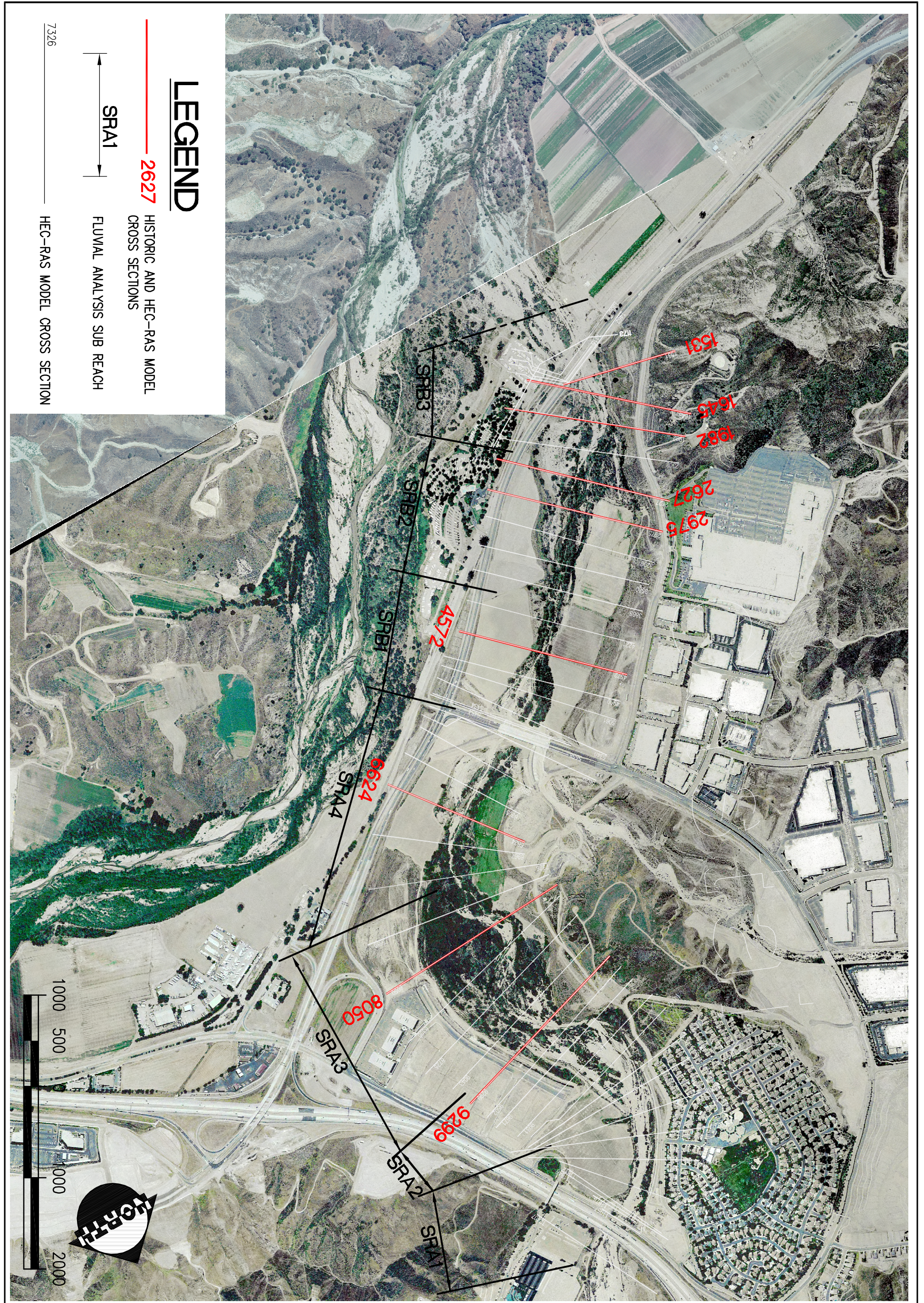


## **Appendix 5.5 (Continued)**

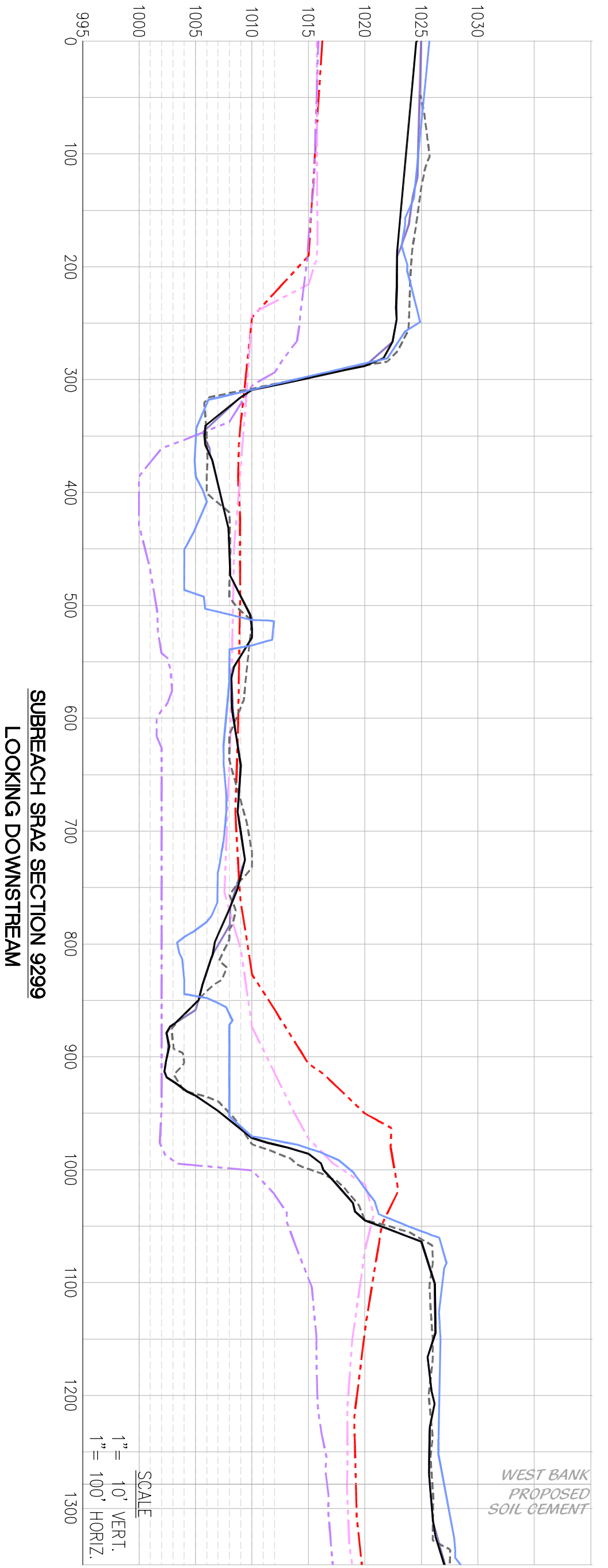
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Hydrology (Part 8 of 15)





<b>FIGURE</b> <b>5.1</b>	 <b>PACE</b> <b>PACIFIC ADVANCED</b> <b>CIVIL ENGINEERING</b> 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE	1" = 1000'	JOB		TITLE	
		DESIGNED	DAJ	<b>CASTAIC CREEK</b> <b>FLUVIAL STUDY</b> <b>LOS ANGELES COUNTY</b>		<b>CA</b>	<b>CASTAIC CREEK</b> <b>HISTORIC SECTION</b> <b>ANALYSIS LOCATION MAP</b>
		DRAWN	DAD				
		CHECKED	D.J.				
		DATE	07/20/05				
		JOB NO.	8065E				



SCALE  
 1" = 10' VERT.  
 1" = 100' HORIZ.

WEST BANK  
 PROPOSED  
 SOIL CEMENT

CROSS SECTIONAL AREAS AT STA 9299 (sf)				
ELEV	1999	2004	2005	2006
1001.0	0.0	0.0	0.0	0.0
1002.0	0.0	0.0	0.0	0.0
1003.0	0.0	27.7	19.9	0.9
1004.0	9.2	57.4	57.5	30.4
1005.0	99.0	71.2	74.8	74.0
1006.0	210.0	101.9	101.0	87.6
1007.0	275.5	169.6	175.1	177.7
1008.0	391.1	246.4	258.4	224.8
1009.0	621.0	424.8	416.4	422.1
1010.0	640.0	614.2	613.0	559.3
1011.0	654.7	665.2	665.5	670.4
1012.0	666.0	670.3	671.3	677.6
<b>Cumulative Area</b>	<b>3566.5</b>	<b>3048.5</b>	<b>3052.9</b>	<b>2924.8</b>

**LEGEND:**

- 2006 SURFACE
- 2005 SURFACE
- 2004 SURFACE
- 1999 SURFACE
- 1963 SURFACE
- 1947 SURFACE
- 1930 SURFACE

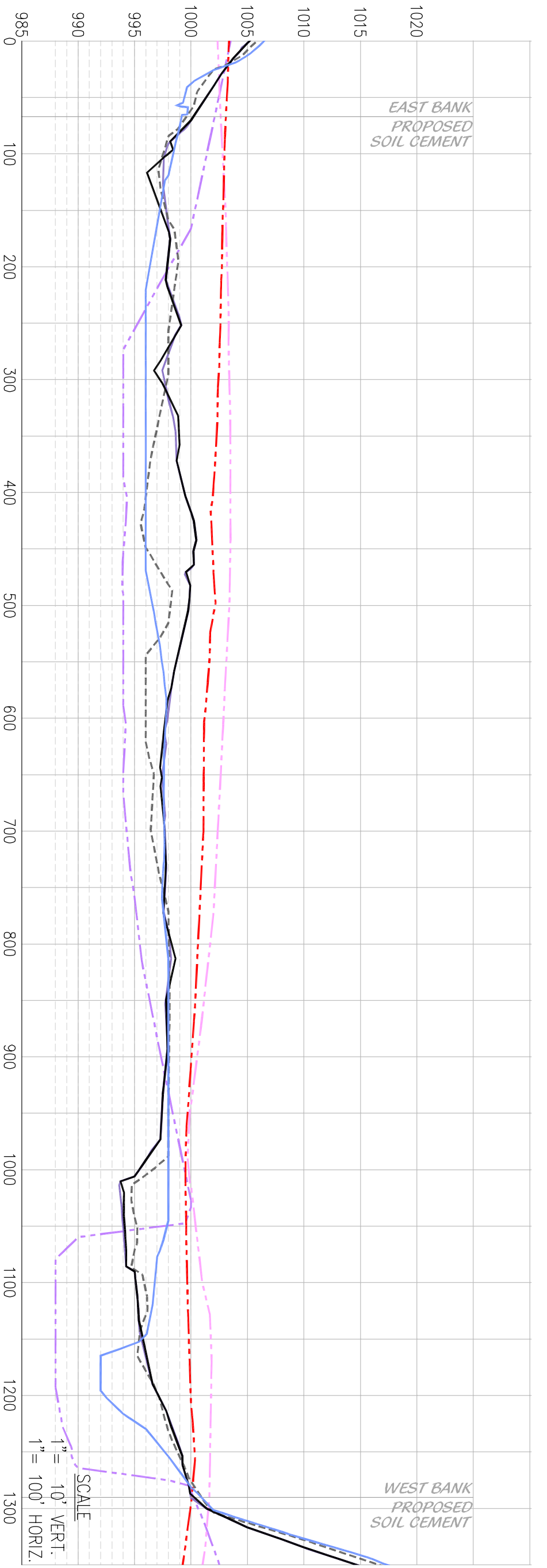
SCALE	AS NOTED
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	11/17/05
JOB NO.	8065E

JOB  
**CASTAIC CREEK  
 FLUVIAL STUDY**  
 LOS ANGELES COUNTY CA

TITLE  
**HISTORICAL  
 CROSS SECTIONS  
 BY STATION**



FIGURE  
**5.2A**



CROSS SECTIONAL AREAS AT STA 8050 (sf)				
ELEV	1999	2004	2005	2006
989.0	0.0	0.0	0.0	0.0
990.0	0.0	0.0	0.0	0.0
991.0	0.0	0.0	0.0	0.0
992.0	0.0	0.0	0.0	0.0
993.0	38.5	0.0	0.0	0.0
994.0	51.9	6.0	0.0	0.0
995.0	64.3	74.8	65.9	8.4
996.0	77.3	136.3	134.0	112.5
997.0	419.0	216.0	216.1	403.6
998.0	686.3	420.2	439.3	638.7
999.0	1164.2	877.3	871.5	1098.0
1000.0	1215.4	1084.5	1081.1	1197.0
<b>Cumulative Area</b>	<b>3716.8</b>	<b>2815.0</b>	<b>2807.9</b>	<b>3458.2</b>

**SUBREACH SRA3 SECTION 8050  
LOOKING DOWNSTREAM**

**LEGEND:**

- 2006 SURFACE
- 2005 SURFACE
- 2004 SURFACE
- 1999 SURFACE
- 1963 SURFACE
- 1947 SURFACE
- 1930 SURFACE
- 2006 PROPOSED SOIL CEMENT
- 2005 PROPOSED SOIL CEMENT
- 2004 PROPOSED SOIL CEMENT
- 1999 PROPOSED SOIL CEMENT

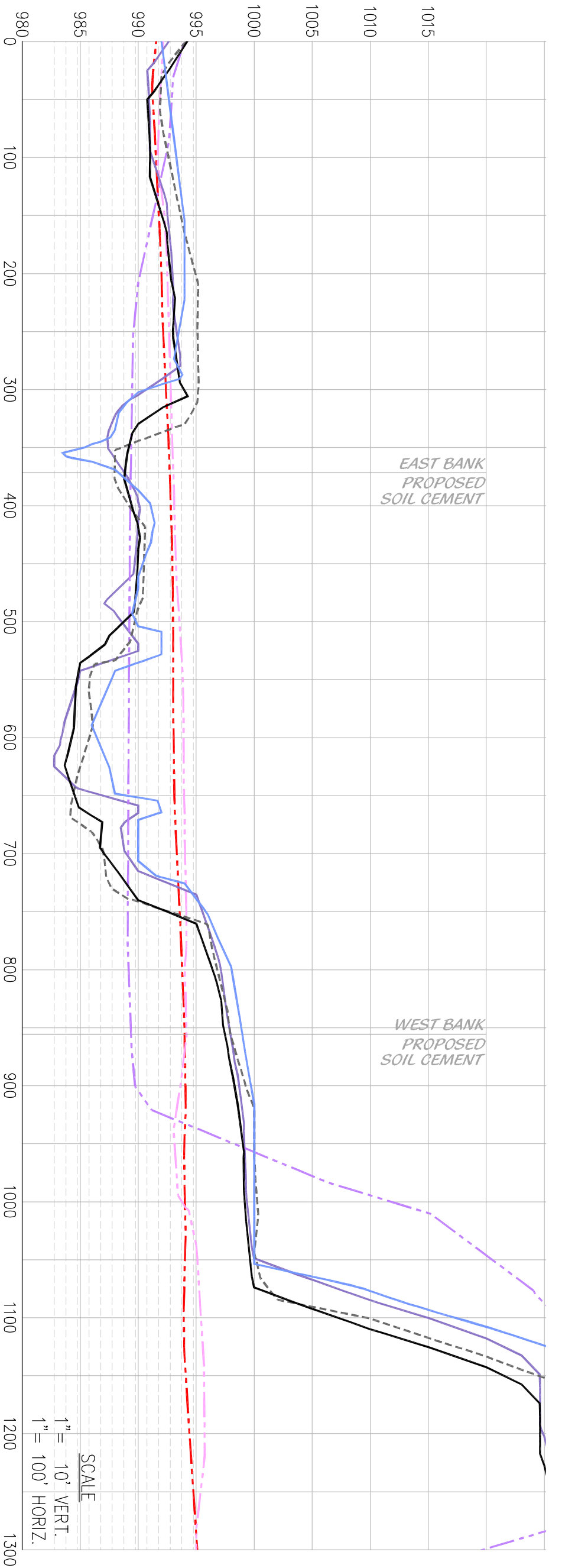
SCALE AS NOTED  
 DESIGNED DAJ  
 DRAWN DAD  
 CHECKED MEK  
 DATE 11/17/05  
 JOB NO. 8065E

JOB  
**CASTAIC CREEK  
 FLUVIAL STUDY**  
 LOS ANGELES COUNTY CA

TITLE  
**HISTORICAL  
 CROSS SECTIONS  
 BY STATION**



FIGURE  
**5.2B**



**SUBREACH SRA4 SECTION 6624  
LOOKING DOWNSTREAM**

CROSS SECTIONAL AREAS AT STA 6624 (sf)				
ELEV	1999	2004	2005	2006
983.8	0.3	30.0	0.4	0.0
984.8	6.3	74.4	47.7	14.5
985.8	14.5	99.2	120.1	59.5
986.8	36.8	109.8	142.5	133.9
987.8	103.1	127.7	184.4	176.1
988.8	159.4	193.6	211.1	227.9
989.8	207.7	281.2	235.2	273.3
990.8	288.2	398.4	399.5	340.9
991.8	370.8	492.3	492.6	403.3
992.8	457.4	564.8	564.8	462.8
993.8	573.3	690.2	685.8	536.2
994.8	737.1	754.8	754.8	601.2
<b>Cumulative Area</b>	<b>2954.9</b>	<b>3816.5</b>	<b>3838.9</b>	<b>3229.6</b>

**LEGEND:**

-----	2006 SURFACE
-----	2005 SURFACE
-----	2004 SURFACE
-----	1999 SURFACE
-----	1963 SURFACE
-----	1947 SURFACE
-----	1930 SURFACE

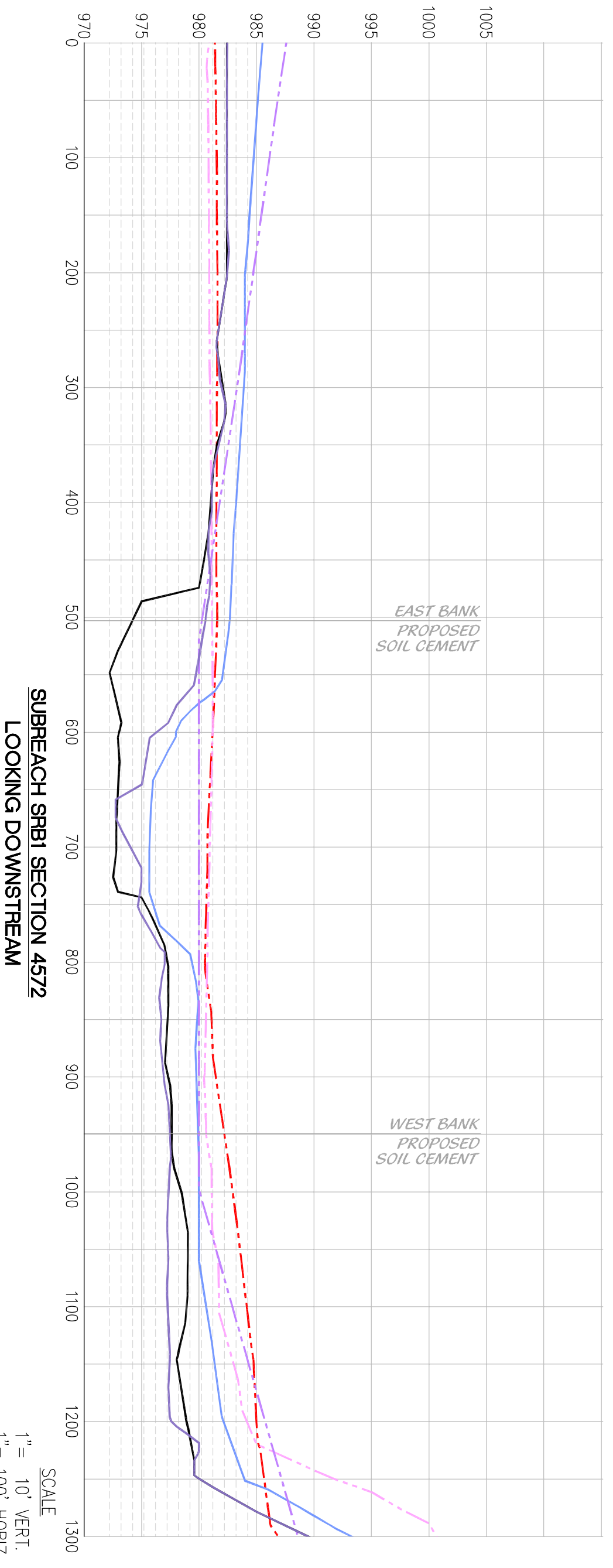
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 DESIGNED DAJ  
 DRAWN DAD  
 CHECKED MEK  
 DATE 11/17/05  
 JOB NO. 8065E

JOB  
**GASTAIC CREEK  
 FLUVIAL STUDY**  
 LOS ANGELES COUNTY CA

TITLE  
**HISTORICAL  
 CROSS SECTIONS  
 BY STATION**



FIGURE  
**5.2C**



**SUBREACH SRB1 SECTION 4572  
LOOKING DOWNSTREAM**

SCALE  
1" = 10' VERT.  
1" = 100' HORIZ.

CROSS SECTIONAL AREAS AT STA 4572 (sf)			
ELEV	1999	2004	2005
973.2	0.0	10.7	87.3
974.2	0.0	41.4	227.8
975.2	0.0	80.4	251.1
976.2	6.9	160.1	273.0
977.2	48.5	247.6	301.6
978.2	91.3	577.2	466.5
979.2	142.7	638.7	616.6
980.2	245.1	683.0	764.3
981.2	484.4	785.9	826.3
982.2	580.3	946.9	946.0
983.2	714.6	1234.9	1240.2
984.2	920.3	1310.6	1310.6
<b>Cumulative Area</b>	<b>3234.1</b>	<b>6717.3</b>	<b>7311.3</b>

**LEGEND:**

	2005 SURFACE
	2004 SURFACE
	1999 SURFACE
	1963 SURFACE
	1947 SURFACE
	1930 SURFACE

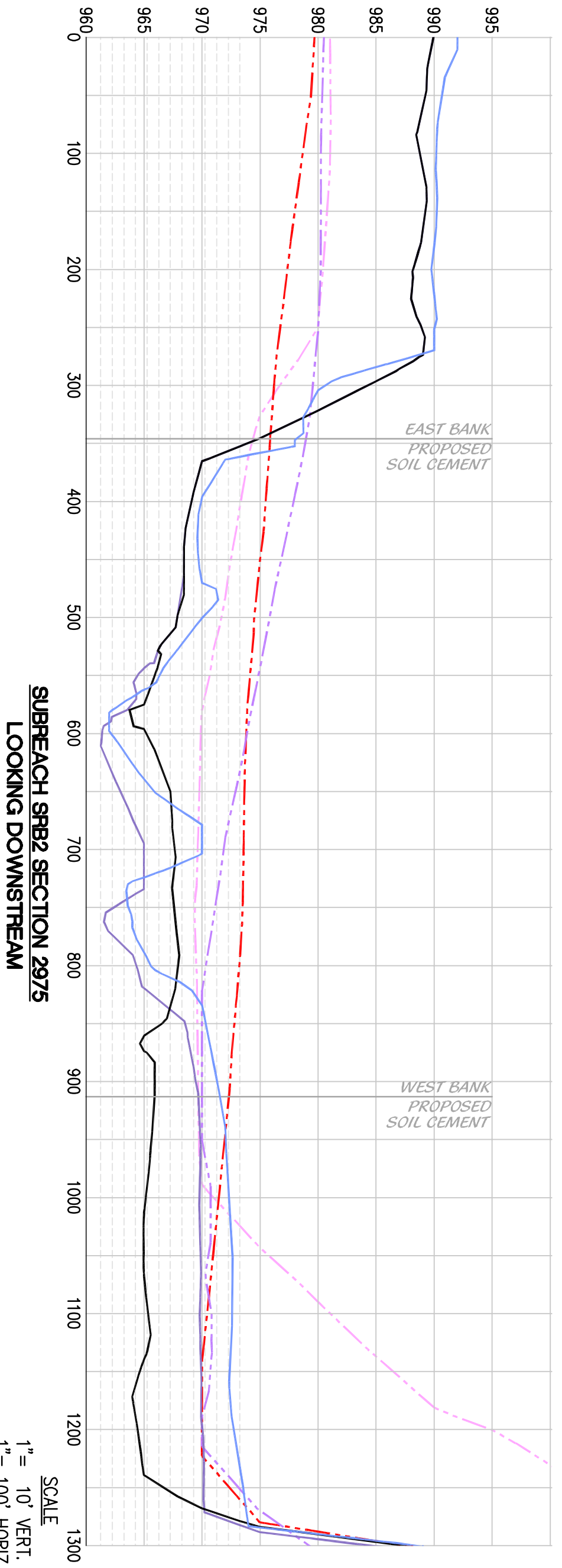
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DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	11/17/05
JOB NO.	8065E

JOB  
**GASTAIC CREEK  
FLUVIAL STUDY**  
LOS ANGELES COUNTY CA

TITLE  
**HISTORICAL  
CROSS SECTIONS  
BY STATION**



FIGURE  
**5.2D**



CROSS SECTIONAL AREAS AT STA 2975 (sf)			
ELEV	1999	2004	2005
962.3	1.3	38.9	0.0
963.3	21.0	98.5	0.0
964.3	67.1	147.4	8.4
965.3	128.2	234.6	150.7
966.3	172.6	288.7	413.8
967.3	208.2	315.0	524.0
968.3	239.2	344.0	700.4
969.3	269.5	437.6	842.9
970.3	337.3	681.9	891.6
971.3	473.8	908.7	907.6
972.3	558.3	917.6	915.6
973.3	796.4	926.0	923.0
Cumulative Area	3272.8	5338.9	6278.1

**LEGEND:**

	2005 SURFACE
	2004 SURFACE
	1999 SURFACE
	1963 SURFACE
	1947 SURFACE
	1930 SURFACE

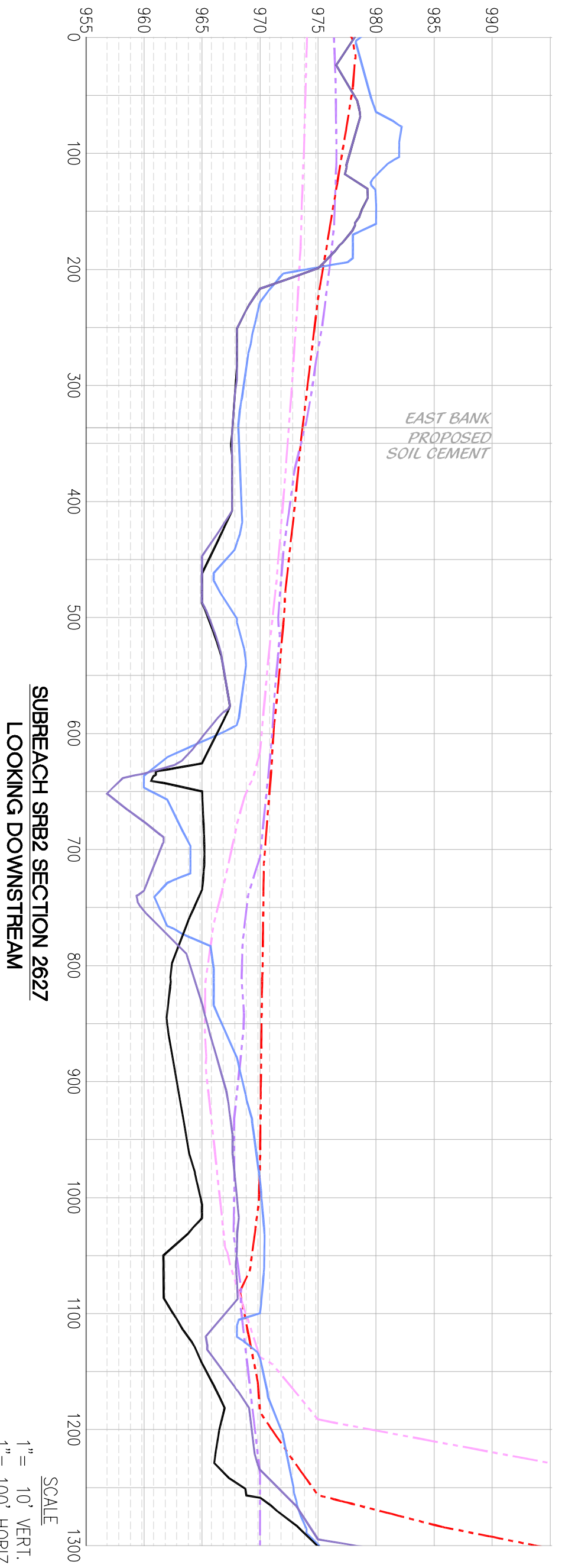
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DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	11/17/05
JOB NO.	8065E

JOB  
**CASTAIC CREEK  
FLUVIAL STUDY**  
LOS ANGELES COUNTY CA

TITLE  
**HISTORICAL  
CROSS SECTIONS  
BY STATION**



FIGURE  
**5.2E**

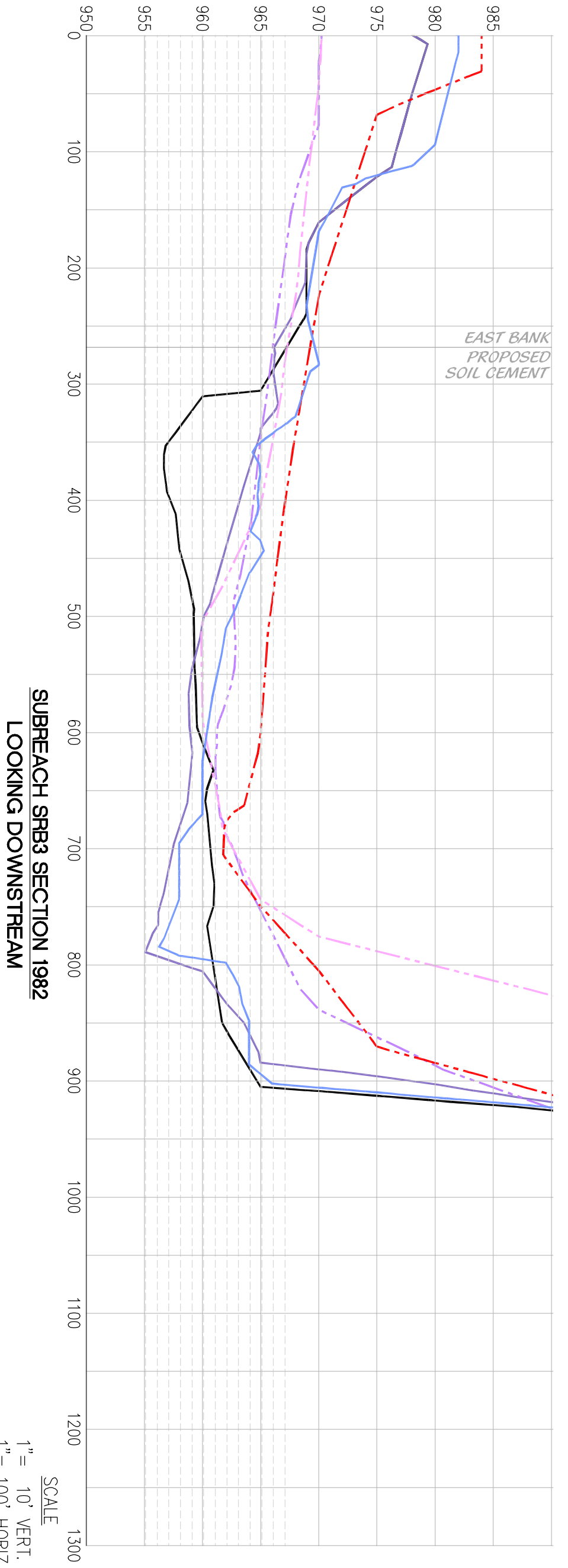


CROSS SECTIONAL AREAS AT STA 2627 (sf)			
ELEV	1999	2004	2005
957.8	0.0	9.0	0.0
958.8	0.0	25.0	0.0
959.8	0.0	39.0	0.0
960.8	12.6	74.0	0.0
961.8	44.2	119.9	23.8
962.8	84.2	150.1	161.6
963.8	118.6	186.2	280.3
964.8	162.6	218.4	394.9
965.8	184.5	298.0	598.0
966.8	250.5	422.1	730.4
967.8	310.9	583.6	896.2
968.8	485.8	894.9	1013.7
969.8	708.1	976.0	1030.8
970.8	879.5	1022.1	1045.4
971.8	976.1	1035.8	1056.6
972.8	1019.1	1049.2	1067.9
973.8	1066.4	1083.2	1079.4
974.8	1092.2	1092.1	1092.7
Cumulative Area	7395	9279	10472

**LEGEND:**

	2005 SURFACE
	2004 SURFACE
	1999 SURFACE
	1963 SURFACE
	1947 SURFACE
	1930 SURFACE

<b>PACIFIC ADVANCED CIVIL ENGINEERING</b> 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE AS NOTED DESIGNED DAJ DRAWN DAD CHECKED MEK DATE 11/17/05 JOB NO. 8065E	JOB <h2 style="margin: 0;">CASTAIC CREEK FLUVIAL STUDY</h2> LOS ANGELES COUNTY CA	TITLE <h2 style="margin: 0;">HISTORICAL CROSS SECTIONS BY STATION</h2>
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CROSS SECTIONAL AREAS AT STA 1982 (sf)			
ELEV	1999	2004	2005
956.1	0.0	13.8	0.0
957.1	8.1	53.6	14.2
958.1	41.3	101.7	72.3
959.1	105.6	155.3	134.3
960.1	124.5	281.9	256.8
961.1	209.7	328.3	388.1
962.1	265.5	372.2	531.0
963.1	311.5	419.1	557.7
964.1	366.2	465.2	575.1
965.1	473.0	517.8	592.4
966.1	552.7	554.3	609.8
967.1	564.9	617.5	627.2
<b>Cumulative Area</b>	<b>3023.0</b>	<b>3880.7</b>	<b>4358.7</b>

**LEGEND:**

	2005 SURFACE
	2004 SURFACE
	1999 SURFACE
	1963 SURFACE
	1947 SURFACE
	1930 SURFACE

SCALE	AS NOTED
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	11/17/05
JOB NO.	8065E

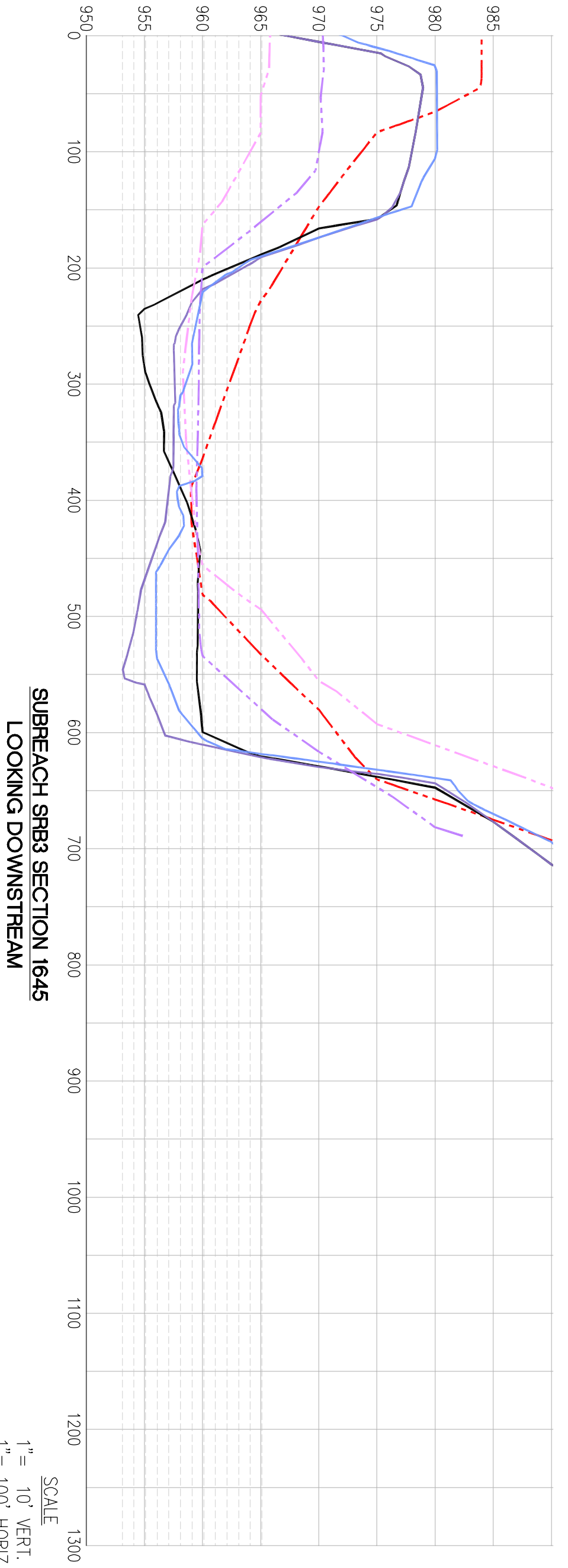
JOB  
**CASTAIC CREEK  
FLUVIAL STUDY**  
LOS ANGELES COUNTY CA

TITLE  
**HISTORICAL  
CROSS SECTIONS  
BY STATION**



5.2G

FIGURE



SUBREACH SRB3 SECTION 1645  
LOOKING DOWNSTREAM

SCALE  
1" = 10' VERT.  
1" = 100' HORIZ.

