
		☒		SS	30	12	119	
					45			
20								
	SC	☒		SS	20	18	110	
					34			
25								
	SW SM	☒		SPT	15	14		
					25			
30		☒		SPT	17	12		
					24			
35	SM							
		☒		SPT	15	13		
					23			
40		☒		SPT	15	15		
					18			
	SW SM							
45		☒		SPT	18	15		
					24			
50		☒		SPT	20	16		
					27			

SC **CLAYEY SAND,** fine- to medium-grained, brown (10YR 3/3), moist, loose to medium dense. Weakly cemented.

SM **SILTY SAND,** fine- to medium-grained with clay, light brown (2.5Y 5/3), moist, medium dense to dense. Well cemented.

SW SC **SAND,** with clay and silt, fine- to coarse-grained, light brown (2.5Y 5/3), moist, dense. Slightly cemented. Interbedded with occasional clays.

SW SC **SAND,** with trace clay, fine- to coarse-grained, light brown (2.5Y 5/4), moist, dense. Moderately cemented.

SC **CLAYEY SAND**, fine- to medium-grained with trace coarse, light brown (10YR 3/3), moist, dense. Well cemented.

SC **CLAYEY SAND**, fine- to medium-grained, brown (10YR 4/3), moist, dense. Well cemented.

SW SM **SAND,** with silt and trace clay, fine- to medium-grained, light brown (10YR 5/4), moist, dense. Moderately cemented, micaceous.

SM **SILTY SAND,** fine- to medium-grained with clay, red-brown (10YR 5/3), moist, medium dense to dense. Moderately cemented.

▽

SW SM **SAND,** with silt and trace clay, fine- to medium-grained, red brown (2.5Y 5/3), very moist to wet, dense. Moderately cemented.

End of boring at 51.5 feet. Groundwater encountered at 43'-4".

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Apparatus Bay - FS #77
Aguanga, CA
Project No. R007-046

Figure No. **A-3**

LOG OF BORING B-02

Elevation:	+/- 3467	Date(s) Drilled:	3/22/16	Logged by:	DRL
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	L-10-T			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	USCS	Description	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
		ARTIFICIAL FILL, Silty sand, fine-to medium-grained, brown, moist, medium dense.			B				
	SM	**SILTY SAND,** with clay, fine-to medium-grained with trace coarse, with trace clay, brown, slightly moist, medium dense to dense.			B				
5	SM	**SILTY SAND,** with clay, fine-to medium-grained with trace coarse, with trace clay, brown, slightly moist, medium dense to dense.			SS	21 45	7	113	
	SW SC	**SAND,** with clay, fine- to medium-grained, light brown (2.5Y 5/4), moist, dense. Moderately cemented.			SS	27 36	17	111	
10	SW	**SAND,** fine- to coarse-grained, light brown (2.5Y 5/3), moist, dense.			SS	39 39	8	110	
15	SC	**CLAYEY SAND**, fine- to medium-grained with trace coarse, brown (2.5Y 5/3), moist, dense. Well cemented.			SS	26 39	15	113	
20					SS	23 34	14	114	
		End of boring at 21.5 feet. No groundwater encountered.							

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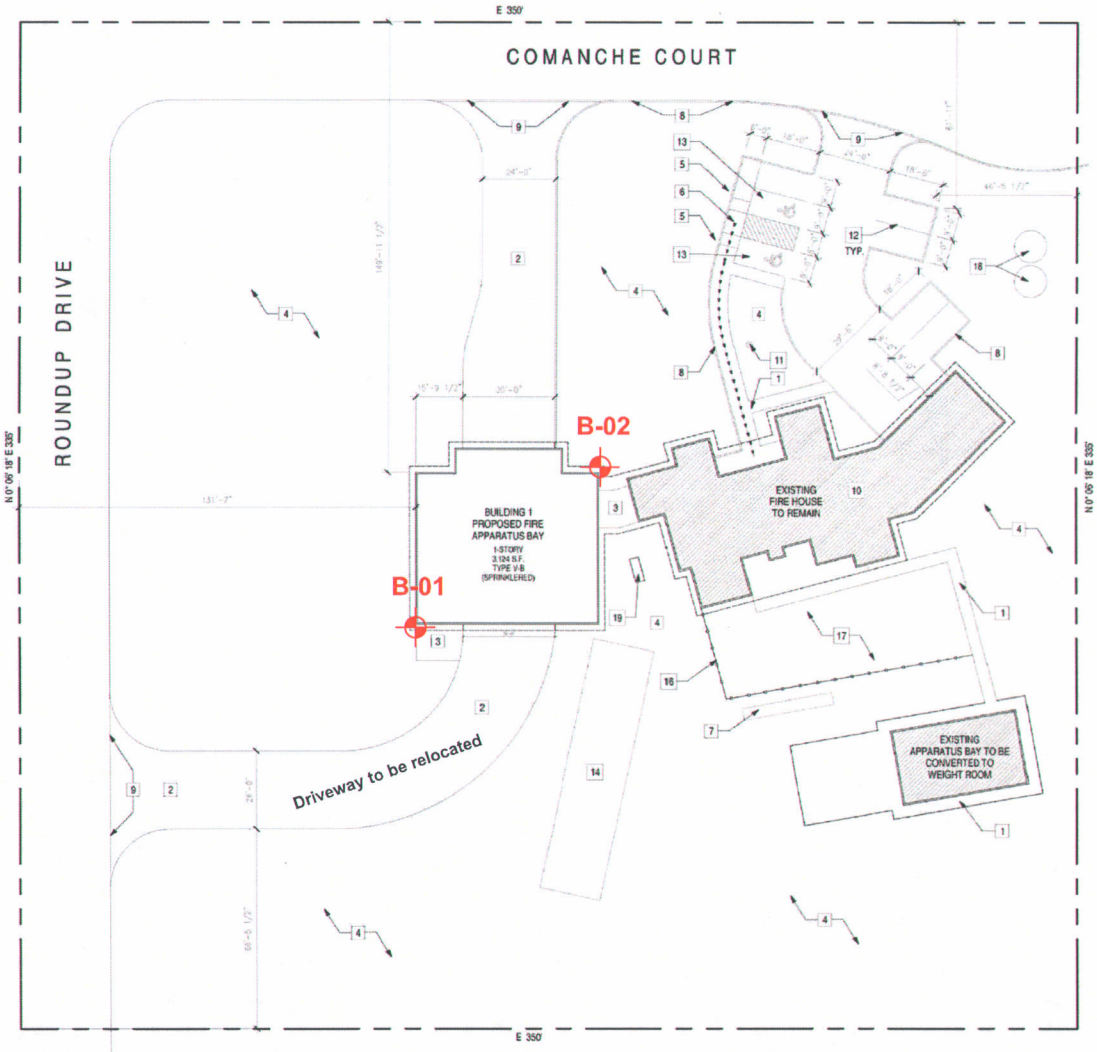
Apparatus Bay - FS #77
Aguanga, CA
Project No. R007-046

