FOR CONTRACT NO.: 11-257144
PROJECT ID. 1100020469

INFORMATION HANDOUT

MATERIALS INFORMATION

WATER SOURCE INFORMATION
MATERIALS INFORMATION BROCHURE, Dated December 13, 2011
REVISED FOUNDATION REPORT for ROUTE 76/15 SEPARATION (WIDEN) Dated May 9, 2011
FOUNDATION REPORT for ROUTE 76/15 SEPARATION (RETROFIT) Dated June 23, 2011
UTILITY MEMO, Dated October 18, 2011
PRELIMINARY SITE ASSESSMENT (HAZARDOUS MATERIALS) SUPPLEMENTAL INITIAL STUDY INFORMATION, Dated June 28, 2010
GEOTHECHNICAL DESIGN REPORT, Dated March 14, 2012

AGREEMENTS

UNITED STATES DEPARTMENT OF THE INTERIOR BIO OPINION, DATED SEPTEMBER 22, 2011
UNITED STATES DEPARTMENT OF THE INTERIOR BIO OPINION, ATTACHMENTS, DATED SEPTEMBER 22, 2011
UNITED STATES DEPARTMENT OF THE INTERIOR BIO OPINION, AMENDMENT #1 DATED Nov. 29, 2011

ROUTE: 11-SD-15/76-R46.1/R47.3, R16.7/R17.7 (PM)

Mohamad Khatib/D11/Caltrans/CAGov
12/20/2011 03:03 PM

To John W Pierce/D11/Caltrans/CAGov@DOT
cc Siavash Akhgarnia/D11/Caltrans/CAGov@DOT
bcc
Subject Fw: EA 257141, 15/76 Interchange Project - Water Source letter

FYI...

Response to water source letter.

Mohamad K
x-6654

----- Forwarded by Mohamad Khatib/D11/Caltrans/CAGov on 12/20/2011 03:02 PM -----

Dave Seymour <DSeymour@rainbowmwd.com>
12/20/2011 02:15 PM

To Mohamad Khatib <mohamad_khatib@dot.ca.gov>
cc
Subject RE: EA 257141, 15/76 Interchange Project - Water Source letter

Mohamad,

Sorry for the delayed reply.

Yes, we can and will supply water for this project. We do not foresee any water shortages in the near future, however we cannot guarantee 100 percent reliability of supply as we have to consider the potential for infrastructure problems, such as pipe line breaks, or temporary disruptions of water supply from our wholesaler. Rest assured that if those problems do arise we will work diligently to restore service to your project as soon as possible.

We look forward to working with Caltrans on this project.

Dave Seymour
General Manager
Rainbow Municipal Water District

-----Original Message-----
From: Mohamad Khatib [mailto:mohamad_khatib@dot.ca.gov]
Sent: Monday, December 12, 2011 5:24 PM
To: Dave Seymour
Subject: Fw: EA 257141, 15/76 Interchange Project - Water Source letter

Mr. Dave Seymour,

I am following up with you regarding the request below.
Thank you for your attention to this matter.

Mohamad Khatib, Caltrans District 11
Project Engineer
SR-76 Corridor
(619) 688-6654

----- Forwarded by Mohamad Khatib/D11/Caltrans/CAGov on 12/12/2011 05:22 PM -----

Mohamad Khatib/D11/Caltrans/CAGov

11/15/2011 03:44 PM

To Dseymour@rainbowmwd.com

cc

Subject EA 257141, 15/76 Interchange Project - Water Source letter

Mr. Dave Seymour,

Please find the attached letter, requesting confirmation of water availability for the 15/76 Interchange project.
[attachment "257141water_availability.pdf" deleted by Mohamad Khatib/D11/Caltrans/CAGov] [attachment "1100000189ab.pdf" deleted by Mohamad Khatib/D11/Caltrans/CAGov]

Please let me know if you need any additional information to process this request.

Mohamad Khatib, Caltrans District 11
Project Engineer
SR-76 Corridor
(619) 688-6654

State of California

Business, Transportation and Housing Agency

Flex Your Power!
Be energy efficient!

Memorandum

Date: May 9, 2011

To: Paul Chung
Senior Bridge Engineer
Division of Engineering Services
Structure Design
Office of Bridge Design South 2

Attn: Wei-kung Hsia

File: 11-SD-076-PM 17.26
1100000189

SR76/I-15 Separation Widening
Bridge No. 57-0872

From: **DEPARTMENT OF TRANSPORATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 2
DESIGN BRANCH A, MS #5

Subject: Revised Foundation Report

The Office of Bridge Design South 2 has requested a revised foundation report due to revised foundation designs for the widening of the SR76/I-15 Separation in San Diego County. This report supersedes the foundation report dated April 4, 2011.

The recommendations are based on the review of the Planning Study dated 9/11/09, the LOTB dated 12/21/77, the General Plan dated 6/15/81, the Foundation Plan dated 6/15/81, the bridge inspection report dated 10/23/08, and the borehole investigation performed July, 2010. Elevations used in this most current report are based on NAVD88.

Project and Site Description

The existing bridge was built in 1981. It is a continuous two-span CIP/PS, 6 cell, with RC open end seated abutments and two column bents, all supported on concrete piles with tip elevations averaging between approximately 244 feet at abutment 1 and 253 feet at bent 2 and abutment 3. Bent 2 and abutment 3 appear to be constructed at approximately original grade while abutment 1 appears to be constructed on approximately 13 feet of fill. The fill material is unknown. Original ground is at approximately elevation 289 feet at abutment 1, 279 feet at bent 2, and 293 feet at abutment 3. The existing piles are approximately 46 feet below the pile cap at abutment 1, 17 feet below the pile cap at bent 2, and 39 feet below the pile cap at abutment 3.

The bridge is exhibiting deterioration according to the bridge inspection report. The new work proposes to widen the existing 2-lane structure to a 4 lane conventional highway, with additional lanes available at the interchange. The widening will be to the south. Tieback walls will be placed adjacent to the shoulders of the proposed loop on-ramps, but their geotechnical investigation has not been included in the scope of this report.

Geologic Data

Based on the 1972 as-built LOTB information, and the 2010 LOTB information, the site is underlain by dense to very dense sand and gravel, along with clayey sand and clayey silt of varying consistencies.

The site is located within the Peninsular Range geomorphic province. As such, the larger area is characterized by generally northwest trending valleys which are subparallel to faults branching from the San Andreas Fault. There is a gentle westerly slope and steep eastern face to most of the ranges within the province. The province contains Jurassic and Cretaceous igneous rocks with some remnants of roof rock. Granitic rock is commonly found intruding the older metamorphic rocks. The extent of this investigation did not extend to underlying bedrock.

Ground Water

Ground water was encountered during the 1972 investigation at an elevation of approximately 245 feet, which is approximately 30 to 65 feet below original grade. This was measured during the winter, a time of usually higher rainfall in the area. During the July, 2010 investigation, ground water was measured at elevation approximately 243 feet. These elevations may vary seasonally, and with recent rainfall totals, as well as; any irrigation or other man made or natural issues that may be present.

Scour

The structure does not overlie a watercourse, thus scour was not investigated and is not considered a potential issue.

Corrosion

The results are presented in the following table. Corrosion, as determined by Caltans, is as follows: If the minimum resistivity is less than 1000 ohm-cm, then chlorides and sulfates will be tested to determine corrosivity. Chlorides above 500 ppm and/or sulfates above 2000 ppm are considered corrosive. If the pH is 5.5 or less, the site is considered corrosive.

SIC Number	Sample Type	Boring Number	Sample Depth	Minimum Resistivity (ohm-cm)	pH	Chloride Content (ppm)	Sulphate Content (ppm)
C640675	Soil	R-10-002	85.0' - 101.5'	1202	7.58		
C640674	Soil	R-10-001	0.0' – 35.5'	864	7.59	109	240
C640455	Soil	R-10-002	various depths	1033	7.29		
C640456	Soil	R-10-003	various depths	1492	7.95		

According to the laboratory information presented in the previous table and the guidelines set by Caltrans, the site is not considered corrosive to foundation elements.

Liquefaction

From the as-built and current log of test borings, it can be seen that the site is underlain by layers of dense to very dense sand along with clayey sand, silty sand, and clay of varying consistencies. Ground water surface was encountered at depth of about 30 to 65 feet below the ground surface. Considering both soil conditions and groundwater levels, the potential for soil liquefaction due to strong ground shaking is low.

Settlement

Due to the granular nature of the majority of soils at the site, settlement induced by the structure should occur in a relatively short time period and be of an elastic nature. Cohesive soil presence is relatively minor. Seismic settlement of more than one inch is not expected.

Seismic Data

Based on the 2009 SDP, the design response spectrum is based on the upper envelope of a deterministic and probabilistic response spectrum, but not to be less than a minimum deterministic response spectrum for a vertical strike-slip fault of $M_{max} = 6.5$ at a distance of approximately 12 km. The deterministic response spectrum is obtained as the arithmetic average of median response spectra calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained from the 2008 USGS Seismic Hazard Map (Petersen et all, 2008) for the 5% in 50 years (corresponding to approximately a 1000 year return period) probability of exceedance. For this site with Vs_{30} of 210 m/s, 2008 USGS Deaggregations (Beta) tool were utilized to calculate the 5% in 50 years probabilistic spectrum. The near fault factors are applied on the results. Digital values of the acceleration response spectrum (ARS curve) recommended for preliminary design are shown below.

Site Specific ARS Curve

Period (sec)	ARS (g)
0	0.433
0.05	0.624
0.1	0.730
0.15	0.835
0.2	0.919
.25	0.927
0.3	0.934
0.4	0.875
0.5	0.832
0.6	0.800
0.7	0.777
0.85	0.737
1	0.701
1.2	0.611
1.5	0.517

2	0.416
3	0.270
4	0.195
5	0.161

The site is not considered prone to surface rupture due to fault movement since there are no known faults projecting towards or passing through the project site. The site is not located within any current Alquist-Priolo Fault Rupture Hazard Zone.

As-Built Foundations

As-Built Pile data are shown in Table 1.

Table 1
As-Built Shaft Data for Bridge 57-0872

Location	Pile Type	Working Stress Design	As-Built Tip Elevations			
			Design Tip Elevation	Average Tip Elevation	Maximum Elevation	Minimum Elevation
Abut 1	Class 140 Alt. X	70 Ton	244.1 ft	244.2 ft	244.2 ft	243.1 ft
Bent 2	Class 140 Alt. X	70 Ton	253.1 ft	253.3 ft	255.3 ft	253.1 ft
Abut 3	Class 140 Alt. X	70 Ton	253.1 ft	253.6 ft	255.0 ft	252.1 ft

Note: As-Built elevations have been converted from NGVD29 to NAVD88.

Footing Design Information Supplied by Design

Support Location	Pile Type	Finished Grade Elevation	Pile Cut-off Elevation	Pile Cap Size		Permissible Settlement Under Service Load	Number of Piles per Support
				B	L		
Abut 1	Class 140 Alt. X	293.50 feet	289.5 feet	7.5 ft	83 ft	1 in	30
Bent 2	Class 200 Alt. X	279.25 feet	270.5 feet	18 ft	62.5 ft	1 in	96
Abut 3	Class 140 Alt. X	295.90 feet	291.9 feet	7.5 ft	83 ft	1 in	30

Support Location	Service 1 Limit State			Strength Limit State (Controlling Group)				Extreme Event Limit State (Controlling Group)			
	Total Loads		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max Per Pile	Per Support	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile
Abut 1	3353 kips	140 kips	2864 kips	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	8955 kips	N/A	6788 kips	13379 kips	162 kips	N/A	N/A	6245 kips	280 kips	N/A	118 kips
Abut 3	3353 kips	140 kips	2864 kips	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Foundation Recommendations

Support Location	Pile Type	Cut-Off Elevation	Service-I Limit State Load per Column	Total Permissible Support Settlement	Required Nominal Resistance				Design Tip Elevation	Specified Tip Elevation	Nominal Driving Resistance
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Abut 1	Class 140 Alt. X	289.5 ft	3353 kips	1 in	N/A	0	N/A	0	243 ft (a-I)	243 ft (a-I)	280 kips
Bent 2	Class 200 Alt. X	271.5 ft	8955 kips	1 in	162 kips	0	280 kips	118 kips	232 ft (a-I)	232 ft (a-I)	281 kips
Abut 3	Class 140 Alt. X	291.5 ft	3353 kips	1 in	N/A	0	N/A	0	252 ft (a-I)	252 ft (a-I)	280 kips

Note: Design tip elevations are controlled by Compression (Strength Limit)

Location	**Design Method**	**Pile Type**	**Cut-Off Elevation**	**Nominal Resistance**		**Design Tip Elevation**	**Specified Tip Elevation**	**Nominal Driving Resistance**
				Compression	Tension			
Abutment 1	WSD	Class 140 Alt. X	289.5 feet	140 kips	N/A	243 ft (a-I)	243 ft (a-I)	280 kips
Bent 2	LRFD	Class 200 Alt. X	270.5 feet	280 kips	118 kips	232 ft (a-I)	232 ft (a-I)	281 kips
Abut 3	WSD	Class 140 Alt. X	291.5 feet	140 kips	N/A	252 ft (a-I)	252 ft (a-I)	280 kips

Note: Design tip elevations are controlled by Compression (Strength Limit)

Construction Considerations

1) Any driven Class 140 pile for abutments 1 and 3 that achieves refusal within 15 feet of specified pile tip elevations during driving may be considered good and cut off with the Engineer's written approval. Any driven Class 140 pile for bent 2 that achieves refusal within 5 feet of specified pile tip elevations during driving may be considered good and cut off with the Engineer's written approval.

2) The contractor should anticipate that some of driven piles probably will not achieve bearing at the end of driving at the specified pile tip elevation do to the nature of underlying cohesive soils. Any concrete piles that do not achieve bearing at the end of driving should be restruck after a minimum setup period. A minimum setup period of 12 hours is required.

If you have any questions or need additional information, please call Bill Levine at 916-227-0505 or Angel Perez-Cobo at 916-227-7167 of the Office of Geotechnical Design South 2A.

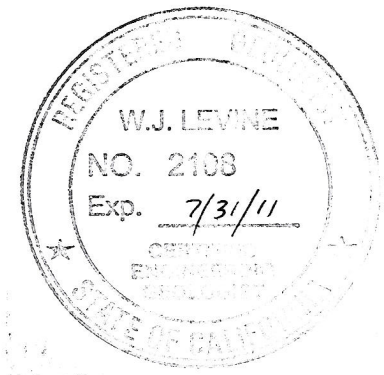
.

Bill Levine
Engineering Geologist
Geotechnical Design-South 2
Design Branch A

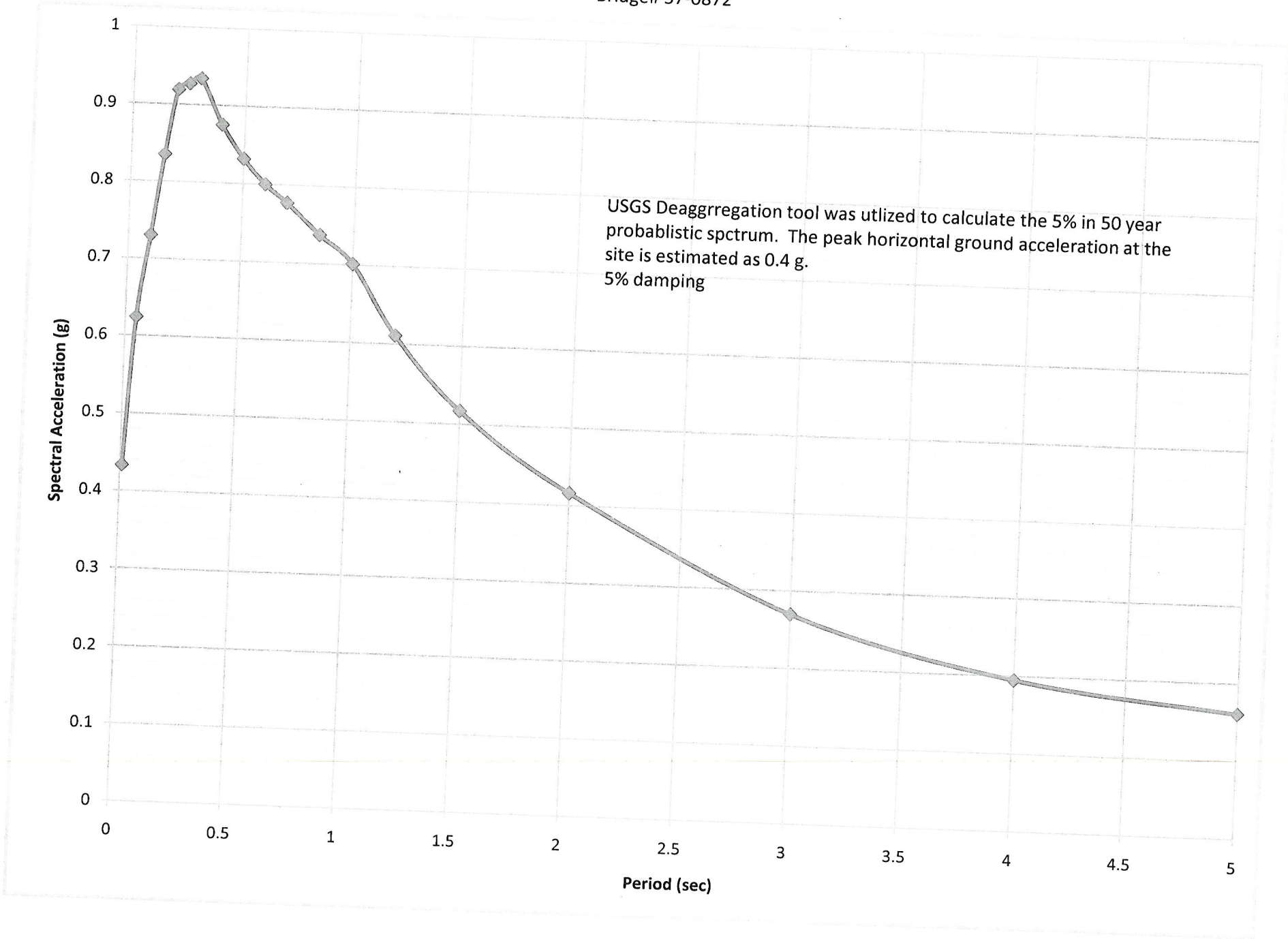
Angel Perez-Cobo
Senior Engineer
Geotechnical Design-South 2
Design Branch A

Attachment: Acceleration Response Curve

cc: Mark Willian-GS Corporate
Ann Fox-District Project Manager
Mark Phelan-District Project Manager
Structure Construction RE Pending File (RE_Pending_File@dot.ca.gov)
DES Office Engineer, Office of PS&E (Rebecca_Harnagel@dot.ca.gov)
Art Padilla-District Materials Engineer
Carl Savage-Design Manager
GS File Room (gs_file_room@dot.ca.gov
A. Perez-Cobo



Recommended Accleraton Response SR 76/15 Separation Widening
Bridge# 57-0872



State of California

Business, Transportation and Housing Agency

Flex Your Power!
Be energy efficient!

Memorandum

Date: June 23, 2011

To: Paul Chung
Senior Bridge Engineer
Division of Engineering Services
Structure Design
Office of Bridge Design South 2

File: 11-SD-076-PM 17.26
1100000189

Attn: Wei-kung Hsia

SR76/I-15 Seismic Retrofit
Bridge No. 57-0872

From: **DEPARTMENT OF TRANSPORATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 2
DESIGN BRANCH A, MS #5

Subject: Foundation Report

The Office of Bridge Design South 2 has requested a foundation report in addition to the previous foundation report dated May 9, 2011. This is due to the revised scope of work, which is now including seismic retrofit to the existing foundation, while the previous report only discussed widening of the SR76/I-15 Separation in San Diego County. This report is in addition to the above mentioned foundation report dated May 9, 2011.

The recommendations are based on the review of the Planning Study dated 9/11/09, the LOTB dated 12/21/77, the General Plan dated 6/15/81, the Foundation Plan dated 6/15/81, the bridge inspection report dated 10/23/08, the foundation report dated May 9, 2011, and the borehole investigation performed July, 2010. Elevations used in this most current report are based on NAVD88.

Project and Site Description

The existing bridge was built in 1981. It is a continuous two-span CIP/PS, 6 cell, with RC open end seated abutments and two column bents, all supported on concrete piles with tip elevations averaging between approximately 244 feet at abutment 1 and 253 feet at bent 2 and abutment 3. Bent 2 and abutment 3 appear to be constructed at approximately original grade while abutment 1 appears to be constructed on approximately 13 feet of fill. The fill material is unknown. Original ground is at approximately elevation 289 feet at abutment 1, 279 feet at bent 2, and 293 feet at abutment 3. The existing piles are approximately 46 feet below the pile cap at abutment 1, 17 feet below the pile cap at bent 2, and 39 feet below the pile cap at abutment 3.

The bridge is exhibiting deterioration according to the bridge inspection report. The new work proposes to widen the existing 2-lane structure to a 4 lane conventional highway, with additional lanes available at the interchange. The widening will be to the south. Tieback walls will be placed

adjacent to the shoulders of the proposed loop on-ramps, but their geotechnical investigation has not been included in the scope of this report.

Geologic Data

Based on the 1972 as-built LOTB information, and the 2010 LOTB information, the site is underlain by dense to very dense sand and gravel, along with clayey sand and clayey silt of varying consistencies.

The site is located within the Peninsular Range geomorphic province. As such, the larger area is characterized by generally northwest trending valleys which are subparallel to faults branching from the San Andreas Fault. There is a gentle westerly slope and steep eastern face to most of the ranges within the province. The province contains Jurassic and Cretaceous igneous rocks with some remnants of roof rock. Granitic rock is commonly found intruding the older metamorphic rocks. The extent of this investigation did not extend to underlying bedrock.

Ground Water

Ground water was encountered during the 1972 investigation at an elevation of approximately 245 feet, which is approximately 30 to 65 feet below original grade. This was measured during the winter, a time of usually higher rainfall in the area. During the July, 2010 investigation, ground water was measured at elevation approximately 243 feet. These elevations may vary seasonally, and with recent rainfall totals, as well as; any irrigation or other man made or natural issues that may be present.

Scour

The structure does not overlie a watercourse, thus scour was not investigated and is not considered a potential issue.

Corrosion

The results are presented in the following table. Corrosion, as determined by Caltrans, is as follows: If the minimum resistivity is less than 1000 ohm-cm, then chlorides and sulfates will be tested to determine corrosivity. Chlorides above 500 ppm and/or sulfates above 2000 ppm are considered corrosive. If the pH is 5.5 or less, the site is considered corrosive.

SIC Number	Sample Type	Boring Number	Sample Depth	Minimum Resistivity (ohm-cm)	pH	Chloride Content (ppm)	Sulphate Content (ppm)
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According to the laboratory information presented in the previous table and the guidelines set by Caltrans, the site is not considered corrosive to foundation elements.

Liquefaction

From the as-built and current log of test borings, it can be seen that the site is underlain by layers of dense to very dense sand along with clayey sand, silty sand, and clay of varying consistencies. Ground water surface was encountered at depth of about 30 to 65 feet below the ground surface. Considering both soil conditions and groundwater levels, the potential for soil liquefaction due to strong ground shaking is low.

Settlement

Due to the granular nature of the majority of soils at the site, settlement induced by the structure should occur in a relatively short time period and be of an elastic nature. Cohesive soil presence is relatively minor. Seismic settlement of more than one inch is not expected.

Seismic Data

Based on the 2009 SDP, the design response spectrum is based on the upper envelope of a deterministic and probabilistic response spectrum, but not to be less than a minimum deterministic response spectrum for a vertical strike-slip fault of $M_{max} = 6.5$ at a distance of approximately 12 km. The deterministic response spectrum is obtained as the arithmetic average of median response spectra calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained from the 2008 USGS Seismic Hazard Map (Petersen et all, 2008) for the 5% in 50 years (corresponding to approximately a 1000 year return period) probability of exceedance. For this site with Vs_{30} of 210 m/s, 2008 USGS Deaggregations (Beta) tool were utilized to calculate the 5% in 50 years probabilistic spectrum. The near fault factors are applied on the results. Digital values of the acceleration response spectrum (ARS curve) recommended for preliminary design are shown below.

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0	0.433
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0.1	0.730
0.15	0.835
0.2	0.919
.25	0.927
0.3	0.934
0.4	0.875
0.5	0.832
0.6	0.800
0.7	0.777

0.85	0.737
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1.2	0.611
1.5	0.517
2	0.416
3	0.270
4	0.195
5	0.161

The site is not considered prone to surface rupture due to fault movement since there are no known faults projecting towards or passing through the project site. The site is not located within any current Alquist-Priolo Fault Rupture Hazard Zone.

As-Built Foundations

As-Built Pile data are shown in Table 1.

Table 1
As-Built Shaft Data for Bridge 57-0872

Location	Pile Type	Working Stress Design	As-Built Tip Elevations			
			Design Tip Elevation	Average Tip Elevation	Maximum Elevation	Minimum Elevation
Abut 1	Class 140 Alt. X	70 Ton	244.1 ft	244.2 ft	244.2 ft	243.1 ft
Bent 2	Class 140 Alt. X	70 Ton	253.1 ft	253.3 ft	255.3 ft	253.1 ft
Abut 3	Class 140 Alt. X	70 Ton	253.1 ft	253.6 ft	255.0 ft	252.1 ft

Note: As-Built elevations have been converted from NGVD29 to NAVD88.

Footing Design Information Supplied by Design

Support Location	Pile Type	Finished Grade Elevation	Pile Cut-off Elevation	Pile Cap Size		Permissible Settlement Under Service Load	Number of Piles per Support
				B	L		
Bent 2	24 inch CIDH	279.25 feet	270.5 feet	37 ft	40 ft	1 in	36

Support Location	Service 1 Limit State			Strength Limit State (Controlling Group)				Extreme Event Limit State (Controlling Group)			
	Total Loads		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max Per Pile	Per Support	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile
Bent 2	1198 kips	N/A	1198 kips	1798 kips	50 kips	N/A	N/A	3182 kips	401 kips	N/A	-194 kips

Foundation Recommendations

State Route 76 and Interstate 15 Separation (Retrofit), Br # 57-0872 Bent 2 Foundation Design Recommendations											
Support Location	Pile Type	Cut-off - Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Bent 2 Col 1	24-inch CIDH	270.5	1198	1	50	N/A	401	194	240.5(*a-I*) 210.5 *(a-II)* 217.5 *(b-II)*	210.0	N/A
Bent 2 Col 2	24-inch CIDH	270.5	1198	1	50	N/A	401	194	240.5(*a-I*) 210.5 *(a-II)* 217.5 *(b-II)*	210.0	N/A

Notes:

1) *Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (b-I) Tension (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (c) Settlement, (d) Lateral Load*
2) *The specified tip elevation shall not be raised above the design tip elevations for tension, lateral, and tolerable settlement.*
3) *The nominal driving resistance required is equal to the nominal resistance needed to support the factored load plus driving resistance from the unsuitable penetrated soil layers (very soft, liquefiable, scourable, etc.), if any, which do not contribute to the design resistance.*

Construction Considerations

1) The recommended pile (CIDH) should be constructed in accordance with Section 49-4 per Caltrans Standard Specifications (Caltrans, 2006) and Memo-To-Designer 3-1

2) Groundwater was measured in 1972 at elevation 245 feet (approximately 34 feet below existing ground surface at bent 2 location). During the July, 2010 investigation, ground water was measured at elevation approximately 243. The actual groundwater elevation may be different during constriction due to seasonal rainfall, surface runoff and other man-made conditions. Therefore, contractors should be prepared to use a "Wet" construction method

3) Loose soils at the bottom of the drilled excavation hole should be cleaned. The drilled holes should be inspected and approve by the geotechnical engineer prior to the installations.

4) Due to the limited overhead space, extreme care should consider during drilling the pile hole, placement of steel cage and pouring concrete to avoid any excessive disturbance of pile boring walls.

5) Concrete placement by pumping or tremie tube to the bottom of the pile borings will be required

6) Sufficient space should be provided in the pile reinforcing cage during fabrication to allow the insertion of a tremie tube for concrete placement

7) Per Caltrans Memo-To-Designer 3-1, PVC tubings must be installed within the reinforcement cage of the CIDH pile for gamma-ray and crosshole sonic testing

8) Pile reinforcing cage should be installed and the concrete pumped immediately after drilling is completed

9) CIDH piles should not be drilled immediately adjacent to another pile until the concrete in the other pile has attained its initial set

10) If any boring becomes ball-shaped and cannot be further advanced due to severe a caving, all loose material should be removed from the bottom of the hole the cave region should be patched and filled with a low strength sand-cement slurry. Drilling may continue when the slurry has reached its initial set.

The recommendations contained in this report are based on specific project information regarding design loads and structure locations that has been provided by Office of Bridge Design South 2. If any conceptual changes are made during final project design, the Office of Geotechnical Design South-2, should review those changes to determine if the foundation recommendations provided in this report are still applicable.

If you have any questions or need additional information, please call Asef Wardak at 916Angel Perez-Cobo at 916-227-7167 of the Office of Geotechnical Design South 2A.

REGISTERED PROFESSIONAL ENGINEER
ASEF WARDAK
No. C 61960
Exp. 9/30/2011
STATE OF CALIFORNIA

Asef Wardak
Engineer
Geotechnical Design-South 2
Design Branch A

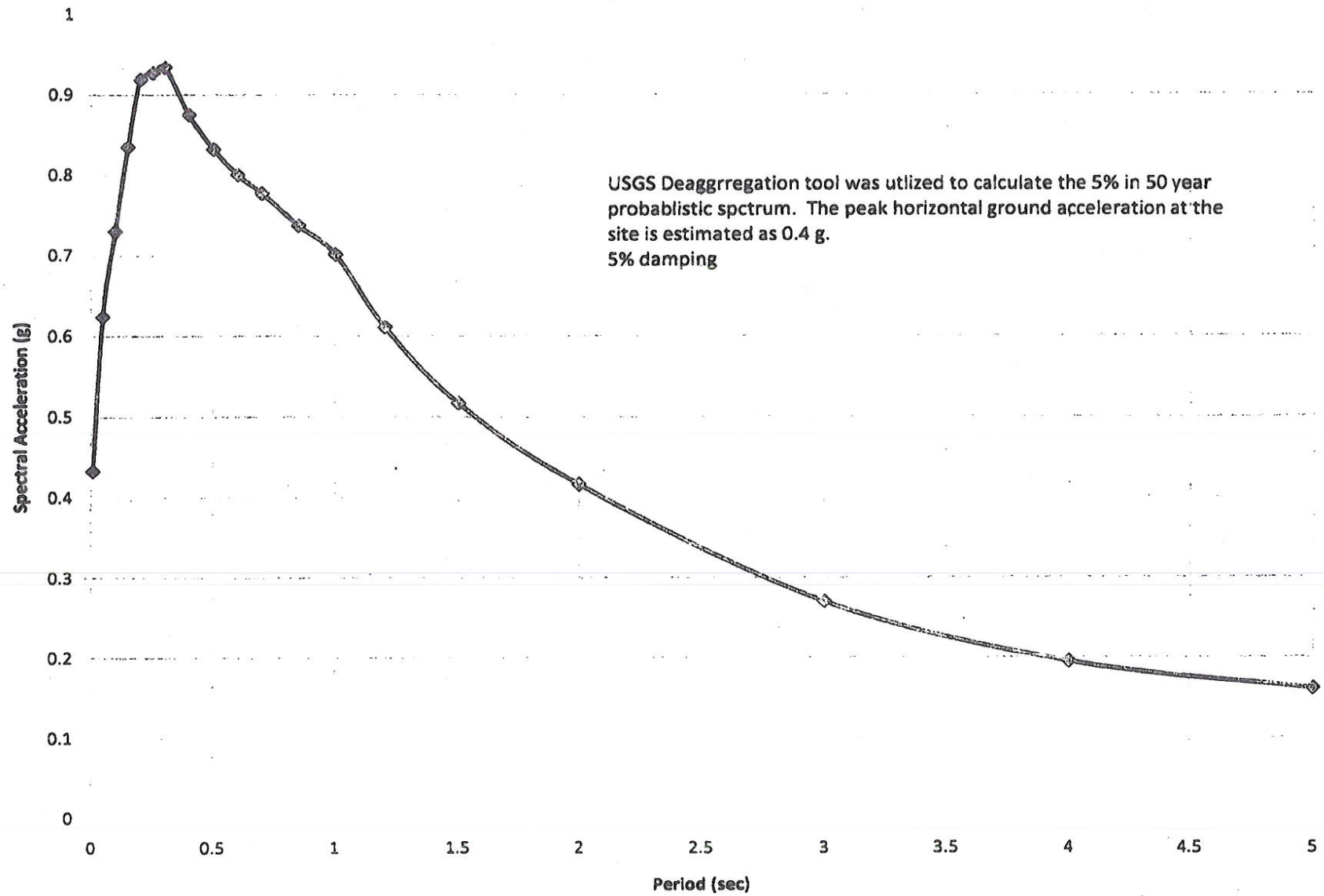
Angel Perez-Cobo
Senior Engineer
Geotechnical Design-South 2
Design Branch A

Bill Levine
Engineering Geologist
Geotechnical Design-South 2
Design Branch A

Attachment: Acceleration Response Curve

cc: Mark Willian-GS Corporate
Ann Fox-District Project Manager
Mark Phelan-District Project Manager
Structure Construction RE Pending File (RE_Pending_File@dot.ca.gov)
DES Office Engineer, Office of PS&E (Rebecca_Harnagel@dot.ca.gov)
Art Padilla-District Materials Engineer
Carl Savage-Design Manager
GS File Room (gs_file_room@dot.ca.gov
A. Perez-Cobo

Recommended Accleraton Response SR 76/15 Separation Widening
Bridge# 57-0872



October 18, 2011

NONHIGHWAY FACILITIES (INCLUDING UTILITIES)

The following are definitions and comments that help explain the columns in the chart.

N-Notification days. Minimum number of working days from the date the Utility Owner receives written notification from the Engineer that the site will be ready for utility work.

W-Working days. Number of working days needed by the utility company to complete the listed Utility Work.

The work described in "Site Preparation by Contractor" must be completed by the Contractor before the associated utility relocation work described in "Location" can be performed by the utility owner.

The Utility Working Days will not begin until the site preparation requirements have been met.

The contractor must be aware of the possible need of multiple utility relocations and move-ins which will require coordination between various utility owners. Only one utility owner can be notified and permitted to work in a specific area at a given time. However, on occasion work overlap at specific locations for different utility owners, and multiple utility owners may be better suited to work in the same vicinity at the same time at specific locations. The Contractor must arrange, coordinate and get the concurrence and approval of the affected utility owners and the Engineer prior to commencing any concurrent utility relocation.

State of California Business, Transportation and Housing Agency

M e m o r a n d u m

8To: **Debra Soifer**
Environmental Planner
Environmental Analysis

Date: June 28, 2010
File: 11-SD-76
EA: 257110
PM: 12.4/17.3

From: **Joel Kloth**
Engineering Geologist
Environmental Engineering

Subject: Preliminary Site Assessment (Hazardous Materials) Supplemental Initial Study Information

The project will involve widening Route 76 from South Mission Road to Route 15. A Preliminary Site Assessment has been performed by Consultants regarding hazardous materials for the subject project. Information regarding additional potential hazardous waste related issues/materials has surfaced which shall be included in the Environmental Document.

Upon researching aerial photographs available at The Department of Transportation, District 11 (Department), a former gasoline service station was apparent on 1964 and 1977 aerial photographs at the northwest corner of the Route 76/former Highway 395 intersection. The facility was not observed in 1982 aerial photographs, and the Route 76/395 intersection had been removed and the existing Route 76/I-15 interchange was apparent. This facility was mentioned in the aerial photograph description in the report entitled “Hazardous Waste Initial Site Assessment for the SR-76 South Mission to I-15 Project, San Diego, California” dated November 2008. However, conclusions or recommendations were not made. Specific information regarding underground storage tanks (USTs) and petroleum hydrocarbon spills at the service station was not found.

Research of available aerial photographs, right-of-way maps, as built plans, and discussion with Department personnel indicate the presence of a former Department San Luis Rey Maintenance Station at the northeast corner of the Route 76/395 intersection. The presence of USTs is not indicated on the as built plans dated 1949, and recollection by Department personnel indicate that a fueling facility was not present. However, there was an oil pump house with underground piping. By 1980, the existing Route 15/76 Interchange had been constructed, and the former maintenance station facilities were demolished. The former maintenance station appears to be located beneath the existing northbound Route 15 main traveled way north of Route 76. Portions of it may be adjacent to the Route 15 northbound shoulder. The maintenance facility was not mentioned in the Hazardous Waste Initial Site Assessment report.

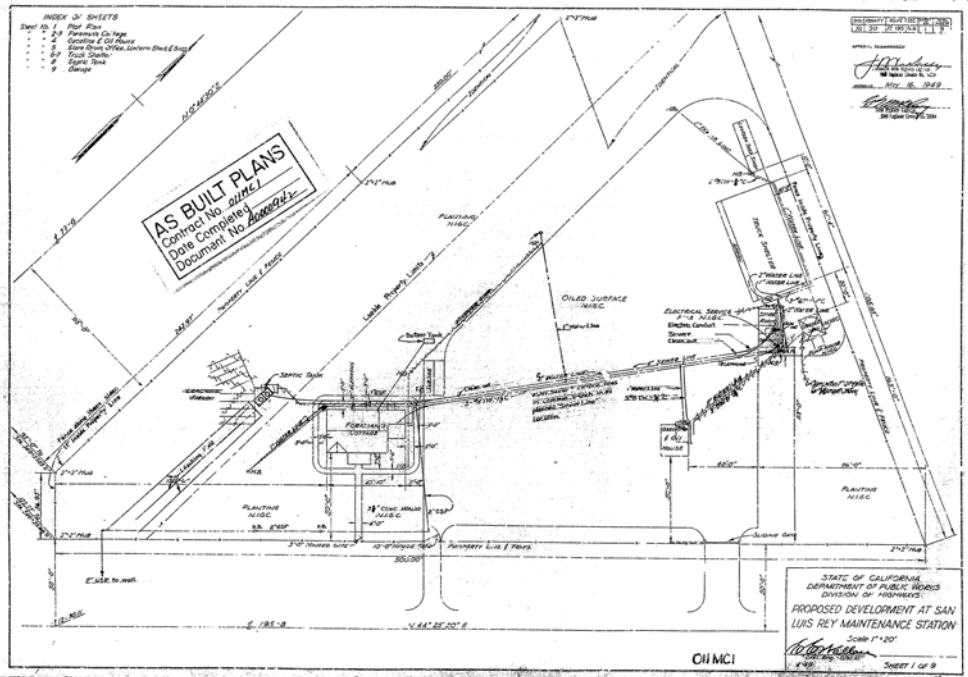
Due to the location and limited information, the potential for adverse environmental impacts is low. Further investigation is not recommended at this time. Petroleum hydrocarbon impacted soil and related facility structures from the former gasoline service station and maintenance station shall be addressed, if encountered, during construction by using the Department emergency construction contract for encountering hazardous waste issues/materials.

An aerial photograph from 1977and an as built map of the former maintenance facility from 1949 are attached. If you have questions please call (619) 668-3146.

Joel Kloth, PG
Engineering Geologist
Environmental Engineering

cc: Jayne Dowda

1:6000 11-SD-15
C.F.L
2



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 7/11/72 SIGNATURE [illegible] TITLE [illegible]

DISTRICT 11

MATERIALS INFORMATION BROCHURE

MATERIALS ENGINEERING BRANCH

11-SD-15, 76
PM R46.1/R47.3 (15)
PM R16.7/R17.7 (76)
11-257141
1100020469

CT CALIFORNIA DEPARTMENT OF TRANSPORTATION

State of California

Business, Transportation and Housing Agency

Memorandum

To : LEON EDMONDS
Office Engineer
District 11

Date: December 13, 2011

File: 11-SD-15, 76
PM R46.1/R47.3 (15)
PM R16.7/R17.7 (76)
EA 11-257141
Project ID: 1100020469

From : **DEPARTMENT OF TRANSPORTATION - DISTRICT 11**
Materials Engineering Branch

Subject: Materials Information Brochure

Attached herewith for your consideration

MATERIALS INFORMATION

FOR PROPOSED PROJECT ON ROUTES 15 AND 76

IN SAN DIEGO COUNTY

STATE ROUTES 15 AND 76

For Construction of a portion of Routes 15 and 76 in San Diego County

Arthur F. Padilla
District Materials Engineer

REGISTERED PROFESSIONAL ENGINEER
ARTHUR F. PADILLA
No. C 49529
Exp. 9-30-2012
CIVIL
STATE OF CALIFORNIA

AFP: ra

cc: MPeinado (330)
CSavage (333)
MKhatib (333)
Project File (mib 257141.doc)

MATERIALS INFORMATION

11-SD-15, 76
PM R46.1/R47.3 (15)
PM R16.7/R17.7 (76)
EA 257141

NOTE: Information contained herein has been compiled in accordance with Section 2-1.03 of the Standard Specifications. Additional information is available for review at the District 11, Materials Laboratory, 7177 Opportunity Road, San Diego, California.

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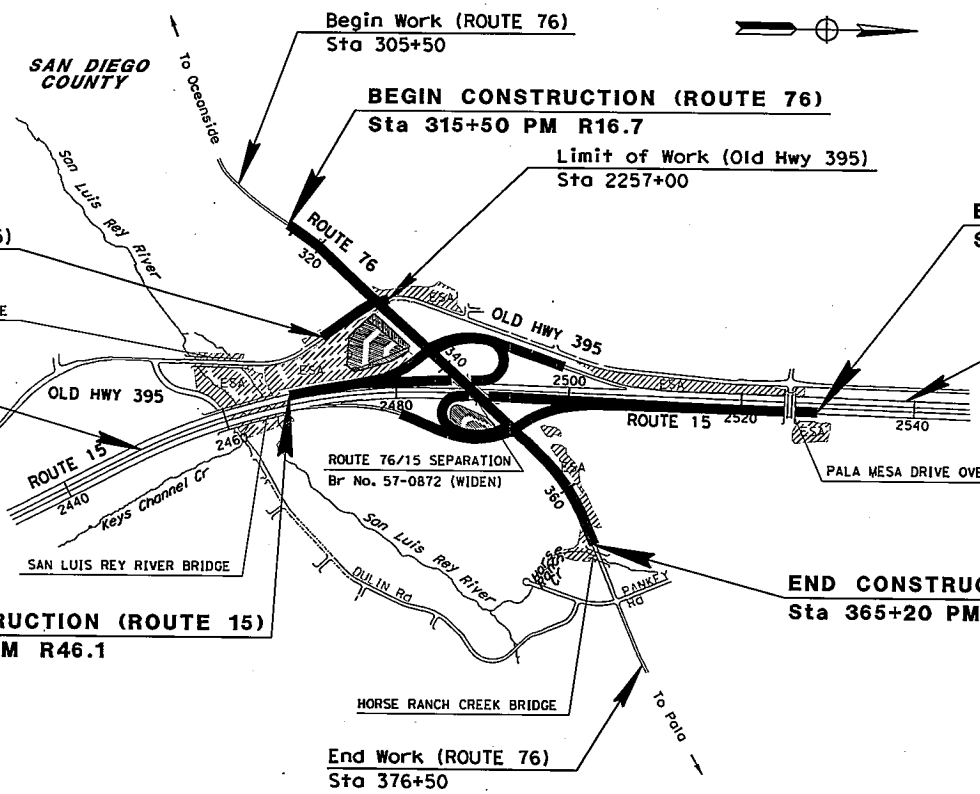
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY

IN SAN DIEGO COUNTY
NEAR BONSALL AND FALLBROOK
ON ROUTE 15 FROM 0.4 MILE SOUTH
TO 0.8 MILE NORTH OF ROUTE 76/15 SEPARATION
AND ON ROUTE 76 FROM 0.5 MILE WEST
TO 0.5 MILE EAST OF ROUTE 76/15 SEPARATION

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3 R16.7/R17.7	1	



NO SCALE

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO BIDDERS."

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER MOHAMAD KHATIB No. Exp. CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

CONTRACT No.	11-257144
PROJECT ID	1100020469

PROJECT MANAGER ANN FOX
DESIGN ENGINEER MOHAMAD KHATIB

LAST REVISION 00-00-00 DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BORDER LAST REVISED 7/2/2010 | CALTRANS WEB SITE IS: HTTP//WWW.DOT.CA.GOV/ | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | USERNAME => $USER DGN FILE => $REQUEST | UNIT 2765 | PROJECT NUMBER & PHASE 11000204691

MATERIALS INFORMATION

R-VALUE

The recommended design R-value of 30 is based on Materials Reports for 11-080101 and 11-037671 and memorandums within the project vicinity.

GROUNDWATER

According to the above Materials Reports, groundwater was not encountered within the project limits.

CORROSION ANALYSIS

Based on previous corrosion investigations within the project vicinity, the in-place materials tested are considered to be corrosive to metal. Any imported fill material should be tested to determine if it is corrosive.

A number of existing culverts were examined and appeared to be in good condition with no apparent corrosion related distresses. With respect to invert abrasion, all locations were classified as being non-abrasive to water flow conditions. The existing culverts can therefore be extended or modified in-kind.

Recommendations for Existing Culverts

1. In accordance with CTM 643, the condition of existing drainage facilities determines design over actual corrosion testing. Therefore, modifications to existing systems should match the "as-builts".

2. Modifications to existing drainage systems could also use Plastic Pipe Culverts that meet the minimum and maximum fill height requirements. Either Corrugated Polyethylene (Type C, D or S), Ribbed Profile Wall Polyethylene or Ribbed Profile Wall Polyvinyl Chloride pipe can be used.

3. Modifications to existing CSPs, such as moving drop inlets, require that any exposed metal be adequately coated on the soil side with a bituminous or mastic compound.

Recommendations for New Culverts:

1. Plastic Pipe Culverts, either Type C, D or S Polyethylene Pipe, Ribbed Profile Wall Polyethylene Pipe, or Ribbed Profile Wall Polyvinyl Chloride Pipe that meet Caltrans' current diameter and fill height requirements. Where designated on the plans as corrugated interior wall type, plastic pipe shall be Type C corrugated polyethylene pipe.

2. Standard Reinforced Concrete Pipe having the following, or equivalently designed specifications: Type IP (MS) Modified cement or Type II Modified cement minimum required by Caltrans Standard Specifications 90-1.01 and maximum water-to-cementitious material ratio of 0.35.

3. The following Steel Pipe Culverts meeting the minimum and maximum fill height requirements: Corrugated Steel Pipe with bituminous coating and paved invert, Steel Spiral Rib Pipes with Polymerized Asphalt Invert, and Spiral Rib Pipes with Polymeric Sheet Coating.

EARTHWORK QUANTITIES

The following earthwork quantities are from the September 13, 2011 Engineer's Estimate.

Roadway Excavation	180,000 CY
Embankment	29,000 CY
Hot Mixed Asphalt (Type A)	43,165 tons
Concrete Pavement	2,400 CY
Class 2 Aggregate Base	53,627 CY

MATERIAL SOURCES

A current list of mining operations eligible to sell materials to the State of California in San Diego County, can be found at the following California Office of Mine Reclamation website:

www.consrv.ca.gov/omr/ab_3098_list/

CALIFORNIA DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL DESIGN REPORT

State Route-76 East Project, Phase I

11-SD-76/PM 12.1/R17.7
11-SD-15/PM 46.1/R47.3

EA 11-257141
EFIS 1100020469

March 14, 2012

Prepared By:

OFFICE OF GEOTECHNICAL DESIGN-SOUTH 2 BRANCH-D
7177 OPPORTUNITY ROAD
SAN DIEGO, CA 92111

State of California

Business, Transportation and Housing Agency

Memorandum

To: Mr. Carl Savage
Project Design Manager

Date: March 14, 2012

File: 11-SD-76 12.1/ 17.7;
11-SD-15 46.1/47.3
EA 11-257141
EFIS 1100020469

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 2 Branch-D

Subject: Geotechnical Design Report for the State Route-76East Project, Phase I

Pursuant to your request, the Office of Geotechnical Design-South 2 (OGDS2) Branch-D has prepared this Geotechnical Design Report (GDR) for Phase I of the State Route-76 East Project.

This GDR documents the prevailing site conditions and provides specific recommendations for the project's features. The report defines the geotechnical conditions as evaluated from field investigation data and used in the geotechnical analyses and design. This report provides recommendations for project design and construction.

OGDS2 staff will be available for further assistance. Should you have any questions or comments regarding this report, please contact Jeff Kermode at (858) 467-4062 or Brian Hinman at (858) 467-4051.

Jeff Kermode

Jeff Kermode
Associate Engineering Geologist
Office of Geotechnical Design - South 2 Branch-D

Brian Hinman

Brian Hinman P.E.
Senior Transportation Engineer (Civil)
Office of Geotechnical Design - South 2 Branch-D

REGISTERED PROFESSIONAL ENGINEER
BRIAN K. HINMAN
No. 55654
Exp. 12/31/12
CIVIL
STATE OF CALIFORNIA

CARBON COPY (CC) LIST

Ann Fox	District Project Manager
Ross Cather	Project Coordination Engineer
Mohamad Khatib	Project Engineer
Art Padilla	District Materials Engineer
Abbas Abghari	Office Chief, OGDS2
Shira Rajendra	Geotechnical Services Corporate
OGDS2 File Room	7177 Opportunity Road, San Diego, CA 92111
Ann Fox for the District Construction R.E. Pending File	District Construction R.E. Pending File

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1.0 INTRODUCTION

The Office of Geotechnical Design-South 2 (OGDS2) Branch-D has prepared the following Geotechnical Design Report (GDR) for the roadway portion of Phase 1 of the State Route 76 (SR-76) East project, hereafter referred to as the project. The project is located in the unincorporated community of Fallbrook in San Diego County, California. The project location is indicated on an aerial photomap provided as Figure 1A and the project limits are depicted on the project location map provided as Figure 1B. The project will construct roadway and interchange improvements to both SR-76 and Interstate 15 (I-15). The SR-76 portion of the project begins approximately eleven tenths-miles (0.11mi) west of the SR-76/Old Highway 395 intersection and ends approximately four tenth-miles (0.4mi) east of the SR-76/I-15 interchange. The I-15 portion of the Project begins one half-mile (0.5mi) south of SR-76 and ends approximately eight-tenths-miles (0.8mi) north of SR-76.

This report is intended to be used in conjunction with the District Preliminary Geotechnical Report (DPGR) that was prepared by Dokken Engineering and was issued on April 16, 2010. The DPGR presents the preliminary characterization of geotechnical conditions used for the Environmental Document (ED) and Project Report (PR), and served as the basis for preliminary design decisions. Subsequent to issuance of the DPGR additional field investigations including geotechnical test borings and engineering analyses were performed to update and refine recommendations presented in the DPGR. The field investigations included in-situ testing and site-specific engineering analyses. Issues that are not addressed in this GDR were sufficiently addressed in the DPGR. In instances where conflict between the two reports occurs, the recommendations contained within this GDR supersede those of the DPGR.

This GDR presents the results of geotechnical reconnaissance, field mapping, subsurface investigations, archival research, and analyses performed by OGDS2. This GDR characterizes geotechnical conditions and provides the basis for geotechnical recommendations relevant to the planning, design, and construction of the roadway portion of the project. Geotechnical characterization, analyses and recommendations related to bridge improvements are provided in a separate foundation report.

The characterization of subsurface conditions is based upon geologic mapping, subsurface investigations, local knowledge, and archived reports derived from antecedent major highway projects. The analyses and recommendations presented within this report are in accordance with current Caltrans standards and practices. The information contained within this report is based upon the alignment and profile drawings that were provided to OGDS2 and were last modified on March 30, 2011.

This GDR was prepared in accordance with the guidelines set forth in the *Caltrans: Guidelines for Preparing Geotechnical Design Report (GDR), Version 1.3, December 2006.* All units referenced in this document are United States (U.S) Customary units, unless otherwise noted. All elevations referenced in this report are in feet and referenced to the NAVD88 vertical datum. Unless otherwise noted, all stations are referenced to the 76RA Line.

2.0 EXISTING FACILITIES AND PROPOSED IMPROVEMENT

The project is located in northwest San Diego County along existing State Route 76 between Sage Road on the west, Horse Ranch Creek on the East, and along I-15 between the San Luis Rey River Bridge on the south and the Pala Mesa Drive Overcrossing on the north.

2.1 Existing Facilities

Structures located within the project alignment include the SR-76/I-15 Separation (Bridge No.57-0872); the Pala Mesa Overcrossing (Bridge No. 57-0873); and small retail buildings comprised of fruit stands, a gas station, store, food concession, a tree nursery venture, and an office building with associated support facilities for the Rainbow Municipal Water District.

The existing SR-76/I-15 Separation is a two (2) lane continuous two (2)-span structure built in 1971. The spans are supported by open-end seated abutments and two (2) column bents. The abutments and bents are supported by concrete piles. As built layout plans and Log of Test Borings (LOTB) for the bridge are included in Appendix I.

The Existing Pala Mesa Overcrossing is a two-span structure built in 1983. The Pala Mesa Overcrossing has never been placed into service and will not be modified by the project.

2.1.1 Existing Roadway

Within the project limits SR-76 is a conventional rural highway comprised of two lanes, nonstandard shoulders, and signalized at-grade intersections. The traveled-way along the SR-76 portion of the project consists of two opposing twelve-foot (12.0ft) wide Asphalt Concrete (AC) traffic lanes with variable paved shoulders that range from one to eight-feet (1.0-8.0ft) in width. The SR-76 corridor is a narrow rural highway with relatively infrequent occurrences of earthen shoulder backing, ditches, and turnouts. Due to the antiquity of the SR-76 facility, comprehensive as-built plans detailing the pavement structural sections are not available.

The I-15 portion of the project is comprised of a divided multilane interstate conforming to modern design standards. The interstate is comprised of four (4) northbound and four (4) southbound Portland Concrete Cement (PCC) lanes with standard AC shoulders. The existing SR-76/I-15 Interchange is a Type L-2 Spread Diamond Interchange.

Based upon experience with similar rural highways, subgrade preparation along the existing SR-76 is anticipated to be minimal in areas not rehabilitated by recent projects. The subgrade soils are generally comprised of very intensely weathered to decomposed granitic rock, alluvium, colluvium, fills derived from decomposed granitic rock and local alluvial deposits.

Signalized intersections with turn pockets occur along the existing alignment at Old Highway 395, SR-76 to I-15 on ramps and at the I-15 to SR-76 off-ramps.

Corrugated Steel Pipe (CSP), Reinforced Concrete Box (RCB), and Reinforced Concrete Pipe (RCP) culverts occur within the project footprint. These minor structures range in age and are in good to excellent condition and there are no plans to replace and/or modify most of these minor structures.

2.1.2 Existing Cut, Fill and Natural Slopes

Generally, the existing travelled way is situated on a series of side-hill cuts, through cuts, and fill-embankments. Table 1 and Table 2 summarize the characteristics and locations of the existing cuts and fills. The embankments located within the project footprint were constructed after 1972. Records documenting embankment design and construction were found in archived reports that are on file in District 11.

Slope ratios of natural slopes occurring within the project vary from very gentle to about one horizontal to one vertical (1.0H:1.0V). Locally steeper natural slopes exist within the area surrounding the project. The natural slopes are generally comprised of highly weathered granitic rock, residual soil (regolith/residuum) colluvium, and alluvium derived from granitic rock sources.

The natural slopes appear stable against landslides and are generally resistant to erosion. Features indicative of deep seated slope instabilities were not observed during field investigations and are not mentioned within archival and/or professional reports encompassing the project area.

Existing highway cut slopes expose weathered granitic rock, colluvium and alluvium. These slopes are inclined from eight horizontal to one vertical (8.0H:1.0V) to one and one quarter horizontal to one vertical (1.25H:1.0V) in the alluvial deposits and are as steep as one horizontal to two vertical (1.0H:2.0V) in the granitics. Existing cut heights are less than twenty five-feet (25.0ft) in older alluvial and colluvial soils and less than sixty-feet (60.0ft) within the granitics. Several cut slopes that expose colluvium and alluvium exhibit erosional rilling, raveling, and sloughing. Rills up to three-feet (3.0ft) deep were observed in some of these cuts. Other than localized erosion, all existing cut slopes remain globally stable and are generally in good to excellent condition.

Existing highway fill slopes span the openings of small tributary stream valleys and comprise the approach embankments to the existing SR-76/I-15 Separation. These fill slopes are generally inclined at two horizontal to one vertical (2.0H:1.0V) or flatter and are composed of locally derived decomposed granitic (DG) soils that often contain boulders. The existing fill slopes are less than twenty-feet (20.0ft) in height and have proven to be stable over time.

2.1.3 Existing Development

Along the SR-76 corridor suburban developments occur sporadically with insular residential communities occurring adjacent to the northwest and southeast quadrants of the existing interchange. Development is primarily comprised of agricultural fields, groves, low-density residential “ranchettes” and custom homes. Several small commercial businesses are present along SR-76; these ventures are comprised of fruit stands, a gas station with convenience store, and a fast food concession. Pala Mesa, a small commercial center, is located along Old Highway 395 just northwest of the interchange. The Rainbow Municipal Water District (RMWD) main office is located in the southwest quadrant of the interchange off Old Highway 395. The RMWD facility includes office space, parking lot, and a maintenance yard.

2.1.4 Existing Utilities

Buried and overhead utilities are present within the project corridor and were observed during the geotechnical investigation along SR-76 and along Old Highway 395. Utilities observed within the project footprint include culverts, water, sewer, electric lines, gas lines, fiber optic lines, and other telecommunication facilities. The existing underground utilities will not be moved during this phase of project development. Based upon project plans dated March 30, 2011, the proposed cuts and embankments will not impact existing underground and above ground utilities.

Ten (10) private Monitoring Wells have been developed in the vicinity of the Exxon-Mobile Gas Station located within the Project footprint. The monitoring well locations are depicted in Figure 3. These wells were developed to determine the presence and extent of hydrocarbons in the subsurface materials. These wells are currently being monitored and are part of an on-going remediation effort. Several of the wells will be impacted by the project and the owners must abandon and replace the wells impacted by the project prior to the start of construction.

2.2 Proposed Improvements

The SR-76/I-15 Interchange Project is designated as an Early Action Project of the second Transnet Measure administered by San Diego Association of Governments (SANDAG). The SR-76/I-15 project is phase 1 of a three phased project intended to realign and increase capacity of SR-76 between Melrose Drive in the city of Oceanside and I-15 in the East. The three phases of the SR-76 capacity enhancement and realignment are:

Phase 1 SR-76/I-15 Interchange Project.

Phase 2 SR-76 East Project that will provide capacity enhancement and realignment of the highway from South Mission Road to I-15.

Phase 3 Melrose Drive to South Mission Road.

Phase 1 and Phase 2 are addressed as a single Phase within the Environmental Document (ED), Project Report (PR), and DPGR; however, for design and construction Phase 1 and Phase 2 are being handled separately. Each phase requires a separate GDR. The Phase 1 project is depicted on modified project layouts that are presented as Figure 2A through Figure 2L.

It is anticipated that construction of Phase 1 will begin sometime in the winter or spring of 2012 and Phase 2 will begin sometime in the fall of 2012 or the winter of 2013. The layouts have been modified to identify the locations of subsurface investigations conducted to support this GDR.

Phase 3 is currently in construction.

2.2.1 Proposed Roadways

The project will provide grading along SR-76 to accommodate an ultimate six (6) lane asphalt concrete paved roadway with standard paved shoulders and recovery areas. The widths needed to accommodate the six (6) lane highway will be achieved primarily through the development of cuts and embankment fills.

According to the ED and the PR, the project will improve the existing Park and Ride facility located north of SR-76, widen the SR-76/I-15 Separation to four (4) lanes, and widen I-15 northbound to accommodate a one thousand-foot (1,000.0ft) auxiliary lane. The project will also reconfigure the SR-76/I-15 interchange on and off ramps to a Type L-9 partial cloverleaf configuration. This interchange design will add channelization lanes, add left turn lanes and right turn lanes to the loop on-ramps, and widen the on ramps to two (2) lanes plus a high-occupancy vehicle (HOV) lane.

The existing open area located in the southwest quadrant of the interchange is to be developed (by others) in the near future as a park and ride facility.

2.2.2 Proposed Slopes

The proposed cut slopes will attain heights up to sixty-feet (60.0ft) and the fill slopes will attain heights up to twenty-feet (20.0ft). The cut slopes will be developed at slope ratios of one and one half horizontal to one vertical (1.5H:1.0V) or flatter and fill slopes will be constructed at slope ratios of two horizontal to one vertical (2.0H:1.0V) or flatter.

2.2.3 Proposed Bridges

The project will widen SR-76 and the freeway crossing at I-15. A new sixty four-foot (64.0ft) wide bridge will be constructed adjacent to the existing bridge. The new columns will be supported on concrete piles. The completed separation will accommodate two (2) eastbound and two (2) westbound lanes.

2.2.4 Proposed Earth Retaining Systems

No Caltrans standard or special design earth retaining walls are proposed for this project.

2.2.5 Proposed Soundwalls/Sound Berms

Soundwalls and sound berms are not proposed as part of this project.

2.2.6 Proposed Overhead Signs

One Changeable Message Sign (CMS) structure is proposed for SB I-15 one hundred and fifty-feet (150.0ft) left of Station 2529+13 of the "RTLN" Line.

3.0 PERTINENT REPORTS AND INVESTIGATIONS

Pertinent reports and investigations utilized in the preparation of this GDR include:

Caltrans Division of Engineering Services OGDS2. August 12, 2011, *Seismic Design Recommendations SR-76/I-15 Interchange.*

Dokken Engineering, May, 2010, *Route 76/I-15 Separation Structure Preliminary Geotechnical Report BR No.57-0872*

Dokken Engineering, April 16, 2010, *District Preliminary Geotechnical Report SR-76 Mission to I-15 Project.*

Caltrans Division of Engineering Services OGDS2, 2009, *Geotechnical Design Report Widening and Realignment of SR-76 Middle Section;* 11-080101.

Caltrans Division of Engineering Services OGDS2, 2006, *District Preliminary Geotechnical Report for the SR-76 Middle Project;* 11-080100.

Dudek and Associates Inc., June 1994, *Final Floodplain Evaluation Report SR 76 Widening and Realignment Project Contract NO. 11c255 11-SD-76 East PMR 7.9-R17.6 EA 010340*

Dudek and Associates Inc., June 1994, *Final Water Quality Report SR 76 Widening and Realignment Project Contract NO. 11c255 11-SD-76 East PMR 7.9-R17.6 EA 010340.*

Caltrans District 11 Materials Laboratory, Oquita, 1990.*Geotechnical Report for an Environmental Study, 11-SD-76-PM R7.1/R17.6 North Santa Fe Avenue to Interstate 15*.

Caltrans, 1989; *As-Built plans, profiles and Log of Test Borings San Luis Rey River Bridge BR No. 57-0957.*

County of San Diego, 1989, *As-Built plans, profiles and Log of Test Borings SR-76 (Pala Rd) I-15 Separation BR No. 57-0872.*

Department of Transportation Division of Highways, September, 1973, *Highway Research Report Design Variables for Cut Slopes Final Report; Ca-DOT-TL-2882-1-73-27*.

4.0 PHYSICAL SETTING

The following section describes the physical setting of the project including: the climate; topography and drainage; man-made and natural features of engineering and construction significance; regional geology and seismicity; and soil survey mapping.

4.1 Climate

The Project lies within a transitional climate zone between interior inland influence and oceanic influence. It is located at an elevation roughly three hundred-feet (300ft) above Mean Sea Level (MSL). The winters are mild and wet and the summers are moderate and dry. The mean yearly rainfall in the Project area is fifteen-inches (15in). Rainfall usually occurs between the months of November and April. Monsoonal down pours are common in August and September when tropical storms can deliver short,

intense downpours. The driest month of the year is typically July and the wettest is typically January. Dense, valley fog occurs frequently in the fall, spring, and early summer. Table 3A and Table 3B summarize regional climatic data obtained from the Western Regional Climate Data Center.

Temperature variations between night and day tend to be moderate during summer with a difference that can reach twenty seven-degrees Fahrenheit (27.0° F) and moderate during winter with an average difference of twenty five-degrees Fahrenheit (25.0° F). The warmest month of the year is August with an average maximum temperature of eighty nine-degrees Fahrenheit (89.0° F), while the coldest month of the year is December with an average minimum temperature of forty two-degrees Fahrenheit (42.0° F). Temperatures of one hundred-degrees Fahrenheit (100.0° F) can occur anytime of the year but usually last a few days or less. The extreme temperatures for this site are one hundred and fifteen-degrees Fahrenheit (115.0° F)115 ° F to twenty two-degrees Fahrenheit (22.0° F). Typically there are two hundred and twenty four (224) frost free days or more per year (From NRCS 1973).

4.2 Topography & Drainage

The project is situated primarily upon an ancient river terrace of the San Luis Rey River that lies within a broad valley formed by the confluence of three significant, intermediate interior canyons. These canyons are identified on the USGS 7.5 Minute Bonsall Quadrangle topographic map as the San Luis Rey River, Keys Canyon, and an unnamed canyon that extends northward parallel to I-15. The unnamed canyon contains the communities of Pala Mesa and Rainbow.

The San Luis Rey River valley is confined by moderately dissected granitic hilltops and ridges that range up to several hundred feet in elevation. Locally some peaks attain an elevation of eight hundred-feet (800.0ft) or more. Both ridges and peaks exhibit high gradient dendritic drainage patterns.

To the west, the river valley opens to broad coastal terraces. To the east the river valley narrows and bifurcates into its many ephemeral tributary streams that drain the hinterland. The floor of the river valley forms a broad flat flood plain ranging in width from several hundred feet to several thousand feet or more. SR-76 generally skirts the northern edge of the floodplain. Just south of the project, I-15 crosses the valley on an alignment perpendicular to the river. The river gradient is less than three tenths-percent (0.3%) and the existing SR-76 roadway gradient is mild due to its proximity to the relatively flat valley bottom. Numerous small ephemeral stream valleys are contributory to the San Luis Rey River along the highway and interstate alignments.

The San Luis Rey River is an ephemeral braided river that has been historically prone to flooding; however, no part of the project lies within the one hundred-year (100yr) floodplain. Both SR-76 and I-15 cross ephemeral tributaries to the river along embankments containing buried pipe culverts.

4.3 Man-made and Natural Features of Engineering and Construction Significance

There are no man-made or natural features that present an unusual engineering or construction challenge.

4.4 Regional Geology and Seismicity

The project lies within the Peninsular Range Geomorphic Province of California. The province is characterized by Mesozoic age crystalline (typically granitic) basement rock, mountainous terrain, and sediment filled basins. The province is transected by numerous northwest trending ridges and valleys, and similarly trending strike-slip and dip-slip faults.

San Diego County sits upon the eastern margin of the Pacific Tectonic Plate. The region is seismically active as a result of relative movement between the Pacific Plate and North American Plate. Relative to the North American Plate the Pacific Plate moves northwestward at an annual rate of about two and one half-centimeters (2.5cm) per year. Tectonic stresses and strains associated with these plate movements have created a complex system of active, northwest trending faults typical to the region.

Major fault systems occurring near the project include the San Andreas, San Jacinto, Elsinore, and Rose Canyon Fault Zones. Additionally, complex systems of northwest trending faults occur offshore from San Diego. These offshore faults include the Coronado Banks and San Diego Trough Faults. All of these faults, as well as faults more distant from the project, are potential seismic sources that could cause minimal to moderate shaking at the project site.

Active faults that have the potential to impact the project are discussed further in Section 7.4.

4.5 Soil Survey Mapping

Pertinent information on site soils can be found in the United States Department of Agriculture (USDA) Soil Survey of San Diego (1973). The USDA soil survey indicate that several different soil associations occur within the project and that at least ten (10) soil series are found within the project area. The soil survey report indicates that many of the soil series occurring within and adjacent to the project possess severe erosion characteristics. Soil properties and USDA designations that are relevant to highway engineering are summarized in Table 4. Soil survey mapping depicting the locations of the soil series relative to project features is included within Appendix I.

5.0 EXPLORATION

The subsurface exploration was comprised of geotechnical borings, hand auger borings, in-situ testing, and geophysical surveys. The purpose of the subsurface investigation was to determine the extent, nature, and engineering characteristics of subsurface materials found within the project footprint. Subsurface exploration locations are depicted on Figure 2A through Figure 2L and Figure 4A through Figure 4L.

Some areas located within the southwest quadrant of the interchange were closed to entry due to the presence of sensitive environmental resources. OGDS2 was unable to conduct subsurface investigations within the closed area.

5.1 Drilling and Sampling

Twenty-six (26) mechanical borings and seven (7) hand auger borings were developed during the course of the subsurface investigation. Of the twenty six (26) borings, nine (9) are shallow borings that were developed by Dokken Engineering during the 2009-2010 investigation conducted in support of the DPGR. Subsequent to the DPGR, OGDS2 Branch D developed fourteen (14) borings to investigate ground conditions at the location of the proposed cuts and embankments. Three (3) additional borings were developed by OGDS2 Branch-A at the locations of the proposed new bridge supports needed to facilitate bridge widening.

Boring location, elevation, depth drilled, and type are summarized in Table 5. It also provides information on borings developed during other investigations conducted at the project site. LOTB and Boring Records from the project investigation are included within Appendix II. Copies of LOTB from the 1971 SR-76/I-15 Separation project and select boring records from the ETIC Engineering hazardous waste investigation at the Exxon Mobile Station are also included within the appendices.

Methods used to develop borings for the project include: hollow flight auger, hand auger, and wet rotary borings (HQ punch core; single wall core barrel and HQ double-wall core barrel).

The equipment used by OGDS2 for drilling and sampling are reported on the Boring Records (BR) and in the Logs of Test Borings (LOTB).

The borings were developed and logged in compliance with the methods and procedures specified in the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual* (2010). Standard Penetration Tests (ASTM D-1586) were corrected in the field for hammer energy ratio (ERi) and normalized for drill rod energy ratioN_{60}. The ERi for the drilling equipment used can be found on the BR and LOTB. Borings were developed to determine the nature and engineering characteristics of the geotechnical earth

materials that occur along the project layout. Samples of subsurface materials were comprised of: standard split spoon samples (ASTM D-1586); bulk samples from hollow flight auger cuttings; HQ punch cores of site soils and decomposed rock with single wall core barrels; and HQ & NQ rock cores obtained by double wall coring barrels and carbide Chris bit.

Representative samples were retained during the subsurface investigation. Some soil samples were bagged and are archived at the OGDS2 Branch-D offices. Some soil samples were submitted for laboratory testing during development of the DPGR by Dokken Engineering. Rock cores were boxed and are archived at the OGDS2 Branch-D offices.

Several hand auger test pits were developed at proposed detention and infiltration basin locations. Test pit locations are described in Table 5, are depicted in Figure 2 and are also depicted on the Percolation Test Data sheet included in Appendix II.

5.2 Geologic Mapping

Detailed geologic mapping was conducted by Dokken Engineering during the DPGR phase of project development. A geologic map was prepared for the SR-76 East Project which includes both the Phase 1 and Phase 2 projects. The portion of the Dokken geologic map that contains the project is included in Figure 4. Dokken's geologic map is based upon field reconnaissance, review of pre-existing geologic maps, archived reports, published reports, and subsurface investigations. The geologic map summarizes the locations of the earth materials found within the project footprint and correlates them to the project improvements.

5.3 Geophysical Studies

The Caltrans Office of Geotechnical Support developed three (3) seismic refraction survey (SRS) lines along two (2) proposed cuts to be developed in granitic rock. The SRS lines were used to develop pressure wave velocity (V_p) profiles along the proposed rock cuts. The V_p is a function of rock density and hardness, therefore, V_p can be used to evaluate the effort required to perform excavations. The V_p has also been correlated to grading factors (relative shrink/swell) of excavated materials.

The location of the SRS lines are depicted on the SRS layout sheet included in Appendix II. Seismic velocity profiles for each line are also included in Appendix II. Table 6 summarizes SRS line characteristics and presents the V_p for each of the three (3) layers detected in the two (2) cuts. The seismic velocities correlate well with descriptions of rock quality as observed in borings developed within the two cuts.

The raw data for the SRS lines are on file in the Office of Geotechnical Support located in Sacramento. Release of the final report presenting the SRS was pending during the preparation of this GDR. When available, the SRS report will be on file at the OGDS2-Branch D office in San Diego.

5.4 Exploration Notes

All borings were abandoned immediately after drilling. Hollow flight auger holes were backfilled with native soils (cuttings). Rotary wet borings were backfilled with enviroplug. Cuttings from the rotary wet borings were placed within labeled steel drums that were transported offsite and appropriately disposed. Subsequent to completion of percolation tests, the test pits were backfilled by native soils.

No potentially hazardous waste was identified during this study.

6.0 GEOTECHNICAL TESTING

The sections below describe the in-situ and laboratory testing program performed for the proposed project.

6.1 In Situ Testing

In situ testing conducted during the Project geotechnical investigation was comprised of Standard Penetration Testing (ASTM D-1586), Pressure Wave Velocity Profiling (see Section5.3), and Percolation Testing (California Test Method 750; CTM 750).

Soil consistency determined by Standard Penetration Testing (SPT) is presented in the BR and LOTB. Table 6 summarizes V_p versus depth.

District 11 project development staff has identified three (3) locations under consideration for use as infiltration/detention basins. Proposed basin locations were designated as Location A, Location B, and Location C. Proposed infiltration basin locations are depicted on the infiltration basin layout sheet included as Figure 5. Infiltration tests were conducted at Locations B and Location C. Testing was not conducted at Location A due to environmental restrictions. A total of six (6) percolation tests were conducted pursuant to California Test Method (CTM) 750. The test locations are depicted in Figure 2 and on the Percolation Test Data sheet included in Appendix II. A copy of the test method has also been included within Appendix II.

At test location PT-1 and PT-3 percolation tests were not conducted because the water poured to pre-saturate the test pits did not infiltrate into the soils during the entire testing period. Table 7 summarizes percolation test results.

6.2 Laboratory Testing

No laboratory testing was conducted for this GDR; however, laboratory test results from previous studies conducted at or adjacent to this site were used to estimate soil and rock parameters. Results of soil testing on project soils, conducted by Dokken Engineering during the DPGR phase of project development, are included in Appendix III. Table 8 summarizes corrosion test results reported in the Project DPGR (after Dokken). The following projects were reviewed in the effort to estimate representative soil and rock parameters:

- 11-SD-76/I-15 Geotechnical Design Investigation; 2012; 11-25714
- 11-SD-15 Lilac Rd to SR-76, 1976 ; 11-095081
- 11-SD-15 Lilac Rd to North of N. Shearer Rd, 1975; 11-095071
- 11-SD-15/76 Rte 76 to Mission Rd, 1973; 11- 144801
- 11-SD-15 N. Shearer Rd. to Rainbow, 1969; 11- 095001
- 11-SD-15 Serving Facilities, Oakcrest Mobile Home Park, 1978; 11-144
- 11-SD-15/76 Mission to I-15 DPGR by Dokken, 04/16/2010; 11-257110
- 11-SD-76/15 Revised Foundation Report for Widening of Bridge 57-0872, 05/09/2011; 20111100000189

7.0 GEOTECHNICAL CONDTIONS

The following section describes geotechnical conditions that will affect the project.

7.1 Site Geology

The soils and geologic formations found and mapped within the project footprint include the following units: 1) artificial fill, 2) recent river valley alluvium, 3) older alluvial deposits, 4) colluvium, and 5) igneous granitic rock. The extent to which these soil and rock units occur within the project is presented on the Project Geologic Map depicted in Figure 4 and the geologic cross sections depicted in Figure 6A through 6G.

7.1.1 Lithology

The formations found in the project area are described as follows:

Artificial Fill (Qaf): Fill soils derived from local materials created from the activities of man. These soils have been placed as either engineered or non-engineered fills and may contain abundant boulder sized rock.

Recent Alluvium (Qa, Qw): Recent Alluvium is comprised of very loose to medium dense silt, sand, and gravel. These granular deposits are usually segregated and washed free of the clayey particles. However, there may be localized deposits of fat clays, lean clays, sandy clays, and clayey sands. Alluvial deposits range in thickness from loose soils typically occur as shallow surface deposits typically less than five-feet (5.0ft) thick.

Older Alluvium (Qoa): Older alluvium consist of silty, sandy, gravelly river and stream deposits that are frequently medium dense in consistency and often cemented. Locally, older alluvium may contain beds of consolidated lean to fat clay. Older alluvium ranges in thickness from zero to eighty-feet (0.0-80.0ft). or more and varies from interbedded to massive. These deposits often comprise the eroded elevated terraces that border the San Luis Rey River. The surface layers are often dark reddish brown and frequently exhibit evidence of zonal soil development. Portions of this unit exhibit distinct colorations typically due to ferric oxy-hydroxide cementation. The older alluvial deposits encountered in exploratory borings and at the ground surface exhibit conditions consistent with pedogenisis (zonal soil development). Pedogeneisis is a chemical-mechanical process that infers that a landform has been stable for a relatively long period of time.

Colluvium (Qc): Colluvium is present as reddish brown to dark brown and orangish gray, clayey, silty, sandy, gravelly slope wash derived from highly weathered granitics. The colluvium may contain localized accumulations of boulder sized material in a soil matrix as well as talus deposits. The distinct color of the colluvial deposits is a result of the mineralogy forming the deposit as well as various types of ferrous cementation. Locally these soils may contain clay binders and/or may be weakly to moderately cemented.

Granitic Rock of the Southern California Batholith (Ki, Kt, Kcc): The Cretaceous aged granitic rock occurs extensively throughout the region and comprises the regional bedrock. This broad lithologic category is comprised of various distinct rock types which are characterized by their individual chemistries and mineral content but often lumped together under the general term “granitic” by the scientific and engineering community. These rocks vary from decomposed to fresh, from soft to extremely strong, and from slightly fractured to very intensely fractured. Weathering profiles within the granitics create pseudo-stratification. The granitic rock is often mantled by or contains zones of regolith, a residual soil developed from the in-place decomposition of the parent rock.

7.1.2 Structure

The definitions of the descriptive terms used in the following discussion are provided in and conform to the *Caltrans Soil and Rock Logging and Classification and Presentation Manual.*

The geologic structure at the site is consistent with that of the regional structure. The relevant geologic structures at this site are bedding, lithologic contacts, and fractures that occur within the granitic rock. The transition between bedding layers or lithologic units (alluvium, colluvium, granitic) can be abrupt, transitional, and/or gradational.

The alluvial deposits are relatively flat lying, exhibit cross bedding, and channel cut/fill features typical to that of braided river deposits. The colluvial deposits are massive and exhibit contacts that generally parallel the ancient ground surface, usually a slope upon which they rest. Colluvial deposits often exhibit inverse gradation.

Structure evident in the granitic rock is comprised of discontinuities. A discontinuity is defined as a disruption in the fabric of a rock. Discontinuities in granitic rock can be comprised of fractures, joints, shears, faults, dikes, sills, contacts, foliation, and weathering horizons. Borings developed in the granitic rock reveal the presence of joints, fractures, shears, and weathering horizons. Based upon exploratory borings, there are at least three (3) sets of joints present in the granitic rock. These discontinuity sets are evident from their dip angles. Since the drilling method used to develop the site borings does not provide oriented cores, the trends of discontinuities cannot be determined from the rock cores. Therefore, additional data on site discontinuities (joints) was collected from window mapping at existing rock cuts and natural outcrops. Outcrops beyond the project footprint were mapped because the outcrops within the project footprint are predominantly mantled by soils that effectively hide any discontinuities that might be present. The mapping revealed the presence of relict jointing exhibiting dip angles consistent with those observed in borings; however, there are insufficient clean exposures to acquire a reasonable statistical sampling of discontinuity trends and dips.

Generally, the discontinuities in the area exhibit a medium to very high persistence and have planar to planar stepped, rough to smooth joint wall surfaces. Discontinuity spacing(s) vary with location, depth below ground surface, and with the joint set under consideration. Within a given joint set, spacing can vary from one-inch (1.0in) to ten-feet (10ft) or greater. Joint apertures can vary from tight to wide, and joint in-fillings can vary from clean to thickly filled. In order of most abundant to least abundant, the fracture fillings include: clean, very thin to thin oxides, thin to thick decomposed granite, and rarely thick clays.

Structure within the granitic rock is complicated by the way the rocks weather. Generally, uniform weathering of granitic rock generates a crude stratification where weathering decreases with depth. The stratification is created by development of zones of consistent weathering that generally parallel the original ground surface (see cross SectionS7-S7'). These layers exhibit typical thicknesses that are a function of mineralogy, slope angle, fracture density, slope aspect, and erosion rates. Weathering in the granitics also occurs chaotically as discrete pockets of intensely weathered to decomposed rock surrounded by slightly to moderately weathered rock or as intensely weathered to decomposed rock containing core stones of fresh, hard granite. Sometimes these core stones occur as ribs of relict rock that run through an outcrop. The irregular velocity profiles and gradients evident in the SRS plots imply these conditions are likely to be present in the subsurface at the location of the proposed cuts. Outcrops exhibiting relict rock ribs and large pockets of intensely to decomposed rock encapsulated in slightly weathered rock masses are evident in slopes adjacent to the project.

7.1.3 Natural Slope Stability

Natural slopes within the project area range from very gentle to about one horizontal to one vertical (1.0H:1.0V). Locally steeper natural slopes exhibit slope ratios of one horizontal to four vertical (1.0H:4.0V). or steeper especially where fresh to moderately weathered rock outcrops in the walls of arroyos and canyons

No deep seated instabilities are recognized or known to occur in the slopes in and/or adjacent to the project. However, rock roll-outs and isolated soil and rock falls are known to occur during and following heavy rains.

7.2 Subsurface Conditions

The following sections describe the relevant geotechnical conditions that impact project design and excavations.

7.2.1 Soil

The location and areal extent of geotechnical materials are indicated on the geologic map provided within Figure 4. Table 9 and Table 10 summarize subsurface materials present at the locations of existing and proposed cuts and embankments. Boring records and LOTB included within the appendices provide detailed descriptions of the soils and rocks and their relative thickness. Soil data from borings were generalized and plotted on geologic cross sections that are included in Figure 6. The geologic cross sections were used as the basis of slope stability and settlement calculations discussed in Section 8.4.

The project site lies within an incised, alluvial filled basin formed at the confluence of three significant canyons eroded in the regional granitic bedrock. The subsurface is comprised of local, thin, granular engineered fills, young and old alluvial soils, and granitic bedrock. Much of the proposed improvements will be constructed within the alluvial deposits.

Borings developed at the location of the new interchange ramps reveal the presence of localized lean clays at elevations of the proposed roadway improvements. Bridge borings reveal the presence of hard fat and lean clays that occur at depths well below the proposed roadway improvements.

North of the SR-76/I-15 Separation, I-15 lies in a through-cut developed within older alluvial deposits. These existing cut slopes were developed at slope ratios of two horizontal to one vertical (2.0H:1.0V) or flatter and are in fair to good condition. However, some of the cuts exhibit severe rilling (see Table 1, Table 2, and Table 9). Along the east side of I-15 the project will widen to the outside thereby re-grading some of these cuts.

Granitic rock underlies all of the earth materials found within the project corridor. The depth to granitic rock varies with location. Surface outcrops are depicted on the geologic map and in cross sections. At the locations of natural, undisturbed granitic outcrops, the granitics are mantled by colluvium and regolith up to fifteen-feet (15.0ft) thick. The contact between colluvium/regolith and the granitic rock may be transitional, gradational, or abrupt. Typically below the regolith is a zone comprised of decomposed to very intensely weathered, very soft granitic rock. At depths of twenty five-feet (25.0ft) or more beneath ground surface, the granitic rock becomes moderately to slightly weathered and moderately hard to hard.

Granitic rock encountered during construction will be comprised of decomposed to slightly weathered, very soft to hard discontinuous rock. The rock quality varies from very poor to excellent. Borings indicate the majority of the rock to be encountered in cut will exhibit a quality designation of good or better.

Based upon rock cores and outcrop mapping the *Geologic Strength Index (GSI, after Geomechanics 2007) and the Rock Mass Rating (RMR, Bieniawski, 1989)* designations of site rock are deemed to be:

GSI: Fair, Blocky Rock ($50 < GSI < 51$)

RMR Poor to Fair Rock ($32 < RMR < 42$)

Table 11 presents Mohr-Coulomb strength parameters for the granitic rock mass. These values are based upon the GSI and RMR and are estimated using the Hoeck-Brown Criterion.

Examples of material unsuitable for embankment subgrade or fill include undocumented fill, organic mud, highly expansive clay, stockpiled trash, and debris.

Unsuitable soils were observed at several locations. These soils are depicted in Cross Section S2-S2'. The unsuitable soils located right of the "B-2A1" Line between Station 2486 + 50 and 2493+20 appear to be undocumented fill. These soils are extensively riddled with piping channels. The existing concrete ditch in this interval is missing soil backing along portions of its layout as a result of piping.

The soils occurring within a disturbed natural swale located between Station 317+80 and 318+10 of the 76RA Line are very loose to loose sands.

Surface soils occurring within the footprint of the proposed excavation located right of the 76RA Line between Station 320+00 and 328+00 contain refuse and detritus associated with the nursery operation. Project soil designations pursuant to the Caltrans Trenching and Shoring Manual are presented in Table12.

7.2.2 Groundwater

Groundwater occurs within the subsurface at an approximate elevation of two hundred and forty six-feet (246ft) MSL. Table 13 summarizes groundwater observations in thirteen (13) borings with records extending back to 1972. It is not anticipated that groundwater will be encountered during construction of features related to the roadway portion of the project.

Two (2) high groundwater anomalies occur where groundwater was encountered in boring R-11-014 at elevation two hundred and eighty two-feet (282ft) MSL at fifteen and six tenths-feet (15.6) feet below ground surface and in boring MW-10 at elevation two hundred and seventy six-feet (276ft) MSL. R-11-04 was developed for design of the CMS sign located along SB- 15 in the vicinity of Station 2534+48 of the "RTLN". MW-10 was developed by ETI engineering to evaluate groundwater contamination related to the Exxon Mobile station in the vicinity of Station 335+00 of the 76RA line.

7.3 Surface Water

Surface water occurs as ephemeral sheet and rill flow emanating from slopes and terraces occurring within the project footprint. The project footprint is somewhat topographically insular and therefore the contributory offsite watershed draining toward the footprint is small. Rainfall on SR-76 and I-15 is gathered by engineered systems and concentrated runoff is conveyed off-site by culverts and concrete ditches that discharge to natural drainage courses. These drainage courses direct storm water to the San Luis Rey River that flows westward to the Pacific Ocean.

Natural arroyos occur occasionally and exhibit V-shaped to a broad based U-shaped cross sectional profiles. In both cases, the banks are near vertical, which implies rapid down-cutting, with heights of eight-feet (8.0ft) or less.

7.3.1 Scour

The older and younger alluvial deposits and colluvial deposits are susceptible to scour particularly where engineered drainages release concentrated storm water into small natural drainages. Severe scour is evident at existing engineered drainage outfalls located right of the I-15 RTLN in the vicinity of Stations 2508+10, 2514+50 and 2516+90.

7.3.2 Erosion

Erosion severity designations are defined in Table 14 A. Natural slopes and existing cuts in colluvium and regolith exhibit very slight to severe erosion. These slopes manifest slight rivulets to rills up to three-feet (3.0ft) deep. Slope wash accumulations are non-existent to slight below most slopes; however, slope wash accumulation is appreciable below those slopes exhibiting moderate to severe rilling. The serrated

cut slope located right of Station 355+00 to Station 360+00 76 RA Line is comprised of colluvium, regolith and rock. This slope is performing very well. No rills were observed within this cut; however, an accumulation of soil is forming upon the serration benches.

Natural slopes and existing cuts developed in older alluvium at slope ratios of two horizontal to one vertical (2.0H:1.0V) or steeper exhibit slight to severe erosion. These slopes manifest slight rivulets to rills up to three-feet (3.0ft) deep. Slope wash accumulations are non-existent to slight below most slopes in older alluvium; however, slope wash accumulation is appreciable below those slopes exhibiting moderate to severe rilling.

Table 4 summarizes the National Resources Conservation Service (NRCS) soil series found in the project footprint. Table 4 also correlates the NRCS soil series to their respective Hydrologic Soil Grouping (HSG) designation. Table 14 B correlates the NRCS HSG designations to soil erosion susceptibility. An NRCS map depicting the location and areal extent of the NRCS soil series relative to project improvements is provided in Appendix I. A comparison of the NRCS map to Figure 4, the Project Geologic Map, reveals that the old and young alluvium, colluvium, and regolith are highly susceptible to erosion.

In summary, the hydrologic soil group designations (Table 14 B) of site soils range from A to C. which correlate to an erodibility designation (Table 14 A) of very slight to severe with the majority of the soils being designated as severe. Therefore, the long-term integrity of project slopes will depend upon implementation of aggressive erosion protection, the use of slope rounding, and the use of brow ditches.

7.4 Site Seismicity

The site seismicity is addressed within a separate memo titled Seismic Design Recommendations SR 76/I-15 Interchange Roadway dated 08-12-2011 and Foundation Report SR 76/I-15 Bridge 57-0872 dated 06-23-2011. Both of these memoranda are included within Appendix V. Site seismicity is also addressed within the project DPGR.

The project site is not located in an Alquist Priolo Earthquake Fault zone as defined by the 1972 Alquist Priolo Fault zone Act. Additionally, the project is not situated in a Seismic Hazard Zone as defined by the 1990 Seismic Hazards Mapping Act.

The design fault is the Elsinore Fault Temecula Segment (EFTS). Relevant ETFS seismic design data is provided in Table 15.

8.0 GEOTECHNICAL ANALYSIS AND DESIGN

The following section describes the geotechnical analyses, parameters, and design criteria that should be utilized by project designers in the continued developed of the project.

8.1 Dynamic Analysis

Dynamic analyses parameter selection and site response spectra are provided in separate reports included within Appendix IV. Since the roadway portion of the project does not include any structures, further discussion of the dynamic analysis and parameter selection is not warranted.

For the pseudo static slope stability analysis the horizontal component of seismic ground acceleration (a_g) is equal to one third the of the peak ground acceleration (1/3PGA).

$$1/3(0.4g) = 0.13g.$$

8.2 Liquefaction Analysis

Liquefaction involves the sudden loss of shear strength of a saturated, cohesionless soil subjected to cyclic loading produced by an earthquake. The cyclic loading and loss of shear strength cause the soil to temporarily exhibit the strength characteristic of a fluid mass. Typically, liquefaction occurs in areas where groundwater is less than fifty-feet (50ft) from the surface and where the soils are predominantly comprised of poorly consolidated poorly graded fine sands, silty sands, and non plastic silts.

Due to the lack of groundwater and the presence of clayey sandy soils, there is little to no potential for soil liquefaction at the site.

8.3 Cuts and Excavations

This section presents the analyses used to determine the stability, rippability, and grading factors of materials in proposed cuts or excavations.

The proposed cuts and excavations are summarized in Table 9 and Table 10.

8.3.1 Stability

Proposed cut slopes were evaluated for stability. Cut slopes will be constructed in both rock and older alluvium. The strength parameters used in the stability analyses are presented in Table 16. To be considered stable at a specified slope ratio and height, a given slope must demonstrate a stability factor-of-safely (FOS) greater than or equal to one and one half (≥1.5) for static conditions and a stability FOS greater than or equal to one and one tenth (≥1.1) for pseudo static conditions. For a temporary slope to be considered stable at a specified slope ratio and height, a stability analysis must demonstrate a FOS greater than or equal to one and two tenths (≥1.2).

Cross sections depicting finished slope ratios and anticipated lithologies are provided in Figure 6. Project slopes were analyzed based upon the profiles illustrated in the cross sections. Copies of the stability analyses are also included within Appendix IV. The allowable slope heights for a specified slope ratio and lithology are summarized in Table 17. Slopes that are constructed at the slope ratios and/or slope heights indicated in Table 17 will demonstrate FOS that satisfies Caltrans stability criteria. Slopes that are constructed flatter and or lower than those indicated in Table 17 will also meet or exceed the stability criteria. Any proposed slopes higher and/or steeper than those indicated in Table 17 should be analyzed for stability prior to inclusion into the project.

Stability of Cuts in Rock

Rock cuts were evaluated for stability as discontinuous rock masses by kinematic analyses and by analyses as homogenous masses (Mohr-Coulomb material) using the computer programs, *PCstabl-5M* and *GSTABL, Version 2.005.*

The stability of rock slopes is typically controlled by discontinuities with joints being the most common and pervasive type of discontinuity. A joint set is defined as a collection of joints that exhibit similar dip and trend range, and a joint system is defined as a unique combination of joint sets characteristic to a given rock mass. A kinematic analysis is a graphical analytic method (as opposed to a numeric method) that utilizes stereonets to evaluate if rock movement along discontinuities is mechanically possible. If a kinematic analysis demonstrates that slope failure is possible based on rock structure for a given slope, then a limit-equilibrium stability analysis of the specific conditions along the discontinuities is conducted to evaluate slope stability.

To facilitate evaluation of discontinuity trends that could result in planar and block modes of slope failure, the dip angles of discontinuities observed in the borings were plotted on stereonets. The stereonet plots of discontinuities observed in rock cores indicate that at least three distinct and regular joint sets occur in the rock mass. To facilitate evaluation of conditions that could result in topples and wedge

modes of failure, the great circles representing the same discontinuities were also plotted on the same stereonets. Subsequent kinematic analyses using Markland's Method of analysis on the composite stereonets (combined plots of dip vectors, great circles, and friction envelopes) indicate that the design cuts will be mechanically stable. These stereonet plots are included within Appendix IV.

To conduct the kinematic analyses, the discontinuity dips were plotted as dip vectors on a polar projection stereonet. Since discontinuity trends could not be determined (see Section 7.1.2) from field data, all similar dip angles were combined to form hypothetical discontinuity sets (Section 7.1.2) with assigned trends. The resulting hypothetical discontinuity sets were then plotted as a discontinuity system in the first quadrant of the stereonet at an assigned trend of zero-degrees (0°). In a similar fashion, the dip sets were assigned another trend direction of twenty-degrees (20.0°) and the resulting system was then re-plotted in the first quadrant of the same stereonet. This process was repeated throughout the first quadrant of the stereonet by re-plotting each hypothetical system (comprised of the three (3) joint sets discussed above) with a twenty-degrees (20.0°) trend separation between systems [i.e. each system was plotted with the same dip angles as observed in the field but with hypothetical trends that vary by twenty-degrees (20.0°)]. To complete the kinematic analysis, additional joint systems were defined and plotted in the other three (3) quadrants of the stereonet. The resulting stereonets were then used to evaluate possible geometric and geo-mechanical relationships of three dimensional discontinuity orientations and to conduct kinematic analyses of rock blocks and wedges formed by the intersection of these discontinuities. The resulting stereonet represents all possible fracture combinations for the project slope and illustrates that cuts developed at slope ratios of one and one half horizontal to one vertical (1.5H:1.0V) or flatter are kinematically stable regardless of actual joint trends.

Since the rock found along the project varies from decomposed to slightly weathered, a Mohr-Coulomb limit equilibrium stability analysis was conducted using the computer program *PCStabl 5m* utilizing both the Bishop and modified Janbu methods of analyses. The slope stability analyses indicates that the sixty-foot (60.0ft) permanent cuts in decomposed to intensely weathered rock will be stable under static and pseudo-static loading conditions.

Cuts in Alluvium

Permanent cuts in older alluvium were evaluated utilizing the computer program *GSTABL, Version 2.005*. The maximum height of the proposed cuts will be about sixteen-feet (16.0ft) with maximum slope ratios of two horizontal to one vertical (2.0H:1.0V). The soils at the site are comprised predominantly of medium dense silty sands. These materials were assigned soil strength parameters according to Table 16. The slope stability analysis indicates that the sixteen-foot (16.0ft) permanent cuts in alluvial soils will be stable under static and pseudo-static loading conditions.

The older alluvium is often bonded by a cementation agent that dissolves in water. These soils exhibit high strengths when dry but may become soft when saturated. Slopes developed in older alluvium will perform well in terms of global stability; however, they will be highly susceptible to erosion if they are not protected.

Materials exposed on the slope face may be highly erodible. These slopes should therefore be protected against erosion and vegetated in accordance with the recommendations presented in Section 11 of this report or as determined by the District 11 Landscape Architect.

At the proposed interchange ramps, clays occur in older alluvium. The clays should perform adequately as roadway foundation soil; however, once exposed in construction, the clays should be protected from the effects of wet weather to prevent softening.

During construction it is anticipated that very loose to loose younger alluvial and fill soils will be predisposed to caving and/or collapse where exposed in drilled shafts and shallow excavations. The

occurrence of younger alluvial deposits is depicted in Figure 4 and is likely to be encountered in temporary excavations developed for or within:

- Unsuitable materials removal.
- Culverts, pipes, irrigation, valve boxes, electrical and/or fiber optic conduits and boxes.
- Drilled shafts developed for signage, telephone poles, and/or electrolier foundations.
- Existing natural drainages.

Drilled shafts and temporary excavations developed within the older alluvium and colluvial deposits should be temporarily stable; however, trench and/or shaft wall collapse may occur locally due to the presence of weak zones and/or wetting. The occurrence of older alluvium and colluvium deposits are depicted in Figure 4 and are likely to be encountered in temporary excavations developed for:

- The staged excavations needed to realign and widen the SR-76/I-15 on and off ramps.
- Culverts, pipes, irrigation, valve boxes, electrical and/or fiber optic conduits and boxes.
- Bridge shoring.
- Drilled shafts developed for the CMS.
- Drilled shafts developed for signs, telephone poles, and/or electrolier foundations.

The drilled shaft for the CMS discussed in Section 8.8 will be developed in older alluvial deposits. A portion of the shaft will be developed at elevations below perched water. Due to the presence of water, the shaft walls will be prone to slaking and/or caving. It is likely that temporary casing, pursuant to *Section 49-4.03 of the Standard Specifications* will be required and that special equipment may be needed to remove loose, saturated soils from the bottom of the shaft.

8.3.2 Rippability

Other than the more competent granitic rock, the soils that will be encountered on the project are considered rippable by standard heavy grading equipment. Table 18 correlates the anticipated excavation effort with soil lithology.

The excavation difficulty estimates presented in the Table 9 and Table 18 are based upon boring records, characteristic pressure wave velocities, conditions visible in outcrops, geologic cross sections, records, anecdotal information from other projects, and professional judgment. The excavation difficulty designations presented in Table 9 and Table 18 are further defined by Table 19 and Table 20. The designations in Table 19 are based upon *Dearman (1978), The California Department of Transportation Laboratory Research Record (FHWA-CA-TL-2153-77-10), The Caterpillar Performance Handbook (1993),* and from the *National Soil Survey Handbook (1993).*

Excavation difficulty designations present in Table 20 are from the *Bulletin of Engineering Geology (1978)* after *Excavation Characterization Designations for Materials Identified in Field Excavations (Tennessee Department of Transportation, 1978)* which correlates level of difficulty to heavy equipment capabilities.

Mechanical fragmentation of boulders and rock will be necessary to develop excavations in portions of the granitic rock. It is anticipated that the excavation difficulty in the granitics will increase with depth of excavation. Table 9 correlates the anticipated excavation difficulty for specific project improvements referenced according to mainline station. It is anticipated that less than twenty five-percent (25.0%) of

the subsurface materials found within the project rock cuts will require fragmentation to facilitate ripping and grading.

The decision to facilitate fragmentation by blasting verses the use of a mechanical breaker is primarily based upon engineering economics and is often the prerogative of the contractor. Therefore, a Standard Special Provision (SSP) for blasting should be included in the contract documents.

8.3.3 Grading Factors

Grading factors relate the in place volume of material to be excavated to the in place volume of material after placement as fill. The factors are defined as in place volume of compacted fill divided by in place volume of material to be excavated.

$$G_f = V_{fill}/V_{exc}$$

Table 21 correlates the anticipated grading factors to the lithologies present in the project footprint.

8.4 Embankments

Portions of the interchange improvements will consist of embankment fill over native soils. The proposed embankments are summarized in Table 10. The maximum height of embankment fill of approximately fifteen-feet (15.0ft) will be at Station 340+50.

Fill materials utilized for embankment construction will be derived from excavations in cut locations and imported from off-site borrow sources if necessary. It is anticipated that during the excavation of cuts the decomposed to moderately weathered granite will disaggregate in response to mechanical disturbance (scrapers, rippers, blades, blasting, etc.). Ripping and track walking should disaggregate the granitics to a poorly graded to well graded silty fine to coarse sand with gravel and cobbles. The actual gradation and size will depend upon the degree of weathering and fracturing present in the parent material and on the relative mixing of lithologies. The granitic formations along with the soils, colluvium, and the fills derived from the granitic formations, generally provide good subgrade for roadways, retaining structures, and culverts.

The proposed embankments will be supported on existing alluvial soils that are comprised predominantly of medium dense silty sands. The mostly granular alluvium will experience settlement in response to the increased overburden. A settlement analysis was performed based on a maximum embankment fill height of fifteen-feet (15.0ft). The Hough's method of analysis was used to estimate settlements.

Recent borings were extended to a depth of about forty five-feet (45.0ft) into existing alluvium. However, review of a boring drilled in 1972 for the existing bridge structure indicates that the alluvium extends deeper. The settlement analysis assumed that the alluvium extends to a depth of at least seventy five-feet (75.0ft) below the existing ground surface. SPT blow counts obtained in the field were corrected for both overburden pressure and hammer efficiency. The settlement analysis indicated an estimated total settlement of about two and one half-inches (2.5in).

Due to the granular nature of the alluvium the estimated settlement should occur rapidly as the embankment is built up to its design height. The settlement waiting period before final grading and the construction of pavements can begin is not expected to exceed thirty-days (30day) following placement of the embankment.

The proposed fill embankments will be about fifteen-feet (15.0ft) high with side slopes two horizontal to one vertical (2.0H:1.0V). Slope stability analyses were performed for both static and pseudo-static loading conditions. The computer program *GSTABL, Version 2.005* was utilized to perform the stability analysis. The modeled slope geometry consisted of a fill slope placed over alluvial soil. The soil strength parameters presented in Table 16 were utilized in the evaluation. A seismic coefficient of thirteen one

hundreths (0.13) was applied for the pseudo-static analysis. The analyses revealed that the proposed fill embankments satisfy Caltrans slope stability criteria.

Materials exposed on the fill slope face may readily erode. Therefore, the surface of fill slopes should be stabilized by appropriate erosion control measures. The District 11 Landscape Architect should be consulted to provide appropriate erosion control measures.

8.5 Earth Retaining Systems

No earth retaining systems are currently proposed for this project.

8.6 Culvert Foundations

The project includes the construction of one culvert system comprised of three (3) side-by-side reinforced concrete pipes. This system is located at Station 320+00 to 328+00 of the 76RA Line and will cross the highway beneath new embankment that will be placed for the realigned SR-76. The native foundation soil at this site is shallow younger alluvium (Qal) over bedrock. The alluvium is susceptible to settlement and piping. The alluvium should be removed and replaced prior to placement of the culvert system. The width of removal should extend three-feet (3.0ft) from the outside edges of the culvert to a depth of three-feet (3.0ft) below existing ground surface. The spoil can be reused in embankments.

8.7 Soundwall Foundations

No soundwalls are proposed for this project.

8.8 Overhead Sign Foundations

A CMS structure is proposed for SB I-15 one hundred and fifty-feet (150.0ft) left of Station 2529+13 of the "RTLN" Line: An exploratory boring (designated as RC-11-014) was conducted to develop subsurface information for the site. An LOTB for RC-11-014 is included in Appendix I.

Based upon RC-11-004, the foundation materials that will be encountered for CMS structure are comprised of medium dense sands and silty sands. These materials are interpreted to be older alluvial deposits. The site conditions satisfy design criterion used in the *2006 Standard Plan Drawing S116* and/or S135 for a CMS Cast-in-Drill Hole (CIDH) concrete pile foundation.

The boring revealed perched groundwater occurring at an elevation above the CIDH pile tip. Due to the presence of water a drilled shaft may be subject to belling and collapse at this location. Therefore, the pile should be designed and constructed for wet conditions pursuant to *Section 49 of the Standard Specifications*.

8.9 Infiltration Basins

Three potential infiltration basin locations were presented to OGDS2 for evaluation and testing. The proposed infiltration basins are identified as Location A, Location B, and Location C; these locations are depicted in Figure 5. Percolation testing conducted at these sites is discussed in Section 6.1. The percolation test results are presented in Table 7. The HSG designation of the site soils is discussed in Section 7.3.2 and summarized in Tables 4.

Depth to rock beneath the proposed infiltration basins is greater than 80 ft. Soils encountered at the proposed basins are alluvial deposits comprised of lean clays silts, and sands. Some of the fine grained soils occur as hard pan. HSG designations at the basins are B,C, and D.

The Caltrans Storm water handbook titled: *Project Planning and Design Guide (PPDG; 2010)* specifies infiltration basin criterion. Infiltration rates observed during percolation testing are presented in Table 7. Based upon infiltration rates and site soil properties observed at proposed infiltration basin Location B and Location C, it appears that these locations do not meet PPDG threshold criterion. In general, the clays along with the hardpans found within older alluvium exhibit very poor percolation rates.

OGDS2 was precluded from conducting percolation testing at Location A due to the presence of sensitive environmental resources; however, based upon surface observations and site geology Location A is likely to have similar characteristics to the other proposed basin sites.

9.0 MATERIAL SOURCES

No off site material source has been identified for this project. Material generated from on site excavations will consist primarily of sand and silt derived from weathered rock and alluvium. The material generated on site is anticipated to be suitable for use as roadway embankment. Material processed by appropriate screening or crushing is anticipated to be suitable for use as structure backfill. Boulders may be broken and used as rip rap or buried in deeper portions of engineered fill.

10.0 MATERIAL DISPOSAL

Material generated during construction that is found to be unsuitable for use as roadway subgrade, embankment, or topsoil should be placed at an appropriate location within the projects limits or properly disposed.

Surplus material may be generated by project excavations. Table 22 provides areas where surplus soils can be stock piled. Table 23 provides areas where surplus soils should not be stock piled, even temporarily, due to the probable consequences of generating adverse ground responses to loading. The potential adverse ground responses include:

- Mobilizing excessive settlements adjacent to structures, flatwork, and culverts.
- Loading of slopes that may result in slope failures.

Soils should not be stockpiled in the open areas inside the loop ramps. These open areas are underlain by thick alluvial deposits that are susceptible to settlement and are near the SR-76/I-15 Separation, flat work, and culverts which could be damaged by excessive settlement. In addition, the open benches located at the top of cut east of I-15 should not be loaded. Surcharging these benches may result in slope failures. Figure 7 depicts a map indicating the areas defined in Tables 22 and Table 23.

11.0 RECOMMENDATIONS

1) A thirty-day (30day) settlement waiting period is required at the location of embankments listed in Table 24

2) Foundation soils encountered at the location of the CMS are conducive to the use of a Standard Plan Foundation pursuant to the *2006 Standard Drawing S116 or S135*. It is anticipated that groundwater will be encountered in the drilled shaft developed for the CIDH pile foundation. Wet and caving conditions may be encountered during drilling operations. Temporary casing pursuant to *Section 49-4.03 of the Standard Specifications* is likely to be necessary.

3) Site soils are designated as severe in terms of erosion potential; therefore, the District 11 Landscape Architect should be consulted to provide appropriate erosion control measures. In order to minimize erosion in cut slopes the following measures should be considered:

   - Aggressive erosion protection through establishment of deep-rooted leafy plants and/or slope serrations.
   - Cut slopes greater than sixty-feet (60ft in height should be benched. Benches should be a minimum of twenty-feet (20ft) in width and should provide concrete lined ditches to collect and conduct drainage off-site.
   - Slope rounding and contouring. Where cuts catch with natural slopes, the transition should be smoothly rounded and contoured. Wherever possible the transitions should be flattened to slope

ratios of two horizontal to one vertical (2.0H:1.0V) or flatter. Lateral slope transitions should be contoured and flattened. Transitions should not be sharp and/or abrupt.

- Brow ditches should be constructed wherever the off-site drainage gradient is toward cut slopes. The drainage ditches should be developed with minimal cuts and should be at elevations below all potential contributory runoff sources.
- Concrete berms should be constructed behind brow ditches at the locations of complex slope falls. The berms should be designed to conduct runoff running parallel to brow ditches toward the brow ditches. These structures are necessary to prevent the development of rills and piping galleries.

4) Remedial grading will be required to mitigate areas underlain by soft/loose soils, collapsible soils, and soils containing unsuitable materials. The extent of remedial grading is conveyed in Table 25. Removal depths greater than those shown in Table 25 may be required depending on the actual subsurface soil conditions encountered. Remedial grading is recommend for:

- Removal of unsuitable soils occurring at embankment foundation elevation between Stations 2486+50 and 2493+20 of the “B2A1” Line. Grading limits are depicted in Cross Section S2-S2. The spoils from this removal may be used as embankment fill if deemed suitable by the Engineer.
- Removal of very loose to loose sands occurring at the foundation elevations of the pipe culvert to be constructed between Station 317+80 and 318+10 of the “76RA” Line. The Spoils generated from these removals may be used as embankment fill.
- Selective removal of surface soils occurring within the footprint of the proposed excavation located between Station 320+00 and 328+00 of the “76RA” Line . These soils contain and/or are mantled by refuse and detritus. These materials should be removed and appropriately disposed.

5) Some heavy ripping and rock fragmentation is anticipated at several cut slope locations. A SSP for controlled blasting should be included within the bid package.

- Unless site conditions warrant otherwise, blasting should proceed under full facility closures.
  - The duration of closure needed to facilitate blasting is typically fifteen-minutes (15.0min) or less; however, misfires, rock on the road, or temporary blast induced slope instabilities may require closures of longer duration.
- Lane closure charts should be included within the SSP.
  - Generally State regulations preclude blasting operations after dark.
  - If the Traffic Management limits facility closures to night-time hours then a special permit allowing for night-time blasting can be obtained from the California Occupational Safety and Health Agency (Cal-OSHA).
  - Obtaining Cal-OSHA permits for blasting is generally the responsibility of the Contractor.

6) Allowable cut slope ratios in granitic rock are presented in Tables 9 and 17. Generally, the allowable slope ratios are one and one half horizontal to one vertical (1.5H:1.0V) or flatter; however, there are intervals where allowable cut slope ratios in granitics are two horizontal to one vertical (2.0H:1.0V) or flatter.

- Table 17 presents allowable slope ratio versus height configurations that provide stable slope geometries. Design changes that propose slopes that are steeper or higher than those presented in the table should be evaluated by OGDS2 before being implemented on the project.

7) Allowable cut slope ratios in alluvial deposits and in engineered fill embankments are presented in Tables 9 and 17. Generally allowable slope ratios in fill or alluvium are two horizontal to one vertical (2.0H:1.0V) or flatter.

   - Table 17 presents allowable slope ratio versus height configurations that provide stable slope geometries. Design changes that propose slopes that are steeper or higher than those presented in the table should be evaluated by OGDS2 before being implemented on the project.

8) The SSP should identify locations deemed appropriate and inappropriate for stock piling soils pursuant to Tables 22 and 23 and discussed in Section 10 above.

12.0 DESIGN ADVISORIES

The planning of staged construction should account for temporary excavations such as the temporary excavations needed to construct the interchange loop ramps**.** Temporary excavations must be designed and maintained in conformance with the *Caltrans Trenching and Shoring Manual*.

1) Underground utilities not explicitly discussed within this GDR that are located in proximity to the proposed embankments or are adjacent to excavations in alluvial soils may be adversely impacted by the placement of overburden or the removal of confinement. The potentially adverse affects of earthwork should be considered by project designers. Utility owners should be notified of the nature and proximity of work adjacent to their lines.

2) Cross drainages that will be deeply buried by new embankments and that are not explicitly discussed in this report may be adversely impacted due to differential settlement.

3) Embankment loads on compressible soils may adversely impact utilities located beneath or adjacent to the loads. Project designers should consider differential settlements and the use of appropriate alternative design measures to mitigate these conditions.

4) As described in Section 8.9, soil conditions at the locations of the three (3) proposed infiltration basins have poor infiltration characteristics.

13.0 CONSTRUCTION CONSIDERATIONS

1) A representative from OGDS2 should be present during the grading of cut slopes to confirm that the conditions exposed in cuts are consistent with the anticipated conditions or to provide alternative slope design if warranted by the conditions exposed.

2) A representative from OGDS2 should be present during remedial grading operations.

3) If soft, saturated, or otherwise unsuitable soils are encountered in excavation OGDS2 should be contacted before the excavation proceeds significantly.

4) Clays and hard pan exposed in subgrade should be protected from moisture. Should clays and hard pans become wet they will likely soften and become unsuitable for use in foundations. If hard pans and clays are deemed too soft for use as subgrade then they should be removed and subgrade elevation should be re-established pursuant to *Section 19 of the Standard Specifications.*

5) It is anticipated that groundwater will be encountered at an elevation above the CIDH pile tip for the CMS. Wet conditions should be anticipated and the pile should be constructed pursuant to *Section 49 of the Standard Specifications*.

6) If blasting will be conducted, then the contractor must:

   - Submit a General Safety Plan pursuant to the SSP.

   - Submit individual site specific blasting plans to the Engineer for each blast prior to drilling for the shot. The information included in the site specific blasting plan submittals must conform to the

blasting SSP. A representative of OGDS2 is available to review shot plans at the request of the Engineer.

7) Temporary excavations should be developed pursuant to *Caltrans Trenching and Shoring Manual*. The sandy nature of some soils present within the project will predispose excavation walls to collapse.

14.0 ACTUAL VS. REPORTED SITE CONDITIONS

The characterizations of geotechnical conditions along the project alignment and presented in this report are based on the review of the design information provided, proposed project features, as-built plans, geologic maps, geologic literature, archival reports, exploration, and laboratory testing. The evaluations and recommendations contained in this report are based on the information discovered and data gathered. If conditions are encountered during the project that appear to differ from the conditions conveyed in this report, or if construction difficulties related to soil conditions are encountered, a representative of OGDS2 Branch-D should be consulted to assist with the assessment of the prevailing geotechnical conditions and to assist in formulating appropriate strategies to facilitate project completion.

Should project design features vary significantly from those described in this report an updated GDR should be prepared by OGDS2 Branch-D to address the geotechnical considerations related to those features.

