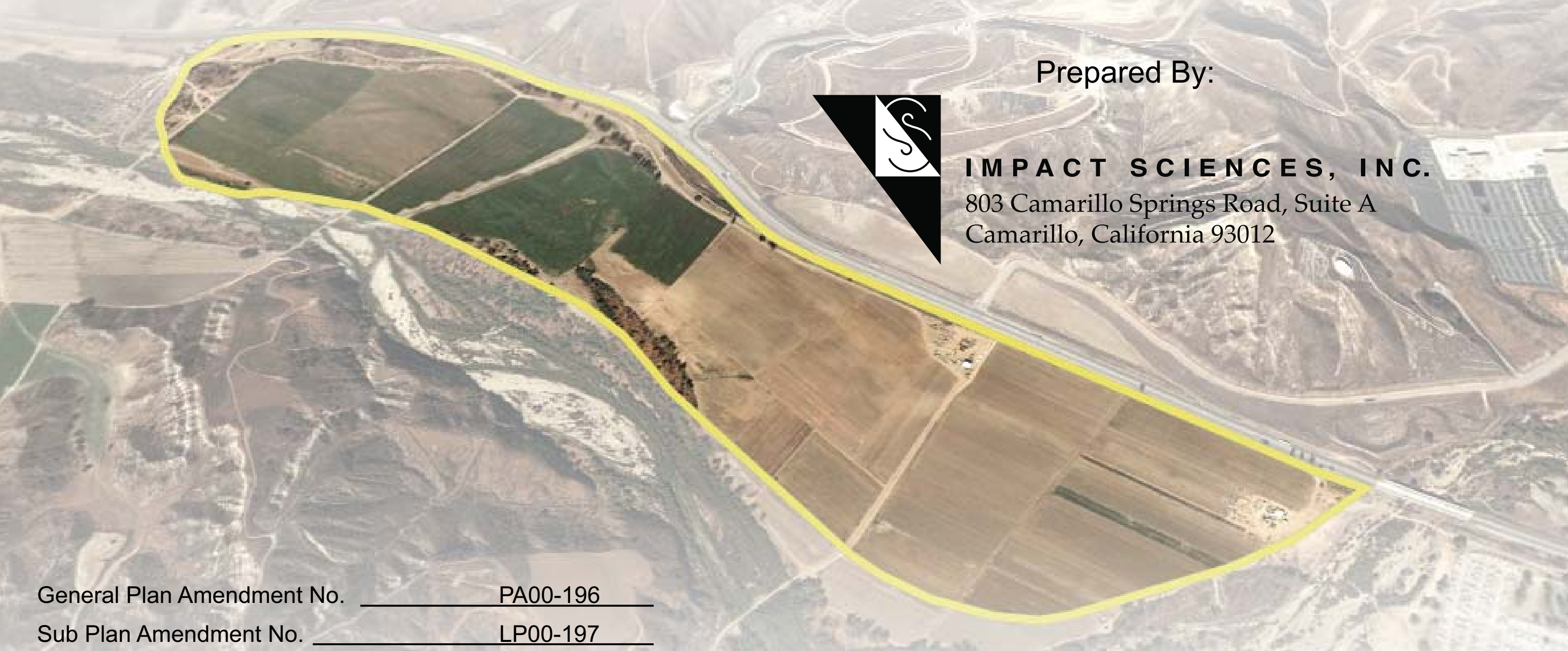
County of Los Angeles

Draft Environmental Impact Report

SCH No. 2004021002

Volume III — Appendices
Appendix ES–Appendix 4.2

LANDMARK VILLAGE



Prepared By:

IMPACT SCIENCES, INC.
803 Camarillo Springs Road, Suite A
Camarillo, California 93012

General Plan Amendment No.	PA00-196
Sub Plan Amendment No.	LP00-197
Specific Plan Amendment No.	SP00-198
Vesting Tentative Tract Map No.	53108
SEA Conditional Use Permit No.	RCUP200500112
Oak Tree Permit No.	OTP00-196
Off-Site Materials Transport Approval No.	CUP00-196
Conditional Use Permit (Off-Site Grading)	CUP00-196

NEWHALL RANCH
Newhall Ranch Company

NOVEMBER 2006

DRAFT
ENVIRONMENTAL IMPACT REPORT
for
LANDMARK VILLAGE

SCH No. 2004021002

Volume III - Appendices
Appendix ES–Appendix 4.2

Prepared for:

Los Angeles County
Department of Regional Planning
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Los Angeles, California 90012

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November 2006

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APPENDIX ES

Initial Study, Notice of Preparation, and Responses

Notice of Completion

See NOTE below
SCH #

Mail to: State Clearinghouse, P. O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613

Project Title: *The River Village Project, Project No. 00-196, TR 53108*
Lead Agency: *L. A. County Department of Regional Planning* Contact Person: *Hsiao-ching Chen*
Street Address: *320 West Temple Street* Phone: *(213) 974 6461*
City: *Los Angeles* *CA* Zip: *90012* County: *Los Angeles*

Project Location
County: *Los Angeles* City/Nearest Community: *Santa Clarita*
Cross Streets: *Chiquita Canyon Rd, Commerce Center Drive* Total Acres: *291.2*
Assessor s Parcel No. *2826-001-003* Section: ____ Twp. ____ Range: ____ Base: *San Bernardino*
Within 2 Miles: State Hwy #: *126* Waterways: *Castaic Creek, Santa Clara*
Airports: *none* Railways: *none* Schools: *none*

Document Type
CEQA: ☒ NOP ☐ Early Cons ☐ Neg Dec ☐ Draft EIR ☐ Supplement/Subsequent ☐ EIR (Prior SCH No.) ________ ☐ Other _____
NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI
Other: ☐ Joint Document ☐ Final Document ☐ Other ________

Local Action Type
☐ General Plan Update
☒ General Plan Amendment
☐ General Plan Element
☒ Local Plan Amendment
☒ Specific Plan Amendment
☐ Master Plan
☐ Planned Unit Development
☐ Site Plan
☐ Rezone
☐ Prezone
☒ Use Permit
☒ Land Division (Subdivision Parcel Map, Tract Map, etc.)
☐ Annexation
☐ Redevelopment
☐ Coastal Permit
☒ Other *Oak Tree Permit*

Development Type
☒ Residential: *Units 1444* *Acres 117.5*
☐ Office: *Sq.ft.* ____ *Acres* ____ *Employees* ____
☒ Commercial: *Sq.ft. 1.5 mi* *Acres 39.3* *Employees* ____
☐ Industrial: *Sq.ft.* ____ *Acres* ____ *Employees* ____
☒ Educational *Elementary School - 7.0 acres*
☒ Recreational *(Open Space 62.6 acres)*
☐ Water Facilities: *Type* ____ *MGD* ____
☐ Transportation: *Type* ____
☐ Mining: *Mineral* ____
☐ Power: *Type* ____ *Watts* ____
☐ Waste Treatment: *Type* ____
☐ Hazardous Waste: *Type* ____
☒ Other: *Roads - 64.8 acres*

Project Issues Discussed In Document
☒ Aesthetic/Visual
☒ Agricultural Land
☒ Air Quality
☒ Archeological/Historical
☐ Coastal Zone
☒ Drainage/Absorption
☒ Economic/Jobs
☐ Fiscal
☒ Flood Plain/Flooding
☒ Forest Land/Fire Hazard
☒ Geologic/Seismic
☒ Minerals
☒ Noise
☒ Population/Housing Balance
☒ Public Services/Facilities
☒ Recreation/Parks
☒ Schools/Universities
☐ Septic Systems
☒ Sewer Capacity
☒ Soil Erosion/Comp./Grading
☒ Solid Waste
☒ Toxic/Hazardous
☒ Traffic/Circulation
☒ Vegetation
☒ Water Quality
☒ Water Supply/Groundwater
☒ Wetland/Riparian
☒ Wildlife
☒ Growth Inducing
☒ Land Use
☒ Cumulative Effects
☒ Other

Present Land Use/Zoning/General Plan Use
Vacant/Specific Plan/Specific Plan

Project Description
The applicant, Newhall Land & Farming Company, proposes to develop the site with 1,444 residential units, up to 1.5 million square feet of non-residential mixed-use space, along with a 7-acre elementary school and public recreational facilities (see attached NOP for details). The project also includes all on-site and off-site infrastructures necessary to support the proposed project, including a domestic water system, sanitary sewer system, and a drainage network. The EIR will also analyze the construction of the Long Canyon Road Bridge across the Santa Clara River.

NOTE: Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g., from a Notice of Preparation or previous draft document), please fill it in. *Revised October 1989*

Reviewing Agencies Checklist

KEY
S = Document sent by lead agency
X = Document sent by SCH
R = Suggested distribution

Resources Agency
_____ Boating & Waterways
_____ Coastal Commission
_____ Coastal Conservancy
_____ Colorado River Board
_____ Conservation
*S*____ Fish & Game
_____ Forestry
_____ Office of Historic Preservation
*S*____ Parks & Recreation
_____ Reclamation
_____ S.F. Bay Conservation & Development Commission
_____ Water Resources (DWR)

Business, Transportation & Housing
_____ Aeronautics
_____ California Highway Patrol
*S*____ CALTRANS District # *7*
_____ Department of Transportation Planning (headquarters)
_____ Housing & Community Development
_____ Food & Agriculture

Health & Welfare
_____ Health Services

State & Consumer Services
_____ General Services
_____ OLA (Schools)

Environmental Affairs
*S*____ Air Resources Board
*S*____ APCD/AQMD
*S*____ California Waste Management Board
_____ SWRCB: Clean Water Grants
_____ SWRCB: Delta Unit
_____ SWRCB: Water Quality
_____ SWRCB: Water Rights
*S*____ Regional WQCB # . (*LA*)

Youth & Adult Corrections
_____ Corrections

Independent Commissions & Offices
_____ Energy Commission
*R*____ Native American Heritage Commission
*S*____ Public Utilities Commission
*S*____ Santa Monica Mountains Conservancy
_____ State Lands Commission
_____ Tahoe Regional Planning Agency

*S*____ Other *DTSC*

Public Review Period (to be filled in by lead agency)

Starting Date *January 30, 2004*

Ending Date *March 1, 2004*

Signature [signature]

Date *January 26, 2004*

Lead Agency (complete if applicable):

Applicant: *Newhall Land and Farming*
Address: *23823 Valencia Boulevard*
City/State/Zip: *Valencia, CA 91355*
Phone: *(661) 255-4003*

Consultant: *Impact Sciences*
Address: *30343 Canwood Street, Suite 210*
City/State/Zip: *Agoura Hills, CA 91301*
Phone: *818 879 1100*

For SCH Use Only:

Date Received at SCH: __________
Date Review Starts: __________
Date to Agencies: __________
Date to SCH: __________
Clearance Date: __________
Notes:

Los Angeles County
Department of Regional Planning

Planning for the Challenges Ahead

NOTICE OF PREPARATION

"The River Village Project"

James E. Hartl, AICP
Director of Planning

Part of the Newhall Ranch Specific Plan
County Project No. 00-196
Tentative Tract Map 53108, Plan Amendment
Oak Tree Permit, Conditional Use Permit

The County of Los Angeles will be the lead agency and will prepare an Environmental Impact Report (EIR) for the project identified above. In compliance with Section 15082 of the CEQA *Guidelines*, the County of Los Angeles is sending this Notice of Preparation to responsible agencies, interested parties and federal agencies which may be involved in approving or permitting the project, and to trustee agencies responsible for natural resources affected by the project. Within 30 days after receiving the Notice of Preparation, each agency shall provide the County of Los Angeles with specific details about the scope and content of the environmental information to be contained in the EIR related to that agency's area of statutory responsibility.

The purpose of this Notice of Preparation is to solicit the views of your agency as to the scope and content of the environmental information germane to your agency's statutory responsibilities in connection with the proposed project. Your agency may need to use the EIR prepared by our agency when considering your permit or other approval for the project.

PROJECT LOCATION

The site is located south of State Route 126 (SR-126), north of the Santa Clara River and west of Castaic Creek near the intersection with Chiquita Canyon Road (**see Vicinity Map**). The 291-acre site is within the Riverwood Planning Area of the Newhall Ranch Specific Plan, located in western Los Angeles County.

PROJECT DESCRIPTION

The applicant, Newhall Land & Farming Company, proposes to develop the site with 1,444 residential units, up to 1.5 million square feet of non-residential mixed-use space, along with a 7-acre elementary school and public recreational facilities (**see Site Plan**). The project also includes all on-site and off-site infrastructures necessary to support the proposed project, including a domestic water system, sanitary sewer system, and a drainage network. The EIR will also analyze the construction of the Long Canyon Road Bridge across the Santa Clara River (**see EIR Study Area**).

Consistent with the CEQA Guidelines, staff of the Los Angeles County Department of Regional Planning have prepared an Initial Study and determined that a project EIR is required for the River Village project. The Draft EIR for the River Village Project (VTTM 53108) will be tiered to the Program EIR for the Newhall Ranch Specific Plan and WRP in accordance with Public Resources Code 21093(a) and CEQA §15168(c). The project EIR will concentrate on site-specific issues, and will incorporate by reference the discussions and analysis contained in the Program EIR (CEQA Guidelines §153865). Through a combination of project review during the preparation of the Initial Study, incorporation of previously specified mitigation measures identified in the Program EIR, the Project EIR will focus on the specific issues that were not addressed at sufficient level of detail.

DISCRETIONARY ACTIONS REQUESTED

The project is requesting the following discretionary entitlements:

1. General Plan Amendment: the project applicant is proposing an amendment to the Highway Plan within the Transportation Element of the Los Angeles Countywide General Plan for a highway located within the Specific Plan Riverwood area. Specifically, the applicant is requesting that "A" Street, as identified on Vesting Tentative Tract Map No. 53108, be downgraded from a Secondary Highway to a Collector Street. This roadway provides a secondary point of connection to the future extension of Long Canyon Road into the interior of the Newhall Ranch Specific Plan. While "A" Street is an integral component of the River Village circulation system, it is not critical to the areawide and overall Specific Plan circulation system and consequently the applicant requests that the Secondary Highway designation is not necessary for "A" Street.

2. Local Plan Amendment: the applicant is proposing an amendment to the Santa Clarita Valley Areawide Plan to downgrade "A" Street, as depicted on Vesting Tentative Tract Map No. 53108, from a Secondary Highway to a Collector Street for the reasons outlined above.

3. Specific Plan Amendment: the applicant is proposing an amendment to the Master Circulation Plan of the Newhall Ranch Specific Plan to downgrade "A" Street, as depicted on Vesting Tentative Tract Map No. 53108, from a Secondary Highway to a Collector Street for the reasons outlined above. The applicant is also proposing an amendment to provide a modified street design within the Newhall Ranch Specific Plan.

4. Vesting Tentative Tract Map: to create residential, commercial, mixed-use, recreational and open space lots as summarized below in Table 1.

Table 1
River Village Statistical Summary

Land Use	Acres	Amount (units /square ft.)	Density (du/acre or far)
Residential*			
Single Family	38	313	8.2

Multi-Family Apartments Subtotal	59.5 20 117.5	678 453 1,444	11.4 22.7 14.1
Commercial/Mixed Use	39.3	1,549,500	0.39
Elementary School	7.0	NA	NA
Open Space Parks Recreation Centers Trails & Misc. (slopes, water quality basins) Subtotal	 20.8 5.2 36.6 62.6	NA	NA
Roads	64.8	NA	NA
TOTAL	291.2	1,444du 1,549,500 sf	0.39

Source: Vesting Tentative Tract Map No. 53108
* Includes units within mixed use areas

5. Oak Tree Permit: for removal of approximately 20 oak trees and encroachment into the protected zone of numerous others.

6. Conditional Use Permit: the Conditional Use Permit is necessary for the applicant's proposal to import approximately 7,000,000 cubic yards of dirt to the site from two borrow locations located within Newhall Ranch Specific Plan but outside of the proposed Tract Map boundary. The Conditional Use Permit is also necessary to ensure compliance with design requirements for development within Significant Ecological Area (SEA) No. 23 pursuant to the Los Angeles County Zoning Code Section 22.56.215. The River Corridor Special Management Area designation applied in Section 2.6, Resource Management Plan, of the Newhall Ranch Specific Plan maintains and incorporates the Significant Ecological Area designations and review process described above.

7. The applicant is also requesting design related modifications authorized by the Newhall Ranch Specific Plan.

POTENTIAL ENVIRONMENTAL IMPACTS

Pursuant to CEQA Guidelines §15063, the Los Angeles County Department of Regional Planning prepared an Initial Study (**see attached Initial Study**) and determined that a project EIR is required. The Initial Study provides a preliminary analysis of the potential environmental effects to be analyzed in the River Village Project EIR. The Initial Study determined that the River Village project may have potentially significant effects relative to the various impact categories, including: hazards (geotechnical, flood, and noise), resources (water quality, air quality, biota, cultural resources, agricultural resources and visual resources/aesthetics), services (traffic/access, sewage disposal, education, fire/sheriff and utilities) and other (general, environmental safety/hazardous materials, land use and recreation).

Pursuant to Public Resources Code §21093 and CEQA Guidelines §15168, the River Village Project EIR will tier from the certified Final Program EIR for the Newhall Ranch Specific Plan and Water Reclamation Plant (SCH #1995011015). Where appropriate, the River Village Project EIR will incorporate by reference previous analysis contained in the certified EIR.

SCOPING MEETING

To assist in local participation, a Scoping Meeting will be held to present the proposed project and to solicit suggestions from the public and responsible agencies on the content of the Draft EIR. This meeting will be held in the in the Boardroom of the Castaic Union School District Office, 28131 Livingston Ave., Valencia, California on Tuesday, **February 12, 2004 from 6:30 p.m. to 9:00 p.m.**

NOTICE OF PREPARATION REVIEW AND COMMENTS

The review period for the Notice of Preparation will be from **January 30 to March 1, 2004.** Copies of the NOP are available for review at Canyon Country Library located at 18536 Soledad Canyon Road, Santa Clarita, CA 91351; Valencia County Library at 23743 West Valencia Boulevard, Santa Clarita, CA 91355; Newhall County Library at 22704 West 9th Street, Santa Clarita, CA 91321; as well as the Department of Regional Planning website http://planning.co.la.ca.us/. Due to the time limits mandated by State law, your response must be sent at the earliest possible date, but not later than **March 4, 2004**. Please direct all written comments to the following address. In your written response, please include the name of a contact person in your agency.

Ms. Hsiao-ching Chen
County of Los Angeles Regional Planning Department
Impact Analysis Section
320 W. Temple St., Room 1348
Los Angeles, CA 90012
Tel (213) 974-6461
Fax (213) 626-0434

STAFF USE ONLY

PROJECT NUMBER: *00-196*

CASES: *TR 53108*

SPA, CUP

****** INITIAL STUDY ******

COUNTY OF LOS ANGELES
DEPARTMENT OF REGIONAL PLANNING

GENERAL INFORMATION

I.A. Map Date: *June 10, 2003* Staff Member: *Hsiao-ching Chen*

Thomas Guide: *4459 E5, E6* USGS Quad: *Val Verde*

Location: *South of State Route 126 ("SR-126") near the intersection with Chiquito Canyon Road north of Santa Clarita River and west of the Castaic Creek.*

Description of Project: *An application to subdivide the subject propertyinto 418 lots to include a maximum of 1,444 residential units , a maximum of 1,353,000 square feet of non-residential mixed-used space, an elementary school, a community park, three private recreational facilities, open space and river trail uses. This Initial Study analyzes impacts associated with all off-site improvements including buried bank stabilization and the Long Canyon Road Bridge to be developed in conjunction with the tract development. Two borrow sites (one located south of the Santa Clara River and the other north of SR-126 of unspecified acreage) and possible haul routes will be located outside of the tract map boundary but within the SP area. The domestic water system will be connected to existing facilities within the Valencia Commerce Center to the northeast)* Gross Area: *291.2 acres(tract map)*

Environmental Setting: *The project site is the first phase of the Riverwood Village Planning Area development of the Newhall Ranch Specific Plan in western unincorporated Los Angeles County, north of the Santa Clara River and west of Interstate 5 ("I-5"). The site is currently used for agricultural purposes and contains miscellaneous, ancillary sheds for agricultural storage and dirt roads. There is southern willow riparian habitat that extends to the central portion of the site along the southern boundary of the tract map. Three oak trees exist on site. Chiquita Landfill is located to the north of the project site. Several active and abandoned oil wells are located within the tract boundary. Some off-site improvement analyzed in this Initial Study are within SEA 23, Santa Clara River, containing habitat for endangered stickleback.*

Zoning: *Commercial, Mixed-Used, Medium Residential, Low-Medium Residential, Low Residential, High Residential, River Corridor, Community Park, Business Park, Open Area, (Newhall Ranch Specific Plan)*

General Plan: *(Newhall Ranch Specific Plan)*

Community/Area Wide Plan: *(Newhall Ranch Specific Plan)*

Major projects in area:

Project Number	Description & Status
00-210	*Castaic Junction Industrial Park (pending)*
89-081	*Chiquita Canyon Landfill (approved)*
87-360	*Valencia Commerce Center (approved)*
03-238 / TR 60030	*21 industrial lots on 110 AC (pending)*

NOTE: For EIRs, above projects are not sufficient for cumulative analysis.

REVIEWING AGENCIES

Responsible Agencies

- ☐ None
- ☒ Regional Water Quality Control Board
  - ☒ Los Angeles Region
  - ☐ Lahontan Region
- ☐ Coastal Commission
- ☒ Army Corps of Engineers
- ☒ *Caltrans*

Trustee Agencies

- ☐ None
- ☒ State Fish and Game
- ☒ State Parks
- ☒ *USFWS*
- ☐ ________

Special Reviewing Agencies

- ☐ None
- ☒ Santa Monica Mountains Conservancy
- ☒ Castaic Union SD
- ☒ William S. Hart SD
- ☒ Castaic Area Town Council
- ☒ California Dept of Water Resources
- ☒ *SCOPE (courtesy notification)*
- ☒ *Valencia Water Company*
- ☒ *DOC DOGGR*
- ☒ *DTSC, AQMD*
- ☒ *City of Santa Clarita*
- ☒ *Ventura County*
- ☒ *SCAG*

Regional Significance

- ☐ None
- ☒ SCAG Criteria
- ☒ Air Quality
- ☒ Water Resources

County Reviewing Agencies

- ☒ Subdivision Committee
- ☒ DPW: *Traffic & Lighting, Transportation Planning, Waterworks, Env Programs, Design, Land Development (Drainage & Grading), Geotechnical and Materials Engineering, Watershed, Waterworks, Flood Maintenance, Programs Development, Building & Safety,*
- ☒ Health Services: *Env Hygiene*
- ☒ *San District, Sheriff*
- ☒ *FD, Library*

IMPACT ANALYSIS MATRIX

ANALYSIS SUMMARY (See individual pages for details)

CATEGORY	FACTOR	Pg	Less than Significant Impact/No Impact	Less than Significant Impact with Project Mitigation	Potentially Significant Impact	Potential Concern
HAZARDS	1. Geotechnical	5	☐	☐	☒	*Expansive soil, high groundwater, excessive grading*
	2. Flood	6	☐	☐	☒	*100-year floodplain*
	3. Fire	7	☒	☐	☐	
	4. Noise	8	☐	☐	☒	*School/residences adjacent to SR-126*
RESOURCES	1. Water Quality	9	☐	☐	☒	*Construction, domestic water supply from groundwater*
	2. Air Quality	10	☐	☐	☒	*Exceed AQMD regional threshold, non-attainment area*
	3. Biota	11	☐	☐	☒	*SEA 23, oaks, southern willow riparian habitat*
	4. Cultural Resources	12	☐	☐	☒	*known resources in the area*
	5. Mineral Resources	13	☐	☐	☒	*Site was previouly used for oil extraction*
	6. Agriculture Resources	14	☐	☐	☒	*Prime farmland*
	7. Visual Qualities	15	☐	☐	☒	*SR-126 scenic corridor*
SERVICES	1. Traffic/Access	16	☐	☐	☒	*Exceed CMP threshold*
	2. Sewage Disposal	17	☐	☐	☒	*Sewage disposal prior to construction of treatment plant*
	3. Education	18	☐	☐	☒	*Limited school space*
	4. Fire/Sheriff	19	☐	☐	☒	*Project specific impacts and mitigations to be determined*
	5. Utilities	20	☐	☐	☒	*Water, solid waste*
OTHER	1. General	21	☐	☐	☒	*Community characteristics*
	2. Environmental Safety	22	☐	☐	☒	*Abandoned oil wells*
	3. Land Use	23	☐	☐	☒	*Specific plan amendment*
	4. Pop./Hous./Emp./Rec.	24	☐	☐	☒	*Demand for new recreation facility*
	Mandatory Findings	25	☐	☐	☒	*Biota, air quality*

DEVELOPMENT MONITORING SYSTEM (DMS) *

As required by the Los Angeles County General Plan, DMS shall be employed in the Initial Study phase of the environmental review procedure as prescribed by state law.

1. Development Policy Map Designation: *Urban expansion and SEA*

2. ☒ Yes ☐ No Is the project located in the Antelope Valley, East San Gabriel Valley, Malibu/Santa Monica Mountains or Santa Clarita Valley planning area?

3. ☒ Yes ☐ No Is the project at urban density and located within, or proposes a plan amendment to, an urban expansion designation?

If both of the above questions are answered "yes", the project is subject to a County DMS analysis.

☒ Check if DMS printout generated (attached) Date of printout: *7/22/2003*

☐ Check if DMS overview worksheet completed (attached)

*EIRs and/or staff reports shall utilize the most current DMS information available.

Environmental Finding:

FINAL DETERMINATION: On the basis of this Initial Study, the Department of Regional Planning finds that this project qualifies for the following environmental document:

☐ NEGATIVE DECLARATION, inasmuch as the proposed project will not have a significant effect on the environment.

An Initial Study was prepared on this project in compliance with the State CEQA Guidelines and the environmental reporting procedures of the County of Los Angeles. It was determined that this project will not exceed the established threshold criteria for any environmental/service factor and, as a result, will not have a significant effect on the physical environment.

☐ MITIGATED NEGATIVE DECLARATION, inasmuch as the changes required for the project will reduce impacts to insignificant levels (see attached discussion and/or conditions).

An Initial Study was prepared on this project in compliance with the State CEQA Guidelines and the environmental reporting procedures of the County of Los Angeles. It was originally determined that the proposed project may exceed established threshold criteria. The applicant has agreed to modification of the project so that it can now be determined that the project will not have a significant effect on the physical environment. The modification to mitigate this impact(s) is identified on the Project Changes/Conditions Form included as part of this Initial Study.

☒ ENVIRONMENTAL IMPACT REPORT*, inasmuch as there is substantial evidence that the project may have a significant impact due to factors listed above as "significant."

☐ At least one factor has been adequately analyzed in an earlier document pursuant to legal standards, and has been addressed by mitigation measures based on the earlier analysis as described on the attached sheets (see attached Form DRP/IA 101). The EIR is required to analyze only the factors not previously addressed.

Reviewed by: *Hsiao-ching Chen* [signature] Date: ____________________

Approved by: *Daryl Koutnik* Daryl Koutnik Date: 26 AUGUST 2003

☐ This proposed project is exempt from Fish and Game CEQA filling fees. There is no substantial evidence that the proposed project will have potential for an adverse effect on wildlife or the habitat upon which the wildlife depends. (Fish & Game Code 753.5).

☐ Determination appealed--see attached sheet.

*NOTE: Findings for Environmental Impact Reports will be prepared as a separate document following the public hearing on the project.

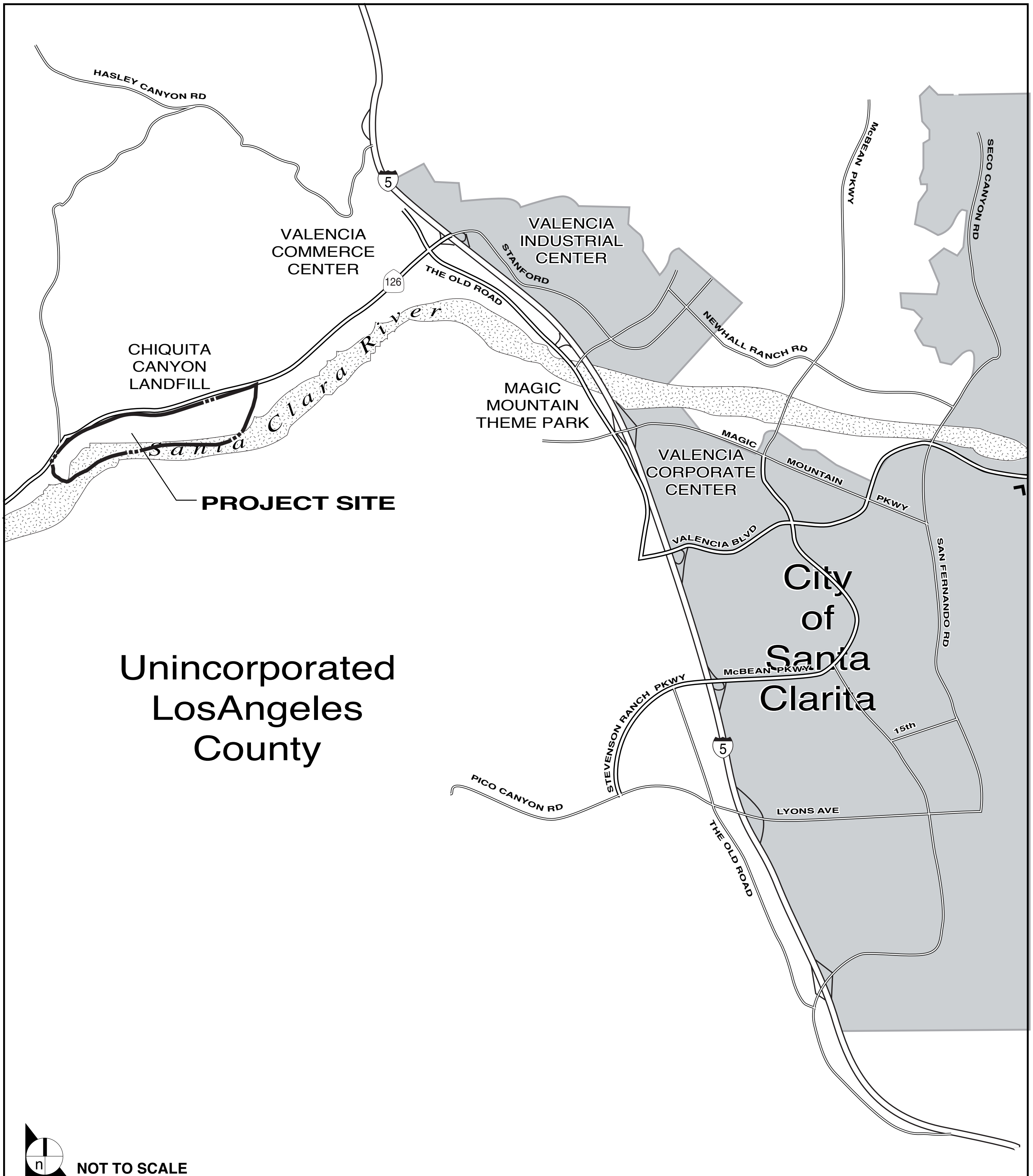


FIGURE 1

Site Vicinity

32-92•01/04

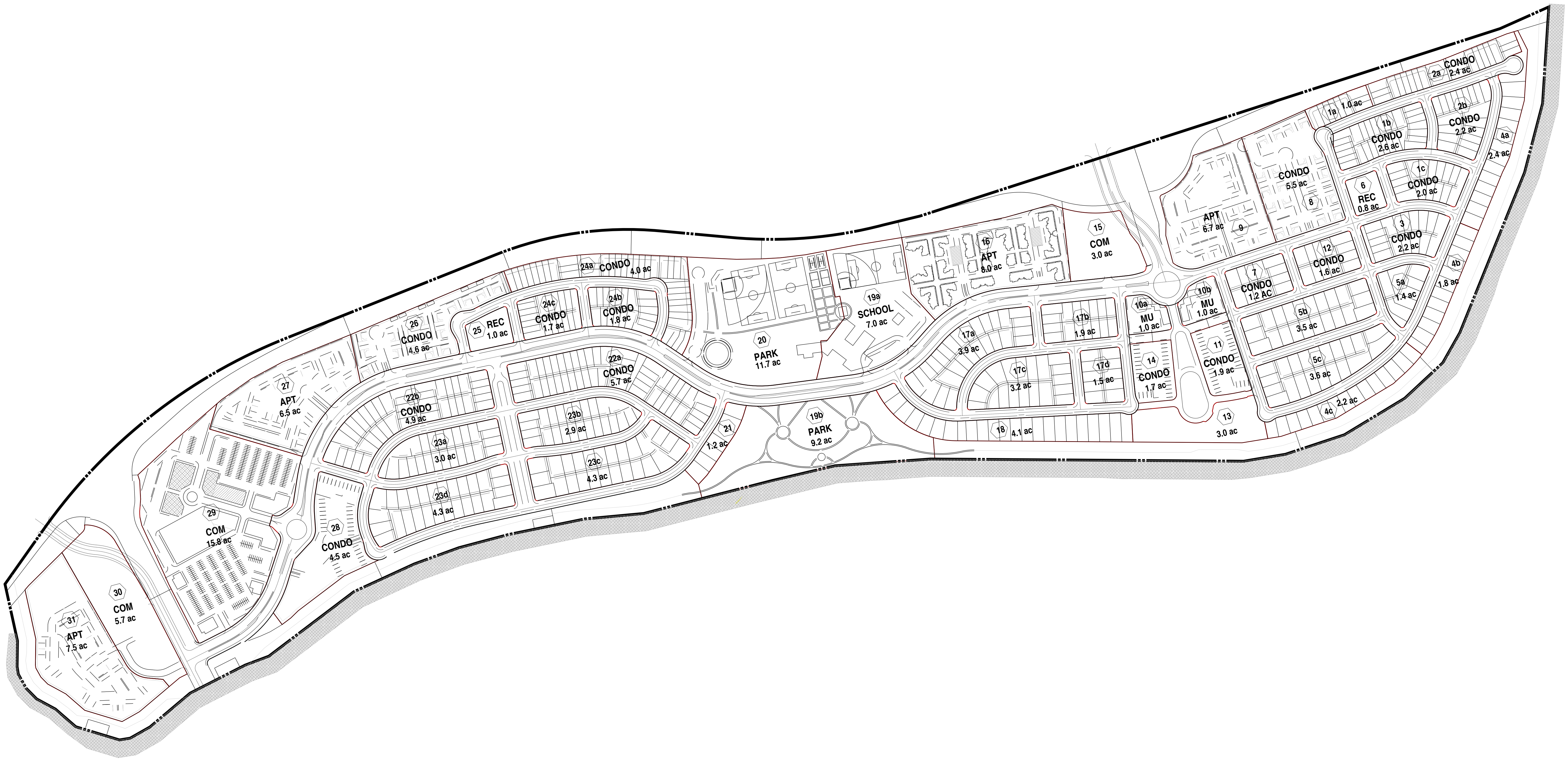
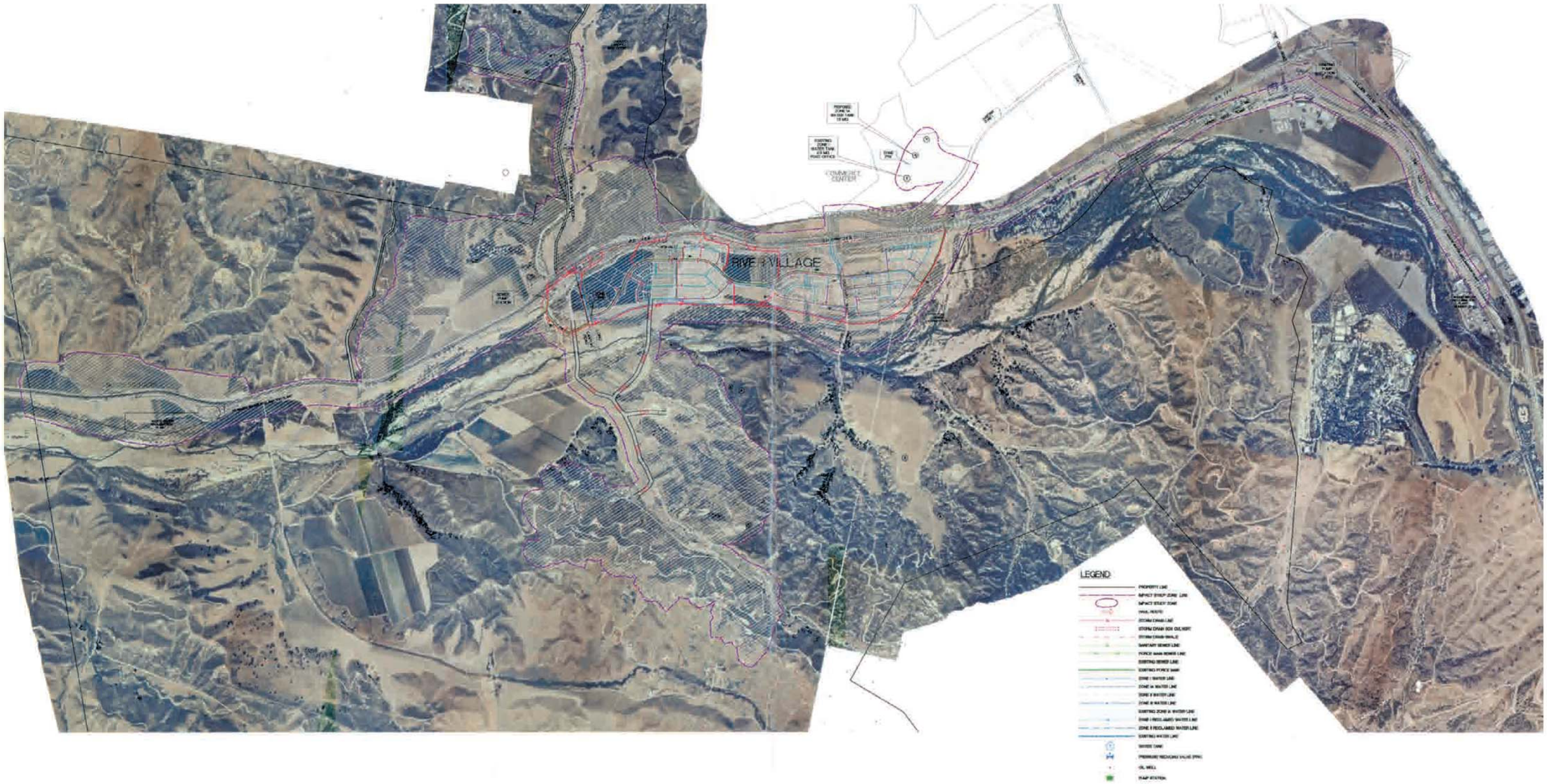


FIGURE 2

Site Plan

32-92•01/04



500 0 1000 2000
APPROXIMATE SCALE IN FEET

SOURCE: PSOMAS – May 2003

FIGURE **3**

EIR Study Area

32-92-01/04

HAZARDS - 1. Geotechnical

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☐	☒	☐	Is the project site located in an active or potentially active fault zone, Seismic Hazards Zone, or Alquist-Priolo Earthquake Fault Zone? *Salt Creek and Del Valle Fault Zone are located to the west of the tract map*
b.	☒	☐	☐	Is the project site located in an area containing a major landslide(s)? *Project site contains a landslide area*
c.	☐	☒	☐	Is the project site located in an area having high slope instability?
d.	☒	☐	☐	Is the project site subject to high subsidence, high groundwater level, liquefaction, or hydrocompaction? *Groundwater levels vary between 6 to 27 feet.*
e.	☒	☐	☐	Is the proposed project considered a sensitive use (school, hospital, public assembly site) located in close proximity to a significant geotechnical hazard? *Project contains an elementary school and residential development*
f.	☒	☐	☐	Will the project entail substantial grading and/or alteration of topography including slopes of more than 25%? *Total grading is estimated to be approximately 7 million cubic yards.*
g.	☒	☐	☐	Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property? *Expansive soils present on site.*
h.	☐	☐	☐	Other factors?

STANDARD CODE REQUIREMENTS

☒ Building Ordinance No. 2225 C Sections 308B, 309, 310 and 311 and Chapters 29 and 70.

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Lot Size ☐ Project Design ☒ Approval of Geotechnical Report by DPW

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on, or be impacted by, **geotechnical** factors?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

HAZARDS - 2. Flood

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☒	☐	☐	Is a major drainage course, as identified on USGS quad sheets by a dashed line, located on the project site? *Santa Clara River, Castaic Creek, and Chiquito Canyon are adjacent to the property*
b.	☒	☐	☐	Is the project site located within or does it contain a floodway, floodplain, or designated flood hazard zone? *Portions of the tract are within 100-year FEMA floodplain*
c.	☐	☐	☒	Is the project site located in or subject to high mudflow conditions? *Santa Clara River, Castaic Creek, and Chiquito Canyon are adjacent to the property*
d.	☐	☐	☒	Could the project contribute or be subject to high erosion and debris deposition from run off? *Earthwork during site development would have the potential to increase erosion and deposition during periods of heavy rain.*
e.	☒	☐	☐	Would the project substantially alter the existing drainage pattern of the site or area? *Project includes a man-made drainage network to capture and control runoff.*
f.	☒	☐	☐	Other factors (e.g., dam failure)? *Site is within the Castaic Lake dam inundation area*

STANDARD CODE REQUIREMENTS

☐ Building Ordinance No. 2225 C Section 308A ☐ Ordinance No. 12,114 (Floodways)
☒ Approval of Drainage Concept by DPW

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Lot Size ☐ Project Design

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on, or be impacted by **flood (hydrological)** factors?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

HAZARDS - 3. Fire

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☐	☒	☐	Is the project site located in a Very High Fire Hazard Severity Zone (Fire Zone 4)? *Site is located within Fire Zone 3*
b.	☐	☒	☐	Is the project site in a high fire hazard area and served by inadequate access due to lengths, widths, surface materials, turnarounds or grade?
c.	☐	☒	☐	Does the project site have more than 75 dwelling units on a single access in a high fire hazard area?
d.	☐	☐	☒	Is the project site located in an area having inadequate water and pressure to meet fire flow standards? *New public water system required.*
e.	☐	☒	☐	Is the project site located in close proximity to potential dangerous fire hazard conditions/uses (such as refineries, flammables, explosives manufacturing)? *Adjacent to Fire Zone 4*
f.	☐	☒	☐	Does the proposed use constitute a potentially dangerous fire hazard?
g.	☐	☐	☐	Other factors?

STANDARD CODE REQUIREMENTS

☒ Water Ordinance No. 7834 ☒ Fire Ordinance No. 2947 ☒ Fire Regulation No. 8

☐ Fuel Modification/Landscape Plan

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Project Design ☐ Compatible Use

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on, or be impacted by **fire hazard** factors?

☐ Potentially significant ☐ Less than significant with project mitigation ☒ Less than significant/No impact

HAZARDS - 4. Noise

SETTING/IMPACTS

Yes No Maybe

a. ☒ ☐ ☐ Is the project site located near a high noise source (airports, railroads, freeways, industry)?

Site is adjacent to SR-126

b. ☒ ☐ ☐ Is the proposed use considered sensitive (school, hospital, senior citizen facility) or are there other sensitive uses in close proximity?

There are residential and school components in this tract map

c. ☐ ☐ ☒ Could the project substantially increase ambient noise levels including those associated with special equipment (such as amplified sound systems) or parking areas associated with the project?

The tract map will include commercial activities.

d. ☒ ☐ ☐ Would the project result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels without the project?

During construction period

e. ☐ ☐ ☐ Other factors? ______________________

STANDARD CODE REQUIREMENTS

☒ Noise Ordinance No. 11,778 ☐ Building Ordinance No. 2225--Chapter 35

☐ MITIGATION MEASURES / ☐ OTHER CONSIDERATIONS

☐ Lot Size ☐ Project Design ☐ Compatible Use

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on, or be adversely impacted by **noise**?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

RESOURCES - 1. Water Quality

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☒	☐	☐	Is the project site located in an area having known water quality problems and proposing the use of individual water wells? *Santa Clara River is impaired waterway; groundwater is proposed water resource*
b.	☐	☒	☐	Will the proposed project require the use of a private sewage disposal system?
	☐	☐	☐	If the answer is yes, is the project site located in an area having known septic tank limitations due to high groundwater or other geotechnical limitations *or* is the project proposing on-site systems located in close proximity to a drainage course?
c.	☒	☐	☐	Could the project's associated construction activities significantly impact the quality of groundwater and/or storm water runoff to the storm water conveyance system and/or receiving water bodies? *Grading and other earth movement during construction period.*
d.	☒	☐	☐	Could the project's post-development activities potentially degrade the quality of storm water runoff and/or could post-development non-storm water discharges contribute potential pollutants to the storm water conveyance system and/or receiving bodies? *Urban runoff*
e.	☒	☐	☐	Other factors? *Domestic water for the site, which will be supplied by the Valencia Water Company, is a blend of imported water and groundwater withdrawn primarily from Alluvial and Saugus aquifers. Some remediation efforts by federal and state agencies are underway.*

STANDARD CODE REQUIREMENTS

☐ Industrial Waste Permit ☒ Health Code Ordinance No. 7583, Chapter 5

☒ Plumbing Code Ordinance No. 2269 ☒ NPDES Permit Compliance (DPW)

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Lot Size ☐ Project Design

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on, or be impacted by, **water quality** problems?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

RESOURCES - 3. Biota

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☒	☐	☐	Is the project site located within a Significant Ecological Area (SEA), SEA Buffer, or coastal Sensitive Environmental Resource (ESHA, etc.), or is the site relatively undisturbed and natural? *Off-site improvement associated with this project is within SEA 23 Santa Clara River*
b.	☒	☐	☐	Will grading, fire clearance, or flood related improvements remove substantial natural habitat areas? *7,000,000 cubic yards of fill to come from within Specific Plan area*
c.	☒	☐	☐	Is a major drainage course, as identified on USGS quad sheets by a blue, dashed line, located on the project site? *Santa Clara River*
d.	☒	☐	☐	Does the project site contain a major riparian or other sensitive habitat (e.g., coastal sage scrub, oak woodland, sycamore riparian woodland, wetland, etc.)? *Southern willow riparian habitat*
e.	☒	☐	☐	Does the project site contain oak or other unique native trees (specify kinds of trees)? *Coast Live Oaks, cottonwood trees*
f.	☒	☐	☐	Is the project site habitat for any known sensitive species (federal or state listed endangered, etc.)? *Least Bell's vireo, San Fernando Valley Spineflower in borrow site area; SEA 23 is habitat for unarmored threespine stickleback.*
g.	☒	☐	☐	Other factors (e.g., wildlife corridor, adjacent open space linkage)? *Santa Clara River*

☒ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Lot Size ☐ Project Design ☒ Oak Tree Permit ☒ SEATAC Review

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on **biotic resources**?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

RESOURCES - 4. Archaeological / Historical / Paleontological

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☒	☐	☐	Is the project site in or near an area containing known archaeological resources or containing features (drainage course, spring, knoll, rock outcroppings, or oak trees) which indicate potential archaeological sensitivity? *CA-LAN-2234*
b.	☒	☐	☐	Does the project site contain rock formations indicating potential paleontological resources? *Portion of Long Canyon under consideration as a borrow site is underlain by the Saugus Formation, which is considered to contain a diverse assemblage of marine and non-marine vertebrate fossils in the Santa Clarita Valley*
c.	☐	☒	☐	Does the project site contain known historic structures or sites? *Site is vacant except for several storage sheds*
d.	☐	☐	☒	Would the project cause a substantial adverse change in the significance of a historical or archaeological resource as defined in 15064.5? *CA-lan-2234 may be impacted.*
e.	☐	☐	☒	Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature? *The construction of a borrow site may destroy a unique paleontological resource*
f.	☐	☐	☐	Other factors?

☐ MITIGATION MEASURES / ☐ OTHER CONSIDERATIONS

☐ Lot Size ☐ Project Design ☒ Phase I Archaeology Report

CONCLUSION

Considering the above information, could the project leave a significant impact (indivdually or cumulatively) on **archaeological, historical**, or **paleontological** resources?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

RESOURCES - 5.Mineral Resources

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☐	☐	☒	Would the project result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state? *Oil extraction activities in portions of the site.*
b.	☐	☒	☐	Would the project result in the loss of availability of a locally important mineral resource discovery site delineated on a local general plan, specific plan or otherland use plan?
c.	☒	☐	☐	Other factors? *Project site has been previously used for oil extraction*

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Lot Size ☐ Project Design

CONCLUSION

Considering the above information, could the project leave a significant impact (individually or cumulatively) on **mineral** resources?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

RESOURCES - 6. Agriculture Resources

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☒	☐	☐	Would the project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?
				Portions of the tract are prime farmland
b.	☐	☒	☐	Would the project conflict with existing zoning for agricultural use, or a Williamson Act contract?
c.	☒	☐	☐	Would the project involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?
				Site is currently used for agricultural purposes
d.	☐	☐	☐	Other factors?

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Lot Size ☐ Project Design

CONCLUSION

Considering the above information, could the project leave a significant impact (individually or cumulatively) on **agriculture** resources?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

RESOURCES - 7. Visual Qualities

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☒	☐	☐	Is the project site substantially visible from or will it obstruct views along a scenic highway (as shown on the Scenic Highway Element), or is it located within a scenic corridor or will it otherwise impact the viewshed? *Project is located along the Santa Clara River/SR-126 view corridor*
b.	☒	☐	☐	Is the project substantially visible from or will it obstructviews from a regional riding or hiking trail? *Santa Clara River trail*
c.	☒	☐	☐	Is the project site located in an undeveloped or undisturbed area, which contains unique aesthetic features? *Area along SR-126 has view of river and mesas to south*
d.	☒	☐	☐	Is the proposed use out-of-character in comparison to adjacent uses because of height, bulk, or other features? *Site is surrounded by vacant land currently undeveloped*
e.	☒	☐	☐	Is the project likely to create substantial sun shadow, light or glare problems? *New buildings may have night lighting and glare surfaces*
f.	☐	☐	☐	Other factors (e.g., grading or land form alteration):

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Lot Size ☒ Project Design ☒ Visual Report ☐ Compatible Use

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on **scenic** qualities?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

SERVICES - 1. Traffic/Access

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☒	☐	☐	Does the project contain 25 dwelling units, or more and is it located in an area with known congestion problems (roadway or intersections)? *1,444 residential units, a maximum of 1,353,000 square feet of non-residential mixed-used space, and a 45,000 sq.ft. school*
b.	☐	☐	☒	Will the project result in any hazardous traffic conditions? *New circulation patterns*
c.	☐	☒	☐	Will the project result in parking problems with a subsequent impact on traffic conditions? *Sufficient parking spaces will be provided according to applicable codes*
d.	☐	☒	☐	Will inadequate access during an emergency (other than fire hazards) result in problems for emergency vehicles or residents/employees in the area?
e.	☒	☐	☐	Will the congestion management program (CMP) Transportation Impact Analysis thresholds of 50 peak hour vehicles added by project traffic to a CMP highway system intersection or 150 peak hour trips added by project traffic to a mainline freeway link be exceeded? *Project exceeds CMP thresholds for residential and commercial development*
f.	☐	☐	☒	Would the project conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)? *To be analyzed in the DEIR on Specific Plan consistency*
g.	☐	☐	☐	Other factors?

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Project Design ☒ Traffic Report ☒ Consultation with Traffic & Lighting Division

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on the physical environment due to **traffic/access** factors?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

SERVICES - 2. Sewage Disposal

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☒	☐	☐	If served by a community sewage system, could the project create capacity problems at the treatment plant? *Site currently is not serviced by any existing sewage system and treatment plant. Although a 6.8-mgd water reclamation plant servicing the area is proposed in the Newhall Ranch Specific Plan, it will not be completed prior to development of this tract. Interim plan for sewage treatment is necessary and its associated impacts will need to be analyzed.*
b.	☒	☐	☐	Could the project create capacity problems in the sewer lines serving the project site? *Same as above*
c.	☐	☐	☐	Other factors?

STANDARD CODE REQUIREMENTS

☐ Sanitary Sewers and Industrial Waste Ordinance No. 6130

☐ Plumbing Code Ordinance No. 2269

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on the physical environment due to **sewage disposal** facilities?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

SERVICES - 3. Education

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☒	☐	☐	Could the project create capacity problems at the district level? *Castaic Union School and William S. Hart Union High School Districts currently operate over capacity. And schools to be constructed within the SP will not be in place prior to development of the tract map. Therefore, interim impacts are to be analyzed.*
b.	☒	☐	☐	Could the project create capacity problems at individual schools which will serve the project site? *Interim impact to be analyzed.*
c.	☒	☐	☐	Could the project create student transportation problems? *No transportation currently exists; interim student transportation problems will occur before elementary, junior high, and high schools are constructed to adequately serve the Specific Plan area.*
d.	☒	☐	☐	Could the project create substantial library impacts due to increased population and demand? *The development of the tract will create new demand to existing library services*
e.	☒	☐	☐	Other factors? *The tract map includes a 7-acre elementary school*

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☒ Site Dedication ☒ Government Code Section 65995 ☒ Library Facilities Mitigation Fee

The applicant has school mitigation agreements with both effected school districts

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) relative to **educational** facilities/services?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

SERVICES - 4. Fire/Sheriff Services

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☐	☐	☒	Could the project create staffing or response time problems at the fire station or sheriff's substation serving the project site? *According to the Specific Plan, three fire stations will be funded by the applicant per Newhall Ranch Specific Plan and two of them are within the Specific Plan area. However, these fire stations will not be in place in time before this first-phase development within the Specific Plan. The closest existing fire station is Fire Station 76 located at 27223 Henry Mayo Drive, less than 1 mile from the site. The nearest sheriff station is located at 23740 Magic Mountain Parkway. However, SP DEIR indicates that project specific impacts on sheriff department's services are to be determined at the time of project proposal. Therefore, this factor needs to be analyzed in this EIR.*
b.	☐	☐	☒	Are there any special fire or law enforcement problems associated with the project or the general area? *New residential area to be covered.*
c.	☐	☐	☐	Other factors?

☒ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☒ Fire Mitigation Fees

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) relative to **fire/sheriff** services?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

SERVICES - 5. Utilities/Other Services

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☐	☐	☒	Is the project site in an area known to have an inadequate public water supply to meet domestic needs or to have an inadequate ground water supply and proposes water wells? *DMS does not provide assessment of water supply and demand for the Valencia Water Company level. The EIR needs to demonstrate that there is sufficient water for the tract map.*
b.	☐	☐	☒	Is the project site in an area known to have an inadequate water supply and/or pressure to meet fire fighting needs? *See above*
c.	☐	☒	☐	Could the project create problems with providing utility services, such as electricity, gas, or propane? *Gas Company and Edison's current infrastructure is capable of serving the entire SP at its build-out.*
d.	☒	☐	☐	Are there any other known service problem areas (e.g., solid waste)? *Newhall SP at its build-out will have unavoidable impacts on solid waste facilities. Provide project specific analysis and mitigation measures in the EIR .*
e.	☒	☐	☐	Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services or facilities (e.g., fire protection, police protection, schools, parks, roads)? *No public infrastructure currently exists in project area.*
f.	☐	☐	☐	Other factors? ______

STANDARD CODE REQUIREMENTS

☐ Plumbing Code Ordinance No. 2269 ☐ Water Code Ordinance No. 7834

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Lot Size ☐ Project Design

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) relative to **utilities/services**?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

OTHER FACTORS - 1. General

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☐	☒	☐	Will the project result in an inefficient use of energy resources?
b.	☒	☐	☐	Will the project result in a major change in the patterns, scale, or character of the general area or community? *Site is currently vacant and high intensity uses are proposed*
c.	☒	☐	☐	Will the project result in a significant reduction in the amount of agricultural land? *See discussion under "Agriculture" resource.*
d.	☐	☐	☐	Other factors?

STANDARD CODE REQUIREMENTS

☐ State Administrative Code, Title 24, Part 5, T-20 (Energy Conservation)

☐ MITIGATION MEASURES / ☐ OTHER CONSIDERATIONS

☐ Lot size ☐ Project Design ☐ Compatible Use

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on the physical environment due to any of the above factors?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

OTHER FACTORS - 2. Environmental Safety

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☐	☒	☐	Are any hazardous materials used, transported, produced, handled, or stored on-site?
b.	☒	☐	☐	Are any pressurized tanks to be used or any hazardous wastes stored on-site? *Propane and other pressurized tanks may be used within commercial areas*
c.	☐	☒	☐	Are any residential units, schools, or hospitals located within 500 feet and potentially adversely affected?
d.	☒	☐	☐	Have there been previous uses which indicate residual soil toxicity of the site? *Site contain several abandoned oil wells*
e.	☐	☒	☐	Would the project create a significant hazard to the public or the environment involving the accidental release of hazardous materials into the environment?
f.	☐	☒	☐	Would the project emit hazardous emissions or handle hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?
g.	☒	☐	☐	Would the project be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or environment? *Site is within the Exxon Castaic Junction Oil Field.*
h.	☐	☒	☐	Would the project result in a safety hazard for people in a project area located within an airport land use plan, within two miles of a public or public use airport, or within the vicinity of a private airstrip?
I.	☐	☒	☐	Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?
j.	☐	☐	☐	Other factors?

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

☐ Toxic Clean up Plan

CONCLUSION

Considering the above information, could the project have a significant impact relative to **public safety**?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

OTHER FACTORS - <u>3. Land Use</u>

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☒	☐	☐	Can the project be found to be inconsistent with the plan designation(s) of the subject property? *Project requires Specific Plan Amendment*
b.	☐	☒	☐	Can the project be found to be inconsistent with the zoning designation of the subject property?
c.				Can the project be found to be inconsistent with the following applicable land use criteria:
	☐	☒	☐	Hillside Management Criteria?
	☐	☐	☒	SEA Conformance Criteria?
	☒	☐	☐	Other? *Resource Management Plan Conformance*
d.	☐	☒	☐	Would the project physically divide an established community?
e.	☐	☐	☐	Other factors?

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on the physical environment due to **land use** factors?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

OTHER FACTORS - 4. Population/Housing/Employment/Recreation

SETTING/IMPACTS

	Yes	No	Maybe	
a.	☐	☒	☐	Could the project cumulatively exceed official regional or local population projections?
b.	☐	☒	☐	Could the project induce substantial direct or indirect growth in an area (e.g., through projects in an undeveloped area or extension of major infrastructure)?
c.	☐	☒	☐	Could the project displace existing housing, especially affordable housing? *Site is vacant*
d.	☐	☒	☐	Could the project result in a substantial job/housing imbalance or substantial increase in Vehicle Miles Traveled (VMT)?
e.	☒	☐	☐	Could the project require new or expanded recreational facilities for future residents?*New recreational facilities are required for the development of the SP. The facilities to be provided for the tract map are to be identified and analyzed in the EIR.*
f.	☐	☒	☐	Would the project displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?
g.	☐	☐	☐	Other factors?

☐ **MITIGATION MEASURES** / ☐ **OTHER CONSIDERATIONS**

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on the physical environment due to **population, housing, employment**, or **recreational** factors?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

MANDATORY FINDINGS OF SIGNIFICANCE

Based on this Initial Study, the following findings are made:

	Yes	No	Maybe	
a.	☒	☐	☐	Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory? *Biota*
b.	☒	☐	☐	Does the project have possible environmental effects which are individually limited but cumulatively considerable? "Cumulatively considerable" means that the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects. *Soild Waste*
c.	☒	☐	☐	Will the environmental effects of the project cause substantial adverse effects on human beings, either directly or indirectly? *Water quality, air quality, noise*

CONCLUSION

Considering the above information, could the project have a significant impact (individually or cumulatively) on the environment?

☒ Potentially significant ☐ Less than significant with project mitigation ☐ Less than significant/No impact

PROJECT NO. 00-196

CASE NO. TR53108

URBAN SERVICES ANALYSIS
WATER CAPACITY ANALYSIS

7/22/2003

WATER AVAILABILITY EVALUATION

(ACRE-FEET/YEAR)

WATER COMPANY	EXISTING DEMAND	DEMAND: POTENTIAL: RECORDED	APPROVED	PENDING	PROJEC	TOTAL	DRY SUPPLY	NORMAL SUPPLY	POTENTIAL SIGNIFICANT IMPACT
VALENCIA WC	22,735	2,895.06	4,973.30	1,332.70	593.27	32,529.32			
SC VALLEY WIDE	64,350	5,983.81	9,372.36	7,044.56	593.27	87,343.99	90,600	96,000	NO

SANTA CLARITA VALLEY WIDE FUTURE SUPPLY

YEAR	DRY SUPPLY	NORMAL SUPPLY	POTENTIAL SIGNIFICANT IMPACT
2004	90,600	96,000	NO
2005	90,600	96,000	NO
2006	90,600	96,000	NO
2007	90,600	96,000	NO

CRITERIA

DEMAND FACTORS (AF/YR):	SF	MF	MH	COMMERCIAL (PER ACRE)	INDUSTRIAL (PER ACRE)
VALENCIA WC	0.56	0.30	0.09	2.77	3.14

Note:

Dry Supply - Ranges from 90,600 to 147,500 acre-feet-per year.

Conjunctive-use and groundwater banking supplies are not included in table.

Normal Supply - Ranges from 96,000 to 151,900 acre-feet-per year.

URBAN SERVICES ANALYSIS

FIRE PROTECTION ANALYSIS

7/22/2003

PROJECT NO. 00-196
CASE NO. TR53108

RESPONSE DISTANCE EVALUATION (MILES)

MAXIMUM DISTANCE CRITERIA

Lot Type	Residential	Commercial Industrial	Approximate Distance	Potential Significant Impact
COMMERCIAL		1.5	0.5	No
MULTIPLE FAMILY	1.5		0.5	No
SINGLE FAMILY	1.5		0.5	No

PROJECT NO. 00-196
CASE NO. TR53108

URBAN SERVICES ANALYSIS
SCHOOL CAPACITY ANALYSIS
7/22/2003

STUDENT EVALUATION

SCHOOL DISTRICT	ENROLLMENT	PENDING	APPROVED	RECORDED	PROJEC	TOTAL	CAPACITY	STUDENT OVERLOAD	POTENTIAL SIGNIFICANT IMPACT
CASTAIC UNION EL	1,135	722	206	644	216	2,923	1,430	1,493	YES
CASTAIC UNION JH	1,350	380	152	452	119	2,453	1,800	653	YES
WM.S. HART SR HI	9,903	1,575	2,811	1,680	156	16,125	9,512	6,613	YES

URBAN SERVICES ANALYSIS

PROJECT NO 00-196
CASE NO. TR53108

LIBRARY CAPACITY ANALYSIS

7/22/2003

LIBRARY	EXISTING DEMAND	DEMAND POTENTIAL RECORDED	APPROVED	PENDING	PROJECT	TOTAL	SUPPLY	POTENITAL SIGNIFICANT IMPACT
VALENCIA								
VOLUMES	174,090	34,039	37,995	26,246	8,924	281,294	211,688	YES
SPACE (SQ FT)	33,861	6,621	7,390	5,105	1,736	54,712	23,966	YES
-AREA CLUSTER-*								
VOLUMES	320,598	68,901	126,506	68,882	8,924	593,811	348,467	YES
SPACE (SQ FT)	62,356	13,401	24,605	13,398	1,736	115,496	67,777	YES

* AREA CLUSTER IS THE GROUP OF LIBRARIES SERVING THE ENTIRE COMMUNITY.

	CRITERIA
VOLUMES PER CAPITA:	2
SQUARE FOOT PER CAPITA:	0.389

URBAN SERVICES ANALYSIS

PROJECT NO. 00-196

CASE NO: TR53108

SEWER TREATMENT CAPACITY ANALYSIS

(MILLION GALLONS PER DAY)

7/22/2003

SEWER AGENCY	EXISTING DEMAND	RECORDED	APPROVED	PENDING	PROJECT	TOTAL	SUPPLY	POTENTIAL SIGNIFICANT IMPACT
S.D. NO. 26 & 32	15.04	3.01	5.19	3.22	0.34	26.80	19.10	YES

PLANNED EXPANSION

SEWER AGENCY	TOTAL CAPACITY	COMPLETION EXPECTED	POTENTIAL SIGNIFICANT IMPACT
S.D. NO. 26 & 32			
FIRST STAGE	28.10	2002	NO
PRACTICAL SITE CAPACITY:	34.10	2010	NO

CRITERIA

DEMAND FACTORS (GAL/DAY):	SF	MF	MH	COMMERCIAL (PER ACRE)	INDUSTRIAL (PER ACRE)
S.D. NO. 26 & 32	260	195	156	1,440	2,009

Responses to the Initial Study and Notice of Preparation

STATE OF CALIFORNIA

ARNOLD SCHWARZENEGGER, *Governor*

PUBLIC UTILITIES COMMISSION
320 West 4th Street, Suite 500
Los Angeles, CA 90013

May 20, 2004

Project No. 00-196

RECEIVED
MAY 24 2004

Hsiao-ching Chen
County of Los Angeles Regional Planning Department
Impact Analysis Section
320 W. Temple Street, Room 1348
Los Angeles, CA 90012

RE: The River Village Project

Dear Ms. Chen:

As the state agency responsible for rail safety within California, we recommend that any commercial or housing projects planned adjacent to or near rail corridors in the County are planned with the safety of these rail corridors in mind. New developments may contribute to an increase in traffic volumes, not only on streets and at intersections, but also at at-grade highway-rail crossings.

Safety factors to consider include the planning for grade separations for major thoroughfares, improvements to existing at-grade highway-rail crossings due to increase in traffic volumes and appropriate fencing to limit the access of trespassers onto the railroad right-of-way.

The above-mentioned safety improvements should be considered when approval is sought for new development. Working with Commission staff early in the conceptual design phase will help improve the safety to motorists in the County.

If you have any questions in this matter, please call me at (213) 576-7082.

Very truly yours,

Mike Robertson
Senior Utilities Engineer
Consumer Protection and Safety Division

California Regional Water Quality Control Board
Los Angeles Region
Over 51 Years Serving Coastal Los Angeles and Ventura Counties
Recipient of the 2001 *Environmental Leadership Award* from Keep California Beautiful

Terry Tamminen
Secretary for Environmental Protection

Arnold Schwarzenegger
Governor

320 W. 4th Street, Suite 200, Los Angeles, California 90013
Phone (213) 576-6600 FAX (213) 576-6640 - Internet Address: http://www.swrcb.ca.gov/rwqcb4

RECEIVED
MAR 23 2004

March 16, 2004

Hsiao-ching Chen
LA County Department of Regional Planning
320 W. Temple Street
Los Angeles, CA 90012

Dear Hsiao-ching Chen,

Re: CEQA Documentation for Project in the Santa Clara Watershed

Project Title : The River Village Project
Project No. 00-196, TR 53108
SCH No. 2004021002

We appreciate the opportunity to comment on the CEQA documentation for the above-mentioned project. For your information a list of permitting requirements and Regional Board Contacts is provided in Attachment A hereto.

The project site lies in the Santa Clara watershed that was listed as being impaired pursuant to Section 303 (d) of the Clean Water Act. Impairments listed in reaches downstream from the proposed project include nutrients and their effects, salts, coliform bacteria, and historic pesticides. The Los Angeles Regional Water Quality Control Board will be developing Total Maximum Daily Loads (TMDLs) for the watershed, but the proposed project is expected to proceed before applicable TMDLs are adopted. In the interim, the Regional Board must carefully evaluate the potential impacts of new projects that may discharge to impaired waterbodies.

Our review of your documentation shows that it does not include information on how this project will change the loading of these pollutants into the watershed. Please provide the following additional information for both the construction and operational phases of the project.

- For each constituent listed above, please provide an estimate of the concentration (ppb) and load (lbs/day) from non-point and point source discharges.

- Estimates of the amount of additional runoff generated by the project during wet and dry seasons.

- Estimate of the amount of increased or decreased percolation due to the project.

- Estimates of the net change in cubic feet per second of groundwater and surface water contributions under historic drought conditions (as compiled by local water purveyors, the Department of Water Resources, and others), and 10-year 50-year, and 100-year flood conditions.

If you have any questions please call me at (213) 576 6683.

Sincerely,

Elizabeth Erickson
Associate Geologist, TMDL Unit
Los Angeles Regional Water Quality Control Board

EE
Attachments (1)
cc:
State Clearinghouse
File

ATTACHMENT A

- ✓ If the proposed project will result in a **discharge of dredge or fill into a surface water** (including a dry streambed), and is subject to a **federal license or permit**, the project may require a *Section 401 Water Quality Certification*, or waiver of Waste Discharge Requirements. For further information, please contact:

  Valerie Carillo, Nonpoint Source Unit at (213) 576-6759.

- ✓ If the project involves **inland disposal of nonhazardous contaminated soils and materials**, the proposed project may be subject to *Waste Discharge Requirements*. For further information, please contact:

  Rodney Nelson, Landfills Unit, at (213) 620-6119

****

- ✓ If the overall project area is **larger than five acres**, the proposed project may be subject to the State *Board's General Construction Activity Storm Water Permit*. For further information, please contact:

  Tracy Woods, Statewide General Construction Activity Storm Water Permits at (213) 620-2095.

- ✓ If the project involves a facility that is proposing to discharge storm water associated with **industrial activity** (e.g., manufacturing, recycling and transportation facilities, etc.), the facility may be subject to the State Board's *General Industrial Activities Storm Water Permit*. For further information, please contact:

  Kristie Chung, Statewide General Industrial Storm Water Permits at (213) 620-2283.

- ✓ If the proposed project involves requirements for new development and construction pertaining to **municipal storm water programs**, please contact:

  Dan Radulescu, Municipal Storm Water Permits, Los Angeles County at (213) 620-2038;
  Jeff Mack, Municipal Storm Water Permits, Ventura County at (213) 620-2121.

- ✓ The proposed project also shall comply with the local regulations associated with the applicable **Regional Board stormwater permit**:

  Los Angeles County and Co-permittees:
  NPDES No. CAS614001
  Waste Discharge Requirements Order No. 96-054.

  Long Beach County and Co-permittees:
  NPDES CAS004003
  Waste Discharge Requirements Order No. 99-060.

  Ventura County and Co-permittees:
  NPDES No. CAS004002
  Waste Discharge Requirements Order No. 00-108.

****

- ✓ If the proposed project involves any construction and/or groundwater **dewatering to be discharged to surface waters**, the project may be subject to *NPDES/Waste Discharge Requirements*. For further information, please contact:

  Augustine Anijielo, General Permitting and Special Projects Unit at (213) 576-6657(All Region 4 Watersheds).

- ✓ If the proposed project involves any construction and/or groundwater **dewatering to be discharged to land or groundwater**, the project may be subject to *Waste Discharge Requirements*. For further information, please contact:

  Kwang-il Lee, Non-Chapter 15 Unit, at (213) 620-2269 (All Region 4 Watersheds).

ROSSMANN AND MOORE, LLP

Attorneys at Law

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ROGER B. MOORE
ADMITTED IN CALIFORNIA
rbm@landwater.com

March 1, 2004

County of Los Angeles Regional Planning Department
Impact Analysis Section
Attn: Ms. Hsio-ching Chen
320 W. Temple St., Rm 1348
Los Angeles, CA 90012

RE: River Village Project, Project No. 00-196, TR 53108

Dear Ms. Chen:

This letter provides comments on the above-referenced project on behalf of the Planning and Conservation League (PCL) and the Citizens Planning Association of Santa Barbara County (CPA). PCL and CPA were two of the plaintiffs whose CEQA challenge resulted in the court-ordered decertification of the original 1995 Monterey Agreement EIR (*Planning and Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4[th] 892 ("*PCL* decision"). PCL and CPA are also signatories to a court-approved settlement agreement subsequently reached with the Department of Water Resources (DWR), state water contractors, and other interested parties. Under this agreement, DWR is preparing a comprehensive statewide environmental review of a revised project designated as "Monterey Plus." (A full copy of that agreement, referred to here as the *PCL* settlement, is posted on the website of the Department of Water Resources at http://www.montereyamendments.water.ca.gov/.)

We are concerned that the Water Capacity Analysis supporting the above-referenced project relies on sources of water whose reliability is questionable. The analysis relies upon non-final and highly contested transfer of 41,000 acre-feet of State Water Project Table A Amounts (previously known as "entitlements") from Kern County Water Agency and one of its member districts to Castaic Lake Water Agency, prior to the statewide assessment of that same transfer already promised under the *PCL* settlement agreement. The 96.000 acre-feet figure used for water supply calculations appears to depend upon the availability of that transfer.

Since the problems with the assumptions of water reliability in this project review closely parallel those in another project on which we recently commented (West Creek project, #98-008), we are attaching our comments recently submitted to the Department of Regional Planning on that project, and ask that the same concerns be fully and fairly addressed in the present project review. Moreover, since the environmental concerns associated with this project overlap with the issues now pending in the statewide "Monterey Plus" environmental review, we are also attaching our scoping comments prepared on that project.

Respectfully,

____
Roger B. Moore

Counsel for Planning and Conservation League and Citizens Planning Association of Santa Barbara County, Inc.

ROSSMANN AND MOORE, LLP

Attorneys at Law

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ROGER B. MOORE
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rbm@landwater.com

February 3, 2004

Via facsimile and email
Los Angeles County Department of Regional Planning
Attention: Daryl Koutnik
320 W. Temple St.
Los Angeles, CA 90012

Re: West Creek Project, #98-008

Dear Mr. Koutnik:

This letter provides comments on the above-referenced project on behalf of the Planning and Conservation League (PCL) and the Citizens Planning Association of Santa Barbara County (CPA). PCL and CPA were two of the plaintiffs whose CEQA challenge resulted in the court-ordered decertification of the original 1995 Monterey Agreement EIR (*Planning and Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892 ("*PCL* decision"). PCL and CPA are also signatories to a court-approved settlement agreement subsequently reached with the Department of Water Resources (DWR), state water contractors, and other interested parties. Under this agreement, DWR is preparing a comprehensive statewide environmental review of a revised project designated as "Monterey Plus." (A full copy of that agreement, referred to here as the *PCL* settlement, is posted on the website of the Department of Water Resources at http://www.montereyamendments.water.ca.gov/.)

Approval of the West Creek project as presently proposed would fail to honor the *PCL* decision and subsequent settlement agreement. Far from correcting the errors in water reliability assessment that resulted in judicial decertification of the original EIR for the West Creek project, the new environmental document on which the County Department of Regional Planning is now asked to act, styled as a "Draft Additional Analysis" to the Final EIR (EIR Addition), would perpetuate and compound these errors. The relevance of the *PCL* decision and subsequent settlement to the present project is direct and inescapable. Based upon the *PCL* decision, the

Second District Court of Appeal in *Santa Clarita Organization for Planning the Environment v. County of Los Angeles* (2003) 106 Cal.App.4th 715 (*SCOPE*) ordered decertification of the West Creek EIR because its water services assessment prejudicially failed to address the distinction between paper and actual water. The West Creek EIR had wrongfully but heavily relied upon Castaic Lake Water Agency's (Castaic's) paper entitlements from the State Water Project rather than deliverable water supplies. (*Id.* at 722.)

Regrettably, history repeats itself in the EIR Addition. The new analysis continues to rely on the non-final and highly contested transfer of 41,000 acre-feet of State Water Project Table A Amounts (previously known as "entitlements") from Kern County Water Agency and one of its member districts to Castaic, prior to the statewide assessment of that same transfer already promised under the *PCL* settlement agreement. Indeed, the SWP allocation attributed to Castaic and used in subsequent calculations expressly presupposes this transfer as a source of deliverable water for the project. (See, e.g., EIR Addition, pp. 2.0-3, 4.0-18, 94-95 and Appendix F, pp. 10-12.)

While the EIR Addition concedes that the 41,000 acre-feet transfer may still be invalidated (page 4.0-65), the addition relies on glaring misstatements to perpetuate its imprudent reliance on that transfer. The notion that the Monterey Agreement somehow provides "blanket pre-approval" for this and other Monterey-dependent transfers (*id.* at 4.0-64) deserves rejection in the strongest possible terms. It cannot be reconciled with the *PCL* decision, which ordered an entirely new statewide EIR to be prepared and recognized that "DWR, with its expertise on the statewide impacts of water transfers, may choose to address those issues in a completely different and more comprehensive manner." (*PCL*, 83 Cal.App.4th at p. 920.) Nor can it be reconciled with the *PCL* settlement, which authorizes only the interim application of Monterey in tandem with new settlement components, while leaving to DWR the responsibility to make a new project decision following comprehensive statewide review. (*PCL* settlement, §§II, VII.)

The EIR Addition's assertion that Castaic is "not a party" to the *PCL* litigation, and therefore presumably not bound by the settlement terms (EIR Addition, p. 4-65), is equally false and misleading. Not only is Castaic a party to a joint defense agreement with respondent Central Coast Water Authority, but it, along with Kern and other state water contractors, was a signatory to the *PCL* settlement agreement. That agreement conspicuously excludes the Kern/ Castaic transfer from the list that the signatories, including Kern and Castaic, recognize as "final." (*PCL* settlement, §III.D and Attachment E.) The contested Kern-Castaic transfer, and other newly proposed and non-final transfers, cannot proceed without new environmental analysis satisfying CEQA. (PCL settlement, §VII.A.)

Recognizing that this transfer remains subject to pending litigation and potential invalidation in the Los Angeles Superior Court, a circumstance which remains the case today, the *PCL* settlement also requires the new "Monterey Plus" EIR to analyze the 41,000 acre-feet transfer, as well as other transfers facilitated by Monterey Amendments provisions, such as other agriculture-to-urban transfers referenced in Article 53 of those amendments. (*PCL* settlement, § II.C.4.) The

EIR supporting the transfer has already been set aside due to its faulty reliance on the decertified Monterey Agreement EIR, and no legally adequate EIR has been prepared. Reliance on this contested transfer, without the benefit of DWR's statewide "Monterey Plus" EIR, would mirror the "provincial experience" criticized in the *Planning and Conservation League* decision. (83 Cal. App. 3d at p. 918.) That reliance would also create a substantial risk of final decisions based on local analysis that is likely to prove inconsistent with the project decision reached after DWR's "Monterey Plus" EIR. The EIR Addition's speculation that the transfer is unlikely to be "unwound" (page 4.0-65) cannot be reconciled with the *PCL* decision and settlement agreement. The EIR Addition is equally speculative in its unsupported assertion that this Monterey-dependent transfer could proceed under present circumstances in the absence of the Monterey Amendments.

Other aspects of the EIR Addition are equally problematic. To provide just several examples, the document relies on a proposed 16,000 acre-foot permanent transfer of Table A amounts from Kern to Castaic (page 4.0-17) that PCL and CPA have already challenged in scoping comments as inconsistent with the *PCL* decision and settlement. It also relies upon a separate 24,000 acre-foot storage agreement that is the subject of a separate judicial challenge. Finally, it relies upon a 2003 reliability report issued by DWR (page 2.0-3) that is the subject of a vigorous and ongoing statewide debate. (See http://swpdelivery.water.ca.gov/commentletters.htm.)

In sum, approval of the project under present circumstances would ignore the central teaching of the *PCL* and *SCOPE* decisions that "the dream of water entitlements from the incomplete State Water Project is no substitute for the reality of actual water the SWP can deliver." (*SCOPE,* 106 Cal.App.4th at p. 717-18.) PCL and CPA urge the County to reject the EIR Addition and proposed project approval.

Respectfully,

Roger B. Moore

Counsel for Planning and Conservation League and Citizens Planning Association of Santa Barbara County, Inc.

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March 28, 2003

Ms. Delores Brown
Chief, Mitigation and Restoration Branch
Department of Water Resources
3251 S Street
Sacramento, CA 95816

Re: Scoping comments in response to Notice of Preparation for Environmental Impact Report for the "Monterey Plus" EIR

Dear Ms. Brown:

We appreciate the opportunity to provide scoping comments in response to the Notice of Preparation (NOP) for the above-referenced EIR on behalf of the Planning and Conservation League (PCL) and the Citizens Planning Association of Santa Barbara County (CPA). PCL, CPA, and the Plumas County Flood Control and Water Conservation District challenged the environmental review and validity of the original 1995 Monterey Amendments to the State Water Project contracts, and participated in two years of settlement negotiations that followed the Third District Court of Appeal's decision in that case. The court set aside the 1995 Monterey Agreement EIR ("1995 CCWA EIR") prepared by a local joint powers agency, the Central Coast Water Authority (CCWA) and required DWR to prepare a new EIR. (*Planning and Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892 (*PCL v. DWR*).)

All three plaintiffs have executed the resulting settlement agreement, which is awaiting final ratification by the Department of Water Resources and the local water districts and agencies that participated in the negotiations. Although the text of the settlement agreement had not yet been released to the public at the time the NOP issued, it is now available on DWR's website (http://www.montereyamendments.water.ca.gov/). DWR is to be commended for encouraging public participation, by extending the scoping comment period for another month following the public release of this agreement.

The new project described in the settlement agreement includes both the Monterey Amendments and additional contract amendments and other program features described in the agreement. The NOP's reference to the new project as "Monterey Plus" is therefore accurate. We believe that the new project offers important benefits that will bring greater public accountability and environmental responsibility to the State Water Project (SWP) in comparison to the original version of the Monterey Amendments reviewed in the invalidated 1995 CCWA EIR.

Equally important as its substantive provisions, the settlement agreement also anticipates that DWR will now prepare an EIR that provides other decision-makers and the public the responsible environmental review denied to them in the 1995 CCWA EIR. In *PCL v. DWR*, the court referred to "the...contractors and the members of the public who were not invited to the table" in the negotiations that led to the Monterey Agreement. (83 Cal.App.4th at 905.) Section III of the settlement agreement provides a detailed overview of elements that DWR has committed to include in its new EIR, while recognizing that the proposed project to be assessed will be specifically defined during the scoping process.

DWR as lead agency retains the ultimate responsibility to ensure that its environmental review and new project decision properly inform decision-makers and the public. We provide specific scoping comments below to encourage DWR to prepare an EIR that is fully consistent with the court's ruling in *PCL v. DWR*, the terms of the settlement agreement, and the requirements of law. If DWR is to overcome the "aura of unreality" identified by the court of appeal in its assessment of the 1995 CCWA EIR (83 Cal.App.4th at 913), the department must prepare a new EIR that is solidly grounded in both legal and hydrologic reality.

PCL v. DWR

The EIR must, as a starting point, analyze the substance of the court of appeal's decision in *PCL v. DWR* and ensure that its new project assessment is consistent with the Third District's analysis in that case. The key components of the ruling are as follows:

- **Lead agency requirement**

Holding that CCWA erroneously acted as lead agency, the court ruled that CEQA required DWR, the only entity with the requisite statewide authority and expertise, to assume its proper role as lead agency in preparing a new EIR.

- **"No project" alternative**

The court also held that the CCWA EIR was fatally defective under CEQA for failing to analyze implementation of pre-Monterey state water contract terms, and particularly the permanent shortage provisions of article 18(b), as part of the EIR's no-project alternative. In the event of a permanent shortage (i.e., inability to reliably deliver the full 4.23 million annual acre-feet (MAF) of previously-labeled "entitlements" listed in Table A of the project contracts), pre-Monterey article 18(b) required the proportional reduction of each contractor's amount listed in Table A to match the available supply.

- **"Paper water" problem**

The relationship between so-called "entitlements" and land-use planning was central to the court's holding that the EIR failed to address the "no project" alternative. The court connected this error to the risk of statewide land-use decisions made on the basis of "paper" water entitlements not grounded in real, deliverable water. The court openly criticized the false expectation that the State Water Project will deliver on its full "entitlement" level of 4.23 MAF when the project's historic capability, evidenced in DWR's own data, has only been roughly half this level. The ruling therefore noted the "huge gap between what is promised and what can be delivered."(83 Cal.App.4th at 908.) With respect to the "humbler, leaner reality" of project capability, the Court also noted the implicit assumption in the Monterey Amendments' rebate provisions (article 51) that certain facilities originally envisioned for the SWP will not be built. (*Id.* at 914.)

- **Validation procedure**

In addition to ruling for the plaintiffs on these CEQA claims, the court of appeal found that the plaintiffs had properly initiated a proceeding to question the substantive validity of the Monterey Amendments, including DWR's transfer of a 20,000-acre conservation and storage facility, the Kern Fan Element, to Kern County Water Agency. The court rejected a procedural challenge based on the theory that nonparty state water contractors were indispensable to the validation challenge.

In sum, as a consequence of the appellate ruling in *PCL v. DWR*, DWR must prepare its own EIR as lead agency. That EIR must fully address the "no project" alternative, and therefore must confront the "paper water" concerns the court of appeal identified in its assessment of that issue. As an integral part of the Monterey Amendments, the Kern Fan Element transfer must also be fully addressed in the new EIR.

Settlement Agreement

The EIR must also accurately describe the project based upon the settlement agreement in sufficient detail to inform decision-makers and the public of its potential impacts. Both the "Monterey" and "plus" components must be fully described. Among the provisions of the agreement are these (all references, except as noted, are to the Settlement Agreement):

- Specified provisions of the SWP contracts shall be amended to delete the term "entitlement," to be replaced with the "Table A amounts" as referenced in Table A of the contracts. (Attach. A.)

- New Article 58 of the SWP contracts will require DWR to issue biennial reports starting in 2003 to city, county and regional planning agencies, providing information on SWP delivery capabilities under a range of hydrologic conditions, as well as historic delivery figures. DWR will also produce guidelines by January 2004 to municipal and industrial contractors to provide accurate information for land use planning, with plaintiffs' input. (Attach. A, B.)

- DWR will issue guidelines on permanent transfers of Table A amounts. The negotiations will take place in public, CEQA compliance will be required, and the place and purpose of use must be specified. (Attach. C.)

- Future project-wide contract amendments and amendments to transfer Table A amounts will be in public with opportunities for public participation (Attach. D.)

- The agreement specifies in detail DWR's commitment to assess certain specified elements in the new EIR, which will analyze the Monterey Amendments, "attachment A" amendments, and other settlement provisions. (Section III.)

- Funding will be provided to Plumas in an amount totaling $8 million, principally to improve and restore the Feather River watershed, including the establishment of a locally run watershed forum. The goals of the program are water retention and quality, vegetative management, and groundwater storage. (Section IV.)

- The Kern Water Bank will become subject to new land use restrictions that protect 490 acres of additional land from development, beyond the restrictions currently in place in the applicable Habitat Conservation Plan. Transfer, development and operation of the bank will be addressed in the EIR. (Sections V, III.F.)

- Funding to plaintiffs ($5.5 million total) will support a variety of purposes, including watershed restoration projects, technical studies, and follow-up actions arising from the settlement. (Section VII.)

Non-reliance on CCWA's 1995 EIR

The appellate ruling required DWR to prepare a new EIR, finding that CCWA's 1995 EIR "failed to meet the most important purpose of CEQA, to fully inform the decision makers and the public of the environmental impacts of the choices before them." (*PCL v. DWR,* 83 Cal.App.4th at 920.) The court found it unnecessary to adjudicate the other CEQA deficiencies identified by the plaintiffs after analyzing the defects in the lead agency selection and no project assessment, observing that "DWR, with its expertise on the statewide impacts of water transfers, may choose to address those issues in a completely different and more comprehensive manner." (*Id.*) The court also noted that the deficiencies in the 1995 EIR might be related to the "provincial experience" of CCWA. (*Id.*)

The settlement agreement likewise requires DWR to prepare a stand-alone EIR (section III), and disclaims further reliance on the 1995 EIR to support any new project approved after March 26, 2001 (section VII.A). To ensure consistency with the appellate ruling and the settlement agreement, the new EIR must fully reflect DWR's independent judgment and assessment as lead agency, and must not incorporate or otherwise rely on CCWA's assessments in the invalidated 1995 EIR.

Project Definition

Leading CEQA decisions have long since recognized that "an accurate, stable and finite project definition is the *sine qua non* of the of an informative and legally sufficient EIR." (*County of Inyo v. City of Los Angeles (III)* (1977) 71 Cal.App.3d 185, 199.) The CEQA process cannot "freeze the ultimate proposal in the precise mold of the initial project; indeed, new and unforeseen insights might emerge during the investigation, evoking revision of the original proposal." (*Id.*)

Precision and consistency in a lead agency's characterization of the project under review also reinforces related principles of CEQA: that the project must embrace the "whole of the action" (14 Cal. Code Regs., § 15378(a)); and that assessments in an EIR may not be used to justify a decision already made. In sum, CEQA "compels an interactive process of assessment of environmental impacts and responsive modification which must be genuine." (*County of Inyo v. City of Los Angeles (VI)* (1984) 160 Cal.App.3d 1178, 1185.)

As appropriately noted in the NOP, both the Monterey Amendments and the additional program components specified in the settlement agreement are integral parts of the new project to be reviewed in the EIR. That understanding is also consistent with the settlement agreement (section III.C). The EIR must describe each component of the project in sufficient detail to adequately inform decision-makers and the public about the nature of the project under review.

Environmental Baseline

Without the development of an adequate baseline condition, "analysis of impacts, mitigation measures and project alternatives becomes impossible." (*County of Amador v. El Dorado County Water Agency* (1999) 76 Cal. App. 4th 931, 953.) The baseline for these assessments must be based on an analysis of "real conditions on the ground," rather than mere opinion or narrative. (*Save Our Peninsula Committee v. Monterey County Board of Supervisors* (2001) 87 Cal.App. 4th 99, 121.)

The NOP correctly observes that although the environmental baseline is "normally" existing conditions at the time the notice is published (14 Cal. Code Regs. § 15125), the baseline for this EIR must be augmented to address DWR's operation under the Monterey Amendment, and partial implementation of those amendments, since completion of the 1995 EIR. This augmentation (producing two baselines) is necessary to ensure that the EIR fully addresses the "whole of the action," including the Monterey Amendments.

This observation requires clarification in two respects. First, the SWP contracts of two contractors that have not signed the Monterey Amendments (Plumas and Empire Westside) are still governed by the pre-Monterey terms. Second, notwithstanding project approvals in 1995, none of the

Monterey Amendments went into effect until August 1996. At that time, following the superior court's announcement of its intended decision but before any review by the court of appeal, DWR and the state water contractors who had signed the Monterey Amendments agreed to waive a provision in the original Monterey Amendments which otherwise required all litigation to be resolved before the Monterey Amendments took effect.

Instead of arbitrarily selecting a single point in time (such as 1995 or 2003) to define the environmental baseline, the EIR will need to fully study *both* pre-Monterey and present conditions. In developing the baseline, it will be useful to consider the different senses of "conditions" that together form the basis for studying project impacts. For example:

- The *contractual* baseline condition must be the pre-Monterey SWP contracts. Any effort to define the baseline as incorporating the Monterey Amendments, or even partial implementation of some of its elements, would make it impossible for the EIR to properly assess the "whole of the action."

- The *hydrologic* baseline condition should not be confined to a single calendar year. Rather, the impacts of water management changes are best addressed under a range of hydrologic circumstances. Constraints on SWP system performance must also be addressed. Anticipating that need, the settlement agreement provides that the new EIR's "environmental setting" section shall analyze "information on water deliveries of the SWP over the relevant historical period (at least 1991-2002), as well as data regarding the deliveries in the last extended drought (at least 1987-1992)." (Section III.C.1.)

- The *regulatory* baseline condition should examine the range of legal and environmental constraints, other than the contracts and hydrologic conditions, that could impact water deliveries to SWP contractors and the environmental impacts of these deliveries. These constraints might include such matters as Delta water quality standards, endangered species requirements, the SWP's coordinated operations agreement with the Central Valley Project (CVP), competing water rights, and elements of the CALFED program. Such constraints should be studied both as they existed before any elements of Monterey were implemented and as they have evolved since that time.

No Project Alternative

CEQA requires that the no project alternative address "existing conditions" as well as "what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services." (14 Cal. Code Regs. §15126(e)(2).) That requirement compels DWR in its new EIR to fully study the consequences of enforcing the terms of pre-Monterey water supply contracts prior to eliminating them.

To overcome the prejudicial error noted in the appellate ruling, DWR must "fulfill its mandate" in the new EIR "to present a complete analysis of the environmental consequences" of enforcing the pre-Monterey permanent shortage provision, article 18(b). (*PCL v. DWR*, 83 Cal.App.4th at 915.) The EIR must directly evaluate reduced Table A allocations resulting from application of that article. As a useful starting point, DWR should carefully review and perform the analysis requested in public comments referenced in the Third District's opinion. (*Id.* at 908, 915.) In addition to confirming the SWP's historic inability to deliver anywhere close to full Table A amounts, these comments "corroborate the common sense notion that land use decisions are appropriately predicated in some large part on assumptions about the available water supply." (*Id.* at 915.)

Section III.C.2 of the settlement agreement provides that the new EIR shall include "[a]s part of the CEQA-mandated 'no-project' alternative analysis, an analysis of the effect of pre-Monterey Amendment SWP contracts, including implementation of Article 18 therein. This analysis shall address, at a minimum, (a) the impacts that might result from application of the provisions of Article 18(b) of the SWP Contracts, as such provision existed prior to the Monterey Amendments, and (b) the related water delivery effects that might follow from any other provisions of the SWP Contracts." Two of the "other" contract provisions inevitably related to this assessment are articles 18(a) and 21, which prior to Monterey required, respectively, that agricultural contractors endure the first cutbacks in water allocations in times of temporary shortage and receive the first allocations in times of surplus.

The environmental effects of proportional reductions in Table A amounts, as calculated in the no project assessment, must be directly compared to those of the proposed project. As the court of appeal made clear in *PCL v. DWR*, neither claims of "infeasibility" nor purported legal disagreements can serve as an excuse for avoiding comparison of the environmental consequences of the no project alternative and the project. (*PCL v. DWR*, 83 Cal.App.4th at 918.)

Project Alternatives

The NOP accurately summarizes the lead agency's requirement under CEQA to examine a range of reasonable alternatives that would feasibly obtain most of the project objectives, but avoid or substantially lessen any significant adverse effects of the project. (14 Cal. Code Regs. §15126.6.) In its screening and review of alternatives, the EIR must provide more than "cursory" analysis. (*PCL v. DWR*, 83 Cal. App. 4th at 919.) It should not construe project objectives so tautologically that only the proposed project could conceivably be capable of achieving them. Nor should the EIR allow the mere "threat of litigation" under a proposed alternative to prevent its environmental review. (*Id.* at 914.)

Assessment of SWP Reliability

DWR's record of deliveries to contractors under the SWP figured centrally in the Third District's conclusion that the 1995 EIR must be set aside. (See *PCL v. DWR*, 83 Cal. App. 4th at 908 (noting the "huge gap between what is promised and what can be delivered" and that "actual, reliable water supply" is "in the vicinity of 2 to 2.5 MAF of water annually" rather than the 4.23 MAF of Table

A "entitlements"); 83 Cal. App. 4th at 913 (average actual deliveries under the SWP from 1980-1993 "were around 2.0 MAF").

Similarly frank assessment of DWR's record of deliveries will be essential to a wide variety of issues to be addressed in the new EIR, including the no project alternative as well as the assessment of hydrologic impacts, land use and planning impacts, growth-inducing impacts, and cumulative impacts. As mentioned above, the settlement agreement anticipates this need by calling for assessment of historic deliveries at least from 1987-1992 and 1991-2002. DWR should also coordinate its information about SWP capability with related discussions of the same subject in other contexts, such as hearings in the California Legislature and the pending efforts to revise DWR's Bulletin 160.

Conversely, although computer models can be useful when applied for their intended objectives, no single computer modeling approach, such as the CALSIM II model referenced in DWR's draft State Water Project Delivery Reliability Report (See http://swpdelivery.water.ca.gov/ "draft reliability report")), should substitute for careful assessment of the historical record of project deliveries. Any model must be assessed and calibrated in terms of actual SWP deliveries. Although the draft reliability report is important in its recognition that the SWP cannot reliably deliver the full 4.23 MAF of table A amounts, we do not recommend that DWR's EIR rely on the model-driven conclusions in this version of the report, which have been the subject of significant criticism and calls for redrafting. The report must be read in light of substantial criticisms made in public comments. (See http://swpdelivery.water.ca.gov/commentletters.htm.)

Relying on the CALSIM II model, the draft reliability report constructs delivery probability charts for the SWP for two years, 2001 and 2021. As noted by several commenters, the median delivery identified in the report (3.297 MAF) is on the order of 50% greater than the actual record of historic deliveries to the SWP as reported by DWR. A detailed analysis by Dennis O'Connor for the California Research Bureau, referenced in the comment letter of Senator Machado, indicates that the draft reliability report provides no credible explanation for this disparity. O'Connor's analysis concludes that among other problems, the results are inconsistent with previous estimates and models, recent deliveries were lower than the modeled 2001 conditions, and 2021 does not reflect any growth in upstream consumptive use. His assessment also observes that CALSIM II is not calibrated or otherwise verified, and that the draft reliability report does not use the CALSIM II model as designed. Because the draft reliability report appears to overstate the supply reliability of the SWP, O'Connor's analysis warns that DWR's assessments of reliability should not replace the "paper water" problem with a new, simulation-based "cyber water" problem. Other comment letters, notably those of Robert C. Wilkinson, Peter Gleick, and Arve Sjovold, reach similar conclusions.

Several other points deserve emphasis as they relate to the EIR's references to SWP reliability:

- Any references to SWP delivery reliability in the EIR should be based upon the portion of full Table A amounts that the project can reliably deliver, not the percentage of contractor "requests" that can be met in any given year. The SWP contractual provisions governing allocations in the event of shortages are based upon Table A amounts, not requests. In *PCL v. DWR*, the court of appeal considered and rejected CCWA's attempt to shift the reliability discussion away from Table A-percentages to the request-percentages. (83 Cal. App. 4th at 913.)

- Any assessment of the reliability of SWP Delta exports in the EIR must be integrated with an assessment of CVP exports. Both projects extract water from the Delta in a coordinated management program that includes pumping, storage, and conveyance. Without integrated study of these projects, it would be impossible to discern whether reliability attributed to the SWP was based on water from the CVP.

- The need for integrated assessment of SWP and CVP exports is corroborated in the Bureau of Reclamation's February 21, 2003 scoping comments, which recognize that many changes have taken place since the 1986 signing of the coordinated operations agreement (COA). Reclamation observes that the operation of the Kern Water Bank and of Metropolitan Water District's Eastside Storage Reservoir "are two prominent influences on SWP operations that were facilitated by the Monterey Amendment" and not considered in the development of the COA. Reclamation also expresses concern about "current and future CVP access to SWP Delta pumping capacity," noting that Monterey Amendment implementation may have influenced these. Reclamation appropriately requests that the EIR "examine in detail how the proposed action would affect CVP access to SWP Delta export capacity both from a historical and future condition perspective. In addition, should the proposed action affect CVP use of SWP Delta export capacity, the EIR should address the environmental and socio-economic effects of these changes."

- Any assessment of the reliability of SWP Delta exports must also consider other potential regulatory and environmental constraints on deliveries. In addition to the COA, these might include Delta water quality standards, endangered species requirements, competing water rights, and elements of the CALFED program.

Changes in SWP Operations and Deliveries

The settlement agreement states that DWR's new EIR shall include "analysis of the potential environmental impacts of changes in SWP operations and deliveries resulting from implementation of the proposed project. If the proposed project results in modifications to the water sources relied upon for the SWP, those sources will be identified and the resulting environmental effects will be assessed." (Section III.C.3.) The EIR must provide this analysis to ensure compliance with the agreement and the requirements of CEQA.

Kern Fan Element Transfer

The EIR must fully address the environmental consequences of transferring the Kern Fan Element from DWR to Kern County Water Agency under article 52 of the Monterey Amendments, as well as its subsequent transfer from KCWA to the Kern Water Bank Authority. As provided in the settlement agreement, "the new EIR shall include an independent study by DWR, as the lead agency, and the exercise of its judgment regarding the impacts related to the transfer, development and operation of the Kern Water Bank" in light of existing environmental permits. (Section III.F.) That study "shall identify SWP and any non-SWP sources of deliveries to the Kern Water Bank." (*Id.*) The EIR must provide this analysis to ensure compliance with the agreement and the requirements of CEQA.

State ownership of the Kern Fan Element must be addressed as the "no project" condition. For the EIR to provide an assessment that can support transfer of the bank to local control, it must provide a sufficient explanation as to whether it would have been feasible to maintain the water bank as a state resource, and under what conditions it could remain a state resource.

The EIR should also analyze an alternative that would allow the Kern Water Bank to remain in local control, subject to operational and financial criteria designed to maximize environmental benefits. One such alternative would require the bank to store environmental water in time of surplus and make it available at no cost to the state in time of drought, as part of the consideration for allowing the asset to operate the rest of the time for local purposes. In sum, a variety of operating and financial arrangements must be explored to maximize the bank's contributions to the State's environment.

Transfers of Table A Amounts Under the Monterey Amendments

The settling parties recognize the finality of certain transfers of table A amounts from agricultural to urban contractors, listed in attachment E of the agreement. (Section III.D) That list does not include as "final" a single transfer of 41,000 acre-feet of table A amount from Kern County Water Agency to Castaic Lake Water Agency, since that transfer remains the subject of active litigation. (Section III.E; see *Friends of the Santa Clara River v. Castaic Lake Water Agency* (2000) 95 Cal. App. 4th 1373 (ordering the EIR for that transfer set aside due to unlawful "tiering" from the invalidated 1995 Monterey EIR)). Nonetheless, since each of these transfers directly relies on the Monterey Amendments, the settlement agreement provides that DWR's new EIR shall study the potential environmental effects of both the attachment E transfers and the Kern- Castaic transfer. (Section III.C.4.)

Growth-Inducing Impacts

In light of the court of appeal's recognition in *PCL v. DWR* of the close connection between water planning and land-use decision-making, it is crucial that the new EIR fully address any potential growth-inducing impacts of the Monterey Amendments, including those arising from changes in project management and operation, failure to reduce Table A amounts to existing and reasonably foreseeable SWP capability, financial restructuring of the project contracts, water transfers facilitated by Monterey, and water sales from the locally administered Kern Water Bank. The cumulative impacts of these changes also require careful analysis. The growth-inducing effects of "completed" attachment E transfers and the Kern-Castaic transfer must be studied, since they were made pursuant to the Monterey Amendments. (Section III.C.4.)

Conclusion

We hope that these scoping comments assist DWR in preparing an exemplary EIR that will succeed in informing decision-makers and the public of the environmental consequences of the proposed action, continuing the spirit of cooperation and inclusion that the settlement agreement has made possible. Do not hesitate to contact us if you have further questions.

Respectfully,

Roger B. Moore

Antonio Rossmann

california water impact network

County of Los Angeles Regional Planning Department
Impact Analysis Section
Attn: Ms. Hsio-ching Chen
320 W. Temple St., Rm 1348
Los Angeles, CA 90012

February 26, 2004

RE: The River Valley Project, Project No. 00-196, TR 53108

Dear Ms. Chen;

The California Water Impact Network (C-WIN) objects to the proposed River Valley Project relying on a contested transfer of 41,000 acre feet (AF) of SWP allocation from the Kern County Water Agency to the Castaic Lake Water Agency (CLWA) as a reliable source of water supply for the proposed River Valley Project. The Notice of Preparation (NOP), in the Water Capacity Analysis, sites 96,000 AF as being part of the available water supply. This 96,000 AF includes the 41,000 AF transfer mentioned above that continues to be clouded by ongoing litigation and its very validity is one of the subjects of the forthcoming and very complex EIR known as "Monterey Plus", to be prepared by the state Department of Water Resources.

C-WIN is currently a plaintiff is several cases against CLWA opposing proposed transfers that depend on the 41,000 AF transfer mentioned above. Any transfer that is dependent on a water source that is not free and clear is not reliable. C-WIN hereby incorporates our January 1, 2004 objection letter to the CLWA on the Negative Declaration for a proposed 35,000 AF transfer for a Groundwater Banking Project that depends on this same 41,000 AF transfer and the C-WIN February 3, 2004 objection letter to the LA County Regional Planning Department on the proposed West Creek Project #98-008 that depends on this same 41,000 AF transfer.

The River Valley Project, along with many other developments in California, is dependent on the analysis by DWR and its State Water Project Delivery Reliability Report, Final 2002. This Reliability Report has been seriously criticized for overstating actual available supply, questionable modeling and simulations, and lack of proper peer review. C-WIN hereby incorporates this Final Report, including all of the published comment letters in Appendix E. Please make a special note of those letters submitted by Senator Michael Machado, Robert Wilkinson, Arve Sjovold, Joan Wells, Dr. Peter Gleick and myself. C-WIN also incorporates "A Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California" submitted by the California Bay Delta Authority Science Program Association of Bay Governments, December 4, 2003. This document raises significant questions as to the reliability of DWR's Delivery Reliability Report.

Please reject the proposed River Valley Project consisting of 1,444 residential units, up to 1.5 million square feet of non-residential mixed-use space, along with a 7 acre elementary school and public recreational facilities on the grounds that the proposed water supply is inadequate and unsubstantiated at this time.

P.O. Box 5462, Santa Barbara, CA 93150, email: caroleekrieger@cox.net, Phone: 805.969.0824, Fax: 805.565.3394

C-WIN hereby incorporates all other comments by reference opposing the Notice of Preparation on The River Village Project.

Sincerely,

Carolee K. Krieger
President, The California Water Impact Network

Department of Toxic Substances Control

Edwin F. Lowry, Director
1011 N. Grandview Avenue
Glendale, California 91201

Terry Tamminen
Agency Secretary
Cal/EPA

Arnold Schwarzenegger
Governor

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FEB 9 2004

February 5, 2004

Ms. Hsiao-ching Chen
L.A. County Department of Regional Planning
320 West Temple Street, Room 1348
Los Angeles, California 90012

NOTICE OF PREPARATION FOR L.A. COUNTY DEPARTMENT OF REGIONAL PLANNING, THE RIVER VILLAGE PROJECT, PROJECT NO. 00-196, TR 53108, CHIQUITA CANYON ROAD AND COMMERCE CENTER DRIVE, LOS ANGELES COUNTY, CALIFORNIA
(SCH 2004021002)

Dear Ms. Chen:

The Department of Toxic Substances Control (DTSC) has reviewed the Notice of Preparation (NOP), dated January 26, 2004, for the subject project. The due date to submit comments is March 1, 2004.

Based on a review of the NOP, DTSC is providing the following comments:

1. Because the project is school site related, DTSC recommends that an environmental review, such as Preliminary Endangerment Assessment (PEA), be conducted to determine whether there has been or may have been a release or threatened release of a hazardous material, or whether a naturally occurring hazardous material is present, based on reasonably available information about the property and the area in its vicinity.

2. Castaic Union School District (CUSD) is invited to participate in DTSC's School Property Evaluation and Cleanup Program authorized by AB 387, SB162, AB 2644 and AB 972. If CUSD wishes to investigate this program's applicability to the school project, please contact the California Department of Education, School Facilities Planning Division at (916) 322-2470. If CUSD elects to proceed to conduct a PEA at the site, it shall enter into an Environmental Oversight Agreement (EOA) with DTSC to oversee the preparation of the PEA.

3. Project site contains several abandoned oil wells. DTSC has developed "Interim Draft Guidance for Characterization of Former Gas and Oil Field Exploration & Production Sites Planned for Use as School Sites". A draft copy is available upon request.

4. Since the project site is currently used for agricultural purposes, pesticides (such as DDT and DDE) and fertilizers (usually containing heavy metals) commonly used as part of past farming operations may be present. These agricultural chemicals are persistent and bio-accumulative toxic substances. DTSC has developed the "Interim Guidance for Sampling Agricultural Soils (Second Revision), dated August 2002." This Guidance should be followed for sampling agricultural properties.

5. Please note that as a condition to receiving state funds pursuant to chapter 12.5 (commencing with section 17010.10) of the Education Code, any school construction project must comply with the requirements of Section 17213.1 and 17213.2 of the Education Code, unless otherwise specifically exempted.