Figure No. **A-4**



SITE PLAN

RIVERSIDE COUNTY FIRE STATION 77
49937 COMANCHE COURT
AGUANGA AREA, RIVERSIDE COUNTY, CALIFORNIA

LEGEND

= Approximate Location of Exploratory Boring

INLAND FOUNDATION ENGINEERING, INC.
1310 South Santa Fe Avenue
San Jacinto, California
(951) 654-1555 FAX (951) 654-0551

DRAWN BY: ES	JOB NO.: R007-046	
SCALE: 1" = 40'	DATE: March 2017	A-5

APPENDIX B – Laboratory Testing

APPENDIX B

LABORATORY TESTING

Representative bulk soil samples were obtained in the field and returned to our laboratory for additional observations and testing. Laboratory testing was generally performed in two phases. The first phase consisted of testing in order to evaluate the apparent compaction of the existing soil and the general engineering classifications of the soils across the site. This testing was performed in order to estimate the engineering characteristics of the soil and to serve as a basis for selecting samples for the second phase of testing. The second phase consisted of soil mechanics and analytical testing. This testing included direct shear testing, consolidation testing, expansion index testing, and testing to estimate the concentration of water-soluble sulfate, pH, resistivity and chlorides. These tests were performed in order to provide a means of developing specific design recommendations based on the strength and corrosive characteristics of the soil.

CLASSIFICATION AND COMPACTION TESTING

Unit Weight and Moisture Content: Each ring sample was weighed and measured to evaluate its unit weight. A small portion of each sample was then subjected to testing to evaluate its moisture content. This testing was performed per the current ASTM Standards D2937 and D2216. This was used in order to evaluate the dry density of the soil in its in-situ condition. The results of this testing are shown on the boring logs (Figure Nos. A-3 through A-4).

Maximum Density-Optimum Moisture: A representative soil type was selected for maximum density testing per the current ASTM D1557 test method A. The results of this testing are presented graphically on Figure No. B-4. The maximum density is compared to the field density of the soil to evaluate the existing relative compaction.

Classification Testing: Two soil samples were selected for classification testing. This testing consists of mechanical grain size analyses and Atterberg limit tests. This testing was performed per ASTM D422 and D4318. These tests provide information for developing classifications for the soil in accordance with the Unified Classification System. This classification system categorizes the soil into groups having similar engineering characteristics. The results of this testing are useful in detecting variations in the soils and in selecting samples for further testing. The results of this testing are presented on Figure No. B-5.

SOIL MECHANICS TESTING

Direct Shear Testing: One sample was selected for direct shear testing. This testing was performed per the current ASTM Standard D3080. This testing measures the shear strength of the soil under various normal pressures and is used in developing parameters for foundation design. Testing was performed using test specimens which were saturated prior to testing. Testing was performed using a strain controlled test apparatus with normal pressures ranging from 500 to 2,500 pounds per square foot. The results of this testing are shown on Figure No. B-6.

Consolidation Testing: One sample was selected for consolidation testing. This testing was performed per the current ASTM Standard D2435. For this test, a relatively undisturbed sample was selected and trimmed into a one inch thick by 2.5-inch diameter consolidometer. The consolidometer was moisture sealed in order to preserve the moisture content of the sample during the initial stages of testing. Loads ranging from 325 to 20,800 pounds per square foot were applied progressively with the rate of settlement declining to a value of 0.0002 inches per hour prior to the application of each subsequent load. At a preselected load, water was introduced into the consolidometer in order to observe the potential for saturation collapse. The results of this testing are presented graphically on Figure No. B-7.