CROSS SECTIONAL AREAS AT STA 1645 (sf)			
ELEV	1999	2004	2005
954.1	0.0	33.4	0.0
955.1	0.0	107.3	7.8
956.1	5.9	137.6	65.1
957.1	92.9	165.7	114.1
958.1	137.8	280.3	155.5
959.1	211.6	367.2	183.5
960.1	342.8	384.0	290.2
961.1	389.0	394.5	391.0
962.1	402.6	403.4	401.1
963.1	412.2	411.3	411.0
964.1	421.2	419.2	420.9
965.1	428.4	427.0	428.4
<b>Cumulative Area</b>	<b>2844.5</b>	<b>3530.8</b>	<b>2868.5</b>

**LEGEND:**

	2005 SURFACE
	2004 SURFACE
	1999 SURFACE
	1963 SURFACE
	1947 SURFACE
	1930 SURFACE

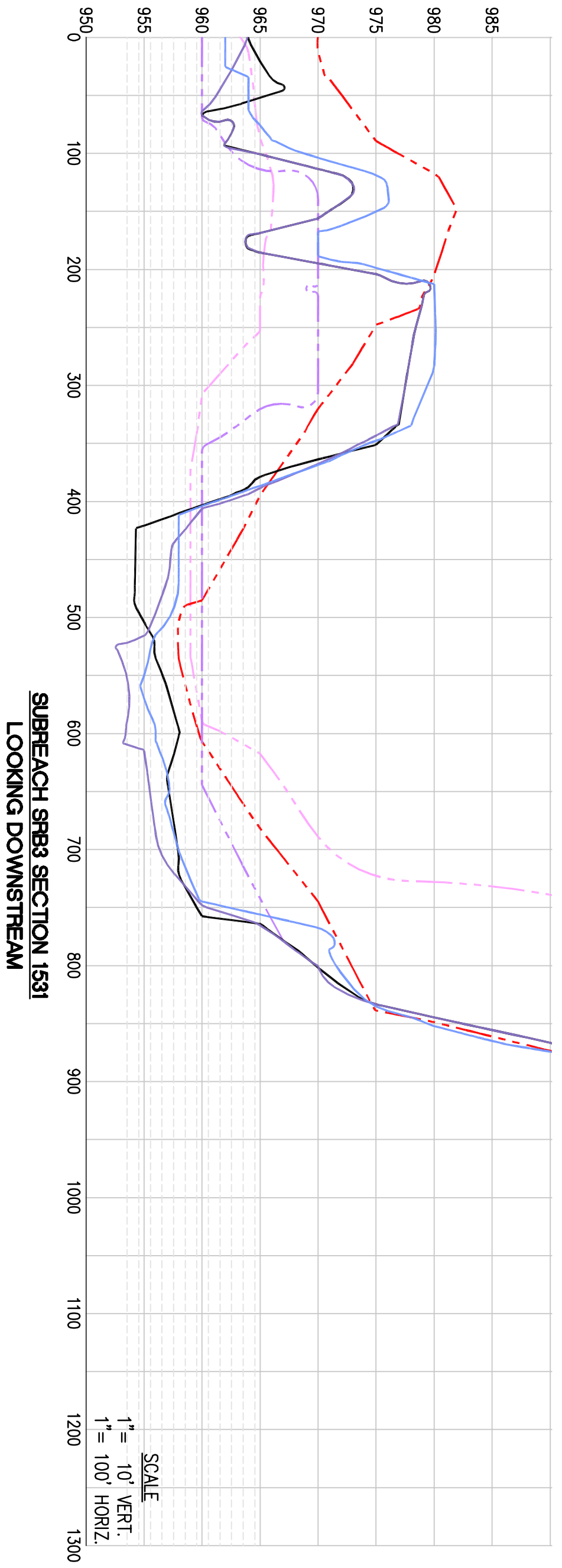
SCALE	AS NOTED
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DRAWN	DAD
CHECKED	MEK
DATE	11/17/05
JOB NO.	8065E

JOB  
**CASTAIC CREEK  
FLUVIAL STUDY**  
LOS ANGELES COUNTY CA

TITLE  
**HISTORICAL  
CROSS SECTIONS  
BY STATION**



FIGURE  
**5.2H**



CROSS SECTIONAL AREAS AT STA 1531 (sf)			
ELEV	1999	2004	2005
953.6	0.0	5.5	0.0
954.6	0.0	38.3	3.1
955.6	13.6	91.0	77.7
956.6	65.0	170.3	97.1
957.6	125.8	239.4	144.7
958.6	218.3	288.3	256.4
959.6	318.1	311.6	329.8
960.6	337.6	336.0	349.4
961.6	345.2	347.0	358.1
962.6	350.9	352.8	362.6
963.6	356.7	359.2	367.8
964.6	362.4	365.9	372.7
Cumulative Area	2493.7	2905.4	2719.4

**LEGEND:**

	2005 SURFACE
	2004 SURFACE
	1999 SURFACE
	1963 SURFACE
	1947 SURFACE
	1930 SURFACE

SCALE	AS NOTED
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	11/17/05
JOB NO.	8065E

JOB  
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 FLUVIAL STUDY**  
 LOS ANGELES COUNTY CA

TITLE  
**HISTORICAL  
 CROSS SECTIONS  
 BY STATION**



FIGURE  
**5.21**

mining activities as evidenced by the cross-sections presented in this section. Placement of the bridges does not appear to have had a measurable impact on long-term bed characteristics, except for very local characteristics. The Highway 126 Bridge, for example, has not been outflanked by bed migration since its construction. Moreover, despite narrowing of the bed locally, bridge placement does not appear to have led to general bed degradation on the Creek as a whole. Periodic fires have burned the flora of the watershed historically, and as recently as Summer, 2004. Fires are important to changes of the Creek bed because these fires deplete vegetation stalks and root systems that hold soil in upland areas, in turn leading to increased erosion on slopes and increased sediment delivery to creeks and rivers. Agricultural fills are important to the historic Creek fluvial mechanics because the fills limit the extent to which the Creek may migrate, in turn possibly causing vertical erosion of the creek bed. LACDPW has noted that lateral erosion of agricultural fill has occurred periodically although no data presently available to date to gage the extent or depth of this erosion. Certainly the volume of fill laterally eroded is not sufficient to prevent vertical bed erosion: as noted in Table 4.2, above, the Creek can transport over 200,000 tons (approximately 90,000 cubic yards) of sediment per day. LACDPW has indicated that the constraining of the lateral erosion at the agricultural infill locations may exacerbate or exceed background erosion downstream. Of particular concern, LACDPW has singled out the northwest bank of the Creek upstream of the Highway 126 Bridge.

Table 5.1A shows the long-term historical cross-sections area from 1999 to 2005. The table lists the area for each historical section in a given subreach. The table also lists the difference between historical sections (e.g. 1999 section 6624 area – 2004 section 6624 area). Table 5.1B shows the historical cross-section average depth and average depth change by section and year. As noted above, the average depth is the area of a given section by year divided by the section geometric top width for that year. The difference between historical areas is also shown. It is important to note that a common minimum elevation is used for the area calculation of each section.

Section 9299 (SRA2) shows almost indiscernible change between 2004 and 2005 (Figure 5.2A) suggesting an armored condition of the bed below which it will not degrade. Between 1999 and 2005, 0.7 feet of aggradation appears to have occurred (Table 5.1A-B) on the section as a whole, although the thalweg is lower in 2005. The reason for this aggradation is unclear, however, it appears that the bed is recovering from historical gravel mining operations (shown in 1963 historical topography Appendix Chapter 5) that lowered the bed well below its present condition. The presence of a resistant Saugus formation sandstone outcrop at approximately station 1000 is evident in the 1930 and 1999-2005 topographies. The outcrop is not as evident in the 1947 and 1963 sections because of the limits of the historical topographies' resolutions on this portion of the Creek from these years. However, historical photographs (personal communication, Brian Swanson, Allan E. Seward Engineering Geology, May, 2005) do indicate the continual presence of this outcropping over the period of record.

Subreach	HEC-RAS Section	Area by Year (sf)			Δ Area by Year (sf)					
		1999	2004	2005	99-04	Change	04-05	Change	99-05	Change
SRA2	9299 <sup>1</sup>	3393	3047	3052	346	AGGRADE	-5	-	341	AGGRADE
SRA3	8050 <sup>1</sup>	6065	5270	5278	795	AGGRADE	-8	-	787	AGGRADE
SRA4	6624 <sup>1</sup>	2816	3359	3882	-543	DEGRADE	-523	DEGRADE	-1066	DEGRADE
SRB1	4572	3234	6717	7311	-3483	DEGRADE	-594	DEGRADE	-4077	DEGRADE
SRB2	2975	3273	5339	6278	-2066	DEGRADE	-939	DEGRADE	-3005	DEGRADE
SRB2	2627	7395	9279	10472	-1884	DEGRADE	-1193	DEGRADE	-3077	DEGRADE
SRB3	1982	3023	3881	4359	-858	DEGRADE	-478	DEGRADE	-1336	DEGRADE
SRB3	1645	2844	3531	2869	-687	DEGRADE	662	AGGRADE	-25	DEGRADE
SRB3	1531	2494	3359	2719	-865	DEGRADE	640	AGGRADE	-226	DEGRADE

<sup>1</sup>: THE PRESENCE OF GRAVEL MINING IN THE 1960'S HAS MODIFIED THE BED CROSS-SECTION

Section 8050 (SRA3) shows approximately no change between 2004 and 2005 suggesting armoring. Section 8050 also aggraded 0.6 feet between 1999 and 2005. The presence of historical gravel mining is much more prominent in 8050 whereby a deep, wide gravel pit is evident between approximately station 1000 and station 1275. Also, the main portion of the bed in 1963 shows signs of excavation. The 1999 section also appears to be recovering from the mining activity in a manner similar to the 9299 section upstream.

Subreach	HEC-RAS Section	Average Depth by Year = Area/Top Width (ft)			Δ Average Depth by Year (ft)					
		1999	2004	2005	99-04	Change	04-05	Change	99-05	Change
SRA2	9299 <sup>1</sup>	5.2	4.5	4.5	0.7	AGGRADE	0.0	-	0.7	AGGRADE
SRA3	8050 <sup>1</sup>	4.8	4.2	4.2	0.6	AGGRADE	0.0	-	0.6	AGGRADE
SRA4	6624 <sup>1</sup>	3.9	4.4	5.1	-0.6	DEGRADE	-0.7	DEGRADE	-1.3	DEGRADE
SRB1	4572	3.5	5.1	5.6	-1.6	DEGRADE	-0.5	DEGRADE	-2.1	DEGRADE
SRB2	2975	4.1	5.8	6.8	-1.7	DEGRADE	-1.0	DEGRADE	-2.7	DEGRADE
SRB2	2627	6.8	8.5	9.6	-1.7	DEGRADE	-1.1	DEGRADE	-2.8	DEGRADE
SRB3	1982	5.4	6.3	6.9	-0.9	DEGRADE	-0.6	DEGRADE	-1.5	DEGRADE
SRB3	1645	6.6	8.3	6.7	-1.6	DEGRADE	1.6	AGGRADE	-0.1	DEGRADE
SRB3	1531	6.9	7.9	7.3	-1.1	DEGRADE	0.6	AGGRADE	-0.4	DEGRADE

<sup>1</sup>: THE PRESENCE OF GRAVEL MINING IN THE 1960'S HAS MODIFIED THE BED CROSS-SECTION

Section 6624 (SRA4) shows continuous degradation over the period of record from 1999 to the present (1.3 feet, Table 5.1). Degradation in 1963 was likely the result of gravel mining, while more recent degradation may be the result to the completion of the upstream dam. Historical grading activities are evident on the west bank starting approximately at station 1000.

Section 4572 (SRB1) shows continuous degradation for the majority of the section from 1963 until the present. Degradation was 2.1 feet between 1999 and 2005 but only 0.5 feet between 2004 and 2005 (Table 5.1). It is important to note that since 1963 the bed has continued to channelize and incise most likely from construction of the dam upstream. Additionally, agricultural activities occur on both sides of the channel in this reach so it is possible that some of the channelization will have resulted from these activities. It is important to note, however, that agricultural activities were commenced prior to the construction of the dam and data from pre-construction times does not appear to indicate incisement.

Section 2975 (SRB2) shows continuous degradation since the construction of the Dam: 2.7 feet between 1999 and 2005 with the majority of the degradation between 2004 and 2005 occurring on the west side of the bed past station 850. The thalweg depths in both 1999 and 2004 are lower than in 2005 despite the continued

degradation into 2005 suggesting that the bed is approaching the armor depth below which no additional degradation will occur. The 1930 feature from station 1000 and to the west is the result of coarse resolution of the data in this portion of the Creek for that year. Section 2627 (SRB2) in the same reach as 2975 shows the same features and trends with similar average sectional degradation (2.8 feet at section 2627 vs. 2.7 feet at section 2975).

Three sections reside in SRB3: 1982, 1645 and 1531. For all three sections the topographies before the construction of the Dam are somewhat variable with respect to sectional characteristics such as depth and area. It should be noted that the west bank topographic data for these years is fairly coarse in the area of this subreach so the positions and elevations of the bank should be considered relative. The highway construction can be seen on the east side of these sections. The most upstream section 1982 degraded consistently between 1999 and 2005 by 1.5 feet on average and 0.6 feet on average between 2004 and 2005. The two downstream sections, section 1645 and section 1531, both degraded between 1999 and 2005 by 0.1 and 0.2 feet on average, respectively. These two sections aggraded, however, between 2004 and 2005 by 1.6 and 0.4 feet on average, respectively. While it is unclear why the observed aggradation occurred it is presently believed to be the result of the fires of Summer, 2004 and the heavy rains of the 2004/2005 rainy season. This combination had the potential to produce high sediment runoff loading into Hasley Canyon Creek, which confluences with Castaic Creek at Commerce Center Drive. Construction occurred on Hasley Canyon Creek prior to both the burn and high discharge events. How or if the construction may have contributed to the observed aggradation on Castaic Creek is presently unclear. It is important to note that the thalweg of Castaic Creek shifted away from the northwest bank in reach SRB3 during the 2004/2005 rainy season, as seen in Figure 5.2. The County has indicated that they believe the shift of thalweg location is the result of earth moving activities. Change in the position of the thalweg may also result from the confinement of the Creek under the Highway 126 Bridge such that the outside bank can no longer erode and the inside bank can not build.

Presently, the historic record is too short with respect to long-term changes in the watershed to determine how land use changes have played a role in creek bed fluctuation as they relate to changes in sediment transport. It does appear that the placement of the Dam on the Creek has played a role in channelizing the Creek over a large portion of the project whereby most sections examined have degraded since the completion of the Dam. It is expected that the presence of the Dam on the Creek has altered the fluvial mechanics of the Creek although long term sediment gradation data is not available at the time of this study. Of the few sections which have aggraded, this aggradation appears to be the result of the creek bed recovering from gravel mining operations upstream of Commerce Center Drive, as shown in the 1963 historic topography (Appendix Chapter 5) or from episodic events in the vicinity of Highway 126. Large scale modifications to the watershed as a whole are a more recent occurrence within the historical record. Agricultural practices may have had an impact on creek fluvial mechanics within the study reach but the impacts of these practices appear to be minimal compared to the completion of dam construction. For the purpose of this study, long-term degradation is calculated as the difference between the 1999 and 2005 beds.

### **5.1 Castaic Creek Water Surface Elevations at Santa Clara River**

Historical aerial photography shows the presence of the thalweg originating from Castaic Creek and flowing into Santa Clara River primarily at the western edge of the confluence. Because the proposed Landmark Village soil cement bank protection will tie into the western side of the State Highway 126 Bridge at the confluence it is important to understand the potential impacts to the proposed Landmark project and the existing Travel Village posed by the Creek. To determine what impacts may occur a model of Castaic Creek was run with a Manning's number of  $n=0.085$ , based on Los Angeles County criteria. The model was run for the  $Q_{CAP}$  discharge. The model results show that the water surface elevation does not change more than approximately 0.1 feet between the existing and proposed condition. This data is shown in Table 5.2. Because the impacts of this analysis are negligible, an additional model with Manning's number of  $n=0.025$  was run for the Creek for both the existing and proposed condition. The results are shown in Table 5.3. The table shows that the velocities in the existing and proposed conditions do not vary more than 0.2 fps.

Table 5.2 Difference Between Existing & Proposed Condition Water Surface Elevation on Castaic Creek Below HWY 126 Bridge				
HEC-RAS Section	Existing Condition WSE (ft)	Proposed Condition WSE (ft)	Difference	
1305.93	967.6	967.6	0.0	
1172.93 44	967.2	967.2	0.0	
1122.93 43	967.0	966.9	-0.1	
1072.93 42	966.7	966.7	0.0	
1022.93 41	966.2	966.2	0.0	
972.93 40	965.9	965.9	0.0	
922.93 39	965.5	965.5	0.0	
872.93 38	965.3	965.3	0.0	
822.93 37	965.1	965.1	0.0	
772.93 36	964.9	964.8	-0.1	
722.93 35	964.6	964.6	0.0	
672.93 34	964.4	964.4	0.0	
622.93 33	964.2	964.2	0.0	
572.93 32	964.0	963.9	-0.1	
522.93 31	963.7	963.7	0.0	
472.93 30	963.4	963.4	0.0	
422.93 29	963.3	963.3	0.0	
372.93 28	963.1	963.1	0.0	
322.93 27	963.0	963.0	0.0	
272.93 26	962.8	962.8	0.0	
222.93 25	962.7	962.7	0.0	
172.93 24	962.6	962.6	0.0	
122.93 23	962.5	962.5	0.0	
72.93 22	962.4	962.4	0.0	
22.93 21	962.4	962.4	0.0	
-27.07 20	962.3	962.3	0.0	
-77.07 19	962.3	962.3	0.0	
-127.07 18	962.2	962.2	0.0	
-177.07 17	962.2	962.2	0.0	
-227.07 16	962.2	962.2	0.0	
-277.07 15	962.2	962.2	0.0	
-327.07 14	962.1	962.1	0.0	
-377.07 13	962.1	962.1	0.0	
-427.07 12	962.1	962.1	0.0	
-477.07 11	962.1	962.1	0.0	
-527.07 10	962.1	962.1	0.0	
-577.07 9	962.1	962.1	0.0	
-627.07 8	962.1	962.1	0.0	
-677.07 7	962.0	962.0	0.0	
-727.07 6	962.0	962.0	0.0	
-777.07 5	962.0	962.0	0.0	
-827.07 4	962.0	962.0	0.0	
-877.07 3	962.0	962.0	0.0	
-927.07 2	962.0	962.0	0.0	
-977.07 1	962.0	962.0	0.0	

HEC-RAS Section	Existing Condition Channel Velocity (fps)	Proposed Condition Channel Velocity (fps)	Difference
1305.93	8.3	8.3	0.0
1172.93 44	8.2	8.2	0.0
1122.93 43	8.9	8.9	0.0
1072.93 42	8.9	8.9	0.0
1022.93 41	12.3	12.3	0.0
972.93 40	11.5	11.5	0.0
922.93 39	11.0	11.0	0.0
872.93 38	9.2	9.2	0.0
822.93 37	7.6	7.6	0.0
772.93 36	7.8	7.8	0.0
722.93 35	7.4	7.4	0.0
672.93 34	6.9	6.9	0.0
622.93 33	6.5	6.5	0.0
572.93 32	6.3	6.3	0.0
522.93 31	5.6	5.6	0.0
472.93 30	5.6	5.6	0.0
422.93 29	4.7	4.7	0.0
372.93 28	4.4	4.4	0.0
322.93 27	4.5	4.5	0.0
272.93 26	4.3	4.3	0.0
222.93 25	4.1	4.1	0.0
172.93 24	3.5	3.5	0.0
122.93 23	3.1	3.1	0.0
72.93 22	2.9	2.9	0.0
22.93 21	2.6	2.6	0.0
-27.07 20	2.3	2.3	0.0
-77.07 19	2.0	2.0	0.0
-127.07 18	1.9	1.9	0.0
-177.07 17	1.8	1.8	0.0
-227.07 16	1.7	1.7	0.0
-277.07 15	1.6	1.6	0.0
-327.07 14	1.3	1.4	0.1
-377.07 13	1.2	1.3	0.1
-427.07 12	1.0	1.2	0.2
-477.07 11	1.0	1.2	0.2
-527.07 10	0.9	1.1	0.2
-577.07 9	0.9	1.1	0.2
-627.07 8	0.9	1.1	0.2
-677.07 7	1.0	1.0	0.0
-727.07 6	1.0	1.0	0.0
-777.07 5	0.7	0.9	0.2
-827.07 4	0.7	0.8	0.1
-877.07 3	0.6	0.8	0.2
-927.07 2	0.6	0.8	0.2
-977.07 1	0.6	0.8	0.2

## 5.2 Single Season Bed Adjustment

With historical topography from successive years, estimates of single-season change can be developed. This is a powerful tool because it can be used to determine the predictive accuracy of SAM modeling. The 2004-2005 rain season was wet on Castaic Creek with strong rain events occurring on already saturated soils both in December, 2004 and January, 2005. These events produced very high discharges on the Creek. Topography from before and after these events provides a tool to estimate the impacts of a single large discharge event, in general, and single season cumulative impacts. The 2004 and 2005 beds are described in Table 5.1 and Figure 5.2A-I. The table and figure illustrate that the bed elevations show no change in the average bed elevation upstream of section 8050 while sections 1982 to 6624 show some degradation from 0.5 to 1.0 feet on average. Aggradation at section 1531 and 1645 is 0.4 and 1.6 feet on average, respectively, and is believed to be due to the Hasley Canyon confluence as noted above. For comparison, aggradation predicted by SAM in the proposed condition (Table 4.2B) occurs in subreaches SRA3, SRA4 and SRB3 and ranges from 0.3 feet (SRA3) to 2.6 feet (SRB3). The values of bed change estimated by SAM are approximately twice that as those observed in the topographic datasets and reach SRA3 and SRA4 predict the opposite trend. These differences can be attributed to the discontinuous nature of the zero-dimensional SAM model. It is important to note, however, that the SAM estimate of general adjustment degradation is more conservative than the change shown above. Final design will be based on the deeper of LACH&SM using SAM and LACFCDDM criteria.

## 5.3 Protection of Highway 126 Northwest Abutment

LACDPW has noted that they believe the placement of the soil cement on the banks of Castaic Creek upstream of Highway 126 may impact the abutment on the northwest bank. This belief was partially predicated by the partial erosion of agricultural fill observed by LACDPW personnel following large discharge events. No data pertaining to any erosion of fill is available at the time of writing. LACDPW believes that the erosion of fill is related to the flow of the Creek trying to maintain a large-radius bend from the Creek into the Santa Clara River confluence. LACDPW has noted concern that if the agricultural fill is protected behind the proposed soil cement bank protection that the flow of the Creek will be directed at the northwest bank adjacent to the Highway 126 Bridge abutment causing erosion that will eventually outflank the abutment and thereby cause failure of the bridge. In previous drafts of this report HEC-RAS numerical modeling was included that compared the existing and proposed conditions water surface elevation and velocity. The modeling indicated that no significant change in water surface elevation or velocity was expected. Another version of the same model was included that modified the existing condition so that erosion of the northwest bank fill was accounted for by removing 50 feet of fill for approximately 2500 feet of channel length. This modeling found no significant changes between the existing-eroded condition and the proposed condition water surface elevation and velocity. LACDPW indicated that they believed the one-dimensional nature of HEC-RAS made it insufficient to

address the velocity and water surface elevation changed between the existing and proposed conditions.

To resolve the issue of the protection of the Highway 126 Bridge abutment an extension of the abutment will be constructed. This extension, shown in Figure 1.1, will continue from the existing abutment to the northwest and tie in to existing Saugus formation sandstone. Allan Seward Engineering Geology has conducted a preliminary investigation of the soils in the area and indicated that there is most likely sufficient sandstone in the vicinity of the Bridge to complete the tie-in of the abutment extension. The draft report is included in Appendix Chapter 5. A final draft of the Seward report will be made available prior to construction to verify the location of sandstone deposits. The extension of the abutment will be buried following construction and will only be utilized if the fill material covering the extension is eroded by hydraulic action of the Creek. The topography of the area at the tie-in is sufficiently steep to ensure that the extension will not be out flanked by Creek flow (See Exhibit). The Saugus sandstone is a moderately cemented material that is much less erodible than the fluvial deposits that form the creek bed. This resistant material can be seen at section 9299, as noted above, where cross-section data indicates that exposed Saugus sandstone has been persistent for the period of record. Communications with LACDPW's Geotechnical & Materials Engineering Division (Charles Nestle, personal communication, 11/2/05) has concurred with this analysis. To address LACDPW concerns as to the curvature of the existing-eroded condition, a curved path based on the 1947 historical thalweg was used for existing conditions calculations in Chapter 6 below. This path and its radius are illustrated in Appendix Chapter 6.

## 6 Other Scour

The calculation of scour depth for design of toe-down for structures is given in Chapter 5 of LACH&SM. The manual defines the toe-down depth as the sum of long-term adjustment, general adjustment, and four local effects that fall into the category of other scour. Other scour falls into four sub-categories: local scour, bend scour, low-flow incisement, and bed form height. Local scour occurs in the vicinity of flow obstructions including piers and abutments. Bend scour occurs because of differential velocity gradients around curves in open channel flow. Four distinct bends are located in the River between Interstate 5 and the Santa Clara River. These existing bends have radii of 1313, 1894, 747 and 848 feet from north to south in the Creek, respectively. The bends can be seen in Figure 1.1. Bend scour is based on Zeller (1981), as directed in LACH&SM. Low flow incisement is included to represent thalweg or low flow channel depth. On-site inspection and analysis of historic topographic data of this feature estimates the thalweg at approximately two feet. Finally, bed form height represents the dunes and anti-dunes that develop in active soft bottomed channels during flow events. Because no observations are available, bed form height has been limited after Kennedy (1963) as presented in LACH&SM.

Bend scour and bed form height have been calculated based on the 1993 LACH&SM design curves in Chapter 5 and Appendix Q. Bend scour is based on equation Q-6A of the manual, given as (Zeller, 1981):

$$Z_{bs} = \frac{0.0685YV^{0.8}}{Y_h^{0.4}S_e^{0.3}} \left[ 1.59 \left( \frac{w}{r} \right)^{0.2} - 1 \right]$$

where  $Z_{bs}$  is the bend scour depth,  $V$  is mean velocity,  $Y$  is maximum depth of flow,  $Y_h$  is hydraulic depth of flow,  $S_e$  is energy slope,  $w$  is channel top width, and  $r$  is radius of curvature to the centerline of the channel. It is important to note that  $w/r > 0.1$  is the approximate limit of the equation. Bed form height is given by equation Q-8 of the manual, given as (Kennedy, 1963):

$$h = 0.027V^2$$

where  $h$  is bed form height.

Results of calculations of other scour components are summarized in LACH&SM calculations tables in Appendix Chapter 6 for both the existing and proposed conditions. The tables show that in the existing and proposed conditions bend scour varies from 0.0 to 9.2 feet. Change in bend scour is observed at the bend upstream of the Santa Clara River confluence. The existing eroded-condition radius has been estimated based on the historical 1947 thalweg as 2677 feet and is presented in Appendix Chapter 6. The curve extends from section 3865 to section 1531 and bend scour ranges from 0.7 to 4.1 feet with the maximum bend scour located at section 3290. In the proposed condition the curve extends from section 1982 to section 1645 and has a radius of 848 feet with bend scour ranging from 4.7 to 5.9 feet. Generally, the areas with the highest bend scour have the highest top width to radius ratio, as seen in subreach SRA1, for example. For both the existing and proposed conditions

the table also shows that bed form half height ranges from 0.2 feet to 3.5 feet in the existing condition and 0.2 to 4.3 feet in the proposed condition. Bed form height is controlled by velocity so the areas with the highest velocities, particularly in SRA1, have the tallest bed forms. Local scour for the proposed condition ranges from 0.0 to 16.0 feet and is only present at the various bridge creek crossings. Commerce Center Bridge has the greatest local scour.