DTSC is also administering the $85 million Cleanup Loans and Environmental Assistance to Neighborhoods (CLEAN) Program which provides low-interest loans to investigate and cleanup hazardous materials at properties where redevelopment is likely to have a beneficial impact to a community. These loans are available to developers, businesses, schools, and local governments.

For additional information on the EOA or CLEAN Program, please visit DTSC's web site at www.dtsc.ca.gov. If you would like to discuss this matter further, please contact me at (818) 551-2860.

Sincerely,

for Ken Chiang
Senior Hazardous Substances Scientist
School Property Evaluation and Cleanup Division

cc: see next page

cc: Mr. Michael O'Neill
School Facilities Planning Division
California Department of Education
1430 N Street, Suite 3207
Sacramento, California 95814

Mr. Scott Morgan
State Clearinghouse
1400 Tenth Street
P.O. Box 3044
Sacramento, California 95812-3044

Department of Toxic Substances Control
CEQA Tracking Center
1001 I Street, 22nd Floor
P.O. Box 806
Sacramento, California 95812-0806

Ms. Beverly W. Silsbee, Superintendent
Castaic Union School District
28131 Livingston Avenue
Valencia, CA 91355

SPECD Reading File

CEQA Reading File

Subject: **FW: River village No. 00-196/TR53108**
Date: Wednesday, June 2, 2004 6:27 AM
From: Chen, Hsiao-Ching <hchen@planning.co.la.ca.us>
To: 'Ken Koch' <kkoch@impactsciences.com>
Priority: Highest

-----Original Message-----
From: Bill Witte [mailto:billboxman@socal.rr.com]
Sent: Thursday, March 04, 2004 2:47 PM
To: hchen@planning.co.la.ca.us
Subject: River village No. 00-196/TR53108
Importance: High

Dr Hsiao-ching Chen AICP

County of Los Angeles

Department of Regional Planning

320 W. Temple St.

Los Angeles, CA 90012-3225

Fax 213-626-0434

Thank you for the opportunity to comment on project No. 00-196/TR53108 "The River Village Project". I have some overall thoughts and concerns about this project. This document show that the majority of this project 84% will have significant impacts on the people that live with in 15 miles for a numerous of reasons.

The largest issue that has never been studied is the impact on people from the countuious grading of earth (dirt) the last 10+ years, and for the next 25+ years. The constant particulate matter floating in the air from new development grading, besides being situated between 2 major freeways, 1 is rated an "F" (14) and the other not far behind (5).

From my brief investigation over the last 10 years this valley has seen 42 million tons of earth graded (mostly in the past 6 years) and currently approved and not graded yet

26 million tons and the next 25+ years on record 38 million tons not counting Tajon Ranch and the Cemex project of 56 million tons for the next 20 years plus countless projects that have not come to the table yet, but will. Please understand that this valley is the worst rate area in the whole USA, and the AQMD is also commenting about recent air issues.

The other big issue is the over crowding in the Hart School district. This issue needs to address, that 3 school campuses will be going though 3 plus years of modernization with most of the time 35% to 45% of the campus will be closed due to construction (space). And the next ten years of modernization that reduces campus capacities.

Another very large issue is the public parks or the lack of them. Also the massive back log that the LA County parks has to build new parks, maintain them and run programs. With a number of parks in "THIS" district that are over 10 years behind be built and can't find funds for; like tract 46908 Pacific Crest Park. Plus with the Hart School district modernizing to synthetic turf on 3 campuses will take space off line and the school district was not going to share with the city of Santa Clarita anymore, bam 3 more fields gone forever for public use.

Please oh please don't let the any school district have a share plan for parks and school campuses. The records show the constant arguments between spaces and use time for park programs.

Well they are many more issues like traffic on the 126. The lack of fire protection in this OVERALL valley and the poor decisions that the B.O.S. made during approvals processes. We have 17 stations planned but have had a hard time building 2 in the past 14 years. Even though they is a station 1.5 miles away, that station can't cover it area "crawl maps area" for the Castaic area.

And let's mention the CHP, we have not had a new officer in the Newhall office since 1987, but they are responsible for ALL traffic in ALL unincorpated area (new & old) and oh yea the freeways.

Dr Hsiao-ching Chen AICP

County of Los Angeles

Department of Regional Planning

320 W. Temple St.

Los Angeles, CA 90012-3225

Fax 213-626-0434

Thank you for the opportunity to comment on project No. 00-196/TR53108 "The River Village Project".

Also a very large concern is where the dirt is coming from for the 9 million tons of earth grading. If you allow the developer to "rough" grade another area for the soil it needs to raise the grade of this complete project. You are giving them and the next EIR the OK to back door the next phase.

I can go on about this project but I will wait till the next phase of the EIR process.

EIR dates River Park site

Report finds signs of ancient settlement

By Susan Abram
Staff Writer

SANTA CLARITA -- Archaeological sites dating to ancient times have been confirmed on portions of the land proposed for the River Park project, and developers plan to preserve part of the area as open space, according to an environmental impact report released Wednesday.

Among the findings on one site just north of the Santa Clara River were tools, bowl fragments and other artifacts that show evidence of a village dating back 3,500 years, the report concluded.

The site "contains a subsurface archaeological deposit and intact prehistoric artifacts that can contribute to the scientific reconstruction of prehistoric life ways in the Santa Clara River Valley. ... Where these resources exist, implementation of the proposed project would represent an incremental adverse cumulative impact to cultural resources," the report said.

Archaeologists studied the sites in two phases.

The findings confirm what American Indian groups had said when the project was first proposed, that their ancestors once flourished along the river bank.

"It doesn't surprise me that you find cultural sites along the Santa Clara River, because what better place to establish your home where the resources were abundant," said Mati Waiya, executive director for the Wishtoyo Foundation, a Ventura County-based environmental and cultural heritage group. "My understanding is that there are two important sites, but the fact is, there is no careful way to destroy a site. I'd rather see them put a cultural preserve on that site. Our history belongs to everyone now."

The project's details were outlined Tuesday night at a meeting of the Santa Clarita Planning Commission. Proposed by The Newhall Land and Farming Company, the project spans more than 695.4 acres just east of Newhall Ranch Road and Bouquet Canyon Road, between Castaic Lake Water Agency property and the Santa Clara River just north of Soledad Canyon Road. About 1,100 homes and apartments, as well as commercial and open space, are proposed.

"Our staff is looking at the concerns very closely," said the city's associate planner, Jeff Hogan. "But some concerns are unavoidable, things that we can't mitigate."

Local environmentalists who spoke out during the meeting called the project another attempt to deny the existence of a natural habitat along the river banks. They asked that a biologist independent of the city and the developer be hired to analyze the river.

"When the city of Santa Clarita wanted to know what was happening on the (proposed) Cemex Inc. site, it's a biologist we hired who made the conclusions," said Teresa Savaiki, referring to the city's battle against planned sand and gravel mine in Canyon Country. ***"That's what we need to do here. We need independent studies, not someone who prepares a document for the developers."*** "It's very frustrating," she said. "It's a repetitive thing. The public has a right to know what's really there; because once a project is approved it's too late."

The report was prepared by the Agoura Hills-based Impact Services, which also compiled the study on the proposed Newhall Ranch development of about 21,000 homes. Copies of the environmental impact report are available at City Hall and at the Valencia Library.

Meanwhile, the Parks, Recreation and Community Services Commission will discuss the details of the proposed open space, park and trail plans of River Park at 6:00 tonight in City Hall, 23920 Valencia Blvd., and Santa Clarita.

Susan Abram, (661) 257-5257 susan.abram@dailynews.com <mailto:susan.abram@dailynews.com>

Bill Wittenberg

28541 N. Haskell Cyn.Rd

Saugus, ca 91390

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 7, OFFICE OF PUBLIC TRANSPORTATION
AND REGIONAL PLANNING
IGR/CEQA BRANCH
120 SOUTH SPRING STREET
LOS ANGELES, CA 90012
PHONE (213) 897-4429
FAX (213) 897-1337

Flex your power!
Be energy efficient!

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MAR 2 2004

February 27, 2004

Ms. Hsiao-ching Chen
County of Los Angeles Regional Planning
Impact Analysis Section
320 W. Temple Street, Room 1348
Los Angeles, CA 90012

Re: ***River Village Project, NOP of DEIR***
IGR/CEQA No. 040209/EA
Vic. LA-126-PM 0.00 – 5.00
SCH No. 2004021002

Dear Ms. Chen:

Thank you for including the California Department of Transportation in the environmental review process for the proposed River Village Project. The proposed development consists of construction of 1,444 residential units, approximately 1.5 million square feet of non-residential mixed-use space, a 7-acre elementary school, and public recreational facilities.

We acknowledge receipt of the Notice of Preparation of the Draft Environmental Impact Report that will be prepared for the proposed project. We have reviewed the Draft Traffic Impact Study (TIS) and offer the following comments:

1. Volume counts taken at NB I-5 off-ramp to SR-126 are questionable because they are close to 50% less than those in record in this Department.

Location	Caltrans*		River Village TIS	
	AM	PM	AM	PM
NB I-5 Off-Ramp to SR-126	1642	962	840	656

* *Caltrans' counts were taken May 14, 2001.*

We believe these counts may have been taken during construction and therefore do not represent a typical day's peak hour traffic. We request that these counts be updated and all derived computations to be revised.

2. We need a thorough explanation as to how the 30% trip capture figured was arrived at. Even though, non-residential uses are planned to serve future residents so they may avoid traveling outside the development area, at this point we believe the 30/70 split seems unreasonably high. Furthermore, some non-residential uses will generate trips from outside the project area.

3. Lane configurations along SR-126 at SB I-5 Off and NB I-5 off are as follows:
   SR-126 / SB I-5 off = 2SBL, 2SBR, 3 WBT, 1WBR (free), 4EBT, 1 EBR (free)
   SR-126 / NB I-5 off = 3NBL, 1NBR, 3 WBT, 1 WBR (free), 4 EBT, 1 EBR

   Please make adjustments to ICU and LOS analysis to account for these lane configurations. As a portion of the traffic mitigation, we recommend re-striping on SB I-5 off to SR-126 for 2.5 SBL lanes and 1.5 SBR lanes and re-striping at the NB I-5 off / SR-126 intersection for 4 WBT lanes.

4. Based on the data provided, our analysis indicates that in the project build-out plus related-projects scenario, there would be a significant impact on SR-126. Therefore, we recommend off-site traffic mitigation to include the Commerce Center Drive/SR-126 interchange connection with a SR-126 upgrade project in order to provide 3 through lanes in each direction. TIS assumes a grade-separated interchange at Commerce Center Drive/SR-126 interchange, is that still the case? What is the likelihood of this project being in place before completion of River Village phase I?

5. Newhall Land and Farm contribution to improvements at SR-126/I-5 was identified as off-site traffic mitigation related to West Creek Development Project and possibly other projects. Will those contributions also be credited as traffic mitigation related to impacts by River Village?

6. Build out of Newhall Ranch Specific Plan plus related-project scenario is expected to significantly impact I-5 during the AM Peak hour, as well. Traffic Mitigation will be required if I-5 does not get improved to 10 lanes (5 in each directions) as it is called for in the Transportation Concept Report.

7. Modified access points to SR-126 do not appear to be traffic mitigation as they do not reduce or minimize trips onto the State Highway; instead, they facilitate access and add trips.

If you have any questions regarding our comments, you may reach me at (213) 897 – 4429 and refer to IGR record number 040209/EA.

Sincerely,

[signature]

STEPHEN J. BUSWELL
IGR/CEQA Program Manager
Caltrans, District 7

RESOURCE MANAGEMENT AGENCY
county of ventura

Planning Division
Christopher Stephens
Director

RECEIVED
FEB 26 2004

February 24, 2004

Hsiao-ching Chen
LA County Dept. of Regional Planning
320 W. Temple Street
Los Angeles, CA 90012

SUBJECT: NOTICE OF PREPARATION – EIR FOR RIVER VILLAGE, NEWHALL RANCH SPECIFIC PLAN

Dear Ms. Chen:

Thank you for the opportunity to comment on the Environmental Impact Report (EIR) Notice of Preparation for the River Village Project, Project No. 00-196, Tract 53108. This is the first subdivision that allows construction under the Newhall Ranch Specific Plan. As such, it is subject to a number of mitigation measures specified in the Newhall Ranch Specific Plan EIR (SP EIR) certified by the LA County Board of Supervisors in September 2003.

The following SP EIR mitigation measures relate to topics of direct concern to Ventura County and should be addressed in the River Village Project EIR. Mitigation measure numbers are taken from the Newhall Ranch Specific Plan and Reclamation Plant Revised Additional Analysis Mitigation Monitoring Plan dated May 2003.

SR-126 in Ventura County

Measure 4.8-9 requires additional traffic studies to be conducted in Ventura County prior to recordation of the first subdivision allowing construction. Since this study will be evaluating environmental effects, it should be included within the EIR rather than wait until the recordation phase.

Noise

Measure 4.9-15 requires payment of fees to the Santa Clara Elementary School District prior to issuance of building permits. Since this is an environmental mitigation measure, the cost of sound mitigation and the amount of the fee to be paid by this project should be included in the EIR.

Measure 4.9-16 requires participation in noise attenuation programs to mitigate noise impacts on SR-23 north of Casey Road in the City of Moorpark. Updated data and mitigation measures will be available from the City of Moorpark and the

County of Ventura by the time the River Village EIR is available to the public. This new information should be included in the EIR.

Measure 4.9-17 requires updated project-specific and cumulative noise studies. These studies should include the following road segments:

> SR-126 from the Ventura County line to the Santa Paula city limits. This should be coordinated with the County of Ventura and the City of Fillmore.
>
> SR-23 from its intersection with SR-126 to its intersection with SR-118. This should be coordinated with the County of Ventura and the City of Moorpark.

Water Resources

Measure 4.11-1 requires installation of a reclaimed water system in order to reduce water demand. This system should be included in the project description or shown as a mitigation measure in the EIR Water Resources analysis.

Measure 4.11-6 requires that the retail water supplier identify the sources of water available to supply the project. These sources should be specified in the project EIR.

Measure 4.11-9 requires the Upper Santa Clara Water Committee or the Newhall Land Company prepare an annual water report. The latest report, dated 2003 or 2004, should be included as an EIR Appendix.

Measure 4.11-15 requires annual reports on agricultural water consumption in LA County by the Newhall Land Company. The latest report, dated 2003 or 2004, should be included as an EIR Appendix. If water from off-site agricultural areas is being "credited" to the Newhall Ranch Specific Plan, the required verification of the transfer of water rights should also be included in the EIR.

Measure 4.11-18 requires an annual report regarding the amount of water Newhall Land Company has stored in the Semitropic Groundwater Banking Project. The latest report, dated 2003 or 2004, should be included as an EIR Appendix.

Measure 4.11-19 requires implementation of a Memorandum of Understanding (MOU) and Water Resource Monitoring Program between the United Water Conservation District and the Upper Basin Water Purveyors. The status of this mitigation measure should be discussed, along with any future plans. As specified in the mitigation measure, any significant impacts to groundwater resources also should be identified.

Measure 4.11-20 requires that the rights to the Nickel family water rights be assigned to the Valencia Water Company or the Castaic Lake Water Agency. These rights, as well as the status and/or disposition of the acquired water, should be included in the EIR.

Measure 4.11-21 requires that prior to approval of the first subdivision map that upstream and downstream surface and groundwater monitoring locations be identified by the Regional Water Quality Control Board and the Newhall Land Company. Since these locations and the required monitoring protocol are necessary to ensure that water quality impacts are adequately monitored, they should be included in the EIR.

Measure 4.11-22 requires the identification of specific irrigated agricultural lands that will retired from irrigation to provide any water for the project. This identification should be included in the EIR.

Additional Conditions of Approval

Condition "e" requires that prior to approval of the first subdivision map that allows construction, the Newhall Land Company shall evaluate methods of recharging the Saugus Formation, as well as identify appropriate candidate land areas for recharge. Since these are EIR mitigation measures, they should be included in the EIR.

Thank you again for the opportunity to comment on the River Village EIR NOP. If you have any questions, please contact Scott Ellison, Senior Planner, at (805) 654-2495, fax at 2509 or e-mail scott.ellison@mail.co.ventura.ca.us

Sincerely,

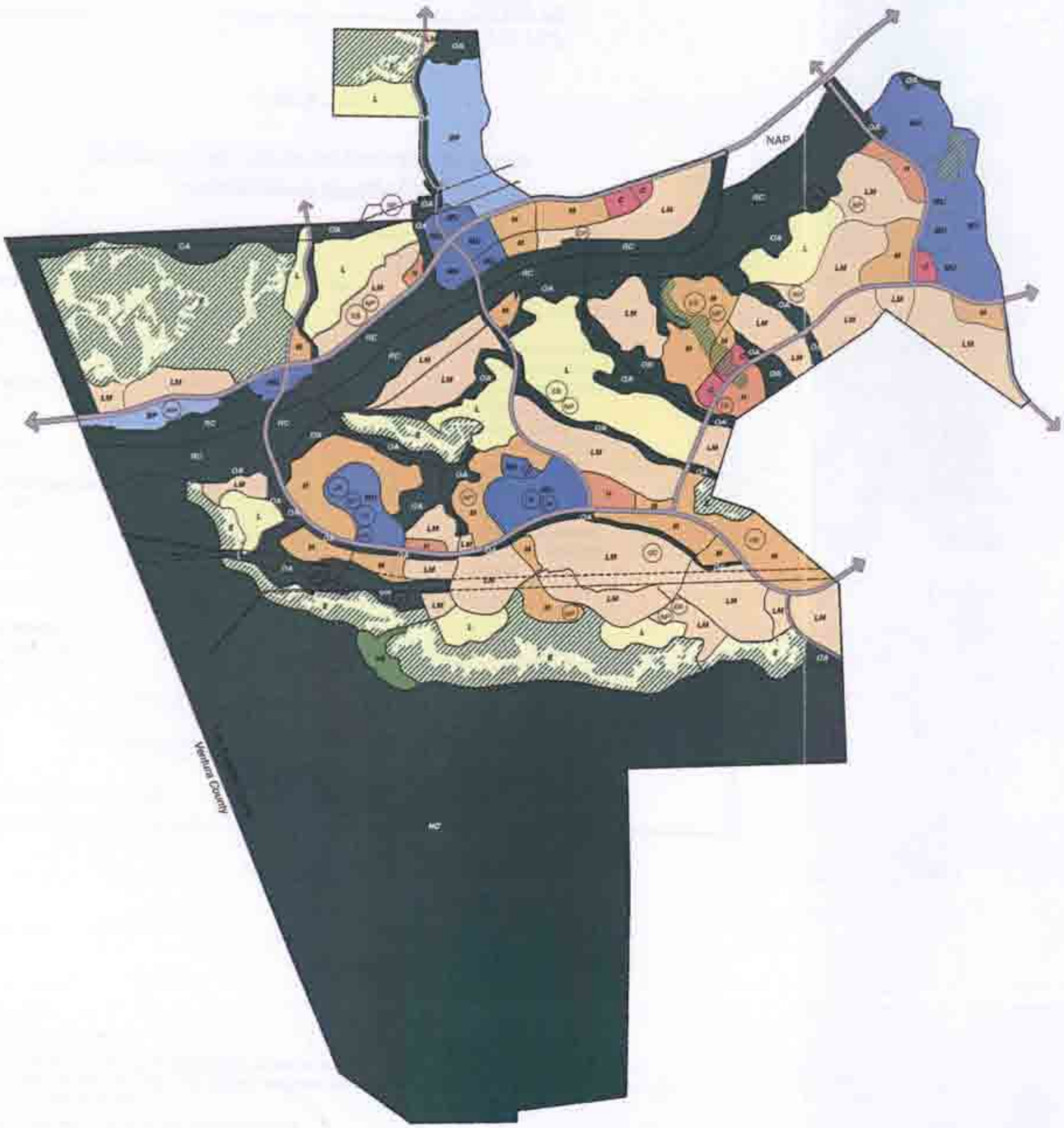
Chris Stephens, Director
Planning Division

c:
Ventura County Board of Supervisors
Johnny Johnston, CEO
Tom Berg, RMA
Dennis Slivinski, County Counsel

APPENDIX 1.0

Project-Level Exhibits

Selected Exhibits and Tables from the Newhall Ranch Specific Plan



NEWHALL RANCH
SPECIFIC PLAN

LEGEND

- E — ESTATES
- L — LOW DENSITY
- LM — LOW-MEDIUM DENSITY
- M — MEDIUM DENSITY
- H — HIGH DENSITY
- MU — MIXED USE
- C — COMMERCIAL
- BP — BUSINESS PARK
- VS — VISITOR SERVING
- OA — OPEN AREA
- RC — RIVER CORRIDOR
- HC — HIGH COUNTRY
- CDFG SPINEFLOWER CONSERVATION EASEMENTS
- ROADS*
- SCE/UTILITY EASEMENT

LAND USE OVERLAYS (POTENTIAL LOCATIONS)

- CP — COMMUNITY PARK
- NP — NEIGHBORHOOD PARK
- ES — ELEMENTARY SCHOOL
- JH — JUNIOR HIGH SCHOOL
- HS — HIGH SCHOOL
- LIB — LIBRARY
- GC — GOLF COURSE
- LK — COMMUNITY LAKE
- FS — FIRE STATION
- S — ELECTRICAL SUBSTATION
- WR — WATER RECLAMATION PLANT

Roads/road rights of way within CDFG spineflower conservation easements and all other spineflower preserves are subject to realignment prior to subdivision approval pursuant to Board motion (March 25, 2003).

English
Metric
NORTH
FORMA

Exhibit 2.3-1

LAND USE PLAN

MAY 2003

TABLE 2.3-1

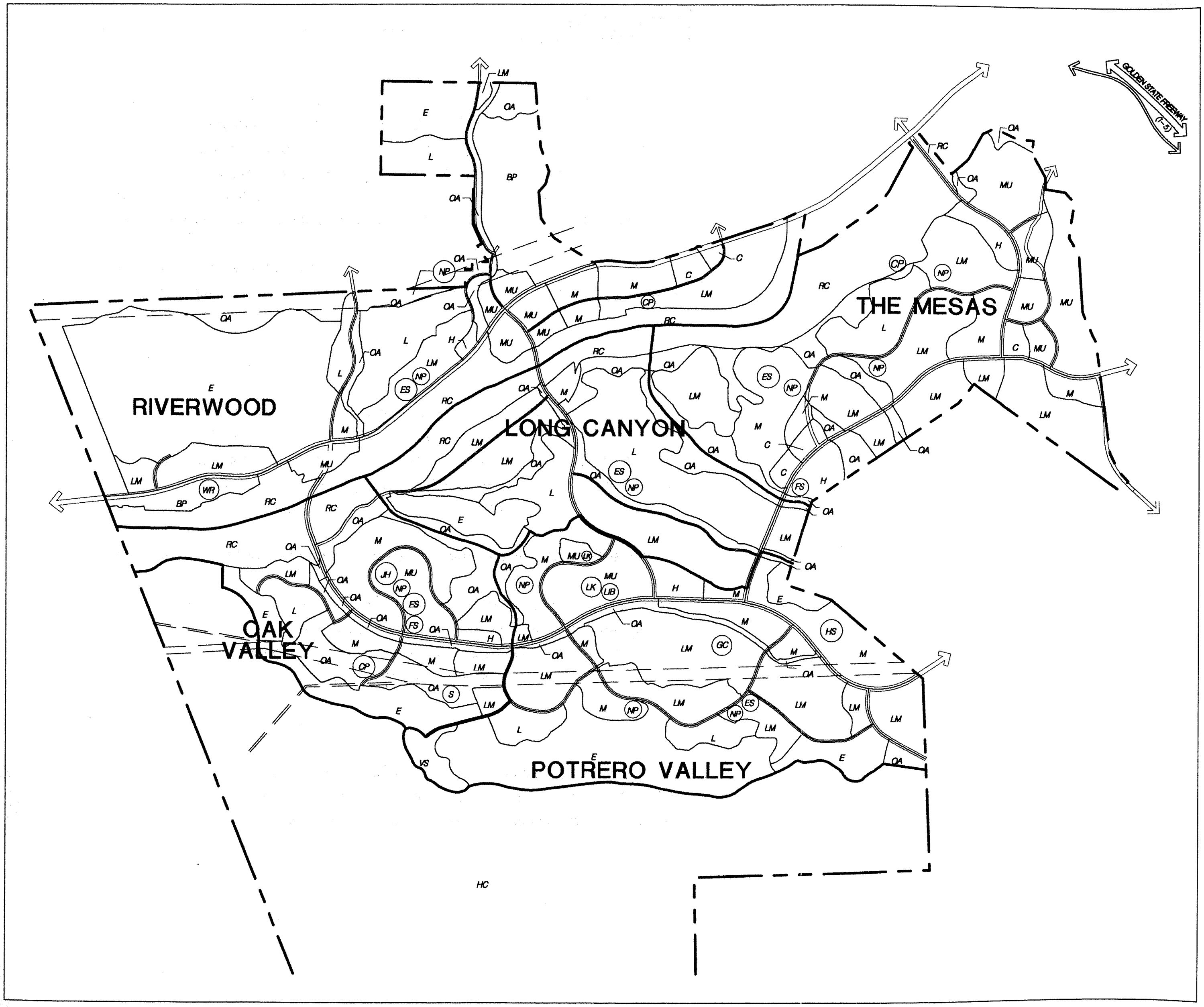
OVERALL LAND USE PLAN STATISTICAL TABLE
Newhall Ranch Specific Plan

LAND USES	Gross Acres	Dwelling Units	Second Units[1]
Residential:			
Estate[1]	1,324.0	423	423
Low	744.4	671	
Low-Medium	1,781.7	6,000	
Medium	841.0	7,371	
High	121.8	2,319	
Subtotal	4,812.9	16,784	423
Mixed-Use and Non-Residential:			
Mixed-Use[2]	628.7	4101	
Commercial	67.2		
Business Park	248.6		
Visitor Serving	36.7		
Subtotal	981.1	4,101	0
Major Open Areas:			
High Country SMA	4,184.6		
River Corridor SMA	974.8		
Open Area	1,010.4		
Subtotal	6,169.8	0	0
TOTAL	11,963.8	20,885	423
(Total Units including Second Units[1])		21,308	

	Land Use Overlays	Approx. Acre Allocation
10	Neighborhood Parks	50 ac
5	Elementary Schools	35 ac
1	Junior High School	25 ac
1	High School	45 ac
1	Golf Course	180 ac
2	Fire Stations	2 ac
1	Library	2 ac
1	Water Recl. Plant	15 ac
1	Lake	15 ac
3	Community Parks	181 ac
1	Electrical Substation	2 ac
	Arterial Roads	331 ac

1 Within each Estate lot one (1) Second Unit is eligible to be constructed with the approval of a CUP (see Second Units, Section 3.9). This may increase the total number of permitted dwelling units of 20,885 by 423, to a maximum total units of 21,308.

2 Mixed-Use includes commercial and residential uses.



NEWHALL RANCH™
SPECIFIC PLAN

Prepared For: Newhall Ranch Company

LEGEND

PV-17	PLANNING AREA
E	ESTATE RESIDENTIAL
L	LOW RESIDENTIAL
LM	LOW-MEDIUM RESIDENTIAL
M	MEDIUM RESIDENTIAL
H	HIGH RESIDENTIAL
MU	MIXED-USE
C	COMMERCIAL (RETAIL/OFFICE)
BP	BUSINESS PARK
VS	VISITOR SERVING
OA	OPEN AREA
RC	RIVER CORRIDOR SPECIAL MANAGEMENT AREA
HC	HIGH COUNTRY SPECIAL MANAGEMENT AREA
	ROADS
	SCE/UTILITY EASEMENTS

LAND USE OVERLAYS (POTENTIAL LOCATIONS):

CP	COMMUNITY PARK
NP	NEIGHBORHOOD PARK
ES	ELEMENTARY SCHOOL
JH	JUNIOR HIGH SCHOOL
HS	HIGH SCHOOL
LIB	LIBRARY
GC	GOLF COURSE
LK	COMMUNITY LAKE
FS	FIRE STATION
S	ELECTRICAL SUBSTATION
WR	WATER RECLAMATION PLANT

10 ACRES 40 ACRES

English 0 1000' 2000'

Metric 0 225m 450m 900m

NORTH

Computer Mapping by FORMA Systems

EXHIBIT 2.3-2
VILLAGE PLAN

MAY 2003
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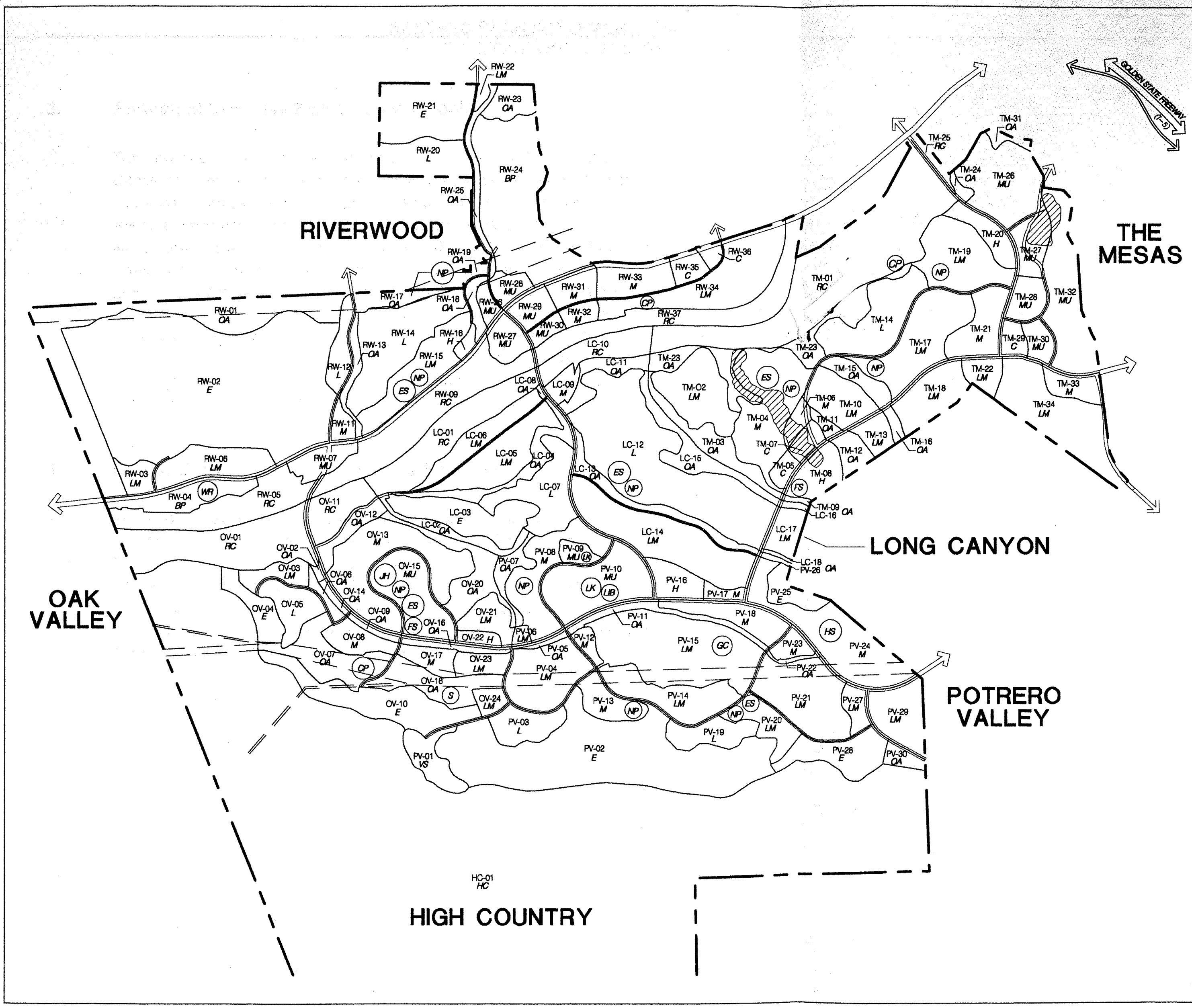

NEWHALL RANCH. SPECIFIC PLAN

Prepared For: Newhall Ranch Company

LEGEND

PV-17	PLANNING AREA
E	ESTATE RESIDENTIAL
L	LOW RESIDENTIAL
LM	LOW-MEDIUM RESIDENTIAL
M	MEDIUM RESIDENTIAL
H	HIGH RESIDENTIAL
MU	MIXED-USE
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BP	BUSINESS PARK
VS	VISITOR SERVING
OA	OPEN AREA
RC	RIVER CORRIDOR SPECIAL MANAGEMENT AREA
HC	HIGH COUNTRY SPECIAL MANAGEMENT AREA
	ROADS*
	SCE/UTILITY EASEMENTS
	CDFG SPINEFLOWER CONSERVATION EASEMENTS

LAND USE OVERLAYS (POTENTIAL LOCATIONS):

CP	COMMUNITY PARK
NP	NEIGHBORHOOD PARK
ES	ELEMENTARY SCHOOL
JH	JUNIOR HIGH SCHOOL
HS	HIGH SCHOOL
LIB	LIBRARY
GC	GOLF COURSE
LK	COMMUNITY LAKE
FS	FIRE STATION
S	ELECTRICAL SUBSTATION
WR	WATER RECLAMATION PLANT

*Roads/road rights of way within CDFG spineflower conservation easements and all other spineflower preserves are subject to realignment prior to subdivision approval pursuant to Board motion (March 25, 2003).

English 0 1000' 2000'
Metric 0 225m 450m 900m

10 ACRES 40 ACRES

NORTH

Computer Mapping by FORMA Systems

EXHIBIT 5.4-1

ANNOTATED LAND USE PLAN

MAY 2003

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TABLE 5.4-1
ANNOTATED LAND USE PLAN
STATISTICAL TABLE

RIVERWOOD				RESIDENTIAL				NON-RESIDENTIAL	
				Dwelling Units		Second Units[1]			
		Planning Area	Gross Acres	Planned Units	Maximum Units	Planned Second Units	Maximum Second Units	Planned Bldg. Square Ft.	Maximum Bldg. Square Ft.
RESIDENTIAL									
E	ESTATE	RW-02	596.7	215	323	215	323	–	–
E		RW-21	95.7	19	29	19	29	–	–
L	LOW	RW-12	29.0	26	39	–	39	–	–
L		RW-14	119.7	108	162	–	162	–	–
L		RW-20	49.5	45	68	–	68	–	–
LM	LOW-MEDIUM	RW-03	20.3	117	176	–	–	–	–
LM		RW-06	64.2	299	449	–	–	–	–
LM		RW-15	81.5	377	566	–	–	–	–
LM		RW-22[2]	5.3	30[2]	45[2]	–	–	–	–
LM		RW-34[3]	116.6	534[3]	801[3]	–	–	–	–
M	MEDIUM	RW-11	15.0	267	401	–	–	–	–
M		RW-31[3]	26.5	304[3]	456[3]	–	–	–	–
M		RW-32[3]	14.1	206[3]	309[3]	–	–	–	–
M		RW-33[3]	39.5	400[3]	600[3]	–	–	–	–
H	HIGH	RW-16	8.3	263	395	–	–	–	–
			1,281.9	**3,210**		**234**		**0**	
MIXED USE									
MU	MIXED USE	RW-07	30.9	–	–	–	–	162,000	243,000
MU		RW-26	12.0	–	–	–	–	191,000	286,500
MU		RW-27[3]	27.8	–[3]	–[3]	–	–	396,000	594,000
MU		RW-28	19.8	–	–	–	–	285,000	427,500
MU		RW-29[3]	25.0	–[3]	–[3]	–	–	317,000	475,500
MU		RW-30[3]	12.5	–[3]	–[3]	–	–	189,000	283,500
			128.0	**0**		**0**		**1,540,000**	
NON-RESIDENTIAL									
C	COMMERCIAL	RW-35	15.6	–	–	–	–	131,000	196,500
C		RW-36[4]	6.7	–	–	–	–	–	–
BP	BUSINESS PARK	RW-04	51.6	–	–	–	–	200,000	300,000
BP		RW-24	197.0	–	–	–	–	1,095,000	1,642,500
OA	OPEN AREA	RW-01	197.2	–	–	–	–	–	–
OA		RW-13	17.2	–	–	–	–	–	–
OA		RW-17	22.6	–	–	–	–	–	–
OA		RW-18	13.7	–	–	–	–	–	–
OA		RW-19	10.4	–	–	–	–	–	–
OA		RW-23	27.1	–	–	–	–	–	–
OA		RW-25	23.5	–	–	–	–	–	–
RC	RIVER CORRIDOR	RW-05	98.9	–	–	–	–	–	–
RC		RW-09	134.1	–	–	–	–	–	–
RC		RW-37	107.5	–	–	–	–	–	–
			923.1	**0**		**0**		**1,426,000**	
VILLAGE TOTAL:			**2,332.9**	**3,210**		**234**		**2,966,000**	

1 Second Units require a CUP.
2 The residential dwelling units within RW-22 are restricted to residences, single-family detached, which may include clustered single-family/court homes. Planning Area RW-22 shall not be converted to commercial land use.
3 The total number of residential dwelling units within the Planning Areas of the Indian Dunes portion of the Specific Plan Area (i.e., RW-27 and RW-29 through RW-34) shall not exceed 1,444.
4 Planning Area RW-36 has been identified as a potential site for a transit station.

TABLE 5.4-1
ANNOTATED LAND USE PLAN
STATISTICAL TABLE
(continued)

OAK VALLEY				RESIDENTIAL				NON-RESIDENTIAL	
				Dwelling Units		Second Units[1]			
		Planning Area	Gross Acres	Planned Units	Maximum Units	Planned Second Units	Maximum Second Units	Planned Bldg. Square Ft.	Maximum Bldg. Square Ft.
RESIDENTIAL									
E	ESTATE	OV-04[2]	32.6	12	18	12	18	–	–
E		OV-10[2]	98.1	28	42	28	42	–	–
L	LOW	OV-05	41.2	37	56	–	56	–	–
LM	LOW MEDIUM	OV-03	25.0	108	162	–	–	–	–
LM		OV-21	30.1	139	209	–	–	–	–
LM		OV-23	21.8	72	108	–	–	–	–
LM		OV-24	13.9	52	78	–	–	–	–
M	MEDIUM	OV-08	30.1	313	470	–	–	–	–
M		OV-13	136.4	1,216	1,824	–	–	–	–
M		OV-17	22.8	258	387	–	–	–	–
H	HIGH	OV-22	11.2	281	422	–	–	–	–
			463.2	**2,516**		**40**		**0**	
MIXED USE									
MU	MIXED USE	OV-15	82.6	337	–	–	–	381,000	571,500
			82.6	**337**		**0**		**381,000**	
NON-RESIDENTIAL									
OA	OPEN AREA	OV-09	8.1	–	–	–	–	–	–
OA		OV-02	2.8	–	–	–	–	–	–
OA		OV-07	69.8	–	–	–	–	–	–
OA		OV-06	10.1	–	–	–	–	–	–
OA		OV-12	25.7	–	–	–	–	–	–
OA		OV-14	6.3	–	–	–	–	–	–
OA		OV-16	15.0	–	–	–	–	–	–
OA		OV-18	57.3	–	–	–	–	–	–
OA		OV-20	51.9	–	–	–	–	–	–
RC	RIVER CORRIDOR	OV-01	144.0	–	–	–	–	–	–
RC		OV-11	45.3	–	–	–	–	–	–
			436.3	**0**		**0**		**0**	
VILLAGE TOTAL:			**982.1**	**2,853**		**40**		**381,000**	

1 Second Units require a CUP.
2 Construction of buildings and other structures shall only be permitted upon developed pads within Planning Areas OV-04 and OV-10 and shall not be permitted on southerly slopes facing High Country SMA or in the area between the original SEA 20 boundary and the High Country boundary (see Appendix 7.7).

TABLE 5.4-1
ANNOTATED LAND USE PLAN
STATISTICAL TABLE
(continued)

POTRERO VALLEY				RESIDENTIAL				NON-RESIDENTIAL	
				Dwelling Units		Second Units[1]			
		Planning Area	Gross Acres	Planned Units	Maximum Units	Planned Second Units	Maximum Second Units	Planned Bldg. Square Ft.	Maximum Bldg. Square Ft.
RESIDENTIAL									
E	ESTATE	PV-02[2]	341.0	93	140	93	140	–	–
E		PV-25	25.2	7	11	7	11	–	–
E		PV-28[2]	58.6	21	32	21	32	–	–
L	LOW	PV-03	39.9	36	54	–	54	–	–
L		PV-19	38.9	35	53	–	53	–	–
LM	LOW-MEDIUM	PV-04	82.2	309	464	–	–	–	–
LM		PV-06	5.7	27	41	–	–	–	–
LM		PV-14	72.8	189	284	–	–	–	–
LM		PV-15	178.7	280	420	–	–	–	–
LM		PV-20	39.6	98	147	–	–	–	–
LM		PV-21	105.9	245	368	–	–	–	–
LM		PV-27	18.8	69	104	–	–	–	–
LM		PV-29	58.6	229	344	–	–	–	–
M	MEDIUM	PV-08	80.4	758	1,137	–	–	–	–
M		PV-12	11.5	166	249	–	–	–	–
M		PV-13	34.8	212	318	–	–	–	–
M		PV-17	10.9	115	173	–	–	–	–
M		PV-18	47.2	350	525	–	–	–	–
M		PV-23	16.9	203	305	–	–	–	–
M		PV-24	122.6	307	461	–	–	–	–
H	HIGH	PV-16	31.4	692	1,038	–	–	–	–
			1,421.6	**4,441**		**121**		**0**	
MIXED USE									
MU	MIXED USE	PV-09	13.7	150	225	–	–	–	–
MU		PV-10	101.5	822	1,233	–	–	540,000	810,000
			115.2	**972**		**0**		**540,000**	
NON-RESIDENTIAL									
VS	VISITOR SERVING	PV-01	36.7	–	–	–	–	174,000	261,000
OA	OPEN AREA	PV-05	6.1	–	–	–	–	–	–
OA		PV-07	19.4	–	–	–	–	–	–
OA		PV-11	26.5	–	–	–	–	–	–
OA		PV-22	3.9	–	–	–	–	–	–
OA		PV-26	2.9	–	–	–	–	–	–
OA		PV-30	13.5	–	–	–	–	–	–
			109.0	**0**		**0**		**174,000**	
	VILLAGE TOTAL:		**1,645.8**	**5,413**		**121**		**714,000**	

1 Second Units require a CUP.
2 Construction of buildings and other structures shall only be permitted upon developed pads within Planning Areas PV-02 and PV-28 and shall not be permitted on southerly slopes facing High Country SMA or in the area between the original SEA 20 boundary and the High Country boundary (see Appendix 7.7).

TABLE 5.4-1
ANNOTATED LAND USE PLAN
STATISTICAL TABLE
(continued)

LONG CANYON				RESIDENTIAL				NON-RESIDENTIAL	
				Dwelling Units		Second Units[1]			
		Planning Area	Gross Acres	Planned Units	Maximum Units	Planned Second Units	Maximum Second Units	Planned Bldg. Square Ft.	Maximum Bldg. Square Ft.
RESIDENTIAL									
E	ESTATE	LC-03	76.1	28	42	28	42	–	–
L	LOW	LC-07	75.3	68	102	–	102	–	–
L		LC-12	261.2	235	353	–	353	–	–
LM	LOW-MEDIUM	LC-05	75.9	437	656	–	–	–	–
LM		LC-06	48.5	247	371	–	–	–	–
LM		LC-14	139.4	377	566	–	–	–	–
LM		LC-17	27.4	70	105	–	–	–	–
M	MEDIUM	LC-09	15.5	231	347	–	–	–	–
			719.3	**1,693**		**28**		**0**	
NON-RESIDENTIAL									
OA	OPEN AREA	LC-02	23.6	–	–	–	–	–	–
OA		LC-04	39.6	–	–	–	–	–	–
OA		LC-08	1.7	–	–	–	–	–	–
OA		LC-11	28.5	–	–	–	–	–	–
OA		LC-13	40.2	–	–	–	–	–	–
OA		LC-15	44.9	–	–	–	–	–	–
OA		LC-16	3.5	–	–	–	–	–	–
OA		LC-18	2.2	–	–	–	–	–	–
RC	RIVER CORRIDOR	LC-01	100.3	–	–	–	–	–	–
RC		LC-10	48.5	–	–	–	–	–	–
			333.1	**0**		**0**		**0**	
	VILLAGE TOTAL:		**1,052.4**	**1,693**		**28**		**0**	

1 Second Units require a CUP.

TABLE 5.4-1
ANNOTATED LAND USE PLAN STATISTICAL TABLE
(continued)

THE MESAS				RESIDENTIAL				NON-RESIDENTIAL	
				Dwelling Units		Second Units[1]			
		Planning Area	Gross Acres	Planned Units	Maximum Units	Planned Second Units	Maximum Second Units	Planned Bldg. Square Ft.	Maximum Bldg. Square Ft.
RESIDENTIAL									
L	LOW	TM-14	89.7	81	122	–	122	–	–
LM	LOW-MEDIUM	TM-02	77.1	313	470	–	–	–	–
LM		TM-10	51.5	148	222	–	–	–	–
LM		TM-13	21.2	63	95	–	–	–	–
LM		TM-17	105.7	364	546	–	–	–	–
LM		TM-18	57.6	129	194	–	–	–	–
LM		TM-19	90.1	294	441	–	–	–	–
LM		TM-22	22.2	52	78	–	–	–	–
LM		TM-34	124.2	332	498	–	–	–	–
M	MEDIUM	TM-04	122.8	1,076	1,614	–	–	–	–
M		TM-06	13.4	83	125	–	–	–	–
M		TM-21	53.6	586	879	–	–	–	–
M		TM-33	27.0	320	480	–	–	–	–
H	HIGH	TM-08	38.9	568	852	–	–	–	–
H		TM-20	32.0	515	773	–	–	–	–
			926.9	**4,924**		**0**		**0**	
MIXED USE									
MU	MIXED USE	TM-26	107.0	439	659	–	–	1,009,500	1,514,250
MU		TM-27	36.2	258	387	–	–	90,000	135,000
MU		TM-28	28.3	591	887	–	–	–	–
MU		TM-30	20.3	314	471	–	–	–	–
MU		TM-32	111.1	1,190	1,785	–	–	69,500	104,250
			302.9	**2,792**		**0**		**1,169,000**	
NON-RESIDENTIAL									
C	COMMERCIAL	TM-05	12.6	–	–	–	–	119,000	178,500
C		TM-07	16.1	–	–	–	–	70,000	105,000
C		TM-29	16.2	–	–	–	–	130,000	195,000
OA	OPEN AREA	TM-03	42.2	–	–	–	–	–	–
OA		TM-09	3.1	–	–	–	–	–	–
OA		TM-11	7.6	–	–	–	–	–	–
OA		TM-12	20.5	–	–	–	–	–	–
OA		TM-15	24.1	–	–	–	–	–	–
OA		TM-16	7.3	–	–	–	–	–	–
OA		TM-23	77.7	–	–	–	–	–	–
OA		TM-24	6.2	–	–	–	–	–	–
OA		TM-31	6.5	–	–	–	–	–	–
RC	RIVER CORRIDOR	TM-01	286.3	–	–	–	–	–	–
RC		TM-25	9.9	–	–	–	–	–	–
			536.3	**0**		**0**		**319,000**	
	VILLAGE TOTAL:		**1,766.1**	**7,716**		**0**		**1,488,000**	

1 Second Units require a CUP.

TABLE 5.4-1
ANNOTATED LAND USE PLAN
STATISTICAL TABLE
(continued)

HIGH COUNTRY			**RESIDENTIAL**				**NON-RESIDENTIAL**	
			Dwelling Units		**Second Units[1]**			
	Planning Area	**Gross Acres**	**Planned Units**	**Maximum Units**	**Planned Second Units**	**Maximum Second Units**	**Planned Bldg. Square Ft.**	**Maximum Bldg. Square Ft.**
NON-RESIDENTIAL								
HC	HC-01	4,184.6	–	–	–	–	–	–
TOTAL		**4,184.6**	**0**		**0**		**0**	

1 Second Units require a CUP.

GRAND TOTAL:	**11,963.8**	**20,885**		**423**		**5,549,000**

TABLE 5.4-2
PARK AND RECREATION IMPROVEMENTS SUMMARY

	DEDICATION REQUIREMENTS			LOCAL PARK IMPROVEMENTS			
VILLAGE _____	A Total Units	B Population Factor	C Local Park Requirement (A x B x .003)	D Local Park Acres Provided	E Local Park Improvements ($)	F Total Acres Provided (D + E/126,000)	Surplus (Deficit) (F - C)
1. Tract #_______							
A. Single-Family Detached Residences		3.17	0.00			0.00	0.00
B. Single-Family Attached Residences and Multi-Family with less than 5 Units/Building		2.73	0.00			0.00	0.00
D. Multi-Family with 5 or more Units/Building		2.38	0.00			0.00	0.00
Tract Total	0		0.00	0.00	0.00	0.00	0.00
2. Tract #_______			0.00			0.00	0.00
A. Single-Family Detached Residences		3.17	0.00			0.00	0.00
B. Single-Family Attached Residences and Multi-Family with less than 5 Units/Building		2.73	0.00			0.00	0.00
C. Multi-Family with 5 or more Units/Building		2.38	0.00			0.00	0.00
Tract Total	0		0.00			0.00	0.00
VILLAGE TOTAL	**0**		**0.00**			**0.00**	**0.00**

TABLE 5.4-3
INFRASTRUCTURE, COMMUNITY AMENITIES, AND ENTITLEMENTS STATUS SUMMARY

___ Village		
Tract/Parcel Map No. ___	**Date of Completion**	**Date of Dedication**
Infrastructure Requirements		
Roads		
Bridges		
Other		
a)		
b)		
c)		
d)		
Community Amenities Requirements		
List		
a)		
b)		
c)		
d)		
Discretionary Applications and Environmental Review	**Government Agency**	**Entitlement Status**
List by type, application no., and associated environmental review document	Agency name	Pending or approved, and date

APPENDIX 2.0

Environmental and Regulatory Exhibits

Consistency Analysis

Landmark Village

SPECIFIC PLAN CONSISTENCY ANALYSIS

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February 2006

Landmark Specific Plan Consistency Analysis

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Landmark Village/Specific Plan Consistency Analysis

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
I. INTRODUCTION	
A. Monitoring Program	
The intent of the Monitoring Program is to provide assurances to the County that Newhall Ranch is developed in a manner which is consistent with the provisions of this Specific Plan. The Monitoring Program for this Specific Plan will serve two functions. The primary function is to establish a system to record annual progress in the phasing of the development and the implementation of corresponding required infrastructure. The secondary function of the Monitoring Program is to establish a system whereby periodic adjustments to Planning Areas and/or land use designations pursuant to Section 3.5 within the Specific Plan Area may be accomplished and documented. This section provides the mechanisms by which the County will monitor the implementation of the Land Use Plan (Exhibit 2.3-1), the Overall Land Use Plan Statistical Summary (Table 2.3-1), the Newhall Ranch Park Requirements, Section 2.7, paragraph 4, and Spineflower Preserve Area Monitoring and Mitigation Plan. A revised Annotated Land Use Plan (Exhibit 5.4-1), a revised Annotated Land Use Plan Statistical Summary Table (Table 5.4-1), a revised Park and Recreation Improvements Summary (Table 5.4-2), and a revised Infrastructure and Community Amenities Improvement Summary Table (Table 5.4-3) shall be provided annually and accompany each tentative subdivision map(s) and/or parcel map(s) submitted to the County. In a like manner, a revised Annotated Land Use Plan, Statistical Table, and Park and Recreation Improvements Table shall be submitted with each conversion, transfer or adjustment to Planning Area(s) regardless of whether or not a subdivision map is filed. The Annotated Land Use Plan, Exhibit 5.4-1, is consistent with the Land Use Plan (Exhibit 2.3-1) and identifies Planning Areas and corresponding land use designations by Village and Planning Area number, along with other planning information relative to implementation of the Land Use Plan (Exhibit 2.3-5) for the Specific Plan. The Annotated Land Use Plan Statistical Table, Table 5.4-1, contains the statistical breakdown for each of the Planning Areas shown on the Annotated Land Use Plan in terms of gross acreage. For Residential and Mixed-Use Planning Areas, the planned and maximum number of permitted dwelling units are set forth; and for Mixed-Use, Commercial, Business Park and Visitor-serving Planning Areas, the planned and maximum non-residential building square footages are given. The estimated gross acres, planned units and planned non-residential building square footages shown in the Annotated Land Use Plan Statistical Table shall be revised only in accordance with the regulations contained in Section 3.5. The total residential dwelling units (i.e., 20,885 dwelling units and 423 Second Units) and the total non-residential building square footage (i.e., 5,549,000) as set forth in the Annotated Land Use Plan Statistical Table shall not be exceeded without amendment to the Specific Plan. The Park and Recreation Improvements Summary, Table 5.4-2, is intended to provide for an ongoing, updated documentation of the fulfillment of Local Park Dedication requirements over the life of the Specific Plan. An updated, revised Park and Recreation Improvements Summary must be submitted to Los Angeles County annually and with each tentative subdivision map permitting construction. A revised summary is also required when dwelling units between Planning Areas are transferred or conversion of residential units is effected (see Section 3.5).	A revised Annotated Land Use Plan (Exhibit 5.4-1), a revised Annotated Land Use Plan Statistical Summary Table (Table 5.4-1), a revised Park and Recreation Improvements Summary (Table 5.4-2), and a revised Infrastructure and Community Amenities Improvement Summary Table (Table 5.4-3) are provide in this document as submitted with The Tentative Tract Map 53108 submitted to the County for Landmark Village.

TABLE 5.4-1
ANNOTATED LAND USE PLAN – STATISTICAL TABLE

Current Implementation Status Based On: Submittal: Date:

Proposed Table 5.4-1 Revisions based on: TTM: 53108 Date: December 2004

RIVERWOOD

			CURRENT RESIDENTIAL					PROPOSED RESIDENTIAL (Tract Map No.: 53108; Date:)						CURRENT NON-RESIDENTIAL		PROPOSED NON-RESIDENTIAL (Tract Map No.: ; Date:)	
				Dwelling Units		Second Units[1]			Dwelling Units		Second Units[1]						
		Planning Area	Gross Acres	Planned Units	Maximum Units	Planned Second Units	Maximum Second Units	Gross Acres	Planned Units	Maximum Units	Planned Second Units	Maximum Second Units	COMMENTS	Planned Bldg. Square Ft.	Maximum Bldg. Square Ft.	Planned Bldg. Square Ft.	Maximum Bldg. Square Ft.
RESIDENTIAL																	
E	ESTATE	RW-02	596.9	215	323	215	323	596.9	215	323	215	323		0	0	0	0
E		RW-21	95.3	19	29	19	29	95.3	19	29	19	29		0	0	0	0
L	LOW	RW-12	29.1	26	39	0	39	29.1	26	39	0	39		0	0	0	0
L		RW-14	119.7	108	162	0	162	119.7	108	162	0	162		0	0	0	0
L		RW-20	58.9	45	68	0	68	58.9	45	68	0	68		0	0	0	0
LM	LOW-MEDIUM	RW-03	19.9	117	176	0	0	19.9	117	176	0	0		0	0	0	0
LM		RW-06	63.6	299	449	0	0	63.6	299	449	0	0		0	0	0	0
LM		RW-15	79.3	377	566	0	0	79.3	377	566	0	0		0	0	0	0
LM		RW-22[2]	5.3	30 [2]	45 [2]	0	0	5.3	30	45 [2]	0	0		0	0	0	0
LM		RW-34-a[3,4]	--	534 [3]	801 [3]	0	0	121.5	676 [3]	1,014 [3]	0	0	PA boundary/acres adjustment and transfer per Section 5.2.5	0	0	0	0
M	MEDIUM	RW-11	14.7	267	401	0	0	14.7	267	401	0	0		0	0	0	0
M		RW-31[3]	26.8	304 [3]	456 [3]	0	0	25.6	143 [3]	215 [3]	0	0	PA boundary/acres adjustment and transfer per Section 5.2.5	0	0	0	0
M		RW-32[3]	14.1	206 [3]	309 [3]	0	0	15	79 [3]	119 [3]	0	0	PA boundary/acres adjustment and transfer per Section 5.2.5	0	0	0	0
M		RW-33[3]	46.2	400 [3]	600 [3]	0	0	40	144 [3]	216 [3]	0	0	PA boundary/acres adjustment and transfer per Section 5.2.5	0	0	0	0
H	HIGH	RW-16	7.9	263	395	0	0	7.9	263	395	0	0		0	0	0	0
			1,177.7	**3,210**		**234**		**1,292.7**	**2,808**		**234**			**0**		**0**	
MIXED USE																	
MU	MIXED USE	RW-07	30.9	0	0	0	0	30.9	0	0	0	0		162,000	243,000	162,000	243,000
MU		RW-26	11.9	0	0	0	0	11.9	0	0	0	0		191,000	286,500	191,000	286,500
MU		RW-27[3]	27.9	0 [3]	0 [3]	0	0	27.8	144 [3]	216 [3]	0	0		396,000	594,000	322,900	484,350
MU		RW-28	19.4	0	0	0	0	19.4	0	0	0	0		285,000	427,500	285,000	427,500
MU		RW-29[3]	25.4	0 [3]	0 [3]	0	0	24.9	152 [3]	228 [3]	0	0	PA boundary/acres adjustment and transfer per Section 5.2.5	317,000	475,500	317,000	475,500
MU		RW-30[3]	12.5	0 [3]	0 [3]	0	0	11.7	50 [3]	75 [3]	0	0	PA boundary/acres adjustment and transfer per Section 5.2.5	189,000	283,500	189,000	283,500
MU		RW-34-b[3,4]	--	0 [3]	0 [3]	0	0	5.8	56 [3]	77 [3]	0	0	PA boundary/acres adjustment/transfer/conversion per Section 5.2.5	0	0	73,100	109,650
			128.0	**0**		**0**		**132.4**	**402**		**0**			**1,540,000**		**1,540,000**	
NON-RESIDENTIAL																	
C	COMMERCIAL	RW-35	17.9	0	0	0	0	15.1	0	0	0	0	PA boundary/acres adjustment and transfer per Section 5.2.5	131,000	196,500	131,000	196,500
C		RW-36[5]	8.7	0	0	0	0	8.9	0	0	0	0	PA boundary/acres adjustment and transfer per Section 5.2.5	0	0	0	0
BP	BUSINESS PARK	RW-04	53.0	0	0	0	0	53.0	0	0	0	0		200,000	300,000	200,000	300,000
BP		RW-24	195.3	0	0	0	0	195.3	0	0	0	0		1,095,000	1,642,500	1,095,000	1,642,500
OA	OPEN AREA	RW-01	196.7	0	0	0	0	196.7	0	0	0	0		0	0	0	0
OA		RW-13	17.2	0	0	0	0	17.2	0	0	0	0		0	0	0	0
OA		RW-17	22.5	0	0	0	0	22.5	0	0	0	0		0	0	0	0
OA		RW-18	13.5	0	0	0	0	13.5	0	0	0	0		0	0	0	0
OA		RW-19	10.2	0	0	0	0	10.2	0	0	0	0		0	0	0	0
OA		RW-23	26.6	0	0	0	0	26.6	0	0	0	0		0	0	0	0
OA		RW-25	23.2	0	0	0	0	23.2	0	0	0	0		0	0	0	0
RC	RIVER CORRIDOR	RW-05	98.6	0	0	0	0	98.6	0	0	0	0		0	0	0	0
RC		RW-09	137.1	0	0	0	0	137.1	0	0	0	0		0	0	0	0
RC		RW-37	109.0	0	0	0	0	109.0	0	0	0	0		0	0	0	0
			929.5	**0**		**0**		**926.9**	**0**		**0**			**1,426,000**		**1,426,000**	
	VILLAGE TOTAL:		**2,235.2**	**3,210**		**234**		**2,352.0**	**3,210**		**234**			**2,966,000**		**2,966,000**	

1 Second Units require a CUP.
2 The residential dwelling units within RW-22 are restricted to residences, single-family detached, which may include clustered single-family/court homes. Planning Area RW-22 shall not be converted to commercial land use.
3 The total number of residential dwelling units within the Planning Areas of the Indian Dunes portion of the Specific Plan Area (i.e., RW-27 and RW-29 through RW-34) shall not exceed 1,444.
4 Planning Area RW-34 has been divided into two sub-areas: Planning Area 34-a (Commercial) and Planning Area 34-b (Mixed Use).
5 Planning Area RW-36 has been identified as a potential site for a transit station.

TENTATIVE TRACT MAP 53108

LANDMARK

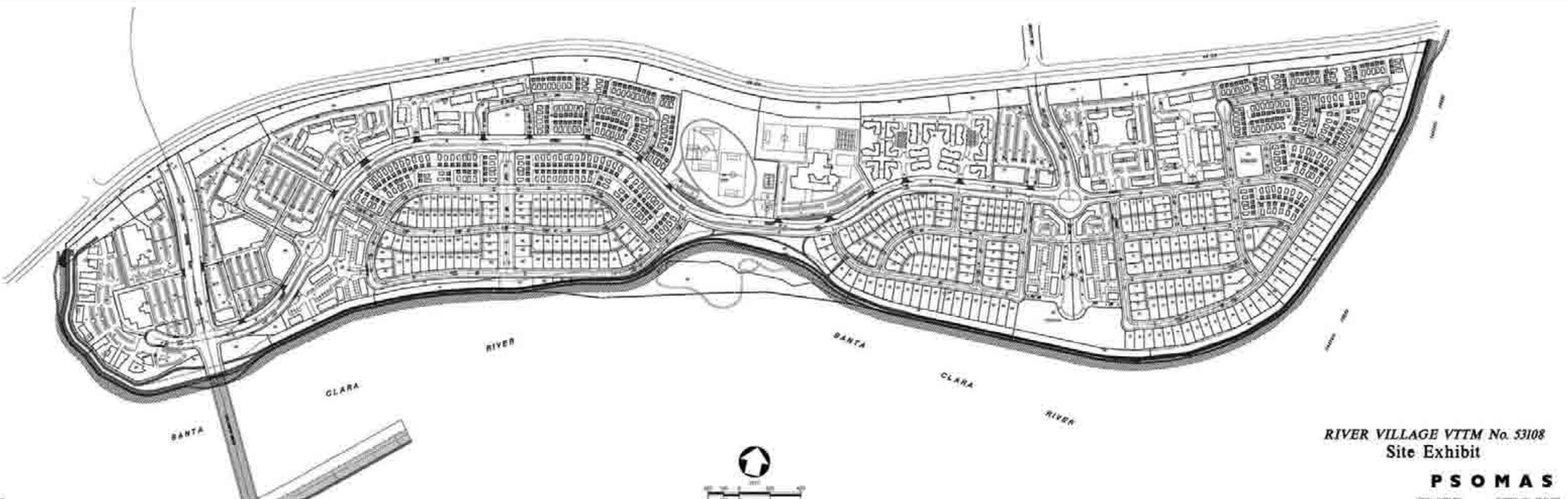
EXISTING AND PROPOSED STATISTICAL SUMMARY

December 1, 2004

			ACREAGE CONFORMANCE				DWELLING UNITS			NON-RESIDENTIAL S.F.		
Specific Plan Planning Area	Land Use		SP Acres	Proposed Acres	SP Acres to Proposed Acres Change	Percent Change in Acres	SP Units	Proposed Units	SP Units to Proposed Units Change	SP Non-Residential S.F.	Proposed Non-Residental S.F.	SP Non-Res. S.F. to Proposed Non-Residential S.F. Change
		PA Acres inside TTM 53108	2.7	2.7	0.0	0.0%						
RW-09	River Corridor	PA Acres outside TTM 53108	134.4	134.4	0.0	N/A						
		Total Planning Area Acres	137.1	137.1	0.0	0.0%						
		PA Acres inside TTM 53108	26.5	26.5	0.0	0.0%						
RW-27	Mixed Use	PA Acres outside TTM 53108	1.4	1.3	-0.1	N/A		144	144	396,000	322,900	-73,100
		Total Planning Area Acres	27.9	27.8	-0.1	-0.4%						
		PA Acres inside TTM 53108	23.2	22.4	-0.8	-3.4%						
RW-29	Mixed Use	PA Acres outside TTM 53108	2.2	2.5	0.3	N/A		152	152	317,000	317,000	0
		Total Planning Area Acres	25.4	24.9	-0.5	-2.0%						
		PA Acres inside TTM 53108	12.5	11.7	-0.8	-6.4%						
RW-30	Mixed Use	PA Acres outside TTM 53108	0	0.0	0.0	N/A		50	50	189,000	189,000	0
		Total Planning Area Acres	12.5	11.7	-0.8	-6.4%						
		PA Acres inside TTM 53108	24.4	22.2	-2.2	-9.0%						
RW-31	Medium	PA Acres outside TTM 53108	2.4	3.4	1.0	N/A	304	143	-161			
		Total Planning Area Acres	26.8	25.6	-1.2	-4.5%						
		PA Acres inside TTM 53108	14.1	15.0	0.9	6.4%						
RW-32	Medium	PA Acres outside TTM 53108	0.0	0.0	0.0	N/A	206	79	-127			
		Total Planning Area Acres	14.1	15.0	0.9	6.4%						
		PA Acres inside TTM 53108	39.4	34.4	-5.0	-12.7%						
RW-33	Medium	PA Acres outside TTM 53108	6.8	5.6	-1.2	N/A	400	144	-256			
		Total Planning Area Acres	46.2	40.0	-6.2	-13.4%						
		PA Acres inside TTM 53108		121.5								
RW-34-a	Low Medium	PA Acres outside TTM 53108		4.8				682				
		Total Planning Area Acres		126.3								
		PA Acres inside TTM 53108		5.8								
RW-34-b*	Mixed Use [Converted]*	PA Acres outside TTM 53108		0.0				50			73,100	73,100
		Total Planning Area Acres		5.8								
		PA Acres inside TTM 53108	115.2	127.3	12.1	10.5%						
RW-34 (Total)	Low Medium	PA Acres outside TTM 53108	6.4	4.8	-1.6	N/A	534	732	198		73,100	73,100
		Total Planning Area Acres	121.6	132.1	10.5	8.6%						
		PA Acres inside TTM 53108	15.2	12.2	-3.0	-19.7%						
RW-35	Commercial	PA Acres outside TTM 53108	2.7	2.9	0.2	N/A				131,000	131,000	0
		Total Planning Area Acres	17.9	15.1	-2.8	-15.6%						
		PA Acres inside TTM 53108	6.3	5.1	-1.2	-19.0%						
RW-36	Commercial	PA Acres outside TTM 53108	2.4	3.8	1.4	N/A						
		Total Planning Area Acres	8.7	8.9	0.2	2.3%						
		PA Acres inside TTM 53108	12.9	12.9	0.0	0.0%						
RW-37	River Corridor	PA Acres outside TTM 53108	96.2	96.2	0.0	N/A						
		Total Planning Area Acres	109.1	109.1	0.0	0.0%						
		PA Acres inside TTM 53108	292.4	292.4	0.0	0.0%						
TOTAL**		PA Acres outside TTM 53108	254.9	254.9	0.0	N/A	1,444	1,444	0	1,033,000	1,033,000	0
		Total Planning Area Acres	547.3	547.3	0.0	0.0%						

* A portion of Planning Area RW-34 converted to Mixed Use (RW-34-b) per Specific Plan Regulation 3.5 #3b: Conversion of Residential to Commercial or Mixed Use.

** Acreage calculations based on grid coordinate system as used by the County of Los Angeles. Acreage difference for total River Village TTM area between grid coordinate system and local coordinate system is ±0.1 acre.



RIVER VILLAGE VTTM No. 53108

Site Exhibit

PSOMAS

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
II. SPECIFIC PLAN OBJECTIVES	
A. Land Use Plan Objectives	
Objective No. 1:	
Create a major new community with interrelated villages that allows for residential, commercial, and industrial development, while preserving significant natural resources, important landforms, and open areas.	Landmark Village Tract Map 53108 is the first village to begin implementing this concept. Designed to provide an eclectic mix of housing types, the residential neighborhoods will contain a range of single-family and attached homes. The mixed use Village Quad and Village Center integrate residential, civic, commercial, office, and park uses. The overall village design features preservation of the open space incorporating active and passive recreation trails and view corridors for the mountains and the river. Many of the traditional neighborhood design principles used are shown in the Landmark Village Planning Notebook. The design principles used in developing the Landmark Village tract map are consistent with the objective of creating an inter-related village that allows for residential, commercial and other development, while still preserving significant natural resources and open areas.
Objective No. 2:	
Avoid leapfrog development and accommodate projected regional growth in a location, which is adjacent to existing and planned infrastructure, urban services, transportation corridors, and major employment centers.	Overall, both the Newhall Ranch and Landmark Village sites are within the Los Angeles County Santa Clarita Valley Planning Area. The Newhall Ranch property site is one-half mile west of the Golden State Freeway (I-5) and largely southwest of the junction of I-5 and State Route 126 (SR-126). The City of Santa Clarita is located east of the Specific Plan site, just beyond I-5, approximately, one-mile from the Specific Plan site. Therefore, due to its overall location, the Los Angeles County Board of Supervisors has already determined that the Newhall Ranch project site avoids leapfrog development and accommodates projected regional growth in a location that is adjacent to existing and planned infrastructure, urban services, transportation corridors and major employment centers (*e.g.*, City of Santa Clarita). The Landmark Village Tract Map 53108 is generally located in the central portion of the Newhall Ranch site, and development of the Landmark Village site remains consistent with the objectives articulated by the Board of Supervisors in approving Newhall Ranch. Specifically, Landmark Village Tract Map 53108 provides for the transition from more intensive to less intensive development near adjacent land uses. Impacts to adjacent development have been minimized by and incorporated into the design of the Land Use Plan. First, Open Area and roadways are used to separate and buffer adjacent development areas. Second, in Landmark Village, the Village concept locates the highest intensity of uses in and around the Village Center, allowing for a range of housing products to have convenient access to the Village Centers, which will contain a variety of retail uses and employment opportunities. This clustering of development around a centralized core provides for growth in a concentrated, rather than dispersed pattern, thus helping to preserve Newhall Ranch Open Area and Special Management Areas (SMAs). Landmark Village Tract Map 53108 provides a logical geographic distribution of land uses within the Newhall Ranch and neighboring community. Higher intensity uses such as Mixed-Use, Commercial, Business Park and Medium and High Residential land use designations will all have direct access to a major or secondary highway. The arrangement of land uses was based upon comprehensive studies of access and traffic, and environmental and topographic conditions, as discussed in the Newhall Ranch EIR.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
II. SPECIFIC PLAN OBJECTIVES	
A. Land Use Plan Objectives	
Objective No. 3:	
Cluster development within the site to preserve regionally significant natural resource areas, sensitive habitat, and major landforms.	Landmark Village Tract Map 53108 provides a logical geographic distribution of land uses within the Newhall Ranch and neighboring community that takes into consideration the presence of natural resource areas, sensitive habitat and natural landforms. This clustering of development around a centralized core provides for growth in a concentrated, rather than dispersed pattern, thus helping to preserve Open Area and SMAs. There are Design Guidelines for Landmark Village Tract Map 53108. These guidelines establish a unique identity for Landmark Village. Natural geologic features such as prominent ridges and rock outcroppings have been preserved by the Specific Plan. These unique features provide a scenic backdrop to the development areas and help to create a sense of place within Landmark Village.
Objective No. 4:	
Provide development and transitional land use patterns, which do not conflict with surrounding communities and land uses.	Landmark Village Tract Map 53108 provides for the transition from more intensive to less intensive development near adjacent land uses. Impacts to adjacent development have been minimized by and incorporated into the design of the Land Use Plan. The tract map provides a logical geographic distribution of land uses within Newhall Ranch. Higher intensity uses will all have direct access to major roadways. The arrangement of land uses was based upon comprehensive studies of access and traffic, and environmental and topographic conditions, as discussed in the Newhall Ranch EIR.
Objective No. 5:	
Arrange land uses to reduce vehicle miles traveled and energy consumption.	The Land Use Plan for Landmark Village Tract Map 53108 minimizes travel time and thereby energy consumption by organizing the community with two convenient Mixed-Use Centers that give residents optimal access to commercial, recreational and public facilities. Facilities are sited to reduce automobile trips and promote the use of pedestrian and bicycle trails. Gathering places such as schools, parks, and shopping occur at three to five minute walk intervals, ensuring pedestrian use of walkways, trails, and public spaces.
Objective No. 6:	
Provide a complementary and supportive array of land uses, which will enable development of a community with homes, shopping, employment, schools, recreation, cultural and worship facilities, public services, and open areas.	Landmark Village Tract Map 53108 will have a full range of services to meet the needs of its residents. Facilities will include an elementary school, church and/or daycare center, and life-long learning center. The Specific Plan land use designations allow cultural facilities and religious institutions to be built within or near the Village. Two convenient mixed-use centers integrate residential, civic, commercial, office, and park uses. Recreational uses include Neighborhood Parks, a Community Park, neighborhood recreation centers, and a system of pedestrian, equestrian and bicycle trails.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
II. SPECIFIC PLAN OBJECTIVES	
A. Land Use Plan Objectives	
Objective No. 7:	
Organize development into villages to create a unique identity and sense of community for each.	The Design Guidelines for Landmark Village Tract Map 53108 establish a unique identity for Landmark Village. Natural geologic features such as prominent ridges and rock outcroppings have been preserved by the Specific Plan. These unique features provide a scenic backdrop to the development areas and help to create a sense of place within Landmark Village. Landmark Village will use its location on the banks of the Santa Clara River to serve as the gateway to Newhall Ranch. Its unique identity will be a traditional, small town community setting.
Objective No. 8:	
Design villages in which a variety of higher intensity residential and nonresidential land uses are located in proximity to each other and to major road corridors and transit stops.	Landmark Village Tract Map 53108 provides for the transition from more intensive to less intensive development near adjacent land uses. Impacts to adjacent development have been minimized by and incorporated into the design of the Land Use Plan. First, Open Area and roadways are used to separate and buffer adjacent development areas. Second, in Landmark Village, the Village concept locates the highest intensity of uses in and around the Village Center, allowing for a range of housing products to have convenient access to the Village Centers, which will contain a variety of retail uses and employment opportunities. This clustering of development around a centralized core provides for growth in a concentrated, rather than dispersed pattern, thus helping to preserve Open Area and SMAs. Landmark Village Tract Map 53108 provides a logical geographic distribution of land uses within Newhall Ranch. Higher intensity uses will all have direct access to major roadways. The arrangement of land uses was based upon comprehensive studies of access and traffic, and environmental and topographic conditions, as discussed in the Newhall Ranch EIR.
Objective No. 9:	
Establish land uses and development regulations which permit a wide range of housing densities, types, styles, prices, and tenancy (for sale and rental).	The residential neighborhoods in Landmark Village Tract Map 53108 are designed to provide an eclectic mix of housing types. The residential neighborhoods will contain a range of single-family and attached homes.
Objective No. 10:	
Designate sites for needed public facilities such as schools, fire stations, libraries, a water reclamation plant, and parks.	Anticipated to be early in the phasing of Landmark Village Tract Map 53108, the Village Quad mixed-use center will contain many of the civic uses necessary for the community, as well as residential and commercial opportunities. The integrated uses are to be implemented consistent with the principles of the Newhall Ranch Specific Plan. Facilities will include an elementary school, park and ride lot, fire station and a community park.
Objective No. 11:	
Allow for the development of community services and amenities by the public and private sectors, such as medical facilities, child care, colleges, worship facilities, cultural facilities, and commercial recreation.	Please see consistency analysis for Objective No. 10, above.
Objective No. 12:	
Create a physically safe environment by avoiding building on fault lines and avoiding or correcting other geologically unstable landforms; by constructing flood control improvements to protect urban areas; and by implementing a fuel modification program to protect against wildfire.	The Specific Plan identifies several project constraints, including those potentially hazardous to public health, safety and welfare, such as fault zones, major landslides, major slopes, and drainage areas. The Landmark Village design reflects these constraints. The tract map also reflects flood control improvements to protect the community. In addition, Design Guidelines for Landmark Village Tract Map 53108 include a fuel modification zone to protect against wildfire.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
II. SPECIFIC PLAN OBJECTIVES	
B. Economics	
Objective No. 1:	
Adopt development regulations, which provide flexibility to respond to and adjust to changing economic and market conditions over the life of Newhall Ranch.	Landmark Village Tract Map 53108 has been designed using the flexibility of the Specific Plan to respond to current and changing economic and market conditions.
Objective No. 2:	
Provide a tax base to support public services.	The proposed residential and commercial land uses in the Landmark Village Tract Map 53108 will generate significant economic benefits, thereby increasing County revenues, while expanding the tax base.
Objective No. 3:	
Adopt development regulations and guidelines, which allow site, parking, and facility sharing and other innovations, which reduce the costs of providing public services.	The Elementary School is integrated with the Landmark Village Community Park to facilitate shared play area and parking, as well as passive interaction with the river. The school and park are centrally located to optimize pedestrian access.
Objective No. 4:	
Earn a reasonable return on investment.	The applicant confirms that the Landmark Village Tract Map 53108 will result in a reasonable return on investment.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
II. SPECIFIC PLAN OBJECTIVES	
C. Mobility	
Objective No. 1:	
Design a mobility system, which includes alternatives to automobile use.	The Landmark Village Tract Map 53108 Circulation Plan seeks to implement the mobility objectives to the greatest degree possible, and remain consistent with the requirements and intent of the Specific Plan. In most cases, minor modifications to the street sections set forth in the Specific Plan and/or the Los Angeles County Subdivision Code are proposed in order to meet the Specific Plan objectives. The Master Trails Plan of the Specific Plan provided general trail alignments and classifications. It ensured that the Landmark Village area would be linked to the greater Newhall Ranch via the Regional River Trail and the Community Trail network. The Landmark Village Trails Plan fulfills the intent of the Specific Plan and provides the level of specificity necessary to ensure that each residence and all community service areas are linked via a pedestrian trail system. The Landmark Village Trails Plan provides a tract map level of detail. It implements the Specific Plan goals and objectives by delineating: • A clearly defined hierarchy of trail sizes and functionality; and • Adding specific access points to off-project regional trail systems; and • Providing locations for observation/interpretive points.
Objective No. 2:	
Provide a safe, efficient, and aesthetically attractive street system with convenient connections to adjoining regional transportation routes.	The roadway network of the Landmark Village Tract Map 53108 has been designed as an extension of the regional circulation element. The Newhall Ranch Specific Plan is designed to integrate modes of travel, accommodate anticipated traffic demands generated by the project and surrounding development, and provide important roadway extensions and improvements, such as the widening of State Route 126 (SR-126), extensions of Magic Mountain Parkway and Valencia Boulevard, construction of Commerce Center Drive and the relocation of Chiquito Canyon Road and San Martinez Grande to provide safer access to SR-126. In most cases, minor modifications to the street sections set forth in the Specific Plan and/or the Los Angeles County Subdivision Code are proposed in order to meet the Specific Plan objectives. The only major departure from the Specific Plan in the Landmark Village Circulation Plan is the change of classification for the spine road through the project site. The Master Circulation Plan of the Specific Plan designated the spine road as a Secondary Highway. Traffic analysis based on the reduced number of residential units and reduced non-residential square footage for Landmark Village has indicated the lack of need for a Secondary Highway. Therefore, this Secondary Highway has been reduced to collector status.
Objective No. 3:	
Facilitate public transit by reserving right-of-way for future MetroLink line, space for a park-and-ride and/or MetroLink station, and by providing bus pull-ins along highways.	The Landmark Village Tract Map 53108 design facilitates transit use and provides for major transit stops at the Mixed-Use Village Centers. In addition, the project's Mobility Plan anticipates the eventual extension of a MetroLink line along the SR-126 corridor, linking Los Angeles County and Ventura County. A continuous transit corridor has been incorporated into the plan for the future transit/rail options. A potential site for a future transit station has been identified which, in the interim, can be used as a park-and-ride site.
Objective No. 4:	
Provide an efficient street circulation system that minimizes impacts on residential neighborhoods and environmentally sensitive areas.	The Landmark Village Circulation Plan seeks to implement the Specific Plan's Mobility Objectives to the greatest degree possible, and remain consistent with the requirements and intent of the Specific Plan to reduce impacts on residential neighborhoods and environmentally sensitive areas. In most cases, minor modifications to the street sections set forth in the Specific Plan and/or the Los Angeles County Subdivision Code are proposed in order to meet the Specific Plan objectives.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
II. SPECIFIC PLAN OBJECTIVES	
C. Mobility	
Objective No. 5:	
Establish a diverse system of pedestrian and bicycle trails, segregated from vehicle traffic, to serve as an alternative to automobile use.	The Master Trails Plan of the Specific Plan provided general trail alignments and classifications. It ensured that the Landmark Village Area would be linked to the greater Newhall Ranch via the Regional River Trail and the Community Trail network. The Landmark Village Tract Map 53108 Trails Plan fulfills the intent of the Specific Plan and provides the level of specificity necessary to ensure that each residence and all community service areas are linked via a pedestrian trail system. The Landmark Village Trails Plan provides a tract map level of detail. It implements the Specific Plan goals and objectives by delineating: • A clearly defined hierarchy of trail sizes and functionality; and • Adding specific access points to off-project regional trail systems; and • Providing locations for observation/interpretive points. Minor modifications to the street sections set forth in the Specific Plan and/or the Los Angeles County Subdivision Code are proposed in order to "establish a diverse system of pedestrian and bicycle trails, segregated from vehicle traffic, to serve as an alternative to automobile use."

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
II. SPECIFIC PLAN OBJECTIVES	
D. Parks, Recreation, and Open Area	
Objective No. 1:	
Retain a major Open Area, which could act as a regional recreational park and an ecological reserve.	The portion of the Landmark Village Tract Map 53108 Community Park located on the riverside of the spine road is planned as the passive, natural recreation area of the park. The concept is for this area to be the Village's portal on the regional River Trail and highlight the very essence of the natural environmental experience. Landscaping will mimic the riparian vegetation of the River Corridor in informal plantings, while low grass swale areas will serve the double purpose of providing for drainage/water quality control, as well as additional picnic/free play opportunities. A Santa Clara River outlook point, accessed by both the Regional River Trail and the Community Spine Road Trail, will serve to promote ecological consciousness for both residents and visitors to Landmark Village.
Objective No. 2:	
Provide for the recreational use of open areas that is compatible with protection of significant natural resources.	The portion of Landmark Village Community Park located on the riverside of the spine road is planned as the passive, natural recreation area of the park. The concept is for this area to be the Village's portal on the regional River Trail and highlight the very essence of the natural environmental experience. A Santa Clara River outlook point, accessed by both the Regional River Trail and the Community Spine Road Trail will serve to promote ecological consciousness for both residents and visitors to Landmark Village. The Regional River Trail would extend along the northern edge of the Santa Clara River, including Landmark Village, providing active and passive recreation opportunities. The Regional River Trail would be built on land that is elevated and provided with bank protection where necessary in order to eliminate flooding and bank erosion. Where bank protection does not exist, the trail would be located on a natural shelf above the elevation of the River.
Objective No. 3:	
Provide neighborhood and Community Parks and improvements, which satisfy park dedication requirements and meet the recreational needs of local residents.	Landmark Village includes a community park, two neighborhood recreation centers, and active and passive recreation opportunities along the Regional River Trail.
Objective No. 4:	
Locate Neighborhood Parks adjacent to schools and establish joint-use agreements between park and school districts.	The Elementary School is integrated with the Landmark Village Community Park to facilitate shared play area and parking, as well as passive interaction with the river. The school and park are centrally located to optimize pedestrian access.
Objective No. 5:	
Provide a range of recreational opportunities including passive and active parks, an 18-hole golf course, and a recreational lake.	Landmark Village includes a community park, two neighborhood recreation centers, and active and passive recreation opportunities along the Regional River Trail. A golf course proposed elsewhere in the Specific Plan is not a part of Landmark Village Tract Map 53108.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
II. SPECIFIC PLAN OBJECTIVES	
D. Parks, Recreation, and Open Area	
Objective No. 6:	
Provide an extensive system of pedestrian, bicycle, and hiking trails within the villages and hiking trails in the Special Management Areas (SMAs) and Open Area.	The Master Trails Plan of the Specific Plan provided general trail alignments and classifications. It ensured that the Landmark Village Area would be linked to the greater Newhall Ranch via the Regional River Trail and the Community Trail network. The Landmark Village Tract Map 53108 Trails Plan fulfills the intent of the Specific Plan and provides the level of specificity necessary to ensure that each residence and all community service areas are linked via a pedestrian trail system. The Landmark Village Trails Plan provides a tract map level of detail. It clearly implements the Specific Plan goals and objectives by delineating: • A clearly defined hierarchy of trail sizes and functionality; • Adding specific access points to off-project regional trail systems; and • Providing locations for observation/interpretive points.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
II. SPECIFIC PLAN OBJECTIVES	
E. Resource Conservation Objectives	
Objective No. 1:	
Protect wetland and endangered species in the Santa Clara River.	Landmark Village Tract Map 53108 contains portions of Significant Ecological Area ("SEA") 23 (the Santa Clara River), which was designated as a SEA because of its ecological resources. The project conserves these resources by maintaining the SEA designation, and by setting aside major portions of the SEA as Special Management Areas, or SMAs. Under the Specific Plan, the SEA/SMAs will continue to be regulated by County standards and procedures for SEAs. Landmark Village implements the Specific Plan Resource Management Plan (Section 2.6) standards and criteria for the land uses and activities that may occur in the SEA in the future, including the Resource Management Plan's regulations mitigating activities that may be carried out to restore or enhance biotic resources, and providing for public access and certain types of recreational uses.
Objective No. 2:	
Preserve the Santa Clara River Corridor and adjacent uplands containing significant natural resources for their resource value, Open Area, and recreational use.	Landmark Village Tract Map 53108 preserves Open Area and SMAs, including some of the most prominent features of the site, including the Santa Clara River and the river bluffs, along with views of the River Corridor bluffs and the major ridgeline of the High Country.
Objective No. 3:	
Retain major Open Area and its natural vegetation as a wildlife or ecological reserve.	Acreage within the SMA/SEA 23 boundary, including the Santa Clara River, will remain in a viable and natural condition in terms of other important ecological functions, even with implementation of Landmark Village Tract Map 53108. The acreage within the SMA/SEA 23 boundary would continue to function as an east/west wildlife movement corridor and as habitat for the unarmored threespine stickleback, because the Project retains both the riparian vegetation in the Santa Clara River and the natural flow of the water without the need for periodic vegetation clearing. In addition, Landmark Village Tract Map 53108 would result in an increase in the amount of river bottom available to the unarmored threespine stickleback.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
II. SPECIFIC PLAN OBJECTIVES	
E. Resource Conservation Objectives	
Objective No. 4:	
Preserve significant stands of oak trees.	Oak Trees will be transplanted or replaced consistent with the Newhall Ranch Specific Plan approval.
Objective No. 5:	
Preserve the site of the historical Asistencia (San Fernando Mission Annex).	The historical site of the Asistencia de San Francisco lies within the boundary of the Newhall Ranch, but is not part of the Landmark Village project site, and it is protected from disturbance from project-related grading because it will be incorporated into the Open Area. This site is to be dedicated to the Archaeological Conservancy, a national cultural resource conservation organization, which will protect the resource and educate the public as to its history.
Objective No. 6:	
Identify and protect significant resources within the two Los Angeles County Significant Ecological Areas (SEAs).	Please see Objective No. 1, this section.
Objective No. 7:	
Preserve or minimally impact the most significant ridgelines and other major topographical landforms.	The Hillside Preservation and Grading Plan (Chapter 2, Section 2.7) for Landmark Village Tract Map 53108 has been prepared in accordance with Los Angeles County Performance Review Criteria for Hillside Management Areas. The Specific Plan includes reducing hillside grading and development by concentrating development in the lower, flatter areas such as the Landmark Village site, thus preserving steep hillsides and prominent ridgelines and avoiding more severe terrain that may be more susceptible to flood, erosion, landslides, and mudslides.
Objective No. 8:	
Provide a water reclamation plant and supplementary distribution system to use reclaimed water.	According to the Specific Plan, a water reclamation plant (WRP) will be developed to serve the Specific Plan land uses, but is not a part of Landmark Village Tract Map 53108. Following construction of the WRP, a recycled water distribution system is designed to use tertiary treated wastewater from the WRP to irrigate land uses within Landmark Village Tract Map 53108 that can accept non-potable water.
Objective No. 9:	
Promote water conservation through design guidelines that encourage use of drought-tolerant and native plants.	The Design Guidelines for Landmark Village will describe five landscape zones within the project: (1) Full Maintenance Landscape; (2) Ornamental Landscape; (3) Drought-Tolerant/Naturalized Landscape; (4) Fuel Modification Areas; and (5) Native Landscape. These descriptions will guide Landmark Village Tract Map 53108 in establishing appropriate landscaping for each area of the Tract Map. For example, development adjacent to the River Corridor SMA/SEA 23 must be more sensitive to native species and intrusive plants than development within an urban village where more ornamental species may be appropriate. In addition, the Resource Management Plan, Section 2.6, contains a detailed list of native species, which must be used when revegetation or enhancement occurs within the River Corridor SMA/SEA 23.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
A. River Corridor Special Management Area (SMA/SEA 23)	
Objective No. 1:	
The Santa Clara River is a regionally significant biological resource. Its value is derived from the inherent value of its wetland and riparian habitats and associated species, and from its function as a regional wildlife corridor. Four federally-listed endangered species and numerous other sensitive species have been observed or detected in riparian habitats of the river. As part of the development of the Specific Plan, a River Corridor has been delineated, which is sufficiently wide to handle the capital flood while retaining nearly all of the riparian vegetation that exists in the river. The river is also a part of SEA 23. The biotic resources of the River are potentially subject to damage from human activities. The Resource Management Plan provides for "transition" areas between the River and development and restricts recreational uses, as discussed below. Finally, the Resource Management Plan provides for the long-term management of the River Corridor SMA/SEA 23.	Development adjacent to the River Corridor SMA/SEA 23 must be more sensitive to native species and intrusive plants than development within an urban village where more intensive development may be appropriate. To accomplish this objective, Landmark Village Tract Map 53108 will use the detailed list of native species found in the Resource Management Plan, Section 2.6, when revegetation or enhancement occurs within the River Corridor SMA area within the Project.
Objective No. 2:	
Mitigation for impacts of the Specific Plan on riparian resources will include restoration of riparian habitat and may include enhancement activities as well. The general areas in which riparian mitigation activities may take place are shown on Exhibit 2.6-3, Candidate Riparian Restoration/Enhancement Areas. The mitigation of project impacts through restoration of habitat and enhancement of existing habitat quality shall conform to the requirements set forth in Specific Plan, Section 2.6.	As directed in the Resource Management Plan, Section 2.6, the mitigation of project impacts through restoration of habitat and enhancement of existing habitat quality in Landmark Village Tract Map 53108 will conform to the requirements set forth in the Resource Management Plan.
Objective No. 3:	
Habitat restoration as referred to in this Specific Plan means the revegetation of native plant communities on sites that have had the habitat removed due to past activities such as agricultural or oil and natural gas operations. Riparian resources along the Santa Clara River that are impacted by the Newhall Ranch project will require restoration of similar habitat and values. Avoidance of impacts to riparian resources shall be the primary goal during the design of the individual stages of the project. Unavoidable impacts to riparian resources shall be minimized through project design, and then mitigated by the implementation of a revegetation plan. The revegetation plan may be prepared as part of a California Department of Fish and Game 1603 Streambed Alteration Agreement or U.S. Army Corps of Engineers Section 404 Permit.	As directed in the Resource Management Plan, Section 2.6, the mitigation of project impacts through restoration of habitat and enhancement of existing habitat quality in Landmark Village Tract Map 53108 will conform to the requirements set forth in the Resource Management Plan. A revegetation plan may be prepared.
Objective No. 4:	
Habitat enhancement as referred to in this Specific Plan means the rehabilitation of areas of native habitat that have been moderately disturbed by past activities (e.g., grazing, roads, oil and natural gas operations, etc.) or have been invaded by non-native plant species such as giant cane (*Arundo donax*) and tamarisk (*Tamarix* sp.).	Removal of grazing is an important means of enhancement of habitat values. Without ongoing disturbance from cattle, many riparian areas will recover naturally. Grazing, except as permitted as a long-term resource management activity, has been removed from the Landmark Village Tract Map 53108 portion of the River Corridor SMA/SEA 23, pursuant to the Long-Term Management Plan set forth in Specific Plan Section 2.6, Management Requirements (subsection (3)(d)). The High Country SMA/SEA 20, which is not a part of Landmark Village Tract Map 53108, is identified as a primary location for oak resource planting to mitigate impacts that might occur within the development areas of the Project.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
A. River Corridor Special Management Area (SMA/SEA 23)	
Objective No. 5:	
The quality of the habitat values that are conserved in the River Corridor SMA will benefit from the control of access to riparian areas.	Access to the River Corridor SMA will be limited to the Landmark Trails Plan. It clearly implements the specific plan by delineating a hierarchy of trial sizes and functionality, adding specific access points to the regional trail system and providing locations for observation /interpretive points.
Objective No. 6:	
Where development lies adjacent to the boundary of the River Corridor SMA a transition area shall be designed to lessen the impact of the development on the conserved area. Transition areas may be comprised of Open Area, natural or revegetated manufactured slopes, other planted areas, bank stabilization areas, and trails.	The south side of the River Corridor SMA is separated from development by the river bluffs, except in one location. The Regional River Trail will serve as transition area on the north side of the river, where development areas adjoin the River Corridor SMA (excluding Travel Village).
Objective No. 7:	
Grading perimeters shall be clearly marked and inspected by the project biologist prior to grading occurring within or immediately adjacent to the River Corridor SMA. The project biologist shall work with the grading contractor to avoid inadvertent impacts to riparian resources.	A project biologist will inspect all marked grading perimeters prior to grading beginning and will work with the grading contractor during grading to avoid inadvertent impacts to riparian resources.
Objective No. 8:	
Upon final approval of the Newhall Ranch Specific Plan, the Special Management Area designation for the River Corridor SMA shall become effective. The permitted uses and development standards for the SMA are governed by the Development Regulations, Chapter 3 of the Specific Plan.	Upon final approval of the Newhall Ranch Specific Plan in 2003, the SMA designation for the River Corridor SMA/SEA 23 became effective. The portion of the SMA within Landmark Village Tract Map 53108 is governed by the Development regulations, Chapter 3 of the Specific Plan.
Objective No. 9:	
Upon completion of development of all land uses, utilities, roads, flood control improvements, bridges, trails, and other improvements necessary for implementation of the Specific Plan within the River Corridor in each subdivision allowing construction within or adjacent to the River Corridor, a permanent, non-revocable conservation and public access easement shall be offered to the County of Los Angeles pursuant to the objectives that follow over the portion of the River Corridor SMA within that subdivision.	Upon final approval of the Newhall Ranch Specific Plan, the SMA designation for the River Corridor SMA/SEA 23 became effective. Upon completion of development of all land uses, utilities, roads, flood control improvements, bridges, trails, and other improvements necessary for implementation of the Specific Plan within the River Corridor in Landmark Village Tract Map 53108, a permanent, non-revocable conservation and public access easement shall be offered to the County of Los Angeles over the portion of the River Corridor SMA/SEA 23 within Landmark Village Tract Map 53108, prior to the transfer of the River Corridor SMA ownership, or portion thereof, to a management entity, as described in Specific Plan, Section 2.6(3)(d).
Objective Nos. 10, 11, and 12:	
The River Corridor SMA conservation and public access easement shall prohibit grazing, except as a long-term resource management activity, and agriculture within the River Corridor and shall restrict recreation use to the established trail system.	The portion of the River Corridor SMA/SEA 23 conservation and public access easement in Landmark Village Tract Map 53108 will prohibit grazing, except as a long-term resource management activity, and agriculture within the River Corridor and will restrict recreation use to the established trail system.
Objective No. 13:	
The River Corridor SMA conservation and public access easement shall be consistent in its provisions with any other conservation easements to state or federal resource agencies, which may have been granted as part of mitigation or mitigation banking activities.	The River Corridor SMA/SEA 23 conservation and public access easement within Landmark Village Tract Map 53108 will be consistent in its provisions with any other conservation easements to state or federal resource agencies, which may have been granted as part of mitigation or mitigation banking activities.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
A. River Corridor Special Management Area (SMA/SEA 23)	
Objective No. 14:	
Prior to the recordation of the River Corridor SMA conservation and public access easement as specified above, the land owner shall provide a plan to the County for the permanent ownership and management of the River Corridor SMA, including any necessary financing. This plan shall include the transfer of ownership of the River Corridor SMA to the Center for Natural Lands Management, or if the Center for Natural Lands Management is declared bankrupt or dissolved, ownership will transfer or revert to a joint powers authority consisting of Los Angeles County (4 members), the City of Santa Clarita (2 members), and the Santa Monica Mountains Conservancy (2 members).	The River Corridor SMA/SEA 23 management plan required by the Specific Plan is part of Landmark Village Tract Map 53108. It will meet the criteria included in Specific Plan, Section 2.6(3)(d).

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
B. High Country Special Management Area/SEA 20	
Objective No. 1:	
Upon final approval of the Newhall Ranch Specific Plan, the Special Management Area designation for the High Country SMA shall become effective. The permitted uses and development standards for the SMA are governed by the Development Regulations, Chapter 3 of the Specific Plan.	There is no High Country SMA within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project. .
Objective No. 2:	
Prior to dedication of the High Country SMA a conservation and public access easement shall be offered to the County of Los Angeles and a conservation and management easement offered to the Center for Natural Lands Management. The High Country SMA conservation and public access easement shall be consistent in its provisions with any other conservation easements to state or federal resource agencies, which may have been granted as part of mitigation or mitigation banking activities.	There is no High Country SMA within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 3:	
The High Country SMA shall be offered for dedication in fee to a joint powers authority consisting of Los Angeles County (4 members), the City of Santa Clarita (2 members), and the Santa Monica Mountains Conservancy (2 members). The joint powers authority will have overall responsibility for recreation within and conservation of the High Country.	There is no High Country SMA within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 4:	
The High Country SMA shall be offered for dedication in three approximately equal phases of approximately 1,400 acres each proceeding from north to south, as follows: (1) The first offer of dedication will take place with the issuance of the 2,000th residential building permit of Newhall Ranch; (2) The second offer of dedication will take place with the issuance of the 6,000th residential building permit of Newhall Ranch; and (3) The remaining offer of dedication will be completed by the 11,000th residential building permit of Newhall Ranch.	There is no High Country SMA within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 5:	
The High Country SMA conservation and public access easement shall prohibit grazing within the High Country; except for those grazing activities associated with long-term resource management programs, and shall restrict recreation to the established trail system.	There is no High Country SMA within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
B. High Country Special Management Area/SEA 20	
Objective No. 6:	
The High Country SMA conservation and public access easement shall be consistent in its provisions with any other conservation easements to state or federal resource agencies, which may have been granted as a part of mitigation or mitigation banking activities.	There is no High Country SMA within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 7:	
An appropriate type of service or assessment district shall be formed under the authority of the Los Angeles County Board of Supervisors for the collection of up to $24 per single-family detached dwelling unit per year and $15 per single-family attached dwelling unit per year, excluding any units designated as Low and Very Low affordable housing units pursuant to Section 3.10, Affordable Housing Program of the Specific Plan. This revenue would be assessed to the homeowner beginning with the occupancy of each dwelling unit and distributed to the joint powers authority for the purposes of recreation, maintenance, construction, conservation and related activities within the High Country Special Management Area.	There is no High Country SMA within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
C. Open Area	
Objective No. 1:	
Open Area is a land use designation, which includes a total 1,010 acres outside of the SMAs, which will be preserved to protect significant resources and to provide open areas and village identification for Newhall Ranch residents. Included in Open Area are (1) Community Parks; (2) major drainages, which are those with flows of 2,000 cubic feet per second (cfs) or more; (3) significant landforms such as the river bluffs, Sawtooth Ridge, and Ayers Rock; (4) oak woodlands and savannahs, which are not part of the SMAs; and (5) cultural sites, including the Asistencia and archaeological sites.	There is no Open Area planning area within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project. The community park is located within the residential land use area.
Objective No. 2:	
Suitable portions of Open Area may be used for mitigation of riparian, oak resources, or elderberry scrub. Mitigation activities within Open Area shall be subject to the requirements presented in the Specific Plan, Section 2.6(2)(c)(2).	There is no Open Area planning area within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project. The community park is located within the residential land use area.
Objective No. 3:	
Drainages with flows greater than 2,000 cfs will have soft bottoms. Bank protection will be of ungrouted rock, or buried bank stabilization as described in Specific Plan Section 2.5.2.a, except at bridge crossings and other areas where public health and safety considerations require concrete or other stabilization.	Although Landmark Village Tract Map 53108 does not contain Open Area, the Landmark Village Drainage and Water Quality Plan, nevertheless, demonstrates conformance with the requirements of the Specific Plan, including this objective. The Drainage and Water Quality Plan incorporates innovative methodologies to meet or exceed the continually upgraded National Pollutant Discharge Elimination System requirements. The plan represents a comprehensive series of flood control and water quality options designed to allow for a flexible state-of-the-art system to both protect development and preserve the Santa Clara River. The features of this plan are intended to blend into the community as an extension of the landscaping. Innovative buried bank stabilization will be implemented, which will provide control protection for residents, while at the same time allowing for a natural riverfront edge and Regional River Trail.
Objective No. 4:	
The precise alignments and widths of major drainages will be established through the preparation of drainage studies to be approved by the County at the time of subdivision maps, which permit construction.	Although Landmark Village Tract Map 53108 does not contain Open Area, the Landmark Village Drainage and Water Quality Plan, nevertheless, demonstrates conformance with the requirements of the Specific Plan, including this objective. The Drainage and Water Quality Plan incorporates innovative methodologies to meet or exceed the continually upgraded National Pollutant Discharge Elimination System requirements. The plan represents a comprehensive series of flood control and water quality options designed to allow for a flexible state-of-the-art system to both protect development and preserve the Santa Clara River. The features of this plan are intended to blend into the community as an extension of the landscaping. Innovative buried bank stabilization will be implemented, which will provide control protection for residents, while at the same time allowing for a natural Riverfront edge and Regional River Trail.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
C. Open Area	
Objective No. 5:	
While Open Area is generally intended to remain in a natural state, some grading may take place, especially for parks, major drainages, trails, and roadways. Trails are also planned to be within Open Area.	There is no Open Area planning area within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project. The community park is located within the residential land use area.
Objective No. 6:	
At the time that final subdivision maps permitting construction are recorded, Open Area will be offered for dedication to the Center for Natural Lands Management. Community Parks within Open Area are intended to be public parks. Prior to the offer of dedication of Open Area to the Center for Natural Lands Management, all necessary conservation and public access easements, as well as easements for infrastructure shall be offered to the County.	There is no Open Area planning area within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project. The community park is located within the residential land use area.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
D. Mitigation Banking	
Objective No. 1:	
The RMP permits the use of mitigation banking if it is approved by state or federal agencies, as applicable. As defined by federal guidance, mitigation banking is a process whereby a type of biotic resource, such as a wetland or riparian habitat, is created, enhanced, or in some cases preserved, as a means of providing compensatory mitigation in advance for authorized impacts to similar resources. The sponsor of the mitigation bank receives mitigation "credits" which can be used by the sponsor or by other parties for the mitigation of impacts that occur on the sponsor's property or in other locations. Mitigation banking can be advantageous to the protection of resources in that mitigation occurs in advance of impacts and generally results in consolidated mitigation in a single area. Mitigation Banking will be permitted within the River Corridor SMA, the High Country SMA, and the Open Area land use designations, subject to the following requirements: (a) Mitigation banking activities for riparian habitats will be subject to state and federal regulations, and shall be conducted pursuant to the mitigation requirements set forth in the Specific Plan, Section 2.6, subsection (2)(a)(2). (b) Mitigation banking for oak resources shall be conducted pursuant to the Oak Resources Replacement Program, of the Specific Plan, Section 2.6, subsection (3). (c) Mitigation banking for elderberry scrub shall be subject to approval of plans by the County Forester.	Mitigation Banking will be permitted within the River Corridor SMA land use designations located within Tract Map 53108, subject to the following requirement: Mitigation banking activities for riparian habitats will be subject to state and federal regulations, and shall be conducted pursuant to the mitigation requirements set forth in the Specific Plan, Section 2.6, subsection (2)(a)(2).

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
E. Spineflower Special Study Mitigation Overlay and Preserve Program Open Area	
Objective No. 1:	
The San Fernando Valley spineflower (spineflower) was recently listed as Endangered by the State Fish and Game Commission. Although not listed under the Federal Endangered Species Act, it is designated as a candidate species at the federal level. When initial biological field surveys were conducted within the Specific Plan area, the spineflower was presumed to be extinct, having not been documented since 1929. Recent surveys have identified spineflower in three known locations within the Specific Plan Area. In consultation with the County and California Department of Fish and Game a mitigation program to minimize impacts to the spineflower has been established and is set forth in Section 2.6 of the Specific Plan. In addition, two conservation easements exist in the Specific Plan Area as shown on Specific Plan Exhibit 5.4-1 Annotated Land Use Plan for the preservation of spineflower.	There are no identified Spineflower locations within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project..