Analytical Testing: Two samples were selected to evaluate the concentration of soluble sulfates, chlorides, pH level, and resistivity of and within the on-site soils. The following table presents the results of this testing:

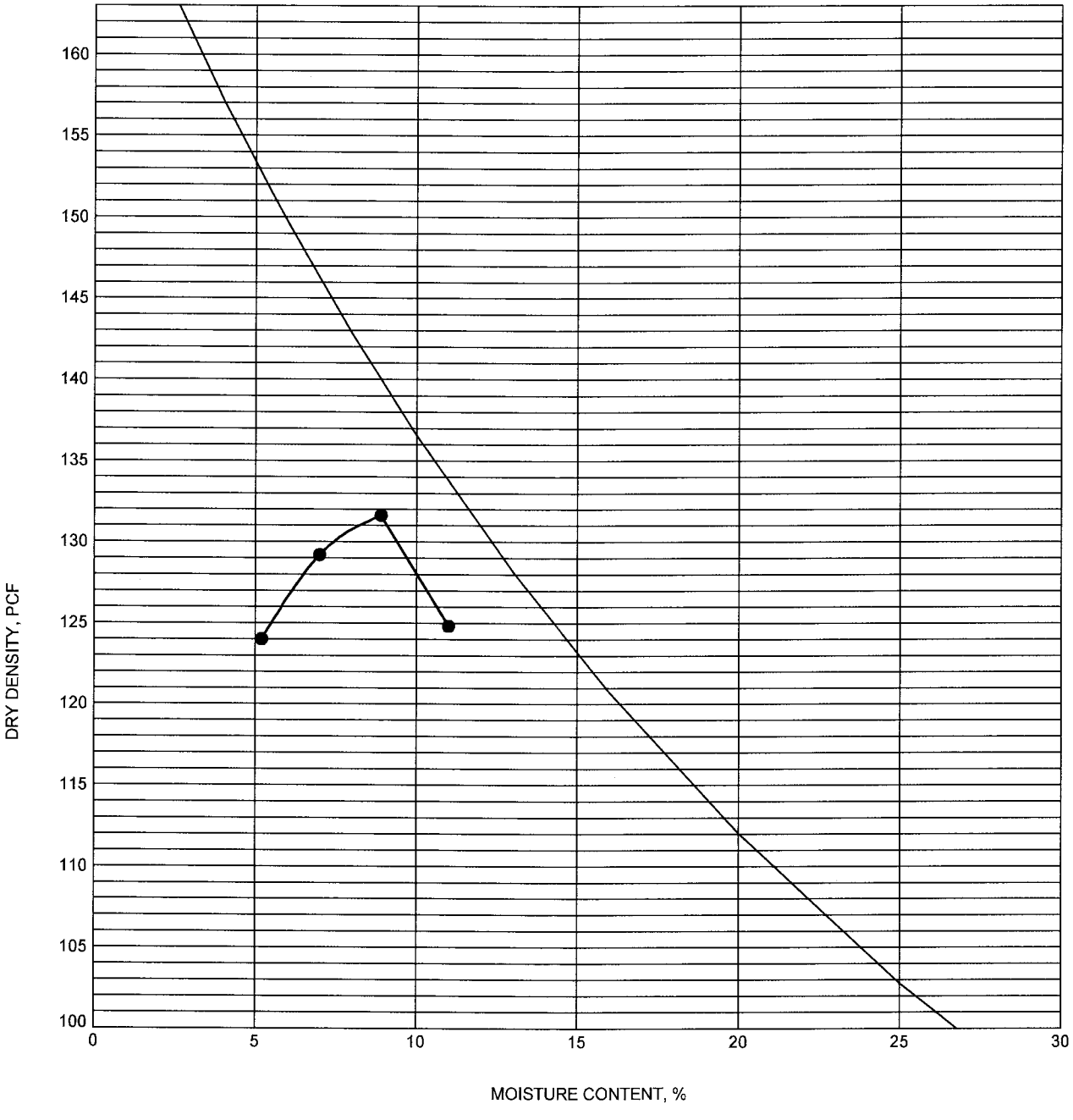
Sample Location	Sample Depth (ft.)	Water-Soluble Sulfates (%)	Chlorides (ppm)	Minimum Resistivity (ohm-cm)	pH
B-01	0.0-2.8	<0.01	420	11,300	8.4
B-01	2.8-7.0	<0.01	330	1,860	7.8

Expansion Index Testing: Two samples were selected for expansion index testing per the current ASTM Standard D4829. This testing consists of remolding 4-inch diameter by 1-inch thick test specimens to a moisture content and dry density corresponding to approximately 50 percent saturation. The samples are subjected to a surcharge of 144 pounds per square foot and allowed to reach equilibrium. At that point the specimens are inundated with distilled water. The linear expansion is then measured until complete. The results of this testing are shown below.

Sample Location	Sample Depth (feet)	Initial Dry Density (pcf)	Initial Moisture Content (%)	Expansion Index	Expansion Class
B-01	0.0-2.8	116.0	7.6	41	Low
B-01	2.8-7.0	117.1	7.9	49	Low

GENERAL

All laboratory testing has been conducted in conformance with the applicable ASTM test methods by personnel trained and supervised in conformance with our QA/QC policy. Our test data only relates to the specific soils tested. Soil conditions typically vary and any significant variations should be reported to our laboratory for review and possible testing. The data presented in this report are for the use of CAL FIRE/ Riverside County Fire Department only and may not be reproduced or used by others without written approval of Inland Foundation Engineering, Inc.