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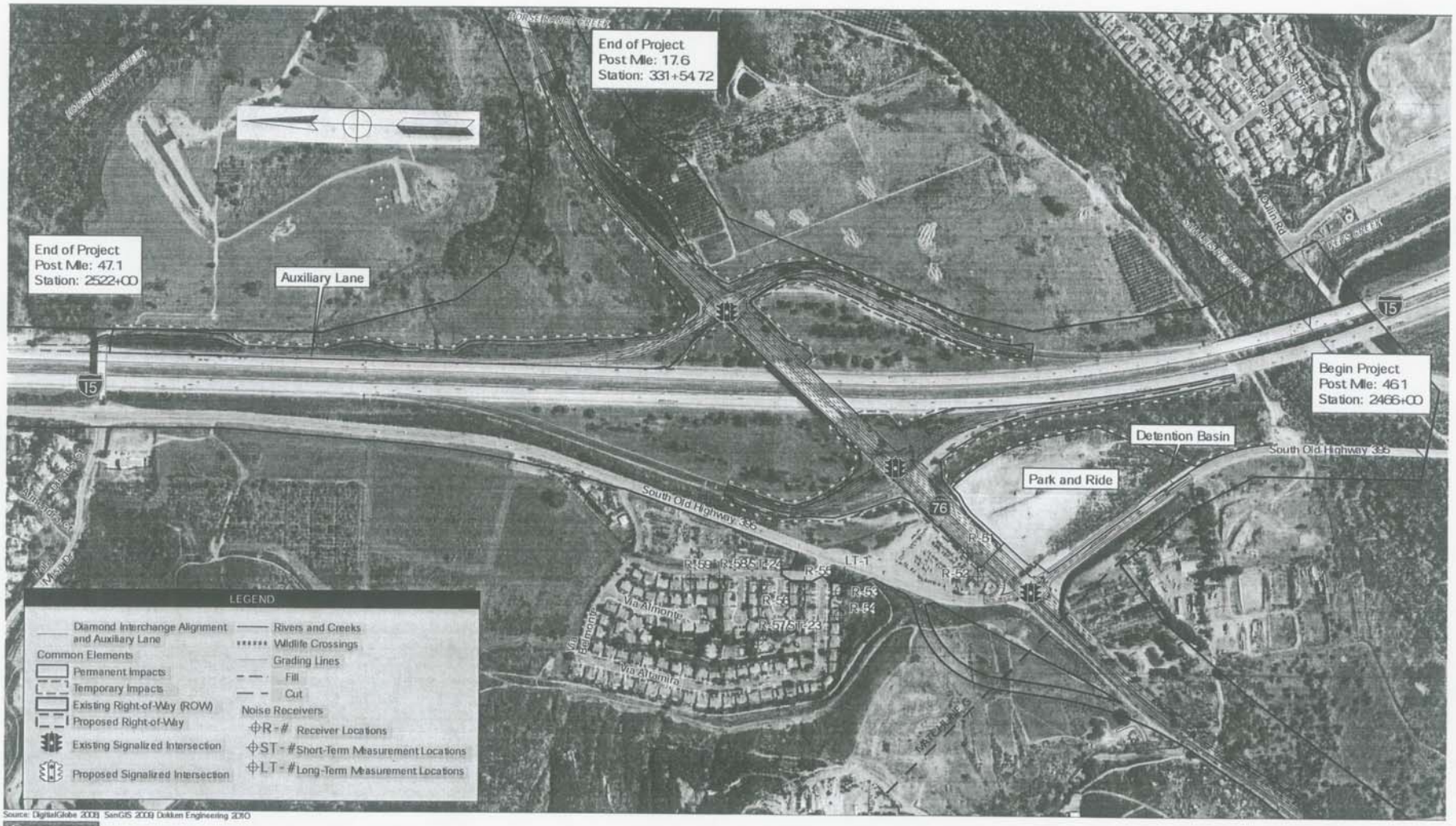
FIGURES



Source: DigitalGlobe 2008; SanGIS 2009; Dokken Engineering 2010

500 250 0 500 Feet

Scale: 1 = 6,000; 1 inch = 500 feet

Phase 1 Aerial Photo Map
Figure 1A

SR-76 South Mission Road to Interstate 15 – Highway Improvement Project

Path: P:\2008\08008105 SR76 East S Mission I-15\FR-ED\GIS\MXD\EIR_EIS\June 2010\Fig 2_01_5_Diamond Interchange.mxd, 08/06/10, augellop

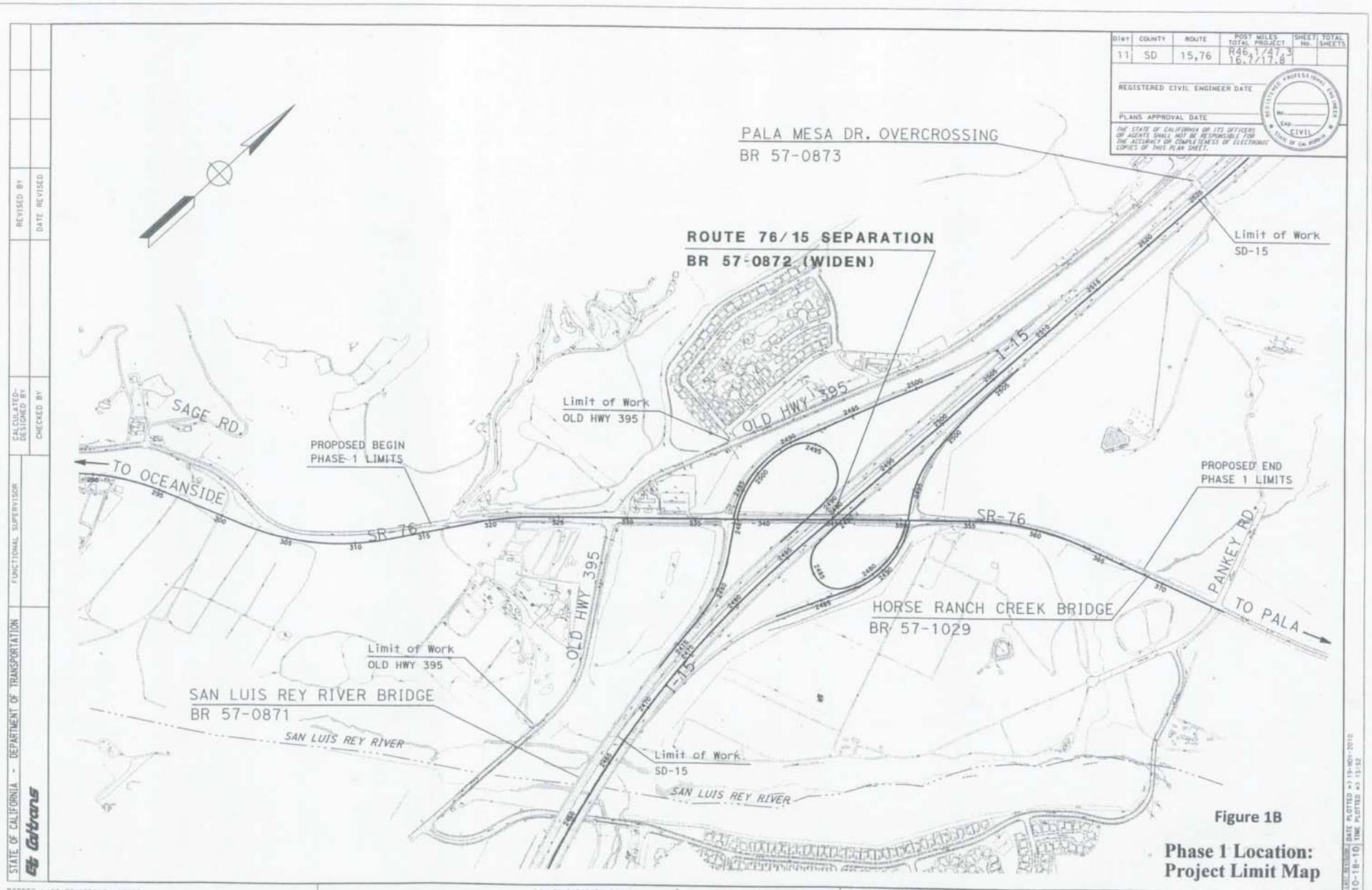


Figure 1B

Phase 1 Location: Project Limit Map

LEGEND TO ALIGNMENT LAYOUT PLANS

6 BOREHOLE LOCATION (A-11-001)

3 BOREHOLE LOCATION (RC-11-002)

○ PERCOLATION TEST LOCATION

▲ CONE PENETROMETER

△ SURVEY MONUMENT

S2 S2' CROSS SECTION

Figure 2A

DIst	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

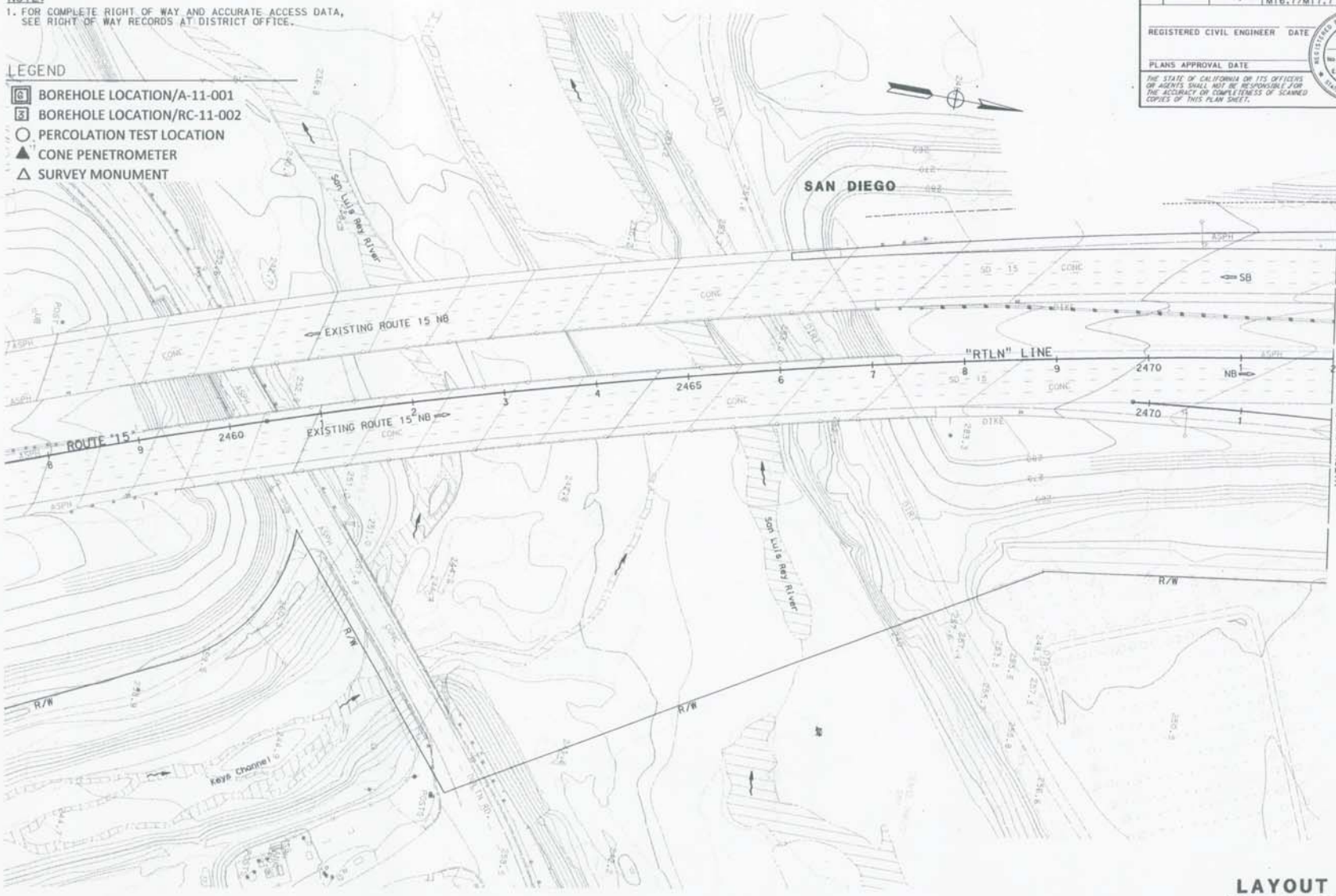
REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

NOTE:

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.

LEGEND

- BOREHOLE LOCATION/A-11-001
- BOREHOLE LOCATION/RC-11-002
- PERCOLATION TEST LOCATION
- CONE PENETROMETER
- SURVEY MONUMENT



ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

LAYOUT

SCALE: 1" = 50'

Figure 2B **L-1**

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE

CALCULATED-DESIGNED BY: MOHAMAD KHATIB

CHECKED BY: JEFF BALUYUT

REVISED BY

DATE REVISED

DATE PLOTTED => 20-APR-2011

TIME PLOTTED => 11:28

03-30-11

BORDER LAST REVISED 7/2/2010

USERNAME => s135192

DGN FILE => 1100000189ea001.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 1100000189

NOTE:
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.

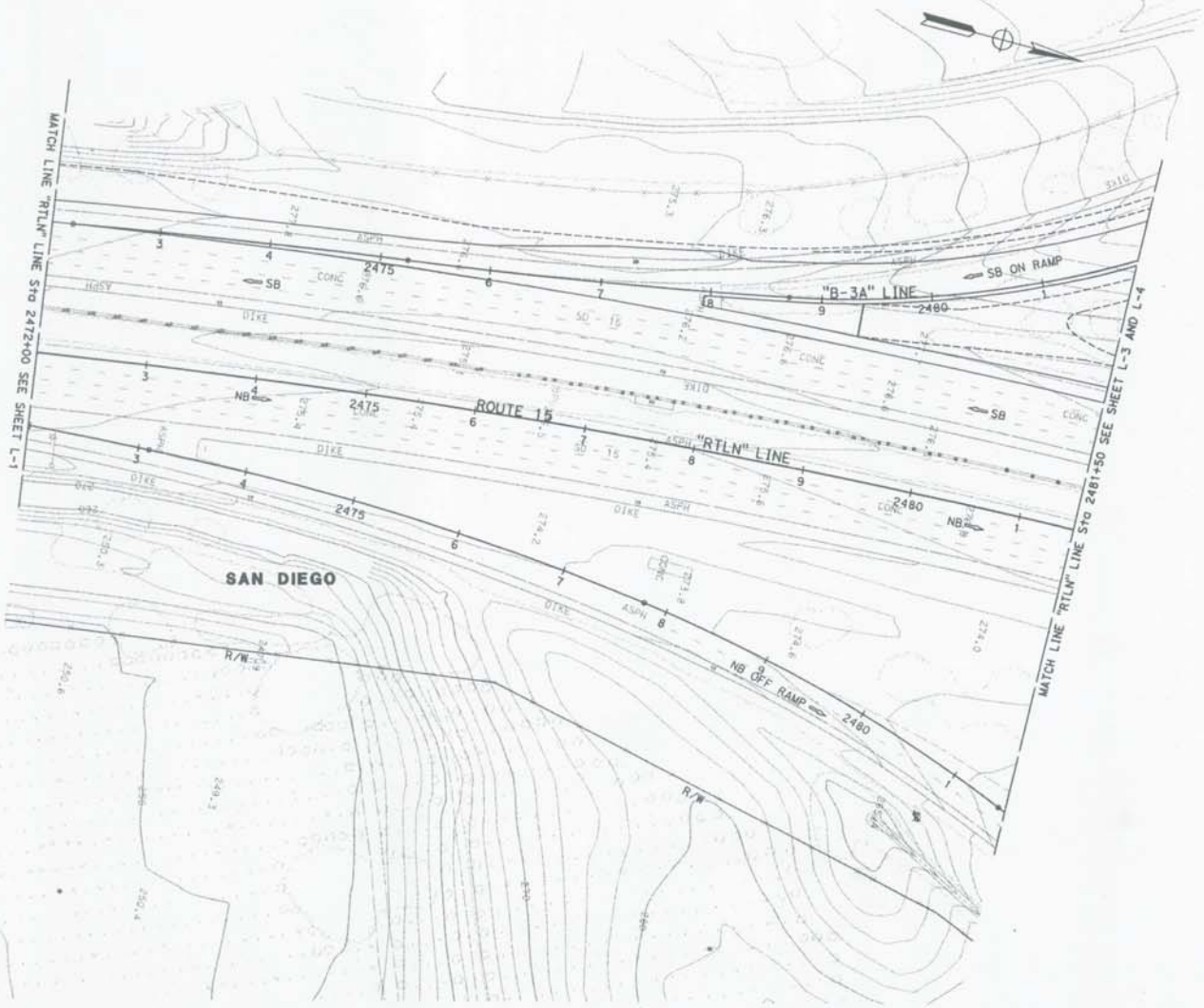
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA



ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

LAYOUT
SCALE: 1" = 50'
Figure 2C **L-2**

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE
CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: JEFF BALUYUT
REVISED BY
DATE REVISED

LAST REVISION 03-30-11 DATE PLOTTED => 20-APR-2011 TIME PLOTTED => 11:28

BORDER LAST REVISED 7/2/2010 | USERNAME => s135192 DGN FILE => 1100000189ea002.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0000 | PROJECT NUMBER & PHASE 1100000189

NOTE:
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.

LINE	LOCATION	NORTHING	EASTING	ELEVATION	STATION	OFFSET
"RTLN"	A11010	2 064 760.106	6 283 608.815	294.054	2483+18.140	359.907 Lt
"RTLN"	A11011	2 064 872.576	6 283 809.196	274.900	2484+26.477	159.305 Lt
"RTLN"	A11012	2 065 271.593	6 283 419.735	291.973	2488+13.882	556.520 Lt
"RTLN"	PT2	2 065 451.587	6 283 550.141	284.959	2489+96.768	430.201 Lt
"RTLN"	PT5	2 065 456.628	6 283 690.697	281.683	2490+04.974	289.794 Lt
"RTLN"	MON154644	2 065 191.720	6 283 940.090	278.780	2487+45.751	34.497 Lt
"76-RA"	MON761720	2 065 055.570	6 283 730.550	305.650	343+34.345	75.679 Rt
"76-RA"	MON761722	2 065 234.160	6 283 799.850	307.400	342+70.351	56.128 Lt
"RTLN"	MON154650	2 065 413.780	6 283 839.360	279.700	2489+65.486	140.204 Lt
"RTLN"	MON154658	2 065 801.920	6 283 954.120	280.270	2493+56.112	34.216 Lt

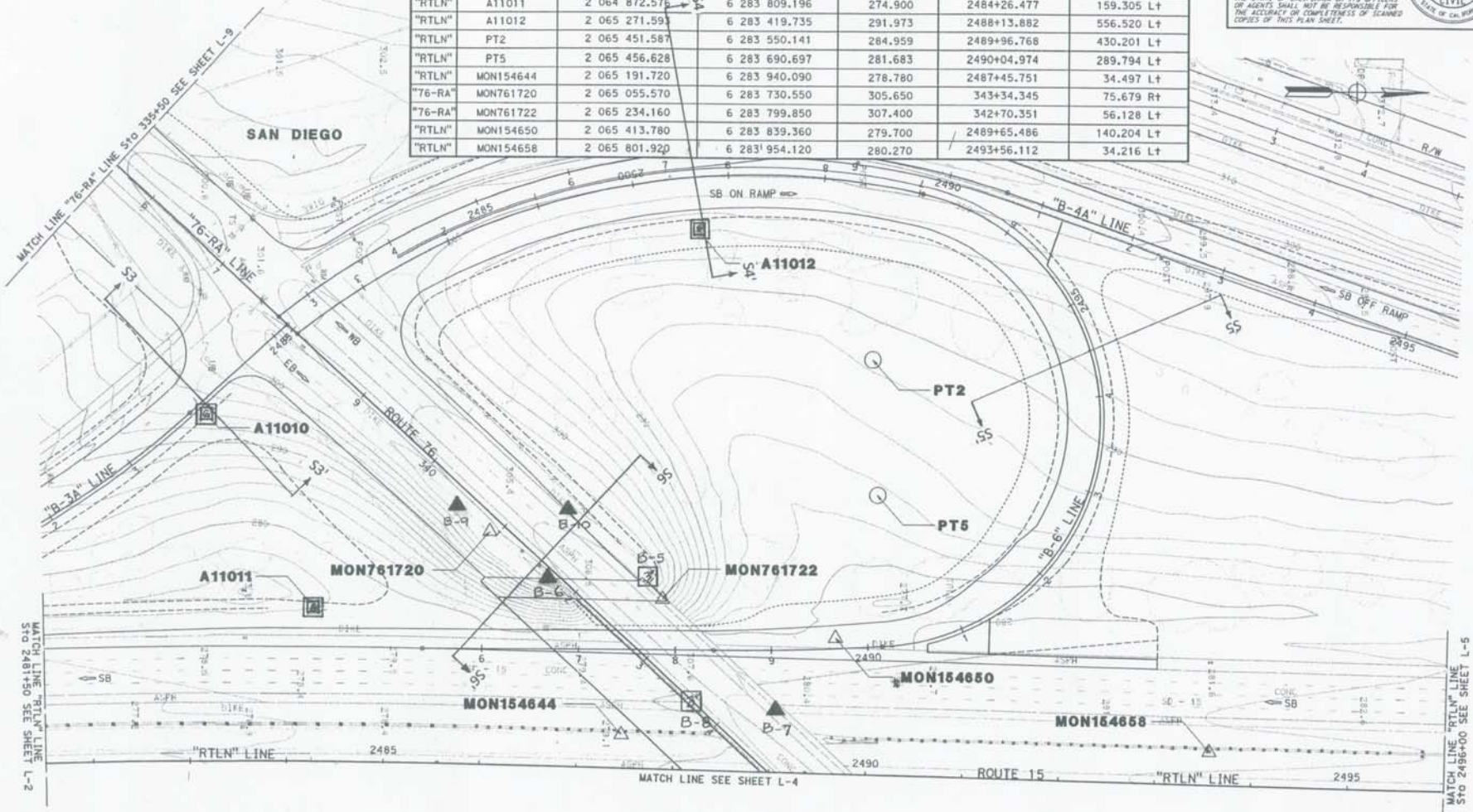
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER NO. EXP. CIVIL STATE OF CALIFORNIA



LAYOUT
SCALE: 1" = 50'
Figure 2D

L-3

ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans PROJECT DEVELOPMENT
FUNCTIONAL SUPERVISOR: CARL SAVAGE
CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: JEFF BALUYUT
REVISED BY
DATE REVISED

DATE PLOTTED => 20-APR-2011
TIME PLOTTED => 11:28
DATE REVISED 03-30-11

BORDER LAST REVISED 7/2/2010
USERNAME => s135192
DGN FILE => 1100000189ea003.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 1100000189

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

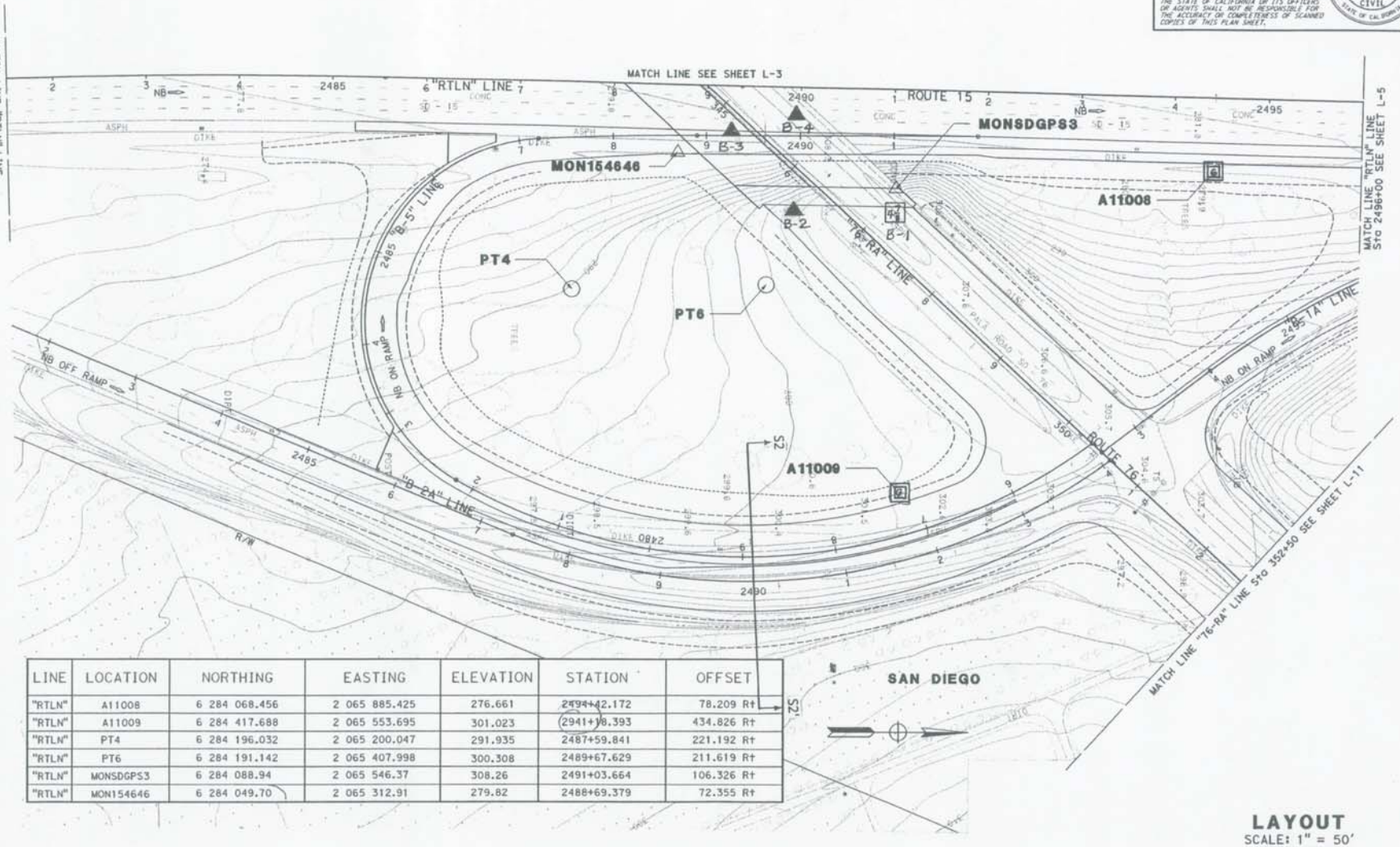
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER No. EXP. CIVIL STATE OF CALIFORNIA

NOTE:

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.



LINE	LOCATION	NORTHING	EASTING	ELEVATION	STATION	OFFSET
"RTLN"	A11008	6 284 068.456	2 065 885.425	276.661	2494+42.172	78.209 Rt
"RTLN"	A11009	6 284 417.688	2 065 553.695	301.023	(2941+18.393)	434.826 Rt
"RTLN"	PT4	6 284 196.032	2 065 200.047	291.935	2487+59.841	221.192 Rt
"RTLN"	PT6	6 284 191.142	2 065 407.998	300.308	2489+67.629	211.619 Rt
"RTLN"	MONSDGPS3	6 284 088.94	2 065 546.37	308.26	2491+03.664	106.326 Rt
"RTLN"	MON154646	6 284 049.70	2 065 312.91	279.82	2488+69.379	72.355 Rt

ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

LAYOUT
SCALE: 1" = 50'
Figure 2E **L-4**

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	MOHAMAD KHATIB	REVISED BY
CARL SAVAGE	CHECKED BY	JEFF BALUYUT	DATE REVISED

LAST REVISION 03-30-11 | DATE PLOTTED => 20-APR-2011 | TIME PLOTTED => 11:28

BORDER LAST REVISED 7/2/2010 | USERNAME => s135192 | DGN FILE => 1100000189ea004.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0000 | PROJECT NUMBER & PHASE 1100000189

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

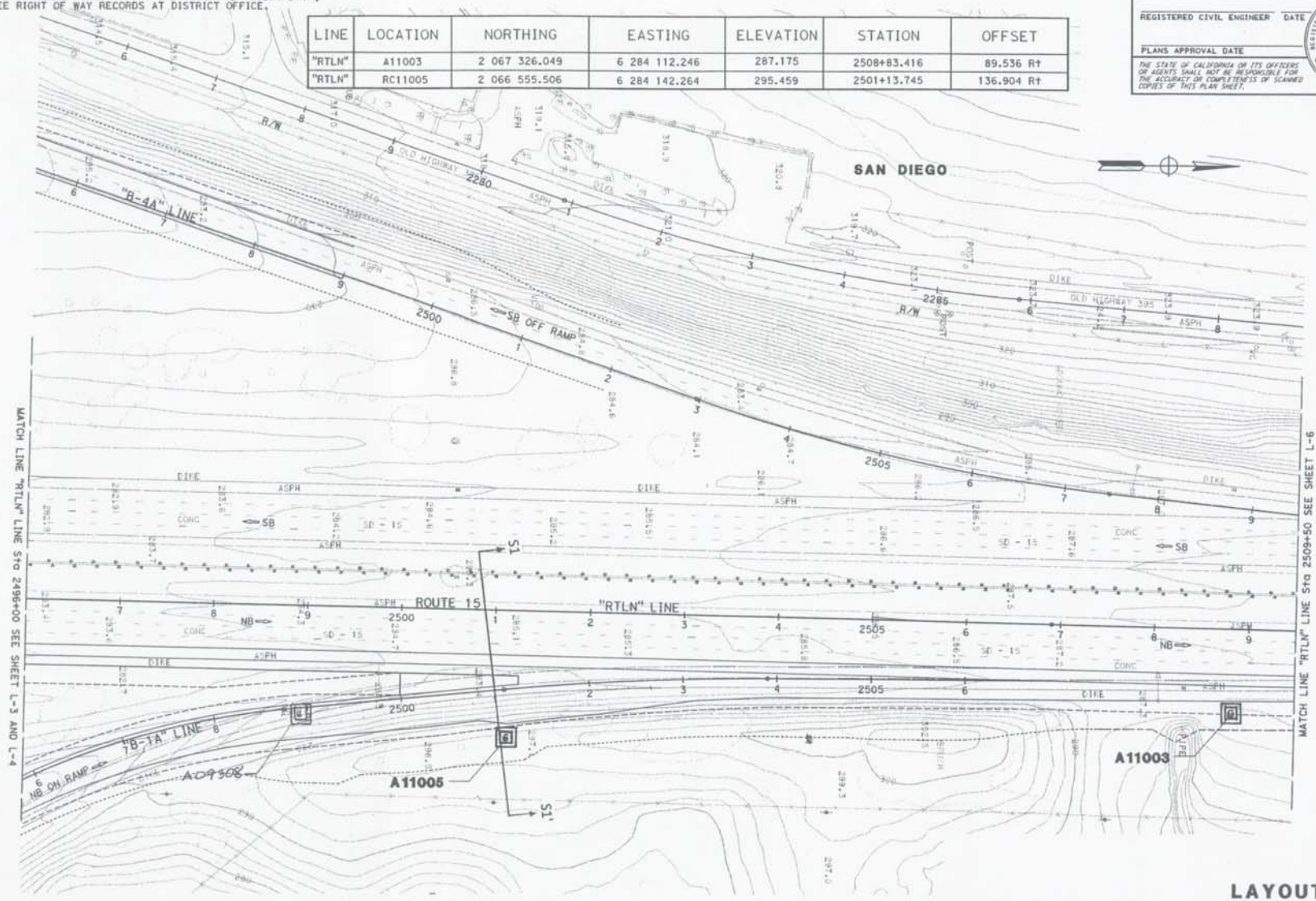
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

NOTE:
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.

LINE	LOCATION	NORTHING	EASTING	ELEVATION	STATION	OFFSET
"RTLN"	A11003	2 067 326.049	6 284 112.246	287.175	2508+83.416	89.536 Rt
"RTLN"	RC11005	2 066 555.506	6 284 142.264	295.459	2501+13.745	136.904 Rt



ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

LAYOUT
SCALE: 1" = 50'
Figure 2F

L-5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE
CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: JEFF BALLYUT
REVISED BY
DATE REVISED

LAST REVISION 03-30-11
DATE PLOTTED => 30-APR-2011
TIME PLOTTED => 11:28

BORDER LAST REVISED 7/2/2010
USERNAME => s135192
DGN FILE => 1100000189ea005.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 1100000189

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

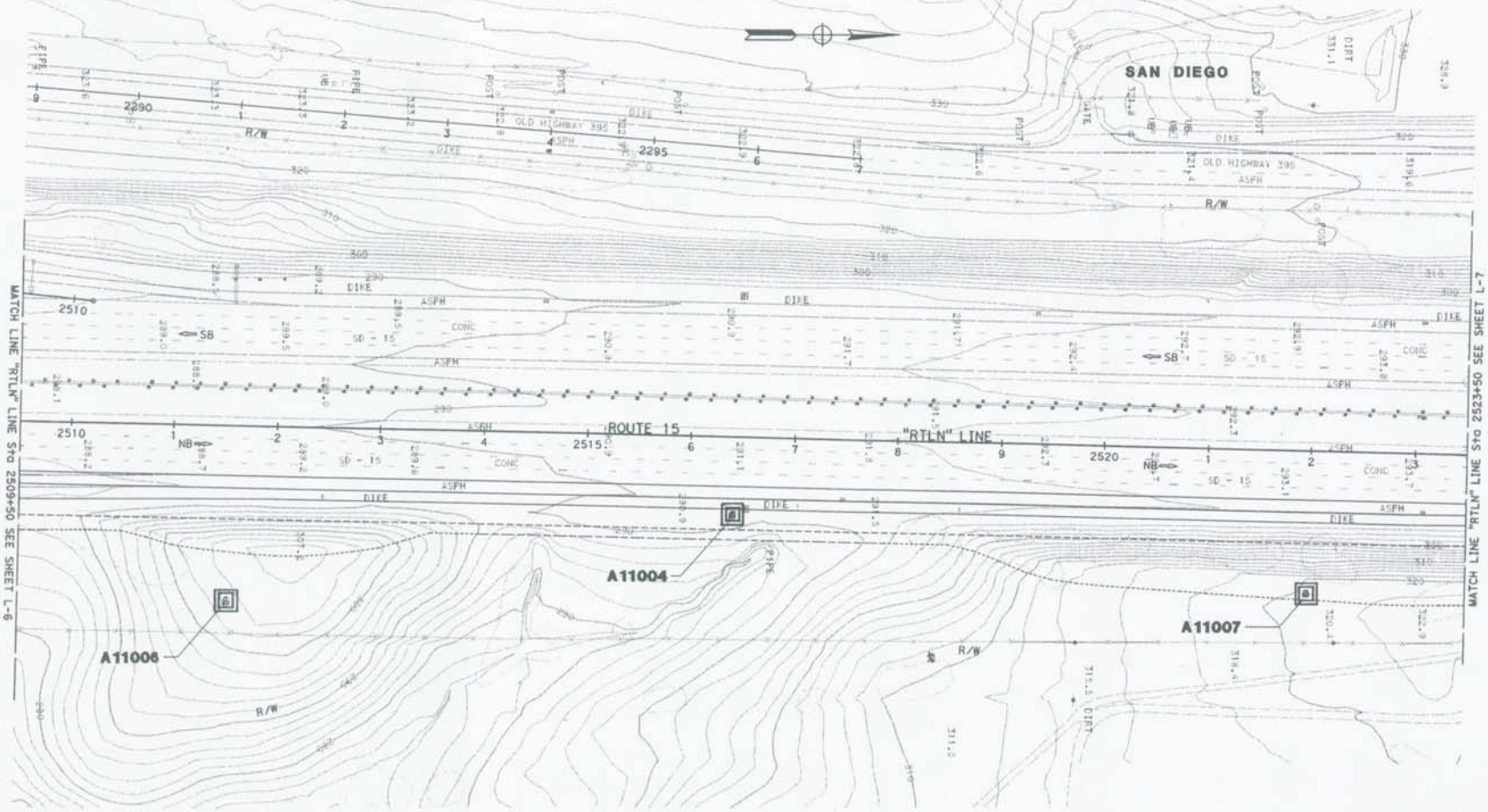
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

NOTE:

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.

LINE	LOCATION	NORTHING	EASTING	ELEVATION	STATION	OFFSET
"RTLN"	A11004	2 068 084.766	6 284 117.082	289.292	2516+42.050	77.280 Rt
"RTLN"	A11006	2 067 594.445	6 284 199.771	302.624	2511+53.716	170.993 Rt
"RTLN"	A11007	2 068 639.915	6 284 192.258	316.270	2521+98.751	139.932 Rt



ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

LAYOUT
SCALE: 1" = 50'
Figure 2G

L-6

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE
CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: JEFF BALUYUT
REVISED BY
DATE REVISED

LAST REVISION DATE PLOTTED => 20-APR-2011
TIME PLOTTED => 11:28
03-30-11

BORDER LAST REVISED 7/2/2010
USERNAME => s135192
DGN FILE => 1100000189ea006.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 1100000189

NOTE:
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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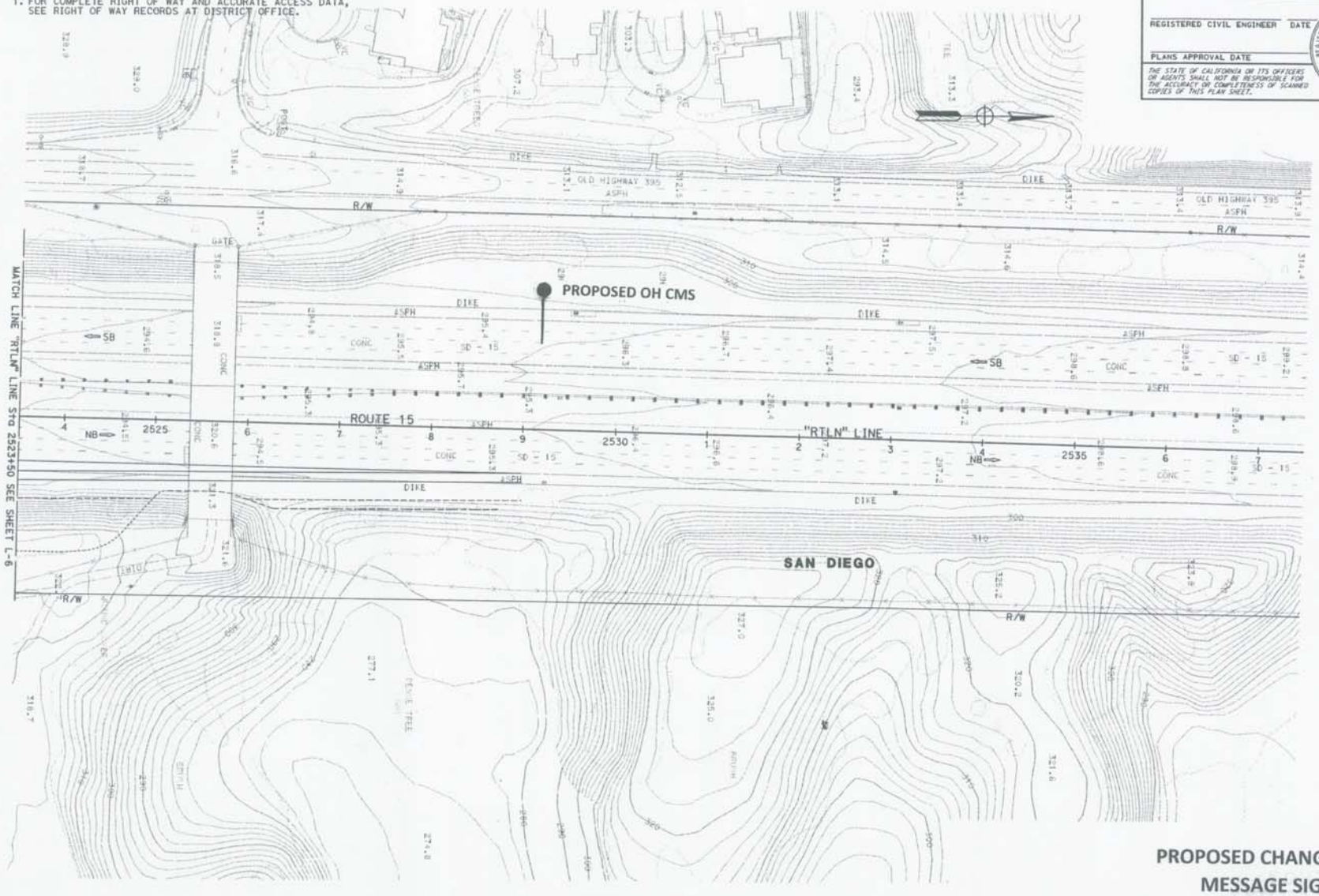
REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA



ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

PROPOSED CHANGEABLE MESSAGE SIGN

Figure 2H

L-7

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE
CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: JEFF BALTYUT
REVISED BY
DATE REVISED

BORDER LAST REVISED 7/2/2010
USERNAME => s135192
DGN FILE => 1100000189ea007.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 1100000189
DATE PLOTTED => 20-APR-2011
TIME PLOTTED => 11:29
03-30-11

NOTE:
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.

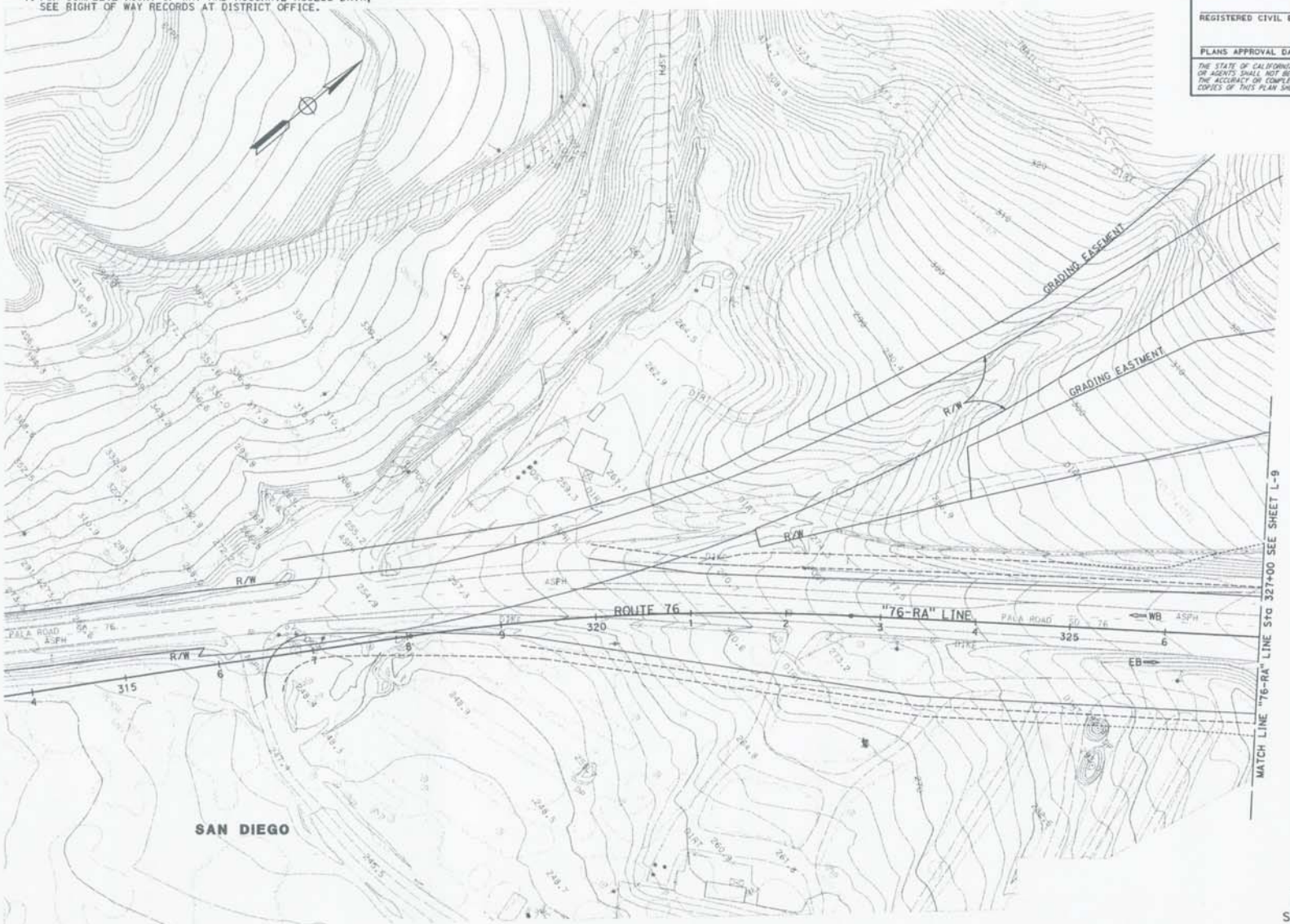
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA



ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

LAYOUT
SCALE: 1" = 50'
Figure 21 **L-8**

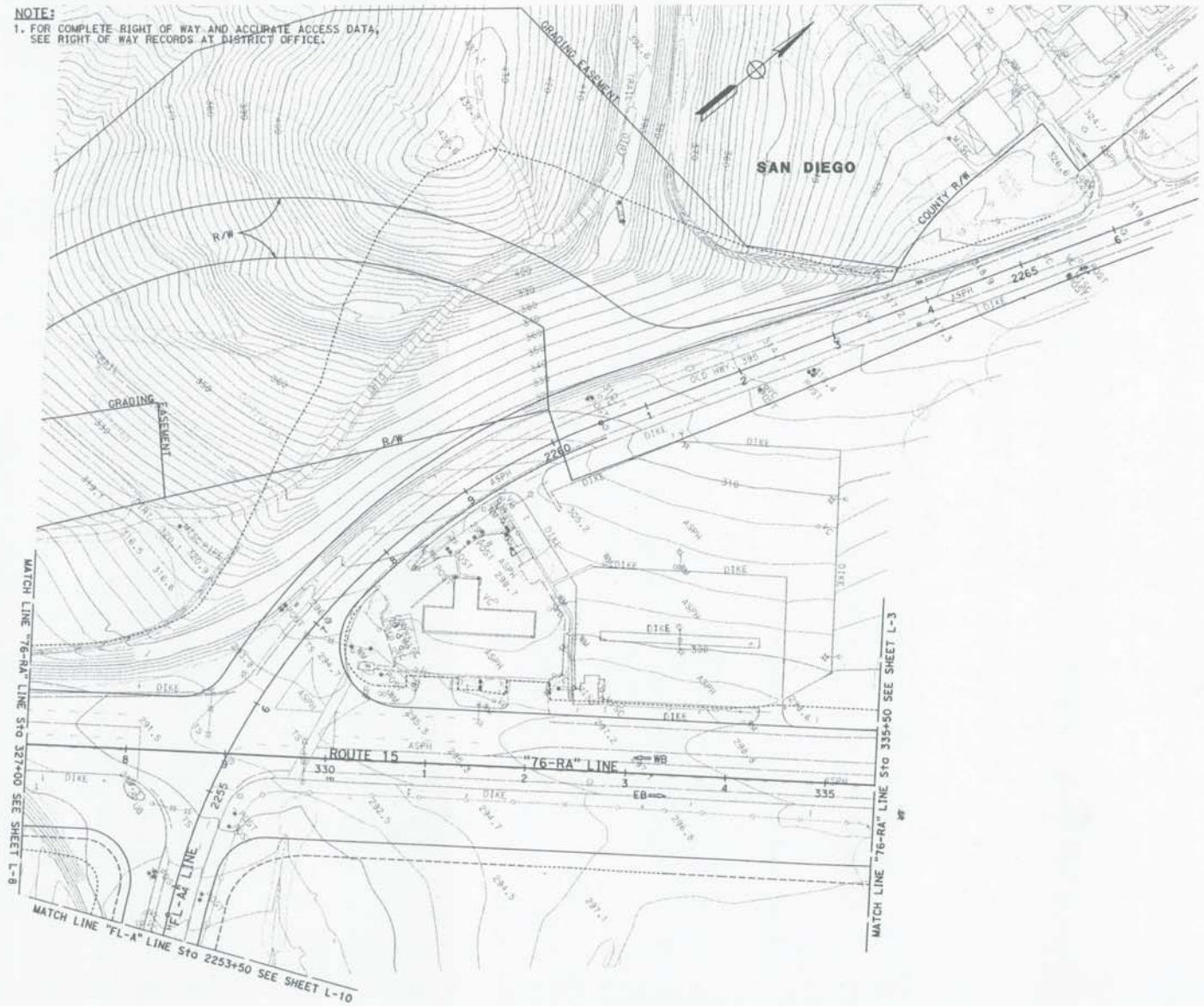
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE
CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: JEFF BALUTUT
REVISED BY
DATE REVISED

LAST REVISION 03-30-11 | DATE PLOTTED => 20-APR-2011 | TIME PLOTTED => 11:29

BORDER LAST REVISED 7/2/2010 | USERNAME => s135192 | DGN FILE => 1100000189ea008.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0000 | PROJECT NUMBER & PHASE 1100000189

NOTE:
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER NO. EXP. CIVIL STATE OF CALIFORNIA

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE
CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: JEFF BALUYUT
REVISED BY
DATE REVISED

ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

LAYOUT
SCALE: 1" = 50'
Figure 2J

L-9

LAST REVISION DATE PLOTTED => 20-APR-2011
TIME PLOTTED => 11:29
03-30-11

BORDER LAST REVISED 7/2/2010
USERNAME => s155192
DGN FILE => 1100000189ea009.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 1100000189

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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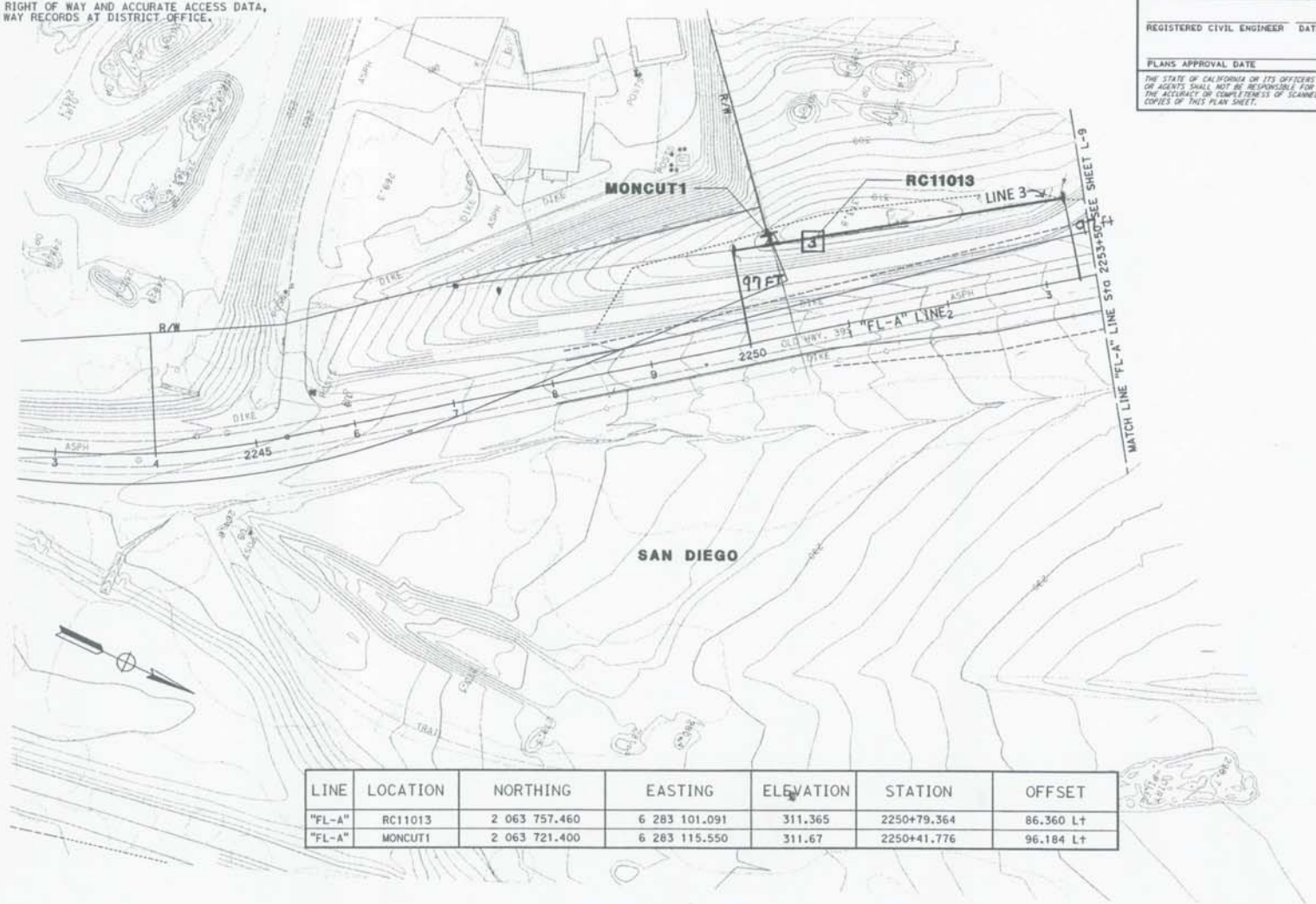
REGISTERED PROFESSIONAL ENGINEER No. EXP. CIVIL STATE OF CALIFORNIA

NOTE:

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.



LINE	LOCATION	NORTHING	EASTING	ELEVATION	STATION	OFFSET
"FL-A"	RC11013	2 063 757.460	6 283 101.091	311.365	2250+79.364	86.360 Lt
"FL-A"	MONCUT1	2 063 721.400	6 283 115.550	311.67	2250+41.776	96.184 Lt

ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

LAYOUT

SCALE: 1" = 50'

Figure 2K

L-10

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE

CALCULATED-DESIGNED BY: MOHAMAD KHATIB

CHECKED BY: JEFF BALUYUT

REVISED BY

DATE REVISED

LAST REVISION 03-30-11

DATE PLOTTED => 20-APR-2011

TIME PLOTTED => 11:29

BORDER LAST REVISED 7/2/2010

USERNAME => s135192

DGN FILE => 1100000189ed010.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 1100000189

NOTE:
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

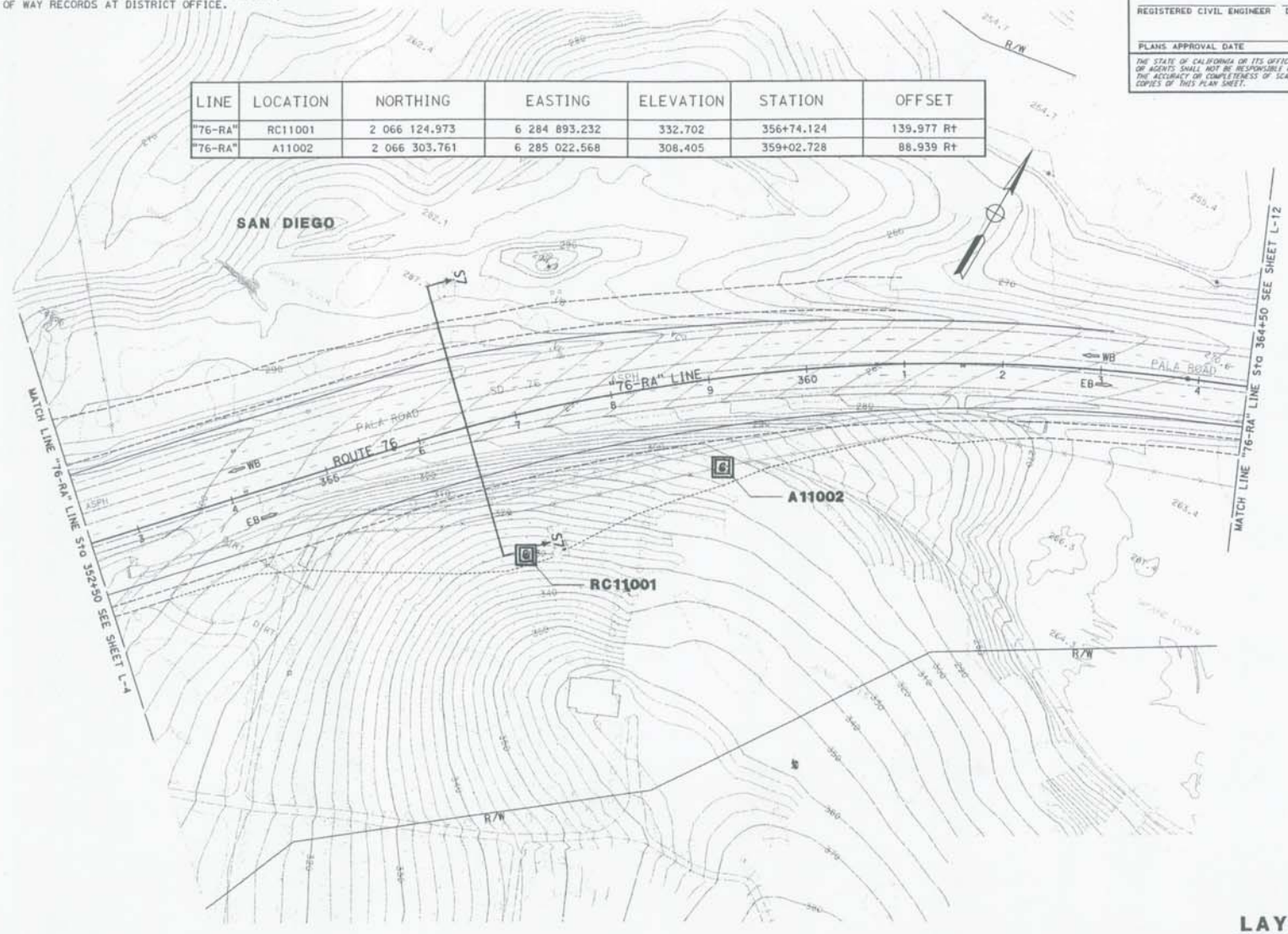
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

LINE	LOCATION	NORTHING	EASTING	ELEVATION	STATION	OFFSET
"76-RA"	RC11001	2 066 124.973	6 284 893.232	332.702	356+74.124	139.977 Rt
"76-RA"	A11002	2 066 303.761	6 285 022.568	308.405	359+02.728	88.939 Rt



ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

LAYOUT
SCALE: 1" = 50'
Figure 2L

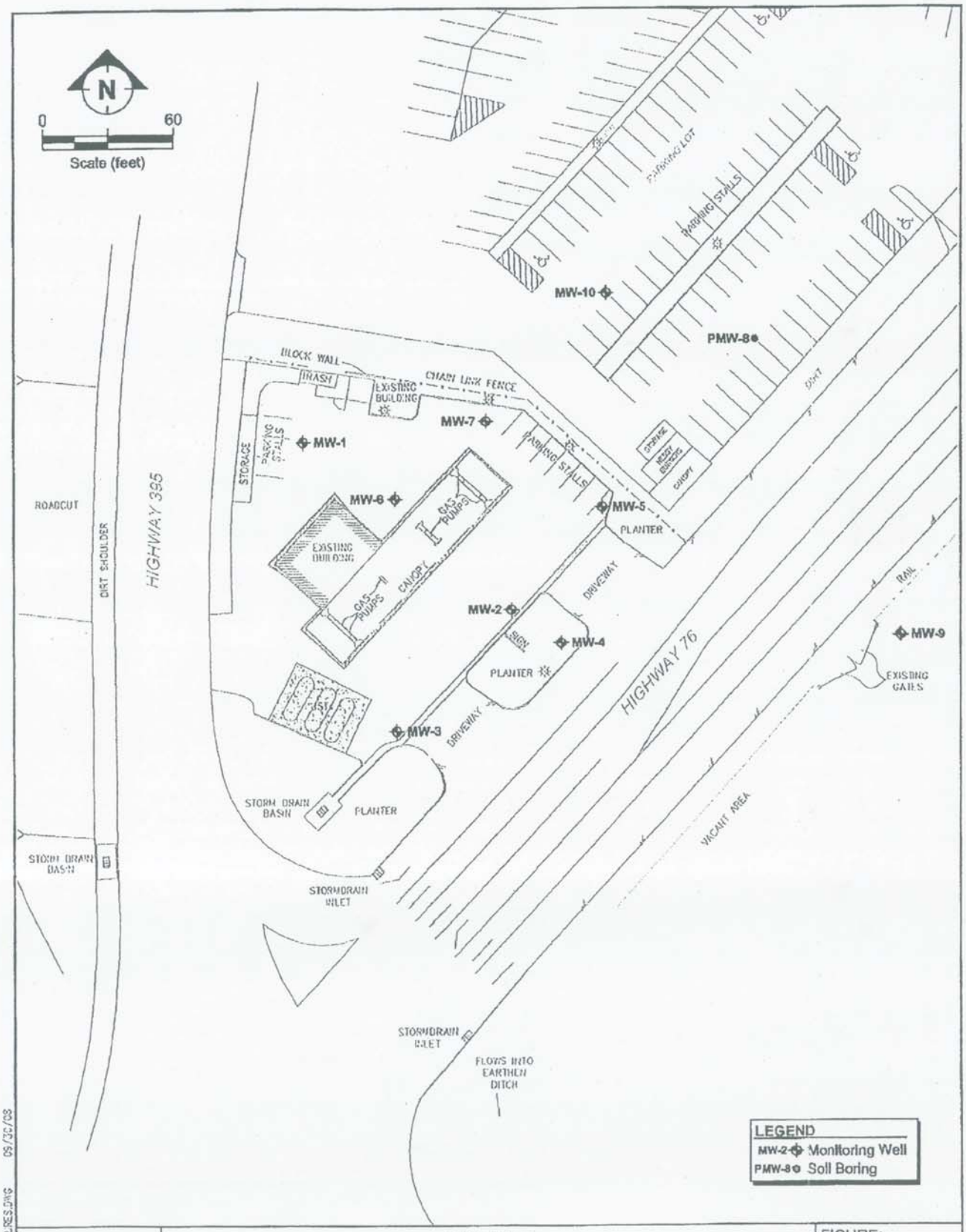
L-11

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE
CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: JEFF BALUYUT
REVISED BY
DATE REVISED

DATE PLOTTED => 20-APR-2011
TIME PLOTTED => 11:29
03-30-11

BORDER LAST REVISED 7/2/2010
USERNAME => s135192
DGN FILE => 1100000189ea011.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 1100000189



ETIC ENGINEERING

SITE MAP
EXXONMOBIL OIL CORPORATION SERVICE STATION 18034
4730 HIGHWAY 76,
FALLBROOK, CALIFORNIA

FIGURE: 3

18034_342038-FIG1RES.DWG 05/30/03

PROJECT GEOLOGIC MAP

AFTER DOKKEN

Geotechnical Design Report; Phase 1 SR76/15 Interchange;
EA 11-257151; 1100020489

Legend

Qaf — **Artificial Fill (Late Holocene)** – Loose sand and gravel constructions by humans such as railroad beds, levees, berms, diversion channels, and settlements. Unit denotes areas where natural drainages may be sufficiently altered to change runoff patterns.

Qw — **Active channel and wash deposits (Late Holocene)** – Unconsolidated to locally poorly consolidated sand and gravel deposits in active washes of streams.

Qc — **Recent Colluvial deposits (Late Holocene)** – Poorly sorted angular to subangular boulders, cobbles and sand. Talus or rockfall below areas of steep bedrock areas that obscures underlying bedrock. Weak soil development.

Qa — **Active Alluvial flood plain deposits (Late Holocene)** – Unconsolidated to locally poorly consolidated sand and gravel deposits in active alluvial flood plains.

Qoa — **Older alluvial flood plain deposits (Pleistocene- younger than 500,00 years)** – Mostly moderately well consolidated, poorly sorted, permeable flood plain deposits.

GRANITICS

Ki — **Granodiorite of Indian Mountain (Cretaceous)** – Biotite leucocratic granodiorite, white, fine to medium grained, massive.

Kt — **Tonalite Undivided (Cretaceous)** – Mostly Hornblende-biotite tonalite; coarse grained, light gray.

Kcc — **Tonalite of Couser Canyon (Cretaceous)** - Hornblende-biotite tonalite; coarse grained and massive. Contains some granodiorite and is characterized by an abundance of pegmatite dikes.

A-09-101 **Existing Boring Location**

A-09-110 **Omitted Boring Location**

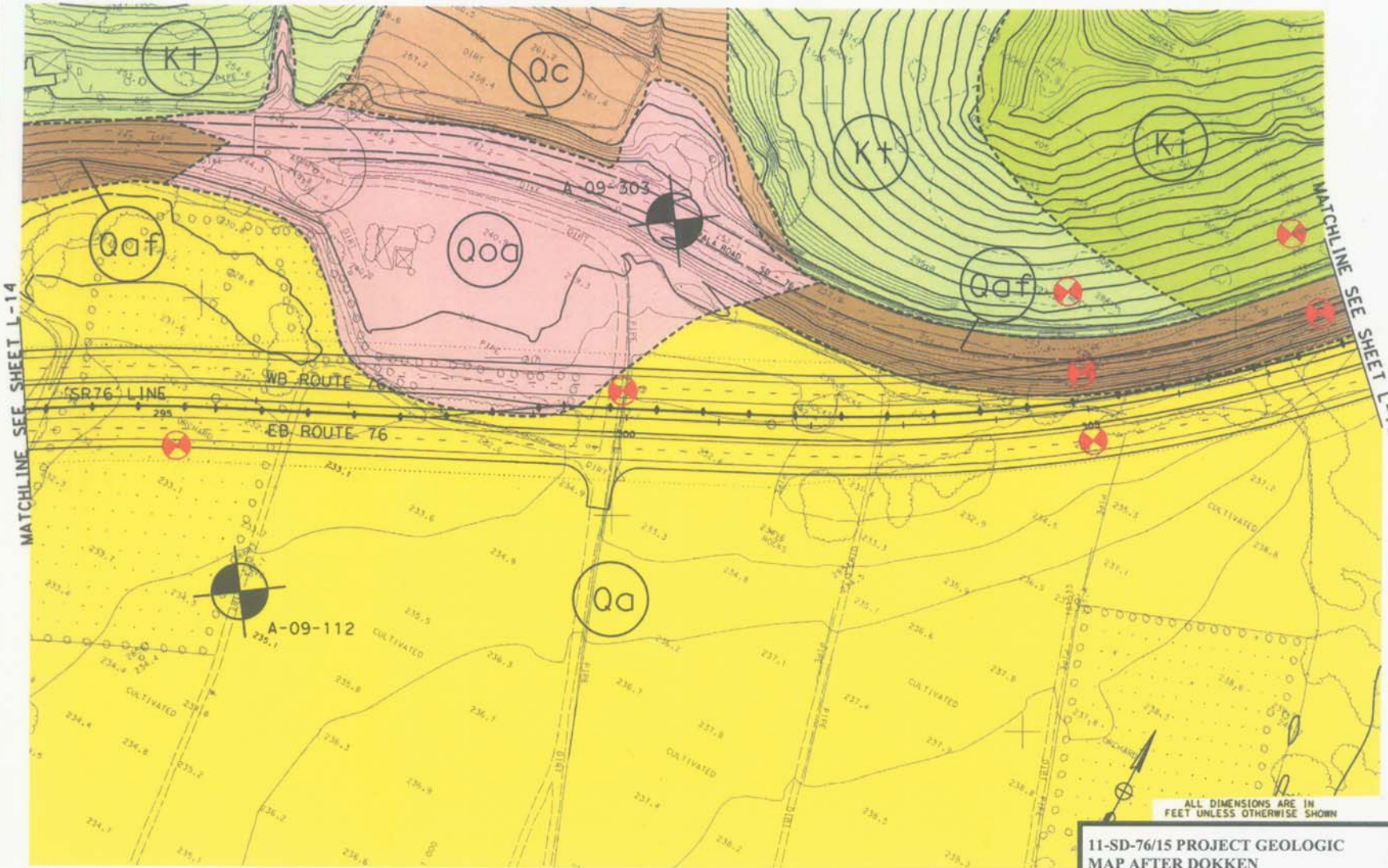
Proposed Boring Location

Approximate Geologic Location

DOKKEN ENGINEERING
www.dokkenengineering.com
5675 RUFFIN ROAD, SUITE 250
SAN DIEGO, CA 92123
(858) 514-8377 (phone)
(858) 514-8608 (fax)

Geologic Legend
SR-76 Mission to I-15 Project
County of San Diego, CA

Figure 4A



11-SD-76/15 PROJECT GEOLOGIC MAP AFTER DOKKEN

Figure 4B L-15

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

REVISED BY

DATE REVISED

DATE

RELATIVE BORDER SCALE IS IN INCHES

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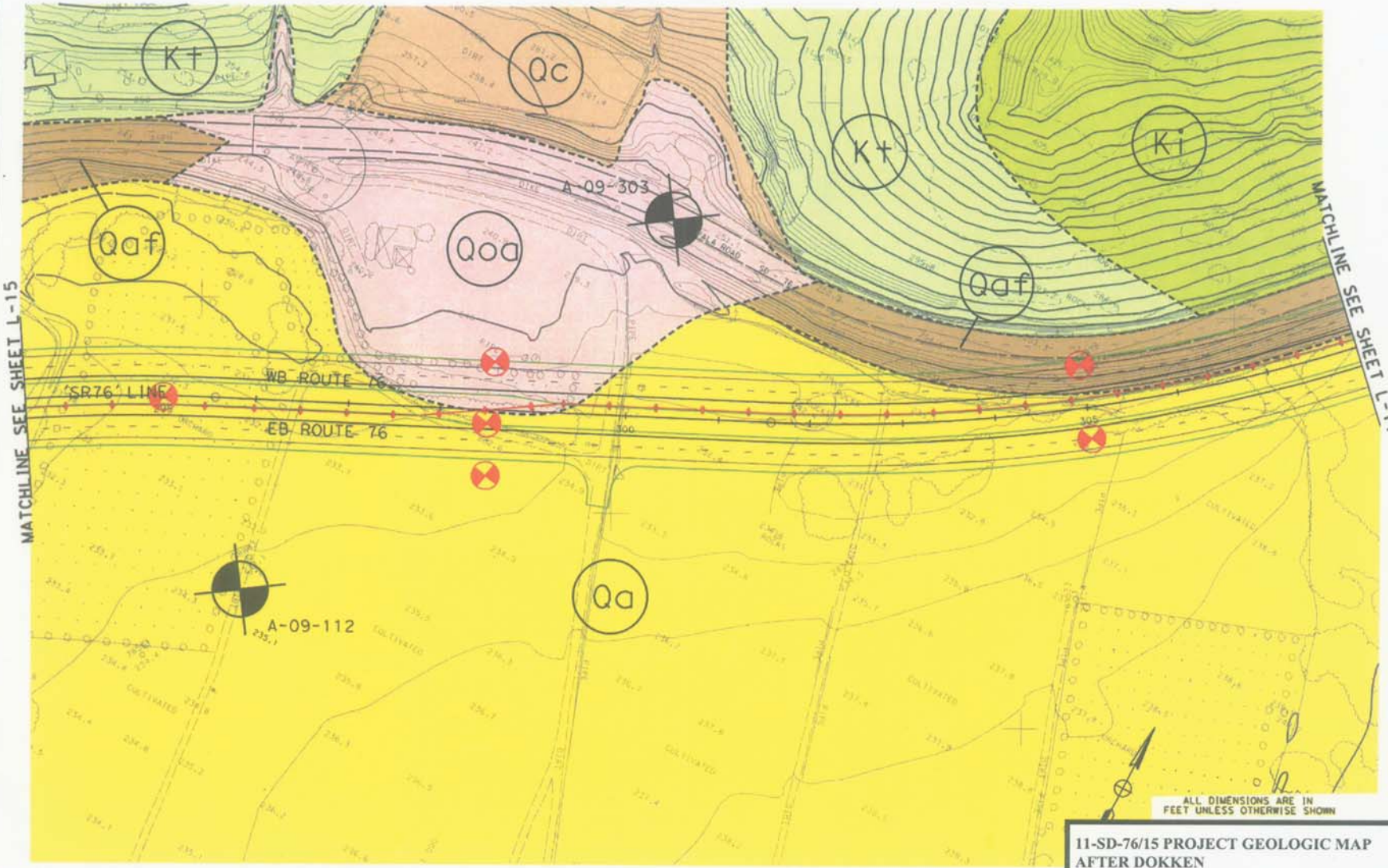
DGN FILE => MREQUEST

CU 00000

EA 257110

DATE PLOTTED => DATE
TIME PLOTTED => TIME

00-00-00



11-SD-76/15 PROJECT GEOLOGIC MAP
AFTER DOKKEN

Figure 4C L-16

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

RELATIVE BORDER SCALE IS IN INCHES

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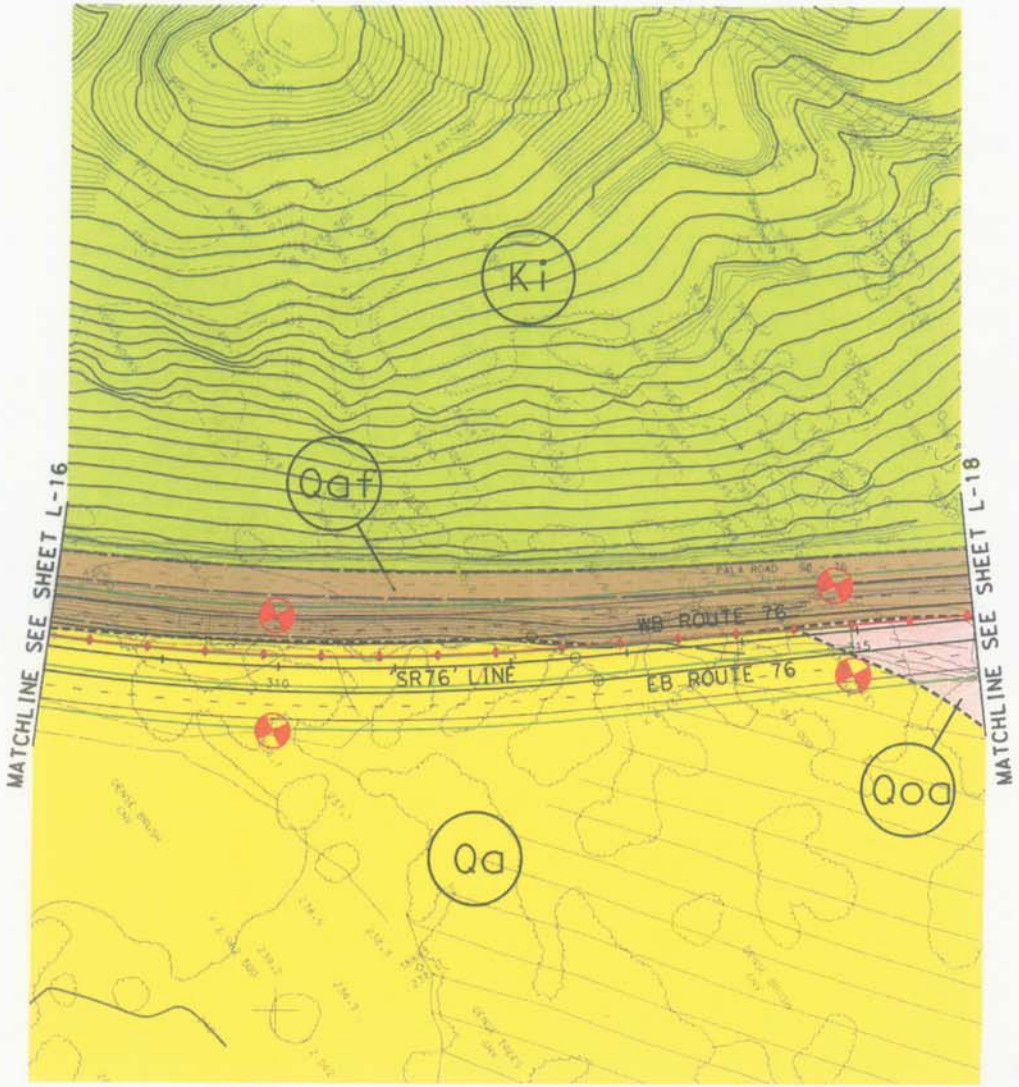

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

11-SD-76/15 PROJECT GEOLOGIC MAP AFTER DOKKEN

Figure 4D L-17

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CALCULATED/DESIGNED BY

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DATE REVISED BY

DATE REVISED

RELATIVE BORDER SCALE IS IN INCHES

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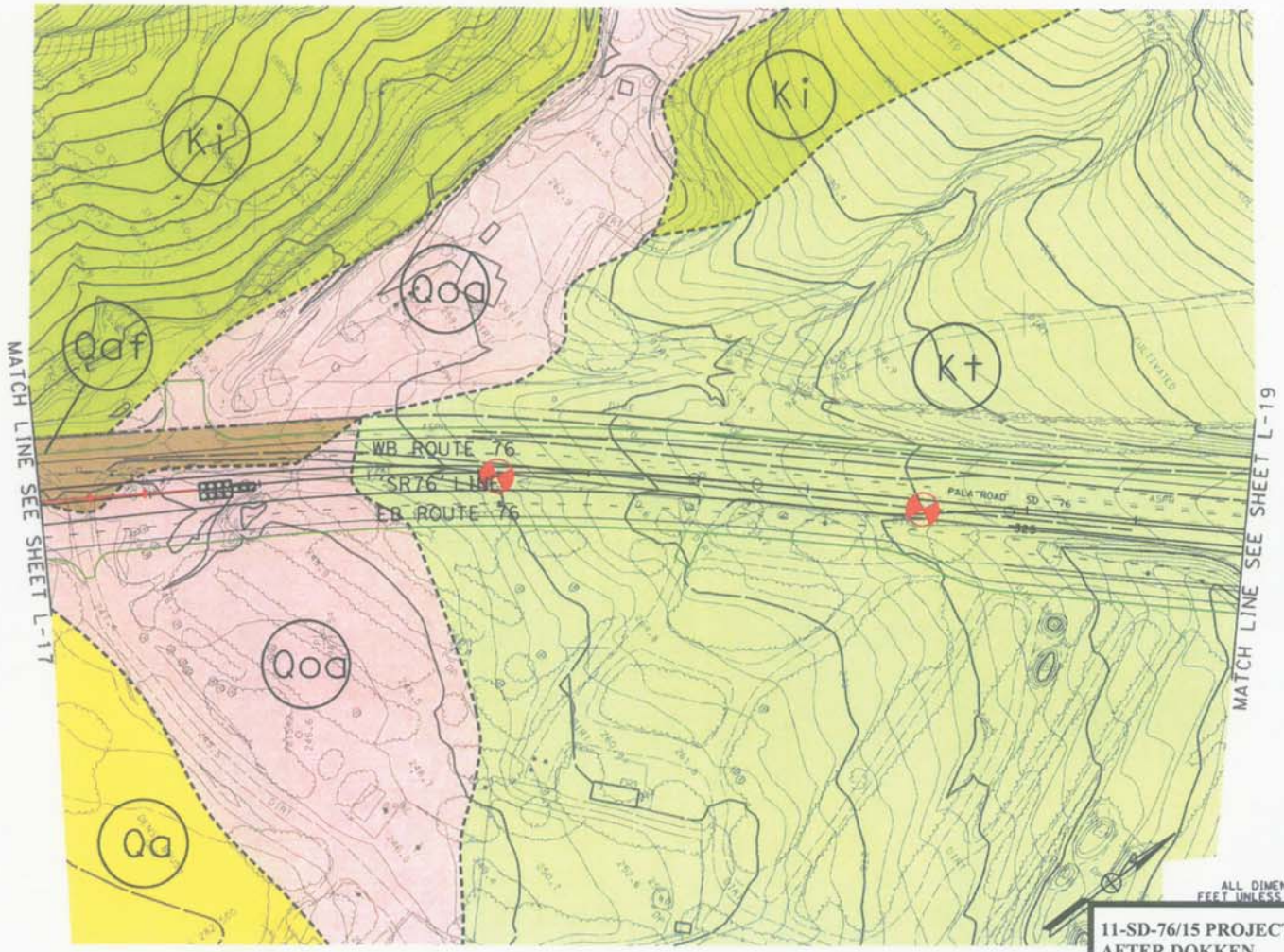

Figure 4E

11-SD-76/15 PROJECT GEOLOGIC MAP AFTER DOKKEN

L-18

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

RELATIVE BORDER SCALE IS IN INCHES

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EA 257110

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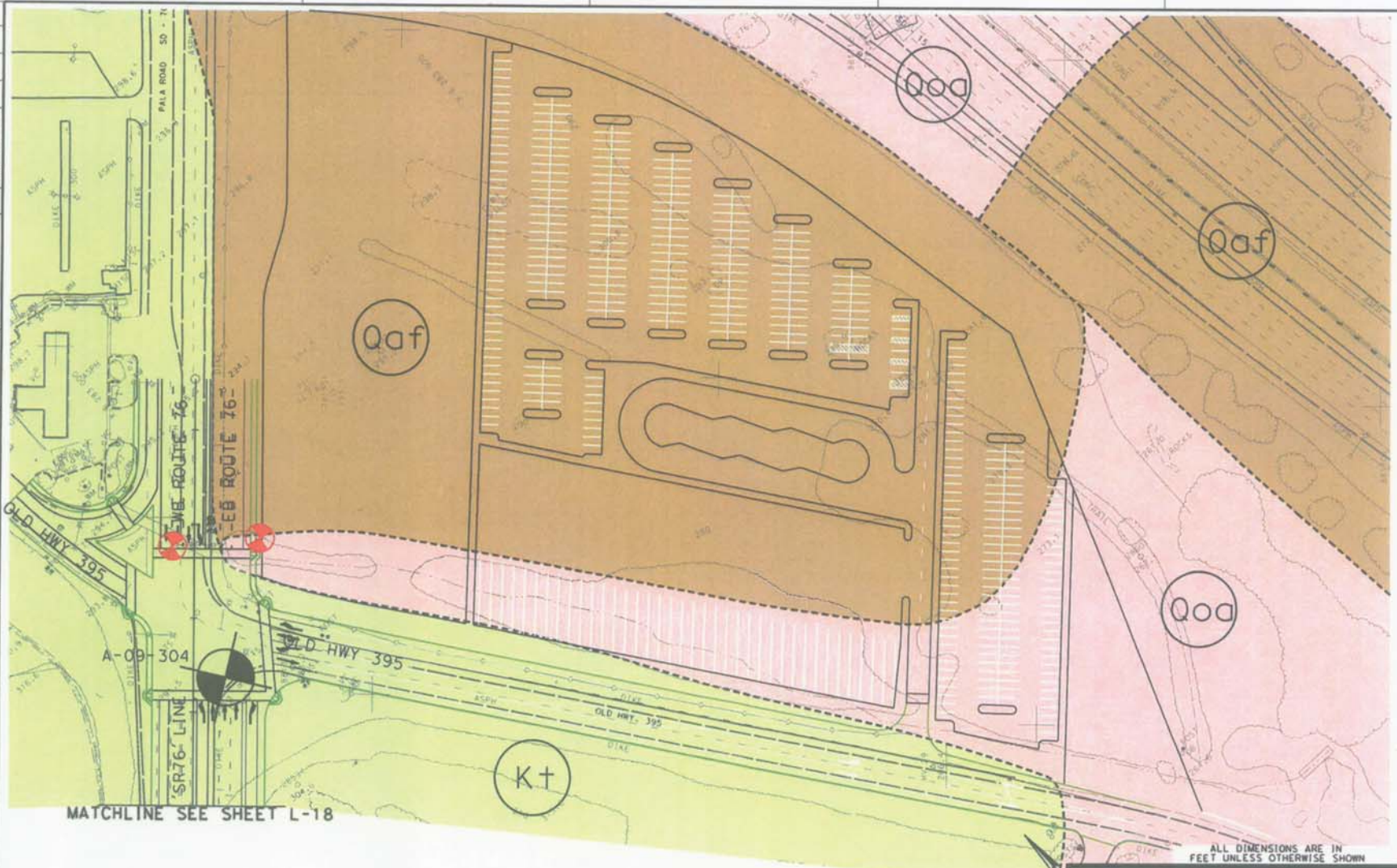

11-SD-76/15 PROJECT GEOLOGIC MAP AFTER DOKKEN

Figure 4F

L-19

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

RELATIVE BORDER SCALE 15 IN INCHES

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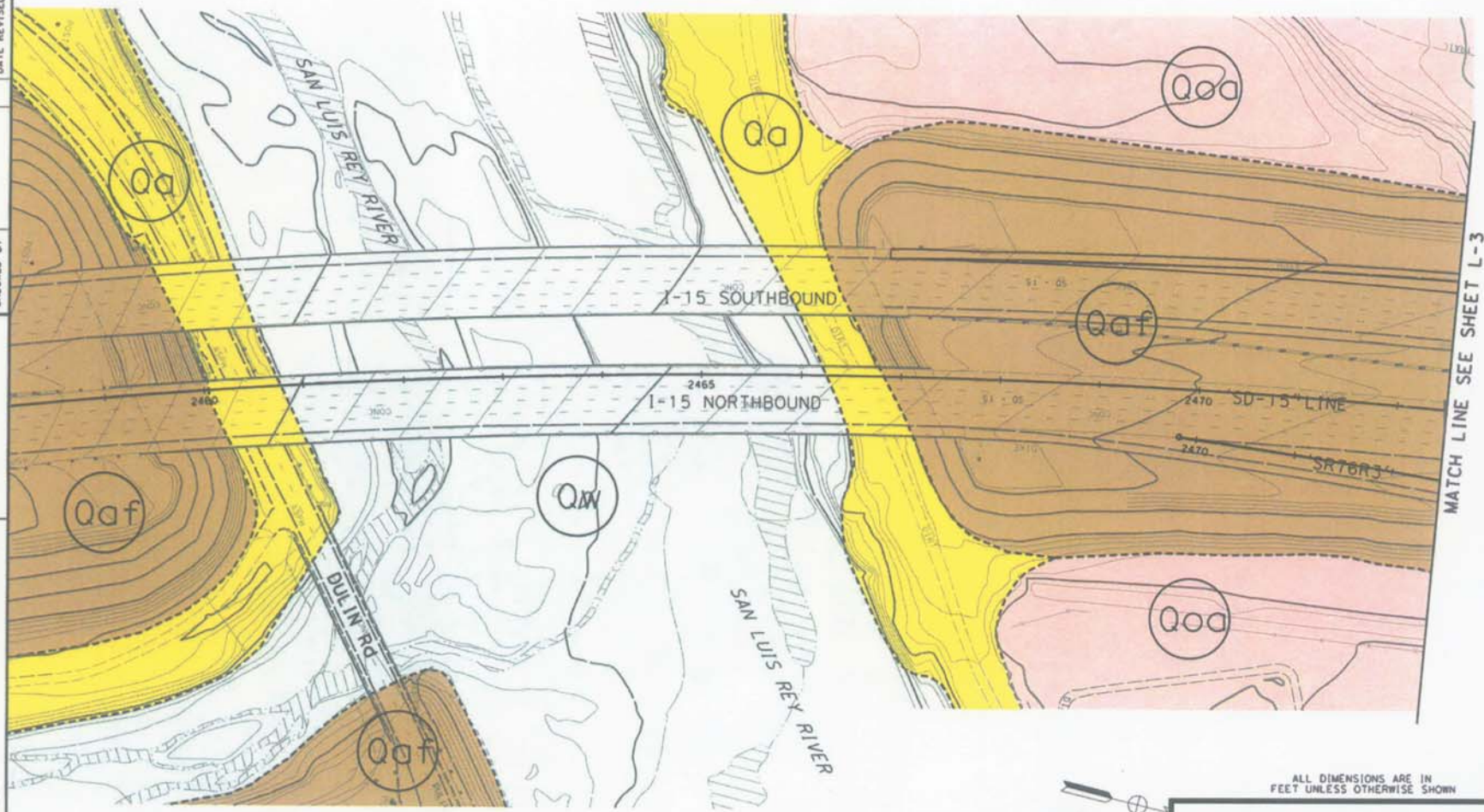

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

11-SD-76/15 PROJECT GEOLOGIC MAP AFTER DOKKEN

Figure 4G L-2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

RELATIVE BORDER SCALE IS IN INCHES

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CU 00000

EA 257110

DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

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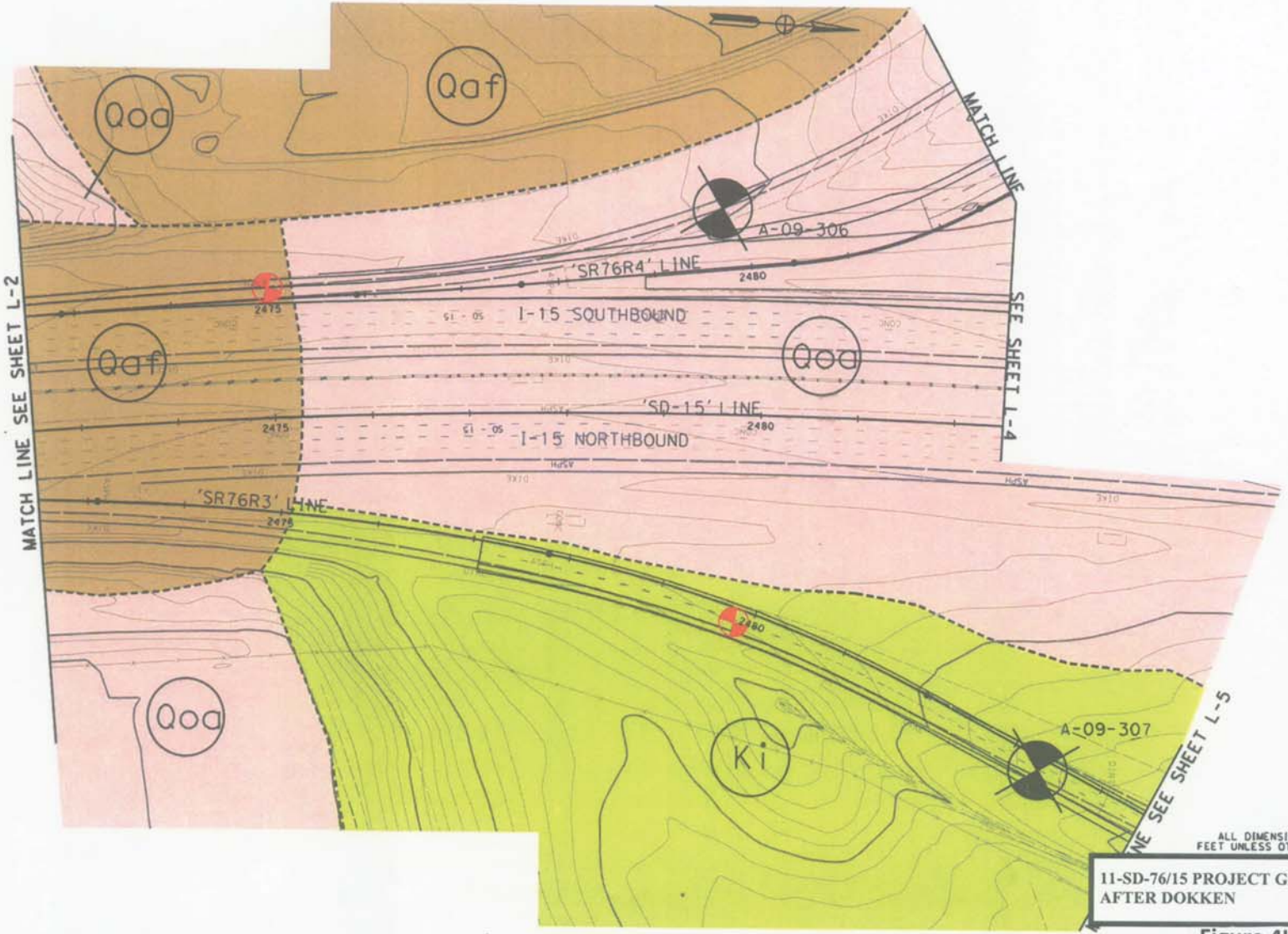

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

11-SD-76/15 PROJECT GEOLOGIC MAP AFTER DOKKEN

Figure 4H **L-3**

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CALCULATED/DESIGNED BY

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DATE REVISED BY

DATE REVISED

RELATIVE BORDER SCALE IS IN INCHES

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DGN FILE => $REQUEST

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EA 257110

DATE PLOTTED => $DATE
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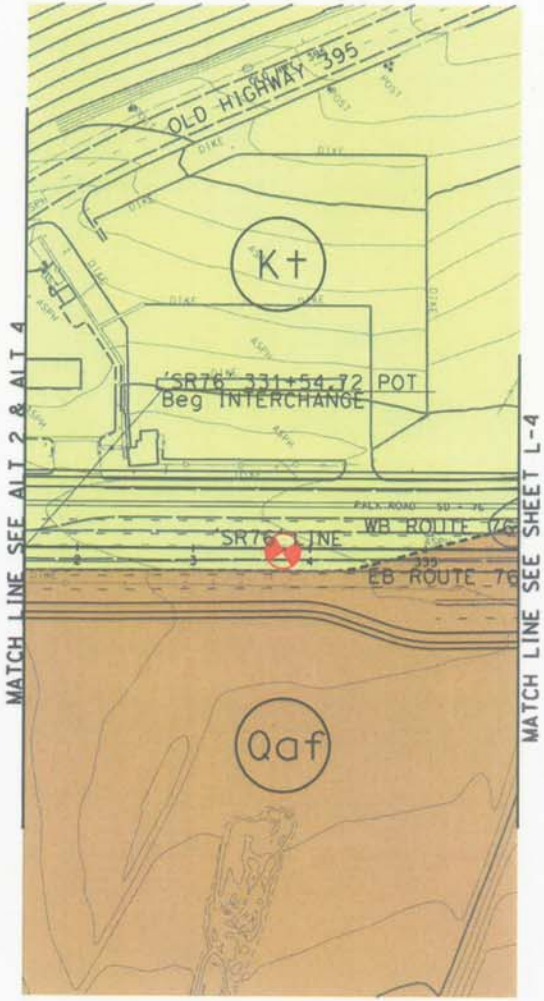

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

11-SD-76/15 PROJECT GEOLOGIC MAP AFTER DOKKEN

Figure 4I **L-1**

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CALCULATED/DESIGNED BY

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DATE REVISED BY

DATE REVISED

RELATIVE BORDER SCALE IS IN INCHES

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CU 00000

EA 257110

LAST REVISION 00-00-00

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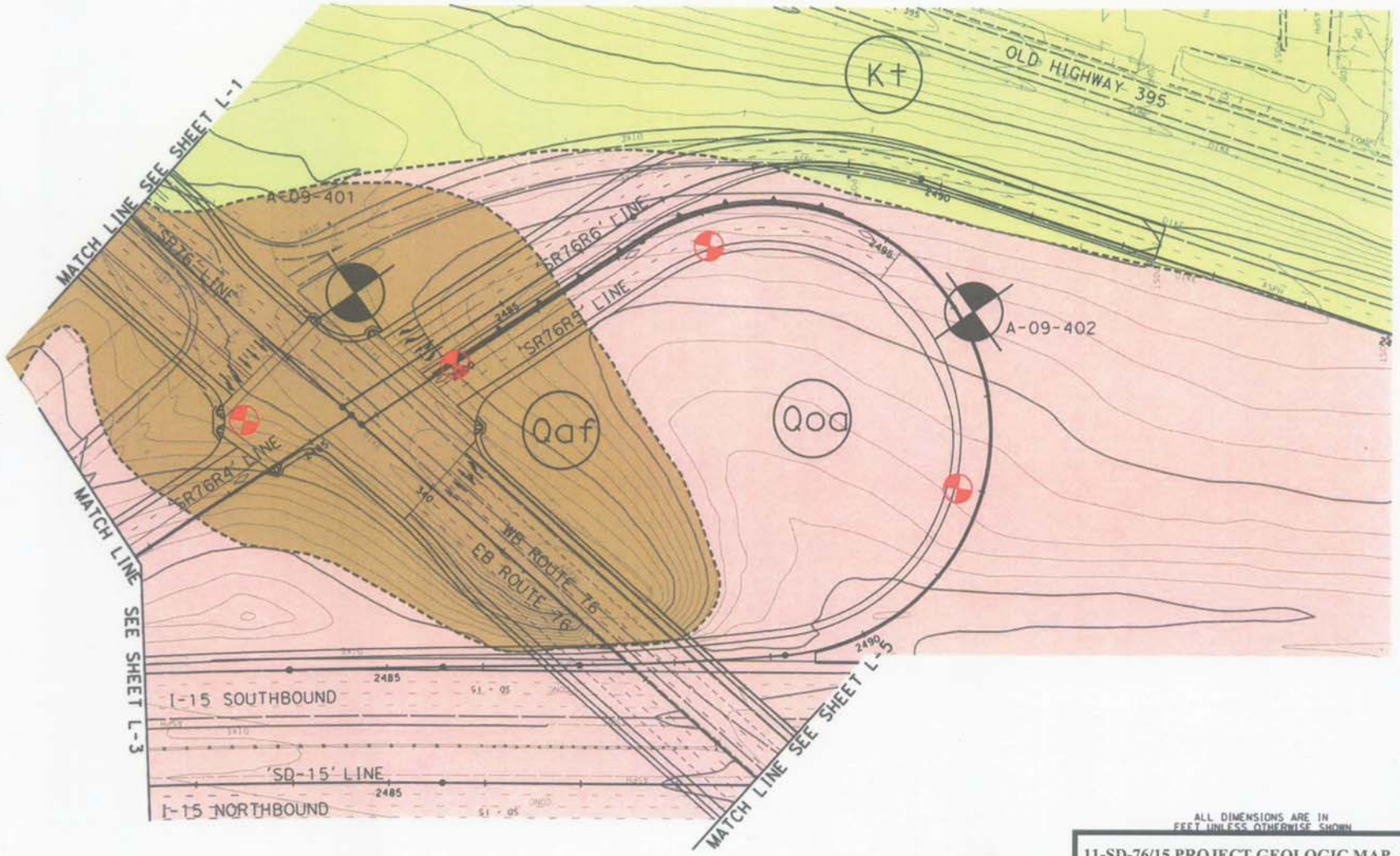

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

11-SD-76/15 PROJECT GEOLOGIC MAP AFTER DOKKEN

Figure 4J L-4

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

RELATIVE BORDER SCALE IS IN INCHES

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DGN FILE => BREQUEST

CU 00000

EA 257110

DATE PLOTTED => MONTH
TIME PLOTTED => MTIME

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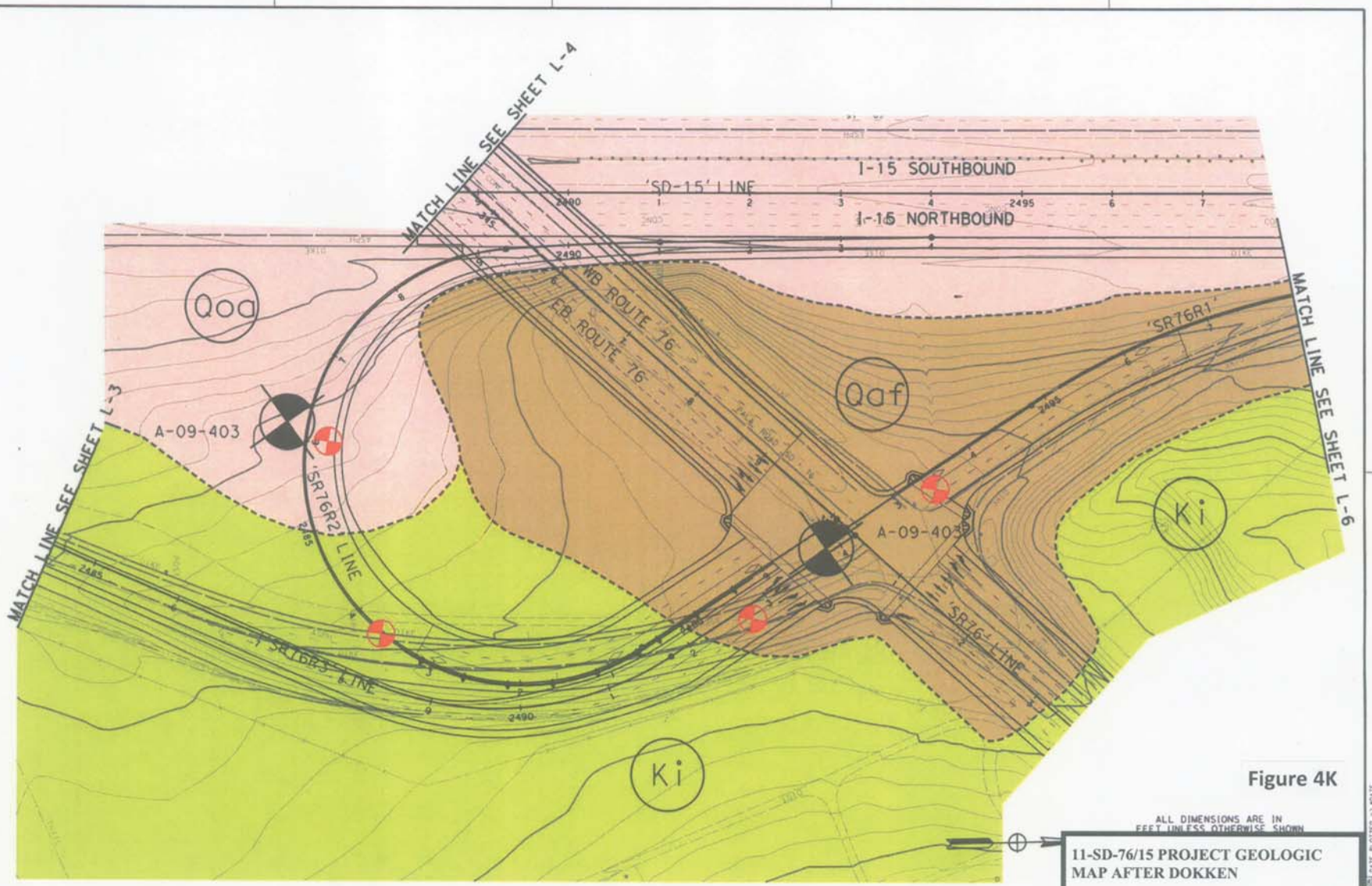

Figure 4K

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

11-SD-76/15 PROJECT GEOLOGIC MAP AFTER DOKKEN

L-5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

RELATIVE BORDER SCALE IS IN INCHES

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DGN FILE => MREQUEST

CU 00000

EA 257110

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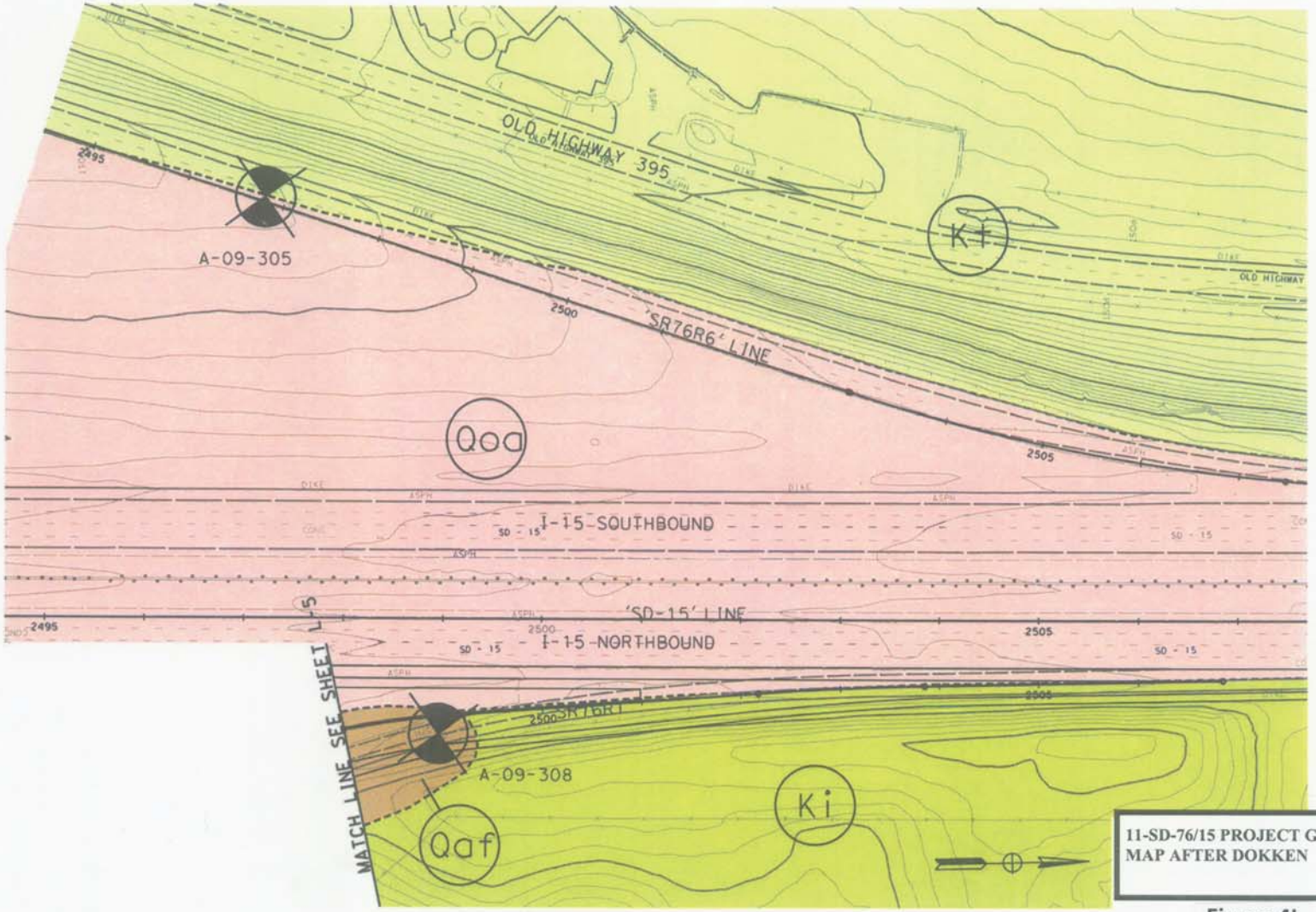

11-SD-76/15 PROJECT GEOLOGIC MAP AFTER DOKKEN

Figure 4L

L-6

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

CALCULATED/DESIGNED BY

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DATE REVISED BY

DATE REVISED

RELATIVE BORDER SCALE IS IN INCHES

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DGN FILE => MREQUEST

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EA 257110

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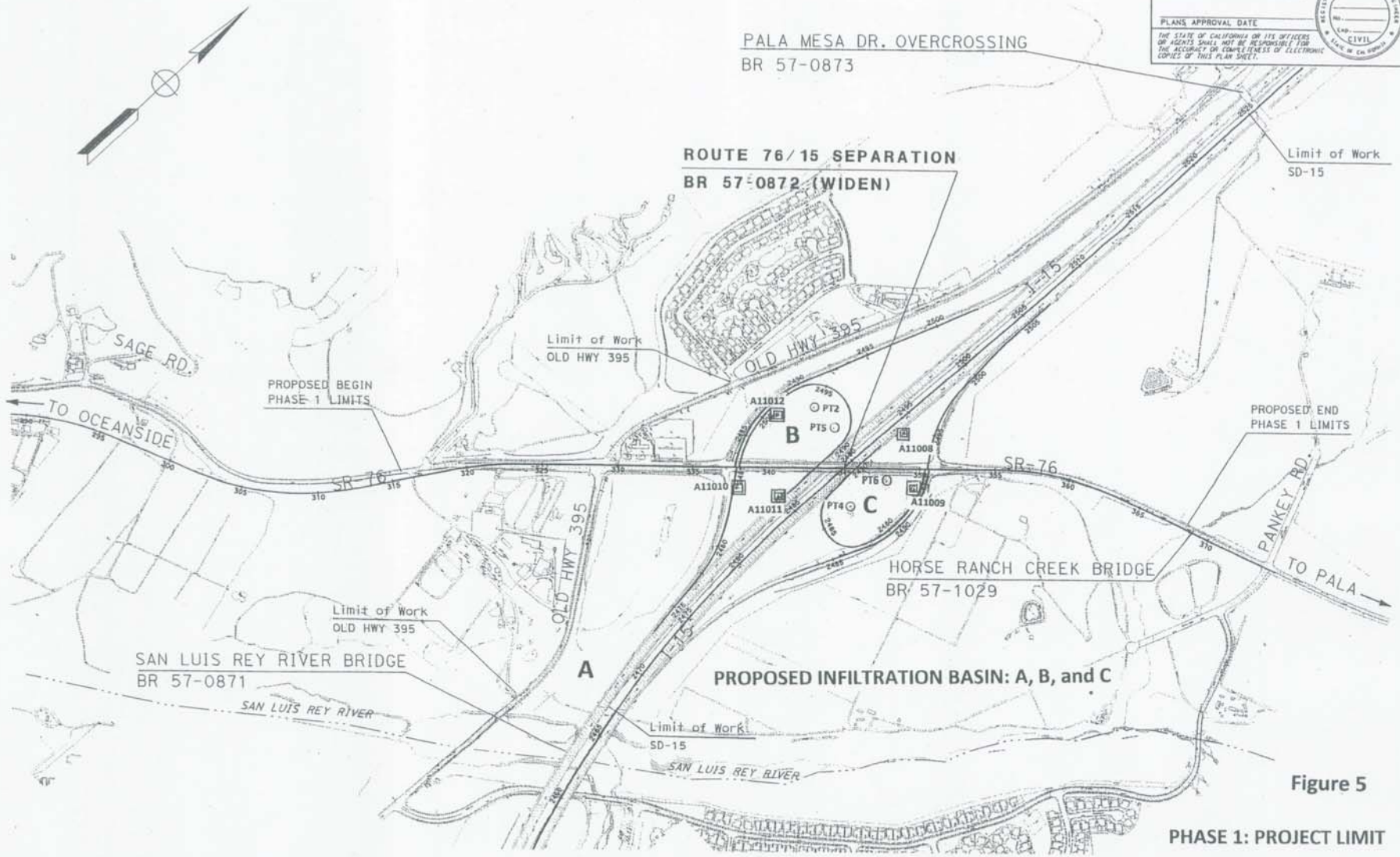

Figure 5

PHASE 1: PROJECT LIMIT

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/47.3 16.7/17.8		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISED | DATE PLOTTED => 19-NOV-2010 | TIME PLOTTED => 15:52

BORDER LAST REVISED 3/1/2007

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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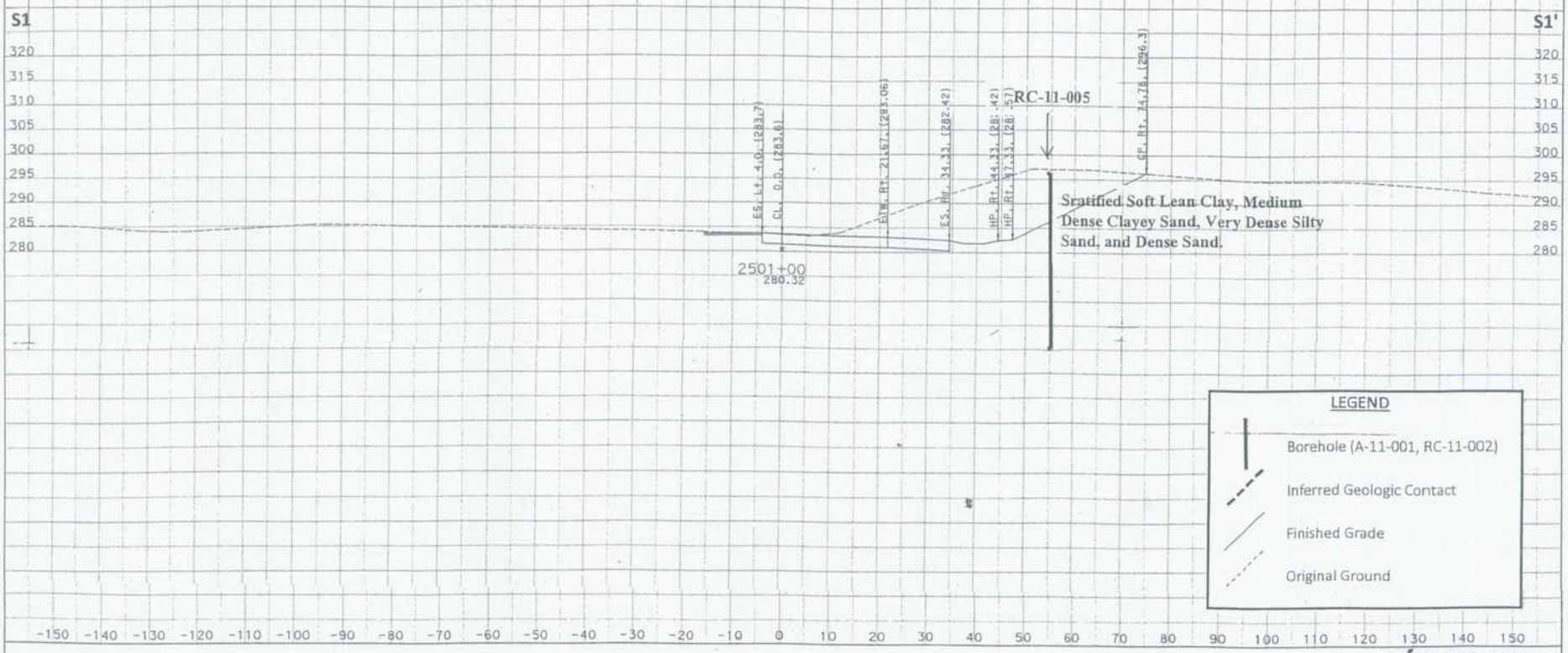
CU 00000

EA 000000

DESIGN STUDY ONLY

CROSS SECTION S1 - S1'



DATE: 7/11/2011
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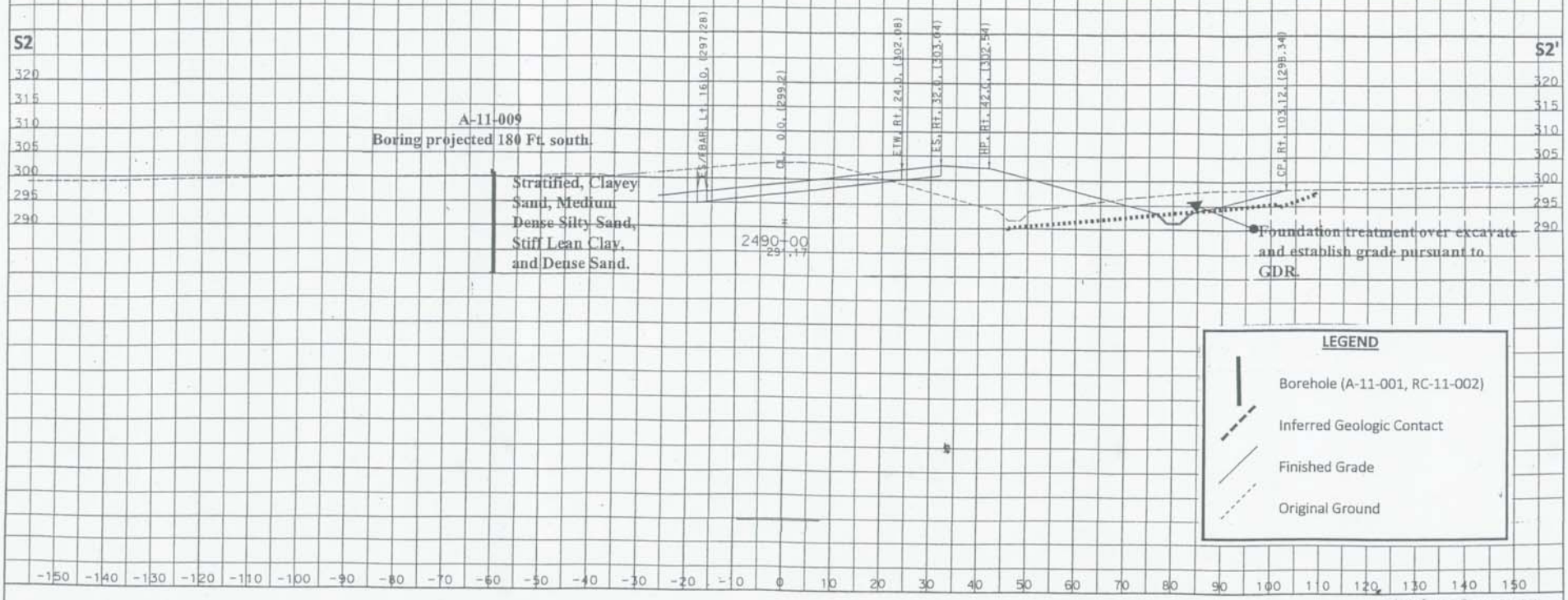
SCALE: 1" = 10' Horiz.
1" = 10' Vert.
All Dimensions are US Survey Feet

CENTER LINE: B1A1
CROSS SECTIONS
Figure 6A

DESIGN STUDY ONLY

CROSS SECTION S2 - S2'