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
F. Oak Resources Replacement Program	
Objective No. 1:	
Oak resources include oak trees of the sizes regulated under the County Oak Tree Ordinance, Southern California black walnut trees, Mainland cherry trees, and Mainland cherry shrubs. The Specific Plan area is estimated to contain more than 16,314 oak trees. These are predominantly coast live oaks (*Quercus agrifolia*), while a smaller percentage are Valley oaks (*Quercus lobata*). Oak woodlands and savannahs occur primarily on the north facing slopes and within the major canyons and drainages of the Specific Plan Area. The Concept Grading Plan for the Specific Plan results in preservation of at least an estimated 15,681 oaks. This represents 96 percent of the total estimated oak trees within the Specific Plan Area. Mainland cherry trees and Mainland cherry shrubs are found in Long and Lion Canyons, intermixed with Coast live oaks, while Southern California black walnut is found mainly in the High Country SMA. Based upon the preliminary oak tree impact analysis in the EIR, approximately 633 oak trees may potentially be impacted over the course of the long-term build out of the Specific Plan. At the time engineering plans are completed for the subdivision process, a more precise oak tree survey shall be conducted and oak tree permits pursuant to Title 22 of the Los Angeles County Code, Part 16 shall be obtained.	Oak trees on the Landmark Tract Map site and affected off-site areas will be transplanted or replaced at ratios required by the SP.
Objective No. 2:	
Suitable areas exist in the High Country SMA for the restoration of oak resources and the enhancement of existing stands of oak trees (Specific Plan Exhibit 2.6-9, Potential Oak Tree Restoration Areas). These include areas in the upper elevations of the Santa Susana Mountains that have been disturbed by grazing. Additional opportunities exist within Open Area where oak resources can be planted as an expansion of existing oak woodlands or savannahs and in other areas that exhibit suitable topographic and soil conditions.	Please see Objective No. 1, this section.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
G. Wildfire Fuel Modification	
Objective No. 1:	
The Specific Plan area is within the extreme and moderate fire hazard zones as identified in the Los Angeles County General Plan. The moderate fire hazard zone extends to those areas of Newhall Ranch where native brush can be found growing in its natural state. This is most common in the hillside areas. The extreme fire hazard zone includes high brush and woodlands, and all steep slopes regardless of vegetation. Development of Newhall Ranch will reduce the amount of native flammable vegetation present within the Specific Plan Area. However, the development of homes potentially exposes residences of the Specific Plan Area to wildfire hazards. Fire fighting capabilities will be provided by three fire stations within the Specific Plan area (see Land Use Plan, Exhibit 2.3-1), other nearby stations, and a system of improved roads and an urban water system with fire flows as required by the County Fire Department. Existing and proposed off-site fire facilities will also serve the Specific Plan Area.	A fire station site has been incorporated into the Landmark Village Tract Map site. Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. A Fuel Modification Plan is included.
Objective No. 2:	
To minimize the potential exposure of the development areas, Open Area, and the SMAs to fire hazards, the Specific Plan is subject to the requirements of the Los Angeles County Fire Protection District (LACFPD), which provides fire protection for the area. At the time of final subdivision maps permitting construction in development areas that are adjacent to Open Area and the High Country SMAs, a wildfire fuel modification plan shall be prepared in accordance with the fuel modification ordinance standards in effect at that time and shall be submitted for approval to the County Fire Department.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
H. Cultural Resources Program	
(a) Archaeological Sites	
Objective No. 1:	
In order to avoid significant impact on the site's archaeological and paleontological resources, Phase I and Phase II archaeological survey work has been conducted. An intensive Phase I archaeological survey of the Specific Plan Area revealed eight prehistoric sites (and the Asistencia and Newhall Ranch headquarters), which represents a low density of archaeological remains for a project site of this size. As a result of Phase II archaeological fieldwork and artifact recovery, it was concluded that future development will not result in adverse impacts to cultural resources for four sites and a part of a fifth site. Sites CA-LAN-2133, -2235, -2241, and the northern portion of -2233, contain subsurface archaeological deposits and intact prehistoric artifacts that may require Phase III recovery if site avoidance and/or preservation is not feasible.	All development in the Landmark Village Tract Map 53108 area will comply with County of Los Angeles and CEQA requirements regarding the preservation of significant archaeological resources.
Objective No. 2:	
Any adverse impacts to CA-LAN-2133, -2235, and the northern portion of -2233 are to be mitigated by avoidance and preservation. Should preservation of these sites be infeasible, a Phase III data recovery (salvage excavation) project is to be completed on the sites so affected, with archaeological monitoring of grading to occur during subsequent soils removals on the site. This will serve to collect and preserve the scientific information contained therein, thereby mitigating all adverse impacts to the effected cultural resource.	All development in the Landmark Village Tract Map 53108 area will comply with County of Los Angeles and CEQA requirements regarding the preservation of significant archaeological resources.
Objective No. 3:	
Any adverse effects to CA-LAN-2241 are to be mitigated through site avoidance and preservation. Should this prove infeasible, an effort is to be made to re-locate, analyze, and re-inter the disturbed site in the arroyo bottom at some more appropriate and environmentally secure locale within the region.	All development in the Landmark Village Tract Map 53108 area will comply with County of Los Angeles and CEQA requirements regarding the preservation of significant archaeological resources.
Objective No. 4:	
To ensure that no additional adverse impacts occur on CA-LAN-2236, -2242 and the southern portion of -2233, an archaeological monitor will be present should any subsurface grading or soils removals occur at these locales.	All development in the Landmark Village Tract Map 53108 area will comply with County of Los Angeles and CEQA requirements regarding the preservation of significant archaeological resources.
Objective No. 5:	
In the unlikely event that additional artifacts are found during grading within the development area or future roadway extensions, an archaeologist will be notified to stabilize, recover and evaluate such finds.	An archaeologist will be available in the unlikely event that additional artifacts are found during grading within Landmark Village Tract Map 53108 to stabilize, recover and evaluate such finds.
Objective No. 6:	
The Asistencia de San Francisco/Newhall Ranch Headquarters site is located outside of the development area and is proposed to be preserved as a part of Community Open Area. The Asistencia site is of historical interest and may contain historical structures and artifacts of significant historical value.	The historical site of the Asistencia de San Francisco lies outside of Landmark Village Tract Map 53108.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
H. Cultural Resources Program	
(b) Paleontological Resources	
Objective No. 7:	
The Newhall Ranch Specific Plan area is underlain by rocks ranging in age from the late Miocene Epoch (approximately 8 million years B.P.) to the Recent and rated from high to low paleontologic potential. Of the seven geologic units found within the Specific Plan Area, the Modelo, Towsley, Pico, and Saugus formations have high paleontological potential; the Terrace and Older Alluvium formations have moderate paleontological potential; and the Young Alluvium formation has a low paleontological potential.	An archaeologist will be available in the unlikely event that additional artifacts are found during grading within Landmark Village Tract Map 53108 to stabilize, recover and evaluate such finds.
As part of an inspection testing program, a Los Angeles County Natural History Museum-approved inspector is to be on-site during an appropriate number of excavations into the Pico Formation, Saugus Formation, Quaternary Terrace Deposits, and Quaternary Older Alluvium. Should the excavations yield significant paleontological resources, excavation is to be stopped or redirected until the extent of the find is established and the resources are salvaged.	A Los Angeles County Natural History Museum-approved inspector will be on-site during an appropriate number of excavations into the Pico Formation, Saugus Formation, Quaternary Terrace Deposits, and Quaternary Older Alluvium located within the boundaries of Landmark Village Tract Map 53108. Should the excavations yield significant paleontological resources, excavation will be stopped or redirected until the extent of the find is established and the resources are salvaged.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
I. Hillside Preservation and Grading Plan	
Objective No. 1:	
The Specific Plan Design Guidelines in Chapter 4 contain grading guidelines designed to achieve the goals of the Specific Plan and assure development that is safe, aesthetic, and cost effective. The Conceptual Grading Plan, Specific Plan Exhibit 2.7-1, identifies areas of grading activities within the Specific Plan Area. As determined by the Conceptual Grading Plan, grading for the project will consist of approximately ninety (90) million cubic yards of earthwork. The grading will be balanced within the Specific Plan Area and will entail the use of four (4) grading elements: mass grading for development areas; final grading for development pads; remedial grading; and custom grading.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
III. RESOURCE PROTECTION, CONSERVATION, AND MANAGEMENT	
J. Drainage and Flood Control	
Objective No. 1:	
The flood corridor must allow for the passage of Los Angeles County Capital Flood Flow without the permanent removal of natural river vegetation (except at bridge crossings).	The Landmark Village Tract Map 53108 Drainage and Water Quality Plan demonstrates conformance with the requirements of the Specific Plan, including this objective. The Drainage and Water Quality Plan incorporates innovative methodologies to meet or exceed the continually upgraded National Pollutant Discharge Elimination System requirements. The plan represents a comprehensive series of flood control and water quality options designed to allow for a flexible state-of-the-art system to both protect development and preserve the Santa Clara River. The features of this plan are intended to blend into the community as an extension of the landscaping. Innovative buried bank stabilization will be implemented, which will provide control protection for residents, while at the same time allowing for a natural Riverfront edge and Regional River Trail.
Objective No. 2:	
The banks of the river will generally be established outside of the "Waters of the United States," as defined by federal laws and regulations and as determined by the delineation completed by the United States Army Corps of Engineers (ACOE) in August 1993.	In conformance with this objective, the location of the bank stabilization is generally outside of the "Waters of the US" as defined by the ACOE.
Objective No. 3:	
Where the ACOE delineation width is insufficient to contain the Capital Flood flow, the flood corridor will be widened by an amount sufficient to carry the Capital Flood flow without the necessity of permanently removing vegetation or significantly increasing velocity.	In conformance with this objective, where the ACOE delineation width is insufficient to contain the Capital Flood flow, the flood corridor will be widened by an amount sufficient to carry the Capital Flood flow without the necessity of permanently removing vegetation or significantly increasing velocity.
Objective No. 4:	
Where development is proposed within the existing Los Angeles County floodplain, the land where development is to occur will be elevated in accordance with Los Angeles County policies to remove it from the floodplain.	In accordance with this objective, the Landmark Village tract map site will be raised consistent with Los Angeles County Department of Public Works requirements.
Objective No. 5:	
Bank stabilization will occur only where necessary to protect against erosion.	In accordance with this objective, bank stabilization has only been placed in areas to protect against erosion. Furthermore, the proposed bank stabilization associated with Landmark Village is consistent with the Newhall Ranch Specific Plan.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
IV. ADJUSTMENT/TRANSFER/CONVERSIONS	
A. Planning Area Adjustments and Transfers	
Objective No. 1: (a) Dwelling Units	
Precise Planning Area boundaries shall be established by the recordation of subdivision maps. A subdivision map submittal may incorporate an adjustment to the current Annotated Land Use Plan boundaries and Annotated Land Use Plan Statistical Table acreages on file at the County without necessitating a Specific Plan Amendment or a Substantial Conformance review, provided that each Planning Area affected by the boundary adjustment must retain a minimum of eighty (80) percent of the original total gross acreage and cannot exceed 120 percent of the original gross acreage approved under the Specific Plan.	The Landmark Village Tract Map 53108 is in direct conformance with the approved Specific Plan.
Objective No. 2:	
The transfer of dwelling units between planning areas shall not result in exceeding the maximum units for any Planning Area, as set forth on the Annotated Land Use Plan Statistical Table (Specific Plan Table 5.4-1).	The transfer of dwelling units between planning areas in Landmark Village Tract Map 53108 does not result in exceeding the maximum units for any planning area, as set forth on the Annotated Land Use Plan Statistical Table (Specific Plan Table 5.4-1).
Objective No. 3:	
The transfer of dwelling units between Planning Areas shall not result in an increase in the total number of planned units permitted in the Newhall Ranch Specific Plan (i.e., 20,885 dwelling units and 423 Second Units).	The transfer of dwelling units between Planning Areas in Landmark Village Tract Map 53108 does not result in an increase in the total number of planned units permitted in the Newhall Ranch Specific Plan in these planning areas.
Objective No. 4:	
An updated revised Annotated Land Use Plan (Specific Plan Exhibit 5.4-1) and Annotated Land Use Plan Statistical Table (Specific Plan Table 5.4-1), and an updated revised Park and Recreation Improvements Summary (Specific Plan Table 5.4-2) must be submitted to Los Angeles County.	An updated, revised Annotated Land Use Plan and Annotated Land Use Plan Statistical Table, and a revised Parks and Recreation Improvements Summary (Table 5.4-2) showing adjusted dwelling unit and Second Unit totals and/or adjusted park acreage totals for all planning areas affected has been submitted to the County with Landmark Village Tract Map 53108.
Objective No. 5: (b) Commercial/Mixed-Use/Visitor-Serving Planning Areas	
The transfer shall not increase the amount of planned non-residential building square footage within a given Planning Area by more than 50 percent as set forth in the Annotated Land Use Plan Statistical Table (Specific Plan Table 5.4-1).	The transfer of building square footage in Landmark Village Tract 53108 does not increase the amount of planned non-residential building square footage within a given Planning Area as set forth in the Annotated Land Use Plan Statistical Table (Specific Plan Table 5.4-1).
Objective No. 6:	
The transfer of building square footage between Planning Areas shall be subject to a traffic study, which confirms that all traffic impacts will be mitigated.	The building square footage in Landmark Village Tract Map 53108 has decreased. A traffic study has been conducted that *confirms* all traffic impacts will be mitigated.
Objective No. 7:	
The transfer of building square footage between Planning Areas shall not result in an increase in the total planned non-residential building square footage permitted in Newhall Ranch (i.e., 5,549,000 sq. ft.).	The transfer of building square footage between planning areas in Landmark Village Tract Map 53108 results in a decrease in the total planned non-residential building square footage permitted.
Objective No. 8:	
An updated revised annotated Land Use Plan (Specific Plan Exhibit 5.4-1) and Annotated Land Use Plan Statistical Table (Specific Plan Table 5.4-1) must be submitted to Los Angeles County.	An updated, revised Annotated Land Use Plan and Annotated Land Use Plan Statistical Table, and a revised Parks and Recreation Improvements Summary (Table 5.4-2) showing adjusted dwelling unit and Second Unit totals and/or adjusted park acreage totals for all planning areas affected has been submitted to the County with Landmark Village Tract Map 53108.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
IV. ADJUSTMENT/TRANSFER/CONVERSIONS	
A. Planning Area Adjustments and Transfers	
Objective No. 9: (c) Business Park Planning Areas	
The transfer shall not increase the amount of planned non-residential building square footage within a given Planning Area by more than 50 percent, as set forth in the Annotated Land Use Plan Statistical Table (Specific Plan Table 5.4-1).	The transfer in Landmark Village Tract Map 53108 of planned non-residential building square footage within a given Planning Area is decreased by less than 50%, as set forth in the Annotated Land Use Plan Statistical Table (Specific Plan Table 5.4-1).
Objective No. 10:	
The transfer of non-residential building square footage between Planning Areas shall be subject to a traffic study, which confirms that all traffic impacts will be mitigated.	A traffic study has been conducted that confirms all traffic impacts will be mitigated.
Objective No. 11:	
The transfer of building square footage between Planning Areas shall not result in an increase in the total planned non-residential building square footage permitted in Newhall Ranch (i.e., 5,549,000 sq. ft.).	The transfer of building square footage between Planning Areas in Landmark Village Tract Map 53108 results in a decrease in the total planned non-residential building square footage permitted.
Objective No. 12	
An updated, revised Annotated Land Use Plan (Specific Plan Exhibit 5.4-1) and Annotated Land Use Plan Statistical Table (Specific Plan Table 5.4-1) must be submitted to Los Angeles County.	An updated, revised Annotated Land Use Plan and Annotated Land Use Plan Statistical Table, and a revised Parks and Recreation Improvements Summary (Table 5.4-2) showing adjusted dwelling unit and Second Unit totals and/or adjusted park acreage totals for all planning areas affected has been submitted to the County with Landmark Village Tract Map 53108.
Objective No. 13: (d) Second Units	
Dwelling units from any Planning Area on the Annotated Land Use Plan Statistical Table may be exchanged for Second Units at a rate of one (1) dwelling unit for each one (1) Second Unit.	Landmark Village Tract Map 53108 has no Second Units, and as a result, this objective does not apply to this project.
Objective No. 14:	
The transfer of Second Units between Planning Areas shall not result in exceeding the maximum Second Units for each Planning Area, as set forth in the Annotated Land Use Plan Statistical Table (Specific Plan Table 5.4-1).	Landmark Village Tract Map 53108 has no Second Units, and as a result, this objective does not apply to this project.
Objective No. 15:	
The exchange and/or transfer shall be documented by the submittal to the County of an updated, revised Annotated Land Use Plan and Annotated Land Use Plan Statistical Table, and a revised Parks and Recreation Improvements Summary (Specific Plan Table 5.4-2). The updated, revised tables will show adjusted dwelling unit and Second Unit totals and/or adjusted park acreage totals for all Planning Areas affected.	An updated, revised Annotated Land Use Plan and Annotated Land Use Plan Statistical Table, and a revised Parks and Recreation Improvements Summary (Specific Plan Table 5.4-2) showing adjusted dwelling unit and Second Unit totals and/or adjusted park acreage totals for all Planning Areas affected has been submitted to the County with Landmark Village Tract Map 53108.
Objective No. 16:	
In no case shall the total number of dwelling units and Second Units allowed in the Specific Plan Area exceed 21,308 (see Overall Land Use Plan Statistical Table, Specific Plan Table 2.3-1, and Annotated Land Use Plan Statistical Table, Specific Plan Table 5.4-1).	The total number of dwelling units and Second Units in the Landmark Village Tract Map 53108 area is consistent with the Specific Plan.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
IV. ADJUSTMENT/TRANSFER/CONVERSIONS	
B. Land Use Conversions	
Objective No. 1: (a) Commercial or Mixed-Use to Residential	
No more than twenty (20) acres of Mixed-Use or Commercial in any village may be converted.	No Mixed-Use or Commercial uses are converted to Residential land uses in Landmark Village Tract Map 53108.
Objective No. 2:	
The conversion of Commercial or Mixed-Use acreage to Residential uses shall be subject to a traffic study, which confirms that all traffic impacts will be mitigated.	No Mixed-Use or Commercial uses are converted to Residential land uses in Landmark Village Tract Map 53108.
Objective No. 3:	
The Residential dwelling units designated for the converted area may be transferred from other Planning Areas pursuant to Specific Plan Section 3.5, paragraph 2b and shall not affect an increase in the total number of planned units in the Specific Plan (i.e., 21,308 dwelling units). The transfer shall be documented by the submittal to the County of a revised Annotated Land Use Plan and Annotated Land Use Plan Statistical Table in which dwelling units transferred shall become the planned units for the new Planning Area.	No Mixed-Use or Commercial uses are converted to Residential land uses in Landmark Village Tract Map 53108.
Objective No. 4:	
The transfer of the non-residential building square footage from the Mixed-Use or Commercial Planning Area being converted to a Residential planning area shall be subject to Section 3.5, paragraph 2c of the Specific Plan.	No Mixed-Use or Commercial uses are converted to Residential land uses in Landmark Village Tract Map 53108.
Objective No. 5: (b) Residential to Commercial or Mixed-Use	
Each site proposed for conversion must not be less than five (5) acres, unless the conversion is of land immediately adjacent to an existing Commercial or Mixed-Use Planning Area, in which case no minimum acreage is required.	There is no conversion from Residential uses to Commercial or Mixed-Use in Landmark Village Tract Map 53108.
Objective No. 6:	
A maximum of ten (10) acres of land within a Planning Area originally designated for Residential uses under the Specific Plan may be converted to Commercial or Mixed-Use in each Village (i.e., the total acres converted in a given Village shall not exceed ten (10) acres).	There is no conversion from Residential uses to Commercial or Mixed-Use in Landmark Village Tract Map 53108.
Objective No. 7:	
Sites proposed for conversion to Commercial or Mixed-Use are located on and must have frontage on a secondary or higher classification highway, unless the conversion is of land immediately adjacent to an existing Commercial or Mixed-Use Planning Area.	There is no conversion from Residential uses to Commercial or Mixed-Use in Landmark Village Tract Map 53108.
Objective No. 8:	
The conversion of Residential to Commercial or Mixed-Use shall be subject to a traffic study, which confirms that all traffic impacts will be mitigated.	There is no conversion from Residential uses to Commercial or Mixed-Use in Landmark Village Tract Map 53108.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
IV. ADJUSTMENT/TRANSFER/CONVERSIONS	
B. Land Use Conversions	
Objective No. 9:	
The planned non-residential building square footage of the newly created Commercial or Mixed-Use Planning Area shall be transferred from planned non-residential building square footage from existing Mixed-Use or Commercial Planning Areas and shall not result in an increase in the total planned non-residential building square footage approved under the Specific Plan (i.e., 5,549,000 sq. ft.). The transfer shall be documented by the submittal to the County of a revised Annotated Land Use Plan Statistical Table in which the non-residential building square footage transferred will become the planned non-residential building square footage for the new Planning Area.	There is no conversion from Residential uses to Commercial or Mixed-Use in Landmark Village Tract Map 53108.
Objective No. 10:	
The conversion of Residential uses to Commercial or Mixed-Use uses within Planning Areas RW-20 and RW-21 (see Annotated Land Use Plan Exhibit 5.4-1 of the Specific Plan) shall be subject to a Conditional Use Permit.	There is no conversion from Residential uses to Commercial or Mixed-Use in Landmark Village Tract Map 53108.
Objective No. 11:	
The conversion of Residential uses, which are within 500 feet of occupied dwelling units to Commercial or Mixed-Use uses, shall be subject to a Conditional Use Permit.	There is no conversion from Residential uses to Commercial or Mixed-Use in Landmark Village Tract Map 53108.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
IV. ADJUSTMENT/TRANSFER/CONVERSIONS	
C. Second Units	
Objective No. 1:	
The intent of the Second Unit provisions for Newhall Ranch include: (1) Providing affordable housing opportunities without public subsidies, while maintaining the general character of a single-family neighborhood; (2) Providing a means for homeowners of new or existing homes to meet mortgage payment and household expenses; (3) Providing security for senior residents; and (4) Providing housing opportunities for extended family.	Landmark Village Tract Map 53108 has no Second Units, and as a result, this objective does not apply to this project.
Objective No. 2: (a) Estate Residential	
423 Second Units are permitted in the Estate Residential land use designation (see Specific Plan Table 3.4-3) subject to the following regulations: (1) One attached or detached Second Unit shall be permitted upon issuance of a CUP. (2) Maximum living area of a Second Unit shall not exceed 1,200 square feet on Estate lots. (3) Second Units shall meet main building setbacks, standard height limits, lot coverage, floor area ratio, and other applicable requirements for Estate Residential (see Specific Plan Section 3.4.)	Landmark Village Tract Map 53108 has no Second Units, and as a result, this objective does not apply to this project.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
IV. ADJUSTMENT/TRANSFER/CONVERSIONS	
C. Second Units	
(4) Second Units must be on the same lot as the primary residence; and cannot be subdivided or sold. Second Units may contain kitchen facilities. (5) Planned Second Units for Estate Residential may be transferred to Planning Areas designated for Low Residential pursuant to Specific Plan Section 3.5, paragraph 2b. (6) The total number of Second Units shall not exceed the maximum Second Units for a given Planning Area, as set by the Annotated Land Use Plan Statistical Table, Specific Plan Table 5.4-1.	
Objective No. 3: (b) Low Residential	
Second Units are permitted in the Low-Residential land use designation areas (see Specific Plan Table 3.4-3) subject to the following regulations: (1) One attached or detached Second Unit shall be permitted upon issuance of a CUP, provided a transfer of dwelling units pursuant to Specific Plan Section 3.5, paragraph 3 has been submitted to the County. (2) Maximum living area of a Second Unit shall not exceed 800 square feet on Low-Residential lots. (3) Second Units shall meet main building setbacks, standard height limits, lot coverage, floor area ratio, and other applicable requirements for the Low-Residential land use designation. (4) Second Units must be on the same lot as the primary residence; and cannot be subdivided or sold. Second Units may contain kitchen facilities. (5) The total number of Second Units shall not exceed the maximum Second Units for a given Planning Area, as set by the Annotated Land Use Plan Statistical Table, Specific Plan Table 5.4-1.	Landmark Village Tract Map 53108 has no Second Units, and as a result, this objective does not apply to this project.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
IV. ADJUSTMENT/TRANSFER/CONVERSIONS	
D. Affordable Housing Program	
Objective No. 1:	
The Newhall Ranch Affordable Housing Program provides for the direct inclusion of very low, low, and moderate income affordable housing opportunities (as defined in Specific Plan) within the Specific Plan Area.	The Landmark community will contain 296 affordable homes located within the development. There will be two affordable programs within this community, moderate-income for-sale homes, and very-low income senior rentals.
Objective No. 2:	
The Newhall Ranch Affordable Housing Program provides very low, low and moderate-income affordable housing opportunities in several housing categories including for-sale units and rental units. While affordable units may be located within any planning area, which allows for residential development, it is anticipated that most units will be located within the land use designations Medium Residential (M), High Residential (H) and Mixed Use (MU). These categories allow for higher-intensity residential uses associated with housing types that can provide sales and rental rates that lower income households can afford. This allows Affordable Housing opportunities to be dispersed throughout the community and within convenient proximity to employment and retail centers.	The Landmark community will contain 296 affordable homes located within the development. There will be two affordable programs within this community, moderate-income for-sale homes, and very-low income senior rentals. These homes will be located with access to transportation services and Highway 126 and proximity to an elementary school, park, and commercial services.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
IV. ADJUSTMENT/TRANSFER/CONVERSIONS	
D. Affordable Housing Program	
Objective No. 3:	
Affordable Housing Units shall be designated and made available at rental rates or sales prices as required in Specific Plan Section 3.10, paragraph 3, Implementation of Affordable Housing Program.	Please see Objective No. 1, this section.
Objective No. 4:	
The following Affordable Housing categories shall be allowed under the Newhall Ranch Affordable Housing Program: (1) Rental units; (2) For-sale units; and (3) Any units supported by state, local, or private affordable housing programs. Nothing set forth in Specific Plan Section 3.10 shall preclude the use of any affordable housing assistance from any sources, private, public or non-profit, for achieving the Affordable Housing Unit Requirement, provided additional Affordable Housing Units in excess of those set forth in Section 3.10, paragraph 2a are also provided in conjunction with the affordable housing assistance.	The Landmark community will contain 296 affordable homes located within the development. There will be two affordable programs within this community, moderate-income for-sale homes, and very-low income senior rentals. Any units supported by state, local, or private affordable housing programs. Nothing set forth in Specific Plan Section 3.10 shall preclude the use of any affordable housing assistance from any sources, private, public or non-profit, for achieving the Affordable Housing Unit Requirement, provided additional Affordable Housing Units in excess of those set forth in Section 3.10, paragraph 2a of the approved Specific Plan are also provided in conjunction with the affordable housing assistance.
Objective No. 5:	
Affordable Housing Units as defined in the Specific Plan may be located within any area designated Low-Medium Residential (LM), Medium Residential (M), High Residential (H) or Mixed-Use (MU) on the Newhall Ranch Land Use Plan, Specific Plan Exhibit 2.3-1.	There will be two affordable programs within this community, moderate-income for-sale homes, and very-low income senior rentals. These homes will be located with access to transportation services and Highway 126 and proximity to an elementary school, park, and commercial services.
Objective No. 6:	
A monitoring program and Affordable Housing Phasing Increments shall be established as set forth in Specific Plan Section 3.10 to provide Very Low, Low Income (65 percent), Low Income (80 percent), and Moderate Income Affordable Housing Units along with the construction of total residential development within the Specific Plan area. The monitoring program shall be initiated when the Newhall Ranch Tentative Tract Map that includes the 5,000th planned residential unit is submitted to Los Angeles County.	The monitoring program will be initiated when the Newhall Ranch Tentative Tract Map that includes the 5,000th planned residential unit is submitted to Los Angeles County.
Objective No. 7:	
Following the first Affordable Housing Report, Annual Affordable Housing Reports shall be submitted to Los Angeles County Department of Regional Planning and CDC on an annual basis no later than March 1 covering the Affordable Housing Program through December 31 of the previous year until such time as it is demonstrated that the Affordable Housing Unit Requirement set forth in Specific Plan Section 3.10, paragraph 2a has been achieved.	Following the first Affordable Housing Report, Annual Affordable Housing Reports will be submitted to Los Angeles County Department of Regional Planning and CDC on an annual basis no later than March 1 covering the Affordable Housing Program through December 31 of the previous year until such time as it is demonstrated that the Affordable Housing Unit Requirement set forth in Specific Plan Section 3.10, paragraph 2a has been achieved.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
A. Sign Regulations	
Objective No. 1:	
Sign regulations are intended to promote and protect the public health, safety and welfare by regulating proposed signs of all types within Newhall Ranch in order to assure that they are: (1) Legible in the circumstances in which they are seen; (2) Compatible with their surroundings and aesthetically attractive; (3) Appropriate to the type of activity to which they pertain; and (4) Expressive of the identity of individual properties, villages or of the community as a whole. All signage within the Specific Plan Area shall be subject to the General Provisions in Specific Plan Section 3.6, paragraph 3 and the Sign Standards set forth in Specific Plan Section 3.6, paragraph 5 and the non-conflicting provisions of LACPZC Section 22.52, part 10. As an alternative to the Sign Standards in Specific Plan Section 3.6, paragraph 5, individual projects (ranging from individual buildings to centers, and Villages) may elect to develop unique individual Sign Programs subject to the provisions set forth in Specific Plan Section 3.6, paragraph 4.	Design Guidelines are being prepared for Landmark Village Tract Map 53108. A unique individual Sign Program will be detailed for Landmark Village. These guidelines will specify that all signs will be: (1) Legible in the circumstances in which they are seen; (2) Compatible with their surroundings and aesthetically attractive; (3) Appropriate to the type of activity to which they pertain; and (4) Expressive of the identity of individual properties, villages or of the community as a whole. In addition, the Landmark Village Sign Program will meet the provisions set forth in Specific Plan Section 3.6, paragraph 4.

OBJECTIVE	IMPLENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
B. Parking	
Objective No. 1:	
The parking regulations govern motor vehicle parking within the Specific Plan Area. They provide parking facilities of sufficient capacity to discourage traffic congestion and provide safe and convenient facilities for motorists and pedestrians. They also establish regulations for the preparation of a Parking Program to provide an alternative to standard parking requirements enabling joint-use or shared parking solutions. Except as otherwise specified in the Specific Plan, parking requirements for the Specific Plan Area shall be in accordance with Los Angeles County Planning and Zoning Code (LACPZC) Section 22.52.1000.	Landmark Village Tract Map 53108 parking facilities will be consistent with Los Angeles County Planning and Zoning Code (LACPZC) Section 22.52.1000. For example, the Elementary School is integrated with the active sports fields of the Landmark Village Community Park to facilitate shared play area and parking opportunities. To maximize safety for students, traffic calming components such as traffic circles, landscape parking bays, and innovatively designed crossing points have been incorporated into the street design.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
C. Home Occupations	
Objective No. 1:	
Home occupations are permitted as an accessory use within all Residential and Mixed-Use land use designations (see Specific Plan Table 3.4-3), subject to all of the regulations provided in Specific Plan Section 3.8.	Landmark Village Tract Map 53108 allows home occupations as an accessory use within all Residential and Mixed-Use land use designations, subject to all of the regulations provided in Specific Plan Section 3.8.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
D. Design Themes	
Objective No. 1:	
Newhall Ranch will not have a single design theme. A variety of architectural, landscape and other theme elements should be employed in order to create diversity and interest.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village Tract Map 53108 is designed as a traditional small town, creating neighborhoods with an eclectic mix of styles and building forms enhanced by thematic landscaping, which will allow a greater sense of individuality for each of the homes and the community as a whole.
Objective No. 2:	
Consideration should be given to strengthening Village identity through the use of landscape palettes, landmark buildings, signage, and other such elements.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The landscape at Landmark Village is inspired by its proximity to the Santa Clara River. California Sycamore, Western Cottonwood, and Alder are a few of the native river species that will form the framework of the Landmark Village landscape. The neighborhoods within this normal planting of Cottonwood and Sycamore are defined by regular plantings of canopy shade trees along narrow local streets. The Landmark Village landscape is comprised of four primary zones; the River Slope, Highway Edge, Park, and Street Landscapes. Drainage and Stormwater management is an important consideration within each of these areas. The character of Landmark Village is, thus, shaped and influenced by the kinds of landscape that inhabit water-born and riverine environments.
Objective No. 3:	
Major natural features should be protected and incorporated into the overall design theme of development areas.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village Tract Map 53108 features the Landmark Village Open Space System, which incorporates the natural landscape and beauty of the Santa Clara River into its design theme. Located at the heart of the community, Landmark Village Community Park is an extensive series of grassy meadows overlooking the Santa Clara River, forming a visual, seamless transition from river to neighborhood. Dense stands of Western Cottonwood and Sycamore and an open lawn accommodating soccer and other organized activities, give way to an expansive meadow of native grasses doubling as an informal play and rainfall detention area. Small children's play areas are 'carved out' of the perimeter tree groves, with seating, picnic, restroom facilities, and an office. The River Slope adjacent to the Santa Clara River is a naturalized bluff-top linear park matching and enhancing the adjacent reverine landscape. The river edge is comprised of a variable 3:1 to 4:1 slope, forming a smooth transition from development edge to river bottom. A 12' multi-use trail runs 10' back of the top edge of the slope, through informal clumps of native Cottonwood, Sycamore, and Alder. These trees provide partial screening for the adjacent residential units, while framing views and providing shade for pedestrians. Large, simple plantings of native clumping grasses (Muhlengbergia rigens, Carex tumilicola) fill the groundplane and shallow detention areas along the path. Downslope transitions to native fescues, sage (Artemisia), Beavertail Cactus, and Arroyo Will. An 8' equestrian trail meanders along this slope face.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
E. View Considerations	
Objective No. 1:	
The siting and design of structures should consider the impact on valuable and sensitive views from all residences or public areas within the Specific Plan Area.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village Tract Map 53108 has implemented the original conceptual viewshed analysis of the Specific Plan.
Objective No. 2:	
Intermittent view opportunities to the Open Area and SMAs should be established along ridges and bluff edges within development areas.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The community has been designed to allow for a view opportunity through the community park area into the river habitat and bluffs beyond. Above the landscape and sound attenuation walls, views of the river corridor bluffs and the major ridgeline of the High Country will remain visible. A section of SR-126 will be at an elevated grade so that partial views of the river corridor, over the development, will be possible.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
F. State Route 126 (SR-126)	
Objective No. 1:	
Where the elevations of buildings will obstruct the views from SR-126 to the south, the location and configuration of individual buildings, driveways, parking, streets, signs and pathways shall be designed to provide view corridors of the river, bluffs and the ridge lines south of the river. Those view corridors may be perpendicular to SR-126 or oblique to it in order to provide for views of passengers within moving vehicles on SR-126.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The major viewshed impact of Landmark Village will be the sound attenuation landscape and structures added to the SR-126 corridor. A conceptual plan has been prepared for the sound attenuation necessary to protect residences from the impacts of traffic noise. Above the landscape and sound attenuation walls, views of the river corridor bluffs and the major ridgelines of the High Country will remain visible. A section of SR-126 will be at an elevated grade so that partial views of the river corridor, over the development, will be possible.
Objective No. 2:	
The Community Park between SR-126 and the Santa Clara River shall be designed to promote views from SR-126 of the river, bluffs and ridge lines to the south of the river.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The community has been designed to allow for a view opportunity through the community park area into the river habitat and bluffs beyond.
Objective No. 3:	
Residential Site Planning Guidelines set forth in Specific Plan Section 4.3.1 and Residential and Architectural Guidelines set forth in Specific Plan Section 4.4.1 shall be employed to ensure that the views from SR-126 are aesthetically pleasing and that views of the river, bluffs and ridge lines south of the river are preserved to the extent practicable.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. A section of SR-126 will be at an elevated grade so that partial views of the river corridor, over the development, will be possible. Sound attenuation walls will be a factor but to a lesser extent than a grade condition. Above the landscape and sound attenuation walls, views of the river corridor bluffs and the major ridgelines of the High Country will remain visible.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
F. State Route 126 (SR-126)	
Objective No. 4:	
Mixed-Use and the Commercial site Planning Guidelines set forth in Specific Plan Section 4.3.2 and Architectural Guidelines set forth in Specific Plan Section 4.4.2 shall be incorporated to the extent practicable in the design of the Riverwood Village Mixed-Use and Commercial land use designations to ensure that the views from SR-126 are aesthetically pleasing and to preserve views of the river, bluffs and ridge lines south of the river.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. A section of SR-126 will be at an elevated grade so that partial views of the river corridor, over the development, will be possible. Sound attenuation walls will be a factor but to a lesser extent than a grade condition. Above the landscape and sound attenuation walls, views of the river corridor bluffs and the major ridgelines of the High Country will remain visible.
Objective No. 5:	
Landscape improvements along SR-126 shall incorporate the Landscape Design Guidelines, set forth in Specific Plan Section 4.6 in order to ensure that the views from SR-126 are aesthetically pleasing and to preserve views of the river, bluffs and ridge lines south of the river.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Much of the current SR-126/Santa Clara River viewshed will remain unaltered. The areas flanking Landmark Village will maintain their views from the highway of River Corridor vegetation. The community has been designed to allow for a view opportunity through the community park area into the river habitat and bluffs beyond.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 1. Residential (a) General Guidelines	
Objective No. 1:	
Residential streets should be designed to direct traffic to the highway system as directly as possible. Circuitous street patterns and very long residential streets should be avoided.	The Landmark Village Tract Map 53108 Circulation Plan implements the Mobility Objectives to the greatest degree possible and remains consistent with the requirements and intent of the Specific Plan. In most cases, minor modifications to the street sections set forth in the Specific Plan and/or the Los Angeles County Subdivision Code are proposed in order to "establish a diverse system of pedestrian and bicycle trails, segregated from vehicle traffic, to serve as an alternative to automobile use". The Entry Roads to Landmark Village and the Village Quad Parkway represent specialized street category solutions at a level of detail not set forth in the more general Specific Plan. They are, however, consistent with the General Plan and Specific Plan goals to make the community more pedestrian friendly and aesthetically pleasing. Substantial Conformance is attained consistent with Specific Plan Section 5.2 paragraph 2(9).
Objective No. 2:	
Multi-family homes should be located in or near the Village Centers.	Attached residential housing in Landmark Village Tract Map 53018 is located near the Village Quad and Village Center.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 1. Residential (a) General Guidelines	
Objective No. 3:	
Design solutions for residential street layouts should consider landform, grades, and circulation hierarchy, and employ appropriate street configurations.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village Tract Map 53108 is designed as a traditional small town, creating neighborhoods with an eclectic mix of styles and building forms enhanced by thematic landscaping, which will allow a greater sense of individuality for each of the homes and the community as a whole. The Landmark Village Circulation Plan implements the Mobility Objectives to the greatest degree possible and remains consistent with the requirements and intent of the Specific Plan. In most cases, minor modifications to the street sections set forth in the Specific Plan and/or the Los Angeles County Subdivision Code are proposed in order to "establish a diverse system of pedestrian and bicycle trails, segregated from vehicle traffic, to serve as an alternative to automobile use." The character and scale of Landmark Village street system creates a pedestrian-oriented community. Graced by generous parkways and medians, Landmark Village contains ample landscape setbacks that make it function and 'feel' like true neighborhood parkways, reflective of the adjacent Santa Clara River. Many streets are shaded by large informal stands of riparian canopy trees, including indigenous river habitat species like California Sycamore and Alders.
Objective No. 4:	
Structures should not dominate the landform as seen from lower elevations; creative siting, design and landscaping solutions should be utilized to blend structures into the terrain, to the extent possible, and to soften their silhouette.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village Tract Map 53108 is designed as a traditional small town, creating neighborhoods with an eclectic mix of styles and building forms enhanced by thematic landscaping, which will allow a greater sense of individuality for each of the homes and the community as a whole. To protect and buffer the residential neighborhoods of Landmark Village from SR-126 highway noise, a sound attenuation wall will be necessary. The wall will be located within the California Department of Transportation right-of-way, as close as possible to the noise source. For undulating grade and land use conditions, it will be necessary for the sound attenuation wall to vary in height. The wall height variations will also serve to break up the plane of the wall and add interest.
Objective No. 5:	
Pedestrian and vehicular circulation should be designed to create a consistent community image of landscaped corridors.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village Tract Map 53108 is designed as a traditional small town, creating neighborhoods with an eclectic mix of styles and building forms enhanced by thematic landscaping, which will allow a greater sense of individuality for each of the homes and the community as a whole. The character and scale of the Landmark Village Tract Map 53108 street system creates a pedestrian-oriented community. The system includes generous parkways, medians and ample landscape setbacks, that allow Landmark Village's street system to function and 'feel' like true neighborhood parkways, reflective of the adjacent Santa Clara River. Many streets are shaded by large informal stands of riparian canopy trees, including indigenous river habitat species like California Sycamore and Alders.
Objective No. 6:	
Entries to major residential developments should be visually reinforced through techniques such as broader setbacks, landscape treatments, monument signage, and/or pavement details.	Connecting the East and West Villages, Landmark Village Drive is the main road by which all residents access their homes, parks, village center, neighborhood school, and community facilities. Graced by generous parkways and a median, Landmark Village Drive contains ample setbacks that make it function and 'feel' like a true neighborhood parkway.
Objective No. 7:	
Where development adjoins Open Area or SMAs, intermittent view corridors should be provided.	A section of SR-126 will be raised so that partial views of the River Corridor are possible. The community has also been designed to allow for a view opportunity through the community park area into the River habitat and bluffs beyond.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 1. Residential (b) Estates	
Objective No. 1:	
Estate homes should be sited to conserve natural landforms when possible. This includes accessory structures such as barns, tennis courts, and guest houses.	There are no estates within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 2:	
Higher elevation Estate areas should be sited and designed to capture view opportunities but harmonize with the natural surroundings when viewed from lower elevations.	There are no estates within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 3:	
Buildings should be sited and designed to minimize disturbance to significant natural resources.	There are no estates within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 4:	
Exterior radio, television, or other type of antennas and satellite reception disks should be sited or screened so as to reduce visual impact.	There are no estates within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 5:	
Tennis and other play courts should meet the following criteria: • Courts should be situated so that fencing and lighting fixtures do not unreasonably impair views from, or otherwise inappropriately impact, adjacent dwellings; and • These should also be built to blend with the natural terrain to the extent possible.	There are no estates within Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 1. Residential (c) Single-Family Detached/Attached	
Objective No. 1:	
Varying house configurations on corner lots is encouraged to promote variety in the street scene and, in the interest of safety, to provide adequate sight distance at intersections.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village is designed to provide an eclectic mix of housing types. The residential neighborhoods will contain a range of single-family and attached homes incorporating many of the traditional neighborhood design principles shown in the Landmark Village Planning Notebook. Home configurations on corner lots are varied consistent with this objective.
Objective No. 2:	
A combination of side-entering and front-entering garages and varied driveway locations are encouraged to break-up repetitive curb cuts and yard patterns.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. A variety of garage configurations are used in Landmark Village Tract Map 53108, including recessed and alley-loaded.
Objective No. 3:	
Common area fencing, walls, gates, and other security features should be sited to accommodate access to pedestrian walkways.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Common area fencing, walls, gates, and other security features are sited to accommodate access to pedestrian walkways.
Objective No. 4:	
Neighborhoods bordering Open Areas should be sited to optimize views, but discourage access into the Open Areas except via established pedestrian trails.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village neighborhoods bordering Open Areas are sited to optimize views, but discourage access into the Open Areas except via established pedestrian trails.
Objective No. 5:	
Cul-de-sacs are encouraged to improve neighborhood safety and character.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. In lieu of traditional cul-de-sacs the Landmark Village street sections include the use of traffic calming features, which will improve neighborhood safety and character.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 1. Residential (d) Multi-Family	
Objective No. 1:	
Improve the quality of the "front yard" streetscape by minimizing curb cuts and driveway aprons.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village's attached homes will be designed so as to resemble traditional urban row houses. These homes will face and are entered from the local neighborhood street. Parking is removed from the front of the structures to promote social interaction.
Objective No. 2:	
Cul-de-sacs are encouraged to improve neighborhood safety and character.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. In lieu of traditional cul-de-sacs, the Landmark Village street sections include the use of traffic calming features, which will improve neighborhood safety and character.
Objective No. 3:	
Buildings should be staggered to create interest in both architectural facades and in adjoining streetscape.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village's attached homes will be designed so as to resemble traditional urban row houses. These homes will face and are entered from the local neighborhood street. Street fronts will be varied to create interest.
Objective No. 4:	
Carports and garages may be detached, but should be clustered in parking "courts" which are removed and/or suitably screened from public thoroughfares.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Parking "courts" are removed and/or suitably screened from public thoroughfares.
Objective No. 5:	
Guest parking should be conveniently accessible.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Guest parking is conveniently accessible.
Objective No. 6:	
Parking areas should be screened through the use of berms, landscaping, "headlight" walls, or a combination of these.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Parking areas are screened through the use of berms, landscaping, "headlight" walls, or a combination of these.
Objective No. 7:	
Walkways should be provided within multi-family neighborhoods.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Walkways are provided within multi-family neighborhoods and are connected to the Master Trails Plan of Landmark Village creating a 'walkable' environment.
Objective No. 8:	
Neighborhoods bordering Open Area and/or SMAs should be sited to optimize views, but discourage access into the Open Area except via established pedestrian trails.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Because multi-family units do not border Open Areas or SMAs, this objective is not applicable to the project.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 1. Residential (d) Multi-Family	
Objective No. 9:	
Recreation areas/greenbelt features should be visible upon entry to neighborhoods to enhance neighborhood value.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The community has been designed to allow for view opportunities into the river habitat, the bluffs beyond, and the major ridgeline of the High Country.
Objective No. 10:	
Avoid long linear stretches of parking. Maximum use of parking courts is encouraged.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Mixed-use areas and multi-family Residential areas incorporate parking courts into their design.
Objective No. 11:	
Individual multi-family buildings should be separated sufficiently to provide a visual break and accommodate walks and other circulation elements.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Walkways are provided within multi-family neighborhoods and are connected to the Master Trails Plan of Landmark Village creating a 'walkable' environment.
Objective No. 12:	
All service areas should be screened from view from adjacent streets and land uses.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. All service areas will be screened from view from adjacent streets and land uses.

OBJECTIVE	IMPLENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 1. Residential (e) Gated Communities	
Objective No. 1:	
Gated Communities should contain the following features: • Separate access lanes for residents and guests, when feasible; • Provide turnaround capacity in front of the control entry gate; • Separate pedestrian entry from the vehicular access gate; • Provide adequate stacking distance for cars waiting for admittance at entry gate; and • Provide clear, visible signage to accommodate residents, service deliveries, and guests.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. As required by the Specific Plan, gated communities will contain the following features: • Separate access lanes for residents and guests, when feasible; • Provide turnaround capacity in front of the control entry gate; • Separate pedestrian entry from the vehicular access gate; • Provide adequate stacking distance for cars waiting for admittance at entry gate; and • Provide clear, visible signage to accommodate residents, service deliveries, and guests.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 2. Mixed-Use/Commercial/Public Facilities	
Objective No. 1:	
Prominent buildings should be sited in key landmark locations and easily accessible.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that Landmark Village Tract Map 53108 incorporates many of the principles of Traditional Neighborhood design. The Village Quad in Landmark Village Tract Map 53108 unites various components of the community, with its formal clustering of buildings around courtyards, and its connection to the river's edge.
Objective No. 2:	
Service areas should be effectively screened.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that service areas will be effectively screened.
Objective No. 3:	
Outdoor space should be designed to create a pedestrian experience, which is visually stimulating, and one, which includes activities that create a sense of variety and excitement.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that outdoor space is designed to create a pedestrian experience, which is visually stimulating, and one, which includes activities that create a sense of variety and excitement as, exemplified in both the Village Quad and the Village Center.
Objective No. 4:	
Pedestrian access routes between adjacent uses should be incorporated into the commercial site design, where feasible.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The Landmark Village Tract Map 53108 Circulation System features a formal vehicular and pedestrian network of streets, traffic circles, courtyards, and paseos, which connect the various components of the community.
Objective No. 5:	
Mixed-Use land use areas should be master planned to the maximum extent feasible. Individual uses should be integrated to provide functional and cohesive relationships.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that Landmark Village Tract Map 53108 incorporates many of the principles of Traditional Neighborhood design. The Village Quad in Landmark Village Tract Map 53108 unites various components of the community, with its formal clustering of buildings around courtyards, and its connection to the river's edge. Its uses will include an interrelated complex of multi-family, commercial, office, and life-long education facilities, connected by a formal vehicular and pedestrian network of streets, traffic circles, courtyards, and paseos.
Objective No. 6:	
Pedestrian spaces should be provided by creating plazas, courtyards, and promenades.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that Landmark Village Tract Map 53108 incorporates many of the principles of Traditional Neighborhood design. The Village Quad in Landmark Village Tract Map 53108 will unite various components of the community, with its formal clustering of buildings around courtyards, and its connection to the river's edge.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 2. Mixed-Use/Commercial/Public Facilities	
Objective No. 7:	
Parking should be oriented to permit pedestrian flow without having to cross numerous traffic aisles.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that parking be oriented to permit pedestrian flow without having to cross numerous traffic aisles. Parallel street parking and medians will help to reduce traffic speeds, thereby increasing pedestrian safety.
Objective No. 8:	
Parking areas should be screened through the use of berms, landscaping, "headlight" walls, or a combination of these.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that parking areas are screened through the use of berms, landscaping, "headlight" walls, or a combination of these.
Objective No. 9:	
Pedestrian courts are encouraged.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Pedestrian courts are incorporated in both the Village Quad and the Village Center.
Objective No. 10:	
Within the Mixed-Use land use designation, commercial and office buildings should be clustered around central gathering places such as plazas.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The Village Quad in Landmark Village Tract Map 53108 unites various components of the community, with its formal clustering of buildings around courtyards, and its connection to the river's edge.
Objective No. 11:	
Within the Mixed-Use land use designation the shared use of service areas, parking, access, etc., should be integrated into the design.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify how shared use of service areas, parking, access, etc., will be integrated into the design of the mixed-use areas.
Objective No. 12:	
Public entrances to buildings should be visible from entry streets as much as possible.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that Landmark Village Tract Map 53108 incorporates many of the principles of Traditional Neighborhood design. The Village Quad in Landmark Village Tract Map 53108 unites various components of the community, with its formal clustering of buildings around courtyards.
Objective No. 13:	
When rear or side building facades are adjacent to different land uses, employ one or more techniques such as landscaping, berms, walls or variable setbacks to avoid visibility of extensive unbroken wall planes.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that when rear or side building facades are adjacent to different land uses, one or more techniques, such as landscaping, berms, walls or variable setbacks, be used to avoid visibility of extensive unbroken wall planes.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 2. Mixed-Use/Commercial/Public Facilities	
Objective No. 14:	
Pedestrian access to adjacent uses is encouraged.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The Landmark Village Mobility Plan ensures that pedestrian access to adjacent uses is provided.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 3. Business Park	
Objective No. 1:	
Site designs should minimize view impacts.	There is no Business Park use in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 2:	
Trash areas should be enclosed with a minimum six (6) foot high masonry wall and located away from public streets.	There is no Business Park use in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 3:	
Within the Business Park in Chiquito Canyon (Planning Area RW-24), roof equipment shall be screened from view from public streets.	There is no Business Park use in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 4:	
Parking areas should be screened through the use of berms, landscaping, "headlight" walls, or a combination of these.	There is no Business Park use in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 5:	
Truck parking should not be located on the street side of any site.	There is no Business Park use in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 6:	
Outside storage areas and/or equipment yards should be screened with walls.	There is no Business Park use in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 7:	
Outside storage should not be located on the street side of any site.	There is no Business Park use in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 4. Parks/Open Area	
Objective No. 1:	
Neighborhood Parks should be located within residential areas and adjacent to schools where feasible.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The Elementary School is integrated with the Landmark Village Community Park to facilitate shared play area and parking, as well as passive interaction with the river. The school and park are centrally located to optimize pedestrian access.
Objective No. 2:	
Streambeds and other large natural features should be incorporated as neighborhood focal points.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The Landmark Village Trails Plan provides specific access points to off project regional trail systems, as well as locations for observation/interpretive points. The Landmark Village design utilizes the River corridor as a focal point of the community.
Objective No. 3:	
Pedestrian circulation systems should link recreation and Open Areas with development.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The Landmark Village Trails Plan fulfills the intent of the Specific Plan and ensures that each residence and all community service areas are linked via a practical, aesthetically pleasing pedestrian trail system.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
G. Site Planning – 5. Visitor-Serving	
Objective No. 1:	
The design of the Visitor-Serving Center shall be sensitive to and integrated into the natural setting of the High Country Special Management Area.	The Visitor-Serving area is not located in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 2:	
Special landscape and siting techniques should be used to make all structures within the Visitor-Serving land use designation fit the natural resource surroundings.	The Visitor-Serving area is not located in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
H. Architecture – 1. Residential	
Objective No. 1:	
A diversity of architectural styles is encouraged to enhance the character of the community.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The homes in Landmark Village Tract Map 53108 are an eclectic mix of styles and building forms, creating a greater sense of individuality for each of the homes and the community as a whole.
Objective No. 2:	
Use of roof overhangs to enhance energy conservation is encouraged.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that use of roof overhangs to enhance energy conservation is encouraged.
Objective No. 3:	
Roof equipment should be screened from view from public streets.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that roof equipment will be screened from view from public streets.
Objective No. 4:	
All utility and service areas should be treated (i.e., color, landscaping, screening) to minimize visual impact.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that all utility and service areas will be treated (i.e., color, landscaping, screening) to minimize visual impact.
Objective No. 5:	
The architecture of ancillary structures (guesthouses, cabanas, barns, storage sheds, etc.) should be compatible with the main structure through the corporation of compatible materials and colors into the design of building walls, roofs, trellises, fence/wall connections, and/or landscaping components.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that the architecture of ancillary structures (guesthouses, cabanas, barns, storage sheds, etc.) will be compatible with the main structure through the corporation of compatible materials and colors into the design of building walls, roofs, trellises, fence/wall connections, and/or landscaping components.
Objective No. 6:	
Integrate separate carport structures with materials used in architectural palette and theme walls.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan . These guidelines will specify that separate carport structures with materials used in architectural palette and theme walls will be integrated.
Objective No. 7:	
Variations in height within and among buildings is encourages to create visual interest and avoid a monotonous streetscene.	Landmark Village Design Guidelines are being prepared. The Guidelines will result in requirements that vary building heights and configuration to ensure a vibrant street scene.
Objective No. 8:	
Siting variations in building facades, articulation, height, mass, and scale is encouraged to create and enhance architectural interest.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that siting variations in building facades, articulation, height, mass, and scale be encouraged to create and enhance architectural interest.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
H. Architecture – 1. Residential	
Objective No. 9:	
Landscaping and architecture should be designed to minimize garage impact on street scenes in narrow lot product types.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. Landmark Village Tract Map 53108 de-emphasizes the impact of the garage by recessing it in relationship to the house, or locating it on the rear of the lot. The garage will be accessed either by ribbon driveways from the street or by rear alleys.
Objective No. 10:	
Rear or side elevations of residential units should be enhanced with architectural treatments and/or landscaping where visible from streets, parking areas, Open Areas, etc.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that rear or side elevations of residential units will be enhanced with architectural treatments and/or landscaping where visible from streets, parking areas, Open Areas, etc.
Objective No. 11:	
Elements such as stairways should be architecturally compatible and integrated into buildings.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that elements such as stairways be architecturally compatible and integrated into buildings.
Objective No. 12:	
Reversing floor plans to minimize repetition is encouraged.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. A variety of floor plans and the reversing of floor plans will be used to increase the sense of individuality of each home.
Objective No. 13:	
Roof equipment should be screened from public view.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that roof equipment should be screened from public view.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
H. Architecture – 2. Mixed-Use/Commercial/Public Facilities	
Objective No. 1:	
The design of public facilities such as police, fire, recreation facilities, and schools should be compatible with the surrounding neighborhood.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The scale and styles of public facilities will reflect the Traditional Neighborhood design of Landmark Village and will be similar to the residential areas, creating a greater sense of shared community throughout Landmark Village.
Objective No. 2:	
Overhangs, trellises, and other architectural elements should be incorporated into the design of retail buildings where feasible, to protect pedestrians from exposure to climatic conditions.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that overhangs, trellises, and other architectural elements be incorporated into the design of retail buildings where feasible, to protect pedestrians from exposure to climatic conditions.
Objective No. 3:	
Each Mixed-Use land use area should include a significant architectural, landscape or other special design feature.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The Village Quad, which will serve as the visual introduction to Landmark Village,. will unite various components of the community with its formal landscaping and clustering of buildings around courtyards. The Village Center will continue this unique nature of Landmark Village's design and landscaping.
Objective No. 4:	
Signage and lighting should be included as an integral element of buildings.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that signage and lighting be included as an integral element of buildings.
Objective No. 5:	
Architectural detailing should be used in Mixed-Use developments to assist in creating a design theme.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The scale and styles of public facilities will reflect the Traditional Neighborhood design of Landmark Village and will be similar to the residential areas, creating a greater sense of shared community throughout Landmark Village.
Objective No. 6:	
The use of energy conservation measures such as roof overhangs for sun protection of glass areas, low energy outdoor lighting, and passive solar systems should be used, where practical.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that the use of energy conservation measures such as roof overhangs for sun protection of glass areas, low energy outdoor lighting, and passive solar systems be encouraged.
Objective No. 7:	
Roofs or soffits should be sloped to minimize building scale.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that roofs or soffits should be sloped to minimize building scale.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
H. Architecture – 2. Mixed-Use/Commercial/Public Facilities	
Objective No. 8:	
Multi-storied buildings should relate to the pedestrian. Ground-story front facades should be designed to strengthen a pedestrian scale. Pedestrian scale along streets should also be established through the use of pedestrian arcades and awnings that add horizontal articulation to facades.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The Village Center will continue the unique nature of Landmark Village established in the Village Quad to emphasize the people scaled, pedestrian-friendly characteristics of Traditional Neighborhood design. Framed by a mix of uses, all residential and retail buildings along the drive will have a strong orientation to the street, providing a variety of pedestrian-friendly architectural facades.
Objective No. 9:	
Architectural elements that are discouraged include: • Highly reflective surfaces; • Large blank walls; • Split-face block; • Exposed concrete block; • Metal siding; and • Plastic siding.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will discourage the following architectural elements: • Highly reflective surfaces; • Large blank walls; • Split-face block; • Exposed concrete block; • Metal siding; and • Plastic siding.
Objective No. 10:	
Roof equipment should be screened from view from public streets.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that roof equipment should be screened from view from public streets.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
I. Fencing – 1. General Guidelines	
Objective No. 1:	
Fencing should be compatible with the architectural theme and character of the neighborhood or development project.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. View fencing and sound attenuation walls are being designed, accented by pilasters, to integrate with the Landmark Village community Traditional Neighborhood design.
Objective No. 2:	
A fencing system should be developed that produces aesthetically-pleasing divisions between uses.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that the fencing system have aesthetically-pleasing divisions between uses.
Objective No. 3:	
Fencing should be consistent in style.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that fencing should be consistent in style.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
I. Fencing – 2. Residential	
Objective No. 1:	
Fencing and walls should be designed to reflect the architectural character of the individual home or neighborhood.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. View fencing and sound attenuation walls are being designed, accented by pilasters, to integrate with the Landmark Village community Traditional Neighborhood design.
Objective No. 2:	
Finish colors and materials should integrate with the colors and materials of the individual home or neighborhood.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that finish colors and materials integrate with the colors and materials of the individual home or neighborhood.
Objective No. 3:	
Walls constructed parallel to the front face of the house should be stepped back to articulate the front elevation.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that walls constructed parallel to the front face of the house be stepped back to articulate the front elevation.

OBJECTIVE	IMPLEMENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
I. Fencing – 2. Residential	
Objective No. 4:	
All fencing and walls of extended length should have posts and/or pilasters to provide for: a. transition breaks between fencing and walls; b. change of over twelve inches (12") in the heights of walls; c. awkward corners and intersections of forty-five (45) degrees and greater; and d. transitions between fencing materials.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. View fencing and sound attenuation walls are being designed, accented by pilasters, to integrate with the Landmark Village community Traditional Neighborhood design. These guidelines will specify that the pilasters and/or posts be used to provide for: a. transition breaks between fencing and walls; b. change of over twelve inches (12") in the heights of walls; c. awkward corners and intersections of forty-five (45) degrees and greater; and d. transitions between fencing materials.
Objective No. 5:	
Wall and fencing material should not be reflective. If a glass panel is used, it should be polarized or treated with anti-reflective coating and bright colors should be avoided.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that wall and fencing material not be reflective. If a glass panel is used, it will be polarized or treated with anti-reflective coating and bright colors will be avoided.

OBJECTIVE	IMPLENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
I. Fencing – 3. Mixed-Use/Commercial/Business Park/Public Facilities	
Objective No. 1:	
Walls should be designed as an integral part of the overall site design. They should be constructed with materials that are complementary to the style of adjacent buildings and incorporate the same finishes and colors.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The Landscape Architect's study for sound attenuation walls is based on actual grade conditions. They will provide the necessary sound attenuation protection to Landmark Village residents, while at the same time minimizing the impact of the walls with landscaping and earth tone materials. For other walls in the project, these guidelines shall specify that walls be designed as an integral part of the overall site design, be constructed of materials that complement the style of adjacent buildings, and incorporate the same finishes and colors.
Objective No. 2:	
Walls should be used to lengthen the horizontal elements of elevations and reduce visual impacts where possible.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that walls be used to lengthen the horizontal elements of elevations and reduce visual impacts where possible. In addition, consistent with commitments made at the Los Angeles County Planning Commission approval of the Specific Plan, a view corridor of the Community Park and River Corridor has been preserved.
Objective No. 3:	
Wall or fencing sections should be horizontally offset at regular intervals to provide visual relief and landscape opportunities.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that wall or fencing sections be horizontally offset at regular intervals to provide visual relief and landscape opportunities.
Objective No. 4:	
Wall or fencing should not be installed immediately in back of a sidewalk or other hardscape, without intervening landscaping.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that wall or fencing not be installed immediately in back of a sidewalk or other hardscape, without intervening landscaping.
Objective No. 5:	
Thinly applied stucco walls are discouraged.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that thinly applied stucco walls are discouraged.
Objective No. 6:	
Corrugated metal walls are discouraged.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that corrugated metal walls are discouraged.
Objective No. 7:	
Walls between the landscape setback area and building frontages should not exceed a height of 3 feet.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that walls between the landscape setback area and building frontages will not exceed a height of 3 feet.

OBJECTIVE	IMPLENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
J. Landscape Design – 1. General Guidelines	
Objective No. 1:	
Landscape concept plans should include a palette rich in drought-tolerant and native plants including highlights of ornamentals for accents, area identification, etc. The use of drought-tolerant plant materials is highly encouraged.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan, including a landscape concept plan. These guidelines shall specific that landscape concept plans include a palette rich in drought-tolerant and native plants including highlights of ornamentals for accents, area identification, etc. The use of drought-tolerant plant materials is highly encouraged.
Objective No. 2:	
Major manufactured slopes should be landscaped with materials that will eventually naturalize, requiring minimal irrigation.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The landscape plan for major manufactured slopes shall specify the use of materials that will eventually naturalize, requiring minimal irrigation.
Objective No. 3:	
Landscaping should be considered to help shade major parking areas.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines include landscaping that is designed to help shade major parking areas.
Objective No. 4:	
The use of landscaped medians at neighborhood entries is encouraged.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines include landscape designs for entries and medians.
Objective No. 5:	
Consider using large groupings of plant materials to create a logical sense of order and continuity throughout the community.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines include local streets that are characterized by narrow street widths and regular plantings of canopy street trees. Neighborhood parks are more formally planted with 'orchards' of regularly-spaced trees, reflecting the site geometry.
Objective No. 6:	
Groups of accent trees may be used at community, Village, and neighborhood focal points to provide distinctive contrast.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines include local streets that are characterized by narrow street widths and regular plantings of canopy street trees. Neighborhood parks are more formally planted with 'orchards' of regularly-spaced trees, reflecting the site geometry.
Objective No. 7:	
Water conservation measures should be incorporated into all irrigation systems.	The Landmark Village Tract Map 53108 Potable and Reclaimed Water Plan provides a detailed framework for implementation within Landmark Village.
Objective No. 8:	
The use of reclaimed water is encouraged.	The Landmark Village Tract Map 53108 Potable and Reclaimed Water Plan provides a detailed framework for implementation within Landmark Village.

OBJECTIVE	IMPLENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
J. Landscape Design – 1. General Guidelines	
Objective No. 9:	
Trash, storage areas, and tanks should be screened from view.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines will specify that trash, storage areas, and tanks be screened from view.
Objective No. 10:	
Landscape concept plans should avoid the use of invasive exotic plant materials such as those shown in the latest available list of "Exotic Pest Plants of Greatest Ecological Concern in California" published by the California Exotic Pest Plant Council.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. The guidelines shall include a list of approved plant materials.

OBJECTIVE	IMPLENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
J. Landscape Design – 2. Landscape Zones	
Objective No. 1:	
Landscape zones are distinguished by their water and maintenance requirements. Landscape concept plans submitted pursuant to the subdivision process will incorporate delineation of landscape zones as described below: • Full Maintenance Landscape - Full maintenance landscape is characterized as areas of high visual impact requiring the greatest amount of care and water. Community and neighborhood entries and accent planting areas fall within this category. The size of these areas should be minimized to conserve water and energy. • Ornamental Landscape - Ornamental landscape requires routine maintenance and water; however, a less intense degree than full maintenance landscape. Limited lawn and groundcover/shrub beds are in this zone; however, seasonal flower color or plants of a highly sensitive nature are not included here. This is intended for parkways, parks, schools, and other areas where a good foundation of ornamental planting is required. Enhanced slopes will also include this type of landscaping. • Drought-Tolerant/Naturalized Landscape - This zone is used in low intensity use areas, and where a natural appearance is more appropriate. It will require much less maintenance and water. In many areas, the landscape will be allowed to naturalize. This zone includes plantings at transitions into native areas and major slopes. • Fuel Modification Areas - Fuel modification zones between development and natural open areas should utilize fire retardant and low fuel plant materials. The location and extent of this zone will be determined and regulated by the Fire Department in conjunction with the approval of parcel-level landscape plans and site conditions. Fuel modification zones are further described in the Wildfire Fuel Modification Program of Specific Plan Section 2.6, Resource Management Plan.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall delineate landscape zones within Landmark Village according to the descriptions included in the Specific Plan.

OBJECTIVE	IMPLENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
J. Landscape Design – 2. Landscape Zones	
• Native Landscape - A native landscape zone is an area where existing vegetation will remain with little or no modification. This zone generally includes native canyons and slopes, as well as the Special Management Areas.	

OBJECTIVE	IMPLENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
K. Lighting – 1. General Guidelines	
Objective No. 1:	
Lighting of streets, public facilities (such as ball fields), and commercial areas will be used appropriately to minimize visual nuisance and maximize safety.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that the lighting of streets, public facilities (such as ball fields), and commercial areas be used appropriately to minimize visual nuisance and maximize safety.
Objective No. 2:	
Light standards should blend in scale and character with buildings, pedestrian areas, landscape, and plaza areas.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that light standards blend in scale and character with buildings, pedestrian areas, landscape and plaza areas.
Objective No. 3:	
Lighting fixtures should be in compliance with all state and local safety and illumination standards.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that lighting fixtures be in compliance with all state and local safety and illumination standards.
Objective No. 4:	
Shielding should be used to avoid lighting glare adversely affecting adjacent properties, uses, buildings, and roadways.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that shielding be used to avoid lighting glare adversely affecting adjacent properties, uses, buildings and roadways.
Objective No. 5:	
Outdoor lighting should be energy-efficient, and shielded and screened to prevent direct rays from reaching adjacent properties.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that outdoor lighting be energy-efficient, and shielded and screened to prevent direct rays from reaching adjacent properties.

OBJECTIVE	IMPLENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
K. Lighting – 2. Lighting Fixtures	
Objective No. 1:	
Lighting fixtures and standards located along streets and public places should play a role in establishing the identity and theme of the development.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that fixtures and standards located along streets and public places should play a role in establishing the identity and theme of the development.
Objective No. 2:	
Roadways – Lighting should be designed to enhance the safety of vehicular and pedestrian flows. Lighting should be concentrated at intersections and crosswalks. This lighting should be in compliance with all government standards.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that for roadways, lighting be designed to enhance the safety of vehicular and pedestrian flows. Lighting should be concentrated at intersections and crosswalks. This lighting should be in compliance with all government standards.
Objective No. 3:	
Parking – The lighting standards should be located within the parking islands. These fixtures should reflect the theme of the village or neighborhood. Fixtures should be shielded to prevent unwanted glare and intrusion into adjacent areas.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that for parking, lighting standards be located within the parking islands. These fixtures should reflect the theme of the village or neighborhood. Fixtures should be shielded to prevent unwanted glare and intrusion into adjacent areas.
Objective No. 4:	
Pedestrian and Entry Lighting – To ensure the safety of pedestrians at twilight and evening hours, light fixtures should be located at building entries and along walkway locations. The fixtures should be designed to reflect the character or theme of the Village and must be positioned in such a manner as to minimize any glare or distraction for the pedestrian or motorist.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that for the safety of pedestrians at twilight and evening hours, light fixtures should be located at building entries and along walkway locations. The fixtures should be designed to reflect the character or theme of the village and must be positioned in such a manner as to minimize any glare or distraction for the pedestrian or motorist.
Objective No. 5:	
Architectural Lighting – The use of architectural lighting to highlight monument signs and architectural features is an important aspect of the nighttime image of Newhall Ranch and should be considered at entry points and intersections. Wall-washing lighting should be used sparingly. All architectural lighting fixtures should be carefully integrated into building details or concealed.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that the use of architectural lighting to highlight monument signs and architectural features is an important aspect of the nighttime image of Newhall Ranch and should be considered at entry points and intersections. Wall-washing lighting should be used sparingly. All architectural lighting fixtures should be carefully integrated into building details or concealed.
Objective No. 6:	
Landscape – Lighting can be used to highlight key landscape features such as specimen trees, walkways, and public plazas. As with architectural lighting, all light sources should be shielded to eliminate the potential for nighttime glare.	Landmark Village Tract Map 53108 Design Guidelines are being prepared. They will further define and implement the requirements of the Specific Plan. These guidelines shall specify that lighting can be used to highlight key landscape features such as specimen trees, walkways, and public plazas. As with architectural lighting, all light sources should be shielded to eliminate the potential for nighttime glare.

OBJECTIVE	IMPLENTATION and CONSISTENCY
V. DESIGN GUIDELINES	
L. Grading	
Objective No. 1:	
Los Angeles County Hillside Development Guidelines should be followed in hillside areas in order to minimize grading impacts.	There are no hillside areas in Landmark Village Tract Map 53108.
Objective No. 2:	
Significant ridges, knolls, and rock outcroppings should be respected in the site design and incorporated as features where feasible.	There are no significant ridges, knolls, and rock outcroppings within Landmark Village. Viewsheds are being preserved pursuant to the viewshed analysis presented at the Los Angeles County Planning Commission hearings.
Objective No. 3:	
Contour grading should be employed where feasible to lessen the visual impact of large slopes and long major uniform slopes should be avoided.	There is no large slope grading in Landmark Village Tract Map 53108.
Objective No. 4:	
Avoid the removal of oak trees to the maximum extent feasible and minimize grading to the edge of tree driplines.	Oak trees within Landmark Village Tract Map 53108 will be transplanted or replaced consistent with the Newhall Ranch Specific Plan requirements.
Objective No. 5:	
Grading should emphasize and accentuate scenic vistas and natural landforms.	Grading associated with the Landmark Village project is confined to development areas within the Specific Plan site, resulting in the preservation of various scenic vistas and natural landforms.
Objective No. 6:	
Slopes requiring special erosion control or fuel modification prevention should be designed for ease of maintenance.	Slopes within Landmark Village Tract Map 53108 requiring special erosion control or fuel modification prevention are designed and landscaped for ease of maintenance.
Objective No. 7:	
Special attention should be given to arrangement of landscape materials as a means of creating a natural, hillside appearance.	Slopes within Landmark Village Tract Map 53108 requiring special erosion control or fuel modification prevention are designed and landscaped to create a natural, hillside appearance.
Objective No. 8:	
Graded slopes should be planted and stabilized in compliance with County-approved landscape, irrigation, and maintenance requirements.	Landscape Plans for Landmark Village Tract Map 53108 are designed to be in compliance with County-approved landscape, irrigation, and maintenance requirements.

OBJECTIVE	IMPLENTATION and CONSISTENCY
VI. VAL VERDE CIVIC ASSOCIATION AGREEMENT	
Objective No. 1:	
Newhall Ranch Company will plant a total of 15 oak trees of approximately 20 inch circumference in the following locations: the north end of the Business Park near existing Val Verde homes, the entrance to the proposed fire station off Chiquito Canyon Road, and the neighborhood park near Chiquito Canyon Road. If space permits, an equal number of oak trees (5 trees) will be planted at each location. The trees will be planted when water lines are installed as part of the Business Park development.	As none of these sites are found within Landmark Village Tract Map 53108, this objective does not apply to this project.
Objective No. 2:	
Newhall Ranch Company will add the following to the Specific Plan (Chapter 4, Section 3 a.) as a mandatory Design Guideline for the Chiquito Canyon Business Park: "Within the Business Park in Chiquito Canyon, roof equipment shall be screened from view from public streets."	As the Chiquito Canyon Business Park is not a part of the Landmark Village Tract Map 53108 site, this objective does not apply to this project.
Objective No. 3:	
The Chiquito Canyon Community Trail will be relocated to the west side of Chiquito Creek.	As the Chiquito Canyon Community Trail is not a part of the Landmark Village Tract Map 53108 site, this objective does not apply to this project.
Objective No. 4:	
An 8-foot-wide equestrian trail will be added to the Community Trail with fencing.	As the Chiquito Canyon Community Trail is not a part of the Landmark Village Tract Map 53108 site, this objective does not apply to this project.
Objective No. 5:	
The Community Trail will be lighted with the lighting directed so as to light the trail only with minimal or no spillover.	As the Chiquito Canyon Community Trail is not a part of the Landmark Village Tract Map 53108 site, this objective does not apply to this project.
Objective No. 6:	
Chiquito Canyon Road will not have street lighting, subject to approval by the Department of Public Works.	As Chiquito Canyon Road is not a part of the Landmark Village Tract Map 53108 site, this objective does not apply to this project.
Objective No. 7:	
Trees and groundcover will be planted within the easterly 8-foot parkway of Chiquito Canyon Road adjacent to the Community Trail. The trees will be staggered asymmetrically and will have varied heights and canopies. A second row of trees and bushes will be planted between the east side of the Creek and the Business Park. The objective of the tree planting is to reduce the visibility of the Business Park buildings nearest to Chiquito Canyon Road. The Val Verde Civic Association will be consulted as to the types of trees to be planted, and the Civic Association may provide a list of tree types that are preferred.	As the Chiquito Canyon Community Trail is not a part of the Landmark Village Tract Map 53108 site, this objective does not apply to this project.
Objective No. 8:	
The Community Trail section will include a 2-foot wide area in which bushes will be planted, to be located immediately east of the equestrian trail.	As the Chiquito Canyon Community Trail is not a part of the Landmark Village Tract Map 53108 site, this objective does not apply to this project.

OBJECTIVE	IMPLENTATION and CONSISTENCY
VI. VAL VERDE CIVIC ASSOCIATION AGREEMENT	
Objective No. 9:	
The Specific Plan areas adjacent to Val Verde will have Open Area, Estate and Low-Medium Residential land uses only, as shown on the revised Land Use Plan for the Specific Plan.	Landmark Village Tract Map 53108 is not adjacent to Val Verde, and as a result, this objective does not apply to this project.
Objective No. 10:	
Adoption of the Specific Plan will result in the existing Commercial land use on Planning Area RW-22 being changed to Low-Medium Residential. The Low-Medium Residential land use area (RW-22) is restricted to not more than 30 detached homes. A footnote will be added to Table 5.4-1 Annotated Land Use Plan in Chapter 5 of the Specific Plan to state that Planning Area RW-22 shall not be converted to Commercial land use.	Planning Area RW-22 is not in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 11:	
Chiquito Canyon Road north of Business Park Drive is to be retained as a two lane Limited Secondary Highway as shown in the "Alternate Highway Plan".	Chiquito Canyon Road north of Business Park Drive is not in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 12:	
Newhall Ranch Company agrees to provide directional signage for the Val Verde Community at the intersection of Chiquito Canyon Road and Business Park Drive.	The intersection of Chiquito Canyon Road and Business Park Drive is not in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 13:	
In the design of the directional sign above, Newhall Ranch Company will consider the use of sign elements to be provided by the Val Verde Civic Association. The Val Verde Civic Association recognizes that the directional sign must be compatible with other Newhall Ranch and Business Park signage.	The intersection of Chiquito Canyon Road and Business Park Drive is not in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 14:	
Within 30 days of recordation of a final subdivision map for purposes of construction within the Estates Planning Area (RW-21), Newhall Ranch Company will pay the costs, not to exceed $2,000, for a community identification sign to identify the Val Verde Community. This community identification sign will be located along Chiquito Canyon Road, north of the Specific Plan boundary. The Val Verde Civic Association is responsible for acquiring a site or the necessary rights to erect the sign.	Planning Area RW-21 is not in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 15:	
Newhall Ranch Company agrees to support the Val Verde Civic Association's efforts to retain the Caltrans directional sign to Val Verde, which is located on SR-126.	Landmark Village Tract Map 53108 is not adjacent to Val Verde, and as a result, this objective does not apply to this project.
Objective No. 16:	
For grading in hillside areas, the Specific Plan states that the Los Angeles County Hillside Development Guidelines should be followed. These call for contour grading and other techniques to maintain the natural appearance of hillsides, and are more restrictive than the County's Grading Ordinance standards, which are normally followed.	Landmark Village Tract Map 53108 is not adjacent to Val Verde, and as a result, this objective does not apply to this project.

OBJECTIVE	IMPLENTATION and CONSISTENCY
VI. VAL VERDE CIVIC ASSOCIATION AGREEMENT	
Objective No. 17:	
Newhall Ranch Company agrees to request that the Board of Supervisors adopt a resolution prohibiting trucks weighing more than 14,000 pounds from using that portion of Chiquito Canyon Road north of Business Park Drive, except for any such trucks making local deliveries within Val Verde.	Landmark Village Tract Map 53108 is not adjacent to Val Verde, and as a result, this objective does not apply to this project.
Objective No. 18:	
Lighting in the Business Park will conform to the Lighting Design Guidelines in Section 4.7 Design Guidelines of the Specific Plan.	There is no Business Park in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 19:	
Newhall Ranch Company will make its best efforts to preserve as many existing oak trees in the Business Park as feasible consistent with the reasonable development of the Business Park.	There is no Business Park in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 20:	
Trail access will be provided from the Chiquito Canyon Community Trail to the easterly Neighborhood Park north of SR-126 in the Riverwood Village and to the Regional River Trail. Pedestrian crossings of Chiquito Canyon Road and SR-126 will be at grade, except the trail will use a sidewalk across SR-126 when the interchange is built. Equestrian crossings will use the creek bed under Chiquito Canyon Road and SR-126.	As the Chiquito Canyon Community Trail is not a part of the Landmark Village Tract Map 53108 site, this objective does not apply to this project.
Objective No. 21:	
Newhall Ranch Company agrees to provide a traffic signal at the Chiquito Canyon/Business Park Road intersection. Newhall Ranch Company agrees to request that the Department of Public Works approve a signal type which has a left-turn arrow for traffic northbound on to Chiquito Canyon Road, and which permits left turns when the arrow is not lighted if there is no opposing traffic. In addition, Newhall Ranch Company agrees to provide a southbound "free-right" turn movement at the above intersection.	The intersection of Chiquito Canyon Road and Business Park Drive is not in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.

OBJECTIVE	IMPLENTATION and CONSISTENCY
VI. VAL VERDE CIVIC ASSOCIATION AGREEMENT	
Objective No. 22:	
In regard to the sewer main lines in SR-126 from the new Water Reclamation Plant to Chiquito Canyon Road, and in Chiquito Canyon Road from SR-126 to the northerly Specific Plan boundary, Newhall Ranch Company agrees: a. If in the future the above sewer lines need to be oversized and those sewer lines can be reserved to provide capacity to serve existing and planned land uses in the Val Verde Community Standards District which are tributary by gravity flow to the Newhall Ranch Water Reclamation Plant, Newhall Ranch Company agrees to fund the costs of over sizing the above sewer lines. (Capacity would not be provided to serve subdivisions proposed by commercial builders or developers.) b. Subject to approval by the County Sanitation Districts of Los Angeles County (CSDLAC), Newhall Ranch Company has no objection to the reservation of the additional sewer main line capacity for the land uses within the Val Verde Community Standards District after the sewer main lines are dedicated to the CSDLAC. c. Newhall Ranch Company and the Val Verde Civic Association mutually agree that in order to avoid delays in construction of the sewer main lines, the amount of over sizing needed to serve the Community Standards District will be estimated by the appropriate County Department or Agency if the Val Verde Community Standards District is not yet adopted by the Board of Supervisors by the time that sewer sizing must be determined. Newhall Ranch Company currently estimates the need to determine sewer sizing could occur in about year 2001.	Landmark Village Tract Map 53108 is not adjacent to Val Verde, and as a result, this objective does not apply to this project.
Objective No. 23:	
Due to the rapid changes in communications technology, including development of "wireless" systems, Newhall Ranch Company does not know at this time whether underground TV cable would be provided to the 30 homes in Planning Area RW-22 adjacent to Val Verde. If cable is extended to Planning Area RW-22, it will be extended to the northerly boundary of that planning area, and Newhall Ranch Company would have no objection to the system being further extended into Val Verde by the cable company.	Planning Area RW-22 is not in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 24:	
Newhall Ranch Company agrees to fund the preparation of a Community Standards District for Val Verde up to a maximum of $75,000. The funding would be provided to Los Angeles County after the final approval of Newhall Ranch by the Board of Supervisors, and final resolution of all legal challenges to the approvals.	The County of Los Angeles has adopted a Castaic Area Community Standards District which has established development standards for the Val Verde community
Objective No. 25:	
All of the work needed to determine the standards and set up the District would be completed by the Department of Regional Planning.	Landmark Village Tract Map 53108 is not adjacent to Val Verde, and as a result, this objective does not apply to this project.
Objective No. 26:	
Newhall Ranch Company agrees to provide a representative to attend meetings and provide advice regarding the formation of the Community Standards District.	Landmark Village Tract Map 53108 is not adjacent to Val Verde, and as a result, this objective does not apply to this project.

OBJECTIVE	IMPLENTATION and CONSISTENCY
VI. VAL VERDE CIVIC ASSOCIATION AGREEMENT	
Objective No. 27:	
The Val Verde Civic Association and Newhall Ranch Company agree that the "frontage road" or "outer highway" is not feasible because it would require large amounts of grading, would intrude into an already-filled portion of the Chiquita Landfill, and because it is not supported by the Department of Public Works. Also, an east-west frontage road is being provided on the south side of SR-126 by the extension of Wolcott Avenue from SR-126 eastward to Long Canyon Road, as shown on Specific Plan Revised Exhibit 2.3-1 Land Use Plan.	In accordance with this objective, a frontage road north of SR 126 was not included within the approved Specific Plan.
Objective No. 28:	
The 5.3-acre parcel on the east side of Chiquito Canyon Road (Planning Area RW-22) was changed from Medium Residential to Low Medium Residential. This change reduces the maximum number of homes that can be built on the parcel from 90 homes to 30 homes, and the overall density to 5.7 dwelling units per acre.	Planning Area RW-22 is not in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 29:	
Planning Area RW-22 was restricted to single-family detached homes only, which may include clustered single-family detached homes such as the Court Homes in Valencia.	Planning Area RW-22 is not in Landmark Village Tract Map 53108, and as a result, this objective does not apply to this project.
Objective No. 30:	
The northern edge of the Chiquito Canyon Business Park was moved southward, creating an Open Area land use designation adjacent to existing Val Verde residences. (Planning Area RW-23). At the request of Newhall Ranch Company and after review by the Department of Public Works, the Regional Planning Commission approved the "Alternate Highway Plan" which retains the existing two-lane Limited Secondary Highway on Chiquito Canyon Road north of Business Park Drive. There would be a traffic signal at the intersection of Chiquito Canyon Road and Business Park Drive. A southbound "free right" turn would be provided at this intersection. The northerly Business Park access to Chiquito Canyon Road would be for emergencies only.	As the Chiquito Canyon Business Park is not a part of the Landmark Village Tract Map 53108 site, this objective does not apply to this project.
Objective No. 32:	
Newhall Ranch Company agreed to seek Caltrans approval for and to fund construction of a traffic signal at the intersection of SR-126 and Chiquito Canyon Road along with the first construction at that intersection.	A traffic signal will be constructed at this intersection prior to occupancy of any Landmark Village unit..

OBJECTIVE	IMPLENTATION and CONSISTENCY
VII. PHASING PROGRAM	
Objective No. 1:	
The basic phasing mechanism of the Specific Plan is the tentative subdivision map. As each tentative subdivision map is processed, infrastructure requirements for that subdivision will be established. The infrastructure requirements for each tentative subdivision map will be consistent with the Conceptual Backbone Infrastructure systems set forth in Section 2.5 of the Specific Plan, subject to review for substantial compliance with the Specific Plan by the Planning Director (see Section 5.2, paragraph 2).	Landmark Village Tract Map 53108 is consistent with the Conceptual Backbone Infrastructure systems set forth in Section 2.5 of the Specific Plan.
Objective No. 2:	
Concurrent with the submittal of each tentative subdivision map, an updated Annotated Land Use Plan Statistical Table, and Park and Recreation Improvements Table will be filed with the County, as set forth in Section 5.4 of the Specific Plan.	An updated Annotated Land Use Plan Statistical Table and Park and Recreation Improvements Table was filed with the County when Landmark Village Tract Map 53108 was submitted.

APPENDIX 3.0

Development Monitoring System Database

APPENDIX 4.1

Geotechnical and Soil Resources

EIR-Level Review of Adobe Canyon and Chiquito Canyon Preliminary Bulk Grading Study, November 14, 2003

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

GEOLOGIC/GEOTECHNICAL REPORT

EIR-Level Review of Adobe Canyon Preliminary Bulk Grading Study and Chiquito Canyon Preliminary Bulk Grading Study

Adobe Canyon Area and Chiquito Canyon Area
Newhall Ranch
Castaic, California

Prepared for

Newhall Ranch Company®
A Division of The Newhall Land and Farming Company
23823 Valencia Boulevard
Valencia, California 91355

Job No: 03-2022-9
Dated November 14, 2003

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

November 14, 2003 Job No.: 03-2022-9

Newhall Ranch Company®
A Division of The Newhall Land and Farming Company
23823 Valencia Boulevard
Valencia, California 91355

Attention: Mr. Keith Herren

Subject: **GEOLOGIC/GEOTECHNICAL SUMMARY REPORT**
EIR Level Review of Adobe Canyon Preliminary Bulk Grading Study and Chiquito Canyon Preliminary Bulk Grading Study

Project: Adobe Canyon Area and Chiquito Canyon Area
Newhall Ranch
Castaic, California

Dear Mr. Herren:

This geologic and geotechnical evaluation of two spatially separate Preliminary Bulk Grading Studies is provided for incorporation into an Environmental Impact Report (EIR). The bulk grading studies address two potential borrow sites at Adobe Canyon and Chiquito Canyon, which are proposed to provide fill material for the River Village Development - Vesting Tentative Tract 53108. In addition, a water tank site is also proposed at the Adobe Canyon site. This summary report presents our opinions regarding the existing geologic and geotechnical conditions and their effects on the future development of the sites.

1.0 SCOPE OF INVESTIGATION

The purpose of this report is to summarize the Geologic and Geotechnical conditions at the Adobe Canyon and Chiquito Canyon sites and provide general recommendations for the proposed use as Borrow Sites for submittal with an Environmental Impact Report. Preliminary recommendations for the proposed tank site are also provided. Some additional subsurface explorations and detailed Geologic and Geotechnical analyses will be required to address specific items covered in this report prior to submittal at the Tentative Map stage. Recommendations for future potential development of the Borrow Sites for residential or commercial use is not a part of this investigation. Geologic and Geotechnical constraints that would apply to such future development will require additional review and analysis.

Our study included the following:

1. Review of in-house data compiled by this office.

2. Review of the published references listed in Appendix A.

3. Review of the Munger Map Book, California-Alaska, Oil and Gas Fields, 2003.

4. Review of the following aerial photographs.

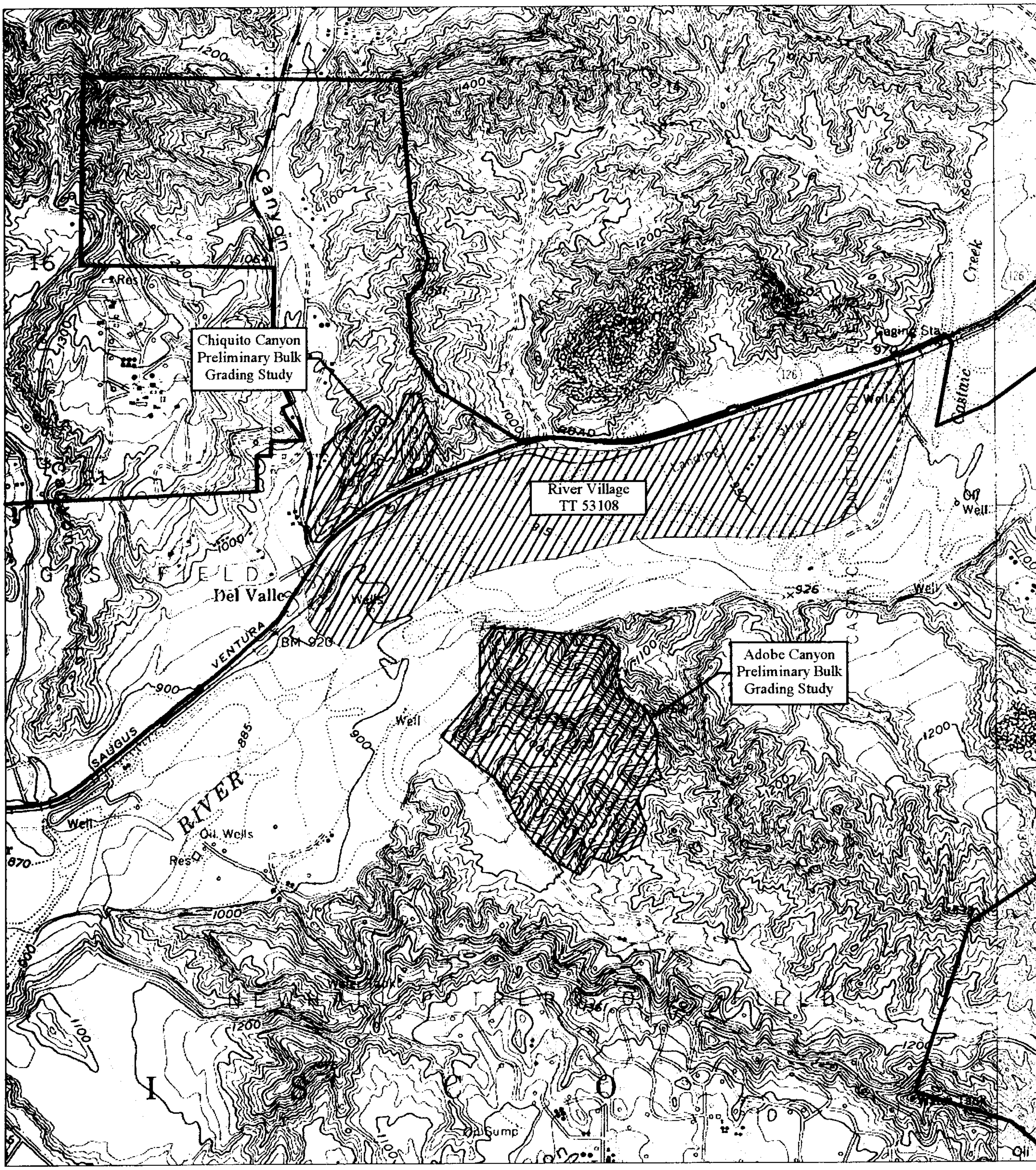
YEAR	PHOTOS	SCALE	AGENCY
1928	E- 51 & E-52	±1"=2,000'	Fairchild
1952	2K-27 & 2K-28	±1"= 1,667'	U. S. Dept. of Agriculture
1963	4 & 5	±1"=1,200'	Mark Hurd Aerial Survey
1968	6-21 & 6-22	±1"=2,000'	Teledyne Geotronics
1977	2-47	±1"=1,500'	Continental

5. Review of the Adobe Canyon Preliminary Bulk Grading Study and the Chiquito Canyon Preliminary Bulk Grading Study both maps prepared by Psomas and both dated October 21, 2003, at a scale of 1 inch = 100 feet. We make no representations regarding the accuracy of these base maps. The Bulk Grading Study Maps are used as the base maps for our Geologic Maps (**Plates I and II**).

6. Delineation of landslides present on both the Chiquito Canyon and Adobe Canyon sites based on topographic and aerial photo analysis, review of the published maps listed in the references, reconnaissance field mapping, and limited subsurface exploration completed during our previous geologic investigations.

7. Performance of a probabilistic seismic hazard assessment for the subject sites.

8. Preparation of a Location Map, Geologic Maps and this Report.



Source: U.S. Geological Survey Val Verde Quadrangle, Dated 1952, Photorevised 1969 Photoinspected 1974

Approximate Scale: 1"=2,000'

NOTE: THIS IS NOT A SURVEY OF THE PROPERTY

N

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

LOCATION MAP

Job No.: 03-2022-9	*Date: 11/14/03*

2.0 BACKGROUND

This office previously performed limited geologic and geotechnical investigations for areas encompassing both the Adobe Canyon and Chiquito Canyon study areas. Phase II – level subsurface explorations were completed at Chiquito Canyon to define landslides and bedrock structure. However, only local Phase I trench explorations have been completed at the Adobe Canyon site at this time. The location of our exploratory test pits and borings are not shown on the Geologic Maps at this time. However, bedding attitudes and geologic contacts obtained from our field mapping and subsurface explorations of each site are shown on the Geologic Maps.

3.0 SITE DESCRIPTION

3.1 Adobe Canyon Area

The Adobe Canyon site is located in the northeastern portion of the Santa Susana Mountains just south of the Santa Clara River and easterly and adjacent to Long Canyon within the unincorporated portion of Los Angeles County. The site is generally in an undeveloped state with the exception of a few access roads for oil well drill pads. The site is covered with natural grasses, chaparral and scattered oak trees. Portions of Long Canyon and the lower portion of Adobe Canyon have been used for agricultural purposes. Dumped fill associated with past oil well drilling activities exists at various locations within the site. Elevations range from approximately 925 in the vicinity of the Santa Clara River to approximately 1350 at the natural ridgeline in the vicinity of the proposed water tank site. Properties adjacent to the Adobe Canyon site are under the same ownership. The detailed topography of the site is shown on the attached Location Map.

3.2 Chiquito Canyon Area

The Chiquito Canyon site is located within the low-lying hills north of the State Route 126 and Santa Clara River, easterly of Chiquito Canyon Road and westerly of the Chiquita Canyon Landfill within the unincorporated portion of Los Angeles County. The site is covered with natural grasses and scattered chaparral with the exception of the alluvial area within Chiquito Canyon, which is commonly used for farming. The site is generally in an undeveloped state with the exception of a few access roads for oil well drill pads. Dumped fill associated with past oil well drilling activities is present at the eastern portion of the site. A southern California Edison easement traverses the northern portion of the site. An existing electrical tower within this easement is located at the top of one of the proposed, semicircular cut-slopes. A second powerline easement is present at the Southern Portion of the subject site. For details on the site topography see the Location Map as well as the Geologic Map **Plate II**.

4.0 PRELIMINARY BULK GRADING STUDIES

4.1 Introduction

It is our understanding that the bulk grading plans are intended to provide fill material required for Vesting Tentative Tract 53108 - River Village Development. The location of proposed haul routes and staging areas are illustrated on the preliminary bulk grading studies. Both preliminary bulk grading study maps were prepared by Psomas, the project supervising civil engineer, dated 10/21/03. These maps are used as the base maps for our Geologic Maps. Specific details for each separate study area are described below.

4.2 Adobe Canyon Preliminary Bulk Grading Study

The Adobe Canyon Preliminary Bulk Grading Study indicates primarily westerly (northwesterly and southwesterly) facing cut slopes with minor portions facing towards the south. These slopes have gradients up to 2 to 1 horizontal to vertical (h/v), but typically are designed at 3 to 1 (h/v) gradients or flatter. The highest proposed cut slope is approximately 100 feet high. The maximum vertical cut to proposed grade is 175 feet located at the northeastern portion of the site south of the proposed temporary debris basin for Area F-1. The maximum proposed fill is approximately 50 feet thick, located at the top of the proposed 3 to 1 (h/v) gradient fill slope west of the proposed water tank site. The proposed graded area consists of approximately 125 acres. The Bulk Grading Study map indicates that 6,580,000 cubic yards of cut material will be generated and 238,850 cubic yards of fill material will be placed, leaving 6,341,150 cubic yards for export to the River Village Development. The relatively level pad areas that will be generated will have sheet flow to the two proposed temporary debris basins, one located within the Adobe Canyon area and one located at the northerly portion of the study. A proposed trapezoidal debris channel is illustrated near the central portion on the plan. In addition to borrow site grading, a pad for a water tank is also proposed at the eastern portion of the site.

4.3 Preliminary Bulk Grading Study for Chiquito Canyon

The preliminary Bulk Grading Study map for Chiquito Canyon indicates primarily south to southwesterly facing cut slopes with the exception of one northerly facing cut slope located along the southern portion of the study adjacent to SR 126. These slopes have gradients up to 2 to 1 (h/v). The highest proposed cut slope is approximately 186 feet high and is a combination 2 to 1 and 3 to 1 (h/v) gradient slope located just south of the existing Edison transmission tower. The maximum vertical cut is approximately 130 feet located at the toe of this 186 foot high slope. Only minor fill (less than 12 feet thick) is proposed on this Bulk Grading Study map. The proposed graded area consists of approximately 45 acres. The Bulk Grading Study indicates that 1,519,000 cubic yards of raw cut material will be generated, and 5,900 cubic yards of fill material will be placed, leaving 1,513,200 cubic yards of fill material for export to the River Village Development. The relatively level pad areas that will be generated will have sheet flow to the various temporary debris basins illustrated on the plan. New access road alignment to the existing Edison transmission tower located at the top of the 186 foot high cut slope is provided on this plan. The existing power transmission lines located at the southerly portion of the site will have to be relocated.

5.0 GEOLOGY

5.1 Regional Geology

The subject site is located along the northeastern margin of the Ventura Basin within the Transverse Ranges geologic province of California. The Ventura Basin consists of an elongated sedimentary trough extending from the Santa Barbara Channel on the west to the San Gabriel fault on the east. The axis of the trough trends east west, reflecting the overall east-west trend of the Transverse Ranges, and generally coincides with the Santa Clara River Valley. This sedimentary basin contains a thick sequence of marine and non-marine sediments that have been uplifted and deformed by past tectonic forces. Bedrock of the Pico Formation and Saugus Formation has been mapped at both sites.

5.2 Geomorphology

5.2.1 Adobe Canyon Area

The Adobe Canyon study area is located east of the confluence of Long Canyon and the Santa Clara River. The site topography is dominated by generally northwesterly trending spur ridges descending towards the Long Canyon drainage and the Santa Clara River located at the northern and northwestern margins of the site. Adobe Canyon, where most the grading is proposed, is a tributary canyon to Long Canyon. An elevated area with subdued topography is present at the northeasterly portion of the site. This elevated area is a remnant of the old valley floor carved into the underlying bedrock as the ancestral Santa Clara River eroded downward and the mapped Quaternary Terrace Deposits are remnants of ancient river deposits. Subdued morphology, possibly resulting from landslide movement is evident on the reviewed aerial photographs. These noted landslide areas are queried on the Geologic Map (**Plate I**), as we have not yet verified their existence with subsurface explorations. Elevations at the site range from approximately 930 at the northwestern portion of the site where Long Canyon merges into the Santa Clara River to approximately 1350 along the ridgeline located at the south eastern portion of the site.

5.2.2 Chiquito Canyon Area

The Chiquito Canyon study area is located in the low-lying hills east of the intersection of Chiquito Canyon drainage and the Santa Clara River floodplain. This site is dominated by three south to southwesterly trending ridges which descend towards the Santa Clara River to the south. Elevations range from approximately 1220 located on the eastern spur ridge at the northeastern portion of the site to approximately 945 at the southwestern corner of the site where Chiquito Canyon merges into the Santa Clara River. Subdued morphology produced by landslide movement is evident at several locations on the reviewed aerial photographs. Some of the mapped landslides have been confirmed by subsurface exploration by this firm.

5.3 Bedrock

5.3.1 Pico Formation (Tp)

The Pliocene Pico Formation underlies the southern and western portion of the Chiquito Canyon study site and is present only at the extreme southwestern corner of the Adobe Canyon site. At the Chiquito Canyon site this formation is gradational and interfingering with the overlying Saugus Formation (see Geologic Map **Plate II**). The Pico Formation observed at both the sites consists of moderately hard, light gray to light greenish-gray sandstone and pebbly sandstone with local interbeds of light greenish-gray to olive-gray siltstone, sandy siltstone and rare moderate-brown mudstone. The sandstones are generally well sorted and massive to locally well bedded with common low angle cross bedding. Pebbles are generally well rounded and commonly crystalline in composition. The siltstone and mudstone units are potentially expansive. Thin, low strength clay seams are present within this formation and can be problematic relative to slope stability.

5.3.2 Saugus Formation (TQ)

The lower portion of the Plio-Pleistocene Saugus Formation is exposed at both the Adobe Canyon site and the Chiquito Canyon site. This formation is the dominant formation at the Adobe Canyon site and is located at the eastern portion of the Chiquito Canyon site where it is gradational and interfingering with the underlying Pico Formation. The Saugus Formation was deposited in a fluvial environment between 0.7 and 2.5 Ma (Levi et al., 1986). The observed bedrock is dominated by moderately hard, light-gray to yellowish-gray sandstone and conglomerate with local interbeds of greenish-gray siltstone and sandy siltstone, and uncommon reddish-brown mudstone. Pebbles within this foundation are typically less rounded and more variable in composition than in the Pico Formation. Siltstone and mudstone units of the Saugus Formation are potentially expansive. Thin, low-strength clay seams occur in the reddish-brown mudstone units both as a result of original deposition and due to flexural slip along bedding during tectonic folding subsequent to deposition. These low strength clay layers may be fairly rare; however where they occur they have proven problematic relative to slope stability.

5.4 Surficial Deposits

5.4.1 Older Alluvium (Qoa)

Uplifted alluvium is present at the Adobe Canyon site in the vicinity of Long and Adobe Canyons as well as along the western portion of the Chiquito Canyon site in the vicinity of the proposed temporary debris basin. This uplifted alluvium is designated as Quaternary older alluvium on both of the Geologic Maps (**Plates I and II**). These deposits generally consist of moderately consolidated to unconsolidated poorly graded sand with gravel lenses, fine silty sand, sandy silt and clay. The upper 1 to 3 ft. of this material has generally been disturbed by agricultural activities.

5.4.2 Alluvium (Qal)

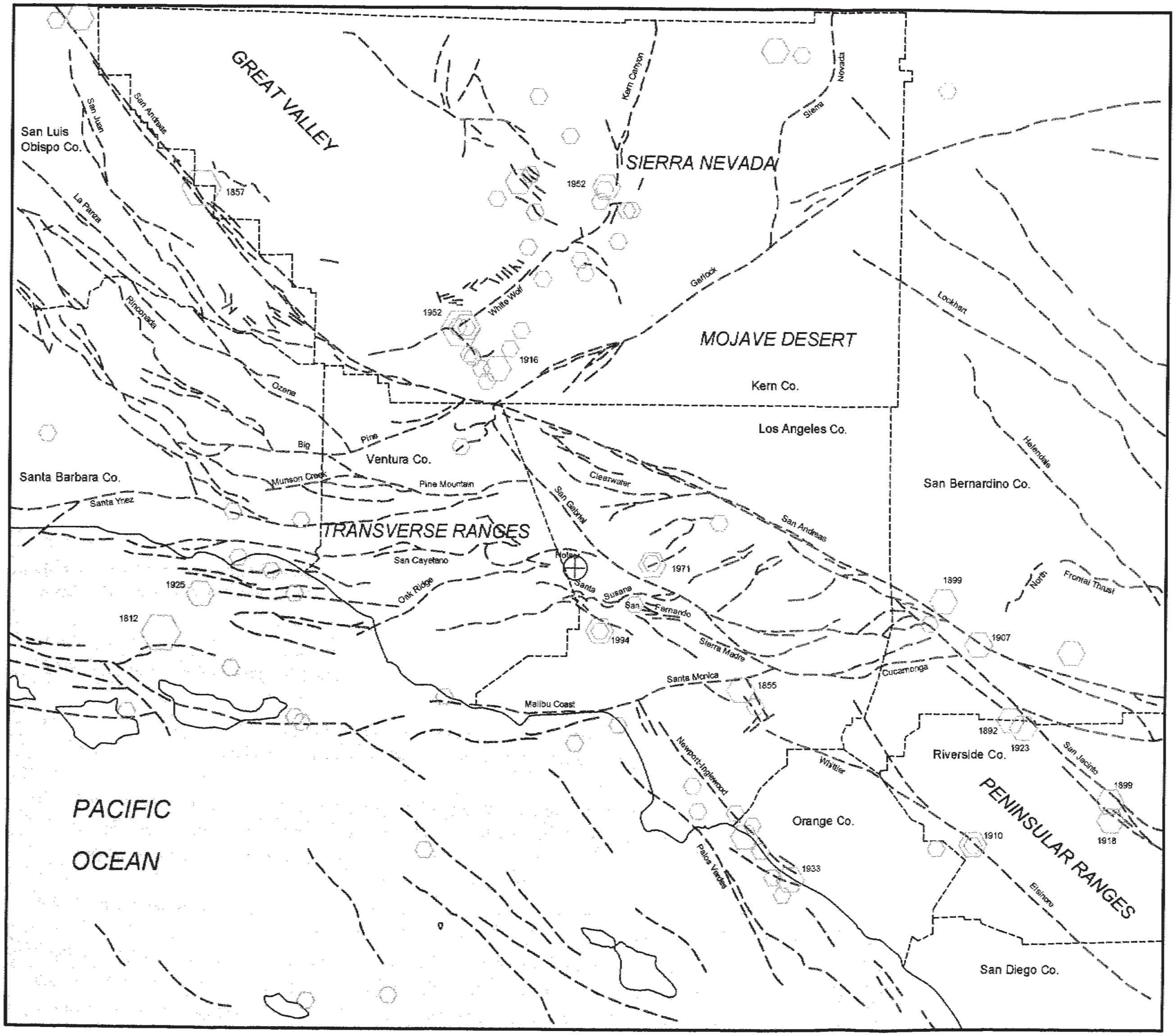
At the Adobe Canyon site, alluvium is present along the northern portion of the site in the vicinity of the Santa Clara River. At the Chiquito Canyon site alluvium is present in the active Chiquito Canyon in drainage channel, as well as within the two northerly trending narrow canyons at the south central portion of the Chiquito Canyon site. This material typically ranges from very fine-grained, silty sand to cobble size deposits.

5.4.3 Slopewash (Qsw)

Slopewash is a non-bedded, heterogeneous accumulation of sand, silt and weathered bedrock fragments deposited by gravity on nearly all of the slopes at both of the sites. This material has accumulated via gradual surface wash and periodic debris flows. The thickest accumulations occur at the toe of slopes and where broad swales join the main drainage areas. This material is generally poorly consolidated and commonly interfingers with the alluvium. The slopewash is designated as Qsw on the Geologic Maps (**Plates I and II**).

5.4.4 Artificial Fill (af)

Artificial fill exists at various locations on both sites and ranges from minor spill fills to large dumped fill pads associated with oil well activities. Only the larger artificial fill areas are illustrated on the Geologic Maps.



40 30 20 10 0 40 KILOMETERS

Approximate Scale 1 : 1,250,000

30 20 10 0 30 MILES

EXPLANATION

APPROXIMATE LOCATION OF MAJOR KNOWN FAULTS

San Andreas

EARTHQUAKE EPICENTERS

Location	Magnitude
⬡	5.0 - 5.9
⬡	6.0 - 6.9
⬡	7.0 - 7.9

APPROXIMATE LOCATION OF ADOBE CANYON AND CHIQUITO CANYON SITES

⊕

Compiled and modified from: Jennings (1994), Real et al. (1978), Yerkes (1985), Ziony and Jones (1989), and Shakal et al. (1994)

N

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

FAULT AND EARTHQUAKE
EPICENTER LOCATION MAP

Job No.: 03-2022-9

Date: 11/14/03 *Figure:* 1

At the Adobe Canyon site artificial fill is present at the southern portion of Adobe Canyon within the limits of the proposed grading. This artificial fill is associated with oil well drilling activities.

At the Chiquito Canyon site artificial fill is present at the proposed eastern temporary debris basin. This artificial fill is also associated with oil well drilling activities. Only minor grading is proposed at this location.

5.5 Landslides

Numerous landslides have been mapped on the subject sites. These landslides are primarily translational failures controlled by the underlying bedding orientation. The landslides vary from small shallow failures to large landslides.

The mapped landslides were identified based on review of previously published and unpublished geologic data, geomorphic features observed on the aerial photos, review of the site topography illustrated on the attached Geologic Maps, reconnaissance field mapping and subsurface explorations. Additional subsurface exploration will be required to confirm the existence of landslides and to accurately delineate the lateral extent and depth of the landslide material.