Subreach	Section	Existing Condition		Proposed Condition		Δ Curved	Δ Straight
		Outside Curved Reach	Straight-Inside Curved Reach	Outside Curved Reach	Straight-Inside Curved Reach		
SRA1	12407	11.4	2.2	11.4	2.2	0.0	0.0
	12162	17.5	15.5	17.5	15.5	0.0	0.0
	11957	5.9	4.0	5.9	4.0	0.0	0.0
	11878	18.3	16.3	18.3	16.3	0.0	0.0
	11846	5.9	3.2	5.9	3.2	0.0	0.0
	11812	8.5	5.2	6.8	5.2	-1.7	0.0
	11551	11.0	5.2	8.9	5.2	-2.1	0.0
	11243	10.4	5.2	9.0	5.2	-1.4	0.0
	10983	13.2	4.8	11.1	4.8	-2.1	0.0
SRA2	10738	8.4	5.3	7.7	5.3	-0.7	0.0
	10491	7.7	4.2	7.7	4.2	0.0	0.0
	10351	8.2	5.4	8.2	5.4	0.0	0.0
	10142	4.3	4.3	4.3	4.3	0.0	0.0
	9931	4.1	4.1	4.2	4.2	0.1	0.1
	9671	2.9	2.9	3.2	3.2	0.3	0.3
	9502	3.5	3.5	3.5	3.5	0.0	0.0
	9299	3.8	3.8	3.8	3.8	0.0	0.0
SRA3	9043	3.9	3.9	3.9	3.9	0.0	0.0
	8725	7.2	3.3	7.2	3.3	0.0	0.0
	8396	6.7	3.6	6.6	3.6	-0.1	0.0
	8050	7.1	2.6	7.0	2.7	-0.1	0.1
	7689	6.8	3.4	6.5	2.8	-0.3	-0.6
SRA4	7326	5.8	3.1	5.8	2.6	0.0	-0.5
	6967	7.7	2.7	5.9	2.6	-1.8	-0.1
	6624	9.1	3.6	5.7	3.2	-3.4	-0.4
	6305	6.9	3.6	6.3	4.5	-0.6	-0.9
	5992	6.5	3.7	6.3	4.7	-0.2	1.0
	5629	5.0	2.9	4.8	2.5	-0.2	-0.4
	5558	22.5	20.5	21.0	18.4	-1.5	-2.1
	5454	7.7	3.1	8.5	2.5	0.8	-0.6
	5434	8.5	3.1	9.8	2.5	1.3	-0.6
	SRB1	5340	12.7	4.0	11.2	4.7	-1.5
	5061	4.7	4.7	6.3	6.3	1.6	1.6
	4900	4.2	4.2	5.3	5.3	1.1	1.1
	4572	3.2	3.2	3.8	3.8	0.6	0.6
	4221	4.0	4.0	4.4	4.4	0.4	0.4
SRB2	3865	7.6	5.4	6.0	6.0	-1.6	0.6
	3580	7.8	5.0	5.0	5.0	-2.8	0.0
	3290	8.1	4.0	4.3	4.3	-3.8	0.3
	2975	6.6	4.5	5.5	5.5	-1.1	1.0
	2627	7.4	3.5	3.6	3.6	-3.8	0.1
SRB3	2308	6.3	3.0	3.1	3.1	-3.2	0.1
	1982	6.1	4.1	10.0	4.1	3.9	0.0
	1645	4.5	3.3	8.0	3.3	3.5	0.0
	1531	5.4	4.7	4.7	4.7	-0.7	0.0
	1462	5.5	5.5	5.5	5.5	0.0	0.0
	1415	3.2	3.2	3.2	3.2	0.0	0.0
	1306	17.2	17.2	17.2	17.2	0.0	0.0
	1173	4.3	4.3	4.3	4.3	0.0	0.0

## 7 Total Scour

To be conservative, general adjustment, long-term adjustment and other scour are summed to determine total potential bed adjustment following LACH&SM methodology, as presented in Chapter 5 of the LACH&SM manual. SAM values for general adjustment, and the long-term analysis presented in Chapter 5 represent long term trends. Previous versions of this report used long-term analysis based on historical thalweg analysis. The presently employed cross-section analysis provides greater detail at individual sections and has replaced the thalweg analysis. The historical thalweg analysis is included in Appendix Chapter 5 for completeness. Individual and combined scour components are shown in Figure 7.1A-D and Table 7.1A-D, for the existing and proposed conditions, respectively. For cross-sections where SAM modeling predicts aggradation, the general adjustment contribution to total bed adjustment is not included. This conservative approach ensures that major trends are captured by the study but local or minor bed adjustments do not decrease total potential degradation. Long-term degradation values are taken as the larger of long-term degradation or two feet. Table 7.1A-D shows that total bed degradation outside of curved reaches ranges from approximately -5.0 to -16.1 feet in the existing condition at sections 2308 and 5340, respectively. Inside of curved reaches and in straight reaches in the existing condition, total degradation ranges from -5.0 to -8.8 feet at sections 2308 and 3865, respectively. In the proposed condition total bed degradation outside of curved reaches range from approximately -5.1 to -16.6 feet at sections 2308 and 5340, respectively. Inside of curved reaches and in straight reaches in the proposed condition, total degradation ranges from -4.6 to -10.1 feet at sections 7326 and 5340, respectively. The largest adjustment for both conditions is in the vicinity of a bend in the Commerce Center Drive Bridge abutment. The existing and proposed conditions closely match at all sections except at 3865 where general adjustment and other components are higher in the proposed condition. It is important to note that the total toe-down is primarily a function of the large other components, which exceed the general adjustment and long-term degradation components by approximately two or more times.

Subreach	US Section	Z <sub>DEG</sub> <sup>2</sup>	Z <sub>GS</sub> (SAM) <sup>1</sup>	Z <sub>OTHER</sub> <sup>3</sup>	Z <sub>TOTAL</sub>
SRA1	12407	-2.0	-2.3	-11.4	-15.7
SRA2	10738	-2.0	-1.3	-8.4	-11.7
SRA3	9043	-2.0	0.1	-3.9	-5.9
SRA4	7326	-2.0	1.0	-5.8	-7.8
SRB1	5340	-2.1	-1.3	-12.7	-16.1
SRB2	3865	-2.7	-0.7	-5.4	-8.8
SRB3	2308	-2.0	3.1	-3.0	-5.0

Table 7.1B: Castaic Creek Proposed Conditions Outside Curved Reach Summary of Degradation Components (ft)					
Subreach	US Section	Z <sub>DEG</sub> <sup>2</sup>	Z <sub>GS</sub> (SAM) <sup>1</sup>	Z <sub>OTHER</sub> <sup>3</sup>	Z <sub>TOTAL</sub>
SRA1	12407	-2.0	-2.4	-11.4	-15.8
SRA2	10738	-2.0	-1.5	-7.7	-11.2
SRA3	9043	-2.0	0.3	-3.9	-5.9
SRA4	7326	-2.0	1.9	-5.8	-7.8
SRB1	5340	-2.1	-3.3	-11.2	-16.6
SRB2	3865	-2.7	-1.0	-6.0	-9.7
SRB3	2308	-2.0	2.4	-3.1	-5.1

Table 7.1C: Castaic Creek Existing Conditions Straight-Inside Curved Reach Summary of Degradation Components (ft)					
Subreach	US Section	Z <sub>DEG</sub> <sup>2</sup>	Z <sub>GS</sub> (SAM) <sup>1</sup>	Z <sub>OTHER</sub> <sup>3</sup>	Z <sub>TOTAL</sub>
SRA1	12407	-2.0	-2.3	-2.2	-6.5
SRA2	10738	-2.0	-1.3	-5.3	-8.5
SRA3	9043	-2.0	0.1	-3.9	-5.9
SRA4	7326	-2.0	1.0	-3.1	-5.1
SRB1	5340	-2.1	-1.3	-4.0	-7.4
SRB2	3865	-2.7	-0.7	-5.4	-8.8
SRB3	2308	-2.0	3.1	-3.0	-5.0

Table 7.1D: Castaic Creek Proposed Conditions Straight-Inside Curved Reach Summary of Degradation Components (ft)					
Subreach	US Section	Z <sub>DEG</sub> <sup>2</sup>	Z <sub>GS</sub> (SAM) <sup>1</sup>	Z <sub>OTHER</sub> <sup>3</sup>	Z <sub>TOTAL</sub>
SRA1	12407	-2.0	-2.4	-2.2	-6.5
SRA2	10738	-2.0	-1.5	-5.3	-8.8
SRA3	9043	-2.0	0.3	-3.9	-5.9
SRA4	7326	-2.0	1.9	-2.6	-4.6
SRB1	5340	-2.1	-3.3	-4.7	-10.1
SRB2	3865	-2.7	-1.0	-6.0	-9.7
SRB3	2308	-2.0	2.4	-3.1	-5.1

<sup>1</sup>Positive values in Z<sub>GS</sub> represent aggradation

<sup>2</sup>Greater of the historical cross-section analysis or 2'; based on single cross-section

<sup>3</sup>LACH&SM calculations represent one cross-section. Data for as sections is presented in Appendix Ch. 6

Z<sub>DEG</sub>: Long-term degradation; Z<sub>GS</sub>: General adjustment degradation

Figure 7.2A-D presents a comparison of total bed adjustment for the summed methodology, presented above, and the methodology based on the Los Angeles County Flood Control District's Design Manual (LACFCDDM), Table F-31. Calculations are shown in Table 7.2A-D. The LACFCDDM methodology is based only on velocity and does not account for any other river parameters. Generally, the LACFCDDM is the most conservative among all total scour methodologies. With the exception of the Hasley Canyon confluence where the proposed condition is more narrow than the existing condition, and at the Interstate 5 Bridge, Figure 7.2A-D shows

that the more intensive LACH&SM methodology predicts a shallower toe-down in both the existing and proposed conditions than does the LACFCDDM methodology for most sections. The LACFCDDM does not effectively account for the local degradation, therefore, the LACH&SM methodology utilizing SAM calculations predicts a deeper toe-down at some locations than does the LACFCDDM methodology. Figure 7.3A-B shows the 1999 (model) minimum bed elevation as discussed in Chapter 4, previously, and the the total toe-down expected to be needed to protect each condition. The figure shows little change between the existing and proposed conditions except in the vicinity of the proposed commerce center bridge and downstream of the Hasley Creek Confluence.

Table 7.2A: Castaic Creek Existing Conditions Outside Curved Reach Toe-down Summary by Methodology (ft) <sup>1</sup>

Subreach	US Section	HEC-RAS Model (1999) Elevation	LACH&SM (SAM)	LACH&SM Toe-down Elevation	LACFCDDM	LACFCDDM Toe-down Elevation
SRA1	12407	1023.8	-15.7	1008.1	-9.0	1014.8
SRA2	10738	1016.0	-11.7	1004.3	-18.0	998.0
SRA3	9043	1000.0	-5.9	994.1	-10.0	990.0
SRA4	7326	988.0	-7.8	980.2	-12.0	976.0
SRB1	5340	978.0	-16.1	961.9	-15.0	963.0
SRB2	3865	970.0	-8.8	961.2	-12.5	957.5
SRB3	2308	960.0	-5.0	955.0	-8.0	952.0

Table 7.2B: Castaic Creek Proposed Conditions Outside Curved Reach Toe-down Summary by Methodology (ft) <sup>1</sup>

Subreach	US Section	HEC-RAS Model (1999) Elevation	LACH&SM (SAM)	LACH&SM Toe-down Elevation	LACFCDDM	LACFCDDM Toe-down Elevation
SRA1	12407	1023.8	-15.8	1008.0	-9.0	1014.8
SRA2	10738	1016.0	-11.2	1004.8	-18.0	998.0
SRA3	9043	1000.0	-5.9	994.1	-10.0	990.0
SRA4	7326	988.0	-7.8	980.2	-12.0	976.0
SRB1	5340	980.0	-16.6	963.4	-15.0	965.0
SRB2	3865	970.0	-9.7	960.3	-12.5	957.5
SRB3	2308	960.0	-5.1	954.9	-8.0	952.0

Table 7.2C: Castaic Creek Existing Conditions Straight-Inside Curved Reach Toe-down Summary by Methodology (ft) <sup>1</sup>

Subreach	US Section	HEC-RAS Model (1999) Elevation	LACH&SM (SAM)	LACH&SM Toe-down Elevation	LACFCDDM	LACFCDDM Toe-down Elevation
SRA1	12407	1023.8	-6.5	1017.3	-6.0	1017.8
SRA2	10738	1016.0	-8.5	1007.5	-12.5	1003.5
SRA3	9043	1000.0	-5.9	994.1	-10.0	990.0
SRA4	7326	988.0	-5.1	982.9	-8.0	980.0
SRB1	5340	978.0	-7.4	970.6	-10.0	968.0
SRB2	3865	970.0	-8.8	961.2	-12.5	957.5
SRB3	2308	960.0	-5.0	955.0	-8.0	952.0

Table 7.2D: Castaic Creek Proposed Conditions Straight-Inside Curved Reach Toe-down Summary by Methodology (ft) <sup>1</sup>

Subreach	US Section	HEC-RAS Model (1999) Elevation	LACH&SM (SAM)	LACH&SM Toe-down Elevation	LACFCDDM	LACFCDDM Toe-down Elevation
SRA1	12407	1023.8	-6.5	1017.3	-6.0	1017.8
SRA2	10738	1016.0	-8.8	1007.2	-12.5	1003.5
SRA3	9043	1000.0	-5.9	994.1	-10.0	990.0
SRA4	7326	988.0	-4.6	983.4	-8.0	980.0
SRB1	5340	980.0	-10.1	969.9	-10.0	970.0
SRB2	3865	970.0	-9.7	960.3	-12.5	957.5
SRB3	2308	960.0	-5.1	954.9	-8.0	952.0

<sup>1</sup>: Based on upstream cross-section. Complete data included in Appendix Chapter 6

Previous studies presented in Chapter 2, previously, found that 3 feet of toe-down would be required for adequate protection of most reaches, while the bed in the vicinity of bridge abutments may require up to 12 feet of toe-down. It should be noted that the SLA study does not appear to consider long-term degradation or local scour in this 3 feet value.

### 7.1 Freeboard Elevation

Freeboard is considered for the purposes of this report to be the additional height required above the top of a levee or other bank protection to prevent overtopping. The factors considered in the calculation of freeboard are long-term adjustment as aggradation, general adjustment as aggradation, super elevation and bed form height. Freeboard elevation is calculated in this study based on LACH&SM Chapter 5A-3, and includes LACFCDDM calculations. Freeboard calculations are presented in Appendix 6. Long-term adjustment was calculated based on historical records in the form of topographic data, and taken as the greater of positive long-term area change values as presented in Table 5.1B, or one foot. General adjustment is taken from SAM aggradation values. For cross-sections where SAM modeling predicts degradation, the general adjustment contribution to freeboard is not included. This conservative approach ensures that major trends are captured by the study but local or minor bed adjustments do not decrease total potential aggradation. Table 7.3A-B summarizes the freeboard calculations for both outside curved reaches (A) and inside curved or straight reaches (B). The table shows that long-term aggradation is generally set to one foot. General aggradation ranges from 0 to 2.6 feet with the maximum general aggradation occurring in subreach SRB3. In all cases either long-term or general aggradation account for the largest component of freeboard. The table also compares the freeboard based on LACH&SM and LACFCDDM methodologies. At most locations the LACFCDDM values are more conservative and the maximum calculated freeboard of either methodology ranges from 2.5 to 3.9 feet.

Table 7.3A: Castaic Creek Proposed Conditions Outside Curved Reach Freeboard Summary (ft)

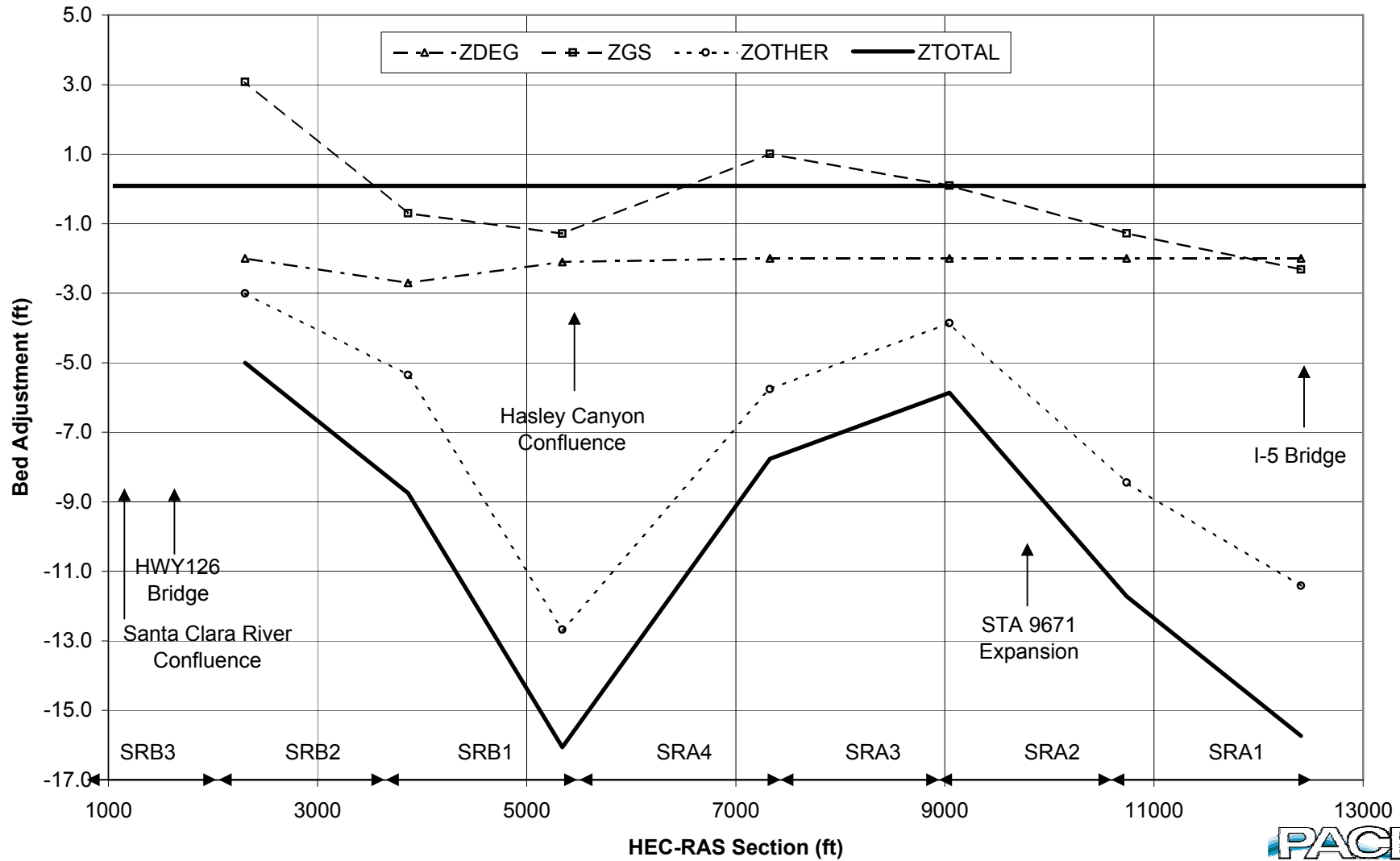
Subreach	HEC-RAS Section	Y <sub>AGG+</sub>	Y <sub>GA+</sub>	Y <sub>SE+</sub>	H/2	Y <sub>H&amp;SM</sub>	Y <sub>DM</sub>	Y <sub>MAX</sub>
SRA1	12407	1.0	0.0	0.0	0.0	1.0	2.5	2.5
SRA2	10738	1.0	0.0	0.2	0.6	1.8	2.5	2.5
SRA3	9043	1.0	0.3	0.0	0.4	1.7	2.5	2.5
SRA4	7326	1.0	1.9	0.1	0.2	3.1	2.5	3.1
SRB1	5340	1.0	0.0	0.8	1.0	2.8	2.5	2.8
SRB2	3865	1.0	0.0	0.0	0.7	1.7	2.5	2.5
SRB3	2308	1.0	2.4	0.0	0.3	3.7	2.5	3.7

Table 7.3B: Castaic Creek Proposed Conditions Straight-Inside Curved Reach Freeboard Summary (ft)

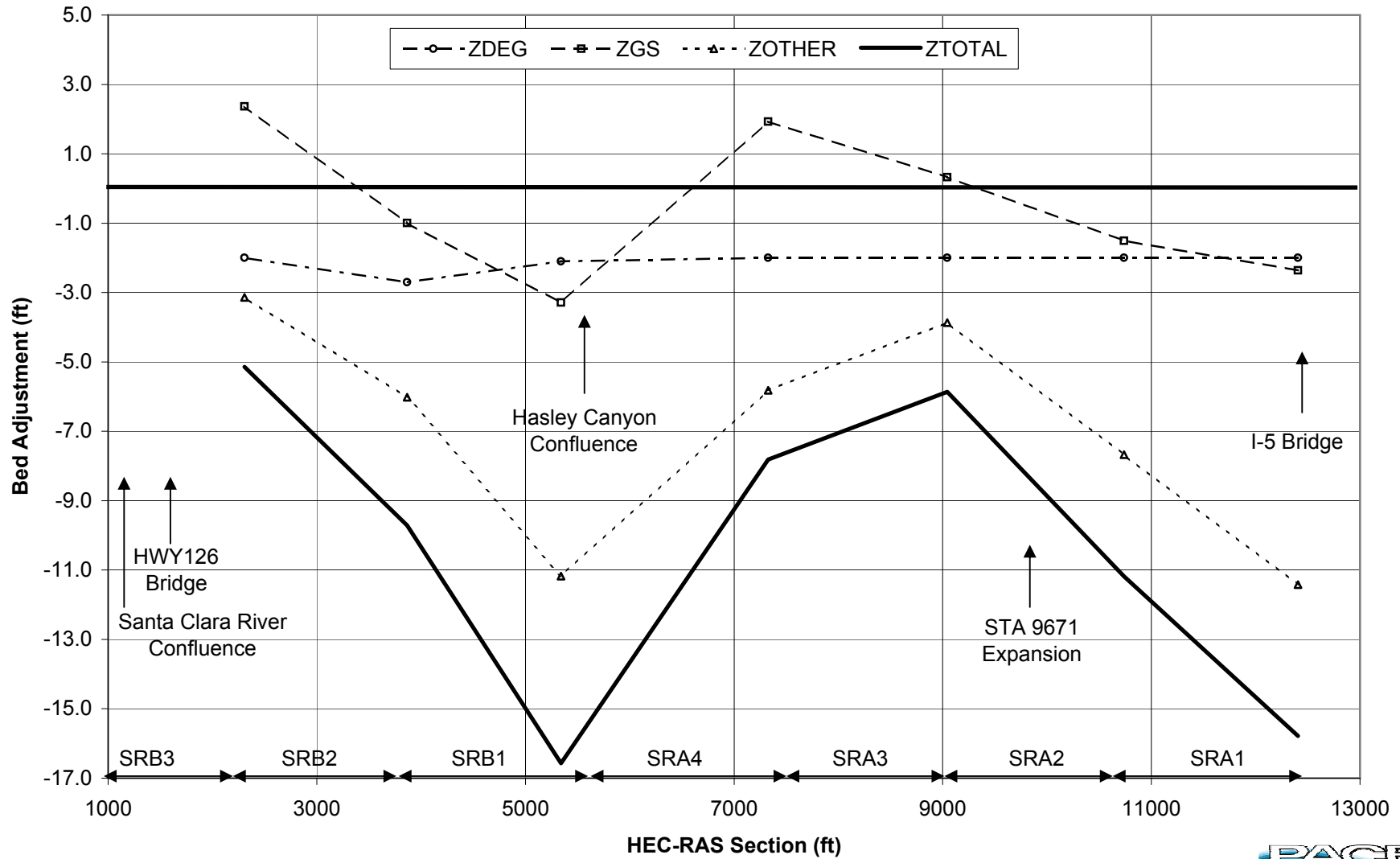
Subreach	HEC-RAS Section	Y <sub>AGG+</sub>	Y <sub>GA+</sub>	Y <sub>SE+</sub>	H/2	Y <sub>H&amp;SM</sub>	Y <sub>DM</sub>	Y <sub>MAX</sub>
SRA1	12407	1.0	0.0	0.0	0.0	1.0	2.5	2.5
SRA2	10738	1.0	0.0	0.0	0.6	1.6	2.5	2.5
SRA3	9043	1.0	0.3	0.0	0.4	1.7	2.5	2.5
SRA4	7326	1.0	1.9	0.0	0.2	3.1	2.5	3.1
SRB1	5340	1.0	0.0	0.0	1.0	2.0	2.5	2.5
SRB2	3865	1.0	0.0	0.0	0.7	1.7	2.5	2.5
SRB3	2308	1.0	2.4	0.0	0.3	3.7	2.5	3.7

YAGG: LONG-TERM AGGRADATION; YGA: GENERAL AGGRADATION; YSE: SUPER ELEVATION ADJUSTMENT; H: BEDFORM HEIGHT;  
 YH&SM: TOTAL FREEBOARD BASED ON LACDPW H&SM METHODOLOGY; YDM: TOTAL FREEBOARD BASED ON LACFDDM METHODOLOGY;  
 YMAX: LARGER OF YH&SM AND YDM. YAGG IS CALCULATED AS THE GREATER OF LONG TERM AGGRADATION FROM TABLE 5.1 OR 1 FOOT.  
 GENERAL ADJUSTMENT IS TAKEN FROM SAM MODELING FOR AN ENTIRE REACH WHILE OTHER VALUES ARE FOR INDIVIDUAL SECTIONS.  
 COMPLETE OUTPUT BY SECTION CAN BE FOUND IN APPENDIX CHAPTER 6.

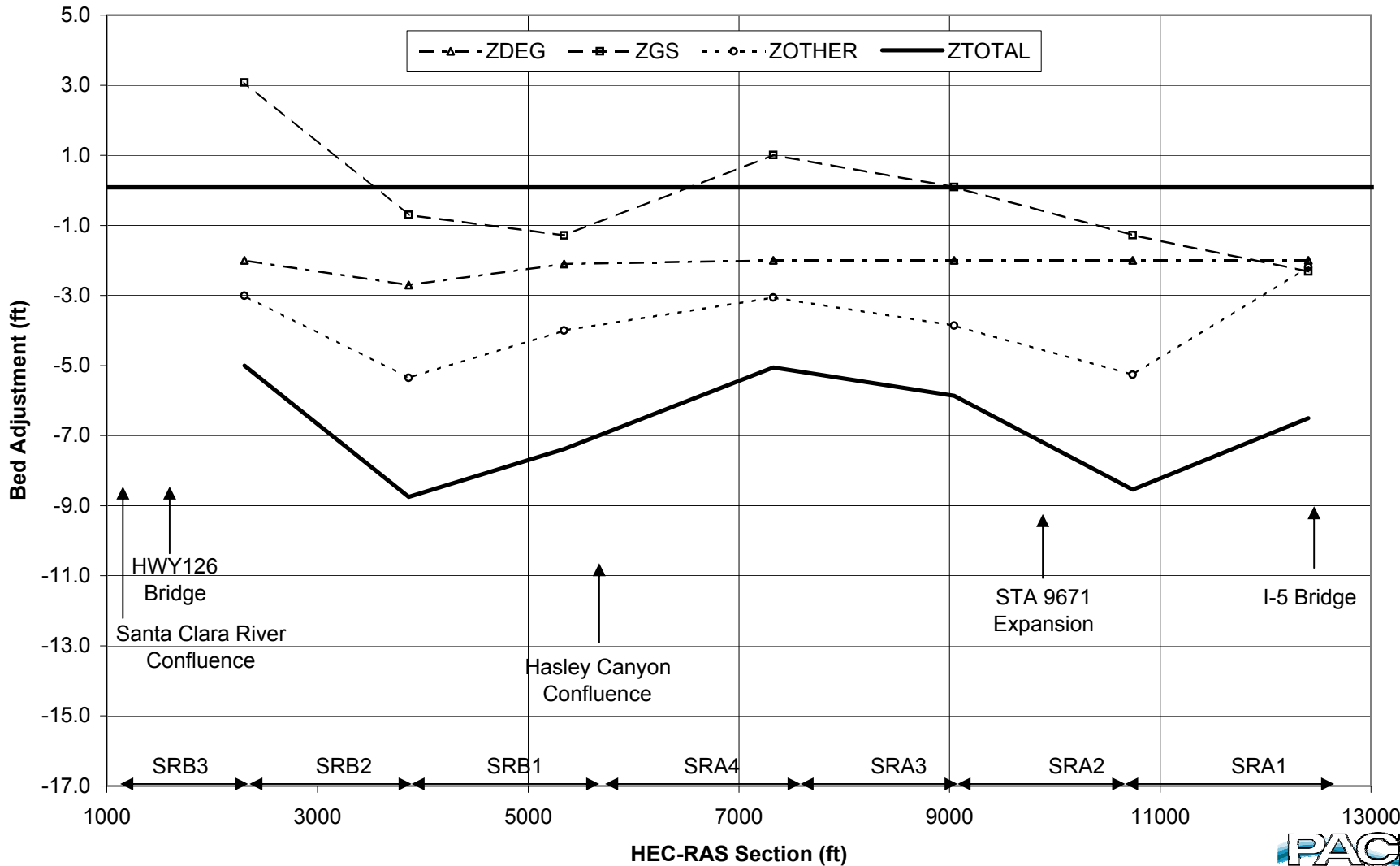
**Figure 7.1A: Castaic Creek Existing Conditions Outside Curved Reach Summary of Degradation Components**



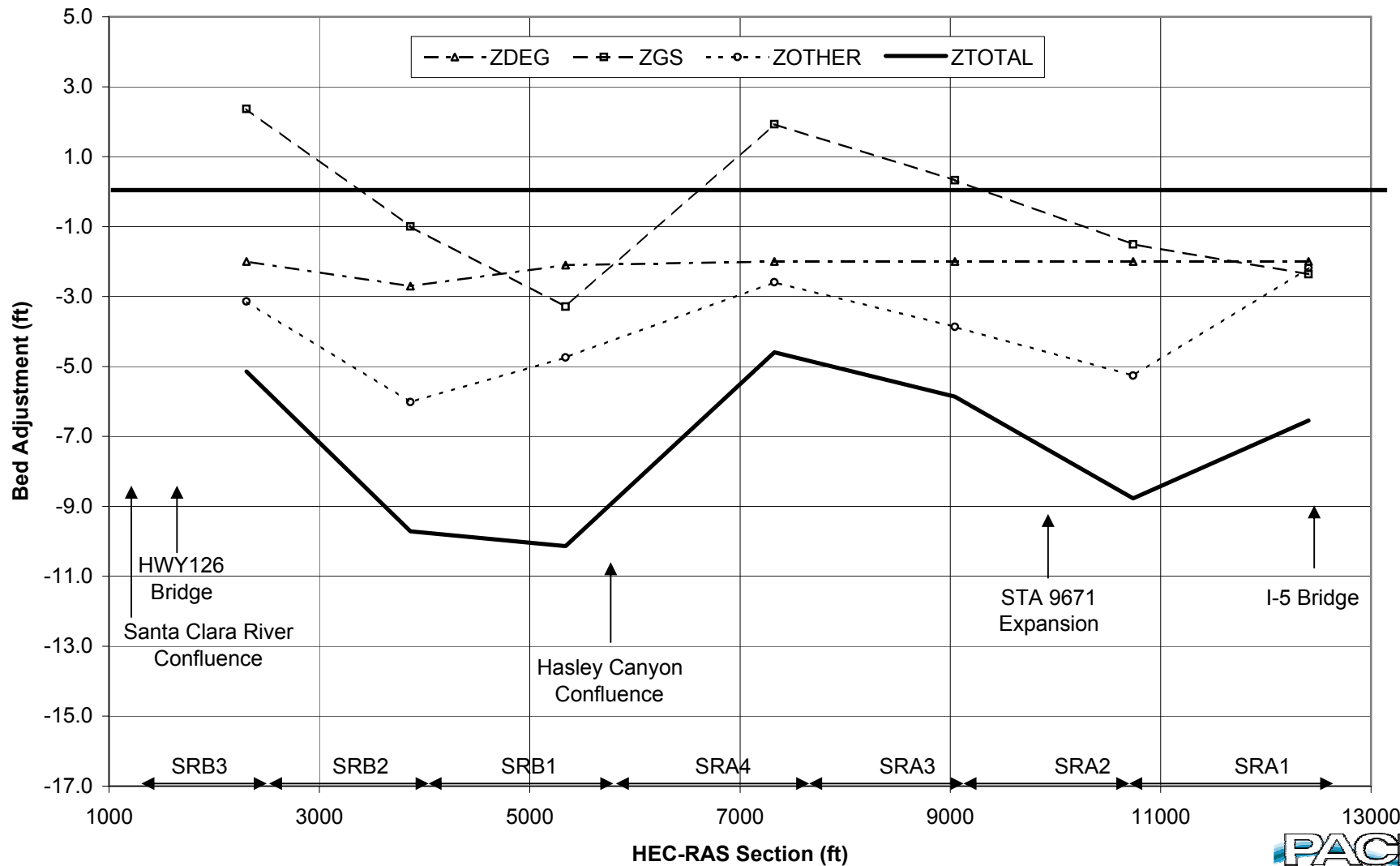
**Figure 7.1B: Castaic Creek Proposed Conditions Outside Curved Reach Summary of Degradation Components**



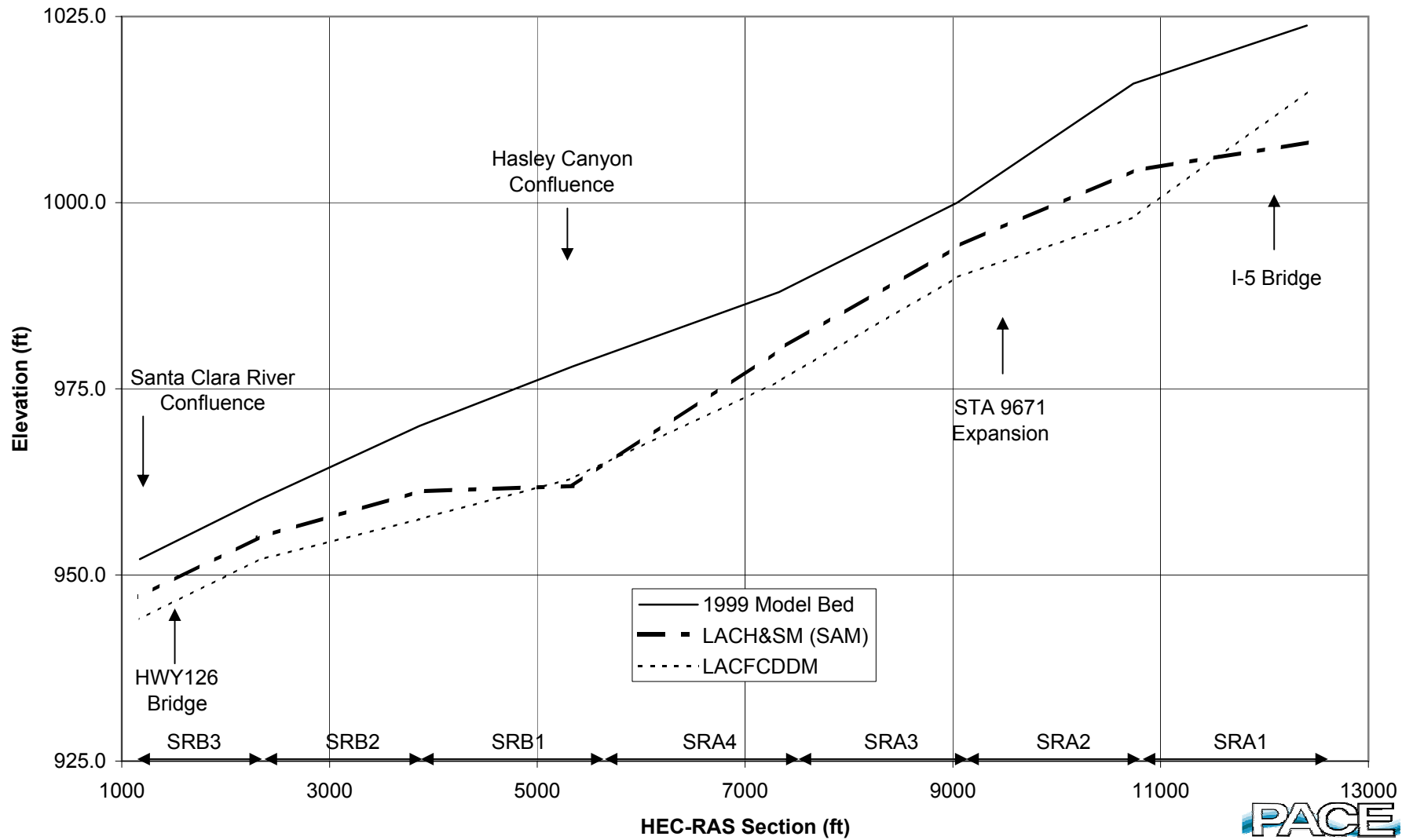
**Figure 7.1C: Castaic Creek Existing Conditions Straight-Inside Curved Reach Summary of Degradation Components**