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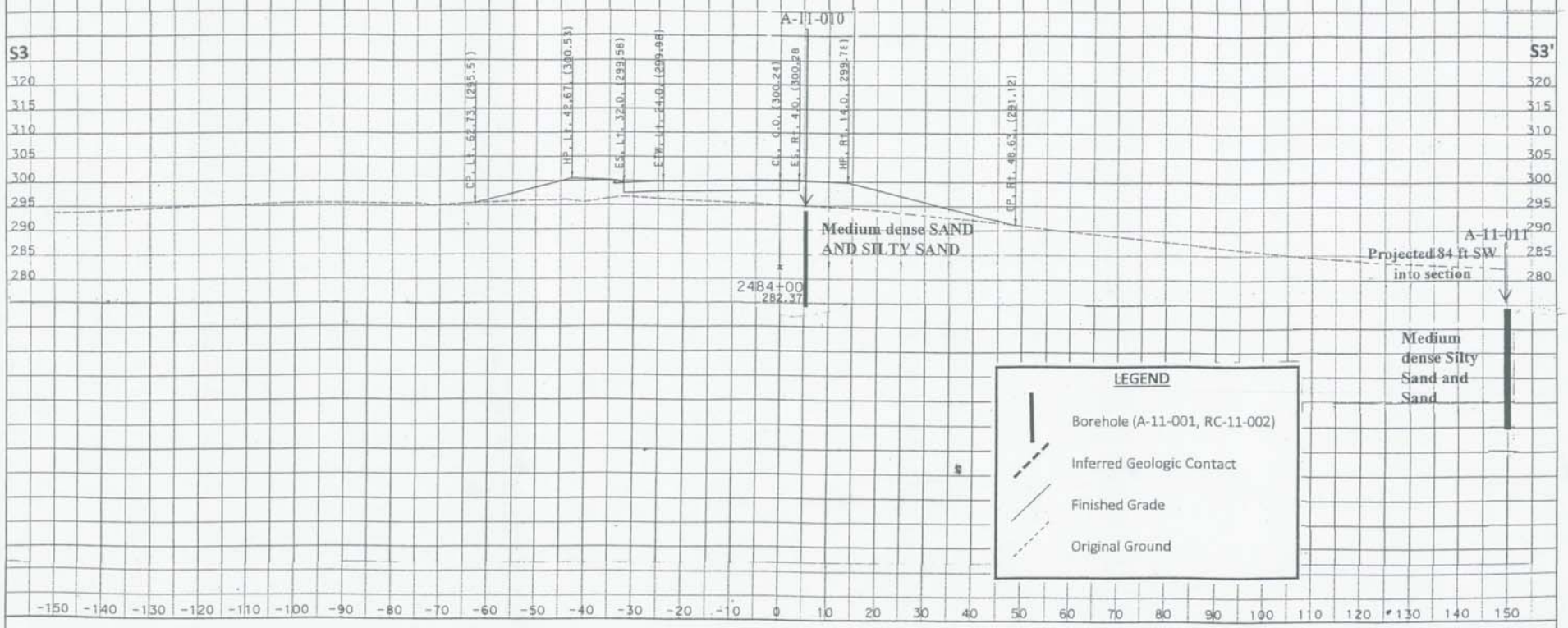
SCALE: 1" = 10' Horiz.
1" = 10' Vert.
All Dimensions are US Survey Feet

CENTER LINE: B2A1
CROSS SECTIONS
Figure 6B

DESIGN STUDY ONLY

CROSS SECTION S3 - S3'



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SCALE: 1" = 10' Horiz.
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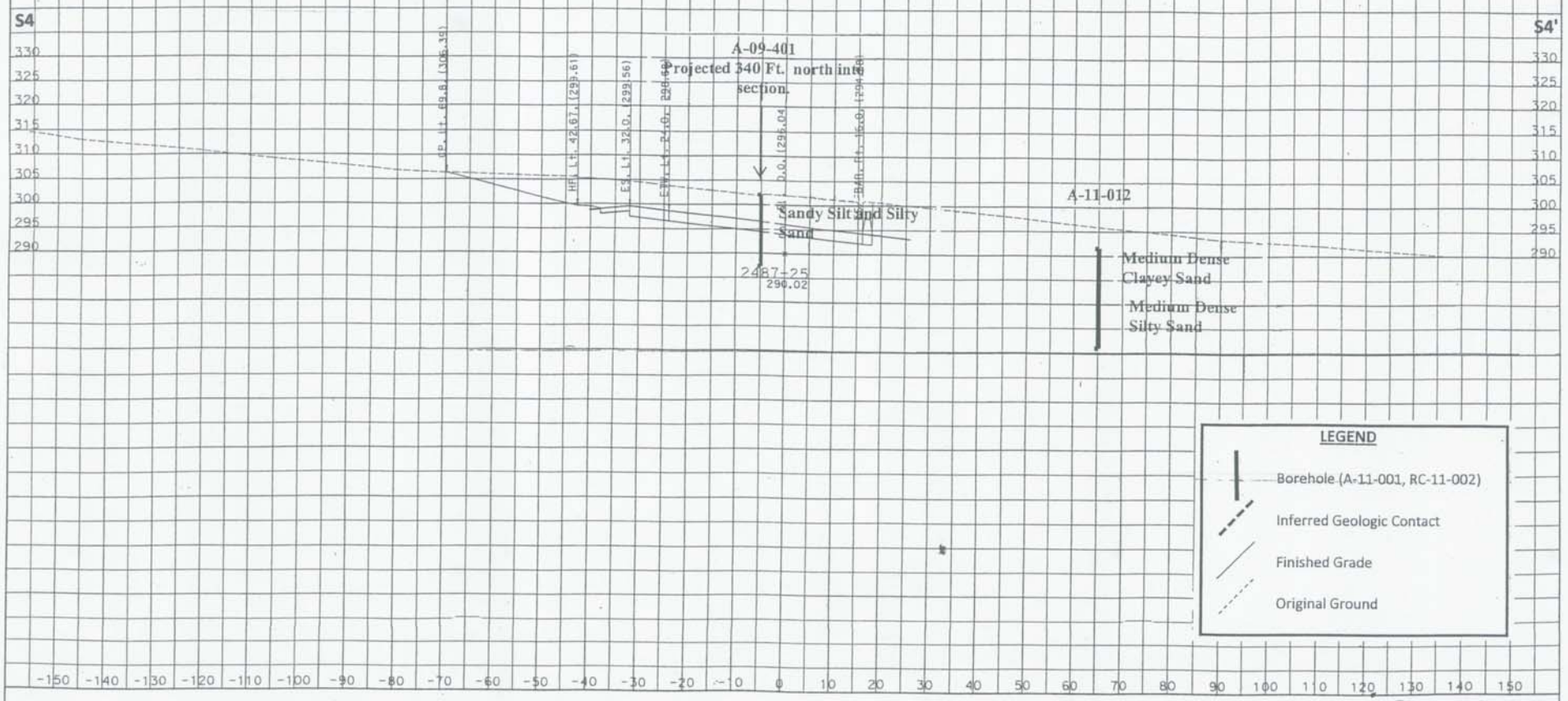
All Dimensions are US Survey Feet

CENTER LINE: B3A1
CROSS SECTIONS
Figure 6C

DESIGN STUDY ONLY

CROSS SECTION S4 - S4'



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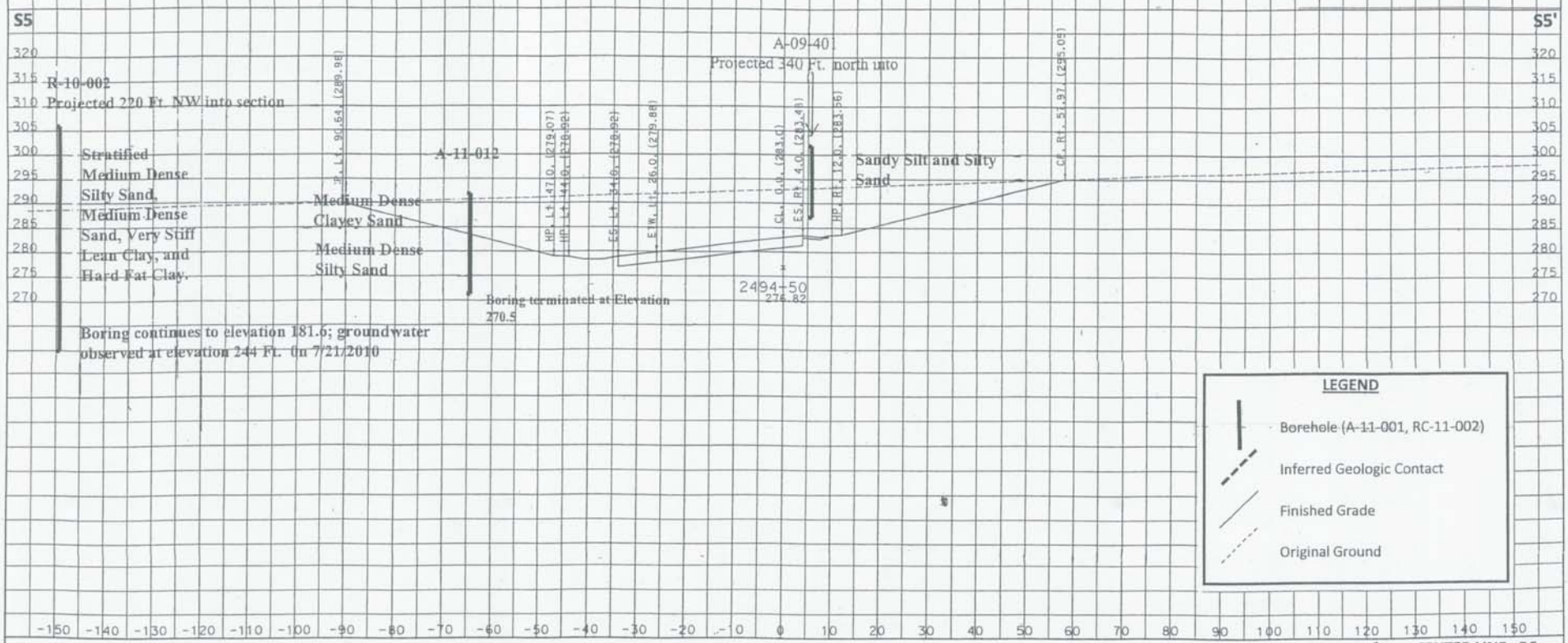
SCALE: 1" = 10' Horiz.
1" = 10' Vert.
All Dimensions are US Survey Feet

CENTER LINE: B4A1
CROSS SECTIONS
Figure 6D

DESIGN STUDY ONLY

CROSS SECTION S5 - S5'



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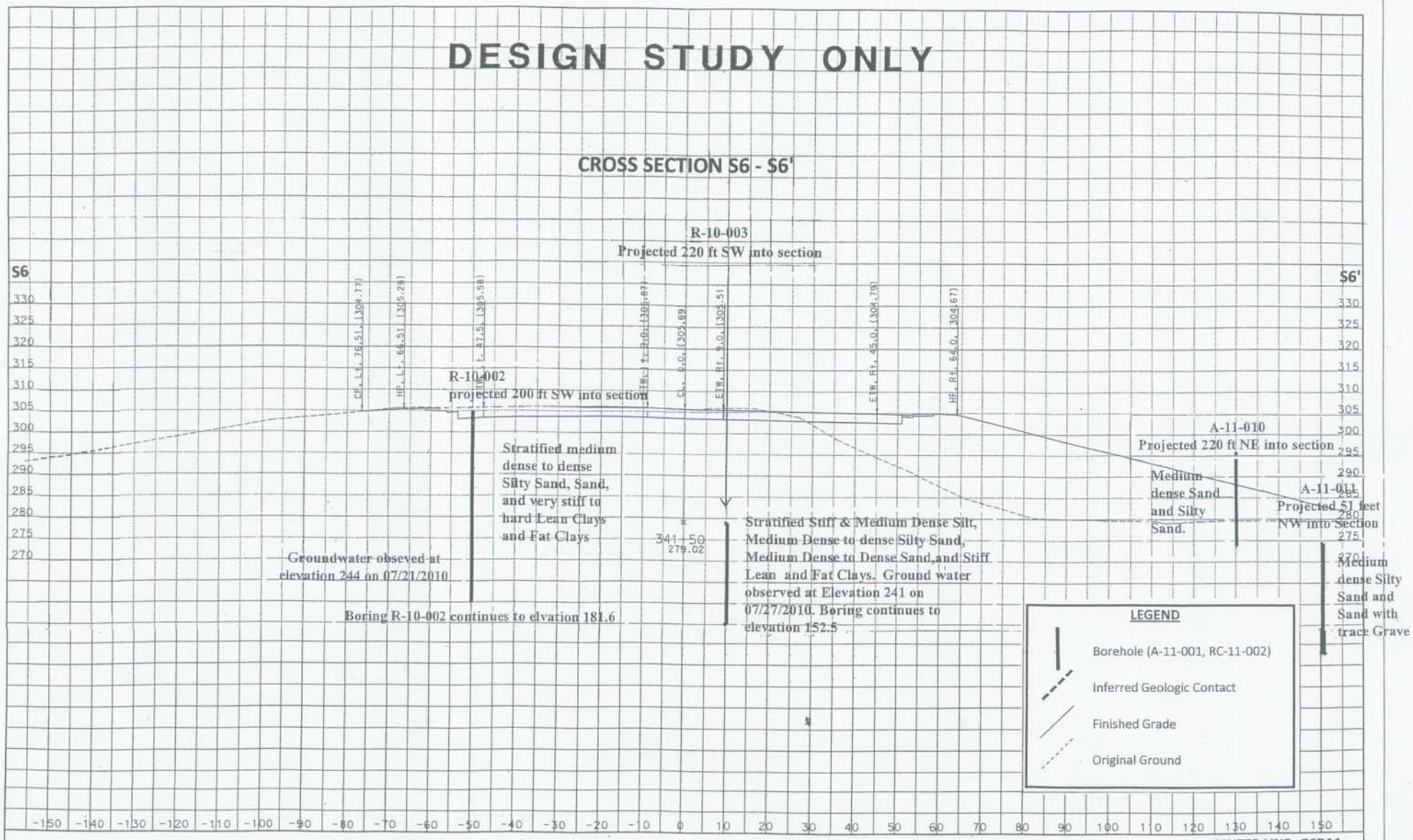
SCALE: 1" = 10' Horiz.
1" = 10' Vert.
All Dimensions are US Survey Feet

CENTER LINE: B6
CROSS SECTIONS
Figure 6E

DESIGN STUDY ONLY

CROSS SECTION S6 - S6'



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SCALE: 1" = 10' Horiz.
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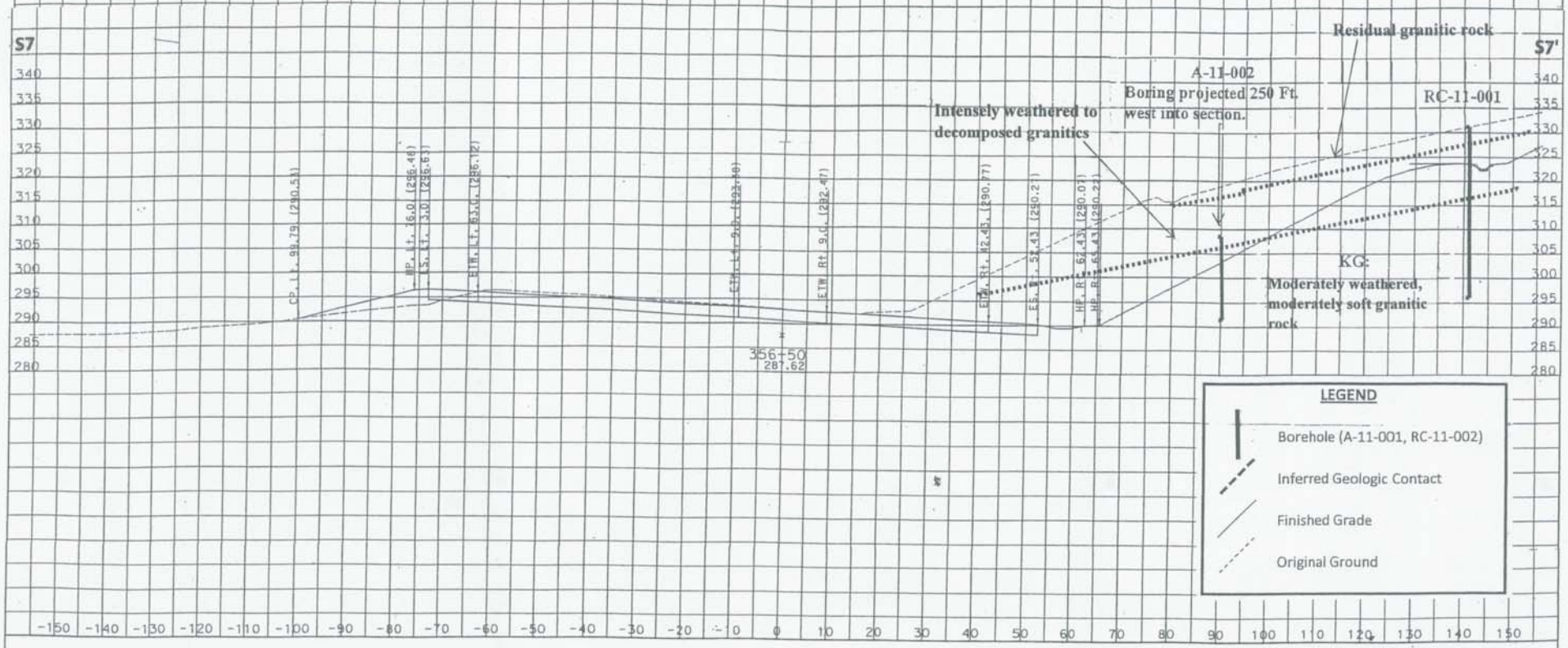
All Dimensions are US Survey Feet

CENTER LINE: 76RA1
CROSS SECTIONS
Figure 6F

DESIGN STUDY ONLY

CROSS SECTION S7 - S7'



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SCALE: 1" = 10' Horiz.
1" = 10' Vert.
All Dimensions are US Survey Feet

CENTER LINE: 76RA1
CROSS SECTIONS
Figure 6G

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/47.3 16.7/17.8		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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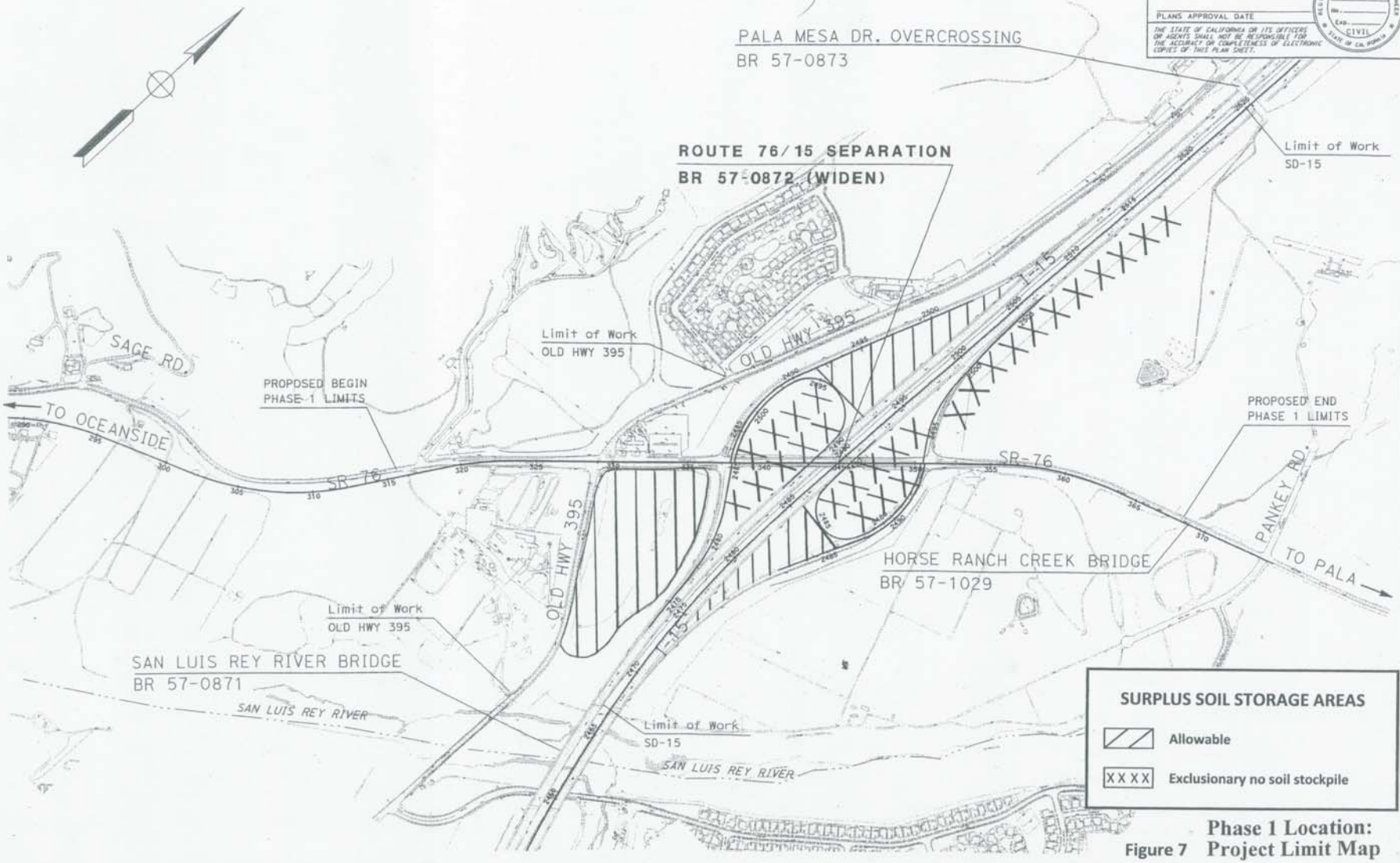

Figure 7 Phase 1 Location: Project Limit Map

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FUNCTIONAL SUPERVISOR

CALCULATED-DESIGNED BY

CHECKED BY

REVISED BY

DATE REVISED

LAST REVISED DATE PLOTTED => 19-NOV-2010 TIME PLOTTED => 15:52

10-16-10

BORDER LAST REVISED 3/1/2007

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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CU 00000

EA 000000

TABLES

Table 1: Existing Cut slopes.

STATION INTERVAL[1]								
FROM	TO	Line	Material	CUT HEIGHT (ft)	SLOPE RATIO (H:V)[2]	BENCH	Observed Erosion	NOTES
318+90	336+00	76RA1	Granitic	0 to 22	2:1	NO	Very Slight (E1) to Slight (E2)	Throughcut
353+00	360+00	76RA1	Decomposed to Moderately Weathered Granitic Rock (existing cut)	0 to 60	1.5: 1 or Flatter	Yes	Very Slight (E1) to Slight (E2)	Serrated Slope Recently Constructed Side-Hill Cut
2480+10	2485+00	B-5	Highway Embankment and Older alluvial Deposits	0-12	4: 1 or Flatter	NO	Very Slight (E1) to Slight (E2)	
2485+00	2488+90	B-5	Highway Embankment and Older alluvial Deposits	0-12	4: 1 or Flatter	NO	Very Slight (E1) to Slight (E2)	
2488+40	2498+70	B-6	Highway Embankment and Older alluvial Deposits	0-10	4: 1 or Flatter	NO	Very Slight (E1) to Severe (E4)	
2245+50	2465+00	FL-A	Decomposed to Moderately Weathered Granitic Rock	25-Oct	1:4	NO	Very Slight (E1) to Slight (E2)	
2475+20	2525+00	RTLN1	Older Alluvial Soils from Granitic Source	0 to 25	2:1	NO	Very Slight (E1) to Severe(E2)	

1: Based upon project layout sheets dated: Rev 03/30/2011. **2:** See Tables 7.3.1.2 A,B,C.

Table 2: Existing Embankments.

STATION INTERVAL[1]						
FROM	**TO**	**Line**	**HEIGHT (ft)**	**SLOPE RATIO (H:V)[2]**	**BENCH**	**Observed Erosion**
345+90	353+10	76RA1	0 to 25	2:1	NO	Very Slight (E1) to Slight (E2)
329+80	342+50	76RA1	0 to 25	2:1	NO	Very Slight (E1) to Slight (E2)
2492+10	2499+10	B-1A	0-15	3:1 or flatter	NO	Very Slight (E1) to Slight (E2)
2483+60	2485+60	B-3A	0-9	3 : 1 or Flatter	NO	Very Slight (E1) to Slight (E2)

1: Based upon project layout sheets dated: Rev 03/30/2011. **2:** See Tables 7.3.1.2 A,B,C.

Table 3A: Temperature in Fahrenheit (F).

SEASON	MINIMUM	MAXIMUM	AVERAGE
ANNUAL	52.0	89.1	77.7
WINTER	41.6	81.0	56.6
SPRING	46.8	77.5	64.2
SUMMER	57.9	89.1	74.0
FALL	46.3	81.0	64.1

Tabular data from WRCDC web page for Escondido, CA 1931 -1979

Table 3B: Precipitation in inches (in.).

SEASON	MINIMUM	MAXIMUM	AVERAGE
ANNUAL	6.15	33.83	15.46
WINTER	.02	11.09	9.88
SPRING	0	8.35	5.49
SUMMER	0	2.20	1.12
FALL	0	8.18	5.97

* Tabular data from WRCDC web page for Escondido, CA 1931 -1979

Table 4: NRCS Soil Series Mapped within the Project Footprint.

Series Name	Hydrologic Soil Group	Classification	Erosivity Index
Fallbrook Sandy Loam 9 to 15 % slopes	C	Formed from weathered in place granodiorite.	SEVERE
Grangeville Fine SandY Loam 0 to 2% Slopes	B	Alluvial Soils; very deep,poorly drained,formed on alluvial fans and plains.	SEVERE
Greenfield Sandy Loam 5 to 9% Slopes	B	Alluvial Soils; very deep,well drained,formed on alluvial fans and plains.	SEVERE
Placentia Sandy Loam 2 to 9 % Slopes	D	Alluvial soils from granitic source area; moderately well drained with hard pan subsoil. Old alluvial fans.	SEVERE
Ramona Sandy Loam 2 to 5 % Slopes	C	Alluvial soils from granitic source area; well drained with hard pan subsoil. Old terraces and alluvial fans.	SEVERE
Ramona Sandy Loam 5 to 9 % Slopes	C	Alluvial soils from granitic source area; well drained with hard pan subsoil. Old terraces and alluvial fans.	SEVERE
Tujunga Sand 0 to 5 % Slopes	A	Alluvium from granitic source areas, excessively drained; Alluvial fans and plains.	SEVERE
Visalia Sandy Loam 2 to 5 % Slopes	B	Alluvium from granitic source areas, moderately well drained; Alluvial fans and plains.	SEVERE
Vista Coarse Sandy Loam 9 to 15 % Slopes	B	Colluvial and top soils formed from weathered in place granodiorite or quartz diorite moderately well drained moderately deep.	MODERATE
Vista Coarse Sandy Loam 15 to 30 % Slopes	B	Colluvial and top soils formed from weathered in place granodiorite or quartz diorite moderately well drained moderately deep.	MODERATE

TABLE 5: Boring Designations and Locations.

BORING DESIGNATION	STATION AND OFFSET	REFERENCE LINE	DEPTH DRILLED (Ft)	Elevation
A-11-010	360 Ft. Lt. Sta 2483+18	RTLN	21.5	294.1
A-11-011	159 Ft. Lt. Sta 2484+27	RTLN	26.5	274.9
A-11-012	556.5 Ft. Lt. Sta 2488+14	RTLN	21.5	292
PT2	430 Ft. Lt. Sta 2489+97	RTLN	9.5	285
PT5	290Ft. Lt. Sta 2490+5	RTLN	6.2	281.7
A-11-008	78 Ft. Rt. Sta 2494+42	RTLN	21.5	276.7
A-11-009	221 Ft. Rt. Sta 2491+18	RTLN	21.5	301
PT4	221 Ft. Rt. Sta 2487+60	RTLN	9.25	292
PT6	212Ft. Lt. Sta 2489+68	RTLN	7	300
A-11-003	90 Ft. Rt. Sta 2508+83	RTLN	21.5	287.2
A-11-005	140 Ft. Rt. Sta 2501+14	RTLN	36.6	295.5
A-11-004	77 Ft. Rt. Sta 2516+42	RTLN	21.5	289.3
A-11-006	171 Ft Rt Sta 2511+54	RTLN	35.5	302.6
A-11-007	140 Ft Rt Sta 2521+99	RTLN	31.5	316.3
RC-11-013	86 Ft Rt Sta 2250+79	RTLN	38.8	311
A-09-304	35 Ft Rt Sta 328+42	76 RA	285	293
A-09-305	7 Ft Lt Sta 2496+79	R6	10.8	294
A-09-306	61 Ft Lt Sta 2479+71	R4 (current plan R3)	11	250

TABLE 5: Boring Designations and Locations.

BORING DESIGNATION	STATION AND OFFSET	REFERENCE LINE	DEPTH DRILLED (Ft)	Elevation
A-09-307	14 Ft Rt Sta 2483+32	R3	13.5	285
A-09-308	115 Ft Rt Sta 2498+96	RTLN	11	285
A-09-401	99 Ft Lt Sta 338+18	76 RA	13	302
A-09-402	13 Ft Lt Sta 2496+17	R5	10.5	294
A-09-403	33 Ft Rt Sta 350+17	76 RA	11.5	290
A-09-404	25 Ft Lt Sta 2486 +22	SR76R2	12.5	305
R-10-002	50 Ft Lt Sta 342 +10	76 RA	125	306.6
R-10-003	10 Ft Rt Sta 343+80	76 RA	126.5	279
R-10-001	16 Ft Rt Sta 347+10	76 RA	136.5	308.2
B-9	48 Ft Rt Sta 937+36	76-R	36.8	275.8
B-10	27 Ft Lt Sta 938+20	76-R	69	276
B-6	40 Ft Rt Sta 938+53	76-R	74	272
B-5	30 Ft Sta 939+25	76-R	57.7	269.7
B-8	31 Ft Rt Sta 960+47	76-R	59.9	280.9
B-7	20 Ft Lt Sta 940+97	76-R	80.2	280.2
B-3	37 Ft Rt Sta 942+08	76-R	79.4	287.4
B-4	22 Ft Lt Sta 942+78	76-R	79.5	288.5
B-2	55 Ft Rt Sta 943+10	76-R	79.9	289.9

TABLE 5: Boring Designations and Locations.

BORING DESIGNATION	STATION AND OFFSET	REFERENCE LINE	DEPTH DRILLED (Ft)	Elevation
B-1	18 Ft Rt Sta 943+90	76-R	60.1	289.1
RC-11-001	140 RT 356+74	76 RA	10.7	308.4
A-11-002	88.9 RT 359+03	76 RA	15	308.4
R-11-014	134 RT STA 2534+48	RTLN	36.5	297.6

TABLE 6: Seismic Refraction Data.

LINE DESIGNATION	FORWARD POINT	REVERSE POINT	APPROXIMATE DEPTH TO VELOCITY INTERFACE BOUNDARY	LAYER VELOCITY RANGE (ft/sec)
RS-1	102 ft Rt Station 355+00 "76-RA" Line	172 ft Rt Station 361+22 "76-RA" Line	0 to 6.7 ft	Layer 1: < 1791 ft/sec
			3 to 43 ft	Layer 2: 1800 to 3900 ft/sec
			26 to 43 ft	Layer 3: 3900 to 7100 ft/sec
RS-2	65 ft Rt Station 356+91 "76-RA" Line	337 ft Rt Station 356+15 "76-RA" Line	0 to 5 ft	Layer 1: < 2700 ft/sec
			14 to 24 m	Layer 2: 2700 to 4600 ft/sec
			18 ft to 68 ft	Layer 3: 4600 to 8400 ft/sec
RS-3	97 ft Lt Station 2250+00 "FL-A" Line	97 ft Lt Station 2253+28 "FL-A" Line	0 to 5 ft	Layer 1 < 1500 ft/sec
			3 to 5 ft	Layer 2 1500 to 3300 ft/sec
			23 to 32 ft	Layer 3: 3300 to 7000 ft/sec

Table 7: Percolation Test Results At Proposed Infiltration Basins B&C. Tests Conducted in Conformance with CTM 750.

Test Location	Basin Designation	Infiltration Rate min/in.
PT2	B	215.4
PT5	B	18.3
PT4	C	11.4
PT6	C	No infiltration

TABLE 8 : Corrosion Test Results (after Dokken).

Boring Designation	Sample Type	Minimum Resistivity (ohm-cm)	pH	Potential Impacts
A-09-402	Soil	2800	8.3	Not Corrosive to Foundation Elements.
A-09-403	Soil	1200	8.2	Not Corrosive to Foundation Elements.

Table 9: Condtions Anticipated at Proposed Cut Slopes.

STATION INTERVAL[1]											
FROM	TO	Line	Material	CUT HEIGHT (ft)	MAXIMUM ALLOWABLE SLOPE RATIO (H:V)[2]	BENCH[3]	ERODABILITY	EXCAVATION DIFFICULTY [4]	BLASTING REQUIRED	BOULDERS [4]	NOTES
324+00	328+00	WT1 & 76RA1	Colluvial and residual soils over decomposed to moderately weathered granitic rock.	0 to 15	2:1	NO	Moderate to Severe	E1 to E8 D1 to D6	NO	Probable Large Granitic Boulders of Very Hard to Extremely Hard Rock	May require mechanical breaker at isolated locations and boulders.
353+00	354+90	76RA1	Colluvium over Decomposed to Moderately Weathered Granitic Rock (existing cut)	0 to 25	1:2	NO	Moderate to Severe	E1 to E8 D1 to D6	20%	Probable Large Granitic Boulders of Very Hard to Extremely Hard Rock	Subsurface not investigated due to access issues. [6]
355+00	359+00	76RA1	Colluvium over Decomposed to Moderately Weathered Granitic Rock	0 to 40	1:1.5	NO	Moderate to Severe	E1 to E8 D1 to D6	20%	Probable Large Granitic Boulders of Very Hard to Extremely Hard Rock	
359+10	362+00	76RA1	Colluvium over Decomposed Granitic Rock	0 to 35	2:1	NO	Moderate to Severe	E1 to E8 D1 to D6	NO	Probable Large Granitic Boulders of Very Hard to Extremely Hard Rock	
2494+00	2507+00	B1A1	Older Alluvial Soils from Granitic Source	0 to 19	2:1	NO	Severe	E1 to E2 D1 to D3	NO	Unlikely	
2485+25	2493+00	B2A1	Engineered Fill and Alluvial Deposits undifferentiated.	0 to 10	2:1	NO	Moderate to Severe	E1 to E2 D1 to D4	NO	Unlikely	
2476+00	2482+75	B3A1	Engineered Fill and Alluvial Deposits undifferentiated.	0 to 5	2:1	NO	Moderate to Severe	E1 to E2 D1 to D3	NO	Unlikely	
2483+50	2499+00	B4A1	Engineered Fill and Alluvial Deposits undifferentiated.	0 to 15	2:1	NO	Moderate to Severe	E1 to E2 D1 to D3	NO	Unlikely	
2476+50	2488+75	B5	Engineered Fill and Alluvial Deposits undifferentiated.	0 to 10	2:1	NO	Moderate to Severe	E1 to E2 D1 to D3	NO	Unlikely	
2486+20	2487+00	B6	Bridge Cone Engineered Fill	0 to	2:1	NO	Low to Moderate	E1 to E2 D1 to D3	NO	Unlikely	
2490+00	2503+00	B6	Engineered Fill and Alluvial Deposits undifferentiated.	0 to 15	2:1	NO	Moderate to Severe	E1 to E8 D1 to D6	NO	Probable Large Granitic Boulders of Very Hard to Extremely Hard Rock	

Table 9: Condtions Anticipated at Proposed Cut Slopes.

STATION INTERVAL[1]											
FROM	TO	Line	Material	CUT HEIGHT (ft)	MAXIMUM ALLOWABLE SLOPE RATIO (H:V)[2]	BENCH[3]	ERODABILITY	EXCAVATION DIFFICULTY [4]	BLASTING REQUIRED	BOULDERS [4]	NOTES
2245+60	2253+50	FL-A	Colluvium over Decomposed to Moderately Weathered Granitic Rock	0 to 15	1.5:1	NO	Moderate to Severe	E1 to E8 D1 to D6	NO	Probable Large Granitic Boulders of Very Hard to Extremely Hard Rock	May require mechanical breaker at isolated locations and boulders.
2486+75	2488+50	RTLN1	Engineered Fill and Alluvial Deposits undifferentiated.	0 to 5	2:1	NO	Severe	E1 to E2 D1 to D3	NO	Unlikely	
2501+00	2507	RTLN1	Older Alluvial Soils from Granitic Source	0 to 17	2:1	NO	Severe	E1 to E2 D1 to D3	NO	Unlikely	

1: Based upon Center Line proposed SR-76 layout Rev 10-04-76. **2:** Analysis of the specified slope ratio indicates a FOS against sliding of 1.5 or greater. All cut slopes must be inspected by a representative of GDS while the cuts are being constructed. **3:** The minimum bench width is 20 ft. The maximum height of slope above or below a bench is 50 ft. **4:** Modified from The National Soil Survey Handbook; 1993, and from the report titled: Correlation of the Seismic Velocity of Rock to the Ripping Ability of the HD41 Tractor; Transportation Laboratory Research Report FHWA-CA-TL-2153-77-10. **5:** Steeper slope ratios are possible at this location. **6:** The subsurface of this interval was not investigated during the GDR phase of project development due to access constraints.

Table 10: Proposed Embankments.

STATION INTERVAL							
FROM	TO	Line	EMBANKMENT HEIGHT (ft)	MAXIMUM ALLOWABLE SLOPE RATIO (H:V) [1]	FOUNDATION TREATMENT REQUIRED[3]	ESTIMATED VOLUME OF MATERIAL TO BE REMOVED (yd^3)	NOTES
316+50	320+25	WT1	0 to 5	2:1	N/A[2]	N/A[2]	
2488+85	2489+75	RTLN1	0 to 10	2:1	Key into existing engineered embankment/ bridge cone.	N/A[2]	
316+75	320+25	WT1	0 to 5	2:1	Removal of up to 2 feet of soil due to high organic and garbage content.	500	
2486+20	2487+00	B6		2:1	N/A[2]		
328+00	342+/-	76RA1	0 to 22	2:1	N/A[2]		Founded on existing engineered embankment (bridge cone) and medium dense granular alluvial deposits.
351+10	353+10	Rt 76RA1	0 to 10	2:1	N/A[2]		Founded on existing engineered embankment (bridge cone) and medium dense granular alluvial deposits.
351+90	360+55	Lt 76RA1	0 to 5	2:1	Removal of Boulders	10	Founded on existing engineered embankment (roadway) and medium dense granular alluvial deposits.
2488+80	2489+80	B5	0 to 15	1.5:1	N/A[2]		Bridge Cone with Slope Paving.

Table 10: Proposed Embankments.

STATION INTERVAL							
FROM	TO	Line	EMBANKMENT HEIGHT (ft)	MAXIMUM ALLOWABLE SLOPE RATIO (H:V) [1]	FOUNDATION TREATMENT REQUIRED[3]	ESTIMATED VOLUME OF MATERIAL TO BE REMOVED (yd^3)	NOTES
2480+00	2484+15	B3A1	0 to 12	2:1	N/A[2]		Founded on existing engineered embankment (roadway) and medium dense granular alluvial deposits.
2487+25	2492+10	B2A1	0 to 10	2:1	Remove topsoil containing detritus from 0.5 to 3 feet depth.	800 yd^3 estimated. Depth and limit of removal should be controlled by representative of the Office of Geotechnical Design south . Spoil may be used in common embankment.	Founded on existing engineered embankment (roadway) and medium dense granular alluvial deposits.

1: Steepest Slope Evaluated to Satisfy minimum acceptable Factor of Safety against failure; 2:N/A: Not Applicable; 3: A representative of OGDS-2 should be on-site during removals. Removal depths and limits may be adjusted pursuant to actual site conditions as revealed during construction. Bottom of removal must be approved by a representative of OGDS-2.

Table 11: Rock mass Mohr-Coulomb strength properties envelope developed from the Hoek and Brown Criterion.

End Member	Cohesion (PSF)	Friction Angle (degrees)
Lower Limit	1000	32
Upper Limit	1800	44

Table 12: Soil designations pursuant to the Caltrans Trenching and Shoring Manual.

Lithology	Soil Designation
Young Alluvial Depostis (Qa) and very loose to loose soils	Type B
Older Alluvial Deposits (QOa, Qt) medium dense to very dense soil, colluvium, regolith	Type A
Disintegrated granite to intensely weathered , intensely fractured rock	Type A

Table 13: Groundwater observations in site borings.

BORING DESIGNATION	Observed Depth Below Ground Surface (Ft)[1]	Groundwater Elevation (Ft)	Observation Date
B-2	48	246.1	2/17/1972
B-4	41	247.5	2/23/1972
B-8	34.5	246.4	4/14/1972
B-7	32.5	247.7	3/7/1972
B-6	30.6	246.4	3/7/1972
B-10	30.2	243.8	4/7/1972
B-9	28.1	245.7	4/7/1972
R-10-002	62.6	244	7/21/2010
R-10-003	38.0	241	7/20/2010
R-10-001	65.2	243	7/20/2010
R-11-0014	15.6	282	12/1/2011
MW-9[2]	52.5	244.3	8/12/2008
MW-10[2]	23.9	276.1	8/30/2008

1: Reported depth to water and elevation are of the highest water level observed. 2: From ETC Engineering Boring at the Exxon Mobile Gas Station.

Table 14 A: Defintions for Erosion Level designations

Table 14 A: Defintions for Erosion Level designations.[1]

Level of Erosion	Classification	Description
E1	Very Slight	Minor erosion at the base of the slope, minor accumulation of debris.
E2	Slight	Erosion consists of rills, which may be up to about 8 cm deep; some debris at the base of the slope.
E3	Appreciable	Rills up to 0.3 m deep; debris at the base of the slope.
E4	Severe	Rills from 0.3 m to 1 m deep and gullies are beginning to form; considerable debris at the base of the slope.
E5	Very Severe	Deep Erosion Channels, consisting of rills and gullies; development of pipes causing underground erosion; very large accumulation of debris at the base of the slope.

1 After Geotechnical Engineers Portable Handbook, Robert Day,2000

Table 14 B: Characteristics of the 4 Hydrologic Soil Group Designations after the NRCS Sand Diego Soil Survey.

GROUP	Description	Soil Erodibility	Significance
A	Soils have high infiltration rate when thoroughly wetted; chiefly deep, well-drained to excessively drained sand gravel or both. Rate of water transmission is high; runoff potential is low.	Slight	Water erosion is a minor problem and soil is suitable for building sites or other intensive use.
B	Soils have a moderate infiltration rate when thoroughly wetted; chiefly soils are moderately deep, moderately well drained to well drained, and moderately coarse textured.	Moderate	Corrective measures are needed to protect against erosion wherever Group B soils are expoed and or occur on graded slopes.
C	Soils have a slow infiltration rate when thoroughly wetted; chiefly soils that have a layer impeding downward movement of water, moderately fine to fine textured soils that have a slow infiltration rate. Rate of water transmission is slow.	Severe	Corrective measures are needed to protect against erosion wherever Group C soils are expoed and or occur on graded slopes.
D	Soils have very slow infiltration rate when thoroughly wetted; chiefly clays that have a high shrink swell potential, soils have a high permanent water.	Low	Engineering judgment is required wherever Type D soils occur. The effects of shrink-swell behavior on project improvement should be considered. Typically these soils should not be concentrated in embankments. Moistening and/or saturation may result in softening. Cut slopes in these soils must be evaluated in terms of shallow and deep seated stability. High rates of runoff issuing from areas underlain by Group D soils may have adverse effects upon adjacent areas underlain by more erodible soils.

Table 15: Controlling Seismic Design Parameters.

Design Fault	Distance to Design (Miles)	Fault Plane Dip	PSH[1] M_m	Ground Acceleration coefficient (a_g)
Elsinore Fault Zone: Temecula Segment	5.5-6.6 to the east	30 degrees west	7.57-7.59	0.4g

1: Probabilistic Seismic Hazard Moment Magnitude (M_m).

Table 16: Strength Parameters Used in Slope Stability Analysis.

Material	Angle of Internal Friction φ (Degrees)	Cohesion (Lbs/Ft.^{2})	Unit Weight (Lbs/Ft.^{3})	Pressure Wave Velocity (Ft./sec.)
Fill comprised of D.G.[1]	32	400	135[a]	
Terrace Deposit [1]	32	100	120	
Recent Alluvium [1]	28	0	120	
Older Alluvium	32	100	120	
Intensely Weathered to Decomposed Granitic (Very Poor to Poor Rock)[2]	30 to 36	300 to 500 [c]	150[b]	1800-6500
Moderately Weathered Granitic Rock (Fair Rock)[2]	36 to 43	600 to 800[c]	170[b]	8200-15000

1: Values based upon professional judgment and local experience. 2: Rock Quality Designation based upon Geomechanics Rock Mass Rating System (RMR) 1989.; a: unit weight at 90% relative compaction; b: From field determination of specific gravity.; c: Value of cohesion reported and used in analysis is a reduction of the actual cohesion value derived from the Hoek and Brown Criteria.

Table 17: Allowable Slope Height as Function of Material and Inclination Ratios.

Material	Inclination[2] (H:V)	Maximum Cut Height
OQA1[1]	2:1 or flatter	20 feet
Regolith[1]	1.5:1 or flatter	15 feet
Decomposed Granitics[1]	2:1 to 1.5:1	40 Feet
Intensely Weathered to Moderately Weathered Granitics	1.5:1 or flatter	60 feet

1: Requires aggressive erosion protection. 2 Allowable slope ratios for project cuts are presented in Table 7.2A. 3: Taller or steeper slopes must be justified by slope specific engineering evaluation.

Table 18: Material Excavation Difficulty.

Material Designation	Excavation Method	Difficulty
Qal	Scrapable / Bladable	Low
Qoa	Scrapable / Bladable	Low-Moderate
Colluvium and Regolith	Bladable / Rippable	Moderate to High
Decomposed to Moderately Intensely Weathered Rock	Bladable to Rippable	Very High to Extremely High
Moderately Weathered to Fresh Granitics	Mechanical Breaker and/or Blasting need for $\leq 25\%$ of the rock mass.	Ripping, Mechanical Breaker Blasting

Table 19: Definitions of Excavation Difficulty Designations.

Table 19: Definitions of Excavation Difficulty Designations.

Level of Difficulty	Classification[1]	Description[(1,2)]	Pressure Wave Velocity (P_v) ft/sec [(4)]
D1	Low	Excavations can be made with a spade using arm-applied pressure only. Neither application of impact energy nor application of pressure with the foot to a spade is necessary. Scraping.	≤ 984
D2	Moderate	Arm applied pressure to a spade is insufficient . Excavation an be accomplished quite easily by application of impact energy with a spade or by foot pressure on a spade. Scraping.	≥ 984
D3	High	Residual Soil. Excavation with a spade can be accomplished with difficulty. Excavation is easily possible with a full length pick, using an over-the-head swing. Scraping.	1600-3300
D4	Very High	Decomposed rock. Excavation with a full length pick using an over-the-head swing is moderately to markedly difficult. Excavation is possible in a reasonable period of time with a backhoe mounted on a 40 to 60 kW (50-80 hp) excavator. Ripping and scraping.	1600 -3300
D5	Extremely High	Very Intensely Weathered Rock. Excavation is impossible with a full length pick using an over-the -head swing. Excavation cannot be accomplished in a reasonable time period with a backhoe mounted on an excavator. Ripping and scraping.	3300 - 6600
D6	Ripping - Blasting[2,3]	Moderately to Intensely Weathered Rock[3], may be rippable depending upon fracture spacing, to non-rippable, requiring hoe-ram or blasting.	4900 -9800
D7	Blasting Required[2,3]	Moderately weathered to fresh rock requiring fragmentation to facilitate excavation.	≥ 8200 -9800

1: Modified from the national Soil Survey Handbook 1993 and the Caterpillar Performance Handbook 26th edition. **2:** From Transportation Laboratory Research Report FHWA-CA-TL-2153-77-10 ; Correlation of the Seismic Velocity of Rock to the Ripping Ability of the HD41 Tractor. **3:** Modified from Dearman 1978. **4:** The indicated pressure wave velocity thresholds represent velocity ranges observed along the subject project.

Table 20: Excavation Index Definitions.

Excavation Index	Degree of Excavation Difficulty	Examples
1	May be easily scraped.	Relatively dry sand or silt; some clays.
2	May be scarped or bladed.	Moist gravel, sand or silt; most clays.
3	May be easily bladed or may be scraped with difficulty.	Moist clay with minor - less that 25%- small disseminated rock particles; some highly weathered shales; some organic materials/
4	May be bladed with difficulty.	Clay with moderate to heavy - 25 to 50% - small disseminated rock particles; minor pinnacle and/or boulder content; some moderately weathered shales; colluvium with minor boulder content; sanitary landfill material; alluvial boulders.
5	May be bladed with great difficulty; may be easily ripped, dredged, or draglined.	Clay with heavily disseminated to some bedded chert; slightly weathered shale; talus or colluvium with minor boulder content; saturated clay, silt, sand or gravel.
6	May be ripped with some difficulty.	Very slightly weathered shale; thin and slabby disjointed limestones and siltstones; Saprolite.
7	Rippable with great difficulty.	Thin bedded chert with clay seams; thin-bedded limestone or siltstone with interbedded shales.
8	Requires blasting up to 25%.	Weathered granite, slate, and other igneous and/or metamorphic rock; Friable sandstone; medium thick bedded limestone with solution cavities (cutters) or that is disjointed with clay and/or shale seams; Soils with rock pinnacles or large boulders.
9	Requires blasting 25 to 50 %.	Hard shale; thin to medium bedded sandstone, siltstone, or limestone with interbedded shale; soils with numerous rock pinnacles or large boulders.
10	Requires Blasting greater that 50%.	Thin to thick-bedded sandstone, siltstone, and limestone; granite, slate, and other well indurated or fresh igneous, metamorphic, or sedimentary rock.

Quoted form the Bulletin of the Association o0f Engineering Geologists Vol XV No. 4 1978: After David L. Royster Director to the Divison of Soils and Geological Engineering Tennessee DOT: *"Excavation Characteristic Designations for Materials Identified in Field Investigations.*

Table 21 Grading Factors anticipated for sight soils.

Material	Grading Factor
Engineered Fill	1
Younger Alluvium (Qa)	0.98
Older Alluvium (QOa)	0.98 – 1
Colluvium	0.98-1
Regolith	1.-1.05
Intensely Weathered to Moderately Weathered Granitics	1.1
Moderately to slightly Weathered Granitics	1.2 -1.3

Table 22: Material Disposal Sites.

FROM	TO	Line	FEATURE	DESIRABLE QUALITY	Notes
2468 + 00	2485+00	"B3A1"/"RTLN"	Open area Located in-between the I-15 mainlanes on the east and the Old Highway 395 on the west.	Flat Open area with easy access form three sides. Comprised of shallow soil on bedrock, no improvements.	Adjacent to areas defined as a biological resource.
2475+00	2485+00	"RTLN"	The open area located inbetween the NB mainlanes to I-15 and the NB off ramp to SR-76 ("B2A1" line)	Isolated flat open area with easy access form two sides. Comprised of thick alluvial soils , Few existing improvements.	The are curently has specimen trees. The area is adjacent to cullverts and flatwork, therefore, the effects of surcharge induced settlements must be considered.
2493+00	2505+00	"RTLN"	The open area located inbetween the SB mainlanes to I-15 and the SB off ramp to SR-76 ("B4A1" line)	Isolated flat open area with easy access form two sides. Comprised of thin soils on bedrock, Few existing improvements.	The are curently has specimen trees. The area is adjacent to cullverts and flatwork, therefore, the effects of surcharge loading must be evaluated.

Table 23: Open Areas Unsuited for Material Disposal Sites

FROM	TO	Line	FEATURE	UNDESIRABLE QUALITY	Notes
2485+00	2493+00	"RTLN"	Open areas located inbetween the I-15 mainlanes and the NB/SB on/off ramps to/from SR-76.	Open flat open area underlain by thick alluvial deposits and is adjacent to the SR-76/I-15 Separation, flatwork, and existing culverts.	Stockpiling soils will induce settlements that may be adverse to existing improvements.
2485+00	2525+00	"RTLN"	Flat opon area located east of I-15 and behind cut hingle line. No improvemnts.	Loading of cut slope developed in older alluvial deposits.	Stockpiling soils will iin this area may result in slope failures. Poor access.

Table 24: Settlement Waiting Periods.

From Station	To Station	Line	UNDESIRABLE QUALITY	Settlement Period	Surcharge Height	Notes
316+50	320+00	"76-RA"	Existing loose to medium dense granular soils used for embankment foundation. Settlement calculations indicate up to 2.5 inches of settlement	30 Days	Finished Embankemnt Height	Allow 30 days to elapse prior to constructing culverts and flatwork. No surcharge necessary
338+50	342+11	"76-RA"	Existing loose to medium dense granular soils used for embankment foundation. Settlement calculations indicate up to 2.5 inches of settlement	30 Days	Finished Embankemnt Height	Allow 30 days to elapse prior to constructing culverts and flatwork. No surcharge necessary
2482+00	2484+50	"B-3A"	Existing loose to medium dense granular soils used for embankment foundation. Settlement calculations indicate up to 2.5 inches of settlement	30 Days	Finished Embankemnt Height	Allow 30 days to elapse prior to constructing culverts and flatwork. No surcharge necessary

Table 25: Recommended Remedial Grading.

	A	B	C	D	E	F	G	H
1								
2	**FROM**	**TO**	**Line**	**FEATURE**	**UNDESIRABLE QUALITY**	**RECOMMENDED MINIMUM DEPTH OF REMOVAL (Ft.)** [1]	**Final Disposition**	**Notes**
3	2486 + 50	2493+20	"B2A1"	Embankment Foundation	Loose soils with organics detritis, refuse, debris, Soil Piping channels, Concrete V-Ditch.	3	May be used as common fill.	Removals and spoil should be inspected by a representative of OGDS
4	317+80	318+10	"76RA1"	Pipe Culvert Foundation	Very loose to loose alluvial sands.	3	May be reused as common fill.	Removals and spoil should be inspected by a representative of OGDS
5	320+00	328+00	"76RA1"	Embankment Foundation	Refuse and organics debris associated with an on-going nursery operation	3	Must be disposed of as rubbish.	Removals pursuant to section 16-103 clearing and grubbing of the Standard Specifications
6								
7	1: Removal depth should be approved by a representative of Geotechnical Design South II during construction. Additional removals may become necessary if site conditions warrant.							
8								
9								

APPENDICES

APPENDIX I

LOG OF TEST BORING AND SITE DATA

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15/76			

CERTIFIED ENGINEERING GEOLOGIST — DATE 5-10-11

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST — Jeff Tesar — No. 2137 — Exp. 01-31-13 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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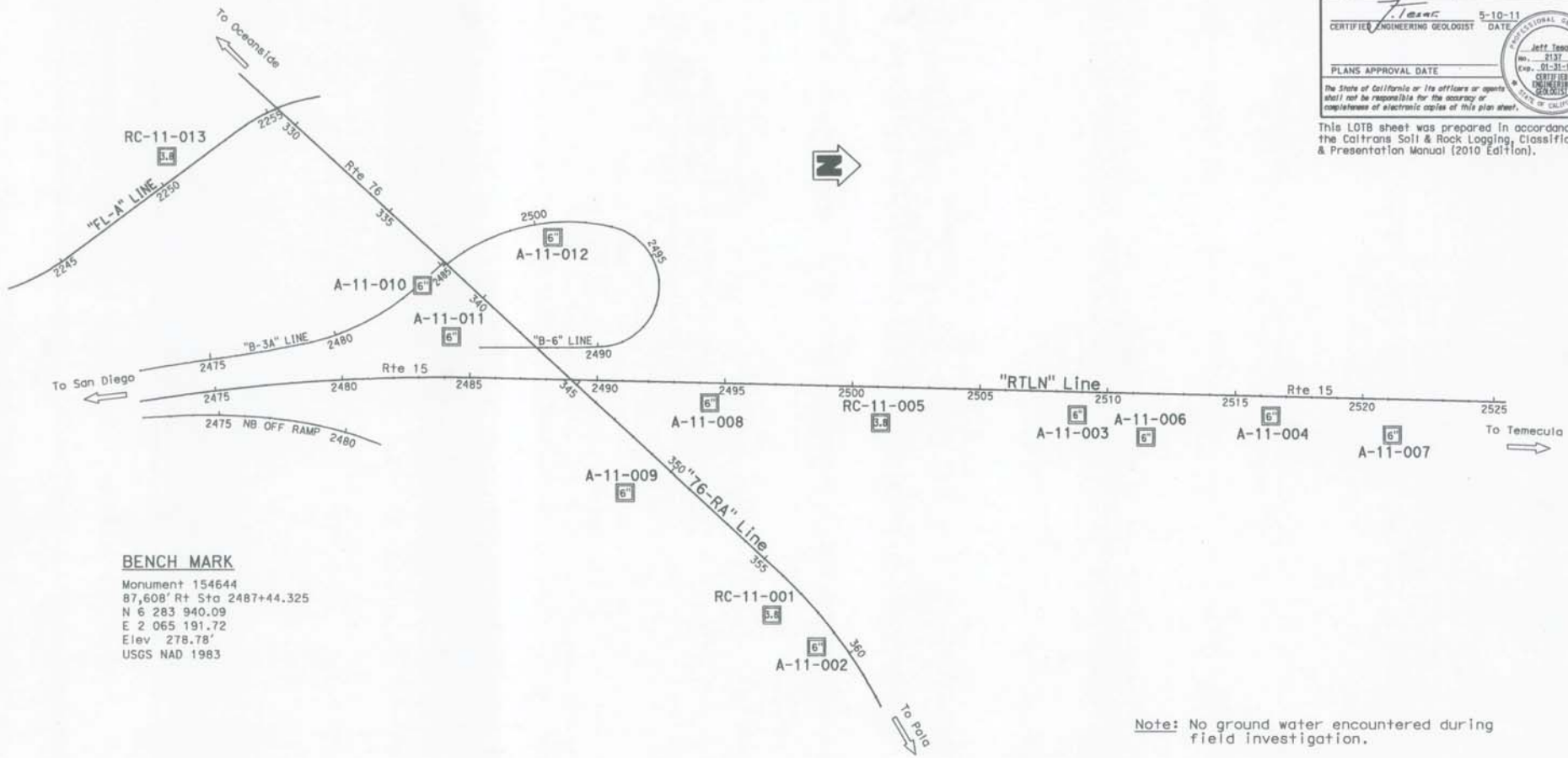

BENCH MARK

Monument 154644
87,608' Rt Sta 2487+44.325
N 6 283 940.09
E 2 065 191.72
Elev 278.78'
USGS NAD 1983

Note: No ground water encountered during field investigation.

PLAN

1" = 200'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILE 46.1/47.3	CONTOUR AND GRADING LOG OF TEST BORINGS 1 OF 10
FUNCTIONAL SUPERVISOR NAME: B. Hinman	DRAWN BY: I.G-Remmen CHECKED BY: Z. Yazdani	FIELD INVESTIGATION BY: J. Tesar			

DGS CIVIL LOG OF TEST BORINGS SHEET — ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 — UNIT: 3643 — PROJECT NUMBER & PHASE: 11000001891 — CONTRACT NO.: 11-257111 — DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES 5-10-11 — SHEET X OF X

FILE => contour01of10.dgn

USERNAME => S116862 DATE PLOTTED => 9-MAY-2011 TIME PLOTTED => 13:40

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15/76			

CERTIFIED ENGINEERING GEOLOGIST — DATE 5-10-11

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — Jeff Tesar No. 2137 Exp. 01-31-13 CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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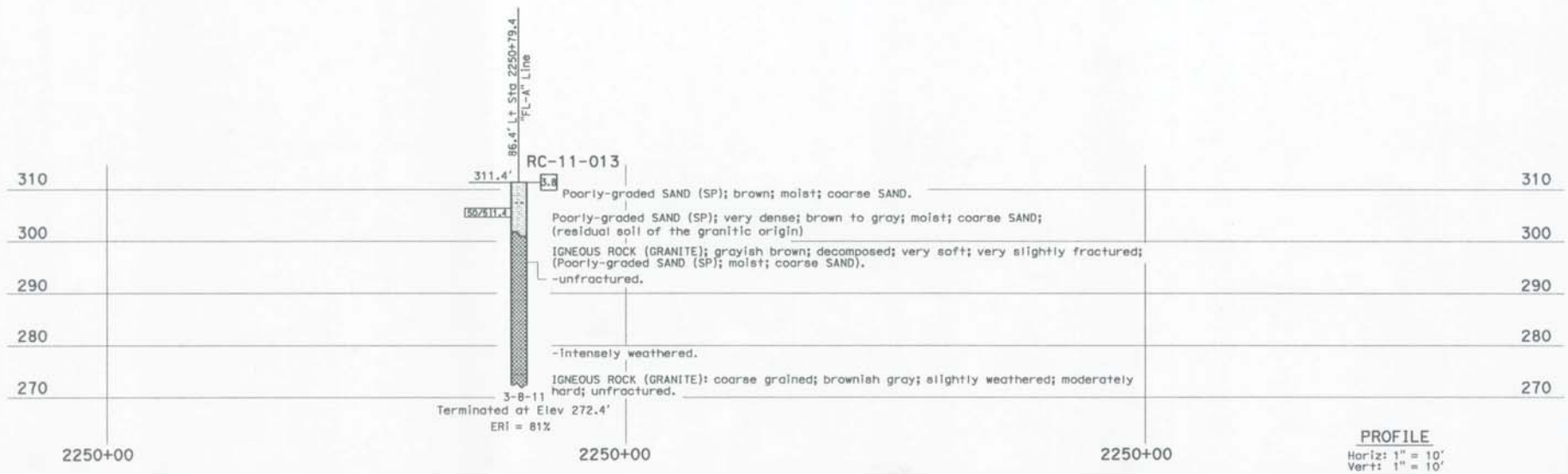
FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 10"



PROFILE
Horiz: 1" = 10'
Vert: 1" = 10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH X	BRIDGE NO. / POST MILE 46.1/47.3	CONTOUR AND GRADING LOG OF TEST BORINGS 2 OF 10
FUNCTIONAL SUPERVISOR NAME: B. Hinman	DRAWN BY: C. Christian, F. Nguyen, I.G-Remmen; CHECKED BY: Z. Yazdani	FIELD INVESTIGATION BY: J. Tesar			

ODS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643
PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: 11-257111

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES 05-10-11 SHEET X OF X

FILE => contour02of10.dgn

USERNAME => s116982 DATE PLOTTED => 18-MAY-2011 TIME PLOTTED => 13:40

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15/76			

J. Tesar 5-10-11
CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST — Jeff Tesar — No. 2137 — Exp. 01-31-13 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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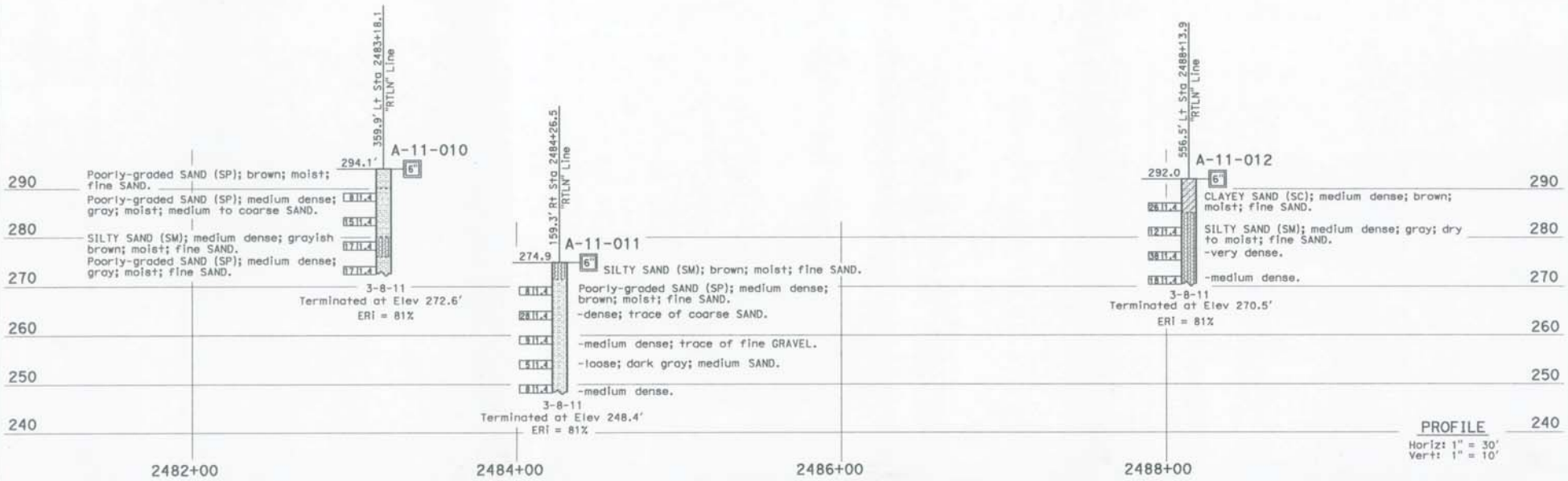
FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 10"



ENGINEERING SERVICES	GEOTECHNICAL SERVICES	
FUNCTIONAL SUPERVISOR	DRAWN BY: C. Christian, F. Nguyen, I.G-Remmen	FIELD INVESTIGATION BY:
NAME: B. Hinman	CHECKED BY: Z. Yazdani	J. Tesar

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO.
POST MILE 46.1/47.3

CONTOUR AND GRADING
LOG OF TEST BORINGS 3 OF 10

005 CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643
PROJECT NUMBER & PHASE: 11000001891
CONTRACT NO.: 11-257111

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 05-10-11 | SHEET X | OF X

FILE => contour03of10.dgn

USERNAME => s116982 DATE PLOTTED => 18-MAY-2011 TIME PLOTTED => 13:40

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15/76			

CERTIFIED ENGINEERING GEOLOGIST DATE 5-10-11

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST — Jeff Tesar — No. 2137 — Exp. 01-31-13 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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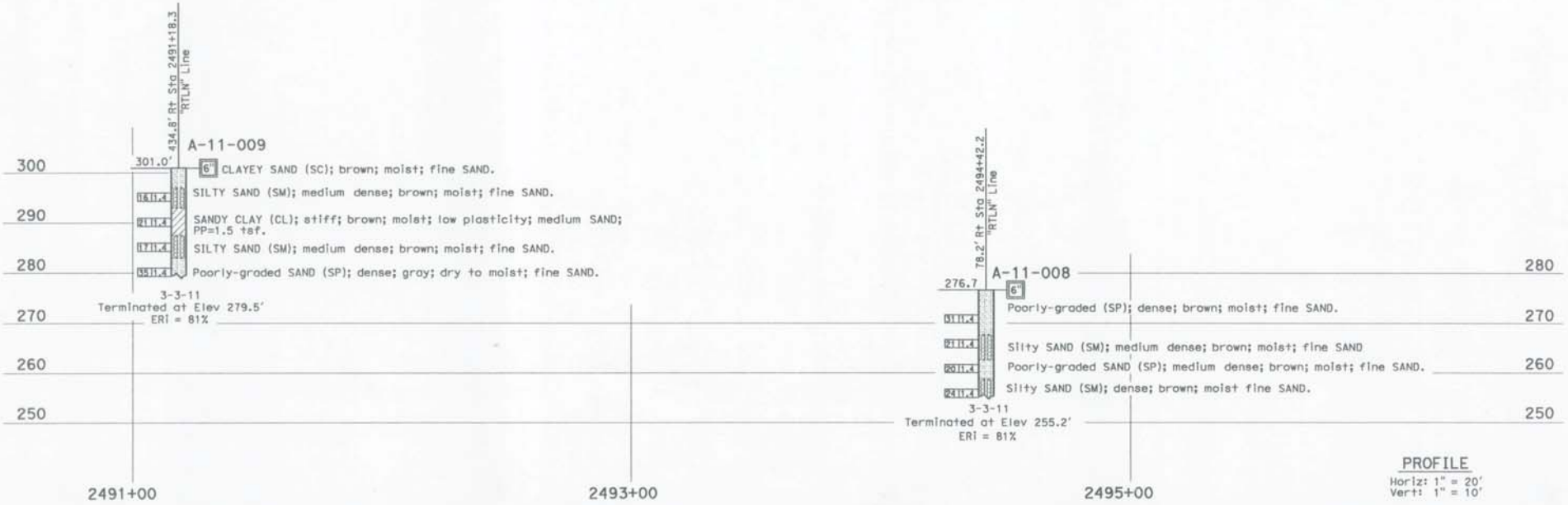
FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 10"



PROFILE
Horiz: 1" = 20'
Vert: 1" = 10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILE 46.1/47.3	CONTOUR AND GRADING LOG OF TEST BORINGS 4 OF 10
FUNCTIONAL SUPERVISOR NAME: B. Hinman	DRAWN BY: C. Christian, F. Nguyen, I-G-Remmen; CHECKED BY: Z. Yazdani	FIELD INVESTIGATION BY: J. Tesar			

UNIT: 3643
PROJECT NUMBER & PHASE: 11000001891
CONTRACT NO.: 11-257111
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 05-19-11
SHEET X OF X
FILE => contour04of10.dgn

005 CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

USERNAME => s116982 DATE PLOTTED => 18-MAY-2011 TIME PLOTTED => 13:40

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15/76			

CERTIFIED ENGINEERING GEOLOGIST 5-10-11 DATE

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST — Jeff Tesar — No. 2137 — Exp. 01-31-13 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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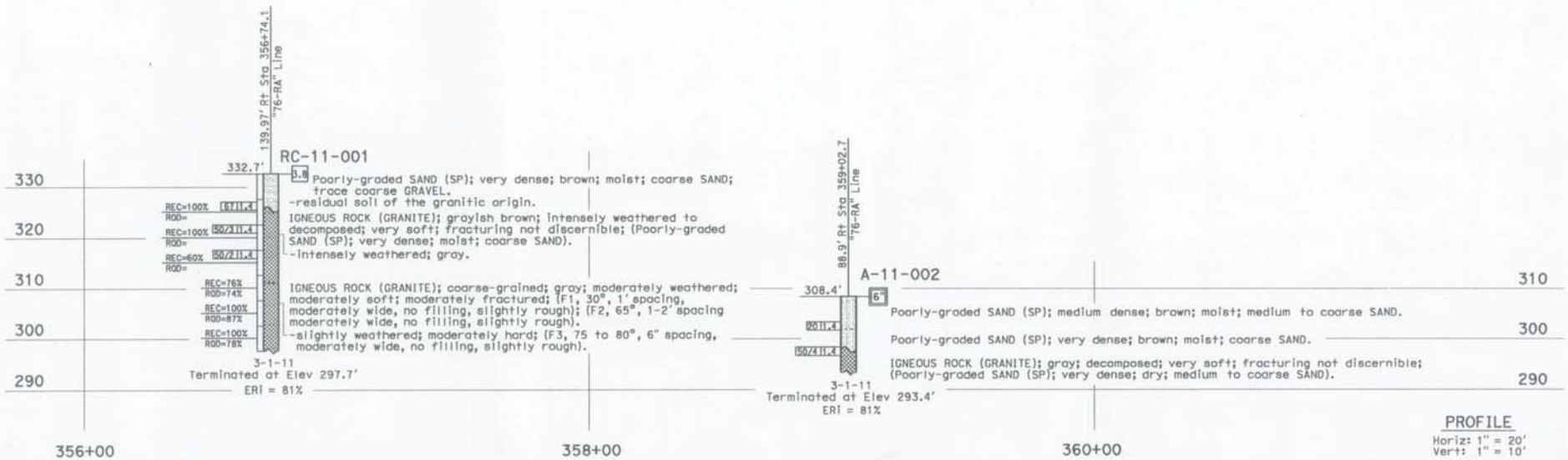
FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 10"



PROFILE
Horiz: 1" = 20'
Vert: 1" = 10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILE 46.1/47.3	CONTOUR AND GRADING LOG OF TEST BORINGS 5 OF 10
FUNCTIONAL SUPERVISOR NAME: B. Hinman	DRAWN BY: C. Christian , F. Nguyen, I-O-Remmen; CHECKED BY: Z. Yazdani	FIELD INVESTIGATION BY: J. Tesar			

DOS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643
PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: 11-257111

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 05-06-11 05-10-11

REVISION DATES | SHEET X | OF X

FILE => contour05of10.dgn

USERNAME => s116982 DATE PLOTTED => 13-MAY-2011 TIME PLOTTED => 13:40

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15/76			

CERTIFIED ENGINEERING GEOLOGIST — DATE 5-10-11

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST — Jeff Tesar — No. 2137 — Exp. 01-31-13 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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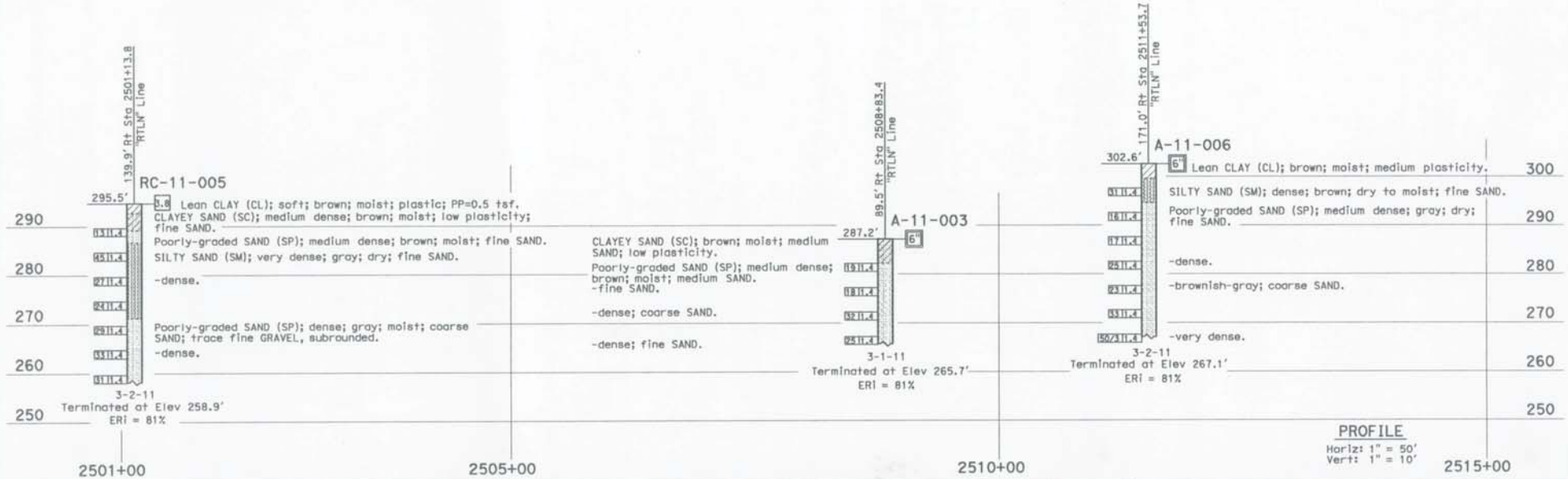
FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 10"



PROFILE
Horiz: 1" = 50'
Vert: 1" = 10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILE 46.1/47.3	CONTOUR AND GRADING LOG OF TEST BORINGS 6 OF 10
FUNCTIONAL SUPERVISOR NAME: B. Hinman	DRAWN BY: C. Christian , F. Nguyen, I-G-Remmen; CHECKED BY: Z. Yazdani; FIELD INVESTIGATION BY: J. Tesar				

UNIT: 3643
PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: 11-257111
DISREGARD PRINTS BEARING EARLIER REVISION DATES → 05-09-11 05-10-11
SHEET X OF X
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3
FILE => contour06of10.dgn
005 CIVIL LOG OF TEST BORINGS SHEET
USERNAME => s116892 DATE PLOTTED => 18-MAY-2011 TIME PLOTTED => 13:42

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15/76			

CERTIFIED ENGINEERING GEOLOGIST J. Tesar DATE 5-10-11

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST Jeff Tesar No. 2137 Exp. 01-31-13 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

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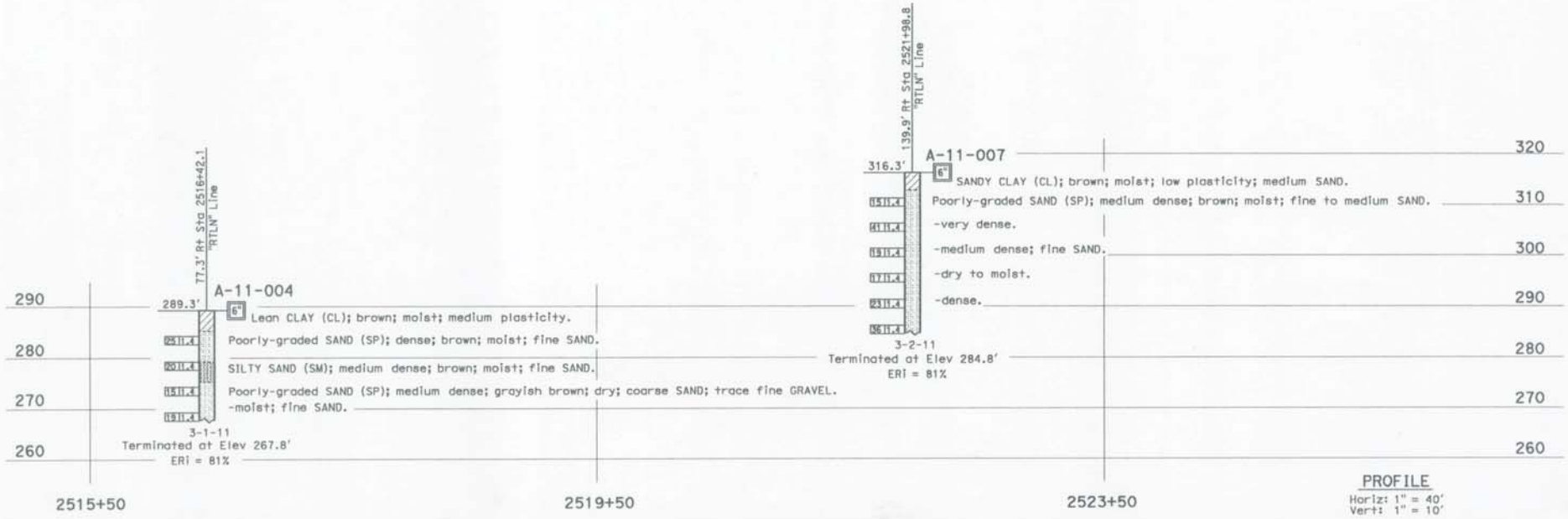
FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 10"



PROFILE
Horiz: 1" = 40'
Vert: 1" = 10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILE 46.1/47.3	CONTOUR AND GRADING LOG OF TEST BORINGS 7 OF 10
FUNCTIONAL SUPERVISOR NAME: B. Hinman	DRAWN BY: C. Christian , F. Nguyen, I-G-Remmen CHECKED BY: Z. Yazdani	FIELD INVESTIGATION BY: J. Tesar				

UNIT: 3643 PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: 11-257111

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 05-04-11 05-10-11

REVISION DATES | SHEET X | OF X

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DGS CIVIL LOG OF TEST BORINGS SHEET

FILE => contourGTof10.dgn

USERNAME => s117692 DATE PLOTTED => 18-MAY-2011 TIME PLOTTED => 13:40

NOTES:

1. AUTOMATIC HAMMER MALFUNCTIONED, USED MANUAL HAMMER INSTEAD. MANUAL HAMMER EFFICIENCY HAS NOT BEEN DETERMINED BY DRILLING SERVICES.
2. GROUND CONDITIONS DEPICTED BY THE LOTB ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS ANTICIPATED AT THE LOCATION OF THE CMS SIGN.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76			

REGISTERED GEOTECHNICAL ENGINEER XXXXXX DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST Z. Yazdani No. 2119 Exp. 03-31-13 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

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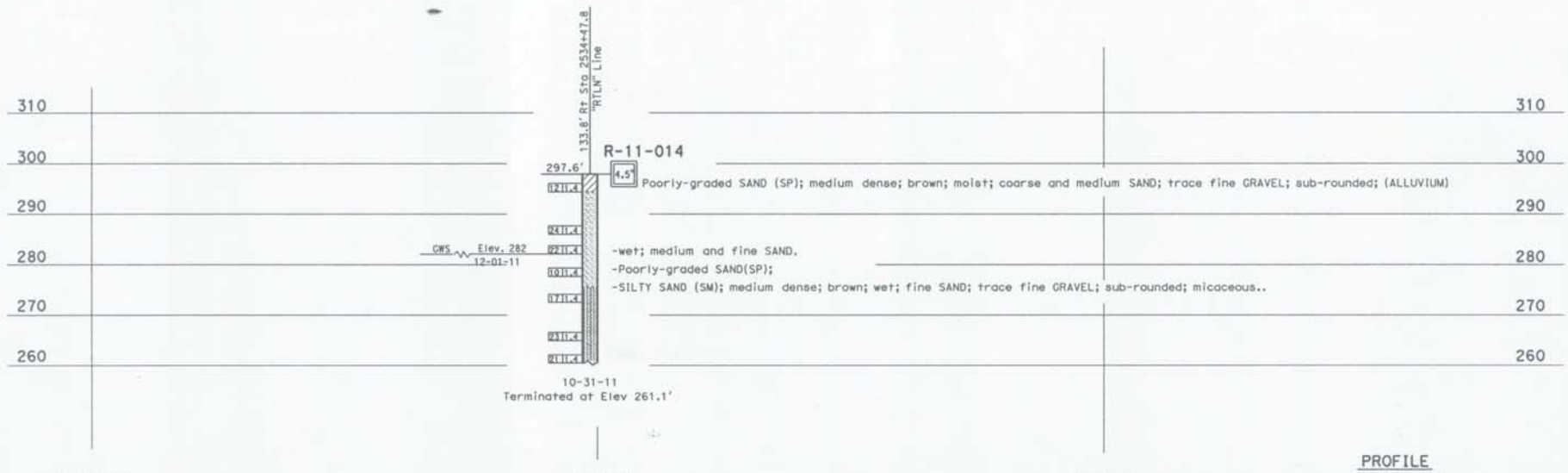
FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 11"



PROFILE
Horiz: 1" = 40'
Vert: 1" = 10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILE 46.1/47.3	CONTOUR AND GRADING LOG OF TEST BORINGS 8 OF 11
FUNCTIONAL SUPERVISOR NAME: B. Hinman	DRAWN BY: W. TOZY CHECKED BY: Z. Yazdani FIELD INVESTIGATION BY: E. GALLETA				

UNIT: 3643
PROJECT NUMBER & PHASE: 11000204691 CONTRACT NO.: 11-257141
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 10-18-12 SHEET X OF X
FILE => 110002046 3hs020.dgn
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3
ODE CIVIL LOG OF TEST BORINGS SHEET
DGNNAME => 81351.92 DATE PLOTTED => 11-JAN-2012 TIME PLOTTED => 16:54

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15/76			

CERTIFIED ENGINEERING GEOLOGIST — DATE 5-10-11

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST — Jeff Tesar — No. 2137 — Exp. 01-31-13 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

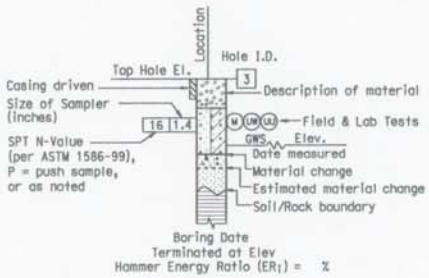
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring (hollow or solid stem bucket)
Size	R RW RC P	Rotary drilled boring (conventional) Rotary drilled with self-casing wire-line Rotary core with continuously-sampled, self-casing wire-line Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778)
⬚	O	Other (note on LOTB)

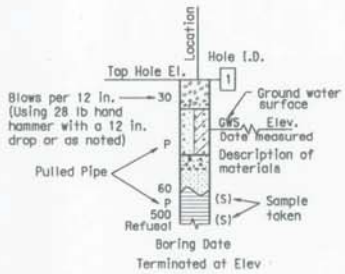
Note: Size in Inches.

CONSISTENCY OF COHESIVE SOILS

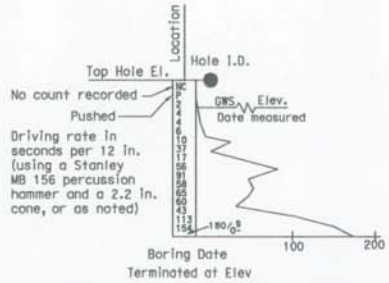
Description	Shear Strength (tsf)	Pocket Penetrometer Measurement, PP, (tsf)	Torvane Measurement, TV, (tsf)	Vane Shear Measurement, VS, (tsf)
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 - 0.25	0.25 - 0.5	0.12 - 0.25	0.12 - 0.25
Medium Stiff	0.25 - 0.5	0.5 - 1	0.25 - 0.5	0.25 - 0.5
Stiff	0.5 - 1	1 - 2	0.5 - 1	0.5 - 1
Very Stiff	1 - 2	2 - 4	1 - 2	1 - 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2



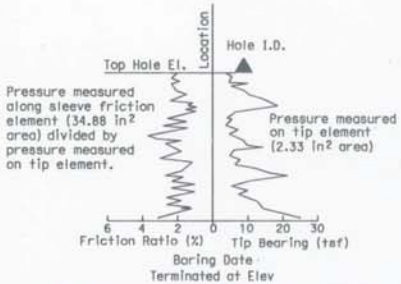
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) BORING

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILE 46.1/47.3	CONTOUR AND GRADING LOG OF TEST BORINGS 8 OF 10
	PREPARED BY: F. Nguyen 4/11				

DS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643 PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: X

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET X | OF X

FILE => contour08of10.dgn

USERNAME => s116992 DATE PLOTTED => 18-MAY-2011 TIME PLOTTED => 13:40

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15/76			

CERTIFIED ENGINEERING GEOLOGIST 5-10-11 DATE

PROFESSIONAL GEOLOGIST Jeff Tesar No. 2137 Exp. 01-31-13 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

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GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly-graded GRAVEL Poorly-graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly-graded GRAVEL with SILT Poorly-graded GRAVEL with SILT and SAND
GP-GC	Poorly-graded GRAVEL with CLAY (or SILTY CLAY) Poorly-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly-graded SAND Poorly-graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly-graded SAND with SILT Poorly-graded SAND with SILT and GRAVEL
SP-SC	Poorly-graded SAND with CLAY (or SILTY CLAY) Poorly-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 in.)
Very Loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Greater than 50

MOISTURE

Description	Criteria
Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5% - 10%
Little	15% - 25%
Some	30% - 45%
Mostly	50% - 100%

PARTICLE SIZE

Description		Size (in.)
Boulder		Greater than 12
Cobble		3 - 12
Gravel	Coarse	3/4 - 3
	Fine	1/5 - 3/4
Sand	Coarse	1/16 - 1/5
	Medium	1/64 - 1/16
	Fine	1/300 - 1/64
Silt and Clay		Less than 1/300

ENGINEERING SERVICES

GEOTECHNICAL SERVICES

PREPARED BY: F. Nguyen 4/11

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH

BRIDGE NO. X

POST MILE 46.1/47.3

CONTOUR AND GRADING

LOG OF TEST BORINGS 9 OF 10

25 LOTS SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643 PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: X

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES SHEET X OF X

FILE => contour09of10.dgn

USERNAME => s113682 DATE PLOTTED => 18-MAY-2011 TIME PLOTTED => 13:40

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15/76			

CERTIFIED ENGINEERING GEOLOGIST 5-10-11 DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

PROFESSIONAL GEOLOGIST — Jeff Tesar No. 2137 Exp. 01-31-13 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

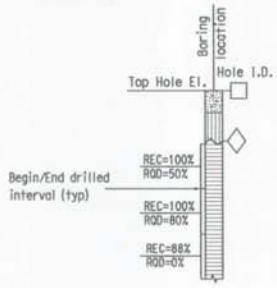
REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

PERCENT CORE RECOVERY (REC) & ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (in.)}}{\text{Total length of core run (in.)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4 \text{ in.}}{\text{Total length of core run (in.)}} \times 100\%$$

RQD* indicates soundness criteria not met.



BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very Thickly Bedded	3 ft - 10 ft
Thickly Bedded	1 ft - 3 ft
Moderately Bedded	4 in. - 1 ft
Thinly Bedded	1 in. - 4 in.
Very Thinly Bedded	1/4 in. - 1 in.
Laminated	Less than 1/4 in.

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Cannot be scratched with a pocketknife or sharp pick. Can only be chipped with repeated heavy hammer blows.
Very Hard	Cannot be scratched with a pocketknife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Can be scratched with a pocketknife or sharp pick with difficulty (heavy pressure). Breaks with heavy hammer blows.
Moderately Hard	Can be scratched with pocketknife or sharp pick with light or moderate pressure. Breaks with moderate hammer blows.
Moderately Soft	Can be grooved 1/16 in. deep with a pocketknife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Can be grooved or gouged easily by a pocketknife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Can be readily indented, grooved or gouged with fingernail, or carved with a pocketknife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very Slightly Fractured	Core lengths greater than 3 ft.
Slightly Fractured	Core lengths mostly from 1 to 3 ft.
Moderately Fractured	Core lengths mostly from 4 in. to 1 ft.
Intensely Fractured	Core lengths mostly from 1 to 4 in.
Very Intensely Fractured	Mostly chips and fragments.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic Features					General Characteristics
	Chemical Weathering-Discoloration and/or Oxidation		Mechanical Weathering-Grain Boundary Conditions (Disaggregation) Primarily for Granitics and Some Coarse-Grained Sediments	Texture and Leaching		
	Body of Rock	Fracture Surfaces		Texture	Leaching	
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change	No leaching	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved	Minor leaching of some soluble minerals.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

ENGINEERING SERVICES

GEOTECHNICAL SERVICES

PREPARED BY: F. Nguyen 4/11

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN — DESIGN BRANCH

BRIDGE NO.

POST MILE 46.1/47.3

CONTOUR AND GRADING

LOG OF TEST BORINGS 10 OF 10

SD LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643 PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: X

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET X OF X

FILE => contour10of10.dgn

USERNAME => s116892 DATE PLOTTED => 16-MAY-2011 TIME PLOTTED => 13:40

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	076			

CERTIFIED ENGINEERING GEOLOGIST 5-13-11

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGISTS — William Levine — No. 2108 — Exp. 7-31-11 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

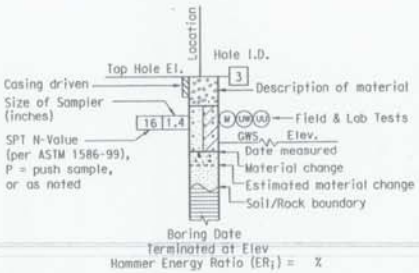
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring (hollow or solid stem bucket)
Size	R RW RC P	Rotary drilled boring (conventional) Rotary drilled with self-casing wire-line Rotary core with continuously-sampled, self-casing wire-line Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778)
⬚	O	Other (note on LOTB)

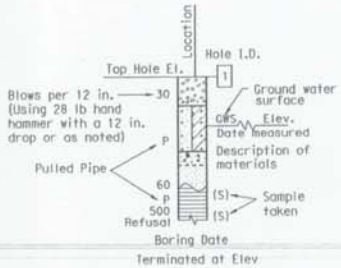
Note: Size in inches.

CONSISTENCY OF COHESIVE SOILS

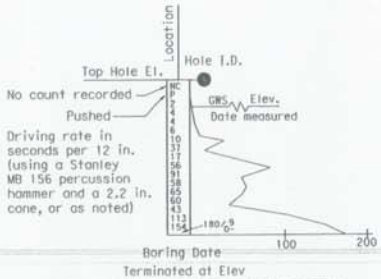
Description	Shear Strength (tsf)	Pocket Penetrometer Measurement, PP, (tsf)	Torvane Measurement, TV, (tsf)	Vane Shear Measurement, VS, (tsf)
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 - 0.25	0.25 - 0.5	0.12 - 0.25	0.12 - 0.25
Medium Stiff	0.25 - 0.5	0.5 - 1	0.25 - 0.5	0.25 - 0.5
Stiff	0.5 - 1	1 - 2	0.5 - 1	0.5 - 1
Very Stiff	1 - 2	2 - 4	1 - 2	1 - 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2



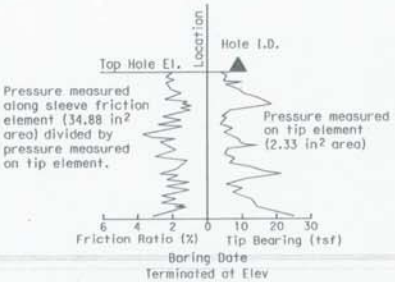
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) BORING

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. 57-0872	76/15 SEPARATION
	PREPARED BY: J.G-Remmen		DESIGN BRANCH X	POST MILE 17.26	LOG OF TEST BORINGS 4 OF 6

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643
PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: 11-257110

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET X OF X

FILE => 76-15sep4.dgn

DATE PLOTTED => 13-JUL-2011 TIME PLOTTED => 10:13

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	076			

CERTIFIED ENGINEERING GEOLOGIST 5-13-11

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST William Levine No. 2108 Exp. 7-31-11 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

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GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly-graded GRAVEL Poorly-graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly-graded GRAVEL with SILT Poorly-graded GRAVEL with SILT and SAND
GP-GC	Poorly-graded GRAVEL with CLAY (or SILTY CLAY) Poorly-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly-graded SAND Poorly-graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly-graded SAND with SILT Poorly-graded SAND with SILT and GRAVEL
SP-SC	Poorly-graded SAND with CLAY (or SILTY CLAY) Poorly-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
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APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 in.)
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Very Dense	Greater than 50

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Moist	Moisture present, but no free water
Wet	Visible free water

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5% - 10%
Little	15% - 25%
Some	30% - 45%
Mostly	50% - 100%

PARTICLE SIZE

Description		Size (in.)
Boulder		Greater than 12
Cobble		3 - 12
Gravel	Coarse	3/4 - 3
	Fine	1/5 - 3/4
Sand	Coarse	1/16 - 1/5
	Medium	1/64 - 1/16
	Fine	1/300 - 1/64
Silt and Clay		Less than 1/300

ENGINEERING SERVICES | GEOTECHNICAL SERVICES

PREPARED BY: J.G-Remmen

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH X

BRIDGE NO. 57-0872 POST MILE 17.26

76/15 SEPARATION

LOG OF TEST BORINGS 5 OF 6

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643 PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: 11-257110

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET X OF X

FILE => 76-15sep5.dgn

DATE PLOTTED => 13-JUL-2011 TIME PLOTTED => 7:10:13

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	076			

CERTIFIED ENGINEERING GEOLOGIST 5-13-11

PLANS APPROVAL DATE

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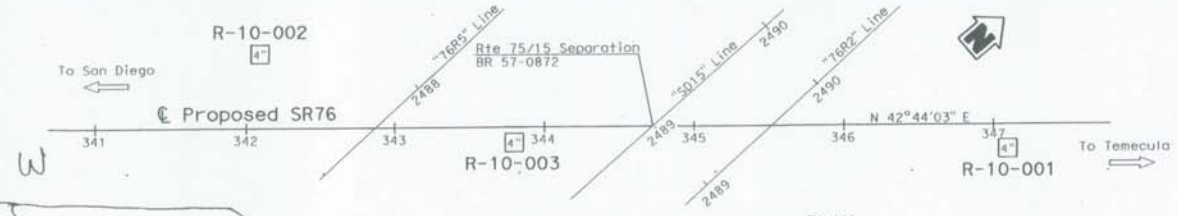
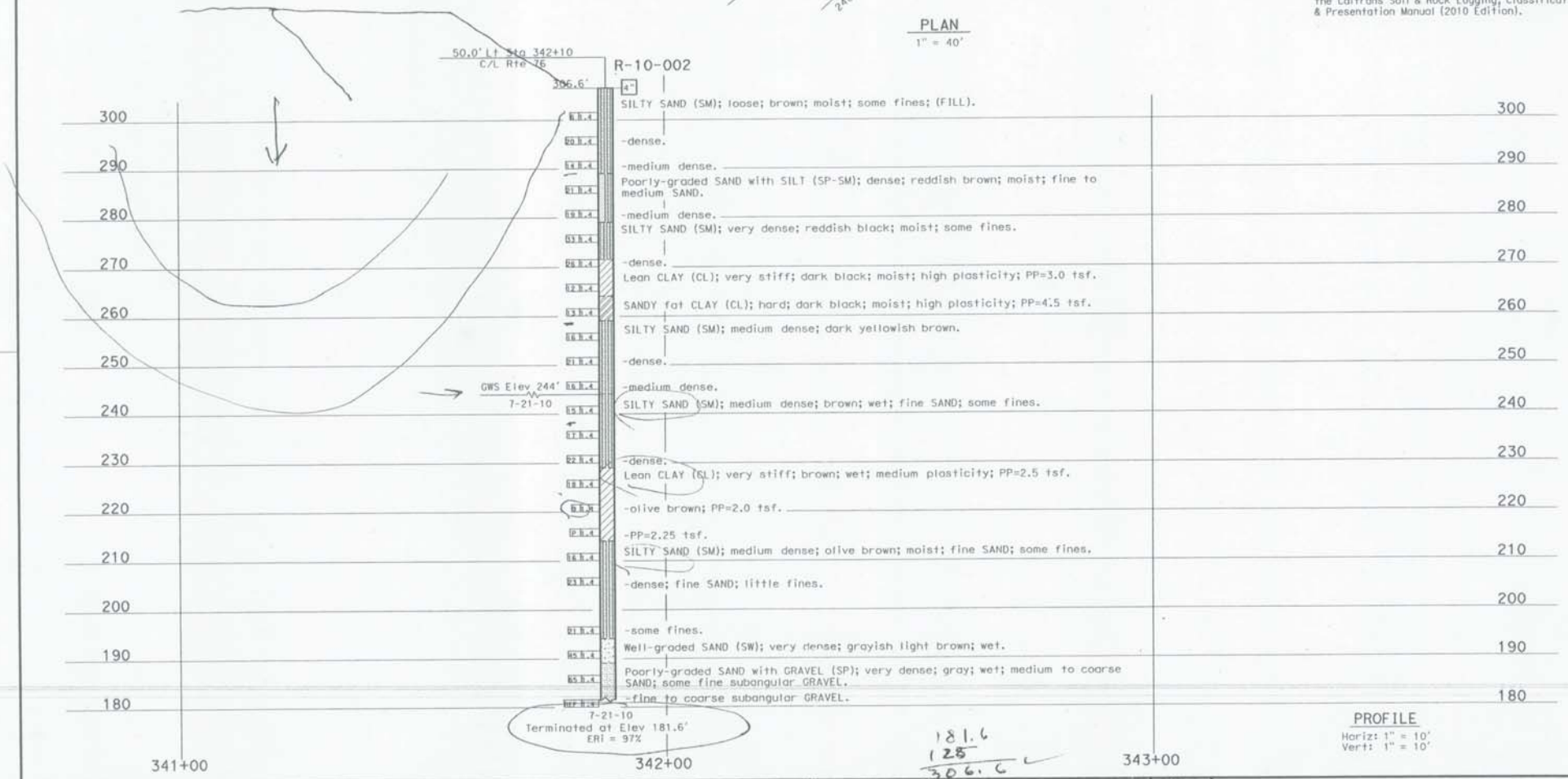
This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, & Presentation Manual (2010 Edition).

BENCH MARK

Metal monument #SDGP 03 (80031) emplaced on concrete sidewalk north side of abutment 3, 56' Lt Sta 347+00 ℄ SR76
Elev 308.26
NAVD88



PLAN
1" = 40'



SILTY SAND (SM); loose; brown; moist; some fines; (FILL).
-dense.
-medium dense.
Poorly-graded SAND with SILT (SP-SM); dense; reddish brown; moist; fine to medium SAND.
-medium dense.
SILTY SAND (SM); very dense; reddish black; moist; some fines.
-dense.
Lean CLAY (CL); very stiff; dark black; moist; high plasticity; PP=3.0 tsf.
SANDY fat CLAY (CL); hard; dark black; moist; high plasticity; PP=4.5 tsf.
SILTY SAND (SM); medium dense; dark yellowish brown.
-dense.
-medium dense.
SILTY SAND (SM); medium dense; brown; wet; fine SAND; some fines.
-dense.
Lean CLAY (CL); very stiff; brown; wet; medium plasticity; PP=2.5 tsf.
-olive brown; PP=2.0 tsf.
-PP=2.25 tsf.
SILTY SAND (SM); medium dense; olive brown; moist; fine SAND; some fines.
-dense; fine SAND; little fines.
-some fines.
Well-graded SAND (SW); very dense; grayish light brown; wet.
Poorly-graded SAND with GRAVEL (SP); very dense; gray; wet; medium to coarse SAND; some fine subangular GRAVEL.
-fine to coarse subangular GRAVEL.

181.6
125
306.6

PROFILE
Horiz: 1" = 10'
Vert: 1" = 10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH X	BRIDGE NO. 57-0872 POST MILE 17.26	76/15 SEPARATION LOG OF TEST BORINGS 1 OF 6
FUNCTIONAL SUPERVISOR	DRAWN BY: W. Tang 04/11	FIELD INVESTIGATION BY: D. Cook			
NAME: A. Perez-Cobo	CHECKED BY: M. Wilson				

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643
PROJECT NUMBER & PHASE: 11000001891
CONTRACT NO.: 11-257110

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 05-06-11 05-16-11

SHEET X OF X

FILE => 76-15sep.dgn

005 CIVIL LOG OF TEST BORINGS SHEET

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	076			

CERTIFIED ENGINEERING GEOLOGIST 5-13-11

PLANS APPROVAL DATE

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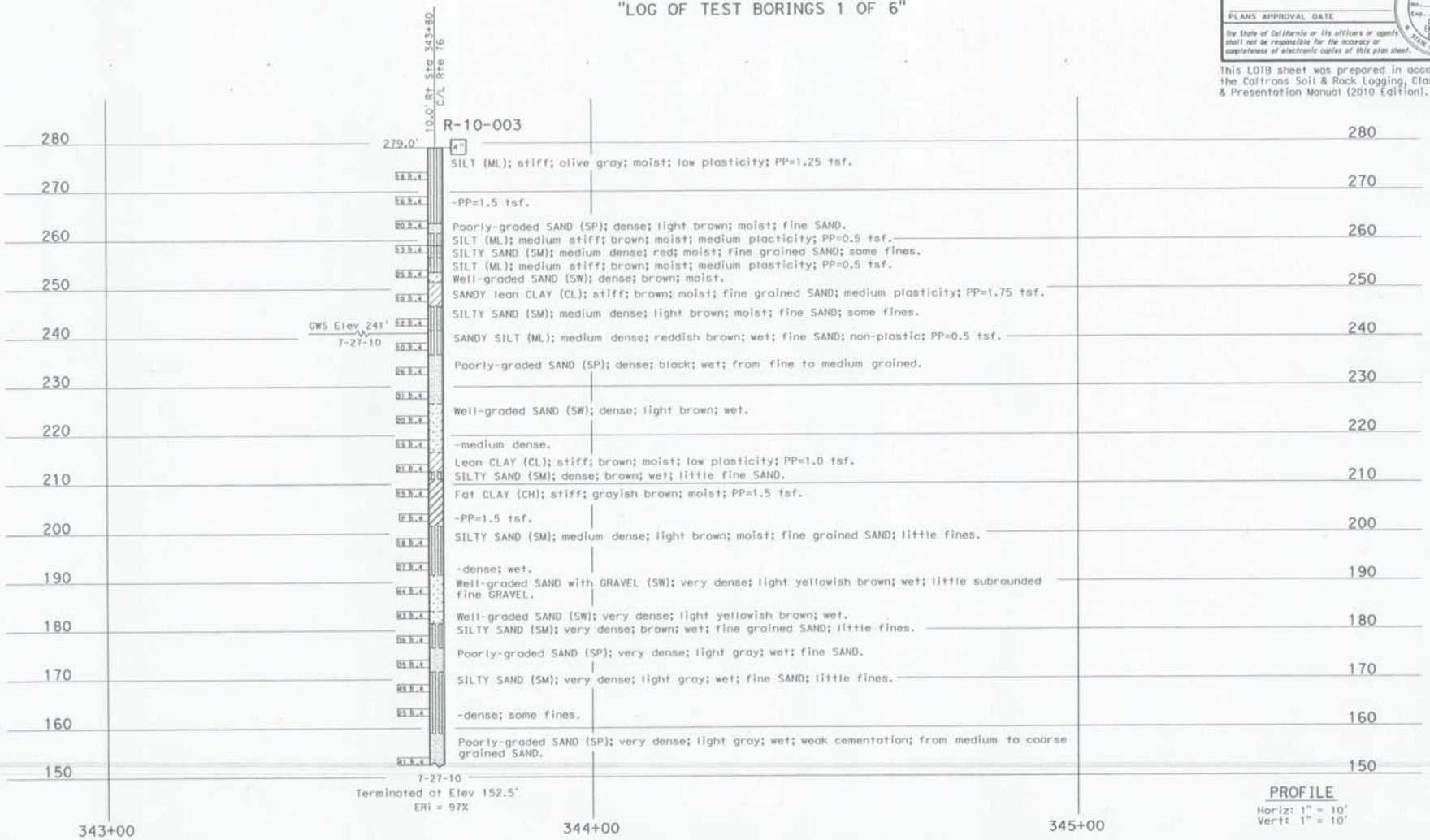
PROFESSIONAL GEOLOGIST William Levine No. 2108 Exp. 7-31-11 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, & Presentation Manual (2010 Edition).

FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 6"



PROFILE
Horiz: 1" = 10'
Vert: 1" = 10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH X	BRIDGE NO. 57-0872 POST MILE 17.26	76/15 SEPARATION LOG OF TEST BORINGS 2 OF 6
FUNCTIONAL SUPERVISOR	DRAWN BY: W. Tang 04/11	FIELD INVESTIGATION BY: D. Cook				
NAME: A. Perez-Cobo	CHECKED BY: M. Wilson					

DGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643
PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: 11-257110

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES			SHEET	OF
05-09-11	05-10-11		X	X

FILE => 76-15sep2.dgn

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	076			

CERTIFIED ENGINEERING GEOLOGIST 5-13-11

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST — William Levine — No. 2108 — Exp. 1-31-11 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, & Presentation Manual (2010 Edition).

FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 6"

16.0' Rt Sta 347+10
C/L Rte 76

R-10-001

308.2'

4"

SILT (ML); medium dense; light brown; moist; non-plastic; (FILL).

-hard; low plasticity; TV=2.0 tsf.

Lean CLAY with SAND (CL); hard; medium plasticity; yellowish brown; fine SAND; trace CALICHE; TV=4.5 tsf.

SANDY Lean CLAY (CL); stiff; dark yellowish brown; moist; fine SAND; medium plasticity; TV=1.0 tsf.

SILT (ML); dense; grayish light brown; moist; non-plastic.

-very dense; olive gray; trace of CALICHE.

SILTY SAND (SM); dense; yellowish brown; moist; fine SAND; some fines.

Well-graded SAND (SW); dense; olive gray; moist.

SILTY SAND (SM); dense; reddish light brown; moist; fine SAND; some fines.

-very dense; mottled olive light gray and brown; moist; some fines.

Poorly-graded SAND (SP); dense; yellowish brown; moist; medium to coarse SAND.

Well-graded SAND (SW); medium dense; brown; moist.

GWS Elev 243'
7-20-10

SILTY SAND (SM); medium dense; brown; wet; fine SAND; some fines.

-dense.

Lean CLAY (CL); very stiff; brown; wet; PP=2.5 tsf.

-PP=2.0 tsf.

-PP=2.25 tsf.

SILTY SAND (SM); medium dense; olive brown; wet; fine SAND; some fines.

-dense; grayish brown.

Well-graded SAND (SW); very dense; grayish brown; wet.

SILTY SAND (SM); dense; grayish brown; wet; fine SAND; some fines.

SANDY SILT (ML); dense; brown; wet; fine SAND; non-plastic.

-very dense.

7-20-10
Terminated at Elev 171.7'
ERi = 97%

	310	300	290	280	270	260	250	240	230	220	210	200	190	180	170

346+00 347+00 348+00

PROFILE
Horiz: 1" = 10'
Vert: 1" = 10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH X	BRIDGE NO. 57-0872 POST MILE 17.26	76/15 SEPARATION LOG OF TEST BORINGS 3 OF 6
FUNCTIONAL SUPERVISOR NAME: A. Perez-Cobo	DRAWN BY: W. Tang 04/11 CHECKED BY: M. Wilson	FIELD INVESTIGATION BY: D. Cook			

DGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643
PROJECT NUMBER & PHASE: 11000001891 CONTRACT NO.: 11-257110

FILE => 76-15sep3.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 05-05-11 05-10-11 SHEET X OF X

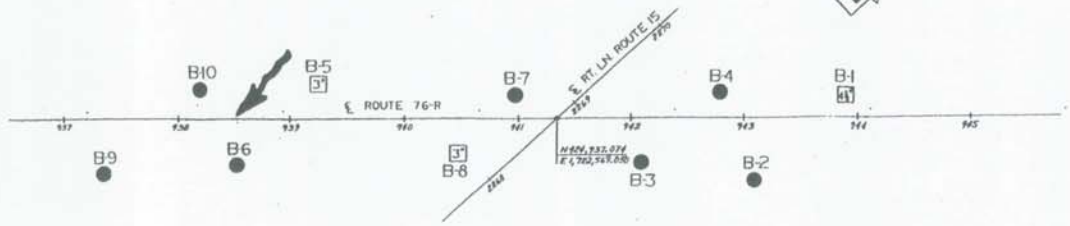
DATE PLOTTED => 13-JUL-2011 TIME PLOTTED => 13:12

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	76	16.8/17.9	177	208

Robert W. Reynolds #1165
Feb. Feb 5, 1979

BENCH MARKS

BM #G-294 Elev. 244.34
D.G.H. cap 305'± Lt. Sta. 2258+00 ± "Rt. Ln."
BM #B-40 Elev. 322.10
2" I.P. and D.O.H. cap 50'± Rt. Sta. 2258+40± "Rt."