Specimen Identification		Classification	Max.Density	MC%
● B-01	0.0	**CLAYEY SAND SC**	**132.0**	**8.5**

PROJECT Geotechnical Investigation
Apparatus Bay - FS #77

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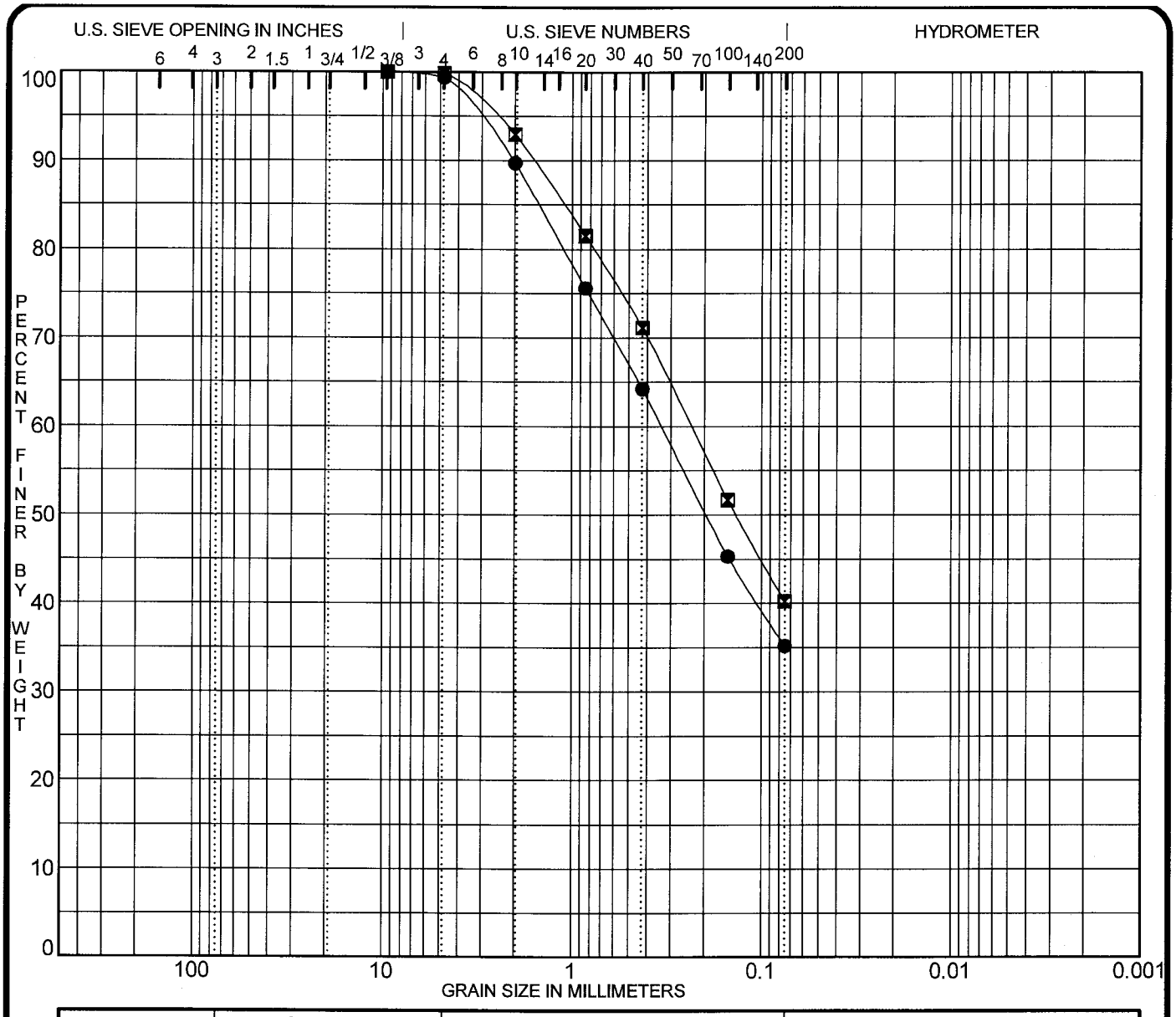
MAXIMUM DENSITY-OPTIMUM MOISTURE CURVES (ASTM D1557)

Inland Foundation Engineering, Inc.

FIGURE NO. B-4



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	S.G.	LL	PL	PI	Cc	Cu
● B-01	0.0	**CLAYEY SAND SC**		**28**	**20**	**8**		
⊠ B-01	2.8	**CLAYEY SAND SC**		**28**	**15**	**13**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-01	0.0	**9.50**	**0.34**			**0.6**	**64.2**	**35.2**	
⊠ B-01	2.8	**9.50**	**0.23**			**0.2**	**59.5**	**40.3**	

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GRADATION CURVES (ASTM D422, ASTM D4318)