The landslides mapped at both the Adobe Canyon and Chiquito Canyon sites have been divided into the two following categories:

- (Qls) Landslides that are mapped with moderate to great certainty are designated with a standard boundary and direction of movement arrows on the Geologic Map.
- (Qls?) Where the existence or lateral extent of the landslide is uncertain or inferred, the landslide is queried with a question mark. These landslides will require subsurface exploration to confirm their existence.

5.6 Surficial Failures

Shallow surficial failures involving soil, slopewash and weathered bedrock have not been delineated on the maps at this time. These features will be shown when the sites are evaluated in more detail on larger scale maps. Numerous shallow failures and rock falls/debris flows were activated on the steeper slopes of both sites by strong ground motion from the 1994 Northridge Earthquake. Areas underlain by weathered siltstones, which are generally highly fractured, are prone to failure during intense rainfall and/or earthquake generated ground motions.

5.7 Geologic Structure

5.7.1 Introduction

The subject sites lie within the tectonically active Transverse Ranges of southern California. North-south compression has produced a series of east-west to northwest-trending folds in the vicinity of both Adobe and Chiquito Canyons. The geologic structure for each site is described below.

5.7.2 Adobe Canyon

The bedrock beneath much of the Adobe Canyon site has been uplifted and deformed by past tectonic forces into a northwest-trending syncline (downfold). The axial trace of this fold is located only at the extreme northeastern corner of the site. The geologic structure of the Saugus and the underlying Pico Formation bedrock exposed over much of the site (southern limb of the syncline) strikes northwest and is dipping at angles ranging between 32 and 48 degrees towards the northeast. The geologic structure of the bedding exposed along the northern limb of the syncline is striking towards the northeast and is dipping at angles ranging between 9 and 17 degrees southwest. Faulting has not been observed within the Adobe Canyon Area.

5.7.3 Chiquito Canyon

The Chiquito Canyon site is located on the southern limb of the Del Valle anticline (upfold) which trends roughly east-west to northwest-southeast just northerly of the site. Both the Pico and Saugus Formation bedrock in the vicinity of the subject site is striking towards the northeast and dipping at angles ranging from 9 to 22 degrees towards the southeast. Faults have not been observed in the vicinity of the proposed grading study.

5.8 Ground Water

5.8.1 Introduction

Ground water beneath the Adobe Canyon and Chiquito Canyon sites can be generally grouped in to two categories: 1) ground water contained in the alluvial deposits; 2) groundwater contained in the bedrock and Quaternary Terrace Deposits.

Historic high ground water levels for the alluvial areas were interpolated for each site based on records from ground water contours by Robson (1972), water levels observed in exploratory excavations by Allan E. Seward Engineering Geology, Inc., and nearby piezometer measurements. Specific details for each site are discussed below. Due to the elevated nature of the subject site, ground water is not expected to significantly affect the project provided our recommendations are implemented during construction. Specific ground water details for each site are discussed below.

5.8.2 Adobe Canyon Site

Historic ground water records for the alluvial areas indicate that the ground water has risen to within 12 to 30 feet of the existing ground surface in the vicinity of Long Canyon and along the margins of the Santa Clara River. In May and June of 2000, exploratory borings drilled to depths of 35 and 40 ft. within the alluvial areas of Long Canyon, just westerly of the proposed grading limits, did not encounter ground water. Perched groundwater within elevated bedrock area has not been observed on the site. Natural springs or seeps were not observed within the Adobe Canyon site during our previous investigations.

5.8.3 Chiquito Canyon Site

Historic ground water records for the alluvial areas indicate that the ground water has risen to within 18 to 30 feet of the existing ground surface in the vicinity of the lower Chiquito Canyon area. In 1999 and 2003, exploratory borings drilled within Chiquito Canyon just westerly of the proposed grading limits did not encounter ground water. Minor seeps were observed with some of our subsurface exploratory borings within landslide material; however, surface springs were not observed during our surface field mapping of the site. Quarterly measurements over the last 4 years from a piezometer located westerly of the site indicate that ground water ranges from 38 to 47 ft. below the ground surface in the canyon alluvium.

6.0 POTENTIAL GEOLOGIC AND GEOTECHNICAL HAZARDS, CONSTRAINTS AND POSSIBLE MITIGATION MEASURES

6.1 Seismicity

6.1.1 Introduction

The subject site lies within the seismically active southern California region. Earthquake-related hazards typically include ground rupture, ground shaking and ground failure.

6.1.2 Ground Rupture

Neither the Adobe Canyon nor the Chiquito Canyon site lie within any of the State's Alquist-Priolo Earthquake Fault Zones. The L.A. County Seismic Safety Element does not show any faults at either of the subject sites. Regional geologic maps do not show any **active** faults (i.e. faults demonstrated to be active in the last 11,000 years) located on or trending towards the site. No evidence of active faulting or ground rupture was observed on either of the sites during our reconnaissance field mapping and limited subsurface explorations. The closest known active fault (surface trace) to the Adobe Canyon site is the San Gabriel fault located approximately 4.7 miles towards the northeast. The closest known active fault (surface trace) to the Chiquito Canyon site is also the San Gabriel fault, which is located approximately 3.5 miles to the northeast.

6.1.3 Ground Shaking

The site is located in southern California, which is an **active** seismic area where large numbers of earthquakes are recorded each year. Historically, the eastern portion of the Santa Susana Mountains area experienced strong ground motion from the 1971 San Fernando earthquake, which was generated on the Sierra Madre-San Fernando fault, and more recently from the 1994 Northridge earthquake. **Table I**, below, summarizes the significant historical earthquakes that have occurred near the site.

Figure 1 shows the most prominent faults and locations of earthquake epicenters within the southern California region.

TABLE I
SIGNIFICANT HISTORICAL EARTHQUAKES

EARTHQUAKE	DISTANCE TO EPICENTER (MILES)		EARTHQUAKE MAGNITUDE*	DATE
	ADOBE CYN.	CHIQUITO CYN.		
Fort Tejon	90	89	7.9	1857
Kern Co.	46	45	7.7	1952
Santa Barbara	57	57	7.0	1812
San Fernando	13.9	14.4	6.4	1971
Northridge	15.1	16.0	6.7	1994

*Moment Magnitude after 1933 or above 6, or Local Magnitude prior to 1933 or below 6 (S.C.E.C.)

Table II summarizes the more significant potential earthquake sources near the site with estimated maximum moment magnitudes.

TABLE II
SIGNIFICANT REGIONAL FAULTS

FAULT	MAXIMUM MOMENT MAGNITUDE	APPROXIMATE DISTANCE TO SITE	
		ADOBE CANYON	CHIQUITO CANYON
Santa Susana	6.6	4.8	5.9
Sierra Madre-San Fernando	6.7	11.8	12.3
San Gabriel	7.0	4.7	3.5
Holser	6.5	2.6	1.3
San Andreas	7.8	21.6	20.4

*Approximate closest distance to surface trace in miles.

Based upon our probabilistic seismic hazard assessment (PSHA) using the computer program FRISKSP by Thomas F. Blake, the estimated peak horizontal ground acceleration with a 10% chance of exceedance in 50 years is 0.79g for the alluvial portions of the Adobe Canyon site and 0.87g for the alluvial portions of the Chiquito Canyon site.

6.1.4 Ground Failure

Ground failure is a general term describing seismically induced secondary permanent ground deformation caused by strong ground motion. This includes liquefaction of granular deposits or fine-grained soils with low plasticity below ground water, lateral spreading, seismic settlement of poorly consolidated materials (dynamic densification), differential materials response, slope failures, sympathetic movement on weak bedding planes or non-causative faults, shattered ridge effects and ground lurching. The most significant types of ground failure are discussed below.

Most of the Adobe Canyon and Chiquito Canyon sites are underlain by bedrock that is not susceptible to liquefaction. The alluvium present in the narrow tributary canyon areas of both sites (see Geologic Maps) may be subject to liquefaction. The alluvial areas within Adobe Canyon site and the alluvial area at the western portion of the Chiquito Canyon site are designated as potential liquefiable areas on the State of California Seismic Hazard Zones Map (Val Verde Quadrangle). However, liquefaction potential is not a significant impact relative to the proposed Borrow Sites. Detailed liquefaction assessments will be required for the alluvial areas prior to any future development of these areas.

Earthquake-induced slope failures include activation and reactivation of landslides, rock falls, debris flows and surficial failures. The potential for earthquake-induced slope failures is moderate to high on the steep canyon slopes. Most of the hillside areas of both the Adobe Canyon and the Chiquito Canyon sites are designated on the State of California Seismic Hazard Zones Map (Val Verde Quadrangle) to have potential for earthquake-induced slope instability. The proposed cut and fill grading for each site eliminates most of these areas. Slope stability issues are addressed in the following section.

6.2 Slope Stability

6.2.1 Adobe Canyon Site

6.2.1.1 Landslides

Three suspected landslides have been mapped within the proposed grading limits for the Adobe Canyon site. These landslides are likely translational failures controlled by the bedding orientation. These landslides are queried on the Geologic Map because their existence or lateral extent is uncertain. Landslides are considered safe for the intended use as a Borrow Site. However, future residential and/or commercial development will require subsurface exploration and analysis relative to potential adverse impacts from landslides prior to the future tentative map for the development of the subject sites.

6.2.1.2 Cut Slopes

The proposed cut slopes shown on the attached Geologic Map (**Plate I**) are designed at a gradient of 2:1 or shallower, (approx. 26.5°) with terrace drains every 25 feet for slopes greater than 3:1 gradients. The highest proposed cut slope is approximately 100 feet and the deepest proposed cut area is approximately 175 feet. Due to the northeast-dipping geologic structure of the bedrock and due to the steepness of dip of the bedrock (32 to 45 degrees), the proposed cut slopes will be favorably to neutrally oriented with respect to the geologic structure of the bedding. If potentially unstable cut slopes are found to exist at the site, they should be considered suitable for the intended use as a Borrow Site. However, future development will require subsurface exploration and slope stability analysis prior to the future tentative map.

6.2.1.3 Natural Slopes and Debris Flows

All proposed natural slopes with daylighted bedding conditions and or steep gradients (greater than 2 to 1) adjacent to graded areas may be potentially unstable and/or subject to debris flow hazard. Based on our review of the Preliminary Bulk Grading Study map, most of the natural slopes are self supporting with respect to the geologic structure of the bedrock bedding planes and slope orientations, hence gross stability is generally favorable, however, the steep drainages and swales present are subject to surficial debris flows. For the intended use as a borrow site, the proposed natural slope areas are generally considered suitable with the exception of the area in the vicinity of the proposed water tank site. The natural slopes in the vicinity of the proposed water tank site will require gross and surficial stability analysis during future project stages when more site specific geologic data is available. Building Setbacks or remedial measures will be required where ascending or descending slopes are not stable as determined by geologic or geotechnical stability analysis. If any natural slopes are determined to be unstable, or subject to debris flow hazard, mitigation measures will need to be designed. Mitigation measures generally consist of avoidance, buttressing with compacted fill, or grading back the slope to stable configuration, constructing impact walls or debris basins.

6.2.1.4 Fill Slopes

Proposed fill slopes are designed at 2 to 1 gradients or shallower with terrace drains every 25 feet. Review of the preliminary Bulk Grading Study indicates that the highest proposed fill slope on the site is approximately 90 feet and the deepest proposed fill area is approximately 50 feet. The fill slopes will be suitable for the intended use as a proposed borrow site.

6.2.1.5 Deep Fill Areas

The maximum proposed fill thickness is approximately 50 feet located within the central portion of Adobe Canyon. If the proposed fill to be placed is intended to support future structures, the areas with deep fills (greater than 40 feet) may experience more settlement than shallow fills. The current compaction requirement for fills greater than 40 feet below proposed grade is 93 percent of the maximum dry density per ASTM D1557 (1998 California Building Code).

6.2.2 Chiquito Canyon Site

6.2.2.1 Landslides

Four landslides have been mapped within the proposed grading limits of the Chiquito Canyon site. These landslides are primarily translational failures controlled by the bedding orientation. The occurrence of these landslides relative to the proposed grading design is shown on the Geologic Map **Plate II**. Cut slopes and/or grading is proposed in landslide material and or landslides are located in areas where they potentially affect the proposed Borrow Site. However, for the intended use as a Borrow Site, the proposed landslides are considered suitable for the development. As long as on-site containment be provided for potential future failures.

6.2.2.2 Cut Slopes

The proposed cut slopes shown on the attached Geologic Map (**Plate II**) are designed at a gradient of 2:1 or shallower, (approx. 26.5°) with terrace drains every 25 feet. The highest proposed cut-slope is approximately 186 feet and the deepest proposed cut area is approximately 130 feet. Due to the south-dipping geologic structure of the bedrock, all proposed southerly facing cut slopes would be potentially unstable. However, for the intended use a Borrow Site, the proposed cut slopes are considered suitable for the development with the exception of the proposed 186 foot high cut slope located in the vicinity of the existing Edison Transmission Tower. Slope stability analyses should be performed relative to the existing transmission tower and the proposed descending cut slope. We have color coded this potentially unstable cut-slope **red** on the attached Geologic Map. If this cut slope does not comply with agency's required minimum factors of safety for static and pseudostatic analyses it will require corrective measures. Corrective measures consist of avoidance, cutting back to a shallower angle or buttressing with compacted fill.

6.2.2.3 Natural Slopes and Debris Flows

All proposed natural slopes with daylighted bedding conditions and or steep gradients (greater than 2 to 1) adjacent to graded areas may be potentially unstable. However, the proposed natural slopes are considered suitable for the intended use as a borrow site. A detailed analysis of the natural slopes will be required at future stages of the development if residential or commercial structures are proposed.

The subject site contains numerous drainages and swales with alluvial and colluvial soil material. These drainages and swales may be subject to potential debris flow during heavy rains, especially in exceptionally wet years. Scattered small debris flow scars were observed within the steeper portions of the site. Debris flow hazard is considered safe for the use intended as a Borrow Site as long as on-site containment be provided.

6.2.2.4 Fill Slopes

Proposed fill slopes are designed at 2 to 1 gradients or shallower with terrace drains every 25 feet. Review of the Preliminary Bulk Grading Study for the site indicates that only minor fill areas are proposed on the site. Fill is proposed within the minor topographic swale located at the western portion of the 186 ft. high cut slope located beneath the existing Edison Tower. This fill slope is considered a sliver fill and will be evaluated along with the proposed 186 foot high cut slope due to the anticipated adverse bedding condition present below the existing Edison transmission tower.

6.2.2.5 Deep Fills

Currently, deep fill areas (greater than 40 feet) are not proposed within this study area.

6.3 Hydroconsolidation

The phenomenon of collapsing soils is the result of water interacting with void-bearing sediments. Water in the sediments reorganizes sediment particles into a more compact arrangement, causing reduction of the void space. This causes settlement (hydroconsolidation) of the material, which is potentially hazardous to future overlying structures. Rapidly buried silty sediments such as thick slopewash and alluvium commonly contain void space and are subject to hydroconsolidation. If the proposed fill material to be placed within the alluvial canyons at the Adobe Canyon and Chiquito Canyon Study areas is intended to support future structures, then the underlying alluvial and slopewash materials should be evaluated relative to hydroconsolidation potential. However, if the fill material over the alluvium and slopewash is not intended to support future structures, then the site is considered suitable for borrow site purposes and the effects of hydroconsolidation is not a consideration. Soils subject to hydroconsolidation can be mitigated by removal and recompaction or other densification measures of upper collapsible soils.

6.4 Erosion Potential and Drainage

Some evidence of erosion was observed within the soil of the subject sites. Bedrock is not expected to be as susceptible to erosion as the overlying soil material. However the future fill, bedrock and soil material at both sites will be susceptible to erosion if sheet flow drainage is not provided. Water should not be allowed to stand or pond on the future graded pad areas nor should it be allowed to flow over natural or constructed slopes, but should be directed to the designed temporary debris basins at each respective site. Debris material generated from the site erosion should be contained within the site boundaries. Debris and erosion of the site materials is referred to the supervising civil engineer relative to providing site drainage containment of material generated during surficial erosion.

6.5 Dam Inundation

Review of the technical appendix to the safety element of the Los Angeles County General Plan (Flood and Inundation Hazards - Plate 6) indicates the extreme southern portion of the Chiquito Canyon site may be subject to dam inundation from Castaic Lake if dam failure were to occur. The Adobe Canyon site is not subject to dam inundation hazard.

6.6 Construction Considerations

6.6.1 Rippability

The bedrock at both sites is moderately consolidated, and grading operations should be able to be performed with conventional equipment. Heavy single shank ripping will probably be required if massive conglomerate units of the Pico and Saugus Formations are encountered.

6.6.2 Oversize Material

Cobbles and small boulders are commonly present within both the alluvium, Quaternary Terrace deposits and the Pico and Saugus Formation present on both the Adobe Canyon site and Chiquito Canyon site. This oversize material may present some difficulties during cutting operations with some types of equipment; however, it is not considered to be a significantly detriment to the development. Oversized material will require special handling during fill construction typical of all grading operations.

6.6.3 Expansive Materials

The fine-grained units of the Saugus Formation and Pico Formation are potentially very expansive, and the clayey artificial fill, slopewash and alluvium deposits present at the site may contain potentially expansive material. The expansive material should be evaluated by the Project Geotechnical Engineer relative to export of fill material to the River Village Development. Special foundation designs and reinforcement can be utilized to mitigate expansive material.

6.6.4 Shrinking and Bulking Characteristics of Earth Materials

Typically, landslide materials, slopewash, fill and alluvial deposits shrink in volume when removed and recompacted, and the Saugus Formation and Pico Formation bedrock bulks. Determination of the shrinking or bulking factors of the on-site materials should be performed at the during the future stages of development to properly assess the cut-fill balance of the proposed grading and verify quantities of fill for export.

6.6.5 Corrosion Potential

Soils on site may have some degree of corrosive characteristics to concrete and ferrous metals. Soil moisture, chemistry, and other physical characteristics all have important effects on corrosivity. Testing should be performed to determine the corrosion potential of the material to be exported to the River Village development. These tests will indicate what special measures, such as cement type or corrosion protection for underground utility pipes, will be required for the future site construction.

6.7 Oil Wells

Review of the 2003 Munger Map book indicates there is one (1) documented oil well present within the proposed grading limits on the Adobe Canyon site. However there are four (4) documented oil wells located in the vicinity surrounding the site. At the Chiquito Canyon site, there is one (1) documented oil well present within the proposed grading limits at the location of the eastern temporary debris basin and one oil well located north of the project grading limits. The approximate location of these oil wells are shown on the Geologic Maps (**Plates I and II**). It should be noted that it is the general policy of the

Division of Oil, Gas and Geothermal Resources that the space above an oil or gas well not be built on to allow access in case of future leaks. If any undocumented oil or gas wells are encountered during the grading operations, their locations should be surveyed and the current well conditions evaluated immediately.

Soils in the vicinity of oil wells could be contaminated with petroleum products spilled during past operations of the wells. Wells may have associated mud pits, which could also contain materials considered to be hazardous under current environmental regulations. The abandonment status and conditions of the nearby soils of each oil well should be addressed during the future stages of the development. The names of the oil wells for each site are provided below.

6.7.1 Adobe Canyon Site

1. Oryx Energy Co. - "NL&F #1"
2. Oryx Energy Co. - "NL&F #142"
3. Oryx Energy Co. - "NL&F #145"
4. Oryx Energy Co. - "NL&F #152"
5. Quintana Petro. Corp. - "NL&F - Trifield #1"

6.7.2 Chiquito Canyon Site

1. Exxon – Castaic Jct. Gas Unit #1
2. LBTH Inc. – (Blair) #27

7.0 PROJECT FEASIBILITY

The proposed Adobe Canyon Preliminary Bulk Grading Study and Chiquito Canyon Preliminary Bulk Grading Study are feasible from the geologic and geotechnical standpoint for the intended use as Borrow Sites. The Chiquito Canyon Preliminary Bulk Grading Study and the Adobe Canyon Preliminary Bulk Grading Study will not adversely impact SR 126, the existing Edison Tower adjacent to the proposed cut slope and the proposed water tank site or adjacent off-site properties provided that the geologic/geotechnical constraints outlined in this report, along with appropriate building and grading codes, are taken into account during the planning, design and construction phases of the project.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions summarize the primary geologic/geotechnical issues that impact the proposed development.

1. The potential for primary ground rupture to occur on a fault on the site is considered to be **very low to non-existent**.

2. Based upon our probabilistic seismic hazard assessment, the peak horizontal ground acceleration for an earthquake with a 10% chance of exceedance in 50 years is expected to be 0.79g for the Adobe Canyon site and 0.87g for the Chiquito Canyon site.

3. The alluvial areas within Adobe Canyon site and the alluvial area at the western portion of the Chiquito Canyon site are designated as potential liquefiable areas on the State of California Seismic Hazard Zones Map (Val Verde Quadrangle). If the proposed fills over alluvium and slopewash are to be considered as "structural fill", subsurface studies should be performed to determine actual liquefaction potential of these soils. In many cases, liquefaction potential can be mitigated by removal and recompaction of the alluvium above groundwater, to provide a cap to bridge effects from liquefaction at depth.

4. The potential for seismic settlement (dynamic densification) during future seismic events is non-existent in the bedrock portions for each site. The fill portions of each site are generally susceptible to seismic settlement, however, these sites are considered safe for the intended use as borrow sites

5. Landslides have been mapped on both the Adobe and Chiquito Canyon sites. Landslide materials are considered safe for the intended use as borrow sites. However, if future residential/commercial developments are proposed at these areas, they will require subsurface explorations and analyses. Mitigation measures consist of complete or partial removal, buttressing, avoidance, and building setbacks. Restricted Use Areas will need to be established around any unmitigated landslides in open space areas.

6. For the intended use as Borrow Sites, cut slopes at both sites are considered safe for the use intended with the exception of the 186 foot high cut slope located below the existing Edison Transmission Tower at the Chiquito Canyon Study Area. Slope stability analysis should be performed on this slope relative to the existing adverse

bedding conditions and the existing transmission tower at the top of the proposed cut slope. If this cut slope does not comply with agency's required minimum factors of safety for static and pseudostatic conditions, it will require corrective measures such as Buttresses or Stability Fills or will need to be redesigned to a more stable configuration.

7. For the intended use as borrow sites, natural slope materials are considered suitable for the proposed development. The natural slopes surrounding the proposed water tank site at the Adobe Canyon Study Area should be evaluated relative to gross stability of these natural slopes. This study should include subsurface investigation to determine the specific geologic conditions for evaluation by the Geotechnical Engineer. If these natural slopes do not comply with agency's required minimum factors of safety for static and pseudostatic conditions, they will require corrective measures. Corrective measures may consist of avoidance, cutting back to a shallower angle or buttressing with compacted fill.

8. A study should be conducted to evaluate potential debris flow in the vicinity of the proposed water tank site located at the Adobe Canyon Study Area. Debris flow hazard can be generally mitigated by the construction of impact or debris walls and/or debris basins, control of run-off or removal of loose surficial materials.

9. Rapidly buried silty and sandy sediments such as thick slopewash and alluvium are subject to hydroconsolidation at both study areas. If the fill material placed within the alluvial canyon areas is intended to support future structures, then the underlying alluvial and slopewash materials should be evaluated relative to hydroconsolidation potential. If the fill material over the alluvium and slopewash is not intended to support future structures, the sites are considered suitable for the intended use as borrow sites relative to hydroconsolidation potential. Soils subject to hydroconsolidation can be mitigated by removal and recompaction or other densification measures of upper collapsible soils.

10. The existing provisions in the Grading Ordinance for planting and irrigation of cut slopes and fill slopes will reduce the potential for erosion

11. The bedrock is moderately consolidated, which indicates that grading operations can be performed with conventional equipment. Heavy single-shank ripping will probably be required if massive conglomerate units are encountered.

12. Cobbles and small boulders are present within the alluvium, Quaternary Terrace Deposits and the Pico and Saugus Formations on both the Adobe and Chiquito Canyon sites. This oversize material may present difficulties during cutting operations with some types of equipment. In addition, oversize material will require special handling during fill construction.

13. A study should be conducted to evaluate the expansive potential of the material to be exported to the River Village Development. If the material is determined to be expansive, it can be mitigated by mixing with soil with low expansive potential or by designing special foundations system.

14. Determination of the shrinking or bulking factors of the on-site materials should be performed at the during the future stages of development to properly assess the cut-fill balance of the proposed grading and verify quantities of fill for export.

15. Testing should be performed to determine the corrosion potential of the material to be exported to the River Village development. These tests will indicate what special measures, such as cement type or corrosion protection for underground utility pipes, will be required for the future site construction of the River Village development.

16. Review of the technical appendix to the safety element of the Los Angeles County General Plan (Flood and Inundation Hazards - Plate 6) indicates the extreme southern portion of the Chiquito Canyon site may be subject to dam inundation from Castaic Lake if dam failure were to occur. The Adobe Canyon site is not subject to dam inundation hazard.

9.0 LIMITATIONS

This report has been prepared for the exclusive use of Newhall Land and their design consultants for the specific site discussed herein. This report should not be considered transferable. Prior to use by others, we should be notified, as additional work may be required to update this report.

In the event that any modifications in the design or location of the proposed development, as discussed herein, are planned, the conclusions and recommendations contained in this report will require a written review by this firm with respect to the planned modifications.

It should be noted that faulting is normally confined to the area immediately adjacent to a known fault, or within a few feet of the last fault movement. Regardless of what criteria are used however, absolute assurance against future fault displacement or strong ground motion cannot be obtained in tectonically active areas. New faults can form, as the orientation and magnitude of deformational forces in the earth's crust change with time. Therefore, the location of new breaks or ground motions during a seismic event cannot be located or anticipated.

In performing these professional services, we have used the degree of care and skill ordinarily exercised, under similar circumstances, by reputable engineering geologists and geotechnical engineers practicing in this or similar localities.

The analyses and interpretations presented in this report have been based on the results of field reconnaissance and review of the referenced reports. It should be recognized that subsurface conditions can vary in time and laterally and with depth at a given site. Our conclusions and recommendations are based on the data available and our interpretation of the data based on our experience and background. Hence, our **conclusions** and **recommendations** are **professional opinions** and are **not meant** to be a control of nature; therefore, **no warranty** is herein **expressed** or **implied**.

This report may not be duplicated without the written consent of this firm.

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

Respectfully submitted,

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

Dharmesh P. Amin, M.S., P.E., GE 2553
Principal Geotechnical Engineer

The following attachments complete this report.

References
Location Map following page 2
Fault and Earthquake Epicenter Location Map - Figure 1 following page 7
Geologic Maps **Plates I & II** (In Pocket)

Distribution: (2) Newhall Land
Attn: Addressee
(2) Psomas
Attn: Mr. Ross Barker
(1) Impact Sciences
Attn: Mr. Ken Koch

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Published

Blake, T.F., 1988-1999 EQFAULT, v.2.2 A Computer Program for the deterministic Prediction of Peak Horizontal Acceleration From Digitized California Faults, User's Manual 79 P.

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Ziony, J.I. and Yerkes, R. F., 1985, Evaluating Earthquake and Surface-Faulting Potential. U. S. Geological Survey Professional Paper 1360, p. 43-92.

Please refer to map No. 4.1-E in the accompanying map box.

Please refer to map No. 4.1-F in the accompanying map box.

Geologic and Geotechnical Report – Addendum No. 1
Response to Comments
Dated February 10, 2001

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

REGISTERED GEOLOGIST 571
ENGINEERING GEOLOGIST 246

February 10, 2001 Job No: 01-1702R-4

Newhall Ranch Company®
A Division of the Newhall Land & Farming Company
23823 W. Valencia Blvd.
Valencia, CA 91355

Attention: Mr. Steve Zimmer

Subject: **GEOLOGIC AND GEOTECHNICAL REPORT - ADDENDUM NO. 1**
Response to County Comments (Review Sheets dated 12/12/00 and 1/2/01)
Vesting Tentative Tract 53108, Map Dated 6/11/00
River Village, Newhall Ranch
Castaic, California

Reference: **Geologic and Geotechnical Report**
Vesting Tentative Tract 53108, Dated 6/11/00
River Village, Newhall Ranch
Castaic, California
Dated September 27, 2000 - JN: 00-1702R-4

Gentlemen:

This addendum report has been prepared in response to the Geologic and Geotechnical Review Sheets dated December 12, 2000 and January 2, 2001, respectively, on the referenced report, addressing the Map for Vesting Tentative Tract 53108, dated 6/11/00. This map corresponds to the proposed River Village development project, a portion of the proposed Newhall Ranch project. The review sheets were issued by the Los Angeles County Department of Public Works. In order to facilitate the review process, we are presenting the County remarks (**in bold**) in the order in which they appear on the original review letter. Each remark is followed immediately by our response. Copies of the review sheets are included in **Appendix A**.

RESPONSE TO COUNTY REVIEW SHEETS

GEOLOGIC REVIEW SHEET (12/12/00)

Remark No. 1

The Soils Engineering review dated 1/2/01 is attached.

Response

Our response to the Geotechnical Engineering review sheet is presented below.

GEOTECHNICAL REVIEW SHEET (1/2/01)

Remark No. 1

Provide results which address the factor of safety against liquefaction (resisting stress vs. earthquake-induced stress) for all liquefaction analyses conducted. Per L.A. County minimum standards, all soils exhibiting a factor of safety less than 1.25 are considered liquefiable. Verify and make revisions as necessary.

Response

Theoretically, liquefiable zones are based upon the premise that liquefaction potential exists if the resistance against liquefaction (strength) is less than the earthquake-induced stress; this is to say, a stress ratio or factor of safety less than unity. As a comfortable margin of safety, the County of Los Angeles considers as liquefiable all soils with a factor of safety less than 1.25. We have retrieved from our computer files the spreadsheets (see **Figures B-1 through B-8 in Appendix B)** showing the factors of safety in the last column, which includes values less than, as well as greater than 1.25. Also included are, among other data, depth intervals, original and corrected blow counts, and percent fines. Blow count and laboratory data of percent fines from correlation borings are shown on graphs (a) and (b) of Figures D-1 through D-8 of the referenced report, which are reproduced and attached to this response report. By comparing CPT data with boring data, CPT data are generally conservative and were used for the analyses.

Our earthquake-induced settlement analyses include all layers under the historic high ground water, with blow counts corrected for clean sands, weather or not the factor of safety against liquefaction is less than 1.25. Settlement analyses were performed for the same locations analyzed for liquefaction potential to estimate possible range of settlements to be expected at the project site. As observed on the attached graphs (c) and (d) of the referenced report, **cyclic settlements increase when liquefaction occurs**. The maximum cumulative calculated settlement is 1.4 inches and, as indicated in the referenced report, differential settlements are expected to be not greater than 0.9 inch in a distance of 30 feet. Actual settlements that may occur at the surface are expected to be less than the calculated settlements at greater depths because of the presence of a natural cap for which cyclic settlements are zero (or negligible). This cap ranges in thickness between 8 feet and 27 feet (see Figures D-1 through D-8).

All of the estimated settlements below the aforementioned natural cap are small and their effects, if any, as well as their corresponding liquefiable layers with a factor of safety less than 1.25, are expected to be attenuated by the natural cap because of expected bridging effects.

In the referenced report, removal and recompaction of upper soils to various depths are recommended for improvement of existing conditions. In addition, certified compacted fill will be placed at some locations to raise the existing grade. **These recompacted soils and new fill will enhance attenuation of any potential minor effects from deeper liquefaction and cyclic settlements.** The removals will increase the strength of upper soils, and the additional fill will increase the thickness of the cap for attenuation of liquefaction and settlements. **Table 1** below shows thicknesses of removals, additional compacted fill, and resulting new (effective) cap (due to the addition of fill) for analyzed critical locations:

ANALYZED LOCATION	APPROX. REMOVAL DEPTH (FT.)	PROPOSED ADDITIONAL FILL (FT.)	EFFECTIVE CAP (FT.)
CPT-05	12*	0	17
CPT-13	8	0	17
CPT-109	10	7	22
CPT-115	9	11	22.5

***Note:** Removal for bank stabilization will probably be greater than 12 feet, to a possible maximum of 20 feet.

Based on the above, and as indicated in the referenced report, special measures to further mitigate liquefaction and cyclic settlements are considered to be unnecessary.

Remark No. 2

Requirements of the Geology Section are attached.

Response

A response to the Geologic Review Sheet dated 12/12/00, is included in this report.

Remark No. 3

Include a copy of this review sheet with your response.

Response

A copy of the review sheet is included in **Appendix A.**

This opportunity to be of service is greatly appreciated. If you have any questions regarding this report, please call.

Respectfully submitted,

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

Edward Castellanos, PE 30279, RGE 191
Principal Geotechnical Engineer

REGISTERED GEOLOGIST
Eric J. Seward
No. 2110
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
EDWARD CASTELLANOS
3/04
NO. 191
GEOTECHNICAL
STATE OF CALIFORNIA

The following attachments and appendices complete this report.

APPENDIX A

County of Los Angeles, Dept. of Public Works - Land Development Division

Geologic Review Sheet dated 12/12/00

Geotechnical Engineering Review sheet dated 1/2/01

APPENDIX B

Spreadsheets of Liquefaction Potential Analyses:

- CPT-05 — Figure B-1
- CPT-13 — Figure B-2
- CPT-18 — Figure B-3
- CPT-103 — Figure B-4
- CPT-109 — Figure B-5
- CPT-115 — Figure B-6
- CPT-125 — Figure B-7
- CPT-128 — Figure B-8

Graphs of Liquefaction Potential and Cyclic Settlement Analyses — Figures D-1 through D-5
(reproduced from the referenced report)

Distribution: (2) Newhall Ranch Company
Attn: Mr. Steve Zimmer
Attn: Mr. Dave Crowder

(3) Psomas
1-Attn: Mr. Jason Fukumitsu
2-L.A. Co. Department of Public Works - Land Development Division
Attn: Geology Section - Mr. Charles Nestle
Attn: Soils Section - Mr. Mark A. Steuer

REVIEWER CALLING HOURS
8-9 a.m. & 3-4 p.m. Mon.-Thurs.

County of Los Angeles Department of Public Works
LAND DEVELOPMENT DIVISION
GEOLOGIC REVIEW SHEET
900 S. Fremont Ave., Alhambra, CA 91803
TEL. (626) 458-4925

DISTRIBUTION
1 Geologist
__ Soils Engineer
1 LDMA/Proc. Center
1 Section File
1 Subdivision

TENTATIVE TRACT/MINOR LAND SUBDIVISION 53108
TENTATIVE MAP DATED 9/11/00
SUBDIVIDER Newhall Land & Farming Co. / Newhall Ranch Co.
LOCATION Newhall Ranch
ENGINEER Psomas
GEOLOGIST AND SOILS ENGINEER Allan Seward
REPORT DATE 9/27/00 (00-1702R-4)

The Regional Planning Commission, developer and engineer are advised that:

PRIOR TO RECOMMENDING APPROVAL OF TENTATIVE TRACT OR MINOR LAND SUBDIVISION MAP:

1. The Soils Engineering review dated 1/2/01 is attached.

NOTE: Provide a copy of this review with your resubmittal.

Prepared by [signature] Charles Nestle
Reviewed by ______
Date 12/12/00

NOTE: **Public Safety, relative to geotechnical subsurface exploration, shall be provided in accordance with current codes for excavations, inclusive of the Los Angeles County Code, Chapter 11.48, and the State of California, Title 8, Construction and Safety Orders.**

The **"Manual for Preparation of Geotechnical Reports"** prepared by County of Los Angeles, Department of Public Works is available on the Internet at the following address: http://dpw.co.la.ca.us/med/manual.pdf

p:\mepubnew\geology review\forms\Form_1
11/23/99

COUNTY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
LAND DEVELOPMENT DIVISION

SOILS ENGINEERING REVIEW SHEET

Address: 900 S. Fremont Ave.
Alhambra, CA 91803
Telephone: (626) 458-4925
Fax: (626) 458-4913
Calling hours - Monday through Thursday 8-9 a.m. & 3-4 p.m.

District Office 8.2
Job No.
Sheet 1 of 1
Geol. Ltr

Tentative Tract 53108
Location Newhall
Developer/Owner Newhall Land & Farming
Engineer/Architect Psomas
Soils Engineer Allan Seward (00-1702R-4)
Geologist Same as above

Review of:

Soils Engineering Report Dated 9/27/00 Geologic Report Dated 9/27/00

Previous review sheet dated 10/2/00

ACTION:

Tentative Map feasibility is not recommended for approval.

REMARKS:

1. Provide results which address the factor of safety against liquefaction (resisting stress vs. earthquake-induced stress) for all liquefaction analyses conducted. Per L.A. County minimum standards, all soils exhibiting a factor of safety less than 1.25 are considered liquefiable. Verify and make revisions as necessary.

2. Requirements of the Geology Section are attached.

3. Include a copy of this review sheet with your response.

REGISTERED PROFESSIONAL ENGINEER
MARK ANDREW STEUER
No. C053672
Exp. 6-30-03
CIVIL
STATE OF CALIFORNIA

Prepared by Mark A. Steuer Date 1/2/01

NOTICE: Public safety, relative to geotechnical subsurface exploration, shall be provided in accordance with current codes for excavations, inclusive of the Los Angeles County Code, Chapter 11.48, and the State of California, Title 8, Construction Safety Orders.

Mark:53108

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-13

Figure B-2

Test Location	CPT-13	Basic Earthquake Magnitude	7.5
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?
Ground Surface Elevation	940 ft. MSL	Design Magnitude	6.5
Ground WaterDuring Investigatior	15 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)
Historic Ground Water Depth	12 ft. Below GL	Design PGA (M = 6.5)	0.87 g.
		Magnification Factor	1.0

Conditions: Existing conditions with historic groundwater level

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
1	0.25	939.8	0	0.49	SM/ML	0.120	0.029	0.029	2.000	11	~	1	1	1	22	35		31	>0.6	>0.6	>2.0	0.999	0.011	Non Liq.
2	0.74	939.3	0.49	0.98	SM/ML	0.120	0.088	0.088	2.000	11	~	1	1	1	22	35		31	>0.6	>0.6	>2.0	0.997	0.034	Non Liq.
3	1.23	938.8	1.0	1.48	SM/ML	0.120	0.148	0.148	2.000	20	~	1	1	1	40	35		53	>0.6	>0.6	>2.0	0.994	0.056	Non Liq.
4	1.73	938.3	1.48	1.97	SP/SM	0.120	0.207	0.207	2.000	24	~	1	1	1	48	6		48	>0.6	>0.6	>2.0	0.992	0.079	Non Liq.
5	2.22	937.8	1.97	2.46	SM/ML	0.120	0.266	0.266	2.000	16	~	1	1	1	32	35		43	>0.6	>0.6	>2.0	0.990	0.101	Non Liq.
6	2.71	937.3	2.46	2.95	SM/ML	0.120	0.325	0.325	2.000	10	~	1	1	1	20	35		29	0.396	0.396	0.129	0.988	0.123	Non Liq.
7	3.20	936.8	2.95	3.44	SM/ML	0.120	0.383	0.383	2.000	7	~	1	1	1	14	35		22	0.245	0.245	0.094	0.985	0.145	Non Liq.
8	3.69	936.3	3.44	3.94	SM/ML	0.120	0.443	0.443	2.000	6	~	1	1	1	12	35		19	0.215	0.215	0.095	0.983	0.167	Non Liq.
9	4.19	935.8	3.94	4.43	SM/ML	0.120	0.502	0.502	1.996	6	~	1	1	1	12	35		19	0.215	0.215	0.108	0.981	0.189	Non Liq.
10	4.68	935.3	4.43	4.92	SM/ML	0.120	0.561	0.561	1.888	7	~	1	1	1	13	35		21	0.233	0.233	0.131	0.978	0.211	Non Liq.
11	5.17	934.8	4.92	5.41	SM/ML	0.120	0.620	0.620	1.796	11	~	1	1	1	20	35		29	0.382	0.382	0.237	0.976	0.232	Non Liq.
12	5.66	934.3	5.41	5.91	SM/ML	0.120	0.679	0.679	1.716	11	~	1	1	1	19	35		28	0.348	0.348	0.236	0.974	0.254	Non Liq.
13	6.16	933.8	5.91	6.40	SM/ML	0.120	0.739	0.739	1.646	13	~	1	1	1	21	35		31	>0.6	>0.6	>2.0	0.972	0.275	Non Liq.
14	6.65	933.4	6.40	6.89	SM/ML	0.120	0.797	0.797	1.584	18	~	1	1	1	29	35		39	>0.6	>0.6	>2.0	0.969	0.296	Non Liq.
15	7.14	932.9	6.89	7.38	SM/ML	0.120	0.856	0.856	1.528	24	~	1	1	1	37	35		49	>0.6	>0.6	>2.0	0.967	0.318	Non Liq.
16	7.63	932.4	7.38	7.87	SP/SM	0.120	0.915	0.915	1.478	26	~	1	1	1	38	6		39	>0.6	>0.6	>2.0	0.965	0.339	Non Liq.
17	8.12	931.9	7.87	8.37	SP/SM	0.120	0.974	0.974	1.433	25	~	1	1	1	36	6		36	>0.6	>0.6	>2.0	0.963	0.360	Non Liq.
18	8.62	931.4	8.37	8.86	SP/SM	0.120	1.034	1.034	1.391	25	~	1	1	1	35	6		35	>0.6	>0.6	>2.0	0.960	0.381	Non Liq.
19	9.11	930.9	8.86	9.35	SP/SM	0.120	1.093	1.093	1.353	25	~	1	1	1	34	6		34	>0.6	>0.6	>2.0	0.958	0.401	Non Liq.
20	9.60	930.4	9.35	9.84	SM/ML	0.120	1.151	1.151	1.318	33	~	1	1	1	43	35		57	>0.6	>0.6	>2.0	0.956	0.422	Non Liq.
21	10.09	929.9	9.84	10.33	SM/ML	0.120	1.210	1.210	1.286	29	~	1	1	1	37	35		50	>0.6	>0.6	>2.0	0.954	0.443	Non Liq.
22	10.58	929.4	10.33	10.83	SP/SM	0.120	1.270	1.270	1.255	30	~	1	1	1	38	6		38	>0.6	>0.6	>2.0	0.951	0.463	Non Liq.
23	11.08	928.9	10.83	11.32	SP/SM	0.120	1.329	1.329	1.227	54	~	1	1	1	66	6		67	>0.6	>0.6	>2.0	0.949	0.484	Non Liq.
24	11.57	928.4	11.32	11.81	SM/ML	0.120	1.388	1.388	1.200	38	~	1	1	1	46	35		60	>0.6	>0.6	>2.0	0.947	0.504	Non Liq.
25	12.06	927.9	11.81	12.30	CL	0.120	1.447	1.443	1.177	34	~	1	1	1	40	52		Fine grained	>0.6	>0.6	>2.0	0.945	0.524	Non Liq.
26	12.55	927.5	12.30	12.80	SM/ML	0.120	1.506	1.472	1.166	30	~	1	1	1	35	35		47	>0.6	>0.6	>2.0	0.942	0.544	Non Liq.
27	13.05	927.0	12.8	13.29	ML/CL	0.120	1.565	1.500	1.155	21	~	1	1	1	24	52		Fine grained	>0.6	>0.6	>2.0	0.940	0.564	Non Liq.
28	13.54	926.5	13.29	13.78	ML/CL	0.120	1.624	1.528	1.144	30	~	1	1	1	34	52		Fine grained	>0.6	>0.6	>2.0	0.938	0.584	Non Liq.
29	14.03	926.0	13.78	14.27	SP/SM	0.120	1.683	1.557	1.133	55	~	1	1	1	62	6		63	>0.6	>0.6	>2.0	0.935	0.604	Non Liq.
30	14.52	925.5	14.27	14.76	SP/SM	0.120	1.742	1.585	1.123	75	~	1	1	1	84	6		85	>0.6	>0.6	>2.0	0.933	0.623	Non Liq.
31	15.01	925.0	14.76	15.26	SP	0.120	1.801	1.801	1.054	83	~	1	1	1	87	0		87	>0.6	>0.6	>2.0	0.931	0.643	Non Liq.
32	15.51	924.5	15.26	15.75	SP/SM	0.120	1.861	1.829	1.046	70	~	1	1	1	73	6		74	>0.6	>0.6	>2.0	0.929	0.663	Non Liq.
33	16.00	924.0	15.75	16.24	SM/ML	0.120	1.919	1.857	1.038	41	~	1	1	1	43	35		56	>0.6	>0.6	>2.0	0.926	0.682	Non Liq.
34	16.49	923.5	16.24	16.73	SM/ML	0.120	1.978	1.886	1.030	28	~	1	1	1	29	35		39	>0.6	>0.6	>2.0	0.924	0.701	Non Liq.
35	16.98	923.0	16.73	17.22	SM/ML	0.120	2.037	1.914	1.022	27	~	1	1	1	28	35		38	>0.6	>0.6	>2.0	0.922	0.720	Non Liq.
36	17.47	922.5	17.22	17.72	SM/ML	0.120	2.096	1.942	1.015	32	~	1	1	1	32	35		44	>0.6	>0.6	>2.0	0.920	0.739	Non Liq.
37	17.97	922.0	17.72	18.21	SM/ML	0.120	2.156	1.971	1.007	23	~	1	1	1	23	35		33	>0.6	>0.6	>2.0	0.917	0.758	Non Liq.
38	18.46	921.5	18.21	18.70	SM/ML	0.120	2.215	1.999	1.000	34	~	1	1	1	34	35		46	>0.6	>0.6	>2.0	0.915	0.777	Non Liq.
39	18.95	921.1	18.7	19.19	SM/ML	0.120	2.273	2.027	0.993	31	~	1	1	1	31	35		42	>0.6	>0.6	>2.0	0.913	0.796	Non Liq.
40	19.44	920.6	19.19	19.69	CL	0.120	2.333	2.056	0.986	17	~	1	1	1	17	52		Fine grained	>0.6	>0.6	>2.0	0.911	0.815	Non Liq.
41	19.94	920.1	19.69	20.18	SM/ML	0.120	2.392	2.084	0.980	27	~	1	1	1	26	35		37	>0.6	>0.6	>2.0	0.908	0.833	Non Liq.
42	20.43	919.6	20.18	20.67	ML/CL	0.120	2.451	2.112	0.973	17	~	1	1	1	17	52		Fine grained	>0.6	>0.6	>2.0	0.906	0.852	Non Liq.
43	20.92	919.1	20.67	21.16	SM/ML	0.120	2.510	2.141	0.967	63	~	1	1	1	61	35		78	>0.6	>0.6	>2.0	0.904	0.870	Non Liq.
44	21.41	918.6	21.16	21.65	ML/CL	0.120	2.569	2.169	0.960	29	~	1	1	1	28	52		Fine grained	>0.6	>0.6	>2.0	0.902	0.888	Non Liq.
45	21.90	918.1	21.65	22.15	ML/CL	0.120	2.628	2.197	0.954	17	~	1	1	1	16	52		Fine grained	>0.6	>0.6	>2.0	0.899	0.906	Non Liq.
46	22.40	917.6	22.15	22.64	SM/ML	0.120	2.687	2.226	0.948	27	~	1	1	1	26	35		36	>0.6	>0.6	>2.0	0.897	0.924	Non Liq.
47	22.89	917.1	22.64	23.13	SM/ML	0.120	2.746	2.254	0.942	18	~	1	1	1	17	35		25	0.296	0.296	0.667	0.895	0.942	0.71
48	23.38	916.6	23.13	23.62	SM/ML	0.120	2.805	2.282	0.936	21	~	1	1	1	20	35		29	0.378	0.378	0.863	0.892	0.960	0.90
49	23.87	916.1	23.62	24.11	ML/CL	0.120	2.864	2.311	0.930	25	~	1	1	1	23	52		Fine grained	>0.6	>0.6	>2.0	0.890	0.978	Non Liq.
50	24.36	915.6	24.11	24.61	SM/ML	0.120	2.923	2.339	0.925	25	~	1	1	1	23	35		33	>0.6	>0.6	>2.0	0.888	0.995	Non Liq.
51	24.86	915.1	24.61	25.10	ML/CL	0.120	2.983	2.368	0.919	39	~	1	1	1	36	52		Fine grained	>0.6	>0.6	>2.0	0.886	1.013	Non Liq.
52	25.35	914.7	25.10	25.59	ML/CL	0.120	3.041	2.396	0.914	24	~	1	1	1	22	52		Fine grained	>0.6	>0.6	>2.0	0.883	1.030	Non Liq.
53	25.84	914.2	25.59	26.08	CL	0.120	3.100	2.424	0.908	32	~	1	1	1	29	52		Fine grained	>0.6	>0.6	>2.0	0.881	1.048	Non Liq.
54	26.33	913.7	26.08	26.57	SM/ML	0.120	3.159	2.452	0.903	38	~	1	1	1	34	35		46	>0.6	>0.6	>2.0	0.879	1.065	Non Liq.
55	26.82	913.2	26.57	27.07	CL	0.120	3.218	2.481	0.898	41	~	1	1	1	37	52		Fine grained	>0.6	>0.6	>2.0	0.877	1.082	Non Liq.
56	27.32	912.7	27.07	27.56	SM/ML	0.120	3.278	2.509	0.893	49	~	1	1	1	44	35		57	>0.6	>0.6	>2.0	0.874	1.099	Non Liq.
57	27.81	912.2	27.56	28.05	CL	0.120	3.337	2.538	0.888	57	~	1	1	1	51	52		Fine grained	>0.6	>0.6	>2.0	0.872	1.116	Non Liq.
58	28.30	911.7	28.05	28.54	CL	0.120	3.395	2.566	0.883	38	~	1	1	1	34	52		Fine grained	>0.6	>0.6	>2.0	0.870	1.133	Non Liq.
59	28.79	911.2	28.54	29.04	CL	0.120	3.455	2.594	0.878	36	~	1	1	1	32	52		Fine grained	>0.6	>0.6	>2.0	0.868	1.149	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-5

Figure B-1

Test Location	CPT-05	Basic Earthquake Magnitude	7.5
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?
Ground Surface Elevation	954 ft. MSL	Design Magnitude	6.5
Ground WaterDuring Investigatior	24 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)
Historic Ground Water Depth	11 ft. Below GL	Design PGA (M = 6.5)	0.87 g.
		Magnification Factor	1.0

Conditions: Existing conditions with historic groundwater level

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
1	0.25	953.8	0	0.49	CL	0.120	0.029	0.029	2.000	8	~	1	1	1	16	52		Fine grained	>0.6	>0.6	>2.0	0.999	0.011	Non Liq.
2	0.74	953.3	0.49	0.98	ML/CL	0.120	0.088	0.088	2.000	11	~	1	1	1	22	52		Fine grained	>0.6	>0.6	>2.0	0.997	0.034	Non Liq.
3	1.23	952.8	1.0	1.48	SM/ML	0.120	0.148	0.148	2.000	14	~	1	1	1	28	35		38	>0.6	>0.6	>2.0	0.994	0.056	Non Liq.
4	1.73	952.3	1.48	1.97	SM/ML	0.120	0.207	0.207	2.000	10	~	1	1	1	20	35		29	0.396	0.396	0.082	0.992	0.079	Non Liq.
5	2.22	951.8	1.97	2.46	SM/ML	0.120	0.266	0.266	2.000	21	~	1	1	1	42	35		55	>0.6	>0.6	>2.0	0.990	0.101	Non Liq.
6	2.71	951.3	2.46	2.95	ML/CL	0.120	0.325	0.325	2.000	15	~	1	1	1	30	52		Fine grained	>0.6	>0.6	>2.0	0.988	0.123	Non Liq.
7	3.20	950.8	2.95	3.44	SM/ML	0.120	0.383	0.383	2.000	10	~	1	1	1	20	35		29	0.396	0.396	0.152	0.985	0.145	Non Liq.
8	3.69	950.3	3.44	3.94	ML/CL	0.120	0.443	0.443	2.000	13	~	1	1	1	26	52		Fine grained	>0.6	>0.6	>2.0	0.983	0.167	Non Liq.
9	4.19	949.8	3.94	4.43	ML/CL	0.120	0.502	0.502	1.996	14	~	1	1	1	28	52		Fine grained	>0.6	>0.6	>2.0	0.981	0.189	Non Liq.
10	4.68	949.3	4.43	4.92	ML/CL	0.120	0.561	0.561	1.888	17	~	1	1	1	32	52		Fine grained	>0.6	>0.6	>2.0	0.978	0.211	Non Liq.
11	5.17	948.8	4.92	5.41	SP/SM	0.120	0.620	0.620	1.796	15	~	1	1	1	27	6		27	0.336	0.336	0.208	0.976	0.232	Non Liq.
12	5.66	948.3	5.41	5.91	SM/ML	0.120	0.679	0.679	1.716	15	~	1	1	1	26	35		36	>0.6	>0.6	>2.0	0.974	0.254	Non Liq.
13	6.16	947.8	5.91	6.40	SM/ML	0.120	0.739	0.739	1.646	19	~	1	1	1	31	35		42	>0.6	>0.6	>2.0	0.972	0.275	Non Liq.
14	6.65	947.4	6.40	6.89	SM/ML	0.120	0.797	0.797	1.584	19	~	1	1	1	30	35		41	>0.6	>0.6	>2.0	0.969	0.296	Non Liq.
15	7.14	946.9	6.89	7.38	SM/ML	0.120	0.856	0.856	1.528	19	~	1	1	1	29	35		40	>0.6	>0.6	>2.0	0.967	0.318	Non Liq.
16	7.63	946.4	7.38	7.87	ML/CL	0.120	0.915	0.915	1.478	24	~	1	1	1	35	52		Fine grained	>0.6	>0.6	>2.0	0.965	0.339	Non Liq.
17	8.12	945.9	7.87	8.37	SM/ML	0.120	0.974	0.974	1.433	23	~	1	1	1	33	35		44	>0.6	>0.6	>2.0	0.963	0.360	Non Liq.
18	8.62	945.4	8.37	8.86	SM/ML	0.120	1.034	1.034	1.391	27	~	1	1	1	38	35		50	>0.6	>0.6	>2.0	0.960	0.381	Non Liq.
19	9.11	944.9	8.86	9.35	SM/ML	0.120	1.093	1.093	1.353	28	~	1	1	1	38	35		50	>0.6	>0.6	>2.0	0.958	0.401	Non Liq.
20	9.60	944.4	9.35	9.84	SM/ML	0.120	1.151	1.151	1.318	27	~	1	1	1	36	35		48	>0.6	>0.6	>2.0	0.956	0.422	Non Liq.
21	10.09	943.9	9.84	10.33	SM/ML	0.120	1.210	1.210	1.286	26	~	1	1	1	33	35		45	>0.6	>0.6	>2.0	0.954	0.443	Non Liq.
22	10.58	943.4	10.33	10.83	SP/SM	0.120	1.270	1.270	1.255	28	~	1	1	1	35	6		35	>0.6	>0.6	>2.0	0.951	0.463	Non Liq.
23	11.08	942.9	10.83	11.32	SM/ML	0.120	1.329	1.324	1.229	34	~	1	1	1	42	35		55	>0.6	>0.6	>2.0	0.949	0.484	Non Liq.
24	11.57	942.4	11.32	11.81	SM/ML	0.120	1.388	1.353	1.216	26	~	1	1	1	32	35		43	>0.6	>0.6	>2.0	0.947	0.504	Non Liq.
25	12.06	941.9	11.81	12.30	SM/ML	0.120	1.447	1.381	1.204	31	~	1	1	1	37	35		50	>0.6	>0.6	>2.0	0.945	0.524	Non Liq.
26	12.55	941.5	12.30	12.80	SM/ML	0.120	1.506	1.409	1.191	33	~	1	1	1	39	35		52	>0.6	>0.6	>2.0	0.942	0.544	Non Liq.
27	13.05	941.0	12.8	13.29	SM/ML	0.120	1.565	1.438	1.179	36	~	1	1	1	42	35		56	>0.6	>0.6	>2.0	0.940	0.564	Non Liq.
28	13.54	940.5	13.29	13.78	SM/ML	0.120	1.624	1.466	1.168	36	~	1	1	1	42	35		55	>0.6	>0.6	>2.0	0.938	0.584	Non Liq.
29	14.03	940.0	13.78	14.27	SM/ML	0.120	1.683	1.494	1.157	29	~	1	1	1	34	35		45	>0.6	>0.6	>2.0	0.935	0.604	Non Liq.
30	14.52	939.5	14.27	14.76	SM/ML	0.120	1.742	1.522	1.146	29	~	1	1	1	33	35		45	>0.6	>0.6	>2.0	0.933	0.623	Non Liq.
31	15.01	939.0	14.76	15.26	SP	0.120	1.801	1.551	1.136	34	~	1	1	1	39	0		39	>0.6	>0.6	>2.0	0.931	0.643	Non Liq.
32	15.51	938.5	15.26	15.75	SP	0.120	1.861	1.579	1.125	84	~	1	1	1	95	0		95	>0.6	>0.6	>2.0	0.929	0.663	Non Liq.
33	16.00	938.0	15.75	16.24	SP*	0.120	1.919	1.608	1.115	100	~	1	1	1	112	6		112	>0.6	>0.6	>2.0	0.926	0.682	Non Liq.
34	16.49	937.5	16.24	16.73	SM/ML	0.120	1.978	1.636	1.106	73	~	1	1	1	81	35		102	>0.6	>0.6	>2.0	0.924	0.701	Non Liq.
35	16.98	937.0	16.73	17.22	SP/SM	0.120	2.037	1.664	1.096	26	~	1	1	1	29	6		29	0.384	0.384	0.639	0.922	0.720	0.89
36	17.47	936.5	17.22	17.72	SM/ML	0.120	2.096	1.693	1.087	29	~	1	1	1	32	35		43	>0.6	>0.6	>2.0	0.920	0.739	Non Liq.
37	17.97	936.0	17.72	18.21	SM/ML	0.120	2.156	1.721	1.078	23	~	1	1	1	25	35		35	>0.6	>0.6	>2.0	0.917	0.758	Non Liq.
38	18.46	935.5	18.21	18.70	SM/ML	0.120	2.215	1.749	1.069	21	~	1	1	1	22	35		32	>0.6	>0.6	>2.0	0.915	0.777	Non Liq.
39	18.95	935.1	18.7	19.19	SM/ML	0.120	2.273	1.778	1.061	18	~	1	1	1	19	35		28	0.355	0.355	0.632	0.913	0.796	0.79
40	19.44	934.6	19.19	19.69	SM/ML	0.120	2.333	1.806	1.052	22	~	1	1	1	23	35		33	>0.6	>0.6	>2.0	0.911	0.815	Non Liq.
41	19.94	934.1	19.69	20.18	SM/ML	0.120	2.392	1.835	1.044	19	~	1	1	1	20	35		29	0.386	0.386	0.709	0.908	0.833	0.85
42	20.43	933.6	20.18	20.67	SM/ML	0.120	2.451	1.863	1.036	18	~	1	1	1	19	35		27	0.341	0.341	0.635	0.906	0.852	0.75
43	20.92	933.1	20.67	21.16	SM/ML	0.120	2.510	1.891	1.028	26	~	1	1	1	27	35		37	>0.6	>0.6	>2.0	0.904	0.870	Non Liq.
44	21.41	932.6	21.16	21.65	SP/SM	0.120	2.569	1.919	1.021	36	~	1	1	1	37	6		37	>0.6	>0.6	>2.0	0.902	0.888	Non Liq.
45	21.90	932.1	21.65	22.15	SP/SM	0.120	2.628	1.948	1.013	43	~	1	1	1	44	6		44	>0.6	>0.6	>2.0	0.899	0.906	Non Liq.
46	22.40	931.6	22.15	22.64	SP/SM	0.120	2.687	1.976	1.006	50	~	1	1	1	50	6		51	>0.6	>0.6	>2.0	0.897	0.924	Non Liq.
47	22.89	931.1	22.64	23.13	SP/SM	0.120	2.746	2.005	0.999	57	~	1	1	1	57	6		57	>0.6	>0.6	>2.0	0.895	0.942	Non Liq.
48	23.38	930.6	23.13	23.62	SP	0.120	2.805	2.033	0.992	65	~	1	1	1	64	0		64	>0.6	>0.6	>2.0	0.892	0.960	Non Liq.
49	23.87	930.1	23.62	24.11	SM/ML	0.120	2.864	2.061	0.985	96	~	1	1	1	95	35		118	>0.6	>0.6	>2.0	0.890	0.978	Non Liq.
50	24.36	929.6	24.11	24.61	SM/ML	0.120	2.923	2.901	0.830	100	~	1	1	1	83	35		104	>0.6	>0.6	>2.0	0.888	0.995	Non Liq.
51	24.86	929.1	24.61	25.10	SP/SM	0.120	2.983	2.929	0.826	94	~	1	1	1	78	6		78	>0.6	>0.6	>2.0	0.886	1.013	Non Liq.
52	25.35	928.7	25.10	25.59	SP/SM	0.120	3.041	2.957	0.822	94	~	1	1	1	77	6		78	>0.6	>0.6	>2.0	0.883	1.030	Non Liq.
53	25.84	928.2	25.59	26.08	SM/ML	0.120	3.100	2.986	0.818	100	~	1	1	1	82	35		103	>0.6	>0.6	>2.0	0.881	1.048	Non Liq.
54	26.33	927.7	26.08	26.57	CL/CH*	0.120	3.159	3.014	0.815	100	~	1	1	1	81	52		Fine grained	>0.6	>0.6	>2.0	0.879	1.065	Non Liq.
55	26.82	927.2	26.57	27.07	CL/CH*	0.120	3.218	3.042	0.811	100	~	1	1	1	81	52		Fine grained	>0.6	>0.6	>2.0	0.877	1.082	Non Liq.
56	27.32	926.7	27.07	27.56	SP*	0.120	3.278	3.071	0.807	100	~	1	1	1	81	6		81	>0.6	>0.6	>2.0	0.874	1.099	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-13

Figure B-2

Test Location	CPT-13	Basic Earthquake Magnitude	7.5
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?
Ground Surface Elevation	940 ft. MSL	Design Magnitude	6.5
Ground WaterDuring Investigatior	15 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)
Historic Ground Water Depth	12 ft. Below GL	Design PGA (M = 6.5)	0.87 g.
		Magnification Factor	1.0

Conditions: Existing conditions with historic groundwater level

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft)		Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, %		Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
			Top	Bottom												Assumed (8).	Lab (9).							
60	29.29	910.7	29.04	29.53	CL	0.120	3.514	2.623	0.873	39	~	1	1	1	34	52		Fine grained	>0.6	>0.6	>2.0	0.865	1.166	Non Liq.
61	29.78	910.2	29.53	30.02	CL/CH*	0.120	3.573	2.651	0.869	71	~	1	1	1	62	52		Fine grained	>0.6	>0.6	>2.0	0.863	1.183	Non Liq.
62	30.27	909.7	30.02	30.51	SM/ML	0.120	3.632	2.679	0.864	57	~	1	1	1	49	35		64	>0.6	>0.6	>2.0	0.861	1.199	Non Liq.
63	30.76	909.2	30.51	31.00	SM/ML	0.120	3.691	2.707	0.859	79	~	1	1	1	68	35		86	>0.6	>0.6	>2.0	0.859	1.215	Non Liq.
64	31.25	908.8	31.00	31.50	SM/ML	0.120	3.750	2.736	0.855	49	~	1	1	1	42	35		65	>0.6	>0.6	>2.0	0.856	1.231	Non Liq.
65	31.75	908.3	31.5	31.99	ML/CL	0.120	3.809	2.765	0.851	47	~	1	1	1	40	52		Fine grained	>0.6	>0.6	>2.0	0.854	1.248	Non Liq.
66	32.24	907.8	31.99	32.48	SM/ML	0.120	3.868	2.793	0.846	22	~	1	1	1	19	35		27	0.340	0.340	0.949	0.852	1.263	0.75
67	32.73	907.3	32.48	32.97	ML/CL	0.120	3.927	2.821	0.842	13	~	1	1	1	11	52		Fine grained	>0.6	>0.6	>2.0	0.849	1.279	Non Liq.
68	33.22	906.8	32.97	33.46	ML/CL	0.120	3.986	2.849	0.838	12	~	1	1	1	10	52		Fine grained	>0.6	>0.6	>2.0	0.847	1.295	Non Liq.
69	33.71	906.3	33.46	33.96	CL	0.120	4.045	2.878	0.834	28	~	1	1	1	23	52		Fine grained	>0.6	>0.6	>2.0	0.845	1.311	Non Liq.
70	34.21	905.8	33.96	34.45	CL	0.120	4.105	2.906	0.830	29	~	1	1	1	24	52		Fine grained	>0.6	>0.6	>2.0	0.843	1.326	Non Liq.
71	34.70	905.3	34.45	34.94	ML/CL	0.120	4.163	2.934	0.826	24	~	1	1	1	20	52		Fine grained	>0.6	>0.6	>2.0	0.840	1.342	Non Liq.
72	35.19	904.8	34.94	35.43	CL	0.120	4.222	2.963	0.822	36	~	1	1	1	30	52		Fine grained	>0.6	>0.6	>2.0	0.838	1.357	Non Liq.
73	35.68	904.3	35.43	35.93	SP/SM	0.120	4.282	2.991	0.818	60	~	1	1	1	49	6		49	>0.6	>0.6	>2.0	0.836	1.372	Non Liq.
74	36.18	903.8	35.93	36.42	SP/SM	0.120	4.341	3.020	0.814	79	~	1	1	1	64	6		65	>0.6	>0.6	>2.0	0.834	1.388	Non Liq.
75	36.67	903.3	36.42	36.91	SP/SM	0.120	4.400	3.048	0.810	81	~	1	1	1	66	6		66	>0.6	>0.6	>2.0	0.831	1.403	Non Liq.
76	37.16	902.8	36.91	37.40	SP	0.120	4.459	3.076	0.806	53	~	1	1	1	43	0		43	>0.6	>0.6	>2.0	0.829	1.418	Non Liq.
77	37.65	902.4	37.4	37.89	SM/ML	0.120	4.517	3.104	0.803	51	~	1	1	1	41	35		54	>0.6	>0.6	>2.0	0.827	1.432	Non Liq.
78	38.14	901.9	37.89	38.39	ML/CL	0.120	4.577	3.133	0.799	51	~	1	1	1	41	52		Fine grained	>0.6	>0.6	>2.0	0.825	1.447	Non Liq.
79	38.64	901.4	38.39	38.88	SM/ML	0.120	4.636	3.161	0.795	44	~	1	1	1	35	35		47	>0.6	>0.6	>2.0	0.822	1.462	Non Liq.
80	39.13	900.9	38.88	39.37	CL	0.120	4.695	3.190	0.792	61	~	1	1	1	48	52		Fine grained	>0.6	>0.6	>2.0	0.820	1.476	Non Liq.
81	39.62	900.4	39.37	39.86	SM/ML	0.120	4.754	3.218	0.788	43	~	1	1	1	34	35		46	>0.6	>0.6	>2.0	0.818	1.491	Non Liq.
82	40.11	899.9	39.86	40.35	SP	0.120	4.813	3.246	0.785	37	~	1	1	1	29	0		29	0.404	0.404	1.311	0.816	1.505	0.87
83	40.60	899.4	40.35	40.85	SP/SM	0.120	4.872	3.275	0.782	34	~	1	1	1	27	6		27	0.327	0.327	1.072	0.813	1.519	0.71
84	41.10	898.9	40.85	41.34	CL/CH*	0.120	4.931	3.303	0.778	86	~	1	1	1	67	52		Fine grained	>0.6	>0.6	>2.0	0.811	1.534	Non Liq.
85	41.59	898.4	41.34	41.83	SP/SM	0.120	4.990	3.331	0.775	39	~	1	1	1	30	6		30	0.600	0.600	1.999	0.809	1.548	1.29
86	42.08	897.9	41.83	42.32	SP	0.120	5.049	3.360	0.772	46	~	1	1	1	35	0		35	>0.6	>0.6	>2.0	0.806	1.562	Non Liq.
87	42.57	897.4	42.32	42.81	SP/SM	0.120	5.108	3.388	0.768	40	~	1	1	1	31	6		31	>0.6	>0.6	>2.0	0.804	1.575	Non Liq.
88	43.06	896.9	42.81	43.31	CL/CH*	0.120	5.167	3.416	0.765	85	~	1	1	1	65	52		Fine grained	>0.6	>0.6	>2.0	0.802	1.589	Non Liq.
89	43.56	896.4	43.31	43.80	ML/CL	0.120	5.227	3.445	0.762	34	~	1	1	1	26	52		Fine grained	>0.6	>0.6	>2.0	0.800	1.603	Non Liq.
90	44.05	896.0	43.80	44.29	ML/CL	0.120	5.285	3.473	0.759	37	~	1	1	1	28	52		Fine grained	>0.6	>0.6	>2.0	0.797	1.616	Non Liq.
91	44.54	895.5	44.29	44.78	SM/ML	0.120	5.344	3.501	0.756	34	~	1	1	1	26	35		35	>0.6	>0.6	>2.0	0.795	1.630	Non Liq.
92	45.03	895.0	44.78	45.28	SP/SM	0.120	5.404	3.530	0.753	35	~	1	1	1	26	6		26	0.322	0.322	1.137	0.793	1.643	0.69
93	45.53	894.5	45.28	45.77	SP	0.120	5.463	3.558	0.750	38	~	1	1	1	28	0		28	0.377	0.377	1.342	0.791	1.656	0.81
94	46.02	894.0	45.77	46.26	SP	0.120	5.522	3.586	0.747	41	~	1	1	1	31	0		31	>0.6	>0.6	>2.0	0.788	1.669	Non Liq.
95	46.51	893.5	46.26	46.75	SM/ML	0.120	5.581	3.615	0.744	52	~	1	1	1	39	35		51	>0.6	>0.6	>2.0	0.786	1.682	Non Liq.
96	47.00	893.0	46.75	47.24	SM/ML	0.120	5.639	3.643	0.741	50	~	1	1	1	37	35		49	>0.6	>0.6	>2.0	0.784	1.695	Non Liq.
97	47.49	892.5	47.24	47.74	SP/SM	0.120	5.699	3.671	0.738	48	~	1	1	1	35	6		35	>0.6	>0.6	>2.0	0.782	1.708	Non Liq.
98	47.99	892.0	47.74	48.23	SP	0.120	5.758	3.700	0.735	58	~	1	1	1	43	0		43	>0.6	>0.6	>2.0	0.779	1.721	Non Liq.
99	48.48	891.5	48.23	48.72	SP	0.120	5.817	3.728	0.732	57	~	1	1	1	42	0		42	>0.6	>0.6	>2.0	0.777	1.733	Non Liq.
100	48.97	891.0	48.72	49.21	SP	0.120	5.876	3.756	0.730	59	~	1	1	1	43	0		43	>0.6	>0.6	>2.0	0.775	1.746	Non Liq.
101	49.46	890.5	49.21	49.70	SP	0.120	5.935	3.785	0.727	57	~	1	1	1	41	0		41	>0.6	>0.6	>2.0	0.773	1.758	Non Liq.
102	49.95	890.1	49.70	50.20	SP/SM	0.120	5.994	3.813	0.724	70	~	1	1	1	51	6		51	>0.6	>0.6	>2.0	0.770	1.771	Non Liq.
103	50.45	889.6	50.2	50.69	SP	0.120	6.053	3.842	0.722	62	~	1	1	1	45	0		45	>0.6	>0.6	>2.0	0.768	1.783	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-18

Test Location	CPT-18	Basic Earthquake Magnitude	7.5	Conditions: Existing conditions with historic groundwater level
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?	
Ground Surface Elevation	928 ft. MSL	Design Magnitude	6.5	Figure B-3
Ground WaterDuring Investigatior	15 ft. Below GL	Peak Ground Accel (M = 7.5)	0.70 g. (DBE)	
Historic Ground Water Depth	11 ft. Below GL	Design PGA (M = 6.5)	1.04 g.	
		Magnification Factor	1.0	

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
1	0.25	927.8	0	0.49	SP/SM	0.120	0.029	0.029	2.000	37	~	1	1	1	74	6		74	>0.6	>0.6	>2.0	0.999	0.013	Non Liq.
2	0.74	927.3	0.49	0.98	SP	0.120	0.088	0.088	2.000	48	~	1	1	1	96	0		96	>0.6	>0.6	>2.0	0.997	0.040	Non Liq.
3	1.23	926.8	1.0	1.48	SM/ML	0.120	0.148	0.148	2.000	45	~	1	1	1	90	35		113	>0.6	>0.6	>2.0	0.994	0.067	Non Liq.
4	1.73	926.3	1.48	1.97	SM/ML	0.120	0.207	0.207	2.000	28	~	1	1	1	56	35		72	>0.6	>0.6	>2.0	0.992	0.093	Non Liq.
5	2.22	925.8	1.97	2.46	SM/ML	0.120	0.266	0.266	2.000	24	~	1	1	1	48	35		62	>0.6	>0.6	>2.0	0.990	0.120	Non Liq.
6	2.71	925.3	2.46	2.95	SM/ML	0.120	0.325	0.325	2.000	22	~	1	1	1	44	35		58	>0.6	>0.6	>2.0	0.988	0.146	Non Liq.
7	3.20	924.8	2.95	3.44	SM/ML	0.120	0.383	0.383	2.000	25	~	1	1	1	50	35		65	>0.6	>0.6	>2.0	0.985	0.172	Non Liq.
8	3.69	924.3	3.44	3.94	SP/SM	0.120	0.443	0.443	2.000	29	~	1	1	1	58	6		58	>0.6	>0.6	>2.0	0.983	0.198	Non Liq.
9	4.19	923.8	3.94	4.43	SM/ML	0.120	0.502	0.502	1.996	32	~	1	1	1	64	35		81	>0.6	>0.6	>2.0	0.981	0.224	Non Liq.
10	4.68	923.3	4.43	4.92	SP/SM	0.120	0.561	0.561	1.888	19	~	1	1	1	36	6		36	>0.6	>0.6	>2.0	0.978	0.250	Non Liq.
11	5.17	922.8	4.92	5.41	SM/ML	0.120	0.620	0.620	1.796	23	~	1	1	1	41	35		54	>0.6	>0.6	>2.0	0.976	0.275	Non Liq.
12	5.66	922.3	5.41	5.91	SM/ML	0.120	0.679	0.679	1.716	47	~	1	1	1	81	35		102	>0.6	>0.6	>2.0	0.974	0.301	Non Liq.
13	6.16	921.8	5.91	6.40	SM/ML	0.120	0.739	0.739	1.646	35	~	1	1	1	58	35		74	>0.6	>0.6	>2.0	0.972	0.327	Non Liq.
14	6.65	921.4	6.40	6.89	SM/ML	0.120	0.797	0.797	1.584	32	~	1	1	1	51	35		56	>0.6	>0.6	>2.0	0.969	0.352	Non Liq.
15	7.14	920.9	6.89	7.38	SP/SM	0.120	0.856	0.856	1.528	39	~	1	1	1	60	6		60	>0.6	>0.6	>2.0	0.967	0.377	Non Liq.
16	7.63	920.4	7.38	7.87	SP/SM	0.120	0.915	0.915	1.478	46	~	1	1	1	68	6		68	>0.6	>0.6	>2.0	0.965	0.402	Non Liq.
17	8.12	919.9	7.87	8.37	SP	0.120	0.974	0.974	1.433	32	~	1	1	1	46	0		46	>0.6	>0.6	>2.0	0.963	0.427	Non Liq.
18	8.62	919.4	8.37	8.86	SM/ML	0.120	1.034	1.034	1.391	23	~	1	1	1	32	35		43	>0.6	>0.6	>2.0	0.960	0.452	Non Liq.
19	9.11	918.9	8.86	9.35	CL	0.120	1.093	1.093	1.353	10	~	1	1	1	14	52		Fine grained	>0.6	>0.6	>2.0	0.958	0.476	Non Liq.
20	9.60	918.4	9.35	9.84	CL	0.120	1.151	1.151	1.318	13	~	1	1	1	17	52		Fine grained	>0.6	>0.6	>2.0	0.956	0.501	Non Liq.
21	10.09	917.9	9.84	10.33	SM/ML	0.120	1.210	1.210	1.286	40	~	1	1	1	51	35		67	>0.6	>0.6	>2.0	0.954	0.525	Non Liq.
22	10.58	917.4	10.33	10.83	SP/SM	0.120	1.270	1.270	1.255	66	~	1	1	1	83	6		83	>0.6	>0.6	>2.0	0.951	0.550	Non Liq.
23	11.08	916.9	10.83	11.32	SP/SM	0.120	1.329	1.324	1.229	83	~	1	1	1	102	6		103	>0.6	>0.6	>2.0	0.949	0.574	Non Liq.
24	11.57	916.4	11.32	11.81	SP/SM	0.120	1.388	1.353	1.216	72	~	1	1	1	88	6		88	>0.6	>0.6	>2.0	0.947	0.598	Non Liq.
25	12.06	915.9	11.81	12.30	SP/SM	0.120	1.447	1.381	1.204	67	~	1	1	1	81	6		81	>0.6	>0.6	>2.0	0.945	0.622	Non Liq.
26	12.55	915.5	12.30	12.80	SP/SM	0.120	1.506	1.409	1.191	39	~	1	1	1	46	6		47	>0.6	>0.6	>2.0	0.942	0.646	Non Liq.
27	13.05	915.0	12.8	13.29	SM/ML	0.120	1.565	1.438	1.179	39	~	1	1	1	46	35		60	>0.6	>0.6	>2.0	0.940	0.670	Non Liq.
28	13.54	914.5	13.29	13.78	SP/SM	0.120	1.624	1.466	1.168	38	~	1	1	1	44	6		45	>0.6	>0.6	>2.0	0.938	0.693	Non Liq.
29	14.03	914.0	13.78	14.27	SP	0.120	1.683	1.494	1.157	43	~	1	1	1	50	0		50	>0.6	>0.6	>2.0	0.935	0.716	Non Liq.
30	14.52	913.5	14.27	14.76	SP	0.120	1.742	1.522	1.146	52	~	1	1	1	60	0		60	>0.6	>0.6	>2.0	0.933	0.740	Non Liq.
31	15.01	913.0	14.76	15.26	SP	0.120	1.801	1.801	1.054	47	~	1	1	1	50	0		50	>0.6	>0.6	>2.0	0.931	0.763	Non Liq.
32	15.51	912.5	15.26	15.75	SP	0.120	1.861	1.829	1.046	43	~	1	1	1	45	0		45	>0.6	>0.6	>2.0	0.929	0.786	Non Liq.
33	16.00	912.0	15.75	16.24	SP/SM	0.120	1.919	1.857	1.038	56	~	1	1	1	58	6		58	>0.6	>0.6	>2.0	0.926	0.809	Non Liq.
34	16.49	911.5	16.24	16.73	SP/SM	0.120	1.978	1.886	1.030	63	~	1	1	1	65	6		65	>0.6	>0.6	>2.0	0.924	0.832	Non Liq.
35	16.98	911.0	16.73	17.22	SP	0.120	2.037	1.914	1.022	43	~	1	1	1	44	0		44	>0.6	>0.6	>2.0	0.922	0.854	Non Liq.
36	17.47	910.5	17.22	17.72	SP	0.120	2.096	1.942	1.015	39	~	1	1	1	40	0		40	>0.6	>0.6	>2.0	0.920	0.877	Non Liq.
37	17.97	910.0	17.72	18.21	SM/ML	0.120	2.156	1.971	1.007	35	~	1	1	1	35	35		47	>0.6	>0.6	>2.0	0.917	0.900	Non Liq.
38	18.46	909.5	18.21	18.70	CL	0.120	2.215	1.999	1.000	24	~	1	1	1	24	52		Fine grained	>0.6	>0.6	>2.0	0.915	0.922	Non Liq.
39	18.95	909.1	18.7	19.19	SP/SM	0.120	2.273	2.027	0.993	65	~	1	1	1	65	6		65	>0.6	>0.6	>2.0	0.913	0.944	Non Liq.
40	19.44	908.6	19.19	19.69	SP	0.120	2.333	2.056	0.986	56	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.911	0.967	Non Liq.
41	19.94	908.1	19.69	20.18	SM/ML	0.120	2.392	2.084	0.980	81	~	1	1	1	79	35		100	>0.6	>0.6	>2.0	0.908	0.989	Non Liq.
42	20.43	907.6	20.18	20.67	SP/SC	0.120	2.451	2.112	0.973	100	~	1	1	1	97	6		98	>0.6	>0.6	>2.0	0.906	1.010	Non Liq.
43	20.92	907.1	20.67	21.16	SM/ML	0.120	2.510	2.141	0.967	94	~	1	1	1	91	35		114	>0.6	>0.6	>2.0	0.904	1.032	Non Liq.
44	21.41	906.6	21.16	21.65	SP/SM	0.120	2.569	2.169	0.960	98	~	1	1	1	94	6		95	>0.6	>0.6	>2.0	0.902	1.054	Non Liq.
45	21.90	906.1	21.65	22.15	SP/SM	0.120	2.628	2.197	0.954	100	~	1	1	1	95	6		96	>0.6	>0.6	>2.0	0.899	1.075	Non Liq.
46	22.40	905.6	22.15	22.64	SP	0.120	2.687	2.226	0.948	71	~	1	1	1	67	0		67	>0.6	>0.6	>2.0	0.897	1.097	Non Liq.
47	22.89	905.1	22.64	23.13	SP/SM	0.120	2.746	2.254	0.942	73	~	1	1	1	69	6		69	>0.6	>0.6	>2.0	0.895	1.118	Non Liq.
48	23.38	904.6	23.13	23.62	SP	0.120	2.805	2.282	0.936	54	~	1	1	1	51	0		51	>0.6	>0.6	>2.0	0.892	1.139	Non Liq.
49	23.87	904.1	23.62	24.11	SP	0.120	2.864	2.311	0.930	53	~	1	1	1	49	0		49	>0.6	>0.6	>2.0	0.890	1.160	Non Liq.
50	24.36	903.6	24.11	24.61	SP/SM	0.120	2.923	2.339	0.925	43	~	1	1	1	40	6		40	>0.6	>0.6	>2.0	0.888	1.181	Non Liq.
51	24.86	903.1	24.61	25.10	CL	0.120	2.983	2.368	0.919	17	~	1	1	1	16	52		Fine grained	>0.6	>0.6	>2.0	0.886	1.202	Non Liq.
52	25.35	902.7	25.10	25.59	SP	0.120	3.041	2.396	0.914	54	~	1	1	1	49	0		49	>0.6	>0.6	>2.0	0.883	1.222	Non Liq.
53	25.84	902.2	25.59	26.08	SP	0.120	3.100	2.424	0.908	55	~	1	1	1	50	0		50	>0.6	>0.6	>2.0	0.881	1.243	Non Liq.
54	26.33	901.7	26.08	26.57	SP/SM	0.120	3.159	2.452	0.903	79	~	1	1	1	71	6		72	>0.6	>0.6	>2.0	0.879	1.263	Non Liq.
55	26.82	901.2	26.57	27.07	SP	0.120	3.218	2.481	0.898	36	~	1	1	1	32	0		32	>0.6	>0.6	>2.0	0.877	1.284	Non Liq.
56	27.32	900.7	27.07	27.56	ML/CL	0.120	3.278	2.509	0.893	22	~	1	1	1	20	52		Fine grained	>0.6	>0.6	>2.0	0.874	1.304	Non Liq.
57	27.81	900.2	27.56	28.05	CL/CH	0.120	3.337	2.538	0.888	77	~	1	1	1	68	52		Fine grained	>0.6	>0.6	>2.0	0.872	1.324	Non Liq.
58	28.30	899.7	28.05	28.54	ML/CL	0.120	3.395	2.566	0.883	55	~	1	1	1	49	52		Fine grained	>0.6	>0.6	>2.0	0.870	1.344	Non Liq.
59	28.79	899.2	28.54	29.04	CL	0.120	3.455	2.594	0.878	14	~	1	1	1	12	52		Fine grained	>0.6	>0.6	>2.0	0.868	1.364	Non Liq.
60	29.29	898.7	29.04	29.53	CL	0.120	3.514	2.623	0.873	15	~	1	1	1	13	52		Fine grained	>0.6	>0.6	>2.0	0.865	1.384	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: **River Village, TT 53108**
Job No.: **00-1702R-4**

CPT-18

Test Location	CPT-18	Basic Earthquake Magnitude	7.5	Conditions: Existing conditions with historic groundwater level
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?	
Ground Surface Elevation	928 ft. MSL	Design Magnitude	6.5	Figure B-3
Ground WaterDuring Investigatior	15 ft. Below GL	Peak Ground Accel (M = 7.5)	0.70 g. (DBE)	
Historic Ground Water Depth	11 ft. Below GL	Design PGA (M = 6.5)	1.04 g.	
		Magnification Factor	1.0	

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
61	29.78	898.2	29.53	30.02	SP/SM	0.120	3.573	2.651	0.869	44	~	1	1	1	38	6		38	>0.6	>0.6	>2.0	0.863	1.403	Non Liq.
62	30.27	897.7	30.02	30.51	SM/ML	0.120	3.632	2.679	0.864	62	~	1	1	1	54	35		69	>0.6	>0.6	>2.0	0.861	1.422	Non Liq.
63	30.76	897.2	30.51	31.00	SM/ML	0.120	3.691	2.707	0.859	49	~	1	1	1	42	35		55	>0.6	>0.6	>2.0	0.859	1.442	Non Liq.
64	31.25	896.8	31.00	31.50	CL/CH	0.120	3.750	2.736	0.855	100	~	1	1	1	85	52		Fine grained	>0.6	>0.6	>2.0	0.856	1.461	Non Liq.
65	31.75	896.3	31.5	31.99	SM/ML	0.120	3.809	2.765	0.851	39	~	1	1	1	33	35		45	>0.6	>0.6	>2.0	0.854	1.480	Non Liq.
66	32.24	895.8	31.99	32.48	CL	0.120	3.868	2.793	0.846	51	~	1	1	1	43	52		Fine grained	>0.6	>0.6	>2.0	0.852	1.499	Non Liq.
67	32.73	895.3	32.48	32.97	SM/ML	0.120	3.927	2.821	0.842	56	~	1	1	1	47	35		61	>0.6	>0.6	>2.0	0.849	1.518	Non Liq.
68	33.22	894.8	32.97	33.46	SP/SM	0.120	3.986	2.849	0.838	54	~	1	1	1	45	6		45	>0.6	>0.6	>2.0	0.847	1.536	Non Liq.
69	33.71	894.3	33.46	33.96	SP/SM	0.120	4.045	2.878	0.834	50	~	1	1	1	42	6		42	>0.6	>0.6	>2.0	0.845	1.555	Non Liq.
70	34.21	893.8	33.96	34.45	SP/SM	0.120	4.105	2.906	0.830	44	~	1	1	1	37	6		37	>0.6	>0.6	>2.0	0.843	1.574	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: **River Village, TT 53108**
Job No.: **00-1702R-4**

CPT-103

Test Location	CPT-103	Basic Earthquake Magnitude	7.5	Conditions:	Existing conditions with historic groundwater level
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?		
Ground Surface Elevation	905 ft. MSL	Design Magnitude	6.5		
Ground WaterDuring Investigatior	10 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)		
Historic Ground Water Depth	3 ft. Below GL	Design PGA (M = 6.5)	0.87 g.		
		Magnification Factor	1.0		

Figure B-4

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Depth of layer below Ground Level (ft) Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Percent Fines, % Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
1	0.25	904.8	0	0.49	SM/ML	0.120	0.029	0.029	2.000	12	~	1	1	1	24	35		34	>0.6	>0.6	>2.0	0.999	0.011	Non Liq.
2	0.74	904.3	0.49	0.98	SP/SM	0.120	0.088	0.088	2.000	26	~	1	1	1	52	6		52	>0.6	>0.6	>2.0	0.997	0.034	Non Liq.
3	1.23	903.8	1.0	1.48	SP/SM	0.120	0.148	0.148	2.000	37	~	1	1	1	74	6		74	>0.6	>0.6	>2.0	0.994	0.056	Non Liq.
4	1.73	903.3	1.48	1.97	SP	0.120	0.207	0.207	2.000	34	~	1	1	1	68	0		68	>0.6	>0.6	>2.0	0.992	0.079	Non Liq.
5	2.22	902.8	1.97	2.46	SP/SM	0.120	0.266	0.266	2.000	39	~	1	1	1	78	6		78	>0.6	>0.6	>2.0	0.990	0.101	Non Liq.
6	2.71	902.3	2.46	2.95	SP/SM	0.120	0.325	0.325	2.000	35	~	1	1	1	70	6		70	>0.6	>0.6	>2.0	0.988	0.123	Non Liq.
7	3.20	901.8	2.95	3.44	SP/SM	0.120	0.383	0.371	2.000	49	~	1	1	1	98	6		98	>0.6	>0.6	>2.0	0.985	0.145	Non Liq.
8	3.69	901.3	3.44	3.94	SP	0.120	0.443	0.400	2.000	53	~	1	1	1	106	0		106	>0.6	>0.6	>2.0	0.983	0.167	Non Liq.
9	4.19	900.8	3.94	4.43	SP	0.120	0.502	0.428	2.000	59	~	1	1	1	118	0		118	>0.6	>0.6	>2.0	0.981	0.189	Non Liq.
10	4.68	900.3	4.43	4.92	SP	0.120	0.561	0.456	2.000	45	~	1	1	1	90	0		90	>0.6	>0.6	>2.0	0.978	0.211	Non Liq.
11	5.17	899.8	4.92	5.41	SP/SM	0.120	0.620	0.485	2.000	35	~	1	1	1	70	6		70	>0.6	>0.6	>2.0	0.976	0.232	Non Liq.
12	5.66	899.3	5.41	5.91	SM/ML	0.120	0.679	0.513	1.974	21	~	1	1	1	41	35		55	>0.6	>0.6	>2.0	0.974	0.254	Non Liq.
13	6.16	898.8	5.91	6.40	ML/CL	0.120	0.739	0.542	1.921	12	~	1	1	1	23	52		Fine grained	>0.6	>0.6	>2.0	0.972	0.275	Non Liq.
14	6.65	898.4	6.40	6.89	CL	0.120	0.797	0.570	1.873	7	~	1	1	1	13	52		Fine grained	>0.6	>0.6	>2.0	0.969	0.296	Non Liq.
15	7.14	897.9	6.89	7.38	CL	0.120	0.856	0.598	1.829	7	~	1	1	1	13	52		Fine grained	>0.6	>0.6	>2.0	0.967	0.318	Non Liq.
16	7.63	897.4	7.38	7.87	CL	0.120	0.915	0.626	1.787	9	~	1	1	1	16	52		Fine grained	>0.6	>0.6	>2.0	0.965	0.339	Non Liq.
17	8.12	896.9	7.87	8.37	ML/CL	0.120	0.974	0.655	1.748	11	~	1	1	1	19	52		Fine grained	>0.6	>0.6	>2.0	0.963	0.360	Non Liq.
18	8.62	896.4	8.37	8.86	SM/ML	0.120	1.034	0.683	1.711	15	~	1	1	1	26	35		36	>0.6	>0.6	>2.0	0.960	0.381	Non Liq.
19	9.11	895.9	8.86	9.35	SP	0.120	1.093	0.712	1.676	32	~	1	1	1	54	0		54	>0.6	>0.6	>2.0	0.958	0.401	Non Liq.
20	9.60	895.4	9.35	9.84	SM/ML	0.120	1.151	0.740	1.644	75	~	1	1	1	123	35		153	>0.6	>0.6	>2.0	0.956	0.422	Non Liq.
21	10.09	894.9	9.84	10.33	SP	0.120	1.210	1.205	1.288	26	~	1	1	1	33	0		33	>0.6	>0.6	>2.0	0.954	0.443	Non Liq.
22	10.58	894.4	10.33	10.83	SM/ML	0.120	1.270	1.233	1.273	26	~	1	1	1	33	35		45	>0.6	>0.6	>2.0	0.951	0.463	Non Liq.
23	11.08	893.9	10.83	11.32	SM/ML	0.120	1.329	1.262	1.259	36	~	1	1	1	45	35		59	>0.6	>0.6	>2.0	0.949	0.484	Non Liq.
24	11.57	893.4	11.32	11.81	SP/SM	0.120	1.388	1.290	1.245	38	~	1	1	1	47	6		48	>0.6	>0.6	>2.0	0.947	0.504	Non Liq.
25	12.06	892.9	11.81	12.30	SM/ML	0.120	1.447	1.318	1.232	13	~	1	1	1	16	35		24	0.277	0.277	0.365	0.945	0.524	0.70
26	12.55	892.5	12.30	12.80	ML/CL	0.120	1.506	1.347	1.219	12	~	1	1	1	15	52		Fine grained	>0.6	>0.6	>2.0	0.942	0.544	Non Liq.
27	13.05	892.0	12.8	13.29	SM/ML	0.120	1.565	1.375	1.206	21	~	1	1	1	25	35		35	>0.6	>0.6	>2.0	0.940	0.564	Non Liq.
28	13.54	891.5	13.29	13.78	SM/ML	0.120	1.624	1.404	1.194	37	~	1	1	1	44	35		58	>0.6	>0.6	>2.0	0.938	0.584	Non Liq.
29	14.03	891.0	13.78	14.27	SM/ML	0.120	1.683	1.432	1.182	31	~	1	1	1	37	35		49	>0.6	>0.6	>2.0	0.935	0.604	Non Liq.
30	14.52	890.5	14.27	14.76	SM/ML	0.120	1.742	1.460	1.170	20	~	1	1	1	23	35		33	>0.6	>0.6	>2.0	0.933	0.623	Non Liq.
31	15.01	890.0	14.76	15.26	SP/SM	0.120	1.801	1.489	1.159	38	~	1	1	1	44	6		44	>0.6	>0.6	>2.0	0.931	0.643	Non Liq.
32	15.51	889.5	15.26	15.75	SP	0.120	1.861	1.517	1.148	30	~	1	1	1	34	0		34	>0.6	>0.6	>2.0	0.929	0.663	Non Liq.
33	16.00	889.0	15.75	16.24	SM/ML	0.120	1.919	1.545	1.138	23	~	1	1	1	26	35		36	>0.6	>0.6	>2.0	0.926	0.682	Non Liq.
34	16.49	888.5	16.24	16.73	CL	0.120	1.978	1.574	1.127	15	~	1	1	1	17	52		Fine grained	>0.6	>0.6	>2.0	0.924	0.701	Non Liq.
35	16.98	888.0	16.73	17.22	CL	0.120	2.037	1.602	1.117	52	~	1	1	1	58	52		Fine grained	>0.6	>0.6	>2.0	0.922	0.720	Non Liq.
36	17.47	887.5	17.22	17.72	SP	0.120	2.096	1.630	1.108	50	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.920	0.739	Non Liq.
37	17.97	887.0	17.72	18.21	SP	0.120	2.156	1.659	1.098	45	~	1	1	1	49	0		49	>0.6	>0.6	>2.0	0.917	0.758	Non Liq.
38	18.46	886.5	18.21	18.70	SP	0.120	2.215	1.687	1.089	51	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.915	0.777	Non Liq.
39	18.95	886.1	18.7	19.19	SP/SM	0.120	2.273	1.715	1.080	45	~	1	1	1	49	6		49	>0.6	>0.6	>2.0	0.913	0.796	Non Liq.
40	19.44	885.6	19.19	19.69	SP/SM	0.120	2.333	1.744	1.071	33	~	1	1	1	35	6		36	>0.6	>0.6	>2.0	0.911	0.815	Non Liq.
41	19.94	885.1	19.69	20.18	SM/ML	0.120	2.392	1.772	1.062	28	~	1	1	1	30	35		41	>0.6	>0.6	>2.0	0.908	0.833	Non Liq.
42	20.43	884.6	20.18	20.67	SM/ML	0.120	2.451	1.800	1.054	38	~	1	1	1	40	35		53	>0.6	>0.6	>2.0	0.906	0.852	Non Liq.
43	20.92	884.1	20.67	21.16	SM/ML	0.120	2.510	1.829	1.046	34	~	1	1	1	36	35		48	>0.6	>0.6	>2.0	0.904	0.870	Non Liq.
44	21.41	883.6	21.16	21.65	SP/SM	0.120	2.569	1.857	1.038	44	~	1	1	1	46	6		46	>0.6	>0.6	>2.0	0.902	0.888	Non Liq.
45	21.90	883.1	21.65	22.15	SP	0.120	2.628	1.885	1.030	51	~	1	1	1	53	0		53	>0.6	>0.6	>2.0	0.899	0.906	Non Liq.
46	22.40	882.6	22.15	22.64	SP	0.120	2.687	1.914	1.022	59	~	1	1	1	60	0		60	>0.6	>0.6	>2.0	0.897	0.924	Non Liq.
47	22.89	882.1	22.64	23.13	SP	0.120	2.746	1.942	1.015	62	~	1	1	1	63	0		63	>0.6	>0.6	>2.0	0.895	0.942	Non Liq.
48	23.38	881.6	23.13	23.62	SP	0.120	2.805	1.970	1.007	46	~	1	1	1	46	0		46	>0.6	>0.6	>2.0	0.892	0.960	Non Liq.
49	23.87	881.1	23.62	24.11	SP	0.120	2.864	1.999	1.000	52	~	1	1	1	52	0		52	>0.6	>0.6	>2.0	0.890	0.978	Non Liq.
50	24.36	880.6	24.11	24.61	SP/SM	0.120	2.923	2.027	0.993	52	~	1	1	1	52	6		52	>0.6	>0.6	>2.0	0.888	0.995	Non Liq.
51	24.86	880.1	24.61	25.10	SP	0.120	2.983	2.056	0.986	64	~	1	1	1	63	0		63	>0.6	>0.6	>2.0	0.886	1.013	Non Liq.
52	25.35	879.7	25.10	25.59	SP	0.120	3.041	2.084	0.980	82	~	1	1	1	80	0		80	>0.6	>0.6	>2.0	0.883	1.030	Non Liq.
53	25.84	879.2	25.59	26.08	SP	0.120	3.100	2.112	0.973	88	~	1	1	1	86	0		86	>0.6	>0.6	>2.0	0.881	1.048	Non Liq.
54	26.33	878.7	26.08	26.57	SP	0.120	3.159	2.140	0.967	71	~	1	1	1	69	0		69	>0.6	>0.6	>2.0	0.879	1.065	Non Liq.
55	26.82	878.2	26.57	27.07	SP	0.120	3.218	2.169	0.960	82	~	1	1	1	79	0		79	>0.6	>0.6	>2.0	0.877	1.082	Non Liq.
56	27.32	877.7	27.07	27.56	SP	0.120	3.278	2.197	0.954	88	~	1	1	1	84	0		84	>0.6	>0.6	>2.0	0.874	1.099	Non Liq.
57	27.81	877.2	27.56	28.05	SP	0.120	3.337	2.226	0.948	88	~	1	1	1	83	0		83	>0.6	>0.6	>2.0	0.872	1.116	Non Liq.
58	28.30	876.7	28.05	28.54	SP	0.120	3.395	2.254	0.942	76	~	1	1	1	72	0		72	>0.6	>0.6	>2.0	0.870	1.133	Non Liq.