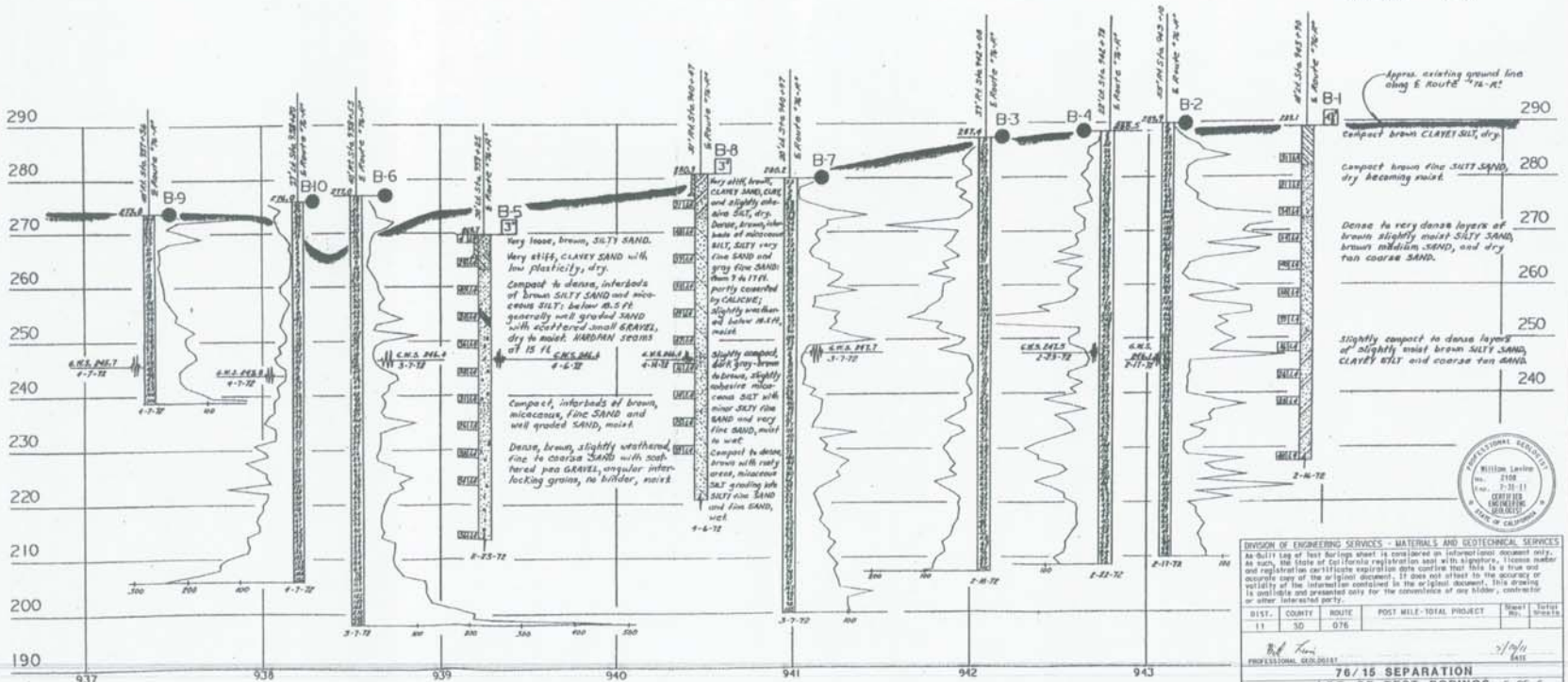
PLAN

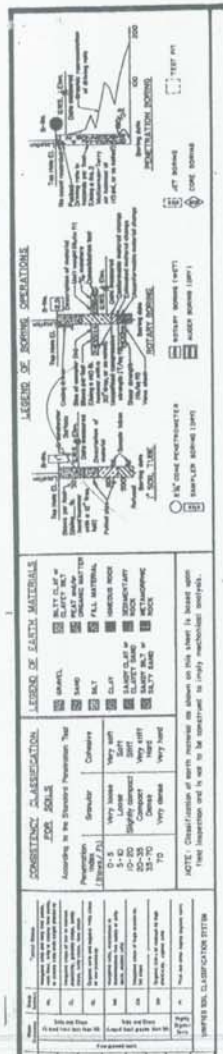
Scale 1" = 50'

REDUCED PLAN
USE SCALE BELOW
3 INCHES ON ORIGINAL PLAN

PROFILE

Horz. Scale 1" = 50'
Vert. Scale 1" = 10'





DIVISION OF ENGINEERING SERVICES - MATERIALS AND GEOTECHNICAL SERVICES

As-built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirms that this is a true and accurate copy of the original document. It does not attest to the accuracy or accurate copy of the original document. This drawing validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
11	SD	076			

PROFESSIONAL GEOLOGIST — DATE 3/10/11

76/15 SEPARATION
LOG OF TEST BORINGS 6 OF 6

UNIT: 3643 — CONTRACT No. 11-257111 — BRIDGE No. 57-0872
PROJECT NUMBER & PHASE: 11000001891

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

Sheet ___ of ___

ENGINEERING GEOLOGY SECTION

FIELD STUDY	By L. E. Rand 4-14-72	Approval Recommended By: Engineering Geologist
DRAWN	By D. B. Crawford 11-2-78	Supervising Engineering Geologist-Materials Engineer
CHECKED	By L. C. Chang 1-3-79	

State of CALIFORNIA
DEPARTMENT OF TRANSPORTATION

OFFICE OF STRUCTURES
DESIGN GROUP
PROJECT ENGINEER J. McHilvey 9604

BRIDGE NO. 57-0872
POST MILE 17.04

CU 11203

ROUTE 76/15 SEPARATION
LOG OF TEST BORINGS

REVISION DATES (FOR, WRKNT STAGE ONLY)

SHEET 17 OF 17

ORIGINAL SCALE IN INCHES

Disregard prints bearing earlier revision dates

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET	TOTAL SHEETS
11	SD	76	16.8/17.7	199	208

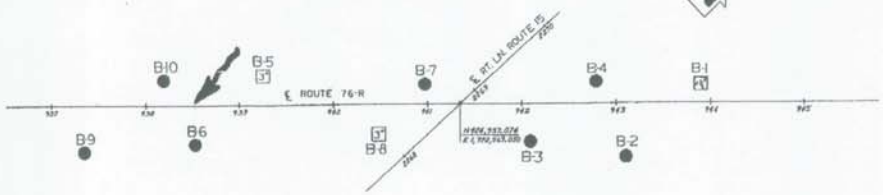
February 5, 1972

BENCH MARKS

BM #6-274 Elev. 248.34
D.S.D. cap 3.55' x 2.6 Sta. 2258+00 ft "RE Lt."
BM #8-10 Elev. 322.10
2" I.P. and D.O.K. cap 30'8 Rt. Sta. 2258+60
"RLT"

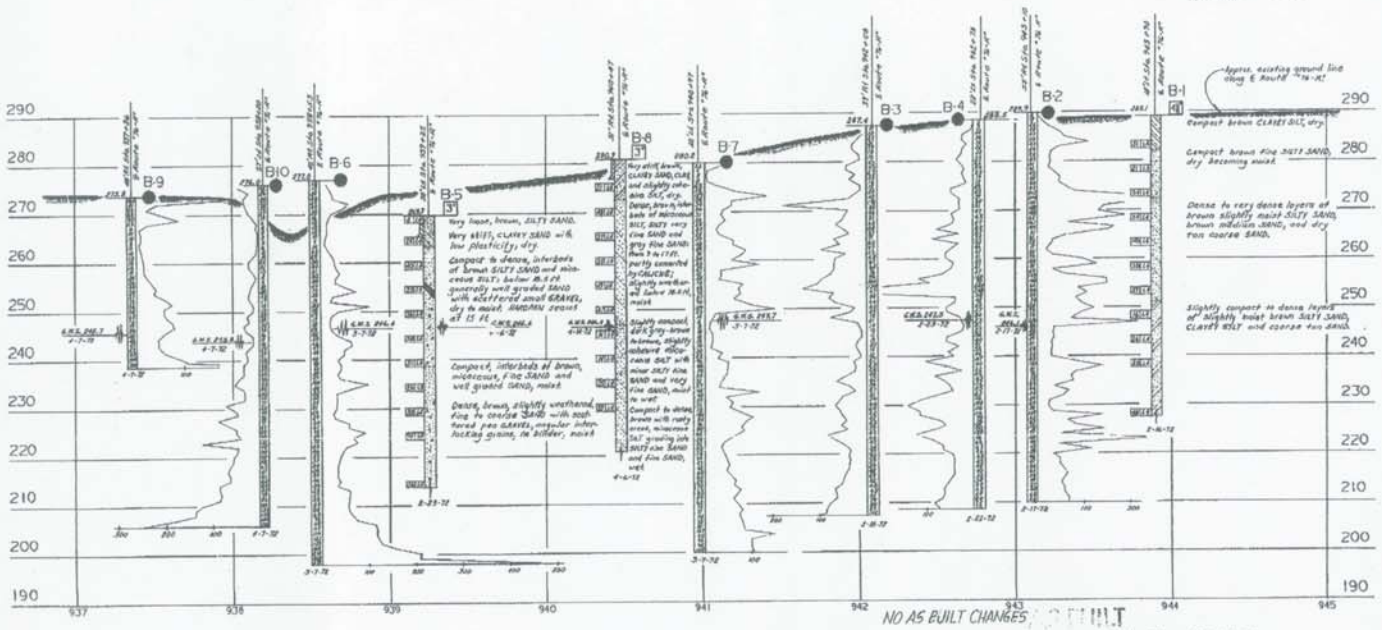
PLAN

Scale 1" = 100'



PROFILE

Horz. Scale 1" = 20'
Vert. Scale 1" = 10'



NO AS BUILT CHANGES

AS BUILT
John I Day P.E. 1-4-82
CONTRACT NO. 11-095094
DATE 6-15-91

LEGEND OF BORING DESCRIPTIONS

LEGEND OF EARTH MATERIALS

CONSISTENCY CLASSIFICATION FOR SOILS

ENGINEERING GEOLOGY SECTION
FIELD STUDY L. E. Reed 4-14-72
DRAWN D. B. Crawford 12-2-77
CHECKED J. I. Day Jr. 1-3-78

State of CALIFORNIA DEPARTMENT OF TRANSPORTATION

OFFICE OF STRUCTURES DESIGN GROUP
PROJECT ENGINEER O. McHenry

BRIDGE NO. 57-0672
POST MILE 17.04

ROUTE 76/15 SEPARATION
LOG OF TEST BORINGS

CU 1120J
WO 095091

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

Disregard prints bearing earlier revision dates

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 12 OF 12

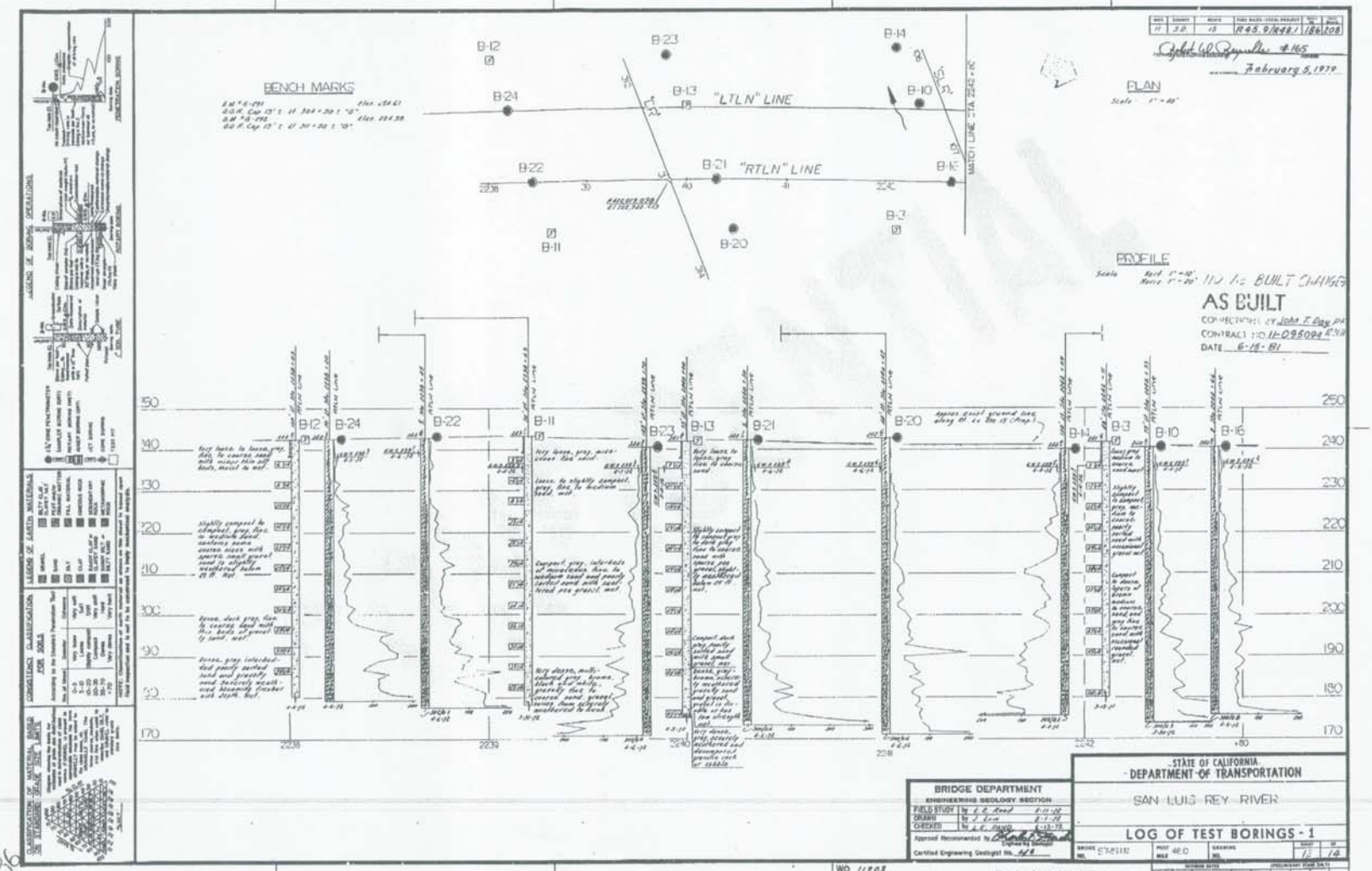
199

AS BUILT PLANS
Contract No. 11-095094
Date Completed
Document No.

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

7-19-82 Donald Blackford SUPERVISOR OF MICROFILM SERVICES

ClibPDF - www.fastio.com

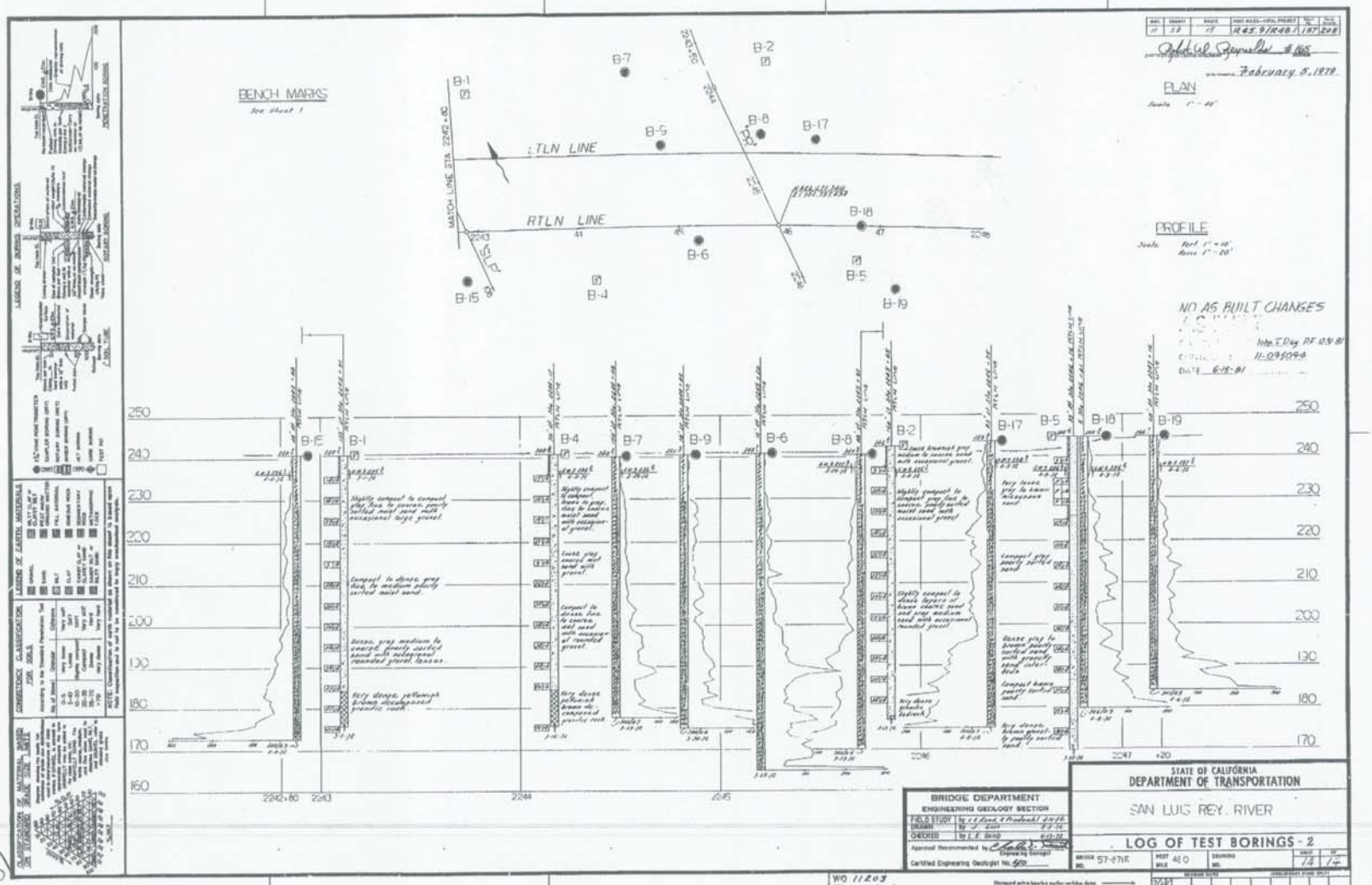


186

AS BUILT PLANS
Contract No. 11-095094
Date Completed
Document No.

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 7-19-82 SIGNATURE Donald Blackford TITLE SUPERVISOR OF MICROFILM SERVICES



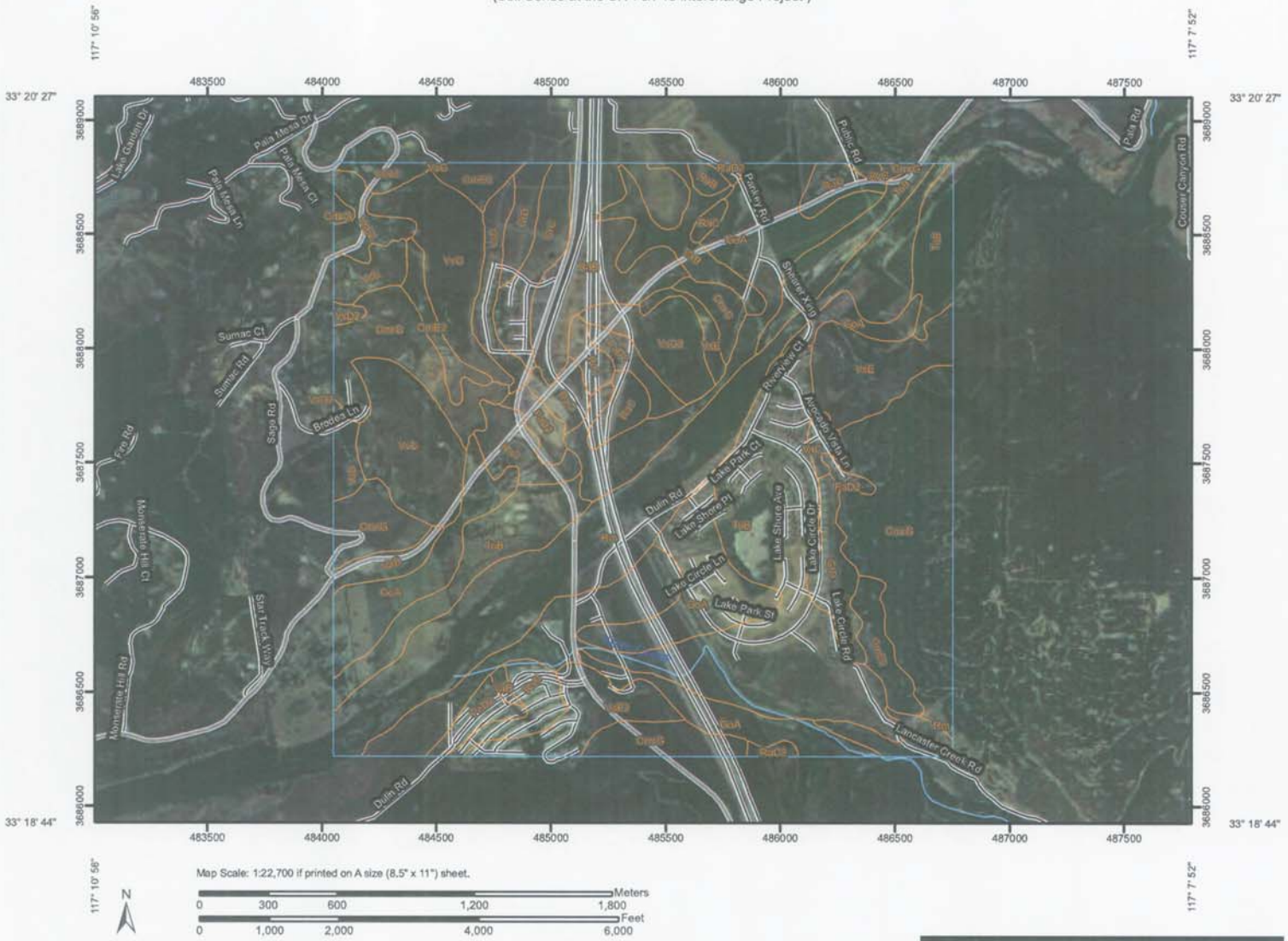
AS BUILT PLANS
Contract No. 11-095094
Date Completed
Document No.

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL, ON THIS DATE IN SACRAMENTO, CALIFORNIA, PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

1-13-82 Donald Bleckford SUPERVISOR OF MICROFILM SERVICES

CutPDF - www.fosho.com

Soil Map—San Diego County Area, California
(Soil Series at the SR-76/I-15 interchange Project)



Map Scale: 1:22,700 if printed on A size (8.5" x 11") sheet.

N

Meters: 0, 300, 600, 1,200, 1,800

Feet: 0, 1,000, 2,000, 4,000, 6,000

USDA Natural Resources Conservation Service

Web Soil Survey
National Cooperative Soil Survey

11-SD-76/15
SOIL SERIES MAP

APPENDIX II
FIELD EXPLORATION DATA

PERCOLATION TEST

GEOTECHNICAL DESIGN SOUTH -2

PROJECT	15/76 SEPARATION
E-Fis (ID)	1100000060
DATE	3/10-14/2011
TEST MADE BY	EG
AMBIENT TEMP	65-70 deg
WEATHER CONDITION	CLEAR/SUNNY
SOAKING PERIOD	24 hrs
TYPE OF SOIL	SILT

CONVERSION FACTOR (K) =0.27 + 8.7/D

CORRECTION FACTOR © = n [1-(O/D)²] + (I/D)²

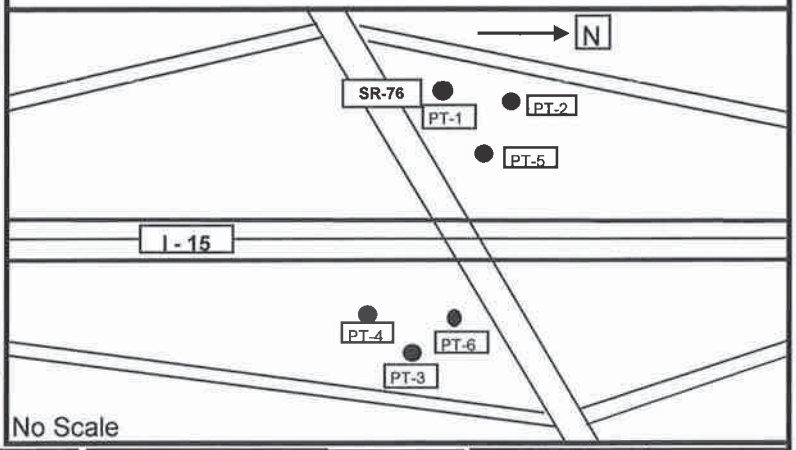
n = Porosity = **0.49**

D = Actual Dia of Perforated Pipe (in)

O = Outside Dia of Perforated Pipe (in)

I = Inside Dia of Perforated Pipe (in)

SITE LAYOUT



HOLE NO.	PT-2
HOLE DEPTH	9' 6"
HOLE DIA.	6"
TIME	READININGS
1hr22min33sec	8" - 7"
1hr10min18sec	8" - 7"
1hr23min43sec	8" - 7"
1hr30min39sec	8" - 7"
Ave(last3) = 1hr21.55min/in	
REMARKS: Time measurements taken for a 1" drop.	
CONVERSION FACTOR (K)	1.72
CORRECTION FACTOR ©	0.65
PERCOLATION RATE CALC.	
P = K x R/C = 1.72 x 81.55/0.65 = **215.4 min/in** = 3.59 hrs/in	
PERCOLATION RATE	215.4 min/in

HOLE NO.	PT-4
HOLE DEPTH	9' 3"
HOLE DIA.	6"
TIME	READININGS
2min03sec	8" - 7"
2min27sec	8" - 7"
3min11sec	8" - 7"
3min52sec	8" - 7"
3min59sec	8" - 7"
4min38sec	8" - 7"
4min18sec	8" - 7"
Ave(last3) = 4.3min/in	
REMARKS: Time measurements taken for a 1" drop.	
CONVERSION FACTOR (K)	1.72
CORRECTION FACTOR ©	0.65
PERCOLATION RATE CALC.	
P = K x R/C = 1.72 x 4.3/0.65 = **11.38 min/in**	
PERCOLATION RATE	11.38 min/in

HOLE NO.	PT-5
HOLE DEPTH	6' 2"
HOLE DIA.	6"
TIME	READININGS
5min30sec	8" - 7"
5min57sec	8" - 7"
6min33sec	8" - 7"
6min58sec	8" - 7"
6min56sec	8" - 7"
6min57sec	8" - 7"
Ave(last3) = 6.95min/in	
REMARKS: Time measurements taken for a 1" drop.	
CONVERSION FACTOR (K)	1.72
CORRECTION FACTOR ©	0.65
PERCOLATION RATE CALC.	
P = K x R/C = 1.72 x 6.95/0.65 = **18.39 min/in**	
PERCOLATION RATE	18.39 min/in

HOLE NO.	PT-6
HOLE DEPTH	7' 0"
HOLE DIA.	6"
TIME	READININGS
2hr35min	0"
Ave(last 3) = 0	
REMARKS: **No movement observed.**	
CONVERSION FACTOR (K)	1.72
CORRECTION FACTOR ©	0.65
PERCOLATION RATE CALC.	
P = 0	
PERCOLATION RATE	0

Note: PT-1 and PT-3 was not tested due to presence of water after 48 hrs soaking period.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

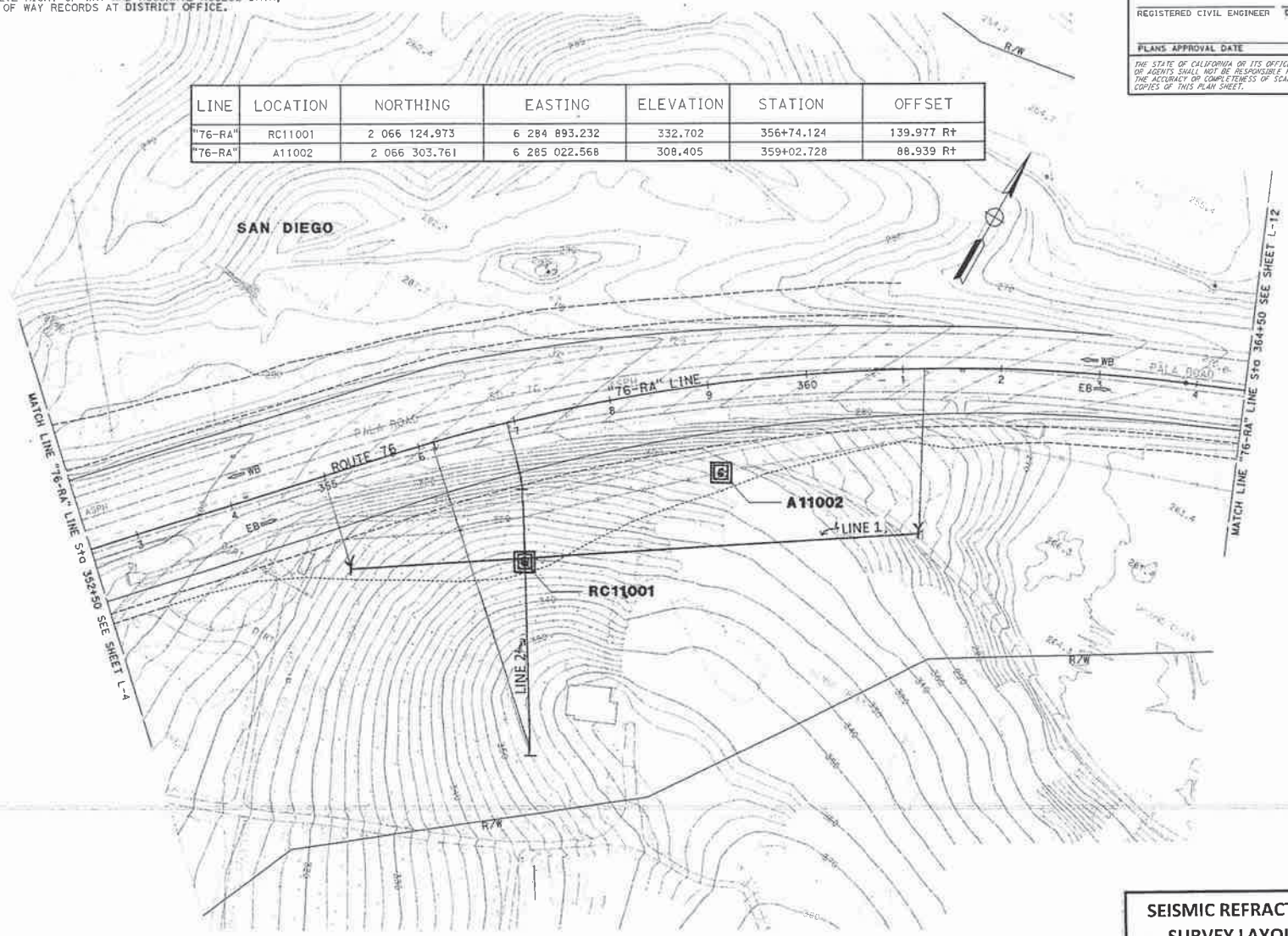
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER NO. EXP. CIVIL STATE OF CALIFORNIA

NOTE:

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.

LINE	LOCATION	NORTHING	EASTING	ELEVATION	STATION	OFFSET
"76-RA"	RC11001	2 066 124.973	6 284 893.232	332.702	356+74.124	139.977 Rt
"76-RA"	A11002	2 066 303.761	6 285 022.568	308.405	359+02.728	88.939 Rt



ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

SEISMIC REFRACTION SURVEY LAYOUT

SCALE: 1" = 50'

L-11

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE

CALCULATED-DESIGNED BY: MOHAMAD KHATIB

CHECKED BY: JEFF BALUYUT

REVISED BY

DATE REVISED

LAST REVISION 03-30-11

DATE PLOTTED => 20-APR-2011

TIME PLOTTED => 11:29

BORDER LAST REVISED 7/2/2010

USERNAME => s135192

DGN FILE => 1100000189e011.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 1100000189

District	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.1/R47.3, M16.7/M17.7		

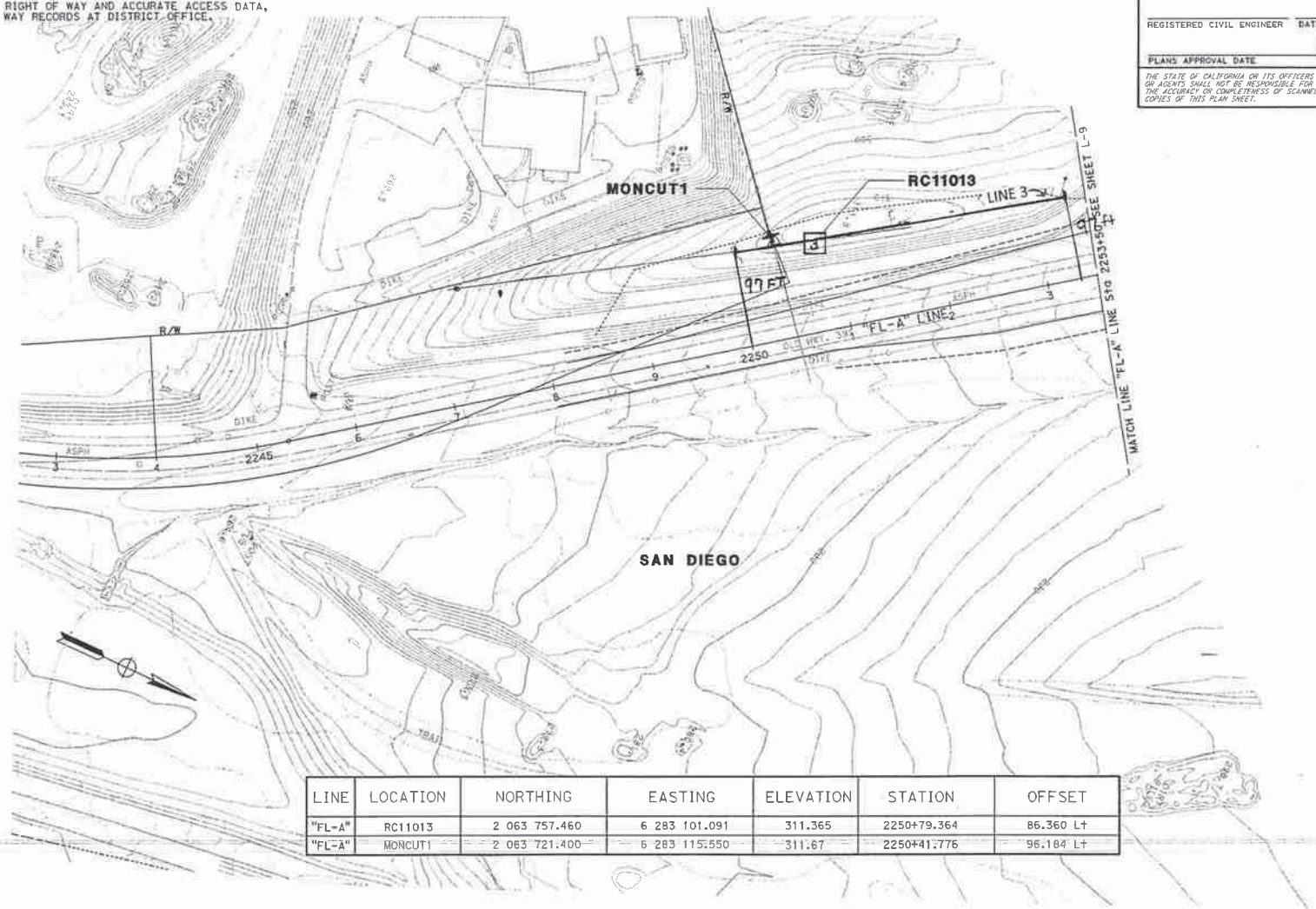
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

NOTE:
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORDS AT DISTRICT OFFICE.



LINE	LOCATION	NORTHING	EASTING	ELEVATION	STATION	OFFSET
"FL-A"	RC11013	2 063 757.460	6 283 101.091	311.365	2250+79.364	86.360 Lt
"FL-A"	MONCUT1	2 063 721.400	6 283 115.550	311.67	2250+41.776	96.184 Lt

LAYOUT
SCALE: 1" = 50'

L-10

ALL DIMENSIONS ARE IN FEET UNLESS SHOWN OTHERWISE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE
CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: JEFF BALUYUT
REVISED BY / DATE REVISED

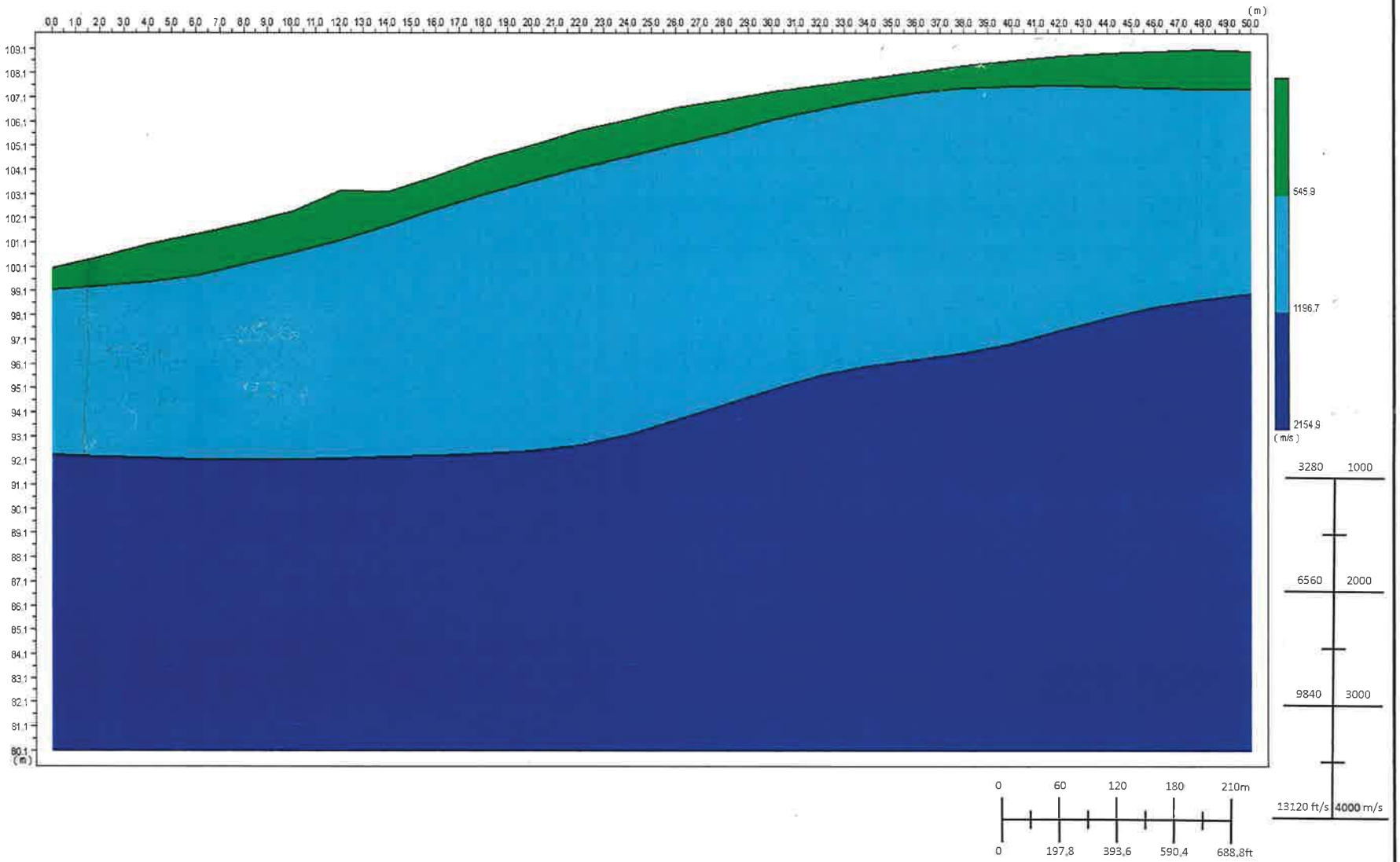
LAST REVISION 03-30-11
DATE PLOTTED => 20-APR-2011
TIME PLOTTED => 11:23

BORDER LAST REVISED 7/2/2010
USERNAME => s135192
DGN FILE => 1100000189ea010.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 1100000189

71 ft
924/100

SEISMIC REFRACTION VELOCITY PROFILE

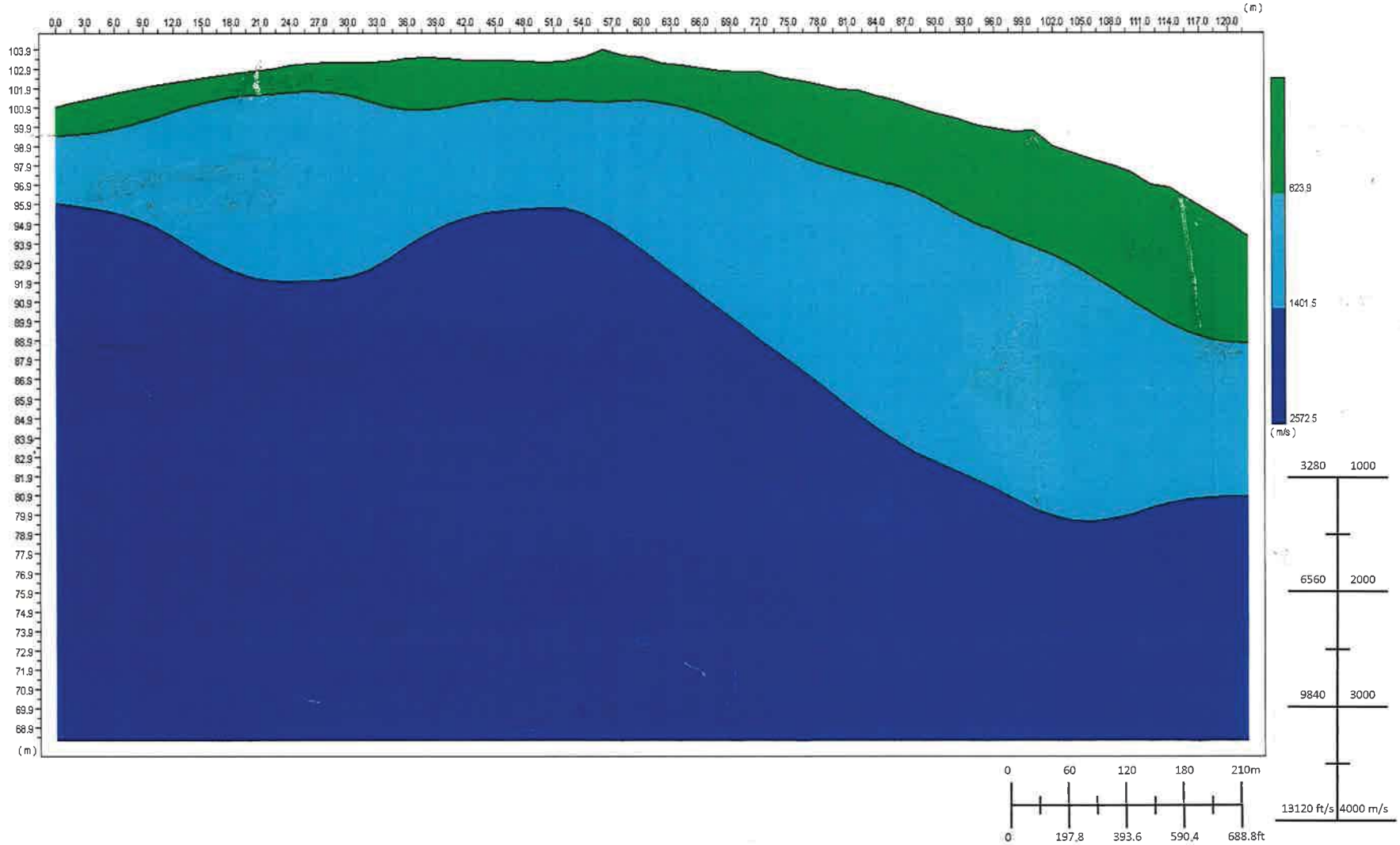
Project 11-0002-0489 Line 1



Caltrans Division of Engineering Services Geotechnical Services Office of Geotechnical Design - North	EA 11-25715	**COLOR DENSITY PLOT**	Plate No. 1
	ID 11-0002-0489	11-SD-76 PM 46.1	

SEISMIC REFRACTION VELOCITY PROFILE

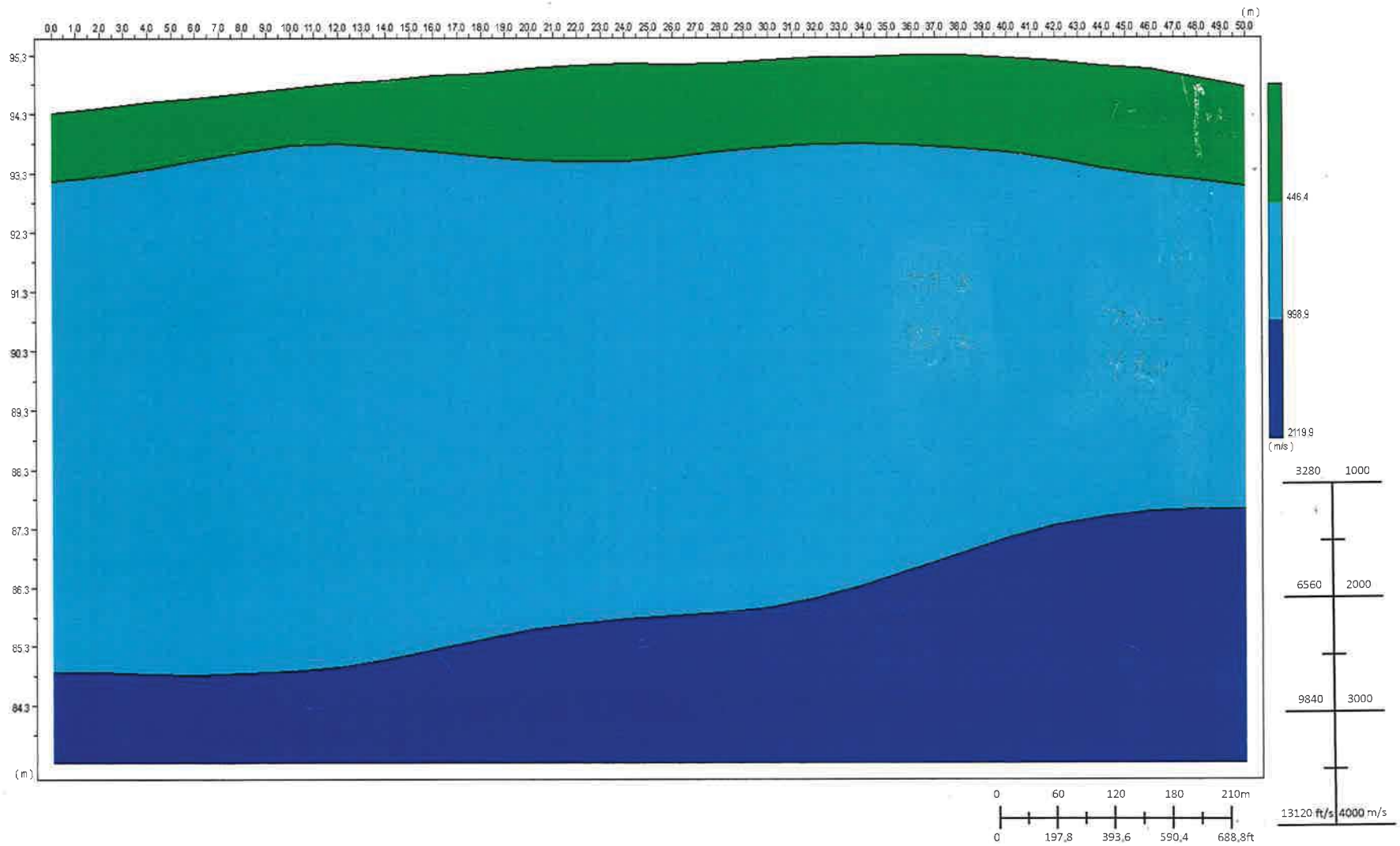
Project 11-0002-0489 Line 2



Division of Engineering Services Geotechnical Services Office of Geotechnical Design - North	EA 11-25715	COLOR DENSITY PLOT	Plate No. 2
	ID 11-0002-0489	11-SD-76 PM 46.1	

SEISMIC REFRACTION VELOCITY PROFILE

Project 11-0002-0489 Line 3



Division of Engineering Services Geotechnical Services Office of Geotechnical Design - North	EA 11-25715	**COLOR DENSITY PLOT**	Plate No. 3
	ID 11-0002-0489	11-SD-76 PM 46.1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-23-08	10-23-08	33° 19' 40" / -117° 9' 45"	A-09-304
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~293 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 8.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 9-inches of AC.												
	1		Poorly graded GRAVEL (GP); 3-inches of AB.												
290.50	2		Poorly graded SAND with SILT and GRAVEL (SP-SM); very light yellowish brown to light grayish brown, dry, little coarse to fine gravel, mostly coarse to fine sand.												
	3														
288.50	4														
	5		Becomes dense.	X		10	35	56							
286.50	6			X		14 21									
	7														
284.50	8		Bottom of borehole at 8.0 ft bgs Auger Refusal (Encountered Bedrock)												
	9														
282.50	10														
	11														
280.50	12														
	13														
278.50	14														
	15														
276.50	16														
	17														
274.50	18														
	19														
	20														

DOKKEN ENGINEERING

2365 Iron Point Road
Suite 200
Folsom, CA 95630

REPORT TITLE				HOLE ID
BORING RECORD				A-09-304
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard	DATE 11-9-09	SHEET 1 of 1	

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-23-08	10-23-08	33° 20' 2" / -117° 9' 38"	A-09-305
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~294 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 10.8 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 7-inches of AC.												
	1		Poorly graded GRAVEL (GP); 7-inches of AB.												
292.00	2		SILTY SAND (SM); yellowish brown, dry, mostly fine sand, some silt.												
	3														
290.00	4														
	5		Becomes very dense.			32 50/6"		100							
288.00	6														
	7														
286.00	8														
	9														
284.00	10		Transitions to trace coarse to medium sand, mostly fine sand, some silt, weak cementation.			32 50/4"		100							
	11		Bottom of borehole at 10.8 ft bgs Planned Termination												
282.00	12														
	13														
280.00	14														
	15														
278.00	16														
	17														
276.00	18														
	19														
	20														

DOKKEN ENGINEERING

2365 Iron Point Road
Suite 200
Folsom, CA 95630

REPORT TITLE				HOLE ID
BORING RECORD				A-09-305
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard		DATE 11-9-09	SHEET 1 of 1

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-24-08	10-23-08	33° 19' 42" / -117° 9' 36"	A-09-306
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~250 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 11.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 10-inches of AC.												
	1		Poorly graded GRAVEL (GP); 5-inches of AB.												
248.00	2		SILTY SAND (SM); yellowish brown, dry, trace coarse to medium sand, mostly fine sand, some silt, weak cementation.												
	3														
246.00	4														
	5		Becomes very dense.	X		50/6"		100							
244.00	6														
	7														
242.00	8		SANDY SILT (ML); hard, brown, dry, trace coarse sand, few medium sand, some fine sand, mostly silt, weakly to moderate cementation, non-plastic.												
	9														
240.00	10			X		34 50/6"		67							
	11		Bottom of borehole at 11.0 ft bgs Planned Termination												
238.00	12														
	13														
236.00	14														
	15														
234.00	16														
	17														
232.00	18														
	19														
	20														

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

DOKKEN ENGINEERING
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REPORT TITLE				HOLE ID
BORING RECORD				A-09-306
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard		DATE 11-9-09	SHEET 1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-24-08	10-24-08	33° 19' 47" / -117° 9' 29"	A-09-307
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~285 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 13.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 7-inches of AC.												
	1		Poorly graded GRAVEL (GP); 8-inches of AB.												
282.50	2		SILTY SAND (SM); brown, dry, some fine sand, mostly silt.												
	3														
280.50	4														
	5		Becomes very dense.			25	77	100							
278.50	6					31 46									
	7														
276.50	8														
	9														
274.50	10					19	66	100							
	11		SILT with SAND (ML); hard, brown to yellowish brown, moist, trace coarse to medium sand, little fine sand, mostly silt.			24 42									
272.50	12					22	82	100							Pocket Pentrometer = 4.5 tsf
	13					34 48									
270.50	14		Bottom of borehole at 13.5 ft bgs Planned Termination												
	15														
268.50	16														
	17														
266.50	18														
	19														
	20														

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REPORT TITLE				HOLE ID
BORING RECORD				A-09-307
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard		DATE 11-9-09	SHEET 1 of 1

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-24-08	10-24-08	33° 20' 3" / -117° 9' 32"	A-09-308
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~285 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 11.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 8-inches of AC.												
	1		Poorly graded GRAVEL (GP); 3-inches of AB.												
282.50	2		SILTY SAND (SM); yellowish brown, dry, mostly coarse to fine sand, some silt, well-graded.												
	3														
280.50	4		SANDY SILT (ML); hard, light yellowish brown, dry, some fine sand, mostly silt.												
	5					23 50/4"		90							
278.50	6														
	7														
276.50	8														
	9		Well-graded SAND (SW); very dense, very light yellowish brown, dry, mostly coarse to fine sand.												
274.50	10					28 50/6"		92							
	11		Bottom of borehole at 11.0 ft bgs Planned Termination												
272.50	12														
	13														
270.50	14														
	15														
268.50	16														
	17														
266.50	18														
	19														
	20														

DOKKEN ENGINEERING

2365 Iron Point Road
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REPORT TITLE				HOLE ID
BORING RECORD				A-09-308
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard		DATE 11-9-09	SHEET 1 of 1

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-27-08	10-27-08	33° 19' 48" / -117° 9' 39"	A-09-401
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~302 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4"); CALMOD (2.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 13.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); yellowish brown, dry, some coarse to fine sand, mostly silt, moderate cementation - Hard Pan.												
	1														
300.00	2														
	3														
298.00	4														
	5		Becomes hard.			37 50/6"		100							Pocket Pentrometer = 4.5+ tsf
296.00	6														
	7		SILTY SAND (SM); very dense, brown, dry, trace coarse gravel, mostly medium to fine sand, some silt, moderate cementation - Hard Pan.			36 50/6"		100							
294.00	8														
	9														
292.00	10					32 50/6"		100							Pocket Pentrometer = 4.5+ tsf
	11														
290.00	12		Transitions to trace coarse gravel, few medium sand, mostly fine sand, some silt.			14 32 50/6"		61							
	13		Bottom of borehole at 13.0 ft bgs Planned Termination												
288.00	14														
	15														
286.00	16														
	17														
284.00	18														
	19														
	20														

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REPORT TITLE				HOLE ID
BORING RECORD				A-09-401
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard		DATE 11-9-09	SHEET 1 of 1

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-27-08	10-27-08	33° 19' 55" / -117° 9' 39"	A-09-402
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~294 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4"); CALMOD (2.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 10.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	SANDY lean CLAY (CL); yellowish brown, dry, little medium to fine sand, mostly clay, moderate cementation - Hard Pan from 0.5- to 10.5-feet.												
	1													
292.00	2													
	3													
290.00	4													
	5	Becomes hard.			32 50/6"		100							Pocket Pentrometer = 4.5+ tsf
288.00	6	Becomes light yellowish brown, little fine sand, mostly silt.			34 50/6"		100							
	7													
286.00	8													
	9													
284.00	10				50/6"		100							
	11	Bottom of borehole at 10.5 ft bgs Planned Termination												
282.00	12													
	13													
280.00	14													
	15													
278.00	16													
	17													
276.00	18													
	19													
	20													

DOKKEN ENGINEERING

2365 Iron Point Road
Suite 200
Folsom, CA 95630

REPORT TITLE				HOLE ID
BORING RECORD				A-09-402
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard	DATE 11-9-09	SHEET 1 of 1	

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-23-08	10-23-08	33° 19' 40" / -117° 9' 45"	A-09-304
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~293 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 8.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 9-inches of AC.												
	1		Poorly graded GRAVEL (GP); 3-inches of AB.												
290.50	2		Poorly graded SAND with SILT and GRAVEL (SP-SM); very light yellowish brown to light grayish brown, dry, little coarse to fine gravel, mostly coarse to fine sand.												
	3														
288.50	4														
	5		Becomes dense.			10	35	56							
286.50	6					14 21									
	7														
284.50	8		Bottom of borehole at 8.0 ft bgs Auger Refusal (Encountered Bedrock)												
282.50	9														
	10														
280.50	11														
	12														
278.50	13														
	14														
276.50	15														
	16														
274.50	17														
	18														
	19														
	20														

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

DOKKEN ENGINEERING
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Folsom, CA 95630

REPORT TITLE				HOLE ID
BORING RECORD				A-09-304
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard	DATE 11-9-09	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-23-08	10-23-08	33° 20' 2" / -117° 9' 38"	A-09-305
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~294 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERI: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 10.8 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 7-inches of AC.												
	1		Poorly graded GRAVEL (GP); 7-Inches of AB.												
292.00	2		SILTY SAND (SM); yellowish brown, dry, mostly fine sand, some silt.												
	3														
290.00	4														
	5		Becomes very dense.			32		100							
288.00	6					50/6"									
	7														
286.00	8														
	9														
284.00	10		Transitions to trace coarse to medium sand, mostly fine sand, some silt, weak cementation.			32		100							
						50/4"									
	11		Bottom of borehole at 10.8 ft bgs Planned Termination												
282.00	12														
	13														
280.00	14														
	15														
278.00	16														
	17														
276.00	18														
	19														
	20														

DOKKEN ENGINEERING

2365 Iron Point Road
Suite 200
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REPORT TITLE				HOLE ID
BORING RECORD				A-09-305
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard		DATE 11-9-09	SHEET 1 of 1

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-24-08	10-23-08	33° 19' 42" / -117° 9' 36"	A-09-306
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~250 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 11.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 10-inches of AC.												
	1		Poorly graded GRAVEL (GP); 5-inches of AB.												
248.00	2		SILTY SAND (SM); yellowish brown, dry, trace coarse to medium sand, mostly fine sand, some silt, weak cementation.												
	3														
246.00	4														
	5		Becomes very dense.	X		50/6"		100							
244.00	6														
	7														
242.00	8		SANDY SILT (ML); hard, brown, dry, trace coarse sand, few medium sand, some fine sand, mostly silt, weakly to moderate cementation, non-plastic.												
	9														
240.00	10			X		34 50/6"		67							
	11		Bottom of borehole at 11.0 ft bgs Planned Termination												
238.00	12														
	13														
236.00	14														
	15														
234.00	16														
	17														
232.00	18														
	19														
	20														

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

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REPORT TITLE				HOLE ID
BORING RECORD				A-09-306
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard	DATE 11-9-09	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-24-08	10-24-08	33° 19' 47" / -117° 9' 29"	A-09-307
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~285 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERI: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 13.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 7-inches of AC.												
	1		Poorly graded GRAVEL (GP); 8-inches of AB.												
282.50	2		SILTY SAND (SM); brown, dry, some fine sand, mostly silt.												
	3														
280.50	4														
	5		Becomes very dense.			25	77	100							
278.50	6					31 46									
	7														
276.50	8														
	9														
274.50	10					19 24	66	100							
	11		SILT with SAND (ML); hard, brown to yellowish brown, moist, trace coarse to medium sand, little fine sand, mostly silt.			42									
272.50	12					22 34	82	100							Pocket Pentrometer = 4.5 tsf
	13					48									
270.50	14		Bottom of borehole at 13.5 ft bgs Planned Termination												
	15														
268.50	16														
	17														
266.50	18														
	19														
	20														

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

DOKKEN ENGINEERING

2365 Iron Point Road
Suite 200
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REPORT TITLE				HOLE ID
BORING RECORD				A-09-307
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard		DATE 11-9-09	SHEET 1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-24-08	10-24-08	33° 20' 3" / -117° 9' 32"	A-09-308
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~285 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 11.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 8-inches of AC.												
	1		Poorly graded GRAVEL (GP); 3-inches of AB.												
282.50	2		SILTY SAND (SM); yellowish brown, dry, mostly coarse to fine sand, some silt, well-graded.												
	3														
280.50	4		SANDY SILT (ML); hard, light yellowish brown, dry, some fine sand, mostly silt.												
	5			X		23 50/4"		90							
278.50	6														
	7														
276.50	8														
	9		Well-graded SAND (SW); very dense, very light yellowish brown, dry, mostly coarse to fine sand.												
274.50	10			X		28 50/6"		92							
	11		Bottom of borehole at 11.0 ft bgs Planned Termination												
272.50	12														
	13														
270.50	14														
	15														
268.50	16														
	17														
266.50	18														
	19														
	20														

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

DOKKEN ENGINEERING
2365 Iron Point Road
Suite 200
Folsom, CA 95630

REPORT TITLE				HOLE ID
BORING RECORD				A-09-308
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard	DATE 11-9-09	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-27-08	10-27-08	33° 19' 48" / -117° 9' 39"	A-09-401
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~302 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4"); CALMOD (2.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 13.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); yellowish brown, dry, some coarse to fine sand, mostly silt, moderate cementation - Hard Pan.												
	1														
300.00	2														
	3														
298.00	4														
	5		Becomes hard.			37 50/6"		100							Pocket Pentrometer = 4.5+ tsf
296.00	6														
	7		SILTY SAND (SM); very dense, brown, dry, trace coarse gravel, mostly medium to fine sand, some silt, moderate cementation - Hard Pan.			36 50/6"		100							
294.00	8														
	9														
292.00	10					32 50/6"		100							Pocket Pentrometer = 4.5+ tsf
	11														
290.00	12		Transitions to trace coarse gravel, few medium sand, mostly fine sand, some silt.			14 32 50/6"		61							
	13		Bottom of borehole at 13.0 ft bgs Planned Termination												
288.00	14														
	15														
286.00	16														
	17														
284.00	18														
	19														
	20														

DOKKEN ENGINEERING
2365 Iron Point Road
Suite 200
Folsom, CA 95630

REPORT TITLE				HOLE ID
BORING RECORD				A-09-401
DIST. 11	COUNTY San Diego	ROUTE SR 76	POSTMILE 12.4/17.6	EA 11-257110
PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project				
BRIDGE NUMBER	PREPARED BY G. Shepard		DATE 11-9-09	SHEET 1 of 1

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Munn	10-27-08	10-27-08	33° 19' 55" / -117° 9' 39"	A-09-402
DRILLING CONTRACTOR: Cascade Drilling			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta ~	SURFACE ELEVATION: ~294 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME-85	BOREHOLE DIAMETER: 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.4"); CALMOD (2.4")			SPT HAMMER TYPE: 140 lbs. wire-line 30-in drop	HAMMER EFFICIENCY, ERi: 72%
BOREHOLE BACKFILL AND COMPLETION: Native Backfill; Set-45 at the top 8 inches			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): GW Not Encountered	TOTAL DEPTH OF BORING: 10.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); yellowish brown, dry, little medium to fine sand, mostly clay, moderate cementation - Hard Pan from 0.5- to 10.5-feet.												
	1														
292.00	2														
	3														
290.00	4														
	5		Becomes hard.			32 50/6"		100							Pocket Pentrometer = 4.5+ tsf
288.00	6		Becomes light yellowish brown, little fine sand, mostly silt.			34 50/6"		100							
	7														
286.00	8														
	9														
284.00	10					50/6"		100							
	11		Bottom of borehole at 10.5 ft bgs Planned Termination												
282.00	12														
	13														
280.00	14														
	15														
278.00	16														
	17														
276.00	18														
	19														
	20														

DOKKEN BORING RECORD MET+ENG FIXED 1704 SR 76 NEW.GPJ DOKKEN CALTRANS 1-06-10.GLB 1/8/10

DOKKEN ENGINEERING

2365 Iron Point Road
Suite 200
Folsom, CA 95630

REPORT TITLE	HOLE ID
BORING RECORD	A-09-402

DIST.	COUNTY	ROUTE	POSTMILE	EA
11	San Diego	SR 76	12.4/17.6	11-257110

PROJECT OR BRIDGE NAME: SR-76 Mission to I-15 Project

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
	G. Shepard	11-9-09	1 of 1

ROTARY FIELD NOTES

TL-1271a (REV. 01/31/00)

BORING NUMBER	DATE	DIST.	CO.	RTE.	P.M. (K.P.)	BRIDGE #
RC-11-01	7/12/11 10:00	11	SD	76		WAC #5

LOCATION (STA/OFFSET or NORTHING/EASTING): 33° 19.331', 117° 10.141'

BRIDGE NAME: WAC #5

EA NUMBER:

TOP HOLE ELEVATION: 235.47 ft

BOTTOM HOLE ELEVATION:

CREW: Rocco — Bob Fanix, Cory Down

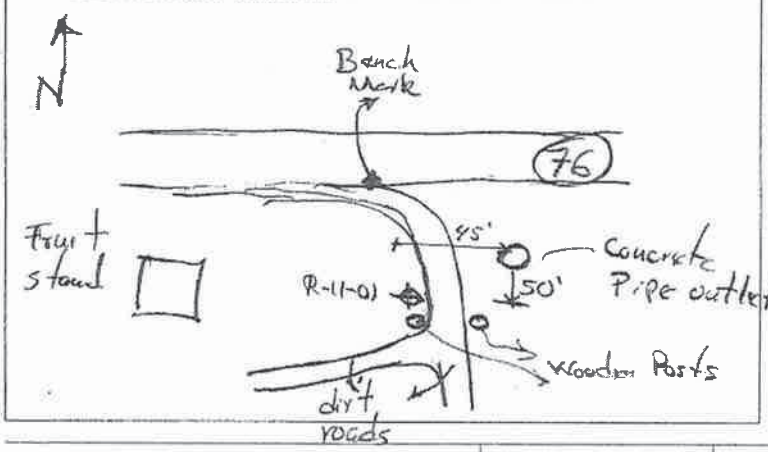
EQUIPMENT: Mobile B-47

CHC NUMBER: #5081

HAMMER ID#: #5081

Surface set drill bit 3 7/8" Er = 68%

SITE LOCATION MAP (Inc. North Arrow & Benchmark Datum)



LOGGER	
Fernando De Haro	
GWS: 220.77	DATE: 8-1-11
GWS	DATE
CASING SIZE	CASING DEPTH
CASING SIZE	CASING DEPTH
SLURRY TYPE: Insta-Pac	

SURFACE CONDITIONS (Slope, Water, Vegetation, etc): BM

REMARKS (Tool Sizes/Type - Rods & Bits, etc) (Hole Condition – Caving, Squeezing, Loss of Circulation, etc. Drill Rig reactions – slowing, chattering, skipping, blocking off)	SAMPLE #	BLOWS PER 6"	SPT (N)	N 60	DEPTH	GRAPHIC LOG	DESCRIPTION Soil Classification (group name, group symbol, consistency/relative density, color, moisture, particle size, gradation, plasticity, structure, cementation, organics, fill, q_u, s_u, Other characteristics) Rock Classification (rock name, color, degree of weathering, relative hardness, bedding, discontinuity characteristics, voids, slaking, odor, other characteristics)
(0 - 5.3 ft)	1					3.8	Silty Sand (SM), very dense, light brown, fine to medium-grained, some silt, FILL
Rec = 1.5'							
L.B.= 7.5'							
S-U= 26" = 2.2'							
							very dense
(5.3 - 6.8 ft) SPT	2	31					at 5.5 ft, cobbles (10%, 8" size, granite), trace small asphalt concrete fragments
		24					
		16	40				
(6.8 - 10.3 ft)	3						At 6.5 ft, 2-in asphalt concrete
Rec = 1.2 ft					7'		
							Poorly-graded sand with silt (SP-SM) very loose, yellowish brown, moist, fine to coarse grained, few silt, trace mica.
(10.3 - 11.8 ft) SPT	4	5					
		2					
Losing water at 9 feet.		2	4				

ROTARY FIELD NOTES

TL-1271b (REV. 07/01/07)

WAC#5 Route 76

BORING NUMBER	DATE	DIST.	CO.	RTE.	P.M. (K.P.)
RC-11-01	7/12/11	11	SD	76	

LOCATION (STA/OFFSET or NORTHING/EASTING) | TOP HOLE ELEVATION: 235.47 | BRIDGE # | EA NUMBER: 11000001285

REMARKS (Tool Sizes/Type - Rods & Bits, etc) (Hole Condition – Caving, Squeezing, Loss of Circulation, etc. Drill Rig reactions – slowing, chattering, skipping, blocking off)	SAMPLE #	BLOWS PER 6"	SPT (N)	N 60	DEPTH ft (m)	GRAPHIC LOG	DESCRIPTION Soil Classification (group name, group symbol, consistency or apparent density, color, moisture, % cobbles or boulders, % or proportion of soils, particle size range, particle angularity & shape, plasticity, dry strength, dilatency, toughness, structure, cementation, organics. Other characteristics) Rock Classification (rock name, rock grain size, bedding spacing, color, texture, weathering descriptors, rock hardness, fracture density, discontinuity type, discontinuity condition, discontinuity dip magnitude, rate of slaking, odor, other characteristics)
11.8 – 15.3	5				10'		
Rec: 3.1'							Poorly-graded sand (SP), medium dense, light gray, moist, fine to coarse-grained, trace silt, salt and pepper color, trace fine gravel (sub-angular), trace mica.
15.3 – 16.8 SPT	6	3					
		7					
		8	(15)				
16.8 – 20.3	7						
Rec = 2.6'							
20.3 – 21.8 SPT	8	7					
		8					
		12	(20)				
							sporadic thin zones of silty sand (SM), fine to medium grained, some silt.
21.8 – 25.3	9						
					25'		
25.3 – 26.8 SPT	10	5					Silty sand (SM), dense, light gray, moist, fine to medium-grained, some silt, trace fine gravel (sub-angular).
		12					
		15	(27)				
26.8 – 30.3	11						
30.3 – 31.8 SPT	12	3					medium dense
		5					
		7	(12)				

ROTARY FIELD NOTES

TL-1271b (REV. 07/01/07)

WAC #5 Route 76

BORING NUMBER	DATE	DIST.	CO.	RTE.	P.M. (K.P.)
RC-11-01		11	SD	76	

LOCATION (STA/OFFSET or NORTHING/EASTING)	TOP HOLE ELEVATION	BRIDGE #	EA NUMBER
	235.47		1100000189

REMARKS (Tool Sizes/Type - Rods & Bits, etc) (Hole Condition – Caving, Squeezing, Loss of Circulation, etc. Drill Rig reactions – slowing, chattering, skipping, blocking off)	SAMPLE #	BLOWS PER 6"	SPT (N)	N 60	DEPTH ft (m)	GRAPHIC LOG	DESCRIPTION Soil Classification (group name, group symbol, consistency or apparent density, color, moisture, % cobbles or boulders, % or proportion of soils, particle size range, particle angularity & shape, plasticity, dry strength, dilatency, toughness, structure, cementation, organics, Other characteristics) Rock Classification (rock name, rock grain size, bedding spacing, color, texture, weathering descriptors, rock hardness, fracture density, discontinuity type, discontinuity condition, discontinuity dip magnitude, rate of slaking, odor, other characteristics)
31.8 – 35.3	13						
							At 35 ft, 6-inch zone, dark gray sand with thin lenses of silt and clay.
35.3 – 36.8 SPT	14	1					
		9					
		7	(16)				gray-brown
At 36.8, changed drill bit to diamond impreg. due to slow drilling.							
36.8 – 40.3	15						Sporadic thin layers of poorly-graded sand (SP)
40.3 – 41.8 SPT	16	7					
		10					
		15	(25)				
End of the day @ 2:20 → Drillers run out of water. 7-13-11 start at 2:30 → Mechanical problems							cobbles (10%, 6" size, granite)
41.8 – 45.3	17						
Rec = 0.8'							
45.3 – 46.8 SPT	18	15					dense; trace fine gravel (subangular)
		17					
		15	(32)				
46.8 – 50.3	19						
Rec = 2.9'							
50.3 – 51.8 SPT	20	4		SW-SM f-c			
		10					
		23	(33)				

ROTARY FIELD NOTES

TL-1271b (REV. 07/01/07)

Route 76 WAC #5

BORING NUMBER	DATE	DIST.	CO.	RTE.	P.M. (K.P.)
RC-11-01	7-18-11 / 7-13-11	11	SD	76	

LOCATION (STA/OFFSET or NORTHING/EASTING)	TOP HOLE ELEVATION	BRIDGE #	EA NUMBER
	235.47		11000 00189

REMARKS (Tool Sizes/Type - Rods & Bits, etc) (Hole Condition – Caving, Squeezing, Loss of Circulation, etc. Drill Rig reactions – slowing, chattering, skipping, blocking off)	FIELD TESTING: SAMPLE #	BLOWS PER 6"	SPT (N)	N 60	DEPTH ft (m)	GRAPHIC LOG	DESCRIPTION (Soil Classification (group name, group symbol, consistency or apparent density, color, moisture, % cobbles or boulders, % or proportion of soils, particle size range, particle angularity & shape, plasticity, dry strength, dilatency, toughness, structure, cementation, organics, Other characteristics) Rock Classification (rock name, rock grain size, bedding spacing, color, texture, weathering descriptors, rock hardness, fracture density, discontinuity type, discontinuity condition, discontinuity dip magnitude, rate of slaking, odor, other characteristics)
51.8 – 55.3	21				52'		
Rec = 2.8'							Poorly-Graded Sand with silt (SP-SM) very dense, gray-brown, moist, fine to coarse-grained, few silt, trace gravel (fine and coarse, subrounded), trace mica.
55.3 – 56.8 SPT	22	21					
		21					
		25	(46)				
End of the day @ 15:35							
Start on 7/18/11 @ 13:20							
56.8 – 60.3	23						
Rec = 3.5 ft							
60.3 – 61.8 SPT	24	11					
		15					
		25	(40)				
61.8 – 65.3	25						At 63 ft, boulders (30%, 15", igneous)
Rec = 3.5'							
					65'		
65.8 – 66.1 SPT	26	50/3"					Igneous Rock (Granite), medium to coarse-grained, gray-brown, decomposed, very soft to soft, slightly fractured, Poorly-graded Sand (SP), very dense, fine to coarse.
			(REF)				
66.1 – 70.3	27						
Rec = 4.2/4.2 = 100							
RQD = 100*							
70.3 – 70.6 SPT	28	50/4"					
			(REF)				

ROTARY FIELD NOTES

TL-1271b (REV. 07/01/07)

Route 76 WAC #5

BORING NUMBER	DATE	DIST.	CO.	RTE.	P.M. (K.P.)
RC-11-01	7-18-11	11	SD	76	

LOCATION (STA/OFFSET or NORTHING/EASTING)	TOP HOLE ELEVATION	BRIDGE #	EA NUMBER
	235.47		11000 00189

REMARKS (Tool Sizes/Type - Rods & Bits, etc) (Hole Condition – Caving, Squeezing, Loss of Circulation, etc. Drill Rig reactions – slowing, chattering, skipping, blocking off)	FIELD TESTING: SAMPLE #	BLOWS PER 6"	SPT (N)	N 60	DEPTH ft (m)	GRAPHIC LOG	DESCRIPTION Soil Classification (group name, group symbol, consistency or apparent density, color, moisture, % cobbles or boulders, % or proportion of soils, particle size range, particle angularity & shape, plasticity, dry strength, dilatency, toughness, structure, cementation, organics, Other characteristics) Rock Classification (rock name, rock grain size, bedding spacing, color, texture, weathering descriptors, rock hardness, fracture density, discontinuity type, discontinuity condition, discontinuity dip magnitude, rate of slaking, odor, other characteristics)
70.6 – 75.3	29						Sporadic quartz fragments
Rec = 3.8/4.7 = 81%							
RQD = 3/4.7 = 64% *							
75.3 – 80.3	30						moderately to slightly weathered, moderately soft to moderately hard, moderately fractured.
Rec = 5/5 = 100%							
RQD = 3.3/5 = 65%							
							Bottom = 80.3 ft
							Elev. 155.17
							Completed on 7/18/11
							ER: = 68%
							2 core boxes collected

APPENDIX III
LABORATORY TEST DATA

Sample ID	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Water Content (%)	Dry Density (pcf)
A-09-109 bulk	1-5							
A-09-301 bulk	1-5				19	29.7		
A-09-303 bulk	1-5							
A-09-303-5'	5-6.5				12.5	17.0		
A-09-304-5'	5-6.5				25	5.6		
A-09-307 bulk	1-5							
A-09-308-5'	5-6.5				25	45.8		
A-09-402 bulk	1-5	29	18	11	37.5	50.1		
A-09-403 bulk	bulk							
A-09-403-6'	6-6.75	36	20	16				
A-09-404 bulk	1-5				25	44.2		

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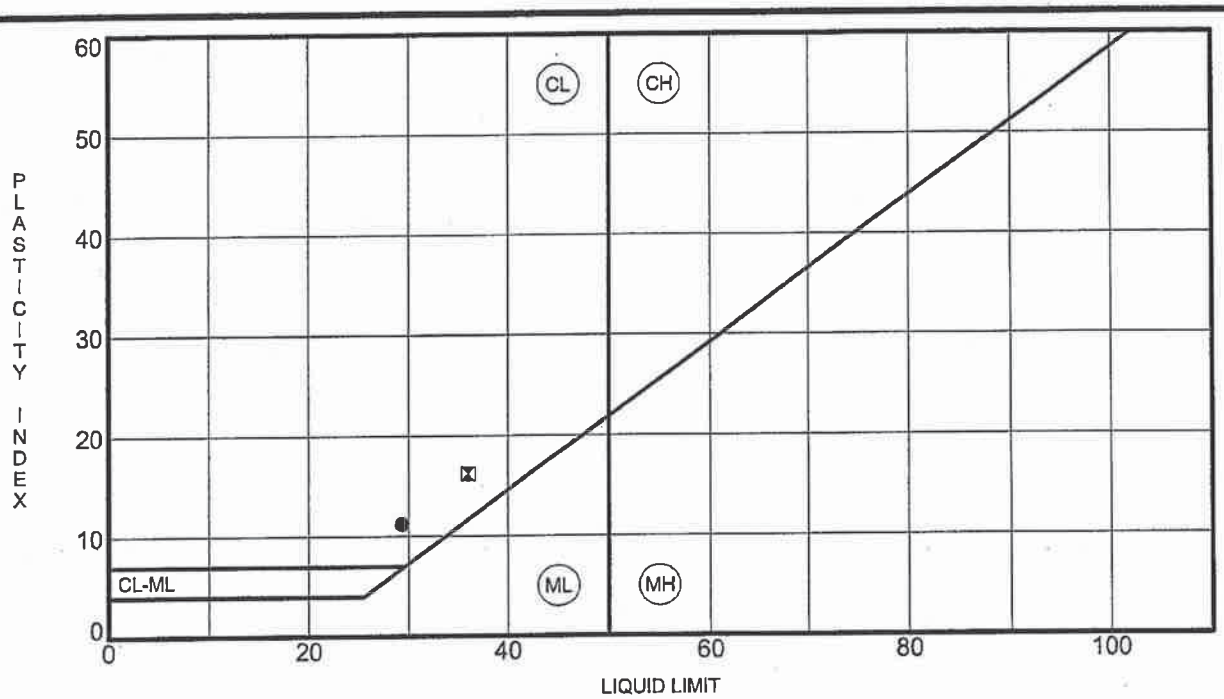
Summary of Laboratory Results

Project: SR 76 East
Location: San Diego, CA
Number: S9033-06-20

US LAB SUMMARY GEOTECH REPORTS (NO B) S9033-06-20 SR 76 EAST.GPJ US LAB.GDT 12/10/09



	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description
●	A-09-402 bulk	29	18	11	50	SANDY LEAN CLAY (CL)
⊠	A-09-403-6'	36	20	16		LEAN CLAY (CL)

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ATTERBERG LIMITS

Project: SR 76 East
Location: San Diego, CA
Number: S9033-06-20

PI COPY 3 (NO FIGURE) S9033-06-20 SR 76 EAST.GPJ US LAB.GDT 12/10/09

Sample ID	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Water Content (%)	Dry Density (pcf)
A-09-109 bulk	1-5							
A-09-301 bulk	1-5				19	29.7		
A-09-303 bulk	1-5							
A-09-303-5'	5-6.5				12.5	17.0		
A-09-304-5'	5-6.5				25	5.6		
A-09-307 bulk	1-5							
A-09-308-5'	5-6.5				25	45.8		
A-09-402 bulk	1-5	29	18	11	37.5	50.1		
A-09-403 bulk	bulk							
A-09-403-6'	6-6.75	36	20	16				
A-09-404 bulk	1-5				25	44.2		

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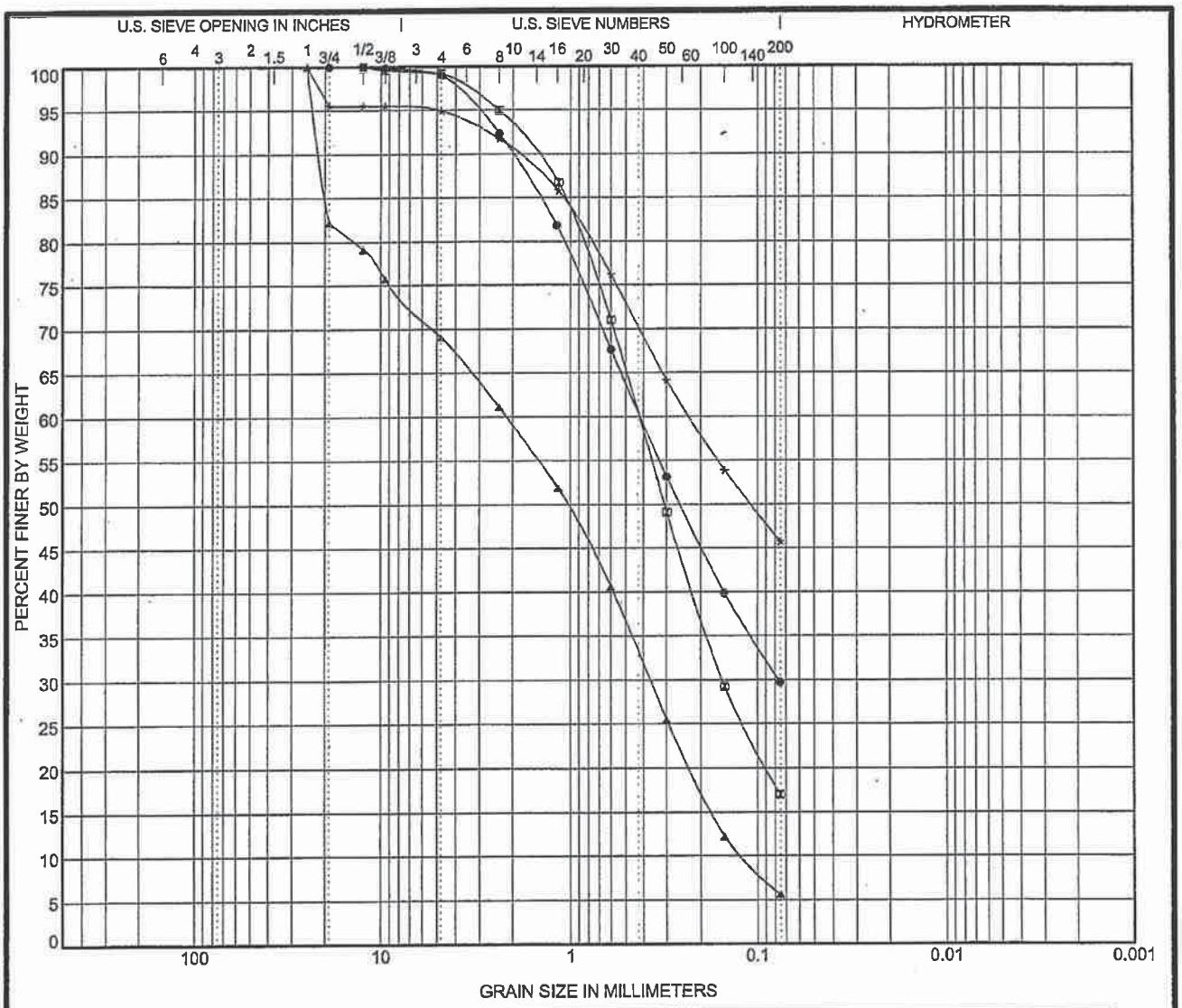
Summary of Laboratory Results

Project: SR 76 East
Location: San Diego, CA
Number: S9033-06-20



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	A-09-301 bulk	CLAYEY SAND (SC)					
⊠	A-09-303-5'	SILTY SAND (SM)					
▲	A-09-304-5'	POORLY GRADED SAND WITH SILT & GRAVEL (SP-SM)				0.53	18.17
★	A-09-308-5'	SILTY SAND (SM)					

	Sample No.	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	A-09-301 bulk	19	0.416	0.076		0.9	69.3	29.7	
⊠	A-09-303-5'	12.5	0.423	0.154		0.8	82.2	17.0	
▲	A-09-304-5'	25	2.157	0.369	0.119	30.9	63.5	5.6	
★	A-09-308-5'	25	0.226			5.0	49.2	45.8	

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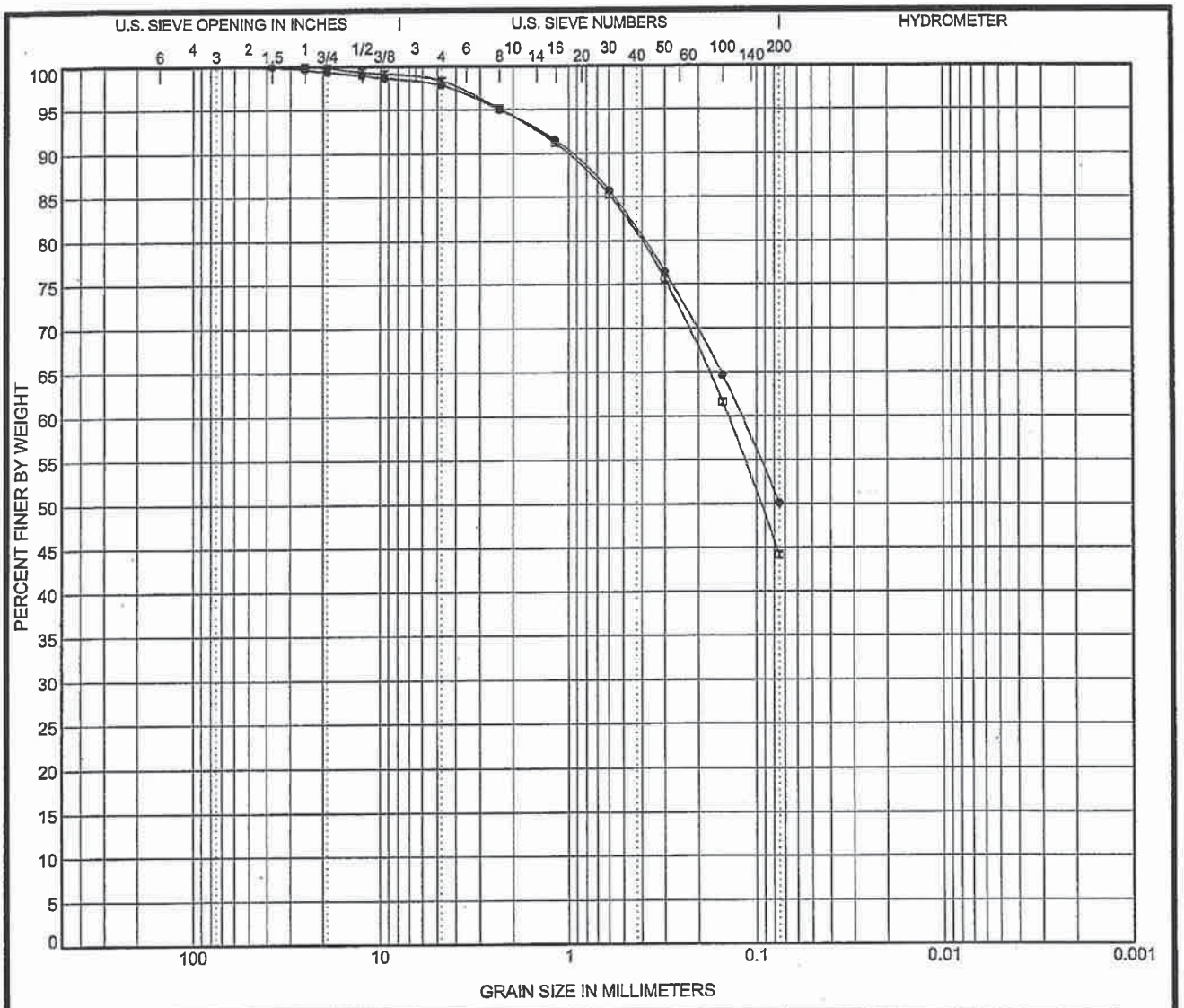
GRAIN SIZE DISTRIBUTION

Project: SR 76 East
Location: San Diego, CA
Number: S9033-06-20

GRAIN SIZE COPY 3 S9033-06-20 SR 76 EAST.GPJ US LAB.GDT 12/10/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	A-09-402 bulk	SANDY LEAN CLAY (CL)	29	18	11		
⊠	A-09-404 bulk	SILTY SAND (SM)					

	Sample No.	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	A-09-402 bulk	37.5	0.12			2.1	47.7	50.1	
⊠	A-09-404 bulk	25	0.141			1.6	54.2	44.2	

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GRAIN SIZE DISTRIBUTION

Project: SR 76 East
Location: San Diego, CA
Number: S9033-06-20

GRAIN SIZE COPY 3 S9033-06-20 SR 76 EAST.GPJ US LAB.GDT 12/10/09

GEOCON
INLAND EMPIRE

41571 CORNING PLACE SUITE 101 MURRIETA CA 92562 (951) 304-2300

CHLORIDE CONTENT

AASHTO T291-94

Project:	DOKKEN ENG (SR-76)
Number:	S9033-06-20
Date	12/4/2008
Tech:	JD

SILVER NITRATE SOLUTION 1ml = 0.5 mg Cl

SAMPLE NUMBER	BLANK	MOISTURE CONTENT	PH (6.0 TO 8.0)	SAMPLE WT.	TITRATION start	TITRATION end	AgNO4
A-09-402	0.3	3.1	OK	30.00	1	1.8	0.8
A-09-403	0.3	4	OK	30.00	15.8	18.2	2.4
							0
							0
							0
							0
							0
							0
							0

SAMPLE NUMER	PPM	%CHLORIDE
A-09-402	26	0.003
A-09-403	109	0.011

GEOCON

INLAND EMPIRE

SULFATE CONTENT

Project Name: DOKKEN ENGINEERING (SR 76)
Project Number: S9033-06-20
Date: 12/4/2008
Technician: JD

Sample No.	A-09-402
Dilution	1
Time (minutes)	
0:30	0
1:00	1.9
1:30	1.8
2:00	4.4
0.001%	

Sample No.	A-09-403
Dilution	1
Time (minutes)	
0:30	7.9
1:00	4.5
1:30	0
2:00	24.8
0.006%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

GEOCON

INLAND EMPIRE

41571 Corning Place, Suite 101 * Murrirta, CA 92562-7605

PROJECT NAME DOKKEN ENG (SR-76)
PROJECT NUMBER S9033-06-20
DATE 12/3/2008
TECHNICIAN PJ
SAMPLE NUMBER A-09-402 bulk

CORROSIVITY TEST DATA

LARGE BOX

MOISTURE ADDED			RESISTIVITY OHMS MULT BY		OHMS	RESISTIVITY	
100			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
						n/a	

MINIMUM RESISTIVITY (OHM CM) : 0
PH:

SMALL BOX

RESISTIVITY MOISTURE ADDED			OHMS MULT BY		OHMS	RESISTIVITY	
16ml			8.3		1000	8300	
10ml			4.8		1000	4800	
10ml			3.1		1000	3100	
10ml			2.8		1000	2800	
10ml			2.8		1000	2800	
10ml			2.9		1000	2900	

MINIMUM RESISTIVITY (OHM CM): 2800
PH: 8.3

GEOCON

INLAND EMPIRE

41571 Corning Place, Suite 101 * Murrirta, CA 92562-7605

PROJECT NAME DOKKEN ENG (SR-76)
PROJECT NUMBER S9033-06-20
DATE 12/3/2008
TECHNICIAN PJ
SAMPLE NUMBER A-09-403 -6'

CORROSIVITY TEST DATA

LARGE BOX

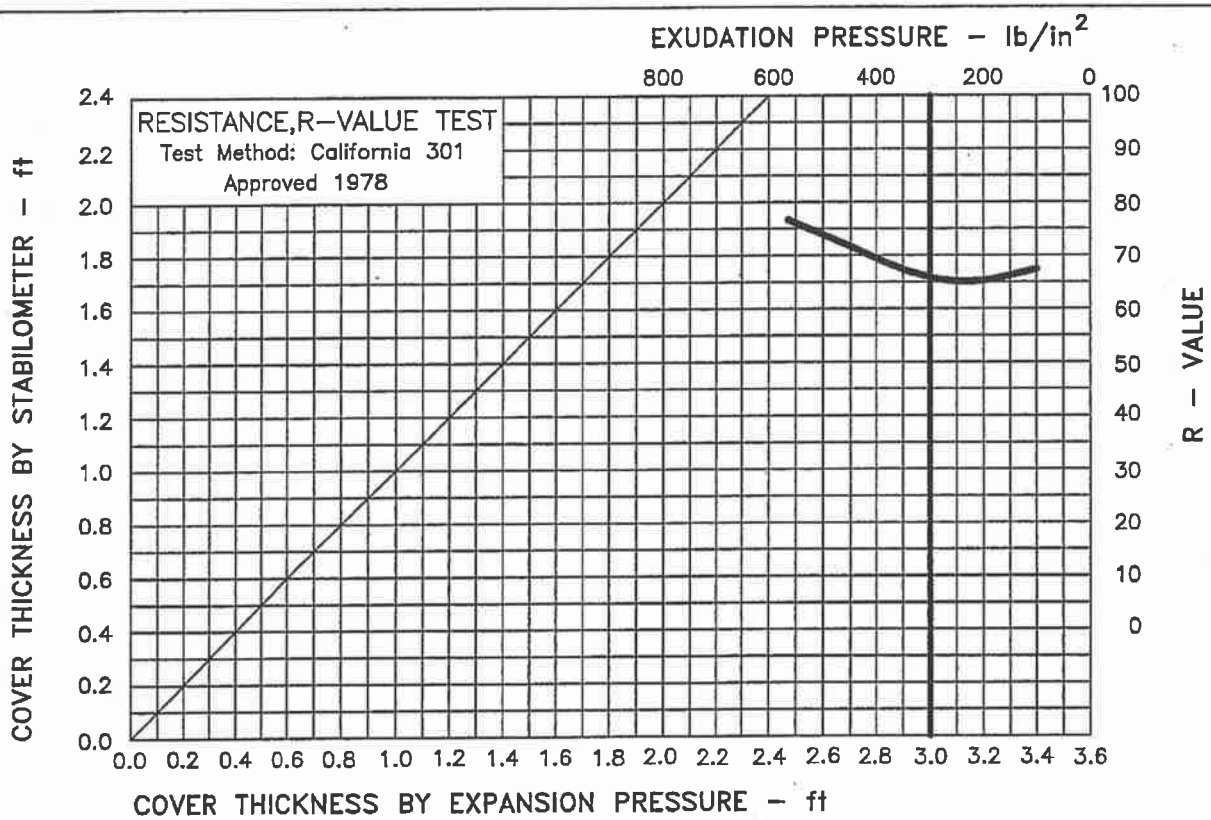
MOISTURE ADDED			RESISTIVITY OHMS MULT BY		OHMS	RESISTIVITY	
100			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
						n/a	

MINIMUM RESISTIVITY (OHM CM) : 0
PH:

SMALL BOX

RESISTIVITY MOISTURE ADDED			OHMS MULT BY		OHMS	RESISTIVITY	
16ml			5.9		1000	5900	
8ml			2.7		1000	2700	
8ml			1.8		1000	1800	
8ml			1.3		1000	1300	
8ml			1.2		1000	1200	
8ml			1.2		1000	1200	
8ml			1.2		1000	1200	

MINIMUM RESISTIVITY (OHM CM): 1200
PH: 8.2



SPECIMEN	M	N	O
EXUDATION PRESSURE, lb/in²	100	240	460
EXPANSION DIAL (.0001")	2	5	11
EXPANSION PRESSURE, lb/ft²	7	22	48
RESISTANCE VALUE, R	67	65	72
% MOISTURE AT TEST	10.9	10.4	9.9
DRY DENSITY AT TEST, lb/ft³	120.1	122.1	122.5
R VALUE AT 300 lb/in² EXUDATION PRESSURE		67	
R VALUE BY EXPANSION PRESSURE (TI = 5.0)		70	

SAMPLE LOCATION: A–09–109, 1–5'

SAMPLE DESCRIPTION: Dark Gray Silty SAND

DATE SAMPLED: Unknown

GEOCON CONSULTANTS, INC
3160 GOLD VALLEY DRIVE - SUITE 800 - RANCHO CORDOVA - CALIFORNIA - 95742
PHONE 916 852-9118 - FAX 916 852-9132

SR-76 East

DOKKEN ENGINEERING

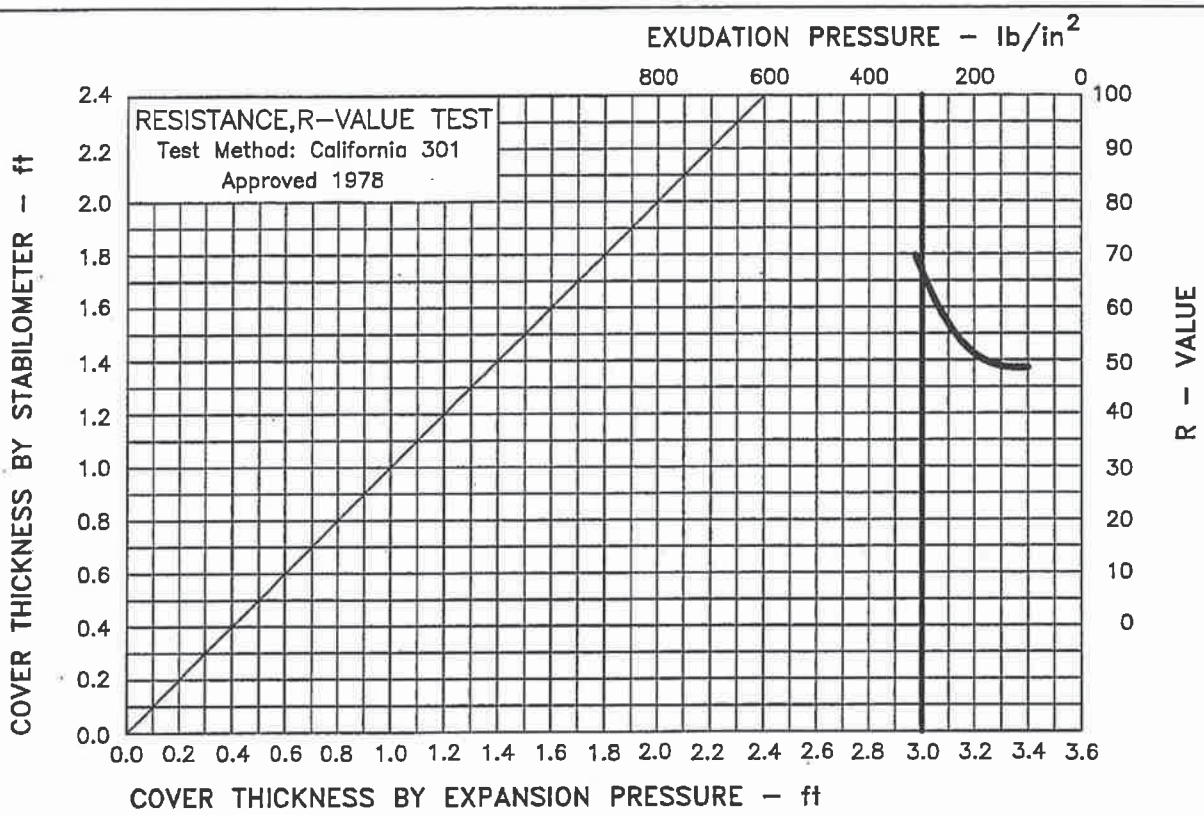
GEOCON PROJECT NO: S9033-06-20

NO SCALE

R-VALUE TEST RESULT

December 2008

FIGURE



SPECIMEN	J	K	L
EXUDATION PRESSURE, lb/in²	100	150	300
EXPANSION DIAL (.0001")	0	0	3
EXPANSION PRESSURE, lb/ft²	0	0	13
RESISTANCE VALUE, R	49	49	67
% MOISTURE AT TEST	10.8	9.8	8.8
DRY DENSITY AT TEST, lb/ft³	125.2	123.5	126.6
R VALUE AT 300 lb/in² EXUDATION PRESSURE			67
R VALUE BY EXPANSION PRESSURE (TI = 5.0)			80

SAMPLE LOCATION: A–09–303, 1–5'

SAMPLE DESCRIPTION: Dark Gray Silty SAND

DATE SAMPLED: Unknown

GEOCON
CONSULTANTS, INC
3160 GOLD VALLEY DRIVE - SUITE 800 - RANCHO CORDOVA - CALIFORNIA - 95742
PHONE 916 852-9118 - FAX 916 852-9132

SR-76 East

DOKKEN ENGINEERING

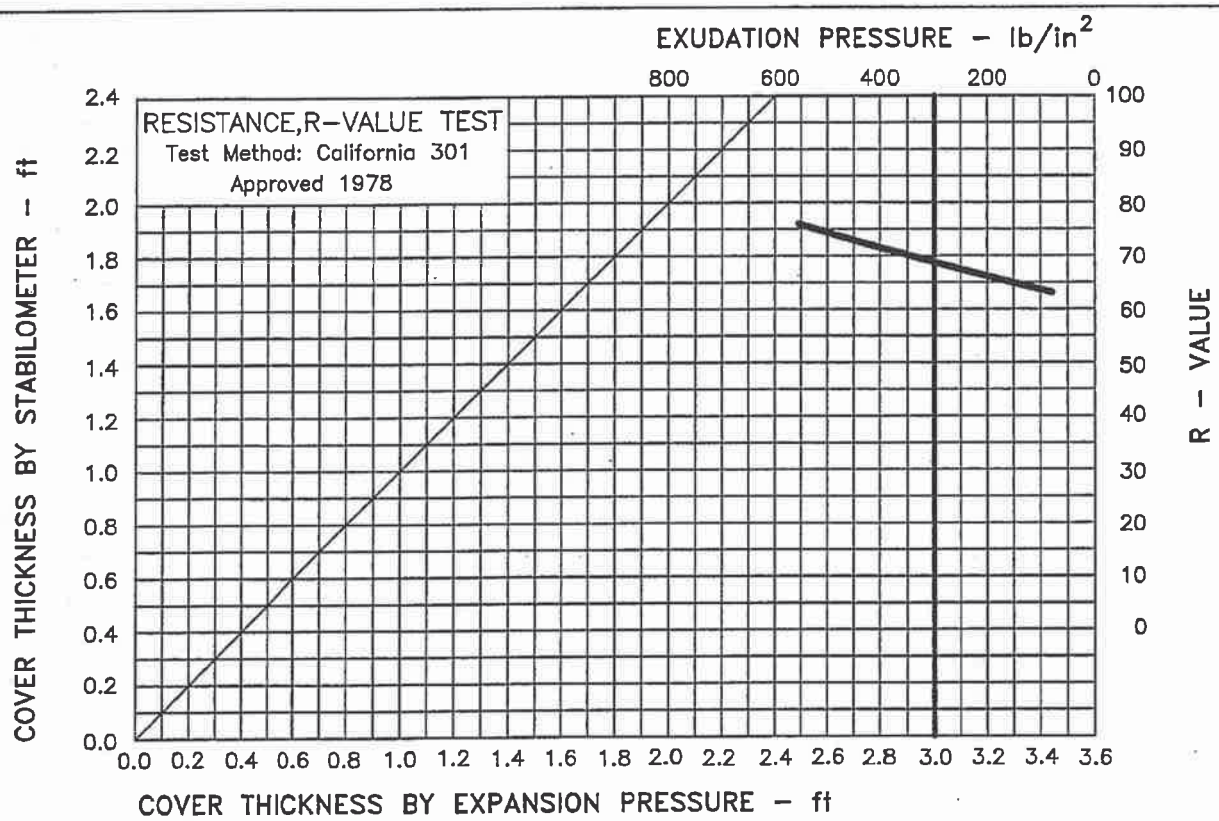
GEOCON PROJECT NO: S9033-06-20

NO SCALE

R-VALUE TEST RESULT

December 2008

FIGURE



SPECIMEN	A	B	C
EXUDATION PRESSURE, lb/in²	80	150	420
EXPANSION DIAL (.0001")	0	0	0
EXPANSION PRESSURE, lb/ft²	0	0	0
RESISTANCE VALUE, R	63	65	72
% MOISTURE AT TEST	12.5	11.5	10.5
DRY DENSITY AT TEST, lb/ft³	120.4	121.7	121.8
R VALUE AT 300 lb/in² EXUDATION PRESSURE		69	
R VALUE BY EXPANSION PRESSURE (TI = 5.0)			

SAMPLE LOCATION: A–09–307, 1–5'

SAMPLE DESCRIPTION: Dark Gray Silty SAND

DATE SAMPLED: Unknown

GEOCON CONSULTANTS, INC.
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SR-76 East

DOKKEN ENGINEERING

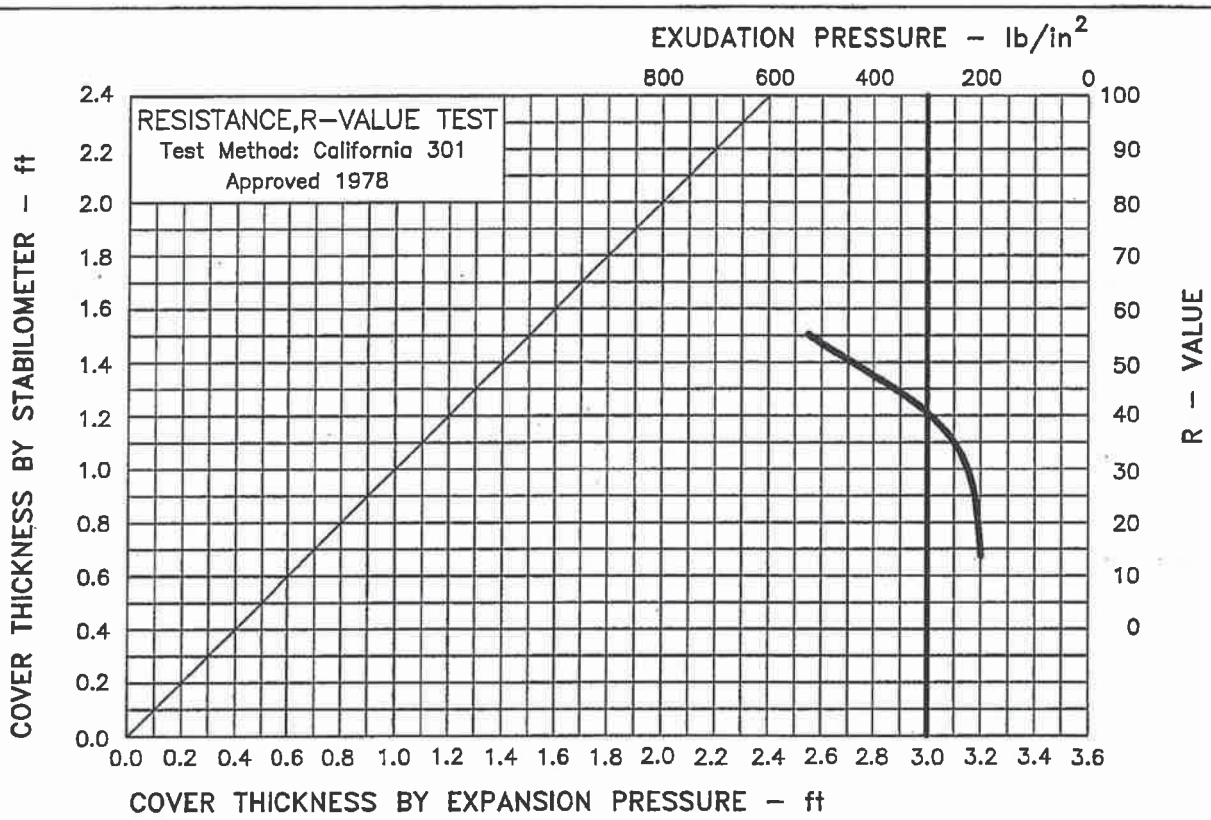
GEOCON PROJECT NO: S9033-06-20

NO SCALE

R-VALUE TEST RESULT

December 2008

FIGURE



SPECIMEN	G	H	I
EXUDATION PRESSURE, lb/in²	200	240	500
EXPANSION DIAL (.0001")	22	23	53
EXPANSION PRESSURE, lb/ft²	95	100	229
RESISTANCE VALUE, R	14	33	54
% MOISTURE AT TEST	14.3	13.3	12.3
DRY DENSITY AT TEST, lb/ft³	114.6	118.9	121.5
R VALUE AT 300 lb/in² EXUDATION PRESSURE		41	
R VALUE BY EXPANSION PRESSURE (TI = 5.0)		38	

SAMPLE LOCATION: A–09–402, 1–5'

SAMPLE DESCRIPTION: Brown Silty SAND

DATE SAMPLED: Unknown

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SR-76 East

DOKKEN ENGINEERING

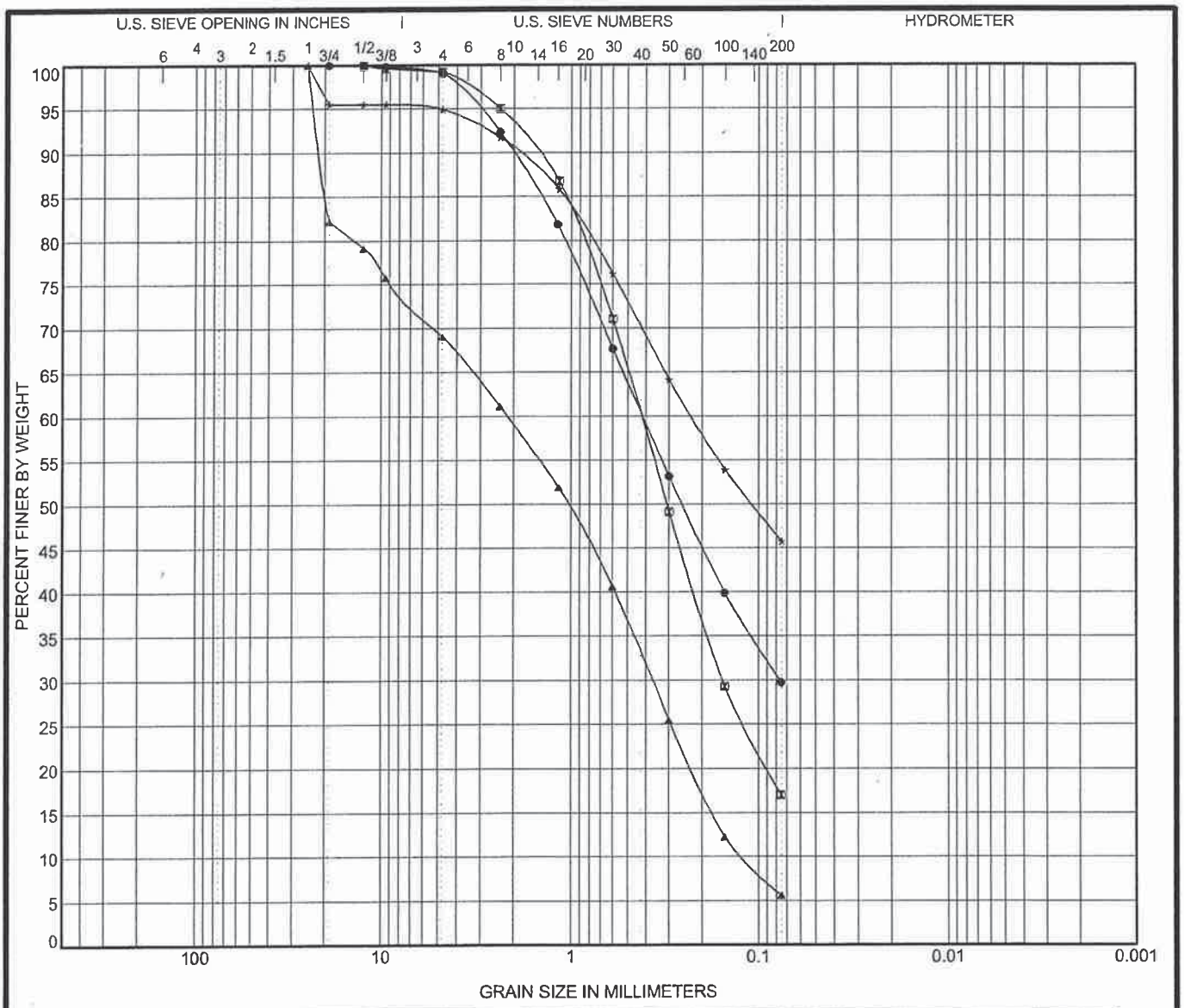
GEOCON PROJECT NO: S9033-06-20

NO SCALE

R-VALUE TEST RESULT

December 2008

FIGURE



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	**A-09-301 bulk**	**CLAYEY SAND (SC)**					
⊠	**A-09-303-5'**	**SILTY SAND (SM)**					
▲	**A-09-304-5'**	**POORLY GRADED SAND WITH SILT & GRAVEL (SP-SM)**				**0.53**	**18.17**
★	**A-09-308-5'**	**SILTY SAND (SM)**					

	Sample No.	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**A-09-301 bulk**	**19**	**0.416**	**0.076**		**0.9**	**69.3**	**29.7**	
⊠	**A-09-303-5'**	**12.5**	**0.423**	**0.154**		**0.8**	**82.2**	**17.0**	
▲	**A-09-304-5'**	**25**	**2.157**	**0.369**	**0.119**	**30.9**	**63.5**	**5.6**	
★	**A-09-308-5'**	**25**	**0.226**			**5.0**	**49.2**	**45.8**	

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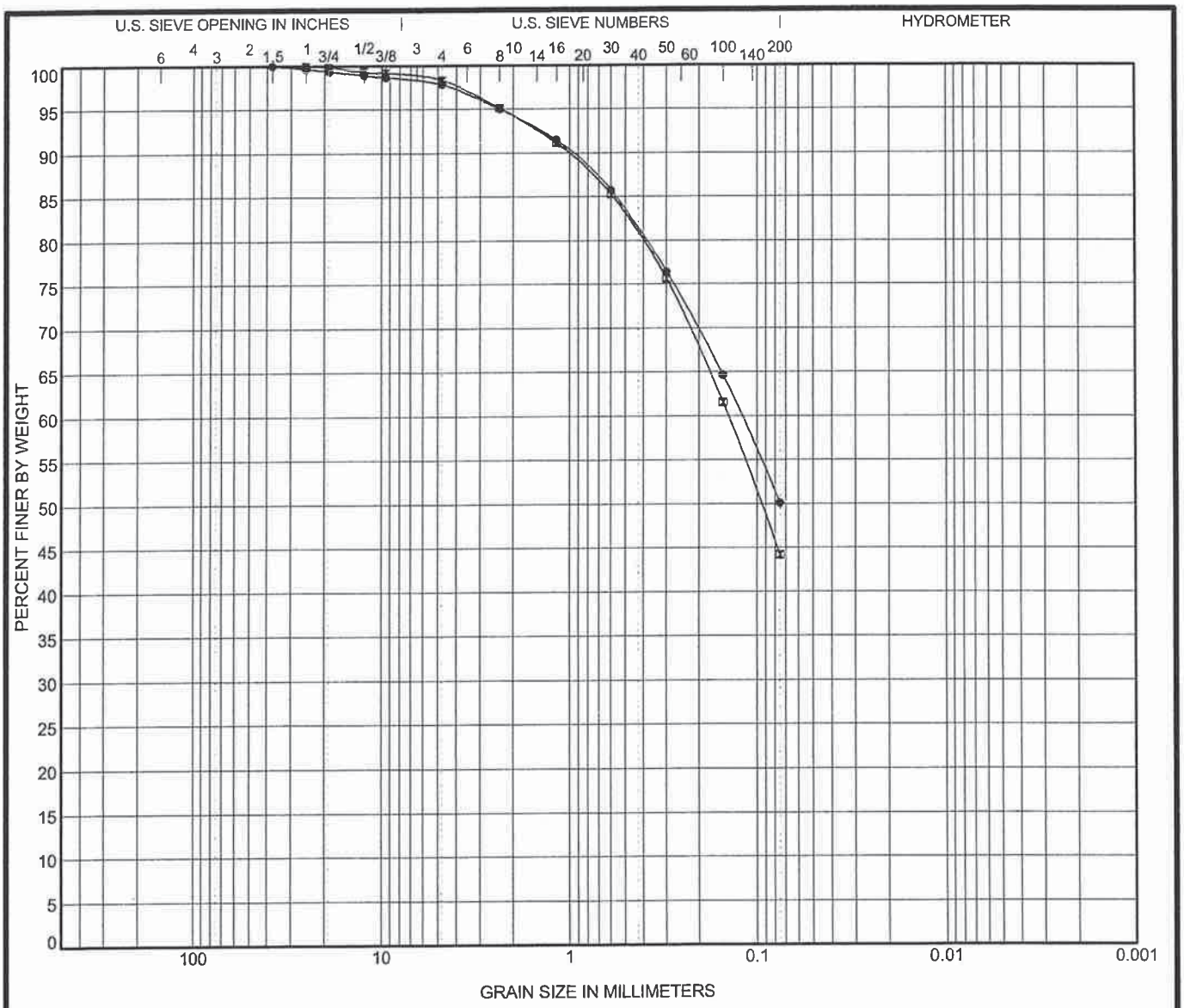
GRAIN SIZE DISTRIBUTION

Project: SR 76 East
Location: San Diego, CA
Number: S9033-06-20

GRAIN SIZE COPY 3 S9033-06-20 SR 76 EAST.GPJ US LAB.GDT 12/10/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	**A-09-402 bulk**	**SANDY LEAN CLAY (CL)**	**29**	**18**	**11**		
⊠	**A-09-404 bulk**	**SILTY SAND (SM)**					

	Sample No.	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**A-09-402 bulk**	**37.5**	**0.12**			**2.1**	**47.7**	**50.1**	
⊠	**A-09-404 bulk**	**25**	**0.141**			**1.6**	**54.2**	**44.2**	

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GRAIN SIZE DISTRIBUTION

Project: SR 76 East
Location: San Diego, CA
Number: S9033-06-20

GRAIN SIZE COPY 3 S9033-06-20 SR 76 EAST.GPJ US LAB.GDT 12/10/09

GEOCON
INLAND EMPIRE

41571 CORNING PLACE SUITE 101 MURRIETA CA 92562 (951) 304-2300

CHLORIDE CONTENT

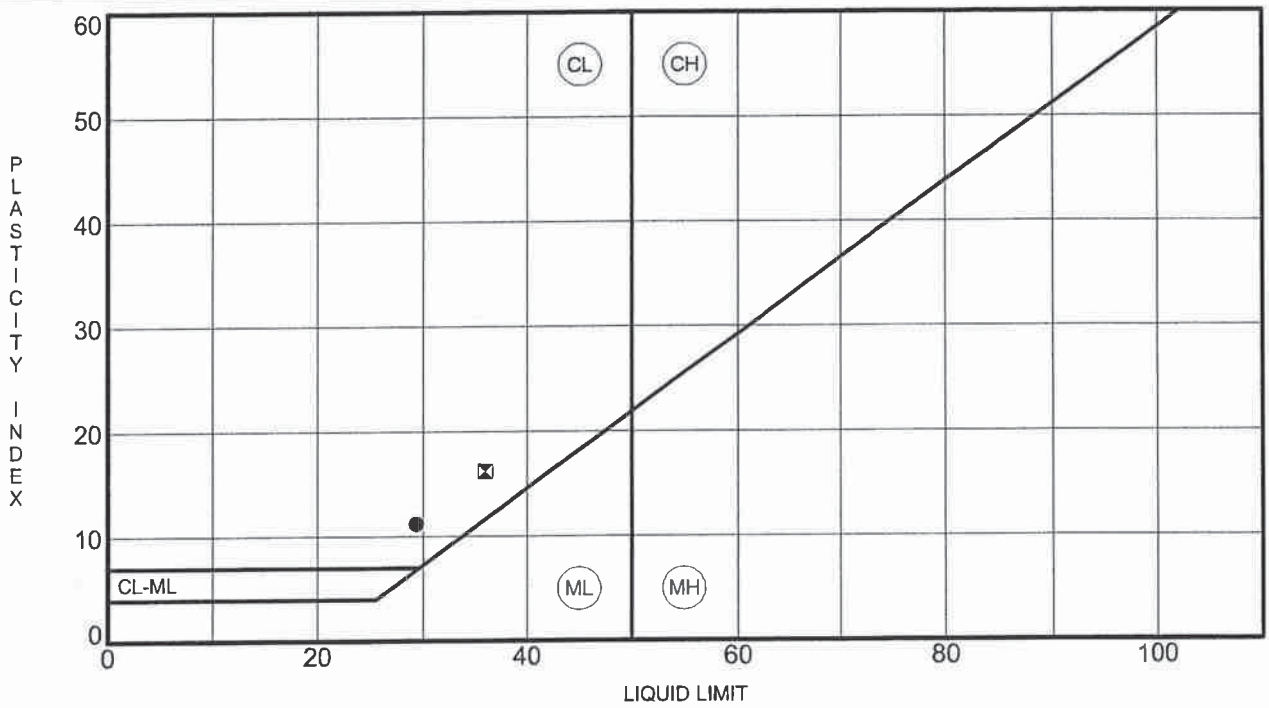
AASHTO T291-94

Project:	DOKKEN ENG (SR-76)
Number:	S9033-06-20
Date	12/4/2008
Tech:	JD

SILVER NITRATE SOLUTION 1ml = 0.5 mg Cl

SAMPLE NUMBER	BLANK	MOISTURE CONTENT	PH (6.0 TO 8.0)	SAMPLE WT.	TITRATION start	end	AgNO4
A-09-402	0.3	3.1	OK	30.00	1	1.8	0.8
A-09-403	0.3	4	OK	30.00	15.8	18.2	2.4
							0
							0
							0
							0
							0
							0
							0