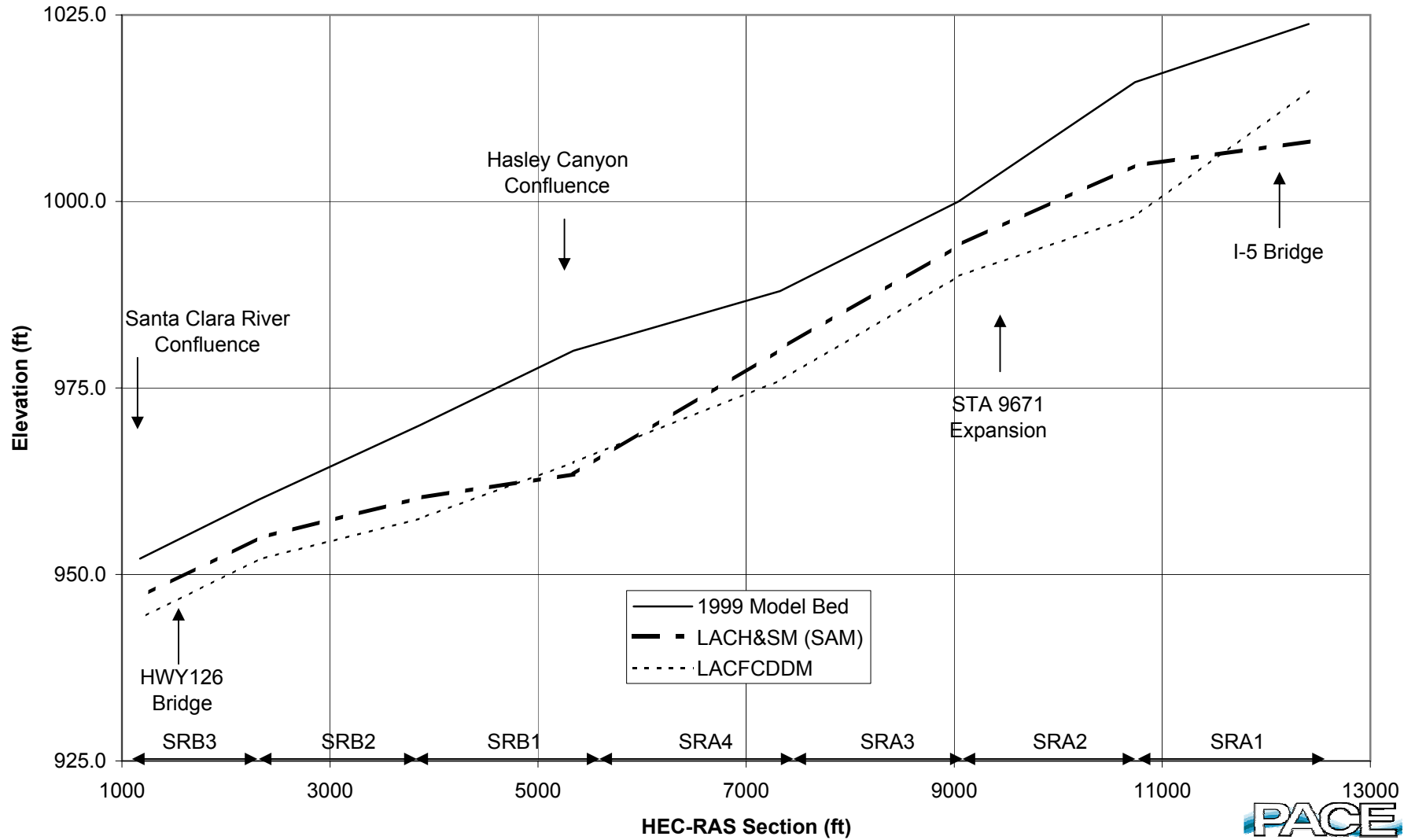
**Figure 7.1D: Castaic Creek Proposed Conditions Straight-Inside Curved Reach Summary of Degradation Components**



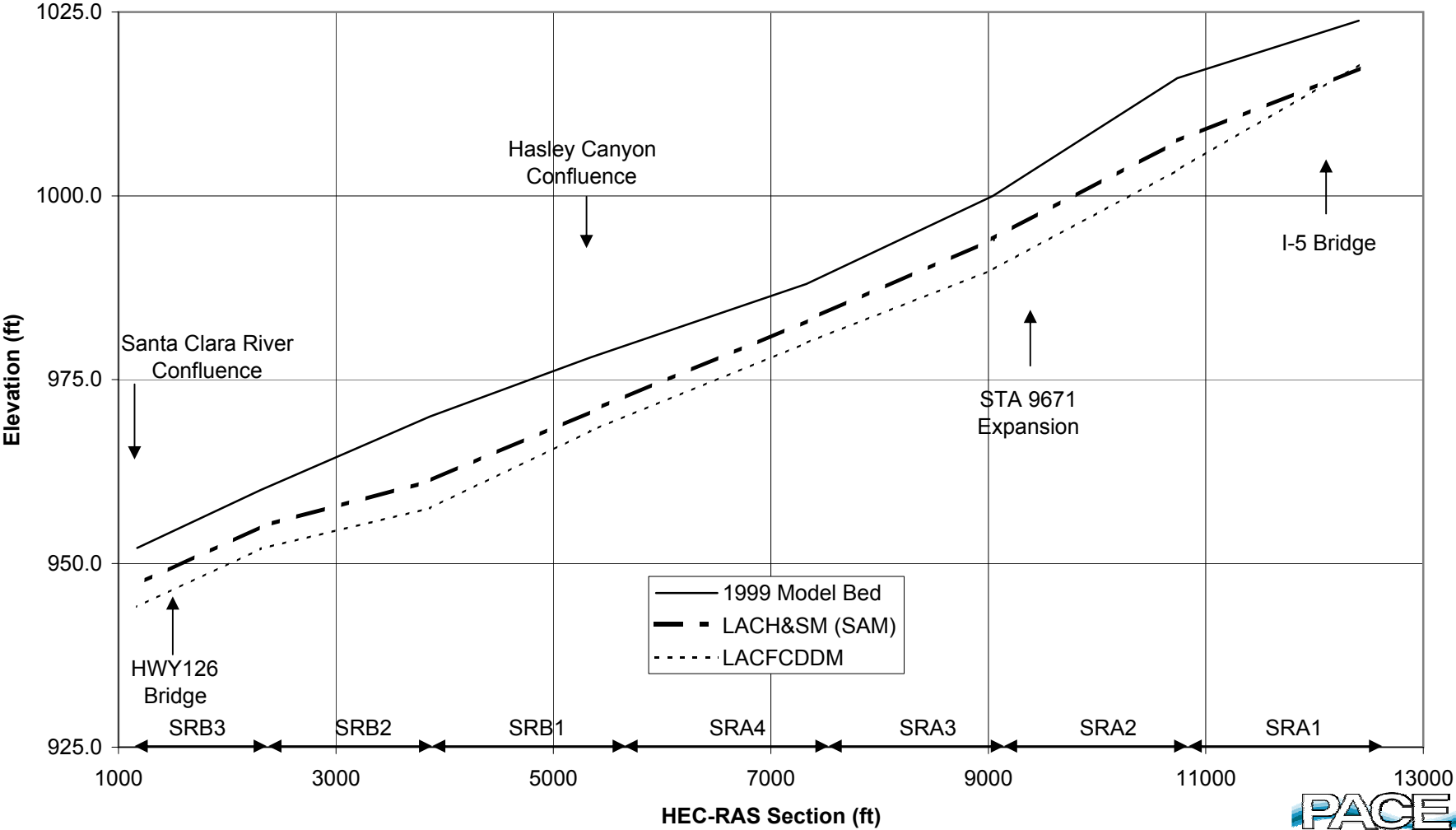
**Figure 7.2A: Castaic Creek Existing Conditions Outside Curved Reach Toe-down Depths by Methodology**



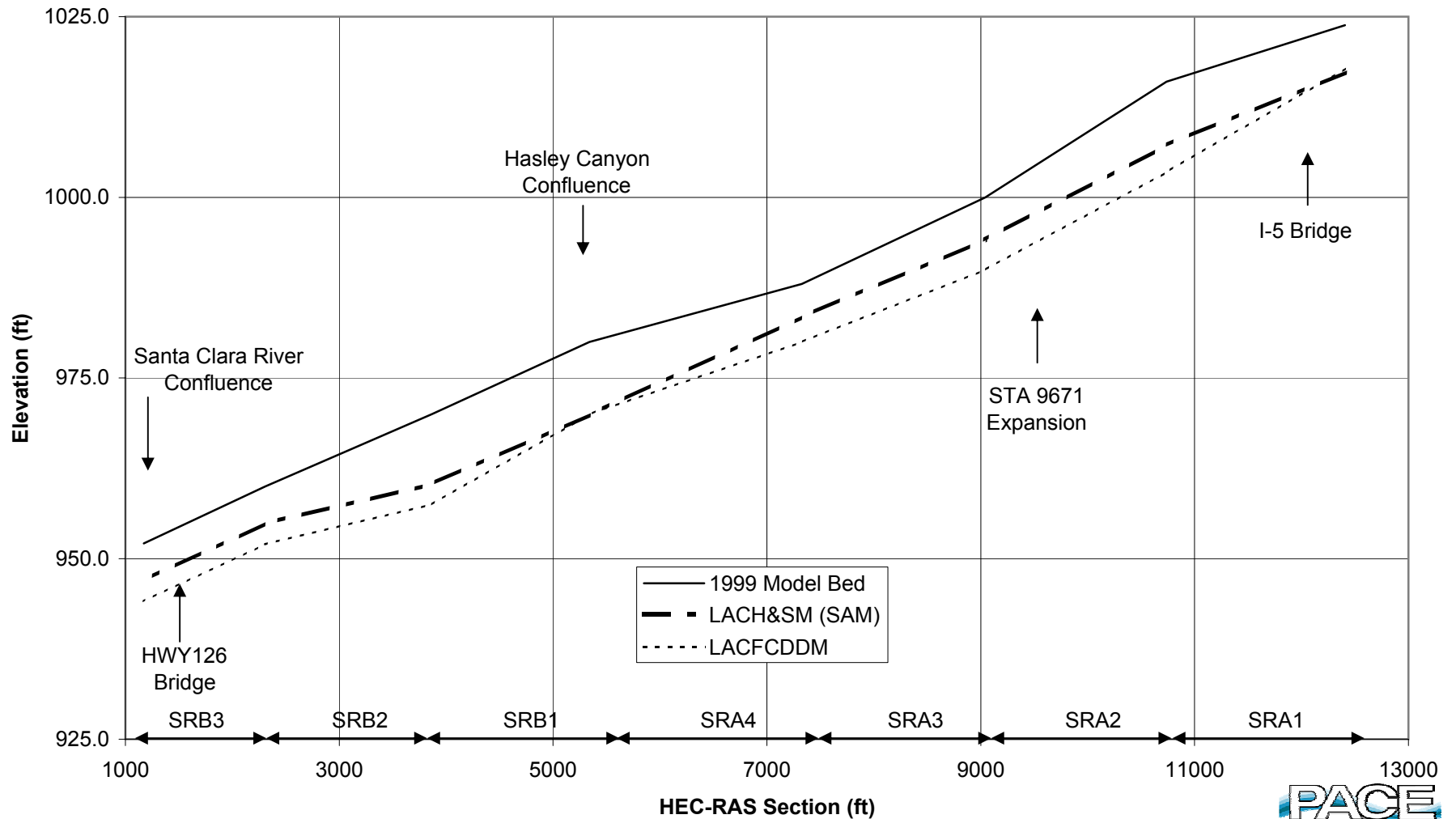
**Figure 7.2B: Castaic Creek Proposed Conditions Outside Curved Reach Toe-down Depths by Methodology**



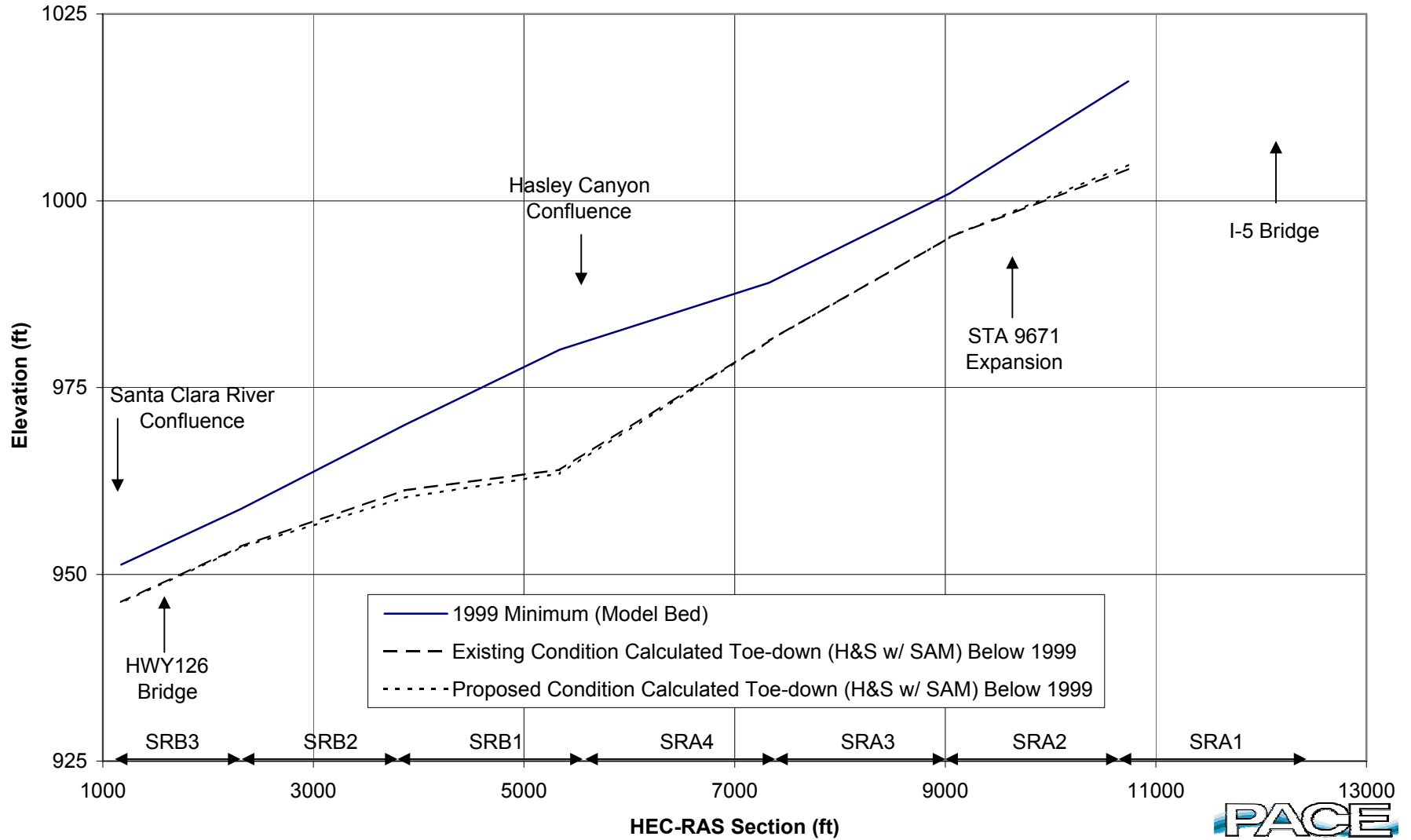
**Figure 7.2C: Castaic Creek Existing Conditions Straight-Inside Curved Reach Toe-down Depths by Methodology**



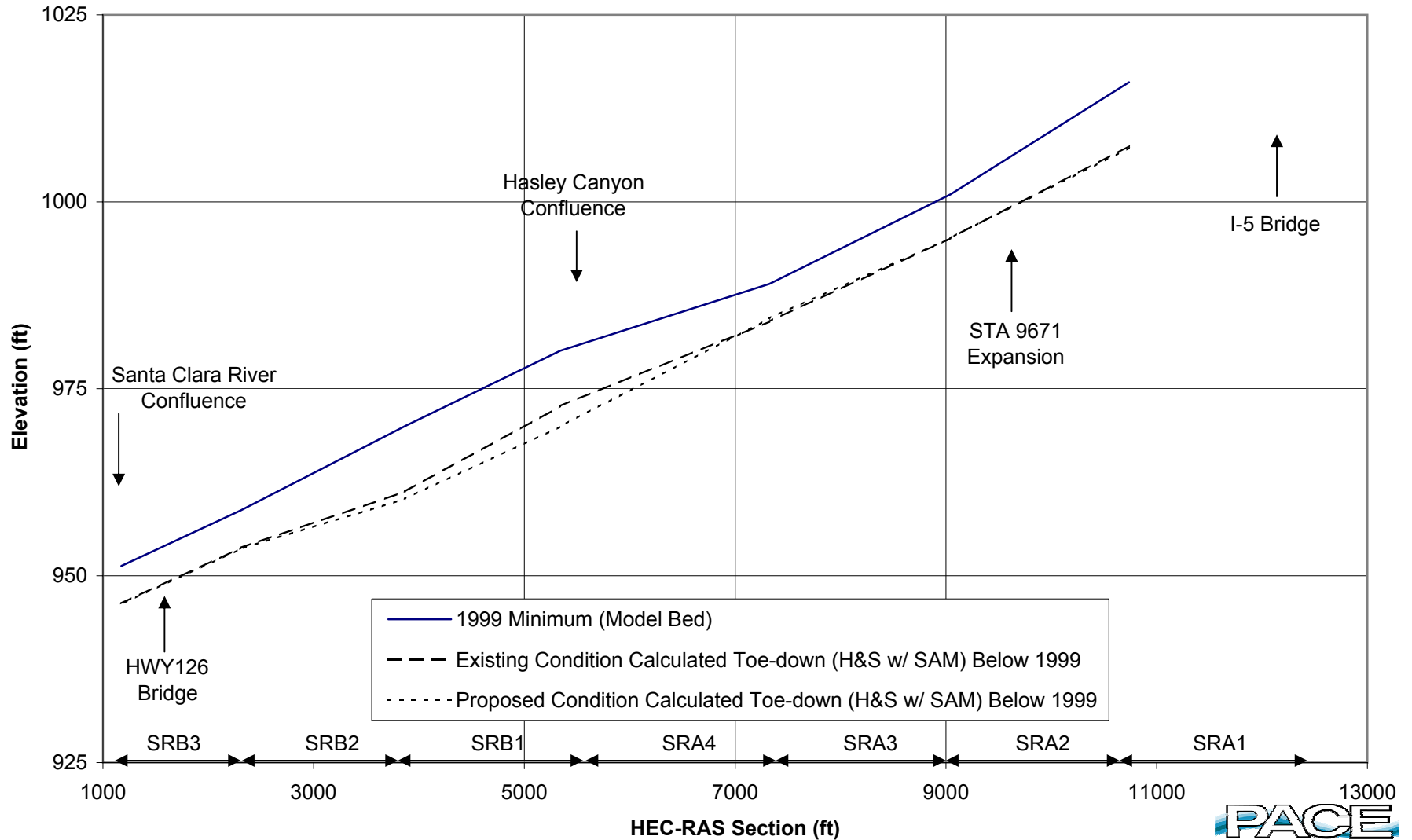
**Figure 7.2D: Castaic Creek Proposed Conditions Straight-Inside Curved Reach Toe-down  
Depths by Methodology**



**Figure 7.3A: Castaic Creek Outside Curved Reach Model Bed and Calculated Toe-down Elevation**



**Figure 7.3B: Castaic Creek Straight-Inside Curved Reach Model Bed and Calculated Toe-down Elevation**



## 8 Summary

The total toe-down is the sum of the individual degradational components as described in Chapter 7: general adjustment, or single-event degradation, calculated using the SAM zero-dimensional numerical modeling (Chapter 4); long-term adjustment, or long-term degradation, calculated from long-term historical topographic analysis (Chapter 5); and other adjustments calculated using LACH&SM (Chapter 6). Likewise, total freeboard is calculated as the sum of aggradational components: general aggradation from SAM calculations; long-term aggradation from long-term topographic analysis; and other aggradation from LACH&SM calculations, which includes superelevation changes to water surface elevations. This data is summarized in Table 8 for the outside curved reaches and inside curved or straight reaches. The table shows the total toe-down below the 1999 model minimum channel bed elevation and the total freeboard above the HEC-RAS water surface elevation by subreach and section. A summary of the significant components and influences of each subreach follows.

Subreach SRA1: SAM numerical calculations predict 2.4 feet of degradation in this reach, while long-term aggradation is expected based on the analysis of SRA2. No long-term data is presently available for SRA1. The expected aggradation is a result of the bed recovering from gravel mining. Aggradation is expected to be approximately 0.7 feet. Other scour is dominated in this subreach by scouring at the Interstate 5 Bridge and Old Road Bridge piers. Toe-down and freeboard calculations on the outside of the curve of the reach may be impacted by the bend in this portion of the Creek. Aggradation is set to the LACFCDDM depth of 2.5 feet for most sections because the total aggradation predicted by LACFCDDM is greater than that predicted by LACH&SM.

Subreach SRA2: SAM calculations estimate degradation of 1.5 feet, and long-term analysis has shown aggradation of 0.7 feet as the bed recovers from historic gravel mining. Some local bend scour can be found in this subreach. When it is present, bend scour will dominate the total toe-down value. Aggradation is set to the LACFCDDM depth of 2.5 feet for all sections because the total aggradation predicted by LACFCDDM is greater than that predicted by LACH&SM.

Subreach SRA3: SAM estimates 0.3 feet of aggradation in this reach. Long-term historic analysis predicts aggradation of 0.6 feet. Section 8050 in this subreach shows approximately no change in cross-section between 2004 and 2005 suggesting armoring. The presence of historical gravel mining is prominent in 8050 whereby a deep, wide gravel pit is evident in the historic data, and the 1999 section also appears to be recovering from the mining activity. Local scour is expected to be significant in this reach because of the presence of a major bend in the Creek's path. Aggradation is set to the LACFCDDM depth of 2.5 feet for all sections because the total aggradation predicted by LACFCDDM is greater than that predicted by LACH&SM.

Subreach SRA4: SAM numerical calculations predict 1.9 feet of aggradation in this reach, while long-term degradation is expected to be 1.3 feet. Other scour is dominated in this subreach by scouring at Commerce Center Bridge piers. Outside of the curve of the reach will also be impacted by the bend in this portion of the Creek. The small change in average bed height between 2004 and 2005 suggests the bed is at or approaching the armoring depth below which no additional degradation will occur

without a change in sediment inflow characteristics or a change in hydrology. Aggradation in this subreach exceeds three feet at every section and the large general adjustment dominates the components. Hasley Creek confluences in this subreach. The result of the confluence is an increase in discharge. Additionally, some sediment delivery from the Hasley Canyon Creek watershed may occur. This may explain some downstream aggradation observed in SRB3.

Subreach SRB1: SAM calculations estimate degradation of 3.3 feet, and long-term analysis has shown degradation of 2.1 feet. Little local scour can be found in most of this subreach as most of it is quite straight. Aggradation is set to the LACFCDDM depth of 2.5 feet for most sections because the total aggradation predicted by LACFCDDM is greater than that predicted by LACH&SM.

Subreach SRB2: SAM estimates degradation of 1.0 feet of degradation in this reach. Long-term historic analysis predicts degradation of 2.7 and 0.8 feet in sections 2975 and 2627, respectively. Section 2975 considers agricultural fill, while 2627 does not. Historic sections show continuous degradation since the construction of the Dam. The thalweg depths in both 1999 and 2004 are lower than in 2005 despite the continued degradation into 2005. Little local scour can be found in this subreach as it is quite straight. Aggradation is set to the LACFCDDM depth of 2.5 feet for all sections because the total aggradation predicted by LACFCDDM is greater than that predicted by LACH&SM.

Subreach SRB3: SAM calculations estimate aggradation of 2.4 feet, and long-term analysis has shown degradation of -1.5, -0.1 and -0.2 feet in sections 1982, 1645 and 1531, respectively. The most upstream section 1982 degraded consistently between 1999 and 2005 by 1.5 feet on average and 0.6 feet on average between 2004 and 2005. The two downstream sections, section 1645 and section 1531, both degraded between 1999 and 2005 by 0.1 and 0.2 feet on average, respectively. These two sections aggraded, however, between 2004 and 2005 by 1.6 and 0.4 feet on average, respectively. While it is unclear why the observed aggradation occurred it is presently believed to be the result of the fires of Summer, 2004 and the heavy rains of the 2004/2005 rainy season. Local scour on this subreach is dominated by the small radius bend in the proposed condition and the piers of the Highway 126 Bridge. Impacts from the proposed development to the bridge are to be mitigated by and extension of the bridge abutment from the bridge northwest edge of the abutment to moderately cemented sandstone approximately 100 feet to the northwest. Aggradation is dominated by predicted general adjustment and total freeboard is approximately four feet or greater for the reach. No impacts are expected to offsite property below this reach. Analysis presented in Chapter 5 finds that no significant increase in water surface elevation or velocity is expected below SRB3.

Table 8: Castaic Creek Summary of Proposed Toe-down & Freeboard (ft)												
Subreach	HEC-RAS Section	Z <sub>99</sub> <sup>3</sup>	Outside Curved Reach		Straight-Inside Curved Reach		WSE	Outside Curved Reach		Straight-Inside Curved Reach		
			Maximum Total Degradation <sup>4</sup>	Proposed Toe-down Elevation <sup>2,5</sup>	Maximum Total Degradation <sup>4</sup>	Proposed Toe-down Elevation <sup>2,5</sup>		Maximum Total Freeboard <sup>4</sup>	Proposed Top of Levee Elevation <sup>2</sup>	Maximum Total Freeboard <sup>4</sup>	Proposed Top of Levee Elevation <sup>2</sup>	
SRA1	12407	1023.8	15.8	1008.0	6.6	1017.2	1047.2	2.5	1049.7	2.5	1049.7	
	12162	1024.0	21.9	1002.1	19.9	1004.1	1046.6	2.5	1049.1	2.5	1049.1	
	11957	1024.0	15.0	1009.0	10.0	1014.0	1042.8	2.5	1045.3	2.5	1045.3	
	11878	1024.0	22.7	1001.3	20.7	1003.3	1037.6	2.5	1040.1	2.5	1040.1	
	11846	1024.0	12.0	1012.0	8.0	1016.0	1037.5	2.5	1040.0	2.5	1040.0	
	11812	1024.0	18.0	1006.0	12.5	1011.5	1036.1	3.1	1039.2	2.7	1038.8	
	11551	1022.0	21.0	1001.0	14.0	1008.0	1033.7	2.5	1036.2	2.5	1036.2	
	11243	1020.0	18.0	1002.0	12.5	1007.5	1031.1	2.5	1033.6	2.5	1033.6	
	10983	1016.0	15.5	1000.5	10.0	1006.0	1028.9	2.5	1031.4	2.5	1031.4	
SRA2	10738	1016.0	18.0	998.0	12.5	1003.5	1026.9	2.5	1029.4	2.5	1029.4	
	10491	1012.0	15.0	997.0	10.0	1002.0	1024.6	2.5	1027.1	2.5	1027.1	
	10351	1012.0	18.0	994.0	12.5	999.5	1022.6	2.5	1025.1	2.5	1025.1	
	10142	1010.0	10.0	1000.0	10.0	1000.0	1020.0	2.5	1022.5	2.5	1022.5	
	9931	1008.0	10.0	998.0	10.0	998.0	1018.1	2.5	1020.6	2.5	1020.6	
	9671	1004.0	8.0	996.0	8.0	996.0	1016.4	2.5	1018.9	2.5	1018.9	
	9502	1004.0	10.0	994.0	10.0	994.0	1015.1	2.5	1017.6	2.5	1017.6	
	9299	1003.2	10.0	993.2	10.0	993.2	1013.2	2.5	1015.7	2.5	1015.7	
	SRA3	9043	1000.0	10.0	990.0	10.0	990.0	1010.7	2.5	1013.2	2.5	1013.2
8725		998.0	12.0	986.0	8.0	990.0	1007.2	2.5	1009.7	2.5	1009.7	
8396		996.0	15.0	981.0	10.0	986.0	1005.7	2.5	1008.2	2.5	1008.2	
8050		992.0	12.0	980.0	8.0	984.0	1005.0	2.5	1007.5	2.5	1007.5	
7689		990.0	12.0	978.0	8.0	982.0	1004.4	2.5	1006.9	2.5	1006.9	
SRA4		7326	988.0	12.0	976.0	8.0	980.0	1003.8	3.1	1006.9	3.1	1006.9
	6967	986.5	12.0	974.5	8.0	978.5	1003.0	3.2	1006.2	3.1	1006.1	
	6624	985.2	12.0	973.2	8.0	977.2	1001.9	3.4	1005.3	3.3	1005.2	
	6305	984.0	15.0	969.0	10.0	974.0	1000.2	3.6	1003.8	3.4	1003.6	
	5992	982.0	15.0	967.0	10.0	972.0	998.0	3.7	1001.7	3.6	1001.6	
	5629	980.1	12.0	968.1	8.0	972.1	997.0	3.3	1000.3	3.2	1000.2	
	5558	980.0	23.0	957.0	20.4	959.6	996.8	3.3	1000.1	3.2	1000.0	
	5454	980.0	12.0	968.0	8.0	972.0	996.2	3.5	999.7	3.2	999.4	
	5434	980.0	12.0	968.0	8.0	972.0	996.1	3.6	999.7	3.3	999.4	
	SRB1	5340	980.0	16.5	963.5	10.1	969.9	994.9	2.8	997.7	2.5	997.4
		5061	976.0	12.5	963.5	12.5	963.5	993.0	2.5	995.5	2.5	995.5
4900		976.0	12.5	963.5	12.5	963.5	992.1	2.5	994.6	2.5	994.6	
4572		976.0	10.0	966.0	10.0	966.0	990.2	2.5	992.7	2.5	992.7	
4221		972.0	10.0	962.0	10.0	962.0	987.1	2.5	989.6	2.5	989.6	
SRB2		3865	970.0	12.5	957.5	12.5	957.5	983.8	2.5	986.3	2.5	986.3
	3580	966.0	12.5	953.5	12.5	953.5	981.6	2.5	984.1	2.5	984.1	
	3290	964.0	10.0	954.0	10.0	954.0	979.0	2.5	981.5	2.5	981.5	
	2975	962.0	12.5	949.5	12.5	949.5	976.7	2.5	979.2	2.5	979.2	
	2627	960.0	10.0	950.0	10.0	950.0	974.7	2.5	977.2	2.5	977.2	
	SRB3	2308	960.0	8.0	952.0	8.0	952.0	973.3	3.7	977.0	3.7	977.0
1982		956.3	15.0	941.3	10.0	946.3	971.6	4.1	975.7	3.8	975.4	
1645		956.0	12.0	944.0	8.0	948.0	969.7	4.3	974.0	4.0	973.7	
1531		955.2	10.0	945.2	10.0	945.2	968.5	4.2	972.7	4.2	972.7	
1462		952.7	14.0	938.7	14.0	938.7	968.4	3.9	972.3	3.9	972.3	
1415		952.0	8.0	944.0	8.0	944.0	968.3	3.9	972.2	3.9	972.2	
1306		952.0	19.2	932.8	19.2	932.8	967.6	3.9	971.5	3.9	971.5	
1123 <sup>1</sup>		952.1	10.0	942.1	10.0	942.1	967.2	3.7	970.9	3.7	970.9	

1 - Historical topo provides data for cross-section 1123 but not 1173. However, WSE from HEC-RAS modeling contains 1173, not 1123.