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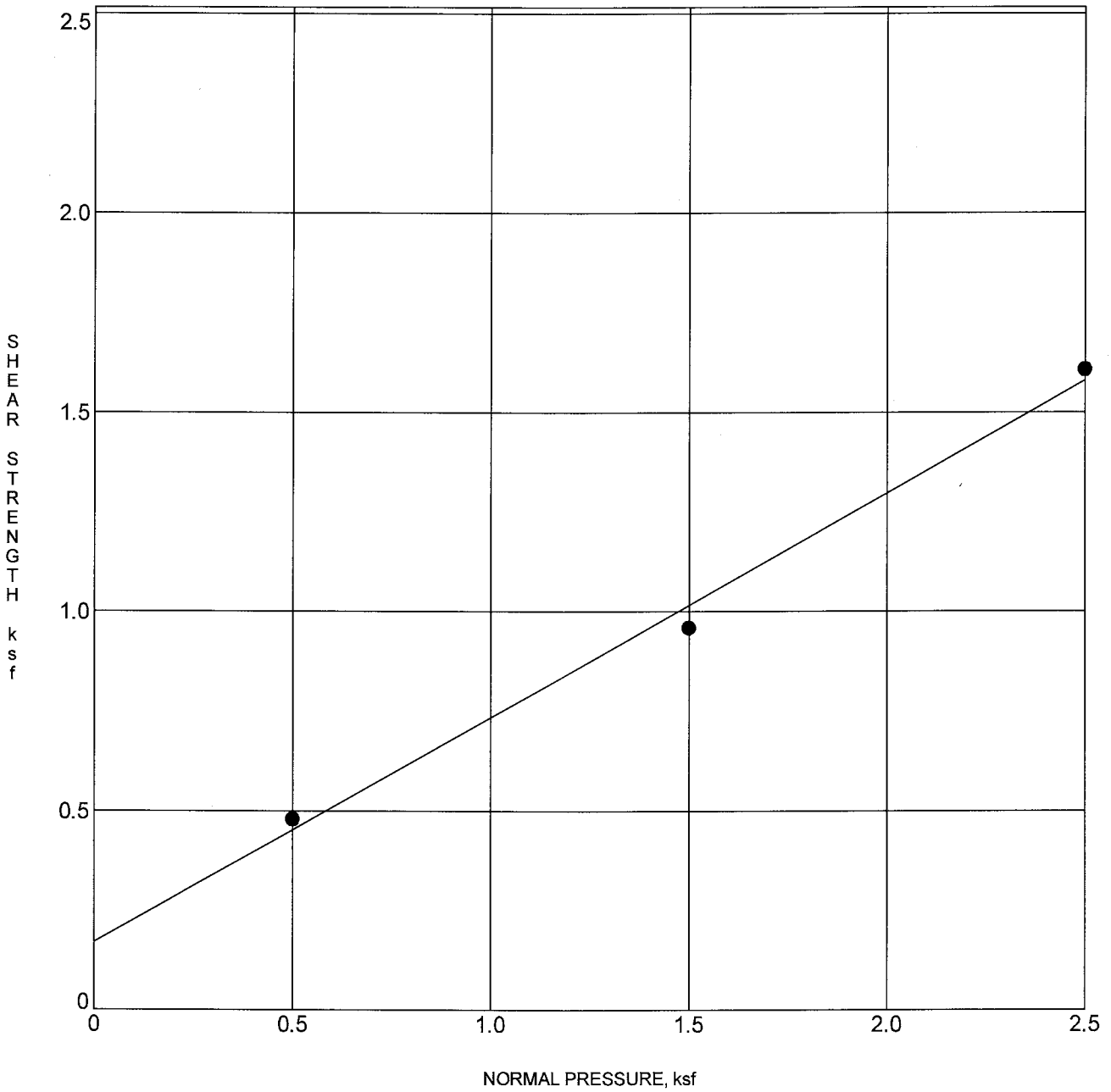
FIGURE NO. B-5



	Specimen Identification		Classification	Phi	Cohesion	DD	MC%
●	B-01	1.5	CLAYEY SAND SC	29	0.170	107	8

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SHEAR TEST DIAGRAM (ASTM D3080)

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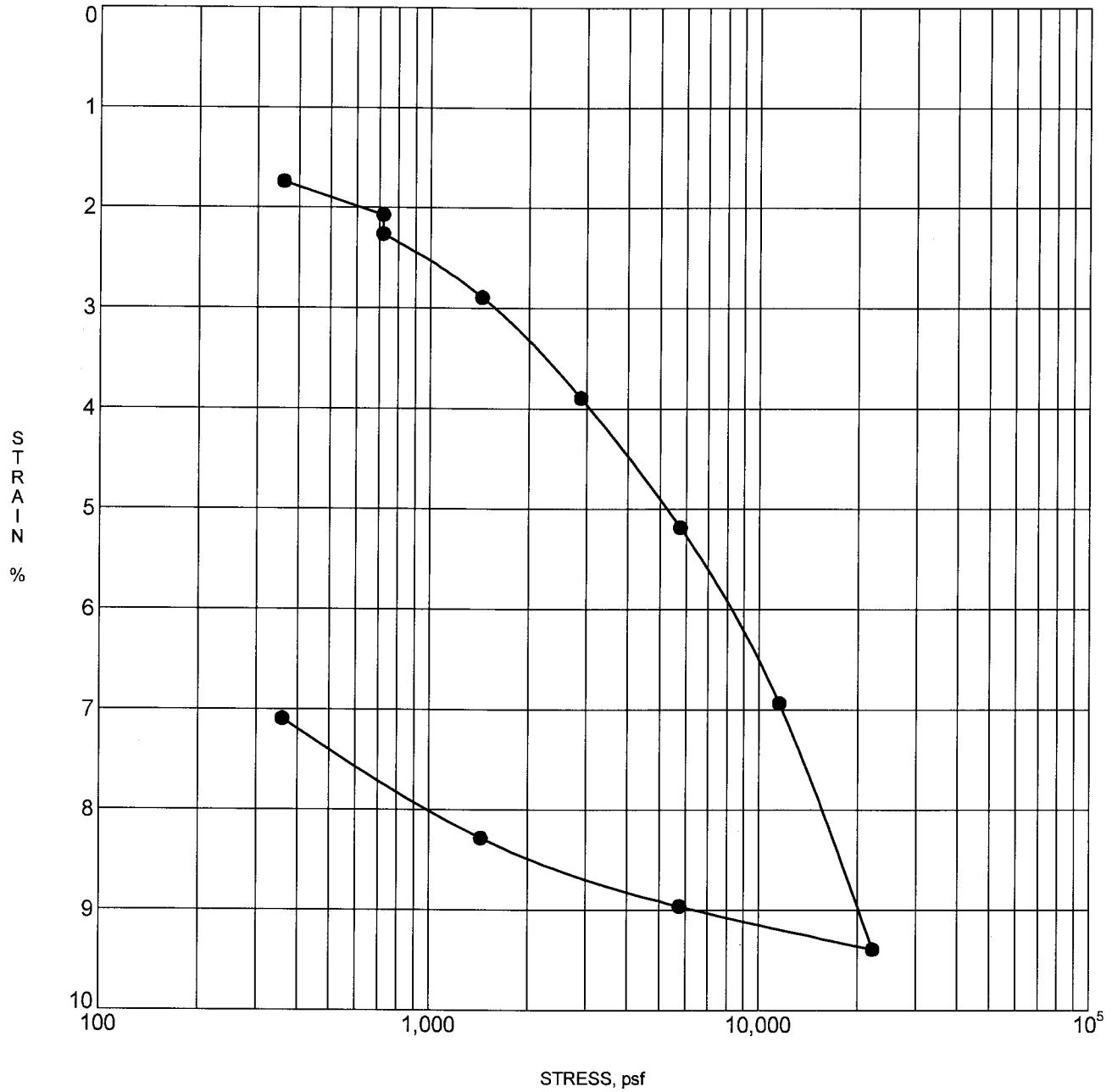
FIGURE NO. B-6