SAMPLE NUMER	PPM	%CHLORIDE
A-09-402	26	0.003
A-09-403	109	0.011



	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description
●	**A-09-402 bulk**	**29**	**18**	**11**	**50**	**SANDY LEAN CLAY (CL)**
⊠	**A-09-403-6'**	**36**	**20**	**16**		**LEAN CLAY (CL)**

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ATTERBERG LIMITS

Project: SR 76 East
Location: San Diego, CA
Number: S9033-06-20

PI COPY 3 (NO FIGURE) S9033-06-20 SR 76 EAST.GPJ US LAB.GDT 12/10/09

GEOCON

INLAND EMPIRE

SULFATE CONTENT

Project Name: DOKKEN ENGINEERING (SR 76)
Project Number: S9033-06-20
Date: 12/4/2008
Technician: JD

Sample No.	A-09-402
Dilution	1
Time (minutes)	
0:30	0
1:00	1.9
1:30	1.8
2:00	4.4
0.001%	

Sample No.	A-09-403
Dilution	1
Time (minutes)	
0:30	7.9
1:00	4.5
1:30	0
2:00	24.8
0.006%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

Sample No.	
Dilution	
Time (minutes)	
0:30	
1:00	
1:30	
2:00	
0.000%	

GEOCON

INLAND EMPIRE

41571 Corning Place, Suite 101 * Murrirta, CA 92562-7605

PROJECT NAME	DOKKEN ENG (SR-76)
PROJECT NUMBER	S9033-06-20
DATE	12/3/2008
TECHNICIAN	PJ
SAMPLE NUMBER	A-09-402 bulk

CORROSIVITY TEST DATA

LARGE BOX

MOISTURE ADDED			RESISTIVITY OHMS MULT BY		OHMS	RESISTIVITY	
100			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
						n/a	

MINIMUM RESISTIVITY (OHM CM) : **0**

PH:

SMALL BOX

RESISTIVITY MOISTURE ADDED			OHMS MULT BY		OHMS	RESISTIVITY	
16ml			8.3		1000	8300	
10ml			4.8		1000	4800	
10ml			3.1		1000	3100	
10ml			2.8		1000	2800	
10ml			2.8		1000	2800	
10ml			2.9		1000	2900	

MINIMUM RESISTIVITY (OHM CM): **2800**

PH: **8.3**

GEOCON

INLAND EMPIRE

41571 Corning Place, Suite 101 * Murrirta, CA 92562-7605

PROJECT NAME	DOKKEN ENG (SR-76)
PROJECT NUMBER	S9033-06-20
DATE	12/3/2008
TECHNICIAN	PJ
SAMPLE NUMBER	A-09-403 -6'

CORROSIVITY TEST DATA

LARGE BOX

MOISTURE ADDED			RESISTIVITY OHMS MULT BY		OHMS	RESISTIVITY	
100			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
50			100			n/a	
						n/a	

MINIMUM RESISTIVITY (OHM CM) : **0**

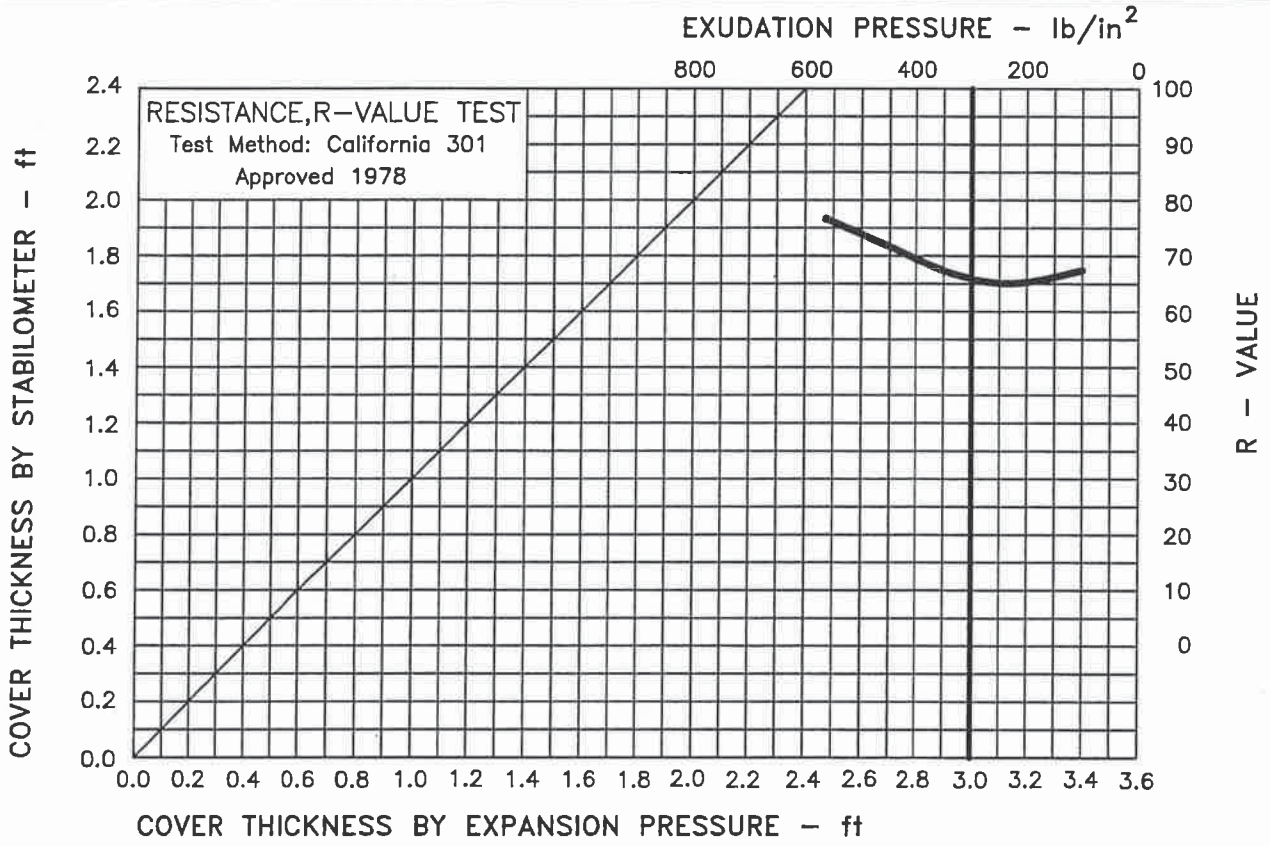
PH:

SMALL BOX

RESISTIVITY MOISTURE ADDED			OHMS MULT BY		OHMS	RESISTIVITY	
16ml			5.9		1000	5900	
8ml			2.7		1000	2700	
8ml			1.8		1000	1800	
8ml			1.3		1000	1300	
8ml			1.2		1000	1200	
8ml			1.2		1000	1200	
8ml			1.2		1000	1200	

MINIMUM RESISTIVITY (OHM CM): **1200**

PH: **8.2**



SPECIMEN	M	N	O
EXUDATION PRESSURE, lb/in²	100	240	460
EXPANSION DIAL (.0001")	2	5	11
EXPANSION PRESSURE, lb/ft²	7	22	48
RESISTANCE VALUE, R	67	65	72
% MOISTURE AT TEST	10.9	10.4	9.9
DRY DENSITY AT TEST, lb/ft³	120.1	122.1	122.5
R VALUE AT 300 lb/in² EXUDATION PRESSURE		67	
R VALUE BY EXPANSION PRESSURE (TI = 5.0)		70	

SAMPLE LOCATION: A–09–109, 1–5'

SAMPLE DESCRIPTION: Dark Gray Silty SAND

DATE SAMPLED: Unknown

GEOCON
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3160 GOLD VALLEY DRIVE - SUITE 800 - RANCHO CORDOVA - CALIFORNIA - 95742
PHONE 916 852-9118 - FAX 916 852-9132

SR-76 East

DOKKEN ENGINEERING

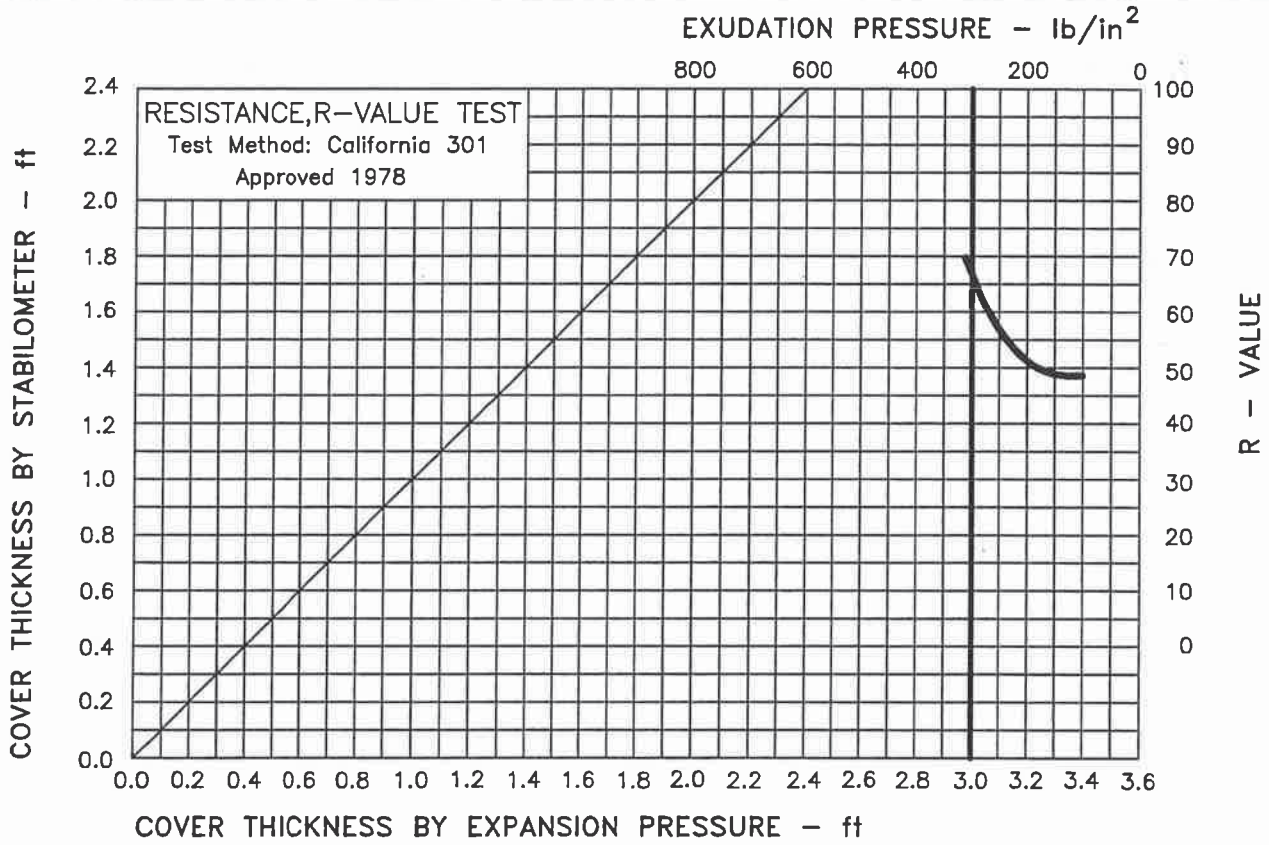
GEOCON PROJECT NO: S9033-06-20

NO SCALE

R-VALUE TEST RESULT

December 2008

FIGURE



SPECIMEN	J	K	L
EXUDATION PRESSURE, lb/in²	100	150	300
EXPANSION DIAL (.0001")	0	0	3
EXPANSION PRESSURE, lb/ft²	0	0	13
RESISTANCE VALUE, R	49	49	67
% MOISTURE AT TEST	10.8	9.8	8.8
DRY DENSITY AT TEST, lb/ft³	125.2	123.5	126.6
R VALUE AT 300 lb/in² EXUDATION PRESSURE			67
R VALUE BY EXPANSION PRESSURE (TI = 5.0)			80

SAMPLE LOCATION: A–09–303, 1–5'

SAMPLE DESCRIPTION: Dark Gray Silty SAND

DATE SAMPLED: Unknown

GEOCON
CONSULTANTS, INC
3160 GOLD VALLEY DRIVE - SUITE 800 - RANCHO CORDOVA - CALIFORNIA - 95742
PHONE 916 852-9118 - FAX 916 852-9132

SR-76 East

DOKKEN ENGINEERING

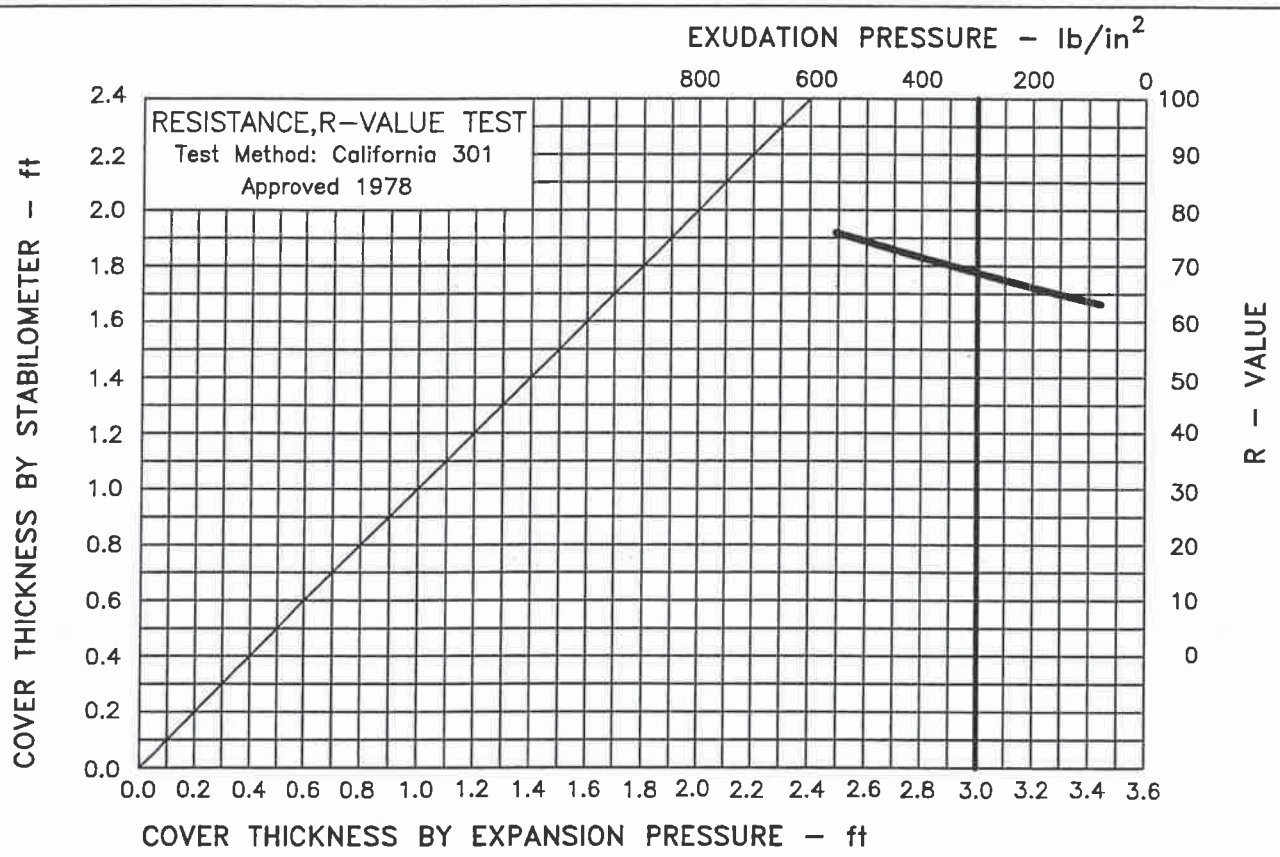
GEOCON PROJECT NO: S9033-06-20

NO SCALE

R-VALUE TEST RESULT

December 2008

FIGURE



SPECIMEN	A	B	C
EXUDATION PRESSURE, lb/in²	80	150	420
EXPANSION DIAL (.0001")	0	0	0
EXPANSION PRESSURE, lb/ft²	0	0	0
RESISTANCE VALUE, R	63	65	72
% MOISTURE AT TEST	12.5	11.5	10.5
DRY DENSITY AT TEST, lb/ft³	120.4	121.7	121.8
R VALUE AT 300 lb/in² EXUDATION PRESSURE		69	
R VALUE BY EXPANSION PRESSURE (TI = 5.0)			

SAMPLE LOCATION: A–09–307, 1–5'

SAMPLE DESCRIPTION: Dark Gray Silty SAND

DATE SAMPLED: Unknown

GEOCON
CONSULTANTS, INC
3160 GOLD VALLEY DRIVE - SUITE 800 - RANCHO CORDOVA - CALIFORNIA - 95742
PHONE 916 852-9118 - FAX 916 852-9132

SR-76 East

DOKKEN ENGINEERING

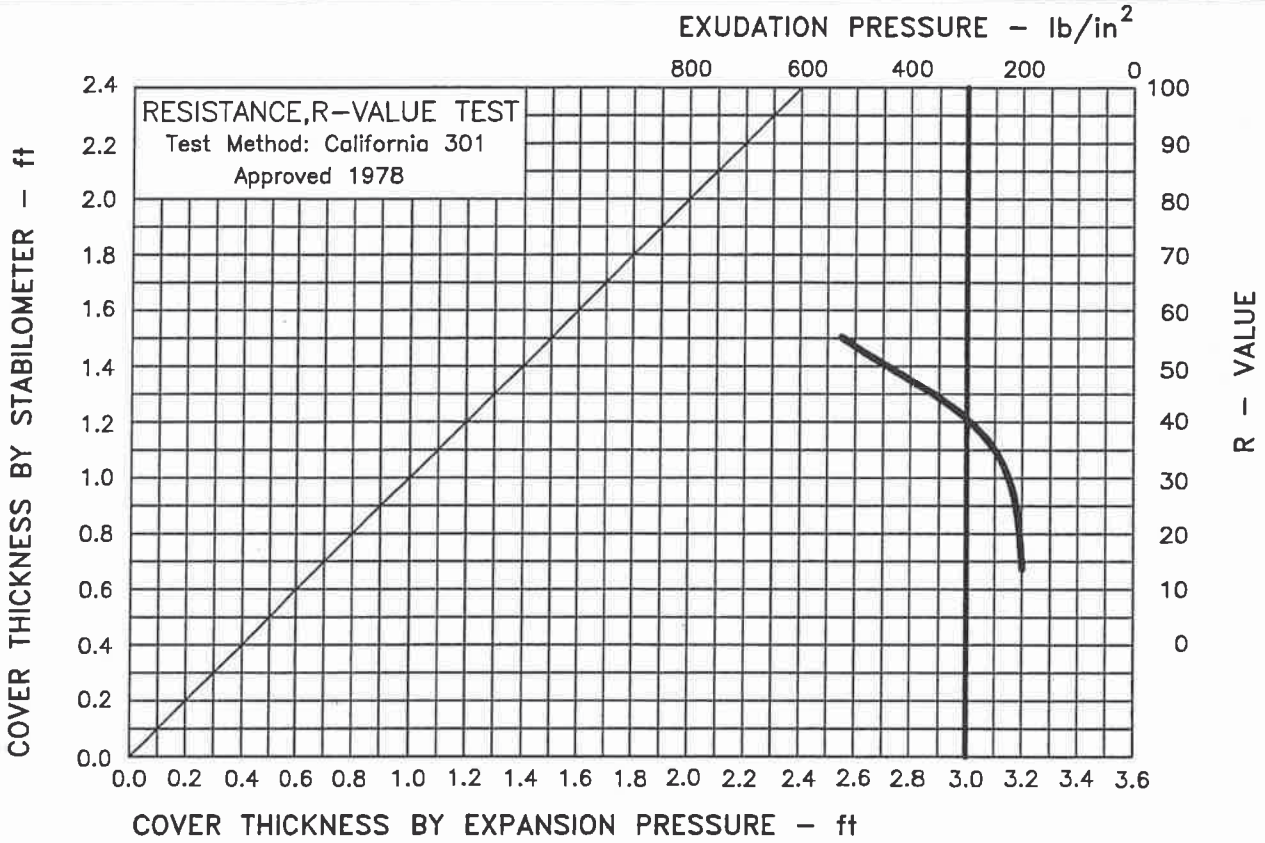
GEOCON PROJECT NO: S9033-06-20

NO SCALE

R-VALUE TEST RESULT

December 2008

FIGURE



SPECIMEN	G	H	I
EXUDATION PRESSURE, lb/in²	200	240	500
EXPANSION DIAL (.0001")	22	23	53
EXPANSION PRESSURE, lb/ft²	95	100	229
RESISTANCE VALUE, R	14	33	54
% MOISTURE AT TEST	14.3	13.3	12.3
DRY DENSITY AT TEST, lb/ft³	114.6	118.9	121.5
R VALUE AT 300 lb/in² EXUDATION PRESSURE		41	
R VALUE BY EXPANSION PRESSURE (TI = 5.0)		38	

SAMPLE LOCATION: A–09–402, 1–5'

SAMPLE DESCRIPTION: Brown Silty SAND

DATE SAMPLED: Unknown

GEOCON
CONSULTANTS, INC
3160 GOLD VALLEY DRIVE - SUITE 800 - RANCHO CORDOVA - CALIFORNIA - 95742
PHONE 916 852-9118 - FAX 916 852-9132

SR-76 East

DOKKEN ENGINEERING

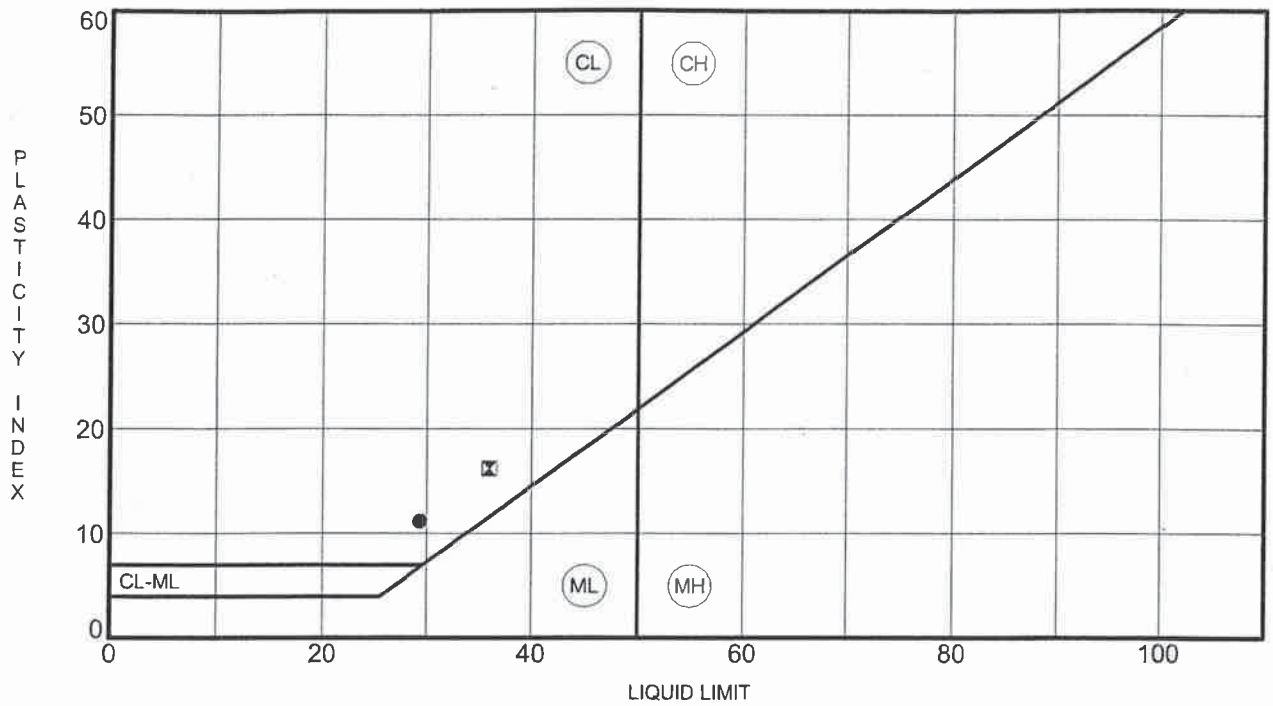
GEOCON PROJECT NO: S9033-06-20

NO SCALE

R-VALUE TEST RESULT

December 2008

FIGURE



	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description
●	**A-09-402 bulk**	**29**	**18**	**11**	**50**	**SANDY LEAN CLAY (CL)**
⊠	**A-09-403-6'**	**36**	**20**	**16**		**LEAN CLAY (CL)**

GEOCON

Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742
Telephone: (916) 852-9118
Fax: (916) 852-9132

ATTERBERG LIMITS

Project: SR 76 East
Location: San Diego, CA
Number: S9033-06-20

PI COPY 3 (NO FIGURE) S9033-06-20 SR 76 EAST.GPJ US LAB.GDT 12/10/09

APPENDIX IV
ANALYSES AND CALCULATION

APPENDIX

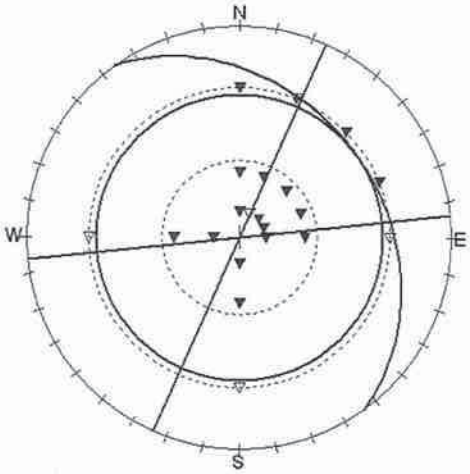
SLOPE STABILTIY ANALYSES

Geotechnical Design Report; Phase 1 SR76/15 Interchange;
EA 11-257151; 1100020489

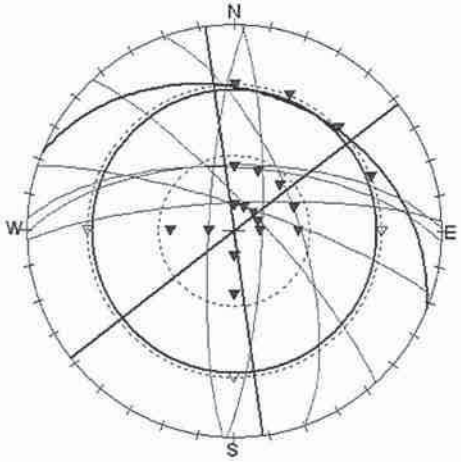
KINEMATIC ANALYSIS (MARKLANDS METHOD) STEREONET PLOT OF DIP VECTORS AND GREAT CIRCLES

PROPOSED 1.5:1 CUT SLOPES DISCONTINUTIES IN GRANTIC ROCK

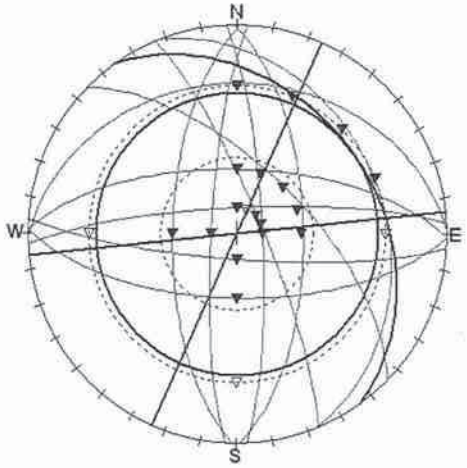
GENERALIZED CASE



Generalized Dip Vector Plot Cut Slopes

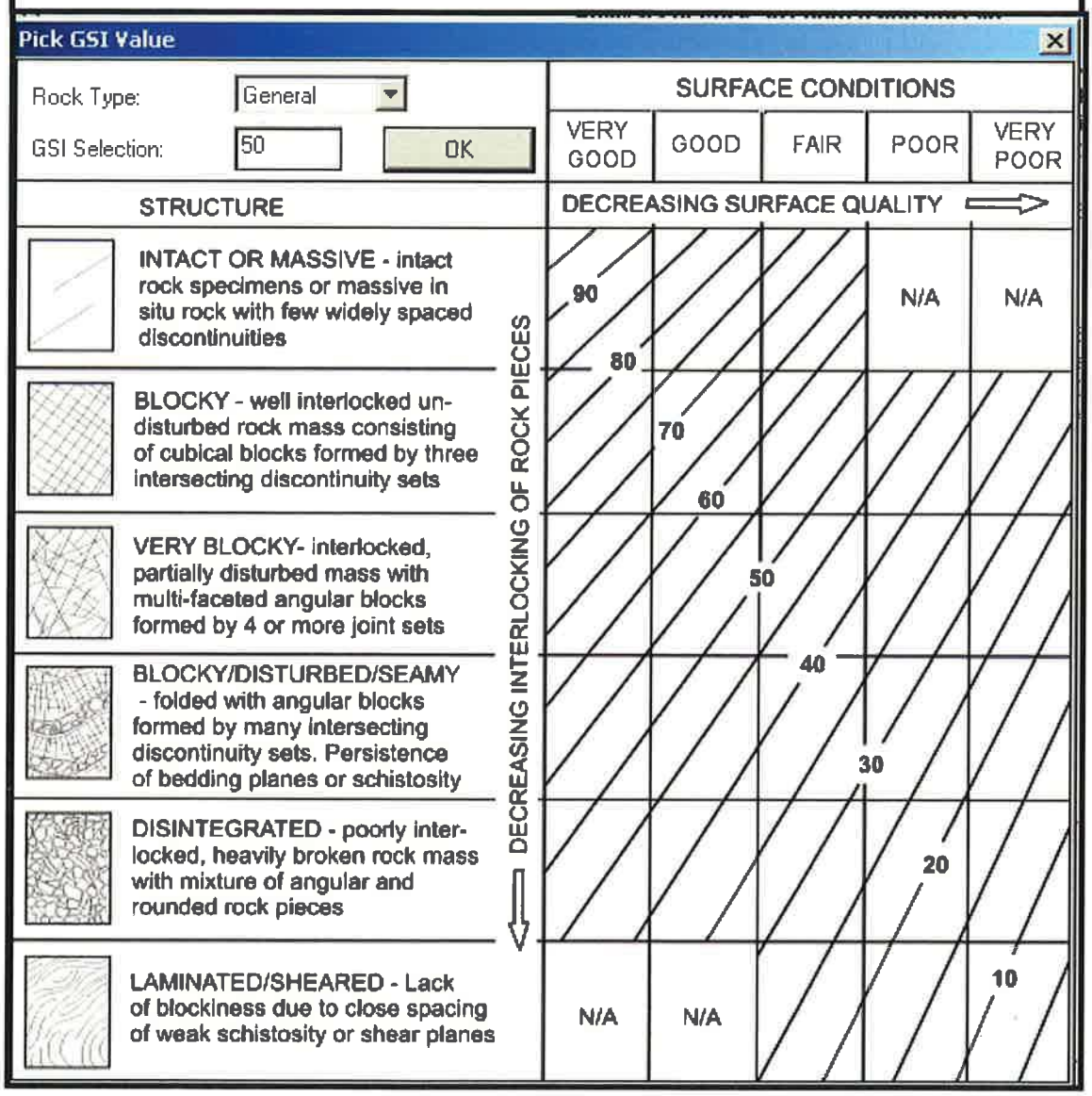


Generalized Dip Vector & Great Circle Plots

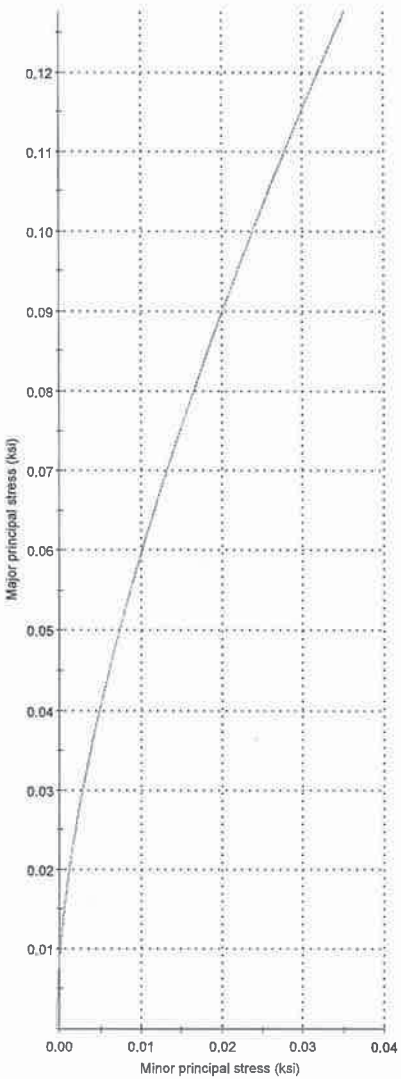


Generalized Dip Vector Plot Cut Slopes

Figure XX: Geologic Strength Index (GSI) after RocLab.



Analysis of Rock Strength using RocLab

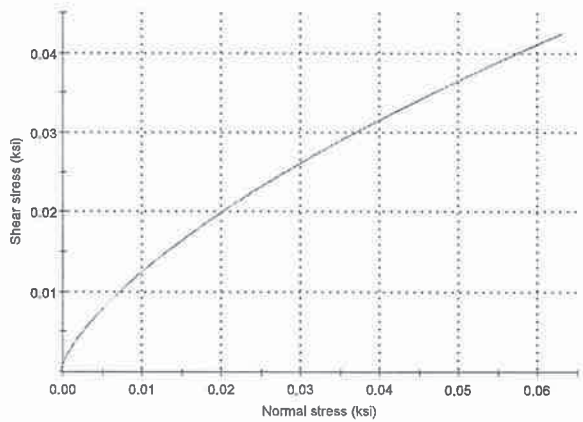


Hoek-Brown Classification
intact uniaxial comp. strength (sigci) = 0.145 ksi
GSI = 50 mi = 10 Disturbance factor (D) = 0
intact modulus (Ei) = 1600 ksi

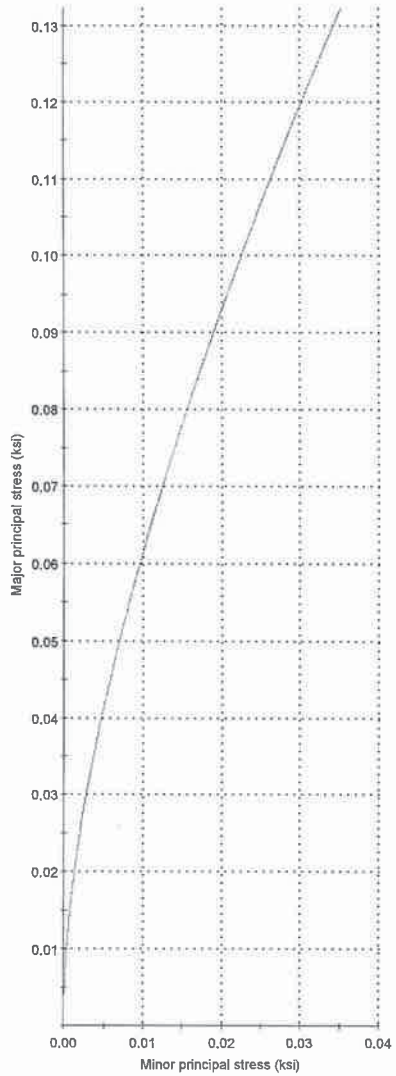
Hoek-Brown Criterion
mb = 1.677 s = 0.0039 a = 0.506

Mohr-Coulomb Fit
cohesion = 0.007 ksi friction angle = 30.77 deg

Rock Mass Parameters
tensile strength = -0.000334 ksi
uniaxial compressive strength = 0.009 ksi
global strength = 0.025 ksi
deformation modulus = 491.50 ksi



Analysis of Rock Strength using RocLab



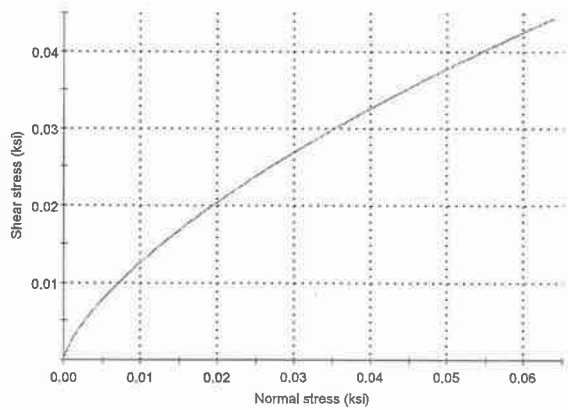
Hoek-Brown Classification
intact uniaxial comp. strength (sigci) = 0.145 ksi
GSI = 50 mi = 29 Disturbance factor (D) = 0.7
intact modulus (Ei) = 1600 ksi

Hoek-Brown Criterion
mb = 1.859 s = 0.0007 a = 0.506

Mohr-Coulomb Fit
cohesion = 0.007 ksi friction angle = 31.69 deg

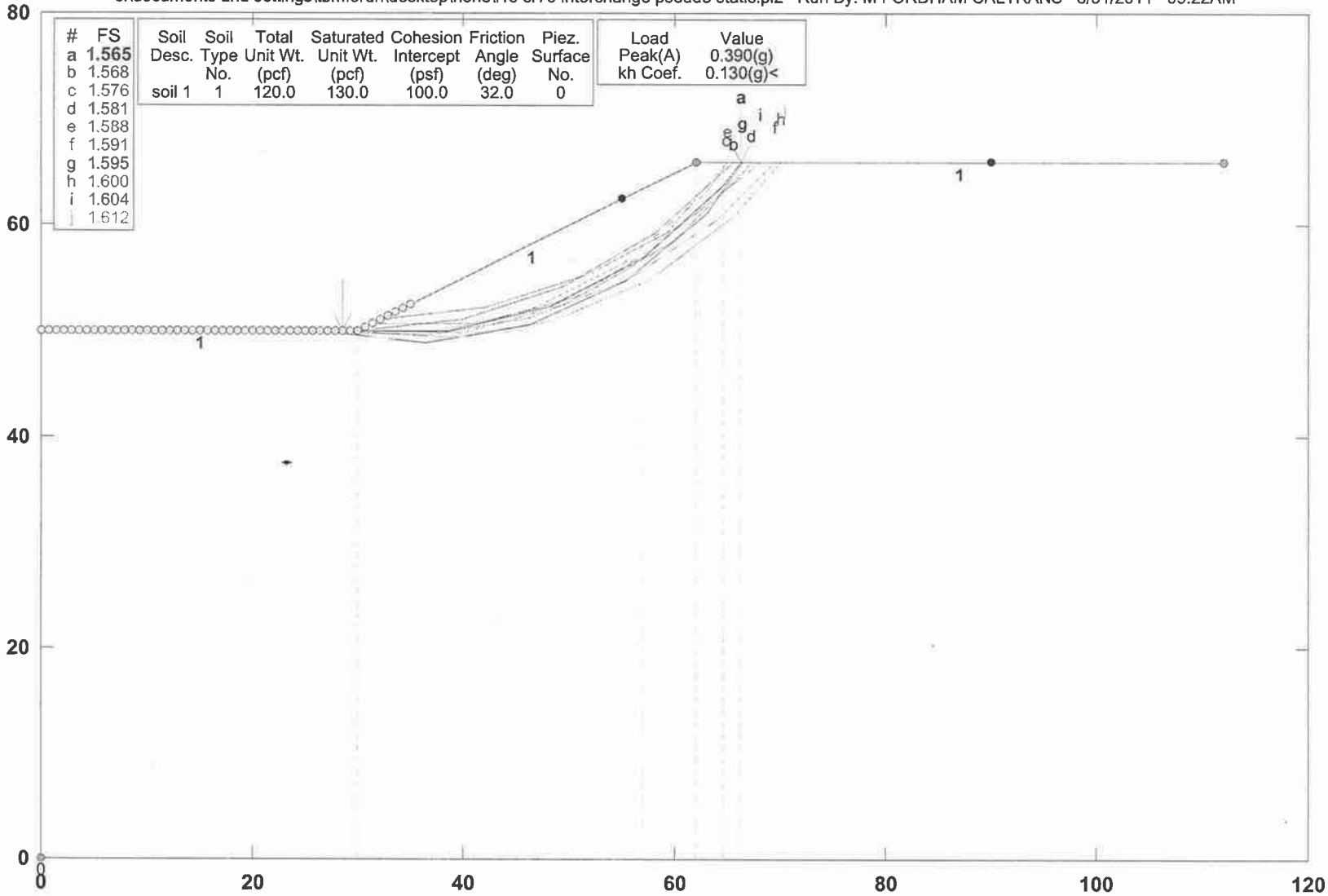
Rock Mass Parameters
tensile strength = -5.56e-5 ksi
uniaxial compressive strength = 0.004 ksi
global strength = 0.026 ksi
deformation modulus = 171.65 ksi

C= 1000 PSF (7 PSI)



I-15/SR-76 Interchange Pseudo Static 16ft 2:1 Permanent cut slope in alluvium

c:\documents and settings\tbmfordh\desktop\none\i15 sr75 interchange pseudo static.pl2 Run By: M FORDHAM CALTRANS 8/31/2011 09:22AM



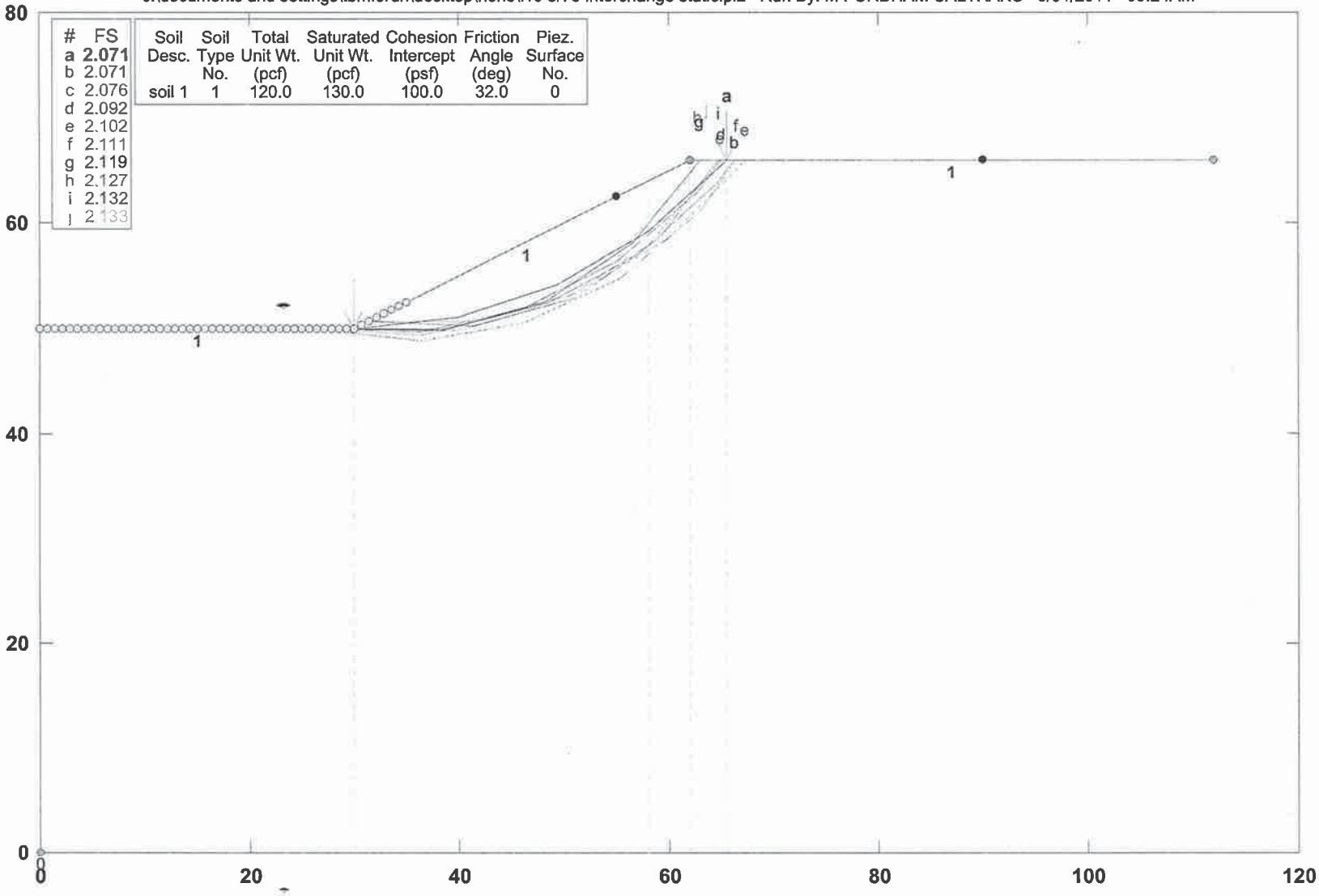
GSTABL7 v.2 FSmin=1.565

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

I-15/SR-76 Interchange 16ft 2:1 Permanent cut slope in alluvium

c:\documents and settings\tbmfordh\desktop\none\i15 sr75 interchange static.pl2 Run By: M FORDHAM CALTRANS 8/31/2011 09:24AM



GSTABL7 v.2 FSmin=2.071

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

```
                    ***  GSTABL7  ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
             (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
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    Time of Run:              09:24AM
    Run By:                   M FORDHAM CALTRANS
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erchange static.in
    Output Filename:          C:\Documents and Settings\tbmfordh\Desktop\none\i15 sr75 int
erchange static.OUT
    Unit System:              English
    Plotted Output Filename:  C:\Documents and Settings\tbmfordh\Desktop\none\i15 sr75 int
erchange static.PLT
    PROBLEM DESCRIPTION:  I-15/SR-76 Interchange
                          16ft 2:1 Permanent cut slope in alluvium
    BOUNDARY COORDINATES
        3 Top   Boundaries
```

4 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	50.00	30.00	50.00	1
2	30.00	50.00	62.00	66.00	1
3	62.00	66.00	112.00	66.00	1
4	0.00	0.00	0.00	0.00	0

Default Y-Origin = 0.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	120.0	130.0	100.0	32.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
1500 Trial Surfaces Have Been Generated.
30 Surface(s) Initiate(s) From Each Of 50 Points Equally Spaced
Along The Ground Surface Between X = 0.00(ft)
and X = 35.00(ft)
Each Surface Terminates Between X = 55.00(ft)
and X = 90.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)
10.00(ft) Line Segments Define Each Trial Failure Surface.
Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -25.0
And 25.0 deg.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 1500
Number of Trial Surfaces With Valid FS = 1500
Statistical Data On All Valid FS Values:
FS Max = 6.429 FS Min = 2.071 FS Ave = 2.832
Standard Deviation = 0.375 Coefficient of Variation = 13.23 %
Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.000	50.000
2	39.938	51.111
3	49.436	54.239
4	58.089	59.252
5	65.527	65.936
6	65.574	66.000

Circle Center At X = 29.630 ; Y = 98.370 ; and Radius = 48.372
Factor of Safety
*** 2.071 ***
Individual data on the 6 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.9	2300.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	9.5	5321.1	0.0	0.0	0.	0.	0.0	0.0	0.0
3	8.7	5332.4	0.0	0.0	0.	0.	0.0	0.0	0.0
4	3.9	1883.4	0.0	0.0	0.	0.	0.0	0.0	0.0
5	3.5	698.0	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.0	0.2	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	28.571	50.000
2	38.571	49.971
3	48.282	52.360
4	57.127	57.026
5	64.581	63.691

```
     6          66.151        66.000
Circle Center At X =    33.794 ; Y =    89.864 ; and Radius =    40.205
       Factor of Safety
      ***    2.071   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         30.000       50.000
    2         39.998       49.822
    3         49.622       52.541
    4         58.050       57.923
    5         64.564       65.511
    6         64.780       66.000
Circle Center At X =    35.629 ; Y =    83.564 ; and Radius =    34.033
       Factor of Safety
      ***    2.076   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         26.429       50.000
    2         36.425       49.723
    3         46.188       51.885
    4         55.132       56.358
    5         62.720       62.871
    6         64.934       66.000
Circle Center At X =    32.641 ; Y =    89.383 ; and Radius =    39.870
       Factor of Safety
      ***    2.092   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         31.429       50.714
    2         41.429       50.737
    3         51.084       53.341
    4         59.739       58.350
    5         66.806       65.424
    6         67.139       66.000
Circle Center At X =    36.383 ; Y =    88.497 ; and Radius =    38.106
       Factor of Safety
      ***    2.102   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         26.429       50.000
    2         36.371       48.926
    3         46.242       50.523
    4         55.339       54.678
    5         63.010       61.092
    6         66.414       66.000
Circle Center At X =    35.404 ; Y =    85.534 ; and Radius =    36.650
       Factor of Safety
      ***    2.111   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         28.571       50.000
    2         38.569       49.774
    3         48.175       52.552
    4         56.509       58.078
    5         62.807       65.847
    6         62.868       66.000
Circle Center At X =    34.316 ; Y =    82.443 ; and Radius =    32.948
       Factor of Safety
      ***    2.119   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         26.429       50.000
    2         36.415       49.480
    3         46.141       51.804
```

Bishop Modified Typical Granitic Cut 1.5:1 No Seismic

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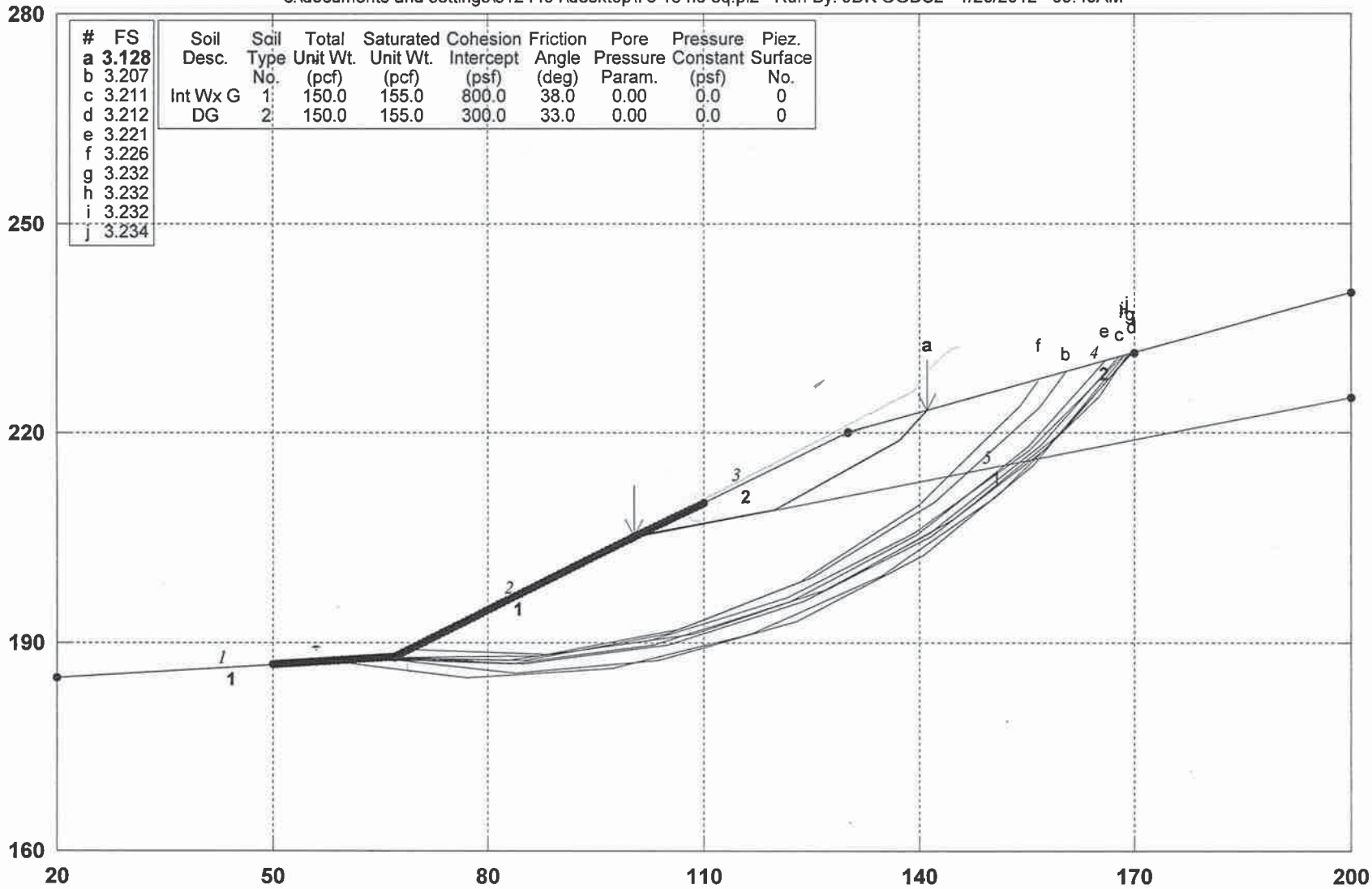

#	FS
a	**3.128**
b	3.207
c	3.211
d	3.212
e	3.221
f	3.226
g	3.232
h	3.232
i	3.232
j	3.234

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Int Wx G	1	150.0	155.0	800.0	38.0	0.00	0.0	0
DG	2	150.0	155.0	300.0	33.0	0.00	0.0	0

GSTABL7 v.2 FSmin=3.128

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

```
                    ***  GSTABL7  ***
            ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
            (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
        Modified Bishop, Simplified Janbu, or GLE Method of Slices.
        (Includes Spencer & Morgenstern-Price Type Analysis)
        Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
        Nonlinear Undrained Shear Strength, Curved Phi Envelope,
        Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
        Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
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   Time of Run:              09:22AM
   Run By:                   M FORDHAM CALTRANS
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erchange pseudo static.in
   Output Filename:          C:\Documents and Settings\tbmfordh\Desktop\none\i15 sr75 int
erchange pseudo static.OUT
   Unit System:              English
   Plotted Output Filename:  C:\Documents and Settings\tbmfordh\Desktop\none\i15 sr75 int
erchange pseudo static.PLT
   PROBLEM DESCRIPTION:  I-15/SR-76 Interchange Pseudo Static
                         16ft 2:1 Permanent cut slope in alluvium
   BOUNDARY COORDINATES
       3 Top   Boundaries
       4 Total Boundaries
   Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
      No.        (ft)       (ft)       (ft)       (ft)     Below Bnd
       1         0.00      50.00      30.00      50.00        1
       2        30.00      50.00      62.00      66.00        1
       3        62.00      66.00     112.00      66.00        1
       4         0.00       0.00       0.00       0.00        0
   Default Y-Origin = 0.00(ft)
   Default X-Plus Value = 0.00(ft)
   Default Y-Plus Value = 0.00(ft)
  ISOTROPIC SOIL PARAMETERS
    1 Type(s) of Soil
   Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
   Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
    No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
     1   120.0    130.0     100.0     32.0    0.00       0.0      0
   Specified Peak Ground Acceleration Coefficient (A) =   0.390(g)
   Specified Horizontal Earthquake Coefficient (kh) =   0.130(g)
   Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
   Specified Seismic Pore-Pressure Factor =   0.000
   A Critical Failure Surface Searching Method, Using A Random
   Technique For Generating Circular Surfaces, Has Been Specified.
   1500 Trial Surfaces Have Been Generated.
     30 Surface(s) Initiate(s) From Each Of    50 Points Equally Spaced
   Along The Ground Surface Between  X =   0.00(ft)
                                  and  X =  35.00(ft)
   Each Surface Terminates Between   X =  55.00(ft)
                                 and   X =  90.00(ft)
   Unless Further Limitations Were Imposed, The Minimum Elevation
   At Which A Surface Extends Is  Y =      0.00(ft)
   10.00(ft) Line Segments Define Each Trial Failure Surface.
   Restrictions Have Been Imposed Upon The Angle Of Initiation.
   The Angle Has Been Restricted Between The Angles Of -25.0
   And  25.0 deg.
   Following Are Displayed The Ten Most Critical Of The Trial
         Failure Surfaces Evaluated. They Are
         Ordered - Most Critical First.
         * * Safety Factors Are Calculated By The Modified Bishop Method * *
         Total Number of Trial Surfaces Attempted =  1500
         Number of Trial Surfaces With Valid FS = 1500
         Statistical Data On All Valid FS Values:
            FS Max =   5.004   FS Min =   1.565   FS Ave =   1.991
            Standard Deviation =    0.220   Coefficient of Variation =   11.04 %
```

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	28.571	50.000
2	38.571	49.971
3	48.282	52.360
4	57.127	57.026
5	64.581	63.691
6	66.151	66.000

Circle Center At X = 33.794 ; Y = 89.864 ; and Radius = 40.205

Factor of Safety

*** 1.565 ***

Individual data on the 7 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.4	0.4	0.0	0.0	0.	0.	0.0	0.0	0.0
2	8.6	2221.1	0.0	0.0	0.	0.	288.7	0.0	0.0
3	9.7	6464.4	0.0	0.0	0.	0.	840.4	0.0	0.0
4	8.8	7067.7	0.0	0.0	0.	0.	918.8	0.0	0.0
5	4.9	3261.4	0.0	0.0	0.	0.	424.0	0.0	0.0
6	2.6	1072.5	0.0	0.0	0.	0.	139.4	0.0	0.0
7	1.6	217.4	0.0	0.0	0.	0.	28.3	0.0	0.0

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.000	50.000
2	39.938	51.111
3	49.436	54.239
4	58.089	59.252
5	65.527	65.936
6	65.574	66.000

Circle Center At X = 29.630 ; Y = 98.370 ; and Radius = 48.372

Factor of Safety

*** 1.568 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.000	50.000
2	39.998	49.822
3	49.622	52.541
4	58.050	57.923
5	64.564	65.511
6	64.780	66.000

Circle Center At X = 35.629 ; Y = 83.564 ; and Radius = 34.033

Factor of Safety

*** 1.576 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	31.429	50.714
2	41.429	50.737
3	51.084	53.341
4	59.739	58.350
5	66.806	65.424
6	67.139	66.000

Circle Center At X = 36.383 ; Y = 88.497 ; and Radius = 38.106

Factor of Safety

*** 1.581 ***

Failure Surface Specified By 6 Coordinate Points

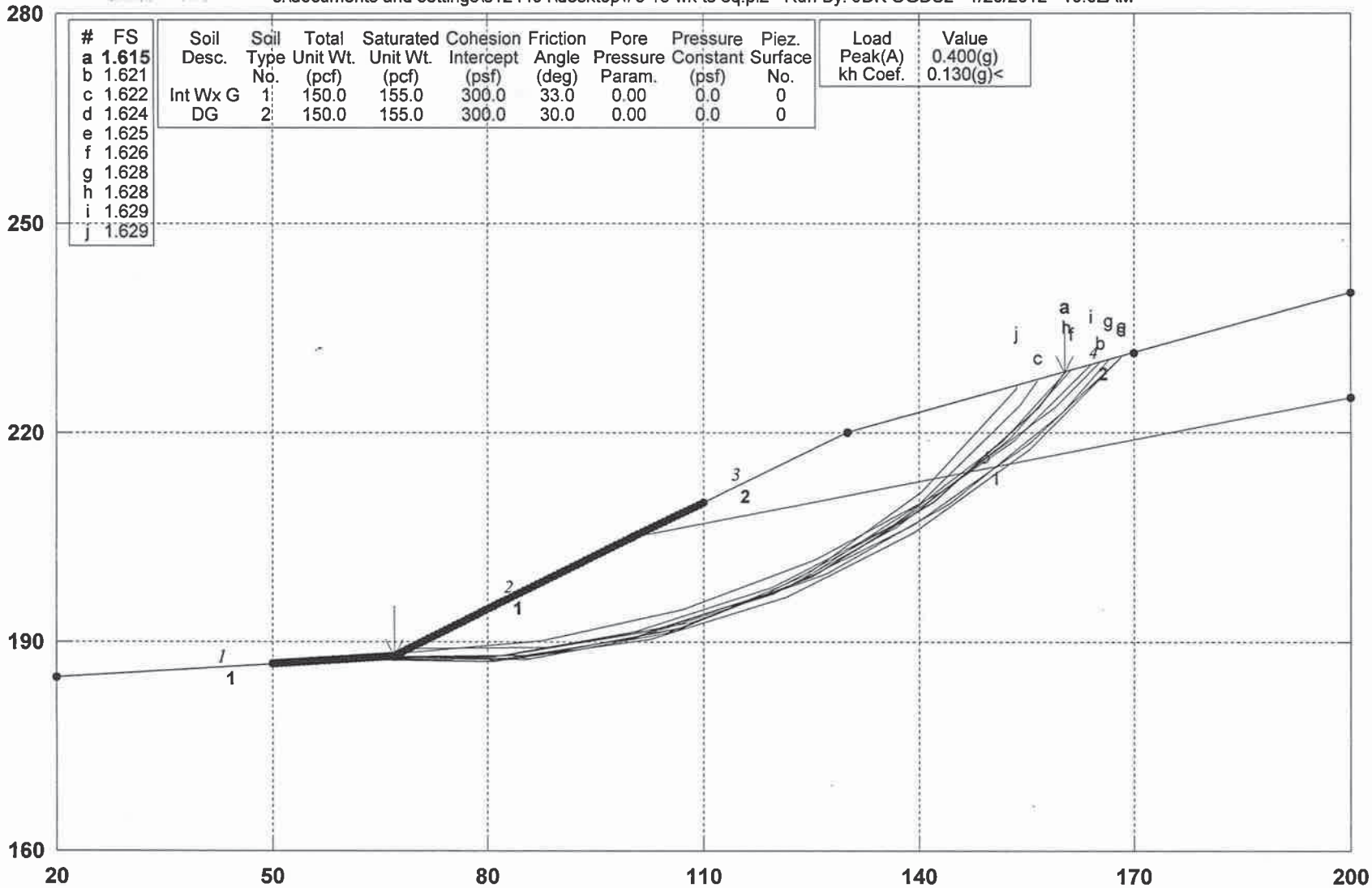
Point No.	X-Surf (ft)	Y-Surf (ft)
1	26.429	50.000
2	36.425	49.723
3	46.188	51.885
4	55.132	56.358
5	62.720	62.871
6	64.934	66.000

Circle Center At X = 32.641 ; Y = 89.383 ; and Radius = 39.870

```
       Factor of Safety
      ***    1.588   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1         26.429       50.000
    2         36.420       49.596
    3         46.280       51.265
    4         55.582       54.936
    5         63.924       60.450
    6         69.399       66.000
Circle Center At X =    33.401 ; Y =    96.976 ; and Radius =    47.491
       Factor of Safety
      ***    1.591   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1         26.429       50.000
    2         36.371       48.926
    3         46.242       50.523
    4         55.339       54.678
    5         63.010       61.092
    6         66.414       66.000
Circle Center At X =    35.404 ; Y =    85.534 ; and Radius =    36.650
       Factor of Safety
      ***    1.595   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1         28.571       50.000
    2         38.550       49.353
    3         48.410       51.025
    4         57.618       54.925
    5         65.679       60.843
    6         70.066       66.000
Circle Center At X =    36.368 ; Y =    91.587 ; and Radius =    42.311
       Factor of Safety
      ***    1.600   ***
Failure Surface Specified By  5 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1         32.143       51.071
    2         42.071       52.270
    3         51.611       55.268
    4         60.440       59.964
    5         68.009       66.000
Circle Center At X =    30.626 ; Y =   105.367 ; and Radius =    54.316
       Factor of Safety
      ***    1.604   ***
Failure Surface Specified By  7 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1         25.714       50.000
    2         35.657       48.932
    3         45.588       50.110
    4         55.005       53.474
    5         63.434       58.854
    6         70.451       65.979
    7         70.463       66.000
Circle Center At X =    35.410 ; Y =    93.467 ; and Radius =    44.536
       Factor of Safety
      ***    1.612   ***
          **** END OF GSTABL7 OUTPUT ****
```

Bishop Modified Typical Granitic Cut 1.5:1 Seismic weak

c:\documents and settings\s124494\desktop\76 15 wk ts eq.pl2 Run By: JDK OGDS2 1/20/2012 10:02AM



GSTABL7 v.2 FSmin=1.615

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

```
                    ***  GSTABL7  ***
          ** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
   ** Original Version 1.0, January 1996; Current Ver. 2.005.2, Jan. 2011 **
              (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                   SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
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Analysis Run Date:        1/20/2012
Time of Run:              09:54AM
Run By:                   JDK OGDS2
Input Data Filename:      c:\Documents and Settings\s124494\Desktop\76 15 eq.
Output Filename:          c:\Documents and Settings\s124494\Desktop\76 15 eq.OUT
Unit System:              English
Plotted Output Filename:  c:\Documents and Settings\s124494\Desktop\76 15 eq.PLT
PROBLEM DESCRIPTION:  Bishop Modified Typical Granitic Cut
                      1.5:1 Seismic
BOUNDARY COORDINATES
    4 Top   Boundaries
    5 Total Boundaries
Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
   No.        (ft)       (ft)       (ft)       (ft)     Below Bnd
    1        20.00     185.00      67.00     188.00        1
    2        67.00     188.00     100.00     205.00        1
    3       100.00     205.00     130.00     220.00        2
    4       130.00     220.00     200.00     240.00        2
    5       100.00     205.00     200.00     225.00        1
User Specified Y-Origin =       160.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
 2 Type(s) of Soil
Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
 No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
  1   150.0    155.0     800.0     38.0    0.00       0.0      0
  2   150.0    155.0     300.0     33.0    0.00       0.0      0
Specified Peak Ground Acceleration Coefficient (A) =   0.400(g)
Specified Horizontal Earthquake Coefficient (kh) =   0.130(g)
Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
Specified Seismic Pore-Pressure Factor =   0.000
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
1000 Trial Surfaces Have Been Generated.
  10 Surface(s) Initiate(s) From Each Of   100 Points Equally Spaced
Along The Ground Surface Between  X =  50.00(ft)
                              and  X = 110.00(ft)
Each Surface Terminates Between   X = 130.00(ft)
                            and   X = 170.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =    100.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -35.0
And  59.0 deg.
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Modified Bishop Method * *
      Total Number of Trial Surfaces Attempted =  1000
      Number of Trial Surfaces With Valid FS = 1000
      Statistical Data On All Valid FS Values:
         FS Max =  89.834   FS Min =   2.322   FS Ave =   3.525
```

Standard Deviation = 3.804 Coefficient of Variation = 107.92 %

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	108.182	209.091
2	128.066	211.238
3	147.089	217.415
4	164.441	227.360
5	168.550	231.014

Circle Center At X = 107.761 ; Y = 306.145 ; and Radius = 97.055

Factor of Safety

*** 2.322 ***

Individual data on the 5 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	19.9	11625.2	0.0	0.0	0.	0.	1511.3	0.0	0.0
2	1.9	2310.0	0.0	0.0	0.	0.	300.3	0.0	0.0
3	17.1	19995.3	0.0	0.0	0.	0.	2599.4	0.0	0.0
4	17.4	12945.4	0.0	0.0	0.	0.	1682.9	0.0	0.0
5	4.1	764.2	0.0	0.0	0.	0.	99.3	0.0	0.0

Failure Surface Specified By 4 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.303	205.152
2	119.913	209.083
3	137.288	218.988
4	141.031	223.152

Circle Center At X = 98.763 ; Y = 263.713 ; and Radius = 58.582

Factor of Safety

*** 2.359 ***

Failure Surface Specified By 4 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	103.334	206.667
2	122.950	210.565
3	141.337	218.434
4	152.854	226.530

Circle Center At X = 95.320 ; Y = 298.307 ; and Radius = 91.990

Factor of Safety

*** 2.395 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	65.152	187.882
2	85.135	187.068
3	104.951	189.772
4	123.987	195.908
5	141.651	205.287
6	157.397	217.619
7	169.677	231.336

Circle Center At X = 79.747 ; Y = 300.550 ; and Radius = 113.609

Factor of Safety

*** 2.399 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	65.152	187.882
2	85.133	187.014
3	104.943	189.762
4	123.934	196.036
5	141.483	205.629
6	157.015	218.228
7	167.771	230.792

Circle Center At X = 79.917 ; Y = 297.401 ; and Radius = 110.510

Factor of Safety

```
      ***    2.402   ***
Failure Surface Specified By  4 Coordinate Points
  Point       X-Surf      Y-Surf
   No.         (ft)        (ft)
    1        108.182      209.091
    2        128.014      211.674
    3        146.589      219.089
    4        159.331      228.380
Circle Center At X =   108.174 ; Y =   286.570 ; and Radius =    77.479
       Factor of Safety
      ***    2.405   ***
Failure Surface Specified By  7 Coordinate Points
  Point       X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         68.788      188.921
    2         88.778      188.306
    3        108.553      191.300
    4        127.466      197.804
    5        144.900      207.605
    6        160.284      220.385
    7        169.374      231.250
Circle Center At X =    82.170 ; Y =   298.772 ; and Radius =   110.663
       Factor of Safety
      ***    2.410   ***
Failure Surface Specified By  7 Coordinate Points
  Point       X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         66.970      187.998
    2         86.969      188.144
    3        106.597      191.983
    4        125.177      199.384
    5        142.070      210.092
    6        156.692      223.737
    7        160.312      228.660
Circle Center At X =    76.188 ; Y =   295.347 ; and Radius =   107.744
       Factor of Safety
      ***    2.415   ***
Failure Surface Specified By  7 Coordinate Points
  Point       X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         63.333      187.766
    2         83.316      186.933
    3        103.125      189.692
    4        122.119      195.954
    5        139.685      205.516
    6        155.254      218.070
    7        165.735      230.210
Circle Center At X =    77.939 ; Y =   298.026 ; and Radius =   111.223
       Factor of Safety
      ***    2.415   ***
Failure Surface Specified By  7 Coordinate Points
  Point       X-Surf      Y-Surf
   No.         (ft)        (ft)
    1         68.788      188.921
    2         88.786      189.224
    3        108.443      192.909
    4        127.193      199.868
    5        144.495      209.902
    6        159.847      222.719
    7        166.377      230.393
Circle Center At X =    77.009 ; Y =   306.337 ; and Radius =   117.704
       Factor of Safety
      ***    2.419   ***
          **** END OF GSTABL7 OUTPUT ****
```

Bishop Modified Typical Granitic Cut 1.5:1 Seismic weak

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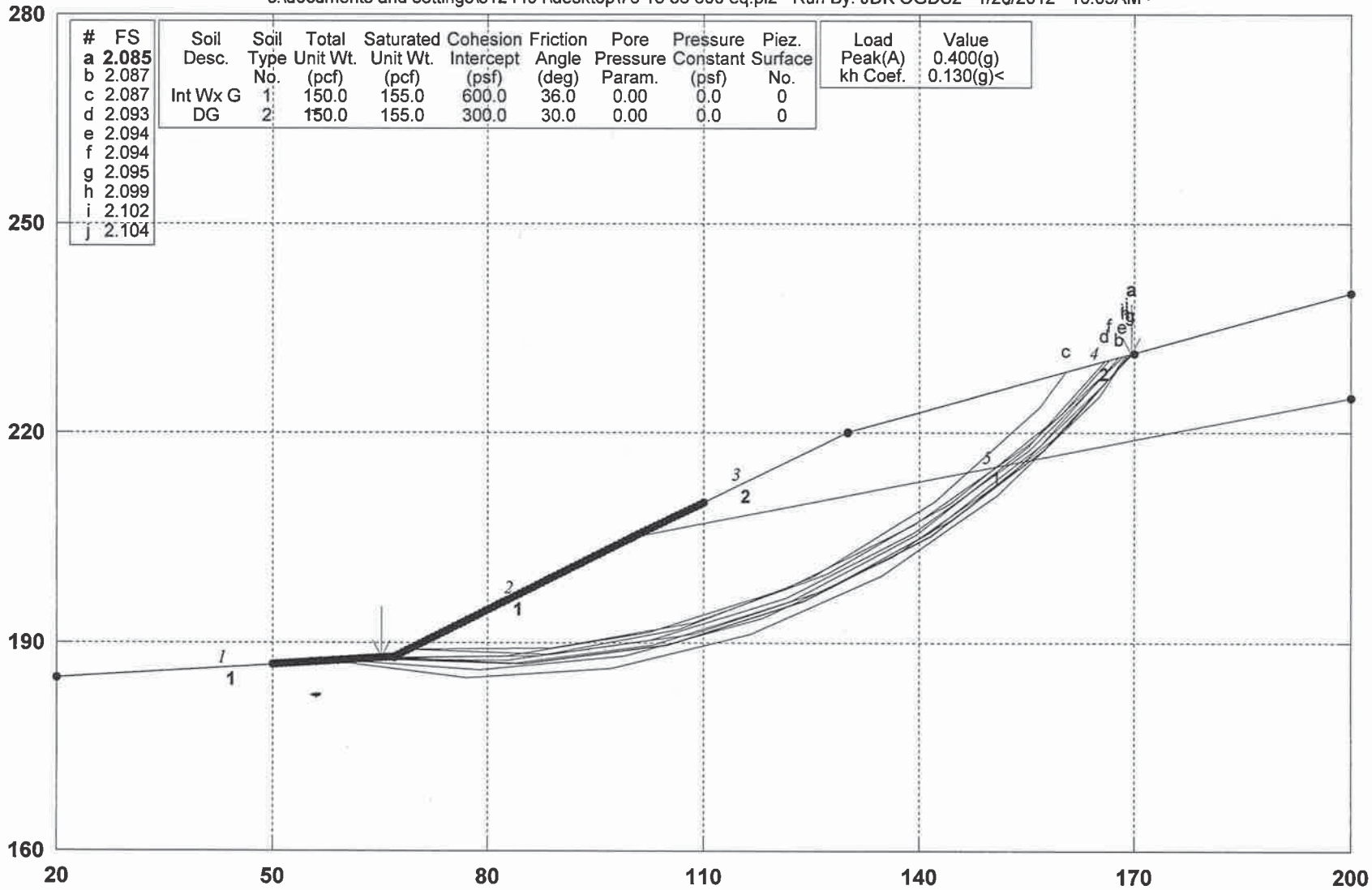


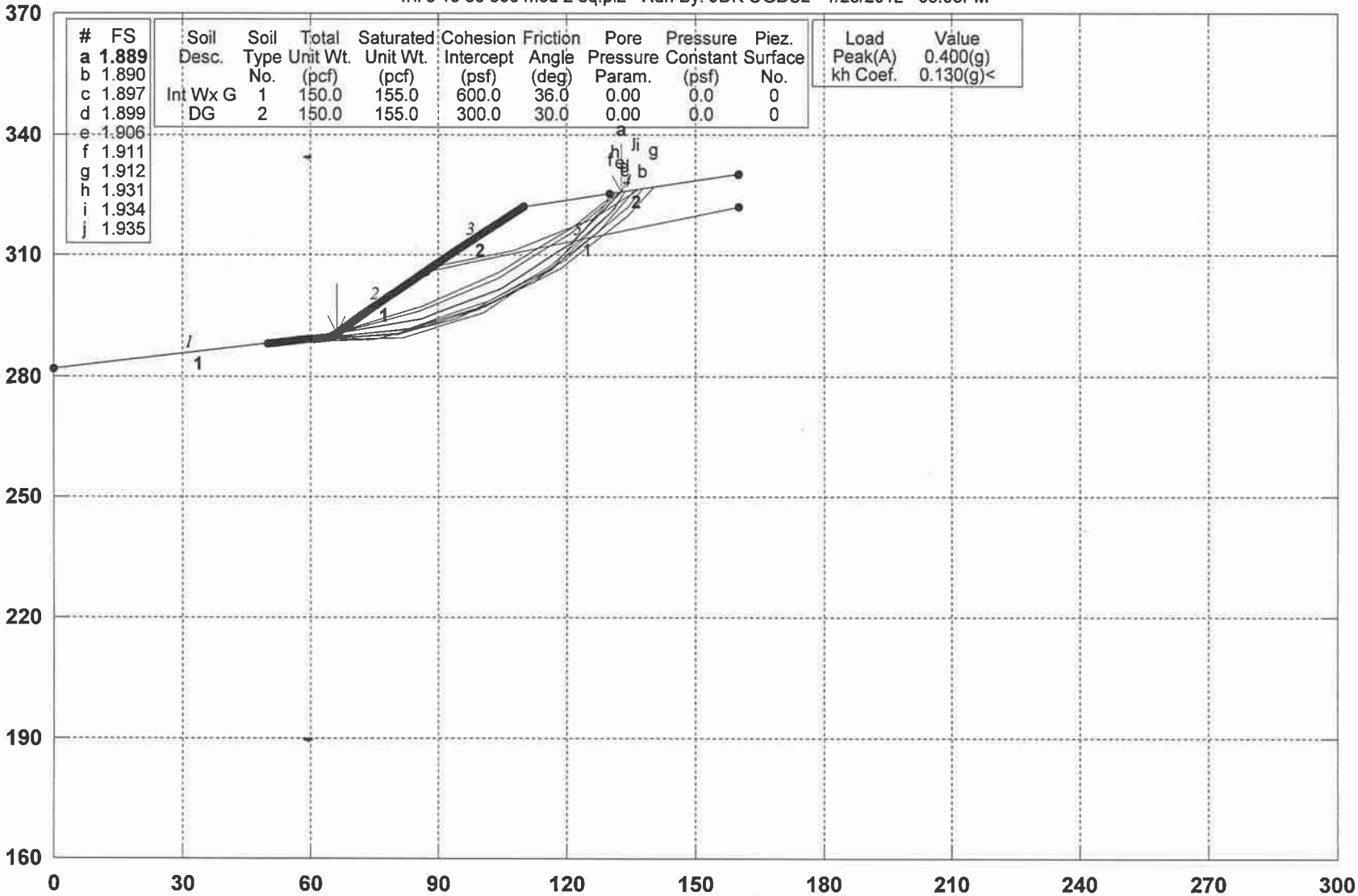
GSTABL7 v.2 FSmin=2.085

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

Bishop Modified Typical Granitic Cut 1.5:1 Seismic weak mod

f:\76 15 36 600 mod 2 eq.pl2 Run By: JDK OGDS2 1/23/2012 03:08PM



#	FS
a	1.889
b	1.890
c	1.897
d	1.899
e	1.906
f	1.911
g	1.912
h	1.931
i	1.934
j	1.935

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Int Wx G	1	150.0	155.0	600.0	36.0	0.00	0.0	0
DG	2	150.0	155.0	300.0	30.0	0.00	0.0	0

Load	Value
Peak(A)	0.400(g)
kh Coef.	0.130(g)<

GSTABL7 v.2 FSmin=1.889

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

```
                    *** GSTABL7 ***
          ** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
   ** Original Version 1.0, January 1996; Current Ver. 2.005.2, Jan. 2011 **
            (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
Analysis Run Date:        1/23/2012
Time of Run:              03:08PM
Run By:                   JDK OGDS2
Input Data Filename:      f:\76 15 36 600 mod 2 eq.
Output Filename:          f:\76 15 36 600 mod 2 eq.OUT
Unit System:              English
Plotted Output Filename:  f:\76 15 36 600 mod 2 eq.PLT
PROBLEM DESCRIPTION:  Bishop Modified Typical Granitic Cut
                      1.5:1 Seismic weak mod
BOUNDARY COORDINATES
    4 Top   Boundaries
    5 Total Boundaries
Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
   No.        (ft)       (ft)       (ft)       (ft)     Below Bnd
    1         0.00     282.00      65.00     290.00        1
    2        65.00     290.00      87.00     306.00        1
    3        87.00     306.00     110.00     322.00        2
    4       110.00     322.00     160.00     330.00        2
    5        87.00     306.00     160.00     322.00        1
User Specified Y-Origin =       160.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
 2 Type(s) of Soil
Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
 No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
  1   150.0    155.0     600.0     36.0    0.00       0.0      0
  2   150.0    155.0     300.0     30.0    0.00       0.0      0
Specified Peak Ground Acceleration Coefficient (A) =   0.400(g)
Specified Horizontal Earthquake Coefficient (kh) =   0.130(g)
Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
Specified Seismic Pore-Pressure Factor =   0.000
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
1000 Trial Surfaces Have Been Generated.
  10 Surface(s) Initiate(s) From Each Of   100 Points Equally Spaced
Along The Ground Surface Between  X =  50.00(ft)
                              and  X = 110.00(ft)
Each Surface Terminates Between   X = 130.00(ft)
                              and   X = 160.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =    100.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -35.0
And  59.0 deg.
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Modified Bishop Method * *
      Total Number of Trial Surfaces Attempted =  1000
      Number of Trial Surfaces With Valid FS = 1000
      Statistical Data On All Valid FS Values:
```

FS Max = 42.186 FS Min = 1.889 FS Ave = 3.282
Standard Deviation = 1.709 Coefficient of Variation = 52.07 %

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.364	290.992
2	86.106	294.192
3	104.662	301.654
4	121.122	313.014
5	132.772	325.643

Circle Center At X = 61.860 ; Y = 381.281 ; and Radius = 90.402

Factor of Safety
*** 1.889 ***

Individual data on the 7 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	19.7	16521.7	0.0	0.0	0.	0.	2147.8	0.0	0.0
2	0.9	1515.8	0.0	0.0	0.	0.	197.1	0.0	0.0
3	17.7	37196.7	0.0	0.0	0.	0.	4835.6	0.0	0.0
4	5.3	13330.2	0.0	0.0	0.	0.	1732.9	0.0	0.0
5	11.1	22879.3	0.0	0.0	0.	0.	2974.3	0.0	0.0
6	0.5	848.0	0.0	0.0	0.	0.	110.2	0.0	0.0
7	11.1	8558.0	0.0	0.0	0.	0.	1112.5	0.0	0.0

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	63.333	289.795
2	83.187	292.206
3	102.145	298.579
4	119.423	308.652
5	134.309	322.009
6	137.559	326.409

Circle Center At X = 61.906 ; Y = 386.232 ; and Radius = 96.448

Factor of Safety
*** 1.890 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.303	289.422
2	80.243	290.969
3	99.296	297.052
4	116.444	307.345
5	130.771	321.299
6	133.625	325.780

Circle Center At X = 63.969 ; Y = 374.139 ; and Radius = 84.797

Factor of Safety
*** 1.897 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.303	289.422
2	80.275	290.489
3	99.390	296.371
4	116.507	306.715
5	130.603	320.903
6	133.495	325.759

Circle Center At X = 66.265 ; Y = 369.295 ; and Radius = 80.095

Factor of Safety
*** 1.899 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.364	290.992
2	85.651	296.284
3	103.914	304.435

```
    4        120.734      315.256
    5        132.430      325.589
Circle Center At X =    41.239 ; Y =   420.338 ; and Radius =   131.764
       Factor of Safety
      ***    1.906   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         61.515      289.571
    2         81.514      289.732
    3        100.576      295.786
    4        117.004      307.193
    5        129.336      322.939
    6        130.213      325.234
Circle Center At X =    71.119 ; Y =   355.068 ; and Radius =    66.198
       Factor of Safety
      ***    1.911   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.121      289.646
    2         82.024      291.612
    3        101.160      297.428
    4        118.791      306.870
    5        134.238      319.573
    6        140.178      326.828
Circle Center At X =    62.562 ; Y =   389.243 ; and Radius =    99.598
       Factor of Safety
      ***    1.912   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         66.970      291.432
    2         86.076      297.343
    3        104.205      305.790
    4        121.021      316.617
    5        131.288      325.406
Circle Center At X =    33.136 ; Y =   434.645 ; and Radius =   147.155
       Factor of Safety
      ***    1.931   ***
Failure Surface Specified By  4 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         88.182      306.822
    2        107.758      310.918
    3        126.088      318.918
    4        136.388      326.222
Circle Center At X =    79.134 ; Y =   398.897 ; and Radius =    92.519
       Factor of Safety
      ***    1.934   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         54.848      288.751
    2         74.842      289.258
    3         94.241      294.124
    4        112.108      303.111
    5        127.579      315.786
    6        135.654      326.105
Circle Center At X =    62.784 ; Y =   377.663 ; and Radius =    89.266
       Factor of Safety
      ***    1.935   ***
          **** END OF GSTABL7 OUTPUT ****
```

Bishop Modified Typical Granitic Cut 1.5:1 Seismic weak mod

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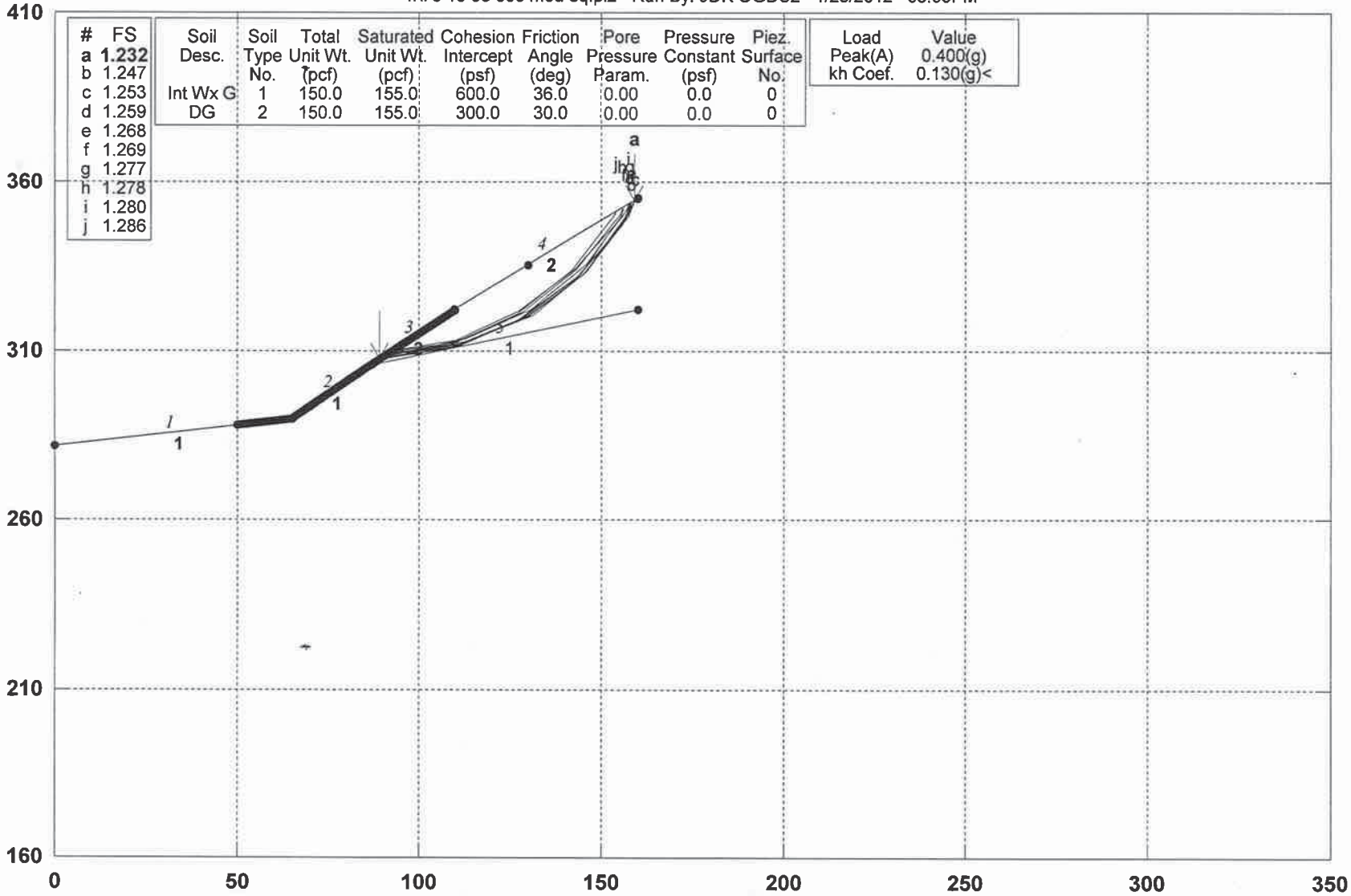

GSTABL7 v.2 FSmin=1.232

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

```
                    ***  GSTABL7  ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
           (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                  SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
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    Time of Run:              09:24AM
    Run By:                   M FORDHAM CALTRANS
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erchange static.OUT
    Unit System:              English
    Plotted Output Filename:  C:\Documents and Settings\tbmfordh\Desktop\none\i15 sr75 int
erchange static.PLT
    PROBLEM DESCRIPTION:  I-15/SR-76 Interchange
                          16ft 2:1 Permanent cut slope in alluvium
    BOUNDARY COORDINATES
        3 Top   Boundaries
```

4 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	50.00	30.00	50.00	1
2	30.00	50.00	62.00	66.00	1
3	62.00	66.00	112.00	66.00	1
4	0.00	0.00	0.00	0.00	0

Default Y-Origin = 0.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	120.0	130.0	100.0	32.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
1500 Trial Surfaces Have Been Generated.
30 Surface(s) Initiate(s) From Each Of 50 Points Equally Spaced
Along The Ground Surface Between X = 0.00(ft)
and X = 35.00(ft)
Each Surface Terminates Between X = 55.00(ft)
and X = 90.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)
10.00(ft) Line Segments Define Each Trial Failure Surface.
Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -25.0
And 25.0 deg.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 1500
Number of Trial Surfaces With Valid FS = 1500
Statistical Data On All Valid FS Values:
FS Max = 6.429 FS Min = 2.071 FS Ave = 2.832
Standard Deviation = 0.375 Coefficient of Variation = 13.23 %
Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.000	50.000
2	39.938	51.111
3	49.436	54.239
4	58.089	59.252
5	65.527	65.936
6	65.574	66.000

Circle Center At X = 29.630 ; Y = 98.370 ; and Radius = 48.372
Factor of Safety
*** 2.071 ***
Individual data on the 6 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.9	2300.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	9.5	5321.1	0.0	0.0	0.	0.	0.0	0.0	0.0
3	8.7	5332.4	0.0	0.0	0.	0.	0.0	0.0	0.0
4	3.9	1883.4	0.0	0.0	0.	0.	0.0	0.0	0.0
5	3.5	698.0	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.0	0.2	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	28.571	50.000
2	38.571	49.971
3	48.282	52.360
4	57.127	57.026
5	64.581	63.691

```
     6          66.151        66.000
Circle Center At X =    33.794 ; Y =    89.864 ; and Radius =    40.205
       Factor of Safety
      ***    2.071   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          30.000       50.000
    2          39.998       49.822
    3          49.622       52.541
    4          58.050       57.923
    5          64.564       65.511
    6          64.780       66.000
Circle Center At X =    35.629 ; Y =    83.564 ; and Radius =    34.033
       Factor of Safety
      ***    2.076   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          26.429       50.000
    2          36.425       49.723
    3          46.188       51.885
    4          55.132       56.358
    5          62.720       62.871
    6          64.934       66.000
Circle Center At X =    32.641 ; Y =    89.383 ; and Radius =    39.870
       Factor of Safety
      ***    2.092   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          31.429       50.714
    2          41.429       50.737
    3          51.084       53.341
    4          59.739       58.350
    5          66.806       65.424
    6          67.139       66.000
Circle Center At X =    36.383 ; Y =    88.497 ; and Radius =    38.106
       Factor of Safety
      ***    2.102   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          26.429       50.000
    2          36.371       48.926
    3          46.242       50.523
    4          55.339       54.678
    5          63.010       61.092
    6          66.414       66.000
Circle Center At X =    35.404 ; Y =    85.534 ; and Radius =    36.650
       Factor of Safety
      ***    2.111   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          28.571       50.000
    2          38.569       49.774
    3          48.175       52.552
    4          56.509       58.078
    5          62.807       65.847
    6          62.868       66.000
Circle Center At X =    34.316 ; Y =    82.443 ; and Radius =    32.948
       Factor of Safety
      ***    2.119   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          26.429       50.000
    2          36.415       49.480
    3          46.141       51.804
```

```
     4          54.813       56.785
     5          61.722       64.014
     6          62.746       66.000
Circle Center At X =    33.287 ; Y =    83.650 ; and Radius =    34.342
       Factor of Safety
      ***    2.127   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
     1        31.429       50.714
     2        41.416       50.221
     3        51.033       52.965
     4        59.257       58.653
     5        64.709       66.000
Circle Center At X =    37.915 ; Y =    80.719 ; and Radius =    30.698
       Factor of Safety
      ***    2.132   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
     1        24.286       50.000
     2        34.240       49.040
     3        44.088       50.772
     4        53.118       55.070
     5        60.672       61.622
     6        63.580       66.000
Circle Center At X =    32.826 ; Y =    85.276 ; and Radius =    36.295
       Factor of Safety
      ***    2.133   ***
          **** END OF GSTABL7 OUTPUT ****
```

```
                    *** GSTABL7 ***
          ** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
   ** Original Version 1.0, January 1996; Current Ver. 2.005.2, Jan. 2011 **
             (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                   SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
Analysis Run Date:        1/23/2012
Time of Run:              03:03PM
Run By:                   JDK OGDS2
Input Data Filename:      f:\76 15 36 600 mod eq.
Output Filename:          f:\76 15 36 600 mod eq.OUT
Unit System:              English
Plotted Output Filename:  f:\76 15 36 600 mod eq.PLT
PROBLEM DESCRIPTION:  Bishop Modified Typical Granitic Cut
                      1.5:1 Seismic weak mod
BOUNDARY COORDINATES
    4 Top   Boundaries
    5 Total Boundaries
Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
   No.        (ft)       (ft)       (ft)       (ft)     Below Bnd
```

1	0.00	282.00	65.00	290.00	1
2	65.00	290.00	87.00	306.00	1
3	87.00	306.00	110.00	322.00	2
4	110.00	322.00	160.00	355.00	2
5	87.00	306.00	160.00	322.00	1

User Specified Y-Origin = 160.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	150.0	155.0	600.0	36.0	0.00	0.0	0
2	150.0	155.0	300.0	30.0	0.00	0.0	0

Specified Peak Ground Acceleration Coefficient (A) = 0.400(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.130(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
1000 Trial Surfaces Have Been Generated.
10 Surface(s) Initiate(s) From Each Of 100 Points Equally Spaced
Along The Ground Surface Between X = 50.00(ft)
and X = 110.00(ft)
Each Surface Terminates Between X = 130.00(ft)
and X = 160.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 100.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -35.0
And 59.0 deg.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 1000
Number of Trial Surfaces With Valid FS = 1000
Statistical Data On All Valid FS Values:
FS Max = 19.562 FS Min = 1.232 FS Ave = 1.968
Standard Deviation = 1.338 Coefficient of Variation = 67.97 %
Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	89.394	307.665
2	109.077	311.212
3	127.359	319.322
4	143.198	331.533
5	155.693	347.150
6	159.055	354.376

Circle Center At X = 85.064 ; Y = 389.422 ; and Radius = 81.871
Factor of Safety
*** 1.232 ***
Individual data on the 6 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	19.7	14977.8	0.0	0.0	0.	0.	1947.1	0.0	0.0
2	0.9	1420.7	0.0	0.0	0.	0.	184.7	0.0	0.0
3	17.4	31915.0	0.0	0.0	0.	0.	4149.0	0.0	0.0
4	15.8	31495.6	0.0	0.0	0.	0.	4094.4	0.0	0.0
5	12.5	16290.5	0.0	0.0	0.	0.	2117.8	0.0	0.0
6	3.4	1262.6	0.0	0.0	0.	0.	164.1	0.0	0.0

Failure Surface Specified By 6 Coordinate Points

Point	X-Surf	Y-Surf

```
   No.        (ft)        (ft)
    1         91.212      308.930
    2        111.007      311.789
    3        129.334      319.797
    4        144.879      332.381
    5        156.528      348.638
    6        158.512      354.018
Circle Center At X =    90.977 ; Y =   382.052 ; and Radius =    73.122
       Factor of Safety
      ***    1.247   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         92.424      309.773
    2        112.240      312.481
    3        130.573      320.476
    4        146.041      333.154
    5        157.480      349.560
    6        159.175      354.456
Circle Center At X =    92.976 ; Y =   381.150 ; and Radius =    71.379
       Factor of Safety
      ***    1.253   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         91.818      309.352
    2        111.633      312.069
    3        129.923      320.160
    4        145.263      332.993
    5        156.455      349.568
    6        157.732      353.503
Circle Center At X =    92.458 ; Y =   379.673 ; and Radius =    70.324
       Factor of Safety
      ***    1.259   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         93.030      310.195
    2        112.887      312.587
    3        131.205      320.616
    4        146.419      333.597
    5        157.232      350.422
    6        158.200      353.812
Circle Center At X =    95.169 ; Y =   377.495 ; and Radius =    67.334
       Factor of Safety
      ***    1.268   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         91.212      308.930
    2        111.033      311.601
    3        129.272      319.809
    4        144.416      332.872
    5        155.211      349.708
    6        155.972      352.341
Circle Center At X =    92.213 ; Y =   377.447 ; and Radius =    68.524
       Factor of Safety
      ***    1.269   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         90.000      308.087
    2        109.403      312.937
    3        127.348      321.768
    4        143.028      334.183
    5        155.740      349.623
    6        157.748      353.513
```

```
Circle Center At X =    77.556 ; Y =   399.878 ; and Radius =    92.631
       Factor of Safety
      ***    1.277   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         90.606      308.509
    2        110.182      312.605
    3        128.166      321.356
    4        143.471      334.231
    5        155.170      350.452
    6        155.902      352.295
Circle Center At X =    84.149 ; Y =   388.716 ; and Radius =    80.467
       Factor of Safety
      ***    1.278   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         93.030      310.195
    2        112.732      313.640
    3        130.805      322.205
    4        145.946      335.272
    5        157.061      351.899
    6        157.554      353.386
Circle Center At X =    90.377 ; Y =   383.952 ; and Radius =    73.804
       Factor of Safety
      ***    1.280   ***
Failure Surface Specified By  6 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         89.394      307.665
    2        108.957      311.826
    3        126.890      320.679
    4        142.088      333.680
    5        153.613      350.025
    6        154.001      351.041
Circle Center At X =    82.728 ; Y =   387.398 ; and Radius =    80.011
       Factor of Safety
      ***    1.286   ***
          **** END OF GSTABL7 OUTPUT ****
```

APPENDIX

SETTLEMENT ANALISIS

Geotechnical Design Report; Phase 1 SR76/15 Interchange;
EA 11-257151; 1100020489

EMBANKMENT SETTLEMENT
I-15 + SR-78 Interchange
Z.Y 9/8/11

STATION 340+50 ; 341+00

Embankment Height = 15', Soil Unit Wt = 120 pcf

Embankment Load = 15 × 120 = 1800 psf

SOIL PROFILE

10'	N at 5' = 8 N at 10' = 15	N' = 11 N' = 20	SAND (SP) γ = 120 pcf	1
10'	N at 15' = 17 N at 20' = 17	N' = 23 N' = 23	SILTY SAND (SM) γ = 120 pcf	2
10'	N at 25' = 8 N at 30' = 28	N' = 11 N' = 38	SILTY SAND (SM γ = 120 pcf	3
15'	N at 35' = 9 N at 45' = 8	N' = 12 N' = 11	SILTY SAND (SM) γ = 120 pcf	4
30'	Average N' = 24		SILTY SAND γ = 120 pcf	5

QUANTITY CALCULATIONS

SHEET 2 OF

ZY

9-8-11

LAYER 1 σ_o' at 5' = 5 × 120 = 600 psf

CORRECTED N' = 1.7 × 11 = 19

σ_o' at 10' = 10 × 120 = 1200 psf

CORRECTED N' = 1.2 × 20 = 24

Average N' for Layer I = 22

Layer 2

σ_o at 15' = 15 × 120 = 1800 psf

Corrected N' @ 15' = 23 × 0.95 = 22

σ_o' @ 20' = 20 × 120 = 2400 psf

Corrected N' @ 20' = 0.9 × 23 = 21

Average N' for Layer 2 = 22

Layer 3 σ_o' at 25', 25 × 120 = 3000 psf

Corrected N' = 11 × .84 = 9

σ_o' at 30', 30 × 120 = 3600 psf

Corrected N' = 0.76 × 38 = 29

Average N' for Layer 3 = 19

Layer 4 σ_o' at 35', 35 × 120 = 4200 psf

Corrected N' = 0.7 × 12 = 8

σ_o' @ 45', $45 \times 120 = 5400$ psf

Corrected $N' = 0.66 \times 11 = \underline{7}$

Average N' for Layer 4 = $\boxed{8}$

Layer 5

σ_o' @ 60', $60 \times 120 = 7200$ psf

Corrected $N' = 0.6 \times 24 = \boxed{14}$

Settlement

Layer I

σ_o' @ midpoint of Layer I = $5 \times 120 = 600$ psf

For N = 22, for well graded fine to medium Silty Sand, $C' = 62$

$$\Delta H = H\left(\frac{1}{C'}\right) \log\left(\frac{\sigma_o + \Delta p}{\sigma_o}\right), \quad \Delta p = 0.85 \times 1800$$

(See page 6)

$$\Delta H = 10' \times \frac{1}{62} \log\left(\frac{600 + 185 \times 1800}{600}\right) \times 12''$$

$$= \boxed{1.06''}$$

Layer 2

σ_o' @ 15', $120 \times 15 = 1800$ psf

For N = 22, $C' = 62$, $\Delta p = 0.7 \times 1800$

(See page 6)

$$\Delta H = 10 \times \frac{1}{62} \times \text{Log}\left(\frac{1800 + 0.7 \times 1800}{1800}\right) \times 12''$$

$$= \boxed{0.45''}$$

Layer 3

σ_o' @ 25', $25 \times 120 = 3000$ psf

For $N = 19$, $C' = 58$, $\Delta p = 0.6 \times 1800$, See page 6

$$\Delta H = 10 \times \frac{1}{58} \times \text{Log}\left(\frac{3000 + 0.6 \times 1800}{3000}\right) \times 12''$$

$$= \boxed{0.28''}$$

Layer 4

σ_o' @ 37.5', $37.5 \times 120 = 4500$ psf

For $N = 8$, $C' = 40$, $\Delta p = 0.5 \times 1800$ (page 6)

$$\Delta H = 15 \times \frac{1}{40} \times \text{Log}\left(\frac{4500 + 0.5 \times 1800}{4500}\right) \times 12$$

$$= \boxed{0.36''}$$

Layer 5

σ_o' @ 60', $60 \times 120 = 7200$ psf

For $N = 14$, $C' = 50$, $\Delta p = 0.4 \times 1800$ (page 7)

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

QUANTITY CALCULATIONS

SHEET 5 OF

FILE NO

SEGREGATION YES NO

DATE 9-8-11

$$\Delta H = 30 \times \frac{1}{50} \times \text{Log}\left(\frac{7200 + 0.4 \times 1800}{7200}\right) \times 12''$$

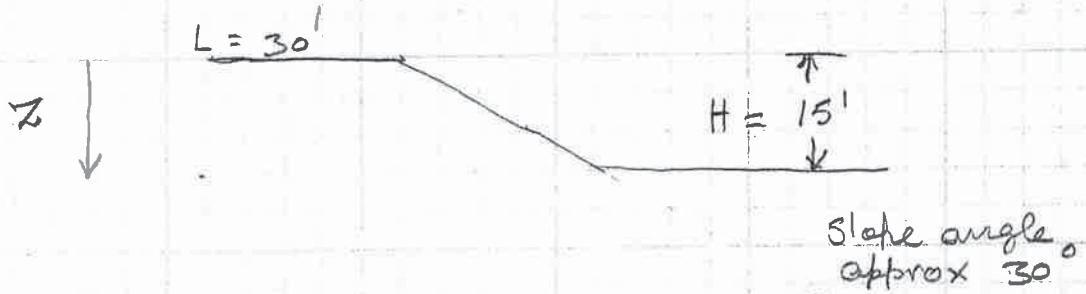
$$= \boxed{0.30''}$$

TOTAL SETTLEMENT

$$= 1.06 + 0.45 + 0.28 + 0.36 + 0.30$$

$$= \boxed{2.45''}$$ Say $2\frac{1}{2}$ inches

Embankment Stress Distribution



From Winterkorn & Fang
Fdn Eng Handbook, page 168

Layer 1, mid depth 5', $Z = 15 + 5 = 20'$

$\frac{Z}{H} = \frac{20}{15} = 1.3$, $\frac{L}{H} = \frac{30}{15} = 2$

From chart, Coeff = 0.85

Layer 2, mid depth = 15', $Z = 15 + 15 = 30'$

$\frac{Z}{H} = \frac{30}{15} = 2$, $L/H = 2$, Coeff = 0.70

Layer 3, mid depth = 25', $Z = 15 + 25 = 40$

$\frac{Z}{H} = \frac{40}{15} = 2.7$, $L/H = 2$, Coeff = 0.6

Layer 4, mid depth = 37.5', $Z = 37.5 + 25 = 62.5$

$\frac{Z}{H} = \frac{62.5}{15} = 4.2$, $L/H = 2$, Coeff = 0.5

QUANTITY CALCULATIONS

SHEET 7 OF

Layer 5, middepth = 60'

$Z = 15 + 60 = 75$,

$\frac{Z}{H} = \frac{75}{15} = 5$, $L/H = 2$, Coeff = 0.4

Page 168
Foundation Engineering Handbook by Winterkorn & Fang

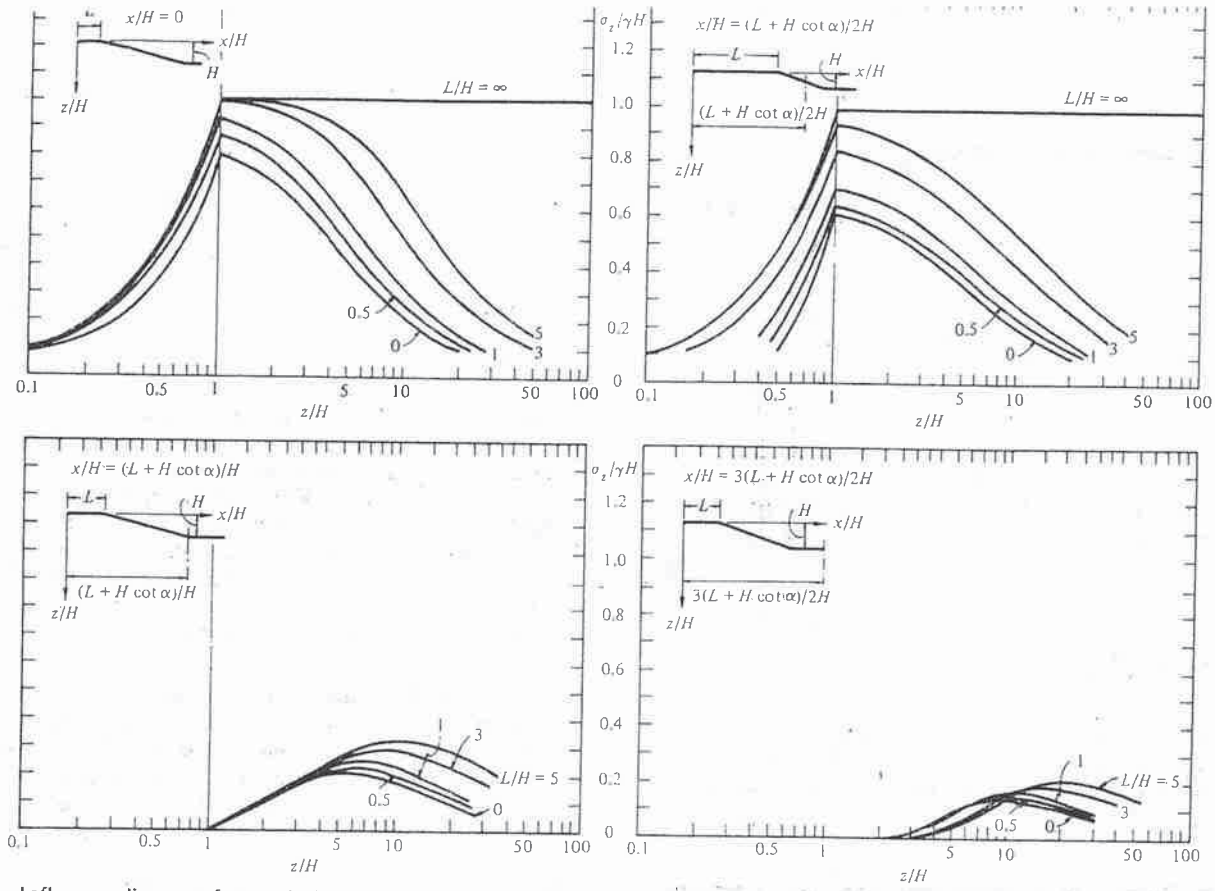


Fig. 4.35 Influence diagrams for vertical normal stress along selected vertical sections due to elastic embankment, $\mu = 0.3$, $\alpha = 15°$. *(After Perloff et al., 1967.)*

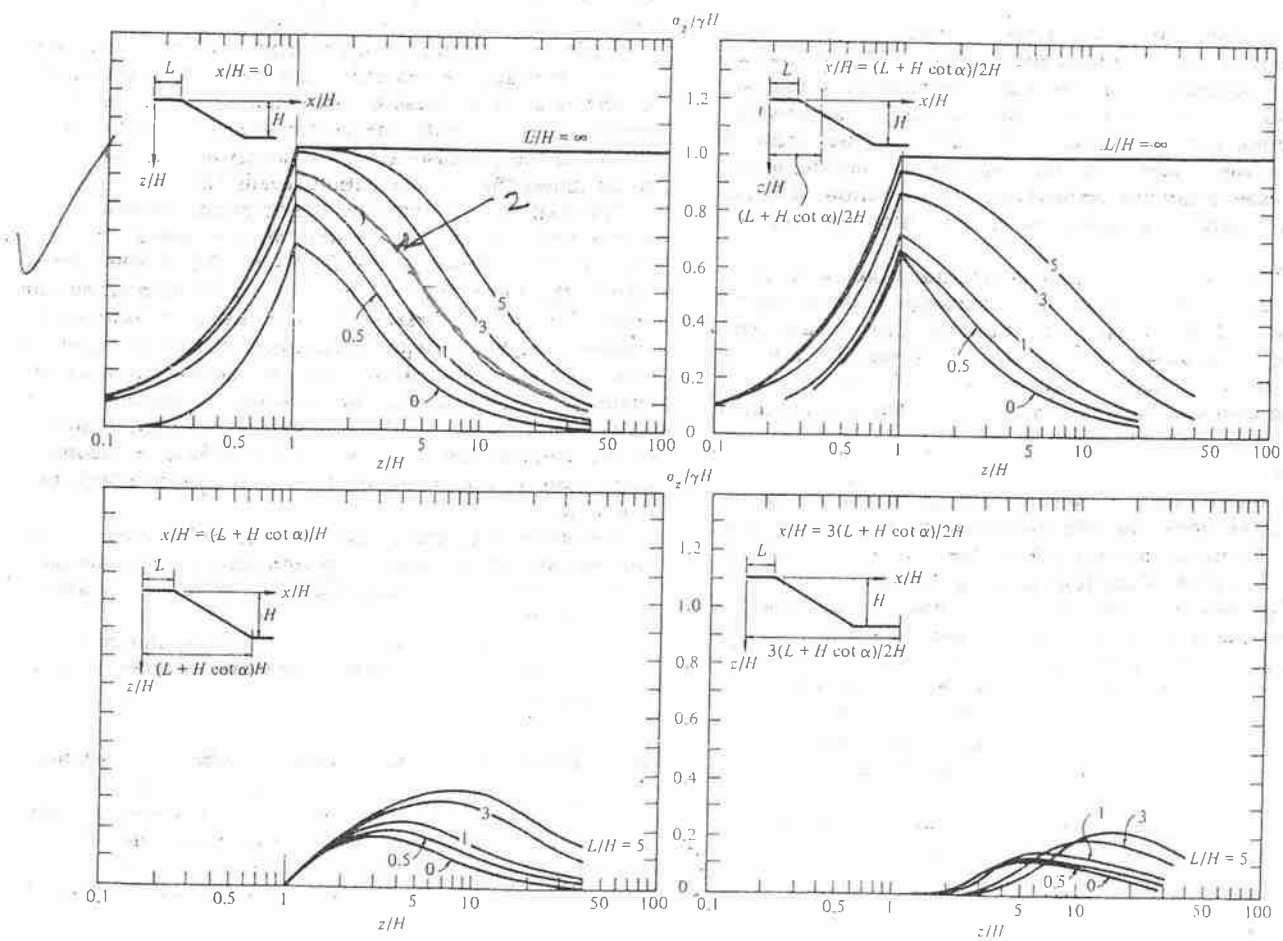


Fig. 4.36 Influence diagrams for vertical normal stress along selected vertical sections due to elastic embankment, $\mu = 0.3$, $\alpha = 30°$. *(After Perloff et al., 1967.)*

12 A

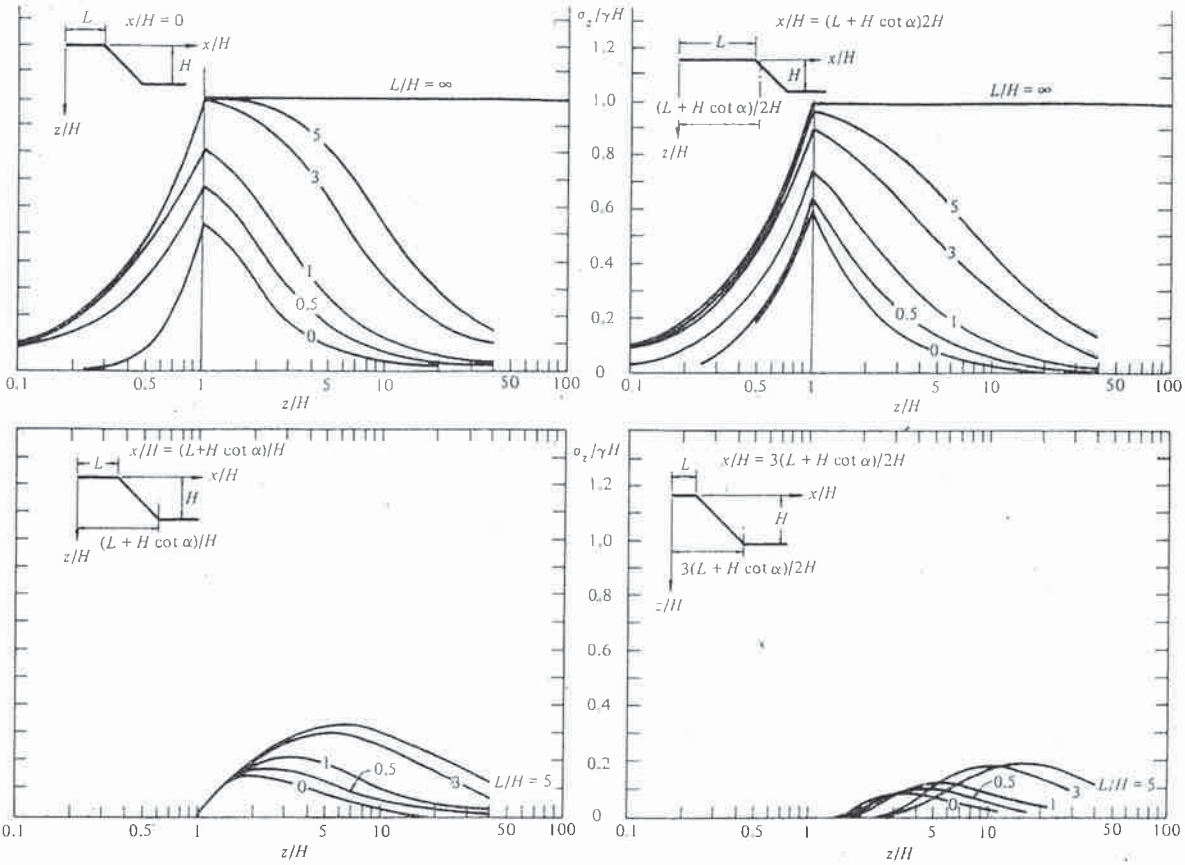


Fig. 4.37 Influence diagrams for vertical normal stress along selected vertical sections due to elastic embankment, $\mu = 0.3$, $\alpha = 45°$. (*After Perloff et al., a1967.*)

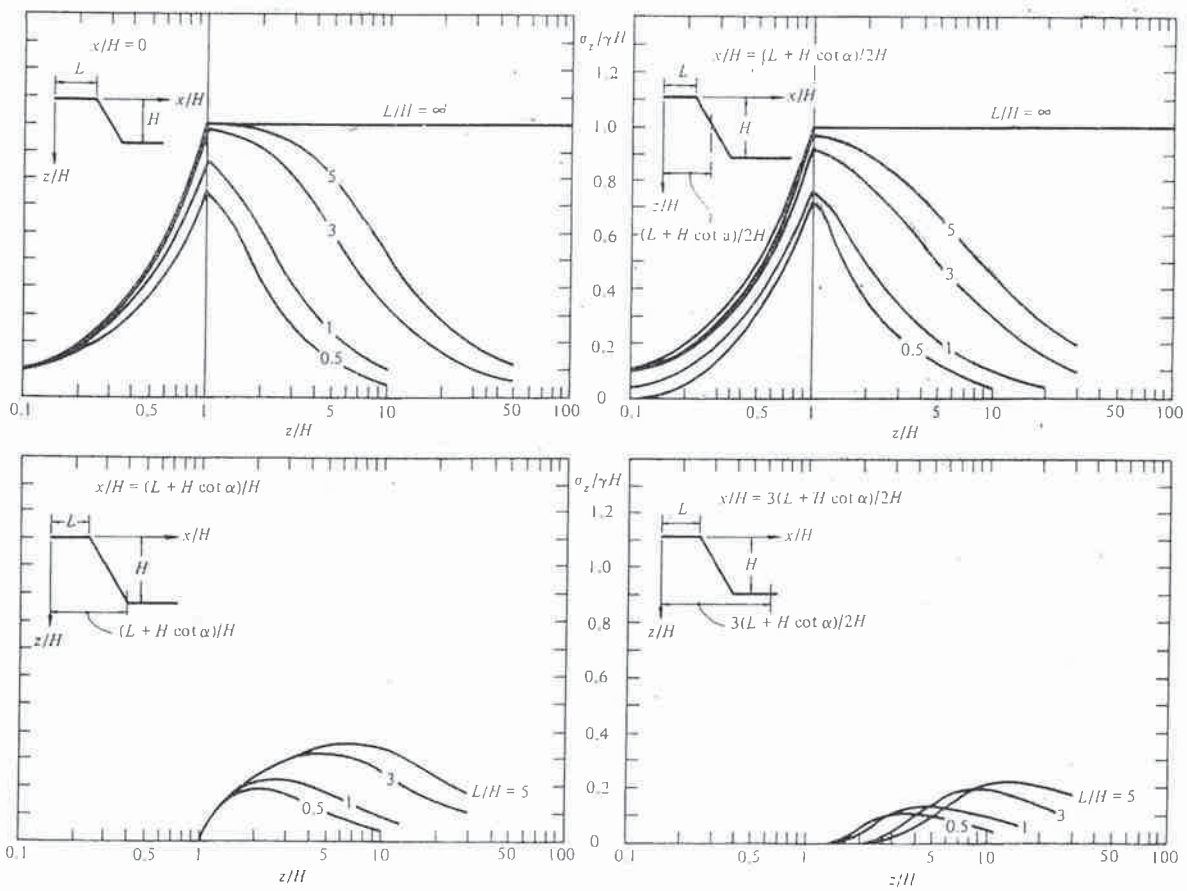


Fig. 4.38 Influence diagrams for vertical normal stress along selected vertical sections due to elastic embankment, $\mu = 0.3$, $\alpha = 60°$. (*After Perloff et al., 1967.*)

APPENDIX V
PROJECT MEMORANDUM

DEPARTMENT OF TRANSPORTATION
DIVISION OF FACILITIES CONSTRUCTION
Office of Transportation Laboratory
P.O. Box 19128
Sacramento, California 95819

California Test 750
1986

METHOD FOR DETERMINING THE PERCOLATION RATE OF SOILS USING A 6-INCH-DIAMETER-TEST HOLE

A. SCOPE

The percolation test is a method of measuring the rate at which water will inflitrate or seep into a soil stratum under specific conditions followed throughout the test. By allowing water, placed in a carefully prepared hole, to percolate, time measurements of the drop in the water level are taken and an equivalent unlined 12-inch diameter percolation rate, expressed in minutes per inch, may be calculated.