2 - Phase 1 Analysis

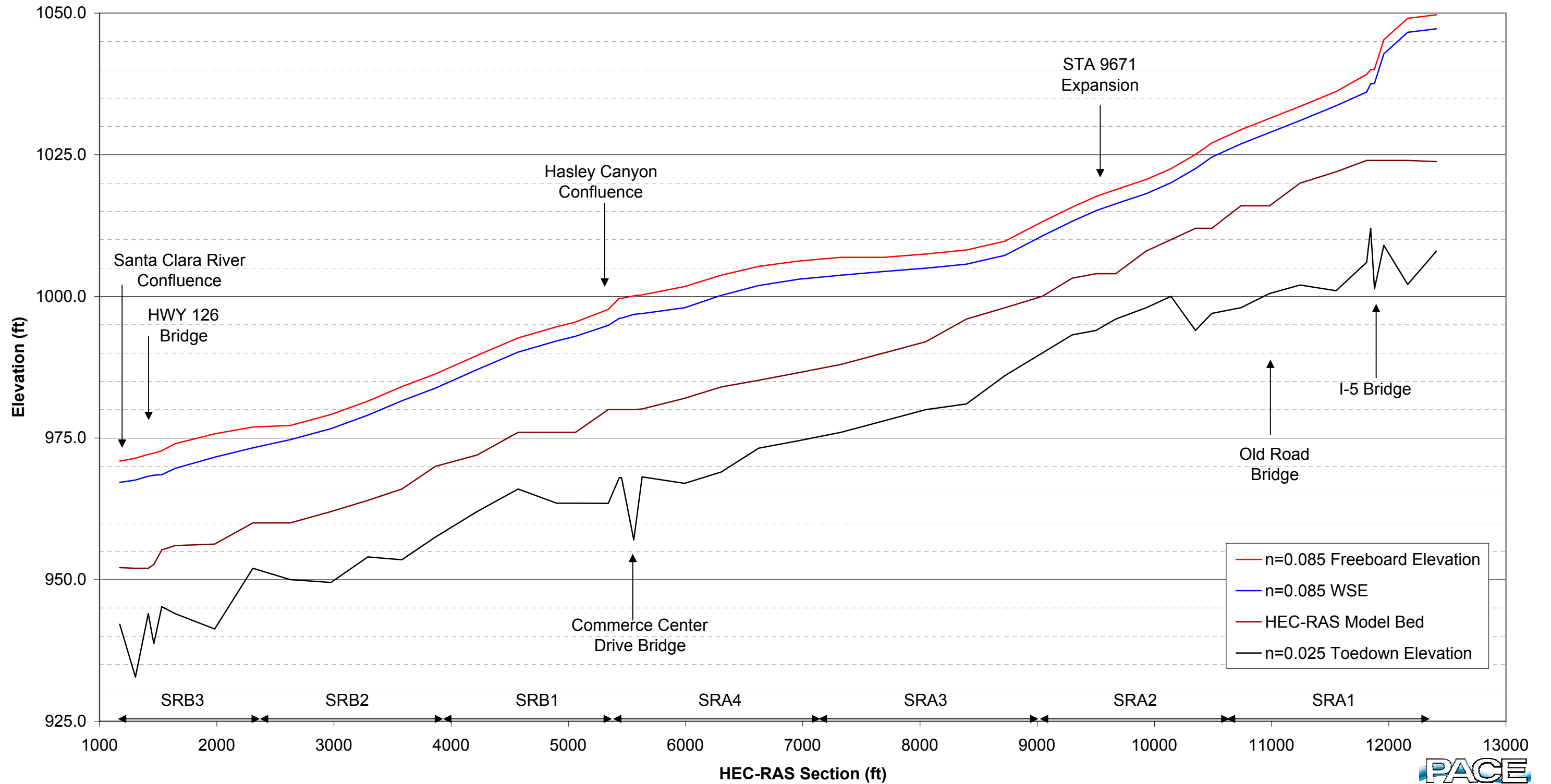
3 - Minimum 1999 Bed Elevation

4 - Toe-down and Freeboard based on max of LA County Hydrology & Sedimentation Manual (with SAM general aggradation) and LA County Design Manual, as per Hydrology & Sedimentation Manual

5 - Final design of levee will include detailed bridge analysis



**Figure 8: Castaic Creek Proposed Conditions Outside Curved Reach Maximum Toe-down & Freeboard Summary**



## **9 References**

Kennedy, J.F. (1963) The mechanics of dunes and antidunes in erodible bed channels: *Journal of Fluid Mechanics*, 16, 521-544.

Los Angeles County Department of Public Works Hydrology and Sedimentation Manual (LACH&SM) (December, 1991)

Los Angeles County Flood Control District Design Manual (LACFCDDM) (October, 1979)

Sikand Engineering in the *Newhall Ranch Castaic Creek HEC-RAS Study* (June, 2000)

Simons, Li & Associates (November, 1990) *Fluvial Study of Santa Clara River and The Tributaries*.

Simons, Li & Associates (January, 1992) *Fluvial Study: Proposed Channelization of Castaic Creek between Henry Mayo Drive and The Golden State Freeway*.

Tetra Tech (November, 2003) *Final Hydraulic and Scour Analyses for I-5 Castaic Creek Bridge Widening: I-5/Hasley Canyon Road Interchange*.

US Army Corps of Engineers (ACOE) (September, 2002) *SAM Hydraulic Design Package For Channels*.

Castaic Creek Fluvial Study  
Phase 1 Final Draft

## ***APPENDIX CHAPTER 3.1***

***Site Visit Photos***

# Appendix Chapter 3.1

Photos 1 thru 7 are dated September 6, 2004



Photo 1. Upstream of Commerce Ctr. Drive Bridge looking Northeast at Castaic Creek from the South bank



Photo 2. Upstream of Commerce Ctr. Drive Bridge looking North at the concrete/riprap bank protection for Hasley Creek



Photo 3. Commerce Ctr. Drive Bridge concrete abutment on the South side



Photo 4. Commerce Ctr. Drive Bridge concrete abutment on the North side



Photo 5. Downstream of Commerce Ctr. Drive Bridge looking upstream



Photo 6. Downstream of Commerce Ctr. Drive Bridge looking North



Photo 7. Vegetation at storm drain outlet for P.D. No. 2298

Castaic Creek Fluvial Study  
Phase 1 Final Draft

## ***APPENDIX CHAPTER 3.2***

### ***Allan Seward Sampling Study***



**ALLAN E. SEWARD**  
**ENGINEERING GEOLOGY, INC.**  
Geological And Geotechnical Consultants

September 15, 2005

Job No: 05-1155BE-9 (9)

The Newhall Land and Farming Company  
23823 W. Valencia Boulevard  
Valencia, California 91355

**Attn:** Mr. Glenn Adamick

**Subject:** **SEDIMENT GRADATION TEST DATA**  
*To Assist Fluvial Analyses by PACE*

**Project:** Castaic Creek below the I-5 Freeway  
Newhall Ranch Area  
Los Angeles County, California

Dear Mr. Adamick:

The following report presents the results of our grain size analyses of sediments collected along Castaic Creek between the I-5 freeway and the Santa Clara River to assist PACE in their fluvial studies.

## 1.0 INTRODUCTION

It is our understanding that PACE is currently conducting fluvial studies of Castaic Creek and the Santa Clara River that require data on the grain size of the channel bed sediments as a basis. A program of sample collecting was developed based on discussions with PACE to provide a representative basis for their studies. Six primary localities were chosen for sampling, as follows:

1. Just down stream of the Old Road bridge (OR sample sites)
2. Roughly half way between the Old Road and Commerce Center Drive, where the channel widens substantially. (OC sample sites)
3. Just upstream of the Commerce Center Drive bridge (CC sample sites)
4. Roughly halfway between Commerce Center Drive and Highway 126 (CH sample sites)
5. Just upstream of the Highway 126 bridge (HW sample sites)
6. Roughly 1500 ft. downstream of Highway 126 (HS sample sites)

Three sample sites were chosen at each location in order to provide data representative of the observed variability across the width of the channel bed (see attached map sheets in Appendix C for location). A target depth of 5 ft. was specified for each sample site. Two additional sample sites were subsequently added based on conditions observed in the field. One was added at the mouth of Hasley Canyon (just upstream from the Commerce Center Drive bridge) to evaluate the contribution of this significant sediment source (HC sample site). A second site was added near the confluence of Castaic Creek with the Santa Clara River, roughly 2,000 ft. south of Highway 126 (CS sample site). One sample site was chosen at each of these locations. A summary of our sampling procedures is presented below.

## 2.0 SAMPLING PROCEDURES

Samples were collected at each of the 20 sites described above and shown on the attached location map sheets (see Appendix C). A test pit was excavated by hand at each site and a bag of representative sediment was collected at 6" depth intervals, resulting in 10 bag samples from each pit. The size of the bag samples was determined based on the following ASTM criteria:

Nominal Maximum Size (square openings)	Minimum Test Sample Size	
3"	130 lbs	1
3.5"	220 lbs	2
4"	330 lbs	3
5"	660 lbs	4
		5
		5

Because rocks with nominal sizes of greater than 5" were observed in most of the excavations, roughly 70 pounds of sediment was collected in each bag resulting in a total sample weight of roughly 700 pounds. The size of the largest rock observed in each pit is noted in the attached summary table (Appendix B). However, in most cases the largest rock was not a part of the representative sample collected at each depth because much more material was excavated to reach a depth of 5 ft. than was needed for the sample. The total field weight (with moisture) collected at each site is noted on the attached logs (13,767 lbs total). The total dry weight is noted on the attached laboratory test reports and on the summary table in Appendix B.

The pits were excavated by hand laborers to eliminate potential environmental impacts from heavy equipment. Where ground water or ravelling conditions prevented excavation to the target depth of 5 ft., the remaining depth was hand augered. The alluvium observed in each

pit was logged to document the depth of cobbly layers and the general stratigraphy (see Appendix A for logs). Photos were taken of each pit and of the general conditions of the adjacent channel. Copies of these photos are provided in Appendix A for reference (Figures 1 thru 20). Following assessment of the necessary sample size, the samples were carried by hand to a truck and transported to our office for laboratory testing.

### **3.0 LABORATORY TEST PROCEDURES**

The collected samples were processed and tested as follows in our laboratory:

- The bag collected from the upper 6" of each pit was sieved to determine the weight retained on the 2" screen to document evidence for concentrations of coarse gravel and cobbles at the surface.
- All 10 bags for each site were processed to separate the fraction coarser than 2".
- The coarse fraction was sieved to determine the weight retained on the 2", 2.5", 3", 3.5", 4" and 5" screens.
- The sample fraction smaller than 2" was split to obtain a sample greater than 44 lbs. in weight per ASTM criteria. 1000 grams of this material was used to determine the average moisture content for each sample locality.
- This sample fraction was processed through the 1.5", 1", 0.75", 0.375" and #4 screens to determine the weight retained on each.
- The remaining sample passing through the #4 sieve was split again for washing per ASTM criteria.
- The sample was washed, dried and sieved through the #8, #16, #30, #50, #100 and #200 screens to determine the weight retained on each and the weight of sediment passing the #200 sieve (ie, silt and clay).
- The sample weights were adjusted to correct for the noted sample splits and the moisture content to obtain the percent retained on each sieve for the entire dry sample weight.
- The data obtained were input into the Geosystem program to generate graphical particle size distribution test reports and backup test data sheets.

### **4.0 RESULTS OF TESTING**

Sampling and laboratory testing of sediments obtained at 20 sample sites along Castaic Creek were completed following the criteria specified by PACE in compliance with ASTM standards. The results of our testing are summarized below.

1. Geologic logs and photographs of each sample site are presented in Appendix A.
2. The location of each sample site is illustrated on the attached sediment sample location maps presented in Appendix C. The sample sites are shown relative to aerial photos shot on 5/19/05 and topography generated based on these photos by McElhanney.
3. The results of laboratory sediment gradation testing are presented on graphical, particle size distribution test reports in Appendix B. The backup grain size distribution test data sheets for each site are also provided. Many of the significant test parameters and results are presented in the summary table of sediment sampling and testing (Appendix B).
4. The observed sediments consist dominantly of poorly graded sand and poorly graded gravel with varying quantities of cobbles. Interbeds of well graded sand, well graded gravel, silty sand and lean clay were locally observed. The maximum cobble size included in our laboratory testing was 7" in intermediated diameter and the largest cobble observed in our excavations was 12.75", although larger rocks were noted elsewhere in the channel. Gravel and cobbles were observed to be concentrated in the upper 6" of excavations at the majority of the sample sites, but occurred at various depths as well.
5. The observed sands generally ranged in color from pale brown (10YR 6/3) to light yellowish brown (10YR 6/4) to yellowish brown (10YR 5/4). The coarser sands and gravelly beds typically ranged from light gray (10YR 7/2) to pale brown (10YR 6/3). The finer silty sands and clays ranged from brown (10YR 5/3) to dark grayish brown (10 YR 4/2) to very dark grayish brown (10YR 3/2).
6. Ground water generally ranged from 3 ft. to greater than 5 ft. in depth at the sample sites.

This opportunity to be of service is appreciated. If you have any questions concerning this report, please give us a call.

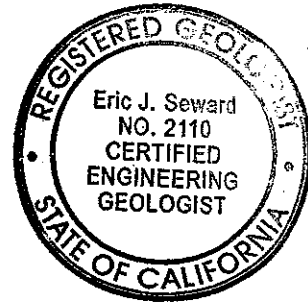
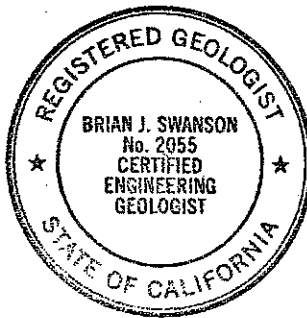
Respectfully,



Brian J. Swanson, CEG 2055  
Senior Project Geologist



Eric J. Seward, CEG 2110  
Principal Engineering Geologist  
Vice President



The following appendices and attachments complete this report.

**APPENDIX A – SUBSURFACE LOGS AND PHOTOS**

Sample Test Pit Logs

T-OR-1 thru T-OR-3  
T-OC-1 thru T-OC-3  
T-CC-1 thru T-CC-3  
T-HC-1  
T-CH-1 thru T-CH-3  
T-HW-1 thru T-HW-3  
T-HS-1 thru T-HS-3  
TCS-1

Photos

Photos of Channel Conditions and Test Pits at Each site

Figures 1-20

**APPENDIX B – LABORATORY TEST RESULTS**

Summary Table of Sediment Sampling and Testing  
Particle Size Distribution Test Reports  
Grain Size Distribution Test Data Sheets for each site (20 Total)

Figures B1-B7

**APPENDIX C – SEDIMENT SAMPLE LOCATION MAPS**

Index Map (1"=600')  
Reach downstream from the I-5 Freeway  
Reach upstream of Commerce Center Drive bridge  
Reach up and downstream of Commerce Center Drive bridge  
Reach upstream of Highway 126  
Reach downstream of Highway 126

Sheet 1  
Sheet 2  
Sheet 3  
Sheet 4  
Sheet 5  
Sheet 6



**Distribution:** (1) The Newhall Land & Farming Company  
Attn: Mr. Glen Adamick  
(1) PACE  
Attn: Mark Krebs

CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek

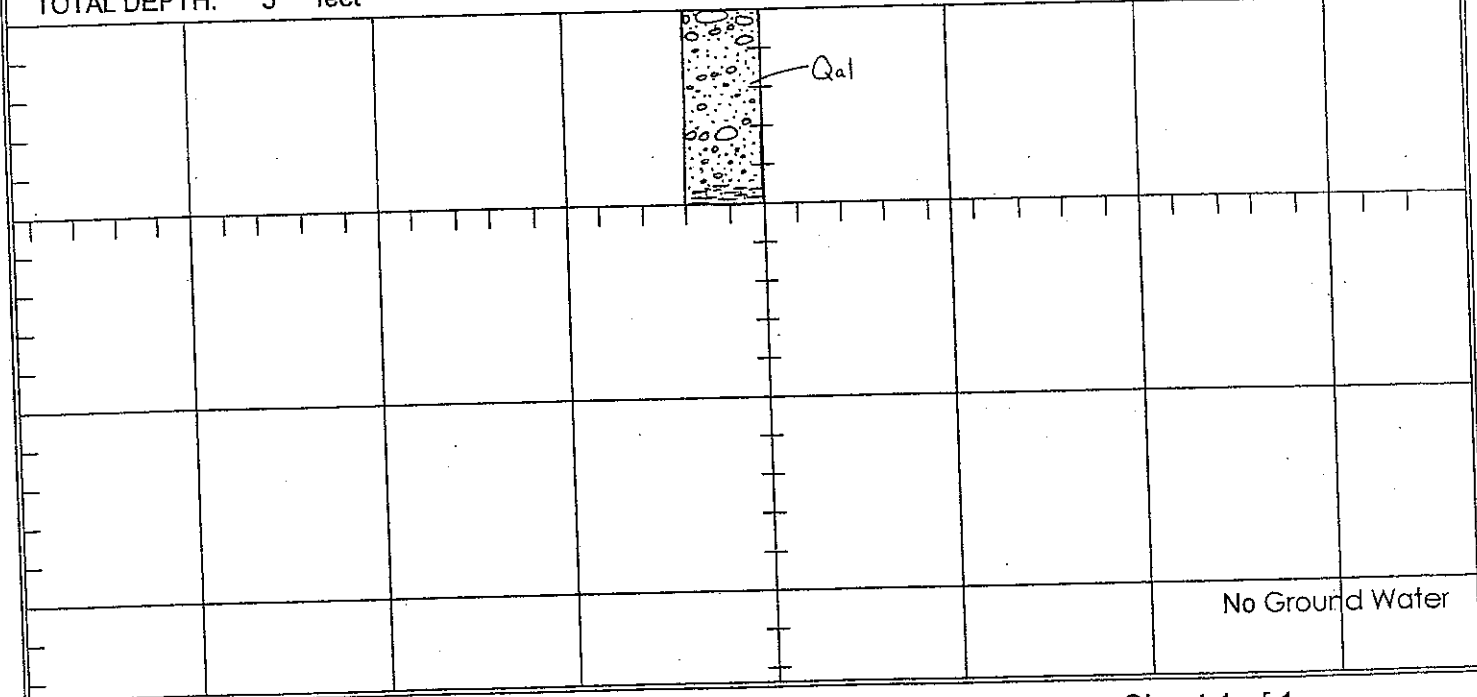
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 DATE: 9/15/05  
 LOGGED BY: JH/BJS  
 EXCAVATED: 8/31/05  
 ELEVATION: 1028'±

# TRENCH LOG NO. T-OR-1

EXCAVATION METHOD: Hand Labor

DEPTH (feet)	SAMPLE TYPE	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
						Moisture Content (%)	Dry Density (pcf)	Other Tests
0			GP SP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light yellowish-brown, poorly graded GRAVEL with sand and cobbles; friable; dry @ 8" Poorly graded SAND with gravel; damp @ 3' -scattered cobbles				Gradation % fines=1.0
5			CL- ML	@ 4.5' Dark grayish-brown, sandy, silty CLAY with gravel; damp to moist				
				<b>COMMENTS:</b> Bulk sample @ 0-5' (756 lbs total)				

TOTAL DEPTH: 5 feet SCALE: 1 inch = 5 feet



CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek  
 EXCAVATION METHOD: Hand Labor

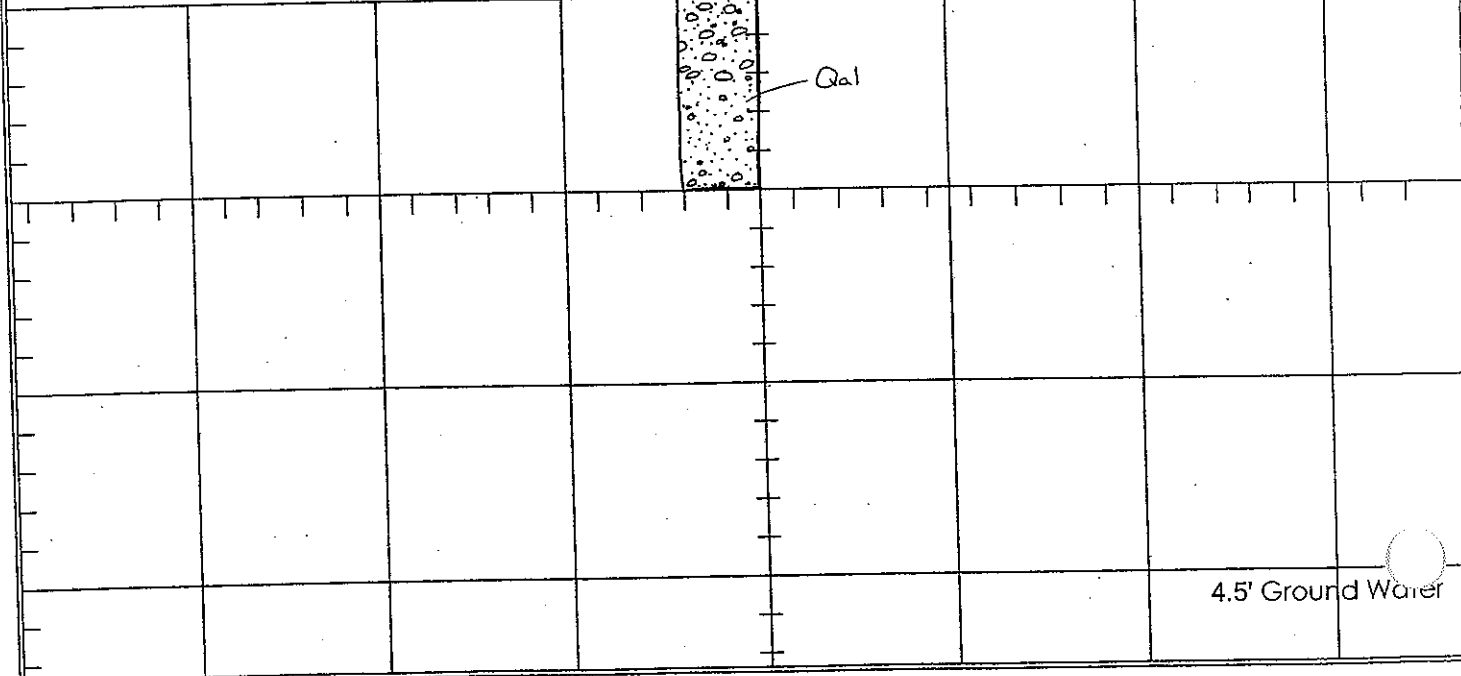
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 LOGGED BY: JH/BJs  
 EXCAVATED: 8/31/05  
 ELEVATION: 1027'±

# TRENCH LOG NO. T-OR-2

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS			
							Moisture Content (%)	Dry Density (pcf)	Other Tests	
0				GP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light-gray, poorly graded GRAVEL with sand and cobbles; friable; dry @ 1.5' -slightly friable; damp @ 2' Light yellowish-brown, poorly graded SAND with gravel and uncommon cobbles; damp @ 4.5' -more cobbles; wet				Gradation % fines=0.2	
5				SP						
10										
15										
20										

**COMMENTS:**  
Bulk sample @ 0-5' (781 lbs total)

TOTAL DEPTH: 5 feet      SCALE: 1 inch = 5 feet



CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek  
 EXCAVATION METHOD: Hand Labor

JOB NO: 05-1155BE-9 (9)  
 DATE: 9/15/05  
 LOGGED BY: JH/BJS  
 EXCAVATED: 8/31/05  
 ELEVATION: 1028'±

# TRENCH LOG NO. T-OR-3

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP	<b>ALLUVIUM; Qal (0 - 4.5')</b> @ 0' Light-gray, poorly graded GRAVEL; very friable; dry @ 1.5' Pale-brown, poorly graded SAND; friable; dry to slightly damp @ 3' -with gravel and local cobbles; damp @ 4.5' Light yellowish-brown, poorly graded GRAVEL with sand and cobbles  <b>COMMENTS:</b> Bulk sample @ 0-4.5' (721 lbs total) Difficult to dig below 4.5' due to cobbles at bottom and loose, ravelling gravel at top			Gradation % fines=0.5	
				SP					
5				GP					
10									
15									
20									

TOTAL DEPTH: 4.5 feet

SCALE: 1 inch = 5 feet

								No Ground Water

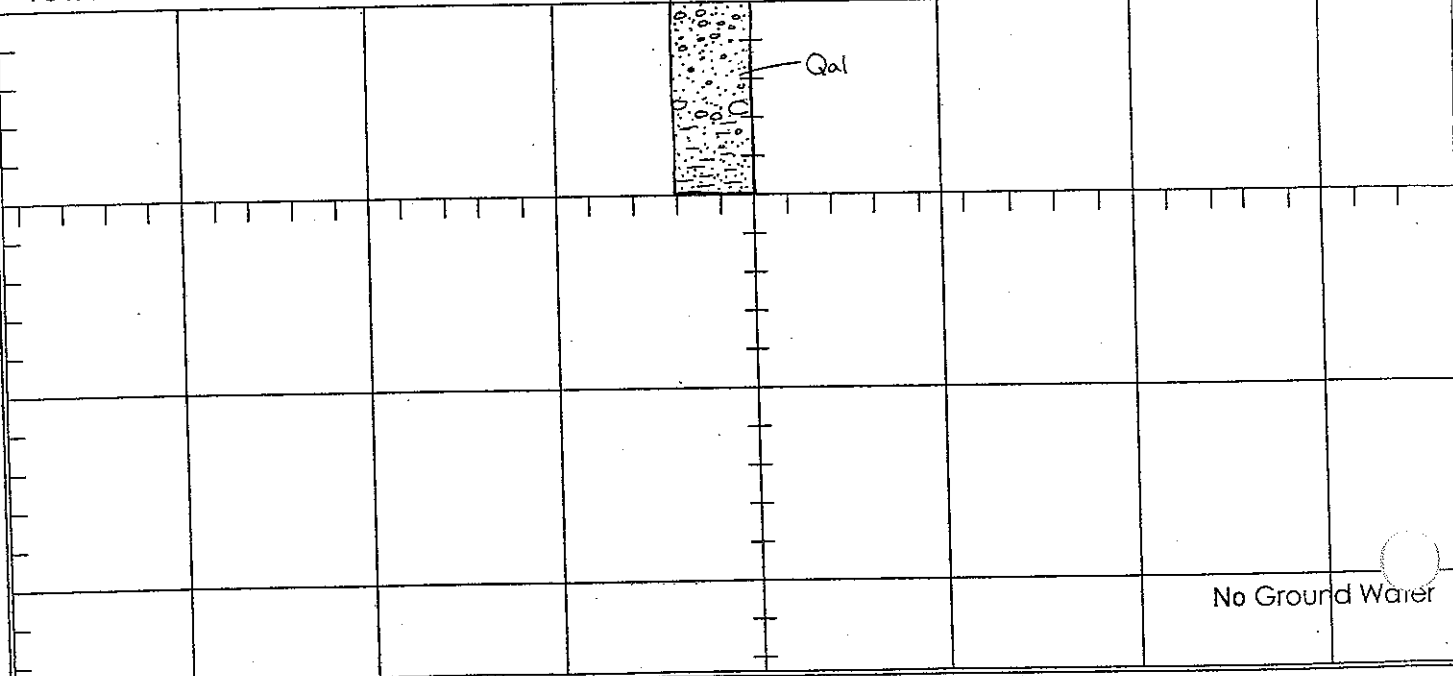
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 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek  
 EXCAVATION METHOD: Hand Labor

JOB NO: 05-1155BE-9 (9)  
 DATE: 9/15/05  
 LOGGED BY: JH  
 EXCAVATED: 8/31/05  
 ELEVATION: 1000'

# TRENCH LOG NO. T-OC-1





DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				SP-SM	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Pale-brown, poorly graded SAND with gravel; friable; dry @ 1' -no gravel; damp @ 2.5' Light-gray, well-graded GRAVEL with sand; damp @ 3' Yellowish-brown, poorly graded SAND with silt and local cobbles; moist @ 4' Dark grayish-brown, silty SAND; moist @ 5' -damp  <b>COMMENTS:</b> Bulk sample @ 0-5' (663 lbs total)			Gradation % fines=2.7	
				GW					
				SP-SM					
				SM					
				SM					
5									
10									
15									
20									

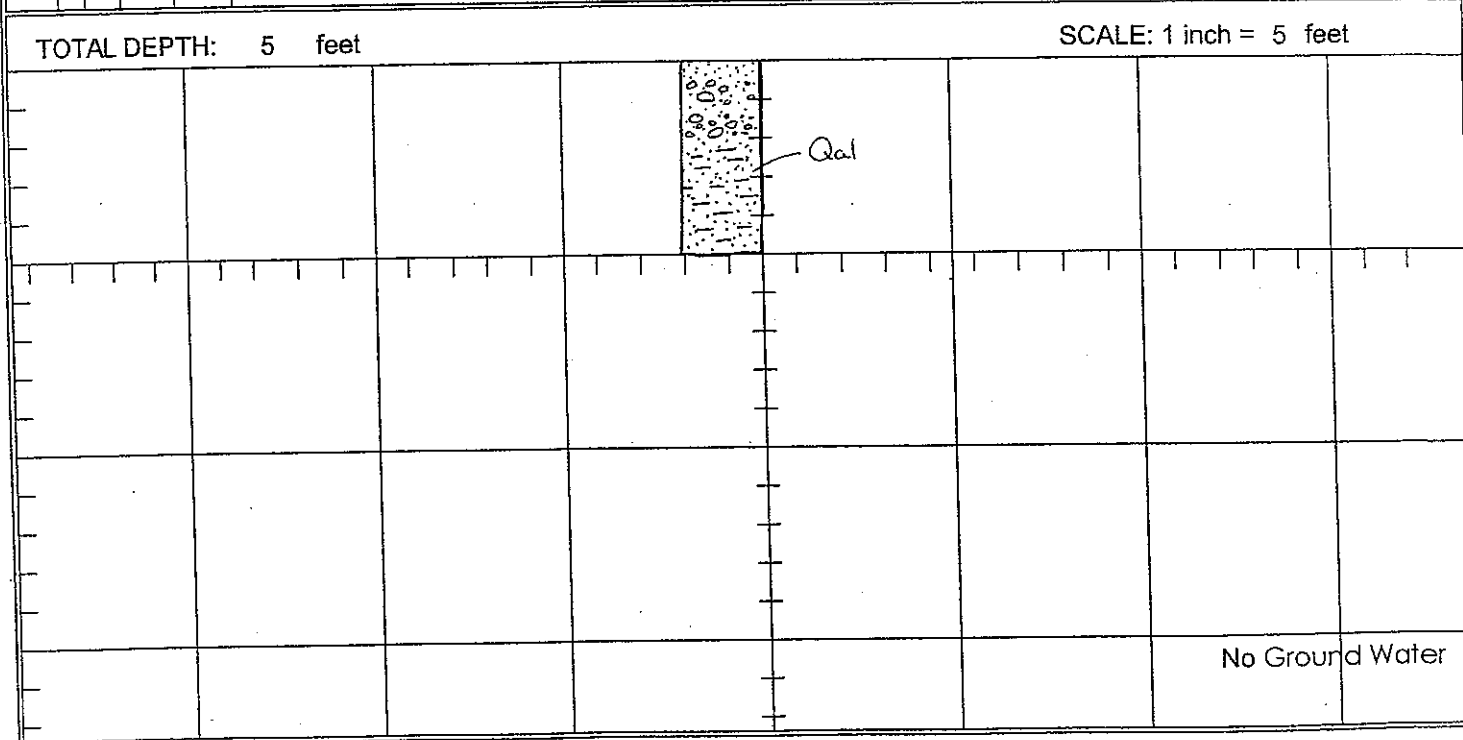
TOTAL DEPTH: 5 feet SCALE: 1 inch = 5 feet



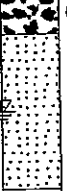
No Ground Water

CLIENT: The Newhall Land & Farming Company	JOB NO: 05-1155BE-9 (9)	<b>TRENCH LOG NO. T-OC-2</b>
PROJECT: Alluvial Sediment Sampling Castaic Creek	DATE: 9/15/05	
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	EXCAVATED: 8/31/05	
EXCAVATION METHOD: Hand Labor	ELEVATION: 1002'	