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CPT-103

Figure B-4

Test Location	CPT-103	Basic Earthquake Magnitude	7.5
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?
Ground Surface Elevation	905 ft. MSL	Design Magnitude	6.5
Ground WaterDuring Investigatior	10 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)
Historic Ground Water Depth	3 ft. Below GL	Design PGA (M = 6.5)	0.87 g.
		Magnification Factor	1.0

Conditions: Existing conditions with historic groundwater level

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
59	28.79	876.2	28.54	29.04	SP	0.120	3.455	2.282	0.936	66	~	1	1	1	62	0		62	>0.6	>0.6	>2.0	0.868	1.149	Non Liq.
60	29.29	875.7	29.04	29.53	SP	0.120	3.514	2.311	0.930	81	~	1	1	1	75	0		75	>0.6	>0.6	>2.0	0.865	1.166	Non Liq.
61	29.78	875.2	29.53	30.02	SP	0.120	3.573	2.339	0.925	77	~	1	1	1	71	0		71	>0.6	>0.6	>2.0	0.863	1.183	Non Liq.
62	30.27	874.7	30.02	30.51	SP	0.120	3.632	2.367	0.919	68	~	1	1	1	63	0		63	>0.6	>0.6	>2.0	0.861	1.199	Non Liq.
63	30.76	874.2	30.51	31.00	SP	0.120	3.691	2.395	0.914	78	~	1	1	1	71	0		71	>0.6	>0.6	>2.0	0.859	1.215	Non Liq.
64	31.25	873.8	31.00	31.50	SP	0.120	3.750	2.424	0.908	100	~	1	1	1	91	0		91	>0.6	>0.6	>2.0	0.856	1.231	Non Liq.
65	31.75	873.3	31.5	31.99	SP	0.120	3.809	2.453	0.903	86	~	1	1	1	78	0		78	>0.6	>0.6	>2.0	0.854	1.248	Non Liq.
66	32.24	872.8	31.99	32.48	SP	0.120	3.868	2.481	0.898	85	~	1	1	1	76	0		76	>0.6	>0.6	>2.0	0.852	1.263	Non Liq.
67	32.73	872.3	32.48	32.97	SP	0.120	3.927	2.509	0.893	95	~	1	1	1	85	0		85	>0.6	>0.6	>2.0	0.849	1.279	Non Liq.
68	33.22	871.8	32.97	33.46	SP/SM	0.120	3.986	2.537	0.888	100	~	1	1	1	89	6		89	>0.6	>0.6	>2.0	0.847	1.295	Non Liq.
69	33.71	871.3	33.46	33.96	SP	0.120	4.045	2.566	0.883	100	~	1	1	1	88	0		88	>0.6	>0.6	>2.0	0.845	1.311	Non Liq.
70	34.21	870.8	33.96	34.45	SP	0.120	4.105	2.594	0.878	76	~	1	1	1	67	0		67	>0.6	>0.6	>2.0	0.843	1.326	Non Liq.
71	34.70	870.3	34.45	34.94	SP	0.120	4.163	2.622	0.873	98	~	1	1	1	86	0		86	>0.6	>0.6	>2.0	0.840	1.342	Non Liq.
72	35.19	869.8	34.94	35.43	SP	0.120	4.222	2.651	0.869	84	~	1	1	1	73	0		73	>0.6	>0.6	>2.0	0.838	1.357	Non Liq.
73	35.68	869.3	35.43	35.93	SP	0.120	4.282	2.679	0.864	96	~	1	1	1	83	0		83	>0.6	>0.6	>2.0	0.836	1.372	Non Liq.
74	36.18	868.8	35.93	36.42	SP	0.120	4.341	2.708	0.859	81	~	1	1	1	70	0		70	>0.6	>0.6	>2.0	0.834	1.388	Non Liq.
75	36.67	868.3	36.42	36.91	SP	0.120	4.400	2.736	0.855	90	~	1	1	1	77	0		77	>0.6	>0.6	>2.0	0.831	1.403	Non Liq.
76	37.16	867.8	36.91	37.40	SP	0.120	4.459	2.764	0.851	87	~	1	1	1	74	0		74	>0.6	>0.6	>2.0	0.829	1.418	Non Liq.
77	37.65	867.4	37.4	37.89	SP	0.120	4.517	2.792	0.846	66	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.827	1.432	Non Liq.
78	38.14	866.9	37.89	38.39	SP	0.120	4.577	2.821	0.842	66	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.825	1.447	Non Liq.
79	38.64	866.4	38.39	38.88	SP	0.120	4.636	2.849	0.838	62	~	1	1	1	52	0		52	>0.6	>0.6	>2.0	0.822	1.462	Non Liq.
80	39.13	865.9	38.88	39.37	SP	0.120	4.695	2.878	0.834	78	~	1	1	1	65	0		65	>0.6	>0.6	>2.0	0.820	1.476	Non Liq.
81	39.62	865.4	39.37	39.86	SP	0.120	4.754	2.906	0.830	74	~	1	1	1	61	0		61	>0.6	>0.6	>2.0	0.818	1.491	Non Liq.
82	40.11	864.9	39.86	40.35	SP	0.120	4.813	2.934	0.826	69	~	1	1	1	57	0		57	>0.6	>0.6	>2.0	0.816	1.505	Non Liq.
83	40.60	864.4	40.35	40.85	SP	0.120	4.872	2.963	0.822	67	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.813	1.519	Non Liq.
84	41.10	863.9	40.85	41.34	SP	0.120	4.931	2.991	0.818	89	~	1	1	1	73	0		73	>0.6	>0.6	>2.0	0.811	1.534	Non Liq.
85	41.59	863.4	41.34	41.83	SP	0.120	4.990	3.019	0.814	81	~	1	1	1	66	0		66	>0.6	>0.6	>2.0	0.809	1.548	Non Liq.
86	42.08	862.9	41.83	42.32	SP	0.120	5.049	3.048	0.810	73	~	1	1	1	59	0		59	>0.6	>0.6	>2.0	0.806	1.562	Non Liq.
87	42.57	862.4	42.32	42.81	SP	0.120	5.108	3.076	0.806	73	~	1	1	1	59	0		59	>0.6	>0.6	>2.0	0.804	1.575	Non Liq.
88	43.06	861.9	42.81	43.31	SP	0.120	5.167	3.104	0.803	85	~	1	1	1	68	0		68	>0.6	>0.6	>2.0	0.802	1.589	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-109

Test Location	CPT-109	Basic Earthquake Magnitude	7.5	Conditions: Existing conditions with historic groundwater level
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?	
Ground Surface Elevation	952 ft. MSL	Design Magnitude	6.5	Figure B-5
Ground WaterDuring Investigatior	25 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)	
Historic Ground Water Depth	15 ft. Below GL	Design PGA (M = 6.5)	0.87 g.	
		Magnification Factor	1.0	

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
1	0.25	951.8	0	0.49	SM/ML	0.120	0.029	0.029	2.000	6	~	1	1	1	12	35		19	0.215	0.215	0.006	0.999	0.011	Non Liq.
2	0.74	951.3	0.49	0.98	SM/ML	0.120	0.088	0.088	2.000	8	~	1	1	1	16	35		24	0.277	0.277	0.024	0.997	0.034	Non Liq.
3	1.23	950.8	1.0	1.48	CL	0.120	0.148	0.148	2.000	12	~	1	1	1	24	52		Fine grained	>0.6	>0.6	>2.0	0.994	0.056	Non Liq.
4	1.73	950.3	1.48	1.97	ML/CL	0.120	0.207	0.207	2.000	10	~	1	1	1	20	52		Fine grained	>0.6	>0.6	>2.0	0.992	0.079	Non Liq.
5	2.22	949.8	1.97	2.46	ML/CL	0.120	0.266	0.266	2.000	8	~	1	1	1	16	52		Fine grained	>0.6	>0.6	>2.0	0.990	0.101	Non Liq.
6	2.71	949.3	2.46	2.95	CL	0.120	0.325	0.325	2.000	8	~	1	1	1	16	52		Fine grained	>0.6	>0.6	>2.0	0.988	0.123	Non Liq.
7	3.20	948.8	2.95	3.44	CL	0.120	0.383	0.383	2.000	11	~	1	1	1	22	52		Fine grained	>0.6	>0.6	>2.0	0.985	0.145	Non Liq.
8	3.69	948.3	3.44	3.94	ML/CL	0.120	0.443	0.443	2.000	8	~	1	1	1	16	52		Fine grained	>0.6	>0.6	>2.0	0.983	0.167	Non Liq.
9	4.19	947.8	3.94	4.43	ML/CL	0.120	0.502	0.502	1.996	7	~	1	1	1	14	52		Fine grained	>0.6	>0.6	>2.0	0.981	0.189	Non Liq.
10	4.68	947.3	4.43	4.92	ML/CL	0.120	0.561	0.561	1.888	8	~	1	1	1	15	52		Fine grained	>0.6	>0.6	>2.0	0.978	0.211	Non Liq.
11	5.17	946.8	4.92	5.41	ML/CL	0.120	0.620	0.620	1.796	6	~	1	1	1	11	52		Fine grained	>0.6	>0.6	>2.0	0.976	0.232	Non Liq.
12	5.66	946.3	5.41	5.91	ML/CL	0.120	0.679	0.679	1.716	6	~	1	1	1	10	52		Fine grained	>0.6	>0.6	>2.0	0.974	0.254	Non Liq.
13	6.16	945.8	5.91	6.40	CL	0.120	0.739	0.739	1.646	8	~	1	1	1	13	52		Fine grained	>0.6	>0.6	>2.0	0.972	0.275	Non Liq.
14	6.65	945.4	6.40	6.89	ML/CL	0.120	0.797	0.797	1.584	5	~	1	1	1	8	52		Fine grained	>0.6	>0.6	>2.0	0.969	0.296	Non Liq.
15	7.14	944.9	6.89	7.38	CL	0.120	0.856	0.856	1.528	6	~	1	1	1	9	52		Fine grained	>0.6	>0.6	>2.0	0.967	0.318	Non Liq.
16	7.63	944.4	7.38	7.87	CL	0.120	0.915	0.915	1.478	4	~	1	1	1	6	52		Fine grained	>0.6	>0.6	>2.0	0.965	0.339	Non Liq.
17	8.12	943.9	7.87	8.37	ML/CL	0.120	0.974	0.974	1.433	4	~	1	1	1	6	52		Fine grained	>0.6	>0.6	>2.0	0.963	0.360	Non Liq.
18	8.62	943.4	8.37	8.86	SM/ML	0.120	1.034	1.034	1.391	8	~	1	1	1	11	35		18	0.202	0.202	0.209	0.960	0.381	Non Liq.
19	9.11	942.9	8.86	9.35	SM/ML	0.120	1.093	1.093	1.353	10	~	1	1	1	14	35		21	0.238	0.238	0.260	0.958	0.401	Non Liq.
20	9.60	942.4	9.35	9.84	SM/ML	0.120	1.151	1.151	1.318	10	~	1	1	1	13	35		21	0.233	0.233	0.268	0.956	0.422	Non Liq.
21	10.09	941.9	9.84	10.33	ML/CL	0.120	1.210	1.210	1.286	10	~	1	1	1	13	52		Fine grained	>0.6	>0.6	>2.0	0.954	0.443	Non Liq.
22	10.58	941.4	10.33	10.83	CL	0.120	1.270	1.270	1.255	9	~	1	1	1	11	52		Fine grained	>0.6	>0.6	>2.0	0.951	0.463	Non Liq.
23	11.08	940.9	10.83	11.32	SM/ML	0.120	1.329	1.329	1.227	12	~	1	1	1	15	35		23	0.255	0.255	0.339	0.949	0.484	Non Liq.
24	11.57	940.4	11.32	11.81	SM/ML	0.120	1.388	1.388	1.200	12	~	1	1	1	14	35		22	0.251	0.251	0.348	0.947	0.504	Non Liq.
25	12.06	939.9	11.81	12.30	SM/ML	0.120	1.447	1.447	1.176	21	~	1	1	1	25	35		35	>0.6	>0.6	>2.0	0.945	0.524	Non Liq.
26	12.55	939.5	12.30	12.80	SP	0.120	1.506	1.506	1.152	31	~	1	1	1	36	0		36	>0.6	>0.6	>2.0	0.942	0.544	Non Liq.
27	13.05	939.0	12.8	13.29	SP	0.120	1.565	1.565	1.130	34	~	1	1	1	38	0		38	>0.6	>0.6	>2.0	0.940	0.564	Non Liq.
28	13.54	938.5	13.29	13.78	SP/SM	0.120	1.624	1.624	1.110	43	~	1	1	1	48	6		48	>0.6	>0.6	>2.0	0.938	0.584	Non Liq.
29	14.03	938.0	13.78	14.27	SP/SM	0.120	1.683	1.683	1.090	36	~	1	1	1	39	6		39	>0.6	>0.6	>2.0	0.935	0.604	Non Liq.
30	14.52	937.5	14.27	14.76	SP	0.120	1.742	1.742	1.072	28	~	1	1	1	30	0		30	0.594	0.594	1.034	0.933	0.623	Non Liq.
31	15.01	937.0	14.76	15.26	SP	0.120	1.801	1.801	1.054	24	~	1	1	1	25	0		25	0.296	0.296	0.534	0.931	0.643	0.83
32	15.51	936.5	15.26	15.75	SP/SM	0.120	1.861	1.829	1.046	28	~	1	1	1	29	6		29	0.440	0.440	0.805	0.929	0.663	1.21
33	16.00	936.0	15.75	16.24	SP/SM	0.120	1.919	1.857	1.038	21	~	1	1	1	22	6		22	0.247	0.247	0.459	0.926	0.682	0.67
34	16.49	935.5	16.24	16.73	SP/SM	0.120	1.978	1.886	1.030	29	~	1	1	1	30	6		30	0.600	0.600	1.131	0.924	0.701	1.61
35	16.98	935.0	16.73	17.22	SP/SM	0.120	2.037	1.914	1.022	42	~	1	1	1	43	6		43	>0.6	>0.6	>2.0	0.922	0.720	Non Liq.
36	17.47	934.5	17.22	17.72	ML/CL	0.120	2.096	1.942	1.015	19	~	1	1	1	19	52		Fine grained	>0.6	>0.6	>2.0	0.920	0.739	Non Liq.
37	17.97	934.0	17.72	18.21	CL	0.120	2.156	1.971	1.007	40	~	1	1	1	40	52		Fine grained	>0.6	>0.6	>2.0	0.917	0.758	Non Liq.
38	18.46	933.5	18.21	18.70	SP/SM	0.120	2.215	1.999	1.000	72	~	1	1	1	72	6		72	>0.6	>0.6	>2.0	0.915	0.777	Non Liq.
39	18.95	933.1	18.7	19.19	SP/SM	0.120	2.273	2.027	0.993	100	~	1	1	1	99	6		100	>0.6	>0.6	>2.0	0.913	0.796	Non Liq.
40	19.44	932.6	19.19	19.69	SP/SM	0.120	2.333	2.056	0.986	88	~	1	1	1	87	6		87	>0.6	>0.6	>2.0	0.911	0.815	Non Liq.
41	19.94	932.1	19.69	20.18	SP	0.120	2.392	2.084	0.980	67	~	1	1	1	66	0		66	>0.6	>0.6	>2.0	0.908	0.833	Non Liq.
42	20.43	931.6	20.18	20.67	SP/SM	0.120	2.451	2.112	0.973	85	~	1	1	1	83	6		83	>0.6	>0.6	>2.0	0.906	0.852	Non Liq.
43	20.92	931.1	20.67	21.16	SP	0.120	2.510	2.141	0.967	59	~	1	1	1	57	0		57	>0.6	>0.6	>2.0	0.904	0.870	Non Liq.
44	21.41	930.6	21.16	21.65	SP	0.120	2.569	2.169	0.960	60	~	1	1	1	58	0		58	>0.6	>0.6	>2.0	0.902	0.888	Non Liq.
45	21.90	930.1	21.65	22.15	SP	0.120	2.628	2.197	0.954	59	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.899	0.906	Non Liq.
46	22.40	929.6	22.15	22.64	SP	0.120	2.687	2.226	0.948	63	~	1	1	1	60	0		60	>0.6	>0.6	>2.0	0.897	0.924	Non Liq.
47	22.89	929.1	22.64	23.13	SP	0.120	2.746	2.254	0.942	59	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.895	0.942	Non Liq.
48	23.38	928.6	23.13	23.62	SP	0.120	2.805	2.282	0.936	54	~	1	1	1	51	0		51	>0.6	>0.6	>2.0	0.892	0.960	Non Liq.
49	23.87	928.1	23.62	24.11	SP/SM	0.120	2.864	2.311	0.930	39	~	1	1	1	36	6		36	>0.6	>0.6	>2.0	0.890	0.978	Non Liq.
50	24.36	927.6	24.11	24.61	CL/CH*	0.120	2.923	2.339	0.925	100	~	1	1	1	92	52		Fine grained	>0.6	>0.6	>2.0	0.888	0.995	Non Liq.
51	24.86	927.1	24.61	25.10	SP	0.120	2.983	2.368	0.919	76	~	1	1	1	70	0		70	>0.6	>0.6	>2.0	0.886	1.013	Non Liq.
52	25.35	926.7	25.10	25.59	SP	0.120	3.041	3.020	0.814	68	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.883	1.030	Non Liq.
53	25.84	926.2	25.59	26.08	SP	0.120	3.100	3.048	0.810	66	~	1	1	1	53	0		53	>0.6	>0.6	>2.0	0.881	1.048	Non Liq.
54	26.33	925.7	26.08	26.57	SP	0.120	3.159	3.076	0.806	74	~	1	1	1	60	0		60	>0.6	>0.6	>2.0	0.879	1.065	Non Liq.
55	26.82	925.2	26.57	27.07	SP	0.120	3.218	3.105	0.803	70	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.877	1.082	Non Liq.
56	27.32	924.7	27.07	27.56	SP	0.120	3.278	3.133	0.799	70	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.874	1.099	Non Liq.
57	27.81	924.2	27.56	28.05	SP	0.120	3.337	3.162	0.795	69	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.872	1.116	Non Liq.
58	28.30	923.7	28.05	28.54	SP	0.120	3.395	3.190	0.792	70	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.870	1.133	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-109

Figure B-5

Test Location	CPT-109	Basic Earthquake Magnitude	7.5
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?
Ground Surface Elevation	952 ft. MSL	Design Magnitude	6.5
Ground WaterDuring Investigatior	25 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)
Historic Ground Water Depth	15 ft. Below GL	Design PGA (M = 6.5)	0.87 g.
		Magnification Factor	1.0

Conditions: Existing conditions with historic groundwater level

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
59	28.79	923.2	28.54	29.04	SP	0.120	3.455	3.218	0.788	83	~	1	1	1	65	0		65	>0.6	>0.6	>2.0	0.868	1.149	Non Liq.
60	29.29	922.7	29.04	29.53	SP	0.120	3.514	3.247	0.785	100	~	1	1	1	78	0		78	>0.6	>0.6	>2.0	0.865	1.166	Non Liq.
61	29.78	922.2	29.53	30.02	SP	0.120	3.573	3.275	0.781	82	~	1	1	1	64	0		64	>0.6	>0.6	>2.0	0.863	1.183	Non Liq.
62	30.27	921.7	30.02	30.51	SP/SM	0.120	3.632	3.303	0.778	100	~	1	1	1	78	6		78	>0.6	>0.6	>2.0	0.861	1.199	Non Liq.
63	30.76	921.2	30.51	31.00	SP	0.120	3.691	3.331	0.775	81	~	1	1	1	63	0		63	>0.6	>0.6	>2.0	0.859	1.215	Non Liq.
64	31.25	920.8	31.00	31.50	SM/ML	0.120	3.750	3.360	0.772	90	~	1	1	1	69	35		88	>0.6	>0.6	>2.0	0.856	1.231	Non Liq.
65	31.75	920.3	31.5	31.99	SP	0.120	3.809	3.389	0.768	80	~	1	1	1	61	0		61	>0.6	>0.6	>2.0	0.854	1.248	Non Liq.
66	32.24	919.8	31.99	32.48	SP	0.120	3.868	3.417	0.765	72	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.852	1.263	Non Liq.
67	32.73	919.3	32.48	32.97	SP	0.120	3.927	3.445	0.762	75	~	1	1	1	57	0		57	>0.6	>0.6	>2.0	0.849	1.279	Non Liq.
68	33.22	918.8	32.97	33.46	SP	0.120	3.986	3.473	0.759	71	~	1	1	1	54	0		54	>0.6	>0.6	>2.0	0.847	1.295	Non Liq.
69	33.71	918.3	33.46	33.96	SP	0.120	4.045	3.502	0.756	60	~	1	1	1	45	0		45	>0.6	>0.6	>2.0	0.845	1.311	Non Liq.
70	34.21	917.8	33.96	34.45	SP	0.120	4.105	3.530	0.753	54	~	1	1	1	41	0		41	>0.6	>0.5	>2.0	0.843	1.326	Non Liq.
71	34.70	917.3	34.45	34.94	SP	0.120	4.163	3.558	0.750	41	~	1	1	1	31	0		31	>0.6	>0.6	>2.0	0.840	1.342	Non Liq.
72	35.19	916.8	34.94	35.43	SP/SM	0.120	4.222	3.587	0.747	23	~	1	1	1	17	6		17	0.191	0.191	0.684	0.838	1.357	0.50
73	35.68	916.3	35.43	35.93	SM/ML	0.120	4.282	3.615	0.744	15	~	1	1	1	11	35		18	0.203	0.203	0.733	0.836	1.372	0.53
74	36.18	915.8	35.93	36.42	SM/ML	0.120	4.341	3.644	0.741	10	~	1	1	1	7	35		14	0.153	0.153	0.557	0.834	1.388	0.40
75	36.67	915.3	36.42	36.91	SM/ML	0.120	4.400	3.672	0.738	10	~	1	1	1	7	35		14	0.152	0.152	0.560	0.831	1.403	0.40
76	37.16	914.8	36.91	37.40	SP/SM	0.120	4.459	3.700	0.735	22	~	1	1	1	16	6		16	0.180	0.180	0.664	0.829	1.418	0.47
77	37.65	914.4	37.4	37.89	SP	0.120	4.517	3.728	0.732	47	~	1	1	1	34	0		34	>0.6	>0.6	>2.0	0.827	1.432	Non Liq.
78	38.14	913.9	37.89	38.39	SP	0.120	4.577	3.757	0.730	28	~	1	1	1	20	0		20	0.229	0.229	0.859	0.825	1.447	0.59
79	38.64	913.4	38.39	38.88	SM/ML	0.120	4.636	3.785	0.727	12	~	1	1	1	9	35		15	0.170	0.170	0.644	0.822	1.462	0.44
80	39.13	912.9	38.88	39.37	CL	0.120	4.695	3.814	0.724	7	~	1	1	1	5	52		Fine grained	>0.6	>0.6	>2.0	0.820	1.476	Non Liq.
81	39.62	912.4	39.37	39.86	CL	0.120	4.754	3.842	0.722	2	~	1	1	1	1	52		Fine grained	>0.6	>0.6	>2.0	0.818	1.491	Non Liq.
82	40.11	911.9	39.86	40.35	CL	0.120	4.813	3.870	0.719	2	~	1	1	1	1	52		Fine grained	>0.6	>0.6	>2.0	0.816	1.505	Non Liq.
83	40.60	911.4	40.35	40.85	CL	0.120	4.872	3.899	0.716	4	~	1	1	1	3	52		Fine grained	>0.6	>0.6	>2.0	0.813	1.519	Non Liq.
84	41.10	910.9	40.85	41.34	SM/ML	0.120	4.931	3.927	0.714	11	~	1	1	1	8	35		14	0.159	0.159	0.623	0.811	1.534	0.41
85	41.59	910.4	41.34	41.83	SM/ML	0.120	4.990	3.955	0.711	25	~	1	1	1	18	35		26	0.317	0.317	1.252	0.809	1.548	0.81
86	42.08	909.9	41.83	42.32	SP	0.120	5.049	3.984	0.709	38	~	1	1	1	27	0		27	0.332	0.332	1.322	0.806	1.562	0.85
87	42.57	909.4	42.32	42.81	SP	0.120	5.108	4.012	0.706	61	~	1	1	1	43	0		43	>0.6	>0.6	>2.0	0.804	1.575	Non Liq.
88	43.06	908.9	42.81	43.31	SP	0.120	5.167	4.040	0.704	92	~	1	1	1	65	0		65	>0.6	>0.6	>2.0	0.802	1.589	Non Liq.
89	43.56	908.4	43.31	43.80	SP	0.120	5.227	4.069	0.701	78	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.800	1.603	Non Liq.
90	44.05	908.0	43.80	44.29	SP	0.120	5.285	4.097	0.699	79	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.797	1.616	Non Liq.
91	44.54	907.5	44.29	44.78	SP	0.120	5.344	4.125	0.696	78	~	1	1	1	54	0		54	>0.6	>0.6	>2.0	0.795	1.630	Non Liq.
92	45.03	907.0	44.78	45.28	SP	0.120	5.404	4.154	0.694	86	~	1	1	1	60	0		60	>0.6	>0.6	>2.0	0.793	1.643	Non Liq.
93	45.53	906.5	45.28	45.77	SP/SM	0.120	5.463	4.182	0.692	100	~	1	1	1	69	6		70	>0.6	>0.6	>2.0	0.791	1.656	Non Liq.
94	46.02	906.0	45.77	46.26	SP	0.120	5.522	4.210	0.689	100	~	1	1	1	69	0		69	>0.6	>0.6	>2.0	0.788	1.669	Non Liq.
95	46.51	905.5	46.26	46.75	SP	0.120	5.581	4.239	0.687	100	~	1	1	1	69	0		69	>0.6	>0.6	>2.0	0.786	1.682	Non Liq.
96	47.00	905.0	46.75	47.24	SP	0.120	5.639	4.267	0.685	100	~	1	1	1	68	0		68	>0.6	>0.6	>2.0	0.784	1.695	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-115

Test Location	CPT-115	Basic Earthquake Magnitude	7.5	Conditions: Existing conditions with historic groundwater level
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?	
Ground Surface Elevation	954 ft. MSL	Design Magnitude	6.5	Figure B-6
Ground WaterDuring Investigatior	21.5 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)	
Historic Ground Water Depth	11 ft. Below GL	Design PGA (M = 6.5)	0.87 g.	
		Magnification Factor	1.0	

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
1	0.25	953.8	0	0.49	SM/ML	0.120	0.029	0.029	2.000	9	~	1	1	1	18	35		27	0.323	0.323	0.009	0.999	0.011	Non Liq.
2	0.74	953.3	0.49	0.98	SM/ML	0.120	0.088	0.088	2.000	14	~	1	1	1	28	35		38	>0.6	>0.6	>2.0	0.997	0.034	Non Liq.
3	1.23	952.8	1.0	1.48	SM/ML	0.120	0.148	0.148	2.000	14	~	1	1	1	28	35		38	>0.6	>0.6	>2.0	0.994	0.056	Non Liq.
4	1.73	952.3	1.48	1.97	CL	0.120	0.207	0.207	2.000	10	~	1	1	1	20	52		Fine grained	>0.6	>0.6	>2.0	0.992	0.079	Non Liq.
5	2.22	951.8	1.97	2.46	SM/ML	0.120	0.266	0.266	2.000	15	~	1	1	1	30	35		41	>0.6	>0.6	>2.0	0.990	0.101	Non Liq.
6	2.71	951.3	2.46	2.95	SM/ML	0.120	0.325	0.325	2.000	17	~	1	1	1	34	35		46	>0.6	>0.6	>2.0	0.988	0.123	Non Liq.
7	3.20	950.8	2.95	3.44	SM/ML	0.120	0.383	0.383	2.000	13	~	1	1	1	26	35		36	>0.6	>0.6	>2.0	0.985	0.145	Non Liq.
8	3.69	950.3	3.44	3.94	ML/CL	0.120	0.443	0.443	2.000	12	~	1	1	1	24	52		Fine grained	>0.6	>0.6	>2.0	0.983	0.167	Non Liq.
9	4.19	949.8	3.94	4.43	ML/CL	0.120	0.502	0.502	1.996	13	~	1	1	1	26	52		Fine grained	>0.6	>0.6	>2.0	0.981	0.189	Non Liq.
10	4.68	949.3	4.43	4.92	CL	0.120	0.561	0.561	1.888	11	~	1	1	1	21	52		Fine grained	>0.6	>0.6	>2.0	0.978	0.211	Non Liq.
11	5.17	948.8	4.92	5.41	SM/ML	0.120	0.620	0.620	1.796	8	~	1	1	1	14	35		22	0.250	0.250	0.155	0.976	0.232	Non Liq.
12	5.66	948.3	5.41	5.91	SM/ML	0.120	0.679	0.679	1.716	9	~	1	1	1	15	35		23	0.257	0.257	0.162	0.974	0.254	Non Liq.
13	6.16	947.8	5.91	6.40	SM/ML	0.120	0.739	0.739	1.646	9	~	1	1	1	15	35		23	0.257	0.257	0.190	0.972	0.275	Non Liq.
14	6.65	947.4	6.40	6.89	ML/CL	0.120	0.797	0.797	1.584	7	~	1	1	1	11	52		Fine grained	>0.6	>0.6	>2.0	0.969	0.296	Non Liq.
15	7.14	946.9	6.89	7.38	ML/CL	0.120	0.856	0.856	1.528	7	~	1	1	1	11	52		Fine grained	>0.6	>0.6	>2.0	0.967	0.318	Non Liq.
16	7.63	946.4	7.38	7.87	ML/CL	0.120	0.915	0.915	1.478	4	~	1	1	1	6	52		Fine grained	>0.6	>0.6	>2.0	0.965	0.339	Non Liq.
17	8.12	945.9	7.87	8.37	CL	0.120	0.974	0.974	1.433	5	~	1	1	1	7	52		Fine grained	>0.6	>0.6	>2.0	0.963	0.360	Non Liq.
18	8.62	945.4	8.37	8.86	SM/ML	0.120	1.034	1.034	1.391	9	~	1	1	1	13	35		20	0.223	0.223	0.230	0.960	0.381	Non Liq.
19	9.11	944.9	8.86	9.35	SM/ML	0.120	1.093	1.093	1.353	19	~	1	1	1	26	35		36	>0.6	>0.6	>2.0	0.958	0.401	Non Liq.
20	9.60	944.4	9.35	9.84	SP/SM	0.120	1.151	1.151	1.318	19	~	1	1	1	25	6		25	0.294	0.294	0.339	0.956	0.422	Non Liq.
21	10.09	943.9	9.84	10.33	SP/SM	0.120	1.210	1.210	1.286	18	~	1	1	1	23	6		23	0.265	0.265	0.320	0.954	0.443	Non Liq.
22	10.58	943.4	10.33	10.83	SP/SM	0.120	1.270	1.270	1.255	20	~	1	1	1	25	6		25	0.295	0.295	0.375	0.951	0.463	Non Liq.
23	11.08	942.9	10.83	11.32	SM/ML	0.120	1.329	1.324	1.229	19	~	1	1	1	23	35		33	>0.6	>0.6	>2.0	0.949	0.484	Non Liq.
24	11.57	942.4	11.32	11.81	SP/SM	0.120	1.388	1.353	1.216	19	~	1	1	1	23	6		23	0.264	0.264	0.357	0.947	0.504	0.71
25	12.06	941.9	11.81	12.30	SM/ML	0.120	1.447	1.381	1.204	11	~	1	1	1	13	35		21	0.234	0.234	0.323	0.945	0.524	0.62
26	12.55	941.5	12.30	12.80	SM/ML	0.120	1.506	1.409	1.191	5	~	1	1	1	6	35		12	0.134	0.134	0.188	0.942	0.544	0.35
27	13.05	941.0	12.8	13.29	ML/CL	0.120	1.565	1.438	1.179	6	~	1	1	1	7	52		Fine grained	>0.6	>0.6	>2.0	0.940	0.564	Non Liq.
28	13.54	940.5	13.29	13.78	SM/ML	0.120	1.624	1.466	1.168	8	~	1	1	1	9	35		16	0.178	0.178	0.261	0.938	0.584	0.45
29	14.03	940.0	13.78	14.27	SM/ML	0.120	1.683	1.494	1.157	15	~	1	1	1	17	35		26	0.305	0.305	0.456	0.935	0.604	0.76
30	14.52	939.5	14.27	14.76	SP/SM	0.120	1.742	1.522	1.146	22	~	1	1	1	25	6		25	0.298	0.298	0.453	0.933	0.623	0.73
31	15.01	939.0	14.76	15.26	SM/ML	0.120	1.801	1.551	1.136	29	~	1	1	1	33	35		44	>0.6	>0.6	>2.0	0.931	0.643	Non Liq.
32	15.51	938.5	15.26	15.75	SP/SM	0.120	1.861	1.579	1.125	24	~	1	1	1	27	6		27	0.337	0.337	0.533	0.929	0.663	0.80
33	16.00	938.0	15.75	16.24	SP/SM	0.120	1.919	1.608	1.115	28	~	1	1	1	31	6		31	>0.6	>0.6	>2.0	0.926	0.682	Non Liq.
34	16.49	937.5	16.24	16.73	SP/SM	0.120	1.978	1.636	1.106	22	~	1	1	1	24	6		24	0.282	0.282	0.461	0.924	0.701	0.66
35	16.98	937.0	16.73	17.22	SM/ML	0.120	2.037	1.664	1.096	19	~	1	1	1	21	35		30	0.522	0.522	0.868	0.922	0.720	1.21
36	17.47	936.5	17.22	17.72	ML/CL	0.120	2.096	1.693	1.087	16	~	1	1	1	17	52		Fine grained	>0.6	>0.6	>2.0	0.920	0.739	Non Liq.
37	17.97	936.0	17.72	18.21	SP/SM	0.120	2.156	1.721	1.078	31	~	1	1	1	33	6		34	>0.6	>0.6	>2.0	0.917	0.758	Non Liq.
38	18.46	935.5	18.21	18.70	SP	0.120	2.215	1.749	1.069	35	~	1	1	1	37	0		37	>0.6	>0.6	>2.0	0.915	0.777	Non Liq.
39	18.95	935.1	18.7	19.19	SP	0.120	2.273	1.778	1.061	46	~	1	1	1	49	0		49	>0.6	>0.6	>2.0	0.913	0.796	Non Liq.
40	19.44	934.6	19.19	19.69	SP	0.120	2.333	1.806	1.052	59	~	1	1	1	62	0		62	>0.6	>0.6	>2.0	0.911	0.815	Non Liq.
41	19.94	934.1	19.69	20.18	SP	0.120	2.392	1.835	1.044	56	~	1	1	1	58	0		58	>0.6	>0.6	>2.0	0.908	0.833	Non Liq.
42	20.43	933.6	20.18	20.67	SP/SM	0.120	2.451	1.863	1.036	75	~	1	1	1	78	6		78	>0.6	>0.6	>2.0	0.906	0.852	Non Liq.
43	20.92	933.1	20.67	21.16	SP	0.120	2.510	1.891	1.028	80	~	1	1	1	82	0		82	>0.6	>0.6	>2.0	0.904	0.870	Non Liq.
44	21.41	932.6	21.16	21.65	SP	0.120	2.569	1.919	1.021	82	~	1	1	1	84	0		84	>0.6	>0.6	>2.0	0.902	0.888	Non Liq.
45	21.90	932.1	21.65	22.15	SP	0.120	2.628	2.603	0.877	70	~	1	1	1	61	0		61	>0.6	>0.6	>2.0	0.899	0.906	Non Liq.
46	22.40	931.6	22.15	22.64	SM/ML	0.120	2.687	2.632	0.872	60	~	1	1	1	52	35		68	>0.6	>0.6	>2.0	0.897	0.924	Non Liq.
47	22.89	931.1	22.64	23.13	SP/SM	0.120	2.746	2.660	0.867	84	~	1	1	1	73	6		73	>0.6	>0.6	>2.0	0.895	0.942	Non Liq.
48	23.38	930.6	23.13	23.62	SP	0.120	2.805	2.688	0.863	91	~	1	1	1	78	0		78	>0.6	>0.6	>2.0	0.892	0.960	Non Liq.
49	23.87	930.1	23.62	24.11	SP	0.120	2.864	2.716	0.858	88	~	1	1	1	76	0		76	>0.6	>0.6	>2.0	0.890	0.978	Non Liq.
50	24.36	929.6	24.11	24.61	SP	0.120	2.923	2.745	0.854	87	~	1	1	1	74	0		74	>0.6	>0.6	>2.0	0.888	0.995	Non Liq.
51	24.86	929.1	24.61	25.10	SP	0.120	2.983	2.773	0.849	69	~	1	1	1	59	0		59	>0.6	>0.6	>2.0	0.886	1.013	Non Liq.
52	25.35	928.7	25.10	25.59	SP	0.120	3.041	2.801	0.845	66	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.883	1.030	Non Liq.
53	25.84	928.2	25.59	26.08	SP	0.120	3.100	2.830	0.841	66	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.881	1.048	Non Liq.
54	26.33	927.7	26.08	26.57	SP	0.120	3.159	2.858	0.837	74	~	1	1	1	62	0		62	>0.6	>0.6	>2.0	0.879	1.065	Non Liq.
55	26.82	927.2	26.57	27.07	SP	0.120	3.218	2.886	0.832	75	~	1	1	1	62	0		62	>0.6	>0.6	>2.0	0.877	1.082	Non Liq.
56	27.32	926.7	27.07	27.56	SP	0.120	3.278	2.915	0.828	73	~	1	1	1	60	0		60	>0.6	>0.6	>2.0	0.874	1.099	Non Liq.
57	27.81	926.2	27.56	28.05	SP	0.120	3.337	2.943	0.824	71	~	1	1	1	59	0		59	>0.6	>0.6	>2.0	0.872	1.116	Non Liq.
58	28.30	925.7	28.05	28.54	SP	0.120	3.395	2.971	0.820	74	~	1	1	1	61	0		61	>0.6	>0.6	>2.0	0.870	1.133	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-115

Test Location	CPT-115	Basic Earthquake Magnitude	7.5	Conditions:	Existing conditions with historic groundwater level
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?		
Ground Surface Elevation	954 ft. MSL	Design Magnitude	6.5		
Ground WaterDuring Investigatior	21.5 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)		
Historic Ground Water Depth	11 ft. Below GL	Design PGA (M = 6.5)	0.87 g.		
		Magnification Factor	1.0		

Figure B-6

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
59	28.79	925.2	28.54	29.04	SP	0.120	3.455	3.000	0.817	74	~	1	1	1	60	0		60	>0.6	>0.6	>2.0	0.868	1.149	Non Liq.
60	29.29	924.7	29.04	29.53	SP	0.120	3.514	3.028	0.813	72	~	1	1	1	59	0		59	>0.6	>0.6	>2.0	0.865	1.166	Non Liq.
61	29.78	924.2	29.53	30.02	SP	0.120	3.573	3.057	0.809	84	~	1	1	1	68	0		68	>0.6	>0.6	>2.0	0.863	1.183	Non Liq.
62	30.27	923.7	30.02	30.51	SP/SM	0.120	3.632	3.085	0.805	32	~	1	1	1	26	6		26	0.309	0.309	0.952	0.861	1.199	0.79
63	30.76	923.2	30.51	31.00	SM/ML	0.120	3.691	3.113	0.802	11	~	1	1	1	9	35		16	0.171	0.171	0.533	0.859	1.215	0.44
64	31.25	922.8	31.00	31.50	CL	0.120	3.750	3.142	0.798	13	~	1	1	1	10	52		Fine grained	>0.6	>0.6	>2.0	0.856	1.231	Non Liq.
65	31.75	922.3	31.5	31.99	SM/ML	0.120	3.809	3.170	0.794	12	~	1	1	1	10	35		16	0.181	0.181	0.573	0.854	1.248	0.46
66	32.24	921.8	31.99	32.48	ML/CL	0.120	3.868	3.198	0.791	9	~	1	1	1	7	52		Fine grained	>0.6	>0.6	>2.0	0.852	1.263	Non Liq.
67	32.73	921.3	32.48	32.97	SM/ML	0.120	3.927	3.227	0.787	12	~	1	1	1	9	35		16	0.180	0.180	0.580	0.849	1.279	0.45
68	33.22	920.8	32.97	33.46	SM/ML	0.120	3.986	3.255	0.784	11	~	1	1	1	9	35		15	0.169	0.169	0.549	0.847	1.295	0.42
69	33.71	920.3	33.46	33.96	SM/ML	0.120	4.045	3.283	0.780	9	~	1	1	1	7	35		13	0.148	0.148	0.485	0.845	1.311	0.37
70	34.21	919.8	33.96	34.45	SM/ML	0.120	4.105	3.312	0.777	17	~	1	1	1	13	35		21	0.233	0.233	0.772	0.843	1.326	0.58
71	34.70	919.3	34.45	34.94	SP	0.120	4.163	3.340	0.774	34	~	1	1	1	26	0		26	0.318	0.318	1.061	0.840	1.342	0.79
72	35.19	918.8	34.94	35.43	SP	0.120	4.222	3.368	0.771	50	~	1	1	1	39	0		39	>0.6	>0.6	>2.0	0.838	1.357	Non Liq.
73	35.68	918.3	35.43	35.93	SP	0.120	4.282	3.397	0.767	72	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.836	1.372	Non Liq.
74	36.18	917.8	35.93	36.42	SP	0.120	4.341	3.425	0.764	81	~	1	1	1	62	0		62	>0.6	>0.6	>2.0	0.834	1.388	Non Liq.
75	36.67	917.3	36.42	36.91	SP	0.120	4.400	3.454	0.761	55	~	1	1	1	42	0		42	>0.6	>0.6	>2.0	0.831	1.403	Non Liq.
76	37.16	916.8	36.91	37.40	SP	0.120	4.459	3.482	0.758	42	~	1	1	1	32	0		32	>0.6	>0.6	>2.0	0.829	1.418	Non Liq.
77	37.65	916.4	37.4	37.89	SP	0.120	4.517	3.510	0.755	40	~	1	1	1	30	0		30	0.600	0.600	2.106	0.827	1.432	1.47
78	38.14	915.9	37.89	38.39	SP/SM	0.120	4.577	3.538	0.752	32	~	1	1	1	24	6		24	0.278	0.278	0.984	0.825	1.447	0.68
79	38.64	915.4	38.39	38.88	SP	0.120	4.636	3.567	0.749	44	~	1	1	1	33	0		33	>0.6	>0.6	>2.0	0.822	1.462	Non Liq.
80	39.13	914.9	38.88	39.37	SP	0.120	4.695	3.595	0.746	67	~	1	1	1	50	0		50	>0.6	>0.6	>2.0	0.820	1.476	Non Liq.
81	39.62	914.4	39.37	39.86	SP	0.120	4.754	3.623	0.743	86	~	1	1	1	64	0		64	>0.6	>0.6	>2.0	0.818	1.491	Non Liq.
82	40.11	913.9	39.86	40.35	SP	0.120	4.813	3.652	0.740	97	~	1	1	1	72	0		72	>0.6	>0.6	>2.0	0.816	1.505	Non Liq.
83	40.60	913.4	40.35	40.85	SP	0.120	4.872	3.680	0.737	91	~	1	1	1	67	0		67	>0.6	>0.6	>2.0	0.813	1.519	Non Liq.
84	41.10	912.9	40.85	41.34	SP	0.120	4.931	3.709	0.734	69	~	1	1	1	51	0		51	>0.6	>0.6	>2.0	0.811	1.534	Non Liq.
85	41.59	912.4	41.34	41.83	SP	0.120	4.990	3.737	0.732	75	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.809	1.548	Non Liq.
86	42.08	911.9	41.83	42.32	SP	0.120	5.049	3.765	0.729	75	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.806	1.562	Non Liq.
87	42.57	911.4	42.32	42.81	SP	0.120	5.108	3.793	0.726	71	~	1	1	1	52	0		52	>0.6	>0.6	>2.0	0.804	1.575	Non Liq.
88	43.06	910.9	42.81	43.31	SP	0.120	5.167	3.822	0.723	92	~	1	1	1	67	0		67	>0.6	>0.6	>2.0	0.802	1.589	Non Liq.
89	43.56	910.4	43.31	43.80	SP	0.120	5.227	3.850	0.721	87	~	1	1	1	63	0		63	>0.6	>0.6	>2.0	0.800	1.603	Non Liq.
90	44.05	910.0	43.80	44.29	SP	0.120	5.285	3.879	0.718	100	~	1	1	1	72	0		72	>0.6	>0.6	>2.0	0.797	1.616	Non Liq.
91	44.54	909.5	44.29	44.78	SP	0.120	5.344	3.907	0.715	100	~	1	1	1	72	0		72	>0.6	>0.6	>2.0	0.795	1.630	Non Liq.
92	45.03	909.0	44.78	45.28	SP	0.120	5.404	3.935	0.713	86	~	1	1	1	61	0		61	>0.6	>0.6	>2.0	0.793	1.643	Non Liq.
93	45.53	908.5	45.28	45.77	SP	0.120	5.463	3.964	0.710	77	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.791	1.656	Non Liq.
94	46.02	908.0	45.77	46.26	SP	0.120	5.522	3.992	0.708	66	~	1	1	1	47	0		47	>0.6	>0.6	>2.0	0.788	1.669	Non Liq.
95	46.51	907.5	46.26	46.75	SP	0.120	5.581	4.020	0.705	60	~	1	1	1	42	0		42	>0.6	>0.6	>2.0	0.786	1.682	Non Liq.
96	47.00	907.0	46.75	47.24	SP	0.120	5.639	4.049	0.703	66	~	1	1	1	46	0		46	>0.6	>0.6	>2.0	0.784	1.695	Non Liq.
97	47.49	906.5	47.24	47.74	SP	0.120	5.699	4.077	0.700	90	~	1	1	1	63	0		63	>0.6	>0.6	>2.0	0.782	1.708	Non Liq.
98	47.99	906.0	47.74	48.23	SP	0.120	5.758	4.106	0.698	82	~	1	1	1	57	0		57	>0.6	>0.6	>2.0	0.779	1.721	Non Liq.
99	48.48	905.5	48.23	48.72	SP	0.120	5.817	4.134	0.696	71	~	1	1	1	49	0		49	>0.6	>0.6	>2.0	0.777	1.733	Non Liq.
100	48.97	905.0	48.72	49.21	SM/ML	0.120	5.876	4.162	0.693	49	~	1	1	1	34	35		46	>0.6	>0.6	>2.0	0.775	1.746	Non Liq.
101	49.46	904.5	49.21	49.70	CL	0.120	5.935	4.190	0.691	57	~	1	1	1	39	52		Fine grained	>0.6	>0.6	>2.0	0.773	1.758	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-125

Figure B-7

Test Location	CPT-125	Basic Earthquake Magnitude	7.5
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?
Ground Surface Elevation	913 ft. MSL	Design Magnitude	6.5
Ground WaterDuring Investigatior	11 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)
Historic Ground Water Depth	9 ft. Below GL	Design PGA (M = 6.5)	0.87 g.
		Magnification Factor	1.0

Conditions: Existing conditions with historic groundwater level

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
1	0.25	912.8	0	0.49	SM/ML	0.120	0.029	0.029	2.000	7	~	1	1	1	14	35		22	0.245	0.245	0.007	0.999	0.011	Non Liq.
2	0.74	912.3	0.49	0.98	SM/ML	0.120	0.088	0.088	2.000	11	~	1	1	1	22	35		31	>0.6	>0.6	>2.0	0.997	0.034	Non Liq.
3	1.23	911.8	1.0	1.48	SM/ML	0.120	0.148	0.148	2.000	20	~	1	1	1	40	35		53	>0.6	>0.6	>2.0	0.994	0.056	Non Liq.
4	1.73	911.3	1.48	1.97	SM/ML	0.120	0.207	0.207	2.000	45	~	1	1	1	90	35		113	>0.6	>0.6	>2.0	0.992	0.079	Non Liq.
5	2.22	910.8	1.97	2.46	SM/ML	0.120	0.266	0.266	2.000	41	~	1	1	1	82	35		103	>0.6	>0.6	>2.0	0.990	0.101	Non Liq.
6	2.71	910.3	2.46	2.95	SM/ML	0.120	0.325	0.325	2.000	40	~	1	1	1	80	35		101	>0.6	>0.6	>2.0	0.988	0.123	Non Liq.
7	3.20	909.8	2.95	3.44	SM/ML	0.120	0.383	0.383	2.000	27	~	1	1	1	54	35		70	>0.6	>0.6	>2.0	0.985	0.145	Non Liq.
8	3.69	909.3	3.44	3.94	SP/SM	0.120	0.443	0.443	2.000	29	~	1	1	1	58	6		58	>0.6	>0.6	>2.0	0.983	0.167	Non Liq.
9	4.19	908.8	3.94	4.43	SP/SM	0.120	0.502	0.502	1.996	35	~	1	1	1	70	6		70	>0.6	>0.6	>2.0	0.981	0.189	Non Liq.
10	4.68	908.3	4.43	4.92	SP/SM	0.120	0.561	0.561	1.888	43	~	1	1	1	81	6		82	>0.6	>0.6	>2.0	0.978	0.211	Non Liq.
11	5.17	907.8	4.92	5.41	SP/SM	0.120	0.620	0.620	1.796	55	~	1	1	1	99	6		99	>0.6	>0.6	>2.0	0.976	0.232	Non Liq.
12	5.66	907.3	5.41	5.91	SP/SM	0.120	0.679	0.679	1.716	30	~	1	1	1	51	6		52	>0.6	>0.6	>2.0	0.974	0.254	Non Liq.
13	6.16	906.8	5.91	6.40	SM/ML	0.120	0.739	0.739	1.646	25	~	1	1	1	41	35		54	>0.6	>0.6	>2.0	0.972	0.275	Non Liq.
14	6.65	906.4	6.40	6.89	SM/ML	0.120	0.797	0.797	1.584	25	~	1	1	1	40	35		52	>0.6	>0.6	>2.0	0.969	0.296	Non Liq.
15	7.14	905.9	6.89	7.38	CL	0.120	0.856	0.856	1.528	23	~	1	1	1	35	52		Fine grained	>0.6	>0.6	>2.0	0.967	0.318	Non Liq.
16	7.63	905.4	7.38	7.87	SP/SM	0.120	0.915	0.915	1.478	46	~	1	1	1	68	6		68	>0.6	>0.6	>2.0	0.965	0.339	Non Liq.
17	8.12	904.9	7.87	8.37	SP/SM	0.120	0.974	0.974	1.433	75	~	1	1	1	107	6		108	>0.6	>0.6	>2.0	0.963	0.360	Non Liq.
18	8.62	904.4	8.37	8.86	SP/SM	0.120	1.034	1.034	1.391	82	~	1	1	1	114	6		115	>0.6	>0.6	>2.0	0.960	0.381	Non Liq.
19	9.11	903.9	8.86	9.35	SP/SM	0.120	1.093	1.086	1.357	84	~	1	1	1	114	6		115	>0.6	>0.6	>2.0	0.958	0.401	Non Liq.
20	9.60	903.4	9.35	9.84	SP/SM	0.120	1.151	1.114	1.340	76	~	1	1	1	102	6		102	>0.6	>0.6	>2.0	0.956	0.422	Non Liq.
21	10.09	902.9	9.84	10.33	SP/SM	0.120	1.210	1.142	1.323	68	~	1	1	1	90	6		90	>0.6	>0.6	>2.0	0.954	0.443	Non Liq.
22	10.58	902.4	10.33	10.83	SP	0.120	1.270	1.171	1.307	54	~	1	1	1	71	0		71	>0.6	>0.6	>2.0	0.951	0.463	Non Liq.
23	11.08	901.9	10.83	11.32	SP	0.120	1.329	1.324	1.229	49	~	1	1	1	60	0		60	>0.6	>0.6	>2.0	0.949	0.484	Non Liq.
24	11.57	901.4	11.32	11.81	SP/SM	0.120	1.388	1.353	1.216	63	~	1	1	1	77	6		77	>0.6	>0.6	>2.0	0.947	0.504	Non Liq.
25	12.06	900.9	11.81	12.30	SP/SM	0.120	1.447	1.381	1.204	80	~	1	1	1	96	6		97	>0.6	>0.6	>2.0	0.945	0.524	Non Liq.
26	12.55	900.5	12.30	12.80	SP	0.120	1.506	1.409	1.191	68	~	1	1	1	81	0		81	>0.6	>0.6	>2.0	0.942	0.544	Non Liq.
27	13.05	900.0	12.8	13.29	SP	0.120	1.565	1.438	1.179	75	~	1	1	1	88	0		88	>0.6	>0.6	>2.0	0.940	0.564	Non Liq.
28	13.54	899.5	13.29	13.78	SP	0.120	1.624	1.466	1.168	59	~	1	1	1	69	0		69	>0.6	>0.6	>2.0	0.938	0.584	Non Liq.
29	14.03	899.0	13.78	14.27	SP	0.120	1.683	1.494	1.157	45	~	1	1	1	52	0		52	>0.6	>0.6	>2.0	0.935	0.604	Non Liq.
30	14.52	898.5	14.27	14.76	SP	0.120	1.742	1.522	1.146	49	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.933	0.623	Non Liq.
31	15.01	898.0	14.76	15.26	SP/SM	0.120	1.801	1.551	1.136	44	~	1	1	1	50	6		50	>0.6	>0.6	>2.0	0.931	0.643	Non Liq.
32	15.51	897.5	15.26	15.75	SP	0.120	1.861	1.579	1.125	37	~	1	1	1	42	0		42	>0.6	>0.6	>2.0	0.929	0.663	Non Liq.
33	16.00	897.0	15.75	16.24	SP	0.120	1.919	1.608	1.115	29	~	1	1	1	32	0		32	>0.6	>0.6	>2.0	0.926	0.682	Non Liq.
34	16.49	896.5	16.24	16.73	SP/SM	0.120	1.978	1.636	1.106	32	~	1	1	1	35	6		36	>0.6	>0.6	>2.0	0.924	0.701	Non Liq.
35	16.98	896.0	16.73	17.22	SP	0.120	2.037	1.664	1.096	62	~	1	1	1	68	0		68	>0.6	>0.6	>2.0	0.922	0.720	Non Liq.
36	17.47	895.5	17.22	17.72	SP	0.120	2.096	1.693	1.087	74	~	1	1	1	80	0		80	>0.6	>0.6	>2.0	0.920	0.739	Non Liq.
37	17.97	895.0	17.72	18.21	SP	0.120	2.156	1.721	1.078	77	~	1	1	1	83	0		83	>0.6	>0.6	>2.0	0.917	0.758	Non Liq.
38	18.46	894.5	18.21	18.70	SP	0.120	2.215	1.749	1.069	73	~	1	1	1	78	0		78	>0.6	>0.6	>2.0	0.915	0.777	Non Liq.
39	18.95	894.1	18.7	19.19	SP	0.120	2.273	1.778	1.061	60	~	1	1	1	64	0		64	>0.6	>0.6	>2.0	0.913	0.796	Non Liq.
40	19.44	893.6	19.19	19.69	SP	0.120	2.333	1.806	1.052	51	~	1	1	1	54	0		54	>0.6	>0.6	>2.0	0.911	0.815	Non Liq.
41	19.94	893.1	19.69	20.18	SM/ML	0.120	2.392	1.835	1.044	53	~	1	1	1	55	35		71	>0.6	>0.6	>2.0	0.908	0.833	Non Liq.
42	20.43	892.6	20.18	20.67	SP	0.120	2.451	1.863	1.036	58	~	1	1	1	60	0		60	>0.6	>0.6	>2.0	0.906	0.852	Non Liq.
43	20.92	892.1	20.67	21.16	SP	0.120	2.510	1.891	1.028	49	~	1	1	1	50	0		50	>0.6	>0.6	>2.0	0.904	0.870	Non Liq.
44	21.41	891.6	21.16	21.65	SP/SM	0.120	2.569	1.919	1.021	58	~	1	1	1	59	6		60	>0.6	>0.6	>2.0	0.902	0.888	Non Liq.
45	21.90	891.1	21.65	22.15	SP/SM	0.120	2.628	1.948	1.013	64	~	1	1	1	65	6		65	>0.6	>0.6	>2.0	0.899	0.906	Non Liq.
46	22.40	890.6	22.15	22.64	SP	0.120	2.687	1.976	1.006	54	~	1	1	1	54	0		54	>0.6	>0.6	>2.0	0.897	0.924	Non Liq.
47	22.89	890.1	22.64	23.13	SP	0.120	2.746	2.005	0.999	66	~	1	1	1	66	0		66	>0.6	>0.6	>2.0	0.895	0.942	Non Liq.
48	23.38	889.6	23.13	23.62	SP	0.120	2.805	2.033	0.992	71	~	1	1	1	70	0		70	>0.6	>0.6	>2.0	0.892	0.960	Non Liq.
49	23.87	889.1	23.62	24.11	SP	0.120	2.864	2.061	0.985	74	~	1	1	1	73	0		73	>0.6	>0.6	>2.0	0.890	0.978	Non Liq.
50	24.36	888.6	24.11	24.61	SP	0.120	2.923	2.090	0.978	75	~	1	1	1	73	0		73	>0.6	>0.6	>2.0	0.888	0.995	Non Liq.
51	24.86	888.1	24.61	25.10	SP	0.120	2.983	2.118	0.972	80	~	1	1	1	78	0		78	>0.6	>0.6	>2.0	0.886	1.013	Non Liq.
52	25.35	887.7	25.10	25.59	SP	0.120	3.041	2.146	0.965	68	~	1	1	1	66	0		66	>0.6	>0.6	>2.0	0.883	1.030	Non Liq.
53	25.84	887.2	25.59	26.08	SP	0.120	3.100	2.174	0.959	57	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.881	1.048	Non Liq.
54	26.33	886.7	26.08	26.57	SP	0.120	3.159	2.203	0.953	53	~	1	1	1	51	0		51	>0.6	>0.6	>2.0	0.879	1.065	Non Liq.
55	26.82	886.2	26.57	27.07	SP	0.120	3.218	2.231	0.947	59	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.877	1.082	Non Liq.
56	27.32	885.7	27.07	27.56	SP	0.120	3.278	2.260	0.941	52	~	1	1	1	49	0		49	>0.6	>0.6	>2.0	0.874	1.099	Non Liq.
57	27.81	885.2	27.56	28.05	SP	0.120	3.337	2.288	0.935	45	~	1	1	1	42	0		42	>0.6	>0.6	>2.0	0.872	1.116	Non Liq.
58	28.30	884.7	28.05	28.54	SP	0.120	3.395	2.316	0.929	51	~	1	1	1	47	0		47	>0.6	>0.6	>2.0	0.870	1.133	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-125

Test Location	CPT-125	Basic Earthquake Magnitude	7.5	Conditions: Existing conditions with historic groundwater level
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?	
Ground Surface Elevation	913 ft. MSL	Design Magnitude	6.5	Figure B-7
Ground WaterDuring Investigatior	11 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)	
Historic Ground Water Depth	9 ft. Below GL	Design PGA (M = 6.5)	0.87 g.	
		Magnification Factor	1.0	

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
59	28.79	884.2	28.54	29.04	SP	0.120	3.455	2.345	0.924	61	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.868	1.149	Non Liq.
60	29.29	883.7	29.04	29.53	SP	0.120	3.514	2.373	0.918	52	~	1	1	1	48	0		48	>0.6	>0.6	>2.0	0.865	1.166	Non Liq.
61	29.78	883.2	29.53	30.02	SP/SM	0.120	3.573	2.401	0.913	66	~	1	1	1	60	6		61	>0.6	>0.6	>2.0	0.863	1.183	Non Liq.
62	30.27	882.7	30.02	30.51	SP	0.120	3.632	2.430	0.907	52	~	1	1	1	47	0		47	>0.6	>0.6	>2.0	0.861	1.199	Non Liq.
63	30.76	882.2	30.51	31.00	SP	0.120	3.691	2.458	0.902	53	~	1	1	1	48	0		48	>0.6	>0.6	>2.0	0.859	1.215	Non Liq.
64	31.25	881.8	31.00	31.50	SP	0.120	3.750	2.486	0.897	51	~	1	1	1	46	0		46	>0.6	>0.6	>2.0	0.856	1.231	Non Liq.
65	31.75	881.3	31.5	31.99	SP/SM	0.120	3.809	2.515	0.892	77	~	1	1	1	69	6		69	>0.6	>0.6	>2.0	0.854	1.248	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-128

Test Location	CPT-128	Basic Earthquake Magnitude	7.5	Conditions: Existing conditions with historic groundwater level
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?	
Ground Surface Elevation	951 ft. MSL	Design Magnitude	6.5	Figure B-8
Ground WaterDuring Investigatior	26 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)	
Historic Ground Water Depth	20 ft. Below GL	Design PGA (M = 6.5)	0.67 g.	
		Magnification Factor	1.0	

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
1	0.25	950.8	0	0.49	SP/SM	0.120	0.029	0.029	2.000	20	~	1	1	1	40	6		40	>0.6	>0.6	>2.0	0.999	0.011	Non Liq.
2	0.74	950.3	0.49	0.98	SM/ML	0.120	0.088	0.088	2.000	35	~	1	1	1	70	35		89	>0.6	>0.6	>2.0	0.997	0.034	Non Liq.
3	1.23	949.8	1.0	1.48	SM/ML	0.120	0.148	0.148	2.000	27	~	1	1	1	54	35		70	>0.6	>0.6	>2.0	0.994	0.056	Non Liq.
4	1.73	949.3	1.48	1.97	SM/ML	0.120	0.207	0.207	2.000	26	~	1	1	1	52	35		67	>0.6	>0.6	>2.0	0.992	0.079	Non Liq.
5	2.22	948.8	1.97	2.46	SM/ML	0.120	0.266	0.266	2.000	14	~	1	1	1	28	35		38	>0.6	>0.6	>2.0	0.990	0.101	Non Liq.
6	2.71	948.3	2.46	2.95	SM/ML	0.120	0.325	0.325	2.000	9	~	1	1	1	18	35		27	0.323	0.323	0.105	0.988	0.123	Non Liq.
7	3.20	947.8	2.95	3.44	SM/ML	0.120	0.383	0.383	2.000	8	~	1	1	1	16	35		24	0.277	0.277	0.106	0.985	0.145	Non Liq.
8	3.69	947.3	3.44	3.94	SM/ML	0.120	0.443	0.443	2.000	5	~	1	1	1	10	35		17	0.187	0.187	0.083	0.983	0.167	Non Liq.
9	4.19	946.8	3.94	4.43	ML/CL	0.120	0.502	0.502	1.996	4	~	1	1	1	8	52		Fine grained	>0.6	>0.6	>2.0	0.981	0.189	Non Liq.
10	4.68	946.3	4.43	4.92	CL	0.120	0.561	0.561	1.888	4	~	1	1	1	8	52		Fine grained	>0.6	>0.6	>2.0	0.978	0.211	Non Liq.
11	5.17	945.8	4.92	5.41	CH	0.120	0.620	0.620	1.796	2	~	1	1	1	4	35		9	0.103	0.103	0.064	0.976	0.232	Non Liq.
12	5.66	945.3	5.41	5.91	CL	0.120	0.679	0.679	1.716	4	~	1	1	1	7	52		Fine grained	>0.6	>0.6	>2.0	0.974	0.254	Non Liq.
13	6.16	944.8	5.91	6.40	CL	0.120	0.739	0.739	1.646	3	~	1	1	1	5	52		Fine grained	>0.6	>0.6	>2.0	0.972	0.275	Non Liq.
14	6.65	944.4	6.40	6.89	OL	0.120	0.797	0.797	1.584	2	~	1	1	1	3	52		Fine grained	>0.6	>0.6	>2.0	0.969	0.296	Non Liq.
15	7.14	943.9	6.89	7.38	OL	0.120	0.856	0.856	1.528	1	~	1	1	1	2	52		Fine grained	>0.6	>0.6	>2.0	0.967	0.318	Non Liq.
16	7.63	943.4	7.38	7.87	CL	0.120	0.915	0.915	1.478	6	~	1	1	1	9	52		Fine grained	>0.6	>0.6	>2.0	0.965	0.339	Non Liq.
17	8.12	942.9	7.87	8.37	CL	0.120	0.974	0.974	1.433	13	~	1	1	1	19	52		Fine grained	>0.6	>0.6	>2.0	0.963	0.360	Non Liq.
18	8.62	942.4	8.37	8.86	CL	0.120	1.034	1.034	1.391	9	~	1	1	1	13	52		Fine grained	>0.6	>0.6	>2.0	0.960	0.381	Non Liq.
19	9.11	941.9	8.86	9.35	SM/ML	0.120	1.093	1.093	1.353	14	~	1	1	1	19	35		28	0.350	0.350	0.383	0.958	0.401	Non Liq.
20	9.60	941.4	9.35	9.84	SM/ML	0.120	1.151	1.151	1.318	10	~	1	1	1	13	35		21	0.233	0.233	0.268	0.956	0.422	Non Liq.
21	10.09	940.9	9.84	10.33	ML/CL	0.120	1.210	1.210	1.286	13	~	1	1	1	17	52		Fine grained	>0.6	>0.6	>2.0	0.954	0.443	Non Liq.
22	10.58	940.4	10.33	10.83	SM/ML	0.120	1.270	1.270	1.255	30	~	1	1	1	38	35		50	>0.6	>0.6	>2.0	0.951	0.463	Non Liq.
23	11.08	939.9	10.83	11.32	SM/ML	0.120	1.329	1.329	1.227	33	~	1	1	1	40	35		53	>0.6	>0.6	>2.0	0.949	0.484	Non Liq.
24	11.57	939.4	11.32	11.81	ML/CL	0.120	1.388	1.388	1.200	28	~	1	1	1	34	52		Fine grained	>0.6	>0.6	>2.0	0.947	0.504	Non Liq.
25	12.06	938.9	11.81	12.30	CL	0.120	1.447	1.447	1.176	14	~	1	1	1	16	52		Fine grained	>0.6	>0.6	>2.0	0.945	0.524	Non Liq.
26	12.55	938.5	12.30	12.80	CL	0.120	1.506	1.506	1.152	9	~	1	1	1	10	52		Fine grained	>0.6	>0.6	>2.0	0.942	0.544	Non Liq.
27	13.05	938.0	12.8	13.29	CL	0.120	1.565	1.565	1.130	8	~	1	1	1	9	52		Fine grained	>0.6	>0.6	>2.0	0.940	0.564	Non Liq.
28	13.54	937.5	13.29	13.78	CL	0.120	1.624	1.624	1.110	9	~	1	1	1	10	52		Fine grained	>0.6	>0.6	>2.0	0.938	0.584	Non Liq.
29	14.03	937.0	13.78	14.27	SM/ML	0.120	1.683	1.683	1.090	26	~	1	1	1	28	35		39	>0.6	>0.6	>2.0	0.935	0.604	Non Liq.
30	14.52	936.5	14.27	14.76	SP/SM	0.120	1.742	1.742	1.072	40	~	1	1	1	43	6		43	>0.6	>0.6	>2.0	0.933	0.623	Non Liq.
31	15.01	936.0	14.76	15.26	SP/SM	0.120	1.801	1.801	1.054	70	~	1	1	1	74	6		74	>0.6	>0.6	>2.0	0.931	0.643	Non Liq.
32	15.51	935.5	15.26	15.75	SP/SM	0.120	1.861	1.861	1.037	74	~	1	1	1	77	6		77	>0.6	>0.6	>2.0	0.929	0.663	Non Liq.
33	16.00	935.0	15.75	16.24	SP/SM	0.120	1.919	1.919	1.021	72	~	1	1	1	73	6		74	>0.6	>0.6	>2.0	0.926	0.682	Non Liq.
34	16.49	934.5	16.24	16.73	SP/SM	0.120	1.978	1.978	1.005	67	~	1	1	1	67	6		68	>0.6	>0.6	>2.0	0.924	0.701	Non Liq.
35	16.98	934.0	16.73	17.22	SP/SM	0.120	2.037	2.037	0.991	76	~	1	1	1	75	6		76	>0.6	>0.6	>2.0	0.922	0.720	Non Liq.
36	17.47	933.5	17.22	17.72	SP	0.120	2.096	2.096	0.977	60	~	1	1	1	59	0		59	>0.6	>0.6	>2.0	0.920	0.739	Non Liq.
37	17.97	933.0	17.72	18.21	SP/SM	0.120	2.156	2.156	0.963	61	~	1	1	1	59	6		59	>0.6	>0.6	>2.0	0.917	0.758	Non Liq.
38	18.46	932.5	18.21	18.70	SP/SM	0.120	2.215	2.215	0.950	34	~	1	1	1	32	6		32	>0.6	>0.6	>2.0	0.915	0.777	Non Liq.
39	18.95	932.1	18.7	19.19	SM/ML	0.120	2.273	2.273	0.938	32	~	1	1	1	30	35		41	>0.6	>0.6	>2.0	0.913	0.796	Non Liq.
40	19.44	931.6	19.19	19.69	SM/ML	0.120	2.333	2.333	0.926	20	~	1	1	1	19	35		27	0.337	0.337	0.786	0.911	0.815	Non Liq.
41	19.94	931.1	19.69	20.18	ML/CL	0.120	2.392	2.392	0.914	12	~	1	1	1	11	52		Fine grained	>0.6	>0.6	>2.0	0.908	0.833	Non Liq.
42	20.43	930.6	20.18	20.67	ML/CL	0.120	2.451	2.424	0.908	13	~	1	1	1	12	52		Fine grained	>0.6	>0.6	>2.0	0.906	0.852	Non Liq.
43	20.92	930.1	20.67	21.16	SM/ML	0.120	2.510	2.453	0.903	13	~	1	1	1	12	35		19	0.211	0.211	0.518	0.904	0.870	0.60
44	21.41	929.6	21.16	21.65	SM/ML	0.120	2.569	2.481	0.898	14	~	1	1	1	13	35		20	0.224	0.224	0.555	0.902	0.888	0.62
45	21.90	929.1	21.65	22.15	CL	0.120	2.628	2.509	0.893	10	~	1	1	1	9	52		Fine grained	>0.6	>0.6	>2.0	0.899	0.906	Non Liq.
46	22.40	928.6	22.15	22.64	CL	0.120	2.687	2.538	0.888	5	~	1	1	1	4	52		Fine grained	>0.6	>0.6	>2.0	0.897	0.924	Non Liq.
47	22.89	928.1	22.64	23.13	CL	0.120	2.746	2.566	0.883	10	~	1	1	1	9	52		Fine grained	>0.6	>0.6	>2.0	0.895	0.942	Non Liq.
48	23.38	927.6	23.13	23.62	CL	0.120	2.805	2.594	0.878	7	~	1	1	1	6	52		Fine grained	>0.6	>0.6	>2.0	0.892	0.960	Non Liq.
49	23.87	927.1	23.62	24.11	SM/ML	0.120	2.864	2.623	0.873	21	~	1	1	1	18	35		27	0.332	0.332	0.871	0.890	0.978	0.89
50	24.36	926.6	24.11	24.61	SM/ML	0.120	2.923	2.651	0.869	48	~	1	1	1	42	35		55	>0.6	>0.6	>2.0	0.888	0.995	Non Liq.
51	24.86	926.1	24.61	25.10	SP	0.120	2.983	2.680	0.864	68	~	1	1	1	59	0		59	>0.6	>0.6	>2.0	0.886	1.013	Non Liq.
52	25.35	925.7	25.10	25.59	SP/SM	0.120	3.041	2.708	0.859	100	~	1	1	1	86	6		86	>0.6	>0.6	>2.0	0.883	1.030	Non Liq.
53	25.84	925.2	25.59	26.08	SP/SM	0.120	3.100	2.736	0.855	100	~	1	1	1	85	6		86	>0.6	>0.6	>2.0	0.881	1.048	Non Liq.
54	26.33	924.7	26.08	26.57	SP/SM	0.120	3.159	3.139	0.798	88	~	1	1	1	70	6		71	>0.6	>0.6	>2.0	0.879	1.065	Non Liq.
55	26.82	924.2	26.57	27.07	SP/SM	0.120	3.218	3.167	0.795	84	~	1	1	1	67	6		67	>0.6	>0.6	>2.0	0.877	1.082	Non Liq.
56	27.32	923.7	27.07	27.56	SP	0.120	3.278	3.196	0.791	76	~	1	1	1	60	0		60	>0.6	>0.6	>2.0	0.874	1.099	Non Liq.
57	27.81	923.2	27.56	28.05	SP	0.120	3.337	3.224	0.788	81	~	1	1	1	64	0		64	>0.6	>0.6	>2.0	0.872	1.116	Non Liq.
58	28.30	922.7	28.05	28.54	SP	0.120	3.395	3.252	0.784	80	~	1	1	1	63	0		63	>0.6	>0.6	>2.0	0.870	1.133	Non Liq.

LIQUEFACTION POTENTIAL AND CYCLIC SETTLEMENT ANALYSIS

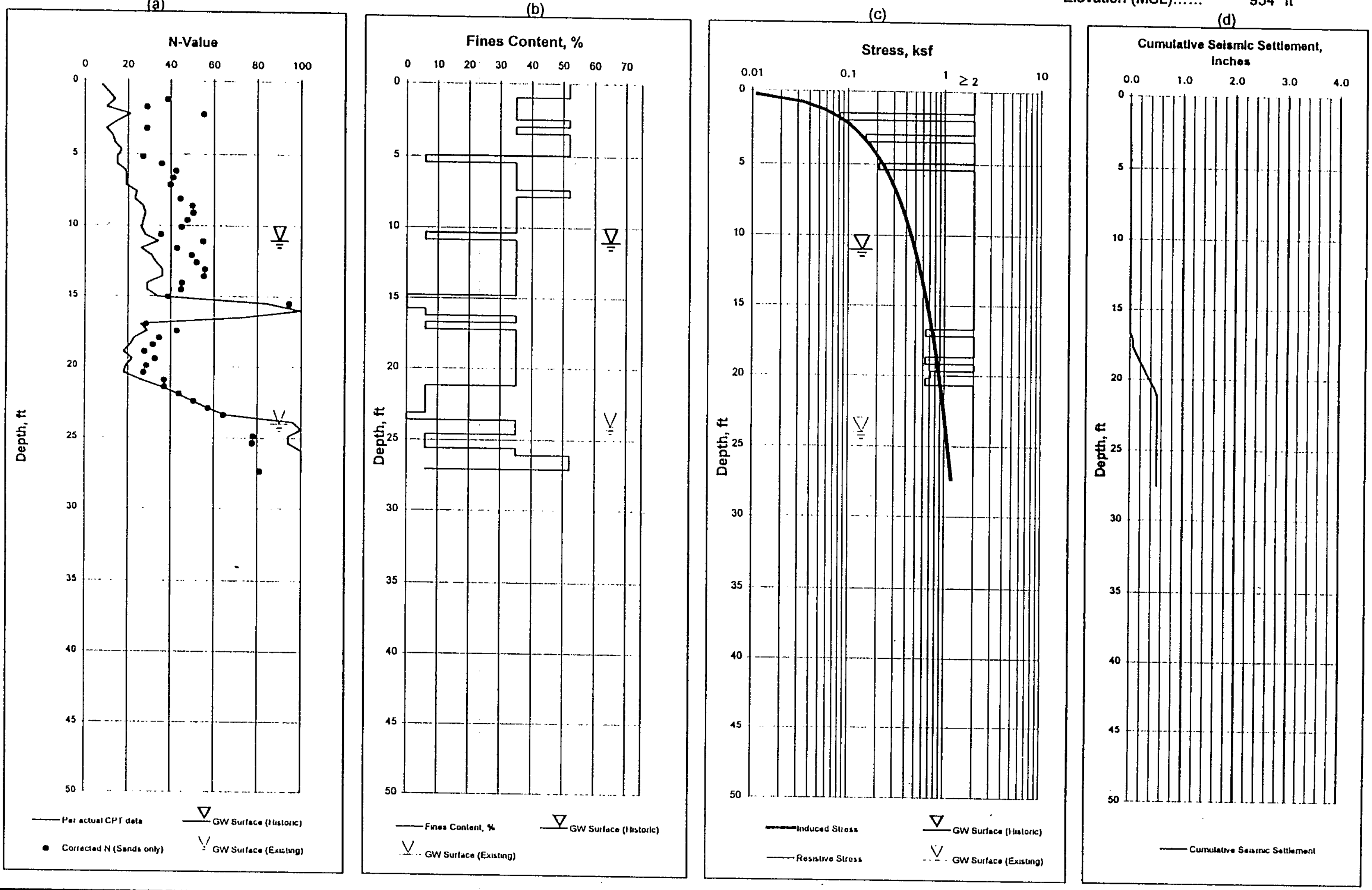
PROJECT: River Village, TT 53108
Job No.: 00-1702R-4

CPT-128

Test Location	CPT-128	Basic Earthquake Magnitude	7.5	Conditions:	Existing conditions with historic groundwater level
Type of Sampler (CPT/SPT/CS)	CPT	Approx. Distance From Site (miles)	?		
Ground Surface Elevation	951 ft. MSL	Design Magnitude	6.5		Figure B-8
Ground WaterDuring Investigatior	26 ft. Below GL	Peak Ground Accel (M = 7.5)	0.59 g. (DBE)		
Historic Ground Water Depth	20 ft. Below GL	Design PGA (M = 6.5)	0.87 g.		
		Magnification Factor	1.0		

Layer No.	Mid-layer Depth (ft)	Elevation (ft. MSL)	Depth of layer below Ground Level (ft) Top	Bottom	Main soil USCS Symbol	Total Unit Wt. (1). (kcf)	Total Stress (ksf)	Effective Stress (ksf)	Cn (2).	SPT Blow Count from CPT-SPT (blows/ft)	Sampler Type (3).	Sampler Correction Factor (4).	Short Rod Correction Factor (5)	Hammer Correction Factor (6).	(N1)60 (blows/ft) (7).	Percent Fines, % Assumed (8).	Lab (9).	Equivalent (N1)60cs for Clean Sand	Cyclic Resistance Ratio (10) M=7.5	Cyclic Resistance Ratio (11) M=7.5	Cyclic Resistance M = 7.5 (ksf) (12)	Stress Reduction Factor (13).	Induced Stress M = 7.5 (ksf) (14)	Theoretical Factor of Safety (15).
59	28.79	922.2	28.54	29.04	SP	0.120	3.455	3.281	0.781	73	~	1	1	1	57	0		57	>0.6	>0.6	>2.0	0.868	1.149	Non Liq.
60	29.29	921.7	29.04	29.53	SP	0.120	3.514	3.309	0.777	71	~	1	1	1	55	0		55	>0.6	>0.6	>2.0	0.865	1.166	Non Liq.
61	29.78	921.2	29.53	30.02	SP	0.120	3.573	3.337	0.774	75	~	1	1	1	58	0		58	>0.6	>0.6	>2.0	0.863	1.183	Non Liq.
62	30.27	920.7	30.02	30.51	SP	0.120	3.632	3.366	0.771	75	~	1	1	1	58	0		58	>0.6	>0.6	>2.0	0.861	1.199	Non Liq.
63	30.76	920.2	30.51	31.00	SP	0.120	3.691	3.394	0.768	93	~	1	1	1	71	0		71	>0.6	>0.6	>2.0	0.859	1.215	Non Liq.
64	31.25	919.8	31.00	31.50	SP	0.120	3.750	3.422	0.764	73	~	1	1	1	56	0		56	>0.6	>0.6	>2.0	0.856	1.231	Non Liq.
65	31.75	919.3	31.5	31.99	SP	0.120	3.809	3.451	0.761	85	~	1	1	1	65	0		65	>0.6	>0.6	>2.0	0.854	1.248	Non Liq.
66	32.24	918.8	31.99	32.48	SP	0.120	3.868	3.479	0.758	97	~	1	1	1	74	0		74	>0.6	>0.6	>2.0	0.852	1.263	Non Liq.
67	32.73	918.3	32.48	32.97	SP/SM	0.120	3.927	3.507	0.755	100	~	1	1	1	76	6		76	>0.6	>0.6	>2.0	0.849	1.279	Non Liq.
68	33.22	917.8	32.97	33.46	SP	0.120	3.986	3.536	0.752	96	~	1	1	1	72	0		72	>0.6	>0.6	>2.0	0.847	1.295	Non Liq.
69	33.71	917.3	33.46	33.96	SP	0.120	4.045	3.564	0.749	95	~	1	1	1	71	0		71	>0.6	>0.6	>2.0	0.845	1.311	Non Liq.
70	34.21	916.8	33.96	34.45	SP	0.120	4.105	3.593	0.746	100	~	1	1	1	75	0		75	>0.6	>0.6	>2.0	0.843	1.326	Non Liq.
71	34.70	916.3	34.45	34.94	SP	0.120	4.163	3.621	0.743	85	~	1	1	1	63	0		63	>0.6	>0.6	>2.0	0.840	1.342	Non Liq.
72	35.19	915.8	34.94	35.43	SP/SM	0.120	4.222	3.649	0.740	98	~	1	1	1	73	6		73	>0.6	>0.6	>2.0	0.838	1.357	Non Liq.
73	35.68	915.3	35.43	35.93	SP/SM	0.120	4.282	3.678	0.737	96	~	1	1	1	71	6		71	>0.6	>0.6	>2.0	0.836	1.372	Non Liq.
74	36.18	914.8	35.93	36.42	SP/SM	0.120	4.341	3.706	0.735	97	~	1	1	1	71	6		72	>0.6	>0.6	>2.0	0.834	1.388	Non Liq.

Test Location.......: **CPT-05**
Elevation (MSL)...... 954 ft

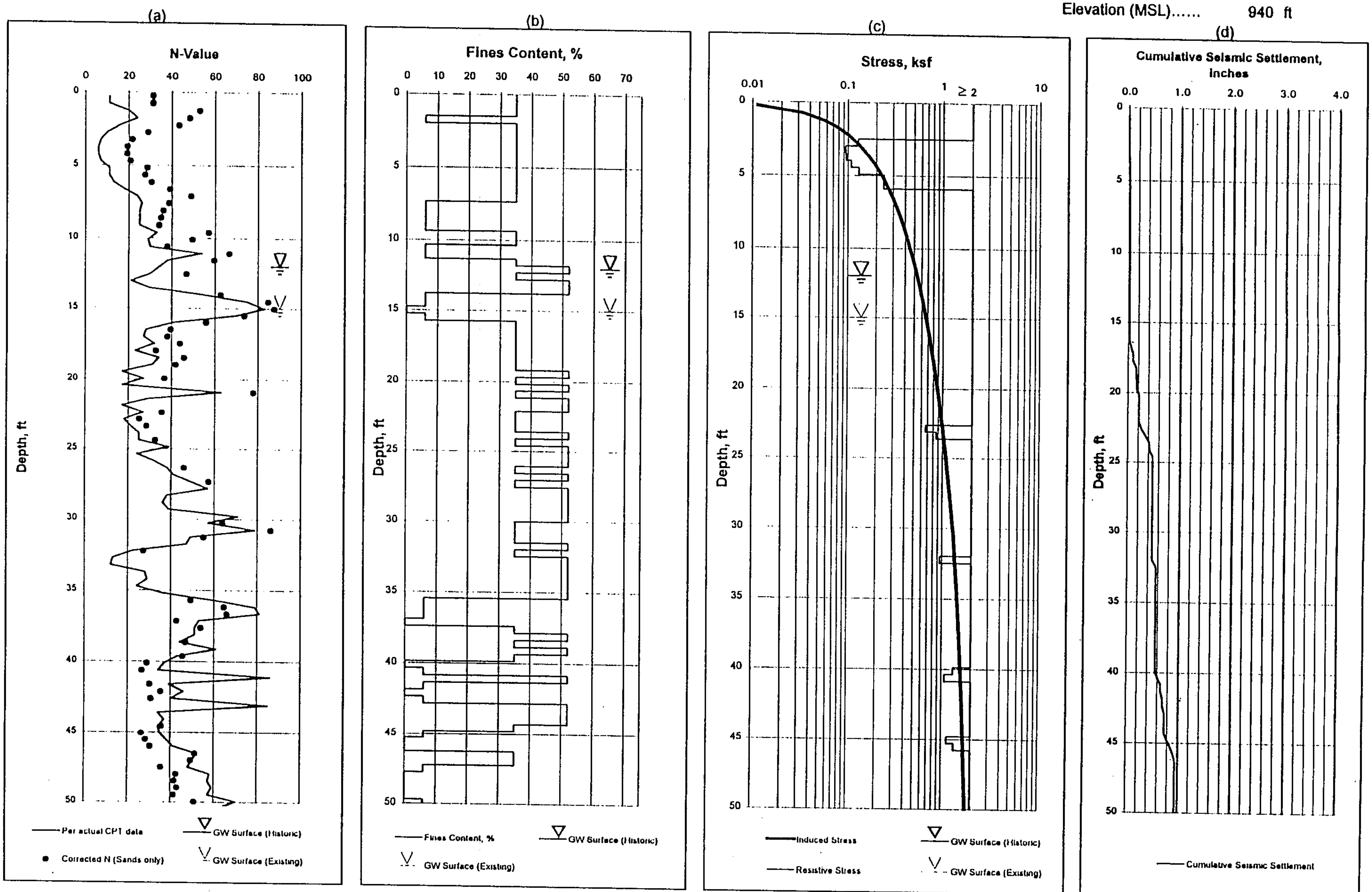


Allan E. Seward Engineering Geology, Inc.	**Analysis of Liquefaction Potential Based on N-Value (Interpreted from CPT Data)**
Geological and Geotechnical Consultants	

River Village, TT 53108	Weighted Gr. Acc. (M=7.5)	0.59 g	Project No.	00-1702R-4
Santa Clarita, California	Design Gr. Acc.(M= 6.5)...	0.87 g	Figure No.	D-1
For: Newhall Ranch Company	Magnification Factor.........	1	Date.	9-27-2000

Test Location.......: **CPT-13**

Elevation (MSL)...... 940 ft



Allan E. Seward Engineering Geology, Inc.
Geological and Geotechnical Consultants

Analysis of Liquefaction Potential Based on N-Value (Interpreted from CPT Data)

River Village, TT 53108	Weighted Gr. Acc. (M=7.5)	0.59 g	Project No.	00-1702R-4
Santa Clarita, California	Design Gr. Acc.(M= 6.5)...	0.87 g	Figure No.	D-2
For: Newhall Ranch Company	Magnification Factor.........	1	Date.	9-27-2000

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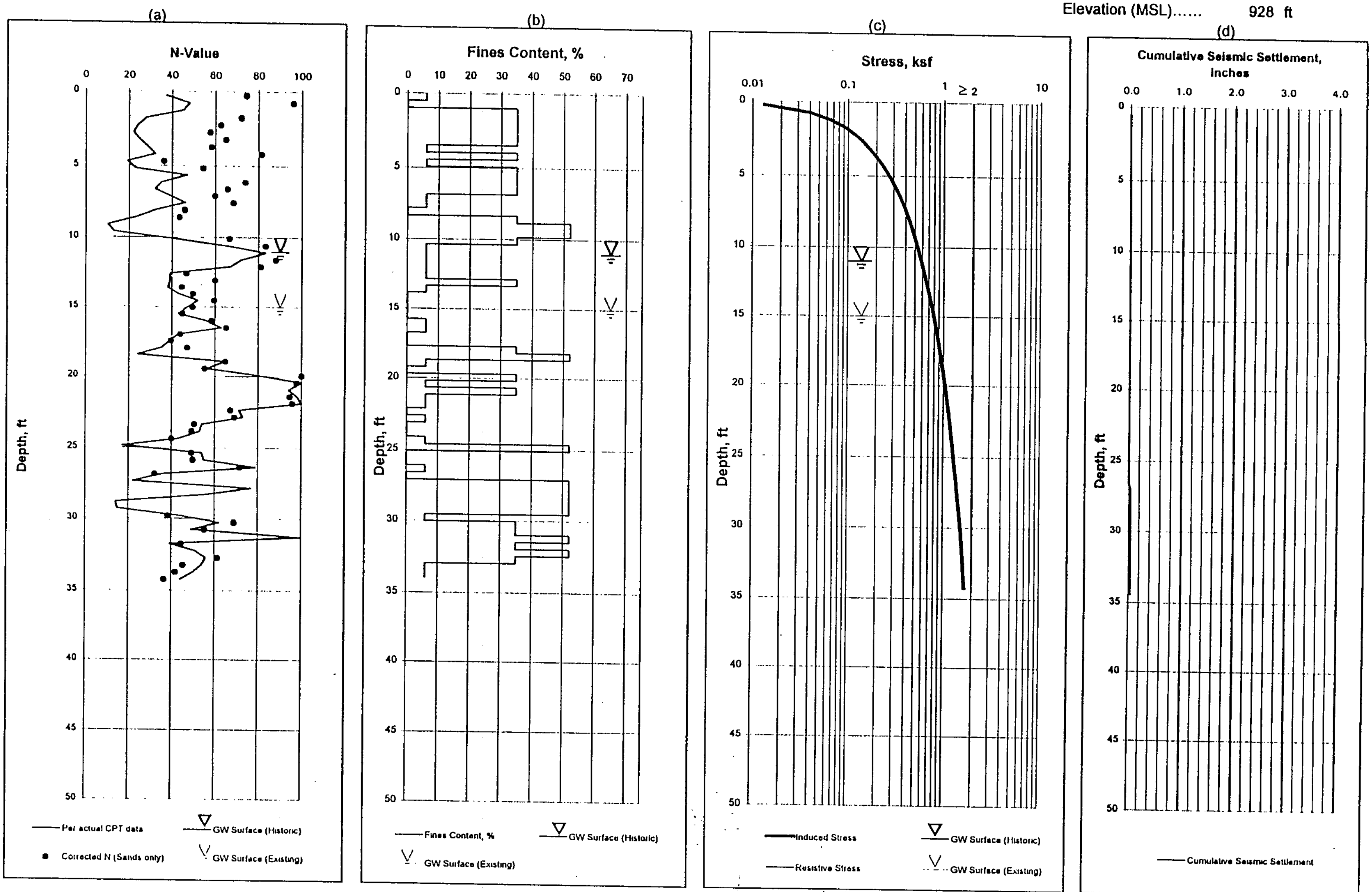
Elevation (MSL)...... 928 ft



Allan E. Seward Engineering Geology, Inc.
Geological and Geotechnical Consultants

Analysis of Liquefaction Potential Based on N-Value (Interpreted from CPT Data)

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Santa Clarita, California	Design Gr. Acc.(M= 6.5)...	1.04 g	Figure No.	D-3
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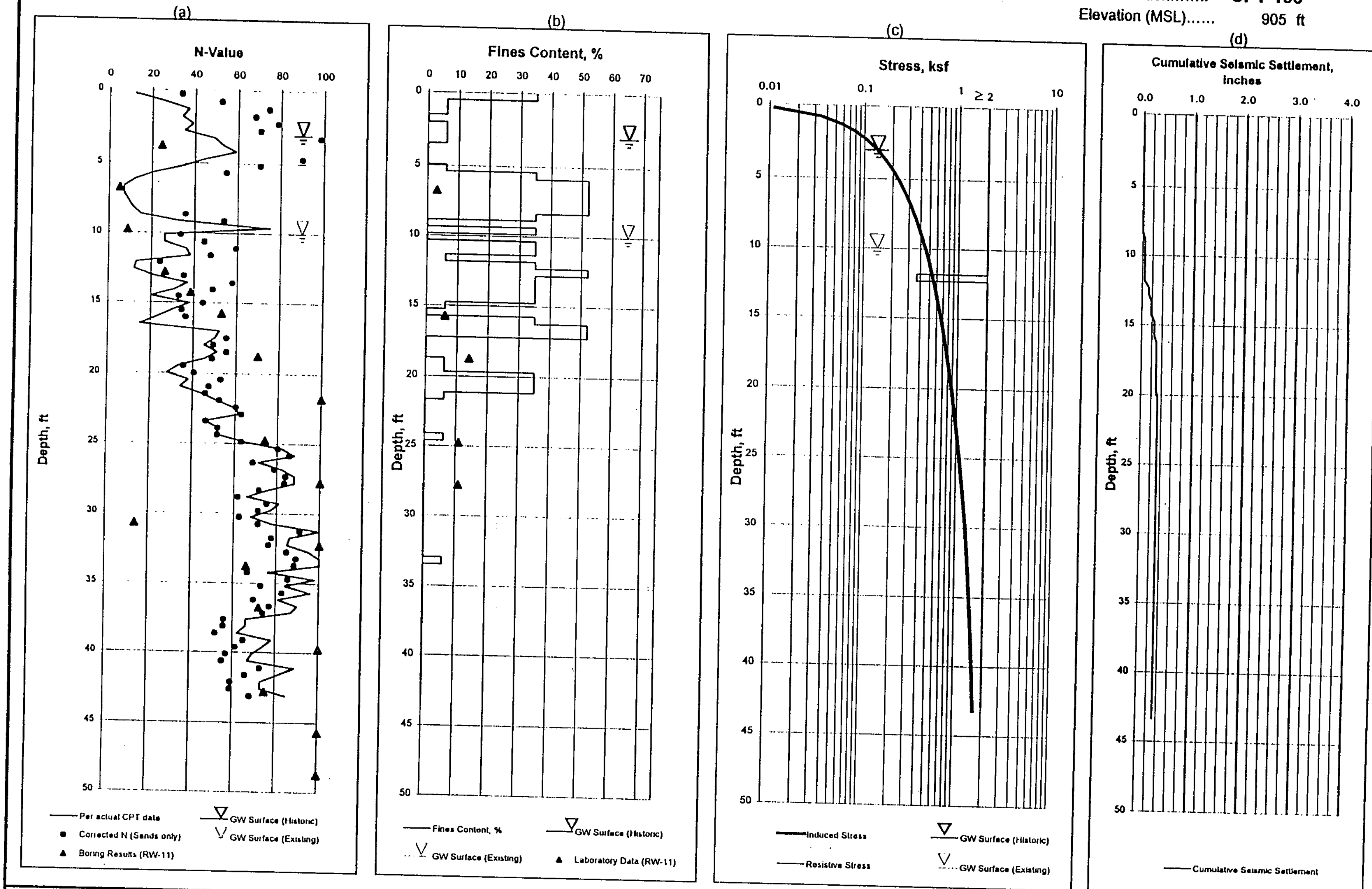

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Geological and Geotechnical Consultants

Analysis of Liquefaction Potential Based on N-Value (Interpreted from CPT Data)

River Village, TT 53108	Weighted Gr. Acc. (M=7.5)	0.59 g	Project No.	00-1702R-4
Santa Clarita, California	Design Gr. Acc.(M= 6.5)...	0.87 g	Figure No.	D-4
For: Newhall Ranch Company	Magnification Factor.........	1	Date.	9-27-2000

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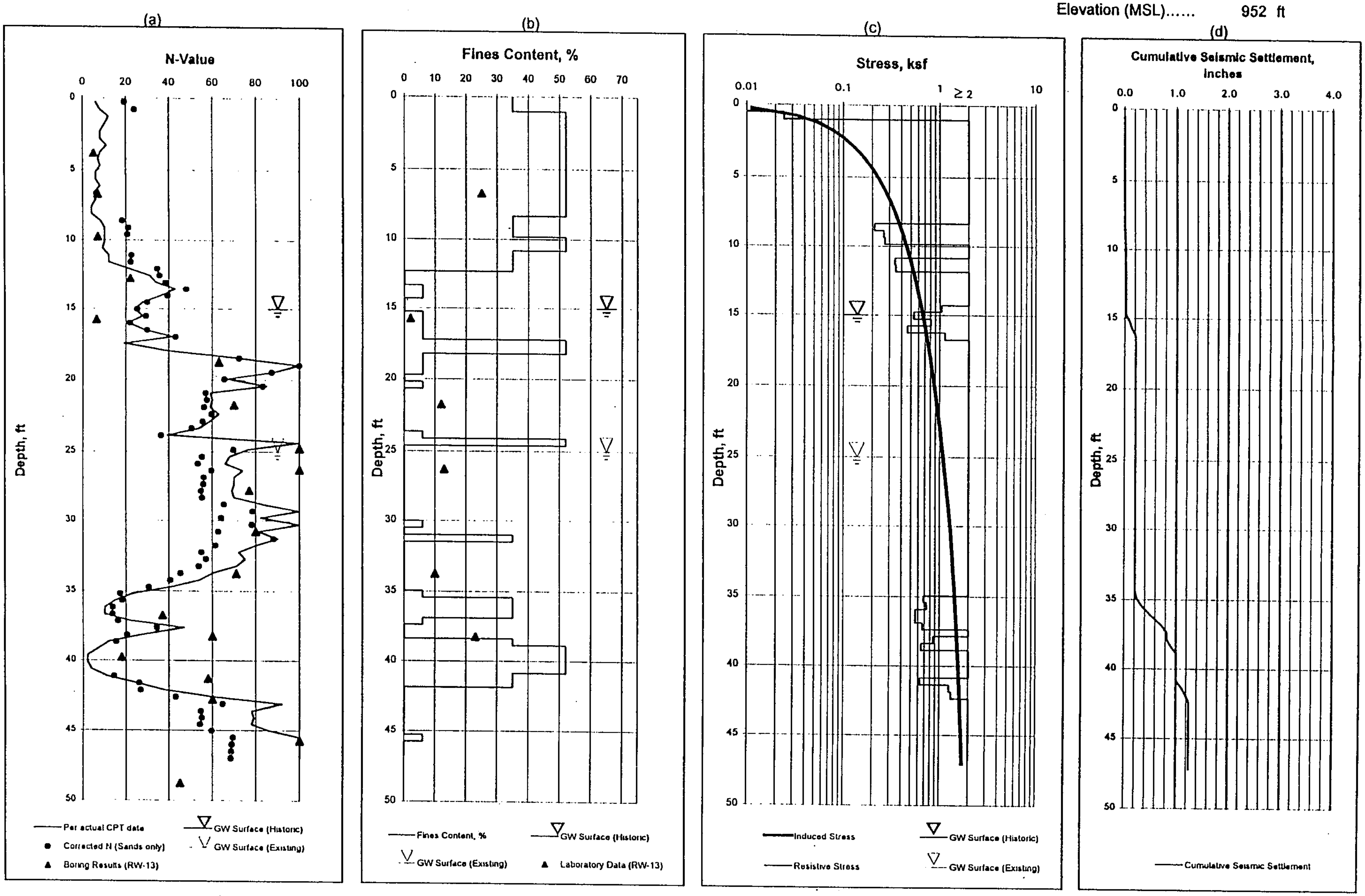
Elevation (MSL)...... 952 ft



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Geological and Geotechnical Consultants

Analysis of Liquefaction Potential Based on N-Value (Interpreted from CPT Data)

River Village, TT 53108	Weighted Gr. Acc. (M=7.5)	0.59 g	Project No.	00-1702R-4
Santa Clarita, California	Design Gr. Acc.(M= 6.5)...	0.87 g	Figure No.	D-5
For: Newhall Ranch Company	Magnification Factor.........	1	Date.	9-27-2000

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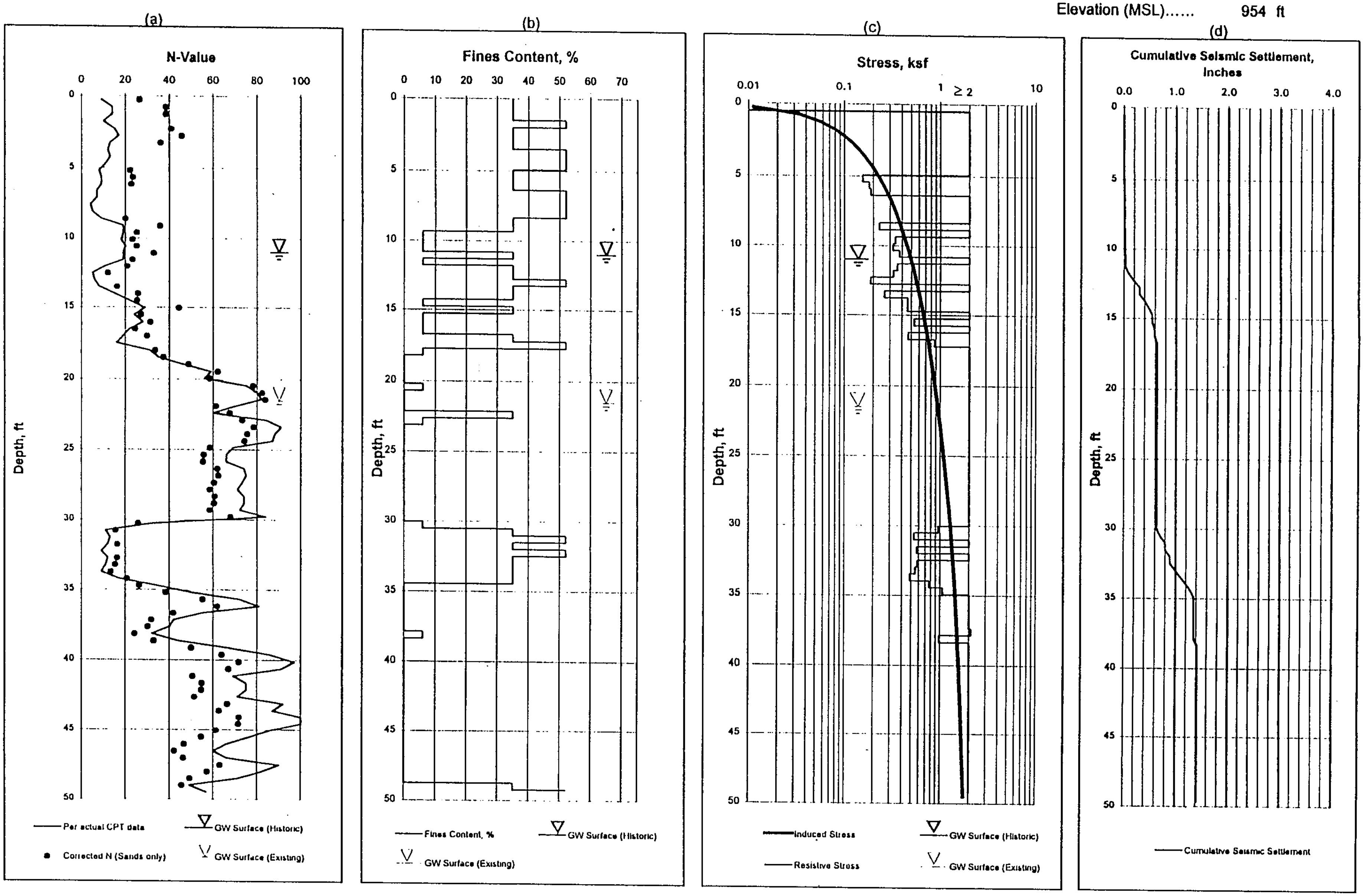

Allan E. Seward Engineering Geology, Inc.
Geological and Geotechnical Consultants

Analysis of Liquefaction Potential Based on N-Value (Interpreted from CPT Data)

River Village, TT 53108	Weighted Gr. Acc. (M=7.5)	0.59 g	Project No.	00-1702R-4
Santa Clarita, California	Design Gr. Acc.(M= 6.5)...	0.87 g	Figure No.	D-6
For: Newhall Ranch Company	Magnification Factor.........	1	Date.	9-27-2000

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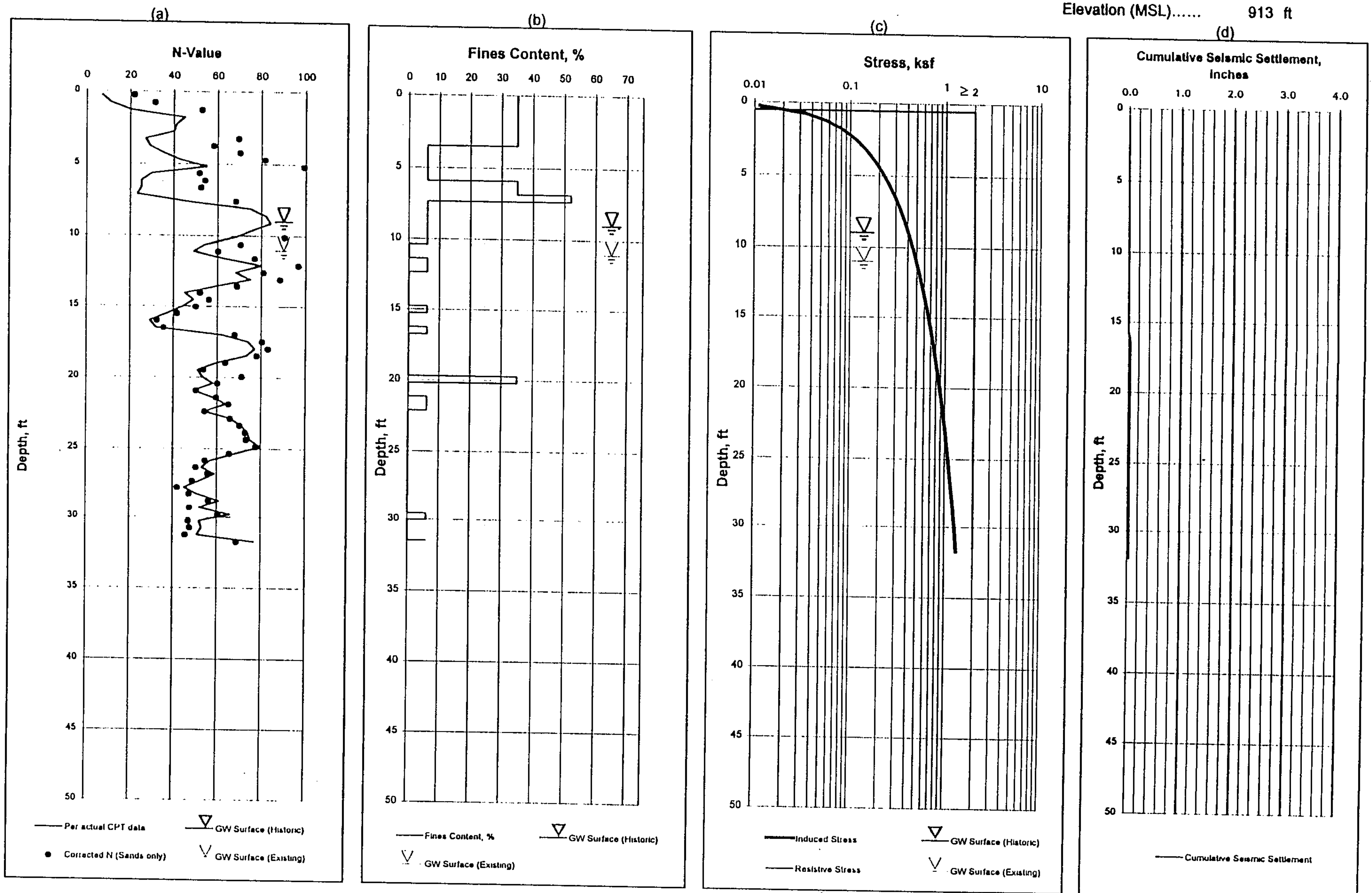
Elevation (MSL)...... 913 ft



Allan E. Seward Engineering Geology, Inc.

Geological and Geotechnical Consultants

Analysis of Liquefaction Potential Based on N-Value (Interpreted from CPT Data)

River Village, TT 53108	Weighted Gr. Acc. (M=7.5)	0.59 g	Project No.	00-1702R-4
Santa Clarita, California	Design Gr. Acc.(M= 6.5)...	0.87 g	Figure No.	D-7
For: Newhall Ranch Company	Magnification Factor.........	1	Date.	9-27-2000

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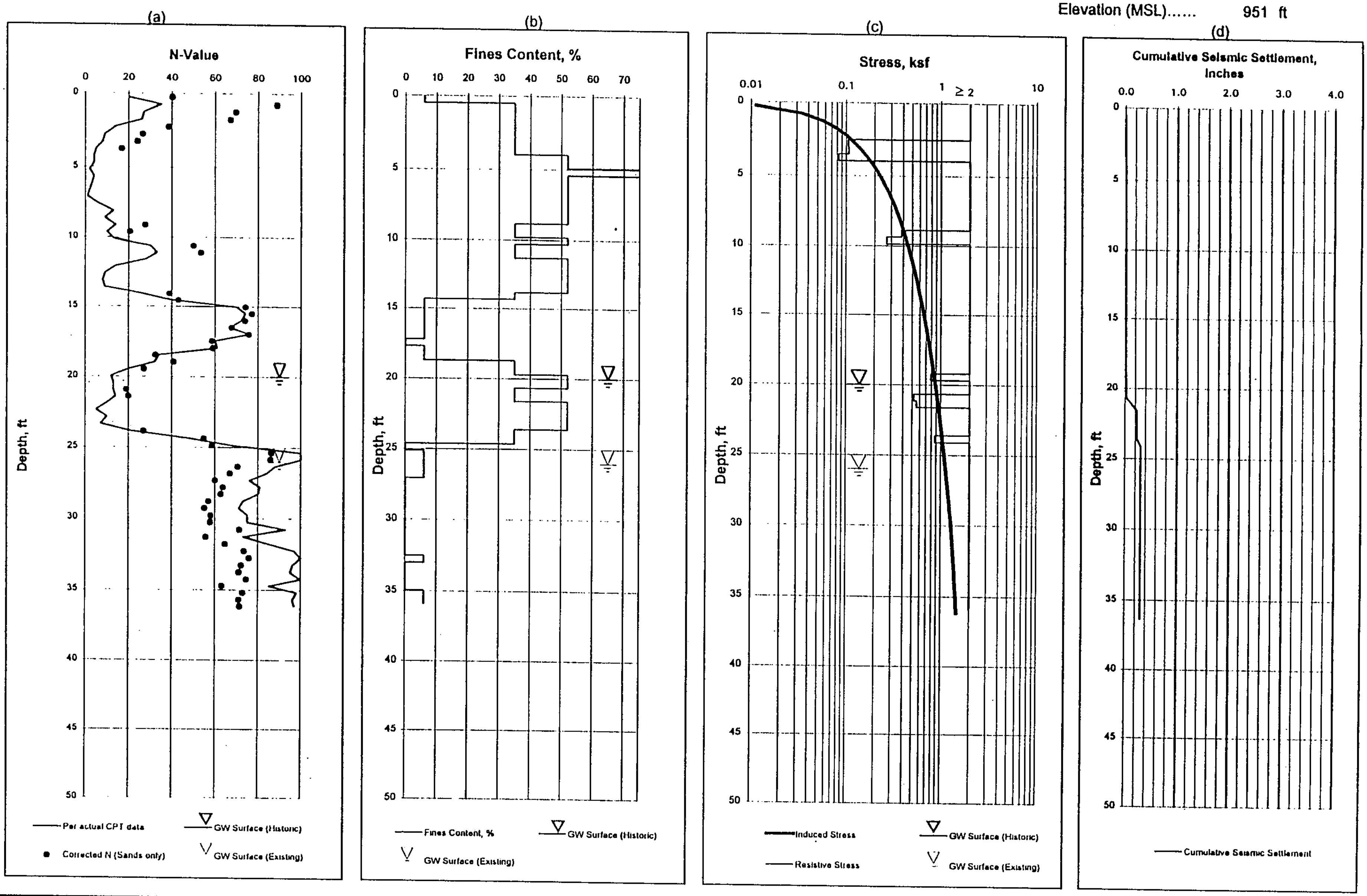

Allan E. Seward Engineering Geology, Inc. **Geological and Geotechnical Consultants**	**Analysis of Liquefaction Potential Based on N-Value (Interpreted from CPT Data)**				
	River Village, TT 53108	Weighted Gr. Acc. (M=7.5)	0.59 g	Project No.	00-1702R-4
	Santa Clarita, California	Design Gr. Acc.(M= 6.5)...	0.87 g	Figure No.	D-8
	For: Newhall Ranch Company	Magnification Factor.........	1	Date.	9-27-2000

APPENDIX 4.2

Hydrology

Landmark Village

FLOOD
TECHNICAL REPORT

August 8, 2006

Prepared For:

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List of Acronyms

ACOE	Army Corps of Engineers
AG	Agricultural and Other Development Uses
AD	Agricultural Drain
AS	Alluvial Scrub
CDFG	California Department of Fish and Game
CRW	Southern California Cottonwood/Willow Riparian Forest
CRWU	Southern California Cottonwood/Willow Upland Forest
CWA	Federal Clean Water Act
CSS	Costal Sage Scrub
ES	Elderberry Scrub
FEMA	Federal Emergency Management Agency
G	Grassland
G/D	Disturbed Grassland
GBSR	Riparian Great Basin Scrub
GR	Riparian Grassland
LACDPW	Los Angeles County Department of Public Works
LOW	Live Oak Woodland
LOW/MC	Like Oak Woodland/Mixed Chaparral
MC	Mixed Chaparral
MFS	Mule Fat Scrub
MFS/D	Disturbed Mule Fat Scrub
RWQCBLAR	Regional Water Quality Control Board, Los Angeles Region
SMFS	Successional Mule Fat Scrub
SS	Scalebroom Scrub
SWRCB	State Water Resources Control Board
WRP	Water Reclamation Plant
WRW	Southern Willow Riparian Woodland
WS	Southern Willow Scrub
N/C	Not Coded

1 Introduction

This technical report is submitted in connection with the Landmark Village tract map project and other related improvements, including flood and erosion control in and adjacent to the Santa Clara River, various drainage improvements and construction of the Long Canyon Road Bridge ("the Project"). The Project would implement a portion of the approved Newhall Ranch Specific Plan, located in northern Los Angeles County, California. The approved Specific Plan was the subject of extensive environmental review in the previously certified Newhall Ranch EIR (March 1999) (State Clearinghouse No. 1995011015) and the related Revised Additional Analysis (May 2003). The Project was assessed at a program-level environmental analysis for the Specific Plan, and at a project-level environmental analysis for the Specific Plan's Water Reclamation Plant (WRP).

As part of that prior review, the previously certified Newhall Ranch EIR (Section 4.2, Flood) and the certified Revised Additional Analysis (Section 2.3, Floodplain Modifications) assessed the hydrology and hydraulics of the Santa Clara River corridor as a result of proposed floodplain modifications associated with build-out of the entire Newhall Ranch Specific Plan. In addition to evaluating the hydrological impacts of the Newhall Ranch Specific Plan, another objective of the analysis was to determine if predicted Project improvements (*i.e.*, "floodplain modifications") would cause significant impacts to the nature, amount and location of the aquatic/riparian habitats in the River corridor, the Specific Plan site, and the downstream reaches in Ventura County. The floodplain modifications included three bridge crossings over the River, buried soil cement bank protection placement along portions of the banks in the River corridor of the Specific Plan, and removal of mostly agricultural acreage from the floodplain by raising the land areas and installing elevated bank protection. The prior analysis, referenced above, evaluated impacts on flows, floodplain and habitat areas, velocities, water depths, and sediment scouring/deposition patterns for a range of storm flows within the River (2-year through 100-year flood flows). The prior analysis determined that the proposed Specific Plan improvements would alter velocities in the River. However, the impacts were only expected during infrequent flood events (*e.g.*, 50-year and 100-year flood events), and those impacts were only anticipated to reach the buried banks. The prior analysis (Section 2.3) also found that the Specific Plan would cause an increase in water velocities, water depth, changes in sediment transport, and changes in the flooded areas. However, these hydraulic effects were found to be minor in magnitude and event. These effects were also found to be insufficient to alter the amount, location and nature of aquatic and riparian habitats in the Specific Plan area and downstream in Ventura County. The prior analysis (Section 2.3) further determined that, under the Specific Plan, the River would still retain sufficient width to allow natural fluvial processes to continue. As a result, the prior analysis (Section 2.3) concluded that the mosaic of habitats in the River that support various sensitive species would be maintained, and the population of the species within and adjacent to the River corridor would not be significantly affected.

Because of the prior environmental analysis (EIR, Section 4.2 and Revised Additional Analysis, Section 2.3), this report will focus on the analysis of the Project's specific improvements, both on-site and in and adjacent to the River corridor. The analysis in this report is facilitated by the project-specific planning conducted for the Project's tentative subdivision map, which is the mechanism used to implement portions of the approved Newhall Ranch Specific Plan. This report will review project-specific design plans, analyze those plans against existing conditions, confirm consistency with prior design assumptions and the impact analysis provided in the previously certified EIR, inclusive of the Revised Additional Analysis, and, where necessary, update the previous analysis to reflect proposed Project conditions.