Percolation test results, along with other considerations, may be used to determine the acceptability of soils for onsite wastewater disposal and for the design sizing of infiltrative surface areas, such as drainage basins.

The 12-inch-diameter-percolation-test method (Calif. Test 749) is the preferred method, however, the 6-inch-diameter-test method can be used in cases where site location limits the use of a backhoe or where 6-inch-diameter equipment is in use.

This method may involve hazardous materials, operations and equipment. This method does not purport to address all the hazards associated with its use. It is the responsibility of whomever uses this method to consult and establish appropriate safe and healthy practices and determine the applicability of regulatory limitations. Users of this method do so at their own risk.

B. APPARATUS

1) Six-inch diameter hand auger.
2) Hole clean-out tools (Figure 1).
3) Perforated plastic pipe: 4½-inch outside diameter with 3/16-inch perforations placed at 3½-inch horizontal and 2-inch vertical spacings, approximate length 5 feet, one per hole (Figure 2).
4) Float gauge (Figure 2).
5) Filler tube: ⅜-inch copper tubing with hand valve, one per hole (Figure 2).
6) Automatic float valve, one per hole (Figure 3).
7) Garden hoses with "Y" connectors.
8) Stopwatch
9) Soil sample sacks
10) Backhoe (optional)
11) Power auger (optional)

C. MATERIALS

1) Pea gravel or equivalent, approximately 0.5 cubic foot per hole.
2) Water (quantity depends on soil type).

D. PERCOLATION TEST PROCEDURE

1) Inspection of Soil: Visual classification of the soil in the area of the proposed leach field is advised. A series of soil profile trenches, approximately 8 to 10 feet deep, should be dug with a backhoe throughout the testing area to ensure that an accurate classification and thickness of each soil layer is obtained [1]. However, if soil borings of the area have been conducted and if the soil types and thicknesses are known, soil profile trenches may not be necessary.

2) Preparation of Test Holes: With the soil visually classified, a judgment as to the most suitable testing depth(s) can be made. Once this depth has been determined and site conditions permit, a minimum of six holes, spaced throughout the testing area, must be dug.

It is recommended that a hand auger be used to dig the 6-inch-diameter test holes [2]. If a power auger is necessary, it may be used only to within 12 inches of the final testing depth. The final 12 inches must be dug with a hand auger.

Upon reaching the selected testing depth, the hole clean-out tools are used to scrape or roughen the sides of the holes to remove any shiny or smeared soil. All of the loose soil must then be removed from the bottom of the holes.

Care must be exercised while preparing the percolation test holes to ensure that the percolation rate obtained will be representative of the percolation rate of the undisturbed soil.

Retain a representative soil sample from the final foot of each test hole and conduct sieve and mechanical analyses of the samples (Calif. Tests 202 & 203). The results will be useful in verifying the visual classification of the soil and interpreting the percolation

[1] It is not necessary to enter the trench; obtain samples from the backhoe and use a measuring tape to obtain the thicknesses.

[2] Attempt to dig the hole exactly 6 inches in diameter; if, however, a larger hole is dug due to the presence of rocks, etc., obtain the actual diameter and use in the correction and conversion factors (See Sections E-2 & E-3).

rates obtained for the design of the leach field network or other drainage facilities.

A 2-inch depth of pea gravel is then placed on the bottom of each hole. The perforated pipe is centered in the hole, and additional pea gravel is used to backfill around the outside. A sample of the pea gravel must be retained so that the porosity (n) can be determined for use in the correction factor calculation (See Section E-1).

3) Presoaking the Test Holes: Presoak each hole to its testing depth (8 inches above the bottom of the hole or 6 inches above the top of the gravel) for a minimum of 18 hours to obtain soil saturation and to allow for the swelling of any expansive clay which might be present in the soil. The use of automatic float valves to maintain the proper water level is preferable; if, however, they are unavailable, other methods must be used to ensure adequate presoaking.

Depending upon the source of the water, "Y" connectors may be used on the hoses to be assured of an adequate supply of water to each test hole.

4) Measuring a Stabilized Percolation Rate: After the presoaking period, remove the automatic float valve, if used, and adjust the water depth to exactly 8 inches above the bottom of the hole (6 inches above the top of the gravel). With a stopwatch, measure the time required for the water level in each test hole to drop one inch[3]. Immediately refill the hole to the 8-inch depth, and retest.

If the time required for a one-inch drop is greater than 60 minutes, record the time required for a one-half inch drop in the water level, then refill to the 8-inch depth, and retest.

A minimum of 6 readings shall be taken for each test hole. If the results of the last 3 readings vary by more than 5%, continue the test until the last 3 readings are within the limits. If, however, an extremely slow percolation rate is observed, conduct as many tests as possible within a 6-hour time limit.

All readings shall be recorded in minutes per inch.

Care must be exercised when water is added to the test holes. Be careful not to allow any material (i.e. loose soil, leaves, etc.) to fall into the holes, as this will lead to an error in the results. With the use of a 4-foot length of ⅜-inch copper tubing with a hand valve connected, water can be added to the holes easily.

An example of four different percolation test readings is shown in Figure 4.

[3] A float gauge similar to the one pictured in Figure 2 can be used for taking the water depth measurements. If this type is used, do not forget to take into account the buoyancy effect of the bottle in the water.

E. CALCULATIONS

The average percolation rate obtained needs to be adjusted for the presence of the pea gravel and the perforated pipe and actual hole diameter.

The procedure and equations for these adjustments are as follows:

1) Determine the porosity (n) of the pea gravel. Fill a container of known volume with the pea gravel sample. The gravel should be poured into the container, do not shake or compact the gravel. Add water, and record the quantity necessary to fill the container. The porosity is equal to the quantity of water required to fill the container divided by the volume of the empty container:

$$n = \text{Volume of voids/Total volume}$$

2) Calculate the correction factor (C), to correct for the presence of the perforated pipe and pea gravel by the following equation:

$$C = n\left[1 - \left(\frac{O}{D}\right)^2\right] + \left(\frac{I}{D}\right)^2 \qquad \text{(See Figure 5)}$$

where D = Actual diameter of percolation test hole in inches

I = Inside diameter of perforated pipe in inches

O = Outside diameter of perforated pipe in inches

n = Porosity

3) Determine the conversion factor (K) to convert the percolation test hole diameter used to an equivalent 12-inch diameter hole:

$$K = 0.27 + \frac{8.70}{D}$$

4) The equivalent unlined 12-inch diameter percolation rate (P) is calculated by the following equation:

$$P = \frac{(K)\ (R)}{C}$$

where R = Average percolation rate

F. SAMPLE CALCULATIONS

An average percolation rate of 2.9 min/in was obtained from a percolation test using the 6-inch diameter test hole method. The actual diameter of the test hole was found to be 7.0 inches. The inside and outside diameters of the perforated pipe were 4.25 and 4.5 inches respectively. The porosity of the pea gravel used was found to be n = 0.40.

What is the equivalent unlined 12-inch diameter percolation rate?

Correction Factor Calculation

$$C = n\left[1 - \left(\frac{O}{D}\right)^2\right] + \left(\frac{I}{D}\right)^2$$

$$= 0.40\left[1 - \left(\frac{4.5\text{ in}}{7.0\text{ in}}\right)^2\right] + \left(\frac{4.25\text{ in}}{7.0\text{ in}}\right)^2$$

$$= 0.60$$

Conversion Factor Calculation

$$K = 0.27 + \frac{8.7}{D}$$

$$= 0.27 + \frac{8.7}{7.0}$$

$$= 1.51$$

Equivalent Unlined 12-inch Diameter Percolation Rate

$$P = \frac{(K)\ (R)}{C}$$

$$= \frac{(1.51)\ (2.9\text{ min/in})}{0.60}$$

$$= \underline{7.3\text{ min/in}}$$

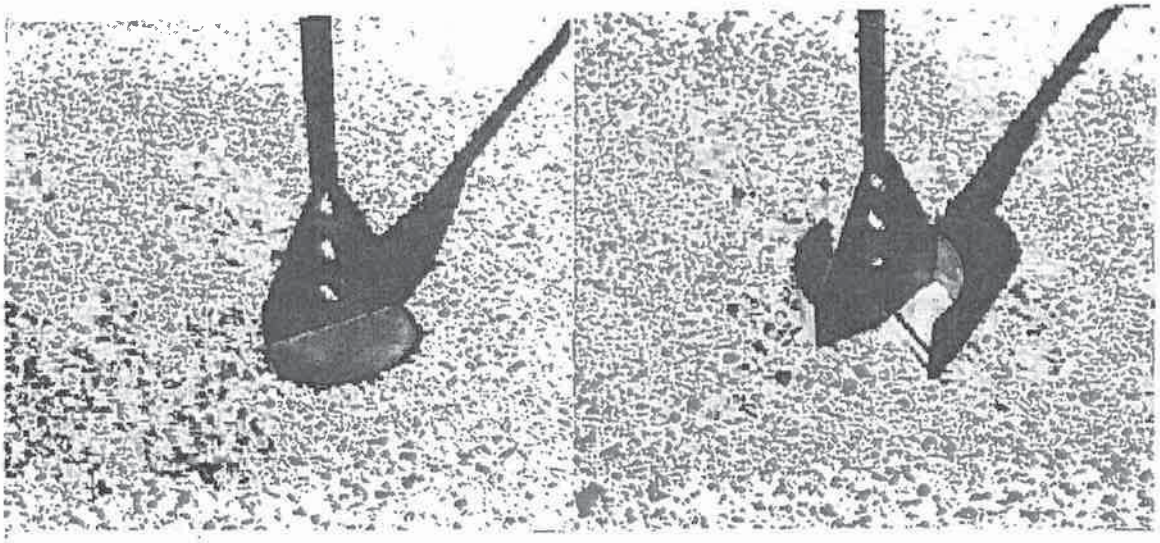


FIGURE 1
Hole Clean-out Tools

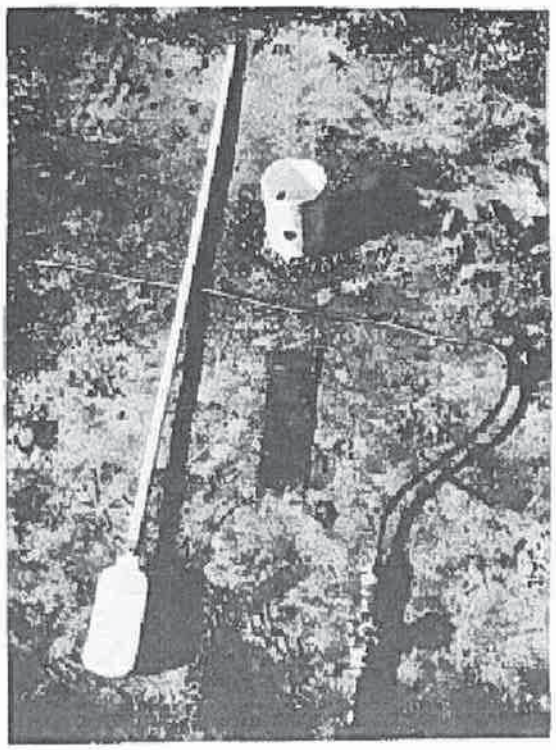


FIGURE 2
Perforated plastic pipe, float gauge and filler tube

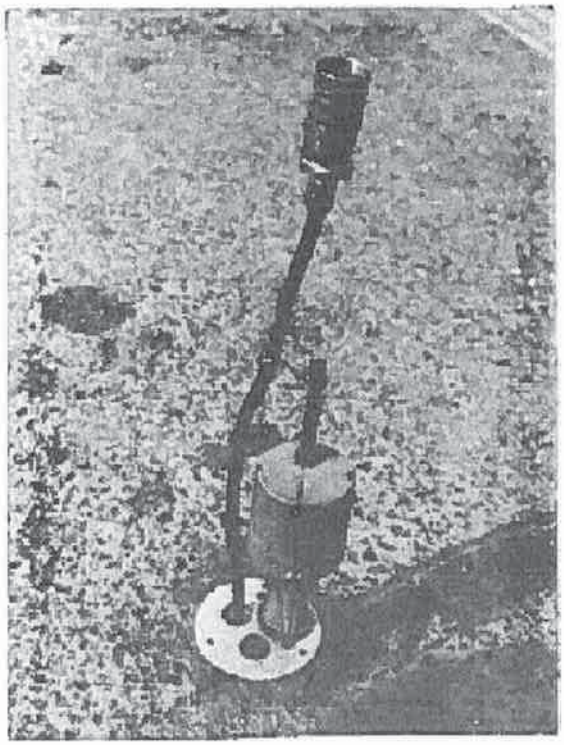


FIGURE 3
Automatic Float Valve

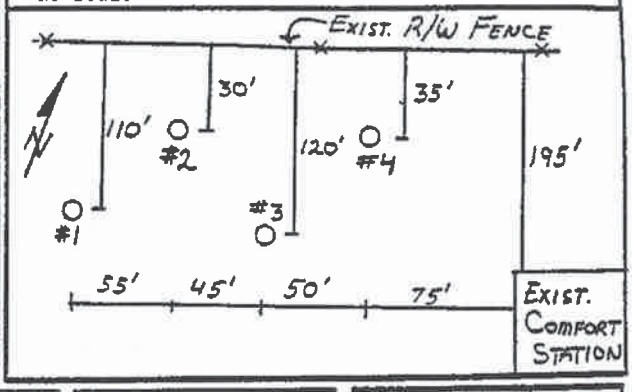
PERCOLATION TEST

TRANSPORTATION LABORATORY

LOCATION	Smalltown CA
DATE	6-24-83
TEST MADE BY	DS/MN
AMBIENT TEMPERATURE	72 F
WEATHER COND.	Clear
SOAKING PERIOD	19 hours
TYPE OF SOIL	Sand-Clay

n=0.40

No Scale — SITE LAYOUT



HOLE NO.	1	HOLE NO.	2	HOLE NO.	3	HOLE NO.	4
HOLE DEPTH	4.5'	HOLE DEPTH	4.5'	HOLE DEPTH	4.0'	HOLE DEPTH	4.0'
HOLE DIA.	7.0"	HOLE DIA.	6.0"	HOLE DIA.	6.0"	HOLE DIA.	6.5"
TIME	READING	TIME	READING	TIME	READING	TIME	READING
2min45sec	8" - 7"	53min15sec	8" - 7"	45min30sec	8" - 7½"	154 min	8" - 7½"
2min50sec	8" - 7"	50min45sec	8" - 7"	47min15sec	8" - 7½"	159 min	8" - 7½"
2min58sec	8" - 7"	51min30sec	8" - 7"	46min15sec	8" - 7½"		
3min10sec	8" - 7"	53min00sec	8" - 7"	46min30sec	8" - 7½"		
2min55sec	8" - 7"	54min30sec	8" - 7"	43min15sec	8" - 7½"		
2min51sec	8" - 7"	52min00sec	8" - 7"	44min45sec	8" - 7½"		
2min54sec	8" - 7"						
Ave(last3)	=2.9min/in	Ave(last3)	=53.2min/in	Ave(last3)	=89.7min/in	Average =	313min/in
REMARKS	Time measurements taken for a 1" drop	REMARKS	Time measurements taken for a 1" drop	REMARKS	Time measurements taken for a ½" drop	REMARKS	Time measurements taken for a ½"drop
CONVERSION FACTOR (K)	1.51	CONVERSION FACTOR (K)	1.72	CONVERSION FACTOR (K)	1.72	CONVERSION FACTOR (K)	1.61
CORRECTION FACTOR (C)	0.60	CORRECTION FACTOR (C)	0.68	CORRECTION FACTOR (C)	0.68	CORRECTION FACTOR (C)	0.64
PERC. RATE CALC.	$P=\frac{K \cdot R}{C} = \frac{(1.51)(2.9)}{0.60} = 7.3$ min/in	PERC. RATE CALC.	$P=\frac{(1.72)(53.2 \text{ min/in})}{0.68} = 135$ min/in	PERC. RATE CALC.	$P=\frac{(1.72)(89.7 \text{ min/in})}{0.68} = 227$ min/in	PERC. RATE CALC.	$P=\frac{(1.61)(313 \text{ min/in})}{0.64} = 787$ min/in
PERCOLATION RATE	7.3 min/in	PERCOLATION RATE	135 min/in	PERCOLATION RATE	227 min/in	PERCOLATION RATE	787 min/in

TL-3163 (REV 1/85)

EXAMPLE OF PERCOLATION TEST DATA

FIGURE 4

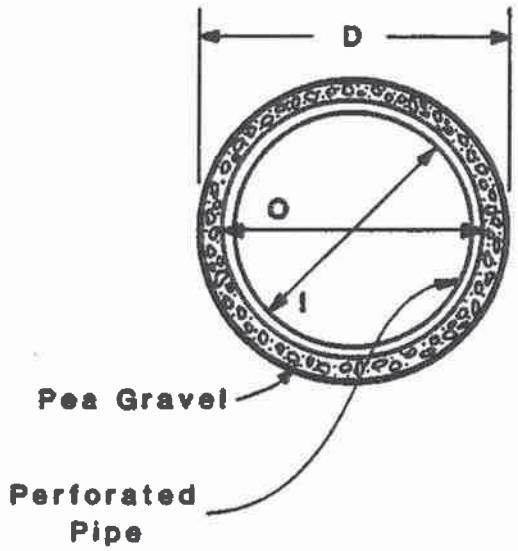


FIGURE 5

Dimensions of Test Hole and Perforated Pipe

Reference: Van Kirk, J.L., W.A. Grottkau, R.B. Howell and E.C. Shirley, "Percolation Testing for Septic Tank Leach Fields At Roadside Rests", FHWA/CA/TL/81/05 1981

STATE WATER RESOURCES CONTROL BOARD

GEOTRACKER

MOBIL 18-034 (T0607399243) - (MAP)

4730 HY 76
FALLBROOK, CA 920289006
SAN DIEGO COUNTY
LUST CLEANUP SITE

CLEANUP OVERSIGHT AGENCIES
SAN DIEGO COUNTY LOP *(LEAD)* - *CASE #: H20409-004*
CASEWORKER: *KEITH KEZER*
SAN DIEGO RWQCB (REGION 9) - *CASE #: 9UT4055*
CASEWORKER: *UNASSIGNED*

Regulatory Profile

PRINTABLE CASE SUMMARY

CLEANUP STATUS - DEFINITIONS
OPEN - SITE ASSESSMENT AS OF 4/7/2010 - CLEANUP STATUS HISTORY

POTENTIAL CONTAMINANTS OF CONCERN
GASOLINE

POTENTIAL MEDIA AFFECTED
AQUIFER USED FOR DRINKING WATER SUPPLY

FILE LOCATION
LOCAL AGENCY

BENEFICIAL USE
GW - INDUSTRIAL SERVICE WATER SUPPLY (IND), GW - AGRICULTURAL SUPPLY, SW - WARM FRESHWATER HABITAT, SW - WILDLIFE HABITAT, GW - MUNICIPAL AND DOMESTIC SUPPLY, SW - MUNICIPAL AND DOMESTIC SUPPLY, SW - NON-CONTACT WATER RECREATION, SW - AGRICULTURAL SUPPLY, SW - INDUSTRIAL SERVICE SUPPLY, SW - WATER CONTACT RECREATION

GROUNDWATER MONITORING FREQUENCY
OF WELLS MONITORED - SEMI-ANNUALLY : 9

Site History

3/00 During a product pipeline integrity test, two leaks were discovered, one at the flexible line "boot" connection to the middle (#5) dispenser and the other
near the western dispenser island. The product pipelines were repaired and soil samples were collected and analyzed.

8/02 Station upgrade activities were performed including the removal of four gasoline USTs (one 6,000-, two 10,000- and one 12,000-gallon) and all
product piping. Three new 15,000-gallon double-walled fiberglass USTs were installed. Approximately 556 tons of soil was excavated to a depth of approximately 17 feet bgs.

3/03 Installed three onsite groundwater monitoring wells (MW-1, MW-2 and MW-3) to depths of approximately 24, 29, and 24 feet bgs, respectively. No soil samples were collected due to the presence of granitic rock.

6/03 The center gasoline UST was found to have a breech in the inner tank wall and was replaced with a new UST. In addition, the northern gasoline UST was found to have a breech in the inner tank wall. The northern UST was repaired and replaced back into the UST cavity. No fuel was known to have been released from either UST.

10/04 Installed four onsite groundwater monitoring wells (MW-4, MW-5, MW-6, and MW-7) to depths of approximately 35, 26, 36, and 15 feet bgs, respectfully. No soil samples were collected below two feet due to the presence of granitic rock. Analytical data of surface soil samples were reportedly below laboratory detection limits for MTBE, BTEX, and TPH-g.

4/07 Environmental consulting and management activities transferred from TRC to ETIC Engineering Inc.

1/08 Submitted encroachment permit application to Caltrans for installation of offsite wells.

6/08 Obtained surety bond for State of California to install and maintain wells on Caltrans properties.

8/08 Installed offsite wells MW-9 and MW-10 and drilled boring PMW-8.

1/09 Conducted 48-hour pumping test of MW-6 to assess fracture connectivity.

State of California

Business, Transportation and Housing Agency

Memorandum

To: **Michael D. Lubin**
Environmental Planner
Environmental Analysis

Date: January 25, 2008

File: 11-SD-76
PM 17.01
EA 937700

From: **Joel Kloth**
Engineering Geologist
Environmental Engineering

Subject: Environmental Engineering Review for Hazardous Materials, Installation of Three Monitoring Wells Within Department of Transportation Right-of-Way for Environmental Investigation of Mobil Station 18-034, 4730 Highway 76, Fallbrook, California, Encroachment Permit 11-08-6SV-0047

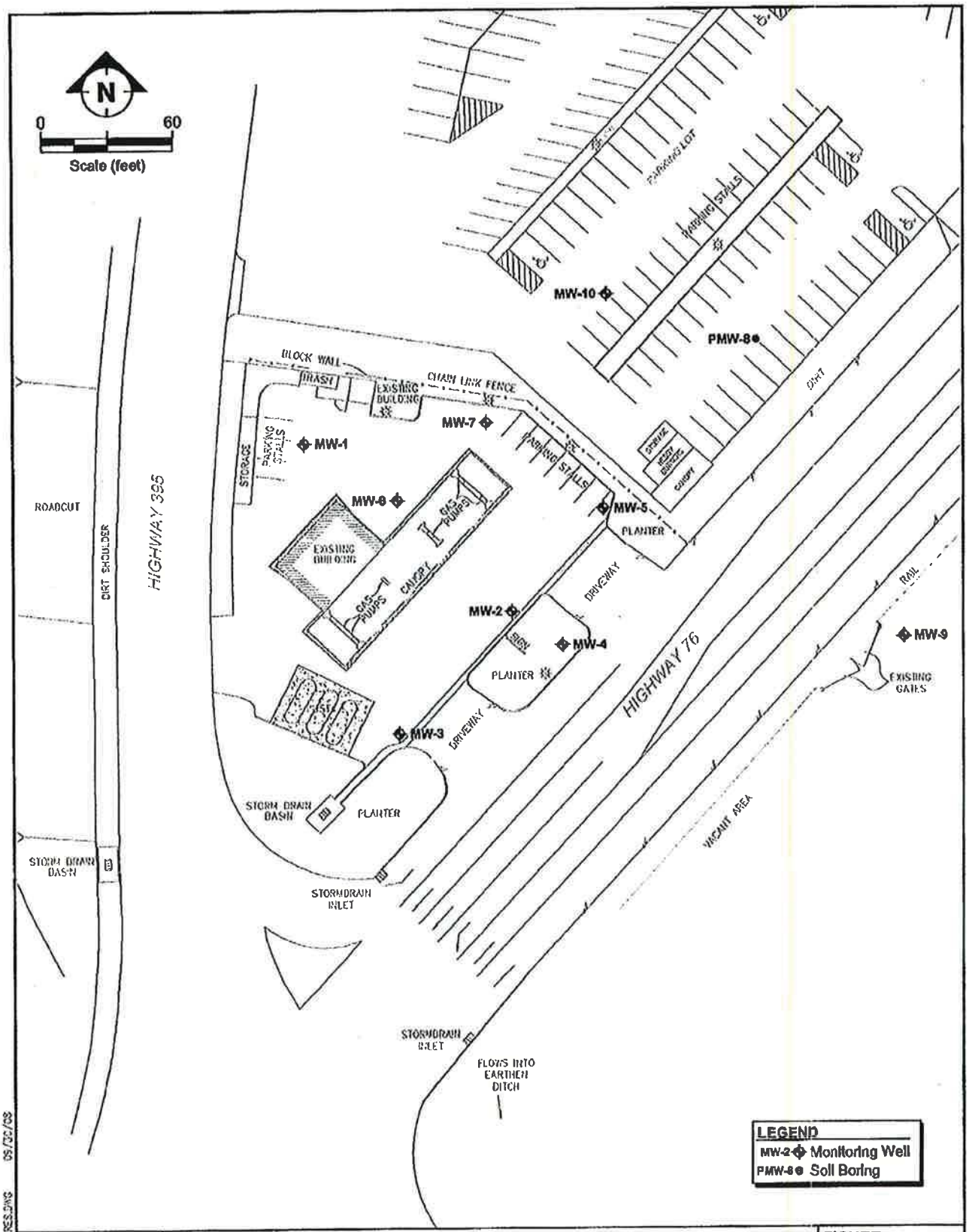
An environmental engineering review of the potential for hazardous waste has been conducted for the subject project. ETIC Engineering on behalf of EXXON/Mobil Oil Corporation proposes to install three groundwater monitoring wells in Department Right-of-Way as a result of a San Diego County Department of Environmental Health request. The wells are to be installed to investigate a petroleum hydrocarbon and oxygenate spill from dispensers at the service station.

The proposed installation of three monitoring wells within Department Right-of-Way for the investigation may encounter petroleum hydrocarbons or oxygenates in soil and/or groundwater. A "Work Plan for Additional Groundwater Assessment and Aquifer Pump Test" dated September 7, 2005, was submitted to The Department by TRC. According to the Work Plan, a Health and Safety Plan shall be prepared and made available onsite during field activities. The Work Plan outlined the proper investigative methods for working in soil and groundwater that is impacted by petroleum hydrocarbons and oxygenates.

As a condition of the encroachment permit, copies of all environmental reports shall be submitted to the Department, District 11, Environmental Engineering, Hazardous Waste Division, 2829 Juan Street, MS-46, San Diego, CA. Given these conditions are met, an encroachment permit for the installation of the three wells within Department Right-of-Way is feasible with regard to hazardous waste issues. If you have questions call (619) 688-3146.

JOEL KLOTH, PG
Engineering Geologist
Environmental Engineering

cc: Jayne Dowda



ETIC ENGINEERING

SITE MAP
EXXONMOBIL OIL CORPORATION SERVICE STATION 18034
4730 HIGHWAY 76,
FALLBROOK, CALIFORNIA

FIGURE: 2

18034_342009-FIGURES.DWG 05/22/09

ETIC ENGINEERING

LOG OF SOIL BORING: MW-10

COORDINATES: N2084591.44 :E6283082.07

ELEVATION TOP OF CASING: 301.23

CASING BELOW SURFACE: 0.38

DRILLING COMPANY: Cascade Drilling, Inc.

LICENSE NUMBER: C57-717610

CLIENT	SITE NUMBER	LOCATION
ExxonMobil	18034	4730 Hwy 76, Fallbrook, CA

DRILLING AND SAMPLING METHODS: 8" Rotary with Tungsten Carbide bit. (No soil samples collected)

				START	FINISH
WATER LEVEL	▽ 30.0	▼ 23.9			
TIME	15:30	11:50		TIME 11:30	TIME 10:45
DATE	7/30/08	8/12/08		DATE 7/30/08	DATE 8/5/08
REFERENCE	GS	TOC			

SURFACE CONDITIONS: Asphalt/Concrete

DESCRIPTION BY: T. Wirths, S. VanScoy

INCHES DRIVEN	INCHES RECOVER	BLOWS / 6" SAMPLER	OVA READING	DEPTH (feet)	AIR SAMPLE	WATER SAMPLE	SOIL SAMPLE	RECOVERED	GRAPHIC LOG	DESCRIPTION
				0						ASPHALT. FILL; sand.
				1						WEATHERED GRANITIC ROCK; brown (10YR 4/3).
				2						
				3						
				4						
				5						
				6						
				7						
				8						
				9						
				10						UNWEATHERED GRANITIC BEDROCK; Tonalite of Couser Canyon (Middle Cretaceous).
				11						
				12						
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						

DETAILS

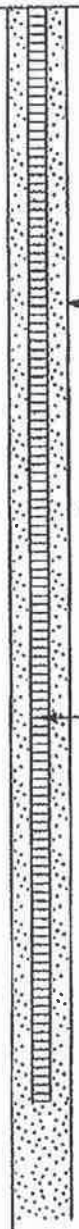
LOG OF SOIL BORING 18034 12-08.GPJ ETIC.GDT 12/10/08

ETIC ENGINEERING

CLIENT	SITE NUMBER	LOCATION
ExxonMobil	18034	4730 Hwy 76, Fallbrook, CA

LOG OF SOIL BORING: MW-10

INCHES DRIVEN	INCHES RECOVER	BLOWS / 6" SAMPLER	OVA READING	DEPTH (feet)	AIR SAMPLE	WATER SAMPLE	SOIL SAMPLE	RECOVERED	GRAPHIC LOG	
				21						
				22						
				23						
				24						
				25						
				26						
				27						
				28						
				29						
				30						
				31						UNWEATHERED GRANITIC BEDROCK; Tonalite of Couser Canyon (Middle Cretaceous).
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						T.D. = 40.5 ft bgs.
				41						Volume of Materials: 3.3 cubic ft of Bentonite grout. 1.5 cubic ft of Bentonite chips. 6.5 cubic ft of sand. 3 cubic ft of concrete.
				42						
				43						
				44						
				45						



LOG OF SOIL BORING 18034 12-08.GPJ ETIC.GDT 12/10/08

ETIC ENGINEERING

LOG OF SOIL BORING: **PMW-8**

COORDINATES:

ELEVATION TOP OF CASING:

CASING BELOW SURFACE:

DRILLING COMPANY: Cascade Drilling, Inc.

LICENSE NUMBER: C57-717510

CLIENT	SITE NUMBER	LOCATION
ExxonMobil	18034	4730 Hwy 76, Fallbrook, CA

DRILLING AND SAMPLING METHODS: 6" Rotary with Tungsten Carbide bit. (No soil samples collected)

					START	FINISH
WATER LEVEL	▽ DRY				TIME 08:30	TIME 16:30
TIME	11:00					
DATE	8/5/08				DATE 7/31/08	DATE 8/4/08
REFERENCE	GS					

SURFACE CONDITIONS: Asphalt/Concrete

DESCRIPTION BY: T. Wirths

INCHES DRIVEN	INCHES RECOVER	BLOWS / 6" SAMPLER	OVA READING	DEPTH (feet)	AIR SAMPLE	WATER SAMPLE	SOIL SAMPLE	RECOVERED	GRAPHIC LOG	DESCRIPTION
				0						ASPHALT/CONCRETE. FILL; sand.
				1						WEATHERED GRANITIC ROCK; brown (10YR 4/3).
				2						
				3						
				4						
				5						
				6						
				7						
				8						
				9						
				10						UNWEATHERED GRANITIC BEDROCK; Tonalite of Couser Canyon (Middle Cretaceous).
				11						
				12						
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						

DETAILS

Concrete from 0 to 3 ft bgs.

Hydrated Bentonite Chips from 3 to 4 ft bgs.

Bentonite Grout from 4 to 65.5 ft bgs.

LOG OF SOIL BORING 18034 12-08.GPJ ETIC.GDT 12/11/08

ETIC ENGINEERING	CLIENT	SITE NUMBER	LOCATION
	ExxonMobil	18034	4730 Hwy 76, Fallbrook, CA

LOG OF SOIL BORING: PMW-8

INCHES DRIVEN	INCHES RECOVER	BLOWS / 6" SAMPLER	OVA READING	DEPTH (feet)	AIR SAMPLE	WATER SAMPLE	SOIL SAMPLE	RECOVERED	GRAPHIC LOG	
				21						
				22						
				23						
				24						
				25						
				26						
				27						
				28						
				29						
				30						
				31						UNWEATHERED GRANITIC BEDROCK; Tonalite of Couser Canyon (Middle Cretaceous).
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

Bentonite Grout from 4 to 65.5 ft bgs.

LOG OF SOIL BORING 18034 12-08.GPJ ETIC.GDT 12/10/08

ETIC ENGINEERING

CLIENT	SITE NUMBER	LOCATION
ExxonMobil	18034	4730 Hwy 76, Fallbrook, CA

LOG OF SOIL BORING: PMW-8

INCHES DRIVEN	INCHES RECOVER	BLOWS / 6" SAMPLER	OVA READING	DEPTH (feet)	AIR SAMPLE	WATER SAMPLE	SOIL SAMPLE	RECOVERED	GRAPHIC LOG	
				46						
				47						
				48						
				49						
				50						
				51						
				52						
				53						
				54						
				55						UNWEATHERED GRANITIC BEDROCK; Tonalite of Couser Canyon (Middle Cretaceous).
				56						
				57						
				58						
				59						
				60						
				61						
				62						
				63						
				64						
				65						T.D. = 65.5 ft bgs.
				66						Volume of Materials: 24 cubic ft of Bentonite grout. 1 cubic ft of Bentonite chips. 6 cubic ft of concrete.
				67						
				68						
				69						
				70						

Bentonite Grout from 4 to 65.5 ft bgs.

LOG OF SOIL BORING 18034 12-08.GPJ ETIC.GDT 12/10/08

ETIC ENGINEERING

LOG OF SOIL BORING: MW-9

COORDINATES: N2064434.7 :E6283198.48

ELEVATION TOP OF CASING: 296.07

CASING BELOW SURFACE: 0.04

DRILLING COMPANY: Cascade Drilling, Inc.

LICENSE NUMBER: C57-717510

CLIENT	SITE NUMBER	LOCATION
ExxonMobil	18034	4730 Hwy 76, Fallbrook, CA

DRILLING AND SAMPLING METHODS: 8" Rotary with Tungsten Carbide bit. (No soil samples collected)

				START	FINISH
WATER LEVEL	▽ 52	▽ 52.5			
TIME	11:00	09:00		TIME 13:00	TIME 14:00
DATE	8/5/08	8/12/08		DATE 7/31/08	DATE 8/5/08
REFERENCE	GS	TOC			

SURFACE CONDITIONS: Unpaved

DESCRIPTION BY: T. Wirths

INCHES DRIVEN	INCHES RECOVER	BLOWS / 6" SAMPLER	OVA READING	DEPTH (feet)	AIR SAMPLE	WATER SAMPLE	SOIL SAMPLE	RECOVERED	GRAPHIC LOG	DESCRIPTION
				0						BACKFILL; SAND.
				1						WEATHERED GRANITIC ROCK; brown (10YR 4/3).
				2						
				3						
				4						
				5						
				6						
				7						
				8						
				9						
				10						UNWEATHERED GRANITIC BEDROCK; Tonalite of Couser Canyon (Middle Cretaceous).
				11						
				12						
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						

DETAILS

LOG OF SOIL BORING 18034 12-08.GPJ ETIC.GDT 12/10/08

ETIC ENGINEERING	CLIENT	SITE NUMBER	LOCATION
	ExxonMobil	18034	4730 Hwy 76, Fallbrook, CA

LOG OF SOIL BORING:

MW-9

INCHES DRIVEN	INCHES RECOVER	BLOWS / 6" SAMPLER	OVA READING	DEPTH (feet)	AIR SAMPLE	WATER SAMPLE	SOIL SAMPLE	RECOVERED	GRAPHIC LOG	
				21						
				22						
				23						
				24						
				25						
				26						
				27						
				28						
				29						UNWEATHERED GRANITIC BEDROCK; Tonalite of Couser Canyon (Middle Cretaceous).
				30						
				31						
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

LOG OF SOIL BORING 18034 12-08.GPJ ETIC.GDT 12/10/08

ETIC ENGINEERING	CLIENT	SITE NUMBER	LOCATION
	ExxonMobil	18034	4730 Hwy 76, Fallbrook, CA

LOG OF SOIL BORING: MW-9

INCHES DRIVEN	INCHES RECOVER	BLOWS / 6" SAMPLER	OVA READING	DEPTH (feet)	AIR SAMPLE	WATER SAMPLE	SOIL SAMPLE	RECOVERED	GRAPHIC LOG	
				46						UNWEATHERED GRANITIC BEDROCK; Tonalite of Couser Canyon (Middle Cretaceous).
				47						
				48						
				49						
				50						
				51						
				52						
				53						
				54						
				55						
				56						
				57						
				58						
				59						
				60						
				61						
				62						
				63						
				64						T.D. = 63.5 ft bgs.
				65						Volume of Materials: 12 cubic ft of Bentonite grout. 3.5 cubic ft of Bentonite chips. 5 cubic ft of sand. 8 cubic ft of concrete.
				66						
				67						
				68						
				69						
				70						

LOG OF SOIL BORING 18034 12-08.GPJ ETIC.GDT 12/10/08

State of California

Business, Transportation and Housing Agency

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Memorandum

To: MR. JEFF KERMODE
ASSOCIATE ENGINEERING GEOLOGIST
DEPARTMENT OF TRANSPORTATION
7177 OPPORTUNIT ROAD
SAN DIEGO, CALIFORNIA 92111

Date: August 12, 2011

File: 11-SD-076-PM 46.1/47.3
11-SD-15-PM 16.7/17.8
Project No. 1100020489
EA No. 11-257114

SR76/I-15 Interchange
Roadway Geotechnical
Design Report

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES - MS #5
OFFICE OF GEOTECHNICAL DESIGN SOUTH-2

Subject: **Seismic Design Recommendations**

Introduction

This memorandum presents seismic design recommendations for the roadway geotechnical design report of State Route 76 / Interstate 15 interchange. Ground motion recommendations are based on the Caltrans 2009 Seismic Design Procedure (SDP) as described in the Seismic Design Criteria Version 1.6 (SDC) Appendix B, the Acceleration Response Spectrum (ARS) Online Tool v1.0.4, 2011 Logs of Test Borings (LOTBs), and approximate coordinates are provided by designer for both north and south ends of the proposed roadway.

Seismicity

Based on the 2007 Caltrans faults database / ARS Online Tool v.1.0.4, the north and south ends of the road way are located about 5.5 and 6.61 miles, respectively from the Elsinore fault zone (Temecula section). This strike-slip fault (Fault ID 245, MMax = 7.6, right lateral strike-slip, rlss, dip = 80 degrees, west, Bottom and Top of Rupture Plane approximately 9.32 and 0 miles, respectively) is the controlling fault for the deterministic seismic design procedure.

At the north end, the modal magnitude and distance of Probabilistic seismic hazard (PSH) Deaggregation are M_w=7.57, 8.2 miles, respectively. At the south end, the model magnitude and distance of PSH Deaggregation are M_w=7.59 and 8.6 miles, respectively. A map showing the location of the sites and the controlling fault is attached.

Soil Profile

The 2011 Log of Test Borings (LOTBs) shows that five (A-11-008, A-11-009, A-11-010, A-11-011, and A-11-012) 6-inch diameter rotary borings were carried out for the proposed I-15/SR 76 roadway way geotechnical report. The borings were drilled to depths approximately ranging from 21.5 to 26.5 feet (elevation 272.6 to 248.4 feet) with auger boring (hollow or solid stem bucket) carried out to the maximum depth below the existing natural grades.

The subsurface soil at the State Route 76 / Interstate 15 interchange is described as loose to very dense poorly graded sand, silty/clayey sand trace of fine gravel. Bedrock was not encountered in mentioned above borings during the 2011 subsurface investigations.

Groundwater was not encountered during 2011 subsurface geotechnical investigation.

Based on the 2011 LOTBs for State Route 76 / Interstate 15 interchange, the average shear wave velocity for the upper 100 feet of subsurface materials is estimated as V_{S30}=270 m/s.

Design Response Spectrum

Based on the 2009 SDP, the design response spectrum is the upper envelope of the deterministic and probabilistic response, but is not less than a minimum deterministic response spectrum resulting from a Mmax = 6.5 earthquake on a vertical strike-slip fault at a distance of 7.5 miles (12 km). The deterministic response spectrum is obtained by taking the arithmetic average of the median response spectra calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained for 5 percent probability of exceedance in 50 years (corresponding to approximately a 975 year return period) using the 2008 USGS Seismic Hazard Map. For this site with Vs30 of 270 m/s, 2008 USGS Deaggregations (Beta) tool were utilized to calculate the 5% in 50 years probabilistic spectrum, adjustments to account for site conditions and fault effects were implemented.

The probabilistic response spectrum controls, and the corresponding peak horizontal ground acceleration at the north and south end of site are estimated 0.404g and 0.398g, respectively. Indeed, 0.4g peak horizontal ground acceleration can be used for both north and south ends in roadway geotechnical design and analyses.

Liquefaction Potential Evaluation

Based on results of subsurface investigations conducted in 2011, liquefaction potential of subsurface soils is likely to be low at State Route 76 / Interstate 15 interchange, because of the lack of groundwater and presence of clayey sandy soils in the upper 26.5 feet of soil.

Seismic Settlement

Seismic settlement resulting from strong ground motion is considered negligible.

Surface Fault Rupture Hazard

The site is not located within an Alquist Priolo Fault Hazard Zone. Holocene active fault is the Elsinore fault (Temecula section) located 8.5 miles to the east of the this site. Potential for surface rupture is low, and no further work or design for surface rupture is required.

Discussion

The seismic design recommendations contained in this report are based on specific project information that was provided by the Office of Bridge Design South-2. If any conceptual changes are made during final project design, the Office of Geotechnical Design South-2 should review those changes to determine whether the seismic design recommendations provided in this report are still applicable. Any questions regarding the above recommendations should be directed to the attention of Asef Wardak (916) 227-1219 or Angel Perez-Cobo (916) 227-7167, Office of Geotechnical Design South-2.

Prepared by: Date: 8/18/2011

Asef Wardak
Transportation Engineer

Supervised by: Date: 8/18/11

Angel Perez-Cobo
Senior Transportation Engineer
Office of Geotechnical Design South-2

Attachments: ARS Curve

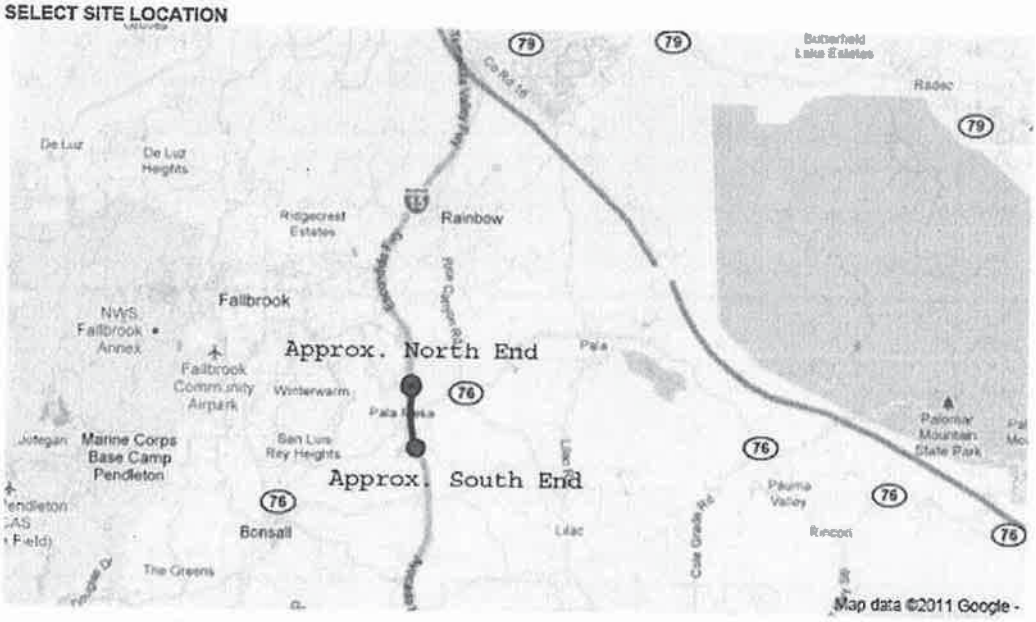
c: Angel Perez-Cobo – GDS-2
File

CALIFORNIA DEPARTMENT OF
TRANSPORTATION

Caltrans ARS Online (v1.0.4)

This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in *Appendix B of Caltrans Seismic Design Criteria*. More...

SELECT SITE LOCATION



Latitude: 33.34238333 | **Longitude:** -117.16003 **Vsw:** 270 m/s [redacted]

State of California

Business, Transportation and Housing Agency

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Memorandum

Date: August 30, 2010

To: Mohammad Ravanipour
Senior Bridge Engineer
Division of Engineering Services
Structure Design
Office of Bridge Design South 2

Attn: Wei-kung Hsia

File: 11-SD-076-PM 17.26
EA 11-257110
Project No. 1100000189

SR76/I-15 Separation Widening
Bridge No. 57-0872

From: **DEPARTMENT OF TRANSPORATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 2
DESIGN BRANCH A, MS #5

Subject: Preliminary Foundation Report

The Office of Bridge Design South 2 has requested a preliminary foundation report for the widening of the SR76/I-15 Separation in San Diego County.

The recommendations are based on the review of the Planning Study dated 9/11/09, the LOTB dated 12/21/77, the General Plan dated 6/15/81, the Foundation Plan dated 6/15/81, and the bridge inspection report dated 10/23/08. The following recommendations are preliminary and should be revised subsequent to the completion of a foundation investigation to supplant the existing information.

Project and Site Description

The existing bridge was built in 1981. It is a continuous two-span CIP/PS, 6 cell, with RC open end seated abutments and two column bents, all supported on concrete piles with tip elevations averaging between approximately 242 feet at abutment 1 and 251 feet at bent 2 and abutment 3. Bent 2 and abutment 3 appear to be constructed at approximately original grade while abutment 1 appears to be constructed on approximately 13 feet of fill. The fill material is unknown. Original ground is at approximately elevation 275 feet at abutment 1, 280 feet at bent 2, and 290 feet at abutment 3. The existing pile tips are approximately 46 feet below the pile cap at abutment 1, 17 feet below the pile cap at bent 2, and 39 feet below the pile cap at abutment 3.

The bridge is exhibiting deterioration according to the bridge inspection report. The new work proposes to widen the existing 2-lane structure to a 4 lane conventional highway, with additional lanes available at the interchange. The widening will be to the south. A tieback wall will be placed adjacent to the shoulders of the proposed loop on-ramps. ?

Geologic Data

Based on the 1972 as-built LOTB information, the site is underlain by dense to very dense sand and gravel, along with clayey sand and clayey silt of varying consistencies. This is a desert environment of alluvium with relatively flat topography and arid conditions.

The location is within the western portion of the Mojave Desert Province, a broad interior region of isolated mountain ranges separated by expanses of desert plains. The drainage is enclosed with the presence of many playas. The topography is controlled by the NW-SE trending San Andreas Fault and the E-W trending Garlock Fault. These faults provide the southern and northern boundaries respectively of the province. ??

Ground Water

Ground water was encountered during the 1972 investigation at an elevation of approximately 245 feet, which is approximately 30 to 35 feet below original grade. This was measured during the winter, a time of usually higher rainfall in the area. This elevation may vary seasonally, and with recent rainfall totals, as well as any irrigation that may be present.

Scour

The site is located within an area where there are no river, creek or hydraulic channels that cross through the project site; therefore,scour should not be considered a design issue in foundation analysis.

Corrosion

Due to the predominance of coarse-grained soils, corrosion is not expected at this site. Soil analytical results will be used during the foundation investigation to confirm soil corrosivity.

Liquefaction

Soil liquefaction is not likely due to the relative density of the sands and the absence of a high water table. Additional information is required to determine if site soils may liquefy during a seismic event. The information needed includes soil density and mechanical properties. This determination should be made after the results of a foundation investigation are completed.

Settlement

Due to the granular nature of the soils at the site, the settlement induced by the structure should occur in a relatively short time period and be of an elastic nature. This determination should be made after the results of a foundation investigation are completed.

Seismic Data

Based on the 2007 Caltrans fault database, the site is located approximately 13.1 km from the Elsinore Fault, Temecula section, (Fault ID 245, M_{max} = 7.6, right lateral strike-slip, dip

angle = 80 degrees), which is the controlling fault for the deterministic seismic procedure. According to the Caltrans California Seismic Hazard Map, the site falls within the peak horizontal bedrock acceleration zone of 0.4 g.

Based on the 2009 Seismic Design Criteria, the design response spectrum is based on the upper envelope of a deterministic and probabilistic response spectrum, but not to be less than a deterministic response spectrum for a vertical strike-slip fault of M_{max} = 7.6 at a distance of approximately 12.8 km to the northeast. The shear wave velocityVs30 is assumed to be 220 m/s .The deterministic spectrum is obtained as the arithmetic average of median response spectra calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained from the 2008 USGS Seismic Hazard Map (Petersen et all, 2008) for the 5% in 50 years probability of exceedance. Digital values of the acceleration response spectrum (ARS curve) recommended for preliminary design are shown below.

Site Specific ARS Curve

Period (sec)	ARS (g)
0.01	0.328
0.02	0.378
0.03	0.410
0.05	0.454
0.075	0.493
0.1	0.523
0.15	0.601
0.2	0.664
0.25	0.675
0.3	0.685
0.4	0.658
0.5	0.638
0.75	0.617
1	0.578
1.5	0.454
2	0.382
3	0.263
4	0.192
5	0.161

The site is not considered prone to surface rupture due to fault movement since there are no known faults projecting towards or passing through the project site. The site is not located within any Alquist-Priolo Fault Rupture Hazard Zone.

Foundation Recommendations

For bridge widening, the following foundations are discussed for use at support locations. Whichever alternative is selected for the bridge foundation, the design engineer must determine the anticipated performance and requirements expected of the foundation types given below. The design engineer has already stated that the new foundations will match the existing foundations. However, the following discussion will cover reasonable considerations.

(1) Spread Footings: Spread footings might be used for support at this site. Lateral capacity will be much less than other foundation types. Excavation below the fill may be necessary at the abutments which may be considered as too deep for this type of excavation. There may also be issues with proximity to the existing footings. However, liquefaction may be an issue, which will be determined during the foundation investigation.

(2) CIDH Piles: Based on the information available to us at this time, CIDH piles with permanent or temporary casing may be used for support at this site. CIDH piles are suitable for sites that might require high lateral capacity, which is probably not required at this site. Due to the likelihood of encountering groundwater, at least 24 inch diameter CIDH piles would be required.

CIDH piles may be used if high axial loads and or tension capacities are required (compared to that of driven concrete or steel piles).

(3) Driven Concrete Piles/Close-ended Steel Pipe Piles: Due to the density of the underlying silty sand, driving may be problematic. However, the pile driving records of the existing foundations only indicate that one pile at abutment 1 required pre-drilling. The existing piles are Class 70 (Class 140), alternative X, 12 inch square, precast, prestressed, concrete.

In order to match the existing foundations, driven concrete piles would be the recommended foundation type.

(4) CISS Piles: CISS piles may not be necessary for support at this site. CISS piles are suitable for sites that might require high lateral capacity, which is probably not required at this site. Driveability should not be an issue.

(5) H-Piles: Steel H-piles could be used for support at this site due to the density of the underlying silty, clayey sand. They can be driven in hard driving conditions more readily than other driven piles, however; the lateral capacity will be minimal.

(6) Open-Ended Steel Pipe Piles: Driven steel pipe piles would be suitable for support at this site due to the density of the underlying silty sand. Driveability should not be an issue.

The above preliminary foundation recommendations may be revised when a site-specific field investigation is completed and more information about the geology, groundwater conditions, and other field data become available. The above discussions are intended to provide preliminary interpretation of the site conditions for the purpose of cost estimates and preliminary planning and are not the final recommendations.

Additional Field Investigation

For a Final Foundation Report, a field drilling investigation may be required to characterize the site and obtain information about soil/bedrock and groundwater conditions, corrosion, site-specific seismic data, and other pertinent geological information.

A request for foundation recommendations should include Foundation and General Plans for the proposed bridge replacement. The District Project Manager should be aware that several permits may be required to commence drilling and should plan to consider time required the district to obtain permits. Permits such as road closure, permits to be on private property (right-of-entry, if required), utility clearance, and any other environmental issues/permits may be required for drilling at the site and in the district/county.

Estimated GS Time and Duration Required

The estimated time and resources are only for this structure. Final design plans should be forwarded to the Office of Geotechnical Design-South 2 for further evaluation. Revision of the resource estimate may be required and is contingent upon the work necessary to complete the foundation recommendations.

The following resource estimate is issued pursuant to "Memo to Designers" 1-35 (Revised June 2008). The estimated hours and duration are based on the following assumptions:

1) The Office of Structure Design will provide all information required by the Office of Geotechnical Design South 2.

2) The Department will provide the appropriate resources (funding, staff, and equipment) for the project.

3) The district will provide necessary permits and clearance for drilling in the county.

The engineering geologist/engineer will determine the number of borings that may be needed to complete the project. Decision to determine the amount of fieldwork will be assessed when complete information and plans become available to our office. The number of borings needed to describe and verify soil below pile tip elevations, to obtain groundwater measurements, corrosion data, and liquefaction information, is estimated at 3 borings. The estimated depth of borings is 50 ft. Table 1 below shows resource estimate for the time and duration to complete work on this bridge.

Table 1: Resource Estimate

Request Type	GS Estimated Hours	GS Estimated Duration
FR (WBS 240)	600 (1)	22 weeks (2)

1) Includes three (3) rotary borings, which may include PS Logged hole.
2) Request for foundation recommendations, including General and Foundation Plans, should be forwarded to the Office of Geotechncial Design South 2 twenty two (22) weeks before the foundation report due date.

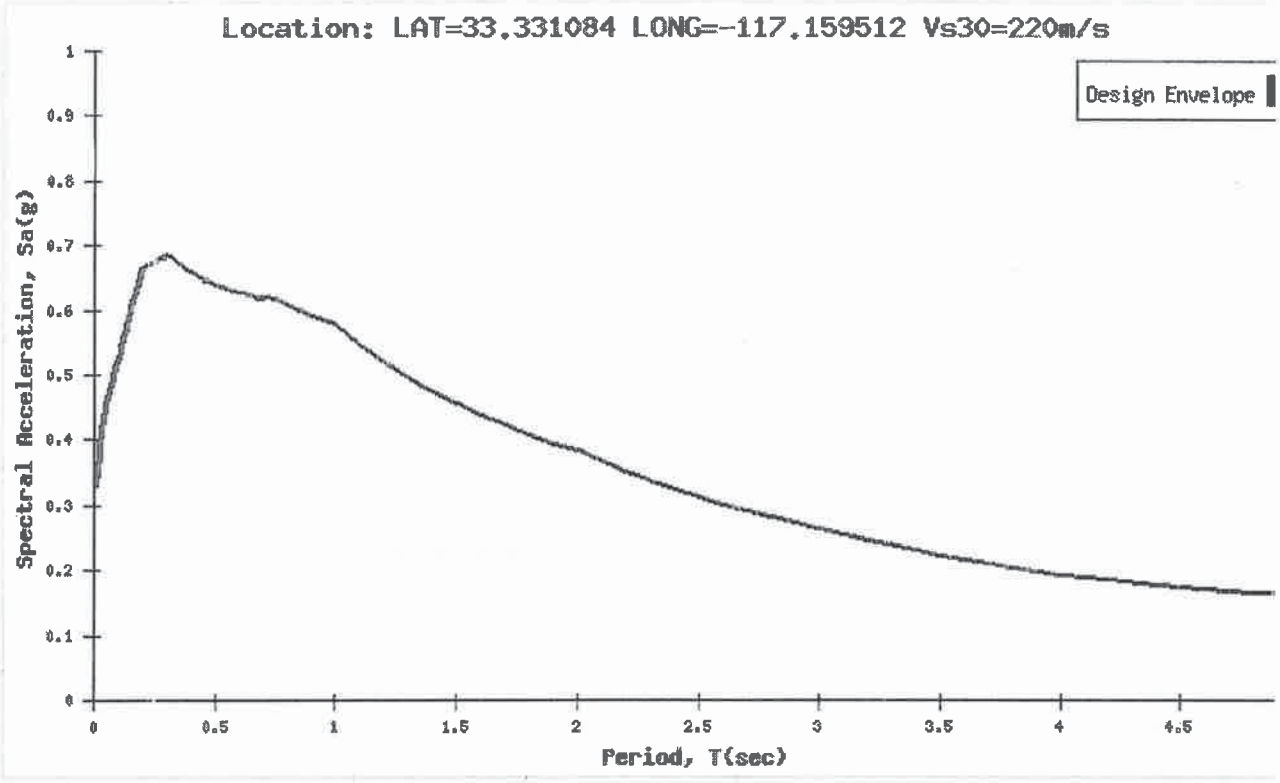
If you have any questions or need additional information, please call Bill Levine at 916-227-0505 or Angel Perez-Cobo at 916-227-7167 of the Office of Geotechnical Design South 2A.

Bill Levine
Engineering Geologist
Geotechnical Design-South 2
Design Branch A

Angel Perez-Cobo
Senior Engineer
Geotechnical Design-South 2
Design Branch A

cc: Mark Willian-GS Corporate
Ann Fox-District Project Manager
Mark Phelan-District Project Manager
Angela Ezekiel-Project Coordination Engineer
Debby Soifer-District Environmental Planner
Art Padilla-District Materials Engineer
Carl Savage-Design Manager
A. Perez-Cobo

REGISTERED GEOLOGIST
W.J. LEVINE
NO. 2108
Exp. 7/31/11
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA


Location: LAT=33.331084 LONG=-117.159512 Vs30=220m/s
Design Envelope
Spectral Acceleration, Sa(g)
Period, T(sec)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0.5
1.5
2
2.5
3
3.5
4
4.5

State of California

Business, Transportation and Housing Agency

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Memorandum

Date: May 9, 2011

To: Paul Chung
Senior Bridge Engineer
Division of Engineering Services
Structure Design
Office of Bridge Design South 2

File: 11-SD-076-PM 17.26
1100000189

Attn: Wei-kung Hsia

SR76/I-15 Separation Widening
Bridge No. 57-0872

From: **DEPARTMENT OF TRANSPORATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 2
DESIGN BRANCH A, MS #5

Subject: Revised Foundation Report

The Office of Bridge Design South 2 has requested a revised foundation report due to revised foundation designs for the widening of the SR76/I-15 Separation in San Diego County. This report supersedes the foundation report dated April 4, 2011.

The recommendations are based on the review of the Planning Study dated 9/11/09, the LOTB dated 12/21/77, the General Plan dated 6/15/81, the Foundation Plan dated 6/15/81, the bridge inspection report dated 10/23/08, and the borehole investigation performed July, 2010. Elevations used in this most current report are based on NAVD88.

Project and Site Description

The existing bridge was built in 1981. It is a continuous two-span CIP/PS, 6 cell, with RC open end seated abutments and two column bents, all supported on concrete piles with tip elevations averaging between approximately 244 feet at abutment 1 and 253 feet at bent 2 and abutment 3. Bent 2 and abutment 3 appear to be constructed at approximately original grade while abutment 1 appears to be constructed on approximately 13 feet of fill. The fill material is unknown. Original ground is at approximately elevation 289 feet at abutment 1, 279 feet at bent 2, and 293 feet at abutment 3. The existing piles are approximately 46 feet below the pile cap at abutment 1, 17 feet below the pile cap at bent 2, and 39 feet below the pile cap at abutment 3.

The bridge is exhibiting deterioration according to the bridge inspection report. The new work proposes to widen the existing 2-lane structure to a 4 lane conventional highway, with additional lanes available at the interchange. The widening will be to the south. Tieback walls will be placed adjacent to the shoulders of the proposed loop on-ramps, but their geotechnical investigation has not been included in the scope of this report.

Geologic Data

Based on the 1972 as-built LOTB information, and the 2010 LOTB information, the site is underlain by dense to very dense sand and gravel, along with clayey sand and clayey silt of varying consistencies.

The site is located within the Peninsular Range geomorphic province. As such, the larger area is characterized by generally northwest trending valleys which are subparallel to faults branching from the San Andreas Fault. There is a gentle westerly slope and steep eastern face to most of the ranges within the province. The province contains Jurassic and Cretaceous igneous rocks with some remnants of roof rock. Granitic rock is commonly found intruding the older metamorphic rocks. The extent of this investigation did not extend to underlying bedrock.

Ground Water

Ground water was encountered during the 1972 investigation at an elevation of approximately 245 feet, which is approximately 30 to 65 feet below original grade. This was measured during the winter, a time of usually higher rainfall in the area. During the July, 2010 investigation, ground water was measured at elevation approximately 243 feet. These elevations may vary seasonally, and with recent rainfall totals, as well as; any irrigation or other man made or natural issues that may be present.

Scour

The structure does not overlie a watercourse, thus scour was not investigated and is not considered a potential issue.

Corrosion

The results are presented in the following table. Corrosion, as determined by Caltans, is as follows: If the minimum resistivity is less than 1000 ohm-cm, then chlorides and sulfates will be tested to determine corrosivity. Chlorides above 500 ppm and/or sulfates above 2000 ppm are considered corrosive. If the pH is 5.5 or less, the site is considered corrosive.

SIC Number	Sample Type	Boring Number	Sample Depth	Minimum Resistivity (ohm-cm)	pH	Chloride Content (ppm)	Sulphate Content (ppm)
C640675	Soil	R-10-002	85.0' - 101.5'	1202	7.58		
C640674	Soil	R-10-001	0.0' – 35.5'	864	7.59	109	240
C640455	Soil	R-10-002	various depths	1033	7.29		
C640456	Soil	R-10-003	various depths	1492	7.95		

According to the laboratory information presented in the previous table and the guidelines set by Caltrans, the site is not considered corrosive to foundation elements.

Liquefaction

From the as-built and current log of test borings, it can be seen that the site is underlain by layers of dense to very dense sand along with clayey sand, silty sand, and clay of varying consistencies. Ground water surface was encountered at depth of about 30 to 65 feet below the ground surface. Considering both soil conditions and groundwater levels, the potential for soil liquefaction due to strong ground shaking is low.

Settlement

Due to the granular nature of the majority of soils at the site, settlement induced by the structure should occur in a relatively short time period and be of an elastic nature. Cohesive soil presence is relatively minor. Seismic settlement of more than one inch is not expected.

Seismic Data

Based on the 2009 SDP, the design response spectrum is based on the upper envelope of a deterministic and probabilistic response spectrum, but not to be less than a minimum deterministic response spectrum for a vertical strike-slip fault of $M_{max} = 6.5$ at a distance of approximately 12 km. The deterministic response spectrum is obtained as the arithmetic average of median response spectra calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained from the 2008 USGS Seismic Hazard Map (Petersen et all, 2008) for the 5% in 50 years (corresponding to approximately a 1000 year return period) probability of exceedance. For this site with Vs_{30} of 210 m/s, 2008 USGS Deaggregations (Beta) tool were utilized to calculate the 5% in 50 years probabilistic spectrum. The near fault factors are applied on the results. Digital values of the acceleration response spectrum (ARS curve) recommended for preliminary design are shown below.

Site Specific ARS Curve

Period (sec)	ARS (g)
0	0.433
0.05	0.624
0.1	0.730
0.15	0.835
0.2	0.919
.25	0.927
0.3	0.934
0.4	0.875
0.5	0.832
0.6	0.800
0.7	0.777
0.85	0.737
1	0.701
1.2	0.611
1.5	0.517

2	0.416
3	0.270
4	0.195
5	0.161

The site is not considered prone to surface rupture due to fault movement since there are no known faults projecting towards or passing through the project site. The site is not located within any current Alquist-Priolo Fault Rupture Hazard Zone.

As-Built Foundations

As-Built Pile data are shown in Table 1.

Table 1
As-Built Shaft Data for Bridge 57-0872

Location	Pile Type	Working Stress Design	As-Built Tip Elevations			
			Design Tip Elevation	Average Tip Elevation	Maximum Elevation	Minimum Elevation
Abut 1	Class 140 Alt. X	70 Ton	244.1 ft	244.2 ft	244.2 ft	243.1 ft
Bent 2	Class 140 Alt. X	70 Ton	253.1 ft	253.3 ft	255.3 ft	253.1 ft
Abut 3	Class 140 Alt. X	70 Ton	253.1 ft	253.6 ft	255.0 ft	252.1 ft

Note: As-Built elevations have been converted from NGVD29 to NAVD88.

Footing Design Information Supplied by Design

Support Location	Pile Type	Finished Grade Elevation	Pile Cut-off Elevation	Pile Cap Size		Permissible Settlement Under Service Load	Number of Piles per Support
				B	L		
Abut 1	Class 140 Alt. X	293.50 feet	289.5 feet	7.5 ft	83 ft	1 in	30
Bent 2	Class 200 Alt. X	279.25 feet	270.5 feet	18 ft	62.5 ft	1 in	96
Abut 3	Class 140 Alt. X	295.90 feet	291.9 feet	7.5 ft	83 ft	1 in	30

Support Location	Service 1 Limit State			Strength Limit State (Controlling Group)				Extreme Event Limit State (Controlling Group)			
	Total Loads		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max Per Pile	Per Support	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile
Abut 1	3353 kips	140 kips	2864 kips	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	8955 kips	N/A	6788 kips	13379 kips	162 kips	N/A	N/A	6245 kips	280 kips	N/A	118 kips
Abut 3	3353 kips	140 kips	2864 kips	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Foundation Recommendations

Support Location	Pile Type	Cut-Off Elevation	Service-I Limit State Load per Column	Total Permissible Support Settlement	Required Nominal Resistance				Design Tip Elevation	Specified Tip Elevation	Nominal Driving Resistance
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Abut 1	Class 140 Alt. X	289.5 ft	3353 kips	1 in	N/A	0	N/A	0	243 ft (a-l)	243 ft (a-l)	280 kips
Bent 2	Class 200 Alt. X	271.5 ft	8955 kips	1 in	162 kips	0	280 kips	118 kips	232 ft (a-l)	232 ft (a-l)	281 kips
Abut 3	Class 140 Alt. X	291.5 ft	3353 kips	1 in	N/A	0	N/A	0	252 ft (a-l)	252 ft (a-l)	280 kips

Note: Design tip elevations are controlled by Compression (Strength Limit)

Location	**Design Method**	**Pile Type**	**Cut-Off Elevation**	**Nominal Resistance**		**Design Tip Elevation**	**Specified Tip Elevation**	**Nominal Driving Resistance**
				Compression	Tension			
Abutment 1	WSD	Class 140 Alt. X	289.5 feet	140 kips	N/A	243 ft (a-l)	243 ft (a-l)	280 kips
Bent 2	LRFD	Class 200 Alt. X	270.5 feet	280 kips	118 kips	232 ft (a-l)	232 ft (a-l)	281 kips
Abut 3	WSD	Class 140 Alt. X	291.5 feet	140 kips	N/A	252 ft (a-l)	252 ft (a-l)	280 kips

Note: Design tip elevations are controlled by Compression (Strength Limit)

Construction Considerations

1) Any driven Class 140 pile for abutments 1 and 3 that achieves refusal within 15 feet of specified pile tip elevations during driving may be considered good and cut off with the Engineer's written approval. Any driven Class 140 pile for bent 2 that achieves refusal within 5 feet of specified pile tip elevations during driving may be considered good and cut off with the Engineer's written approval.

2) The contractor should anticipate that some of driven piles probably will not achieve bearing at the end of driving at the specified pile tip elevation do to the nature of underlying cohesive soils. Any concrete piles that do not achieve bearing at the end of driving should be restruck after a minimum setup period. A minimum setup period of 12 hours is required.

If you have any questions or need additional information, please call Bill Levine at 916-227-0505 or Angel Perez-Cobo at 916-227-7167 of the Office of Geotechnical Design South 2A.

Bill Levine
Engineering Geologist
Geotechnical Design-South 2
Design Branch A

Angel Perez-Cobo
Senior Engineer
Geotechnical Design-South 2
Design Branch A

Attachment: Acceleration Response Curve

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Structure Construction RE Pending File (RE_Pending_File@dot.ca.gov)
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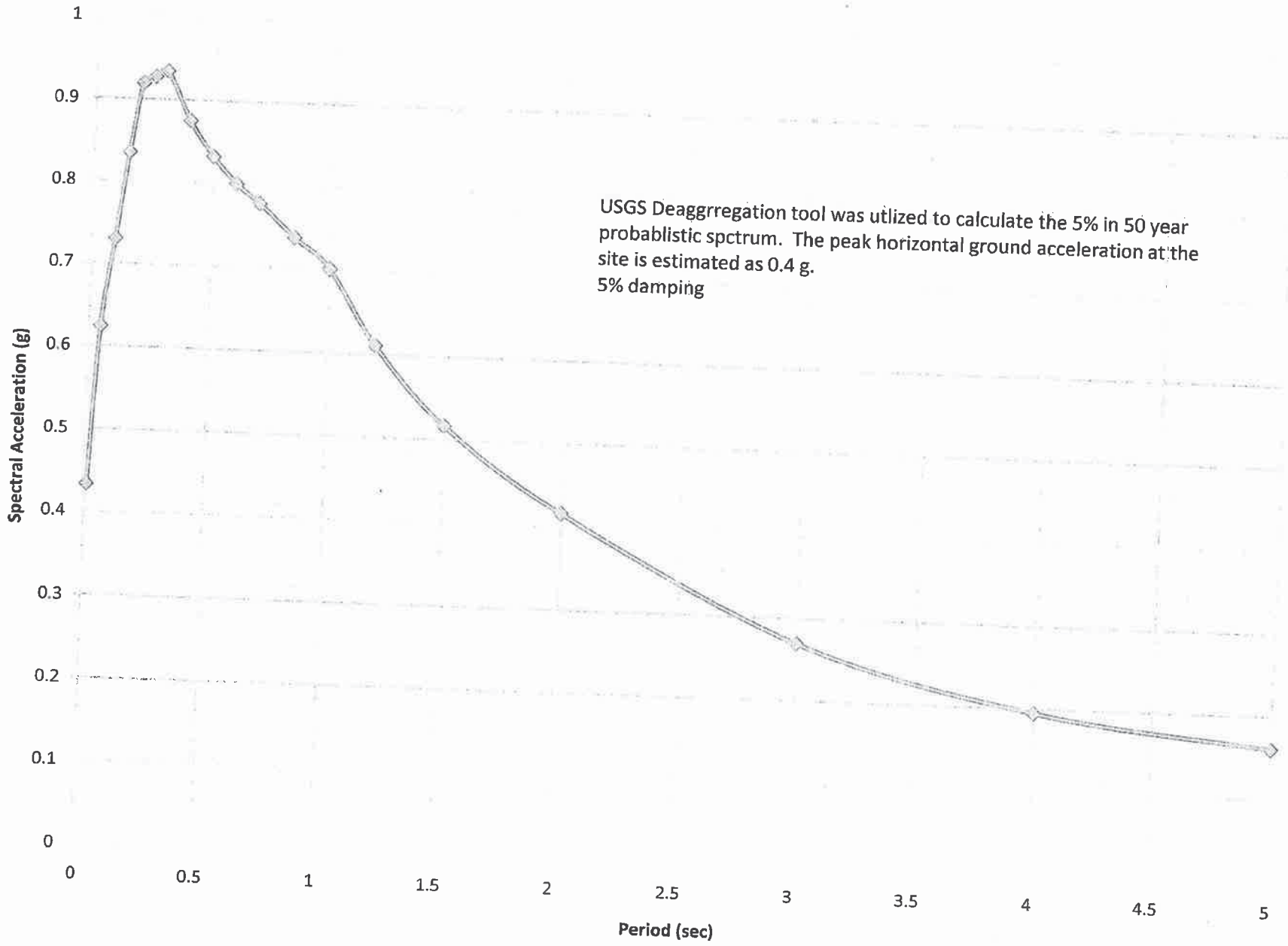
Recommended Accleraton Response SR 76/15 Separation Widening
Bridge# 57-0872



State of California

Business, Transportation and Housing Agency

Flex Your Power!
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Memorandum

Date: June 23, 2011

To: Paul Chung
Senior Bridge Engineer
Division of Engineering Services
Structure Design
Office of Bridge Design South 2

File: 11-SD-076-PM 17.26
1100000189

Attn: Wei-kung Hsia

SR76/I-15 Seismic Retrofit
Bridge No. 57-0872

From: **DEPARTMENT OF TRANSPORATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 2
DESIGN BRANCH A, MS #5

Subject: Foundation Report

The Office of Bridge Design South 2 has requested a foundation report in addition to the previous foundation report dated May 9, 2011. This is due to the revised scope of work, which is now including seismic retrofit to the existing foundation, while the previous report only discussed widening of the SR76/I-15 Separation in San Diego County. This report is in addition to the above mentioned foundation report dated May 9, 2011.

The recommendations are based on the review of the Planning Study dated 9/11/09, the LOTB dated 12/21/77, the General Plan dated 6/15/81, the Foundation Plan dated 6/15/81, the bridge inspection report dated 10/23/08, the foundation report dated May 9, 2011, and the borehole investigation performed July, 2010. Elevations used in this most current report are based on NAVD88.

Project and Site Description

The existing bridge was built in 1981. It is a continuous two-span CIP/PS, 6 cell, with RC open end seated abutments and two column bents, all supported on concrete piles with tip elevations averaging between approximately 244 feet at abutment 1 and 253 feet at bent 2 and abutment 3. Bent 2 and abutment 3 appear to be constructed at approximately original grade while abutment 1 appears to be constructed on approximately 13 feet of fill. The fill material is unknown. Original ground is at approximately elevation 289 feet at abutment 1, 279 feet at bent 2, and 293 feet at abutment 3. The existing piles are approximately 46 feet below the pile cap at abutment 1, 17 feet below the pile cap at bent 2, and 39 feet below the pile cap at abutment 3.

The bridge is exhibiting deterioration according to the bridge inspection report. The new work proposes to widen the existing 2-lane structure to a 4 lane conventional highway, with additional lanes available at the interchange. The widening will be to the south. Tieback walls will be placed

adjacent to the shoulders of the proposed loop on-ramps, but their geotechnical investigation has not been included in the scope of this report.

Geologic Data

Based on the 1972 as-built LOTB information, and the 2010 LOTB information, the site is underlain by dense to very dense sand and gravel, along with clayey sand and clayey silt of varying consistencies.

The site is located within the Peninsular Range geomorphic province. As such, the larger area is characterized by generally northwest trending valleys which are subparallel to faults branching from the San Andreas Fault. There is a gentle westerly slope and steep eastern face to most of the ranges within the province. The province contains Jurassic and Cretaceous igneous rocks with some remnants of roof rock. Granitic rock is commonly found intruding the older metamorphic rocks. The extent of this investigation did not extend to underlying bedrock.

Ground Water

Ground water was encountered during the 1972 investigation at an elevation of approximately 245 feet, which is approximately 30 to 65 feet below original grade. This was measured during the winter, a time of usually higher rainfall in the area. During the July, 2010 investigation, ground water was measured at elevation approximately 243 feet. These elevations may vary seasonally, and with recent rainfall totals, as well as; any irrigation or other man made or natural issues that may be present.

Scour

The structure does not overlie a watercourse, thus scour was not investigated and is not considered a potential issue.

Corrosion

The results are presented in the following table. Corrosion, as determined by Caltrans, is as follows: If the minimum resistivity is less than 1000 ohm-cm, then chlorides and sulfates will be tested to determine corrosivity. Chlorides above 500 ppm and/or sulfates above 2000 ppm are considered corrosive. If the pH is 5.5 or less, the site is considered corrosive.

SIC Number	Sample Type	Boring Number	Sample Depth	Minimum Resistivity (ohm-cm)	pH	Chloride Content (ppm)	Sulphate Content (ppm)
C640675	Soil	R-10-002	85.0' - 101.5'	1202	7.58		
C640674	Soil	R-10-001	0.0' – 35.5'	864	7.59	109	240
C640455	Soil	R-10-002	various depths	1033	7.29		
C640456	Soil	R-10-003	various depths	1492	7.95		

According to the laboratory information presented in the previous table and the guidelines set by Caltrans, the site is not considered corrosive to foundation elements.

Liquefaction

From the as-built and current log of test borings, it can be seen that the site is underlain by layers of dense to very dense sand along with clayey sand, silty sand, and clay of varying consistencies. Ground water surface was encountered at depth of about 30 to 65 feet below the ground surface. Considering both soil conditions and groundwater levels, the potential for soil liquefaction due to strong ground shaking is low.

Settlement

Due to the granular nature of the majority of soils at the site, settlement induced by the structure should occur in a relatively short time period and be of an elastic nature. Cohesive soil presence is relatively minor. Seismic settlement of more than one inch is not expected.

Seismic Data

Based on the 2009 SDP, the design response spectrum is based on the upper envelope of a deterministic and probabilistic response spectrum, but not to be less than a minimum deterministic response spectrum for a vertical strike-slip fault of $M_{max} = 6.5$ at a distance of approximately 12 km. The deterministic response spectrum is obtained as the arithmetic average of median response spectra calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained from the 2008 USGS Seismic Hazard Map (Petersen et all, 2008) for the 5% in 50 years (corresponding to approximately a 1000 year return period) probability of exceedance. For this site with Vs_{30} of 210 m/s, 2008 USGS Deaggregations (Beta) tool were utilized to calculate the 5% in 50 years probabilistic spectrum. The near fault factors are applied on the results. Digital values of the acceleration response spectrum (ARS curve) recommended for preliminary design are shown below.

Site Specific ARS Curve

Period (sec)	ARS (g)
0	0.433
0.05	0.624
0.1	0.730
0.15	0.835
0.2	0.919
.25	0.927
0.3	0.934
0.4	0.875
0.5	0.832
0.6	0.800
0.7	0.777

0.85	0.737
1	0.701
1.2	0.611
1.5	0.517
2	0.416
3	0.270
4	0.195
5	0.161

The site is not considered prone to surface rupture due to fault movement since there are no known faults projecting towards or passing through the project site. The site is not located within any current Alquist-Priolo Fault Rupture Hazard Zone.

As-Built Foundations

As-Built Pile data are shown in Table 1.

Table 1
As-Built Shaft Data for Bridge 57-0872

Location	Pile Type	Working Stress Design	As-Built Tip Elevations			
			Design Tip Elevation	Average Tip Elevation	Maximum Elevation	Minimum Elevation
Abut 1	Class 140 Alt. X	70 Ton	244.1 ft	244.2 ft	244.2 ft	243.1 ft
Bent 2	Class 140 Alt. X	70 Ton	253.1 ft	253.3 ft	255.3 ft	253.1 ft
Abut 3	Class 140 Alt. X	70 Ton	253.1 ft	253.6 ft	255.0 ft	252.1 ft

Note: As-Built elevations have been converted from NGVD29 to NAVD88.

Footing Design Information Supplied by Design

Support Location	Pile Type	Finished Grade Elevation	Pile Cut-off Elevation	Pile Cap Size		Permissible Settlement Under Service Load	Number of Piles per Support
				B	L		
Bent 2	24 inch CIDH	279.25 feet	270.5 feet	37 ft	40 ft	1 in	36

Support Location	Service 1 Limit State			Strength Limit State (Controlling Group)				Extreme Event Limit State (Controlling Group)			
	Total Loads		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max Per Pile	Per Support	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile
Bent 2	1198 kips	N/A	1198 kips	1798 kips	50 kips	N/A	N/A	3182 kips	401 kips	N/A	-194 kips

Foundation Recommendations

State Route 76 and Interstate 15 Separation (Retrofit), Br # 57-0872 Bent 2 Foundation Design Recommendations											
Support Location	Pile Type	Cut-off - Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Bent 2 Col 1	24-inch CIDH	270.5	1198	1	50	N/A	401	194	240.5(*a-I*) 210.5 *(a-II)* 217.5 *(b-II)*	210.0	N/A
Bent 2 Col 2	24-inch CIDH	270.5	1198	1	50	N/A	401	194	240.5(*a-I*) 210.5 *(a-II)* 217.5 *(b-II)*	210.0	N/A

Notes:

1) *Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (b-I) Tension (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (c) Settlement, (d) Lateral Load*
2) *The specified tip elevation shall not be raised above the design tip elevations for tension, lateral, and tolerable settlement.*
3) *The nominal driving resistance required is equal to the nominal resistance needed to support the factored load plus driving resistance from the unsuitable penetrated soil layers (very soft, liquefiable, scourable, etc.), if any, which do not contribute to the design resistance.*

Construction Considerations

1) The recommended pile (CIDH) should be constructed in accordance with Section 49-4 per Caltrans Standard Specifications (Caltrans, 2006) and Memo-To-Designer 3-1

2) Groundwater was measured in 1972 at elevation 245 feet (approximately 34 feet below existing ground surface at bent 2 location). During the July, 2010 investigation, ground water was measured at elevation approximately 243. The actual groundwater elevation may be different during constriction due to seasonal rainfall, surface runoff and other man-made conditions. Therefore, contractors should be prepared to use a "Wet" construction method

3) Loose soils at the bottom of the drilled excavation hole should be cleaned. The drilled holes should be inspected and approve by the geotechnical engineer prior to the installations.

4) Due to the limited overhead space, extreme care should consider during drilling the pile hole, placement of steel cage and pouring concrete to avoid any excessive disturbance of pile boring walls.

5) Concrete placement by pumping or tremie tube to the bottom of the pile borings will be required

6) Sufficient space should be provided in the pile reinforcing cage during fabrication to allow the insertion of a tremie tube for concrete placement

7) Per Caltrans Memo-To-Designer 3-1, PVC tubings must be installed within the reinforcement cage of the CIDH pile for gamma-ray and crosshole sonic testing

8) Pile reinforcing cage should be installed and the concrete pumped immediately after drilling is completed

9) CIDH piles should not be drilled immediately adjacent to another pile until the concrete in the other pile has attained its initial set

10) If any boring becomes ball-shaped and cannot be further advanced due to severe a caving, all loose material should be removed from the bottom of the hole the cave region should be patched and filled with a low strength sand-cement slurry. Drilling may continue when the slurry has reached its initial set.

The recommendations contained in this report are based on specific project information regarding design loads and structure locations that has been provided by Office of Bridge Design South 2. If any conceptual changes are made during final project design, the Office of Geotechnical Design South-2, should review those changes to determine if the foundation recommendations provided in this report are still applicable.

If you have any questions or need additional information, please call Asef Wardak at 916Angel Perez-Cobo at 916-227-7167 of the Office of Geotechnical Design South 2A.

REGISTERED PROFESSIONAL ENGINEER
ASEF WARDAK
No. C 61960
Exp. 9/30/2011
STATE OF CALIFORNIA

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Geotechnical Design-South 2
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Senior Engineer
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Bill Levine
Engineering Geologist
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Attachment: Acceleration Response Curve

cc: Mark Willian-GS Corporate
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DES Office Engineer, Office of PS&E (Rebecca_Harnagel@dot.ca.gov)
Art Padilla-District Materials Engineer
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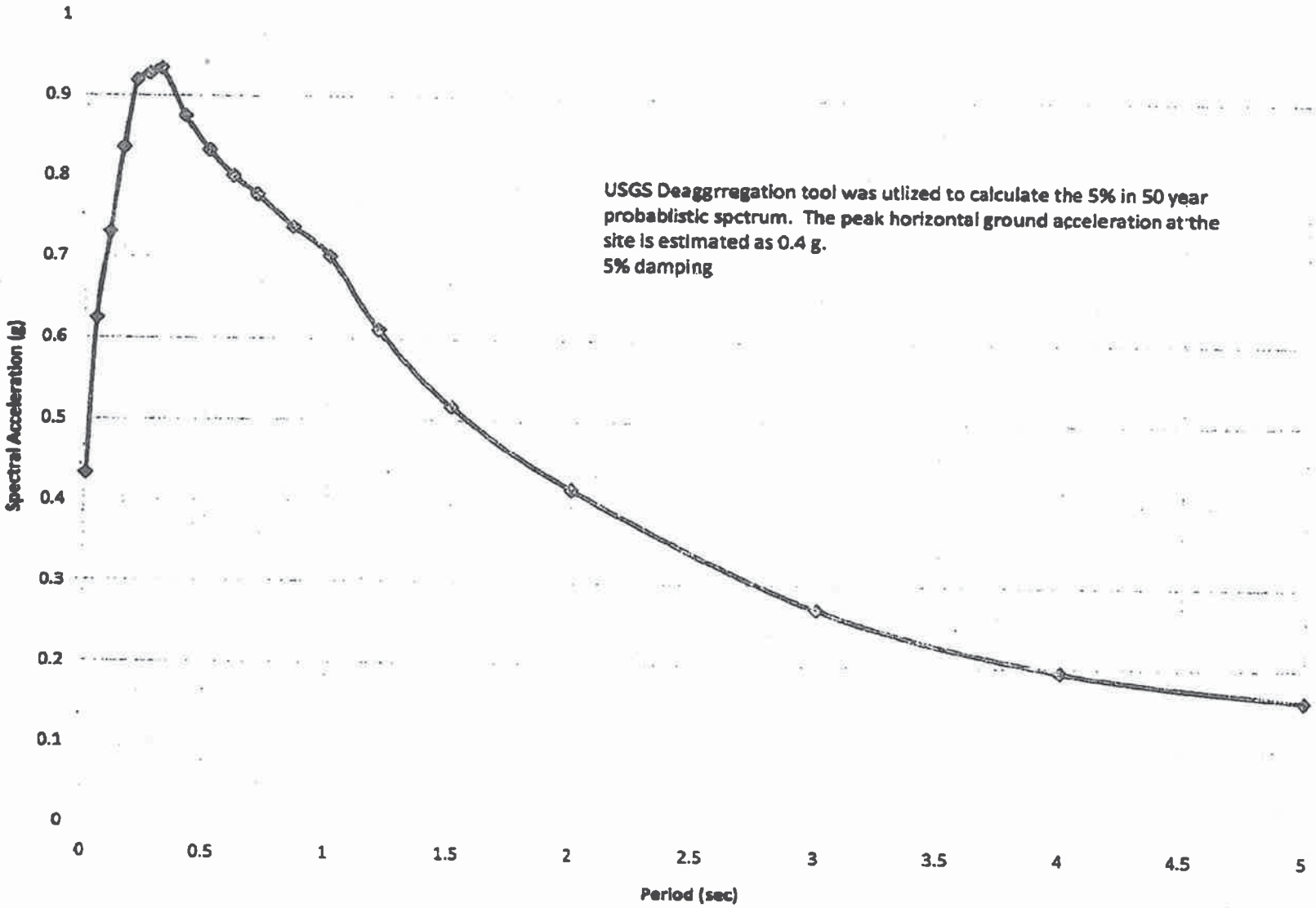
Recommended Accleraton Response SR 76/15 Separation Widening
Bridge# 57-0872



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road, Suite 101
Carlsbad, California 92011

In Reply Refer To:
FWS-SDG-09B0003-11F0420

SEP 22 2011

Mr. Robert James, Acting Chief
Environmental Resource Studies
California Department of Transportation - District 11
4050 Taylor Street
San Diego, California 92110

Attention: Rush Abrams, Associate Environmental Planner

Subject: Formal Section 7 Consultation for the State Route 76 South Mission to I-15 Highway Improvement Project, San Diego County, California

Dear Mr. James:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the State Route 76 (SR-76) South Mission to Interstate 15 (I-15) Highway Improvement Project and its effects on the federally threatened coastal California gnatcatcher (*Polioptila californica californica*, "gnatcatcher"), the federally endangered least Bell's vireo (*Vireo bellii pusillus*, "vireo"), southwestern willow flycatcher (*Empidonax traillii extimus*, "flycatcher"), arroyo toad [*Anaxyrus californicus* (*Bufo microscaphus c.*)], and San Diego ambrosia (*Ambrosia pumila*, "ambrosia"), and their designated critical habitats, in accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*). The California Department of Transportation (Caltrans) has assumed the Federal Highway Administration's (FHWA) responsibilities under the Act for this consultation in accordance with Sections 6004 and 6005 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) 2005, as described in the National Environmental Policy Act Delegation Pilot Program Memorandum of Understanding between FHWA and Caltrans (effective July 1, 2007) and codified in Renewed 23 U.S.C. 326 and 23 U.S.C. 327.

This biological opinion is based on information provided in: 1) *State Route 76 South Mission to Interstate 15 Highway Improvement Project Biological Assessment* (Caltrans 2011, "BA"); 2) *State Route 76 South Mission to Interstate 15 Highway Improvement Project Draft Environmental Impact Report/ Environmental Impact Statement* (Caltrans 2010, "DEIS"); 3) field meetings on July 27, 2010, September 23, 2010, March 10, 2011, and May 11, 2011; and 4) other sources of information including survey reports and email correspondence. A complete project file of this consultation is maintained at the Carlsbad Fish and Wildlife Office (CFWO).

CONSULTATION HISTORY

Extensive and early coordination between Caltrans and the Service occurred on the project. The following chronology reflects a summary of significant events.

May 2008-May 2010	A series of coordination meetings were held between Caltrans, Army Corps of Engineers, Environmental Protection Agency, Regional Water Quality Control Board, and California Department of Fish and Game in accordance with the NEPA/404 MOU Integration Process. The proposed project's Purpose and Need, Selection Criteria, and Range of Alternatives were developed and refined during these meetings in order to minimize impacts to biological resources.
July 28, 2009	The Service provided written concurrence on the Purpose and Need statement for the project.
April 5, 2010	The Service provided written concurrence on the Range of Alternatives for the project.
June 28, 2010	The Service provided a list of species and their critical habitats expected to be present in or near the proposed action area.
July 27, 2010	Representatives from Caltrans and the Service attended an onsite meeting to discuss the proposed project, impacts to listed species and critical habitats, and wildlife connectivity.
September 23, 2010	Representatives from Caltrans and the Service visited the Vessels mitigation property.
November 8, 2010	The Service provided comments on the DEIS for the project.
November 15, 2010	The Service provided written concurrence on the project's proposed mitigation in accordance with the Conservation and Mitigation Strategy of the TransNet Memorandum of Agreement.
December 21, 2010	The Service consulted informally on the Vessels mitigation property geotechnical borings, which were proposed to evaluate subsurface conditions for restoration of the site in association with the project.
March 10, 2011	Representatives from Caltrans and the Service visited the Groves mitigation property.

March 22, 2011	The Service provided written agreement on the Preferred Alternative and Preliminary Least Environmentally Damaging Practicable Alternative for the project.
April 11, 2011	Caltrans provided a letter requesting initiation of formal consultation on the proposed action, together with the BA.
May 11, 2011	Representatives from Caltrans and the Service visited the ambrosia plants within the project impact area and the translocation receptor sites at the Morrison mitigation property.
May 12, 2011	The Service provided approval of the translocation receptor sites on the Morrison mitigation property.
May - June 2011	Representatives from the Service and Caltrans attended a series of meetings to finalize the project description and conservation measures.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Using Federal funds provided through the FHWA, Caltrans proposes to widen the existing two-lane SR-76 between South Mission Road and just east of I-15 within the San Luis Rey River Valley in unincorporated San Diego County (Figures 1 and 2). Construction of the project will result in a total of four travel lanes, with two 3.7-meter (m) [12-foot (ft)] lanes in either direction (Figures 3-10), improvements to the Park and Ride facility near the SR-76/I-15 interchange (Figure 11), and improvements to the SR-76/I-15 interchange (Figures 12 and 13). Project work will begin in late 2012 and end in 2015. While the DEIS for the proposed project includes several alternatives, consultation has been requested for the Existing Alignment Alternative (the Preferred Alternative), which includes the following design features and elements:

- The length of the project is approximately 8.4 kilometers (km) [5.2 miles (mi)].

- Two westbound and two eastbound lanes will be separated by a median that will vary in width from 6.7 m (22 ft) to 12.8 m (42 ft) [8.8-m (29-ft) typical median width] with a concrete barrier.

- The project includes a 1.5-m (5-ft) wide minimum paved inside shoulder and a 2.4-m (8-ft) wide paved outside shoulder to accommodate bicycles, pedestrians, and emergency parking and to provide for roadside safety.

- The project will require approximately 695,745 cubic meters (m^3) [910,000 cubic yards (y^3)] of fill material to create the embankment for the road. Approximately 535,188 m^3 (700,000 y^3) of fill material will be obtained by removing existing material to restore riparian habitats

on the Vessels mitigation property. Approximately 53,519 m^3 (70,000 y^3) of fill material will be obtained by removing existing material to restore riparian habitats on the Tabata mitigation property. Approximately 30,582 m^3 (40,000 y^3) will be obtained from existing material from the reconfiguration of the SR76/I-15 interchange. The remaining approximately 91,747 m^3 (120,000 y^3) of fill material will be obtained by project contractors at the time of construction need, and the source of the fill material will be specified in the plan set.

- Left-turn channelization and median openings will be provided at the following unsignalized intersections: Sweetgrass Lane and Star Track Way.

- Two-lane on-ramps with a High Occupancy Vehicle (HOV) lane are proposed at the I-15 on-ramps.

- Between South Mission Road and the I-15 interchange, the proposed alignment is primarily located along the existing roadway alignment but shifts north or south to provide for more gradual curves. This will result in decommissioning of stretches of the existing SR-76 as shown in red in Figures 3-10. Along decommissioned stretches of roadway, there is an existing 6-m (20-ft) wide sewer easement which will be maintained. In the sewer easement area, pavement will be removed and a 3.6 to 4.6 m (12 to 15 ft) dirt/decomposed granite access road will be maintained. The remaining decommissioned area adjacent to the sewer easement access road will be restored with native species. At Live Oak Creek, the sewer line runs south of the existing SR-76 and north of the proposed SR-76. While there will be a 6-m (20-ft) wide sewer easement at Live Oak Creek, there will be no sewer easement access road across the riparian habitat at Live Oak Creek. A small pad may be required on the west side of the riparian area to provide access to two manholes, and on the east side of the riparian area to provide access to a third manhole. Between Star Track Way and Sage Road, existing SR-76 will be maintained as a frontage road.

- The existing two-span concrete box girder bridge structure over I-15 will be widened approximately 19 m (63 ft) to the south by building a new box girder bridge adjacent to the existing 19-m (64-ft) bridge.

- At-grade, signalized intersections will be constructed at South Mission Road, Via Monserate, Gird Road, Old Highway 395, the I-15 southbound ramps, and the I-15 northbound ramps.

The project will result in direct permanent impacts to approximately 46.94 hectares (ha) [115.89 acres (ac)], direct temporary impacts to approximately 26.69 ha (65.89 ac), and permanent indirect impacts to approximately 107.08 ha (264.40 ac) of the San Luis Rey River Valley. The impacts to vegetation communities are summarized in Table 1. The project will result in impacts to listed species and designated critical habitats as summarized in Tables 2 and 3 and Figures 14-18. The indirect impact area for the project depicted in Tables 1, 2, and 3 is defined as a 91-m (300-ft) buffer beyond the permanent impact area, plus areas beyond 91 m (300 ft) where noise

from project operations is anticipated to exceed 60 dBA, less the 91-m (300-ft) buffer and 60 dBA noise contour from the existing SR-76.

Table 1. Summary of Permanent, Temporary, and Indirect Impacts to Sensitive Vegetation Communities from the Proposed Project

Vegetation Communities and Cover Type[1]	Project Impacts					
	Permanent Impacts		Temporary Impacts		Indirect Impacts	
Riparian and Wetland Vegetation and Aquatic Habitat	hectares	acres	hectares	acres	hectares	acres
Disturbed Wetland (Arundo Dominated Riparian)	0.26	0.63	0.13	0.31	0.17	0.43
Coastal and Valley Freshwater Marsh	0.02	0.06	0.02	0.05	0.00	0.01
Elderberry Scrub	0.00	0.0	0.00	0.0	0.15	0.36
Mulefat Scrub	2.17	5.36	0.38	0.93	0.00	0
Southern Cottonwood-Willow Riparian Forest	9.15	22.6	3.13	7.73	11.19	27.63
Southern Willow Scrub (Including Disturbed)	1.62	3.99	0.60	1.49	2.94	7.26
Open Water (San Luis Rey River)	0.00	0.01	0.04	0.09	0.52	1.28
Riparian and Wetland Vegetation and Aquatic Habitat Total	***13.22***	***32.65***	***4.29***	***10.6***	***14.97***	***36.97***
Upland Vegetation						
Coast Live Oak Woodland	0.85	2.09	0.00	0	0.55	1.36
Diegan Coastal Sage Scrub	0.22	0.54	0.74	1.83	0.78	1.93
Diegan Coastal Sage Scrub (Disturbed)	2.57	6.35	0.67	1.66	1.12	2.76
Nonnative Grassland	10.99	27.14	8.39	20.72	27.33	67.48
Valley Needlegrass Grassland (Native)	0.00	0.0	0.00	0.0	0.00	0
Uplands Total	***14.50***	***35.81***	***9.93***	***24.52***	***29.78***	***73.53***
Total All Sensitive Vegetation	**27.73**	**68.46**	**14.22**	**35.12**	**44.75**	**110.5**
Other Vegetation and Cover Types						
Disturbed Habitat	2.16	5.33	1.27	3.13	7.63	18.83
Eucalyptus Woodland	0.76	1.87	4.11	10.16	1.79	4.42
Field/Pasture	0.65	1.61	0.34	0.84	4.41	10.89
General Agriculture	2.71	6.7	0.96	2.38	14.84	36.64
Nonnative Vegetation (Ornamental)	0.11	0.28	0.06	0.15	5.25	12.96
Orchards and Vineyards	0.49	1.21	0.51	1.27	6.48	16.01
Urban/Developed	12.32	30.43	5.20	12.84	21.93	54.15
Other Vegetation Total	***19.21***	***47.43***	***12.46***	***30.77***	***62.33***	***153.9***
Total All Vegetation	**46.94**	**115.89**	**26.68**	**65.89**	**107.08**	**264.4**

[1] The vegetation communities listed consist of a number of vegetation alliances and related associations that occur within the Northern Foothills Ecoregion of Western San Diego County as described in Sproul et al. 2011.

Table 2. Impacts to Federally Listed Species

Species	Project Impacts[1]		
	Permanent	**Temporary**	**Indirect**
Coastal California Gnatcatcher	2 (1 pair)	0	2 (1 pair)
Least Bell's Vireo	6 (3 pairs)	0	11 (~6 territories)
Southwestern Willow Flycatcher	0	0	4 (2 pairs)
Arroyo Toad	4	2	8
San Diego Ambrosia	<0.01[2]	0	0

[1] Reported as the number of individuals observed (animals) or acres (ambrosia).
[2] Within this acreage, approximately 2,633 ramets (plants that have grown vegetatively from another individual) of ambrosia will be directly impacted based on the most current survey data.

Table 3. Impacts to Designated Critical Habitat

Critical Habitat	Project Impacts					
	Permanent		**Temporary**		**Indirect**	
	hectares	acres	hectares	acres	hectares	acres
Coastal California Gnatcatcher	16.91	41.79	12.22	30.19	12.92	31.92
least Bell's Vireo	25.56	63.15	13.19	32.60	29.83	73.72
Southwestern Willow Flycatcher	15.03	37.13	4.42	10.93	22.81	56.36
Arroyo Toad	31.56	77.98	26.01	64.27	41.31	102.07
San Diego Ambrosia	0.60	1.50	0.24	0.60	0.83	2.06

Geotechnical Work

Geotechnical work is required at 35 locations along the project alignment to evaluate subsurface and soil conditions (as shown in electronic mail attachments from Caltrans dated August 25, 2011). Geotechnical work is anticipated to be conducted in fall of 2011. All geotechnical work will take place within the footprint of the proposed project. Access routes and earth disturbance associated with the geotechnical work will impact a total of approximately 0.68 ha (1.68 ac).

Four methods will be used to evaluate the subsurface and soil conditions: Mud Rotary (MR), Cone Penetrometer Test (CPT), Hollow Flight (HF), and Trench. The MR, CPT and HF use the same type of drill rig and support equipment. The drill rig is truck or trailer mounted. Support equipment includes a drill-tender truck that carries drilling supplies, augers, and water; a utility truck that carries steel drums to transport spoils and drilling fluids; a support loader used to free equipment stuck in soil or mud; and a track mounted dozer that is used to crush vegetation to provide ingress to the drilling site and to create a level and firm 6-m by 6-m (20-ft by 20-ft) pad for the drill rig.

The MR creates a 108-millimeter (mm) [4.25-inch (in)] diameter hole to a maximum depth of 30.5 m (100 ft), which would be backfilled with bentonite slurry. Spoils are collected and removed from the site. The CPT pushes a 38 mm (1.50-in) diameter cylindrical steel probe into the ground a maximum depth of 46 m (150 ft). The hole will collapse into itself, and in cases where the hole does not close completely, dry bentonite grains would be used as backfill. The HF creates a hole up to 203 mm (8 in) in diameter and to a maximum depth of 18 m (60 ft) which will be backfilled with cuttings.

The trenches will be excavated with a back-hoe or similar equipment at four locations. The back-hoe is anticipated to have rubber balloon tires rather than tracks. The trenches will be a maximum width of 0.9 m (3 ft), a maximum depth of 4.5 m (15 ft) and a maximum length of 6 m (20 ft). Trenching will not progress significantly below perched water or the water table if encountered. Spoils will be placed within 4.5 m (15 ft) or less of the trench. Trenches will be created and backfilled the same day. About 6 m (20 ft) will be needed around the trench to stock pile, move equipment, and backfill the trench.

Conservation Measures

Caltrans has agreed to implement the following conservation measures as part of the proposed action to avoid, minimize, and offset impacts to gnatcatchers, vireos, flycatchers, arroyo toads, ambrosia, their critical habitats, and other sensitive resources such as wetlands, aquatic resources, and rare plants:

Conservation/Restoration/Management

1. Permanent and temporary impacts to gnatcatchers, vireos, flycatchers, arroyo toads, ambrosia, and their critical habitats (as summarized in Tables 2 and 3 above) will be offset through conservation and restoration at the Groves, Tabata, and Vessels mitigation properties (Figures 19-21) as documented in Tables 4 and 5 below.

Table 4. Conservation and Restoration by Location

Location	**Riparian**		**Upland**	
	Hectares	Acres	Hectares	Acres
Tabata				
Riparian Creation	2.96	7.30		
Riparian Restoration	6.24	15.40		
Total	***9.19***	***22.70***		
Vessels				
Riparian Creation	35.52	87.70		
Riparian Restoration	9.27	22.90		
Coast Live Oak Woodland Creation			1.23	3.03
Non-Native Grassland Conservation			18.77	46.37
Total	***44.79***	***110.60***	***20.01***	***49.4***
Groves				
Coastal Sage Scrub Conservation			22.64	55.89
Non-Native Grassland Conservation			5.14	12.69
Coast Live Oak Woodland Conservation			1.02	2.51
Total			***28.8***	***71.09***
Total	**53.99**	**133.30**	**48.81**	**120.49**

Table 5. Conservation of Designated Critical Habitat

Critical Habitat	Location						Total	
	Groves		Tabata		Vessels			
	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres
Coastal California Gnatcatcher	28.80	71.09	7.98	19.70	0	0	36.74	90.79
Least Bell's Vireo	0	0	9.19	22.70	65.61	162.00	74.80	184.70
Southwestern Willow Flycatcher	0	0	5.91	14.60	35.44	87.50	41.35	102.10
Arroyo Toad	14.41	35.57	9.19	22.70	65.61	162.00	89.21	220.27
San Diego Ambrosia	8.45	20.89	0	0	0	0	8.45	20.89

2. Perpetual biological conservation easements or other conservation mechanisms acceptable to the CFWO will be recorded over the areas preserved, restored, and/or enhanced by the project at the Groves, Tabata, and Vessels mitigation properties. The conservation mechanisms will specify that no easements or activities (e.g., fuel modification zones, public trails, drainage facilities, walls, maintenance access roads) that will result in soil disturbance and/or native vegetation removal will be allowed within the biological conservation easement areas (with the exception of approved trails at the Groves shown in Figure 22). Caltrans anticipates that they will not be able to place the conservation easements or other conservation mechanisms for these properties prior to initiating project impacts; however, annual reports will be provided on their status until the conservation mechanisms have been placed over the properties.

3. The Groves, Tabata, and Vessels mitigation properties were purchased with funding from SANDAG's TransNet Environmental Mitigation Program (EMP), with approval from the CFWO, to offset the impacts of transportation infrastructure improvement projects funded by the TransNet Extension Ordinance, including the SR-76 South Mission to I-15 Highway Improvement Project. An approved Memorandum of Agreement (MOA) among the SANDAG, Caltrans, CFWO, and California Department of Fish and Game outlines the roles and commitments of the organizations with regard to implementation of the EMP. Caltrans, under the EMP MOA, will ensure that perpetual management, maintenance, and monitoring plans are prepared and implemented for the Groves, Tabata, and Vessels mitigation properties. Caltrans, under the EMP MOA, will ensure that non-wasting endowments for amounts approved by the CFWO based on Property Analysis Records (PAR) (Center for Natural Lands Management ©1998) or similar cost estimation methods are established to secure the ongoing funding for the perpetual management, maintenance and monitoring of the Groves, Tabata, and Vessels mitigation properties. Caltrans, under the EMP MOA, will ensure that draft management plans are submitted to the CFWO for review and approval. The HMPs will include, but not be limited to, the following: 1) the

PAR or other cost estimation results for the non-wasting endowment; 2) proposed land manager's name, qualifications, business address, and contact information; 3) method of protecting the resources in perpetuity (e.g., conservation easement), monitoring schedule, measures to prevent human and exotic species encroachment, funding mechanism, and contingency measures should problems occur. Caltrans will ensure that the final management plans are submitted to the CFWO and will coordinate with the CFWO to determine a mutually satisfactory solution for the establishment of endowments for perpetual management. Caltrans anticipates that the management plans will not be prepared prior to initiating project impacts; however, annual reports will be provided on their status until the final management plans have been provided and the endowments have been established, which will occur no later than December 1, 2014.

4. To the maximum extent practicable, all temporary impact areas will be revegetated and restored with native species, with the exception of small, isolated areas adjacent to landscaped or developed areas where planting native species would provide little or no biological value. The SR76/I-15 interchange will be included in the area to be restored with native species. Prior to initiating project impacts, a restoration plan will be developed for the temporary impact areas. The plan will be submitted to the CFWO for review and approval. This plan will include a detailed description of restoration methods, slope stabilization, and erosion control, criteria for restoration to be considered successful, and monitoring protocol(s). Following the completion of construction activities, the restoration plan will be implemented for a minimum of 5 years, unless success criteria are met earlier and all artificial water has been off for at least 2 years. Sections of existing SR-76 proposed for decommissioning (shown in red in Figures 3-10; with the exception of the 3.6 to 4.6 m (12 to 15 ft) dirt/decomposed granite sewer easement access road) will be restored using the same practices and plans as those areas temporarily impacted by the project. These areas will be planted as soon as possible following grading to prevent encroachment by weeds.

5. Access to the sewer easement access road will be limited through the use of locked gates or similar methods which will prevent unauthorized vehicles from using the sewer easement access road while maintaining connectivity for wildlife at the wildlife undercrossings. Access control measures for the sewer easement access road will be provided to the CFWO for review and approval.

6. A CFWO-approved biologist (Biological Monitor)[1] will monitor project construction to ensure that the project is implemented consistent with the measures described herein. Caltrans will submit the biologist's name, address, telephone number, and work schedule on the project to the CFWO at least 5 working days prior to initiating project impacts.

7. Cut and fill slopes (shown in white in Figures 3-10) are included within the permanent impact area. To the maximum extent possible, cut slopes adjacent to native habitats will be

[1] The Biological Monitor will be familiar with the federally listed species potentially affected by the project (i.e., gnatcatcher, vireo, flycatcher, arroyo toad, and ambrosia) and with the habitats that support these species.

revegetated with native upland habitats with similar composition to those within the project study area. Fill slopes and areas adjacent to wetlands and drainages will be revegetated with appropriate native upland and wetland species. The revegetated areas will have temporary irrigation and will be planted with native container plants and seeds selected in coordination with the Caltrans Project Biologist[2]. At least 3 years of plant establishment/ maintenance on these slopes will be conducted to control invasive weeds. Bioswales will be planted with appropriate species as determined in coordination with the Caltrans Project Biologist and storm water pollution prevention professional. These areas will be planted as soon as possible following grading to prevent encroachment by weeds.

8. Duff from areas with coastal sage scrub and chaparral will be saved and rare plants will be salvaged to aid in revegetating slopes and temporarily disturbed areas with native species.

9. If maintenance of a wetland restoration/enhancement area potentially occupied by vireos or flycatchers is necessary between March 15 and September 15, a qualified biologist will survey for vireos and flycatchers within the creation/restoration/enhancement area, access paths to it, and other areas susceptible to disturbances by creation/restoration/enhancement site maintenance. Surveys will consist of three visits separated by 2 weeks starting April 10 of each maintenance/monitoring year. Restoration work will be allowed to continue on the site during the survey period. However, if vireos or flycatchers are found during any of the visits, the Caltrans Project Biologist will notify and coordinate with the CFWO to identify measures to avoid and/or minimize effects to the vireo and/or flycatcher (e.g., nests and an appropriate buffer will be flagged by the biologist and avoided by the maintenance work).

Vegetation Clearing, Temporary Construction Fencing, Monitoring, Reporting

10. All vegetation clearing for the project will occur between September 16 and February 14 to avoid the gnatcatcher, vireo, flycatcher and toad breeding seasons. Clearing may commence earlier in the fall if the Caltrans Project Biologist demonstrates to the satisfaction of the CFWO that all breeding is complete.