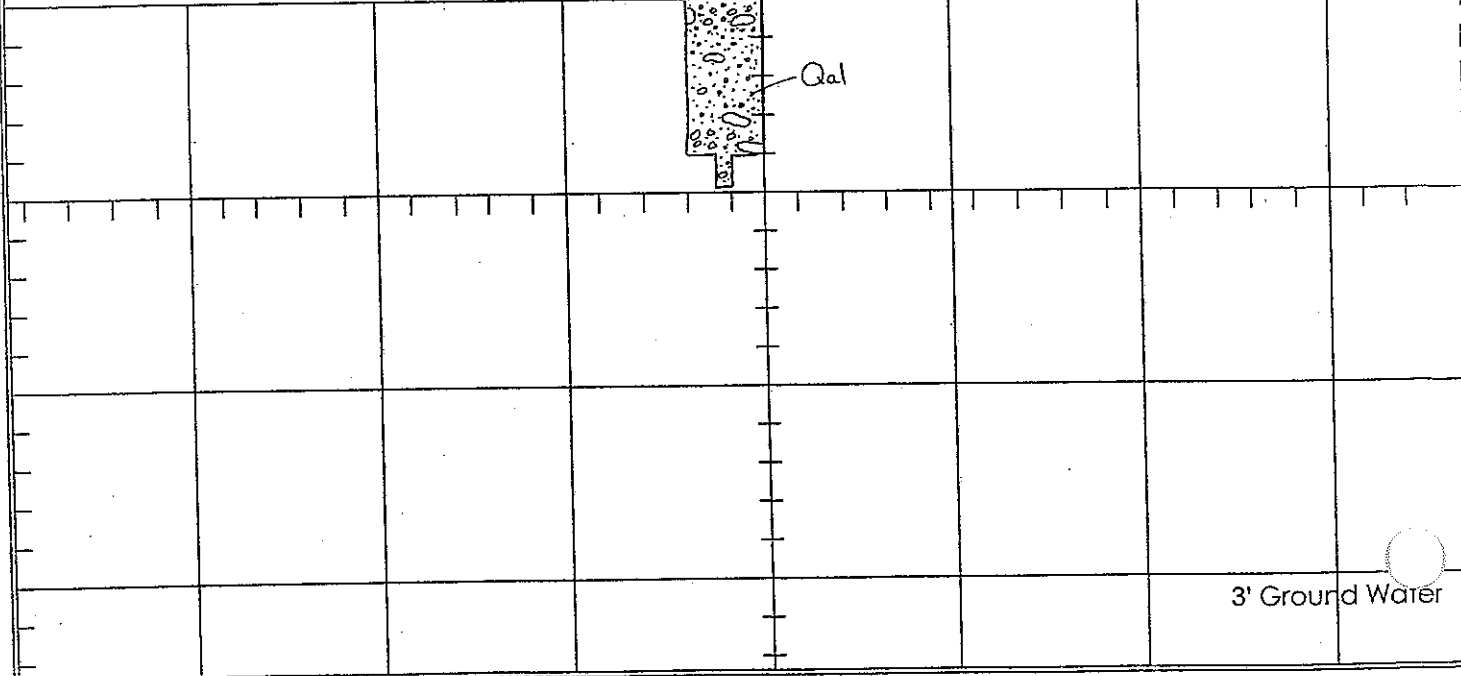
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							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				SP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Pale-brown, poorly graded SAND; friable; dry @ 0.5' -with gravel and local cobbles @ 1.5' Yellowish-brown, poorly graded GRAVEL; friable; damp @ 2' Brown, silty SAND; damp @ 2.5' -with gravel @ 3' -dark brown to greenish gray  <b>COMMENTS:</b> Bulk sample @ 0-5' (636 lbs total) Roots exposed @ 5'			Gradation % fines=4.4	
				GP					
				SM					
5									
10									
15									
20									



CLIENT: The Newhall Land & Farming Company	JOB NO: 05-1155BE-9 (9)	<b>TRENCH LOG NO. T-OC-3</b>
PROJECT: Alluvial Sediment Sampling Castaic Creek	DATE: 9/15/05	
	LOGGED BY: JH	
	EXCAVATED: 9/1/05	
EXCAVATION METHOD: Hand Labor	ELEVATION: 1000'	

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GW SP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Pale-brown, well-graded GRAVEL with sand and cobbles; friable; dry @ 1' Yellowish-brown, poorly graded SAND with gravel; friable; damp @ 1.5' -with cobbles; moist @ 3' -local cobbles; wet  <b>COMMENTS:</b> Bulk sample @ 0-5' (781 lbs total) Sample hand-augered from 4 to 5' due to ground water			Gradation % fines=0.6	
5									
10									
15									
20									

TOTAL DEPTH: 5 feet SCALE: 1 inch = 5 feet



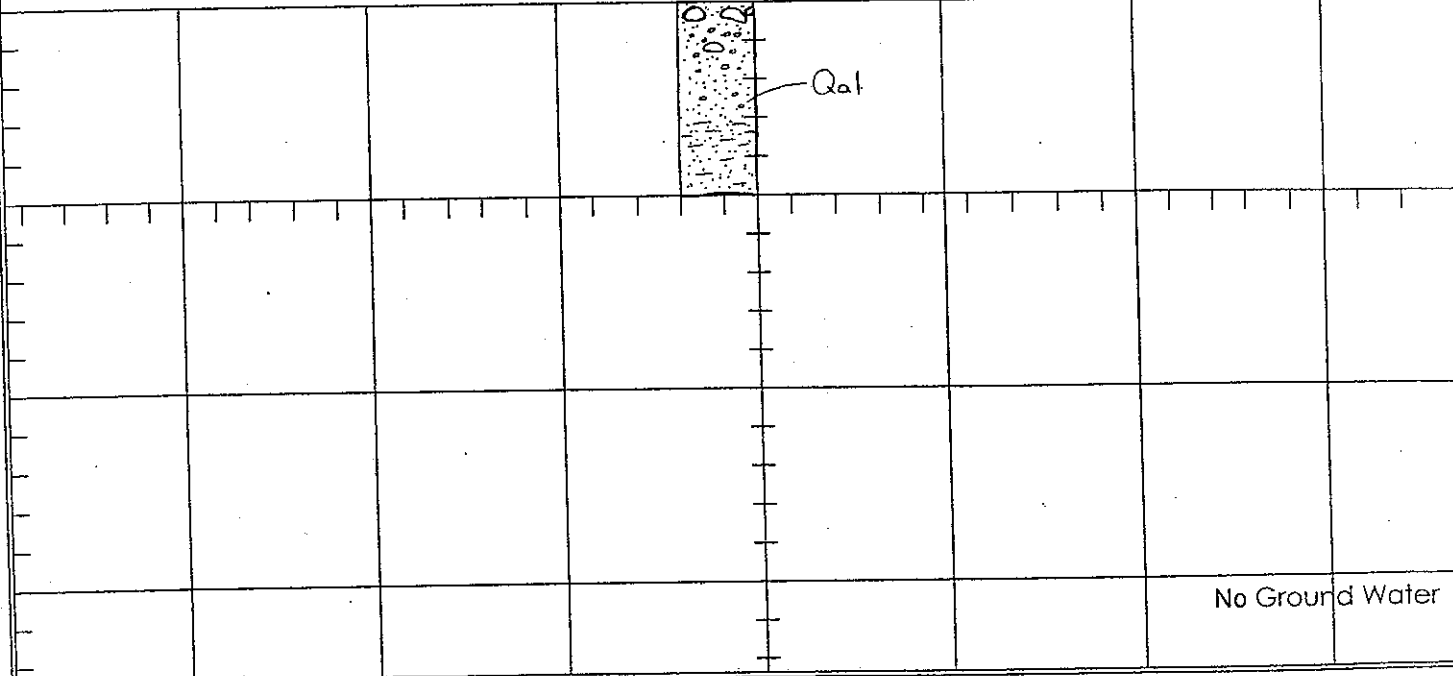
CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek  
 EXCAVATION METHOD: Hand Labor

JOB NO: 05-1155BE-9 (9)  
 DATE: 9/15/05  
 LOGGED BY: JH  
 EXCAVATED: 9/1/05  
 ELEVATION: 983'

# TRENCH LOG NO. T-CC-1






DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Pale-brown, poorly graded GRAVEL with sand and cobbles; damp @ 0.5' Yellowish-brown, poorly graded SAND with gravel and local cobbles; damp @ 1' Yellowish-brown, well-graded SAND @ 2' Yellowish-brown, poorly graded SAND with local cobbles; damp @ 3' Brown, silty clayey SAND; damp @ 4' Light yellowish-brown, well-graded SAND with silt; damp  <b>COMMENTS:</b> Bulk sample @ 0-5' (679 lbs total)			Gradation % fines=8.0	
				SP					
				SW					
				SC					
				SM					
5				SW					
				SM					
10									
15									
20									

TOTAL DEPTH: 5 feet SCALE: 1 inch = 5 feet



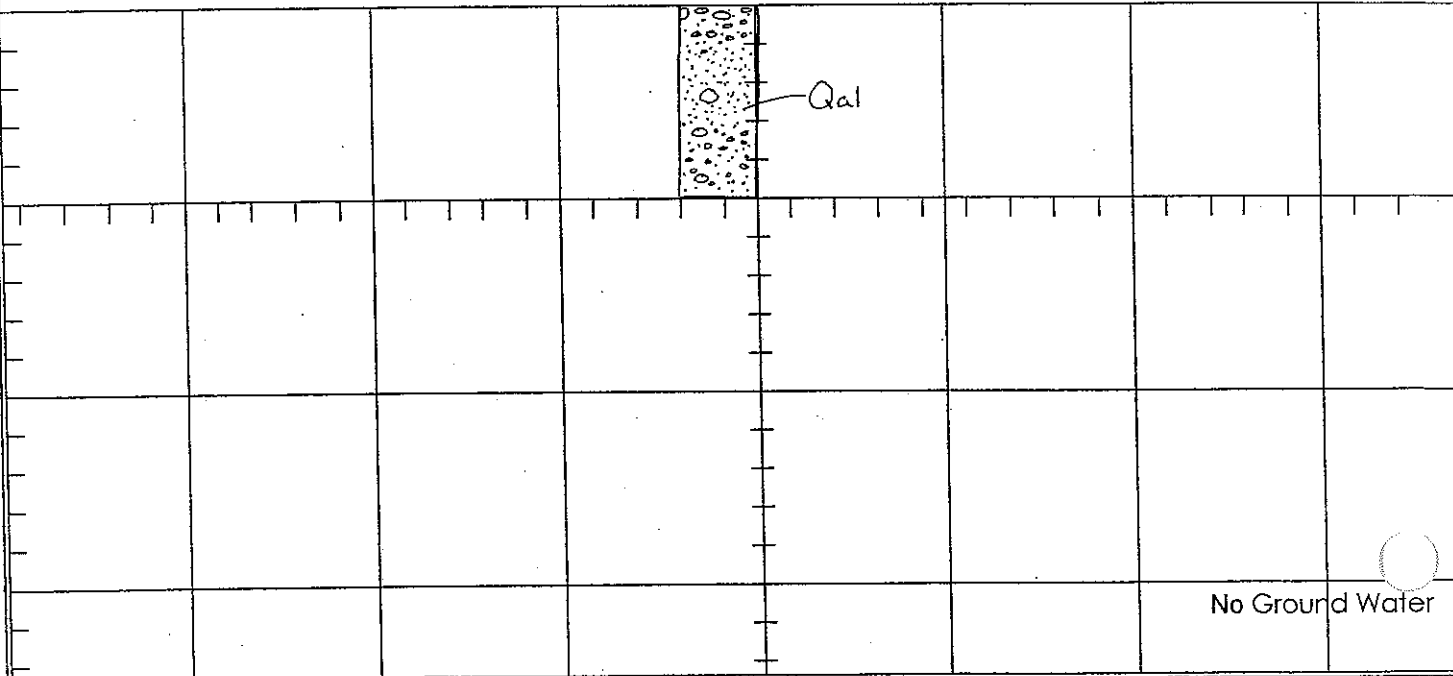
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PROJECT: Alluvial Sediment Sampling Castaic Creek	DATE: 9/15/05
	LOGGED BY: JH
	EXCAVATED: 9/1/05
EXCAVATION METHOD: Hand Labor	ELEVATION: 980'

# TRENCH LOG NO. T-CC-2

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light-gray, poorly graded GRAVEL with sand and cobbles; friable; dry @ 0.5' Light-gray, poorly graded SAND with gravel; friable; dry @ 1' -no gravel; damp @ 2' Pale-brown, well-graded SAND with local cobbles; damp @ 3' Pale-brown, poorly graded SAND with gravel @ 4' -local cobbles  <u>COMMENTS:</u> Bulk sample @ 0-5' (707 lbs total)			Gradation % fines=1.4	
				SP					
				SW					
				SP					
5				SP					
10									
15									
20									

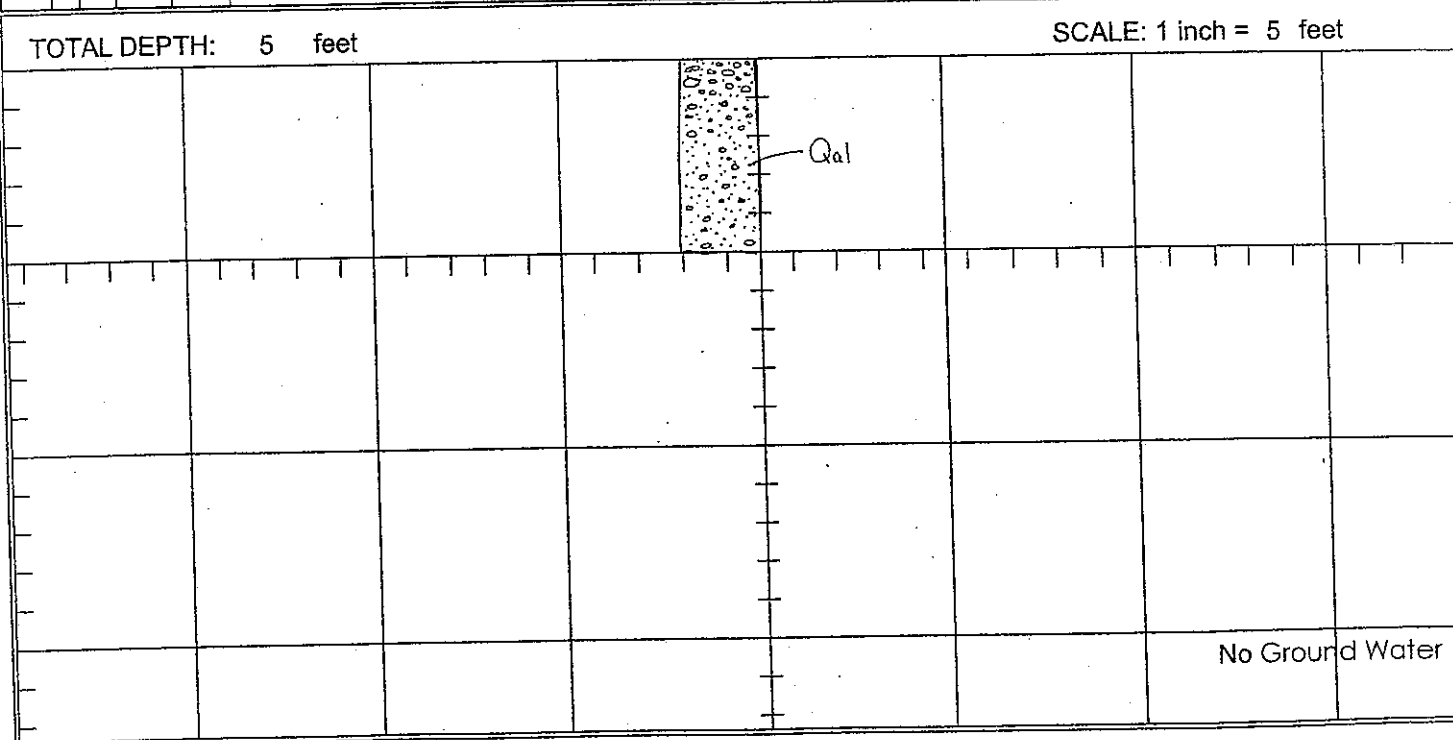
TOTAL DEPTH: 5 feet

SCALE: 1 inch = 5 feet



CLIENT: The Newhall Land & Farming Company	JOB NO: 05-1155BE-9 (9)	<b>TRENCH LOG NO. T-CC-3</b>
PROJECT: Alluvial Sediment Sampling Castaic Creek	DATE: 9/15/05	
	LOGGED BY: JH	
	EXCAVATED: 9/1/05	
EXCAVATION METHOD: Hand Labor	ELEVATION: 980'	

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light-gray, poorly graded GRAVEL with sand; friable; dry @ 1' -damp @ 2' Pale-brown, poorly graded SAND with gravel and local cobbles @ 3' -no cobbles  <u>COMMENTS:</u> Bulk sample @ 0-5' (750 lbs total)			Gradation % fines=1.0	
5				SP					
10									
15									
20									



No Ground Water

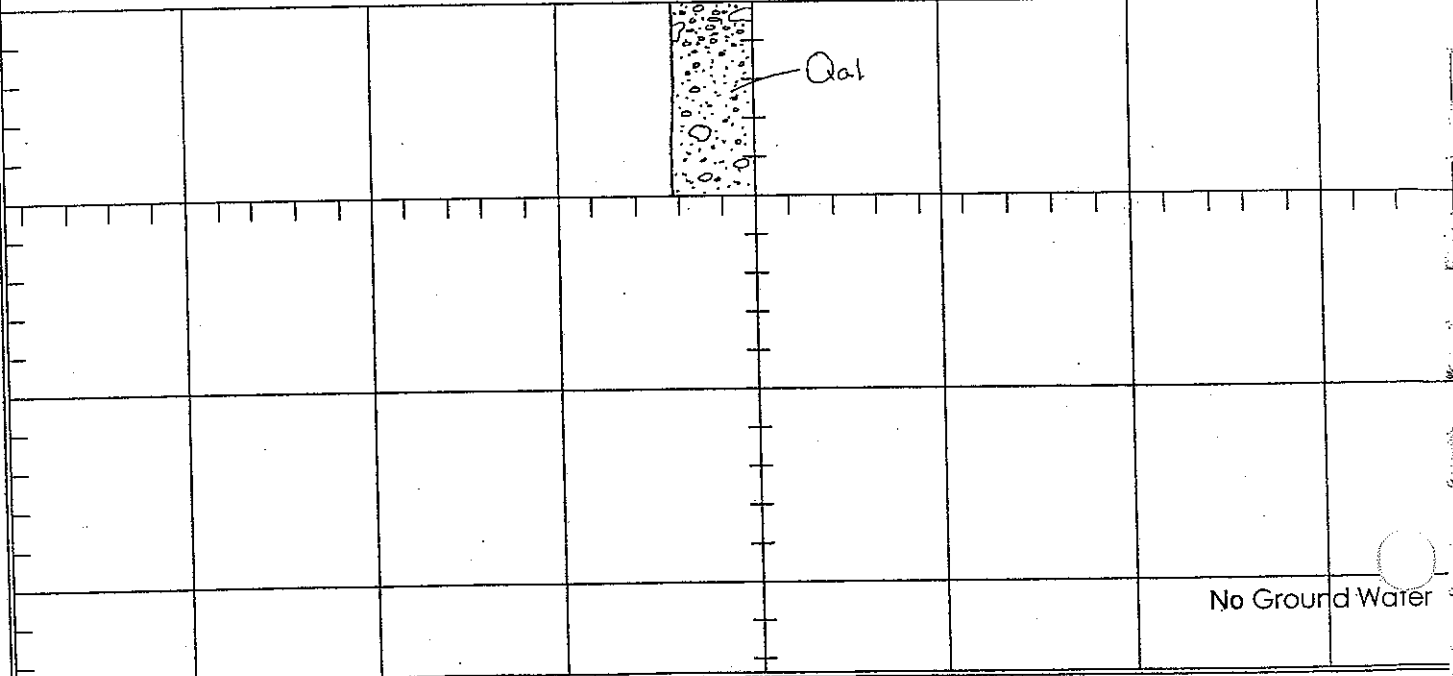
CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek  
 EXCAVATION METHOD: Hand Labor

JOB NO: 05-1155BE-9 (9)  
 DATE: 9/15/05  
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 EXCAVATED: 9/2/05  
 ELEVATION: 989'

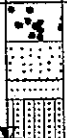
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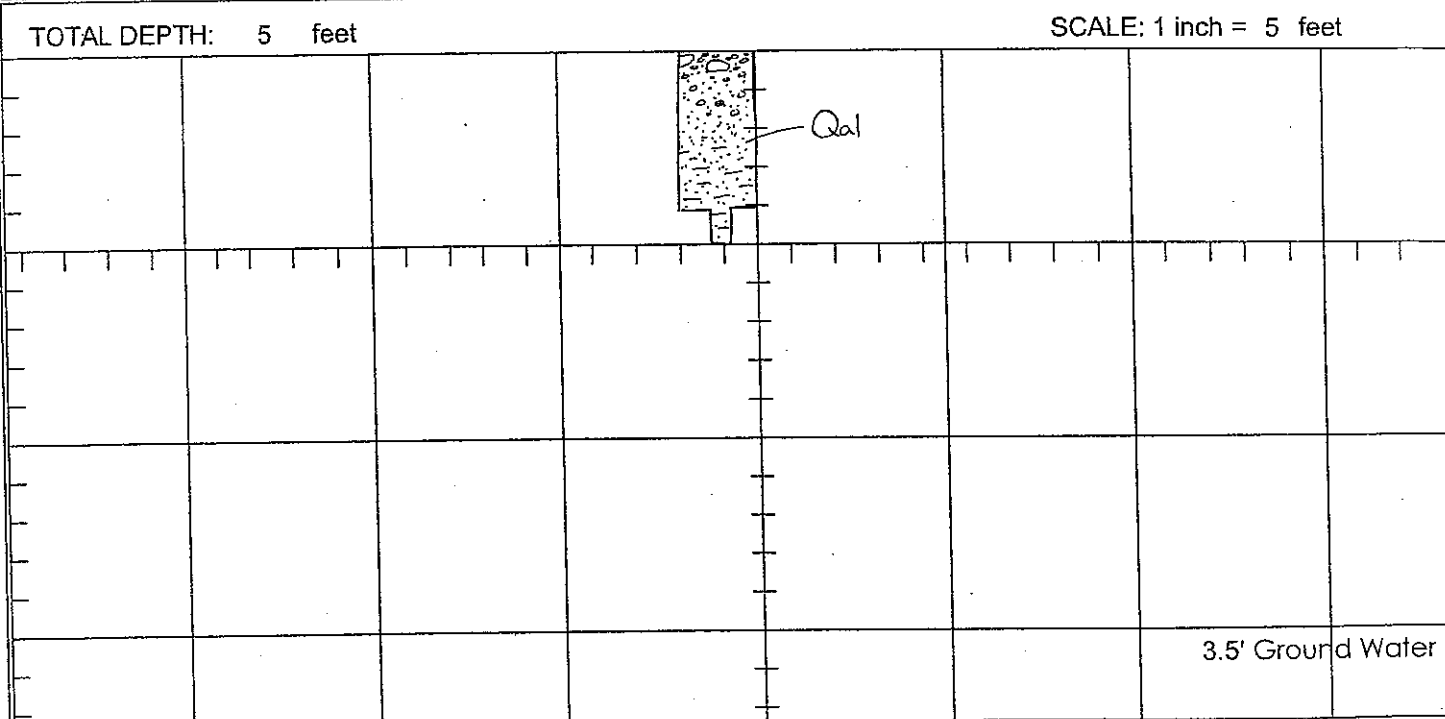
DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP SP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light-gray, poorly graded GRAVEL with sand and cobbles; friable; dry @ 1' Pale-brown, poorly graded SAND with gravel; damp @ 3' -local cobbles  <b>COMMENTS:</b> Bulk sample @ 0-5' (752 lbs total)			Gradation % fines=1.1	
5									
10									
15									
20									

TOTAL DEPTH: 5 feet SCALE: 1 inch = 5 feet



CLIENT: The Newhall Land & Farming Company	JOB NO: 05-1155BE-9 (9)	<b>TRENCH LOG NO. T-CH-1</b>
PROJECT: Alluvial Sediment Sampling Castaic Creek	DATE: 9/15/05	
	LOGGED BY: JH	
	EXCAVATED: 9/2/05	
EXCAVATION METHOD: Hand Labor	ELEVATION: 969'	

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP SP SW SM	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light-gray, poorly graded GRAVEL with sand and local cobbles; friable; dry @ 1' Pale-brown, poorly graded SAND with gravel; damp @ 2' Light yellowish-brown, well-graded SAND; damp @ 2.5' Dark-brown, silty SAND with local cobbles; damp @ 3.5' -wet  <b>COMMENTS:</b> Bulk sample @ 0-5' (392 lbs total) Sample hand-augered from 4 to 5' due to ground water			Gradation % fines=3.1	
5									
10									
15									
20									

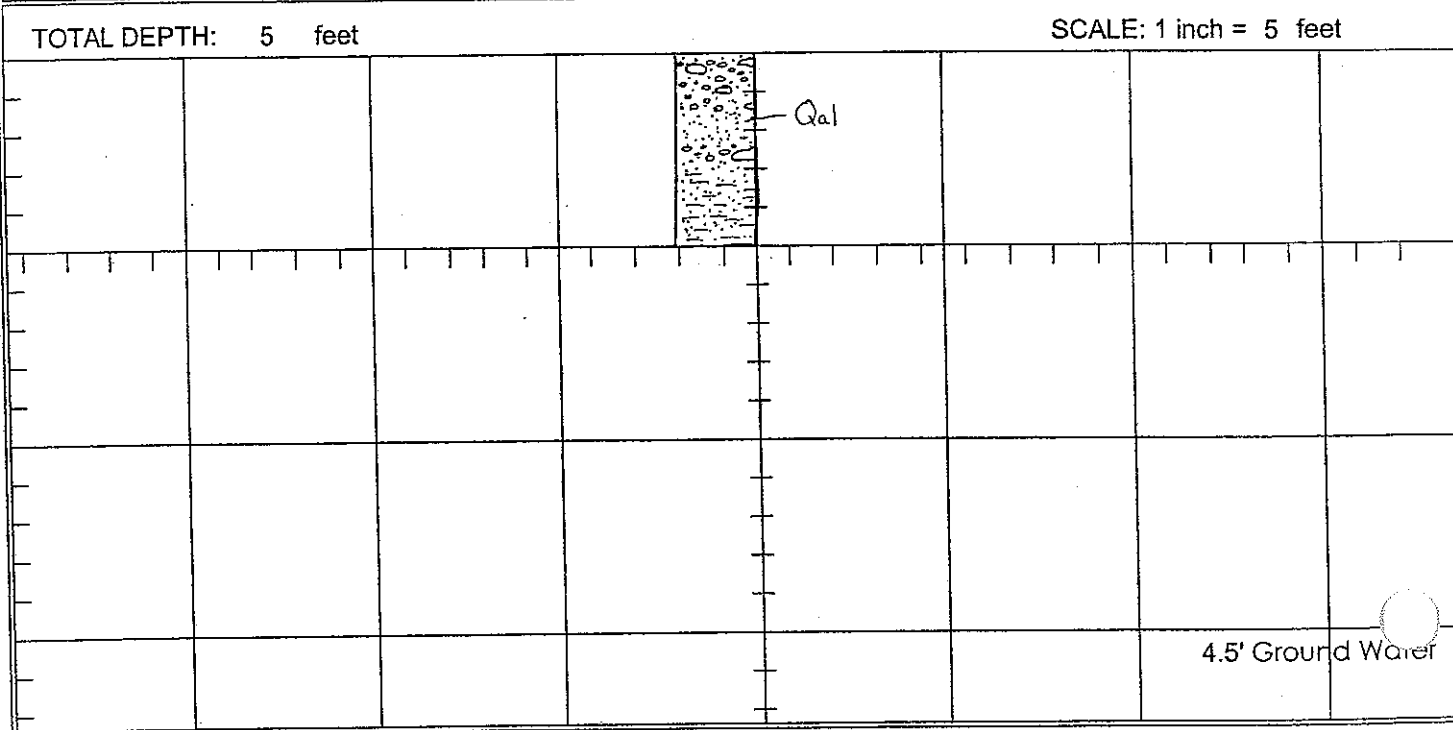


CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek  
 EXCAVATION METHOD: Hand Labor


JOB NO: 05-1155BE-9 (9)  
 DATE: 9/15/05  
 LOGGED BY: JH  
 EXCAVATED: 9/2/05  
 ELEVATION: 968'

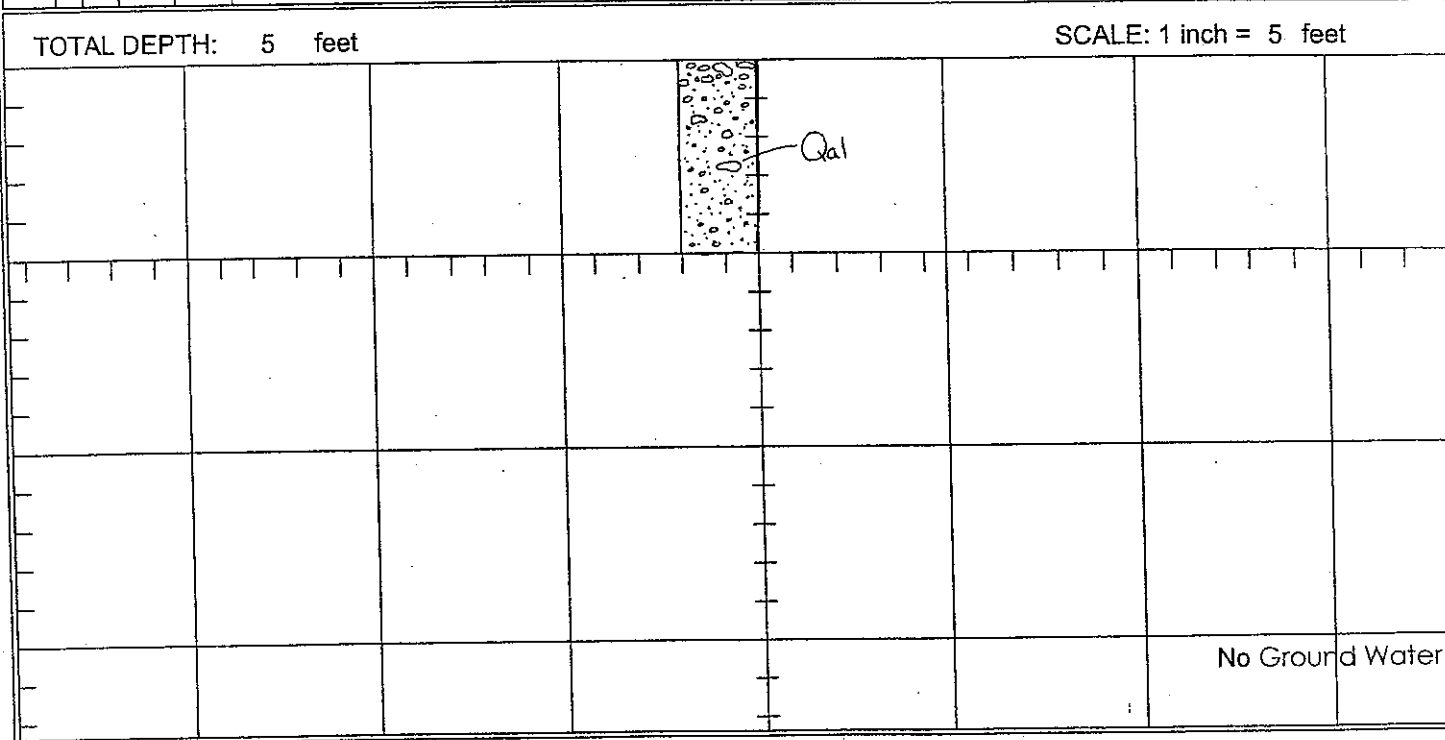
# TRENCH LOG NO. T-CH-2

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light-gray, poorly graded GRAVEL with sand and rare cobbles; friable; dry @ 1' -damp @ 2' Pale-brown, poorly graded SAND; damp @ 2.5' Pale-brown, poorly graded GRAVEL with sand and local cobbles; moist @ 3' Yellowish-brown, silty, clayey SAND; moist @ 4.5' -wet  <b>COMMENTS:</b> Bulk sample @ 0-5' (717 lbs total)			Gradation % fines=14.8	
5									
10									
15									
20									



CLIENT: The Newhall Land & Farming Company	JOB NO: 05-1155BE-9 (9)	<b>TRENCH LOG NO. T-CH-3</b>
PROJECT: Alluvial Sediment Sampling Castaic Creek	DATE: 9/15/05	
	LOGGED BY: JH	
	EXCAVATED: 9/2/05	
EXCAVATION METHOD: Hand Labor	ELEVATION: 970'	

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP SP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light-gray, poorly graded GRAVEL with sand and cobbles; friable; dry @ 1' Pale-brown, poorly graded SAND with gravel and local cobbles; damp @ 2' -no cobbles @ 3' -local cobbles  <u>COMMENTS:</u> Bulk sample @ 0-5' (732 lbs total)			Gradation % fines=0.8	
5									
10									
15									
20									



CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek  
 EXCAVATION METHOD: Hand Labor

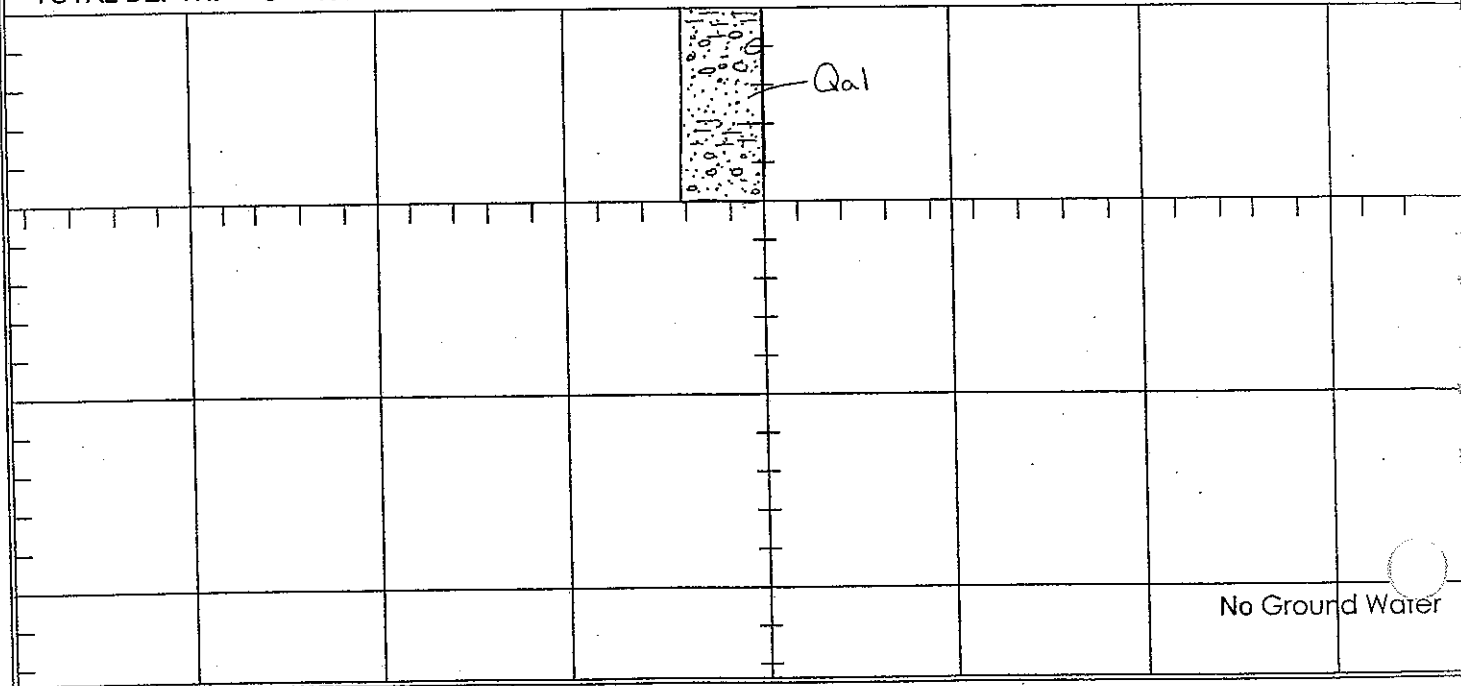
JOB NO: 05-1155BE-9 (9)  
 DATE: 9/15/05  
 LOGGED BY: JH  
 EXCAVATED: 9/2/05  
 ELEVATION: 957'