Specimen Identification		Classification	DD	MC%
● B-01	3.5	**SILTY SAND SM**	**117**	**8**

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CONSOLIDATION TEST (ASTM D2435)

Inland Foundation Engineering, Inc.

FIGURE NO. B-7

APPENDIX D

MITIGATION MONITORING AND REPORTING PROGRAM

RIVERSIDE COUNTY FIRE STATION #77
EXPANSION PROJECT

Lake Riverside Community, Riverside County, California

COUNTY OF RIVERSIDE
EDA
ECONOMIC DEVELOPMENT AGENCY

November 2017

MITIGATION MONITORING AND REPORTING PROGRAM

FIRE STATION #77 EXPANSION PROJECT

Community of Lake Riverside, Riverside County, California

COUNTY OF RIVERSIDE
EDA
ECONOMIC DEVELOPMENT AGENCY

The proposed Project site is located at 49937 Comanche Court in the southwestern portion of unincorporated Riverside County in the community of Lake Riverside. The Project is located on a 2.69-acre County-owned property consisting of one parcel, Assessor's Parcel Number 580-240-022, and bordered by Roundup Drive on the west, Comanche Court on the north, vacant land to the south and east, and a combination of residential and vacant land extending beyond the adjacent properties. The existing site is previously developed with the Fire Station 77, and currently has three access points to the property, two 500 gallon water tanks, a concrete pad containing the approximately 1,000 square-foot firetruck garage, and the main building comprising the 3,222 square-foot Fire Station residence.

The proposed Project consists of the expansion of the existing Fire Station #77. Specifically, the expansion includes the construction of an approximately 3,370 square-foot apparatus bay adjacent to the west of the existing Fire Station #77. The existing access points which currently consist of dirt roads, would be paved and reconfigured to facilitate ingress/egress into the Project site, with a paved parking lot in front of the existing station. The Project also entails the construction of drainage facilities and retention basins to ensure that no impacts from stormwater occur during operation of the Project. The new apparatus bay would contain two bays, a workshop, a restroom, a storage area, an entry hall, and locker room.

The Project would also involve some utility alterations to provide service to the new building. Construction is anticipated to start in early 2018 and would be completed by the end of 2018/beginning of 2019. The implementation of the proposed Project would not require additional staff or engines and would meet the goal of balancing the efficiency of operation with the provision of quality fire services to surrounding residents in the County. Mitigation measures were identified in the Project's Initial Study and incorporated into the Project to reduce potential environmental impacts to a level determined to be less than significant.

Section 21081.6 of the California Public Resources Code requires a Lead Agency to adopt a *reporting or monitoring program for the changes made to the project or conditions of project approval, adopted in order to mitigate or avoid significant effects on the environment.* Section 15097 of the *State CEQA Guidelines* summarizes the criteria required for mitigation monitoring and/or reporting. This Mitigation Monitoring and Reporting Program (MMRP) has been compiled to verify implementation of adopted mitigation measures.

The County of Riverside Economic Development Agency will have the responsibility for implementing the measures and various public agencies will have the primary responsibility for enforcing, monitoring, and reporting the implementation of the mitigation measures. This MMRP is set up as a Documentation of Compliance Report, with space for confirming that mitigation measures have been implemented. The required mitigation measures are listed and categorized by impact area, with an accompanying identification of the following:

- **Mitigation Measure**
- **Monitoring Phase** – the phase of the Project during which the mitigation measure shall be implemented and monitored:
- **Enforcement Agency** – the agency with the authority to enforce the mitigation measure
- **Monitoring Agency** – the agency to which reports involving feasibility, compliance, and implementation are made
- **Action Indicating Compliance**
- **Verification of Compliance**, which will be used during the reporting/monitoring