1.1 Project Description

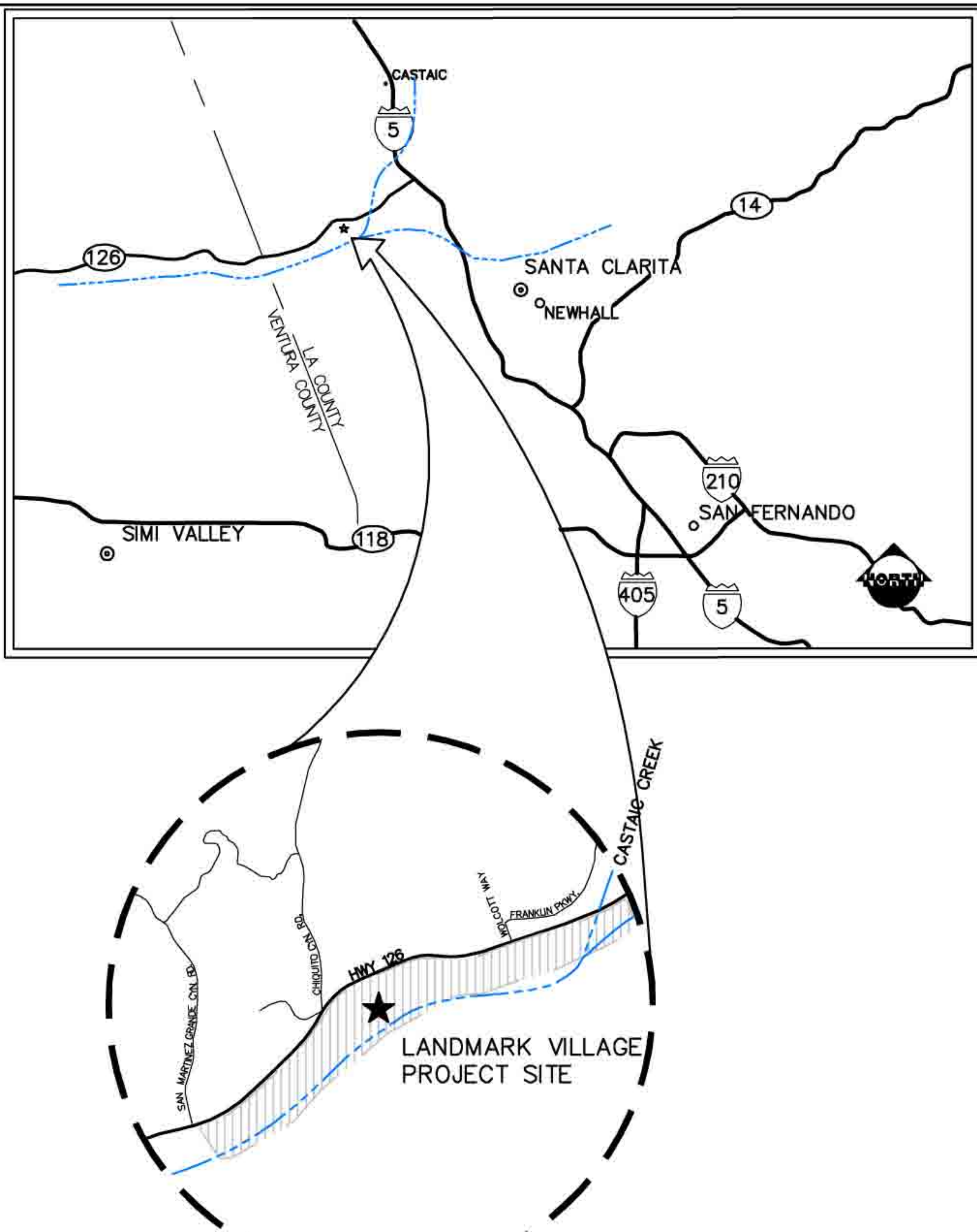
1.1.1 Project Site

The Project lies within a contributing drainage of 996 acres of the 1,634 square-mile Santa Clara River basin watershed (Psomas, Landmark Village Drainage Concept Report). The River banks form the southern boundary of the Project site, and SR-126 forms the northern boundary of the Project site. The Project site is located east of the Chiquito Creek tributary and west of the River's confluence with Castaic Creek on the north bank of the River (Figure 1.1).

Tributaries drain into or adjacent to the Project site, including Chiquito Creek on the River's north bank (RS 22195), Long Canyon Creek on the south bank (RS 22790), and Castaic Creek, which enters the River upstream of the Project site (RS 31585) (Figure 1.2). The Chiquito Creek drainage is approximately 4.8 square miles, with a stream length of approximately 22,000 feet. The Long Canyon Creek drainage area is approximately 1.5 square miles, with a stream length of approximately 1,000 feet. The Castaic Creek watershed, the largest of the tributary watersheds, is approximately 16.8 square miles below the dam. The Project is bounded by Castaic Creek to the east and Chiquito Creek to the west. Long Canyon Creek is downstream of the Project site to the west (Figure 1.2).

Other tributaries adjacent or in the vicinity of the Project site include San Martinez Grande Canyon Creek (RS 17510), and Potrero Canyon Creek (RS 15335), as well as drainage from the adjacent landfill (RS 24115). One unnamed, jurisdictional drainage is located on the Project site and drains the offsite landfill (Figure 1.2).

The Project site, which consists of approximately 291 acres, is currently used for agricultural production, and is within the boundaries of the approved Newhall Ranch Specific Plan. The Specific Plan describes the type and intensity of development proposed for the Project site. The Project consists of 1,136 multi-family units, 308 single-family detached units, and a maximum of 1,033,000 square feet of retail/commercial uses. The Project also includes an elementary school, a community park, private recreational facilities, and various trail and road improvements. Site preparation will include a cut and fill grading operation with fill being imported to the site from a location south of the site within the Specific Plan area. The Project also includes buried soil cement bank protection on both the north and south banks of the River, erosion protection, and construction of Long Canyon Road Bridge over the River. The bridge would include bridge abutments, piers, and soil cement on the north and



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PACIFIC ADVANCED CIVIL ENGINEERING
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(714) 843-5734 FAX. 848-4922

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DRAWN	JEP
CHECKED	D.J.
DATE	01/07/05
JOB NO.	7841E

LANDMARK VILLAGE

VICINITY MAP

FIGURE 1.1

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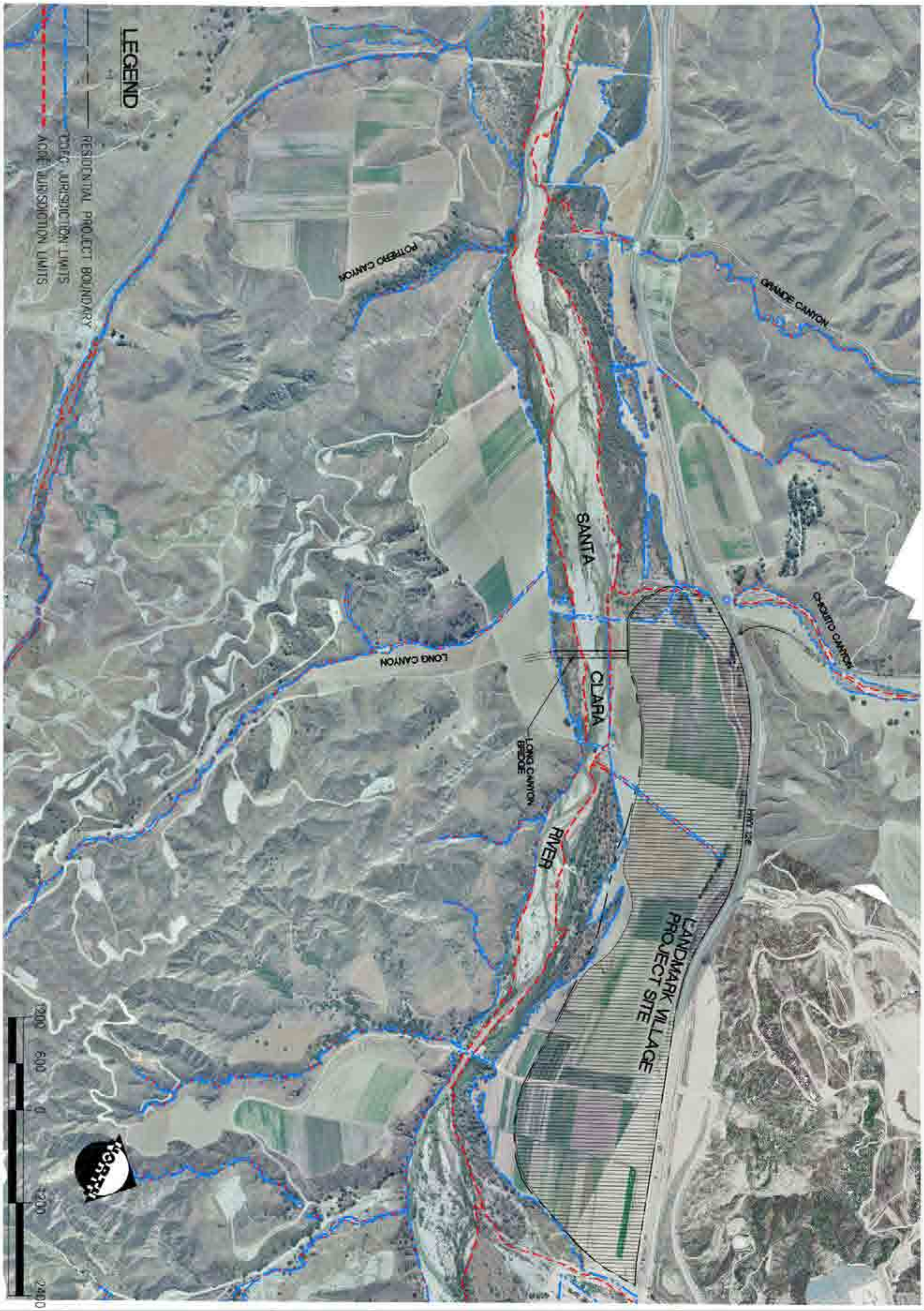

FIGURE 1.2	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX	SCALE 1" = 1200' DESIGNED DJ DRAWN JFP CHECKED MER DATE 04-26-05 JOB NO.	JOB LANDMARK VILLAGE SANTA CLARITA CA	JURISDICITIONAL LIMITS

P:\7841E\Engineering\GlobalExhibits\7841E-JURISDICTIONAL LIMITS-FIG 1.2.dwg -- Tab: 11X17 By: llron on Jun 27, 2005 at 04:12 pm south side of the bridge (Figure 1.3). These and other proposed Project-related drainage features are described below in Sections 1.1.2 and 1.1.3.

1.1.2 Proposed Drainage Improvements – Project and Santa Clara River

The proposed improvements on the Project site that would provide flood and erosion control and that would occur in and adjacent to the River and its tributaries include:

- Bank stabilization;
- Various stormwater drainage outlet structures;
- Construction of the Long Canyon Road Bridge and related bridge abutments and piers; and
- SR-126/Castaic Creek Bridge improvements adjacent to Castaic Creek.

Bank stabilization is comprised of soil cement, rip-rap and reinforced concrete. Additionally, a form of biotech stabilization, turf reinforcement mats (TRM's) or similar protection would be utilized along portions of the utility corridor. Improvement locations are shown in Figure 1.4. Most of the soil cement would be buried however some portions may be exposed, and rip-rap may be grouted or not grouted. Flood control improvements evaluated in this report are similar to those identified in the previously approved Newhall Ranch Specific Plan. Minor deviations from the Specific Plan were considered and evaluated in this report. These are highlighted in the text below.

The Project's drainage facilities that would occur in or adjacent to the River corridor, including Castaic Creek, include:

1. *Stormwater Drainage Outlets/Energy Dissipaters*
   a. To reduce storm flow velocities and prevent erosion at stormwater discharge points into the River, energy dissipaters consisting of either rip-rap or other larger reinforced concrete standard impact-type energy dissipaters would be constructed at storm system outlets into the River. These energy dissipaters would slow the rate of flow of runoff into the River to prevent erosion of the stream channel. Additional dissipaters would be located at the outlet of Chiquito Creek, San Martinez Grande and Long Canyon Creek. The location of proposed energy dissipaters is provided on Figure 1.4. Dissipaters will be designed based upon storm drain outlet hydraulic conditions, such as discharge, velocity and pipe size, and location within the River. The Chiquito dissipater will be located below a three barrel 14'x14', 100 foot long culvert extension with stilling basin and 10 foot drop structure. The Grande utility corridor extension will include a 200 foot rip-rap dissipater structure.

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LANDMARK VILLAGE

SANTA CLARITA CA

PROPOSED BANK

FIGURE 1.3

P:\7841E\Engineering\GlobalExhibits\7841E-BANK PROTECTION FIG 1.3.dwg - Tab: IMPROV MAP By: jpreston on Jun 28, 2005 at 01:38 pm

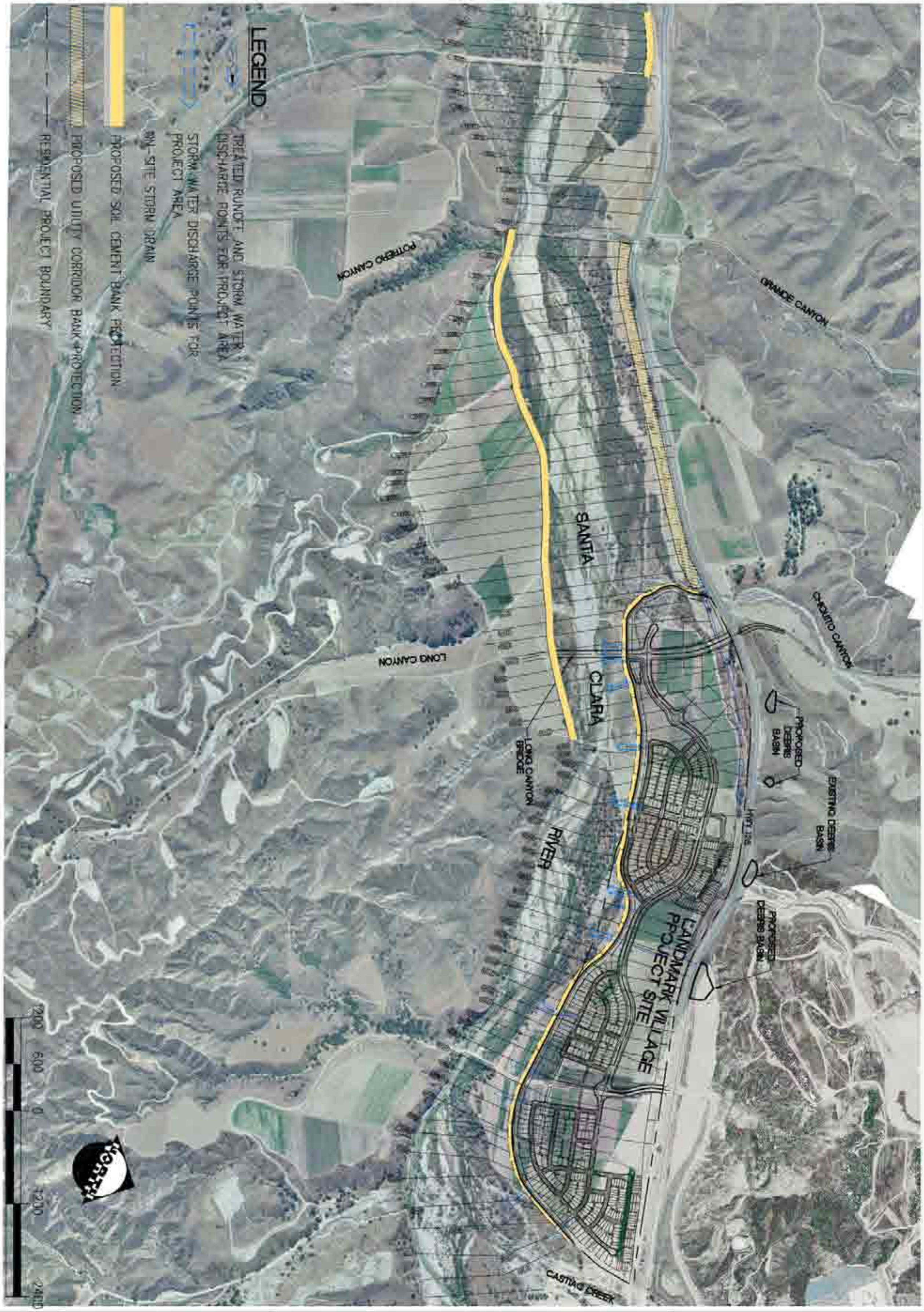


FIGURE 1.4	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"=1200' DESIGNED DJ DRAWN JFP CHECKED MER DATE 04-26-05 JOB NO.	JOB LANDMARK VILLAGE SANTA CLARITA CA

TITLE DEBRIS BASINS AND DISCHARGE LOCATIONS

P:\7841E\Engineering\GlobalExhibits\7841E-IMPROVEMENTS-MAP-FIG 1.4.dwg -- Tab: 11X17 By: jpreston on Jun. 28, 2005 at 02:09 pm

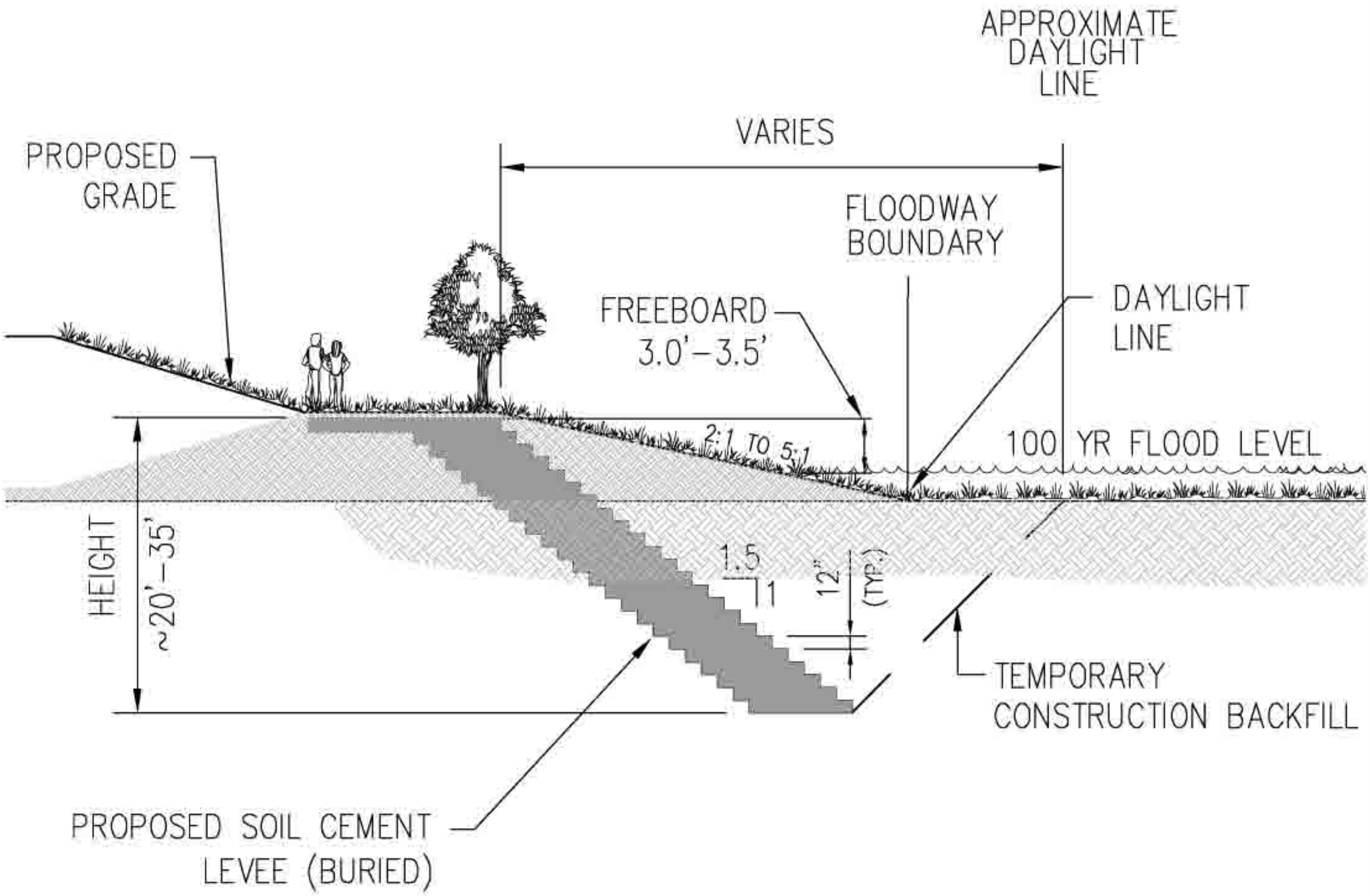
b. Drainage from the Project and SR-126 would pass through storm drain outlet pipes that discharge to the River. Eleven outlet structures would be constructed in conjunction with the soil cement improvements. Please refer to the attached Psomas Landmark Village Drainage Concept report and the summary in Section 1.1.3 below.

2. *Soil Cement/Bank Stabilization*
The Project would include buried soil cement along the River and Castaic Creek adjacent to and downstream of the Project site. In total, approximately 18,600 linear feet (LF) of River and creek bank would be provided with buried soil cement protection. This would include approximately 11,000 feet fronting the Project site (RS 32265 to 22195), and approximately 6,400 LF on the south bank adjacent to the Long Canyon Road Bridge (Figure 1.4). The soil cement is required to protect residential and commercial development and the Long Canyon Road Bridge. The installation of soil cement in the vicinity of the approved Newhall Ranch Water Reclamation Plant (WRP) will likely be installed prior to implementation of the Project, and was previously evaluated as part of the Project-specific impact analysis for the WRP, which was provided in the previously certified Newhall Ranch EIR (SCH No. 95011015).

Figure 1.4 depicts soil cement bank protection extending about 6,400 feet downstream (west) of the Long Canyon Road Bridge along the southern bank of the River. The bank stabilization proposed downstream of Long Canyon Road Bridge is necessary to mitigate impacts associated with the Landmark project. An additional approximately 1,200 LF of soil cement bank stabilization is located approximately between STA 950 and STA 5700, downstream of the Project site, and is designed to protect the WRP. The bank stabilization related to the WRP was approved and analyzed at a project-level with the Newhall Ranch EIR.

The portion of bank stabilization between the River and Old Road will be constructed as a part of this Project because protection of the utility corridor may be needed. This bank stabilization was analyzed as part of the previously certified EIR/EIS in conjunction with the approval of the Natural River Management Plan (NRMP).

Most of the proposed bank protection would consist of buried soil cement to provide scour and freeboard flood control protection. In determining the design of the bank protection, several factors were considered, including: (1) flood control stability and durability of bank protection; (2) bank protection maintenance considerations; (3) environmental compatibility with the native area, resource enhancement concepts, and aesthetic considerations; and (4) prior success in construction and cost of construction. Soil cement bank protection provides a stable



PACE PACIFIC ADVANCED CIVIL ENGINEERING 17902 GEORGETOWN LANE, H.B. CA. 92647 (714) 843–5734 FAX. 848–4922	SCALE N.T.S. DESIGNED DRAWN JEP CHECKED D.J. DATE 01/07/05 JOB NO. 7841E	LANDMARK VILLAGE TYPICAL SOIL CEMENT CROSS SECTION	FIGURE 1.5

Xrefs:
P:\7841E\Engineering\GlobalExhibits\7841E-TYP- SOIL CEMENT X-SECT FIG 1.5.dwg By: jpreston Date: Jun. 28, 2005 Time: 02:23 pm

riverbank protection material, in terms of both surface erosion and structural stability. Additionally, soil cement bank protection will be mostly buried. The exposed top portion of the soil cement will be compatible with the native earth re-vegetated resource area. A typical soil cement cross-section is shown in Figure 1.5.

Soil cement is a highly compacted mixture of soil, cement, and water. As the cement hydrates, it hardens into a strong, durable, low-permeability material. Among the benefits to soil cement is that it may provide a more pleasant visual appearance, similar to that of a natural arroyo, as opposed to the visual harshness of traditional rip-rap. Construction projects like the proposed Project, generally utilize an on-site central batch plant whereby material can be directly excavated from the channel. Excavated material is then transported to a plug mill to separate the native material, if required, and then proceed by conveyor to a batch plant. The overriding benefit to a batch plant operation is that it allows quality control of the design mix being generated through computer management. The percentage by weight for the cement content can range from eight to 12 percent, depending on native material clay content. High clay content increases the cement requirement. Soil cement mix from the batch plant has a water content of approximately 90% when ready for application. The soil cement mixture is applied in 6-9" sheets called lifts, equal in width to the spreading equipment, which is generally nine feet (trimmed to eight feet). A roller then compacts the soil cement after each lift is applied. Soil cement bank protection slopes can be constructed very steep, usually 1h:1v, which reduces the right-of-way requirements compared to other alternatives with milder side slopes Following the final lift application, the exposed channel face can be trimmed to generate a clean surface and remove any soil cement that was not compacted.

3. _Turf Reinforcement Mat_
Turf Reinforcement Mat (TRM) or a similar bank stability protection along the Newhall Ranch SR-126/River utility corridor would be provided by installing approximately 6600 LF (RS 22195 to 17785) of TRMs along the southern edge of the utility corridor from the western end of the Project to the easterly end of the previously approved Newhall Ranch WRP. Figure 1.4 depicts the locations where TRMs would be installed.

TRMs are designed to reinforce vegetation at the root and stem allowing vegetation to be used as erosion control in areas where flow conditions exceed the ability of natural vegetation to remain rooted. This includes applications with high slopes or stream banks where grouted rip-rap and concrete channels are aesthetically undesirable.

TRM products are constructed of two basic materials that perform different functions: (1) permanent netting designed to provide permanent structure and strength to the vegetation at the root and stem level; and (2) degradable natural and synthetic fiber netting that provides erosion control immediately after installation by holding seed and soil particles in place and trapping moisture on the soil surface. A combination of the two can be used to provide erosion control, vegetation establishment and reinforcement at one location. TRMs are secured to the soil surface using a predetermined staple pattern and either wire soil staples or biodegradable stakes.

4. *Long Canyon Road Bridge*

The Long Canyon Road Bridge over the River is to be located at RS 22960, approximately 500 feet upstream of the Long Canyon Creek discharge to the River (Figure 1.4). The bridge's proposed span is approximately 980 LF with eleven piers within the River along the span. Bridge abutments are approximately 500 LF of River length consisting of reinforced concrete transitioning to soil cement through a 50 LF of River length of rip-rap.

5. *SR-126/Castaic Creek Bridge Improvements*

The SR-126/Castaic Creek Bridge is to be widened to three lanes in each direction. Concurrently, bridge abutments would be widened and extend up to 500 LF on both sides of Castaic Creek. The buried bank stabilization would tie into the abutment with an approximate 50 LF section of rip-rap.

1.1.3 Proposed On-Site Drainage Improvements

At Project build-out, runoff from the six drainage areas that drain through or onto the Project site, as defined by the Psomas Landmark Village Drainage Concept Report (September 15, 2004) (Figure 1.6), would continue to flow through the Project site. Runoff from the developed portions of the Project would be channeled through the proposed stormwater conveyance system and discharged to the River after passing through various debris and water quality basins. (*Refer to*, Psomas Landmark Village Drainage Concept Report.) As required in the Los Angeles County Department of Public Works memorandum entitled, "*Level of Flood Protection and Drainage Protection Standards*," all on-site drainage systems carrying runoff from developed areas are to be designed for the 25-year Design Storm (Urban Flood), while storm drains under major and secondary highways, open channels (main channels), debris carrying systems, and sumps are to be designed for the Capital Flood.

Runoff from the developed portions of the Project would be conveyed through the Project site using a combination of grading, storm drainpipes, vegetated swales, catch basins, retention/detention basins, water quality basins, outlet structures, and debris basins. The proposed on-site drainage improvements are described below. The locations of such improvements are also illustrated in the Psomas Drainage Concept Map

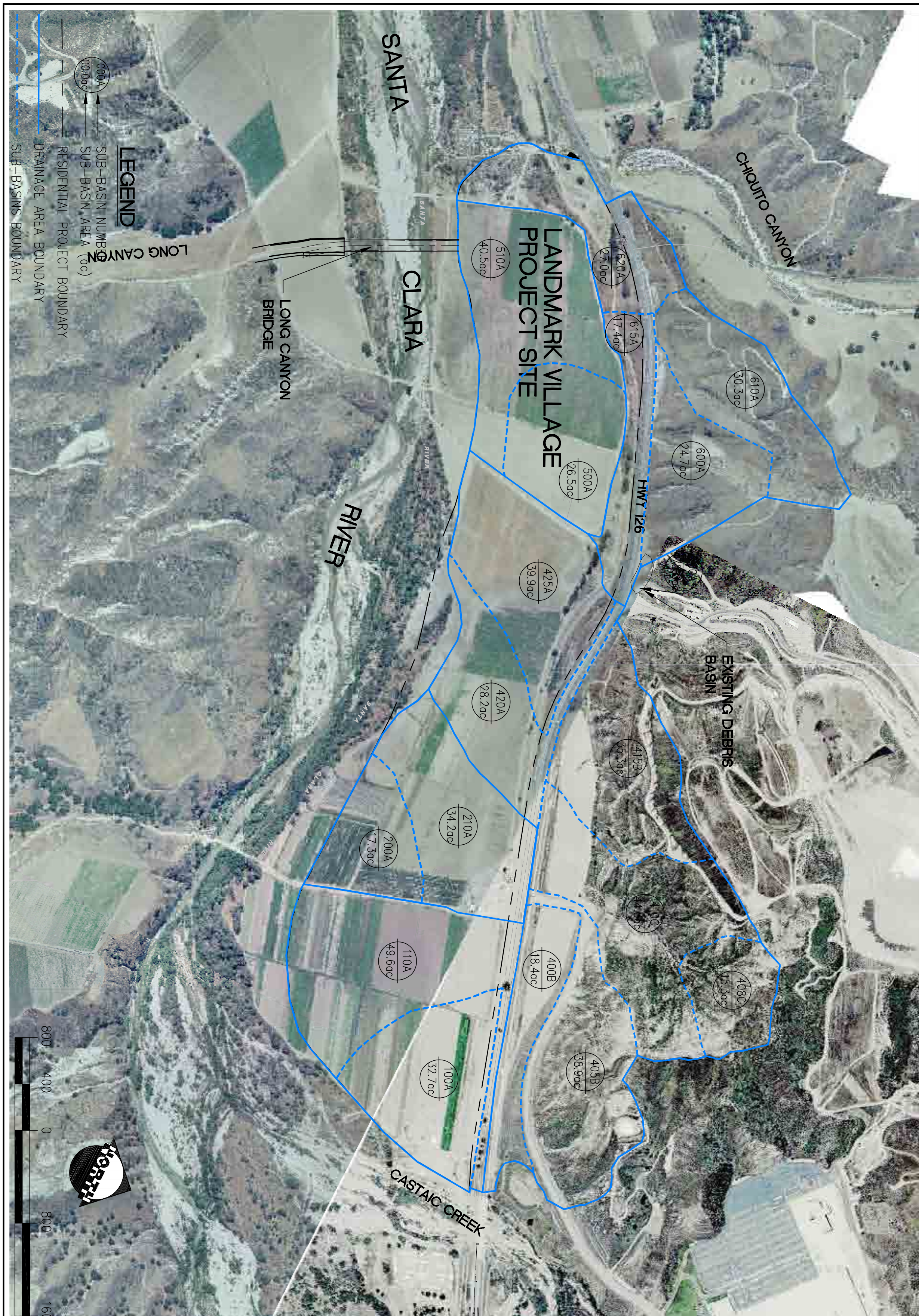


FIGURE **1.6**	**PACE** PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 800' DESIGNED DJ DRAWN JEP CHECKED MEK DATE 04-26-05 JOB NO.	JOB **LANDMARK VILLAGE** SANTA CLARITA CA	TITLE **ON-SITE EXISTING CONDITIONS SUB BASINS (FROM PSOMAS DRAINAGE CONCEPT)**

P:\7841E\Engineering\GlobalExhibits\7841E-EXISTING PSOMAS SUB BASINS-FIG 1.6.dwg - Tab: IMPROV MAP-1000 SCALE By: mwheeler on Sep. 11, 2006 at 09:21 am

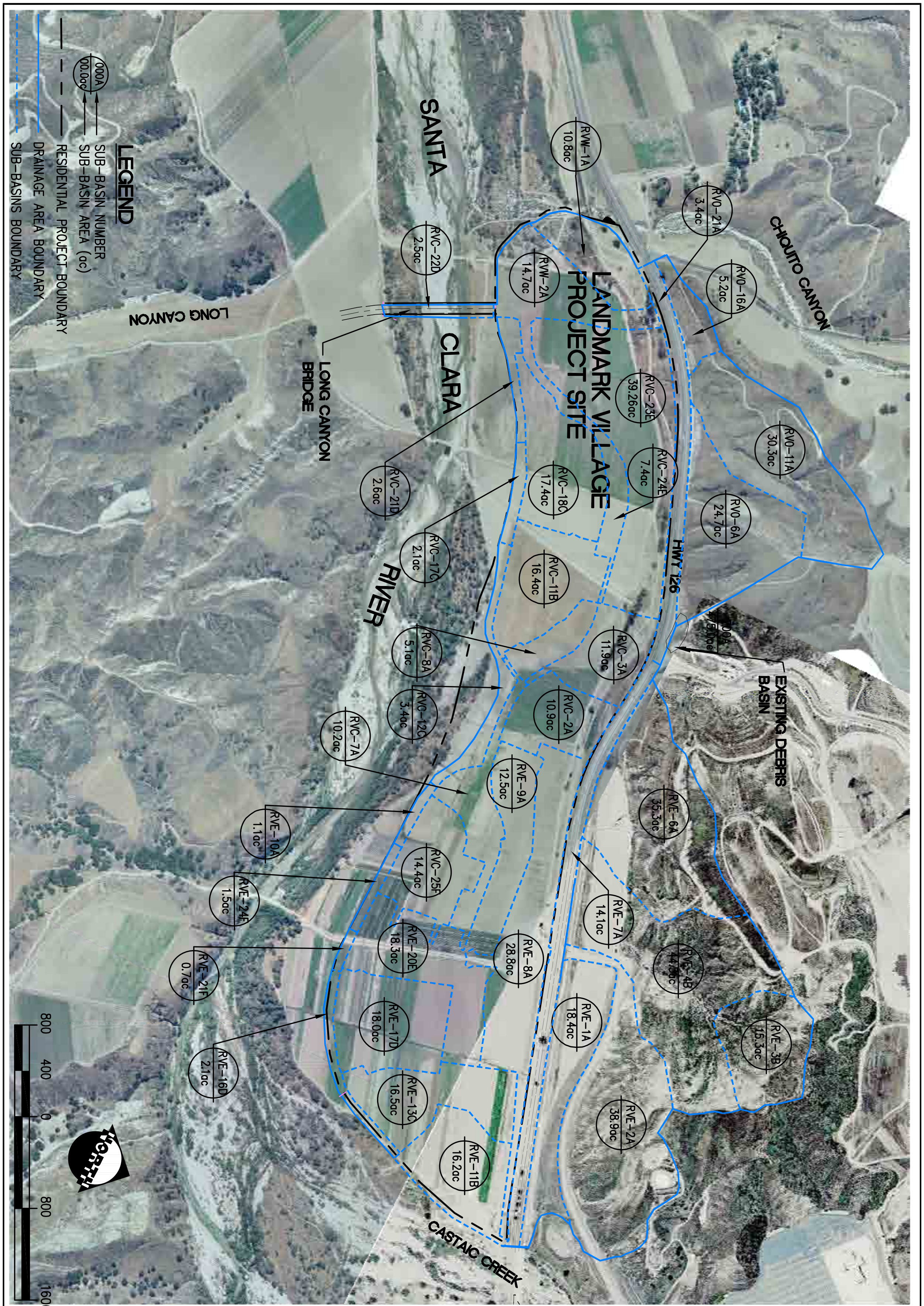


FIGURE 1.7	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 1200' DESIGNED DJ DRAWN JEP CHECKED MEK DATE 04-26-05 JOB NO.	JOB LANDMARK VILLAGE SANTA CLARITA CA
			TITLE ON-SITE PROPOSED CONDITIONS SUB BASINS (FROM PSOMAS DRAINAGE CONCEPT)

P:\7841E\Engineering\GlobalExhibits\7841E-PROPOSED PSOMAS SUB BASINS-FIG 1.7.dwg - Tab: IMPROV MAP-1000 SCALE By: jpinto on Jun. 30, 2005 at 08:20 am in Figure 1.7, which also depicts the post-development drainage patterns of the Project site.

Project on-site drainage facilities include:

- _Storm Drains_
  Storm drains (pipes and reinforced concrete boxes) designed for either the 25-year or 50-year Capital storm would consist of both privately maintained systems (Homeowner's Associations, Assessment Districts etc.) and publicly maintained systems (County of Los Angeles). The minimum publicly-maintained mainline pipe size is 18-inch connector pipes for clear flows.

- _Open Channels_
  Small open channels would consist of rectangular and trapezoidal concrete channels, and would be designed for either the 25-year or 50-year Capital storm, depending on the source of the runoff. The channels sized for the 50-year Capital storm would have greater capacity than those sized for the 25-year storm.

- _Low Flow Pipes and Outlets_
  To reduce pollution impacts from the low flow runoff, a series of pipes and outlets would be provided to intercept first flush runoff from developed portions of the Project. Pollutants expected to be generated on the Project site, their potential water quality impacts, and water quality control are discussed in the Geosyntec Water Quality Technical Report for the Project. Additionally, the Psomas Drainage Concept Report provides a Standard Urban Stormwater Mitigation Plan (SUSMP) for the Project site.

- _Catch Basins_
  Catch basins would be provided to intercept flows beyond the 10- and 25-year storms and at strategic locations to minimize flooding at street intersections and at sump locations.

- _Debris Basins_
  To reduce debris discharged through and from the Project site, debris basins are proposed to intercept flows from undeveloped upland areas prior to discharge into the on-site storm system (Figure 1.4).

- _Treatment BMPs_
  In order to comply with Storm Water Pollution Prevention Plans (SWPPPs) mandated by the State of California, treatment BMPs including ponds, vegetated swales and bioretention areas will be constructed where necessary to ensure that urban runoff from the Project site will meet or exceed water quality criteria.

1.2 Materials and Documents Incorporated by Reference

The following is a list of references used in this report. The documents referred to, referenced or cited in this report are incorporated by reference and are available for public review at the Los Angeles County Department of Regional Planning, 320 West Temple Street, Room 1382, Los Angeles, California 90012.

- Center for Watershed Protection. *The Practice of Watershed Protection* (2000).
- Chow, VT. Open Channel Hydraulics (pg *165* and pg *185).* McGraw Hill Civil Engineering Series (1959).
- *Federal Emergency Management Agency (FEMA) Flood Insurance Map 065043-0340* (October 20, 2002).
- Los Angeles County Department of Public Works. *Hydrology Manual* (December 1991) and *Sedimentation Manual* (June 1993).
- Los Angeles County Department of Public Works. *Hydrology Manual & Appendix*, 1991.
- Los Angeles County Department of Public Works. *Development Planning for Storm Water Management, A Manual for the Standard Urban Storm Water Mitigation Plan (SUSMP)* (September 2002).
- Los Angeles County of Public Works. *Level of Flood Protection and Drainage Protection Standards* (1986).
- Los Angeles County Department of Public Works. Santa Clara River Enhancement and Management Plan, *Flood Protection Report* (June 1996 Final Draft)
- Pacific Advanced Civil Engineering. *Newhall Ranch River Fluvial Study Phase 1 Final Draft* (March 9, 2006)
- Pacific Advanced Civil Engineering. *Newhall Ranch Santa Clara River HEC-RAS Modeling Study* (December, 2005).
- Psomas. *Landmark Village Drainage Concept Report* (September 15, 2004).
- Psomas. *Surveyed topography data for River Village (Landmark Village)*, dated 1999.
- United States Army Corps of Engineers. *Santa Clara River Adopted Discharge Frequency Values* (adopted May 3, 1994 by the United States Army Corps of Engineers, the Ventura County Flood Control Department and the Los Angeles County Department of Public Works).
- Valencia Company. *Natural River Management Plan (Permitted Projects and Activities under the United States Corps of Engineers 404 Permit, California Department of Fish and Game 1603 Agreement and 2081 Permit* (November 1998).
- Sikand. *Newhall Ranch Specific Plan Master Drainage Concept, Santa Clara River* (April 2001).
- Sikand. *Newhall Ranch Santa Clara River HEC-RAS Study* (June, 28 2000).
- Sikand. *Supplemental Report for Newhall Ranch Santa Clara River HEC-RAS Study* (July 2000).
- Simons, Li & Associates. *Summary Report, Fluvial Study of Santa Clara River and the Tributaries* (November 1990).
- Revised Additional Analysis to the Newhall Ranch Specific Plan and Water Reclamation Plant Final EIR (SCH No. 95011015), Volume VIII, May 2003, including Section 2.3, Floodplain Modifications.

1.3 Definitions

The following terms and acronyms are defined below, and are used in this report:

100-year storm	Precipitation event corresponding to a flood that has a 1/100, or one percent, chance of occurring in any given year.
ACOE	Army Corps of Engineers
Runoff (Qbb)	Runoff from burned areas that are laden with burned vegetation, fines, rocks, mud and other debris.
Capital Flood (Qcap)	The runoff resulting from a theoretical storm based on Los Angeles County Department of Public Works methodology. The "model" storm is derived from 50-year frequency rainfall values, which occur in a time sequence patterned after actual major extra-tropical storms occurring in the Los Angeles Region. The calculations of runoff are also based on the soil types and percent of impervious surfaces in a watershed area, and on the assumption that some undeveloped portions of the watershed are burned, resulting in significant amounts of debris and sediment being added to the runoff.
CDFG	California Department of Fish and Game
Clear Runoff (Qc)	Runoff that is absent of fines (finely crushed or powdered material), mud, rocks, vegetation, and other debris.
Coefficient of Runoff	Variable in the rational and modified rational method runoff formula, which is dependent upon soil type, rainfall intensity, and the percent of imperviousness.
CWA	Federal Clean Water Act
Detention Basin	Physical flood control structure that captures storm flows and temporarily stores these flows in man-made surface depressions and, therefore, not available for producing surface runoff during storm events. See also "Water Quality Detention Basins."
Depression Storage	Runoff that is captured by and settles in a natural or manmade depression and does not continue downstream.
Erosion	The wearing away of land surfaces by water, wind, and ice.
FEMA	Federal Emergency Management Agency
First Flush	First flush is defined in Los Angeles County as the runoff volume generated from the first 0.75-inches of rainfall in a

	24-hour period.
Floodplain	Total area subject to inundation by a 100-year flood.
Impervious	A description of a soil that will not permit water to flow through it.
Infiltration	The penetration of water through the ground surface into sub-surface soil or the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.
Interception	That portion of precipitation captured by vegetation. Intercepted precipitation is disposed of by drip, stem flow, or evaporation (or sometimes sublimation, in the case of snow, sleet, hail, or freezing rain).
LACDPW	Los Angeles County Department of Public Works
Peak Flow	Peak discharge rate measured in cubic feet per second (cfs).
Percolation	The downward flow or filtering of water through pores or spaces in rock or soil.
Q	Discharge rates measured in cubic feet per second.
Q50bb	Peak runoff from a 50-year rainfall intensity storm from undeveloped areas that is laden with burned vegetation, fines, rocks, and other debris.
Q50c	Peak runoff from a 50-year rainfall intensity storm from developed areas or from undeveloped areas that are not assumed to be burned or bulked.
River	Santa Clara River
Runoff	The portion of rainfall, melted snow, or irrigation water that flows across the ground surface rather than filtrating into the soil.
RWQCBLAR	Regional Water Quality Control Board, Los Angeles Region
Sedimentation	Deposition of waterborne sediments due to a decrease in water velocity and a corresponding reduction in the size and amount of sediment, which can be carried by the flowing water.
Sump	An area from which there is no surface flow outlet.

SUSMP	Standard Urban Stormwater Mitigation Plan
SWPPP	Storm Water Pollution Prevention Plans
SWRCB	State Water Resources Control Board
Transpiration	The process by which water vapor is lost to the atmosphere from living plants.
Velocity	The rate or speed at which surface runoff water flows either over land or through a channel, measured in feet per second (fps).
Watershed	All land and water within the confines of a drainage divide.
Waters of the U.S.	Although the definition is subject to change, "Waters of the U.S." is defined as follows: All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; all interstate waters including interstate wetlands; and all other waters, such as interstate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce including any such waters: (1) which are or could be used by interstate or foreign travelers for recreational or other purposes; or (2) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or (3) which are used or could be used for industrial purposes by industries in interstate commerce. Also included are all impoundments of waters otherwise defined as waters of the United States under the definition; tributaries of waters identified above; the territorial seas; and wetlands adjacent to waters (other than waters that are themselves wetlands) identified above. (33 C.F.R. §328.3(a)(2004).) Under the U.S. Army Corps of Engineers' definition, “Waters of the United States” are defined by the “ordinary high water mark,” which can be identified by physical characteristics, such as channel scouring, bank “shelving,” areas cleared of terrestrial vegetation, litter and debris, or other indications that may be appropriate.
Wetlands	Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support,

a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. (33 C.F.R. §328.3(b)(2004).)

2 Methodology

Two development scenarios are addressed in this report:

1. Existing;
2. Existing with Project.

Brief summaries of the hydrologic and hydraulic methodology used in this report are presented as background information. The methodology was used to calculate pre- and post-development runoff quantities, the capacities of proposed improvements, and the effects of development on the River.

A third scenario, not addressed in this report, is a cumulative buildout scenario. This scenario was previously evaluated in the certified Newhall Ranch EIR, as revised by the Revised Additional Analysis, Vol. VIII (May 2003). As indicated earlier in this report, the flood protection improvements proposed in conjunction with the Project are substantially consistent with those shown and analyzed in the buildout scenario for the Newhall Ranch Specific Plan.

2.1 Hydrology Background and Methodology

2.1.1 Los Angeles County Criteria

The Flood Control Division of the Los Angeles County Department of Public Works (LACDPW) regulates storm runoff protection. The LACDPW issued a 1986 memorandum entitled, "Level of Flood Protection and Drainage Protection Standards," for development projects in Los Angeles County. The memorandum established Los Angeles County policy on levels of flood protection and requires that the following facilities be designed for the Capital Flood: all facilities not under State of California jurisdiction that intercept flood waters from natural drainage courses; all areas mapped as floodways; all facilities that are constructed to drain natural depressions or sumps; and all culverts under major and secondary highways. All facilities in developed areas that are not covered by the Capital Flood protection conditions must be designed for the Urban Flood, or runoff from a 25-year frequency design storm. Because the Project would also intercept flood flows from natural areas, the Project's storm drainage facilities that accept these flows must be sized and designed for the Capital Flood.

In addition to meeting this required level of flood protection, all development in the River watershed must meet standards adopted by the LACDPW for the River and its major tributaries. (*Refer to*, County Sedimentation Manual, pp. 2-2 to 2-6.) Further, properties adjacent to the River that include improvements along and across a segment of the River (including the Project) must meet the standards adopted in the Newhall Ranch EIR and Revised Additional Analysis, Volume VIII (May 2003).

2.1.2 Explanation of the County Capital Flood

In 1931, the Los Angeles County Flood Control District (LACFCD) (now, the Flood Control Division of the County's Department of Public Works) began development of a comprehensive plan of flood control facilities to collect and convey flows from the mountainous canyons, the alluvial fans, and the urbanized coastal plain.

The major needs in designing the system were: reduction of damage due to high canyon flows, conveyance of large volumes of water in a major storm, and the ability to meet future flood control needs. The design of the flood protection system for the County is based on the Department of Public Works' Capital Flood hydrology.

The Department's Capital Flood (or Q_{CAP}) hydrology is based on a "design," or theoretical storm event that is derived from 50-year frequency rainfall values and is patterned after actual major extra-tropical storms observed in the Los Angeles region. The 50-year frequency design storm is assumed to occur over a period of four days, with maximum rainfall occurring on the fourth day.

Analysis of recorded major storms reveals that, during the 24-hour period of maximum rainfall, rainfall intensity typically increases during the first 70 to 90 percent of the period and decreases in the remaining time. Furthermore, approximately 80 percent of the amount of the 24-hour rainfall occurs within the same 70 to 90 percent of the period. In developing the Q_{CAP}, the 50-year frequency design storm is assumed to fall on saturated soils. In converting rainfall to runoff, rainfall that is not lost due to the hydrologic processes of interception, evaporation, transpiration, depression storage, infiltration, or percolation is assumed to be surface runoff. The effect of snowfall or snow melt on rainfall-runoff relationships is a consideration in only a very limited portion of the County (i.e., the higher elevations) where snowfall accumulates in winter.

Another assumption made in developing a Capital Flood design flow rate is that some natural portions of the watershed have been burned by fire. When a watershed burns, the soil infiltration rate decreases due to the loss of vegetation and physical changes in the soil. The County has run field infiltrometer tests to quantify the effect that burning has on the coefficient of runoff. The effect of burning the watershed can increase the design runoff rate from 10 percent to 20 percent.

The final factor in adjusting the Capital Flood design flow rate is referred to as a bulking factor. In the area where a watershed is burned, the runoff would carry with it a large layer of eroded topsoil. This sediment, along with the associated burned trees and brush, is referred to as debris. In order to account for these quantities of debris, the design flow rate is artificially increased using a prescribed bulking factor, which is a function of not only soil type, but also the steepness of the terrain and the size of the drainage basin. The bulking factors for larger drainage basins range from about 1.20 to 1.50, or from 20 to 50 percent over and above the burned flow rate.

In September, 2003, LACDPW revised the hydrologic method that accounts for fire effects on runoff computations. In the previous practice, a completely burned watershed was assumed. The current policy was updated to employ a statistical approach that relates historical fire data and vegetation recovery rates to changes in runoff coefficient of soil. A fire factor (*FF*) has been developed to represent the effectively burned percentage of a given watershed. This factor is used to adjust runoff coefficients for Q_{CAP} hydrology. The *FF* adjusts the coefficient by indexing between an unburned and completely burned soil coefficient for a given soil. This method has yet to be officially adopted by the County.

In this report, the former Capital discharge is used for analysis and comparison. In design stages, the updated 2003 Capital discharge will be employed as this updated version is anticipated to be adopted by the County between now and approval of the Project. Because the 2003 Capital discharge rate is lower than the pre-2003 discharge rate, using the updated discharge values in the design phase will result in reduced calculated flood flows and a reduced calculated potential for flood-related impacts. Using the pre-2003 Capital discharge is more conservative in determining impacts. Any changes in design of bank protection resulting from utilizing the updated Capital discharge will only reduce the top of bank protection elevation and toe of the bank protection depth. Final design of bank protection will adhere to LACDPW Q_{CAP} design standards.

In summary, the County's Q_{CAP} is based on a theoretical four-day storm event occurring right after the watershed has been burned with the resulting flow rate being increased again by a bulking factor, thereby yielding a peak flow rate that is 32 to 80 percent higher than a 50-year storm over an unburned-unbulked drainage basin. The probability of the occurrence of all the theoretical assumptions identified in the County's Capital Flood is extremely small, and yields greater design flows than the Federal Insurance Administration's methodology for calculating the 100-year and 500-year floods. As a result, the County's methodology is more conservative than that of the Federal Emergency Management Agency (FEMA).

2.1.3 Method of Drainage Analysis

The engineering term for the method used to properly size pipes and channels is "hydraulic analysis." To determine the proper sizes of pipes and channels, assumptions must be made regarding the amount of rainfall to design for and the amount and type of development that would take place in a drainage basin. An estimate must also be made of how often that amount of rainfall could be surpassed. This is referred to as the event exceedence probability, or its reciprocal value — return period. For example, a storm that has a 10 percent exceedence probability is a storm that has a 10 percent chance of meeting or exceeding a particular volume of rain in any given year. The reciprocal of this number is also known as a 10-year return period storm. An important concept to keep in mind is that a pipe or channel is designed for a discharge (measured in cubic feet per second), not a volume (measured in cubic feet or acre-feet). A dam or a lake is designed for storing or containing a fixed volume of water. A pipe of a fixed size, on the other hand, can carry discharges, depending on the pressure placed on the water.

In designing a storm drain system, the size of a pipe that would safely carry a predicted discharge must be calculated. A 1-foot square box that is 1-foot deep (a cubic-foot) can hold 7.5 gallons of water. Based on this fact, the amount of stormwater passing through a pipe or channel in one second can be calculated by multiplying the cross sectional area of the flow in the pipe (in square feet) by the velocity of storm flows through the pipe in feet per second. This three-dimensional rate of flow is measured in cubic feet per second, or cfs.

With the above concepts in mind, the effects of development on natural ground can be considered. Buildings, driveways, patios, sidewalks, and roads all create new impervious cover to the natural ground and prevent water from infiltrating into the ground. The water that would normally infiltrate the ground would therefore run off at a higher than normal rate. Therefore, the surface discharge from developed areas will be greater than that from undeveloped areas.

LACDPW requires that all designs utilize exceedence probability calculations for design and analysis. By employing this methodology herein, this report ensures consistency with County design standards.

2.1.4 Explanation of Design Hydrology

(a) Effects of Soil Type and Amount of Imperviousness on Runoff Rates

The rate of runoff is directly related to the type of soil on the site. Certain soil types accept water faster (are more permeable) than other soils. Therefore, the types of soils present on a site are used in the calculations of runoff. Different soil types have very different water infiltration rates. If sandy soil (highly permeable) is paved over, the coefficient of runoff (C) would greatly increase, whereas if clay soil (not highly permeable) is paved over, runoff values would go up, but by a smaller percent of the total when compared to sandy soil (because sandy soils conduct water faster). In small storms, some soils can absorb 100 percent of the rainfall. For example, soil type 015 (Tujunga Fine Sandy Loam) can completely absorb a 0.5-inch per hour (in/hr) storm and almost completely absorb a 1.0 in/hr storm, thereby yielding extremely low runoff rates. For a 200 acre parcel with soil types 015 (Tujunga Fine Sandy Loam) and 012 (Ramona Clay Loam), radically different runoff quantities for the same rainfall events occur. For an intense storm, *I=1.0 in/hr*, and the very pervious soil type 015 (Tujunga Fine Sandy Loam), the runoff rate would be 20 cfs. For the same size parcel on a very impervious soil, such as soil type 012 (Ramona Clay Loam), the runoff rate would be 168 cfs.

(b) Effects of Burning and Bulking

In an undeveloped watershed, Capital Flood flow rates assume a burned condition, which causes the coefficient of runoff to increase. Further, after increasing the coefficient of runoff for burning, the flow rate is then multiplied by a bulking factor, which is used to account for the amount of mud and debris that would be contained within the flow from the burned watershed. In the case of the Project, the increase in runoff, or flow rates, due to an increase in the coefficient of runoff (C) to account for burning is from 10 to 20 percent. Application of the bulking factor to account for debris production would increase runoff quantities by 20 to 50 percent over and above the burned flow rate.

(c) Effects of Development

As previously noted, development places impervious materials over soils that had previously infiltrated stormwater. Once the impervious materials are placed over the soil, little direct infiltration occurs and runoff increases. Because development does not typically completely cover the ground surface, portions of each developed parcel (e.g., front, side, and rear yards, landscaping, open space, etc.) remain permeable to stormwater. Percent imperviousness for each land use (existing and proposed) on the Project site is presented in Table 2.1.

Table 2.1: Percent Impervious for Selected Land Uses

Land Use	Percent Imperviousness (%)
Agricultural[3]	15
Transportation	100
Single Family Residential	42
Multi Family Residential	68
Commercial	92
Open Space	0

Values are from GeoSyntec Consultants (2005).

2.2 Santa Clara River Hydraulics

The floodplain conditions of the River were modeled using River Analysis System (RAS) software developed by the U.S. Army Corps of Engineers (U.S. ACOE) Hydrologic Engineering Center (HEC). Inputs to the HEC-RAS model include channel geometry, boundary conditions, hydraulic roughness, and hydrology. HEC-GeoRAS is a HEC-developed pre-/post-processor to the hydraulic model HEC-RAS and was used to compile and store a three-dimensional representation of the land surface for defining channel and floodplain geometry. A Triangular Irregular Network (TIN) was created from surveyed 2-foot topographic data using the ArcInfo program Topogrid. The TIN was used to extract geometric data for hydraulic analysis. The original River modeling prepared by Sikand Engineering and utilized in the Newhall Ranch Revised Additional Analysis, Volume VIII (May 2003) used the HEC-RAS predecessor hydraulic model, HEC-2. The HEC-2 geometric data input methodology utilized proprietary hydraulic modeling software BOSS, which follows a very similar data input methodology as described above. The original HEC-2 model was converted and input into HEC-RAS.

The HEC-RAS model was used to provide current state of the art one-dimensional hydraulic water surface profile modeling data output. The output data from HEC-RAS is capable of being utilized by Graphic Information System (GIS) software in a variety of methods, which facilitate more detailed evaluation of the modeling output data such as water surface elevation, floodplain limit, velocity, depth of flow, and other hydraulic parameters.

The Newhall Ranch HEC-RAS model was submitted and approved by LACDPW in the Newhall Ranch Santa Clara River HEC-RAS Modeling study (December, 2005) prepared by PACE. The report included the capital discharge run with Manning's values of 0.025, 0.060 and 0.085 for the existing and proposed conditions. The proposed condition includes proposed soil cement bank protection including: 1) the previously approved WRP soil cement, 2) bank protection between Potrero and Grande confluences (Landmark Village off-site/Homestead West), 3) Homestead bank protection, 4) Landmark Village Soil Cement bank protection (both north and south banks), 5) Commerce Center Drive/HWY 126 Widening bank protection, 6) Castaic Junction Soil Cement bank protection, and 7) 1,000 linear feet of buried soil cement protection on the north bank of the river east of the approved WRP. Number 5 and 6 are not a part of Newhall Ranch. Three bridges are included in the model: 1) Commerce Center Drive Bridge, 2) Long Canyon Bridge, and 3) Potrero Canyon Bridge. Design data for the bridges was the latest available at the time of this report. The approved model was used for both the approved fluvial study conducted by PACE (Newhall Ranch River Fluvial Study Phase 1 Final Draft (March 9, 2006) and this Landmark Village EIR Technical Study.

It is important to note that the HEC-RAS study, as well as the fluvial study, covers the Santa Clara River corridor from I-5 to an area generally west of the Ventura County/Los Angeles County line, of which the Landmark Village project is a part. The Landmark project is comprised of 1) a total of approximately 11,000 linear feet of buried soil cement protection on the north side of the river with an additional 1,200 linear feet east of the approved WRP, 2) 6,400 linear feet of buried soil cement bank protection on the south side of the River adjacent to the Long Canyon Road Bridge, and 3) 6,600 linear feet of TRMs (or other non-hardened bank protection method) installed downstream of the project site along the northern edge of the river corridor from Chiquito Canyon to San Martinez Grande Canyon. The studies that include areas outside of the Landmark project consider impacts to the Landmark project from all of the proposed Newhall Ranch improvements and they act as boundary conditions both in terms of maximum flow and physical extent.

The numerical modeling prepared for Landmark Village is consistent with that prepared for the Newhall Ranch Specific Plan Program EIR. Discharges include the 0.5 (2-year), 0.2 (5-year), 0.1 (10-year), 0.05 (20-year), 0.02 (50-year), and 0.01 (100-year) annual probability return periods. The numerical modeling includes velocity distributions for more than 100 River cross-sections and more than 20 tributary cross-sections. A portion of these cross-sections is illustrated in Figure 1.4. Manning's roughness values for the model bed were taken from analysis of aerial photography of the Project site, and vary horizontally along each model cross-section. The proposed conditions analysis was conducted by modifying the existing conditions model such that bank protection, described below, was placed within the model as encroaching levees. The impacts of the bridge are included as a part of the numerical modeling analysis.

The Project models for the River were created by modifying existing cross-section geometrics of the River to simulate the hydraulic effects of the proposed Project soil cement and erosion protection, including the Long Canyon Road Bridge abutments and piers. The encroachment due to the soil cement was conservatively approximated with levees as a part of the geometry in the hydraulic model. The modeling of the proposed Long Canyon Road Bridge span, soil cement, pier spacing, and abutment locations are substantially consistent with the Newhall Ranch Revised Additional Analysis, Volume VIII (May 2003). For modeling and impact analysis consideration, these conservative bridge configurations would have the greatest impact on River hydraulics. It should be pointed out that the present analysis is based on the Project-specific design details, not assumptions from the previous Newhall Ranch Specific Plan evaluation.

Existing Santa Clara River discharge rates for the 2-, 5-, 10-, 20-, 50-, and 100-year storm events were obtained from a 1994 U.S. ACOE study entitled, Santa Clara River Adopted Discharge Frequency Values. The revised Q_{CAP} values are provided by LACDPW. This study is based upon a frequency analysis of stream flow data along the Santa Clara River and, therefore, approximates River flows from observed data. These values are presented in Table 2.2. It is important to note that these values include discharges from upstream tributaries and direct runoff from the watershed. Additionally, the approved Newhall Ranch HEC-RAS and fluvial studies use the revised Q_{CAP} discharge as shown in Table 2.2, while the previous analysis including the ML maps and Specific Plan EIR use the older Q_{CAP} discharges also shown in the table.

Six of the seven recurrence intervals included in the analysis were obtained from the 1994 study; the seventh, the Los Angeles County Capital Flood, is referenced from the previously published LACDPW ML Maps 43-ML-24 and 43-ML-25 of floodplain and floodway.

Table 2.2 Santa Clara River Existing Conditions Discharge By Return Period (cfs)

Location	Station	2-year	5-year	10-year	20-year	50-year	100-year	Q_{CAP-SP}	Q_{CAP}
DS Commerce Center Drive	35245	1,720	5,240	9,490	15,600	27,500	40,300	138,000	116,236
At Castaic Cr. Confluence	32265	2,527	8,232	14,942	24,157	41,141	58,207	163,000	140,776
DS Chiquito Cr. Confluence	22195	2,558	8,333	15,123	24,453	41,646	58,922	165,000	141,426
At Grande Cyn. Cr. Confluence	17360	2,581	8,408	15,263	24,675	42,025	59,457	166,500	141,426
DS Protrero Cr. Confluence	15125	2,600	8,480	15,400	24,900	42,400	60,000	168,000	142,475

DS - downstream; Q_{CAP-SP} - Q_{CAP} used for the Specific Plan EIR

The following hydraulic modeling parameters apply to the two scenarios analyzed in this report:

1. Bank stations;
2. Hydraulic roughness; and
3. Boundary conditions.

As stated previously, buildout or cumulative condition parameters are not addressed in this report, because they were analyzed previously in the certified Newhall Ranch EIR, as revised by the Revised Additional Analysis, and there have been no significant changes to the Specific Plan or its circumstances that would warrant a reanalysis of the prior program-level assessment conducted for the entire Specific Plan area (which includes the Project site).

1. Bank Stations: The bank station locations are approximated as the water surface elevation level of the runoff from an existing scenario 2-year storm event. The 2-year return interval approximates a typical ordinary high water mark.

2. Hydraulic Roughness: Discharge is calculated using hydraulic roughness coefficients in the Manning's equation. Manning's roughness coefficient values are employed in Manning's equation of the form:

$$Q = \frac{1.49}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

where *Q* is the discharge in cfs, *n* is Manning's roughness coefficient, *A* is the flow area, *R* is the hydraulic radius, and *S* is the energy slope.

For this report, the Manning's roughness coefficients were estimated from local condition observations of in-stream and floodplain vegetation, mapped by field biologists (Impact Sciences, 2002). Table 2.3 shows the variation of Manning's roughness coefficients based on vegetation and how those compare to published values. It is important to note that LACDPW bank protection design criteria require use of *n=0.085* and *0.025* for final design of bank protection top and toe elevation, respectively.

Table 2.3: Hydraulic Roughness Coefficients

Vegetation/Land Use	Manning's Roughness Coefficient [used in this study]	Reference Manning's Coefficient (Chow 1959)
Sand with no vegetation	0.025	0.025-0.033
Sand with Sporadic Growth/Grass Pasture	0.035	0.03-0.05
Scattered Brush/Heavy Weeds/Light Brush and Trees	0.05	0.035-0.07
Dense trees	0.15	0.11-0.20

3. Boundary Conditions: Boundary conditions represent the flow conditions at the limits of the hydraulic analysis. In this study, boundary conditions reflect normal depth and an approximate channel slope of 0.5 percent at the upstream boundary and critical depth at the downstream boundary. The input hydrology is the flow rate data for the seven return periods as documented in Table 2.2.

The proposed Project model was created by modifying existing condition cross-section geometries to simulate the proposed Project soil cement and bridges. The encroachment due to the soil cement was approximated with levees in the hydraulic model (model levees set at equivalent elevation on slope of channel invert).

Three minor modifications, as compared to the Newhall Ranch EIR analysis, are proposed with the Project flood protection improvements. They are as follows: (1) modifications to the location of the soil cement tie-in at Chiquito Canyon Creek; (2) avoidance of riparian resource areas near the proposed central park area in the Project site; and (3) a minor realignment of the soil cement both upstream and downstream of the Long Canyon Road Bridge. All three of the bank position modifications are cases in which flood protection is pulled further back from the channel (*i.e.*, farther away from the River) than what was analyzed in the Newhall Ranch Revised Additional Analysis, Volume VIII (May 2003).

2.3 Santa Clara River Fluvial Mechanics

An evaluation of the existing and proposed fluvial characteristics and long-term stability of Santa Clara River between Interstate 5 and an area generally west of the Los Angeles/Ventura County line in the vicinity of the Newhall Ranch Specific Plan was previously prepared by PACE (Newhall Ranch River Fluvial Study Phase 1 Final Report [March 6, 2006]) and approved by LACDPW. Development along the River within the study area has the potential to modify the fluvial mechanics of the River, and the PACE fluvial analysis evaluates impacts from build-out of Newhall Ranch from (1) fluvial modifications of the river bed from single hypothetical storm events, and (2) changes in the floodplain fluvial operation over the long-term. It is important to note that the HEC-RAS and fluvial study covers an area from I-5 to generally west of the Ventura County/Los Angeles County line and is not just limited to the Landmark project site, as noted above.

2.3.1 Sediment Data Collection

Sediment data collection for the Santa Clara River along the study reach was conducted by Allan E. Seward Engineering Geology Inc. Eighteen samples were collected at six different locations positioned along River subreaches. All sampling was conducted using grab samples of the upper foot of the active or recently active portion of the bed. No fine material is included in the sediment analysis because fine material is generally transported as wash load. A review of the raw gradation curves indicates that most samples are comprised of poorly graded sands with gravels and silts. The D50 values for all samples ranged from 0.25 to 4.67 mm with an average of 0.8 mm. Additionally, previous studies noted above also found similar sandy characteristics.

2.3.2 Fluvial Analysis Components

Modifications to the river bed are measured as bed adjustment in feet. Positive adjustment indicates aggradation and negative adjustment indicates degradation. Several types of adjustment are considered in the PACE study including general adjustment, long-term adjustment, and other scour. General adjustment is scour that occurs in an individual discharge event and is calculated as the difference between sediment inflow and outflow of a given River reach. Long-term adjustment consists of fluvial processes that occur over several years. Other scour is made up of local scour, bend scour, low-flow incisement, and bedform formation.

General adjustment was estimated in this study using the US Army Corps of Engineers (ACOE) SAM steady-state, zero-dimensional numerical model. SAM is utilized to provide a first approximation of sediment transport potential for subreaches within Santa Clara River. The SAM numerical model is built upon hydraulic and fluvial representations of the study bed. The hydraulic component includes representations of bed characteristics and discharge. The fluvial component includes representation of bed gradation and sediment transport functions. SAM's hydraulic component utilized average cross-section data imported from HEC-2 numerical models of the river converted from HEC-RAS numerical models. The conversion process modifies the original numerical model, as discussed in Chapter 4 of the PACE study, so some differences in numerical models are created. Both the existing and proposed conditions HEC-RAS models are the same as those approved in the PACE HEC-RAS study of Santa Clara River. River subreaches that make up the SAM model are determined by examining the hydraulic parameters of the individual HEC-RAS cross-sections and identifying correlations between those hydraulic parameters and the longitudinal position in the channel.

Representation of sediment grain size distribution in SAM is percent finer data obtained from sieve analysis of channel sediment samples. At each sample location, multiple samples are collected and the average data is input into the model. Sediment transport equations used in all SAM modeling were chosen with the assistance of the Army Corps' SAM.AID subroutine. The SAM.AID subroutine determines the most representative transport function based on the hydraulic parameters and percent finer data by comparing model data with peer-reviewed sediment transport studies. The study found that Meyer-Peter and Muller (MPM) was the representative transport function for all subreaches for both existing and proposed conditions because it produced adjustment values within physical reason.

SAM was run for all River reaches and bed stability was estimated based on the change in potential transport between adjacent channel subreaches for the QCAP discharge. General adjustment was also calculated using the equation specified in the Los Angeles County Hydrology and Sedimentation Manual (LACH&SM).

Long-term adjustment was calculated based on historical records in the form of topographic data. Topographic data dating from 1930, 1947, 1963, 1999, 2004 and 2005, was digitized. Cross-sections were cut at the locations of select HEC-RAS sections for each of the above referenced years from historical topography. At least one cross-section was chosen for each subreach. Areas of the 1947, 1963, 1999, 2004 and 2005 sections are calculated and the areas of the 1947, 2004 and 2005 bed are used to calculate the average change in bed elevation over time. The 1930 topography is not used to calculate average change in bed because the trends in bed change that occurred during this year occurred immediately following the failure of the St. Francis Dam upstream of the project site. Several events within the available historical record (1930 to present) have had an impact on the River bed and fluvial mechanics. Within the project reach, the failure of the Dam appears to have resulted in the abrupt scour of the bed. The sectional analysis finds that some historical sections (SRD2, SRD3, SRE1, SRE2) show little change between 1947 and 2005 suggesting an approximate equilibrium state for these subreaches. Between 1947 and 2005, 0.5, 0.7, 1.0, and 0.8 feet, respectively, of cumulative degradation appears to have occurred on these sections. Upstream sections SRA1 to SRC3 show continuous degradation over the period of record from 1947 to the present. Three sections, SRC4, SRD1 and SRE3 aggraded cumulatively between 1947 and 2005 by 1.9, 1.4, and 3.1 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 the Summer of 2004 and the heavy rains of the 2004/2005 rainy season. This combination had the potential to produce high sediment runoff loading into the River. Degradation seems to be more prevalent on the upper half of the study reach while mild fluctuations are more apparent on the lower half. This appears to result from the relatively steep, narrow, winding upper portion of the study reach versus the relatively flat, wide, braided channel in the lower portion of the study reach of the River. Agricultural activities occurred, primarily in downstream sections but in upstream sections as well, so some of the observed channelization may have resulted from these activities.

Other scour considered in this study is comprised of four sub-categories: local scour, bend scour, low-flow incisement, and bedform height. Local scour occurs in the vicinity of flow obstructions including piers and abutments. Bend scour occurs because of velocity gradients around curves in fluvial systems. Three distinct bends are located in the study reach. Low flow incisement is included to represent thalweg or low flow channel depth. On-site inspection and review of historic data of this feature suggest a thalweg depth of approximately two feet. Finally, bedform height represents the dunes and anti-dunes that develop in active soft-bottomed channels during flow events. In this study, bedform height has been limited after Kennedy (1963).

General adjustment, long-term adjustment, and other scour are summed to determine total potential bed adjustment following LACH&SM methodology (Figure 2.1). For cross-sections where SAM modeling predicts aggradation, the general adjustment contribution to total bed adjustment is not included for degradation calculations.

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. Freeboard elevation is calculated in this study based on LACH&SM Chapter 5A-3, and includes LACFCDDM calculations.

3 Existing Conditions

3.1 Drainage Areas and Watercourses

The Santa Clara River traverses the southern portion of the Project site, which is located within a contributing drainage of 996 acres out of the 1,634 square mile Santa Clara River watershed basin (Psomas, Landmark Village Drainage Concept Report). This area represents less than 1 percent of the Santa Clara River basin and consists primarily of agricultural and vacant property. Rainfall in the tributary area is an annual average of 17-inches and generally occurs in the winter months. Runoff flows to and through six contributing drainage areas on the site via sheet flows and natural concentrated flows.

3.1.1 Santa Clara River

The reach of the Santa Clara River adjacent to, and downstream of, the Project site has perennial surface flows primarily created by tertiary treated effluent discharges from two upstream water reclamation plants operated by the County Sanitation Districts of Los Angeles County. Natural flows in the River usually only occur in the winter due to storm runoff. The flows vary significantly from year-to-year.

The reach of the River within and adjacent to the Project site has multiple channels (braided). This kind of system is characterized by high sediment loads, high bank erodibility, and intense and intermittent runoff conditions. Combined with the relatively flat gradient of the River at this point (less than one percent), the River has a high potential to aggrade (deposit sediment) at low flow velocities.

Velocities and water surface elevations in the River vary from section-to-section based on various hydraulic and hydrologic parameters. In general, velocity and depth along the River will increase with higher discharge. An example of these relationships is provided in Table 3.1. This data indicates that velocities measured in feet per second (fps), more than double, on average, from the 2-year to the 100-year event, while depth increases approximately 10.25 times, on average. In contrast, discharge increases almost 24 times from the 2-year to the 100-year event. Velocity and water depth percent increases do not correspond to the percent discharge increases because the wide River channel allows flood flows to spread out with increasing discharge.

TABLE 3.1: DISCHARGE, VELOCITY AND FLOW AREA CHANGES BY CROSS SECTION FOR Q2 AND Q100

STATION	EVENT	Q (CFS)	VELOCITY (FPS)	FLOW AREA (SQFT)	Q_{100}/Q_2	A_{100}/A_2
33310	Q2	1720	4.6	374.6		
	Q100	40300	9.7	4146.7	2.1	11.1
33115	Q2	1720	2.9	602.9		
	Q100	40300	10.4	3874.9	3.6	6.4
32795	Q2	1720	4.9	348.2		
	Q100	40300	8.4	4787.8	1.7	13.7
32605	Q2	1720	4.0	432.0		
	Q100	40300	7.4	5413.7	1.9	12.5
32265	Q2	2527	5.4	468.3		
	Q100	58207	10.9	5362.5	2.0	11.5
31875	Q2	2527	3.7	688.4		
	Q100	58207	8.4	6961.4	2.3	10.1
31585	Q2	2527	2.7	950.1		
	Q100	58207	5.7	10229.1	2.1	10.8
31360	Q2	2527	4.3	592.5		
	Q100	58207	7.2	8074.1	1.7	13.6
31060	Q2	2527	5.4	464.8		
	Q100	58207	5.2	11250.0	1.0	24.2
30720	Q2	2527	3.8	668.1		
	Q100	58207	4.0	14526.6	1.1	21.7
30445	Q2	2527	5.7	446.6		
	Q100	58207	3.6	16362.6	0.6	36.6
30095	Q2	2527	2.3	1119.8		
	Q100	58207	3.6	16071.5	1.6	14.4
29815	Q2	2527	1.7	1461.3		
	Q100	58207	4.2	13861.0	2.4	9.5
29565	Q2	2527	1.3	2017.5		
	Q100	58207	4.2	13770.7	3.4	6.8
29385	Q2	2527	1.5	1654.8		
	Q100	58207	5.2	11200.7	3.4	6.8
29140	Q2	2527	3.5	727.8		
	Q100	58207	8.5	6820.6	2.5	9.4
28895	Q2	2527	7.8	325.8		
	Q100	58207	15.7	3712.6	2.0	11.4
28695	Q2	2527	5.2	483.1		
	Q100	58207	25.1	2315.0	4.8	4.8
28500	Q2	2527	6.7	379.0		
	Q100	58207	22.5	2588.7	3.4	6.8
28280	Q2	2527	3.8	670.9		
	Q100	58207	16.5	3528.9	4.4	5.3
28080	Q2	2527	4.6	545.7		
	Q100	58207	16.3	3566.8	3.5	6.5
27925	Q2	2527	6.0	422.4		
	Q100	58207	14.6	4000.1	2.4	9.5
27725	Q2	2527	3.4	745.9		
	Q100	58207	16.5	3535.9	4.9	4.7
27545	Q2	2527	6.1	413.5		
	Q100	58207	16.9	3438.7	2.8	8.3
27335	Q2	2527	3.6	703.4		
	Q100	58207	18.2	3207.5	5.1	4.6
27155	Q2	2527	3.9	654.1		
	Q100	58207	14.9	3906.9	3.9	6.0

TABLE 3.1: DISCHARGE, VELOCITY AND FLOW AREA CHANGES BY CROSS SECTION FOR Q_2 AND Q_{100} (CONTINUED)

STATION	EVENT	Q (CFS)	VELOCITY (FPS)	FLOW AREA (SQFT)	Q_{100}/Q_2	A_{100}/A_2
26990	Q2	2527	5.6	451.4		
	Q100	58207	15.2	3841.5	2.7	8.5
26780	Q2	2527	5.4	465.3		
	Q100	58207	18.0	3240.4	3.3	7.0
26575	Q2	2527	3.3	756.7		
	Q100	58207	11.7	4958.9	3.5	6.6
26355	Q2	2527	6.4	392.2		
	Q100	58207	12.5	4675.8	1.9	11.9
26170	Q2	2527	4.6	550.6		
	Q100	58207	9.9	5861.5	2.2	10.6
25965	Q2	2527	3.6	707.6		
	Q100	58207	8.9	6512.3	2.5	9.2
25785	Q2	2527	2.7	945.2		
	Q100	58207	8.5	6860.9	3.2	7.3
25600	Q2	2527	5.7	447.0		
	Q100	58207	10.4	5578.0	1.8	12.5
25425	Q2	2527	3.9	646.6		
	Q100	58207	8.8	6640.0	2.2	10.3
25215	Q2	2527	6.6	383.6		
	Q100	58207	10.8	5394.3	1.6	14.1
25000	Q2	2527	5.1	493.4		
	Q100	58207	13.8	4209.4	2.7	8.5
24795	Q2	2527	6.1	414.4		
	Q100	58207	13.7	4242.0	2.2	10.2
24550	Q2	2527	4.0	639.3		
	Q100	58207	14.9	3907.6	3.8	6.1
24335	Q2	2527	5.3	474.0		
	Q100	58207	9.8	5955.9	1.8	12.6
24115	Q2	2527	5.8	435.7		
	Q100	58207	11.0	5298.9	1.9	12.2
23975	Q2	2527	4.5	557.9		
	Q100	58207	10.7	5438.6	2.4	9.7
23755	Q2	2527	6.7	376.1		
	Q100	58207	8.5	6831.8	1.3	18.2
23565	Q2	2527	5.2	486.8		
	Q100	58207	9.9	5902.0	1.9	12.1
23365	Q2	2527	6.7	378.5		
	Q100	58207	11.7	4997.7	1.7	13.2
23180	Q2	2527	4.4	571.4		
	Q100	58207	12.9	4511.1	2.9	7.9
23000	Q2	2527	5.6	452.1		
	Q100	58207	7.4	7918.4	1.3	17.5
22790	Q2	2527	4.6	549.3		
	Q100	58207	8.7	6684.7	1.9	12.2
22600	Q2	2527	4.4	578.2		
	Q100	58207	8.6	6807.8	2.0	11.8
22415	Q2	2527	5.9	430.4		
	Q100	58207	8.2	7100.3	1.4	16.5
22195	Q2	2558	6.8	378.8		
	Q100	58922	12.3	4789.4	1.8	12.6
22010	Q2	2558	4.7	550.2		
	Q100	58922	15.2	3886.9	3.3	7.1

TABLE 3.1: DISCHARGE, VELOCITY AND FLOW AREA CHANGES BY CROSS SECTION FOR Q_2 AND Q_{100} (CONTINUED)

STATION	EVENT	Q (CFS)	VELOCITY (FPS)	FLOW AREA (SQFT)	Q_{100}/Q_2	A_{100}/A_2
21790	Q2	2558	4.2	608.4		
	Q100	58922	11.3	5194.9	2.7	8.5
21615	Q2	2558	5.4	476.7		
	Q100	58922	9.9	5982.6	1.8	12.5
21440	Q2	2558	3.7	699.2		
	Q100	58922	12.6	4688.1	3.4	6.7
21225	Q2	2558	6.7	381.5		
	Q100	58922	10.7	5493.6	1.6	14.4
21020	Q2	2558	2.3	1113.5		
	Q100	58922	16.1	3657.5	7.0	3.3
20845	Q2	2558	5.4	473.9		
	Q100	58922	9.8	6020.3	1.8	12.7
20595	Q2	2558	3.6	705.3		
	Q100	58922	7.7	7689.4	2.1	10.9
20435	Q2	2558	2.7	962.3		
	Q100	58922	6.9	8499.8	2.6	8.8
20280	Q2	2558	5.6	460.5		
	Q100	58922	10.5	5630.4	1.9	12.2
20070	Q2	2558	5.5	465.8		
	Q100	58922	15.5	3791.2	2.8	8.1
19855	Q2	2558	4.9	526.5		
	Q100	58922	11.2	5248.7	2.3	10.0
19630	Q2	2558	5.6	460.6		
	Q100	58922	12.2	4828.3	2.2	10.5
19440	Q2	2558	3.7	684.7		
	Q100	58922	7.7	7618.7	2.1	11.1
19240	Q2	2558	5.0	512.0		
	Q100	58922	8.9	6637.4	1.8	13.0
19050	Q2	2558	4.7	550.4		
	Q100	58922	6.9	8605.3	1.5	15.6
18830	Q2	2558	6.2	414.7		
	Q100	58922	6.5	9013.4	1.1	21.7
18650	Q2	2558	5.5	461.9		
	Q100	58922	5.7	10437.5	1.0	22.6
18475	Q2	2558	4.5	565.8		
	Q100	58922	4.9	12129.1	1.1	21.4
18290	Q2	2558	6.5	394.0		
	Q100	58922	5.0	11680.0	0.8	29.6
18025	Q2	2558	3.1	825.2		
	Q100	58922	4.4	13528.9	1.4	16.4
17785	Q2	2558	3.4	747.3		
	Q100	58922	4.9	12068.3	1.4	16.2
17510	Q2	2558	3.6	711.3		
	Q100	58922	8.1	7301.5	2.2	10.3
17360	Q2	2581	4.3	600.4		
	Q100	59457	9.6	6222.2	2.2	10.4
17110	Q2	2581	4.8	536.8		
	Q100	59457	9.0	6576.4	1.9	12.3
16970	Q2	2581	3.9	667.8		
	Q100	59457	13.4	4448.7	3.5	6.7
16720	Q2	2581	5.7	450.2		
	Q100	59457	12.0	4967.5	2.1	11.0

TABLE 3.1: DISCHARGE, VELOCITY AND FLOW AREA CHANGES BY CROSS SECTION FOR Q_2 AND Q_{100} (CONTINUED)						
STATION	EVENT	Q (CFS)	VELOCITY (FPS)	FLOW AREA (SQFT)	Q_{100}/Q_2	A_{100}/A_2
16515	Q2	2581	6.7	383.6		
	Q100	59457	11.2	5304.4	1.7	13.8
				MAXIMUM=	7.0	36.6
				MINIMUM=	0.6	3.3
				AVERAGE=	2.4	11.7

3.1.2 On-Site Drainages

Flows discharge from the Project to the River from six on-site areas (18 sub-basins). The acreage for each of the existing drainage subbasins is provided in Table 3.2. There are currently no existing drainage or erosion/sedimentation control improvements located within the Project site other than existing minor agricultural drainage ditches and an insignificant amount of earthen River bank protection. The Chiquita Landfill drainage drains through the Project site and this man-made, open drainage would be put into pipe upon completion of the Project. However, the Project is not proposing to drain into this channel and, therefore, it would remain a separate, unmodified discharge.

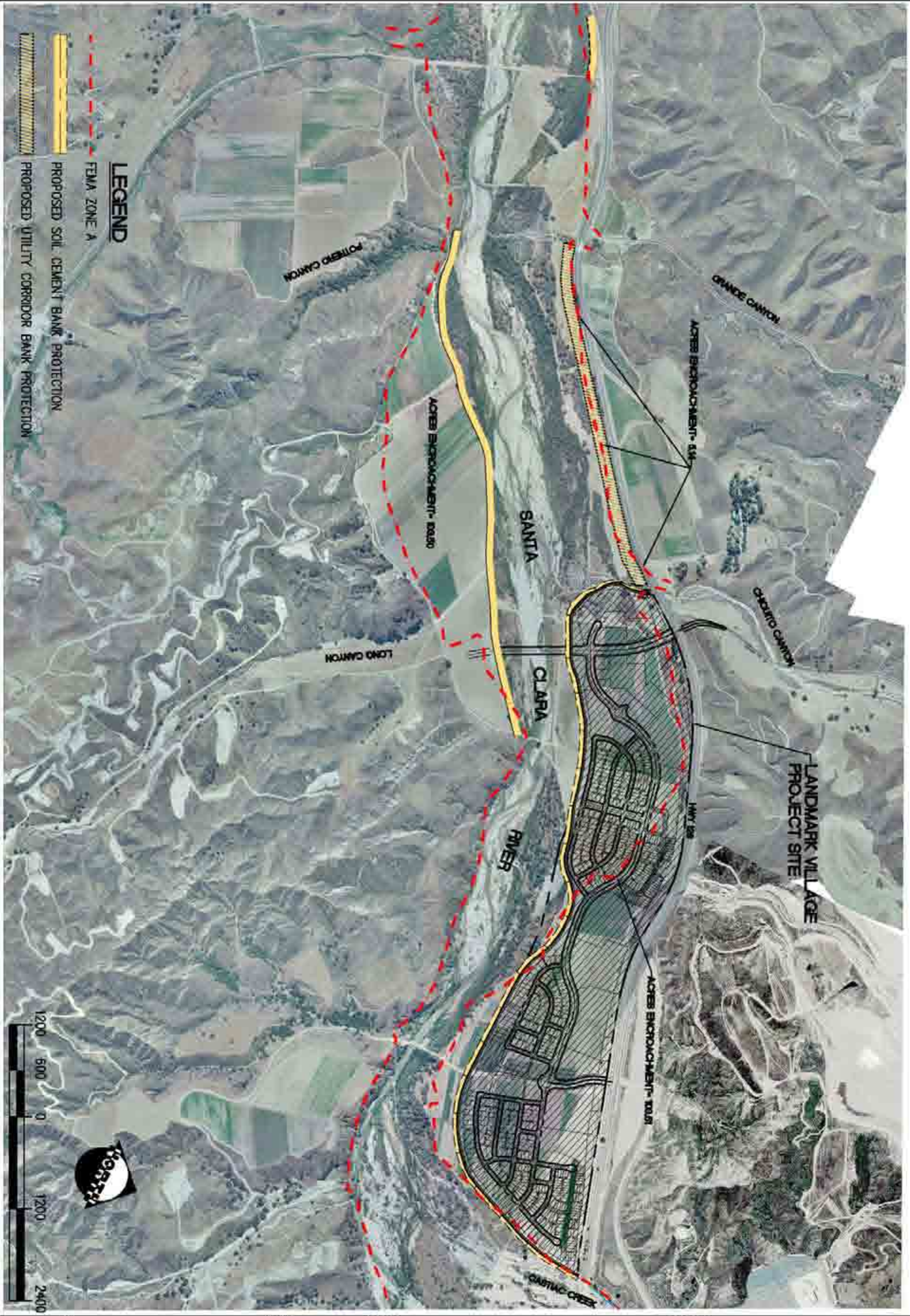
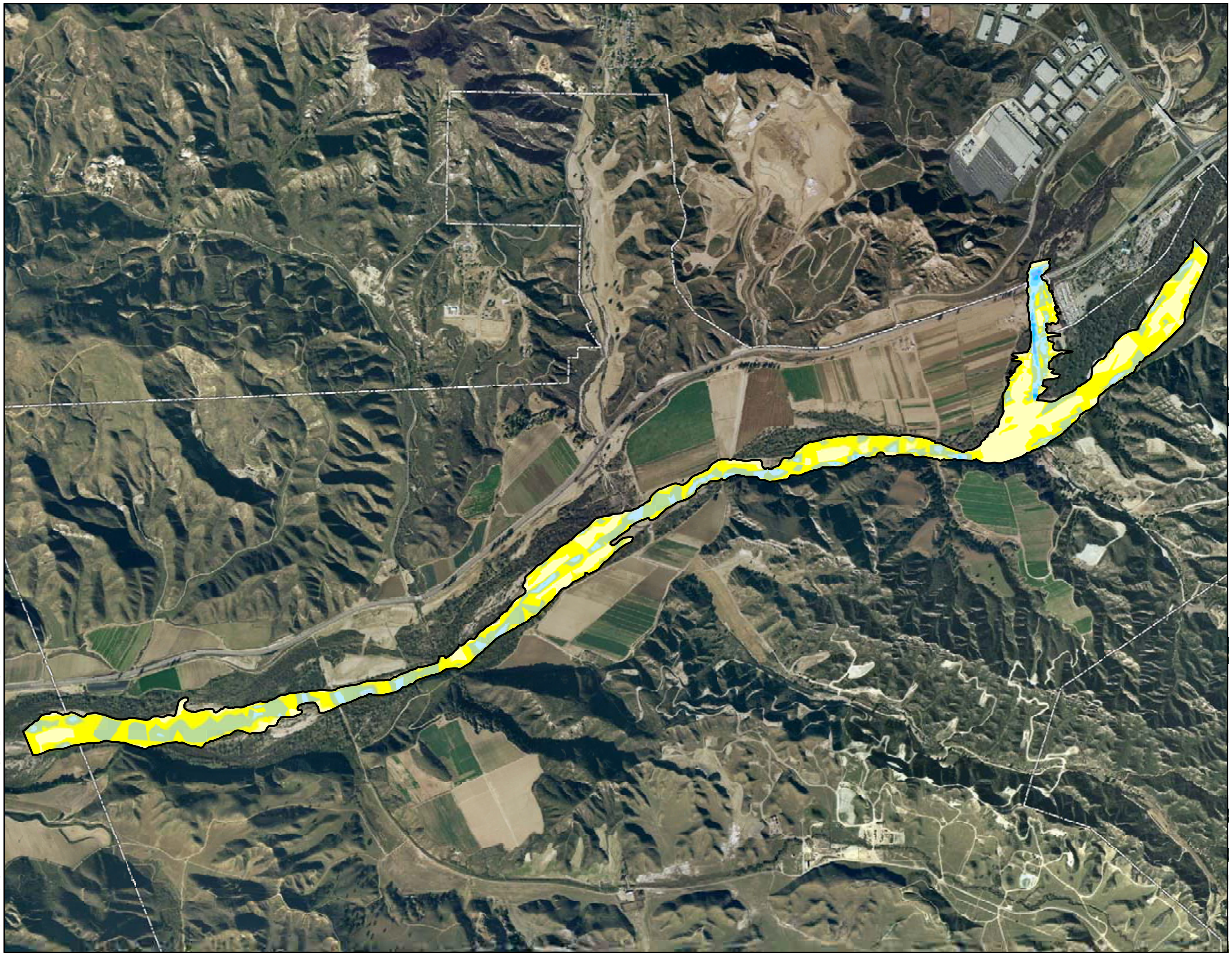


FIGURE	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 1200'	JOB	TITLE
3.1		DESIGNED DJ	LANDMARK VILLAGE	FEMA FLOOD PLAIN
		DRAWN JEP		
		CHECKED MEK		
		DATE 04-26-05		
		JOB NO.	SANTA CLARITA CA	

P:\7841E\Engineering\GlobalExhibits\7841E-FLOODWAY-MAP-FIG 3.1.dwg — Tab: IMPROV MAP-1000 SCALE By: ddrohn on Jun. 30, 2005 at 10:30 am



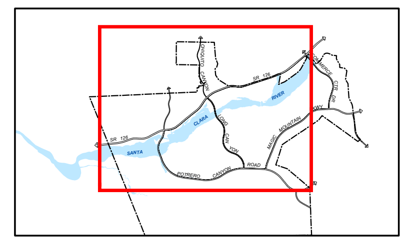
NEWHALL RANCH
Newhall Ranch Company

L E G E N D

Newhall Ranch Specific Plan Boundary

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



Feet: 1,000 500 0 1,000
Meters: 305 152.5 0 305

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

Figure 3.2A

EXISTING CONDITIONS
2 YEAR FLOOD EVENT
LANDMARK VILLAGE

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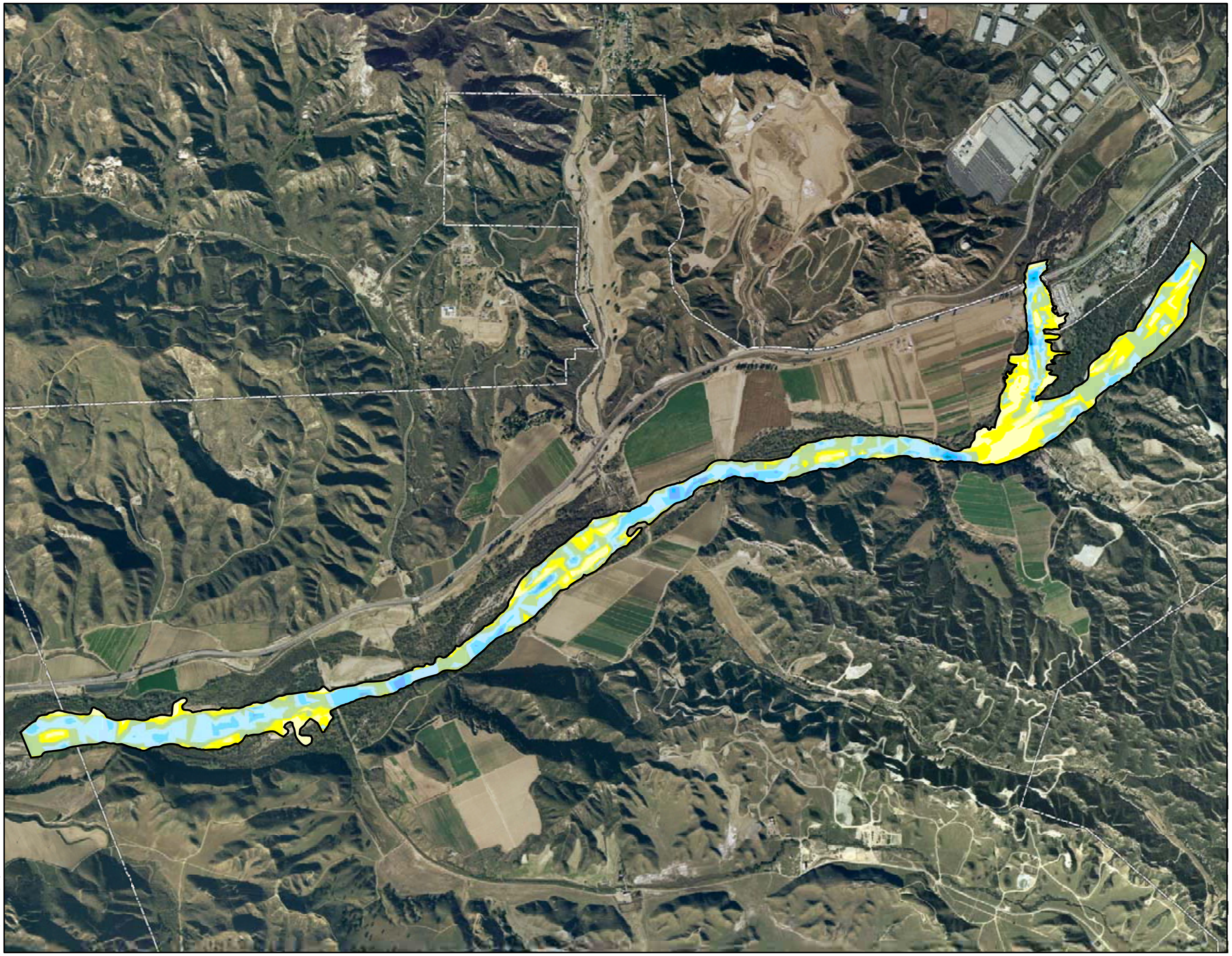

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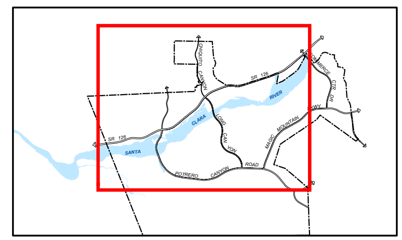
NEWHALL RANCH
Newhall Ranch Company

L E G E N D

Newhall Ranch Specific Plan Boundary

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



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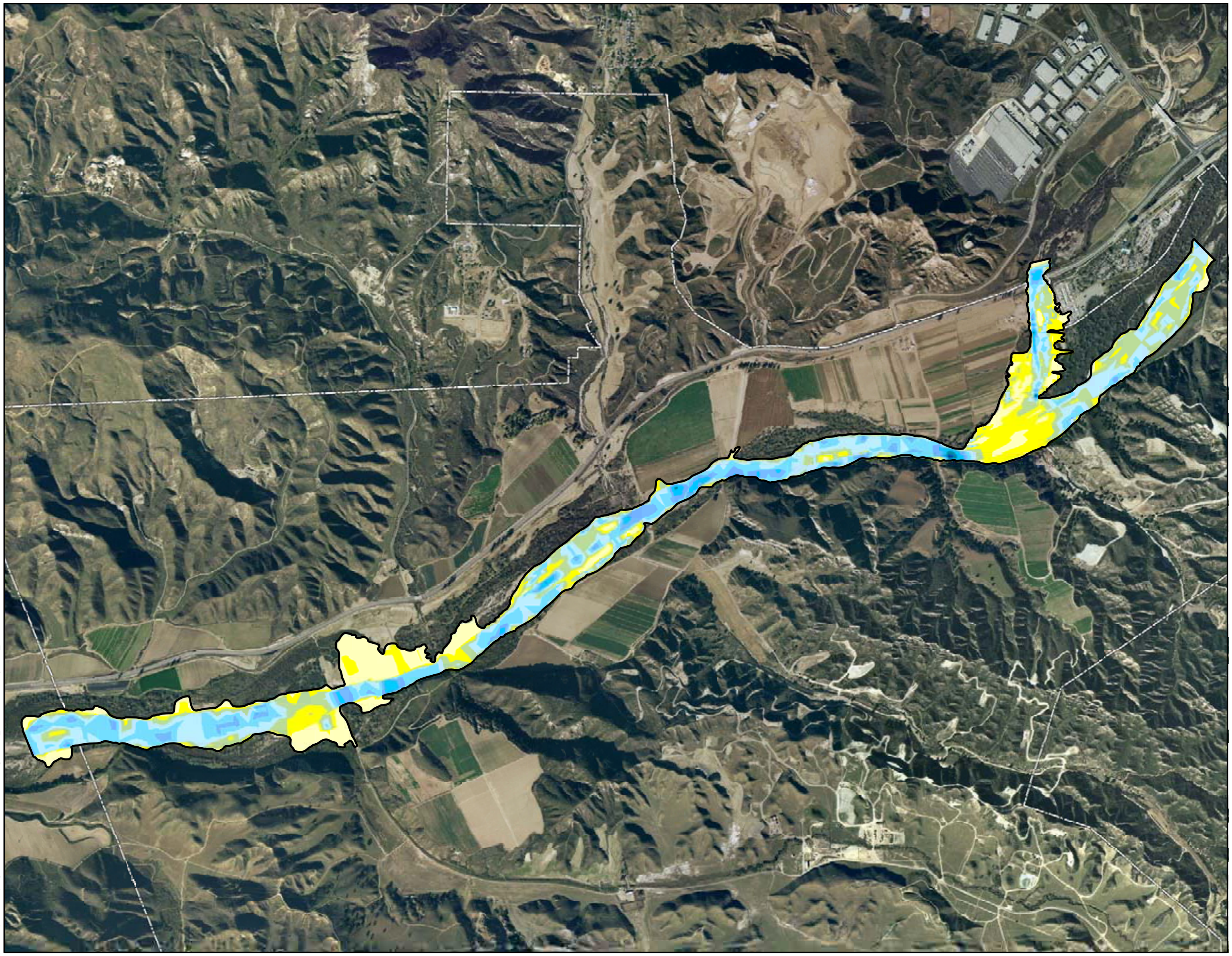
Meters: 305 152.5 0 305

PACE
PACIFIC ADVANCED CIVIL ENGINEERING

Figure 3.2B

EXISTING CONDITIONS
5 YEAR FLOOD EVENT
LANDMARK VILLAGE



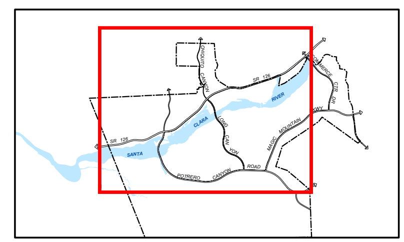
NEWHALL RANCH
Newhall Ranch Company

L E G E N D

Newhall Ranch Specific Plan Boundary

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



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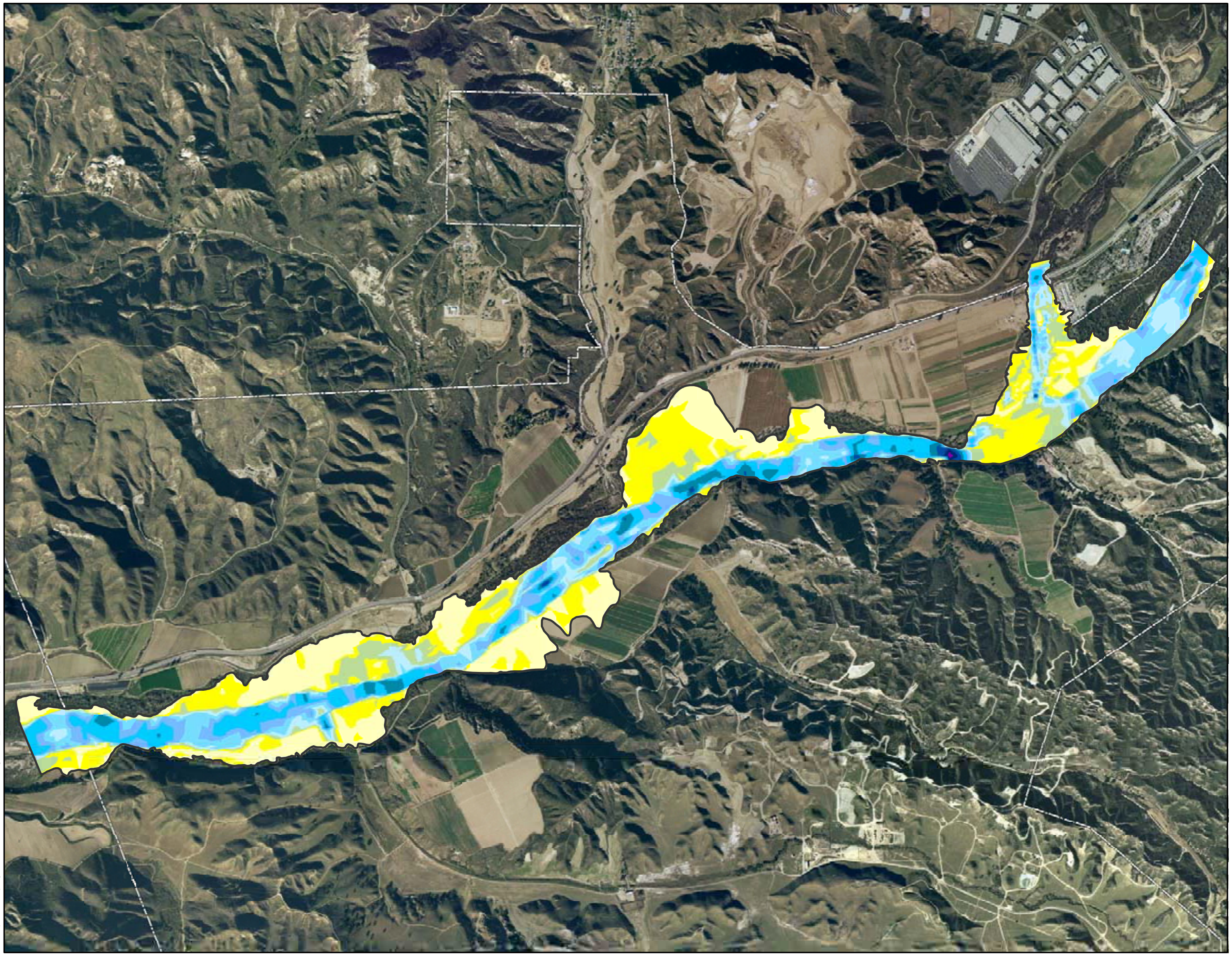
Meters: 305 152.5 0 305

PACE
PACIFIC ADVANCED CIVIL ENGINEERING

Figure 3.2C

EXISTING CONDITIONS
10 YEAR FLOOD EVENT
LANDMARK VILLAGE

FILE: \\pacefs01\projects\8238E\GIS\mxds\existing\8238E_LandmarkEx10yrPC1_041406.mxd



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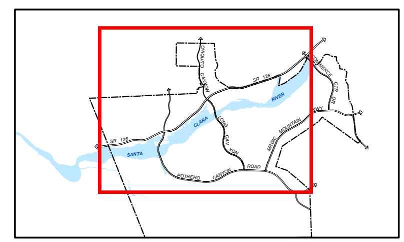
NEWHALL RANCH
Newhall Ranch Company

L E G E N D

Newhall Ranch Specific Plan Boundary

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



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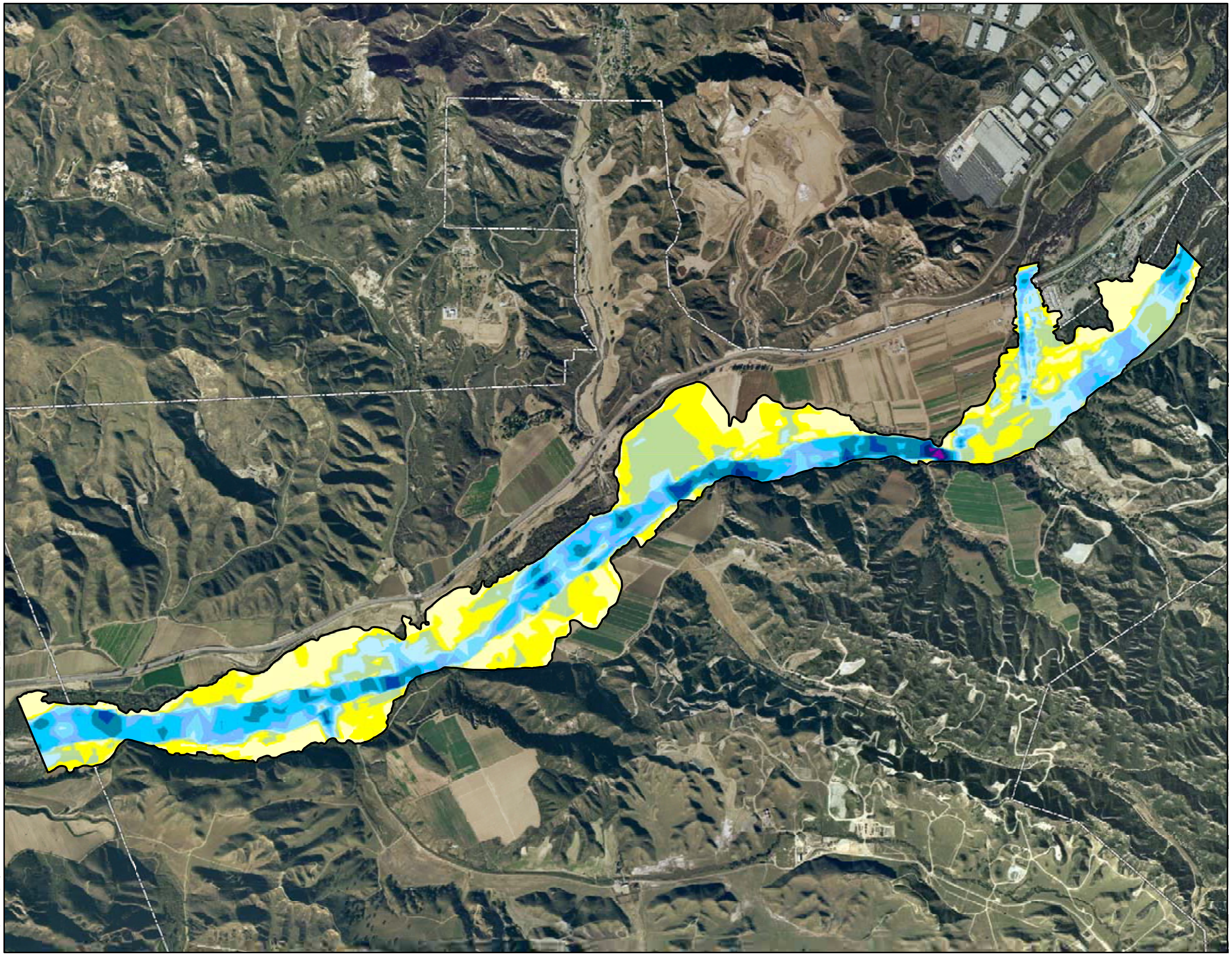
Meters: 305 152.5 0 305

PACE
PACIFIC ADVANCED CIVIL ENGINEERING

Figure 3.2E

EXISTING CONDITIONS
50 YEAR FLOOD EVENT
LANDMARK VILLAGE



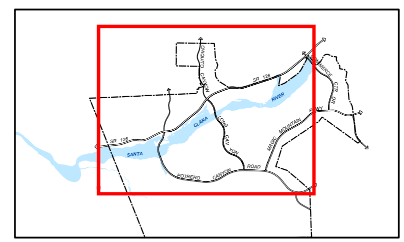
NEWHALL RANCH
Newhall Ranch Company

L E G E N D

Newhall Ranch Specific Plan Boundary

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



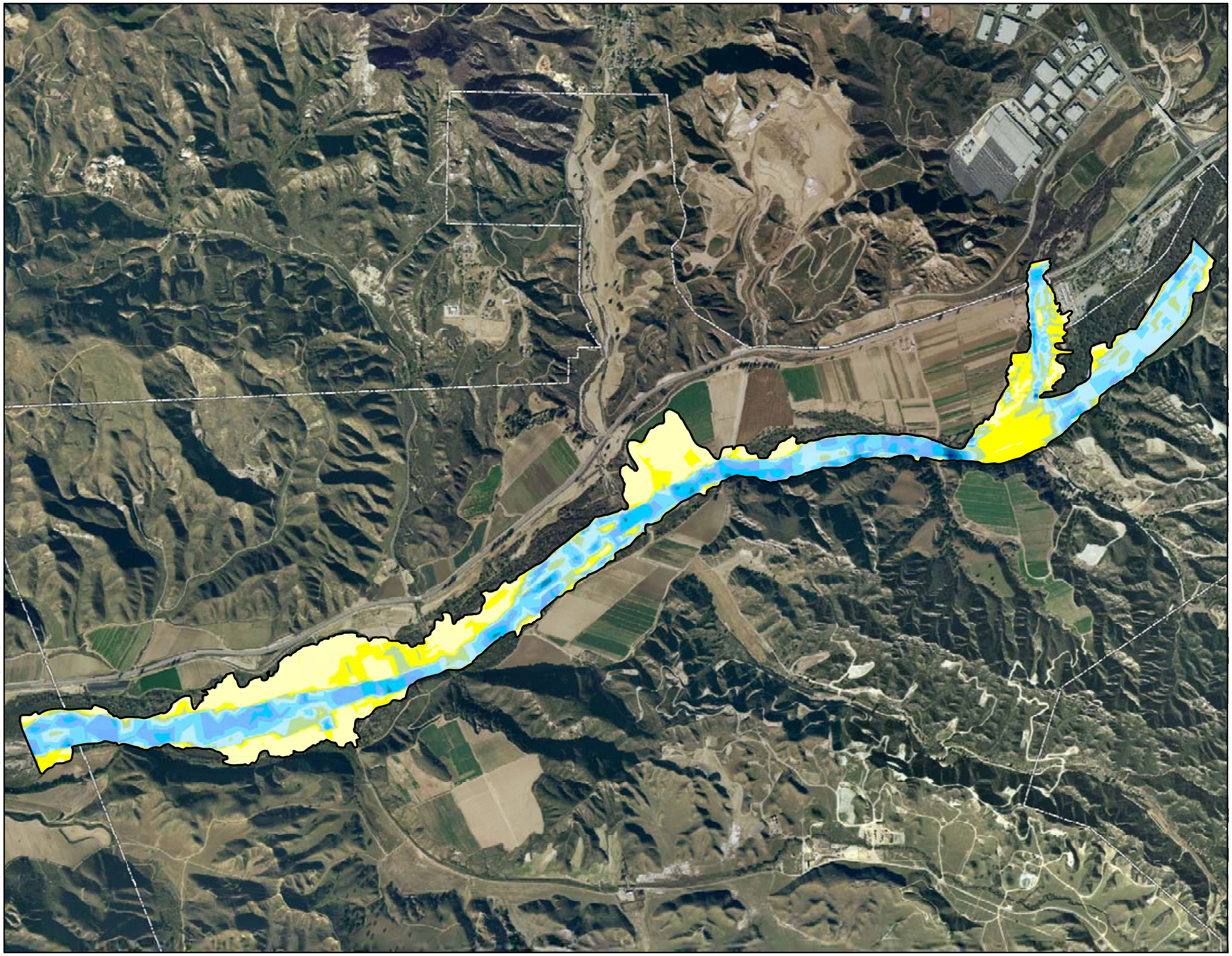
Feet: 1,000 500 0 1,000
Meters: 305 152.5 0 305

PACE
PACIFIC ADVANCED CIVIL ENGINEERING

Figure 3.2F

EXISTING CONDITIONS
100 YEAR FLOOD EVENT
LANDMARK VILLAGE

FILE: \\pacefs01\projects\8238E\GIS\mxds\existing\8238E_LandmarkEx100yrPC1_041406.mxd



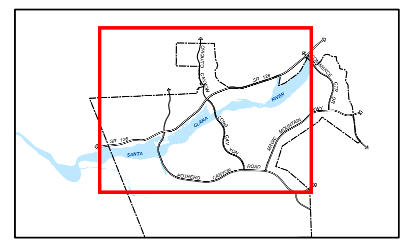
NEWHALL RANCH
Newhall Ranch Company

L E G E N D

Newhall Ranch Specific Plan Boundary

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



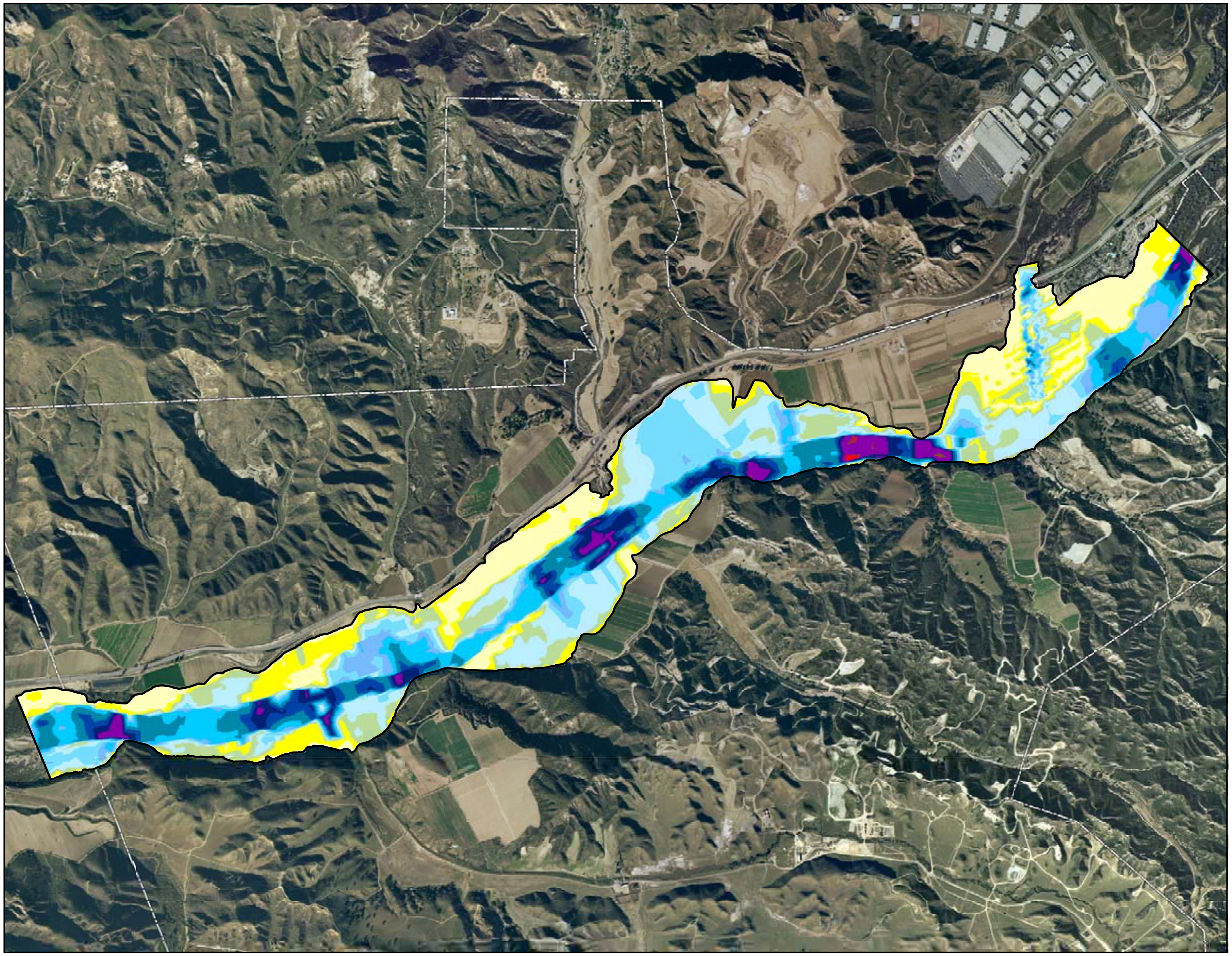
Feet: 1,000 500 0 1,000
Meters: 305 152.5 0 305

PACE
PACIFIC ADVANCED CIVIL ENGINEERING

Figure 3.2D

EXISTING CONDITIONS
20 YEAR FLOOD EVENT
LANDMARK VILLAGE

FILE: \\pacefs01\projects\8238E\GIS\mxds\existing\8238E_LandmarkEx20yrPC1_041406.mxd

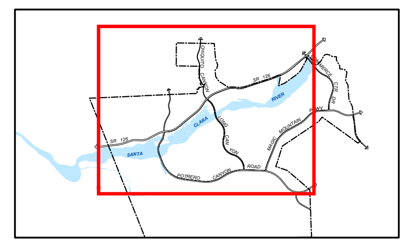


NEWHALL RANCH
Newhall Ranch Company

L E G E N D

Newhall Ranch Specific Plan Boundary

Velocity Profile (fps)
- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



Feet: 1,000 500 0 1,000
Meters: 305 152.5 0 305

PACE Pacific Advanced Civil Engineering

Figure 3.2G

EXISTING CONDITIONS
CAPITAL FLOOD EVENT
LANDMARK VILLAGE

FILE: \\pacefs01\projects\8238E\GIS\mxds\existing\8238E_LandmarkExCapPC1_042706.mxd

Table 3.2: Existing On-site Drainages and Runoff Quantities				
Sub basins	Area (AC)	Capital Storm Event		
		Time of Conc. (min)	Qbb (cfs)	Q/A (cfs/Ac)
100A	32.7	22	54	1.65
110A	49.6	20	87	1.75
200A	17.3	17	34	1.97
210A	35.8	25	55	1.54
400B	18.4	24	29	1.58
405B	38.9	29	54	1.39
408C	15.3	8	46	3.01
410C	44.3	19	81	1.83
415B	35.3	11	89	2.52
420A	34.4	25	53	1.54
425A	39.9	21	69	1.73
500A	26.5	20	47	1.77
510A	40.0	25	61	1.53
CTQ-1A	6.1	8	18	2.95
CTQ-2A	3.6	6	13	3.61
CTQ-3A	1.8	5	7	3.89
CTQ-4A	12.3	10	33	2.68
CTQ-5A	4.4	5	17	3.86
CTQ-6A	24.9	15	52	2.09
CTQ-7A	2.1	5	8	3.81
CTQ-8A	2.8	5	11	3.93
CTQ-9A	31.8	14	70	2.20
CTQ-10A	15.6	11	39	2.50
CTQ-11A	10.2	17	27	2.65
CTQ-12A	11.7	10	40	3.42
620A	12.4	23	20	1.61
Σ	568.1			

Notes:

bb: Burned and bulked flow

This was calculated by Sikand in the Newhall Ranch Specific Plan Master Hydrology and Drainage Concept, Date 3/14/05

Project Site runoff quantities for the Capital Flood for each of the six existing drainages defined by Psomas are provided in Table 3.2. Under existing conditions, combined flows from the Project site to the River total 1,823 cfs. Existing flow rates from observed data for the River at the Project site during 2-, 5-, 10-, 20-, 50-, and 100-year storm events are compiled in Table 3.3.