# TRENCH LOG NO. T-HW-1

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				SP-SM	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Pale-brown, poorly graded SAND with silt; friable; dry @ 0.5' -with gravel @ 1' -with local cobbles @ 2' Light yellowish-brown, well-graded SAND; damp @ 3' Brown, poorly graded SAND with silt; damp @ 4' Light yellowish-brown, well-graded SAND with gravel; damp  <u>COMMENTS:</u> Bulk sample @ 0-5' (671 lbs total)			Gradation % fines=3.0	
				SW					
				SP-					
				SM					
5				SW					
10									
15									
20									

TOTAL DEPTH: 5 feet

SCALE: 1 inch = 5 feet



CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek

JOB NO: 05-1155BE-9 (9)  
 DATE: 9/15/05  
 LOGGED BY: JH  
 EXCAVATED: 9/2/05  
 ELEVATION: 956'

# TRENCH LOG NO. T-HW-2

EXCAVATION METHOD: Hand Labor

DEPTH (feet)	SAMPLE TYPE	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
						Moisture Content (%)	Dry Density (pcf)	Other Tests
0			SP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Pale-brown, poorly graded SAND with gravel and cobbles; friable; dry				Gradation % fines=4.0
			SW	@ 1' -no cobbles; damp				
			GP	@ 2' Light yellowish-brown, well-graded SAND; damp				
			SP	@ 3' Light-gray, poorly graded GRAVEL with sand; damp				
5			SC-SM	@ 4' Light yellowish-brown, poorly graded SAND with gravel; damp @ 4.5' Light yellowish-brown to medium-gray, poorly graded SAND with clay; damp				
				<u>COMMENTS:</u> Bulk sample @ 0-5' (711 lbs total)				
10								
15								
20								

TOTAL DEPTH: 5 feet

SCALE: 1 inch = 5 feet

								No Ground Water

CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek

JOB NO: 05-1155BE-9 (9)  
 DATE: 9/15/05  
 LOGGED BY: JH  
 EXCAVATED: 9/6/05  
 ELEVATION: 955'

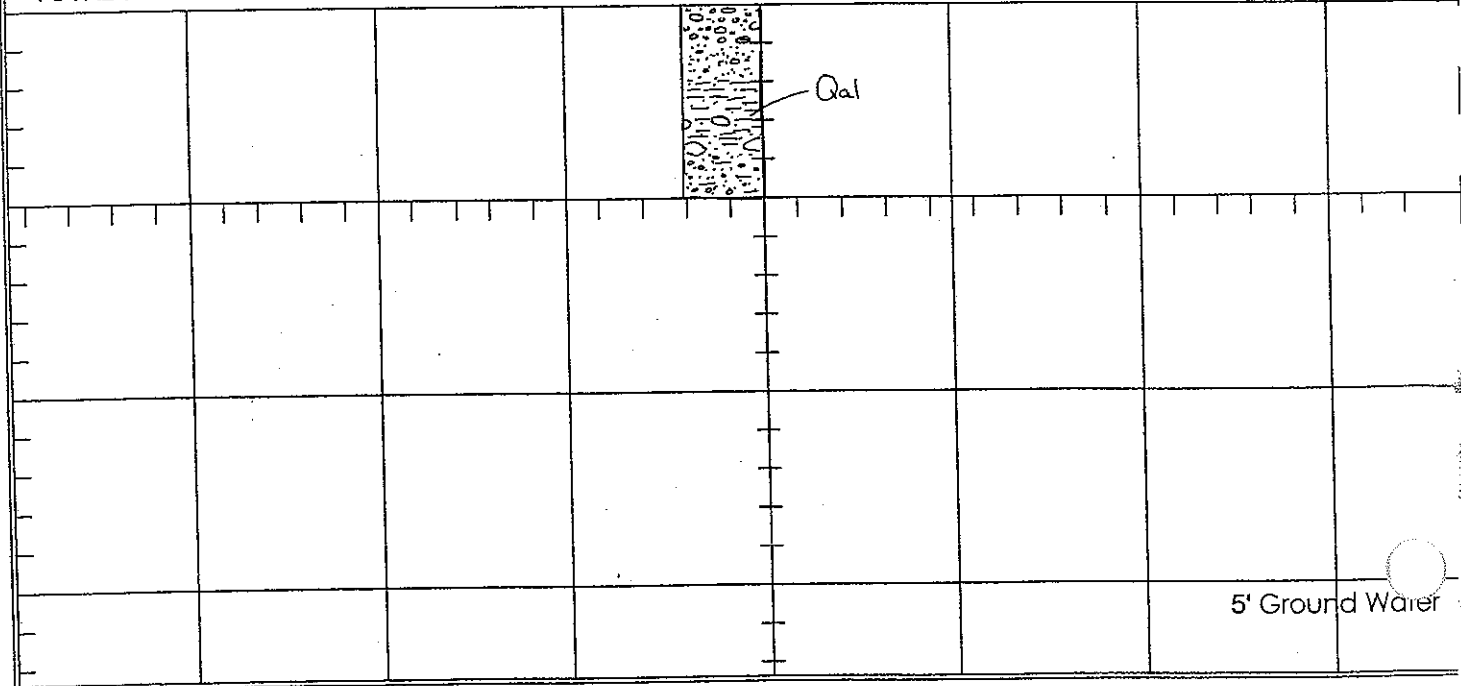
# TRENCH LOG NO. T-HW-3

EXCAVATION METHOD: Hand Labor

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light-gray, poorly graded GRAVEL with sand and cobbles; friable; dry @ 1' Pale-brown, poorly graded SAND with gravel; damp @ 2' Very dark grayish-brown, sandy lean CLAY; damp; some organic material @ 3' -local cobbles @ 4' Brown, poorly graded SAND with silt and gravel; damp @ 5' -wet  <b>COMMENTS:</b> Bulk sample @ 0-5' (718 lbs total)			Gradation % fines=26.4	
				SP					
				CL					
				SP-SM					
5									
10									
15									
20									

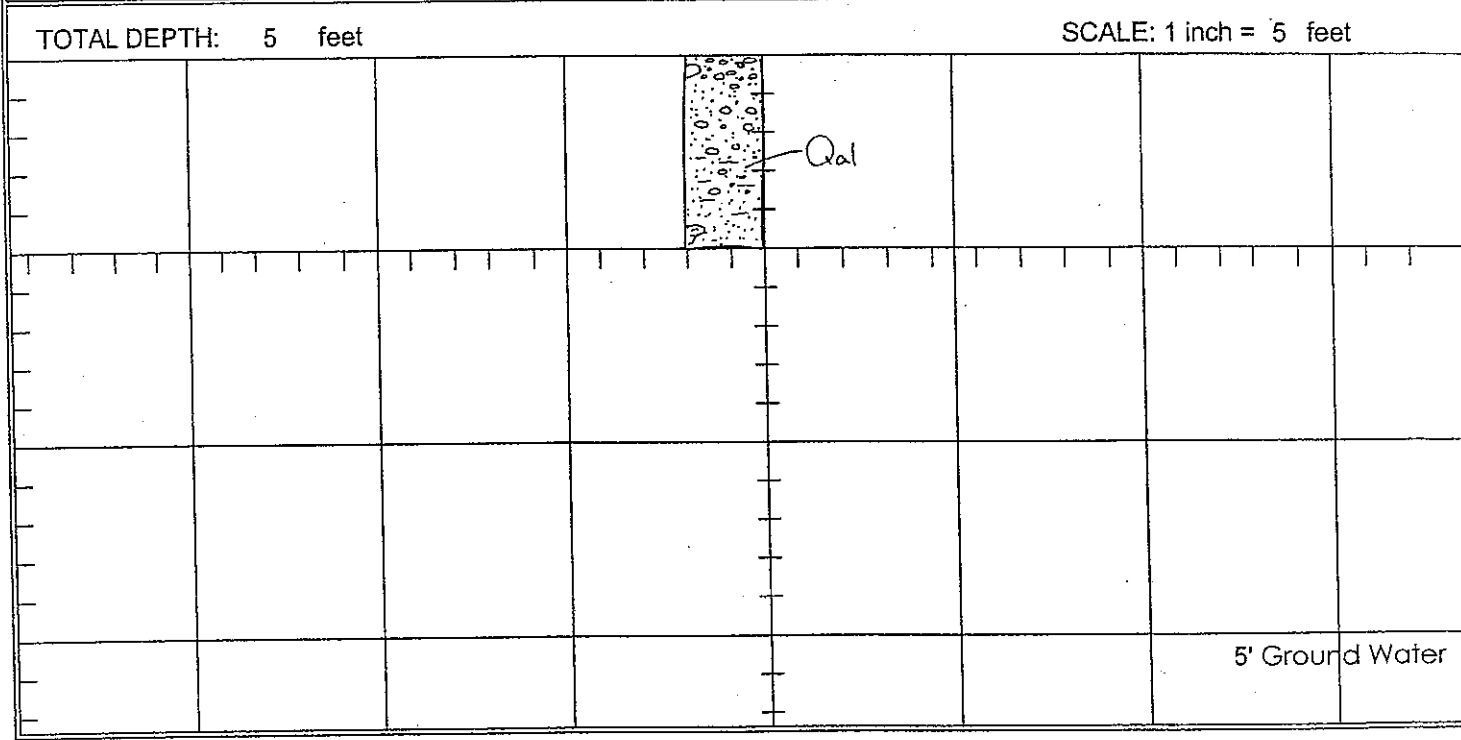
TOTAL DEPTH: 5 feet

SCALE: 1 inch = 5 feet



CLIENT: The Newhall Land & Farming Company	JOB NO: 05-1155BE-9 (9)	<b>TRENCH LOG NO. T-HS-1</b>
PROJECT: Alluvial Sediment Sampling Castaic Creek	DATE: 9/15/05	
	LOGGED BY: JH	
	EXCAVATED: 9/6/05	
EXCAVATION METHOD: Hand Labor	ELEVATION: 943'	

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP SP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light yellowish-brown, poorly graded GRAVEL with sand and local cobbles; friable; dry			Gradation % fines=2.3	
0.5				SW-SM	@ 0.5' Yellowish-brown, poorly graded SAND with gravel; damp @ 2' -dark grayish-brown; moist @ 2.5' Dark grayish-brown, well-graded SAND with silt and gravel; moist @ 4.5' -local rip-up clasts of silt and clay @ 5' -local cobbles; wet				
5					<b>COMMENTS:</b> Bulk sample @ 0-5' (561 lbs total)				
10									
15									
20									



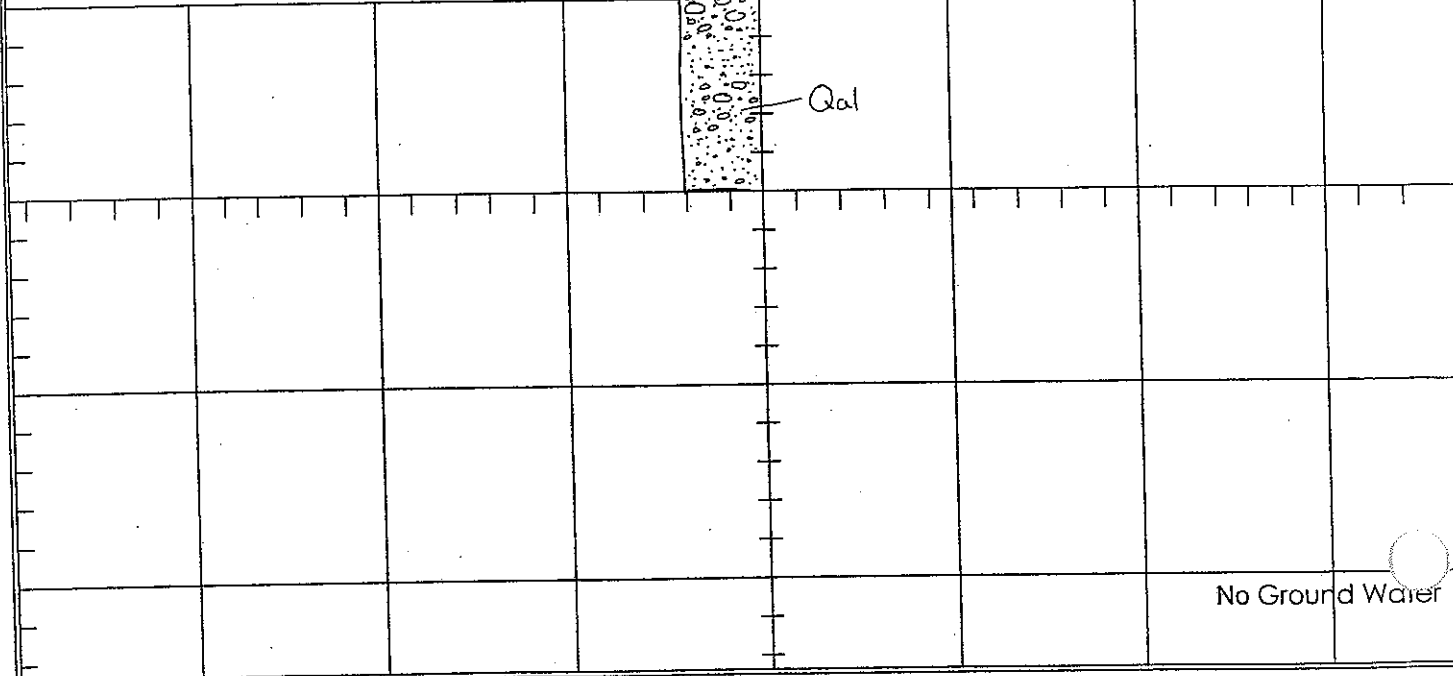
CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek  
 EXCAVATION METHOD: Hand Labor

JOB NO: 05-1155BE-9 (9)  
 DATE: 9/15/05  
 LOGGED BY: JH  
 EXCAVATED: 9/6/05  
 ELEVATION: 941'

# TRENCH LOG NO. T-HS-2

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP SW SP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light-gray, poorly graded GRAVEL with sand and cobbles; friable; dry @ 1' Pale-brown, well-graded SAND with gravel; friable; dry @ 2' Light yellowish-brown, poorly graded SAND with gravel and cobbles; damp @ 4' -no cobbles  <u>COMMENTS:</u> Bulk sample @ 0-5' (684 lbs total)			Gradation % fines=2.6	
5									
10									
15									
20									

TOTAL DEPTH: 5 feet SCALE: 1 inch = 5 feet



CLIENT: The Newhall Land & Farming Company  
 PROJECT: Alluvial Sediment Sampling  
 Castaic Creek  
 EXCAVATION METHOD: Hand Labor

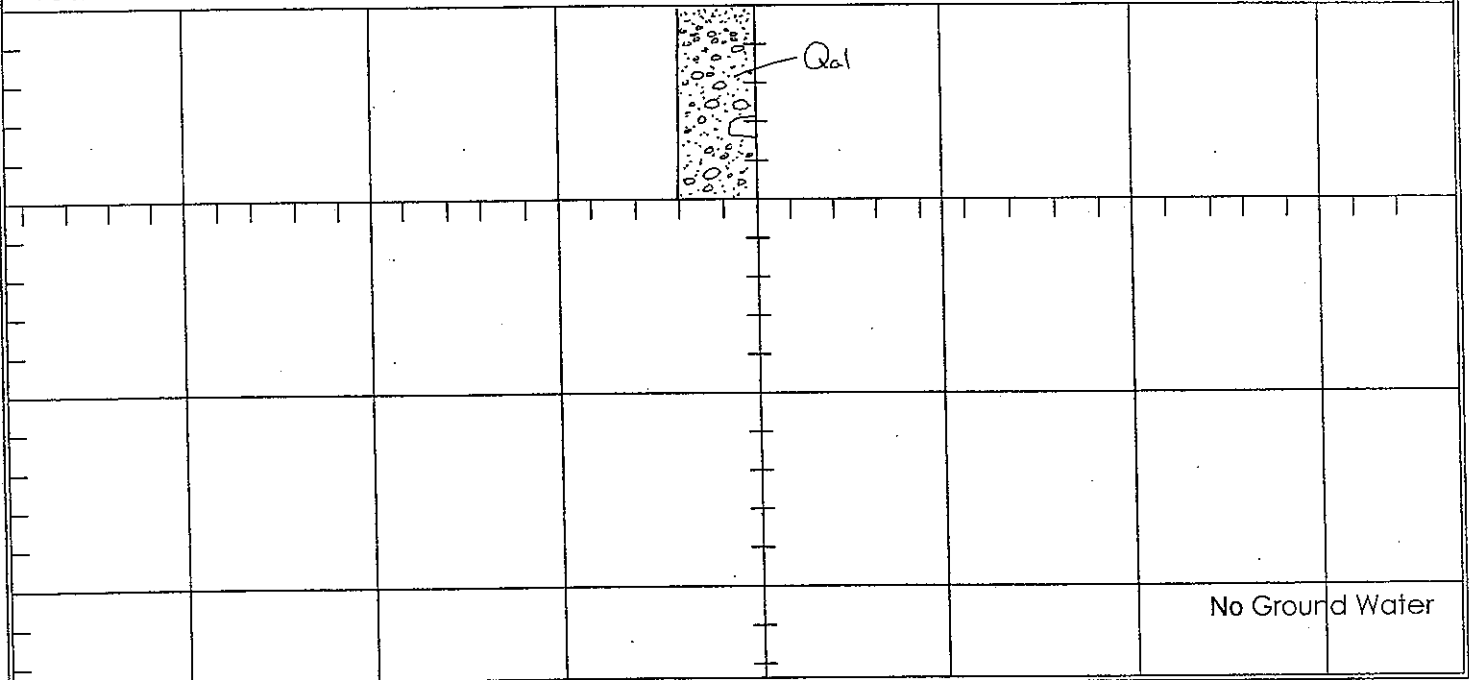
JOB NO: 05-1155BE-9 (9)  
 DATE: 9/15/05  
 LOGGED BY: JH  
 EXCAVATED: 9/6/05  
 ELEVATION: 939'

# TRENCH LOG NO. T-HS-3

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				SP GP SP SW	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Yellowish-brown, poorly graded SAND with uncommon cobbles, friable; dry @ 0.5' Light yellowish-brown, poorly graded GRAVEL with sand; friable; damp @ 1' Light yellowish-brown, poorly graded SAND with gravel; damp @ 3' Pale-brown to yellowish-brown, well-graded SAND with gravel and local cobbles; damp  <b>COMMENTS:</b> Bulk sample @ 0-5' (643 lbs total)			Gradation % fines=0.5	
5									
10									
15									
20									

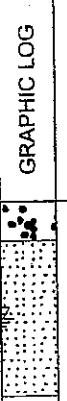
TOTAL DEPTH: 5 feet

SCALE: 1 inch = 5 feet

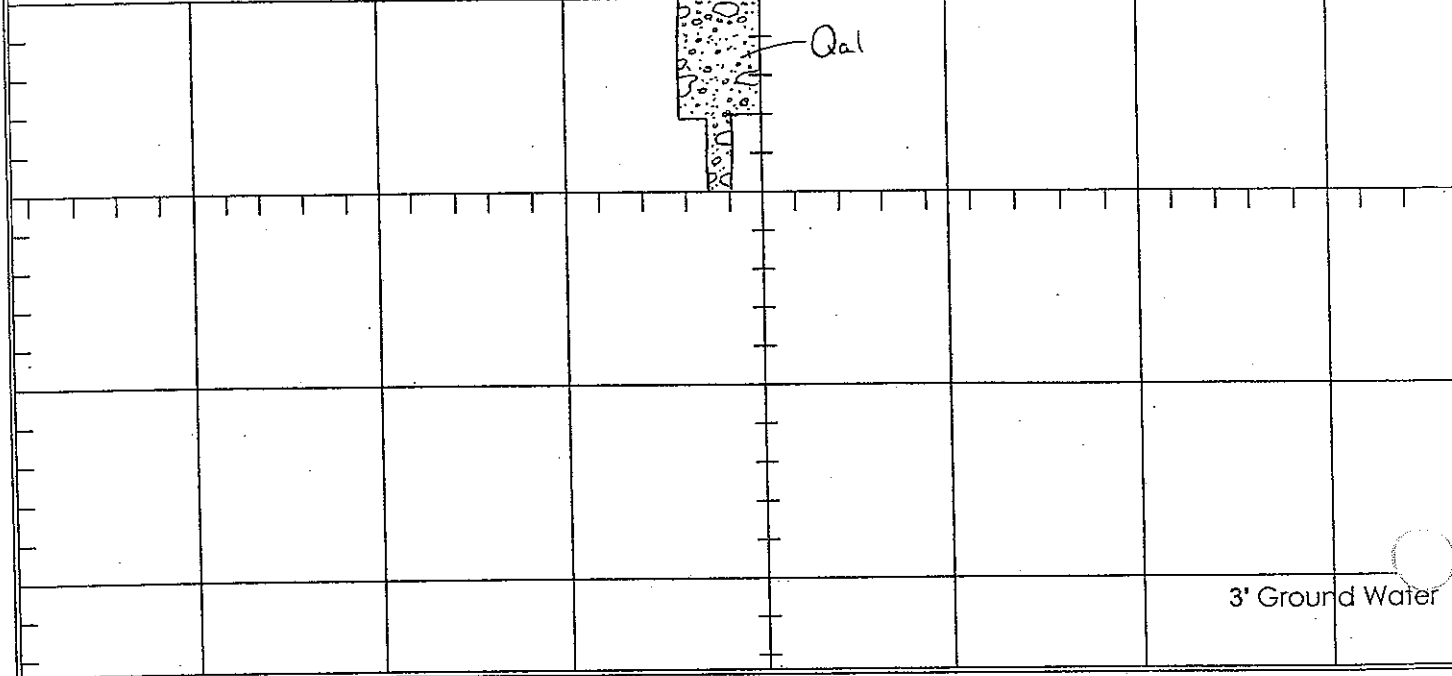


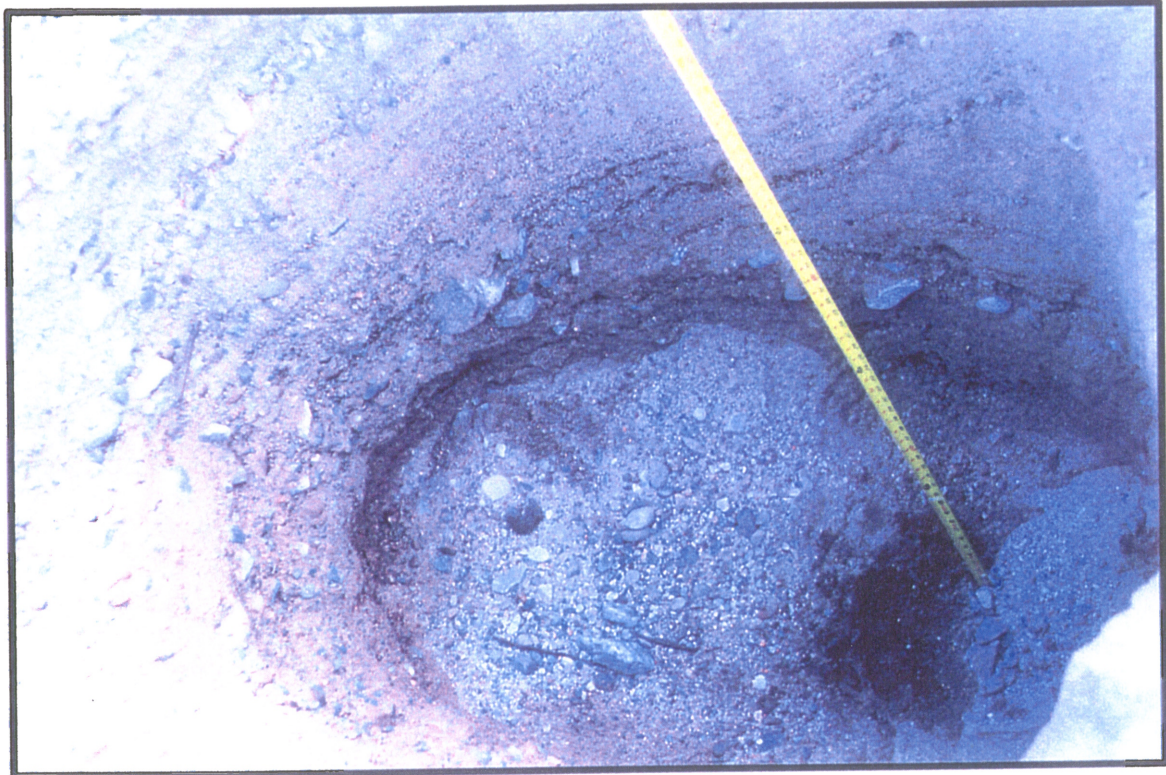
CLIENT: The Newhall Land & Farming Company	JOB NO: 05-1155BE-9 (9)
PROJECT: Alluvial Sediment Sampling Castaic Creek	DATE: 9/15/05
	LOGGED BY: JH
	EXCAVATED: 9/6/05
EXCAVATION METHOD: Hand Labor	ELEVATION: 936'

# TRENCH LOG NO. T-CS-1

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				GP SP	<b>ALLUVIUM; Qal (0 - 5')</b> @ 0' Light-gray, poorly graded GRAVEL with sand and cobbles; friable; dry @ 1' Light yellowish-brown, poorly graded SAND with gravel; damp @ 2' -with local cobbles @ 3' -wet  <b>COMMENTS:</b> Bulk sample @ 0-5' (712 lbs total) Sample hand-augered from 3 to 5' due to ground water			Gradation % fines=1.0	
5									
10									
15									
20									

TOTAL DEPTH: 5 feet SCALE: 1 inch = 5 feet





**ALLAN E. SEWARD  
ENGINEERING GEOLOGY, INC.**  
Geological and Geotechnical Consultants

Site: OR-1

Views: Upstream with North Abutment of Old Rd  
Bridge in Background, and of Pit

Figure: 1

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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Site: OR-2

Views: Downstream and of Pit

Figure: 2

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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Geological and Geotechnical Consultants

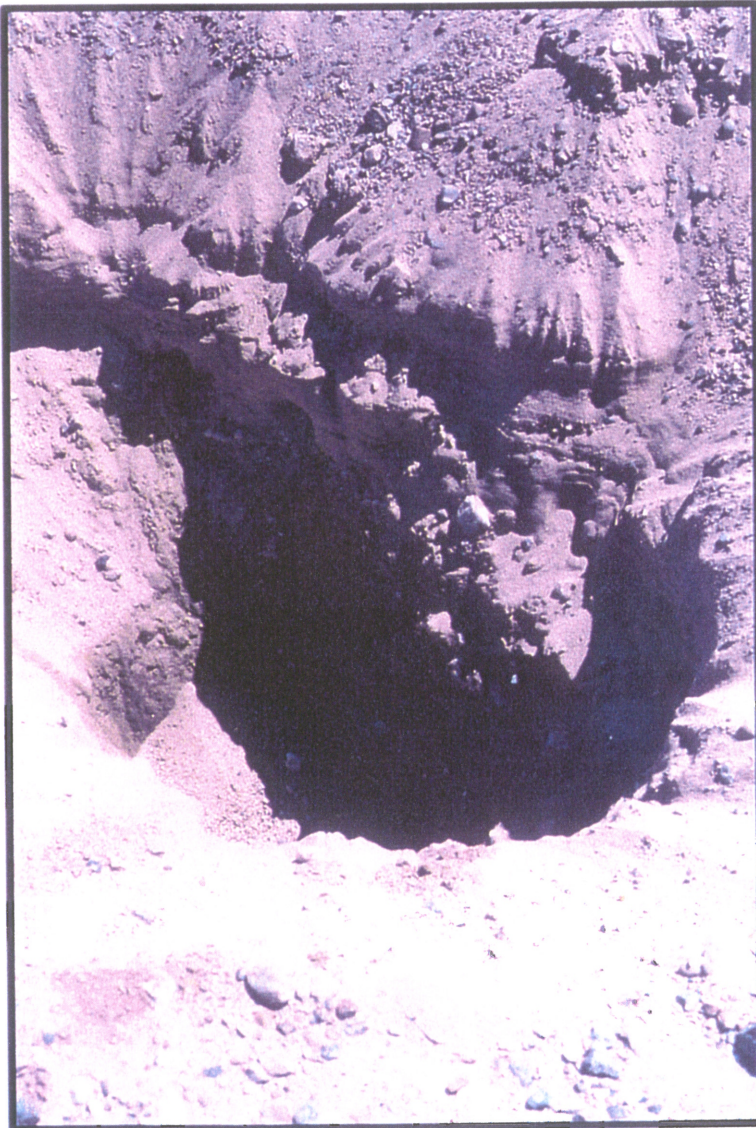
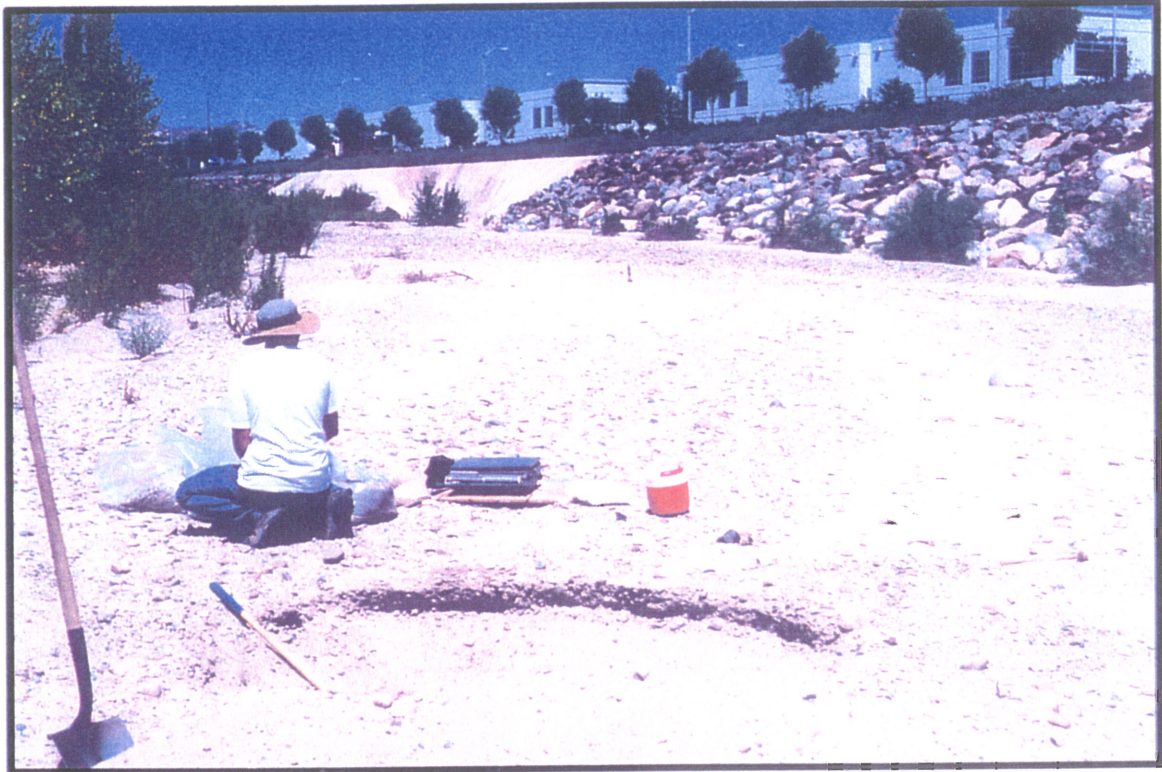
*Site:* OR-3

*Views:* Upstream with South End of Old Rd  
Bridge in Background, and of Pit

*Figure:* 3

*Job No.:* 05-1155BE-9 (9)