Mitigation Measure	Monitoring Phase	Enforcement Agency	Monitoring Agency	Action Indicating Compliance	Compliance Verification	
					Initials	Date
BIOLOGICAL RESOURCES						
BIO 1: A survey for burrowing owls will be conducted by a qualified biologist prior to construction. If the survey confirms occupied burrowing owl habitat, an impact assessment and avoidance measures will be implemented. The biologist will assess each occupied burrow to determine if the impact of the Project activities will directly or substantially indirectly impact the burrow, ultimately causing death of a burrowing owl. Active burrows will be monitored regularly to confirm avoidance and status of the burrow.	Pre-Construction:	California Department of Fish and Wildlife	Qualified Biologist	Completion of burrowing owl survey; establishment of buffer zone if active nest identified on-site. In the event of an active nest, the biologist will periodically monitor until the nest is inactive		
BIO 2: The removal of trees and vegetation shall be conducted to the extent feasible outside the avian nesting season (February 1 – August 31). If construction is required during the avian nesting period, a preconstruction survey for active nests shall be conducted prior to the disturbance of any vegetation. If an active nest is observed within the vicinity, a minimum buffer of 250 feet shall be established to ensure to avoid impacts to sensitive avian species and could be greater depending on the bird species found to be occurring from the nest. A qualified biologist would be required to determine whether a smaller buffer can be implemented. The buffer will be delineated by roping or taping off the boundaries of construction and shall remain in place until the nest is either abandoned or the young have fledged. A qualified biologist would be required to determine that the nest is no longer active, at which time vegetation removal and/or ground disturbance could continue. Vegetation removal and/or ground disturbance activities within the vicinity of the nest may commence at the discretion of the biological monitor.	Pre-Construction: 30 days prior to construction work or vegetation removal between February 1 and August 31.	California Department of Fish and Wildlife	Qualified Biologist	Completion of nesting bird survey; establishment of buffer zone if birds identified on-site		

Mitigation Measure	Monitoring Phase	Enforcement Agency	Monitoring Agency	Action Indicating Compliance	Compliance Verification	
					Initials	Date
CULTURAL RESOURCES						
CR-1: Prior to issuance of a grading permit, the County shall retain a qualified archaeological monitor in the event that any cultural resources are identified during earthmoving activities. Any newly discovered cultural resource deposits shall be subject to a cultural resources evaluation.	Pre-construction	County EDA	County EDA, Qualified Archaeologist	Contract with Archaeologist for Monitoring		
CR-2: At least 30 days prior to seeking a grading permit, the County shall contact the consulting Tribes for notification of ground-disturbing construction work, and to provide notice of who will be responsible for archaeological monitoring during construction. Additionally, prior to the seeking and/or issuance of a grading permit, the applicant, Project Archaeologist, and consulting Tribes will co-create a Tribal Monitoring Agreement ("Agreement") that (1) assures Tribal Monitors will be present during all grading, excavation, and ground-disturbing activities within the Project Area of Potential Effect (APE) and (2) discusses and delineates subjects including, but not limited to, (a) the monitors' scheduling; (b) the monitors' duties and/or SOW; (c) monitors' compensation by the applicant; (d) safety requirements; and (e) the protocols and stipulations that the County/applicant, contractor, Tribal Monitors, and Project Archaeologist will follow in the event of inadvertent cultural resources discoveries. The creation of the Agreement will be overseen by Riverside County EDA and enforced by the same. Stipulations for treatment and final disposition of any cultural resources, with the exception of human remains, funerary objects, and sacred objects are addressed in Mitigation Measure **CR-4**. The treatment of human remains, funerary objects, and sacred objects are addressed in Mitigation Measure **CR-5**.	Pre-construction	County EDA	County EDA, Project Archaeologist Tribal Monitor	Tribal Monitoring Agreement		

Mitigation Measure	Monitoring Phase	Enforcement Agency	Monitoring Agency	Action Indicating Compliance	Compliance Verification	
					Initials	Date
CR-3: In accordance with Mitigation Measure **CR-1** and **CR-2**, both the Project Archaeologist and the Tribal Monitor(s)—together and/or separately—shall have the authority to stop and redirect any and all ground disturbing activities in order to identify and preliminarily evaluate any cultural resource(s) discovered on the property. If the resource(s) is determined to hold potential significance, a 25-foot buffer shall be established and the Project Archaeologist shall, in consultation with the Tribal Monitor(s) present on site, make a preliminary determination of the significance of the resource(s).	Grading/ Excavation	County Archaeologist,	County EDA, Project Archaeologist Tribal Monitor	Evaluation of Resource and Report from County Archaeologist and Tribal Representative		
CR-4: In the event that Native American cultural resources are inadvertently discovered during the course of ground-disturbing activity for this Project, the following procedures will be carried out for treatment and disposition of the discoveries: **Temporary Curation and Storage**: During the course of construction, all discovered resources shall be temporarily curated in a secure location onsite or at the offices of the Project Archaeologist. The removal of any artifacts from the Project site will need to be thoroughly documented via inventory and conducted with Tribal Monitor(s) oversight of the process. **Treatment and Final Disposition**: The County/applicant/contractor shall relinquish ownership of all cultural resources, including sacred items, unassociated funerary objects/burial goods, all archaeological artifacts, and non-human remains as part of the required mitigation for impacts to cultural resources. The County/applicant/contractor shall relinquish the artifacts through one or more of the following methods and provide the County with evidence of same:	Grading/ Excavation	County Archaeologist,	County EDA, Project Archaeologist Tribal Monitor	Evaluation of Resource and Report from County Archaeologist and Tribal Representative		