11. The names, permit numbers, resumes, and at least three references (of people who are familiar with the relevant qualifications of the proposed biologist) of all biologists who will conduct surveys for gnatcatchers and vireo and who may need to handle, move, or monitor arroyo toads for the project will be submitted to the CFWO for approval at least 15 days prior to the initiation of species-specific surveys or monitoring efforts. The Caltrans Project Biologist will be responsible for overseeing and coordinating the surveys and monitoring efforts of all other biologists working on the project.

[2] The Caltrans Project Biologist will be a Caltrans biologist familiar with the federally listed species potentially affected by the project and with the habitats that support these species; he/she will be the primary contact for the CFWO during project implementation.

12. A minimum of three focused surveys, on separate days, will be conducted to determine the presence of gnatcatchers in the project impact footprint (vireos and flycatchers are migratory and are not anticipated to be present during vegetation clearing, and arroyo toads are addressed with specific measures below). Surveys will begin a maximum of 30 days prior to performing vegetation clearing/grubbing, and one survey will be conducted the day immediately prior to the initiation of vegetation clearing.

13. The Caltrans Project Biologist and/or Biological Monitor will be on site during: a) initial clearing and grubbing; and b) weekly during project construction within 152 m (500 ft) of offsite gnatcatcher, vireo, flycatcher, arroyo toad, and ambrosia habitat to ensure compliance with all conservation measures. The Biological Monitor will have the following responsibilities with respect to construction oversight:

    a. If any gnatcatchers are found within the project impact footprint, the Biological Monitor or Caltrans Project Biologist will request that the resident engineer direct construction personnel to begin vegetation clearing/grubbing in an area away from the gnatcatchers. It will be the responsibility of the Caltrans Project Biologist and Biological Monitor to ensure that gnatcatchers will not be injured or killed by vegetation clearing/grubbing. A CFWO-approved gnatcatcher biologist will walk ahead of clearing/grubbing equipment to flush birds towards areas of coastal sage scrub to be avoided and will record the number and location of gnatcatchers disturbed by vegetation clearing/grubbing. The Caltrans Project Biologist will notify the CFWO at least 7 days prior to vegetation clearing/grubbing;

    b. Oversee installation of and inspect the construction fencing, arroyo toad fencing, and erosion control measures a minimum of once per week to ensure that any breaks in the fencing or erosion control measures are repaired immediately;

    c. Periodically monitor the work area to ensure that work activities do not generate excessive amounts of dust;

    d. Train all contractors and construction personnel on the biological resources associated with the projects and ensure that training is implemented by construction personnel. At a minimum, training will include: 1) the purpose for resource protection; 2) a description of the sensitive resources and their habitats; 3) the conservation measures that should be implemented during project construction to conserve the sensitive resources, including strictly limiting activities, vehicles, equipment, and construction materials to the fenced project footprint to avoid sensitive resource areas in the field (i.e., avoided areas delineated on maps or on the project site by fencing); 4) environmentally responsible construction practices; 5) the protocol to resolve conflicts that may arise at any time during the construction process; and 6) the general provisions of the Act, the need to adhere to the provisions of the Act, and the penalties associated with violating the Act;

e. Request that the resident engineer halt work, if necessary, and confer with the Caltrans Project Biologist to ensure the proper implementation of species and habitat protection measures. The Caltrans Project Biologist will confer with the CFWO and report any non-compliance issue to the CFWO within 24 hours of its occurrence;

f. Submit monthly email reports (including photographs of impact areas) to the Caltrans Project Biologist during clearing of native habitats and project construction. The monthly reports will document that authorized impacts were not exceeded and general compliance with all conditions. The reports will also outline the location of construction activities, the type of construction that occurred, and equipment used. These reports will specify numbers, locations, and sex of gnatcatchers, vireos, flycatchers and arroyo toads (if observed), their observed behavior (especially in relation to construction activities), and remedial measures employed to avoid and minimize impacts to listed species. The Caltrans Project Biologist will review reports and forward them to the CFWO. Raw field notes should be available upon request by the CFWO; and

g. Submit a final report to the Caltrans Project Biologist within 120 days of project completion that includes: photographs of habitat areas that were to be avoided and other relevant summary information documenting that authorized impacts were not exceeded and that general compliance with all conservation measures was achieved. As-built construction drawings with an overlay of habitat that was impacted and avoided will be provided as well once they have been completed. The Caltrans Project Biologist will review the report and forward it to the CFWO.

14. All native or sensitive habitats outside and adjacent to the permanent and temporary construction limits will be designated as Environmentally Sensitive Areas (ESAs) on project maps. ESAs will be temporarily fenced during construction with orange plastic snow fence, orange silt fencing, or in areas of flowing water, with wire mesh, t-posts, and sand or gravel bags. No personnel, equipment or debris will be allowed within the ESAs. Fencing and flagging will be installed in a manner that does not impact habitats to be avoided and such that it is clearly visible to personnel on foot and operating heavy equipment. Caltrans will submit to the CFWO for approval, at least 5 days prior to initiating project impacts (except for impacts resulting from clearing to install temporary fencing), the final plans for initial clearing and grubbing of habitat and project construction. These final plans will include photographs that show the fenced and flagged limits of impact and all areas to be impacted or avoided. If work occurs beyond the fenced or demarcated limits of impact, the Biological Monitor will request that the resident engineer halt work until the problem has been remedied. The Caltrans Project Biologist will notify the CFWO of the problem within 24 hours of its occurrence. Temporary construction fencing and markers will be maintained in good repair until the completion of project construction and removed upon project completion.

Arroyo Toad Exclusion Fencing, Translocation, Monitoring

15. An arroyo toad translocation monitoring program will be developed and implemented. The program will be provided to the CFWO for review and approval. The program will include the following requirements:

    a. Prior to clearing, grubbing, and construction activities, a CFWO-approved arroyo toad biologist will monitor arroyo toad breeding activity in those project areas containing or adjacent to breeding habitat. The biologist will determine when egg clutches or larvae are no longer present in the waterway (generally late May at lower elevation, June at higher elevation). When sign of breeding is no longer evident, an exclusionary fence will be installed and clearance surveys initiated.

    b. Prior to clearing, grubbing, and construction activities, arroyo toad exclusionary fencing will be installed around the perimeter of all work areas within potential arroyo toad habitat. In areas without water flows, the fence will consist of woven nylon fabric or similar material at least 0.6-m (2-ft) high, staked firmly to the ground. In areas where soils are suitable for aestivation, the lower 0.3 m (1 ft) of material will stretch outward along the ground and be secured with a continuous line of sandbags to prevent burrowing beneath the fence. Doubling this line (i.e., stacking sand or gravel bags two-deep) may reduce maintenance and should be considered to improve the integrity of the fencing. In areas where soils are not suitable for aestivation, (i.e., hardpack soils), fencing may be buried to reduce maintenance concerns and improve the integrity of the fencing over time. Mechanized installation of buried portions of the fencing may be considered as it may reduce foot-traffic and disturbance of adjacent habitat. In areas where there is existing or potential inundation, wire mesh held in place with t-posts and secured with sand or gravel bags should be utilized to allow for the passage of water flows without compromising the integrity of the fencing. A small amount of vegetation may be removed to facilitate installation of the fencing, so long as it is conducted without disturbing the soil in areas where soils are suitable for aestivation, and does not impact habitats to be avoided. Decisions on the appropriate fencing installation method for a given reach will be made by the arroyo toad biologist. Fencing will be clearly visible to personnel on foot and operating heavy equipment. Arroyo toad exclusionary fencing will be maintained in good repair until the completion of project construction and removed upon project completion.

    c. Prior to the initiation of construction activities, but after exclusionary fencing has been installed, a minimum of six consecutive night surveys for arroyo toads will be conducted within the fenced project area by the approved arroyo toad biologist. Surveys will continue until there have been 2 consecutive nights without toads inside the fence. Arroyo toads will be excluded from the fenced project footprint before large-scale vegetation removal efforts commence; however, some vegetation removal may occur to improve visibility for salvage of arroyo toads, so long as it is conducted without disturbing the soil and within the fenced project footprint. Surveys will be

conducted during the appropriate climatic conditions and during the appropriate time of night to maximize the likelihood of encountering arroyo toads. If climatic conditions are not appropriate for arroyo toad movement during the surveys, the biologist may attempt to illicit a response from the arroyo toads, during nights (i.e., at least 1 hour after sunset) with temperatures above 10 degrees Celsius (50 degrees Fahrenheit), by spraying the project area with water to simulate a rain event. It is not feasible to spray the entire project area with water; therefore, spraying would occur in the areas of greatest concern under the direction of the approved toad biologist.

d. Capture methods will follow commonly accepted techniques for amphibian field sampling, including capture by hand and pit-fall trapping. All pitfall traps will be covered or removed when clearance surveys are not occurring. Arroyo toads will be handled in an expedient manner with minimal harm. Captured arroyo toads will not be handled for more than 15 minutes. Any arroyo toad exhibiting signs of physiological distress will be immediately released in the most proximal and safe suitable habitat. Any arroyo toads captured will be checked for a Passive Integrated Transponder (PIT) tag with a PIT-tag reader by the approved arroyo toad biologist.

e. If the exclusion fencing is found damaged during weekly monitoring conducted by the arroyo toad biologist or Biological Monitor during the active season for the arroyo toad (March 15 to July 31), thereby allowing arroyo toads access to the impact area, arroyo toad exclusion surveys will be repeated by the approved arroyo toad biologist for a minimum of 3 consecutive nights prior to any additional construction activities occurring in the area.

f. The approved arroyo toad biologist will monitor all groundbreaking activities that occur within areas demarcated with arroyo toad exclusion fencing to salvage and relocate arroyo toads and to quantify take of arroyo toads.

g. If construction will occur in arroyo toad breeding habitat during the active season for the arroyo toad (March 15 to July 31) while water is flowing in the creek or has ponded within the action area, the approved arroyo toad biologist will monitor potential arroyo toad breeding habitat to determine whether egg clutches, larvae, or juveniles are present in the waterway. If eggs, larvae, or juvenile arroyo toads are found, the Biological Monitor will request that the resident engineer halt work in the area until sign of breeding is no longer evident.

h. To avoid transferring disease or pathogens between aquatic habitats during surveys and handling of arroyo toads, the Biologist will follow the Declining Amphibian Population Task Force's Fieldwork Code of Practice (DAPTF 1998), or newer version when available.

i. American bullfrogs (*Lithobates catesbeiana*) and other exotic animal species that prey upon or compete with arroyo toads for resources will be excluded, destroyed, or

otherwise permanently removed from the habitat by the approved arroyo toad biologist if encountered.

j. The approved arroyo toad biologist will maintain a complete record of all arroyo toads encountered and relocated in association with the project. The date and time of observation, sex, physical dimensions, PIT-tag code, coordinates/specific location of capture and release, and photographs (when possible) will be recorded and provided to the CFWO, within 30 days of the completion of translocation.

Ambrosia Salvage and Translocation

16. Prior to construction, all ambrosia within the direct impact area (approximately 2,633 ramets on <0.01 ac) will be salvaged and translocated to the Morrison mitigation property, which is near the salvage location. Conservation and long term management of the Morrison mitigation property is addressed in Biological Opinion FWS-SDG-08B0136-08F0900. An ambrosia translocation plan will be prepared and provided to the CFWO for review and approval. The translocation will be implemented by a biologist with a history of translocating sensitive plant species. The locations where the ambrosia ramets will be transplanted have been approved following field review by the CFWO (Figure 23). The translocated ambrosia population will be monitored for a minimum of 5 years to document success or failure of the translocation efforts.

Preventing the Spread of Invasive Species / Landscaping

17. A qualified biologist will monitor the project site immediately prior to and during construction to identify the presence of invasive weeds from the Cal-IPC list and recommend measures to avoid their inadvertent spread in association with the project. Such measures may include inspection and cleaning of construction equipment and use of eradication strategies. Where feasible, invasive weeds found growing within the project right-of-way during construction will be removed at least once per year. Special care will be taken during transport, use, and disposal of soils containing invasive weed seeds.

18. Caltrans will ensure that project landscaping does not include plant species listed on the California Invasive Plant Council's (Cal-IPC) “Invasive Plant Inventory” list. A copy of the complete list can be obtained from Cal-IPC’s web site at http://www.cal-ipc.org.

19. Caltrans will submit a draft list of species to be included in the landscaping to the CFWO for approval. Caltrans will submit to the CFWO the final list of species to be included in the landscaping within 30 days of receiving approval of the draft list of species.

20. Landscaping will not use plants that require intensive irrigation, fertilizers, or pesticides adjacent to preserve areas, and water runoff from landscaped areas will be directed away from adjacent native habitats and contained and/or treated within the development footprint.

Construction Noise

21. To minimize construction noise impacts to listed species, all pile driving for the project will be conducted between September 16 and February 14 which is outside of the gnatcatcher, vireo, flycatcher and toad breeding seasons. Pile driving may commence earlier in the fall if the Caltrans Project Biologist demonstrates to the satisfaction of the CFWO that all breeding is complete within the area where construction noise will exceed ambient levels as a result of pile driving. In addition, all construction equipment, fixed or mobile, will be equipped with properly operating and maintained mufflers.

Construction and Operational Lighting

22. If nighttime construction is necessary, all project lighting (e.g., staging areas, equipment storage sites, roadway) will be selectively placed and directed onto the roadway or construction site and away from sensitive habitats. Light glare shields will be used to reduce the extent of illumination into sensitive habitats. No nighttime construction or lighting will occur in arroyo toad breeding habitat during the active season (March 15 – June 30).

23. Permanent project lighting will be of the lowest illumination necessary for safety and will be directed toward the roadway and the Park and Ride facility and away from sensitive habitats. Light glare shields will be used to reduce the extent of illumination into sensitive habitats. The Caltrans Project Biologist will review the permanent lighting plans and then submit them to the CFWO for review and approval.

Best Management Practices, Erosion and Dust Control, Staging Areas

24. Appropriate best management practices (BMPs) will be used to control erosion and sedimentation. No sediment or debris will be allowed to enter creeks, rivers, or other drainages. All debris from the construction of bridges will be contained so that it does not fall into rivers and creeks.

25. Erosion and sediment control devices used for the proposed project, including fiber rolls and bonded fiber matrix, will be made from biodegradable materials such as jute, with no plastic mesh, to avoid creating a wildlife entanglement hazard.

26. All equipment maintenance, staging, and dispensing of fuel, oil, coolant, or any other such activities will be restricted to designated areas that are a minimum of 30.5 m (100 ft) from any sensitive plant populations, sensitive habitats, or drainages. Such designated areas will be surrounded with berms, sandbags, or other barriers to further prevent the accidental spill of fuel, oil, or chemicals from entering existing native vegetation areas.

27. Impacts from fugitive dust will be avoided and minimized through watering and other appropriate measures.

Fill, Debris, Material Disposal

28. The project site will be kept as clear of debris as possible. All food-related trash items will be enclosed in sealed containers and regularly removed from the site.

29. The project will require approximately 695,745 m^3 (910,000 y^3) of fill material to create the embankment for the road. Approximately 535,188 m^3 (700,000 y^3) of fill material will be obtained by removing existing material to restore riparian habitats on the Vessels mitigation property. Approximately 53,519 m^3 (70,000 y^3) of fill material will be obtained by removing existing material to restore riparian habitats on the Tabata mitigation property. Approximately 30,582 m^3 (40,000 y^3) will be obtained from existing material from the reconfiguration of the SR76/I-15 interchange. The remaining approximately 91,747 m^3 (120,000 y^3) of fill material will be obtained by project contractors at the time of construction need, and the source of the fill material will be specified in the plan set, and will be reported to the CFWO. Caltrans will pursue any available options to obtain the remaining fill material from an environmentally responsible location, such as a wetland restoration site where removal of existing material is required. If no such options are available, the construction contractor will identify the source of fill material, as well as any disposal locations. All spoils and material disposal will be disposed of properly.

Human Encroachment, Construction Personnel

30. Contractors and construction personnel will strictly limit their activities, vehicles, equipment, and construction materials to the fenced project footprint.

31. Project personnel will be prohibited from bringing domestic pets to construction sites to ensure that domestic pets do not disturb or depredate wildlife in adjacent native habitats.

Wildlife Connectivity

32. A wildlife connectivity plan will be developed and implemented to ensure that ecosystem functions are maintained for the benefit of listed species. The plan will be provided to the CFWO for review and approval. The plan will include the following requirements:

    a. The existing SR-76 bridge across Live Oak Creek adjacent to Gird Road will be replaced with a wider, longer bridge that will be shifted to the south as a result of the roadway realignment. The bridge will consist of a single-frame, three-span reinforced concrete slab 32 m (105 ft) long and 38.1 m (125 ft) wide. The bridge is anticipated to have a vertical clearance of approximately 3.6 m (12 ft) in the center of the channel through the Live Oak Creek riparian area.

    b. Culverts 1, 2, 10, 11, 13 and 15 (“Wildlife Crossings”, Figures 24-25) will have openness ratios of at least 0.1 (openness = width of culvert x height of culvert/culvert length, measured in meters). The Wildlife Crossings will have soft bottom channels.

i. Restoration of temporary impact areas will be designed such that vegetation does not obscure the Wildlife Crossing openings. Vegetation may be used to funnel wildlife toward the openings.

ii. To the maximum extent feasible, rock slope protection will be avoided at the Wildlife Crossing openings. If rock slope protection is required, modifications (e.g., small pebble, dirt, or grouted movement pathways) will be made such that animals of all sizes can access the Wildlife Crossings.

iii. Animals may not be able to navigate steep vertical bends and they may not utilize the Wildlife Crossings if they have horizontal bends that limit visibility. Wildlife Crossings for the project will be straight with no vertical or horizontal bends.

iv. The Wildlife Crossing openings will be flush with the road slope and ground, and they will not extend out into the habitat. In addition, fencing will tie into the openings. This will allow animals following the fencing to easily find and access the Wildlife Crossings.

c. Additional small pipe culverts provided for drainage will be modified to promote wildlife use. These culverts will be straight and flush with the road slope and ground, and fencing will tie into the culverts. If feasible, the additional culverts will incorporate grates to allow in water and light. If feasible, the additional culverts will be constructed of concrete and not galvanized steel.

d. Wildlife fencing will be installed on the south side of the roadway for the entire length of the project alignment. Wildlife fencing will be installed on the north side of the roadway from Flowerwood Road on the west to the end of the project alignment on the east. The fencing will be installed prior to the completion of project construction.

i. The fencing will be made of chain-link with a total height of 3.0 m (10 ft) of which 2.4 m (8 ft) will be above the ground and 0.6 m (2 ft) will be buried beneath the ground to discourage animals from burrowing under the fence. A fine mesh lining made of durable material such as metal will be attached to the bottom 1.2 m (4 ft) of the fencing (including the buried portion of the fencing) to prevent arroyo toads from moving through the chain-link.

ii. There will be approximately 10 access points to SR-76 from the north that will require openings in the fencing on the north side of the road. At each access point, the fencing will continue back along the access roads or driveways and, to the greatest extent feasible, tie in to a logical location, such as steep, impassable terrain, a property fence, or developed land that may not be attractive to animals. Where this is not feasible, the fencing will extend approximately 9 m (30 ft) (or as close to this length as is practicable) up the

driveway or road away from SR-76 and angle away from the intersection to direct wildlife away from the opening and limit their access to the intersections.

e. Wildlife escape ramps will be constructed at five locations as shown in Figures 24 and 25 to allow any animals that gain access to the road to exit safely.

f. Post-project monitoring will be conducted on the effectiveness of the wildlife connectivity features such that the effectiveness of wildlife connectivity features can be improved, and to inform decision-making for future projects. This monitoring will include research on the degree to which various undercrossings are utilized by target species, the effectiveness of the fencing at preventing wildlife from accessing the roadway, and the effectiveness of the escape ramps for target species, including carnivores such as bobcats and coyotes (to ensure they are not using escape ramps to gain access to the roadway). Remote cameras will be utilized in post-project monitoring to document use of wildlife undercrossings. Post-project monitoring will be conducted over a minimum of 3 years to allow wildlife to become accustomed to the wildlife connectivity features. Annual post-project monitoring reports, including photographs, modifications made to wildlife connectivity features to improve their functionality, and recommendations, will be provided to the CFWO each year for the duration of the 3-year post-project monitoring period.

g. Wildlife connectivity features, including directional fencing, undercrossings, and escape ramps, will be maintained in perpetuity to ensure that wildlife connectivity in the project area is not lost over time. The wildlife connectivity plan will include a detailed explanation of how wildlife connectivity features will be maintained, and how the maintenance will be funded.

Geotechnical Work

33. Geotechnical work will be conducted between September 16 and February 14 to avoid the gnatcatcher, vireo, flycatcher, and toad breeding seasons and will proceed in advance of other project impacts. In order to minimize temporal impacts to habitats in the project area, and due to the minimal area of impact proposed in association with the geotechnical work, this work will proceed prior to placement of ESA fencing, arroyo toad exclusion fencing (except as feasible for trenching locations), completion of the arroyo toad translocation and monitoring program for the larger project, and gnatcatcher preconstruction surveys.

34. To ensure there are no unanticipated impacts to gnatcatchers, all activities conducted for geotechnical work will be monitored by a CFWO-approved gnatcatcher biologist who will walk ahead of equipment to flush birds towards areas of habitat to be avoided and will record the number and location of gnatcatchers disturbed by geotechnical work. Caltrans will submit the biologist’s name, address, telephone number, and work schedule on the

project to the Service for review and approval at least 5 working days prior to initiating project impacts. The biologist will be provided with a copy of this consultation.

35. All activities conducted for geotechnical work will also be monitored by a CFWO-approved arroyo toad biologist who will salvage and relocate arroyo toads and quantify take of arroyo toads. Arroyo toad translocation and monitoring methodology for the geotechnical work will be defined and documented in coordination with the CFWO and should be consistent with measures 15d, h, i, and j. Caltrans will submit the biologist's name, address, telephone number, and work schedule on the project to the Service for review and approval at least 5 working days prior to initiating project impacts. The biologist will be provided with a copy of this consultation.

36. Under the guidance of the arroyo toad biologist, trenching locations will be located, to the greatest extent feasible, out of areas deemed to be more likely to harbor aestivating arroyo toads. As feasible, and in coordination with the CFWO, arroyo toads may be excluded from trenching areas through the use of temporary fencing and watering; however water trucks may not be able to reach all trenching locations or may result in greater disturbance of habitat. Decisions on whether arroyo toads can effectively be excluded from trenching areas will be made by the arroyo toad biologist in coordination with the CFWO.

37. Under the guidance of the arroyo toad biologist, boring sites will be hand excavated using a small spade to a depth of 0.3 m (1 ft) to detect and salvage aestivating arroyo toads if present.

38. Work during rain events should be avoided to the greatest extend feasible as arroyo toads may become active during rain events and the movement of equipment through mud may result in sedimentation into breeding habitat. To ensure that work is completed as rapidly as possible such that the temporal disturbance of the habitat is limited, work may continue during a light or intermittent rain early in the fall, if the arroyo toad biologist, using his/her best judgment, determines that increased impacts to arroyo toads are unlikely.

39. All movement of personnel and equipment will be limited to designated access routes which will be established through the crushing of vegetation. To establish access routes, a minimal amount of grading may be required where there is a drop-off between the pavement and the ground, and no other grading will occur to establish access routes. In addition, topsoil may be scraped when anything too large to drive over has to be moved out of the way (e.g., logs), and no other soil movement will occur to establish access routes. Access routes will be approximately 3 m (10 ft) wide, which is the width necessary to access boring sites. Wood or metal will be placed where soils could cause equipment to become stuck.

40. If possible, equipment used will have soft tires with minimal tread, and a wide wheel base to better distribute weight and reduce soil disturbance.

41. Plastic sheeting will be placed under drill rigs to prevent equipment oils from reaching the ground. Amphibians are known to be attracted to plastic sheeting due to the moisture it captures. If plastic sheeting must be left in arroyo toad habitat overnight, the edges will be secured such that amphibians are not able to crawl underneath the plastic.

42. All boring holes will be filled to prevent small animals from becoming trapped in the holes.

43. To ensure that arroyo toads do not burrow into loose dirt that will later be moved, trenches will be created and filled the same day. If it is necessary to leave piles of loose dirt in areas of arroyo toad habitat for more than a day, they will be surrounded by sediment fencing to prevent toads from burrowing into the dirt.

44. Vehicle speed will not exceed 24 km per hour (15 mi per hour).

45. All spoils and material disposal will be removed out of the project area and stored or disposed of properly.

46. Measures 13d (contractor training), 28 (trash disposal), and 30 (no pets) will be implemented for geotechnical work.

Action Area

According to 50 CFR § 402.02 pursuant to section 7 of the Act, the "action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. Subsequent analyses of the environmental baseline, effects of the action, and levels of incidental take are based upon the action area. For this project, we have defined the action area to be the 8.4 km (5.2 mi) project site, which includes 14.50 ha (35.81 ac) of permanent and 9.93 ha (24.52 ac) of temporary impacts to sensitive native upland habitats and 13.22 ha (32.65 ac) of permanent and 4.29 ha (10.60 ac) of temporary impacts to wetland habitats. The action area also includes the surrounding habitat which may be exposed to project-related effects such as increased noise, light, and dust levels and human activity during project construction and operation of the facilities. This indirect impact area for the project is defined as a 91-m (300-foot) buffer beyond the permanent impact area, plus areas beyond 91 m (300 feet) where noise from project operations is anticipated to exceed 60 dBA, less the 60 dBA noise contour from the existing SR-76. In addition, the action area includes the Groves, Tabata, Vessels, and Morrison mitigation properties, which are located in close proximity to the project site in the San Luis Rey River Valley, unincorporated San Diego County, California (Figure 26).

STATUS OF THE SPECIES/CRITICAL HABITAT

The status of the gnatcatcher, vireo, flycatcher, arroyo toad, and ambrosia were described in detail in a biological opinion for the Caltrans-sponsored State Route 76 Melrose Drive to South Mission Highway Improvement Project, San Diego County, California (FWS-SDG-08B0136-08F0900, dated October 1, 2008). Additional information can be found in the recovery plans for

the arroyo toad, flycatcher and vireo and 5-year reviews for the arroyo toad, gnatcatcher, vireo, and ambrosia (Service 1998, 1999, 2002a, 2006, 2009, 2010a, 2010b). Please refer to these documents for detailed information on the life history requirements of the species, threats to the species, and conservation needs of the species.

Summary of Species' Distribution and Numbers Range-wide and Critical Habitat

Coastal California Gnatcatcher

The gnatcatcher occurs in coastal sage scrub and associated habitats from southern Ventura County to Baja California, Mexico. In 1993, the Service estimated that about 2,562 gnatcatcher pairs remained in the United States, with the highest densities occurring in Orange and San Diego counties (Service 1993). In a recent study using more rigorous sampling techniques, Winchell and Doherty (2008) estimated there were 1,324 (95 percent confidence interval: 976–1,673) gnatcatcher pairs over a 44,923-ha (111,006-ac) area on public and quasi-public lands in Orange and San Diego counties. Their sampling frame covered only a portion of the U.S. range, focusing on the coast, and was limited to 1 year. Although it is not valid to extrapolate beyond the sampling frame, especially in light of known differences in population densities across the range of the gnatcatcher (Atwood 1992), it is likely there are more gnatcatchers in the U.S. portion of the range than was suggested by earlier estimates; Winchell and Doherty (2008) estimated nearly as many gnatcatchers in the portion of the U.S. range sampled in their study as was originally estimated for the entire U.S. range. We are not aware of any recent estimates of gnatcatcher populations in Baja California.

Critical habitat for the gnatcatcher was designated on December 19, 2007 (Service 2007). There are 11 designated critical habitat units for the gnatcatcher that include 79,846 ha (197,303 ac) of Federal, State, local, and private land in Ventura, Los Angeles, Orange, Riverside, San Bernardino, and San Diego counties. Designated critical habitat includes habitat throughout the species' range in a variety of climatic zones and vegetation types to preserve the genetic and behavioral diversity that currently exists within the species. The individual units contain essential habitat for the gnatcatcher and help to identify special management considerations for the species. The project is located within and adjacent to Unit 5 of designated gnatcatcher critical habitat.

Unit 5 (planning area for the North County Multiple Species Conservation Program for Unincorporated San Diego County) includes 11,995 ha (29,639 ac) and contains large blocks of high-quality habitat capable of supporting several core gnatcatcher populations. In addition, this unit constitutes the primary inland linkage along the Interstate 15 corridor between San Diego populations and those in southwestern Riverside. Specific information for each of the remaining critical habitat units can be found within the final rule designating critical habitat for the gnatcatcher (Service 2007). This unit may require special management considerations or protection to minimize impacts associated with habitat type conversion and degradation occurring in conjunction with urban and agricultural development.

Primary Constituent Elements (PCEs) for the gnatcatcher are those habitat components that are essential for the primary biological needs of foraging, nesting, rearing of young, intra-specific communication, roosting, dispersal, genetic exchange, or sheltering. These include: 1) sage scrub habitats that provide space for individual and population growth, normal behavior, breeding, reproduction, nesting, dispersal, and foraging; and 2) non-sage scrub habitats such as chaparral, grassland, and riparian areas, in proximity to sage scrub habitats that provide space for dispersal, foraging, and nesting.

Least Bell's Vireo

The vireo population in the U.S. has increased 10-fold since its listing in 1986 (Service 1986), from 291 to 2,968 known territories (Service 2006). The population has grown during each 5-year period since the original listing, although the rate of increase has slowed over the last 10 years. Most of the vireo breeding sites are located in southern California between the Tehachapi Mountains in Kern and Ventura counties south to northwestern Baja California, Mexico (Service 2006). Within the 11 Population Units designated in the draft recovery plan, the following areas have the greatest number of vireos in order of number: Camp Pendleton/Santa Margarita River (827 territories), Santa Ana River (813 territories), and the San Luis Rey River (233 territories) (Service 2006).

In 1994, the Service designated areas at 10 locations, encompassing approximately 15,378 ha (38,000 ac), in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego counties, California, as critical habitat for the least Bell's vireo (Service 1994). Critical habitat for the vireo occurs on the Santa Ynez River (Santa Barbara County), Santa Clara River (Ventura and Los Angeles Counties), Santa Ana River (Riverside and San Bernardino Counties), and Santa Margarita River, San Luis Rey River, Sweetwater River, San Diego River, Tijuana River, Coyote Creek, and Jamul-Dulzura Creeks (San Diego County). In the action area, critical habitat is designated along the San Luis Rey River. The project site occurs within the San Luis Rey Area of designated critical habitat for the vireo, which includes approximately 2,428 ha (6,000 ac) of critical habitat along the San Luis Rey River between I-5 and Pala Road.

PCEs for the vireo are those habitat components that are essential for the primary biological needs of feeding, nesting, roosting and sheltering. These PCEs can be described as riparian woodland vegetation that generally contains both canopy and shrub layers, and includes some associated upland habitats. Vireos meet their survival and reproductive needs (food, cover, nest sites, nestling and fledgling protection) within the riparian zone in most areas. In some areas they also forage in adjacent upland habitats, which may include sage scrub and grassland communities (Service 1994).

Southwestern Willow Flycatcher

The breeding range of the flycatcher includes most of the southwestern United States (Unitt 1987, Browning 1993) with data from 1993 to 2005 indicating that flycatcher breeding territories ranged from Arizona (40.8 percent) to New Mexico (32.4 percent), California (15.7 percent),

Nevada (5.6 percent), Colorado (5.2 percent), and Utah (0.3 percent) (Durst et al. 2006). Past records of breeding in Mexico are few and confined to extreme northern Baja California and Sonora (Howell and Webb 1995). Flycatchers winter in Mexico, Central America, and northern South America (Howell and Webb 1995).

Although the breeding range extends through six states, Kus and Sogge (2003) noted that southwestern willow flycatchers have declined to the point of near extinction as urbanization and burgeoning human populations have resulted in widespread loss and degradation of riparian habitat. Flycatchers have been dramatically reduced in number along the lower Colorado River, which historically probably supported one of the largest flycatcher populations in the Southwest (Unitt 1987). Durst et al. (2006) reported 1,214 territories located among 275 sites rangewide within the United States using data from 1993 to 2005.

Over the range of the species, most (83 percent) of the breeding sites are small, both in terms of population size (five or fewer territories) and habitat patch size (Durst et al. 2006). Only 17 percent of the sites rangewide have more than five territories. Seven of these sites (populations) consist of 20 or more territories and only two sites have 50 or more territories, one of which is the upper San Luis Rey River in San Diego County. The primary flycatcher drainages in California are the San Luis Rey River (58 territories), the Santa Ana River (34 territories), the Owen's River (28 territories), the Santa Margarita River (21 territories), and the Kern River (20 territories) (Durst et al. 2006).

The rangewide population of flycatcher has not experienced the significant increase in numbers since its listing that the vireo population has experienced. This may be a byproduct of the flycatchers need for mature vegetation (greater than 8 years old), their need for nearby open water, the reduced benefit that cowbird trapping provides the flycatcher, and/or an unknown stressor in the flycatcher's overwintering habitat.

Critical habitat for the flycatcher was designated on October 19, 2005 (Service 2005). The critical habitat includes approximately 48,896 ha (120,824 ac) in Apache, Cochise, Gila, Graham, Greenlee, Maricopa, Mohave, Pinal, Pima, and Yavapai counties in Arizona; Kern, Santa Barbara, San Bernardino, and San Diego counties in southern California; Clark County in southeastern Nevada; Grant, Hidalgo, Mora, Rio Arriba, Socorro, Taos, and Valencia counties in New Mexico; and Washington County in southwestern Utah. Fifteen Management Units found in five Recovery Units were designated as critical habitat for the flycatcher. The five Recovery Units are: 1) Coastal California; 2) Basin and Mojave in California; 3) Lower Colorado River in Nevada, California/Arizona Border, Arizona, and Utah; 4) Gila in Arizona and New Mexico; and 5) Rio Grande in New Mexico.

The project is located within the San Diego Management Unit of the Coastal California Recovery Unit of southwestern willow flycatcher critical habitat. A total of 1,944 ha (4,805 ac) of critical habitat are designated within this management unit along the Santa Margarita River, San Luis Rey River, Pilgrim Creek, Agua Hedionda Creek, San Ysabel River, Temescal Creek, and Temecula Creek (Service 2005). This management unit encompasses a combination of large

populations and other nearby stream segments with high quality habitat and smaller numbers of territories to provide for population connectivity, metapopulation stability, population growth, and protection against catastrophic loss.

PCEs for the flycatcher are those habitat components that are essential for the primary biological needs of feeding, nesting, roosting and sheltering. Specifically, PCEs include riparian vegetation consisting of a variety of riparian trees and shrubs with dense riparian thickets, foliage, and canopy (PCE 1) and a variety of insect prey populations in or adjacent to riparian floodplains or moist environments (PCE 2) (Service 2005).

Arroyo Toad

There are an estimated 23 populations of arroyo toad from Monterey County, California, south to Baja California, Mexico (Service 2009). These populations persist primarily in the headwaters of streams as small, isolated populations. The current distribution of the arroyo toad in the United States is from the Salinas River Basin in Monterey County, south to the Tijuana River and Cottonwood Creek Basin along the Mexican Border. Arroyo toads are also known from a seemingly disjunct population in the Arroyo San Simeon River System, about 10 miles (mi) southeast of San Quintín, Baja California, Mexico (Gergus et al. 1997). Although the arroyo toad occurs principally along coastal drainages, it also has been recorded at several locations on the desert slopes of the Transverse range (Patten and Myers 1992, Jennings and Hayes 1994). The current elevational range for most arroyo toad populations in San Diego County is about 305 to 1,402 m (1,000 to 4,600 ft), although they were historically known to extend into the lower portions of most river basins and still occur near the coast on Marine Corps Base Camp Pendleton (Service 1999).

This species was historically found in at least 22 river basins in southern California from the upper Salinas River system in Monterey County to San Diego County and southward to the vicinity of San Quintín, Baja California, Mexico. They have been extirpated from an estimated 75 percent of their former range in the United States, and they now occur primarily in small, isolated areas in the middle to upper reaches of streams (Service 1999).

Final critical habitat for the arroyo toad was designated on February 9, 2011 (Service 2011). The critical habitat encompasses approximately 39,807 ha (98,366 ac) of lands located in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego counties, California (Service 2011). Twenty-one critical habitat units have been designated for the arroyo toad. The project is located within designated arroyo toad critical habitat Unit 14. This unit is located in northern San Diego County and includes 4,093 ha (10,115 ac) including 2 ha (4 ac) of Bureau of Land Management land, 4 ha (10 ac) of State land, and 4,088 ha (10,101 ac) of private land. Unit 14 encompasses approximately 48 km (30 mi) of the San Luis Rey River from the western edge of the La Jolla Indian Reservation downstream to the confluence with Guajome Creek near the City of Oceanside. It also includes approximately 5.5 km (3.4 mi) of Pala Creek and 2.7 km (1.7 mi) of Keys Creek upstream from the confluence with the San Luis Rey River. This unit supports one of the largest contiguous river reaches that is occupied by the species.

The physical and biological features essential to the conservation of the species in this unit may require special management considerations or protection to address threats from dams and water diversions, intensive urbanization, agriculture, and nonnative predators and plants (Service 2011).

The PCEs of arroyo toad critical habitat include: rivers or streams with hydrologic regimes that supply water to provide space, food, and cover needed to sustain eggs, tadpoles, metamorphosing juveniles, and adult breeding toads (PCE 1); riparian habitats for breeding and rearing of tadpoles and juveniles and adjacent uplands including areas of loose soil where toads can burrow underground that provide foraging and living areas for juvenile and adult arroyo toads (PCE 2); a natural flooding regime (PCE 3); and stream channels and adjacent upland habitats that allow for movement to breeding pools, foraging areas, overwintering sites, upstream and downstream dispersal, and connectivity to areas that contain suitable habitat (PCE 4). The recent final critical habitat rule (Service 2011) includes detailed information on the units, including their sizes, locations, and special management considerations.

San Diego Ambrosia

There are 16 known native occurrences of ambrosia in Riverside and San Diego Counties. In addition there are seven known instances in which ambrosia have been translocated from their place of origin to new areas, and one translocation planned for 2011. There are also two confirmed occurrences reported from northwestern Estado de Baja California, Mexico. Four occurrences have effectively been extirpated since listing in 2002 (Service 2002b) and 7 of the 16 remaining native occurrences are conserved or partially conserved (Service 2010b).

Critical habitat was designated for ambrosia on November 30, 2010 (Service 2010c). Designated critical habitat for ambrosia encompasses approximately 317 ha (783 ac) in 6 units with 13 subunits in Riverside and San Diego counties. The project is located in and adjacent to designated ambrosia critical habitat Unit 4, Subunits 4A and 4D. Subunit 4A is located near junction of SR-76 and Calle de la Vuelta in unincorporated San Diego County. Subunit 4A consists of approximately 0.3 ha (0.8 ac) of State or local government-owned land and 6 ha (14 ac) of privately owned land, for a total of approximately 6 ha (15 ac). Subunit 4D is located adjacent to the north side of SR-76, almost equidistant from Gird Road (to the west) and Monserate Hill Road (to the east). Subunit 4D consists of 0.3 ha (0.7 ac) of State-owned land and 8 ha (20 ac) of privately owned land, for a total of approximately 9 ha (21 ac). The physical and biological features essential to the conservation of the species in these subunits may require special management considerations or protection to address threats from nonnative plant species human encroachment, road maintenance activities, and widening of SR-76.

The PCEs of ambrosia critical habitat include: 1) sandy loam or clay soils (regardless of disturbance status), including, but not limited to, the Placentia (sandy loam), Diablo (clay), and Ramona (sandy loam) soil series that occur near (up to several hundred meters from but not directly adjacent to) a river, creek, or other drainage, or within the watershed of a vernal pool, and that occur on an upper terrace (flat or gently sloping areas of 0 to 42 percent slopes are

typical for terraces on which ambrosia occurrences are found); and 2) grassland or ruderal habitat types, or openings within coastal sage scrub, on the soil types and topography described in PCE 1, that provide adequate sunlight, and airflow for wind pollination.

ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation and the impacts of State and private actions that are contemporaneous with the consultation in progress.

Site Characteristics and Surrounding Land Uses

The Biological Study Area (BSA) for the project totals approximately 950 ha (2,348 ac) and consists of the footprint of the proposed project (Existing Alignment Alternative) as well as the Southern Alignment Alternative, all areas lying between the two alignments, and a 152-m (500-ft) limit from the outer edges of the proposed shoulder (Figure 2). The BSA includes a portion of the San Luis Rey River, its associated floodplain, and other adjacent lands. The overall topography consists of a broad, level floodplain and valley floor bordered by steep hillsides divided by lesser tributaries. The San Luis Rey River and its floodplain are the dominant topographic features in the BSA. The project abuts both private and public land, including the Rainbow Water District, commercial, residential, agricultural and undeveloped lands. Elevation in the BSA ranges from approximately 40 m (132 ft) above mean sea level (AMSL) along the San Luis Rey River at the western terminus of the BSA to approximately 150 m (493 ft) AMSL along the hills in the north portion of the BSA, just west of I-15.

Soils within the BSA are dominated by sandy loams and riverwash. The riverbed at this location is composed of an alluvial deposit of riverwash (Bowman 1973). The alluvium in the floodplain and valley floor can provide suitable substrate (friable) for burrowing animals, including arroyo toad. A broad range of vegetation communities and other cover types were identified within the BSA during the surveys, including native riparian and wetland, native upland, and non-native vegetation types such as eucalyptus woodland and nonnative grassland (Table 1). Gnatcatcher, vireo, flycatcher, arroyo toad, and ambrosia all occur within the BSA in the San Luis Rey River Valley.

Relationship to Regional Preserves

The highway widening would occur in an area covered under the California Department of Fish and Game's Natural Community Conservation Planning program (NCCP) (CDFG 2007). The NCCP, which began in 1991, is a cooperative effort between public and private entities to protect habitats and species. The program's primary objective is to conserve local and regional biological diversity while accommodating compatible land use. The NCCP attempts to

prevent/resolve issues related to species' listings by concentrating on the long-term stability of wildlife and plant communities, and including key interests in the process.

The project falls within the Draft North County Multiple Species Conservation Program (NCMSCP) (County of San Diego 2008), which is under development. The NCMSCP is a comprehensive habitat conservation plan that addresses multiple species' needs and the preservation of native vegetation communities. The plan proposes a preserve system that would replace the approach of using project-specific biological mitigation. The San Luis Rey River and associated riparian habitat have been identified as an important regional wildlife movement corridor in northern San Diego County, California, and are identified as a pre-approved mitigation area (PAMA) within the NCMSCP. The San Luis Rey River Linkage provides connectivity to both conservation lands in Riverside County to the north and coastal areas to the west.

Species and Critical Habitats within the Project Area

Projects and land uses affecting species and habitats in the San Luis Rey River are described in detail in the biological opinion for the Caltrans-sponsored State Route 76 Melrose Drive to South Mission Highway Improvement Project, San Diego County, California (FWS-SDG-08B0136-08F0900, dated October 1, 2008). Please refer to this document for detailed information on projects and land uses in the San Luis Rey River. Baseline information on presence of species and critical habitats within the BSA and action area is provided below.

Coastal California Gnatcatcher

Gnatcatchers were detected in the BSA during protocol surveys conducted in 2006 through 2008 (EDAW, Inc. 2006a, 2007a, 2008). Gnatcatchers were observed in coastal sage scrub in the northeastern portion of the BSA on the north side of the existing SR-76 roadway, in the southwestern portion of the BSA on the south side of Lilac Road, and in the I-15 interchange area. A total of four gnatcatchers (two pairs) were observed within the action area for the project. Two individual gnatcatchers (one pair) were observed within the temporary impact area for the project; however, portions of their territories are located within the permanent impact area. Two more gnatcatchers (one pair) were observed within the indirect impact area for the project (Figure 14).

Approximately 318 ha (785 ac) of designated critical habitat for the gnatcatcher is located within the BSA for the project, in Unit 5. Within the action area, approximately 16.91 ha (41.79 ac) of designated critical habitat for the gnatcatcher is located within the project's permanent impact area. The temporary impact area includes 12.22 ha (30.19 ac) of designated gnatcatcher critical habitat. An additional 12.92 ha (31.92 ac) of designated gnatcatcher critical habitat is located within the project's indirect impact area.

Least Bell's Vireo

Focused surveys to determine the presence/absence of least Bell's vireo within the BSA were conducted April through June 2006 and incidentally during other survey efforts in 2007 and 2008 (EDAW, Inc. 2006b). Abundance, distribution, and nesting activity of this species within the San Luis Rey River area has also been monitored by the U.S. Geological Survey for several years (USGS 2003-2007). Approximately 26 breeding territories of least Bell's vireo were identified throughout the BSA during 2006 protocol surveys by EDAW (EDAW, Inc. 2006b); 43 breeding territories were identified by Kus (USGS 2006). A total of 17 individual vireos were observed within the action area for the project. Six individual vireos (three pairs) were observed within the permanent and temporary impact areas for the project. Eleven more vireos (about six territories) were observed within the indirect impact area for the project (Figure 15).

Approximately 781 ha (1,930 ac) of critical habitat for this species occurs within the BSA. Within the action area, approximately 25.56 ha (63.15 ac) of designated critical habitat for the vireo is located within the project's permanent impact area. The temporary impact area includes 13.19 ha (32.60 ac) of designated vireo critical habitat. An additional 29.83 ha (73.72 ac) of designated vireo critical habitat is located within the project's indirect impact area.

Southwestern Willow Flycatcher

Focused surveys to determine the presence/absence of the southwestern willow flycatcher within the BSA were conducted from May through July in 2006 and 2007 (EDAW, Inc. 2006c, 2007b). Abundance, distribution, and nesting activity of this species within the San Luis Rey River area has also been monitored by the U.S. Geological Survey for several years (USGS 2003-2007). Southwestern willow flycatchers were detected in riparian and wetland habitat during focused surveys in 2006 and 2007 (EDAW, Inc. 2006c, 2007b, USGS 2006). Approximately eight breeding flycatcher territories were identified throughout the BSA during 2006–2007 protocol surveys (EDAW, Inc. 2006c, 2007b); three territories were identified in 2006 by Kus (USGS 2007). Within the action area, no flycatchers were observed within the permanent and temporary impact areas. Two individual flycatchers (one pair) were observed within the indirect impact area for the project (Figure 16).

Approximately 330 ha (815 ac) of critical habitat for this species is located within the BSA. Within the action area, approximately 15.03 ha (37.13 ac) of designated critical habitat for the flycatcher is located within the project's permanent impact area. The temporary impact area includes 4.42 ha (10.93 ac) of designated flycatcher critical habitat. An additional 22.81 ha (56.36 ac) of designated flycatcher critical habitat is located within the project's indirect impact area.

Arroyo Toad

Protocol arroyo toad surveys were performed during 2006 and 2007 (EDAW, Inc. 2006d, 2007c). These surveys were completed throughout suitable breeding habitat in the BSA, with the

exception of the I-15 interchange area and I-15 bridge over the San Luis Rey River. Because of the proximity and connection to known occupied arroyo toad habitat and the suitability of habitat for arroyo toad under the bridge, the species is assumed present by Caltrans in this relatively small area. In addition to protocol arroyo toad breeding surveys, aestivation habitat was mapped for arroyo toads throughout the BSA. Arroyo toads were observed during focused protocol surveys in 2006 and 2007 throughout wetland and riparian habitat in the BSA. The majority of arroyo toads were observed on the north side of the San Luis Rey River in sandy substrate along existing game trails and equestrian trails. Arroyo toads were also observed calling and breeding in the river in the central portion of the BSA. Arroyo toad tadpoles were observed infrequently in pools of the San Luis Rey River. On the south side of the San Luis Rey River, arroyo toads were observed, but in lower numbers. Within the action area, four individual arroyo toads were observed in the permanent impact area for the project, and two arroyo toads were observed in the temporary impact area for the project. Eight more arroyo toads were observed within the project's indirect impact area (Figure 17).

Approximately 781 ha (1,930 ac) of critical habitat for the arroyo toad occurs within the BSA. Within the action area, approximately 31.56 ha (77.98 ac) of designated critical habitat for the arroyo toad is located within the project's permanent impact area. The temporary impact area includes 26.01 ha (64.27 ac) of designated arroyo toad critical habitat. An additional 41.31 ha (102.07 ac) of designated arroyo toad critical habitat is located within the project's indirect impact area.

San Diego Ambrosia

Qualified botanists conducted rare plant surveys for the proposed project during appropriate blooming periods between April 17, 2006, and June 5, 2008 (Caltrans 2009). Focused surveys were conducted for San Diego ambrosia to monitor the known population within the BSA and look for additional populations. During these surveys, the populations were delineated using a submeter geographic positioning system. Additionally, the density was estimated for each population by taking meter-square quadrat samples and counting individual ramets within each sample. During surveys completed from 2006 through 2008, San Diego ambrosia was encountered in several patches within the project area, north of the existing SR-76 roadway. Within the project area, approximately 0.49 ha (1.22 ac) are occupied by San Diego ambrosia, and most of this occupied acreage is avoided by the project. Approximately 2,633 ramets of San Diego ambrosia occupying <0.004 ha (<0.01 ac) are within the direct impact area for the project. No ambrosia ramets are located within the indirect impact area for the project (Figure 18).

Approximately 10 ha (25 ac) of ambrosia critical habitat occurs within the BSA. Within the action area, approximately 0.6 ha (1.5 ac) of designated critical habitat for ambrosia is located within the project's permanent impact area. The temporary impact area includes 0.24 ha (0.60 ac) of designated ambrosia critical habitat. An additional 0.83 ha (2.06 ac) of designated ambrosia critical habitat is located within the project's indirect impact area.

Proposed Offsite Compensation Locations

The Groves Property

The Groves property consists of a total of 116 ha (286 ac) located at the southwest corner of SR-76 and Olive Hill Road in the community of Bonsall (Figure 19). The property is located within the PAMA of the NCMSCP. Approximately 73 ha (180 ac) of coastal sage scrub occurs on the property with about 33 ha (82 ac) categorized as disturbed. Additional vegetation communities on the property include 4.5 ha (11 ac) of coast live oak woodland and 20 ha (50 ac) of non-native grassland.

Most of the property contains designated critical habitat for the gnatcatcher. Numerous gnatcatchers have been recorded onsite during formal and informal surveys (Pacific Southwest Biological Services, Inc. 2003, Caltrans 2008). A total of five pairs of gnatcatchers and one single male were observed on the Groves property in 2008 (Caltrans 2008).

The Groves property is located in close proximity to the San Luis Rey River, which supports a significant arroyo toad population. Although the Groves property does not provide breeding habitat for the arroyo toad, it does contain upland habitat appropriate for burrowing, dispersing, and foraging. Approximately 14.39 ha (35.57 ac) of the Groves property is included within designated critical habitat for the arroyo toad. In addition, wildlife crossings were constructed to connect the Groves property with the San Luis Rey River in association with the SR-76 Melrose Drive to South Mission Highway Improvement Project, allowing for arroyo toads to access and utilize the upland habitat.

Approximately 8.45 ha (20.89 ac) of the Groves property, including 0.11 ha (0.28 ac) occupied by the species, is included within designated critical habitat for San Diego ambrosia. Access control and trails are present at this site as shown in Figure 22.

Tabata Property

The 13.7-ha (33.8-ac) Tabata property is located adjacent to the SR-76 Melrose Drive to South Mission Highway Improvement Project footprint, south of SR-76 and east of Camino Del Rey (Figure 20). The parcel is bordered to the south by the San Luis Rey River. Two other waterways pass through this property: Bonsall Creek to the west and Ostrich Creek to the east. The property is located within the PAMA of the NCMSCP. The majority of the parcel is cottonwood willow riparian forest habitat, which is degraded by invasive plants including arundo and tamarisk. Additional habitats on the property include disturbed habitat and an abandoned agricultural field. Approximately 4.5 ha (11.1 ac) of the property will be used to build a portion of the SR-76 Melrose Drive to South Mission Highway Improvement Project.

Vireos have been documented on the property, and flycatchers have been observed in habitat directly adjacent to the property (Scheidt 2004a, Jones & Stokes 2007). Though arroyo toad surveys on the property were negative (Scheidt 2004b), arroyo toads are present in contiguous

habitat farther east in the San Luis Rey River. The property falls entirely within designated critical habitat for the arroyo toad and vireo. The property also includes approximately 5.9 ha (14.6 ac) of flycatcher critical habitat and 8.0 ha (19.7 ac) of gnatcatcher critical habitat.

Vessels Property

The 65.6-ha (162-ac) Vessels property is located along the south side of the San Luis Rey River, south of SR-76 and approximately 1.75 miles west of I-15. An unnamed drainage flows southeast to northwest through the site, ending in ponds along the southern boundary. The property is located within the PAMA of the NCMSCP. Much of the site currently consists of a dirt landing strip that was created through the placement of fill in the San Luis Rey River. The majority of the vegetation is non-native grassland habitat [33.3 ha (82.4 ac)], agricultural land [10.4 ha (25.7 ac)], and disturbed habitat [6.8 ha (16.8 ac)]. The remaining 15.0 ha (37.1 ac) consists of riparian scrub, southern willow scrub, cottonwood willow scrub, and upland habitat types. Portions of the riparian habitats are disturbed and degraded by invasive plants, including arundo and tamarisk.

The Vessels property supports a population of vireos along the northern edge of the property (EDAW, Inc. 2006b). Arroyo toads and flycatchers are present in habitat directly north of the site (EDAW, Inc. 2006c, 2006d, 2007b, 2007c). Negative arroyo toad surveys have been conducted on the Vessels property (Cadre Environmental 2010). The property falls entirely within critical habitat for the arroyo toad and vireo and includes approximately 35.3 ha (87.2 ac) of southwestern willow flycatcher critical habitat.

Morrison Property

The Morrison property, totaling about 45 ha (121 ac), is located southeast of Gird Road and SR-76 in Bonsall (Figures 20-23). The San Luis Rey River crosses the southern portion of the property. The property is located within the PAMA of the NCMSCP. The property includes approximately 1.13 ha (2.8 ac) of freshwater marsh, 15.7 ha (38.7 ac) riparian forest, 30 ha (74 ac) of riparian scrub, 1.5 ha (3.6 ac) of disturbed habitat, and 2.1 ha (5.3 ac) of non-native grassland. Both arroyo toad and vireo have been documented on the Morrison property (USGS 2003-2007; EDAW, Inc. 2006b, 2006d, 2007c). Flycatchers may use the site, but they have not been documented on it. The Morrison property was conserved in association with the SR-76 Melrose Drive to South Mission Highway Improvement Project (Biological Opinion FWS-SDG-08B0136-08F0900). The Morrison property is the approved receptor site for ambrosia that will be salvaged from the proposed project's direct impact area.

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species, together with the effects of other activities that are interrelated and interdependent with that action, which will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are

those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action, are later in time, and still reasonably certain to occur.

Construction and operation of the project will result in impacts to gnatcatcher, vireo, flycatcher, arroyo toad, ambrosia, and their critical habitats (see Tables 1-3). Effects to habitats located within the alignment footprint are considered permanent direct effects, and impacts to habitat located between the alignment and limits of disturbance (for construction access and grading) were assessed as temporary direct effects.

Operation of existing roadways can affect species and habitats through factors such as increased noise and lighting, changed hydrology, increased fire risk, invasion of exotic plants, habitat fragmentation, and creation of barriers to movement (e.g., Forman et al. 1997, Forman and Deblinger 2000). Given the potentially broad-reaching, long-term nature of indirect impacts, they are difficult to quantitatively assess. Due to the importance of the habitats in the project area, and through coordination between our agency and Caltrans, the indirect impact area for the project was defined to allow for such quantification. For the purposes of this analysis, a 91-m (300-ft) buffer was applied around the proposed project, and areas beyond 91 m (300 ft) where noise from project operations is anticipated to exceed 60 decibels on the A-scale (dBA)[3] were then added. The 91-m (300-ft) buffer and 60 dBA contour of the existing SR-76 were subtracted from the area of indirect effects to account for baseline conditions associated with operation of the existing roadway. The 60 dBA contour was used because this noise level is generally accepted as the level at which potential effects could occur to sensitive avian species.

Forman and Deblinger (2000) estimated that the average maximum distance of changed environmental conditions from a suburban highway is just over 300 m (984 ft) from the edge of the highway but noted a high degree of variability in that average. In general, road-related effects decrease asymptotically with increased distance from the road edge, so the ecologically meaningful effects are much more pronounced close to the road than farther from the edge. Therefore, we believe that the 91-m (300-ft) buffer plus the 60 dBA noise contour encompasses the ecologically meaningful indirect impacts of the project for the listed species in the action area. Indirect effect areas for the project, as defined above, are quantified in Tables 1-3 and shown in Figures 14-18.

Direct and indirect impacts to the vegetation communities, species, and critical habitats summarized in Tables 1-3 will be offset through the conservation, restoration, and management of habitats for these species and their critical habitats as summarized in Tables 4 and 5. This document has discussed the importance of the San Luis Rey River and associated native habitat communities, both as live-in habitat for listed species, and as a regional wildlife movement corridor. The Groves, Tabata, and Vessels mitigation properties, and the Morrison translocation receptor site, are close to the project site in the San Luis Rey River Valley (Figure 26). The

[3] The A-scale is weighted such that sound frequencies to which humans are sensitive are given greater weight than sound frequencies to which we are less sensitive. Although wildlife can be sensitive to different sound frequencies than humans, the frequencies that are heavily weighted on the A-scale are audible to most wildlife.

project will remove fill from the San Luis Rey River at the Tabata and Vessels properties, to be used in project construction, which will restore native habitats along the river corridor. This compensation for project impacts is anticipated to improve the integrity of this important habitat and linkage area and contribute to the conservation and recovery of the species.

Coastal California Gnatcatcher

Direct Effects

Construction activities associated with the project are not anticipated to result in the death or injury of any gnatcatchers or nests. A CFWO-approved gnatcatcher biologist will be present to ensure that gnatcatchers are not directly killed or injured during geotechnical work, vegetation removal and other construction activities. The clearing and grubbing of native habitats will be conducted between September 16 and February 14 to avoid the gnatcatcher, vireo, flycatcher and toad breeding seasons.

The project will result in a total of 2.79 ha (6.89 ac) of permanent direct impacts and 1.41 ha (3.49 ac) of temporary direct impacts to coastal sage scrub throughout the 8.4-km (5.2-mi) long project area. Permanent direct impacts consist of 0.22 ha (0.54 ac) of coastal sage scrub and 2.57 ha (6.35 ac) of disturbed coastal sage scrub. Temporary direct impacts consist of 0.74 ha (1.83 ac) of coastal sage scrub, and 0.67 ha (1.66 ac) of disturbed coastal sage scrub. Note that the above is a summary of impacts to a specific vegetation community that is favored by gnatcatchers, and impacts to designated gnatcatcher critical habitat are analyzed in a separate section below.

A portion of one gnatcatcher territory is located within the permanent and temporary impact areas of the proposed project (Caltrans 2011). The project will result in the permanent loss of part of a gnatcatcher territory that is located south of the southern park and ride, north of the San Luis Rey River, and east of I-15 (Figure 14). Temporary impacts will also occur to this gnatcatcher territory. Caltrans estimates that permanent impacts will occur to approximately 50 percent, and temporary impacts will occur to approximately 10 percent of the pair's use area.

Although habitat removal will be conducted outside the gnatcatcher nesting season, gnatcatchers are non-migratory territorial birds, and removal of a substantial portion of a gnatcatcher pair's breeding territory will force the pair to expand their existing territory or establish a new territory, particularly during the breeding season, when territorial boundaries are better defined (Preston et al. 1998). Because gnatcatchers are distributed throughout much of the suitable habitat in the project area (Caltrans 2011), it is likely that the gnatcatchers affected by habitat loss within their primary use areas will be forced to compete with resident gnatcatchers when attempting to expand an existing territory or establish a new territory. The pair will lose approximately 60 percent of its use area over the short term. Because these displaced birds likely will be less able to find suitable habitat to forage and shelter in, we anticipate they will be more vulnerable to predation and otherwise may die or be injured.

Following construction, all temporarily impacted habitats, including coastal sage scrub, will be restored and are expected to be re-occupied by gnatcatchers. Since restored coastal sage scrub usually takes a minimum of 4 to 5 years of growth before it is suitable for occupation by gnatcatchers (O'Connell and Erickson 1998, Miner et al. 1998), a temporal loss of coastal sage scrub available to gnatcatchers will occur in the project area. This temporal loss likely will reduce the number and reproductive fitness of gnatcatchers in the project area. However, because at least two to three breeding gnatcatcher pairs will remain in the intact habitat in the action area, with more in the surrounding environment, we do not anticipate that the temporary impacts will increase the risk of gnatcatcher extirpation in the area, and we expect that the temporarily impacted habitat will be re-occupied as soon as it is mature enough to support gnatcatcher breeding.

Overall, the permanent loss of habitat for one gnatcatcher pair will reduce the number of gnatcatchers that can be supported in the general project area. Impacts to one gnatcatcher pair represent less than 1 percent of the rangewide estimate of gnatcatcher pairs, and gnatcatchers will continue to occupy the general project area; thus, the project is not expected to result in an appreciable reduction in the numbers, reproduction, or distribution of the species rangewide.

Indirect Effects

Approximately 1.90 ha (4.69 ac) of coastal sage scrub and disturbed coastal sage scrub is present within the indirect impact area for the project. Note that this is a quantification of impacts to a specific vegetation community that is favored by gnatcatchers, and indirect impacts to designated gnatcatcher critical habitat are quantified in a separate section below. A portion of a gnatcatcher territory is located within the indirect impact area for the project. This pair is located north of SR-76, east of Monserate Hill Road, and west of Star Track Way. Caltrans estimates that about 5 percent of this pair's territory overlaps with the area of indirect impact defined for this project. Indirect impacts to these birds may degrade a small portion of their use area. However, as described in more detail below, with this small amount of impact, this pair is expected to survive and experience only minimal degradation of habitat within their territory.

The project will result in an increase in operational noise to 60 dBA within this 1.90 ha (4.69 ac) of coastal sage scrub. Noise and vibrations associated with the use of heavy equipment during construction and traffic noise during operations of the proposed facility have the potential to disrupt gnatcatcher behaviors in adjacent habitat by masking intraspecific communication and startling birds (e.g., see Dooling and Popper 2007 for a discussion of observed effects of highway noise on birds). The project has incorporated measures to minimize the effects of construction noise on gnatcatchers. Pile driving for the project near habitats that support gnatcatchers will be conducted outside of the gnatcatcher breeding season to minimize construction noise impacts to nesting gnatcatchers. In addition, all construction equipment, fixed or mobile, will be equipped with properly operating and maintained mufflers. These measures are anticipated to minimize the impact of construction noise on gnatcatcher behavior in adjacent habitat to the point where such effects are insignificant. For the purposes of section 7 consultation, an insignificant effect is one that is sufficiently small that a person would not be

able to meaningfully measure, detect, or evaluate it. Permanent indirect effects from operational noise will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

Lighting associated with the project may affect gnatcatchers within the adjacent habitat. Light that alters natural light patterns in ecosystems can lead to increased predation, disorientation, and disruption of inter-specific interactions (Longcore and Rich 2004). The project has incorporated measures to minimize the effects of lighting on gnatcatchers. If night work is necessary, night lighting will be selectively placed, shielded and directed away from natural habitats. Permanent safety lighting installed for the project will be lowest illumination necessary for safety and will be directed toward the facility and away from sensitive habitats. This is anticipated to minimize the impact of lighting on gnatcatcher behavior in adjacent habitat to the point where such effects are insignificant. In addition, the permanent indirect effects of the project will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

The project could result in an increase in the introduction of invasive plant species into native habitats adjacent to the facility. Invasive species are now recognized as a threat to biodiversity in native plant communities, second only to direct habitat loss and fragmentation (Pimm and Gilpin 1989, Scott and Wilcove 1998). Non-native, weedy species often out-compete and exclude native species, potentially altering the structure of the vegetation, degrading or eliminating upland habitat utilized by the gnatcatcher, and providing food and cover for undesirable non-native animals (Bossard et al. 2000). The project has incorporated measures to prevent the spread of invasive species. A qualified biologist will monitor the project site immediately prior to and during construction to identify the presence of invasive weeds and recommend measures to avoid their inadvertent spread in association with the project. Invasive plants will not be used in project landscaping. This is anticipated to minimize the impact of invasive species introduction resulting from project implementation on gnatcatcher habitat to the point where such effects are insignificant. In addition, the permanent indirect effects of the project will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

The project will increase habitat fragmentation for gnatcatchers in the vicinity of SR-76 by replacing an existing two-lane road with a four-lane road, resulting in a higher traffic volume and a wider barrier for gnatcatchers to cross. Roads are potential barriers to gnatcatcher dispersal and may occasionally result in gnatcatcher mortality due to vehicle strikes, as gnatcatchers are not strong flyers. However, gnatcatchers can disperse over four-lane freeways (e.g., Varanus Biological Services and Campbell BioConsulting 2003), and the limited decrease in habitat connectivity is not anticipated to have a substantial impact on the surrounding gnatcatcher population. The project will not affect east/west dispersal along the San Luis Rey River south of SR-76 or through undeveloped open space to the north, and gnatcatchers are still expected to cross over the four-lane road, although the frequency of such dispersal events will likely decrease relative to baseline conditions. Furthermore, the conservation of undeveloped open space and coastal sage scrub in the Groves, Vessels, and Tabata properties will help maintain

long-term connectivity along the San Luis Rey, and restoration of coastal sage scrub at the SR-76/I-15 intersection will facilitate gnatcatcher dispersal in both the east/west and north/south directions.

Additional indirect effects include an increase in human encroachment and wildfire. Permanent fencing will be installed along the facility in association with the wildlife connectivity measures which should also limit increased human encroachment and associated wildfires. SR-76 is an existing facility, so with the proposed conservation measures, any increase in habitat degradation associated with these factors is likely to be insignificant.

Critical Habitat

The project will result in the permanent loss of 16.91 ha (41.79 ac) of designated critical habitat for the gnatcatcher. Temporary impacts will occur to 12.22 ha (30.19 ac) of gnatcatcher critical habitat, and 12.92 ha (31.92 ac) of designated gnatcatcher critical habitat occurs within the indirect impact area for the project. The area of critical habitat that will be impacted is located within Unit 5 of designated gnatcatcher critical habitat, which totals 11,995 ha (29,639 ac). This unit contains large blocks of high-quality habitat capable of supporting several core gnatcatcher populations and constitutes the primary inland linkage along the Interstate 15 corridor between San Diego populations and those in southwestern Riverside.

The direct and indirect impacts of the project will affect less than 0.4 percent of the designated critical habitat within Unit 5 and an even smaller percentage of all critical habitat designated for this species. Of the critical habitat in the project area, most (about 85 percent) consists of vegetation communities other than coastal sage scrub, which provide fewer resources to support gnatcatchers. The loss of this amount of critical habitat and associated PCEs (sage scrub and non-sage scrub vegetation that provide space and resources for nesting, foraging, and dispersal) will not substantially impact the function of Unit 5 to support core gnatcatcher populations.

The project will also not have a substantial impact on the function of Unit 5 to provide connectivity between San Diego populations and those in southwestern Riverside. The project will likely reduce the frequency of north/south dispersal events over SR-76, but such dispersal will still occur, and the primary dispersal corridor in the vicinity of the project is likely east/west along the San Luis Rey River and north/south on either side of I-15, and these corridors will not be negatively impacted by the project.

Proposed conservation to offset impacts of the project, as summarized in Tables 4 and 5, will include 36.74 ha (90.79 ac) of gnatcatcher critical habitat on the Groves and Tabata properties, which are located almost entirely within Unit 5 of designated gnatcatcher critical habitat. In addition, though it is currently highly disturbed and was not included within the critical habitat designation, the conservation and restoration proposed on the 65.6-ha (162-ac) Vessels property (Table 4) will occur directly adjacent to gnatcatcher critical habitat along the San Luis Rey River (Figure 26), helping to maintain gnatcatcher dispersal through Unit 5. Further, Caltrans has agreed to restore all of the project's temporary impact areas with native species, with the

exception of small areas adjacent to landscaped or developed areas where planting native species would provide little or no biological value. This will include extensive areas that are currently vegetated with non-native species, including the SR76/I-15 interchange, which is located at a pinch point within the critical habitat linkage. The proposed conservation and restoration will help maintain the functions of Unit 5 to support core gnatcatcher populations and provide connectivity between gnatcatchers in San Diego and Riverside counties.

According to the final critical habitat rule (Service 2007), the physical and biological features essential to the conservation of the species in Unit 5 may require special management considerations or protection to minimize impacts associated with habitat type conversion and degradation occurring in conjunction with urban and agricultural development. The measures that the project has incorporated to address indirect impacts and habitat degradation adjacent to the facility are discussed in the indirect effects section above.

Habitat Restoration

Temporarily impacted coastal sage scrub will be restored in association with the project. Restoration activities may result in minor disturbance of gnatcatchers that are adjacent to or within the restoration sites, but only a small amount of coastal sage scrub [0.74 ha (1.83 ac) of coastal sage scrub and 0.67 ha (1.66 ac) of disturbed coastal sage scrub] will be temporarily impacted, and we anticipate that the restoration plan will include measures to ensure that gnatcatchers are not significantly disrupted during breeding activities and that no nests are destroyed as a result of weed removal activities. Therefore, effects to gnatcatcher associated with habitat restoration are anticipated to be insignificant.

Effect on Recovery

There is no recovery plan for the gnatcatcher, but the project is consistent with the general recovery goals of maintaining core populations of gnatcatchers and maintaining connectivity between these populations. As described above, the permanent loss of 2.79 ha (6.89 ac) of coastal sage scrub, permanent indirect impacts to 1.90 ha (4.69 ac) of coastal sage scrub, and loss of one gnatcatcher pair is a small impact relative to the thousands of ha/ac and gnatcatcher territories (roughly 2,562 pairs) rangewide. Furthermore, because substantial areas of occupied habitat will remain adjacent to the impact area, and habitat restoration will be initiated immediately following construction, little risk exists that the project will extirpate any gnatcatcher populations in the project area.

Caltrans will offset the impacts to coastal sage scrub, as well as impacts to other native upland habitats on the site, through the preservation of the Groves and Tabata properties, which include 22.64 ha (55.89 ac) of gnatcatcher occupied coastal sage scrub. Although the proposed conservation of gnatcatcher and upland habitat off the project site will not avoid or minimize impacts to the individual gnatcatchers impacted by the project, the offsite conservation will permanently protect a total of 22.64 ha (55.89 ac) of coastal sage scrub within critical habitat Unit 5, which is located in proximity to the impact area within the San Luis Rey River Valley,

and will contribute to the conservation and recovery of the species by maintaining gnatcatcher breeding habitat and connectivity between core gnatcatcher populations in San Diego and Riverside counties.

Least Bell's Vireo and Southwestern Willow Flycatcher

Direct Effects

Construction activities associated with the project are not anticipated to result in the death or injury of any vireos or flycatchers or nests. The clearing and grubbing of native habitats will be conducted between September 16 and February 14 to avoid the gnatcatcher, vireo, flycatcher and toad breeding seasons.

The project will result in a total of 13.22 ha (32.65 ac) of permanent direct impacts and 4.29 ha (10.6 ac) of temporary direct impacts to vireo and flycatcher habitat (riparian and wetland vegetation and aquatic habitats, itemized by vegetation type in Table 4) throughout the 8.4-km (5.2-mi) long project area.

No flycatchers were observed within the permanent and temporary impact areas for the project, so flycatchers are not discussed further in this section of this analysis. Portions of three vireo territories are located within the permanent and temporary impact areas of the proposed project (Caltrans 2011). These territories are all located south of SR-76 between Gird Road and Monserate Hill Road. While the easternmost pair was observed within the temporary impact area, a significant portion of the pair's territory is located within the permanent impact area. Caltrans estimates that permanent impacts will occur to nearly all of the western and central pair's use areas. Caltrans estimates that approximately 40 percent of the eastern pair's use area will be permanently impacted, and 10 percent will be temporarily impacted.

Although habitat removal will be conducted outside the vireo nesting season, vireo pairs usually return to the same breeding territory each year (Kus 2002), so removal of a substantial portion of a vireo pair's territory will force the pair to expand their existing territory or establish a new territory. Because vireos are distributed throughout much of the suitable habitat in the project area (Caltrans 2011), it is likely that the vireos affected by habitat loss within their primary use areas will be forced to compete with resident vireos when attempting to expand an existing territory or establish a new territory. The pairs will lose between 100 and 50 percent of their use areas over the short term. Because these displaced birds likely will be less able to find suitable habitat to forage and shelter in, we anticipate they will be more vulnerable to predation and otherwise may die or be injured.

Vireos that successfully establish territories in adjacent habitat are expected to experience reduced productivity (e.g., delayed initiation or prevention of nest building, fewer nesting attempts per season, and/or overall reduction in reproductive output) due to reduced availability of foraging and breeding habitat and increased territorial interactions. For example, surveys conducted during the 2004 and 2006 breeding seasons on San Diego Creek in Orange County

found that vireos occupying an area where habitat had been removed to address flood risk had lower productivity in the breeding season immediately following vegetation removal than 2 years later, after vegetation was allowed to recover. Only 1 fledgling (0.33 young/pair) was produced in 2004 immediately following vegetation removal and 14 fledglings (2.33 young/pair) were produced in the same area in 2006 (Bloom 2004, Chambers Group 2006).

Following construction, all temporarily impacted habitats, including riparian habitats, will be restored and are expected to be re-occupied by vireos. Depending on the nature of the impacts (i.e., removal of above-ground vegetation only or removal of all vegetation, including root systems), vireo habitat can recover in about 2 to 7 years following construction. Because large numbers of vireo pairs will be breeding in the intact riparian habitat adjacent to the impact area, we expect that the temporarily impacted habitat will be re-occupied as soon as it is mature enough to support vireo breeding.

Overall, the permanent loss of habitat for three vireo pairs will reduce the number of vireos that can be supported in the general project area. The loss of three vireo pairs represents 1.3 percent of the territories along the San Luis Rey River and about 0.1 percent of the rangewide estimate of vireo pairs. Therefore, vireos will continue to occupy the general project area, and the project is not expected to result in an appreciable reduction in the numbers, reproduction, or distribution of the species rangewide.

Indirect Effects

Approximately 14.97 ha (36.97 ac) of vireo and flycatcher habitat (riparian and wetland vegetation; Table 4) is present within the indirect impact area for the project. Note that this is a quantification of impacts to vegetation communities that are favored by vireos and flycatchers; indirect impacts to designated critical habitat for these species are quantified in a separate subsection below. Within the indirect impact area for the project, 11 individual vireos (approximately six territories) were observed. The vireos were observed south of SR-76 along the length of the project. Two pairs of flycatchers were observed within the indirect impact area for the project. One pair of flycatchers was observed south of SR-76, just east of Calle de la Vuelta. The second pair of flycatchers was observed south of SR-76, east of Monserate Hill Road, and west of Star Track Way. Caltrans estimates that the project will indirectly and permanently affect approximately 50 percent of each of these vireo and flycatcher territories. Indirect impacts to these vireos and flycatchers are anticipated to degrade the northern half of their use areas.

The project will result in an increase in operational noise to 60 dBA within this 14.97 ha (36.97 ac) of vireo and flycatcher habitat. Noise and vibrations associated with the use of heavy equipment during construction and traffic noise during operations of the proposed facility have the potential to disrupt vireo and flycatcher behaviors in adjacent habitat by masking intraspecific communication and startling birds (e.g., see Dooling and Popper 2007 for a discussion of observed effects of highway noise on birds). The project has incorporated measures to minimize the effects of construction noise on vireos and flycatchers. Pile driving for

the project that will occur near habitats that support vireos and flycatchers will be conducted outside of the breeding season to minimize construction noise impacts to nesting birds. In addition, all construction equipment, fixed or mobile, will be equipped with properly operating and maintained mufflers. These measures are anticipated to minimize the impact of construction noise on vireo and flycatcher behavior in adjacent habitat to the point where such effects are insignificant. Permanent effects from operational noise will likely result in limited interference with intraspecific communication during the vireo and flycatcher breeding season, but the affected pairs are expected to survive and continue to reproduce. The indirect effects from noise will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

Lighting associated with the project may affect vireos and flycatchers within the adjacent habitat. Light that alters natural light patterns in ecosystems can lead to increased predation, disorientation, and disruption of inter-specific interactions (Longcore and Rich 2004). The project has incorporated measures to minimize the effects of lighting on vireos and flycatchers. If night work is necessary, night lighting will be selectively placed, shielded and directed away from natural habitats. Permanent safety lighting installed for the project will be lowest illumination necessary for safety and will be directed toward the facility and away from sensitive habitats. This is anticipated to minimize the impact of lighting on vireo and flycatcher behavior in adjacent habitat to the point where such effects are insignificant. In addition, the permanent indirect effects of the project will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

The project could result in an increase in the introduction of invasive plant species into native habitats adjacent to the facility. Invasive species are now recognized as a threat to biodiversity in native plant communities, second only to direct habitat loss and fragmentation (Pimm and Gilpin 1989, Scott and Wilcove 1998). Non-native, weedy species often out-compete and exclude native species, potentially altering the structure of the vegetation, degrading or eliminating habitat utilized by the vireo and flycatcher, and providing food and cover for undesirable non-native animals (Bossard et al. 2000). The project has incorporated measures to prevent the spread of invasive species. A qualified biologist will monitor the project site immediately prior to and during construction to identify the presence of invasive weeds and recommend measures to avoid their inadvertent spread in association with the project. Invasive plants will not be used in project landscaping. This is anticipated to minimize the impact of invasive species introduction resulting from project implementation on vireo and flycatcher habitat to the point where such effects are insignificant. In addition, the permanent indirect effects of the project will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

The project is not anticipated to substantively increase habitat fragmentation for vireo or flycatcher. The project replaces the existing two-lane facility that runs to the north of the San Luis Rey River. The project will not bisect or fragment habitat in the river itself. The expansion of SR-76 to four lanes will create a wider barrier for dispersal between the river and riparian habitat in tributaries to the north of the San Luis Rey River, but vireos and flycatchers are

migratory birds and are capable of establishing territories on either side of the SR-76 when they return to breed.

Additional indirect effects include an increase in human encroachment and wildfire. Permanent fencing will be installed along the facility in association with the wildlife connectivity measures which should also limit increased human encroachment and associated wildfires. SR-76 is an existing facility, so with the proposed conservation measures, any increase in habitat degradation associated with these factors is likely to be insignificant.

Critical Habitat

The project will result in the permanent loss of 25.56 ha (63.15 ac) of designated critical habitat for the vireo and 15.03 ha (37.13 ac) of designated critical habitat for the flycatcher. About 13.19 ha (32.60 ac) of vireo critical habitat and 4.42 ha (10.93 ac) of flycatcher critical habitat will be temporarily impacted and then restored. Approximately 29.83 ha (73.72 ac) of designated vireo critical habitat and 22.81 ha (56.36 ac) of designated flycatcher critical habitat occur within the indirect impact area for the project. The area of critical habitat that will be impacted is located within the San Luis Rey Area of critical habitat for the vireo and the San Diego Management Unit of the Coastal California Recovery Unit of southwestern willow flycatcher critical habitat, which include approximately 2,428 ha (6,000 ac) and 1,944 ha (4,805 ac), respectively. These units encompass high quality habitat within the San Luis Rey River, which supports the third-largest population of vireos (233 territories, Service 2006) and the largest population of flycatchers (58 territories, Durst et al. 2006) rangewide.

The project will impact a fraction of designated critical habitat for vireo and flycatcher. The permanent direct and indirect impacts of the project on the San Luis Rey Area of designated critical habitat for the vireo and the San Diego Management Unit of the Coastal California Recovery Unit of southwestern willow flycatcher critical habitat represent less than 3 percent of the designated critical habitat within the respective units, less than 0.4 percent of all vireo critical habitat, and less than 0.1 percent of all flycatcher critical habitat.

There are no unit-specific goals identified in the final rules designating critical habitat for vireo. Therefore, our analysis focuses on the effect of the project on PCEs in San Luis Rey Area of critical habitat and the effect of the project on the unit's ability to support a core population of vireo. The PCEs for vireo critical habitat are those habitat components that are essential for the primary biological needs of feeding, nesting, roosting, and sheltering (i.e., riparian woodland vegetation that generally contains both canopy and shrub layers, and includes some associated upland habitats).

The project will result in the permanent loss of 25.56 ha (63.15 ac) of vireo critical habitat, about half of which is riparian vegetation and half of which is upland vegetation adjacent to the San Luis Rey River. The project will result in limited degradation in habitat quality within the area of indirect effects, but this area will still contain PCEs essential for the primary biological needs of feeding, nesting, roosting, and sheltering. The project will benefit vireo critical habitat

through the creation of 38.45 ha (95.00 ac) of riparian vegetation and the restoration of 15.50 ha (38.30 ac) on the Tabata and Vessels properties, so there will be a net increase in riparian vegetation (the most important PCE for vireo critical habitat) in the San Luis Rey Area. In addition, the conservation of 74.75 ha (184.70 ac) of vireo critical habitat, including all restored and created riparian habitat, will help maintain the long-term viability of PCEs in the San Luis Rey Area and the ability of this critical habitat unit to support a core population of vireo.

The final rule designating flycatcher critical habitat describes critical habitat units generally as stream segments with large populations and nearby stream segments with high quality habitat and smaller numbers of territories that provide for population connectivity, metapopulation stability, population growth, and protection against catastrophic loss. The PCEs for flycatcher critical habitat are those habitat components that are essential for the primary biological needs of feeding, nesting, roosting and sheltering [i.e., riparian vegetation with dense riparian thickets, foliage, and canopy (PCE 1) and a variety of insect prey populations in or adjacent to the riparian vegetation (PCE 2)].

The project will impact 15.03 ha (37.13 ac) of flycatcher critical habitat, almost all of which is riparian vegetation. The project will result in limited degradation in habitat quality within the area of indirect effects, but this area will still contain PCEs essential for the primary biological needs of feeding, nesting, roosting, and sheltering. The project will result in the conservation of 41.35 ha (102.10 ac) of flycatcher critical habitat. The project will also result in the creation of 38.45 ha (95.00 ac) of riparian vegetation and the restoration of 15.50 ha (38.30 ac) on the Tabata and Vessels properties. Some of the proposed riparian restoration and creation is within the critical habitat unit, and some is outside, but contiguous with, the critical habitat boundaries. All of the proposed conservation, restoration, and creation on the Tabata and Vessels properties will contribute to the goals of maintaining a large population of flycatchers and providing population connectivity within the San Diego Management Unit of flycatcher critical habitat.

Special management considerations, including protecting critical habitat from future development and degradation, will be addressed through conservation and management of the Groves and Tabata properties and through measures designed to limit indirect effects associated with facility operation.

Habitat Restoration

Riparian creation and restoration is proposed at the Tabata and Vessels properties. To accomplish this restoration, fill material and nonnative vegetation will be removed. Vireos have been documented on the Tabata property, and flycatchers have been observed in habitat directly adjacent to the property (Scheidt 2004a, Jones & Stokes 2007). The Vessels property presently supports a population of vireos along the northern edge of the property (EDAW, Inc. 2006b), and flycatchers are present in habitat directly north of the property (EDAW, Inc. 2006c, 2007b).

Restoration activities associated with the project are not anticipated to result in the death or injury of any vireos or flycatchers or nests. Vegetation clearing will be conducted out of the

vireo and flycatcher breeding seasons, with the exception of maintenance activities that may occur in association with habitat restoration and enhancement actions during the breeding season (i.e., weeding, treating tamarisk and arundo re-sprouts with herbicide). Surveys will be conducted prior to treating any restoration areas during the breeding season to ensure that impacts to vireo and flycatcher breeding are avoided.

The proposed restoration work will result in the removal of fill and nonnative vegetation and the establishment of native vegetation on the properties. This will greatly improve the ability of the Tabata and Vessels properties to support vireos and flycatchers, which will benefit these species.

Effect on Recovery

The proposed project is consistent with the recovery goals identified in the draft recovery plan for vireo (Service 1998) and the recovery plan for flycatcher (Service 2002a). As described above, the project will result in impacts to vireos, flycatchers, and their habitats. However, the impacts are small relative to the amount of habitat and territories rangewide. Furthermore, conservation measures incorporated into the project will help accomplish recovery actions identified in the recovery plans.

For vireo, proposed habitat conservation, creation, restoration, and management will help accomplish recovery task 1, which is to protect and manage riparian and adjacent upland habitat within the vireo's historic range and recovery task 3, which is to develop and evaluate vireo habitat restoration projects and techniques. For flycatcher, proposed conservation measures will help accomplish recovery task 1.1, which is to secure and enhance flycatcher habitat by developing management plans (1.1.1), manage physical processes that maintain flycatcher habitat (e.g., restoring hydrology to impacted floodplains; 1.1.2), and manage biotic elements that maintain flycatcher habitat (e.g., removing non-native invasive plant species; 1.1.3). Conservation of the Tabata and Vessels properties will help accomplish recovery task 1.2, which is to work with landowners to conserve occupied flycatcher habitat.

Importantly, with the proposed conservation measures, the project will result in a net increase in the amount of habitat for vireo and flycatcher. The project will permanently destroy 13.22 ha (32.65 ac) of vireo and flycatcher habitat and an additional 14.97 ha (36.97 ac) will be within the area of indirect effects. However, the project will create 38.45 ha (95.00 ac) and restore 15.50 ha (38.30 ac) of riparian and wetland vegetation. The project will not substantially fragment existing populations or interfere with dispersal between populations, and the conservation of the Tabata and Vessels properties will contribute to the long-term maintenance of the important population of vireos and flycatchers along the San Luis Rey River.

Arroyo Toad

Direct Effects

The project will result in a total of 13.22 ha (32.65 ac) of permanent direct impacts and 4.29 ha (10.60 ac) of temporary direct impacts to arroyo toad breeding habitat (riparian and aquatic vegetation communities; Table 4) throughout the 8.4-km (5.2-mi) long project area. The project will result in a total of 14.49 (35.81 ac) of permanent direct impacts and 9.92 ha (24.52 ac) of temporary direct impacts to arroyo toad aestivation/upland habitat throughout the project area. Note that the above is a summary of impacts to breeding habitats and aestivation habitats, which were mapped by Caltrans throughout the project area and included in the Biological Assessment (Caltrans 2011). Impacts to designated arroyo toad critical habitat are analyzed in a separate section below.

Quantifying the number of arroyo toads within the project impact area is difficult for a number of reasons. The exact distribution and population size is difficult to estimate due to the dynamic conditions associated with their habitat. Suitable habitat may change from year to year depending on climatic conditions, flooding, or other natural or human-related events (Service 1999), which in turn influence reproductive success and juvenile survival. Therefore, it is anticipated that the arroyo toad population subject to impacts from the project will experience population fluctuations making it difficult to determine the precise number of arroyo toads that could be adversely affected at any given time.

In addition, except during the early juvenile stage (first 4-5 weeks), arroyo toads forage at night and burrow during the day. Nocturnal activity is usually associated with rainfall and moderate temperatures and some nights of very high relative humidity (Service 1999). Arroyo toads may be found in upland habitat up to 1.0 km (0.62 mi) from a known breeding area. Therefore, detection of arroyo toads outside of the breeding season is very difficult, with limited ability for anticipating when the species may be active. Lastly, no reliable survey method exists for determining the locations or densities of arroyo toads that may be burrowed within upland habitat.

Due to these constraints, the precise number of arroyo toads that may be located within the project area is not known. As discussed in the Environmental Baseline section, four individual arroyo toads were observed in the permanent impact area for the project, and two arroyo toads were observed in the temporary impact area for the project during protocol arroyo toad surveys (EDAW, Inc. 2006d, 2007c). However, for the reasons detailed above, there are expected to be more toads in the project area than were observed during surveys. Because we do not have site specific data regarding the density of arroyo toads at this location, it is difficult to accurately quantify the number of individuals that may be present within the project's impact area.

The project has incorporated measures to exclude arroyo toads from the project footprint. These measures include installation of arroyo toad exclusion fencing, surveys, and translocation of individuals out of the fenced project footprint to proximal and safe suitable habitat. In addition,

if there is no natural rainfall, the arroyo toad biologist will try to encourage toads within the fenced project footprint to surface by spraying the project area with water to simulate a rain event. It is not feasible to spray the entire project area with water; therefore spraying will occur in the areas of greatest concern under the direction of the approved toad biologist.

Nevertheless, some arroyo toads will likely escape detection during translocation efforts, and any arroyo toads in the project footprint at the beginning of project construction are likely to be killed or injured as a result of being crushed during earth-disturbing activities and grading and by driving over them with heavy equipment. There is also potential for arroyo toads to be killed or injured by the geotechnical work that will be conducted at 35 locations within the project footprint on approximately 0.68 ha (1.68 ac) prior to arroyo toad exclusion; however, this work will occur within a limited area, and numerous measures have been incorporated to avoid and minimize take, the implementation of which will be overseen by an experienced arroyo toad biologist.

It is anticipated that arroyo toads in the project footprint may be killed or injured during project construction or geotechnical investigations, but because of the proposed avoidance and minimization measures, and the difficulty of detecting toads that may be buried or crushed by proposed construction, we anticipate that no more than six arroyo toads (the number of live toads observed during pre-project surveys) will be observed dead or injured during project monitoring.

There is the potential for arroyo toads to be killed, injured, or stressed if they become entangled or trapped within exclusionary fencing and during capture and relocation efforts. However, fence placement and trapping and relocation efforts will be conducted by individuals familiar with arroyo toad biology and ecology, whose qualifications will be subject to review by the Service. Therefore, we anticipate that very few arroyo toads (no more than two) will be killed or injured during capture and relocation efforts.

Given the fact that a large amount of suitable arroyo toad breeding and upland habitat will remain adjacent to the action area after project construction, we do not anticipate that the translocation of arroyo toads within the impact area to suitable adjacent habitat will result in adverse impacts associated with overcrowding. Furthermore, precautions will be taken to avoid transferring disease or pathogens during surveys and handling of arroyo toads through implementation of the conservation measures. As described above, it is difficult to estimate the number of arroyo toads in the project footprint, but we expect that the number of arroyo toads captured using pitfall traps and watering of habitat will result in the observation and capture of more arroyo toads than were observed by walking the site. Therefore, we estimate that no more than 24 arroyo toads will be captured and translocated.
Because it is difficult to estimate the number of arroyo toads in the project footprint and in the population as a whole, it is useful to consider the project impacts to arroyo toad habitat relative to available habitat along the San Luis Rey River when assessing the effects of the project on the population along the San Luis Rey River. The permanent loss of breeding [13.22 ha (32.65 ac)] and aestivation [14.49 (35.81 ac)] habitat in the watershed represents about 5 percent and 6 percent of riparian and upland habitat, respectively, in the BSA for the project. The BSA covers

about one-third of the stretch of occupied arroyo toad habitat along the San Luis Rey River. Therefore, the project is expected to impact a fraction of the arroyo toad population on the San Luis Rey River and will have a limited effect on the availability of habitat in which arroyo toads can forage, disperse, and aestivate. The temporarily impacted habitat will be restored upon project completion, and because arroyo toads are not dependent on mature vegetation in either the riparian or upland environment, we expect temporarily impacted areas to be re-occupied shortly following project completion.

Indirect Effects

Approximately 14.97 ha (36.97 ac) of arroyo toad breeding habitat (riparian and wetland vegetation and aquatic habitats, itemized by vegetation type in Table 4) and 11.6 ha (28.67 ac) of arroyo toad aestivation habitat is present within the indirect impact area for the project. Note that the above is a summary of indirect impacts to breeding habitats and aestivation habitats, which were mapped by Caltrans throughout the project area and included in the Biological Assessment (Caltrans 2011). Impacts to designated arroyo toad critical habitat are analyzed in a separate section below.

As discussed above, it is difficult to accurately quantify the number of individuals that may be present within the project's impact area. This is particularly challenging in the permanent indirect impact area for the project because the arroyo toad population in the project area is expected to experience population fluctuations over time. As discussed in the environmental baseline section, approximately eight individual arroyo toads were observed within the indirect impact area for the project during project surveys (EDAW, Inc. 2006d, 2007c). The arroyo toads were observed south of SR-76, east of Gird Road and west of Star Track Way. Indirect impacts are anticipated to degrade a portion of the use areas, but arroyo toads are still anticipated to breed, forage, and aestivate in suitable habitat within the area of indirect effects.

The project will result in an increase in operational noise to 60 dBA within 14.97 ha (36.97 ac) of arroyo toad breeding habitat and 11.6 ha (28.67 ac) of arroyo toad aestivation habitat. Noise and vibrations associated with the use of heavy equipment during construction and traffic noise during operations of the proposed facility have the potential to disrupt arroyo toad behaviors in adjacent habitat. The project has incorporated measures to minimize the effects of construction noise on arroyo toads. Pile driving for the project that will occur near habitats that support arroyo toads will be conducted outside of the breeding season to minimize construction noise impacts to breeding toads. In addition, all construction equipment, fixed or mobile, will be equipped with properly operating and maintained mufflers. These measures are anticipated to minimize the impact of construction noise on arroyo toad behavior in adjacent habitat to the point where such effects are insignificant. Permanent indirect effects from operational noise will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

Lighting associated with the project may affect arroyo toads within the adjacent habitat. Light that alters natural light patterns in ecosystems can lead to increased predation, disorientation, and

disruption of inter-specific interactions (Longcore and Rich 2004). The project has incorporated measures to minimize the effects of lighting on arroyo toads. If night work is necessary, night lighting will be selectively placed, shielded and directed away from natural habitats. Permanent safety lighting installed for the project will be lowest illumination necessary for safety and will be directed toward the facility and away from sensitive habitats. No nighttime construction or lighting will occur in arroyo toad breeding habitat during the active season (March 15 – June 30). This is anticipated to minimize the impact of lighting on arroyo toad behavior in adjacent habitat to the point where such effects are insignificant. In addition, the permanent indirect effects of the project will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

The project could result in an increase in the introduction of invasive plant species into native habitats adjacent to the facility. Invasive species are now recognized as a threat to biodiversity in native plant communities, second only to direct habitat loss and fragmentation (Pimm and Gilpin 1989, Scott and Wilcove 1998). Non-native, weedy species often out-compete and exclude native species, potentially altering the structure of the vegetation, degrading or eliminating habitat utilized by the arroyo toad, and providing food and cover for undesirable non-native animals (Bossard et al. 2000, Service 2009). The project has incorporated measures to prevent the spread of invasive species. A qualified biologist will monitor the project site immediately prior to and during construction to identify the presence of invasive weeds and recommend measures to avoid their inadvertent spread in association with the project. Invasive plants will not be used in project landscaping. The measures for the project also require that American bullfrogs (*Lithobates catesbeiana*) and other exotic animal species that prey upon or compete with arroyo toads for resources will be excluded, destroyed, or otherwise permanently removed from the habitat by the approved arroyo toad biologist if encountered. These measures are anticipated to minimize the impact of invasive species introduction resulting from project implementation on arroyo toad habitat to the point where such effects are insignificant. In addition, the permanent indirect effects of the project will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

Implementation of the project has the potential to increase pollution and siltation in the creek as a result of sediment moving, grading, cutting, and filling, and operating heavy equipment in proximity to the creek. Changes to water quality in adjacent arroyo toad breeding habitat could result due to construction-related sedimentation and pollution. Increased sedimentation has the potential to kill arroyo toad eggs and larvae through asphyxiation (Sweet 1992, Service 1999). Changes to the water quality (temperature and chemical composition) can lead to reduced oxygen uptake, reduced feeding, and a general decline in species health, which can lead to disease, decreased growth and reproduction, or death. To minimize the potential for water quality impacts to the San Luis Rey River from the proposed project, measures will be implemented to prevent construction-related siltation and runoff from entering the river and other drainages. Temporary erosion control measures will be installed and BMPs will be implemented to avoid and minimize soil erosion, sedimentation, and pollution of adjacent watercourses and degradation of breeding habitat. With the proposed measures in place, we anticipate that effects to erosion and water quality will be reduced to the point where they are insignificant.

The project is not anticipated to substantially increase habitat fragmentation or the mortality rate due to vehicle strikes for the arroyo toad population in the San Luis Rey River. The new alignment will run along the north bank of the San Luis Rey River in a similar location to the existing alignment. The existing alignment separates the arroyo toad population in the San Luis Rey River from upland habitats to the north of the road and likely results in occasional arroyo toad mortality due to vehicle strikes. The proposed project includes multiple culverts and other wildlife undercrossings that may be used by arroyo toads to move between the riparian habitat in the San Luis Rey River and the upland habitat to the north. It also includes wildlife exclusionary fencing with barriers that will reduce the number of toads dispersing over the road. With the proposed measures in place, we anticipate that effects to habitat fragmentation and mortality due to vehicle strikes will be reduced to the point where they are insignificant.

Additional indirect effects include an increase in human encroachment and wildfire. Human activity in the project area during construction may result in accumulation of trash and food, attracting predators that may prey on arroyo toads. However, the project measures require that trash and debris be removed from the site daily to avoid attracting predators. In addition, permanent fencing will be installed along the facility in association with the wildlife connectivity measures which should also limit increased human encroachment and associated wildfires. SR-76 is an existing facility, so with the proposed conservation measures, any increase in habitat degradation associated with these factors is likely to be insignificant.

Critical Habitat

The project will permanently impact 31.56 ha (77.98 ac) of designated critical habitat for the arroyo toad. Temporary impacts will occur within 26.01 ha (64.27 ac) of arroyo toad critical habitat, and 41.31 ha (102.07 ac) of designated arroyo toad critical habitat are within the indirect impact area for the project. The temporarily impacted habitat will be restored following project completion, so temporary impacts are not anticipated to have a long-term impact on arroyo toad critical habitat. The indirect impacts will result in limited degradation of arroyo toad habitat, but the indirect impact area will still contain the PCEs essential to the conservation of the species [aquatic habitat for breeding and non-breeding activities (PCEs 1, 2, and 3) and upland habitat for foraging and dispersal activities (PCE 4)].

The area of critical habitat that will be impacted is located within Unit 14, which includes 4,093 ha (10,115 ac) of designated critical habitat. This unit supports one of the largest contiguous river reaches that is occupied by the species. The direct and indirect impacts of the project on Unit 14 of designated critical habitat for the arroyo toad represent less than 2 percent of the designated critical habitat within the unit, and an even smaller percentage of the critical habitat designated for this species.

According to the final rule designating critical habitat (Service 2011), “Unit 14 contains the physical and biological features that are essential to the conservation of the species, including aquatic habitat for breeding and non-breeding activities (PCEs 1, 2, and 3) and upland habitat for foraging and dispersal activities (PCE 4). The physical and biological features essential to the

conservation of the species in this unit may require special management considerations or protection to address threats from dams and water diversions, intensive urbanization, agriculture, and nonnative predators and plants" (Service 2011). About half of the permanent impacts will be to riparian and aquatic habitat and half will be to upland habitat.

Conservation and restoration to offset impacts of the project, as summarized in Tables 4 and 5, will include 89.21 ha (220.27 ac) of arroyo toad critical habitat on the Groves, Tabata, and Vessels properties, within the same critical habitat unit that is being affected by the project. Proposed restoration on the Vessels property, in particular, is anticipated to restore aquatic habitat for breeding and non-breeding activities and upland habitat for foraging and dispersal. Although the Vessels property contains upland habitat, recent surveys have been negative for the arroyo toad, likely because the San Luis Rey River channel is deeply incised as it passes the Vessels property, and the property is dominated by non-native grassland. The proposed restoration is anticipated to restore the identified PCEs for arroyo toad critical habitat to this property by recontouring the channel to restore hydrology to the property and increase accessibility to arroyo toads. Applicable special management considerations, including nonnative predators and plants, are addressed in the indirect effects section above.

Habitat Restoration

Riparian creation and restoration is proposed at the Tabata and Vessels properties. To accomplish this restoration, fill material and nonnative vegetation will be removed. Though negative arroyo toad surveys have been completed on the Tabata property (Scheidt 2004b), arroyo toads are present in contiguous habitat within the San Luis Rey River. Several records from 2006 are present half a mile northeast of the site (EDAW, Inc. 2006d), and there are historic records to the south of the site within the San Luis Rey River as well (CFWO data records).

Arroyo toads are present in habitat directly north of the Vessels Property (EDAW, Inc. 2006d, 2007c). The San Luis Rey River channel is incised along the southern bank in the vicinity of the Vessels property. In addition, patches of arundo and tamarisk are located between and within the San Luis Rey River flood-prone area and Vessels property, and extensive ruderal/non-native grasslands are located immediately south of the San Luis Rey River primary flood-prone area. Non-native vegetation and channel incision are expected to restrict the movement of arroyo toads from the San Luis Rey River, where densities are highest (Cadre Environmental 2010), to the Vessels property. While there are isolated areas where arroyo toads could move between the Vessels property and the San Luis Rey River to burrow within upland habitat on the site, there are 3 years of negative surveys for the Vessels property.

The project has incorporated extensive measures to exclude arroyo toads from project footprint and minimize effects upon arroyo toads. These measures will be implemented within all work areas with potential for arroyo toad breeding and upland habitat and this is not exclusive of restoration properties. The analysis presented in the direct effects section above is considered to be inclusive of these restoration properties. The proposed restoration work will result in the

removal of fill and nonnative vegetation and will address channel incision, which will benefit the species by improving the ability of the Tabata and Vessels properties to support arroyo toads.

Effect on Recovery

The project is consistent with the recovery goals identified in the recovery plan for the arroyo toad (Service 1999). As described above, the project will result in impacts to arroyo toads and their habitats. However, the impacts are small relative to the amount of habitat and number of arroyo toads rangewide. Furthermore, conservation measures incorporated into the project will help accomplish recovery actions identified in the recovery plans.

Proposed habitat conservation, creation, restoration, and management will help accomplish recovery task 1, which is to secure existing populations by "protecting, maintaining, restoring, and enhancing breeding and upland habitats" Service (1999).

Importantly, with the proposed conservation measures, the project will result in a net increase in the amount of arroyo toad breeding habitat and will contribute to the long-term maintenance of the important population of arroyo toad along the San Luis Rey River.

San Diego Ambrosia

Direct Effects

The project will result in less than 0.004 ha (0.01 ac) of permanent direct impacts to occupied ambrosia habitat. There will be no temporary direct impacts to occupied ambrosia habitat. Note that this is an estimate of impacts to occupied ambrosia habitat as mapped by Caltrans and included in the Biological Assessment (Caltrans 2011). Impacts to designated ambrosia critical habitat are analyzed in a separate section below.

Approximately 2,633 ramets of ambrosia will be directly impacted by the project based on the most current survey data. The number of ambrosia individuals within the impact area may change from year to year depending on climatic conditions. All ambrosia within the direct impact area for the project will be salvaged and translocated to the Morrison property. The Morrison property is close to the salvage location, within the same watershed and drainage. An ambrosia translocation plan will be prepared and provided to the CFWO for review and approval. The translocation will be implemented by a biologist with a history of translocating sensitive plant species. The locations where the ambrosia ramets will be transplanted have been approved following field review by the CFWO (Figure 23).

The Morrison property will be permanently conserved and managed, which will benefit the translocated ambrosia. Conservation and long-term management of the Morrison property is addressed in Biological Opinion FWS-SDG-08B0136-08F0900 for the State Route 76 Melrose Drive to South Mission Highway Improvement Project. The translocated ambrosia population will be monitored for a minimum of 5 years to document success or failure of the translocation

efforts. Since Caltrans has had success within recent years in translocating San Diego ambrosia on the Marron property, we believe the translocation proposed as a part of this project has a high likelihood of success.

Despite the proposed efforts to salvage all ambrosia within the direct impact area, we expect at least some ramets to be destroyed during the collection and translocation process. Any ramets that are inadvertently overlooked and not salvaged will be destroyed during project clearing, grading, and construction activities.

Within the BSA for the proposed project, Caltrans mapped approximately 329,813 ambrosia ramets within two populations on approximately 0.49 ha (1.22 ac), and most of these plants will be avoided by the project. The direct project impacts to less than 0.004 ha (0.01 ac) of occupied ambrosia habitat which is occupied by approximately 2,633 ambrosia ramets represents only 0.8 percent of the individuals and occupied acreage within the BSA, and an even smaller percentage of the individuals and occupied acreage within the San Luis Rey River Valley and rangewide. The habitat that will be impacted is degraded habitat adjacent to the existing SR-76 facility. The translocated plants will be moved to the Morrison property, which will be conserved and managed in perpetuity. Thus, we do not expect the habitat loss and destruction of ramets associated with the project to appreciably reduce the number of individuals, reproduction, or distribution of ambrosia in the action area or across its range. Further, additional conservation for this species is proposed to offset the direct and indirect impacts of the project, as discussed in the Effects on Recovery section below.

Indirect Effects

While there is no known occupied ambrosia habitat within the defined indirect impact area for the project, as discussed above, the number of ambrosia individuals within a given area may change from year to year depending on climatic conditions. There is a small amount of designated ambrosia critical habitat within the project's indirect impact area that is currently unoccupied. To address these areas, which have the potential to support ambrosia in the future, we have included a discussion of the permanent indirect effects of the project in this analysis. This section of this biological opinion analyzes indirect effects, and impacts to designated ambrosia critical habitat are quantified and analyzed in a separate section below.

Operational lighting installed for the project could increase light spill into the adjacent habitat, including habitats which could support ambrosia. Light can affect a broad range of plant physiological responses, including seed germination, seedling development, induction of flowering, and rapid, membrane-based activities (Hopkins 1995). Therefore, there is potential for light pollution resulting from the project to have a negative impact on ambrosia plants. Measures have been incorporated into the project to reduce light spill into the adjacent habitat. Permanent safety lighting installed for the project will be the lowest illumination necessary for safety and will be directed toward the facility and away from sensitive habitats. This is anticipated to minimize the impact of lighting on ambrosia in the adjacent habitat to the point where such effects are insignificant. In addition, the permanent indirect effects of the project

will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

The project could result in an increase in the introduction of invasive plant species into native habitats adjacent to the facility. Nonnative plants, if present in large enough numbers, may change the plant community in ambrosia habitat to the extent that ambrosia plants can no longer receive adequate sunlight and airflow (Service 2010b). The project has incorporated measures to prevent the spread of invasive species. A qualified biologist will monitor the project site immediately prior to and during construction to identify the presence of invasive weeds and recommend measures to avoid their inadvertent spread in association with the project. Invasive plants will not be used in project landscaping. This is anticipated to minimize the impact of invasive species introduction resulting from project implementation on ambrosia habitat to the point where such effects are insignificant. In addition, the permanent indirect effects of the project will be offset by conservation and restoration in the project area as discussed in the Effects on Recovery section below.

The project is not anticipated to substantially impact connectivity within or between existing ambrosia populations. As with the existing alignment, the new alignment will run to the south of the known ambrosia populations in the BSA and will impact only a small amount of occupied habitat in the southern-most portion of one population. Undeveloped open space will remain between the ambrosia populations on the north side of SR-76, allowing for movement of pollinators and potential genetic exchange between the populations in the BSA.

Additional indirect effects include an increase in human encroachment and wildfire. Permanent fencing will be installed along the facility in association with the wildlife connectivity measures which should also limit increased human encroachment and associated wildfires. SR-76 is an existing facility, so with the proposed conservation measures, any increase in habitat degradation associated with these factors is likely to be insignificant.

Critical Habitat

The project will result in impacts to subunits 4A and 4D, and conservation will occur in subunit 4B. According to the final rule designating ambrosia critical habitat, each of the subunits (4A, 4B, and 4D) affected by this project is "essential to the conservation of this species because of its contribution to the genetic diversity of the species [and] contains physical and biological features that are essential to the conservation of *Ambrosia pumila*, including sandy loam or clay soils located on an upper terrace of a water source, which provide nutrients, moisture, and periodic flooding presumed necessary for the plant's persistence (PCE 1), and ruderal vegetation, which allows adequate sunlight and airflow for *A. pumila* (PCE 2). The PCEs in this subunit may require special management considerations or protection to address threats from nonnative plant species in situations where nonnative species are outcompeting *A. pumila* for resources, human encroachment, road maintenance activities, and future widening of State Route 76." Ambrosia critical habitat was mapped to include primarily those areas that contain the identified PCEs

(Service 2010c), so all ambrosia critical habitat that is impacted or conserved in association with this project is assumed to contain the appropriate PCEs.

The project will result in the permanent loss of 0.6 ha (1.5 ac) of designated critical habitat for ambrosia. Temporary impacts will occur to 0.24 ha (0.6 ac) of ambrosia critical habitat, and 0.83 ha (2.06 ac) of designated ambrosia critical habitat occur within the indirect impact area for the project. The area of critical habitat that will be impacted is located within Unit 4, which includes a total of 37 ha (91 ac) of habitat. The project will impact Subunit 4A and 4D, which include 6 ha (15 ac) and 9 ha (21 ac) of designated critical habitat, respectively. The direct and indirect impacts of the project on Unit 4 of designated critical habitat for ambrosia represent about 3.9 percent of the designated critical habitat within the unit, and less than 1 percent of critical habitat designated for this species. The amount of critical habitat that will be affected by the project is a small percentage of the critical habitat for this species, and the loss of this small amount of critical habitat will not affect the function of the unit to support ambrosia, and the genetic diversity within the unit at Subunits 4A and 4D will be maintained.

Conservation and restoration to offset impacts of the project, as summarized in Tables 4 and 5, will include 8.45 ha (20.89 ac) of ambrosia critical habitat, including 0.11 ha (0.28 ac) occupied by the species on the Groves property, within the same critical habitat unit that is being affected by the project. The project will result in the conservation of 20 percent of Unit 4, consisting of 80 percent of Subunit 4B. In addition, Caltrans has agreed to restore all of the project's temporary impact areas with native species, with the exception of small areas adjacent to landscaped or developed areas where planting native species would provide little or no biological value. This restoration is anticipated to improve the function of this critical habitat unit.

The physical and biological features essential to the conservation of the species in these subunits may require special management considerations or protection to address threats from nonnative plant species, human encroachment, road maintenance activities, and widening of SR-76. Road maintenance activities will take place within the permanent impact area for the project, and this analysis addresses widening of SR-76. Nonnative plant species and human encroachment are addressed in the indirect effects section above.

Effect on Recovery

There is no recovery plan for ambrosia. However, the project is consistent with the general recovery goals of maintaining remaining populations and conserving/restoring the habitat that supports them. As described above, the project will result in impacts to ambrosia and its habitat. However, the impacts are small relative to the amount of individuals within the BSA for the project. In addition, a majority of the ambrosia within the anticipated impact area are anticipated to be translocated to adjacent suitable habitat, which will substantially reduce the number of ambrosia killed as a result of the project. Furthermore, because substantial areas of occupied habitat will remain adjacent to the impact area, and habitat restoration will be initiated immediately following construction, little risk exists that the project will extirpate any ambrosia populations in the project area.

Caltrans will offset the permanent direct loss of occupied ambrosia habitat [less than 0.004 ha (0.01 ac)], through the preservation of 0.11 ha (0.28 ac) of occupied ambrosia habitat at the Groves property. Although the proposed conservation of ambrosia habitat off the project site will not avoid or minimize impacts to the individual ambrosia ramets that will be impacted by the project, the offsite conservation will permanently protect a 0.11 ha (0.28 ac) of occupied ambrosia habitat which is located in proximity to the impact area within the San Luis Rey River Valley, and will contribute to the conservation and recovery of the species.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. We are unaware of any future non-Federal actions that are reasonably certain to occur within the action area and may affect gnatcatchers, vireos, flycatchers, arroyo toads, ambrosia, and their critical habitats.

CONCLUSION

After reviewing the current status of the gnatcatcher, vireo, flycatcher, arroyo toad, ambrosia, and their critical habitats, the environmental baseline for the action area, effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of these species and is not likely to result in the destruction or adverse modification of designated critical habitat for these species. We reached this conclusion by considering the following:

All Species

- Adverse effects to all federally listed species and their critical habitats will be reduced by implementation of the avoidance and minimization measures identified in the “Project Description” of this biological opinion.

- The restoration of all temporary impact areas with native species, with the exception of small areas adjacent to landscaped or developed areas where planting native species would provide little or no biological value with native species, will help minimize and offset the project impacts by restoring habitat for listed species to forage, shelter, and disperse.

- Wildlife connectivity measures proposed in association with the project will ensure that ecosystem functions are maintained for the benefit of listed species.

  With the proposed conservation measures, project-related impacts to federally listed species will be fully offset, and we consider the project and associated conservation and restoration to be consistent with the recovery goals of the species.

Coastal California Gnatcatcher and Critical Habitat

- The project will permanently directly impact 0.22 ha (0.54 ac) of coastal sage scrub and 2.57 ha (6.35 ac) of disturbed coastal sage scrub and permanently indirectly impact 0.78 ha (1.93 ac) of coastal sage scrub and 1.12 ha (2.76 ac) of disturbed coastal sage scrub out of many thousands of hectares/acres of coastal sage scrub gnatcatcher habitat rangewide.

- The project will result in the temporary impact to 0.74 ha (1.83 ac) of coastal sage scrub, and 0.67 ha (1.66 ac) of disturbed coastal sage scrub but this scrub community will be restored, and within 4 to 5 years will again be suitable habitat for gnatcatcher breeding and foraging.

- Permanent, temporary, and indirect project-related habitat loss and degradation will impact up to four individual gnatcatchers (2 pairs), which represents less than 1 percent of the roughly 2,562 pairs rangewide.

- Impacts to occupied gnatcatcher habitat will be offset by conserving 22.64 ha (55.89 ac) of occupied coastal sage scrub at the Groves Property.

- The project will permanently directly impact 16.91 ha (41.79 ac) of gnatcatcher critical habitat and permanently indirectly impact 12.92 ha (31.92 ac) of gnatcatcher critical habitat out of approximately 79,846 ha (197,303 ac) of gnatcatcher critical habitat rangewide, which represents less that 1 percent of the critical habitat rangewide.

- The project will not affect the function of critical habitat Unit 5 to support gnatcatcher populations or to provide connectivity between San Diego populations and those in southwestern Riverside. In addition, the project will result in the conservation of 36.74 ha (90.79 ac) of gnatcatcher critical habitat on the Groves and Tabata properties, which are located almost entirely within Unit 5 of designated gnatcatcher critical habitat. Further, though it is currently highly disturbed and was not included within the critical habitat designation, the conservation and restoration that is proposed on the 65.6-ha (162-ac) Vessels property will occur directly adjacent to gnatcatcher critical habitat along the San Luis Rey River and is anticipated to improve the integrity and function of this linkage and critical habitat unit. Temporary impact areas, including 12.22 ha (30.19 ac) of critical habitat, will be restored primarily with native species, which will improve the function of this linkage and critical habitat unit.

Least Bell's Vireo and Southwestern Willow Flycatcher and Critical Habitats

- The project will permanently directly impact 13.22 ha (32.65 ac) of riparian and wetland habitat and permanently indirectly impact 14.97 ha (36.97 ac) of riparian and wetland habitat out of many thousands of hectares (acres) of vireo and flycatcher habitat rangewide.

- The project will result in the temporary impact to 4.29 ha (10.60 ac) of riparian and wetland habitat used by vireo, but these habitats will be restored, and within 2 to 7 years will again be suitable for habitat for vireo breeding and foraging.

- Permanent, temporary, and indirect project-related habitat loss and degradation will impact up to 17 individual vireos (8.5 pairs), which represents less than 1 percent of the roughly 2,968 pairs rangewide, and 4 flycatchers (2 pairs), which represents less than 1 percent of the roughly 1,214 pairs rangewide.

- Impacts to occupied vireo and flycatcher habitat will be offset by restoring and creating a total of 53.99 ha (133.3 ac) of riparian and wetland habitats at the Tabata and Vessels properties.

- The project will permanently directly impact 25.56 ha (63.15 ac) of designated critical habitat for the vireo and 15.03 ha (37.13 ac) of designated critical habitat for the flycatcher and permanently indirectly impact 29.83 ha (73.72 ac) of designated vireo critical habitat and 22.81 ha (56.36 ac) of designated flycatcher critical habitat out of approximately 15,378 ha (38,000 ac) of vireo critical habitat and 48,896 ha (120,824 ac) of flycatcher critical habitat rangewide, which represents less that 1 percent of each of these critical habitats rangewide.