*Date:* 9/15/05



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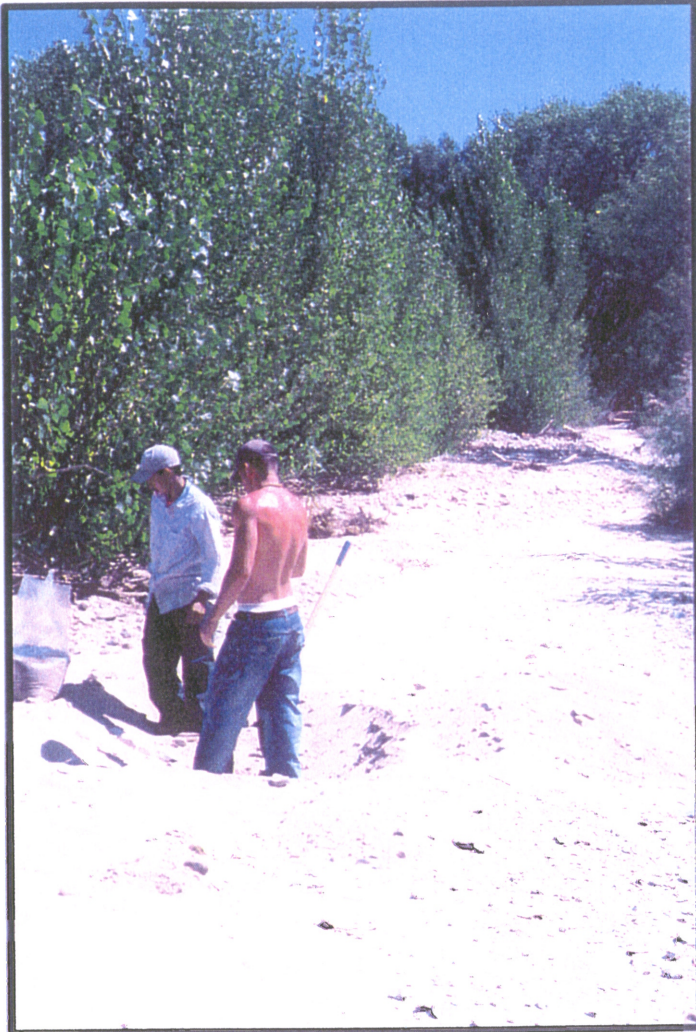
Site: OC-1

Views: Upstream with Channel Liner Below  
Hancock Pkwy in Background, and of Pit

Figure: 4

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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Site: OC-2


Views: Downstream and of Pit

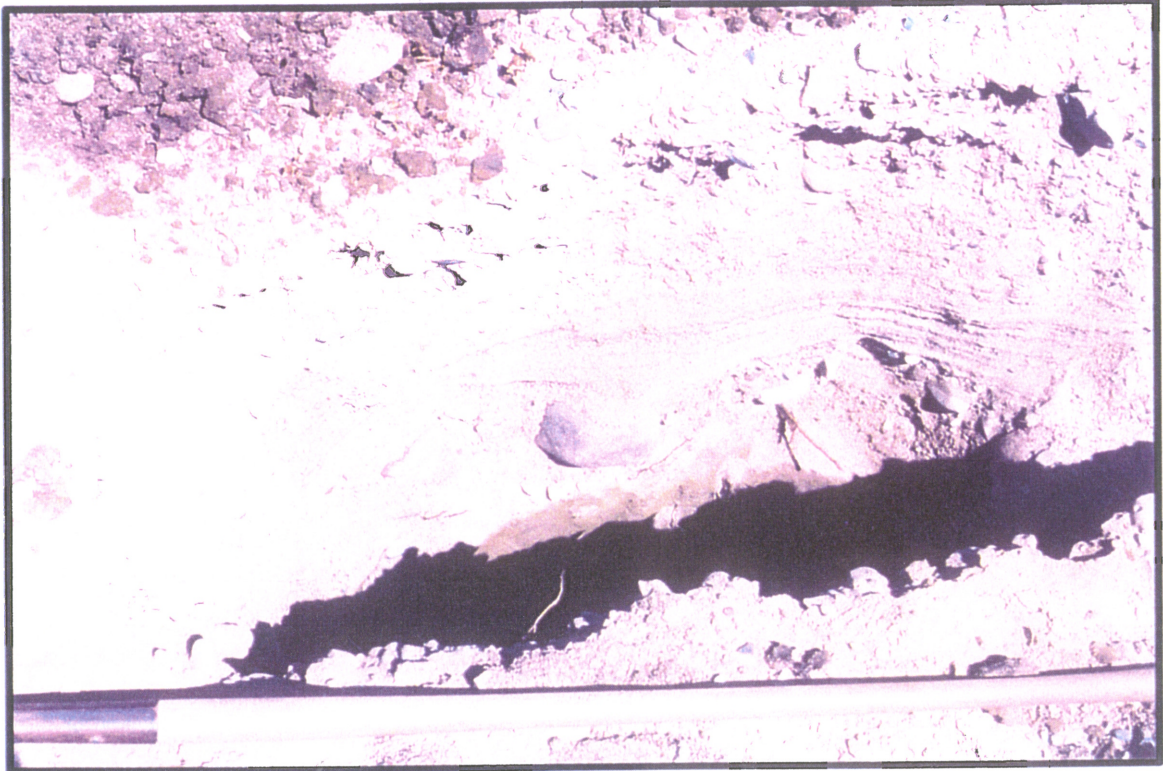
Figure: 5

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



 <b>ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.</b> Geological and Geotechnical Consultants		
<i>Site:</i> OC-3	<i>Views:</i> Downstream and of Pit	
<i>Figure:</i> 6	<i>Job No.:</i> 05-1155BE-9 (9)	<i>Date:</i> 9/15/05



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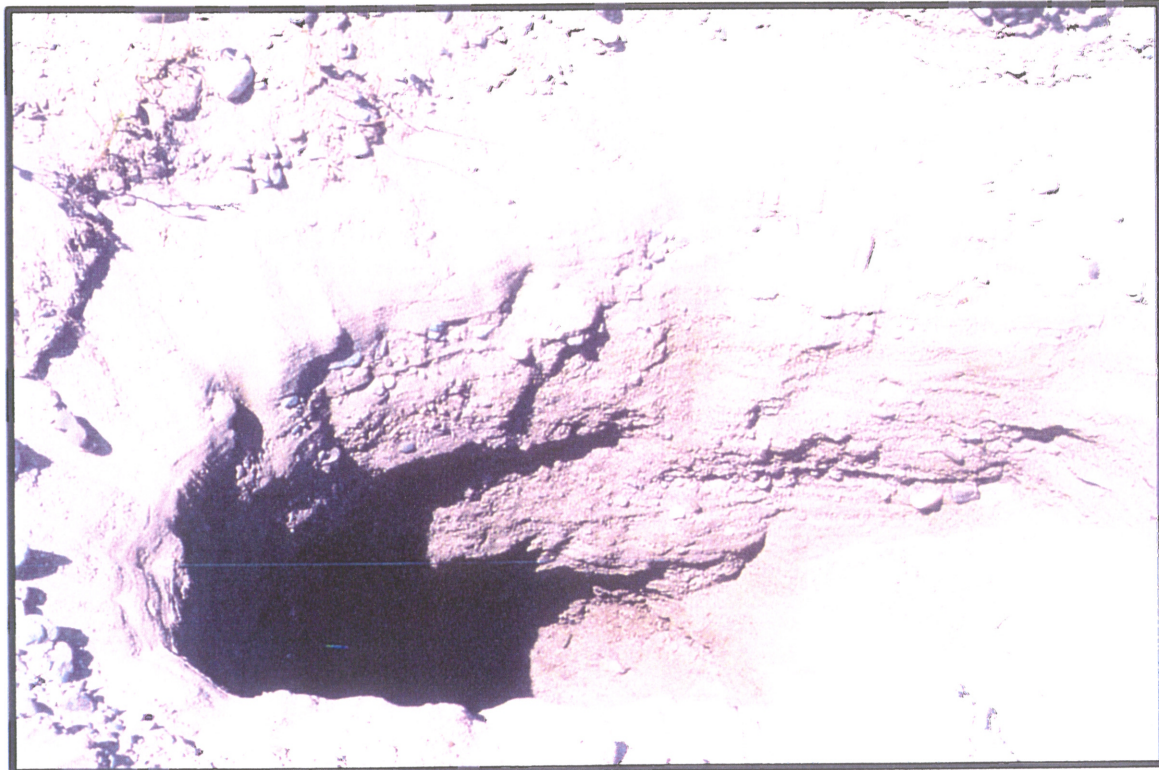
Site: CC-1

Views: Of Pit and Downstream with Commerce  
Center Drive Bridge in Background

Figure: 7

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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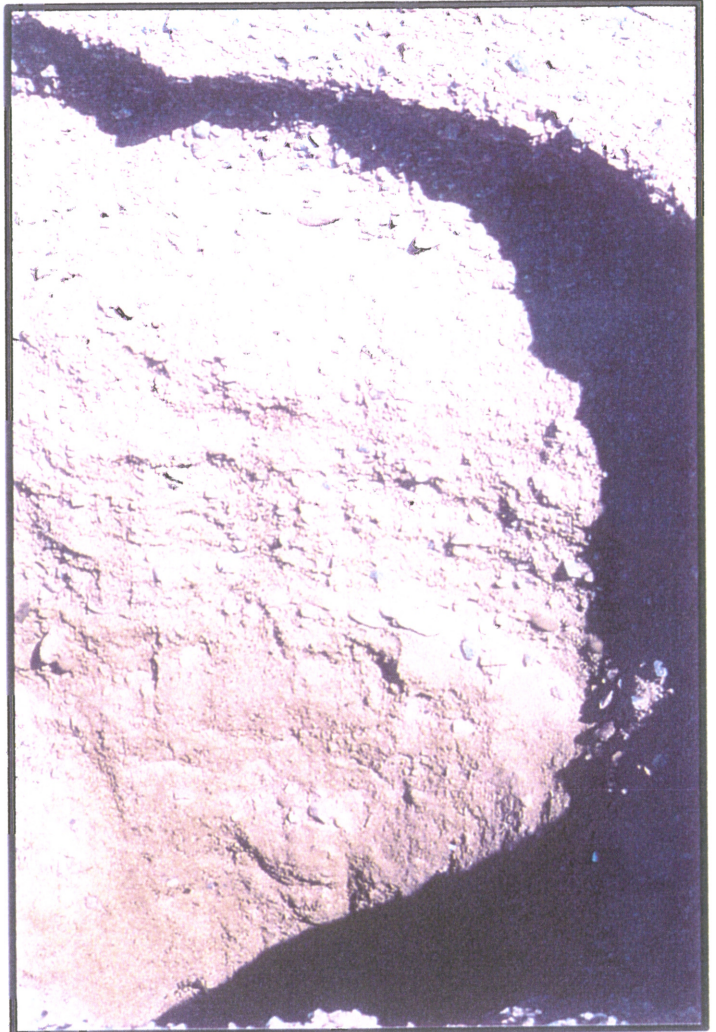
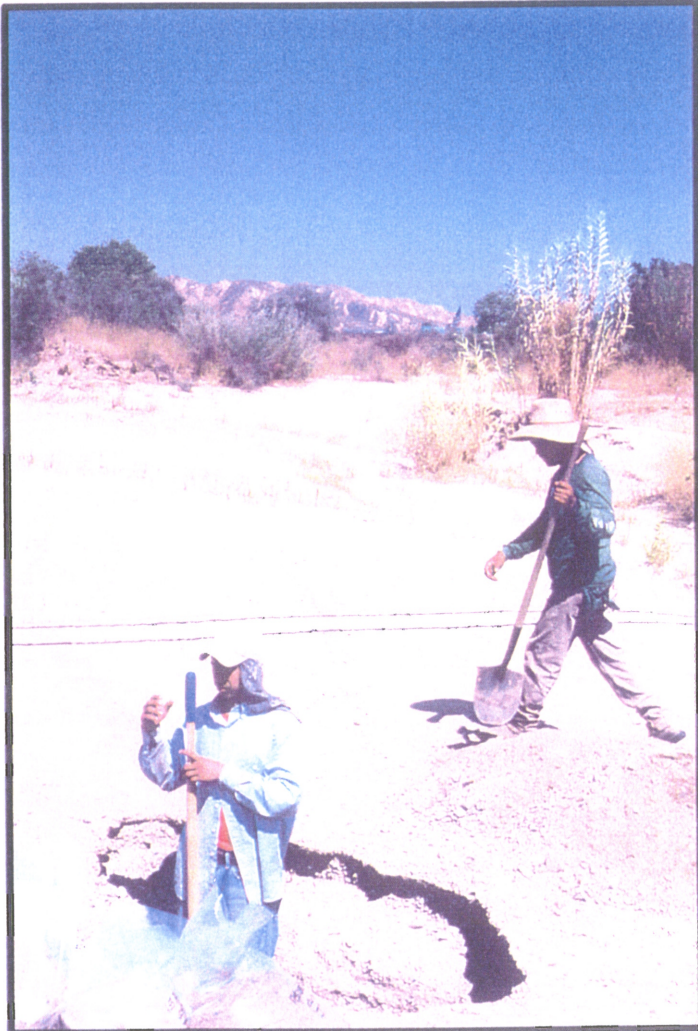
Site: CC-2

Views: Downstream with Commerce Center Drive Bridge in Background, and of Pit

Figure: 8

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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Site: CC-3

Views: Upstream and of Pit

Figure: 9

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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Geological and Geotechnical Consultants

Site: HC-1

Views: Downstream with Commerce Center Drive  
Bridge in Background, and of Pit

Figure: 10

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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**ENGINEERING GEOLOGY, INC.**  
Geological and Geotechnical Consultants

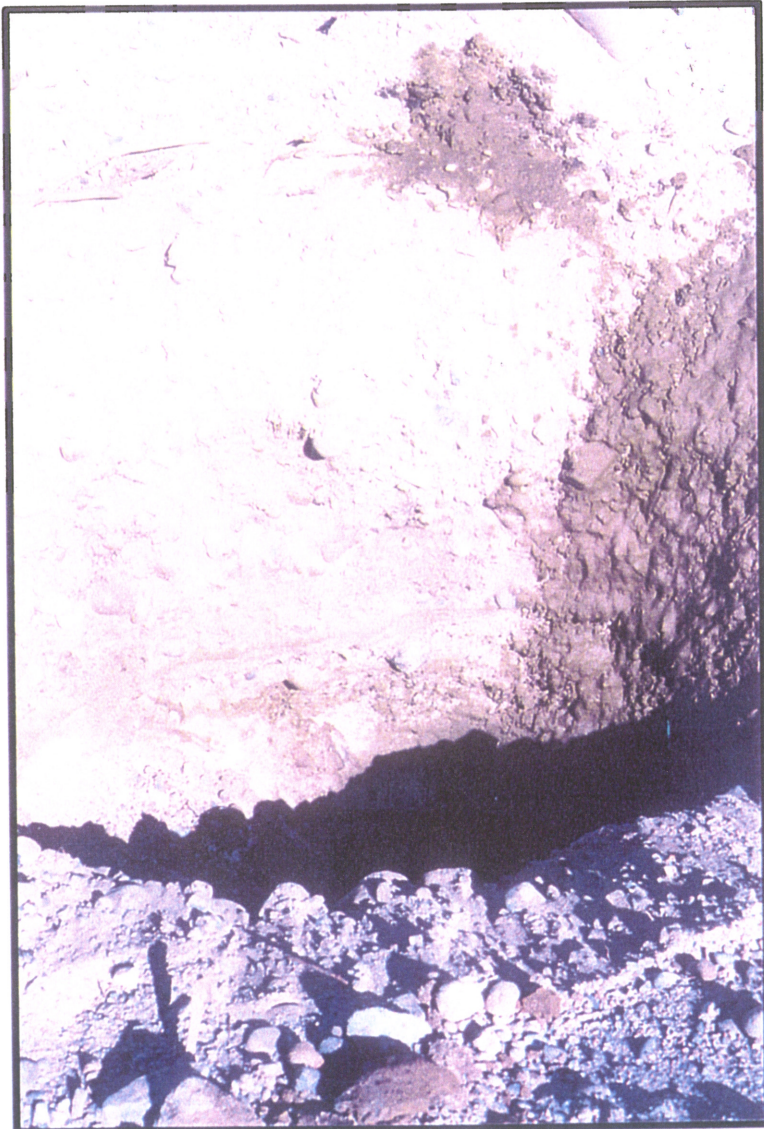
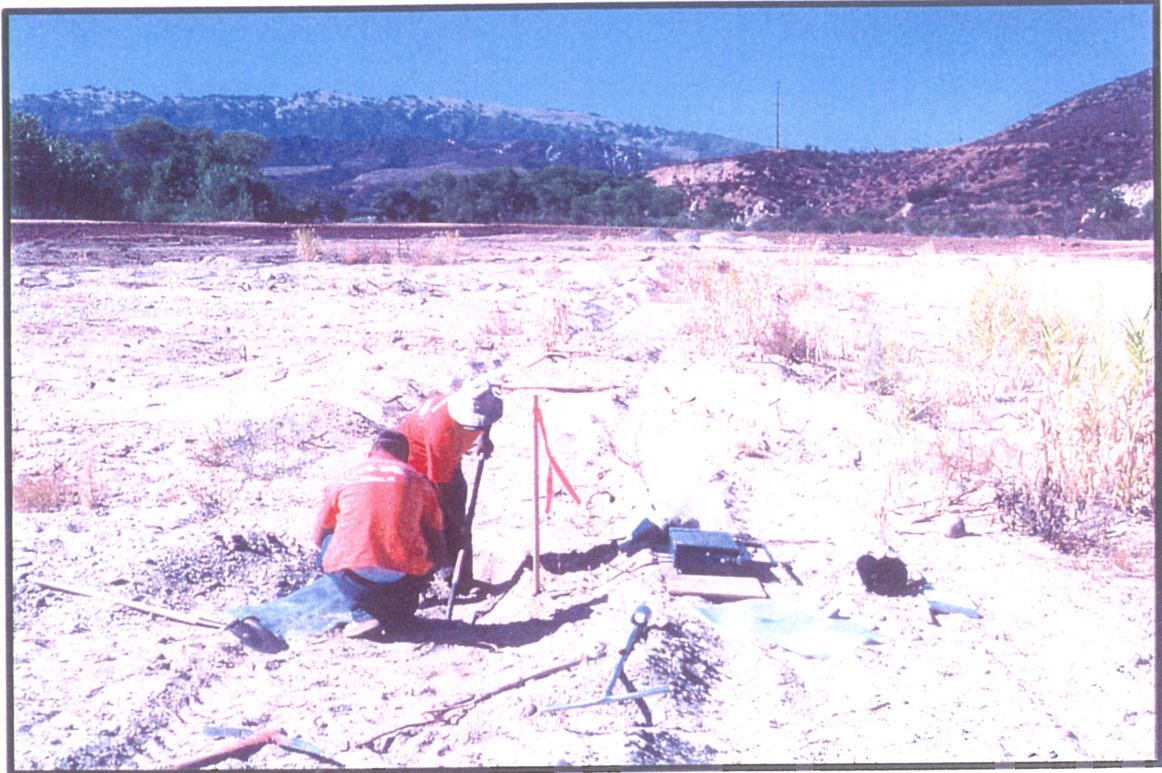
Site: CH-1

Views: Downstream and of Pit

Figure: 11

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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Geological and Geotechnical Consultants

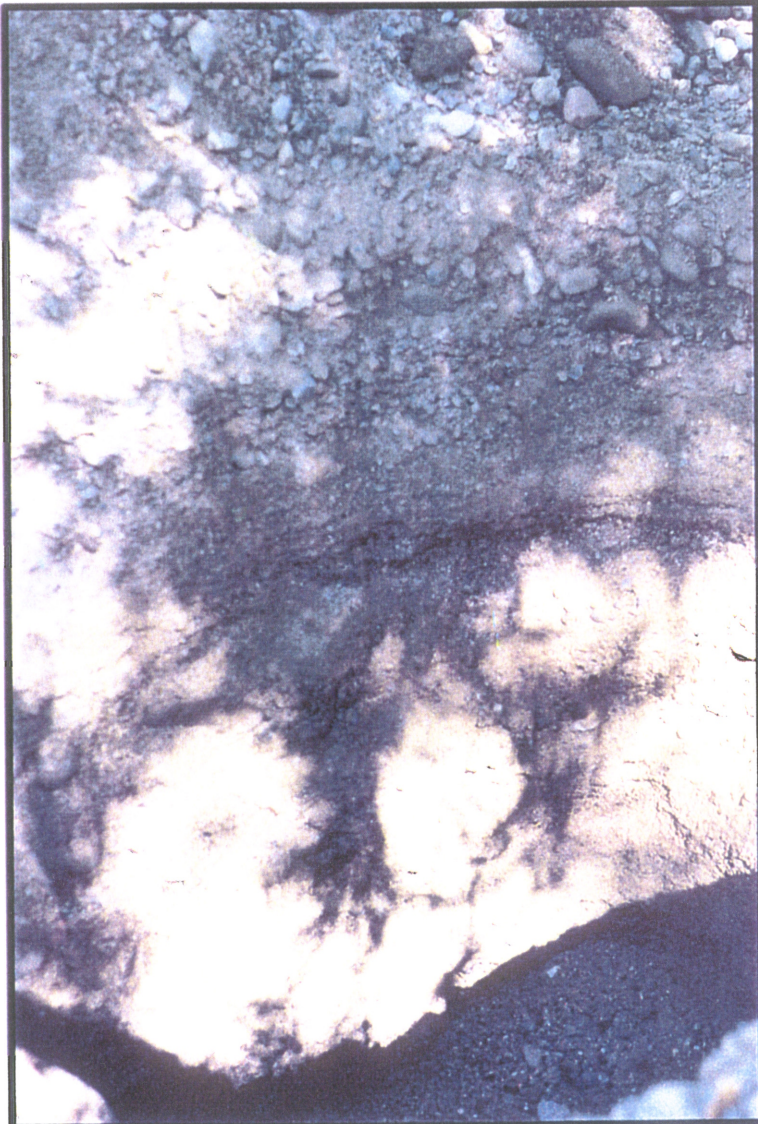
Site: CH-2

Views: Downstream and of Pit

Figure: 12

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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Geological and Geotechnical Consultants

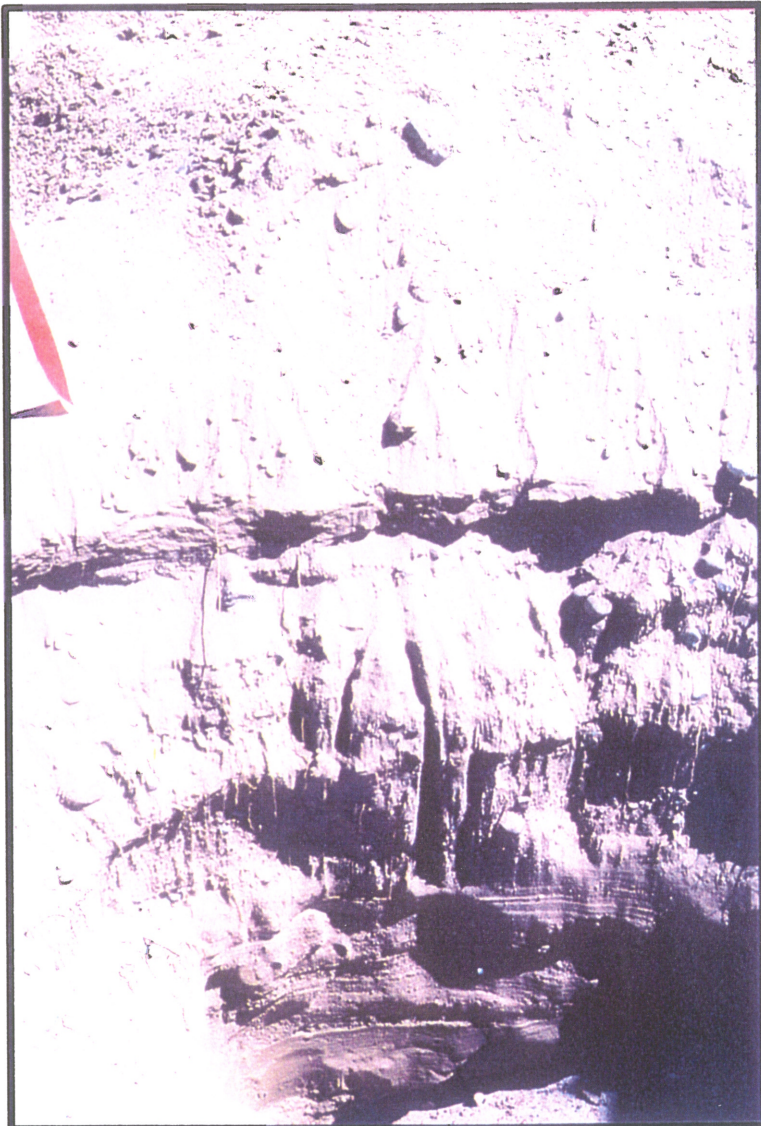
Site: CH-3

Views: Downstream and of Pit

Figure: 13

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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Geological and Geotechnical Consultants

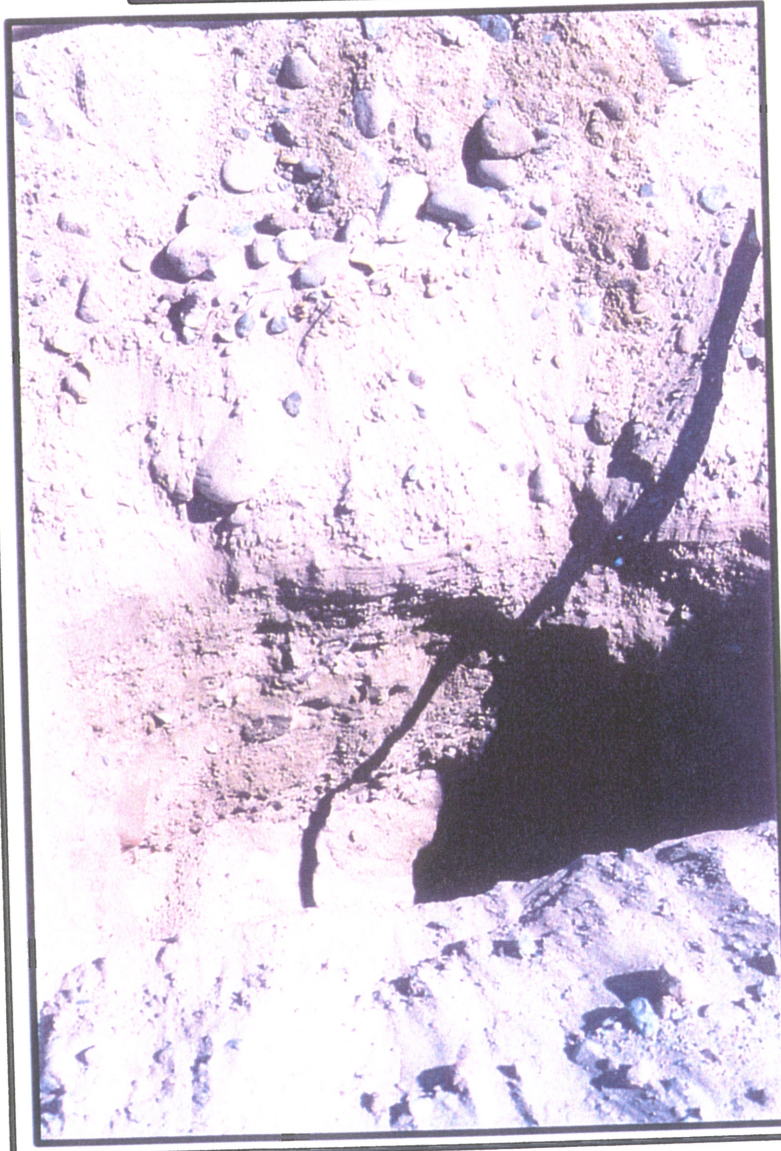
Site: HW-1

Views: Downstream with Highway 126  
Bridge in Background, and of Pit

Figure: 14

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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Geological and Geotechnical Consultants

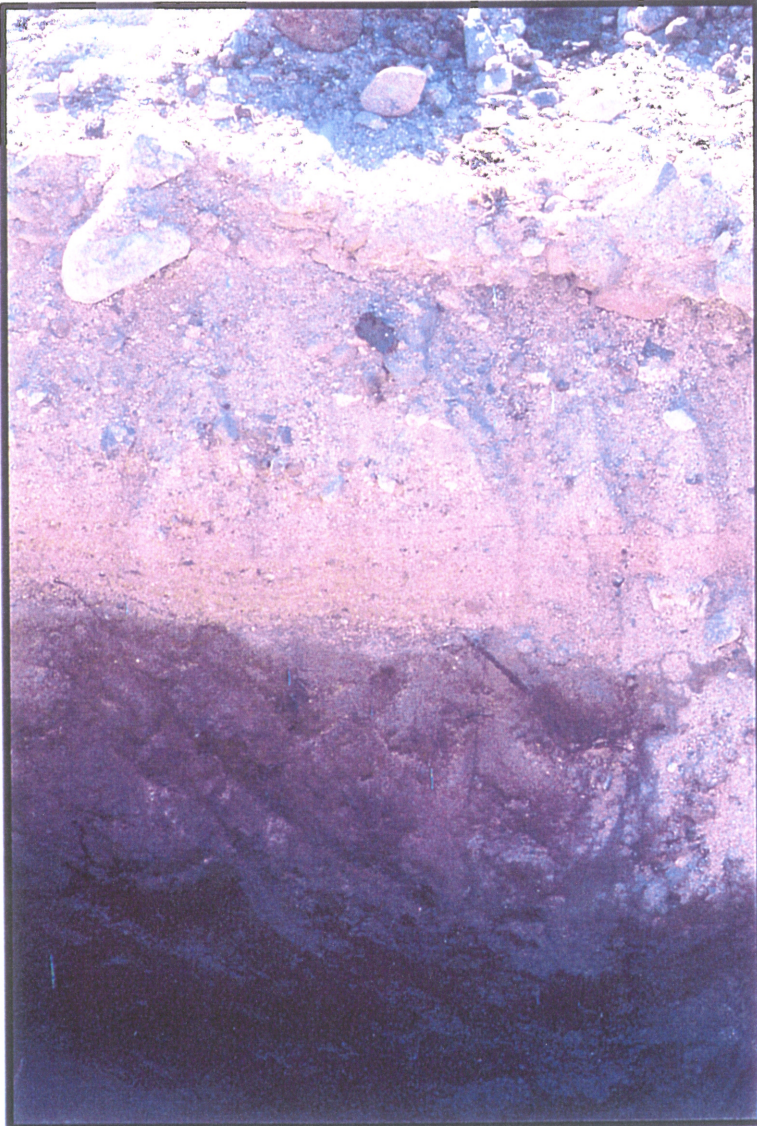
*Site:* HW-2

*Views:* Downstream with Highway 126 in Background, and of Pit

*Figure:* 15

*Job No.:* 05-1155BE-9 (9)

*Date:* 9/15/05



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Geological and Geotechnical Consultants

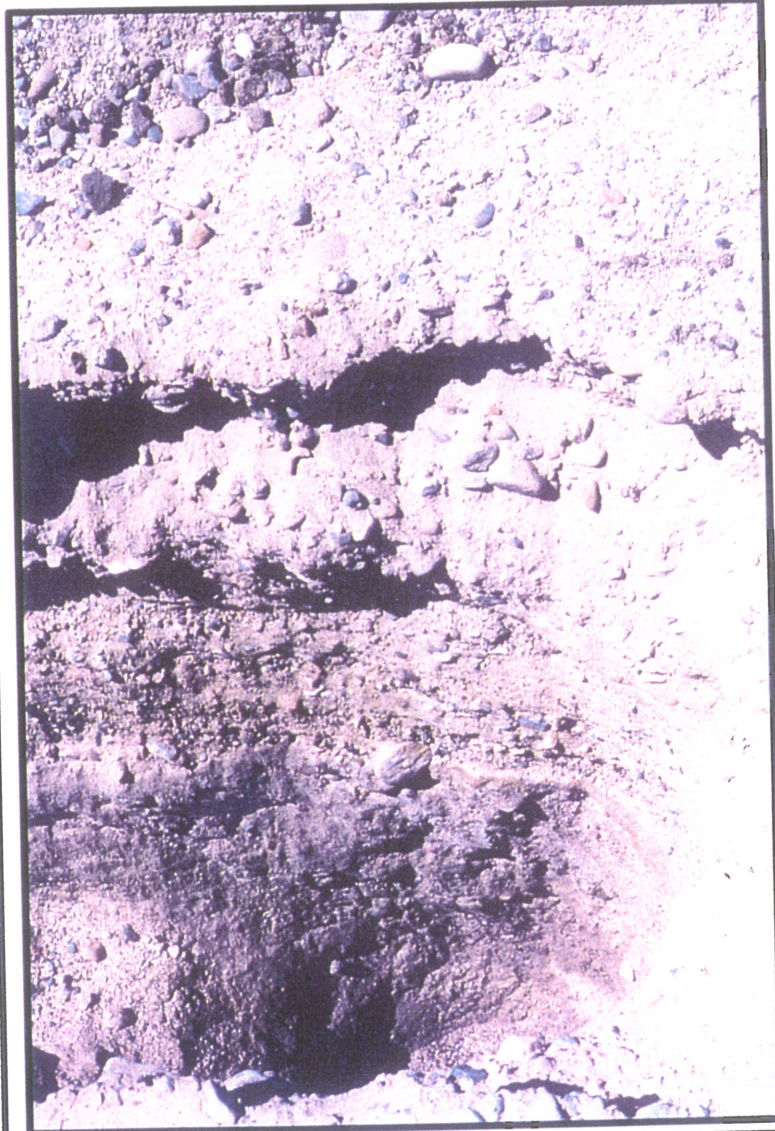
Site: HW-3

Views: Upstream and of Pit

Figure: 16

Job No.: 05-1155BE-9 (9)

Date: 9/15/05



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ENGINEERING GEOLOGY, INC.**  
Geological and Geotechnical Consultants

<i>Site:</i> HS-1	<i>Views:</i> Upstream with Highway 126 in Background, and of Pit
<i>Figure:</i> 17	<i>Job No.:</i> 05-1155BE-9 (9) <i>Date:</i> 9/15/05