a. Accommodate the process for onsite reburial of the discovered items with the consulting Tribes. This shall include measures and provisions to protect the future reburial area from any future impacts. Reburial shall not occur until all cataloguing and basic recordation have been completed. A reburial site shall be documented as a new site and recorded with the Eastern Information Center; b. A curation agreement with an appropriately qualified repository within Riverside County that meets federal standards per 36 CFR Part 79 whereby the collections and associated records shall be transferred, including title, and accompanied by payment from the County/applicant of the fees necessary for permanent curation; c. On request by the consulting Tribe for repatriation of the discovered items, the County shall relinquish ownership and shall deliver the items to the custody of the consulting Tribe.For purposes of conflict resolution, if the consulting Tribes cannot come to an agreement as to the disposition of cultural materials, they shall be curated at the Western Science Center or Riverside Metropolitan Museum by default; and d. At the completion of any and all ground disturbing activities on the Project site, a Phase IV Monitoring Report shall be written by the Project Archaeologist and submitted to the County within 120 days of the completion of ground-disturbing activities related to the Project. This report shall (1) document monitoring activities conducted by the Project Archaeologist and Tribal Monitors; (2) document the impacts to the known resources on the property, if any; (3) describe how each mitigation measure was fulfilled; (4) document the type of cultural resources discovered during Project implementation, the treatment of those resources, and their disposition; (5) provide evidence of the required cultural sensitivity training for the construction staff held during the required pre-grade meeting; and (6) in a confidential appendix, include the daily/weekly monitoring notes from the Project Archaeologist. All reports produced will be submitted to the County, Eastern Information Center and consulting Tribes.						

Mitigation Measure	Monitoring Phase	Enforcement Agency	Monitoring Agency	Action Indicating Compliance	Compliance Verification	
					Initials	Date
CR-5: If human remains are encountered, California Health and Safety Code Section 7050.5 states that no further disturbance shall occur until the Riverside County Coroner has made the necessary findings as to origin. Further, pursuant to California Public Resources Code Section 5097.98-.99 remains shall be left in place and free from disturbance until a final decision as to the treatment and disposition has been made. If the Riverside County Coroner determines the remains to be Native American, the Native American Heritage Commission must be contacted by the County/applicant within 24 hours. The Native American Heritage Commission must then immediately identify the "most likely descendant(s)" (MLD) and provide the MLD(s) with notification of the discovery. The MLD(s) shall then make recommendations within 48 hours, and engage in consultations concerning the treatment of the remains and any associated funerary objects/burial goods as provided in Public Resources Code 5097.98-.99.	Grading/ Excavation	County EDA, County Coroner Native American Heritage Commission	County EDA, County Coroner, MLD	Coroner's Report; NAHC declaration of MLD; MLD Recommendations; Compliance with Monitoring and Treatment Agreement		
CR-6 All sacred sites and burial sites, should they be encountered within the Project area, shall be avoided and preserved as the preferred mitigation, whenever feasible.	Grading/ Excavation	County EDA	County EDA, Project Archaeologist	Sacred and burial sites preserved in place, as feasible		

Mitigation Measure	Monitoring Phase	Enforcement Agency	Monitoring Agency	Action Indicating Compliance	Compliance Verification	
					Initials	Date
CR-7 If inadvertent discoveries of subsurface archaeological/cultural resources are discovered during grading, Riverside County EDA, the Project Archaeologist, and the monitoring Tribe shall assess the significance of such resources and shall meet and confer regarding the mitigation for such resources. Pursuant to California Public Resources Code § 21083.2(b) and 21084.3(b) avoidance is the preferred method of preservation for archaeological resources and tribal cultural resources. If the EDA, the Project Archaeologist and the monitoring Tribe cannot agree on the significance or the mitigation for such resources, these issues will be presented to the Riverside County Archaeologist. The County Archaeologist shall make the determination based on the provisions of the California Environmental Quality Act with respect to archaeological resources and tribal cultural resources and shall take into account the religious beliefs, customs, and practices of the consulting Tribes.	Grading/ Excavation	County EDA	County EDA, Project Archaeologist	Evaluation of cultural resource(s) discovered on-site; Report from Project Archaeologist		
CR-8: In the event that any paleontological resources are unintentionally discovered during proposed project construction, construction activities in the vicinity of the resource shall immediately halt and/or be moved to other parts of the project site. A Riverside County-qualified paleontologist shall be retained by the County or their designee to determine the significance of the resource, if any. If the find is determined to be significant, avoidance or other appropriate measures including extraction and relocation, as recommended by the paleontologist, shall be implemented.	Grading/ Excavation	County EDA	County EDA, Project Paleontologist	Evaluation of cultural resource(s) discovered on-site; Report from Project Paleontologist		

Mitigation Measure	Monitoring Phase	Enforcement Agency	Monitoring Agency	Action Indicating Compliance	Compliance Verification	
					Initials	Date
NOISE						
NOI-1: A construction noise coordinator shall be established prior to construction and signage will be provided on site that will identify the designated person and contact number. The coordinator shall be responsible for receiving calls from residents regarding specific construction noise-related complaints. The coordinator would then be responsible for taking appropriate measures to reduce or eliminate noise levels as appropriate.	Pre-construction	County EDA, Construction Contractor	County EDA, Construction Contractor	Documentation of Coordinator and evidence of signage		
NOI-2: Construction activity shall be prohibited during the hours of 6:00 p.m. and 7:00 a.m. and on weekends and County-designated holidays.	Grading and Construction	County EDA, Construction Contractor	EDA, Construction Contractor	Periodic inspections and monitoring during construction		
NOI-3: Construction equipment shall be properly maintained and equipped with mufflers and other State-required noise-attenuation devices.	Grading and Construction	County EDA, Construction Contractor	EDA, Construction Contractor	Periodic inspections and monitoring during construction		