- The project will not substantially impact the function of the San Luis Rey Area of designated critical habitat for the vireo and the San Diego Management Unit of the Coastal California Recovery Unit of southwestern willow flycatcher critical habitat to support vireo and flycatcher populations. Further, the project will result in the conservation of 74.80 ha (184.70 ac) of vireo critical habitat and 41.35 ha (102.10 ac) of flycatcher critical habitat on the Tabata and Vessels properties, within the same critical habitat units that are being affected by the project. Temporary impact areas, including 13.19 ha (32.60 ac) of vireo critical habitat, and 4.42 ha (10.93 ac) of flycatcher critical habitat, will be restored primarily with native species, which will improve the function of these critical habitat units.

Arroyo Toad and Critical Habitat

- The project will permanently directly impact 13.22 ha (32.65 ac) of arroyo toad breeding habitat and permanently indirectly impact 14.97 ha (36.97 ac) of arroyo toad breeding habitat out of many thousands of hectares/acres of arroyo toad breeding habitat rangewide. The project will permanently directly impact 14.49 ha (35.81 ac) of arroyo toad aestivation habitat and permanently indirectly impact 11.60 ha (28.67 ac) of arroyo toad aestivation habitat out of many thousands of hectares/acres of arroyo toad aestivation habitat rangewide. This is a small impact relative to the size of the arroyo toad population in the San Luis Rey River and will affect only 1 of the estimated 23 populations of arroyo toad from Monterey County, California south to Baja California, Mexico.

- The project will result in the temporary impact to 4.29 ha (10.60 ac) of arroyo toad breeding habitat and 9.92 ha (24.52 ac) of arroyo toad aestivation habitat, but these habitats will be

restored, and because arroyo toads are not dependent on mature vegetation in either the riparian or upland environment, we expect temporarily impacted areas to be re-occupied shortly following project completion.

- The construction-related death and injury of aestivating arroyo toads in the direct impact area (i.e., those toads that are not moved as an avoidance and minimization measure) will not appreciably reduce the overall numbers or reproduction of the San Luis Rey population of arroyo toads and, therefore, will not affect the distribution of the species as a whole.

- The handling and relocation of up to 24 arroyo toads as a minimization measure is not anticipated to substantially increase their risk of mortality or substantially interfere with their foraging, sheltering, and breeding activities.

- Impacts to occupied toad breeding habitat will be offset by restoring and creating a total of 53.99 ha (133.3 ac) of riparian and wetland habitats at the Tabata and Vessels properties, and impacts to upland areas that may provide aestivation habitat for toads will be offset by conserving 51.70 ha (127.65 ac) of upland habitats at the Groves and Vessels properties.

- The project will permanently directly impact 31.56 ha (77.98 ac) of designated critical habitat for the arroyo toad and permanently indirectly impact 41.31 ha (102.07 ac) of designated arroyo toad critical habitat out of approximately 39,807 ha (98,366 ac) of arroyo toad critical habitat rangewide, which represents less that 1 percent of this critical habitat rangewide.

- The project will not substantially impact the function of critical habitat Unit 14 to support a core arroyo toad population. Further, the project will result in the conservation of 89.21 ha (220.27 ac) of arroyo toad critical habitat on the Groves, Tabata, and Vessels properties, within the same critical habitat unit that is being affected by the project. Temporary impact areas, including 26.01 ha (64.27 ac) of arroyo toad critical habitat, will be restored primarily with native species, which will improve the function of this critical habitat unit.

San Diego Ambrosia and Critical Habitat

- Permanent and temporary project-related habitat loss will impact approximately 2,633 ambrosia ramets of the approximately 329,937 ramets within the BSA for the project, which represents less than 1 percent of the individuals and occupied acreage within the BSA, and an even smaller percentage of the individuals and occupied acreage within the San Luis Rey River Valley, and rangewide.

- Ambrosia within the direct impact area for the project will be salvaged and translocated to the Morrison Property, which will be preserved and managed in perpetuity.

- The project will permanently directly impact 0.6 ha (1.5 ac) of ambrosia critical habitat and permanently indirectly impact 0.83 ha (2.06 ac) of ambrosia critical habitat out of

approximately 317 ha (783 ac) of ambrosia critical habitat rangewide, which represents less that 1 percent of the critical habitat rangewide.

- The project will not substantially impact the function of Unit 4 to support ambrosia and the project will result in small impacts to Subunits 4A and 4D, so the genetic diversity within these subunits will be maintained. Further, the project will result in the conservation of 8.45 ha (20.89 ac) of ambrosia critical habitat on the Groves property, within the same critical habitat unit that is being affected by the project. This conserved area supports PCEs of ambrosia critical habitat, and includes 0.11 ha (0.28 ac) that is occupied by the species.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not intended as part of the proposed action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by Caltrans for the exemption in section 7(o)(2) to apply. If Caltrans fails to implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of the incidental take, Caltrans must report the progress of the action and its impact on the species to the CFWO as specified in the incidental take statement [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

The take limits for gnatcatcher, vireo, and arroyo toad are defined as take thresholds that, if exceeded, will trigger reinitiation of consultation. These take thresholds include the number of pairs or individuals observed within the project footprint prior to construction, the amount of habitat impacted, and in the case of arroyo toads, the number of dead or injured individuals observed.

Coastal California Gnatcatcher

Take of gnatcatcher is authorized as follows:

- Take in the form of harm of up to one gnatcatcher pair is authorized due to the permanent removal of 0.22 ha (0.54 ac) of coastal sage scrub and 2.57 ha (6.35 ac) of disturbed coastal sage scrub and the temporary removal of 0.74 ha (1.83 ac) of coastal sage scrub, and 0.67 ha (1.66 ac) of disturbed coastal sage scrub. The take threshold will be exceeded if more than the specified amount of habitat or more than one gnatcatcher pair is directly impacted.

Least Bell's Vireo

Take of vireo is authorized as follows:

- Take in the form of harm of up to three vireo pairs is authorized due to the permanent removal of 13.22 ha (32.65 ac) of riparian and wetland habitat and the temporary removal of 4.29 ha (10.6 ac) of riparian and wetland habitat. The take threshold will be exceeded if more than the specified amount of habitat or more than three vireo pairs are directly impacted.

Arroyo Toad

The exact distribution and population size of arroyo toads is difficult to determine due to the dynamic conditions associated with their habitat and biology and because detection of arroyo toads outside of the breeding season is very difficult. Because we do not have site specific data regarding the density of arroyo toads at this location, it is difficult to accurately quantify the amount of take that will occur. Nevertheless, based on the best available scientific information, we have established the following take thresholds for arroyo toad:

1. Capture and release of up to 24 arroyo toads;

2. Observed death or injury of no more than 6 arroyo toads as a result of project activities;

3. Accidental death or injury of up to 2 arroyo toads as a direct result of exclusionary fencing, capture, and release efforts;

4. Take in the form of harm is authorized as follows:

    - The permanent removal of 13.22 ha (32.65 ac) of arroyo toad breeding habitat and 14.49 ha (35.81 ac) of arroyo toad aestivation habitat; and

    - The temporary removal of 4.29 ha (10.6 ac) of arroyo toad breeding habitat and 9.92 ha (24.52 ac) of arroyo toad aestivation habitat.

EFFECT OF TAKE

In the accompanying biological opinion, we determined that this level of anticipated take is not likely to result in jeopardy to the gnatcatcher, vireo, and arroyo toad.

REASONABLE AND PRUDENT MEASURES

Caltrans will implement conservation measures as part of the proposed action to minimize the incidental take of gnatcatchers, vireos, flycatchers, and arroyo toads. In addition to these conservation measures, the following reasonable and prudent measure is necessary to monitor and report the effects of the incidental take on gnatcatchers, vireos, and arroyo toads:

1. Caltrans will monitor and report on compliance with established take thresholds for gnatcatchers associated with the proposed action.

2. Caltrans will monitor and report on compliance with established take thresholds for vireos associated with the proposed action.

3. Caltrans will monitor and report on compliance with established take thresholds for arroyo toads associated with the proposed action.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, Caltrans must comply with the following terms and conditions which implement the reasonable and prudent measures described above.

Coastal California Gnatcatcher

1.1 Prior to initiating the proposed project (with the exception of geotechnical work), three preconstruction surveys will be conducted within all suitable gnatcatcher habitat within the footprint for the project, within 30 days prior to initiation of vegetation removal activities to verify that no more than one gnatcatcher pair will be taken as a result of the project. Prior to initiating the project, Caltrans will provide to the CFWO a map showing the distribution of gnatcatchers relative to the project footprint, an estimate of the number of gnatcatchers territories that will be impacted by the project, and the cumulative total of gnatcatcher territories impacted by the project, or confirm in writing that maps, distribution information, and the number of territories that will be impacted by the project as shown in the BA remain correct.

1.2 Caltrans will notify the CFWO within 30 days of completing removal of gnatcatcher occupied habitat. The purpose of this notification is to ensure that impacts to gnatcatcher-occupied habitat from the proposed project do not exceed the take thresholds.

Least Bell's Vireo

2.1 Prior to initiating the proposed project (with the exception of geotechnical work), Caltrans will review the latest survey data for the project area, if available through USGS or other sources, to verify that no more than three vireo pairs will be taken as a result of the project. If current surveys (i.e., surveys less than 1 year old) of the project area are not available, three preconstruction surveys will be conducted within all suitable vireo habitat in the footprint for the project. These surveys will be conducted at least 10 days apart between April 10 and July 31. Prior to initiating the project, Caltrans will provide to the CFWO a map showing the most recent distribution of vireo relative to the project footprint, and an estimate of the number of vireo territories that will be impacted by the project.

2.2 Caltrans will notify the CFWO within 30 days of completing removal of vireo occupied habitat. The purpose of this notification is to ensure that impacts to vireo-occupied habitat from the proposed project do not exceed the take thresholds.

Arroyo Toad

3.1 Within 30 calendar days of the completion of project activities within arroyo toad habitat, Caltrans will provide the CFWO with a report documenting the area of arroyo toad habitat impacted, the number of dead or injured toads observed in the action area, and the number of arroyo toads captured and released. The report will include information on the gender, life history stage, and general condition of all arroyo toads that were killed, injured, and captured/released. It will also include an assessment of how or why arroyo toads may have been injured or killed and information on where toads were captured and released and observed physiological responses of relocated arroyo toads. Caltrans will report incidences of take (observed death or injury or capture and relocation of arroyo toads) to the CFWO within 3 days. All field notes and other documentation generated by the biological monitor shall be made available to the CFWO upon request. The purpose of this notification is to ensure that impacts to arroyo toad-occupied habitat from the proposed project do not exceed the take thresholds.

DISPOSITION OF SICK, INJURED, OR DEAD SPECIMENS

Upon locating dead, injured, or sick individuals of threatened or endangered species, initial notification must be made to our Division of Law Enforcement in either San Diego, California, at 619-557-5063 or in Torrance, California, at 310-328-6307 within 3 working days. Notification should also be sent by telephone and writing to this office in Carlsbad, California, at 6010 Hidden Valley Road, Suite 101, Carlsbad, California 92011, 760-431-9440. Written notification must be made within 5 calendar days and include the collection date and time, the location of the animal, and any other pertinent information. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to

preserve biological material in the best possible state. The remains of intact specimens shall be placed with educational or research institutions holding the appropriate State and Federal permits. Remains shall be placed with the San Diego Natural History Museum, San Diego. Arrangements regarding proper disposition of potential museum specimens shall be made with the institution by the authorized biologist prior to implementation of the action.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. We have not identified any conservation recommendations that would provide further benefit to the gnatcatcher, vireo, flycatcher, arroyo toad and ambrosia in the action area of the project.

REINITIATION NOTICE

This concludes formal consultation regarding State Route 76 South Mission to I-15 Highway Improvement Project as outlined in materials submitted to us. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; and (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions regarding this biological opinion, please contact Sally Brown of this office at 760-431-9440, extension 278.

Sincerely,

for Jim A. Bartel
Field Supervisor

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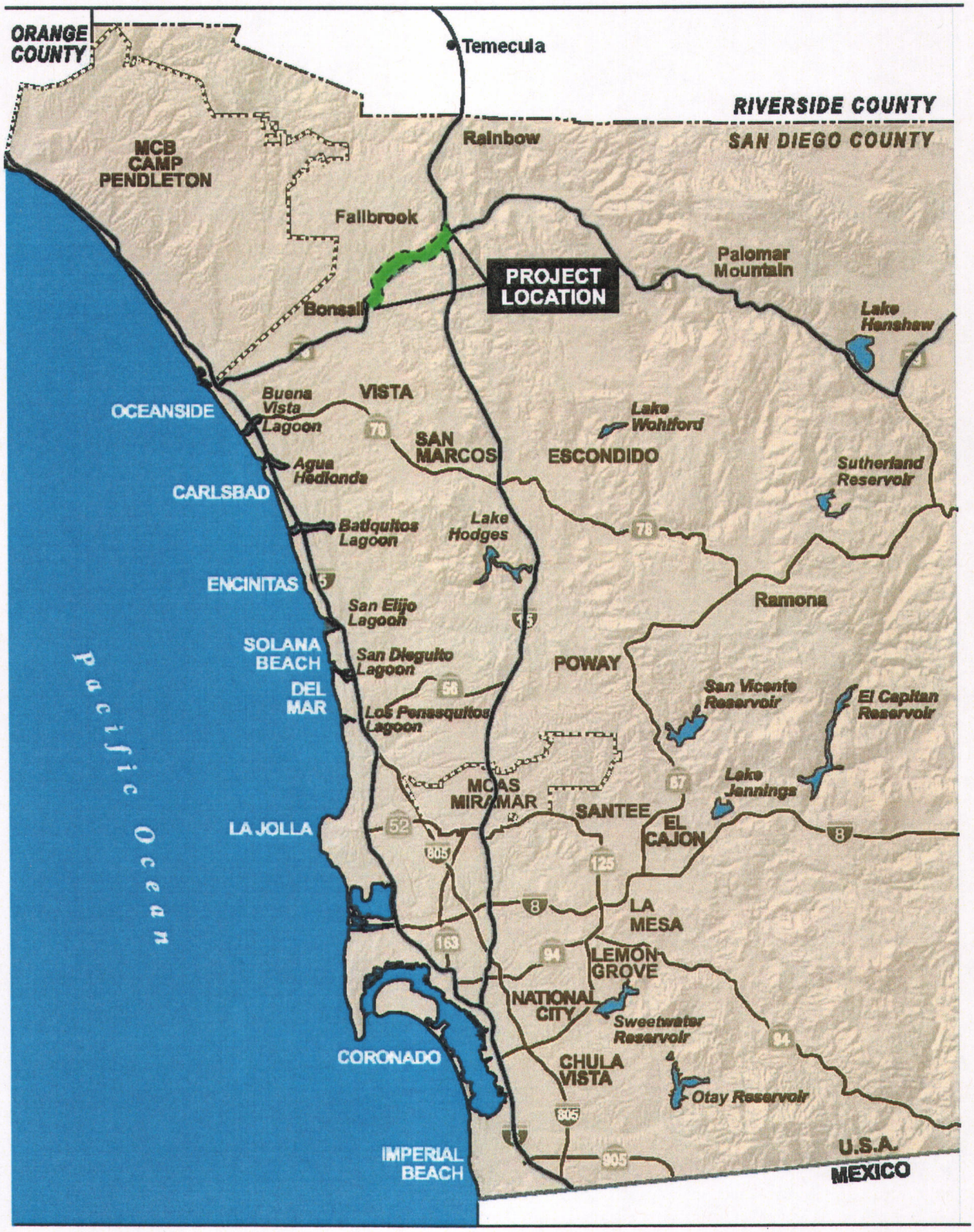

Figure 1.
Project Location Map

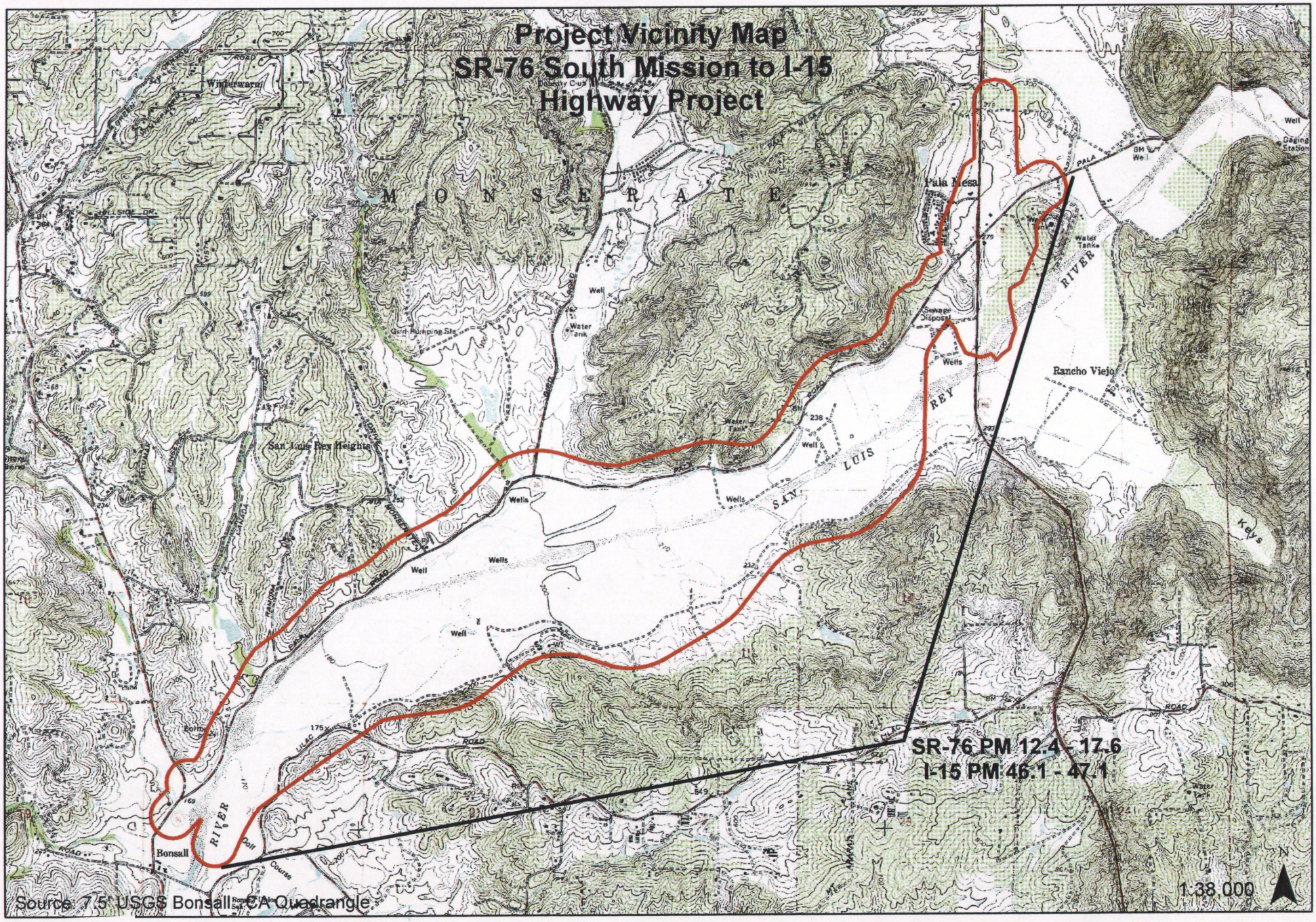
Project Vicinity Map
SR-76 South Mission to I-15
Highway Project
SR-76 PM 12.4 - 17.6
I-15 PM 46.1 - 47.1
Source: 7.5' USGS Bonsall, CA Quadrangle
1:38,000
N
MONSERATE
Pala Mesa
Rancho Viejo
San Luis Rey Heights
Bonsall
SAN LUIS REY RIVER
Winterwarm
Water Tank
Sewage Disposal
Wells
Well
Gaging Station
Keys

Figure 2

LEGEND:

- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- 100-YEAR FLOODPLAIN
- PARCEL BOUNDARY
- PROPOSED GRADING LIMITS (F/C)
- WILD LIFE FENCE
- PROPOSED TRAVELED WAY
- PROPOSED EDGE OF SHOULDER
- PROPOSED LANE STRIPE
- PROPOSED MEDIAN BARRIER
- PROPOSED GRADING CONTOUR

- PROPOSED TRAVELED WAY
- REMOVE EXIST SR-76
- EXIST SR-76
- PROPOSED BRIDGE
- EXISTING BRIDGE

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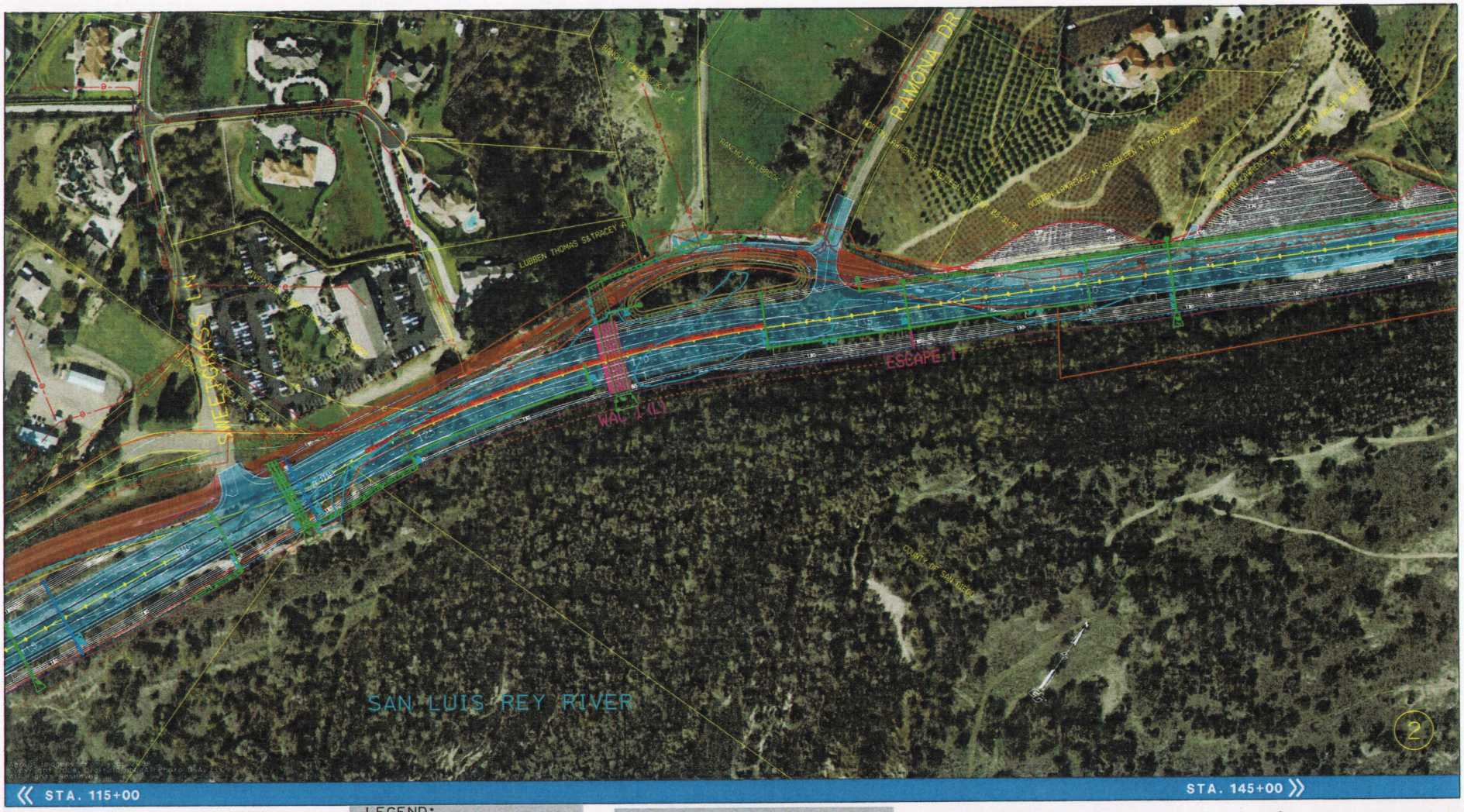
STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)

State Route 76 Corridor

Revised: 04-12-2011

Figure 3



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LEGEND:

- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- 100-YEAR FLOODPLAIN
- PARCEL BOUNDARY
- PROPOSED GRADING LIMITS (F/C)
- WILD LIFE FENCE
- PROPOSED TRAVELED WAY
- PROPOSED EDGE OF SHOULDER
- PROPOSED LANE STRIPE
- PROPOSED MEDIAN BARRIER
- PROPOSED GRADING CONTOUR

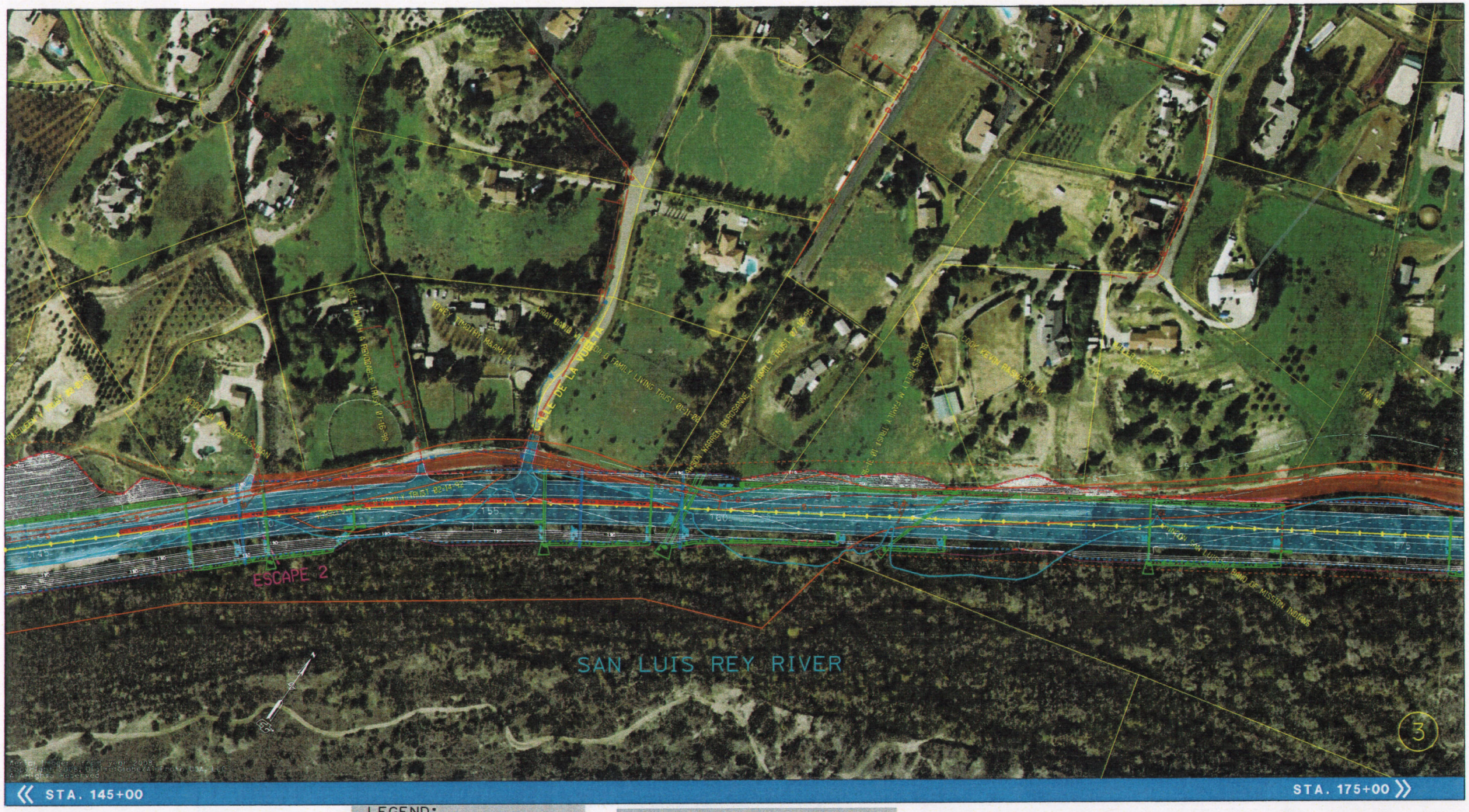
- PROPOSED TRAVELED WAY
- REMOVE EXIST SR-76
- EXIST SR-76
- PROPOSED BRIDGE
- EXISTING BRIDGE

STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)

State Route 76 Corridor

Revised: 04-12-2011

Figure 4



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DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

LEGEND:

- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- 100-YEAR FLOODPLAIN
- PARCEL BOUNDARY
- PROPOSED GRADING LIMITS (F/C)
- WILD LIFE FENCE
- PROPOSED TRAVELED WAY
- PROPOSED EDGE OF SHOULDER
- PROPOSED LANE STRIPE
- PROPOSED MEDIAN BARRIER
- PROPOSED GRADING CONTOUR

- PROPOSED TRAVELED WAY
- REMOVE EXIST SR-76
- EXIST SR-76
- PROPOSED BRIDGE
- EXISTING BRIDGE

STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)

State Route 76 Corridor

Revised: 04-12-2011

Figure 5

LEGEND:

- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- 100-YEAR FLOODPLAIN
- PARCEL BOUNDARY
- PROPOSED GRADING LIMITS (F/C)
- WILD LIFE FENCE
- PROPOSED TRAVELED WAY
- PROPOSED EDGE OF SHOULDER
- PROPOSED LANE STRIPE
- PROPOSED MEDIAN BARRIER
- PROPOSED GRADING CONTOUR

- PROPOSED TRAVELED WAY
- REMOVE EXIST SR-76
- EXIST SR-76
- PROPOSED BRIDGE
- EXISTING BRIDGE

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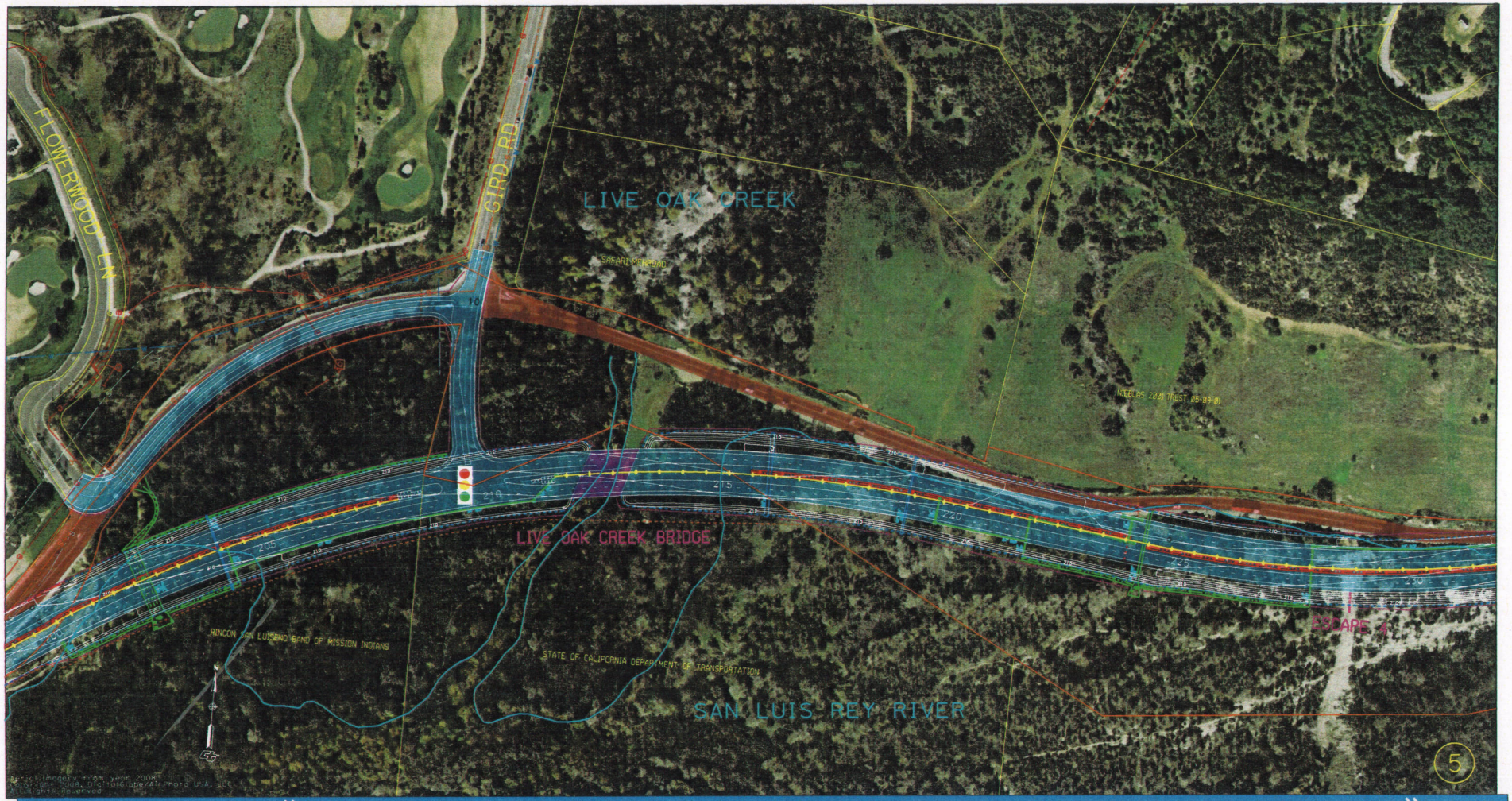
DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)

State Route 76 Corridor

Revised: 04-12-2011

Figure 6



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LEGEND:

- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- 100-YEAR FLOODPLAIN
- PARCEL BOUNDARY
- PROPOSED GRADING LIMITS (F/C)
- WILD LIFE FENCE
- PROPOSED TRAVELED WAY
- PROPOSED EDGE OF SHOULDER
- PROPOSED LANE STRIPE
- PROPOSED MEDIAN BARRIER
- PROPOSED GRADING CONTOUR

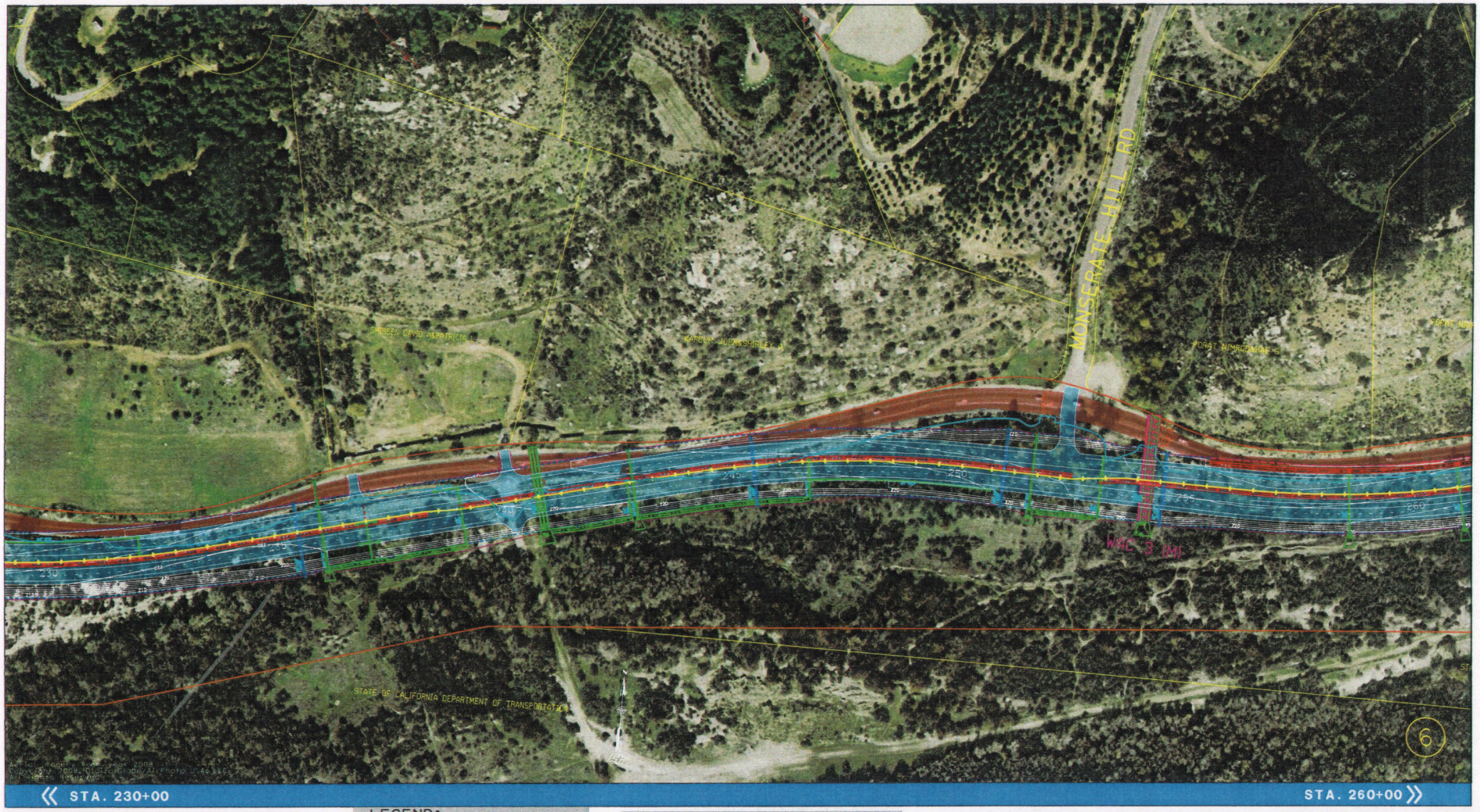
- PROPOSED TRAVELED WAY
- REMOVE EXIST SR-76
- EXIST SR-76
- PROPOSED BRIDGE
- EXISTING BRIDGE

STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)

State Route 76 Corridor

Revised: 04-12-2011

Figure 7



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DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

LEGEND:

- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- 100-YEAR FLOODPLAIN
- PARCEL BOUNDARY
- PROPOSED GRADING LIMITS (F/C)
- WILD LIFE FENCE
- PROPOSED TRAVELED WAY
- PROPOSED EDGE OF SHOULDER
- PROPOSED LANE STRIPE
- PROPOSED MEDIAN BARRIER
- PROPOSED GRADING CONTOUR

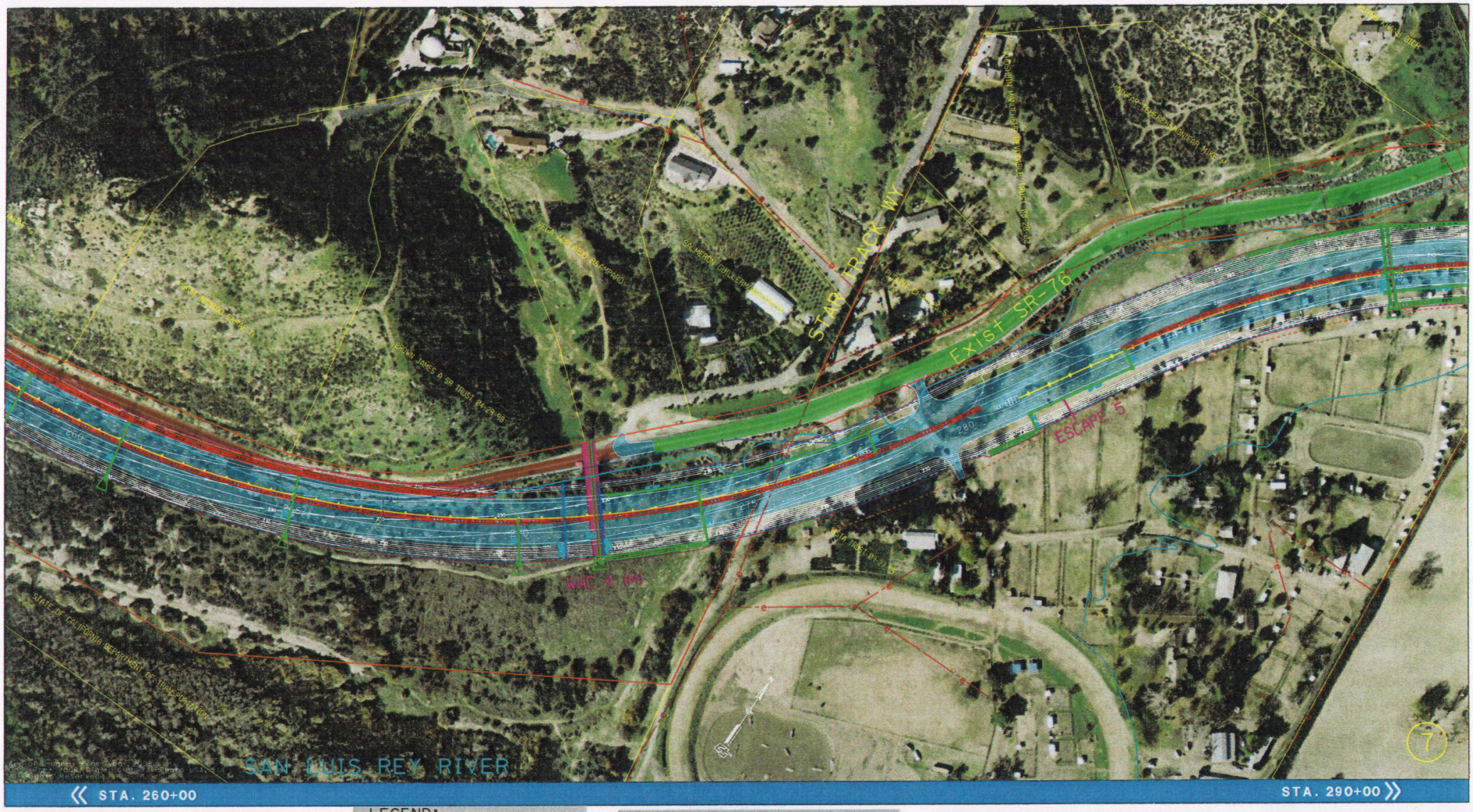
- PROPOSED TRAVELED WAY
- REMOVE EXIST SR-76
- EXIST SR-76
- PROPOSED BRIDGE
- EXISTING BRIDGE

STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)

State Route 76 Corridor

Revised: 04-12-2011

Figure 8



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DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

LEGEND:

- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- 100-YEAR FLOODPLAIN
- PARCEL BOUNDARY
- PROPOSED GRADING LIMITS (F/C)
- WILD LIFE FENCE
- PROPOSED TRAVELED WAY
- PROPOSED EDGE OF SHOULDER
- PROPOSED LANE STRIPE
- PROPOSED MEDIAN BARRIER
- PROPOSED GRADING CONTOUR

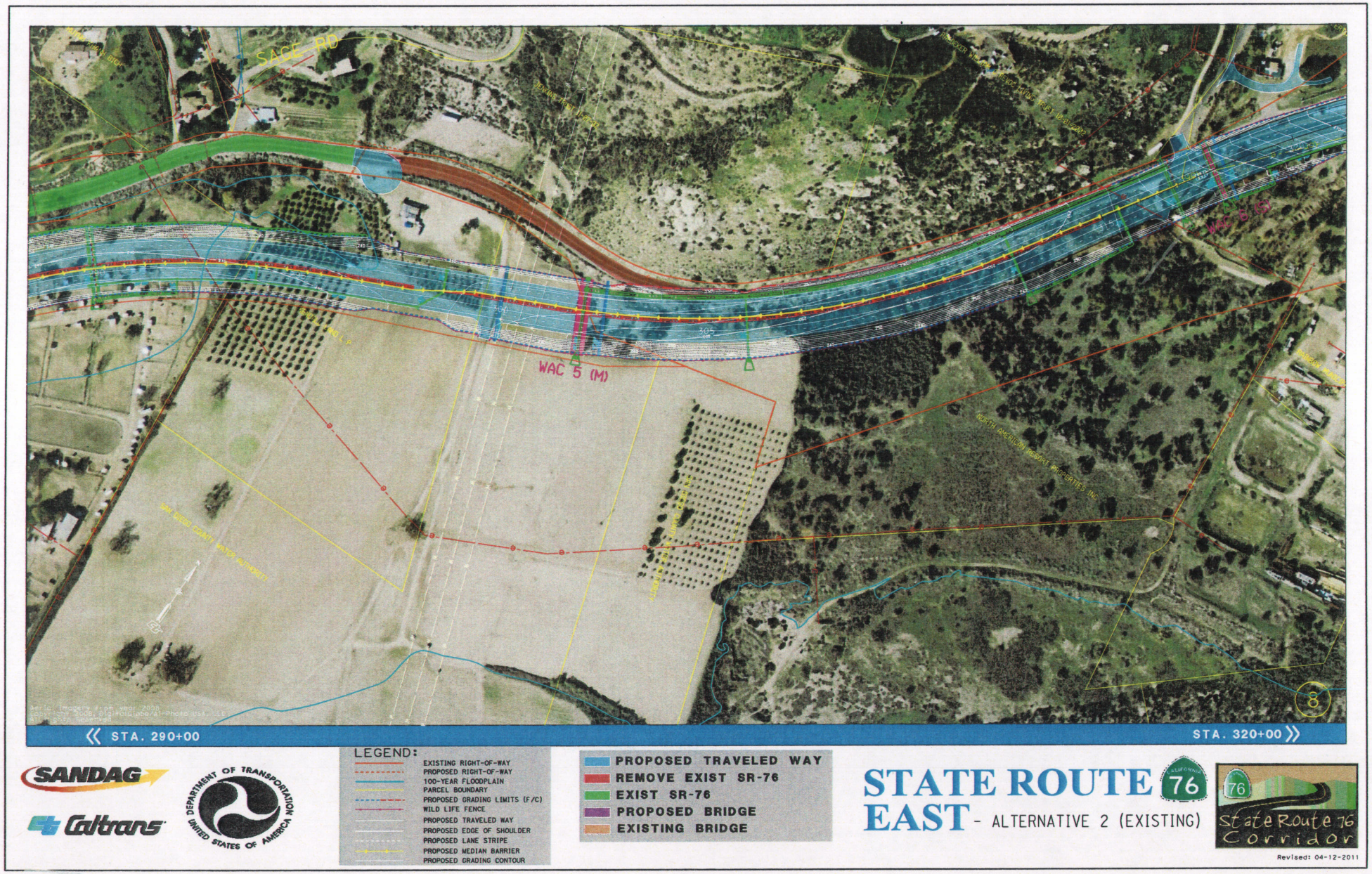
- PROPOSED TRAVELED WAY
- REMOVE EXIST SR-76
- EXIST SR-76
- PROPOSED BRIDGE
- EXISTING BRIDGE

STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)

State Route 76 Corridor

Revised: 04-12-2011

Figure 9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NORTH AMERICAN MOBILE PROPERTIES INC
SAN DIEGO COUNTY WATER AUTHORITY
8
STA. 290+00
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LEGEND:
EXISTING RIGHT-OF-WAY
PROPOSED RIGHT-OF-WAY
100-YEAR FLOODPLAIN
PARCEL BOUNDARY
PROPOSED GRADING LIMITS (F/C)
WILD LIFE FENCE
PROPOSED TRAVELED WAY
PROPOSED EDGE OF SHOULDER
PROPOSED LANE STRIPE
PROPOSED MEDIAN BARRIER
PROPOSED GRADING CONTOUR
PROPOSED TRAVELED WAY
REMOVE EXIST SR-76
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STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)
State Route 76 Corridor
Revised: 04-12-2011

Figure 10

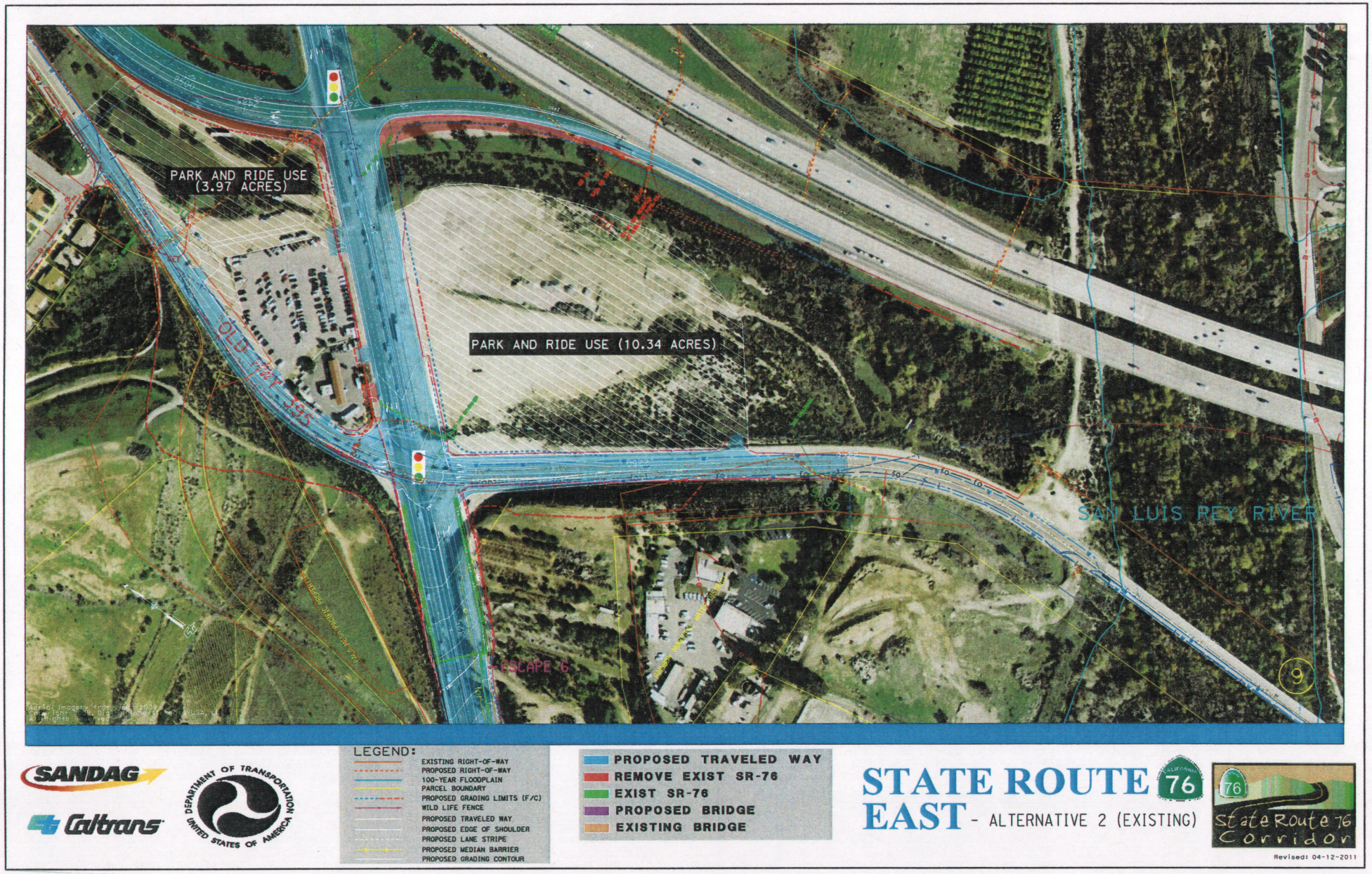
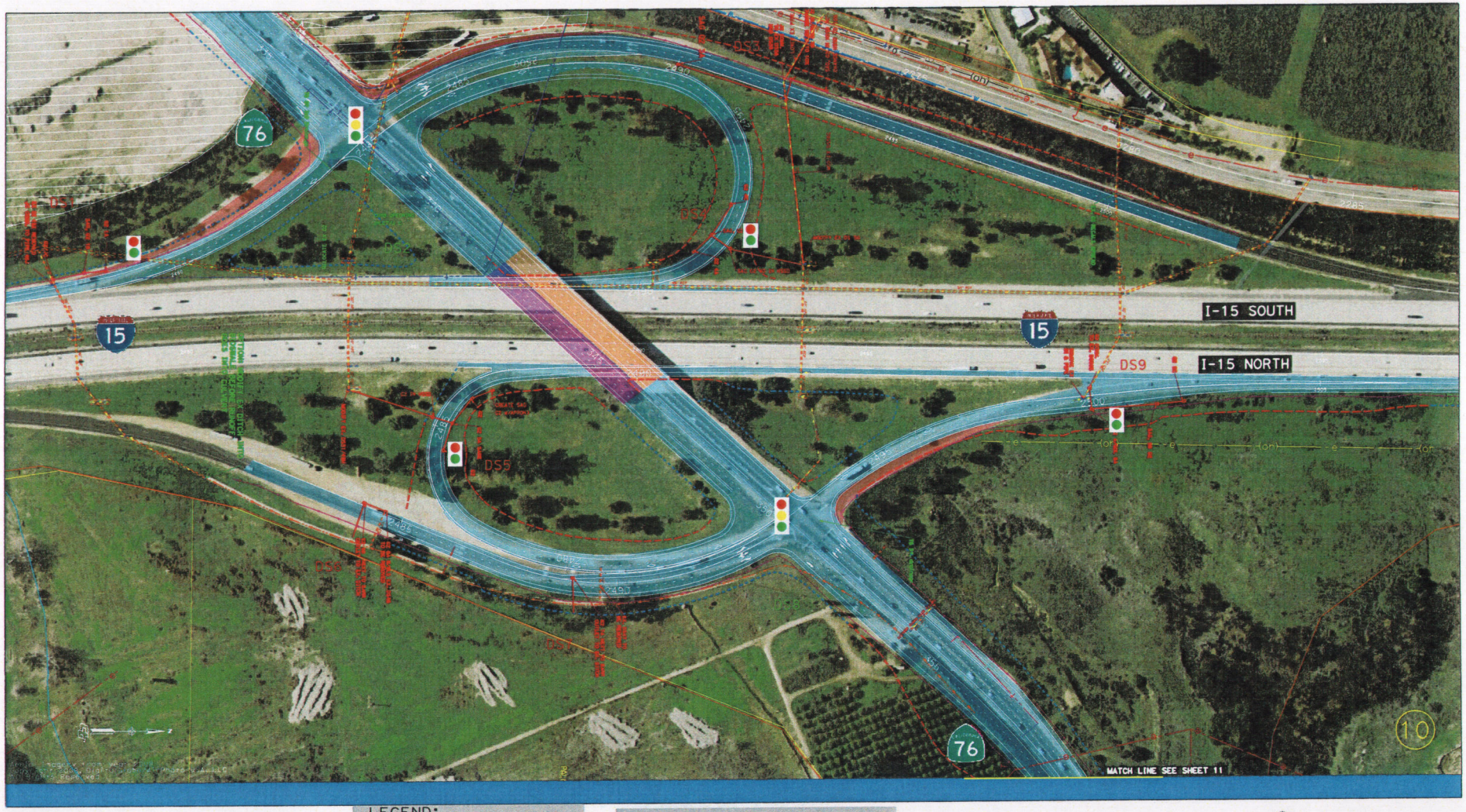

PARK AND RIDE USE (3.97 ACRES)
PARK AND RIDE USE (10.34 ACRES)
OLD HWY 395
SAN LUIS REY RIVER
ESCAPE 6
9
SANDAG
Caltrans
DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA
LEGEND:
EXISTING RIGHT-OF-WAY
PROPOSED RIGHT-OF-WAY
100-YEAR FLOODPLAIN
PARCEL BOUNDARY
PROPOSED GRADING LIMITS (F/C)
WILD LIFE FENCE
PROPOSED TRAVELED WAY
PROPOSED EDGE OF SHOULDER
PROPOSED LANE STRIPE
PROPOSED MEDIAN BARRIER
PROPOSED GRADING CONTOUR
PROPOSED TRAVELED WAY
REMOVE EXIST SR-76
EXIST SR-76
PROPOSED BRIDGE
EXISTING BRIDGE
STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)
CALIFORNIA 76
State Route 76 Corridor
Revised: 04-12-2011

Figure 11



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DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

LEGEND:

- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- 100-YEAR FLOODPLAIN
- PARCEL BOUNDARY
- PROPOSED GRADING LIMITS (F/C)
- WILD LIFE FENCE
- PROPOSED TRAVELED WAY
- PROPOSED EDGE OF SHOULDER
- PROPOSED LANE STRIPE
- PROPOSED MEDIAN BARRIER
- PROPOSED GRADING CONTOUR

- PROPOSED TRAVELED WAY
- REMOVE EXIST SR-76
- EXIST SR-76
- PROPOSED BRIDGE
- EXISTING BRIDGE

STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)

State Route 76 Corridor

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Figure 12

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DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

LEGEND:

- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- 100-YEAR FLOODPLAIN
- PARCEL BOUNDARY
- PROPOSED GRADING LIMITS (F/C)
- WILD LIFE FENCE
- PROPOSED TRAVELED WAY
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- PROPOSED LANE STRIPE
- PROPOSED MEDIAN BARRIER
- PROPOSED GRADING CONTOUR

- PROPOSED TRAVELED WAY
- REMOVE EXIST SR-76
- EXIST SR-76
- PROPOSED BRIDGE
- EXISTING BRIDGE

STATE ROUTE 76 EAST - ALTERNATIVE 2 (EXISTING)

State Route 76 Corridor

Revised: 04-12-2011

Figure 13

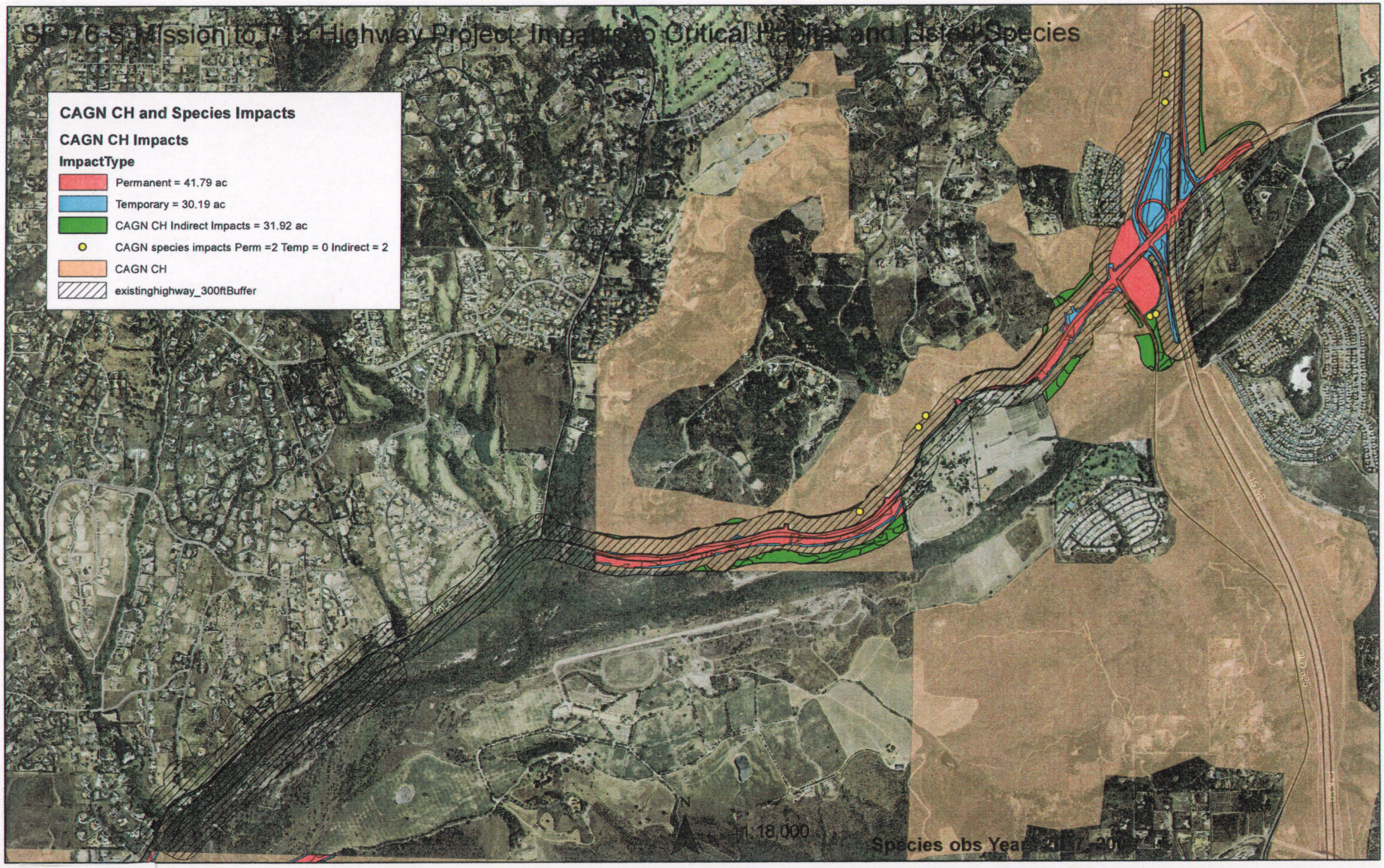

SR 76 S Mission to I-15 Highway Project Impacts to Critical Habitat and Listed Species
CAGN CH and Species Impacts
CAGN CH Impacts
ImpactType
Permanent = 41.79 ac
Temporary = 30.19 ac
CAGN CH Indirect Impacts = 31.92 ac
CAGN species impacts Perm =2 Temp = 0 Indirect = 2
CAGN CH
existinghighway_300ftBuffer
N
1:18,000
Species obs Year

Figure 14

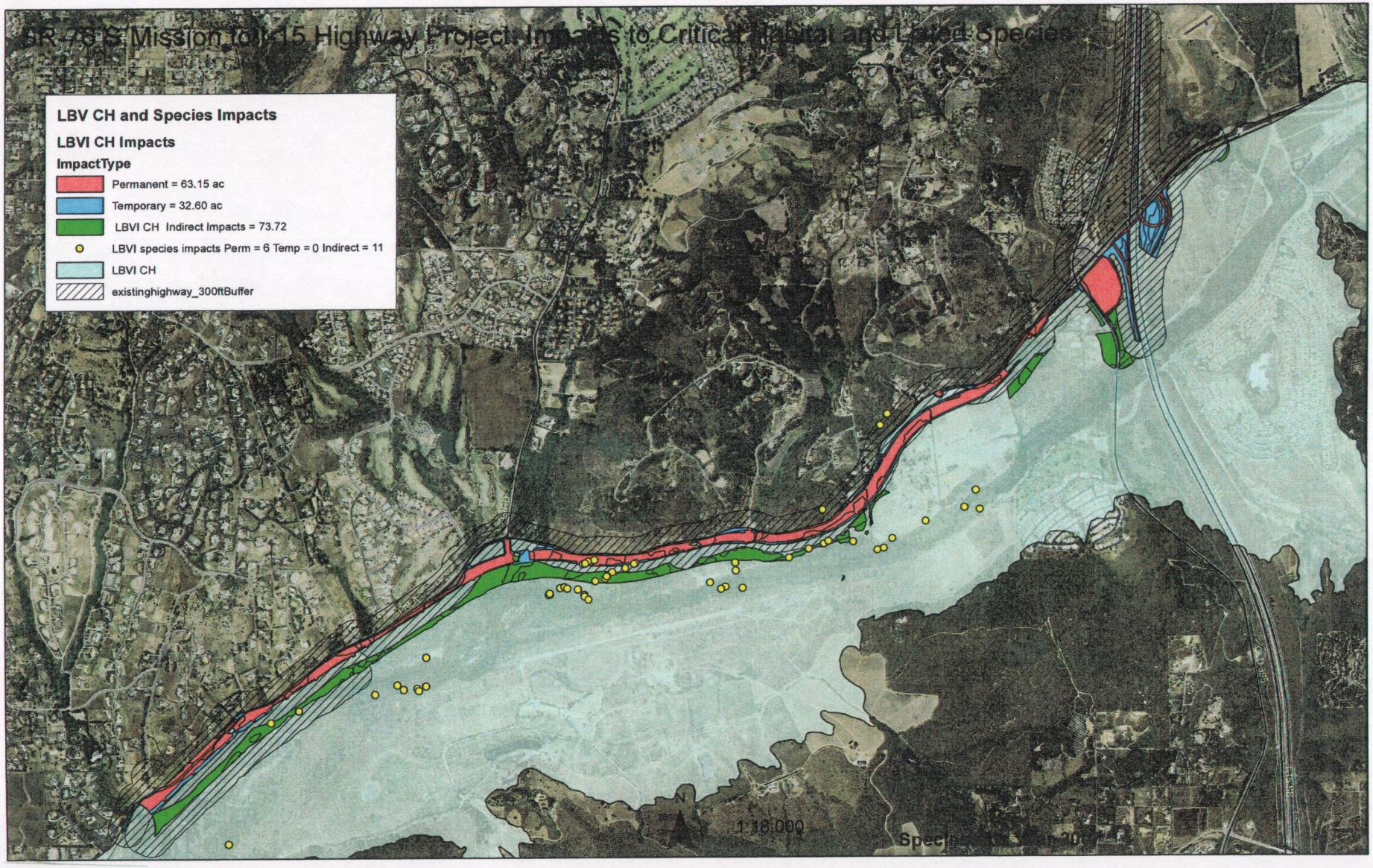

SR 76 S Mission to I-15 Highway Project Impacts to Critical Habitat and Listed Species
LBV CH and Species Impacts
LBVI CH Impacts
ImpactType
Permanent = 63.15 ac
Temporary = 32.60 ac
LBVI CH Indirect Impacts = 73.72
LBVI species impacts Perm = 6 Temp = 0 Indirect = 11
LBVI CH
existinghighway_300ftBuffer
N
1:18,000

Figure 15

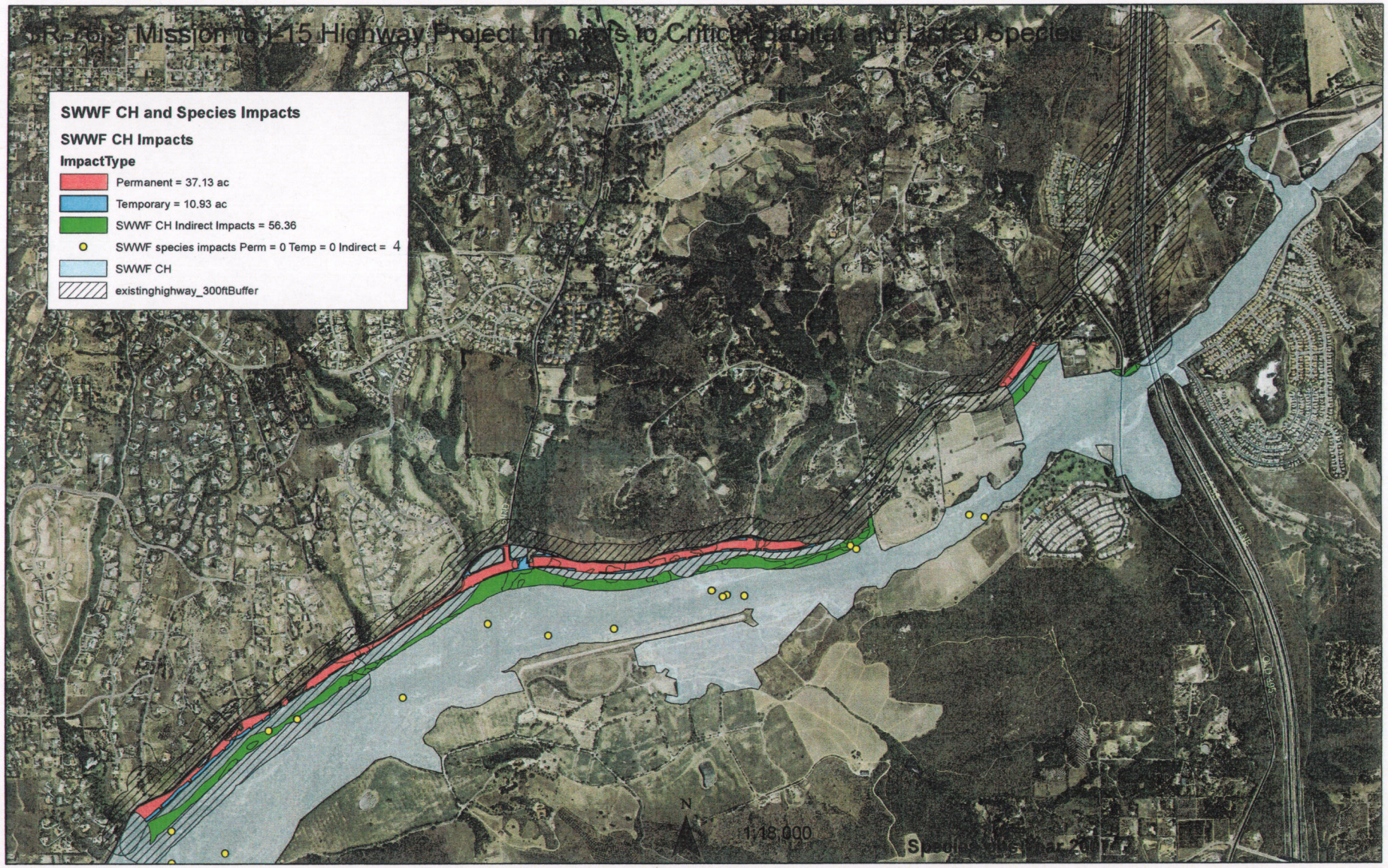

SWWF CH and Species Impacts
SWWF CH Impacts
ImpactType
Permanent = 37.13 ac
Temporary = 10.93 ac
SWWF CH Indirect Impacts = 56.36
SWWF species impacts Perm = 0 Temp = 0 Indirect = 4
SWWF CH
existinghighway_300ftBuffer
N
1:18,000

Figure 16

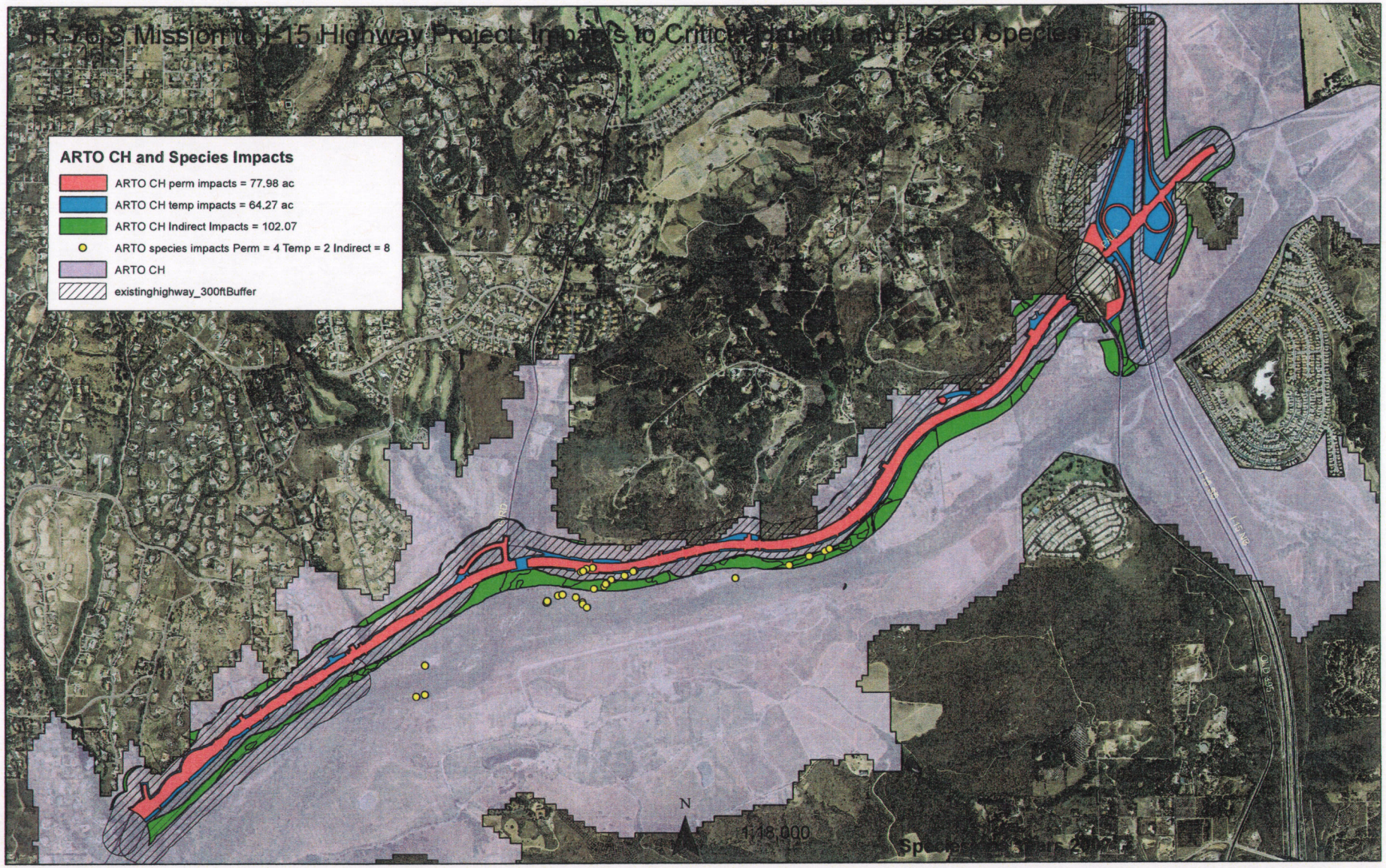

SR-76 S Mission to I-15 Highway Project, Impacts to Critical Habitat and Listed Species
ARTO CH and Species Impacts
ARTO CH perm impacts = 77.98 ac
ARTO CH temp impacts = 64.27 ac
ARTO CH Indirect Impacts = 102.07
ARTO species impacts Perm = 4 Temp = 2 Indirect = 8
ARTO CH
existinghighway_300ftBuffer
N
1:18,000

Figure 17

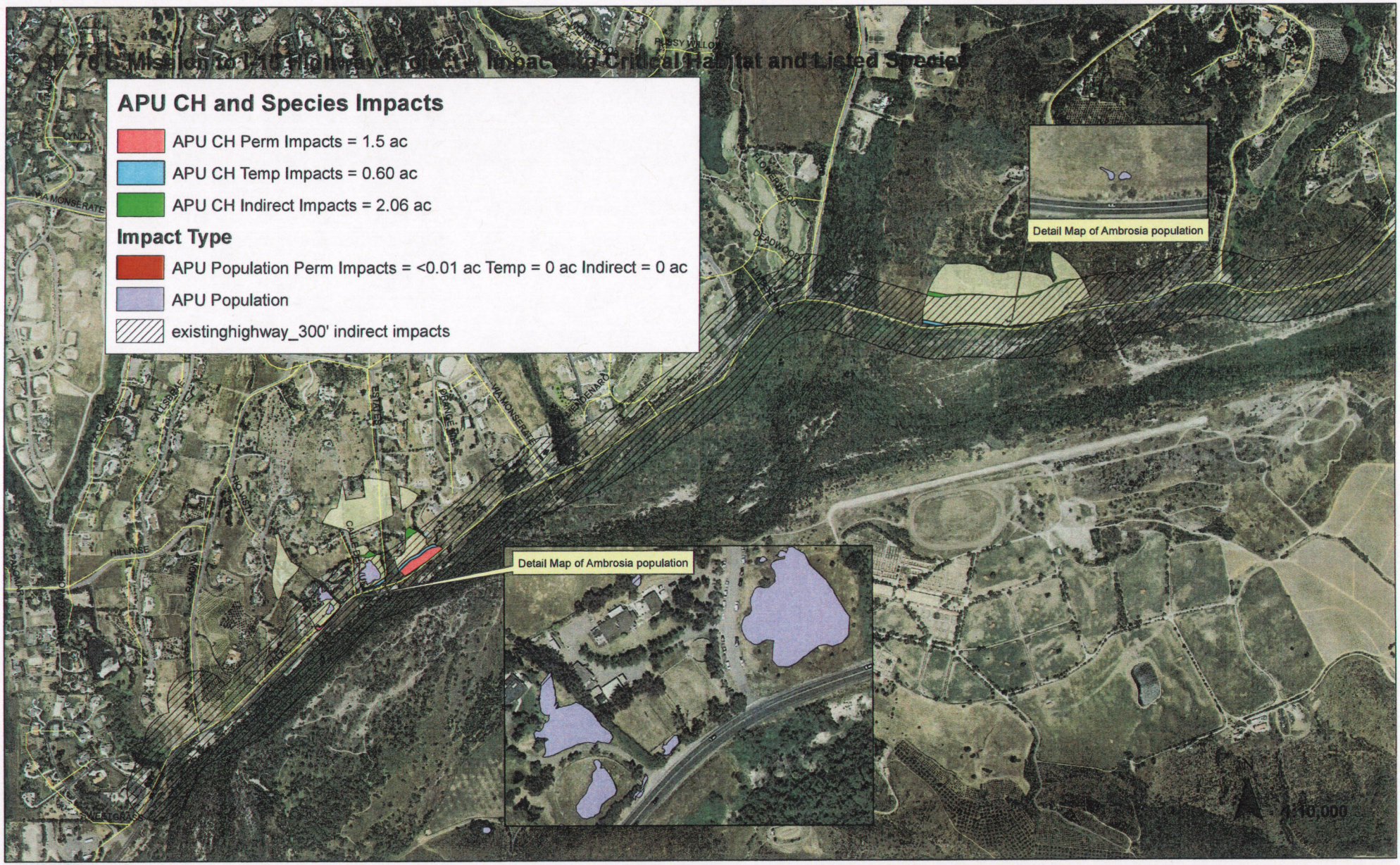

SR 76 Mission to I-10 Highway Project Impacts to Critical Habitat and Listed Species
APU CH and Species Impacts
APU CH Perm Impacts = 1.5 ac
APU CH Temp Impacts = 0.60 ac
APU CH Indirect Impacts = 2.06 ac
Impact Type
APU Population Perm Impacts = <0.01 ac Temp = 0 ac Indirect = 0 ac
APU Population
existinghighway_300' indirect impacts
Detail Map of Ambrosia population
Detail Map of Ambrosia population
1:10,000

Figure 18

Figure 19 . Tabata Mitigation Site

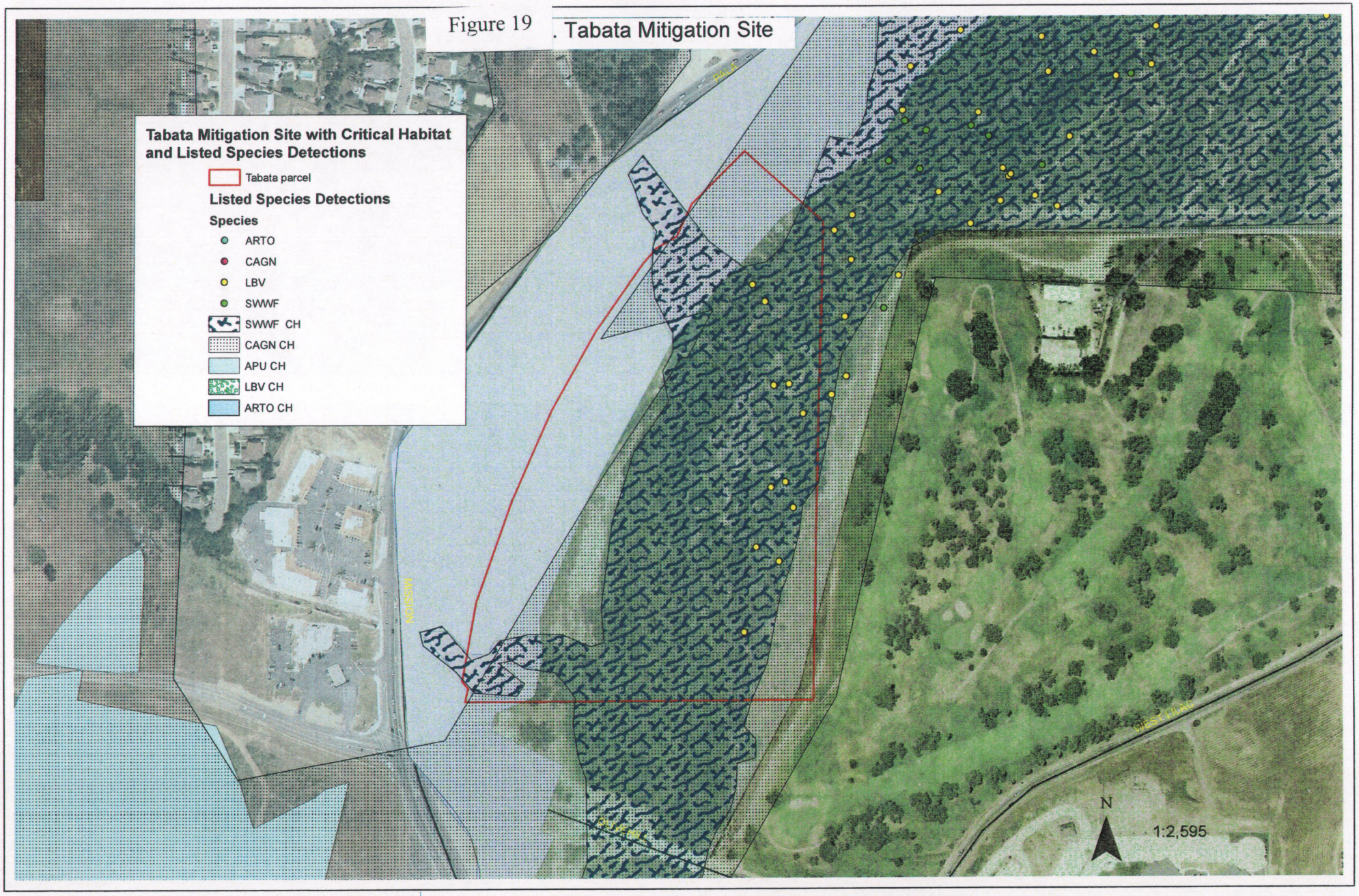


Figure 20 . Vessels Mitigation Site

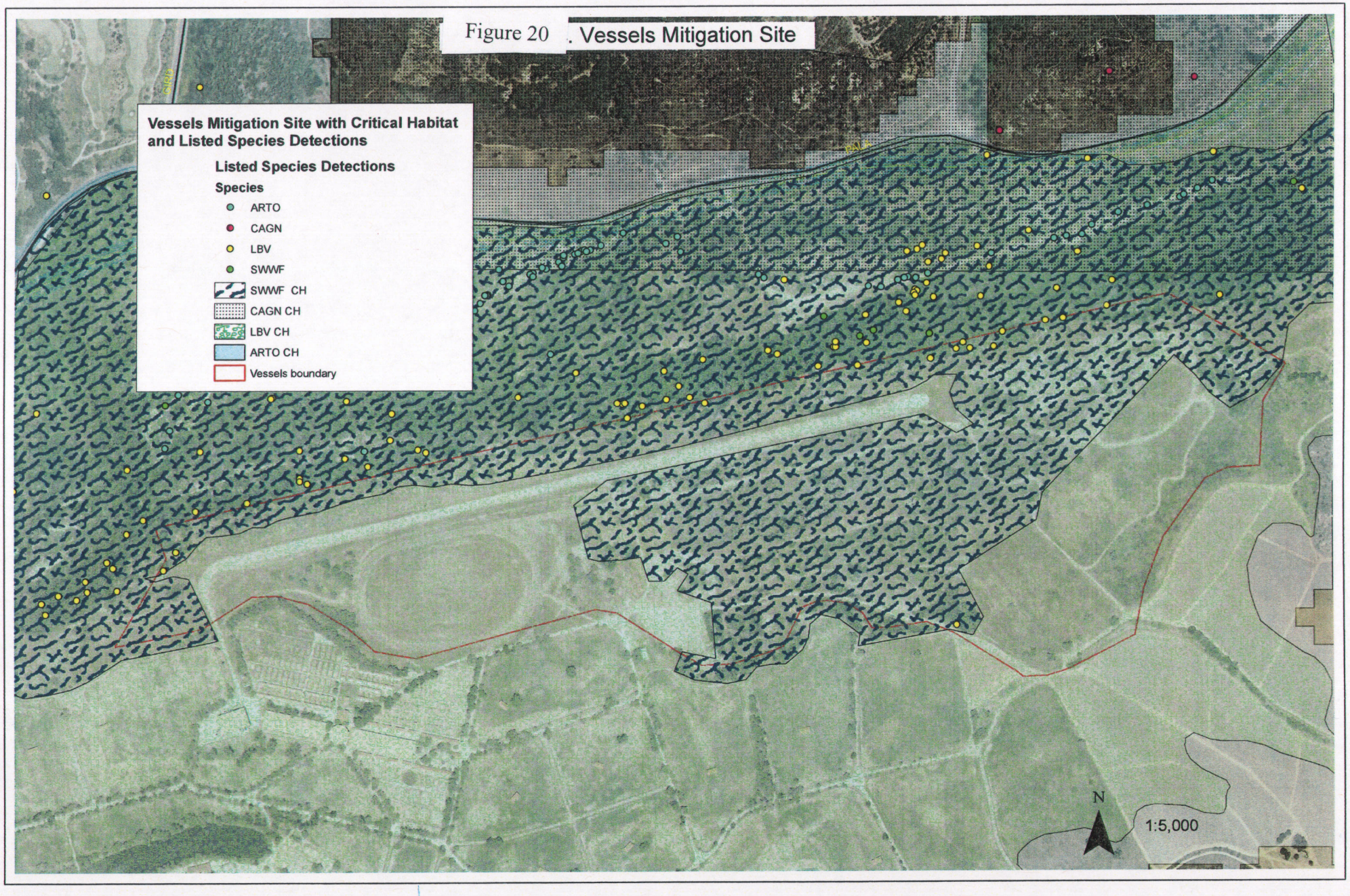
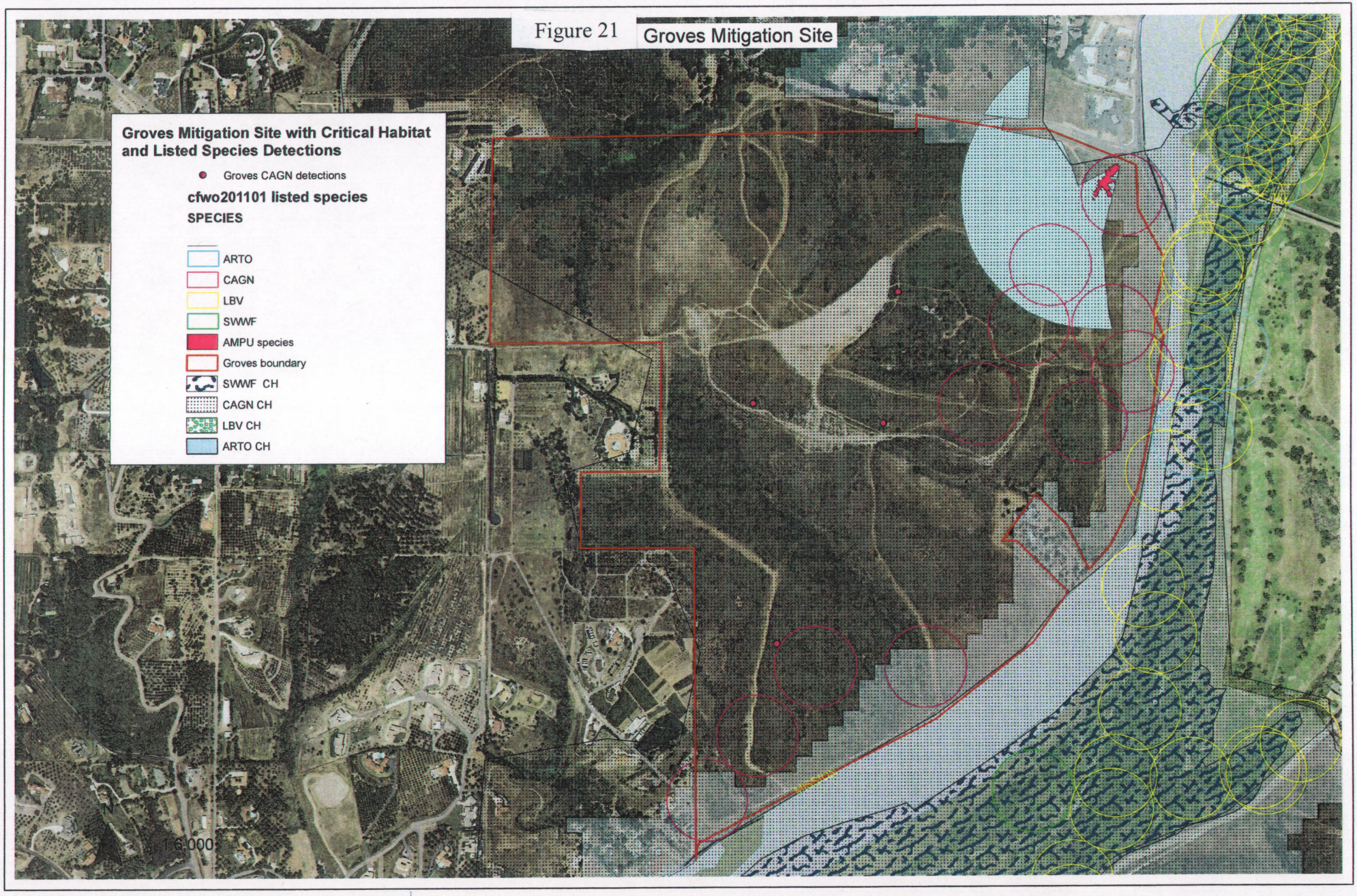


Figure 21 Groves Mitigation Site



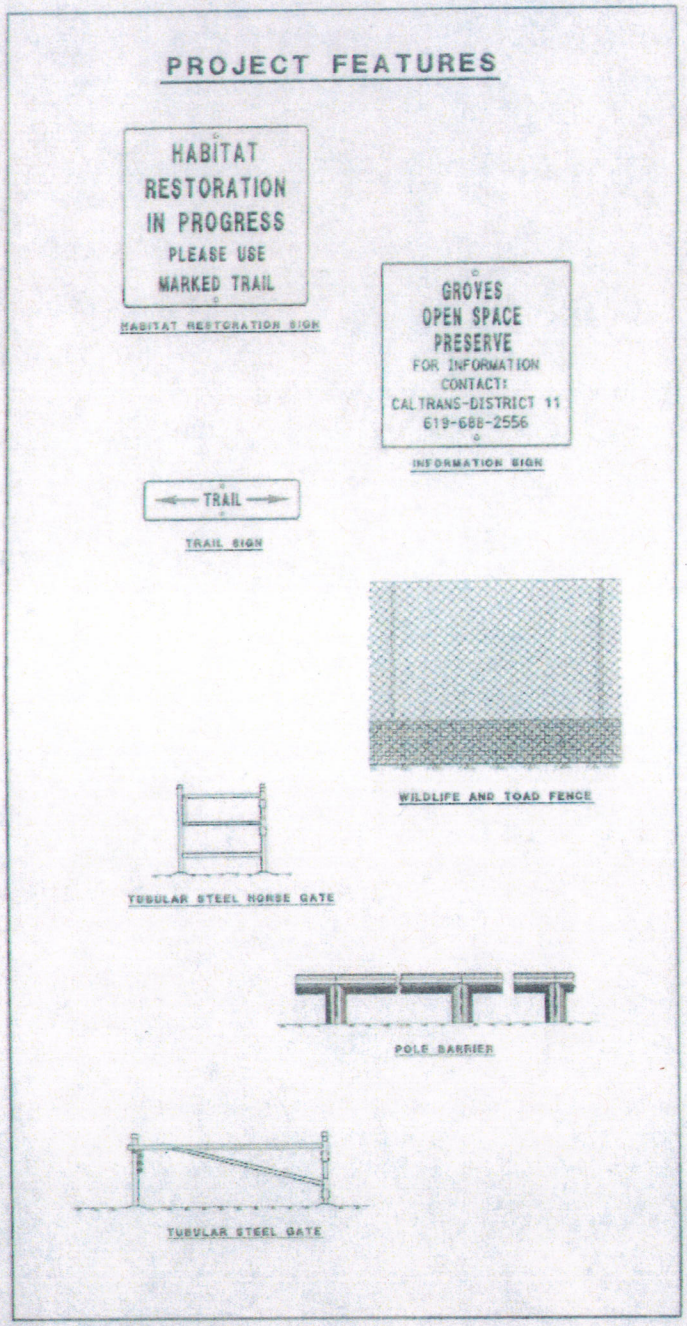


Figure 22

GROVES OPEN SPACE PRESERVE

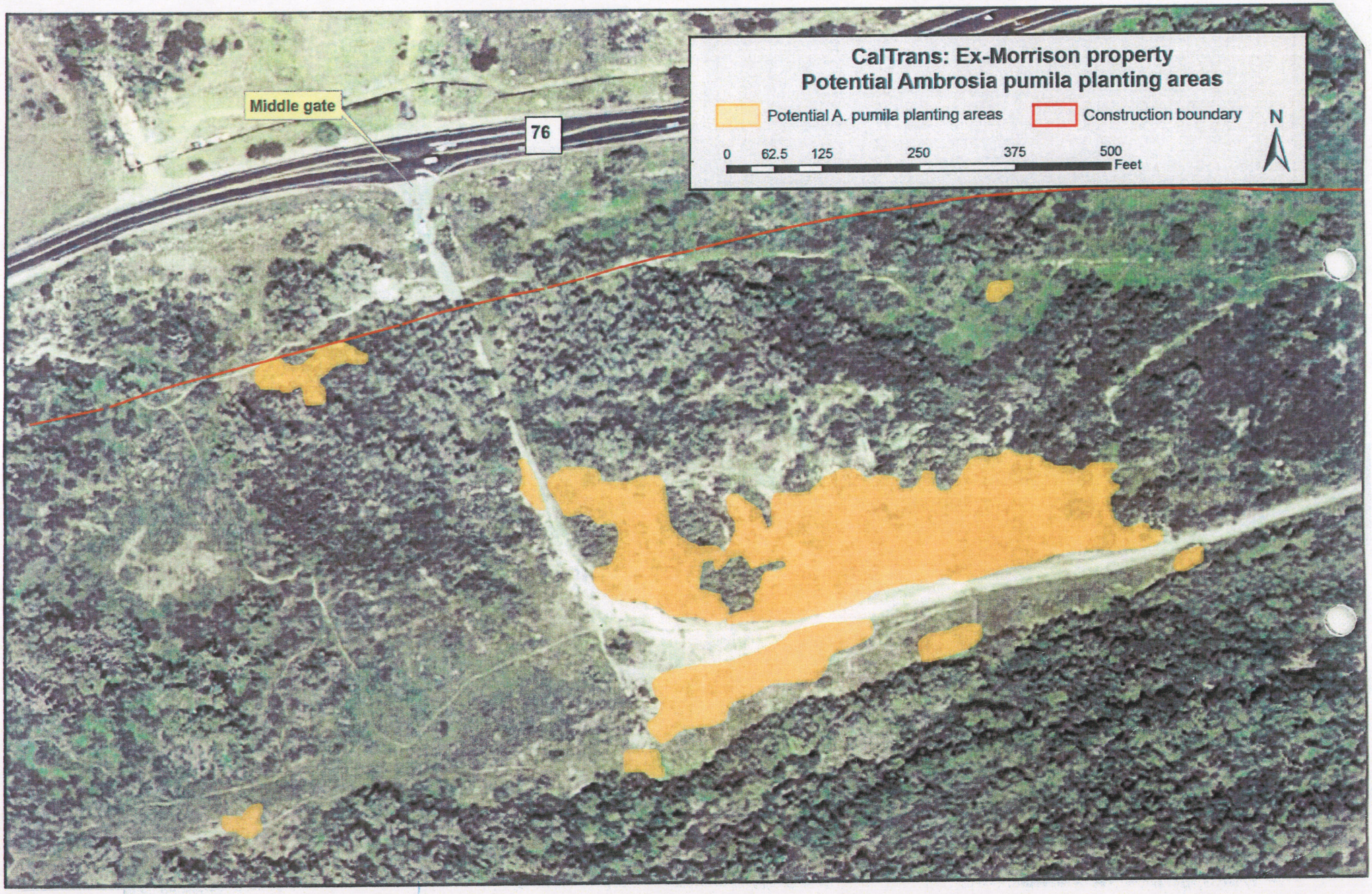
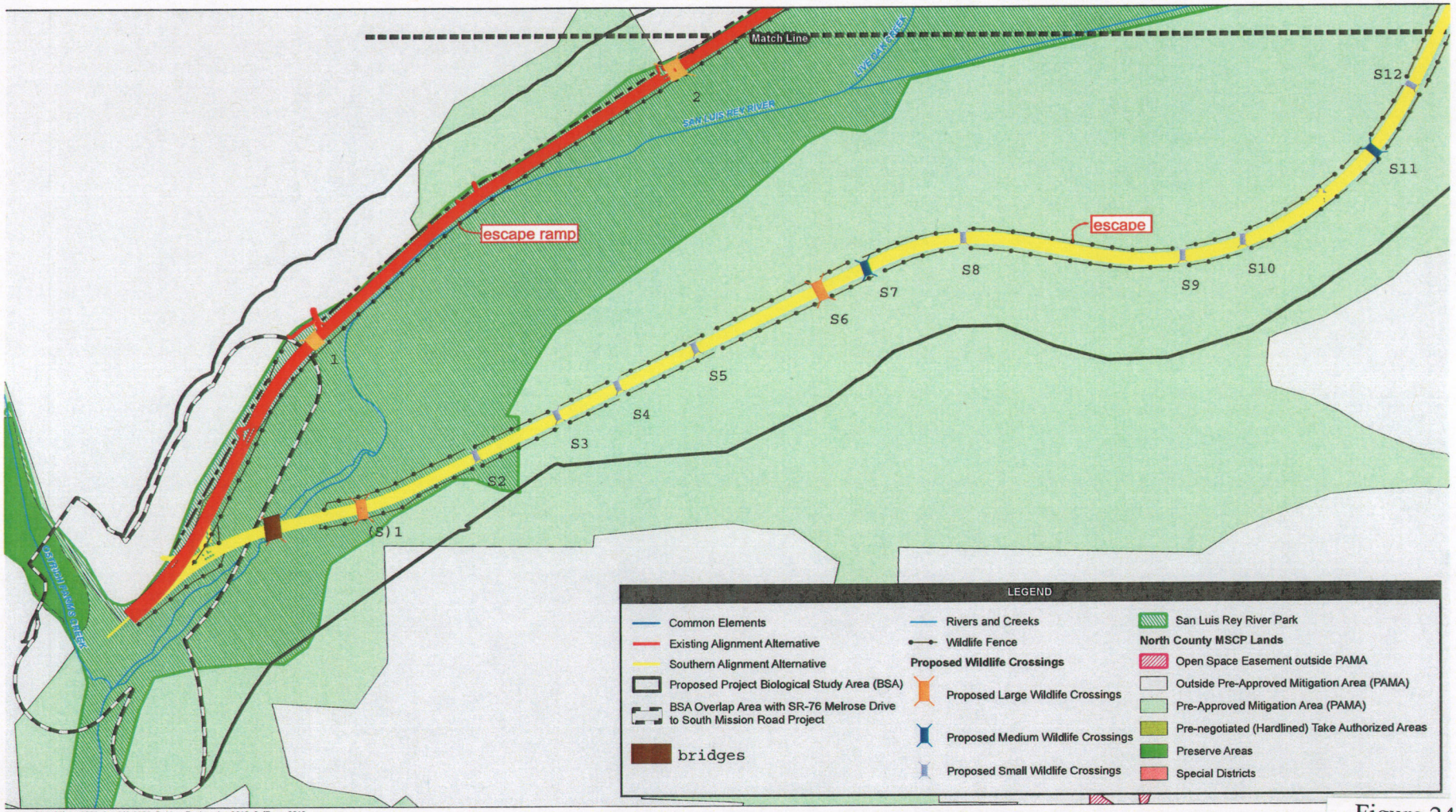

CalTrans: Ex-Morrison property
Potential Ambrosia pumila planting areas
Potential A. pumila planting areas
Construction boundary
0
62.5
125
250
375
500
Feet
N
Middle gate
76

Figure 23



Source: DigitalGlobe 2008; SanGIS 2008; Dokken Engineering 2010; CalTrans 2010

1,000 500 0 1,000 Feet

Scale: 1 = 12,000; 1 inch = 1,000 feet

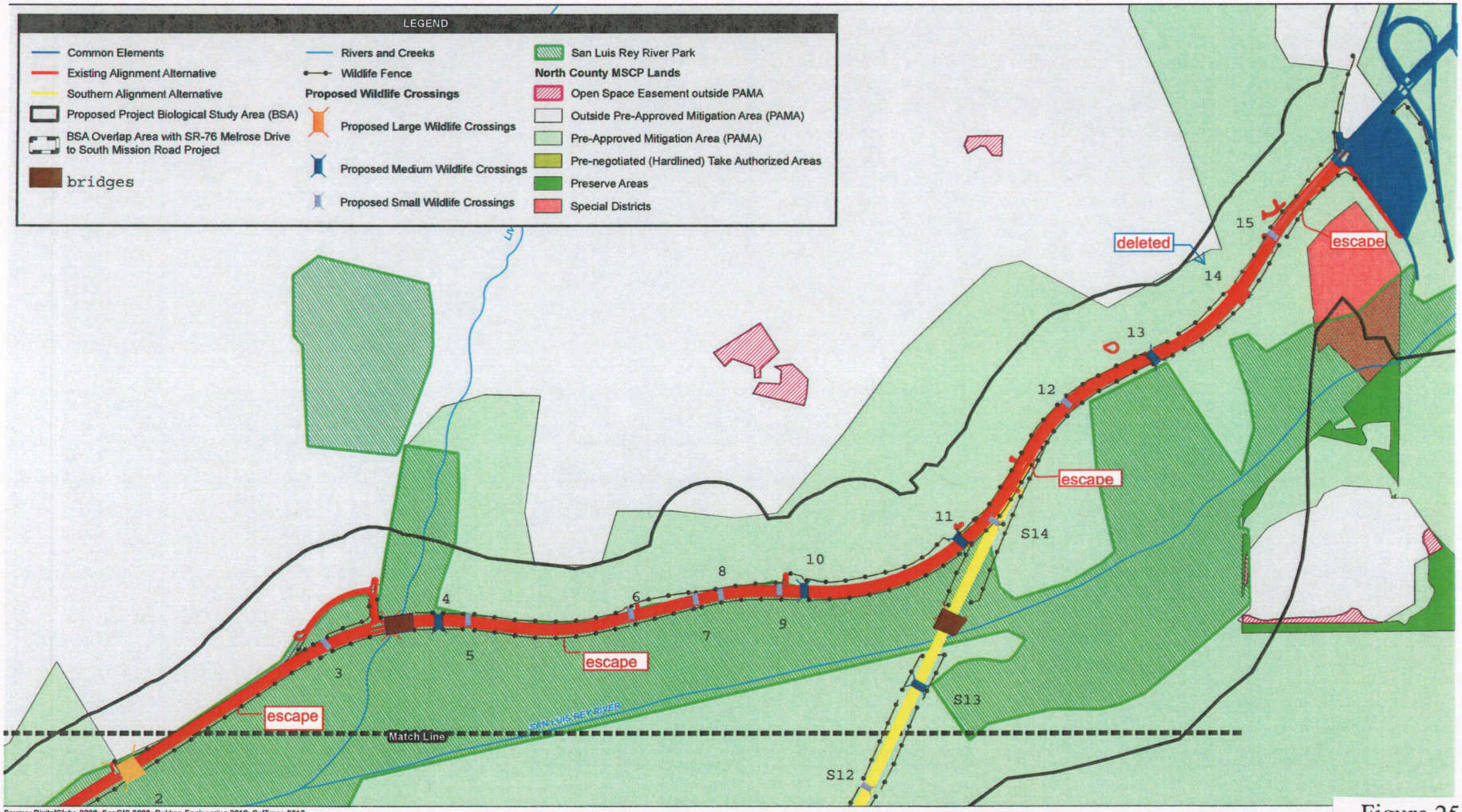
Six culverts along either alignment will have a 0.1 openness ratio.

Figure 24

Wildlife Crossings and Fencing

SR-76 South Mission to Interstate 15 – Highway Improvement Project

Path: P:\2008\08080105 SR76 East S.Mission I-15 PA-ED\SGIS\MXD\EIR_EIS\June 2010\fig 3_20_6_WildlifeFence.mxd, 08/11/10, angellop



Source: DigitalGlobe 2008; SanGIS 2008; Dokken Engineering 2010; CalTrans 2010

1,000 500 0 1,000 Feet

Scale: 1 = 12,000; 1 inch = 1,000 feet

six culverts along either alignment will have a 0.1 openess ratio.

Figure 25

Wildlife Crossings and Fencing

SR-76 South Mission to Interstate 15 – Highway Improvement Project

Path: P:\2008\080/80105 SR76 East S.Mission I-15 PA-ED\SGIS\MXD\EIR_EIS\June 2010\fig 3_20_6_WildlifeFence.mxd, 08/11/10, augellop

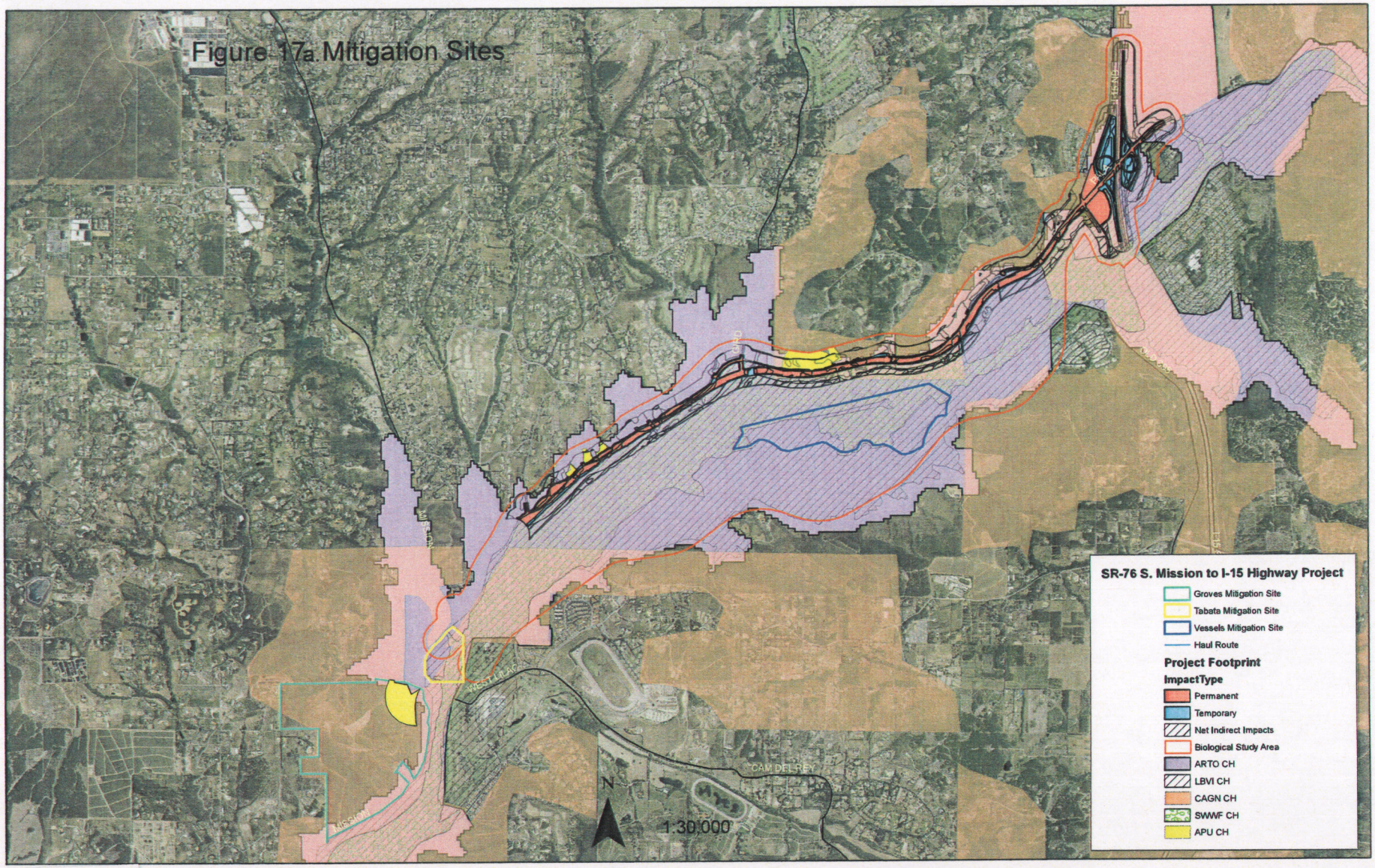


Figure 17a. Mitigation Sites
SR-76 S. Mission to I-15 Highway Project
Groves Mitigation Site
Tabata Mitigation Site
Vessels Mitigation Site
Haul Route
Project Footprint
ImpactType
Permanent
Temporary
Net Indirect Impacts
Biological Study Area
ARTO CH
LBVI CH
CAGN CH
SWWF CH
APU CH
N
1:30,000
CAM DEL REY
MISSION
WEST FULLER

Figure 26

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road, Suite 101
Carlsbad, California 92011

In Reply Refer To:
FWS-SD-09B0003-12F0043

NOV 29 2011

Ms. Kim T. Smith
Branch Chief, Environmental Resource Studies
California Department of Transportation
4050 Taylor Street
San Diego, California 92110

Attention: Rush Abrams, Associate Environmental Planner

Subject: Reinitiation of the Biological Opinion (FWS-SDG-09B0003-11F0420) for the State Route 76 South Mission to Interstate 15 Improvement Project, San Diego County, California

Dear Ms. Smith:

This is in response to your correspondence dated October 25, 2011, requesting the reinitiation of formal consultation for the State Route 76 (SR-76) South Mission to Interstate 15 (I-15) Improvement Project to address a modification to the project that has the potential to result in effects to the federally threatened coastal California gnatcatcher (*Polioptila californica californica*, "gnatcatcher"), and the federally endangered least Bell's vireo (*Vireo bellii pusillus*, "vireo"), southwestern willow flycatcher (*Empidonax traillii extimus*, "flycatcher"), and arroyo toad [*Anaxyrus californicus* (*Bufo microscaphus c.*)] that were not addressed in the original biological opinion (FWS-SDG-09B0003-11F0420).

The project is receiving Federal funding through the Federal Highway Administration (FHWA), and Caltrans has assumed FHWA's responsibilities under the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*), for this consultation in accordance with Section 6005 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) 2005, as described in the National Environmental Policy Act (NEPA) Delegation Pilot Program Memorandum of Understanding between FHWA and Caltrans (effective July 1, 2007) and codified in 23USC327(a)(2)(A). We initiated consultation on October 27, 2011, the date we received your request.

The project is located on SR-76 between South Mission Road and just east of I-15 within the San Luis Rey River Valley in unincorporated San Diego County, California. Construction of the project will widen the existing two-lane SR-76 to a total of four travel lanes, (two lanes in either direction), improvements to the Park and Ride facility near the SR-76/I-15 interchange, and improvements to the SR-76/I-15 interchange.

Caltrans requests that conservation measure 21 from biological opinion FWS-SDG-09B0003-11F0420 be amended such that pile driving at the SR-76 bridge over I-15 could occur during the breeding season. Thus, conservation measure 21 would be amended as indicated in the following underlined text:

21. To minimize construction noise impacts to listed species, all pile driving for the project, <u>with the exception of pile driving for the SR-76 bridge over I-15,</u> will be conducted between September 16 and February 14 which is outside of the gnatcatcher, vireo, flycatcher and toad breeding seasons. Pile driving may commence earlier in the fall if the Caltrans Project Biologist demonstrates to the satisfaction of the CFWO that all breeding is complete within the area where construction noise will exceed ambient levels as a result of pile driving. In addition, all construction equipment, fixed or mobile, will be equipped with properly operating and maintained mufflers.

The SR-76 bridge over I-15 is located in the middle of the interchange, which is currently vegetated with ornamentals and non-native grasses. The nearest area of native habitat is unoccupied coastal sage scrub located northwest of the existing park and ride facility, approximately 1,000 feet (ft) from the bridge where the noise level from the proposed pile driving is expected to reach 69 dBA (Caltrans 2011). However, gnatcatchers were last observed in this habitat in 2006 (EDAW, Inc. 2006). Subsequent gnatcatcher surveys were conducted in this habitat in 2007 (EDAW, Inc. 2007), 2008 (EDAW, Inc. 2008), and 2011(Caltrans 2011) with negative results.

Coastal sage scrub habitat located south of the proposed southern park and ride, approximately 1,500 ft from the bridge, is known to be occupied by a pair of gnatcatchers (EDAW, Inc. 2007, 2008). At 1500 ft, the noise level resulting from the proposed pile driving is expected to be at 66 dBA (Caltrans 2011). However, the topography of the project site in relation to the area where the gnatcatcher has been detected slopes such that noise from construction occurring at the bridge is likely to be dampened within the occupied habitat. In addition, existing traffic noise has resulted in ambient noise levels above 60 dBA in the occupied habitat (AECOM 2009).

It is approximately 2,000 ft from the SR-76 bridge over I-15 to the San Luis Rey River riparian corridor, where there is potential for vireo, flycatcher, and arroyo toad breeding. Again, the topography of the area slopes such that noise from construction occurring at the bridge is likely to be reduced within the riparian habitat, and existing traffic noise produces ambient noise levels above 60 dBA (AECOM 2009).

Because of the distance to coastal sage scrub and riparian habitats, existing ambient noise levels, and topography of the project site and surrounding habitat areas, the proposed project modification is not anticipated to result in any impacts to the gnatcatcher, vireo, flycatcher, or arroyo toad breeding behavior and is expected to be insignificant. For the purpose of section 7 consultation, an insignificant effect is one that is sufficiently small that a person would not be able to meaningfully measure, detect, or evaluate it.

Based on the above information, we have determined that the proposed project modification will not change the conclusion or alter the incidental take statement of our September 22, 2011, biological opinion. Therefore, the interagency consultation requirements of section 7 of the Act have been satisfied. With the exception of the conservation measure amended above, all other conservation measures and terms and conditions will be implemented as written in the biological opinion (FWS-SDG-09B0003-11F0420) previously issued for the proposed action. By copy of this letter, we are formalizing these changes to the September 22, 2011 biological opinion. If you have any questions regarding this amendment, please contact Sally Brown of this office at 760-431-9440, extension 278.

Sincerely,

for Karen A. Goebel
Assistant Field Supervisor

Literature Cited

AECOM. 2009. Noise Report for Sensitive Avian Wildlife Receivers, State Route 76 South Mission Road to Interstate 15. Prepared for Caltrans. 128+pp.

California Department of Transportation (Caltrans). 2011. Request for Amendment to Biological Opinion FWS-SDG-09B003-11F0420 from the U.S. Fish and Wildlife Service for the SR-76 South Mission to I-15 Highway Project, San Diego County, California. October 25.

EDAW, Inc. 2006. 45-Day Report Summarizing Results of Focused Surveys for Coastal California Gnatcatcher for the Proposed State Route 76 East Expansion Project, County of San Diego, California. 5+pp.

EDAW, Inc. 2007. 45-Day Summary Report of 2007 Focused Surveys for the Coastal California Gnatcatcher for the Proposed State Route 76 East Expansion Project, County of San Diego, California. 6+pp.

EDAW, Inc. 2008. 45-Day Summary Report of Focused Surveys for the Coastal California Gnatcatcher for the Proposed State Route 76 South Mission Road to Interstate 15 Highway Improvement Project, County of San Diego, California. 6+pp.