Table 3.3: Existing Conditions River Discharge Stations 32265 to 22195 Downstream of Castaic Creek Confluence	
Recurrence Interval	**Flow (Discharge) Rate (cfs)**
2-Year[1]	2,527
5-Year[1]	8,232
10-Year[1]	14,942
20-Year[1]	24,157
50-Year[1]	41,141
100-Year[1]	58,207
Capital Flood[2,3]	163,000
Capital Flood[2]	140,776

[1]*Existing flows from United States Army Corps of Engineers, Santa Clara River Adopted Discharge Frequency Values. Adopted May 3, 1994 by the United States Army Corps of Engineers, the Ventura County Flood Control Department*

[2]*LADPW Published Capital Flood Design Flows*

[3] *Q_{CAP} used in the SPEIR*

3.1.3 Off-Site Drainages

The total contributing drainage area that drains through the Project site is approximately 996 acres (Psomas, Landmark Village Drainage Concept Report). This runoff flows to and through the Project site via sheet flows and natural concentrated flows. The revised Capital Flood on the River is approximately 140,780 cfs at the Castaic Creek confluence. The Project site peak existing (burned and bulked) flow rate is approximately 1,660 cfs. Therefore, Capital Flood flows from the Project site are approximately one percent of the River Capital Flood discharge rate.

In addition to the 996 acre drainage area, there are four jurisdictional drainages located in the vicinity of the Project, excluding the Santa Clara River. These include Castaic Creek, Chiquito Canyon Creek, San Martinez Grande Canyon Creek and Potrero Canyon Creek.

3.2 Flood Hazards

A portion of the Project site lies within the 100-year floodplain of the River and within the FEMA 100-year floodplain identified by FEMA Flood Insurance Rate Map (FIRM) No. 065043-0340 (October 20, 2002) for the unincorporated areas of Los Angeles County. The FEMA 100-year floodplain is shown in Figure 3.1, and the FIRM is included in the Appendix. The 100-year floodplain boundaries are based on historical runoff records as measured with stream gauges. Mapping the 100-year floodplain is important because FEMA and the Federal Insurance Administration (FIA) use it to establish standards for flood insurance coverage. Under FIA criteria, the 100-year flood elevation is the "base flood" and any land that is outside of this 100-year, or base flood, elevation would be considered reasonably safe and free from flood hazard. The Capital flood is a discharge used by LACDPW for design purposes in Los Angeles County, as described above. All bank protection in Newhall Ranch will be designed to County Capital flood criteria.

Table 3.4 shows the areas of each existing floodplain and stream for eight storm events. The existing velocities for the 2-, 5-, 10-, 20-, 50-, 100-year and Capital flood events are shown in Figure 3.2A-G.

Table 3.4: Floodplain Area for Different Discharges – Existing Conditions

Flood Event (years)	Acreage of Floodplain that is Flooded
2	333.2
5	374.5
10	449.2
20	561.4
50	674.8
100	757.4
CAP	893.8

3.3 Channel and Floodplain Existing Conditions

The difference in elevation between the active channel bottom and the 100-year floodplain along the margins of the River varies greatly at the Project site. This difference ranges from approximately 4.3 to 16.3 feet and is dependent upon the width of the River channel at a particular location. For example, in wider portions of the River channel where flows widen with corresponding low velocities, there is only a small elevation difference between the channel bottom and the adjacent floodplain boundary. In contrast, the channel is often deep where it is narrower, creating a large elevation difference between the channel bottom and the floodplain boundary.

The existing River channel contains a variety of vegetation types. The active River channel is mostly barren due to annual scouring. However, vegetation types on the adjacent terraces vary based on elevation relative to the active channel bottom and the frequency of flooding. The following series of vegetation types occur along a vertical gradient from the channel bottom to the highest River terrace on the floodplain: emergent herbaceous, woody shrubs, and trees.

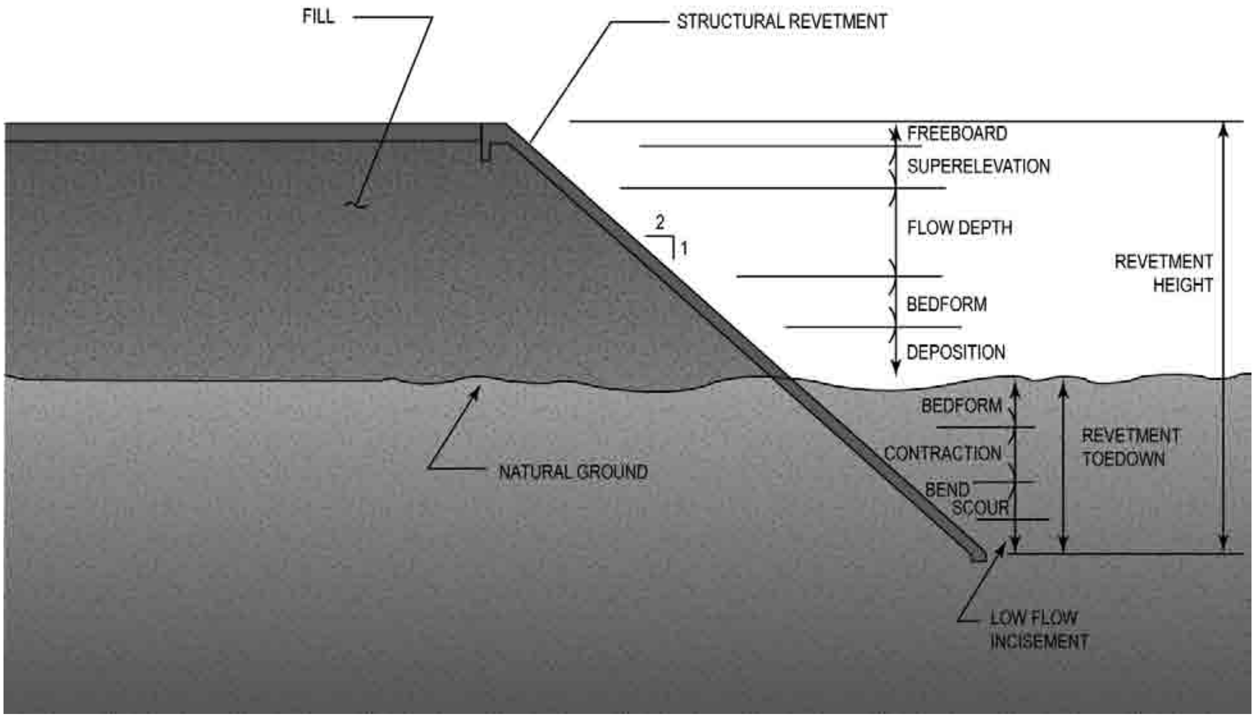
The substrate of the River channel (i.e., top layer of the River bottom) is primarily sand, which is actively eroded and deposited in flood events. Previous studies (Simons and Li) by the Los Angeles County Flood Control District have demonstrated that sediment deposition and scouring along the upper Santa Clara River are generally in equilibrium, and that there are no major trends of channel degradation or aggradation. However, some localized areas may experience either greater scouring or deposition.

The existing conditions hydraulics for the River from west of I-5 to an area generally west of the Ventura County/Los Angeles County line is presented in the Newhall Ranch Santa Clara River HEC-RAS Modeling study (PACE, December, 2005 The model examined the existing conditions hydrology for the 0.025, 0.060

and 0.085 Manning's values. Existing conditions sediment transport was studied in the Newhall Ranch River Fluvial Study Phase 1 Final Report (PACE, March, 2006). Both reports have been approved by LACDPW. As noted above, the fluvial study used the same HEC-RAS model as that presented in the hydraulic study. For the existing condition SAM was run for all River reaches and bed stability was estimated based on the change in potential transport between adjacent channel subreaches for the QCAP discharge. General adjustment was also calculated using the equation specified in the Los Angeles County Hydrology and Sedimentation Manual (LACH&SM). The LACH&SM general adjustment calculation is based only on existing conditions flow mean velocity. In most circumstances, adjustment predicted by the LACH&SM is greater (more scour) than that predicted by SAM. SAM results predict general adjustment from -2.9 to +2.3 feet, and LACH&SM methodology predicts general adjustment from -2.1 to -8.1 feet, both outside of curves (PACE, March, 2006, Table 4.4). In the PACE report the outside of the curve values and inside of curve values are considered separately, as per LACDPW criteria, since outsides of curves tend to degrade while insides of curves tend to aggrade. A general trend in general adjustment for the study reach as indicated by SAM modeling is not apparent for either the existing condition. Calculations of bend scour vary from 0.0 to 11.3 feet for the existing condition and the bedform height ranges from 0.5 to 8.3 feet.

General adjustment, long-term adjustment, and other scour are summed to determine total potential bed adjustment following LACH&SM methodology (illustrated conceptually in Figure 3.3). The existing condition is predicted to have a combined bed adjustment of approximately -6.9 to -19.7 feet for the outside of curved reaches and -6.2 to -15.4 feet for the inside of curved and straight reaches. A comparison of total bed adjustment estimated by both the summed methodology and the LACFCDDM methodology shows that the more intensive LACH&SM methodology using SAM for general adjustment and historical analysis for long-term adjustment predicts a shallower toe-down for both the existing conditions than does the LACFCDDM methodology except for sections in the vicinity of subreach SRA2 and SRC2. In subreach SRA2 section 43820, very high long-term adjustment causes LACH&SM calculations of this section to exceed LACFCDDM calculations by 1.4 feet for both outside of curved reaches and straight or inside of curved reaches in the existing conditions. In SRC2 section 29140, higher general adjustment and higher bedform height cause LACH&SM calculations of this section to exceed LACFCDDM calculations by 0.6 feet in outside curved reaches and 1.2 feet in straight and inside of curved reaches for the existing condition. LACH&SM methodology utilizing SAM calculations predicts a deeper toe-down than does the LACFCDDM at these locations methodology because the LACFCDDM does not account for the effects of local degradation as effectively.

Figure 3.3: Conceptual Representation of Toe-down and Freeboard Components.



4 Project Conditions

The impacts of Project implementation are discussed below. In summary, the Project includes the construction of approximately 18,600 LF of soil cement, which is primarily necessary to protect the Project's residential and commercial development and the Long Canyon Road Bridge, as well as the property immediately downstream of the Project from potential erosion due to Project implementation. In addition, approximately, 6,600 LF of TRMs, or similar protection methodologies, would be installed downstream of the Project site along the northern edge of the River corridor to protect the utility corridor from Chiquito Canyon to San Martinez Grande Canyon (stations STA 22195 and STA 17510). The impacts of installing bank protection, bridge piers and abutments (Long Canyon Road Bridge) and erosion protection along the River are analyzed in this section. This analysis focuses on the Project's hydrologic and hydraulic impacts on the River.

4.1 Alteration of Existing Drainage Patterns

4.1.1 Santa Clara River

Portions of the River corridor (from a hydrological perspective) will be encroached upon with the placement of the buried soil cement, TRMs, bridge abutments and piers, storm drain outlets and energy dissipaters proposed by the Project. Project impacts are expected to include habitat removal and disturbance, localized erosion, localized increased sedimentation, and habitat modification as a result of changes to River velocity and water surface elevation due to Project improvements. The Project will not impact overall discharge in the River because no discharge is diverted from or to the River as a result of the Project (Table 4.1). Therefore, no impacts will occur as a result of discharge changes.

Table 4.1: Project-Related Changes in Discharge Below the Specific Plan Site

Location - Downstream of the Specific Plan Site Below RS 15125	Discharge for Different Return Periods (cfs)						
	2-year	5-year	10-year	20-year	50-year	100-year	CAP
Existing Conditions	2,600	8,480	15,400	24,900	42,400	60,000	142,175
Proposed Conditions	2,600	8,480	15,400	24,900	42,400	60,000	142,175
Net Change	0	0	0	0	0	0	0

Source: Sikand Engineering (2000b). The above noted changes are considered to be "conservative" in that the predicted discharges under proposed conditions do not include the effect of the timing of flows from the Specific Plan site, which would reduce th

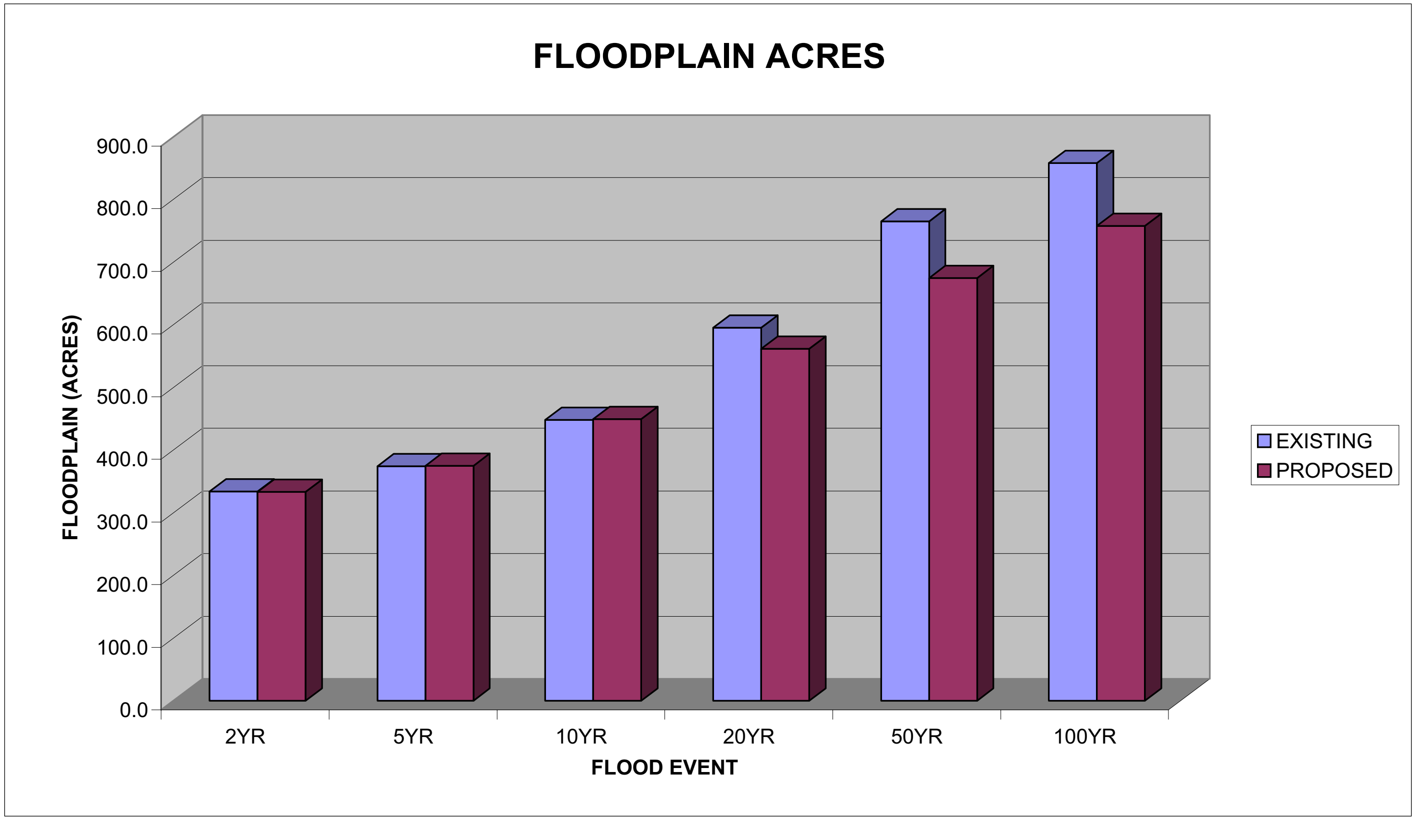
4.1.1A Changes to Velocity and Floodplain Acreage

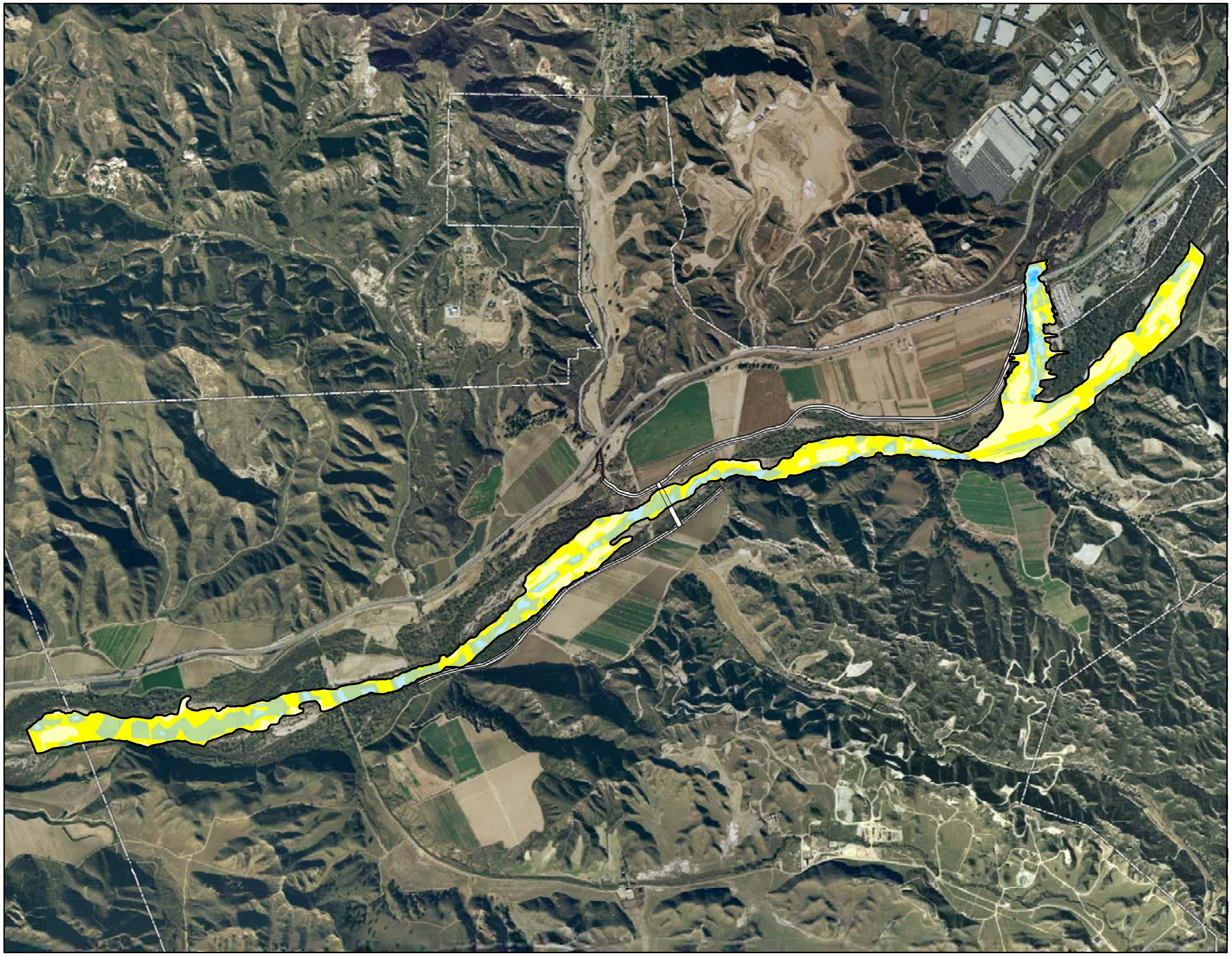
Figure 4.1 compares the changes in floodplain acreage between the existing and proposed conditions for the Landmark project site for the 2- through 100-year and Capital events. The figure shows that for the 2- and 5- year event no change in velocities within the floodplain is expected. Figure 4.2A-G shows the velocity profile for the proposed conditions floodplain and the floodplain boundary for the 2- through 100-

RIVER VILLAGE VELOCITY/VEGETATION IMPACTS STATISTICS

Floodplain Area Analysis

Flood Frequency	Existing Area	Proposed Area	Delta	Delta %
YR	(AC)	(AC)	(AC)	(AC)
2	333.7	333.2	-0.5	99.9%
5	374.0	374.5	0.5	100.1%
10	448.1	449.2	1.1	100.2%
20	595.3	561.4	-33.9	94.3%
50	765.0	674.8	-90.2	88.2%
100	858.0	757.4	-100.6	88.3%
CAP	1062.9	893.8	-169.1	84.1%





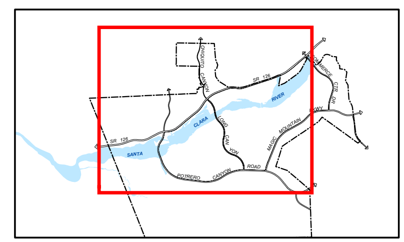
NEWHALL RANCH
Newhall Ranch Company

L E G E N D

- Newhall Ranch Specific Plan Boundary
- Bank Stabilization

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



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Meters: 305 152.5 0 305

PACE PACIFIC ADVANCED CIVIL ENGINEERING

Figure 4.2A

PROPOSED CONDITIONS
2 YEAR FLOOD EVENT
LANDMARK VILLAGE

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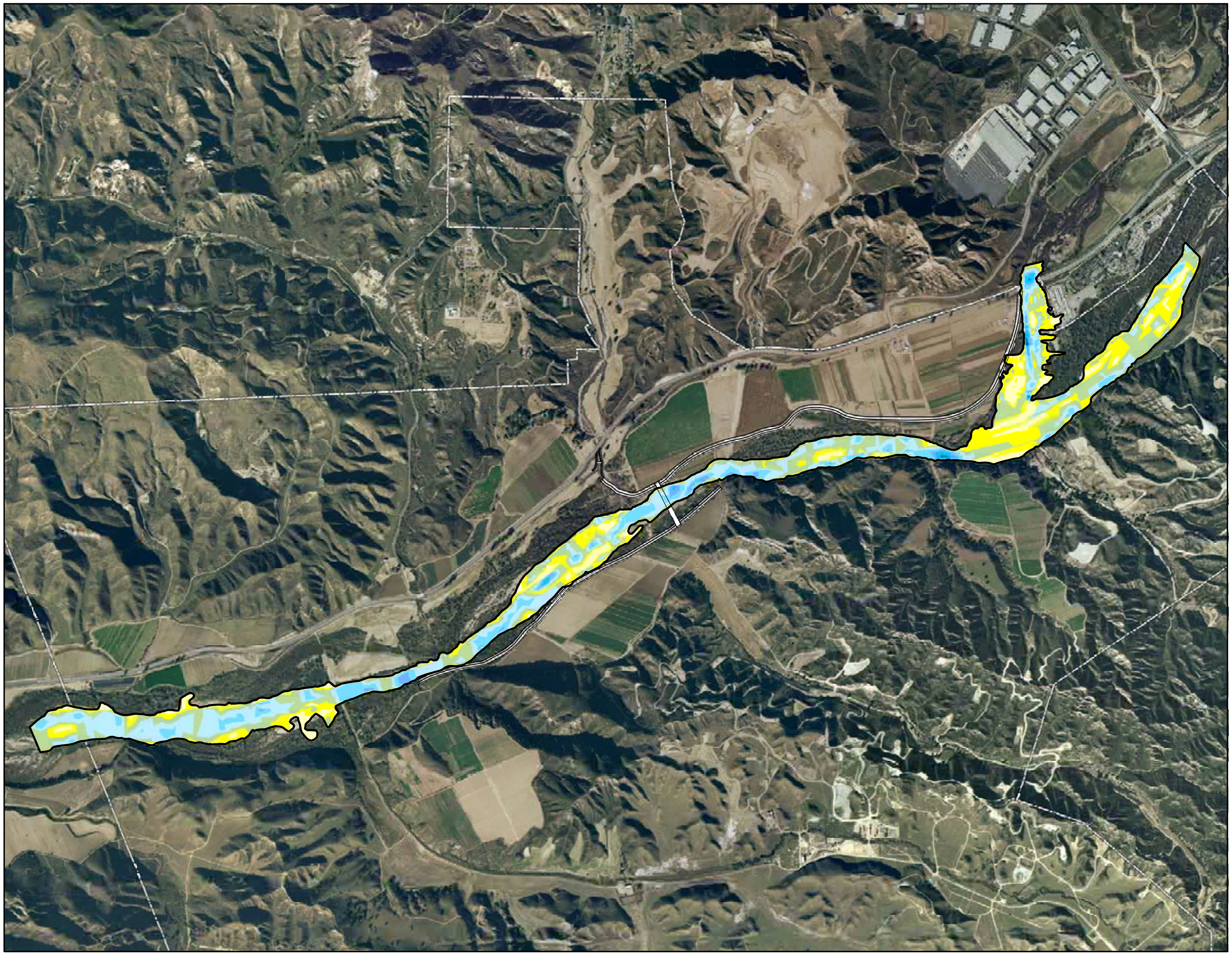

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NEWHALL RANCH
Newhall Ranch Company

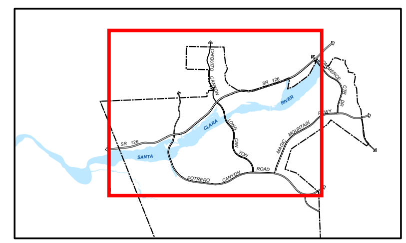
L E G E N D

Newhall Ranch Specific Plan Boundary

Bank Stabilization

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39

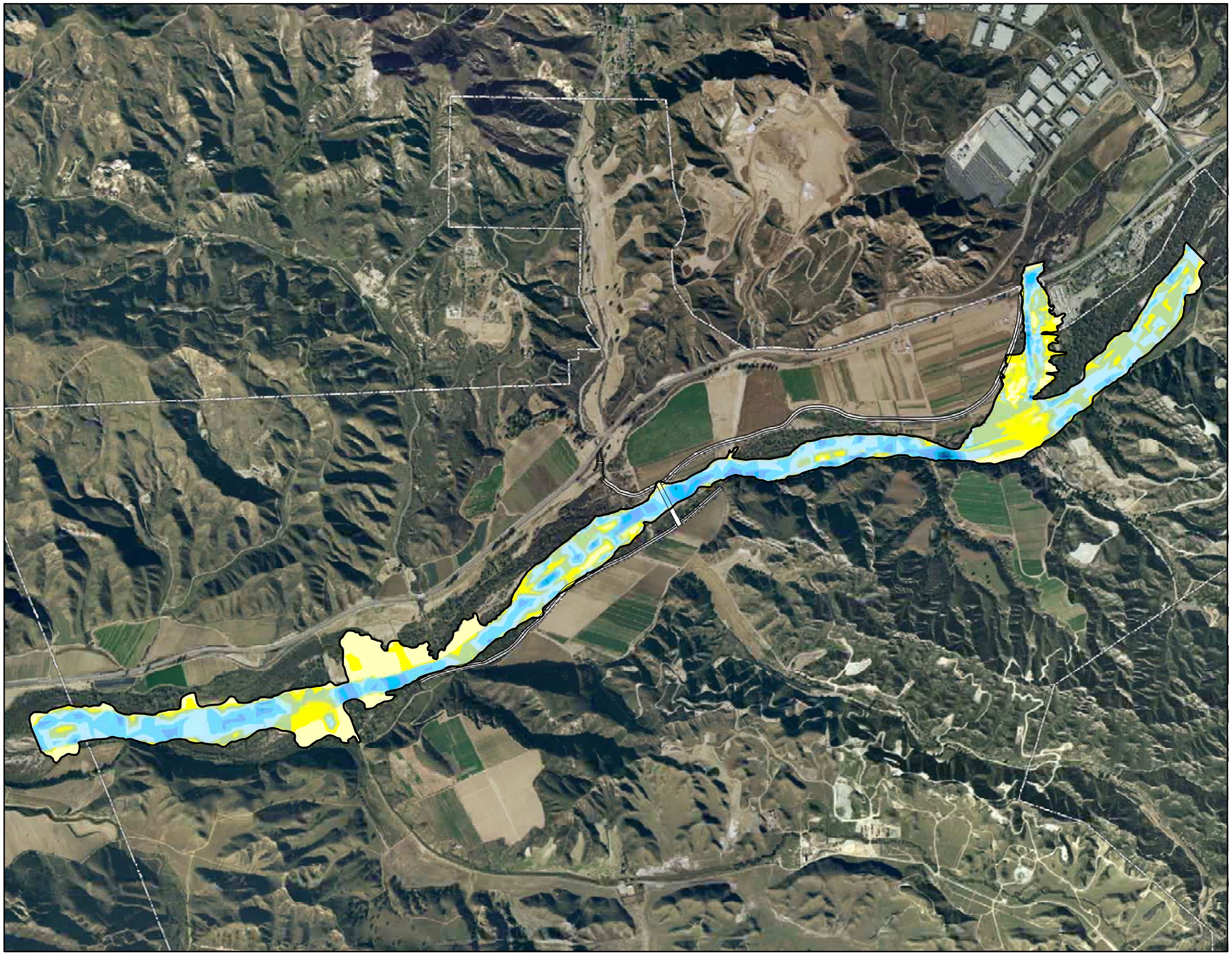


Feet: 1,000 500 0 1,000
Meters: 305 152.5 0 305

PACE PACIFIC ADVANCED CIVIL ENGINEERING

Figure 4.2B

PROPOSED CONDITIONS
5 YEAR FLOOD EVENT
LANDMARK VILLAGE



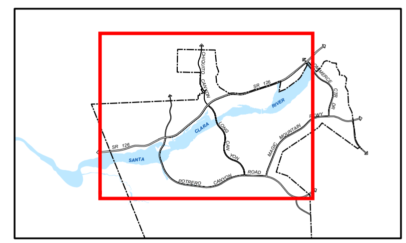
NEWHALL RANCH
Newhall Ranch Company

L E G E N D

- Newhall Ranch Specific Plan Boundary
- Bank Stabilization

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



1,000 500 0 1,000 Feet
305 152.5 0 305 Meters

PACE PACIFIC ADVANCED CIVIL ENGINEERING

Figure 4.2C

PROPOSED CONDITIONS
10 YEAR FLOOD EVENT
LANDMARK VILLAGE

FILE: \\pacefs01\projects\8238E\GIS\mxds\proposed\8238E_LandmarkPr10yrPC1_041306.mxd

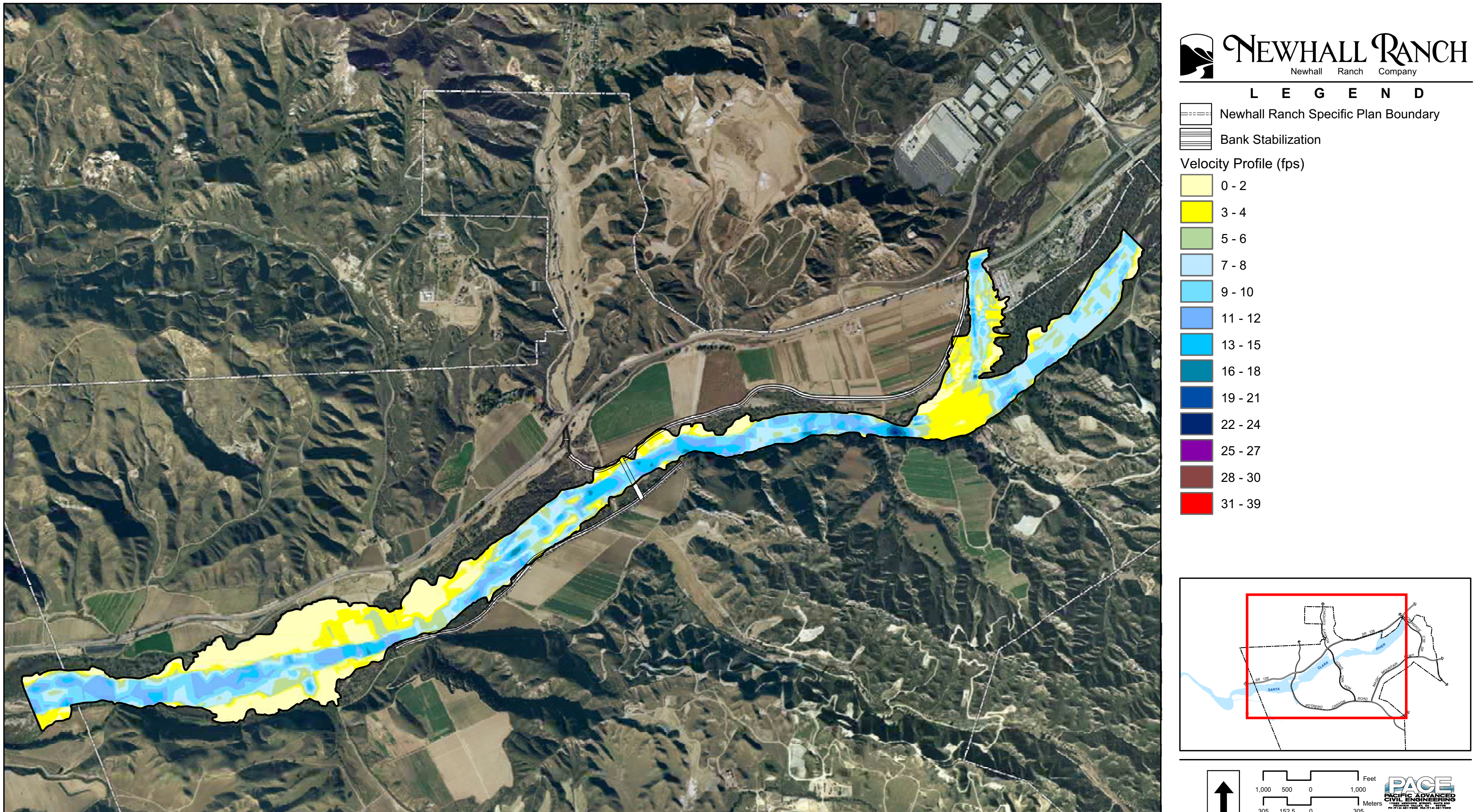
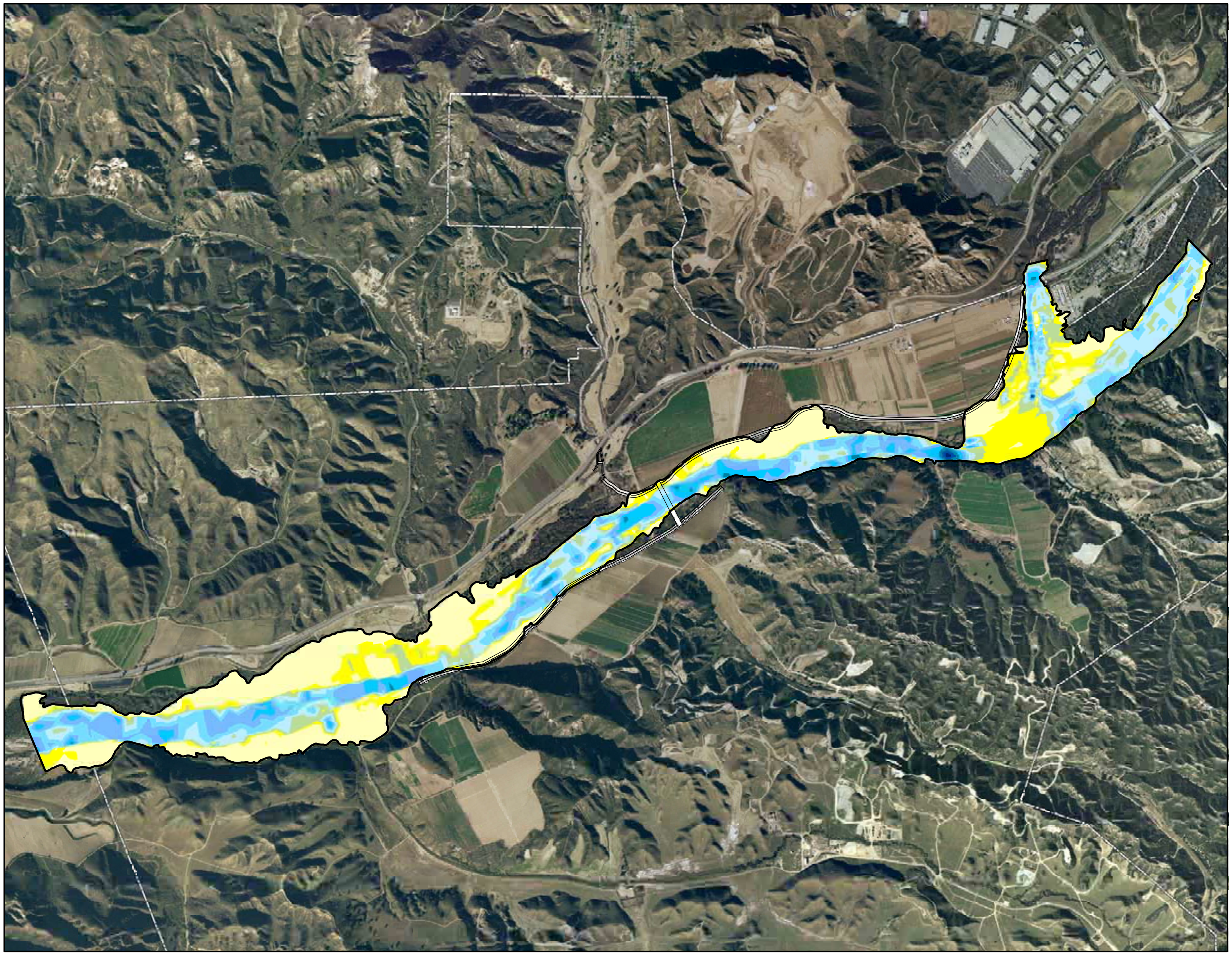


Figure 4.2D

PROPOSED CONDITIONS
20 YEAR FLOOD EVENT
LANDMARK VILLAGE

FILE: \\pacefs01\projects\8238E\GIS\mxds\proposed\8238E_LandmarkPr20yrPC1_041306.mxd



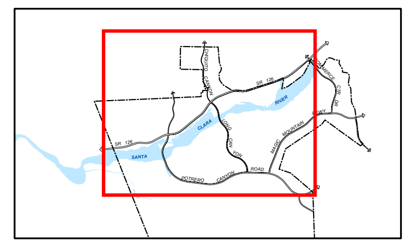
NEWHALL RANCH
Newhall Ranch Company

L E G E N D

- Newhall Ranch Specific Plan Boundary
- Bank Stabilization

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



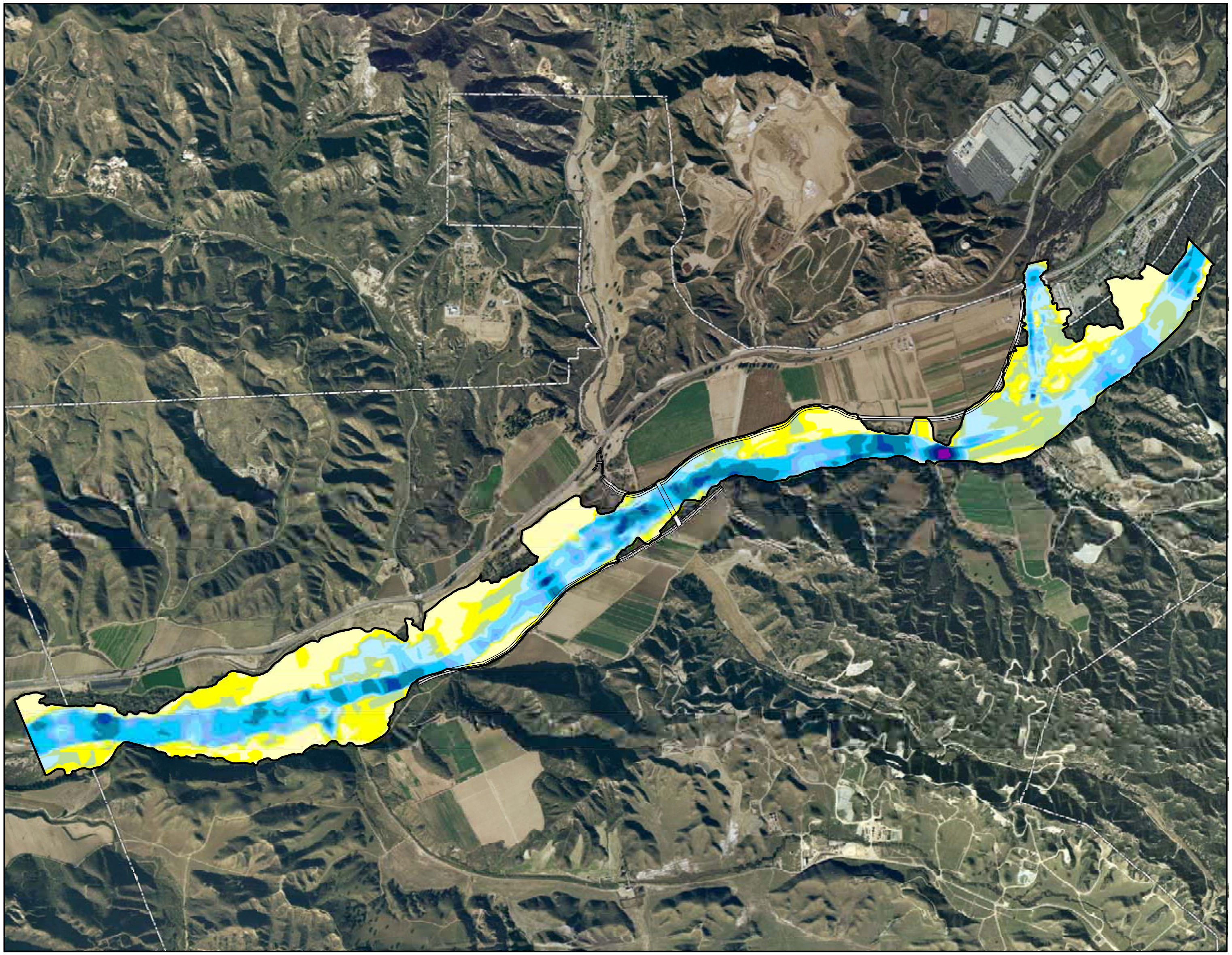
1,000 500 0 1,000 Feet
305 152.5 0 305 Meters

PACE
PACIFIC ADVANCED CIVIL ENGINEERING

Figure 4.2E

PROPOSED CONDITIONS
50 YEAR FLOOD EVENT
LANDMARK VILLAGE

FILE: \\pacefs01\projects\8238E\GIS\mxds\proposed\8238E_LandmarkPr50yrPC1_041306.mxd



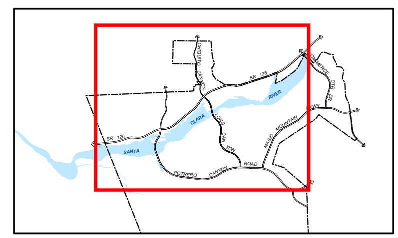
NEWHALL RANCH
Newhall Ranch Company

LEGEND

Newhall Ranch Specific Plan Boundary
Bank Stabilization

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



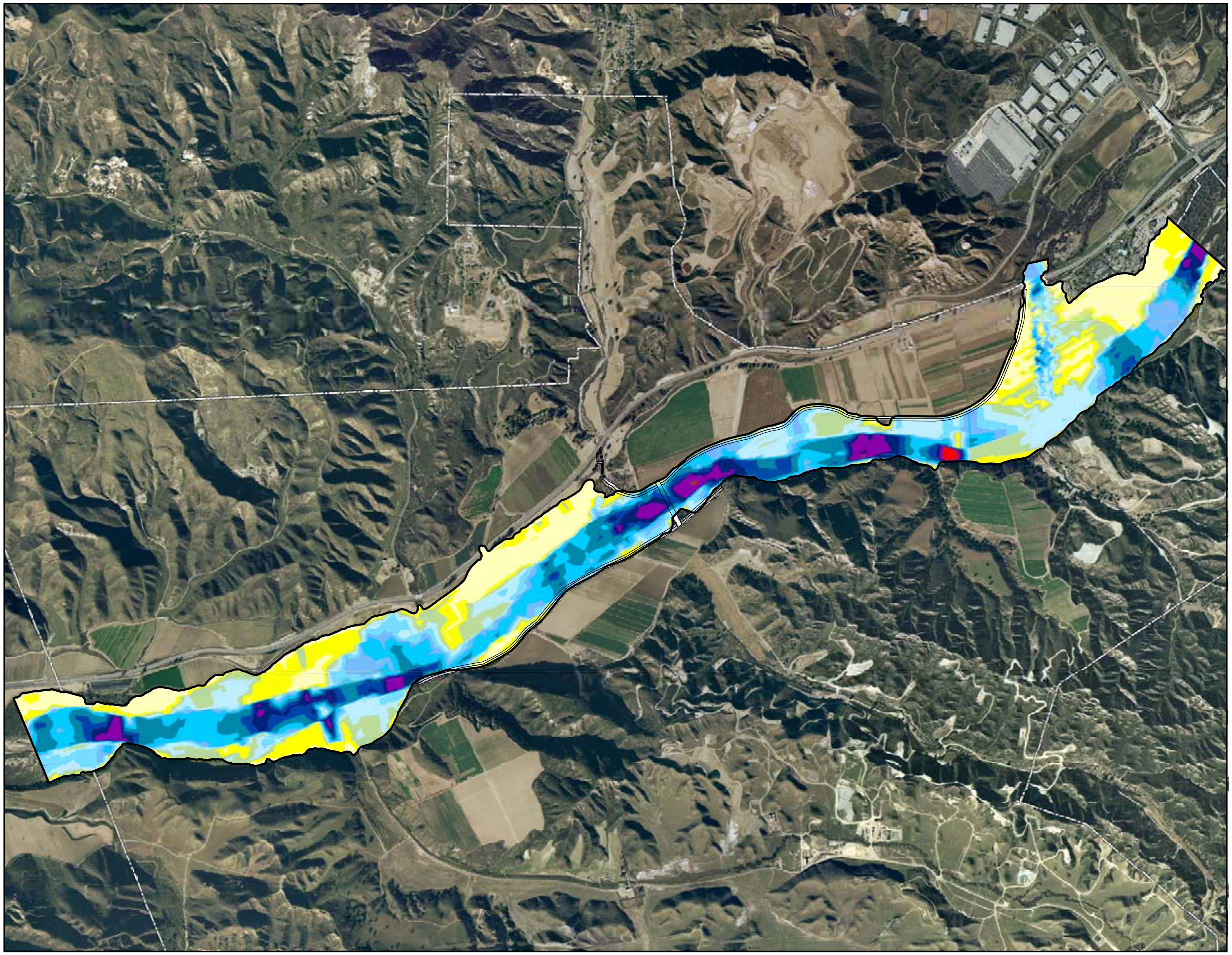
Feet: 1,000 500 0 1,000
Meters: 305 152.5 0 305

PACE
PACIFIC ADVANCED CIVIL ENGINEERING

Figure 4.2F

PROPOSED CONDITIONS
100 YEAR FLOOD EVENT
LANDMARK VILLAGE

FILE: \\pacefs01\projects\8238E\GIS\mxds\proposed\8238E_LandmarkPr100yrPC1_041306.mxd



NEWHALL RANCH
Newhall Ranch Company

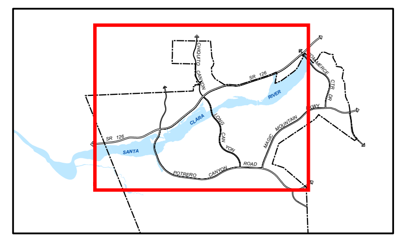
L E G E N D

Newhall Ranch Specific Plan Boundary

Bank Stabilization

Velocity Profile (fps)

- 0 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 15
- 16 - 18
- 19 - 21
- 22 - 24
- 25 - 27
- 28 - 30
- 31 - 39



Feet: 1,000 500 0 1,000

Meters: 305 152.5 0 305

PACE PACIFIC ADVANCED CIVIL ENGINEERING

Figure 4.2G

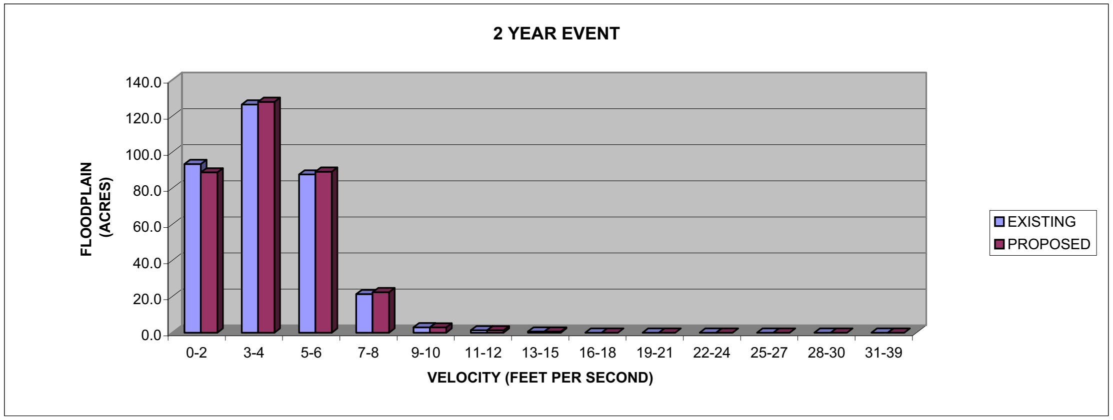
PROPOSED CONDITIONS
CAPITAL FLOOD EVENT
LANDMARK VILLAGE

FILE: \\pacefs01\projects\8238E\GIS\mxds\proposed\8238E_LandmarkPrCapPC1_042706.mxd

RIVER VILLAGE FLOODPLAIN AREA BY VELOCITY IMPACTS STATISTICS

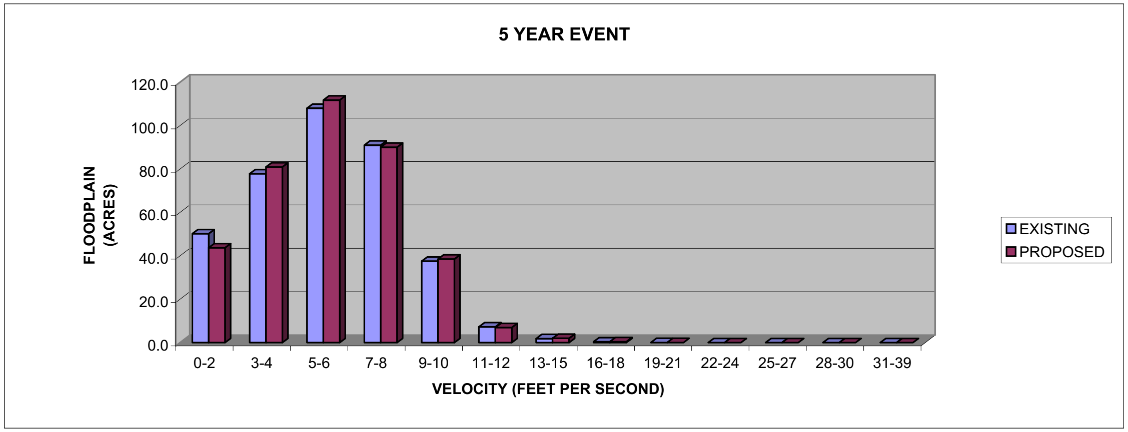
2 YEAR - Floodplain Area by Velocity

Velocity (fps)	Existing Area (AC)	Proposed Area (AC)	Delta (AC)	Delta % (%)
0-2	93.4	88.8	-4.7	1.0
3-4	126.4	127.9	1.5	1.0
5-6	87.6	89.2	1.6	1.0
7-8	21.4	22.5	1.1	1.1
9-10	3.0	2.9	0.0	1.0
11-12	1.3	1.3	0.0	1.0
13-15	0.6	0.6	0.0	1.0
16-18	0.0	0.0	0.0	0.9
19-21	0.0	0.0	0.0	0.0
22-24	0.0	0.0	0.0	0.0
25-27	0.0	0.0	0.0	0.0
28-30	0.0	0.0	0.0	0.0
31-39	0.0	0.0	0.0	0.0
	333.7	**333.2**	**-0.5**	**99.8%**



5 YEAR - Floodplain Area by Velocity

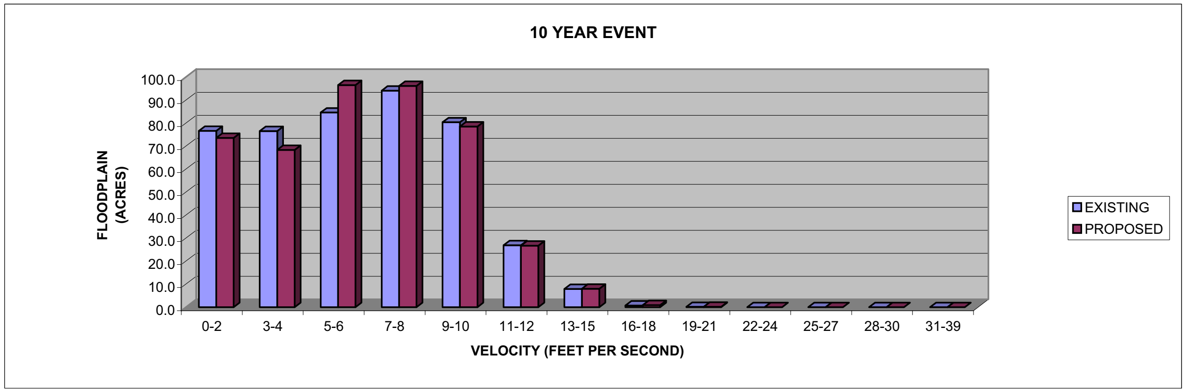
Velocity (fps)	Existing Area (AC)	Proposed Area (AC)	Delta (AC)	Delta % (%)
0-2	50.2	43.7	-6.5	0.9
3-4	77.8	81.0	3.2	1.0
5-6	108.0	111.8	3.7	1.0
7-8	91.0	90.1	-0.9	1.0
9-10	37.5	38.5	1.0	1.0
11-12	7.3	7.0	-0.3	1.0
13-15	1.8	2.0	0.2	1.1
16-18	0.4	0.4	0.0	1.1
19-21	0.0	0.0	0.0	1.0
22-24	0.0	0.0	0.0	1.0
25-27	0.0	0.0	0.0	0.0
28-30	0.0	0.0	0.0	0.0
31-39	0.0	0.0	0.0	0.0
	374.1	**374.5**	**0.4**	**100.1%**



RIVER VILLAGE FLOODPLAIN AREA BY VELOCITY IMPACTS STATISTICS

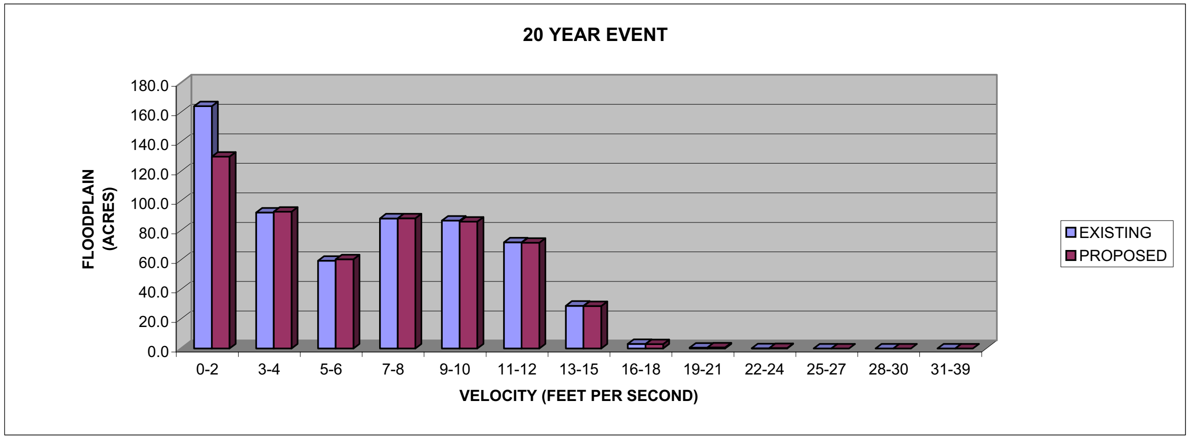
10 YEAR - Floodplain Area by Velocity

Velocity (fps)	Existing Area (AC)	Proposed Area (AC)	Delta (AC)	Delta % (%)
0-2	76.7	73.6	-3.1	1.0
3-4	76.5	68.4	-8.2	0.9
5-6	84.6	96.6	11.9	1.1
7-8	94.2	96.2	2.0	1.0
9-10	80.4	78.5	-1.9	1.0
11-12	26.9	26.8	-0.1	1.0
13-15	7.9	8.1	0.1	1.0
16-18	0.7	0.9	0.2	1.3
19-21	0.2	0.2	0.0	1.2
22-24	0.0	0.0	0.0	0.0
25-27	0.0	0.0	0.0	0.0
28-30	0.0	0.0	0.0	0.0
31-39	0.0	0.0	0.0	0.0
	448.1	**449.2**	**1.1**	**100.2%**



20 YEAR - Floodplain Area by Velocity

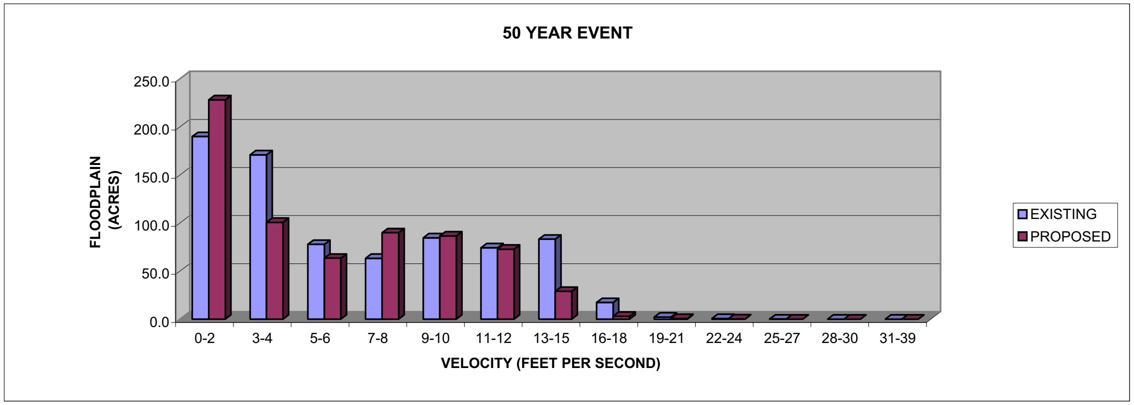
Velocity (fps)	Existing Area (AC)	Proposed Area (AC)	Delta (AC)	Delta % (%)
0-2	164.2	130.0	-34.2	0.8
3-4	92.2	92.7	0.5	1.0
5-6	59.5	60.5	1.0	1.0
7-8	88.1	88.2	0.1	1.0
9-10	86.7	86.0	-0.7	1.0
11-12	71.9	71.7	-0.3	1.0
13-15	28.9	28.7	-0.2	1.0
16-18	3.0	2.9	-0.1	1.0
19-21	0.5	0.6	0.1	1.2
22-24	0.2	0.2	0.0	1.1
25-27	0.0	0.0	0.0	0.0
28-30	0.0	0.0	0.0	0.0
31-39	0.0	0.0	0.0	0.0
	595.2	**561.4**	**-33.8**	**94.3%**



RIVER VILLAGE FLODDPLAIN AREA BY VELOCITY IMPACTS STATISTICS

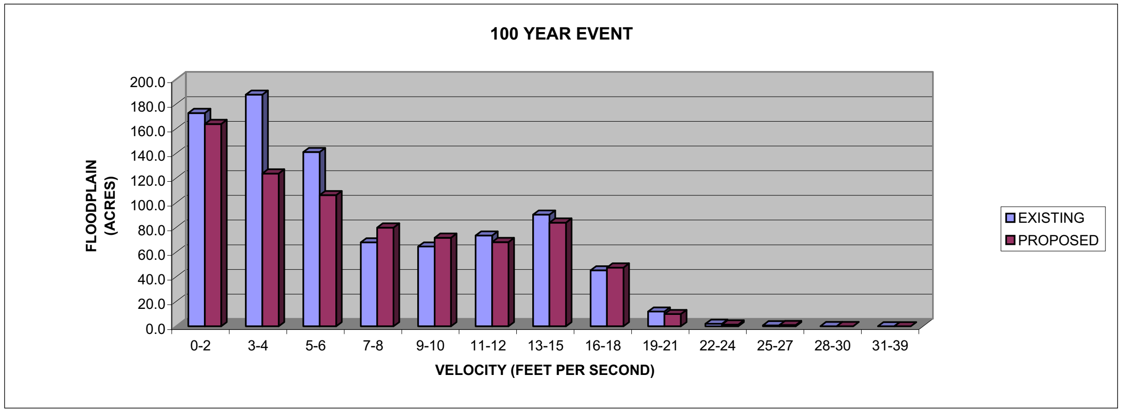
50 YEAR - Floodplain Area by Velocity

Velocity (fps)	Existing Area (AC)	Proposed Area (AC)	Delta (AC)	Delta % (%)
0-2	190.0	228.2	38.2	1.2
3-4	171.0	100.8	-70.2	0.6
5-6	77.9	63.4	-14.4	0.8
7-8	63.3	89.9	26.6	1.4
9-10	84.7	86.6	1.9	1.0
11-12	74.3	72.9	-1.5	1.0
13-15	83.3	29.0	-54.3	0.3
16-18	17.4	3.1	-14.3	0.2
19-21	2.3	0.6	-1.6	0.3
22-24	0.7	0.2	-0.5	0.3
25-27	0.1	0.0	-0.1	0.0
28-30	0.0	0.0	0.0	0.0
31-39	0.0	0.0	0.0	0.0
	764.9	**674.8**	**-90.2**	**88.2%**



100 YEAR - Floodplain Area by Velocity

Velocity (fps)	Existing Area (AC)	Proposed Area (AC)	Delta (AC)	Delta % (%)
0-2	172.8	163.8	-8.9	0.9
3-4	187.6	123.7	-63.9	0.7
5-6	141.1	106.2	-34.9	0.8
7-8	68.0	79.9	12.0	1.2
9-10	64.6	71.7	7.2	1.1
11-12	73.5	68.2	-5.3	0.9
13-15	90.4	83.9	-6.5	0.9
16-18	45.3	47.6	2.3	1.0
19-21	11.9	9.9	-2.0	0.8
22-24	2.0	1.4	-0.6	0.7
25-27	0.7	1.0	0.2	1.3
28-30	0.1	0.1	0.0	1.3
31-39	0.0	0.0	0.0	0.0
	858.0	**757.4**	**-100.6**	**88.3%**



RIVER VILLAGE FLODDPLAIN AREA BY VELOCITY IMPACTS STATISTICS

Velocity (fps)	Existing Area (AC)	Proposed Area (AC)	Delta (AC)	Delta % (%)
0-2	165.72	140.34	-25.4	0.8
3-4	123.83	110.66	-13.2	0.9
5-6	137.48	103.20	-34.3	0.8
7-8	178.22	116.22	-62.0	0.7
9-10	110.57	66.95	-43.6	0.6
11-12	60.57	65.03	4.5	1.1
13-15	95.01	108.51	13.5	1.1
16-18	80.93	84.46	3.5	1.0
19-21	46.89	42.81	-4.1	0.9
22-24	36.04	28.70	-7.3	0.8
25-27	16.34	20.16	3.8	1.2
28-30	10.72	5.42	-5.3	0.5
31-39	0.63	1.40	0.8	2.2
	1062.9	**893.8**	**-169.1**	**84.1%**

CHANGE IN FLOODPLAIN AREA WHERE VELOCITY >4fps BY VEGETATION TYPE

Vegetation Type	2 YEAR EXISTING	PROPOSED	DELTA	DELTA %
AD	0.0	0.0	0.0	0.0%
AG	1.9	0.9	-1.0	48.5%
AS	1.0	1.0	0.0	100.0%
AWS	0.0	0.0	0.0	0.0%
CRW	2.0	2.3	0.2	110.0%
CRWU	0.0	0.0	0.0	0.0%
CSS	0.0	0.0	0.0	0.0%
ES	0.0	0.0	0.0	0.0%
FM	0.0	0.0	0.0	0.0%
G	0.0	0.0	0.0	0.0%
GBSR	0.0	0.0	0.0	0.0%
GBSR-ADJ	0.0	0.0	0.0	0.0%
GR	0.0	0.0	0.0	0.0%
LOW	0.0	0.0	0.0	0.0%
LOW/MC	0.0	0.0	0.0	0.0%
MC	0.0	0.0	0.0	0.0%
MFS	0.1	0.1	0.0	100.0%
MFS/D	0.0	0.0	0.0	0.0%
SMFS	100.8	103.1	2.3	102.2%
SS	0.0	0.0	0.0	0.0%
WRW	0.0	0.0	0.0	0.0%
WS	1.3	1.4	0.1	107.6%
N/C	6.7	6.8	0.1	101.5%
<=4 FPS	219.8	217.6	-2.2	99.0%
TOTAL	333.7	333.2	-0.5	99.8%

Vegetation Type	5 YEAR EXISTING	PROPOSED	DELTA	DELTA %
AD	0.0	0.0	0.0	0.0%
AG	2.7	3.1	0.4	115.3%
AS	1.4	2.1	0.7	149.2%
AWS	0.0	0.0	0.0	0.0%
CRW	4.0	6.5	2.5	164.3%
CRWU	0.0	0.0	0.0	0.0%
CSS	0.0	0.0	0.0	0.0%
ES	0.0	0.0	0.0	0.0%
FM	0.0	0.0	0.0	0.0%
G	0.0	0.0	0.0	0.0%
GBSR	0.0	0.0	0.0	0.0%
GBSR-ADJ	0.0	0.0	0.0	0.0%
GR	0.1	0.1	0.0	100.0%
LOW	0.0	0.0	0.0	0.0%
LOW/MC	0.0	0.0	0.0	0.0%
MC	0.0	0.0	0.0	0.0%
MFS	0.8	0.8	0.0	100.0%
MFS/D	0.0	0.0	0.0	0.0%
SMFS	219.2	219.5	0.3	100.1%
SS	0.0	0.0	0.0	0.0%
WRW	0.2	0.3	0.1	150.0%
WS	2.5	2.9	0.3	113.1%
N/C	15.2	15.4	0.1	100.8%
<=4 FPS	128.0	123.9	-4.1	96.8%
TOTAL	374.1	374.5	0.4	100.1%

Vegetation Type	10 YEAR EXISTING	PROPOSED	DELTA	DELTA %
AD	0.0	0.0	0.0	0.0%
AG	3.4	3.1	-0.3	92.0%
AS	1.8	2.1	0.3	118.4%
AWS	0.0	0.0	0.0	0.0%
CRW	7.3	14.8	7.5	203.5%
CRWU	0.0	0.0	0.0	0.0%
CSS	0.0	0.0	0.0	0.0%
ES	0.0	0.0	0.0	0.0%
FM	0.0	0.0	0.0	0.0%
G	0.1	0.1	0.0	100.0%
GBSR	0.0	0.0	0.0	0.0%
GBSR-ADJ	0.0	0.0	0.0	0.0%
GR	0.3	0.3	0.0	99.4%
LOW	0.0	0.0	0.0	0.0%
LOW/MC	0.0	0.0	0.0	0.0%
MC	0.0	0.0	0.0	0.0%
MFS	1.5	1.2	-0.3	79.4%
MFS/D	0.0	0.0	0.0	0.0%
SMFS	256.9	261.4	4.4	101.7%
SS	0.0	0.0	0.0	0.0%
WRW	0.7	0.9	0.2	133.3%
WS	4.0	4.4	0.4	110.3%
N/C	19.0	18.9	0.0	99.9%
<=4 FPS	153.2	142.0	-11.2	92.7%
TOTAL	448.1	449.2	1.1	100.2%

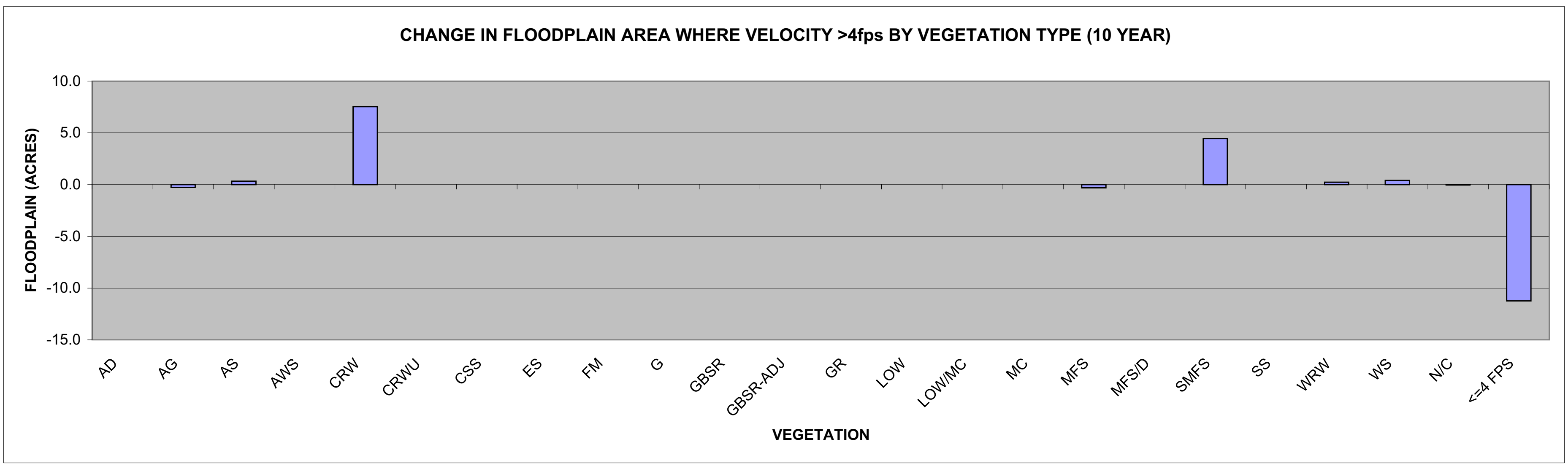


Figure 4.4A

CHANGE IN FLOODPLAIN AREA WHERE VELOCITY >4fps BY VEGETATION TYPE

Vegetation Type	20 YEAR EXISTING	20 YEAR PROPOSED	20 YEAR DELTA	20 YEAR DELTA %
AD	0.0	0.0	0.0	0.0%
AG	6.7	6.8	0.1	101.5%
AS	2.5	2.5	0.0	100.0%
AWS	0.0	0.0	0.0	0.0%
CRW	12.0	12.0	0.0	100.0%
CRWU	0.0	0.0	0.0	0.0%
CSS	0.1	0.0	-0.1	0.0%
ES	0.0	0.0	0.0	0.0%
FM	0.0	0.0	0.0	0.0%
G	0.2	0.2	0.0	100.0%
G/D	0.0	0.0	0.0	0.0%
GBSR	0.1	0.1	0.0	100.0%
GBSR-ADJ	0.0	0.0	0.0	0.0%
GR	0.5	0.5	0.0	100.0%
LOW	0.0	0.0	0.0	0.0%
LOW/MC	0.0	0.0	0.0	0.0%
MC	0.0	0.0	0.0	0.0%
MFS	3.7	3.7	0.0	100.0%
MFS/D	0.1	0.2	0.1	200.0%
SMFS	284.6	283.6	-0.9	99.7%
WRW	1.4	1.7	0.3	119.3%
WS	5.8	6.2	0.3	106.0%
N/C	21.2	21.3	0.1	100.5%
<=4 FPS	256.4	222.6	-33.8	86.8%
TOTAL	595.3	561.4	-33.9	94.3%

Vegetation Type	50 YEAR EXISTING	50 YEAR PROPOSED	50 YEAR DELTA	50 YEAR DELTA %
AD	0.1	0.0	-0.1	0.0%
AG	26.3	7.0	-19.4	26.4%
AS	4.2	4.2	0.0	100.0%
AWS	0.1	0.0	0.0	0.0%
CRW	24.1	13.4	-10.7	55.7%
CRWU	0.0	0.0	0.0	0.0%
CSS	0.2	0.1	-0.1	50.0%
ES	0.0	0.0	0.0	0.0%
FM	0.0	0.0	0.0	0.0%
G	0.2	0.2	0.0	100.0%
G/D	0.0	0.0	0.0	0.0%
GBSR	0.1	0.1	0.0	100.0%
GBSR-ADJ	0.0	0.0	0.0	0.0%
GR	1.1	1.1	0.0	100.0%
LOW	0.1	0.1	0.0	100.0%
LOW/MC	0.0	0.0	0.0	0.0%
MC	0.0	0.0	0.0	0.0%
MFS	9.0	3.8	-5.2	42.4%
MFS/D	0.3	0.2	-0.1	66.7%
SMFS	299.4	284.0	-15.3	94.9%
WRW	3.4	1.7	-1.7	50.0%
WS	9.7	6.8	-2.9	70.5%
N/C	25.8	23.2	-2.6	89.8%
<=4 FPS	360.9	328.9	-32.0	91.1%
TOTAL	765.0	674.8	-90.2	88.2%

Vegetation Type	100 YEAR EXISTING	100 YEAR PROPOSED	100 YEAR DELTA	100 YEAR DELTA %
AD	0.2	0.3	0.1	150.0%
AG	73.8	41.7	-32.2	56.4%
AS	5.6	5.9	0.3	104.7%
AWS	0.2	0.1	0.1	50.0%
CRW	35.5	39.4	4.0	111.2%
CRWU	0.0	0.0	0.0	0.0%
CSS	0.3	0.2	-0.1	66.7%
ES	0.0	0.0	0.0	0.0%
FM	0.0	0.0	0.0	100.0%
G	0.2	0.2	0.0	100.0%
G/D	0.0	0.0	0.0	0.0%
GBSR	0.2	0.2	0.0	100.0%
GBSR-ADJ	0.1	0.1	0.0	100.0%
GR	2.1	2.2	0.1	104.8%
LOW	0.1	0.1	0.0	100.0%
LOW/MC	0.0	0.0	0.0	0.0%
MC	0.0	0.0	0.0	0.0%
MFS	13.3	13.3	0.0	100.0%
MFS/D	1.5	1.1	-0.4	75.7%
SMFS	314.4	315.8	1.4	100.5%
WRW	7.3	6.3	-1.0	86.4%
WS	13.2	13.6	0.4	102.7%
N/C	29.7	29.4	-0.3	99.1%
<=4 FPS	360.4	287.6	-72.8	79.8%
TOTAL	858.0	757.5	-100.5	88.3%

VegetationType	CAP EVENT EXISTING	CAP EVENT PROPOSED	CAP EVENT DELTA	CAP EVENT DELTA%
AD	0.9	0.3	-0.6	33.3%
AG	215.2	81.6	-133.6	37.9%
AS	7.1	7.4	0.3	104.2%
AWS	0.8	0.8	0.0	0.0%
CRW	69.8	72.9	3.1	104.4%
CRWU	0.0	0.0	0.0	0.0%
CSS	2.8	2.9	0.1	103.6%
ES	0.2	0.0	-0.2	0.0%
FM	0.0	0.0	0.0	0.0%
G	0.3	0.3	0.0	0.0%
G/D	0.1	0.0	-0.1	0.0%
GBSR	0.5	0.5	0.0	0.0%
GBSR-ADJ	0.1	0.0	-0.1	0.0%
GR	5.0	5.0	0.0	0.0%
LOW	0.3	0.2	-0.1	66.7%
LOW/MC	0.0	0.0	0.0	0.0%
MC	0.1	0.1	0.0	0.0%
MFS	46.0	45.6	-0.4	99.1%
MFS/D	2.8	1.3	-1.5	46.4%
SMFS	326.1	326.5	0.4	100.1%
WRW	31.7	33.1	1.4	104.4%
WS	26.0	25.9	-0.1	99.6%
N/C	37.5	38.4	0.9	0.0%
<=4 FPS	289.6	251.0	-38.6	86.7%
	1062.9	893.8	-169.1	986.5%

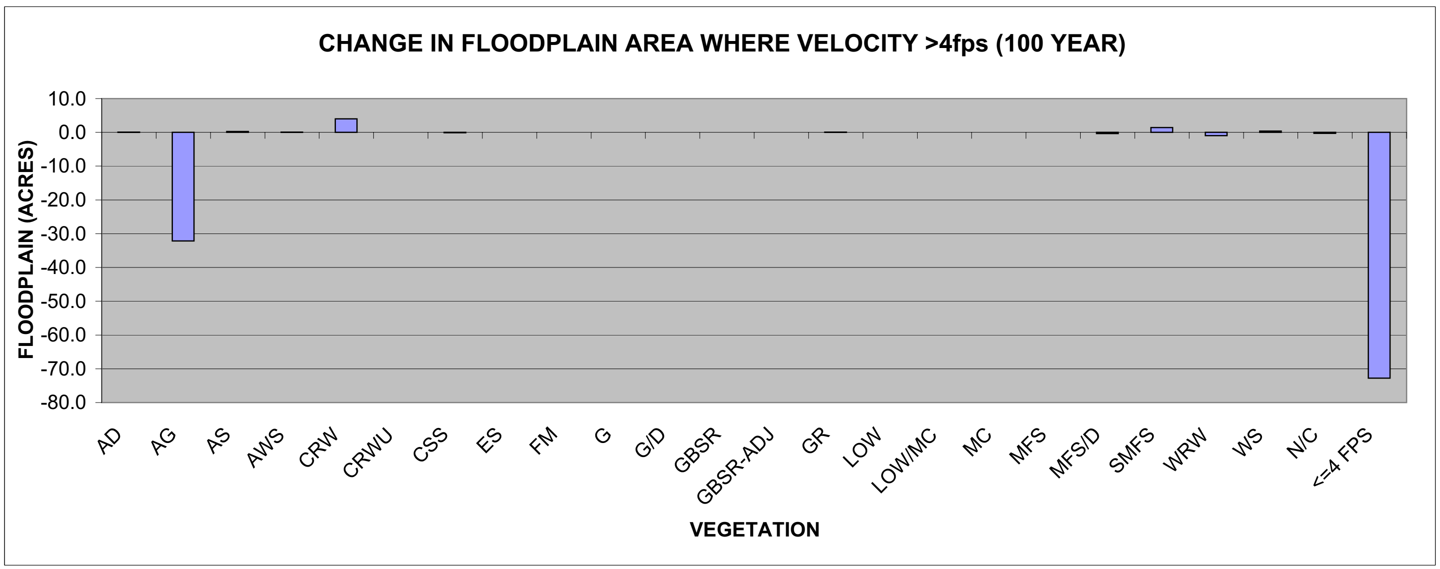
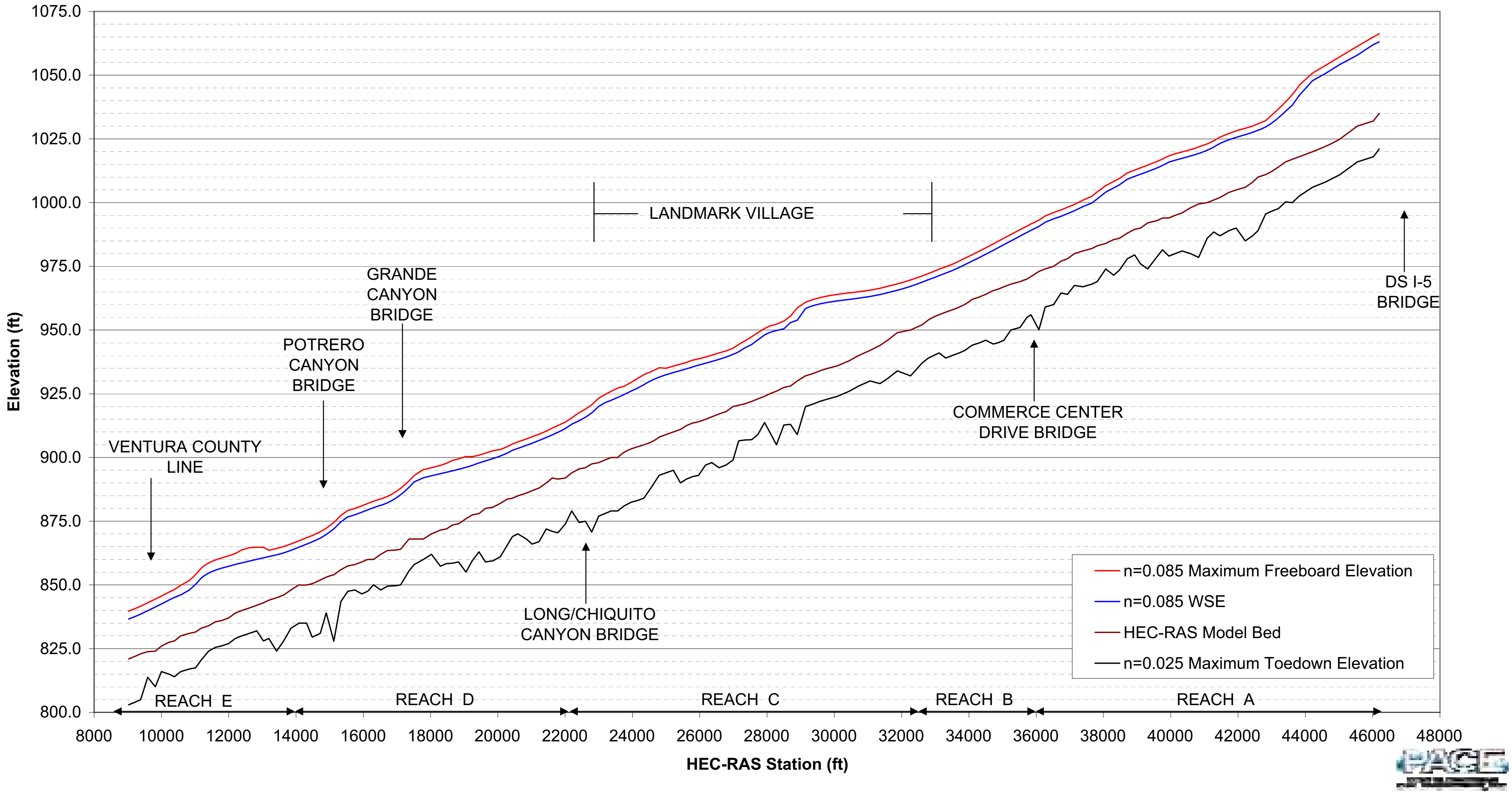


Figure 4.5: Santa Clara River Proposed Conditions Outside Curved Reach Maximum Toedown & Freeboard Summary



year and Capital events. This figure can be compared directly to Figure 3.2A-G to show the difference between both the size and shape of the floodplain for the various events, and also the change in velocity distribution for the various events, between the existing and proposed conditions. These differences are quantified in Figure 4.3A-C, which breaks down the floodplain area by velocity range for both the proposed and existing conditions. As with Figure 4.1, the figure shows that for the 2- and 5- year event no change in floodplain acreage is expected, while for the remaining events, a change in floodplain acreage between the existing and proposed is expected. Generally, however, these changes are quite small, all being less than two percent for the range of discharges from the 10- to 100-year return period.

The total area of floodplain where discharge velocities would be over 4 fps during a 100-year storm would be decreased by 100.3 acres as a result of the proposed Project through the installation of flood protection.

Table 4.2 provides a summary of floodplain acreage where Project-related increases or decreases in discharge velocities in excess of 4 fps would occur. In total, the area of floodplain subject to flows in excess of 4 fps would be reduced by approximately -1.7, -4.5, -12.4, 0.1, 58.1 and 27.5 and -169.1 acres as a result of the proposed Project during the 2-, 5-, 10-, 20-, 50-, 100-year and Capital storm events, respectively. Figure 4.4A-B shows that the largest reductions in floodplain acreage with flows in excess of 4 fps would be on land presently used for agricultural purposes and that is proposed for conversion to residential and commercial uses.

TABLE 4.2: CHANGE (PROPOSED-EXISTING) IN ACREAGE OF VELOCITIES >4FPS BY RETURN PERIOD

Velocity	2-YR	5-YR	10-YR	20-YR	50-YR	100-YR	CAP
>4 FPS	1.7	4.5	12.4	-0.1	-58.1	-27.5	-130.5
<4 FPS	-2.2	-4.10	-11.2	-33.8	-32.0	-72.8	-38.6
TOTAL	-0.5	0.4	1.2	-33.9	-90.1	-100.3	-169.1

Finally, increases in velocity in excess of 4 fps would occur downstream of the Project site. In total, the area of floodplain subject to velocities in excess of 4 fps would be reduced by approximately -1.7, -4.5, -12.4, 0.1, 58.1 and 27.5 and -169.1 acres as a result of the proposed Project during the 2-, 5-, 10-, 20-, 50- and 100-year and Capital storm events, respectively. Such increases have the potential of causing erosion. However, the Project-related increases in velocity downstream of the Project site would be mitigated by installation of buried soil cement bank protection on the southern edge of the River corridor from the Long Canyon Road Bridge to Station No. 17510.

As expected, Table 4.3 shows that during the 100-year storm event, Project-related improvements would result in 31 locations where there is an increase in water surface elevation (10 of which exceed one foot) and

21 locations where there is a decrease in water surface elevations (one of which exceeds one foot). All of these increases are localized, and as such, are not significant to water surface elevations on the River as a whole. Additionally, no impacts to water surface elevation will occur upstream or downstream of the Project.

4.1.1B Changes to Water Surface Elevation

Changes on the Santa Clara River in the form of alterations of water surface elevations and velocities, as reported in Newhall Ranch Santa Clara River HEC-RAS Modeling study (PACE, December, 2005. Newhall Land owns both sides of the River for the majority of the study reach. However, at the portion of the Santa Clara River where the existing Travel Village development is located (at approximately River stations 35725 through 31585) Newhall Land does not own this property on the north bank (Travel Village). The bank protection on the south bank of the River within Landmark Village and across from the Travel Village development is at the edge of the floodplain limits and therefore does not impact the River water surface or velocity. In addition, there are no increases in water surface elevation on the Travel Village property due to the Landmark Village Bank Protection project.

The Landmark Village Proposed Bank Protection creates various changes in water surface elevation and velocity in the River. At the upstream end of the project between River stations 31585 and 28080 there are decreases in water surface elevation of up to a maximum of 2.54 ft except at River Station 28895 where the surface elevation increases by 0.11 feet. This increase occurs since the Landmark Village project proposes to excavate existing farm fields and increase the River bed width in this area of the project. However, starting at River station 27925 through 23000 there are increases in water surface elevation of up to a maximum of 5.48 ft. This occurs because the proposed project extends into the existing floodplain resulting in higher water surface elevations and velocities during a Capital event. This increase is localized and dissipates by Station 23000. This same scenario occurs again between River stations 22195 and 15745 as the Landmark Village off-site bank protection project on the south bank of the River encroaches into the existing floodplain resulting in increases in water surface elevation and velocity. Increases in water surface elevation of up to 3.27 ft occur in this reach of the River, but dissipate by station 15745. The north bank of the River in this same reach shows no proposed soil cement bank protection. A detailed analysis and review of the existing vs. proposed condition flow depth and velocity along the north bank of the River in the over bank area is presented in the Newhall Ranch Santa Clara River HEC-RAS Modeling study (PACE, December, 2005). The analysis shows non-scouring or minimal scour velocities in this reach and therefore to meet the environmental requirements of the project, it is proposed to utilize vegetative TRM or geotextile type bank protection in this area.

For most of the project reach changes to water surface elevation are one foot or less. In a few subreaches changes in water surface elevation exceed one foot, however, these changes are infrequent and localized.

The previously mapped (ML Map # 43-ML-23) Capital Floodplain and Floodway are based upon higher flow rate (Qcap old = 168,000cfs) vs. revised Capital Flood rate (Qcap new = 142,475cfs). This does not represent a change in hydrology of the River, but rather in analysis criteria as established by Los Angeles County.

4.1.1C Floodplain Impacts Associated with Aggradation or Degradation
SAM results for the proposed condition predict general adjustment from -1.6 and +2.1 feet (vs. -2.9 -- +2.3 feet in the existing condition). LACH&SM methodology predicts general adjustment, from -1.8 to -7.6 feet for the proposed condition. A general trend in general adjustment for the study reach as indicated by SAM modeling is not apparent for either the existing or proposed condition. As illustrated above, little change is expected between the existing and proposed conditions general adjustment.

Local scour ranges from 0.0 to 17.4 feet in the proposed condition at the various river crossings. Results of calculations of bend scour vary from 0.0 to 8.9 feet for the proposed condition. For the proposed condition, the bedform height ranges from 0.5 to 8.3 feet. Changes between the existing and proposed conditions are a reflection primarily of the change in velocity brought about by the proposed condition. These changes tend to be very localized, primarily at crossings, and are not expected to impact fluvial mechanics on the River as a whole.

General adjustment, long-term adjustment, and other scour are summed to determine total potential bed adjustment following LACH&SM methodology. Calculations for the proposed condition predict that the combined bed adjustment ranges from approximately -6.7 to -26.2 feet for both the outside of curved reaches and for the inside of curved and straight reaches.

A comparison of total bed adjustment estimated by both the summed methodology and the LACFCDDM methodology shows that the more intensive LACH&SM methodology using SAM for general adjustment and historical analysis for long-term adjustment predicts a shallower toe-down for proposed conditions than does the LACFCDDM methodology except for sections in the vicinity of subreach, SRB1 and SRE1. In SRB1 section 36080 and SRE1 section 15125, the presence of proposed bridges causes LACH&SM calculations of this section to greatly exceed LACFCDDM calculations, by more than 10 feet. LACH&SM methodology utilizing SAM calculations predicts a deeper toe-down than does the LACFCDDM at these locations methodology because the LACFCDDM does not account for the effects of local degradation as effectively. Only minor differences are expected between the existing and proposed condition with the largest differences being local to bridge crossings.

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. Freeboard elevation is calculated in this study based on LACH&SM Chapter 5A-3, and includes LACFCDDM calculations. The freeboard for the River ranges from approximately 2.5 to 5.2 feet for both outside of curved and straight or inside of curved reaches in the proposed condition. Maximum total toe-down, total freeboard, toe-down elevation and freeboard elevation are presented in Table 4.4 and Figure 4.5. It should be noted that the fluvial study findings confirm the of the velocity distribution data above and the vegetation data below concerning the minimal change to erosion expected by the construction of the proposed project.

These changes are not considered significant and it is expected that various Newhall related impacts will be localized, and, with respect to implementation of the proposed improvements, that the fluvial mechanics of the River will remain essentially the same after construction of the Landmark Village flood protection improvements. The River is expected continue to behave fluvially as it did prior to construction of these proposed improvements.

Impacts associated with erosion and sediment deposition and, therefore, streambed modification within the River are evaluated as a function of in-stream velocities, which are indicators for potential riverbed scouring. This is discussed in detail in Section 4.5.1.

TABLE 4.3: EXISTING AND PROPOSED WATER SURFACE ELEVATION BY STATION FOR THE 100 YEAR DISCHARGE, SANTA CLARA RIVER STATIONS STA 35245 TO STA 14315

River Station	Existing	Proposed	η	River Station	Existing	Proposed	η
35245	976.5	976.5	**0.0**	24115	913.2	913.9	**0.7**
35040	974.6	974.6	**0.0**	23975	911.9	913.4	**1.5**
34860	973.1	973.1	**0.0**	23755	911.3	912.1	**0.8**
34720	971.7	971.7	**0.0**	23565	910.0	910.9	**0.8**
34495	971.0	970.0	**-1.0**	23365	908.1	910.2	**2.1**
34310	971.4	971.3	**-0.1**	23180	906.1	906.9	**0.9**
34090	971.4	971.3	**-0.1**	23000	907.0	907.9	**0.9**
33880	971.2	971.0	**-0.1**	22790	906.1	907.0	**1.0**
33710	970.2	970.0	**-0.2**	22600	905.6	905.4	**-0.2**
33500	968.8	968.5	**-0.3**	22415	905.1	903.3	**-1.9**
33310	963.8	963.8	**0.0**	22195	903.0	903.0	**0.0**
33115	961.9	961.9	**0.0**	22010	900.8	900.9	**0.2**
32795	961.5	961.5	**0.0**	21790	900.7	899.0	**-1.6**
32605	961.3	961.3	**0.0**	21615	899.9	898.9	**-1.0**
32265	959.4	959.4	**0.0**	21440	897.4	898.2	**0.8**
31875	958.2	958.2	**0.0**	21225	896.9	896.6	**-0.3**
31585	956.6	956.6	**0.0**	21020	892.9	896.6	**3.7**
31360	954.2	954.3	**0.1**	20845	894.4	895.4	**1.0**
31060	954.0	954.1	**0.1**	20595	894.2	895.7	**1.5**
30720	954.0	954.0	**0.1**	20435	893.9	895.3	**1.4**
30445	953.9	954.0	**0.1**	20280	892.4	892.7	**0.3**
30095	953.6	953.7	**0.1**	20070	888.6	888.8	**0.2**
29815	953.3	953.5	**0.1**	19855	888.1	889.8	**1.7**
29565	952.9	953.1	**0.1**	19630	886.5	889.3	**2.8**
29385	952.0	951.7	**-0.3**	19440	887.1	888.9	**1.8**
29140	949.4	949.5	**0.1**	19240	886.3	888.7	**2.4**
28895	945.2	945.2	**0.0**	19050	886.1	888.7	**2.6**
28695	937.5	937.5	**0.0**	18830	885.7	888.2	**2.5**
28500	935.8	935.8	**0.0**	18650	885.5	885.9	**0.4**
28280	935.2	934.6	**-0.6**	18475	885.4	885.7	**0.2**
28080	933.7	936.6	**2.9**	18290	885.2	885.1	**-0.1**
27925	933.9	933.9	**0.0**	18025	885.1	884.8	**-0.3**
27725	932.1	932.1	**0.0**	17785	884.7	884.4	**-0.3**
27545	930.9	930.9	**0.0**	17510	882.5	882.4	**-0.1**
27335	928.7	928.7	**0.0**	17360	881.1	880.7	**-0.4**
27155	929.6	929.6	**0.0**	17110	879.0	878.2	**-0.7**
26990	928.6	928.6	**0.0**	16970	875.3	875.3	**0.0**
26780	925.6	925.9	**0.3**	16720	871.9	871.8	**-0.1**
26575	926.6	926.6	**0.0**	16515	870.4	870.5	**0.1**
26355	925.5	925.4	**0.0**	16305	867.8	867.7	**0.0**
26170	925.5	925.5	**0.1**	16130	868.1	868.1	**0.0**
25965	925.0	925.1	**0.1**	15960	867.4	867.4	**0.0**
25785	924.2	924.3	**0.1**	15745	866.7	866.7	**0.0**
25600	922.1	923.2	**1.2**	15540	865.9	865.9	**-0.1**
25425	921.7	922.0	**0.4**	15335	864.3	864.2	**-0.1**
25215	920.4	920.0	**-0.4**	15125	863.7	863.7	**0.0**
25000	918.2	918.1	**0.0**	14900	862.3	862.4	**0.1**
24795	917.0	917.8	**0.8**	14720	859.4	859.4	**0.0**
24550	914.7	916.5	**1.9**	14480	858.6	858.5	**0.0**
24335	915.3	915.2	**-0.1**	14315	857.9	857.9	**0.0**
						MAX=	3.7
						MIN=	-1.9

Table 4.4: Santa Clara River Summary of Maximum Proposed Toe-down & Freeboard (ft)

Subreach	HEC-RAS Section	Z_{99} [2]	Outside Curved Reach		Straight-Inside Curved Reach		WSE	Outside Curved Reach		Straight-Inside Curved Reach	
			Maximum Total Degradation [3]	Proposed Toe-down Elevation [1,4]	Maximum Total Degradation [3]	Proposed Toe-down Elevation [1,4]		Maximum Total Freeboard [3]	Proposed Top of Levee Elevation [1]	Maximum Total Freeboard [3]	Proposed Top of Levee Elevation [1]
SRA1	46195	1035.0	14.0	1021.0	14.0	1021.0	1063.1	3.1	1066.3	3.1	1066.3
	46020	1032.0	14.0	1018.0	14.0	1018.0	1062.0	3.0	1065.0	3.0	1065.0
	45545	1030.0	14.0	1016.0	14.0	1016.0	1057.9	3.4	1061.3	3.4	1061.3
	45030	1025.0	14.0	1011.0	14.0	1011.0	1054.2	3.0	1057.3	3.0	1057.3
	44585	1022.0	14.0	1008.0	14.0	1008.0	1050.6	3.2	1053.8	3.2	1053.8
	44210	1020.0	14.0	1006.0	14.0	1006.0	1047.8	2.9	1050.8	2.9	1050.8
SRA2	43820	1018.0	15.4	1002.6	15.4	1002.6	1042.1	3.9	1046.0	3.9	1046.0
	43610	1017.0	17.0	1000.0	17.0	1000.0	1038.3	4.0	1042.2	4.0	1042.2
	43410	1016.0	15.8	1000.2	15.8	1000.2	1035.8	3.6	1039.4	3.6	1039.4
	43200	1014.0	16.3	997.7	16.3	997.7	1033.2	3.5	1036.7	3.5	1036.7
	42975	1012.0	15.5	996.5	15.5	996.5	1031.0	2.9	1033.8	2.7	1033.7
	42815	1011.0	15.5	995.5	15.5	995.5	1029.7	2.5	1032.2	2.5	1032.2
	42590	1010.0	21.0	989.0	14.7	995.3	1028.4	2.5	1030.9	2.5	1030.9
	42430	1008.0	21.0	987.0	15.3	992.7	1027.5	2.5	1030.0	2.5	1030.0
	42215	1006.0	21.0	985.0	14.7	991.3	1026.7	2.5	1029.2	2.5	1029.2
	41940	1005.0	15.0	990.0	11.9	993.1	1025.6	2.5	1028.1	2.5	1028.1
	41730	1004.0	15.0	989.0	12.0	992.0	1024.6	2.5	1027.1	2.5	1027.1
	41460	1002.0	15.0	987.0	11.9	990.1	1023.2	2.5	1025.7	2.5	1025.7
SRA3	41280	1001.0	12.5	988.5	12.5	988.5	1021.8	2.5	1024.3	2.5	1024.3
	41080	1000.0	14.0	986.0	14.0	986.0	1020.5	2.5	1023.0	2.5	1023.0
	40825	999.5	21.0	978.5	14.0	985.5	1019.3	2.5	1021.8	2.5	1021.8
	40585	998.0	18.0	980.0	12.5	985.5	1018.3	2.5	1020.8	2.5	1020.8
	40335	996.0	15.0	981.0	10.0	986.0	1017.4	2.5	1019.9	2.5	1019.9
	40130	995.0	15.0	980.0	10.0	985.0	1016.6	2.5	1019.1	2.5	1019.1
	39945	994.0	15.0	979.0	10.0	984.0	1015.9	2.5	1018.4	2.5	1018.4
	39755	994.0	12.5	981.5	12.5	981.5	1014.6	2.5	1017.1	2.5	1017.1
	39605	993.0	14.0	979.0	14.0	979.0	1013.7	2.5	1016.2	2.5	1016.2
	39310	992.0	18.0	974.0	12.5	979.5	1012.2	2.5	1014.7	2.5	1014.7
	39100	990.0	14.0	976.0	14.0	976.0	1011.1	2.5	1013.6	2.5	1013.6
	38925	989.5	10.0	979.5	10.0	979.5	1010.3	2.5	1012.8	2.5	1012.8
SRA4	38710	988.0	10.0	978.0	10.0	978.0	1009.2	2.5	1011.7	2.5	1011.7
	38475	986.0	12.5	973.5	12.5	973.5	1007.0	2.6	1009.5	2.6	1009.5
	38300	985.5	14.0	971.5	14.0	971.5	1005.8	2.5	1008.3	2.5	1008.3
	38065	984.0	10.0	974.0	10.0	974.0	1004.1	2.5	1006.6	2.5	1006.6
	37810	983.0	14.0	969.0	14.0	969.0	1001.4	2.8	1004.2	2.8	1004.2
	37655	982.0	14.0	968.0	14.0	968.0	999.9	2.6	1002.5	2.6	1002.5
	37390	981.0	14.0	967.0	14.0	967.0	998.5	2.5	1001.0	2.5	1001.0
	37135	980.0	12.5	967.5	12.5	967.5	996.8	2.5	999.3	2.5	999.3
	36930	978.0	14.0	964.0	14.0	964.0	995.7	2.5	998.2	2.5	998.2
	36735	977.0	12.5	964.5	12.5	964.5	994.6	2.5	997.1	2.5	997.1
	36515	975.0	15.0	960.0	10.0	965.0	993.6	2.5	996.1	2.5	996.1
	36265	974.0	15.0	959.0	10.0	964.0	992.3	2.5	994.8	2.5	994.8
SRB1	36080	973.0	22.9	950.1	22.0	951.0	990.6	2.5	993.1	2.5	993.1
	35845	971.0	15.0	956.0	10.0	961.0	989.1	2.5	991.6	2.5	991.6
	35725	970.0	15.0	955.0	10.0	960.0	988.3	2.5	990.8	2.5	990.8
	35515	969.0	18.0	951.0	12.5	956.5	986.9	2.5	989.4	2.5	989.4
	35245	968.0	18.0	950.0	12.5	955.5	985.0	2.5	987.5	2.5	987.5
	35040	967.0	21.0	946.0	14.0	953.0	983.6	2.5	986.1	2.5	986.1
	34860	966.0	21.0	945.0	14.0	952.0	982.3	2.5	984.8	2.5	984.8
	34720	965.5	21.0	944.5	14.0	951.5	981.3	2.5	983.8	2.5	983.8
	34495	964.0	18.0	946.0	12.5	951.5	979.7	2.5	982.2	2.5	982.2
	34310	963.0	18.0	945.0	12.5	950.5	978.4	2.5	980.9	2.5	980.9
	34090	962.0	18.0	944.0	12.5	949.5	977.0	2.5	979.5	2.5	979.5
SRB2	33880	960.0	18.0	942.0	12.5	947.5	975.7	2.5	978.2	2.5	978.2
	33710	959.0	18.0	941.0	12.5	946.5	974.6	2.5	977.1	2.5	977.1
	33500	958.0	18.0	940.0	12.5	945.5	973.3	2.5	975.8	2.5	975.8
	33310	957.0	18.0	939.0	12.5	944.5	972.3	2.5	974.8	2.5	974.8
	33115	956.0	15.0	941.0	10.0	946.0	971.4	2.5	973.9	2.5	973.9
	32795	954.0	15.0	939.0	10.0	944.0	969.7	2.5	972.2	2.5	972.2
	32605	952.0	15.0	937.0	10.0	942.0	968.7	2.5	971.2	2.5	971.2
SRC1	32265	950.0	18.0	932.0	12.5	937.5	967.2	2.5	969.7	2.5	969.7
	31875	949.0	15.0	934.0	10.0	939.0	965.6	2.5	968.1	2.5	968.1
	31585	946.0	15.0	931.0	10.0	936.0	964.7	2.5	967.2	2.5	967.2
	31360	944.0	15.0	929.0	10.0	934.0	963.9	2.5	966.4	2.5	966.4
	31060	942.0	12.0	930.0	8.0	934.0	963.2	2.5	965.7	2.5	965.7
	30720	940.0	12.0	928.0	8.0	932.0	962.5	2.5	965.0	2.5	965.0
	30445	938.0	12.0	926.0	8.0	930.0	962.1	2.5	964.6	2.5	964.6
	30095	936.0	12.0	924.0	8.0	928.0	961.5	2.5	964.0	2.5	964.0
	29815	935.0	12.0	923.0	8.0	927.0	960.8	2.5	963.3	2.5	963.3
	29565	934.0	12.0	922.0	8.0	926.0	960.3	2.5	962.8	2.5	962.8
	29385	933.0	12.0	921.0	8.0	925.0	959.6	2.5	962.1	2.5	962.1
SRC2	29140	932.0	12.0	920.0	9.1	922.9	958.4	2.5	960.9	2.5	960.9
	28895	930.0	21.0	909.0	14.0	916.0	953.8	4.8	958.6	4.7	958.5
	28695	928.0	15.0	913.0	15.0	913.0	952.9	2.5	955.4	2.5	955.4
	28500	927.5	14.7	912.8	14.7	912.8	950.5	3.1	953.5	2.9	953.4
	28280	926.0	21.0	905.0	14.0	912.0	949.8	2.5	952.3	2.5	952.3
	28080	925.0	15.0	910.0	10.0	915.0	949.1	2.5	951.6	2.5	951.6
	27925	924.0	10.3	913.7	10.3	913.7	948.1	2.5	950.6	2.5	950.6
	27725	923.0	14.0	909.0	14.0	909.0	946.1	2.9	949.0	2.9	949.0
	27545	922.0	15.0	907.0	15.0	907.0	944.3	3.1	947.4	3.1	947.4
	27335	921.0	14.1	906.9	14.1	906.9	943.0	2.7	945.7	2.6	945.6
	27155	920.5	14.0	906.5	14.0	906.5	941.5	2.9	944.4	2.8	944.2
SRC3	26990	920.0	21.0	899.0	14.0	906.0	940.4	2.5	942.9	2.5	942.9
	26780	918.0	21.0	897.0	14.0	904.0	939.3	2.5	941.8	2.5	941.8
	26575	917.0	21.0	896.0	14.0	903.0	938.5	2.5	941.0	2.5	941.0
	26355	916.0	18.0	898.0	12.5	903.5	937.6	2.5	940.1	2.5	940.1
	26170	915.0	18.0	897.0	12.5	902.5	936.9	2.5	939.4	2.5	939.4
	25965	914.0	21.0	893.0	14.0	900.0	936.2	2.6	938.8	2.5	938.7
	25785	913.5	21.0	892.5	14.0	899.5	935.5	2.7	938.2	2.5	938.0
	25600	912.5	21.0	891.5	14.0	898.5	934.8	2.5	937.3	2.5	937.3
	25425	911.0	21.0	890.0	14.0	897.0	934.1	2.5	936.7	2.5	936.6
	25215	910.0	15.0	895.0	10.0	900.0	933.3	2.5	935.8	2.5	935.8
	25000	909.0	15.0	894.0	10.0	899.0	932.5	2.5	935.0	2.5	935.0
SRC4	24795	908.0	15.0	893.0	10.0	898.0	931.5	3.7	935.2	3.4	934.9
	24550	906.0	18.0	888.0	12.5	893.5	930.1	3.6	933.6	3.3	933.4
	24335	905.0	21.0	884.0	14.0	891.0	928.5	3.9	932.4	3.6	932.1
	24115	904.0	21.0	883.0	14.0	890.0	927.0	3.8	930.8	3.5	930.5
	23975	903.5	21.0	882.5	14.0	889.5	926.1	3.5	929.7	3.3	929.4
	23755	902.0	21.0	881.0	14.0	888.0	924.7	3.2	927.9	3.1	927.8
	23565	900.0	21.0	879.0	14.0	886.0	923.6	3.7	927.3	3.4	927.0
	23365	900.0	21.0	879.0	14.0	886.0	922.4	3.5	925.9	3.2	925.6
	23180	899.0	21.0	878.0	14.0	885.0	921.5	3.2	924.6	3.0	924.4
	23000	898.0	21.0	877.0	14.0	884.0	920.0	3.3	923.3	3.0	923.0
	22790	897.5	26.8	870.7	23.0	874.5	917.5	3.1	920.6	3.0	920.5
	22600	896.0	21.0	875.0	14.0	882.0	915.8	3.2	919.0	2.9	918.7
	22415	895.5	21.0	874.5	14.0	881.5	914.4	3.2	917.6	2.9	917.4

1 - Phase 1 Analysis, see end note

2 - Minimum 1999 Bed Elevation

3 - 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

4 - Values at bridges are approxmiate. Final design of levee at bridge locations will include detailed bridge analysis

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Table 4.4: Santa Clara River Summary of Proposed Toe-down & Freeboard (ft) continued

Subreach	HEC-RAS Section	Z_{99} [2]	Outside Curved Reach		Straight-Inside Curved Reach		WSE	Outside Curved Reach		Straight-Inside Curved Reach	
			Maximum Total Degradation [3]	Proposed Toe-down Elevation [1,4]	Maximum Total Degradation [3]	Proposed Toe-down Elevation [1,4]		Maximum Total Freeboard [3]	Proposed Top of Levee Elevation [1]	Maximum Total Freeboard [3]	Proposed Top of Levee Elevation [1]
SRD1	22195	894.0	15.0	879.0	10.0	884.0	913.1	2.5	915.6	2.5	915.6
	22010	892.0	18.0	874.0	12.5	879.5	911.4	2.5	913.9	2.5	913.9
	21790	891.5	21.0	870.5	14.0	877.5	909.9	2.6	912.6	2.5	912.4
	21615	892.0	21.0	871.0	14.0	878.0	908.9	2.6	911.5	2.5	911.4
	21440	890.0	18.0	872.0	12.5	877.5	907.8	2.5	910.3	2.5	910.3
	21225	888.0	21.0	867.0	14.0	874.0	906.7	2.5	909.2	2.5	909.2
	21020	887.0	21.0	866.0	14.0	873.0	905.6	2.5	908.1	2.5	908.1
	20845	886.0	18.0	868.0	12.5	873.5	904.7	2.5	907.2	2.5	907.2
	20595	885.0	15.0	870.0	10.0	875.0	903.6	2.5	906.1	2.5	906.1
	20435	884.0	15.0	869.0	10.0	874.0	902.8	2.5	905.3	2.5	905.3
	20280	883.7	18.0	865.7	12.5	871.2	901.8	2.5	904.3	2.5	904.3
	20070	882.0	21.0	861.0	14.0	868.0	900.6	2.5	903.1	2.5	903.1
SRD2	19855	880.5	21.0	859.5	14.0	866.5	899.6	3.0	902.6	2.9	902.5
	19630	880.0	21.0	859.0	14.0	866.0	898.6	2.9	901.5	2.9	901.5
	19440	878.0	15.0	863.0	10.0	868.0	897.9	3.0	900.8	3.0	900.8
	19240	877.5	18.0	859.5	12.5	865.0	896.9	3.4	900.3	3.4	900.2
	19050	876.0	21.0	855.0	14.0	862.0	896.2	4.1	900.3	4.1	900.3
	18830	874.0	15.0	859.0	10.0	864.0	895.4	4.1	899.4	4.0	899.4
	18650	873.5	15.0	858.5	10.0	863.5	894.7	4.0	898.7	4.0	898.7
	18475	872.0	13.6	858.4	8.0	864.0	894.3	3.4	897.6	3.4	897.6
	18290	871.5	14.1	857.4	8.0	863.5	893.6	3.2	896.8	3.2	896.8
	18025	870.0	8.0	862.0	8.0	862.0	892.9	3.1	895.9	3.1	895.9
	17785	868.0	8.0	860.0	8.0	860.0	892.0	3.2	895.2	3.2	895.2
SRD3	17510	868.0	10.0	858.0	10.0	858.0	890.4	2.5	892.9	2.5	892.9
	17360	868.0	12.5	855.5	12.5	855.5	888.3	2.5	890.8	2.5	890.8
	17110	864.0	14.0	850.0	14.0	850.0	885.5	2.5	888.0	2.5	888.0
	16970	863.7	14.0	849.7	14.0	849.7	884.0	2.5	886.5	2.5	886.5
	16720	863.5	14.0	849.5	14.0	849.5	882.3	2.5	884.8	2.5	884.8
	16515	862.0	14.0	848.0	14.0	848.0	881.2	2.5	883.7	2.5	883.7
	16305	860.0	10.0	850.0	10.0	850.0	880.4	2.5	882.9	2.5	882.9
	16130	860.0	12.5	847.5	12.5	847.5	879.4	2.5	881.9	2.5	881.9
	15960	859.0	12.5	846.5	12.5	846.5	878.6	2.5	881.1	2.5	881.1
	15745	858.0	10.0	848.0	10.0	848.0	877.6	2.5	880.1	2.5	880.1
	15540	857.5	10.0	847.5	10.0	847.5	876.7	2.5	879.2	2.5	879.2
	15335	856.0	12.5	843.5	12.5	843.5	874.8	2.5	877.3	2.5	877.3
SRE1	15125	854.0	26.1	827.9	26.1	827.9	872.0	2.5	874.5	2.5	874.5
	14900	853.0	14.0	839.0	14.0	839.0	869.7	2.5	872.2	2.5	872.2
	14720	852.0	21.0	831.0	14.0	838.0	868.4	2.5	870.9	2.5	870.9
	14480	850.5	21.0	829.5	14.0	836.5	866.9	2.5	869.4	2.5	869.4
	14315	850.0	15.0	835.0	10.0	840.0	866.0	2.5	868.5	2.5	868.5
	14090	850.0	15.0	835.0	10.0	840.0	864.8	2.5	867.3	2.5	867.3
	13850	848.0	15.0	833.0	10.0	838.0	863.6	2.5	866.1	2.5	866.1
	13635	846.0	18.0	828.0	12.5	833.5	862.5	2.5	865.0	2.5	865.0
	13425	845.0	21.0	824.0	14.0	831.0	861.8	2.5	864.3	2.5	864.3
	13190	844.0	15.0	829.0	10.0	834.0	861.1	2.5	863.6	2.5	863.6
SRE2	13030	843.0	15.0	828.0	10.0	833.0	860.6	4.2	864.8	4.1	864.8
	12835	842.0	10.0	832.0	10.0	832.0	860.0	4.7	864.7	4.6	864.7
	12615	841.0	10.0	831.0	10.0	831.0	859.3	5.2	864.6	5.2	864.6
	12395	840.0	10.0	830.0	10.0	830.0	858.7	5.1	863.8	5.1	863.8
	12195	839.0	10.0	829.0	10.0	829.0	858.1	4.2	862.3	4.2	862.3
	11995	837.0	10.0	827.0	10.0	827.0	857.3	4.1	861.4	4.1	861.4
	11780	836.0	10.0	826.0	10.0	826.0	856.6	4.0	860.5	4.0	860.5
	11605	835.5	10.0	825.5	10.0	825.5	855.8	4.0	859.8	4.0	859.8
	11405	834.0	10.0	824.0	10.0	824.0	854.6	3.9	858.6	3.9	858.6
	11180	833.0	12.5	820.5	12.5	820.5	852.7	3.9	856.6	3.9	856.6
SRE3	11015	831.5	14.0	817.5	14.0	817.5	850.2	3.8	854.0	3.8	854.0
	10835	831.0	14.0	817.0	14.0	817.0	848.1	3.7	851.8	3.7	851.8
	10575	830.0	14.0	816.0	14.0	816.0	846.1	3.8	849.9	3.8	849.9
	10390	828.0	14.0	814.0	14.0	814.0	845.1	3.1	848.2	3.1	848.2
	10225	827.5	12.5	815.0	12.5	815.0	844.1	3.1	847.2	3.1	847.2
	10000	826.0	10.0	816.0	10.0	816.0	842.6	3.1	845.7	3.1	845.7
	9820	824.0	14.0	810.0	14.0	810.0	841.4	3.1	844.5	3.1	844.5
	9595	823.8	10.0	813.8	10.0	813.8	839.9	3.1	843.0	3.1	843.0
	9385	823.0	18.0	805.0	12.5	810.5	838.6	3.1	841.7	3.1	841.7
	9220	822.0	18.0	804.0	12.5	809.5	837.6	3.1	840.7	3.1	840.7
	9025	821.0	18.0	803.0	12.5	808.5	836.6	3.1	839.7	3.1	839.7

1 - Phase 1 Analysis, see end note

2 - Minimum 1999 Bed Elevation

3 - 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

4 - Values at bridges are approxmiate. Final design of levee at bridge locations will include detailed bridge analysis

4.1.2 On-site drainage

Implementation of the Project (with the associated storm drain system) would affect the previously described on-site natural tributary drainage channels. While existing discharges from the Project site are not concentrated into centralized outlet structures (as proposed by the Project), surface water flows naturally form paths of least resistance and concentrate at existing topographic depressions or cut channels that serve as concentrated discharge locations. Therefore, while the Project includes development of the storm drain system and will have predefined outlets, this condition will not significantly alter existing drainage patterns. The Project also includes the use of energy dissipaters at the storm drain outlets to the River. Installation of these improvements will dissipate the energy that could cause erosion at the Project outlets.

The Psomas Drainage Concept compares the existing and proposed developed condition hydrology, and concludes that a net decrease of Q_{CAP}=*-267 cfs* is expected to occur in the proposed Project condition, as presented in Table 4.5. The apparent cause of the reduction of the peak discharge is a function of the reduction of the time of concentration for the project. That is, the increase in imperviousness reduces the time of concentration for various subbasins. As a result the hydrograph of water discharged from the Project site is flatter and broader, reducing the peak. This small change (<1%) shows that the existing and proposed Project condition are substantially consistent. It is important to note that the existing condition is the 50-year burned and bulked discharge, also defined as the Capital discharge. The proposed Project condition, in contrast, is the burned and unbulked discharge. In the proposed Project condition, water from off-site discharging through the Project will pass through sediment basins that act to remove or unbulk sediment from the water. While the volume of water is the same for both the existing condition and proposed Project condition, the existing condition discharge is laden with sediment while the proposed Project condition discharge has had sediment removed.

Table 4.5: Existing vs. Proposed Condition On-site Hydrology Comparison 50-Year Event (CFS)

Existing[1]	Proposed[2]	Δ
1117	850	-267

1. Burned and bulked 2. Burned or Design

4.1.3 Proposed Floodplain Modifications

4.1.3.1 Consistency with the Newhall Ranch EIR

The Newhall Ranch Specific Plan utilized innovative techniques to meet the requirements of flood control while maintaining the natural resources within the Santa Clara River. The Project will implement these techniques as part of its flood control improvements. Traditional flood control techniques in use in Los Angeles County rely on reinforced concrete or grouted rock rip-rap to minimize erosion while maximizing the volume of flood flows carried by the drainage. While exceedingly efficient as a flood control technique, this approach retains none of the natural resource value.

In contrast, the Conceptual Backbone Drainage Plan of the Newhall Ranch Specific Plan provides drainage and flood control protection to developed uses while preserving the River as a natural resource. The Drainage Plan utilizes several criteria that are to be implemented by projects that develop within the Specific Plan area. The primary criteria are as follows:

- Flood corridor must allow for the passage of Los Angeles County Capital Flood discharge without the permanent removal of natural River vegetation (except at bridge crossings);

- The banks of the River will generally be established outside of the "waters of the United States" as defined by federal laws and regulations and as determined by the delineation completed by the ACOE in August 1993;

- Where the ACOE delineation width is insufficient to contain the Capital Flood flow, the flood corridor will be widened by an amount sufficient to carry the Capital Flood flow without the necessity of permanently removing vegetation or significantly increasing velocity; and

- Soil cement will occur only where necessary to protect against erosion adjacent to the proposed development. Where existing bluffs are determined to be stable and there is no adjacent proposed development, no bank protection will be built.

The improvements proposed by the Project are consistent with these criteria. Most of the flood protection associated with the Project is buried bank stabilization to stabilize River and creek banks. As illustrated in this report, the design and location of the flood protection improvements is sufficient to carry the Capital Flood discharge and adheres to FEMA requirements. The location of areas where soil cement would be provided is depicted on Figure 1.4 and, in most cases, is outside of the ACOE jurisdictional limits. Finally, only areas where flood protection is necessary are proposed for improvements.

At limited locations on the Project site, such as at outlet structures, access ramps, or bridge abutments, grouted rip-rap or reinforced concrete would be used to minimize erosion. In the Project area, approximately 63 percent of the River corridor would be protected with flood protection improvements, while 37 percent of the River corridor would remain in a natural state. Approximately 76 percent of the area proposed for flood protection improvements would consist of buried bank stabilization. Approximately 20 percent would consist of TRM's (those areas along the utility corridor). Approximately 4 percent would consist of rip-rap or reinforced concrete (primarily at Long Canyon Bridge and SR 126 over Castaic Creek).

Buried soil cement, now employed on numerous projects within the Santa Clarita Valley, is a modern flood control technique used to protect against erosion while maintaining natural vegetation and soft banks. Figure 1.5 depicts a typical cross-section for buried soil cement. As shown, this approach uses soil cement, primarily consisting of on-site materials, generally installed in locations set back from the riparian corridor, which is then buried and re-vegetated with native plant species. This type of flood protection allows for the creation of a large river corridor with significant buffers, which maintains the natural habitat presently found along the River.

In conclusion, this report confirms the project's consistency with the Newhall Ranch Specific Plan.

4.1.3.2 Modification of County Floodway Map/Consistency with County Capital discharge requirements

Los Angeles County has mapped the 100-year floodplain and flood way for the River under its Q_{CAP} requirements (Figure 4.6). All projects developed within the unincorporated areas of the County of Los Angeles are required to comply with the County's Q_{CAP} requirements. The project design is consistent with the Capital discharge requirements since design modeling is based on the Capital discharge. Finally, if the Project is approved, the County's Map Floodway will be changed to correspond with Project improvements.

4.1.3.3 FEMA 100-Year Floodplain

The Project would necessitate encroachments into the existing FEMA 100-year floodplain. These encroachments were all discussed in detail in the Newhall Ranch Specific Plan EIR. These encroachments would require FEMA review and approval in the form of the Conditional Letter of Map Revision/Letter of Map Revision (CLOMR/LOMR) floodplain map revision process. Approximately 327 acres of the Project development acreage (project site plus off-site components) is within the existing FEMA 100-year floodplain. In summary, the FEMA 100-year floodplain line corresponds to an existing elevation where flooding could occur in a 100-year storm. To meet the FEMA requirements, the Project proposes the raising of the development footprint to an elevation above the existing FEMA maximum flooding elevation. Additionally, the Project incorporates bank stabilization along the River corridor to protect the site from erosion.

Encroachment impacts were evaluated using floodplain and habitat engineering and analyzed on the basis of depth and velocity, as described below. Additionally, some banks located out of the floodplain will require stabilization because of the need to protect for the Q_{CAP} discharge.

The bank stabilization and erosion protection would provide adequate protection to the developed areas from flood hazards. Additionally, the locations and dimensions of this bank stabilization, erosion protection and bridge abutments are such that neither would impede or redirect flood flows within the River. Therefore, a modification to the FEMA flood hazard boundary is appropriate to correspond to the location of the flood protection improvements.

Finally, in most areas, the soil cement would be placed outside the existing River channel, creating areas that would convert to River channel or upland. For example, soil cement proposed on the north side of the River near the confluence with Castaic Creek would be constructed on agricultural land, north of the existing riparian or River corridor. The land located between the existing River corridor and the newly created stabilized and revegetated bank would be excavated to widen the existing River corridor, which would increase the area available within the corridor.

The Long Canyon Road Bridge is proposed to be constructed across the River, near the western end of the Project site at STA 22190 (Figure 1.4). Long Canyon Road Bridge is to include abutments, rip-rap transitions to soil cement, and approaches that would reduce the width of the 100-year floodplain. However, as summarized in Table 4.6, the existing active River channel width, which carries the 2- through 5-year flood events, would be completely spanned by the bridge and remain unaffected. The 10- through 100-year events would be impacted by the narrowing of the channel resulting in localized increases in velocity and water surface elevation necessitating the westerly extension of bank stabilization along the southern edge of the River corridor. This bank stabilization, located downstream from the residential and commercial areas of the Project site, is consistent with the bank stabilization improvements described in the Newhall Ranch Specific Plan. Finally, flooding up to and including the 100-year and Q_{CAP} events would be contained within the north and south bridge abutments.

Table 4.6: Pre- and Post-Development Floodplain/Stream Area			
Storm Event	**Existing Conditions**	**Post Development**	η∂ 9
2-Year	333.7	333.2	-0.2
5-Year	374	374.5	0.1
10-Year	448.1	449.2	0.2
20-Year	595.3	561.4	-6.0
50-Year	765	674	-13.5
100-Year	858	757.5	-13.3
CAP	1062.9	893.8	-18.9

4.2 Housing or Structures within a 100-Year Flood Hazard Area

Consistent with the approved Newhall Ranch Specific Plan, a portion of the project tract map site, which consists of residential lots, internal roads and other development, is within the existing FEMA 100-year floodplain (Figure 3.1). This portion of the proposed development is situated on existing agricultural lands. However, this portion of the proposed development would be filled and, thereby elevated, so that the developed topography would no longer be within the existing FEMA 100-year floodplain. As additional flood protection, the Project's southern boundary proposes buried soil cement, which would stabilize the elevated bank and protect the proposed development from flood hazards. The buried soil cement is designed to act as a non-erodible boundary to contain flood waters during a Capital Flood discharge. Figure 3.1 illustrates the existing FEMA 100-year floodplain zone, proposed development within that area and the proposed soil cement bank protection.

Because a portion of the Project development is within the existing FEMA 100-year floodplain, adjustments to the FEMA published maps, (FIRMs), are required. These adjustments are administered by FEMA, and revisions to the mapping are made by applicants applying for a Letter of Map Revisions -- based on Fill (LOMR-F). LOMR-Fs are documents issued by FEMA that remove property and/or structures from special flood hazard areas. It is a common accepted practice, both nationwide and within Los Angeles County, to process revisions to the FEMA floodplain maps (*i.e.*, LOMR-Fs). The issuance of a LOMR-F would eliminate the property and/or structures from the applicable FEMA 100-year map. Any property and/or structures that are elevated above the FEMA 100-year floodplain zone are considered reasonably safe and free from flood hazard. Figure 4.7A-G depicts the proposed final FEMA 100-year floodplain zone, consistent with the proposed developed topography and soil cement bank protection.

The proposed Long Canyon Road Bridge would be constructed across the River, and would include piers, abutments and rip-rap within the FEMA 100-year floodplain area (Figure 3.1). However, as shown on Table 4.6, the existing active River channel width, which carries the 2- through 5-year flood events, would be completely spanned by the bridge and remain unaffected. During the 10- through 100-year flood events, the narrowing of the River channel width would result in localized increases in velocity and water surface elevation, which causes the need for the westerly extension of buried soil cement bank protection along the southern edge of the River corridor. This buried soil cement bank protection, located downstream from the Project tract map site, is consistent with the bank

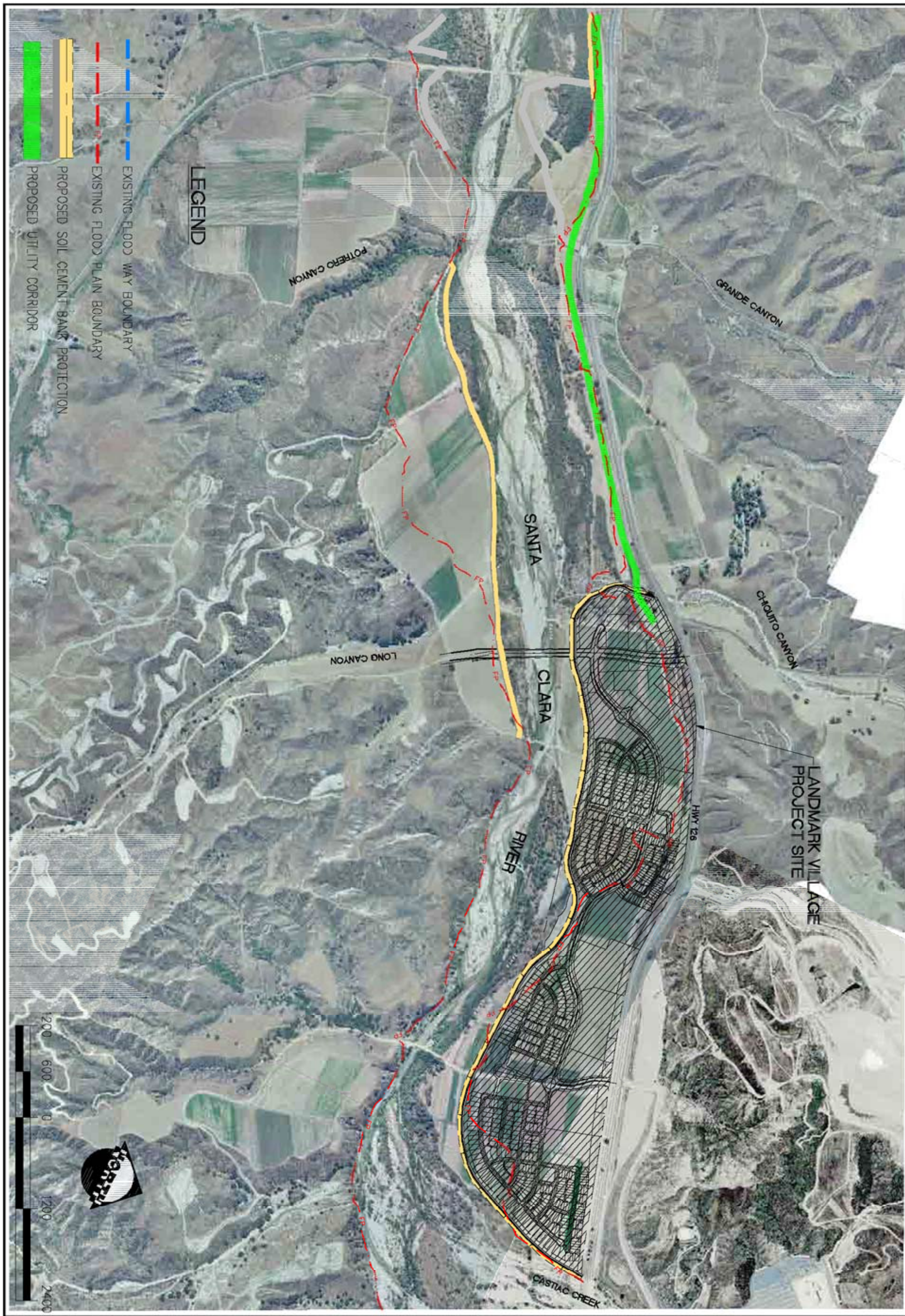


FIGURE		SCALE	1"= 1200'	JOB	TITLE
4.6	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	DESIGNED	DJ	LANDMARK VILLAGE	COUNTY FLOOD PLAIN BOUNDARY LINES
		DRAWN	JEP		
		CHECKED	MEK		
		DATE	04-26-05		
		JOB NO.		SANTA CLARITA CA	

P:\7841E\Engineering\GlobalExhibits\7841E-COUNTY FLOOD PLAIN BOUNDARIES-FIG 4.6.dwg - Tab: IMPROV MAP-1000 SCALE By: csponsler on Apr. 28, 2006 at 11:32 am

Xrefs: 7841E-Plong_bridge.dwg; 7841-PSIRV.dwg; P-bank protection_REV.dwg; 7142-Lining.dwg; 7142-Flood.Resource.dwg; 7142-river-sections1.dwg; NR-cdfg_2004.dwg; NR-acoe_2004.dwg; NR-Sea23.
Dimscale = 600; LTscale = 0.2; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

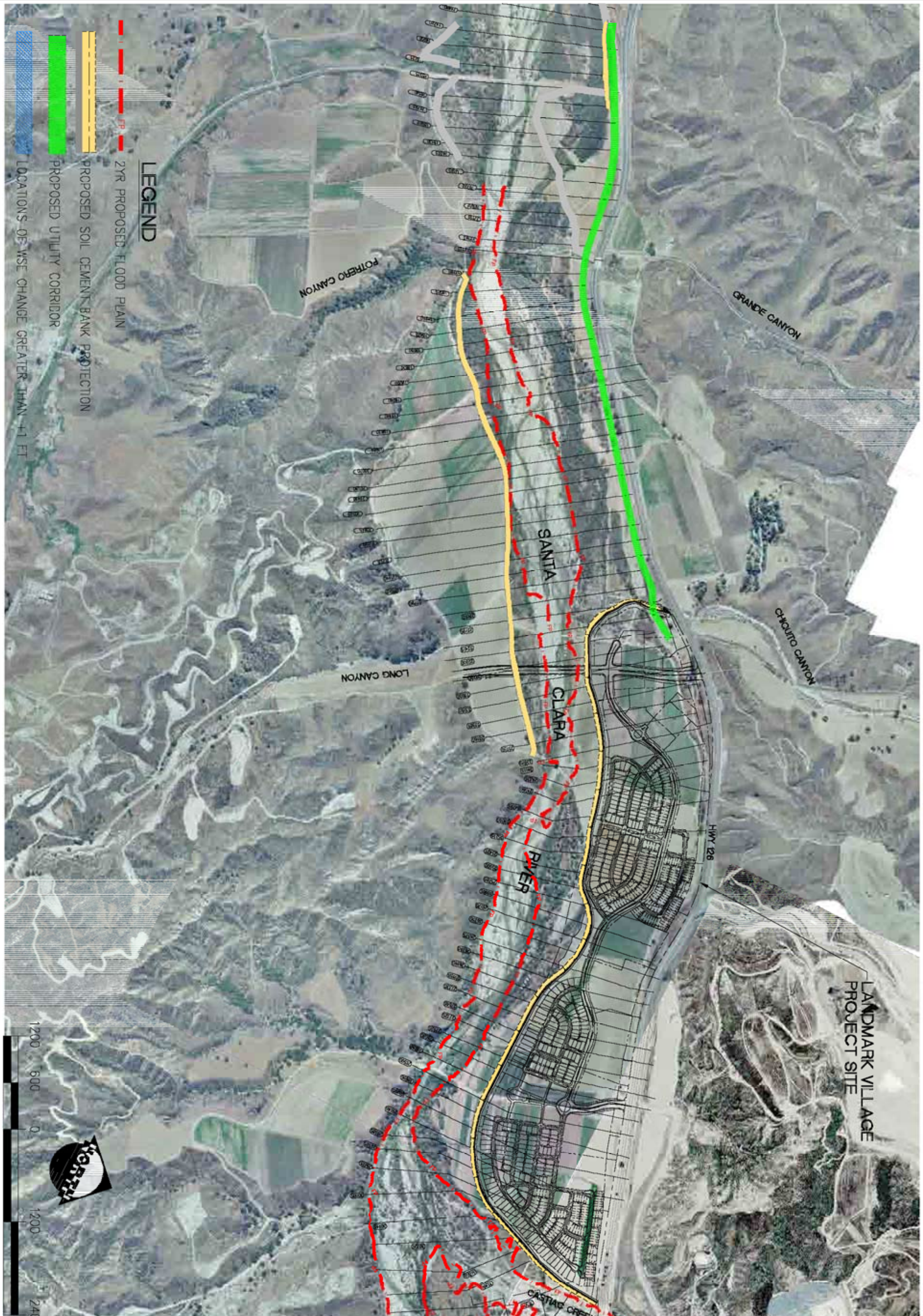


FIGURE 4.7A	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 1200'	JOB LANDMARK VILLAGE	TITLE PROPOSED 2YR FLOOD PLAIN LOCATIONS WITH WSE CHANGE GREATER THAN 1 FT
		DESIGNED DJ		
		DRAWN JEP		
		CHECKED MEK		
		DATE 04-26-05		
		JOB NO. 7841-E	SANTA CLARITA CA	

P:\7841E\Engineering\GlobalExhibits\7841E-EX-PROP-COMPARISON-2YR-FIG 4.7A.dwg - Tab: 2YR PROP-FP By: csponsler on Apr. 28, 2006 at 11:44 am

Xrefs: 7841E-Plong_bridge.dwg; 7841-PSIRV.dwg; P-bank protection_REV.dwg; 7142-Lining.dwg; 7142-Flood.Resource.dwg; 7142-river-sections1.dwg; NR-cdfg_2004.dwg; NR-acoe_2004.dwg; NR-Sea23.
Dimscale = 600; LTscale = 0.2; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

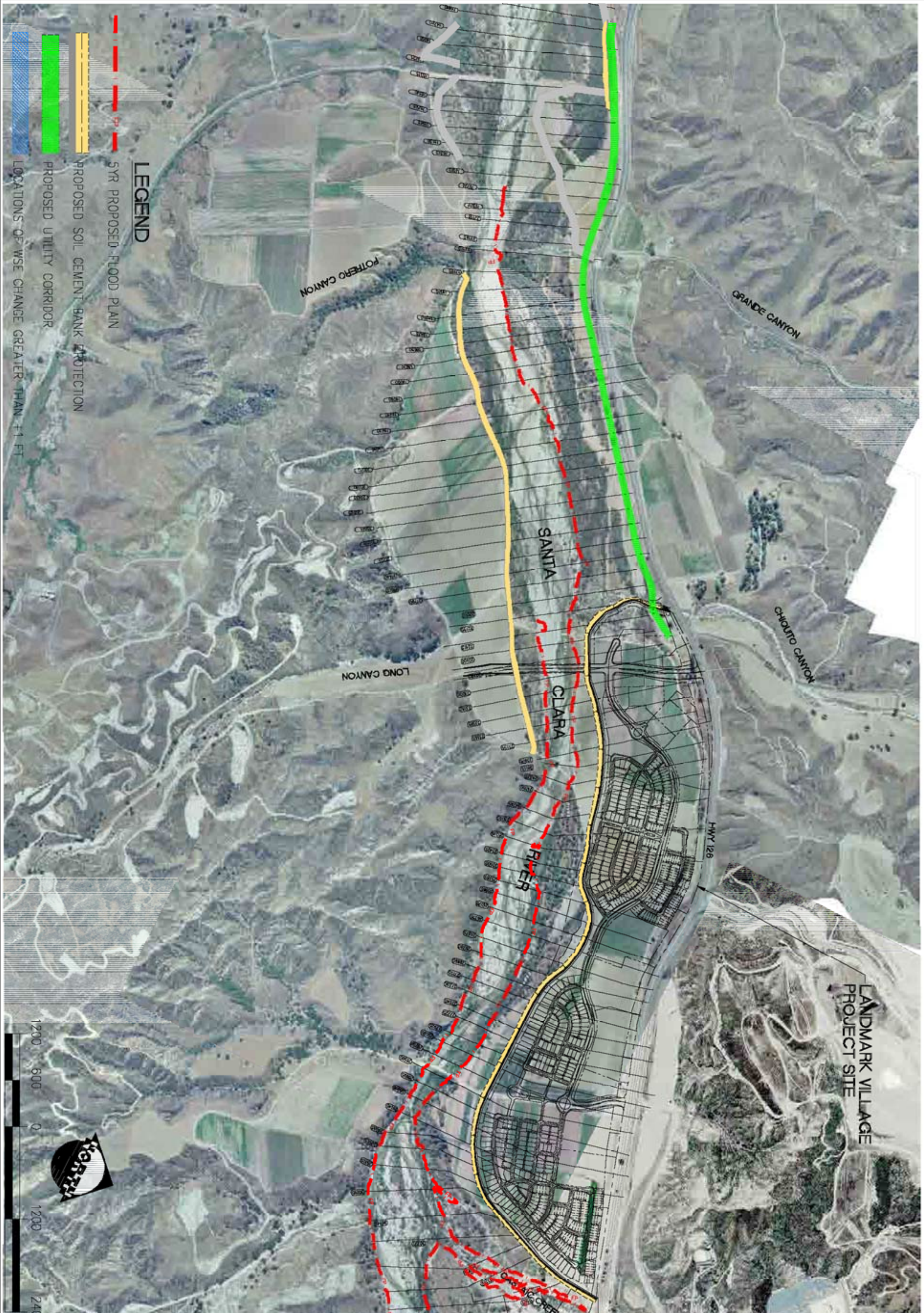


FIGURE 4.7B	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 1200' DESIGNED DJ DRAWN JEP CHECKED MEK DATE 04-26-05 JOB NO. 7841-E	JOB LANDMARK VILLAGE SANTA CLARITA CA

TITLE
PROPOSED 5YR FLOOD PLAIN LOCATIONS WITH WSE CHANGE GREATER THAN 1 FT

P:\7841E\Engineering\GlobalExhibits\7841E-EX-PROP-COMPARISON-5YR-FIG 4.7B.dwg - Tab: 5YR PROP-FP By: csponsler on Apr. 28, 2006 at 11:51 am

Xrefs: 7841E-Plong_bridge.dwg; 7841-PSIRV.dwg; P-bank protection_REV.dwg; 7142-Lining.dwg; 7142-Flood.Resource.dwg; 7142-river-sections1.dwg; NR-cdfg_2004.dwg; NR-acoe_2004.dwg; NR-Sea23.
Dimscale = 600; LTscale = 0.2; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

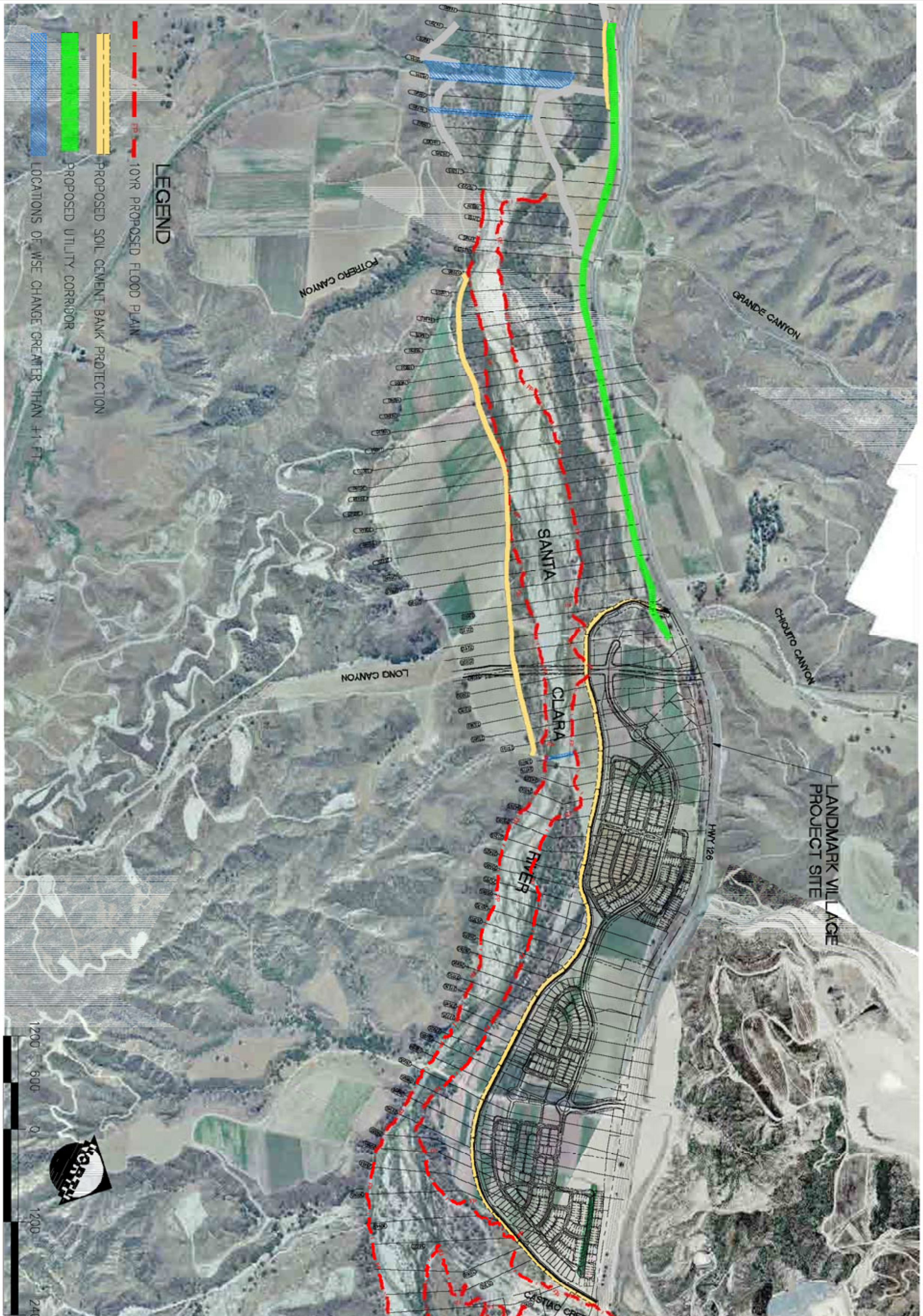


FIGURE 4.7C

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1"= 1200'
DESIGNED	DJ
DRAWN	JEP
CHECKED	MEK
DATE	04-26-05
JOB NO.	7841-E

JOB
LANDMARK VILLAGE
SANTA CLARITA CA

TITLE
PROPOSED 10YR FLOOD PLAIN LOCATIONS WITH WSE CHANGE GREATER THAN 1 FT

P:\7841E\Engineering\GlobalExhibits\7841E-EX-PROP-COMPARISON-10YR-FIG 4.7C .dwg - Tab: 10YR PROP-FP By: csponsler on Apr. 28, 2006 at 11:57 am

Xrefs: 7841E-Plong_bridge.dwg; 7841-PSIRV.dwg; P-bank protection_REV.dwg; 7142-Lining.dwg; 7142-Flood.Resource.dwg; 7142-river-sections1.dwg; NR-cdfg_2004.dwg; NR-acoe_2004.dwg; NR-Sea23.
Dimscale = 600; LTscale = 0.2; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

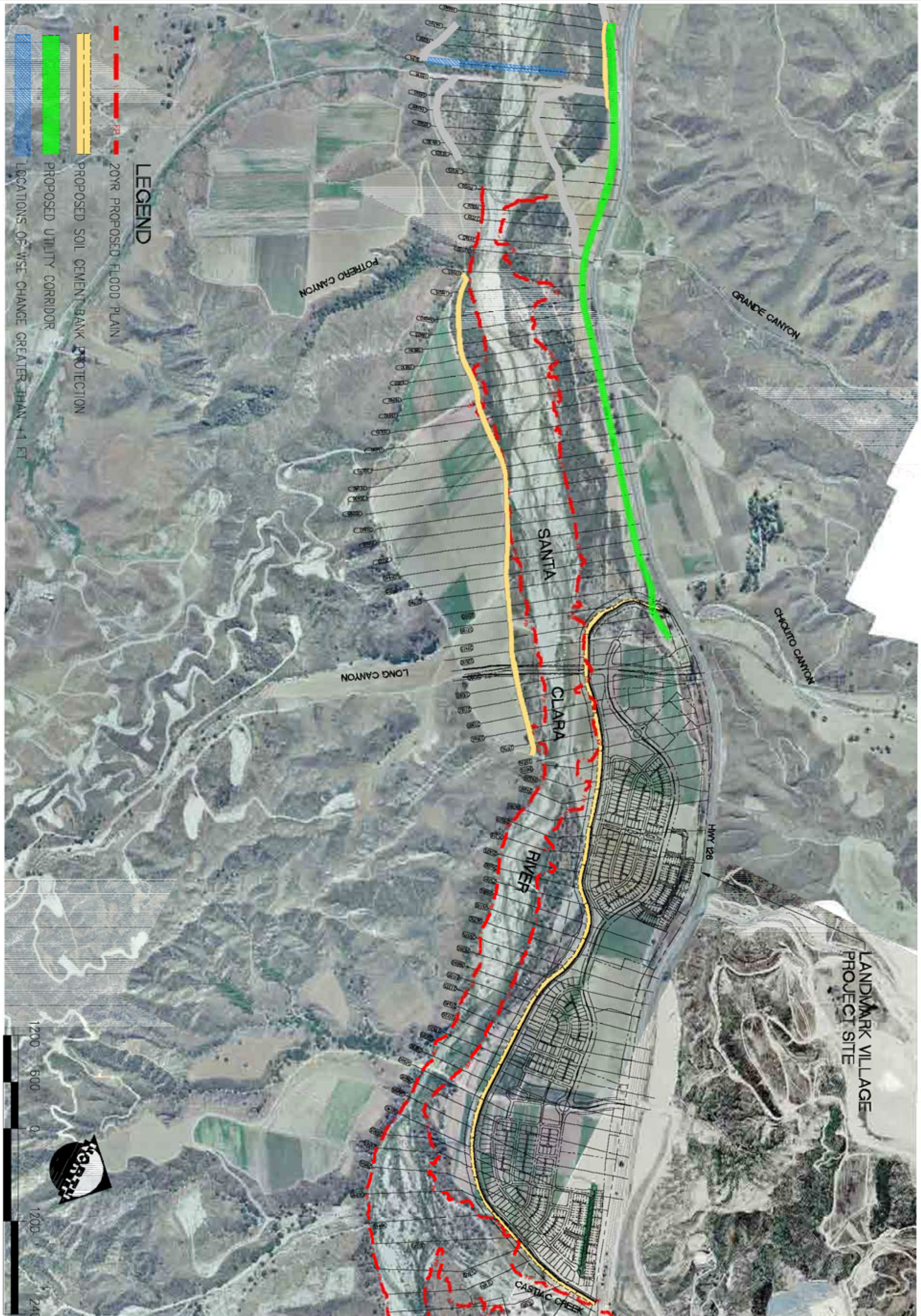


FIGURE 4.7D	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 1200'	JOB LANDMARK VILLAGE	TITLE PROPOSED 20YR FLOOD PLAIN LOCATIONS WITH WSE CHANGE GREATER THAN 1 FT
		DESIGNED DJ		
		DRAWN JEP		
		CHECKED MEK		
		DATE 04-26-05		
		JOB NO. 7841-E	SANTA CLARITA CA	

P:\7841E\Engineering\GlobalExhibits\7841E-EX-PROP-COMPARISON-20YR-FIG 4.7D.dwg - Tab: 20YR PROP-FP By: csponsler on Apr. 28, 2006 at 12:04 pm

Xrefs: 7841E-Plong_bridge.dwg; 7841-PSIRV.dwg; P-bank protection_REV.dwg; 7142-Lining.dwg; 7142-Flood.Resource.dwg; 7142-river-sections1.dwg; NR-cdfg_2004.dwg; NR-acoe_2004.dwg; NR-Sea23.
Dimscale = 600; LTscale = 0.2; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

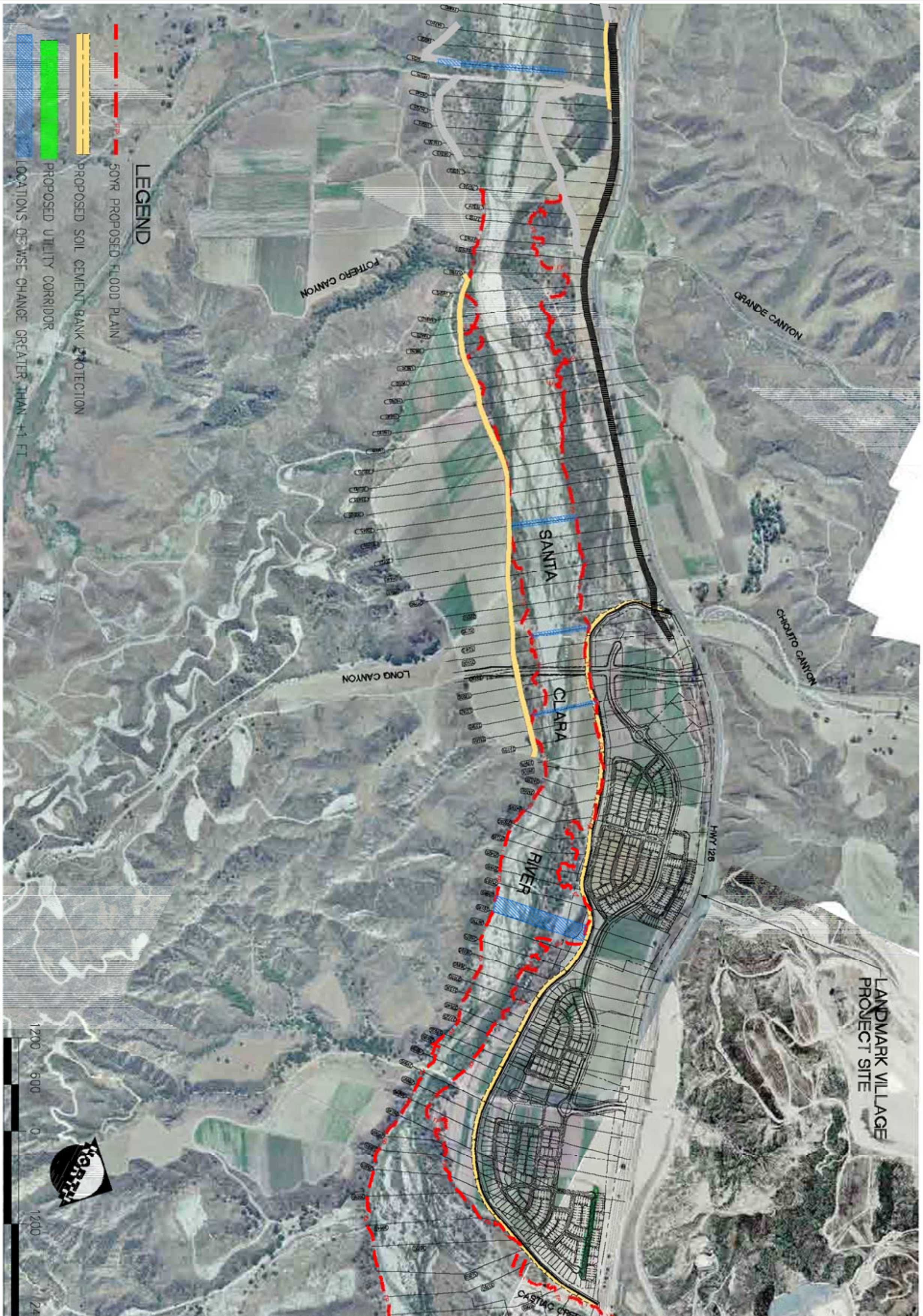


FIGURE 4.7E	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 1200' DESIGNED DJ DRAWN JEP CHECKED MEK DATE 04-26-05 JOB NO. 7841-E	JOB LANDMARK VILLAGE SANTA CLARITA CA	TITLE PROPOSED 50YR FLOOD PLAIN LOCATIONS WITH WSE CHANGE GREATER THAN 1 FT

P:\7841E\Engineering\GlobalExhibits\7841E-EX-PROP-COMPARISON-50YR-FIG 4.7E.dwg - Tab: 50YR PROP-FP By: csponsler on Apr. 28, 2006 at 12:12 pm

Xrefs: 7841E-Plong_bridge.dwg; 7841-PSIRV.dwg; P-bank protection_REV.dwg; 7142-Lining.dwg; 7142-Flood.Resource.dwg; 7142-river-sections1.dwg; NR-cdfg_2004.dwg; NR-acoe_2004.dwg; NR-Sea23.
Dimscale = 600; LTscale = 0.2; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

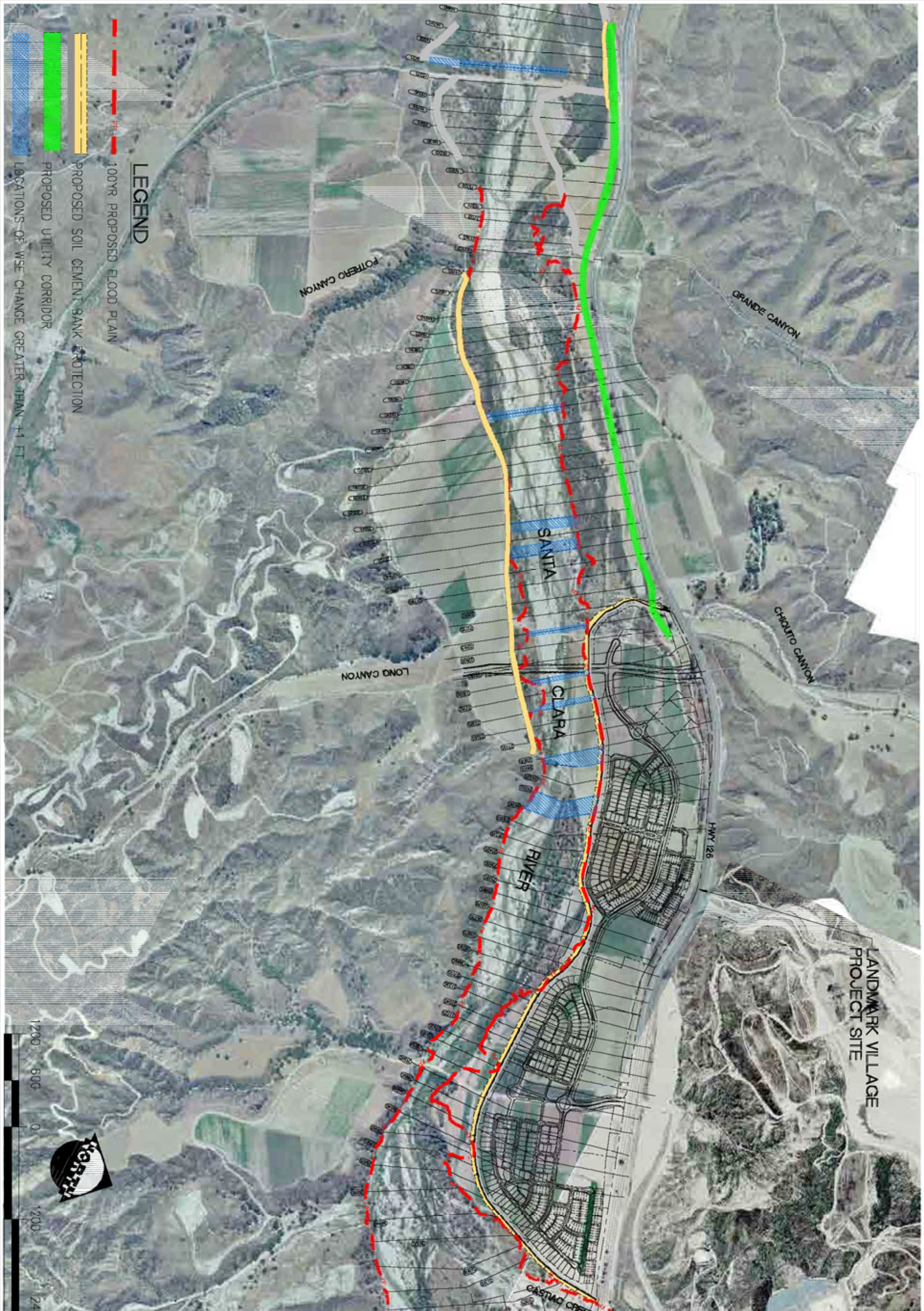
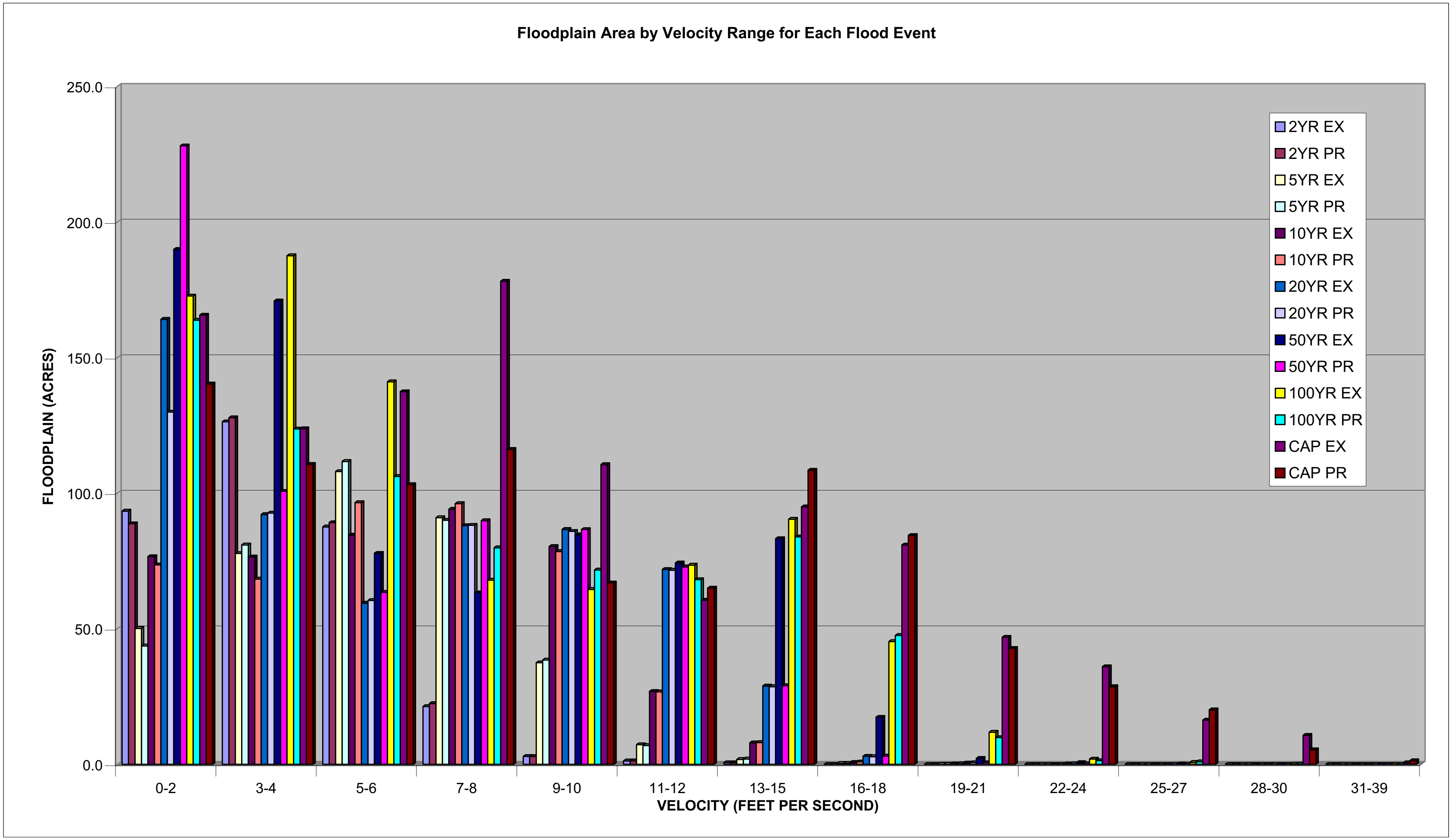


FIGURE 4.7F	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 1200' DESIGNED DJ DRAWN JEP CHECKED MEK DATE 04-26-05 JOB NO. 7841-E	JOB LANDMARK VILLAGE SANTA CLARITA CA	TITLE PROPOSED 100YR FLOOD PLAIN LOCATIONS WITH WSE CHANGE GREATER THAN 1 FT

P:\7841E\Engineering\GlobalExhibits\7841E-EX-PROP-COMPARISON-100YR-FIG 4.7F.dwg - Tab: 100YR PROP-FP By: csponsler on Apr. 28, 2006 at 01:23 pm

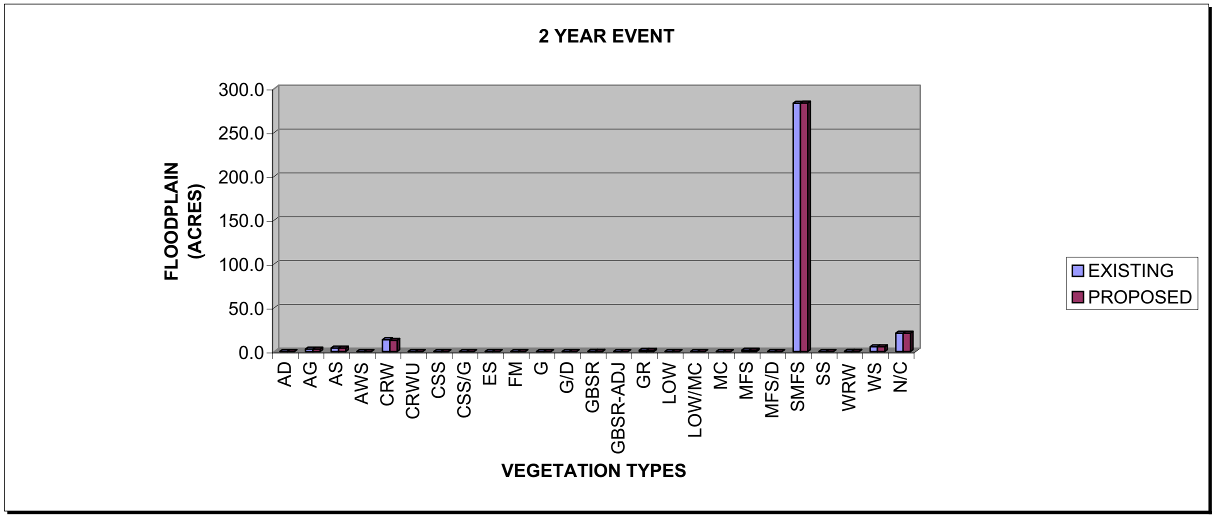
RIVER VILLAGE FLOODPLAIN AREA BY VELOCITY IMPACTS STATISTICS



FLOODPLAIN OVERALL VEGETATION COMPARISONS

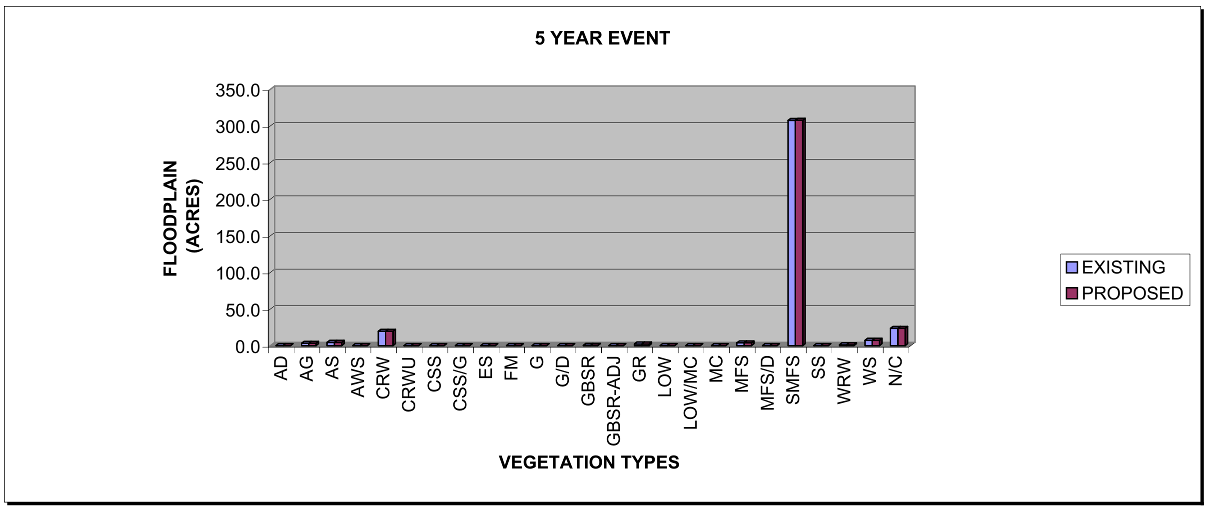
2 YEAR - Floodplain Overall Vegetation

Vegetation TYPE	EXISTING (AC)	PROPOSED (AC)	DELTA (AC)	DELTA % (%)
AD	0.0	0.0	0.0	0.0
AG	2.8	2.8	0.0	1.0
AS	4.0	4.0	0.0	1.0
AWS	0.0	0.0	0.0	0.0
CRW	13.6	12.8	-0.8	0.9
CRWU	0.0	0.0	0.0	0.0
CSS	0.0	0.0	0.0	1.0
CSS/G	0.0	0.0	0.0	0.0
ES	0.0	0.0	0.0	0.0
FM	0.0	0.0	0.0	0.0
G	0.0	0.0	0.0	1.0
G/D	0.0	0.0	0.0	0.0
GBSR	0.3	0.3	0.0	1.0
GBSR-ADJ	0.0	0.0	0.0	0.0
GR	1.3	1.3	0.0	1.0
LOW	0.0	0.0	0.0	1.1
LOW/MC	0.0	0.0	0.0	1.0
MC	0.0	0.0	0.0	0.0
MFS	1.7	1.7	0.0	1.0
MFS/D	0.0	0.0	0.0	1.0
SMFS	283.2	283.5	0.3	1.0
SS	0.0	0.0	0.0	0.0
WRW	0.3	0.3	0.0	1.0
WS	5.4	5.4	0.0	1.0
N/C	21.0	21.0	0.0	1.0
TOTAL	**333.7**	**333.2**	**-0.5**	**-0.2%**



5 YEAR - Floodplain Overall Vegetation

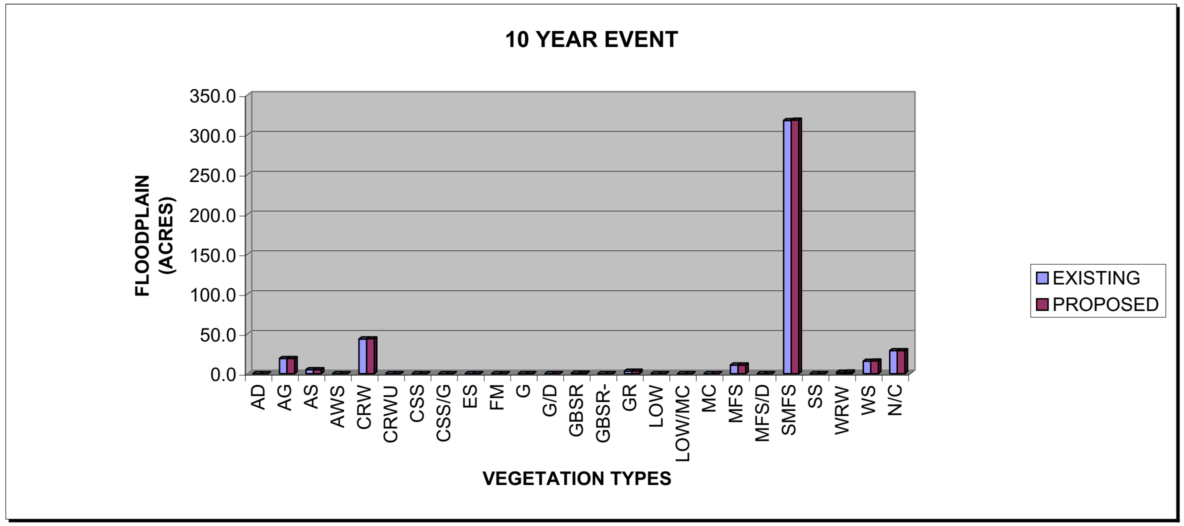
Vegetation TYPE	EXISTING (AC)	PROPOSED (AC)	DELTA (AC)	DELTA % (%)
AD	0.0	0.0	0.0	0.0
AG	3.4	3.4	0.0	1.0
AS	4.5	4.5	0.0	1.0
AWS	0.0	0.0	0.0	0.0
CRW	19.7	19.6	-0.1	1.0
CRWU	0.0	0.0	0.0	0.0
CSS	0.0	0.0	0.0	0.0
CSS/G	0.0	0.0	0.0	0.0
ES	0.0	0.0	0.0	0.0
FM	0.0	0.0	0.0	0.0
G	0.0	0.0	0.0	0.0
G/D	0.0	0.0	0.0	0.0
GBSR	0.4	0.4	0.0	1.0
GBSR-ADJ	0.0	0.0	0.0	0.0
GR	2.3	2.3	0.0	1.0
LOW	0.0	0.0	0.0	0.0
LOW/MC	0.0	0.0	0.0	0.0
MC	0.0	0.0	0.0	0.0
MFS	3.9	3.9	0.0	1.0
MFS/D	0.0	0.0	0.0	1.0
SMFS	307.6	308.0	0.4	1.0
SS	0.0	0.0	0.0	0.0
WRW	1.2	1.2	0.0	1.0
WS	7.4	7.4	0.0	1.0
N/C	23.7	23.7	0.0	1.0
TOTAL	**374.1**	**374.5**	**0.4**	**0.1%**



FLOODPLAIN OVERALL VEGETATION COMPARISONS

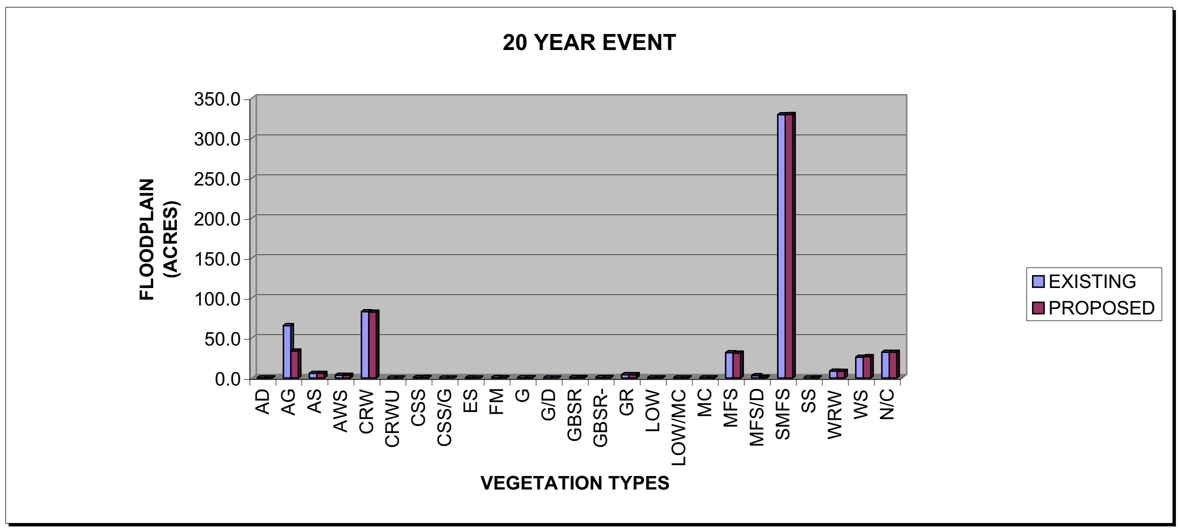
10 YEAR - Floodplain Overall Vegetation

Vegetation Type	EXISTING (AC)	PROPOSED (AC)	DELTA (AC)	DELTA % (%)
AD	0.1	0.1	0.0	1.0
AG	19.1	19.1	0.0	1.0
AS	5.1	5.1	0.0	1.0
AWS	0.0	0.0	0.0	1.0
CRW	43.8	43.9	0.1	1.0
CRWU	0.0	0.0	0.0	0.0
CSS	0.0	0.1	0.0	1.2
CSS/G	0.0	0.0	0.0	0.0
ES	0.0	0.0	0.0	0.0
FM	0.0	0.0	0.0	0.0
G	0.1	0.1	0.0	1.0
G/D	0.0	0.0	0.0	0.0
GBSR	0.5	0.5	0.0	1.0
GBSR-ADJ	0.0	0.0	0.0	0.0
GR	3.3	3.3	0.0	1.0
LOW	0.0	0.0	0.0	1.4
LOW/MC	0.0	0.0	0.0	1.0
MC	0.0	0.0	0.0	14.8
MFS	11.0	11.0	0.0	1.0
MFS/D	0.0	0.0	0.0	1.0
SMFS	318.1	318.6	0.5	1.0
SS	0.0	0.0	0.0	0.0
WRW	2.0	2.2	0.1	1.1
WS	15.8	16.0	0.3	1.0
N/C	29.1	29.1	0.0	1.0
TOTAL	**448.1**	**449.2**	**1.1**	**0.2%**



20 YEAR - Floodplain Overall Vegetation

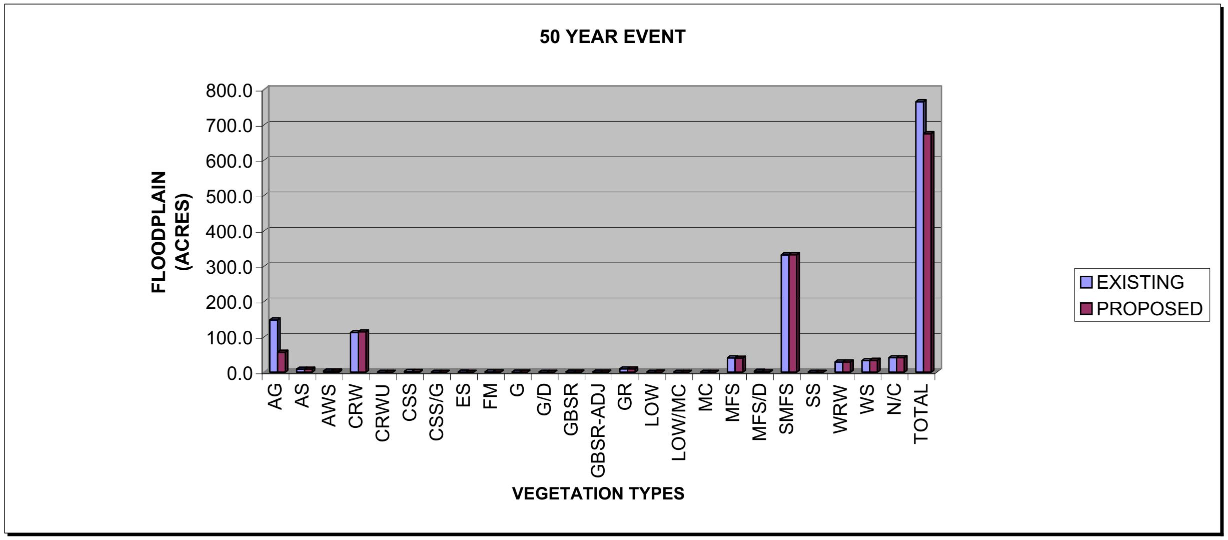
Vegetation Type	EXISTING (AC)	PROPOSED (AC)	DELTA (AC)	DELTA % (%)
AD	0.2	0.2	0.0	1.0
AG	65.5	33.8	-31.7	0.5
AS	5.7	5.7	0.0	1.0
AWS	3.5	3.5	0.0	1.0
CRW	82.9	82.4	-0.5	1.0
CRWU	0.0	0.0	0.0	0.0
CSS	0.6	0.8	0.1	1.2
CSS/G	0.0	0.0	0.0	0.0
ES	0.1	0.0	-0.1	0.0
FM	0.5	0.3	0.0	0.6
G	0.2	0.2	0.0	1.0
G/D	0.0	0.0	0.0	0.0
GBSR	0.5	0.5	0.0	1.0
GBSR-ADJ	0.5	0.5	0.0	1.0
GR	4.1	4.1	0.0	1.0
LOW	0.1	0.1	0.0	1.6
LOW/MC	0.0	0.0	0.0	1.0
MC	0.0	0.0	0.0	3.9
MFS	31.8	31.1	-0.7	1.0
MFS/D	2.9	1.2	-1.7	0.4
SMFS	329.4	329.6	0.2	1.0
SS	0.0	0.0	0.0	0.0
WRW	8.6	8.4	-0.2	1.0
WS	26.0	26.7	0.7	1.0
N/C	32.1	32.1	0.0	1.0
TOTAL	**595.3**	**561.4**	**-33.7**	**-5.7%**



FLOODPLAIN OVERALL VEGETATION COMPARISONS

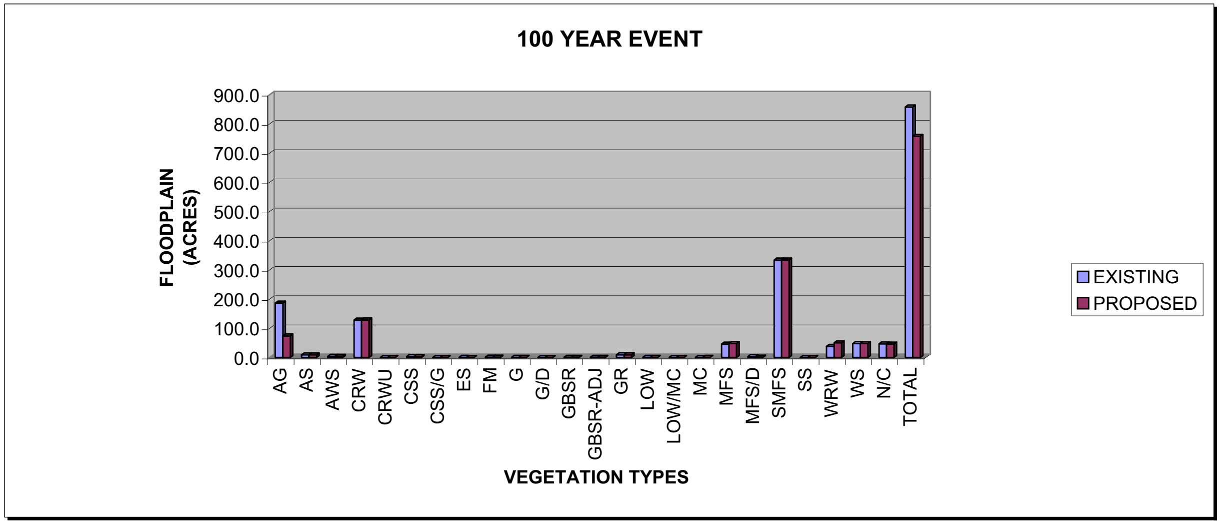
50 YEAR - Floodplain Overall Vegetation

Vegetation Type	EXISTING (AC)	PROPOSED (AC)	DELTA (AC)	DELTA % (%)
AD	0.5	0.3	-0.2	0.7
AG	147.9	56.7	-91.2	0.4
AS	8.7	8.7	0.0	1.0
AWS	3.6	3.6	0.0	1.0
CRW	112.0	114.2	2.2	1.0
CRWU	0.0	0.0	0.0	0.0
CSS	2.1	2.1	0.0	1.0
CSS/G	0.0	0.0	0.0	0.0
ES	0.2	0.0	-0.2	0.0
FM	0.9	0.9	0.0	1.0
G	0.2	0.2	0.0	1.0
G/D	0.0	0.0	0.0	0.0
GBSR	0.5	0.5	0.0	1.0
GBSR-ADJ	0.5	0.5	0.0	1.0
GR	9.3	9.3	0.0	1.0
LOW	0.1	0.1	0.0	1.4
LOW/MC	0.0	0.0	0.0	1.0
MC	0.0	0.1	0.1	23.5
MFS	40.6	39.8	-0.8	1.0
MFS/D	2.9	1.2	-1.7	0.4
SMFS	331.8	332.5	0.6	1.0
SS	0.0	0.0	0.0	1.2
WRW	29.1	29.1	0.0	1.0
WS	32.9	33.8	0.9	1.0
N/C	41.1	41.1	0.0	1.0
TOTAL	**765.0**	**674.8**	**-90.2**	**-11.8%**

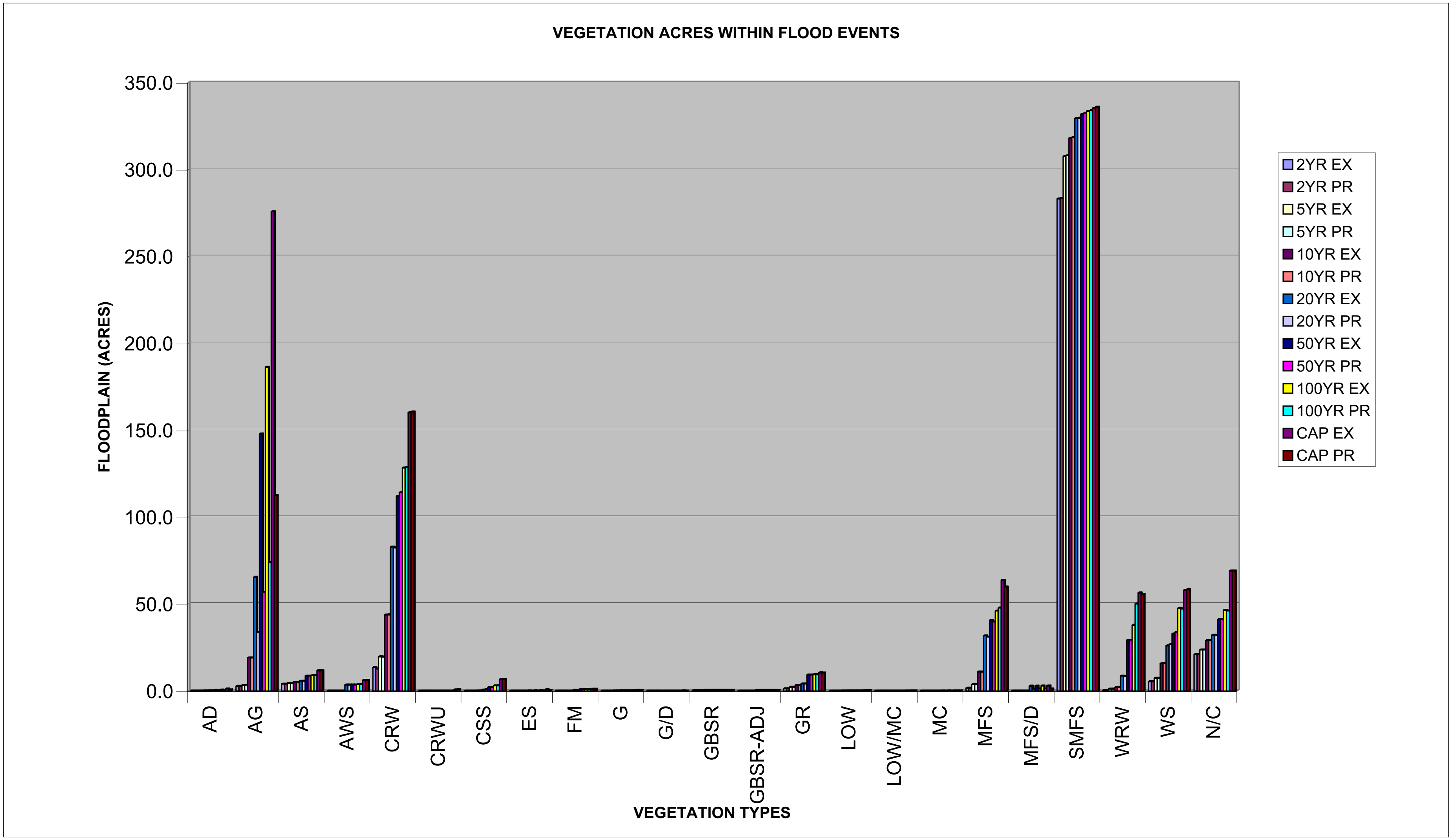


100 YEAR - Floodplain Overall Vegetation

Vegetation Type	EXISTING (AC)	PROPOSED (AC)	DELTA (AC)	DELTA % (%)
AD	0.6	0.3	-0.3	0.5
AG	186.3	74.0	-112.4	0.4
AS	8.9	8.9	0.0	1.0
AWS	3.7	3.9	0.0	1.1
CRW	128.4	128.7	0.3	1.0
CRWU	0.0	0.0	0.0	1.0
CSS	3.0	3.0	0.0	1.0
CSS/G	0.0	0.0	0.0	0.0
ES	0.3	0.0	0.0	0.0
FM	0.9	0.9	0.0	1.0
G	0.2	0.2	0.0	1.0
G/D	0.0	0.0	0.0	0.0
GBSR	0.5	0.5	0.0	1.0
GBSR-ADJ	0.5	0.5	0.0	1.0
GR	9.5	9.5	0.0	1.0
LOW	0.1	0.2	0.1	2.0
LOW/MC	0.0	0.0	0.0	0.0
MC	0.0	0.1	0.1	0.0
MFS	46.1	47.8	1.7	1.0
MFS/D	2.9	1.2	-1.7	0.4
SMFS	333.6	334.0	0.4	1.0
SS	0.0	0.0	0.0	0.0
WRW	37.9	50.2	12.2	1.3
WS	47.7	47.3	-0.4	1.0
N/C	46.5	46.1	-0.4	1.0
TOTAL	**858.0**	**757.5**	**-100.5**	**-11.7%**



FLOODPLAIN OVERALL VEGETATION COMPARISONS



stabilization improvements described in the previously approved Newhall Ranch Specific Plan. Finally, flooding up to and including the 100-year flood event and the Q_{CAP} event, would be contained within the north and south bridge abutments. As a result, no flood impacts are anticipated due to the location of the proposed bridge.

4.3 Whether Runoff Volumes Would Exceed Existing or Planned Systems

The Project would increase the amount of runoff from the Project areas covered by roads, buildings, paved parking areas, and other relatively impermeable or impervious features (refer to Table 2.1 for the assumed percent imperviousness for each land use proposed for the Project site). Specifically, impervious surfaces on the Project site would increase the amount of clear flow runoff from the site. Burned and bulked runoff and debris volumes, however, would be reduced because the developed portions of the Project site would be covered with impervious surfaces and non-erodible vegetation, and because debris basins are proposed just upstream of the Project site that would reduce the amount of debris and sediment in the runoff.

The post-development runoff quantities are provided in Table 4.7 and the discharge is predicted to total 1117 cfs for the Project site during a 50-year storm, which is a 267 cfs reduction in 50-year flows when compared to pre-development conditions. This reduction in the discharge is largely due to Project debris basins that would capture upstream bulk flows and allow debris to settle out from the runoff before it enters the storm system through the developed portion of the site.

The LACDPW defined criteria for design of flood control systems establish the more severe hydrologic conditions (e.g., burned and bulked) as the basis of impact evaluation (refer to Sections 2.1.1 and 2.1.2 of this report). The 50-year total runoff from the Project site essentially would be the same under existing and proposed Project conditions because, despite the increase in imperviousness, the sediment basins reduce the bulking. Therefore, the Project would not result in a significant increase in on-site or downstream flooding impacts.

Table 4.7: Post-Development Site Runoff Summary				
Subbasins	**Area(Ac)**	**50-Year Storm Event[A]**		
		Time of Concentration (min)	**Q_{bb} (cfs)**	**Q/A (cfs/Ac)**
RVE-1A	18	24	29	1.6
RVE-2A	39	28	56	1.4
RVE-3B	15	8	46	3.1
RVE-4B	44	19	81	1.8
RVE-6A	35	11	89	2.5
			Q_{DESIGN} (cfs)	
RVE-7A	14	29	21	1.5
RVE-8A	29	30	33	1.1
RVE-9A	13	16	22	1.7
RVE-10A	1	14	1	1.0
RVE-11B	16	14	27	1.7
RVE-12C	1	15	1	1.0
RVE-13C	17	19	25	1.5
RVE-16D	2	20	2	1.0
RVE-17D	18	15	29	1.6
RVE-20E	18	16	28	1.6
RVE-21F	1	7	1	1.0
RVE-24F	2	14	2	1.0
RVE-25F	14	16	22	1.6
RVC-2A	11	9	18	1.6
RVC-3A	12	15	20	1.7
RVC-7A	10	24	14	1.4
RVC-8A	5	14	8	1.6
RVC-11B	16	11	30	1.9
RVC-12C	3	18	3	1.0
RVC-13C	1	12	1	1.0
RVC-17C	2	19	2	1.0
RVC-18C	17	14	29	1.7
RVC-21D	3	16	3	1.0
RVC-22D	2	12	5	2.5
RVC-23E	39	24	53	1.4
RVC-24E	7	22	12	1.7
			Q_{bb} (cfs)	
CQT-1/4A	23.9	7	72	3.0
CQT-5A	4.4	5	15	3.4
CQT-6A	22.6	11	61	2.7
CQT-7/8A	6.2	5	19	3.1
CQT-9A	31.8	14	51	1.6
CQT-10A	14.5	8	42	2.9
CQT-11A	7.4	21	12	1.6
CQT-12A	4.4	12	9	2.0
			Q_{DESIGN} (cfs)	
RVW-1A	11	14	17	1.5
RVW-2A	15	14	28	1.9
Σ	566.2			

A. Clear flow in developed areas. Burned, unbulked flow in undeveloped areas
B. This was calculated by Sikand in the Newhall Ranch Specific Plan Master Hydrology and Drainage Concept, Dated 3/25/05

4.4 Exposure to Significant Risk of Loss, Injury, or Death

Although the site is presently subject to some debris and mud flows, adequate building setbacks from natural slopes and debris control facilities proposed in upstream areas of the Project site would protect the proposed development from debris and mudflow hazards.

As designed, the proposed soil cement and the Long Canyon Road Bridge would increase the water surface elevation of the River on-site at several locations. All changes in water surface elevation greater than one foot are presented in Table 4.8 and changes along the Project reach are illustrated in Figure 4.7A-G. The floodplain presented in the figure, the 2-year floodplain, is the same as that presented in Figure 4.3A. A discussion of water surface elevation change based on the approved Newhall Ranch Santa Clara River HEC-RAS Modeling study is included in 4.1.1, above. However, increases in water levels would dissipate, returning to a pre-project condition, prior to the end of the proposed soil cement as indicated by HEC-RAS numerical modeling, because encroachments into the floodplain only minimally impact water surface elevations at the downstream portions of the Project, below STA 18650. Therefore, increases in flood water elevations due to Project-related improvements would be limited to the applicant's property, in areas where no development is planned, or would be mitigated with the installation of flood protection. Therefore, the Project improvements would not expose people or structures to a significant risk of loss, injury or death involving flooding.

TABLE 4.8: WATER SURFACE ELEVATION CHANGES GREATER THAN 1 FT PROPOSED VS EXISTING CONDITION BY RETURN PERIOD AND STATION

T_{RETURN}	STATION	$WSE_{PROPOSED}$	$WSE_{EXISTING}$	**DELTA**
10	19630	883.1	884.7	**1.6**
	18830	879.2	880.6	**1.4**
20	18650	878.9	880.8	**1.9**
	18475	879.7	880.8	**1.1**
	18290	879.6	880.7	**1.1**
	18025	879.7	880.8	**1.1**
	28080	933.2	934.3	**1.1**
	25600	921.1	922.1	**1.0**
	25425	919.6	920.8	**1.2**
	23975	911.2	912.3	**1.1**
	23755	909.9	911.3	**1.3**
	23365	907.2	908.7	**1.4**
	19855	887.1	888.2	**1.1**
	19630	885.2	887.6	**2.4**
	19440	886.0	887.1	**1.1**
	19240	884.7	886.9	**2.2**
	19050	884.2	886.9	**2.7**
	18830	883.0	886.4	**3.4**
	18650	882.6	883.9	**1.3**
	18475	882.3	883.7	**1.3**
	18290	882.1	883.1	**1.0**

TABLE 4.8: WATER SURFACE ELEVATION CHANGES GREATER THAN 1 FT PROPOSED VS EXISTING CONDITION BY RETURN PERIOD AND STATION (CONTINUED)				
T_{RETURN}	STATION	$WSE_{PROPOSED}$	$WSE_{EXISTING}$	**DELTA**
50	28080	933.2	934.3	**1.1**
	25600	921.1	922.1	**1.0**
	25425	919.6	920.8	**1.2**
	23975	911.2	912.3	**1.1**
	23755	909.9	911.3	**1.3**
	23365	907.2	908.7	**1.4**
	19855	887.1	888.2	**1.1**
	19630	885.2	887.6	**2.4**
	19440	886.0	887.1	**1.1**
	19240	884.7	886.9	**2.2**
	19050	884.2	886.9	**2.7**
	18830	883.0	886.4	**3.4**
	18650	882.6	883.9	**1.3**
	18475	882.3	883.7	**1.3**
	18290	882.1	883.1	**1.0**
100	28080	933.7	936.6	**2.9**
	25600	922.1	923.2	**1.2**
	24550	914.7	916.5	**1.9**
	23975	911.9	913.4	**1.5**
	23365	908.1	910.2	**2.1**
	21020	892.9	896.6	**3.7**
	20845	894.4	895.4	**1.0**
	20595	894.2	895.7	**1.5**
	20435	893.9	895.3	**1.4**
	19855	888.1	889.8	**1.7**
	19630	886.5	889.3	**2.8**
	19440	887.1	888.9	**1.8**
	19240	886.3	888.7	**2.4**
	19050	886.1	888.7	**2.6**
	18830	885.7	888.2	**2.5**
Cap	28500	943.7	946.9	**3.1**
	28280	940.4	944.9	**4.5**
	27925	941.8	943.8	**2.1**
	27545	936.3	938.3	**2.0**
	26780	929.5	930.5	**1.0**
	25965	929.0	930.6	**1.6**
	25785	927.7	929.9	**2.3**
	25600	926.6	928.6	**2.1**
	25425	926.4	927.5	**1.1**
	25215	924.0	926.7	**2.7**
	25000	921.7	926.3	**4.6**
	24795	919.8	925.4	**5.5**
	24550	920.5	924.1	**3.6**
	24335	918.2	921.1	**2.9**
	24115	916.4	919.4	**3.0**
	23975	915.5	917.7	**2.3**

TABLE 4.8: WATER SURFACE ELEVATION CHANGES GREATER THAN 1 FT PROPOSED VS EXISTING CONDITION BY RETURN PERIOD AND STATION (CONTINUED)				
T_{RETURN}	STATION	$WSE_{PROPOSED}$	$WSE_{EXISTING}$	**DELTA**
Cap	23755	914.6	917.8	**3.2**
	23565	913.2	915.4	**2.2**
	23365	912.6	915.0	**2.4**
	23000	912.5	914.3	**1.8**
	21615	901.6	904.6	**3.0**
	21440	899.9	903.1	**3.1**
	21225	898.9	903.4	**4.5**
	21020	896.6	902.4	**5.8**
	20845	898.0	900.8	**2.9**
	20595	897.5	900.8	**3.4**
	20435	897.1	900.2	**3.1**
	20280	895.5	897.8	**2.2**
	20070	892.2	897.8	**5.7**
	19855	894.1	897.9	**3.8**
	19630	893.9	897.3	**3.4**
	19440	893.7	896.9	**3.2**
	19240	893.5	896.7	**3.2**
	19050	893.4	896.7	**3.3**
	18830	893.1	896.3	**3.2**
	18650	893.0	895.2	**2.2**
	18475	892.8	895.0	**2.1**
	18290	892.6	894.6	**2.0**

4.5 Whether Substantial Alteration of an Existing Drainage Pattern Would Result In Substantial Erosion or Siltation and Harmful Increases in Erosion

4.5.1 Santa Clara River/Castaic Creek/Chiquito Creek

Erosion is not anticipated to be a concern on developed portions of the Project site because the site would be covered with impermeable or impervious surfaces and landscaping would minimize the potential for erosion from undeveloped areas. Potential for erosion within the River and the major tributaries impacted by the Project can be evaluated by reviewing changes to hydraulic shear stress or flow velocities, in conjunction with potentially erodible materials. In Los Angeles County, velocities are the preferred indicator for potential streambed erosion. Because the riverbed is composed of alluvial materials, the non-erodible velocities (velocities below which no erosion would occur) range from 2.5 feet per second (fine gravels under clear flow conditions) to 5.0 feet per second (alluvial silts transporting colloidal materials) (Chow, 1959). Therefore, a representative velocity of 4.0 feet per second was determined to be the appropriate indicator for potential erosion.

A potentially significant erosion impact would arise if a significant amount of the 2- to 100-year floodplain area were in the 0-4-foot per second range, but as a result of the Project (including the Long Canyon Road Bridge and downstream bank protection), the area would be subjected to velocities greater than 4 feet/second. However, Figure 4.8 indicates that there are no increases in areas of the River that would be subject to velocities over 4 feet/second during a 2- and 5-year storm event. Additionally, there would be decreases in velocity for 10-year through 100-year and Capital storm events. The changes in acreage for a given velocity range are shown in Figure 4.8A-D6d. Additionally, the approved Newhall Ranch River Fluvial Study Phase 1 Final Draft (PACE, March, 2006) found that large changes in bed elevation during a Capital event are not expected except at proposed bridge piers.

4.5.2 On-Site Drainage Discharge Points

The Los Angeles MS4 Permit notes that increased volume, velocity, and discharge duration of stormwater runoff from developed areas could potentially accelerate downstream erosion and impair stream habitat. As a result, the Permit stipulates that "Permittees shall control post-peak stormwater runoff in Natural Drainage Systems to prevent accelerated stream erosion and protect stream habitat." The following discussion supports the conclusion that there are no significant downstream impacts potentially accelerating erosion or significantly impacting stream habitat:

- In natural riverine systems such as Santa Clara River and its tributaries, frequent discharges (on the order of the average annual and 2-year flows) dictate stream geomorphology. Extended and frequent discharges at these critical flow rates would potentially impact stream health. The Project proposes to install water quality design features, which will capture runoff from small, frequent storms and release flows to the River at non-erosive rates. That is, water from the basins would be released a rate substantially less than existing discharges associated with two-year storms, therefore, erosive impacts to the River would be reduced to a less than significant level.

- To reduce storm flow velocities during smaller, more frequent flows (i.e., 2-year storm events) and to prevent erosion at stormwater discharge points into the River, the Project incorporates energy dissipaters consisting of either rip-rap or larger standard impact type energy dissipaters at affected storm system outlets in the River. These energy dissipaters would slow the rate of flow of runoff into the River in order to prevent erosion of the stream channel.

- Energy dissipaters and water quality basins used to reduce erosion risk in smaller events will also reduce erosion risk in larger events. It should be noted, however, that erosive forces in the River associated with less frequent, large events (100-year discharge) have erosive impacts that far exceed the erosive impacts of the Project.

4.5.3 Utility Corridor Analysis

The proposed utility corridor is comprised of two parts: the westerly extension of the utility corridor (protected with TRM's) and approximately 1,000 linear feet of buried bank stabilization, and the easterly extension of the utility corridor, a portion of which requires bank stabilization that was already approved and analyzed under the previously adopted Natural River Management Plan. This analysis supports the use of TRM's on the westerly extension of the utility corridor, rather than exposed or buried soil cement.

A hydraulic analysis of the westerly extension of the utility corridor (protected with TRM's) is described below. This analysis evaluated water velocities in the reach between the Project site and the WRP on the northern edge of the River corridor, STA 22195 to STA 15745. A uniform distance from the road and the rail right-of-way area to the southern edge of the utility corridor was established for the entire reach. The horizontal location of the corridor was determined to be 67 feet from the rail right-of-way area to the edge of the utility corridor. At this location, a vertical levee was created in HEC-RAS to represent the boundary between the River and the utility corridor. The levee affected the hydraulic geometry of 33 cross-sections in the reach from Landmark Village west to the WRP. A primary simulation was run in HEC-RAS, the Q_{CAP} flood event (140,793 cfs), under a mixed flow regime and a mixed Manning's *n* conditions based on aerial photography analysis. Under these conditions, when the water surface elevation was high enough to reach the banks, the water velocities at the levee were low, ranging from 3.0 to 7.0 ft/s for n=0.06 and 4.3 to 7.6 for n=0.025 (Table 4.9). These modeled velocities would not require hardened bank protection. In this case, approximately 4,600 linear feet of TRM will be permanently placed on the bank to ensure protection from erosion.

TABLE 4.9: MODELED Q_{CAP} VELOCITY ALONG THE UTILITY CORRIDOR (FPS)		
STATION	$WSE_{0.060}$	$WSE_{0.025}$
22195	NR	NR
22010	NR	NR
21790	NR	NR
21615	NR	NR
21440	NR	NR
21225	NR	NR
21020	**5.0**	NR
20845	**6.0**	**6.7**
20595	**5.8**	**6.4**
20435	**5.8**	**5.9**
20280	**7.0**	**7.6**
20070	**6.1**	**4.3**
19855	**4.9**	NR
19630	4.0	NR
19440	3.3	NR
19240	3.0	NR
19050	3.0	NR
18830	NR	NR
18650	NR	NR
18475	**4.9**	NR
18290	**5.1**	NR
18025	NR	NR
17785	NR	NR
17510	NR	NR
17360	NR	NR
17110	**6.6**	NR
16970	**5.8**	NR
16720	**5.1**	NR
16515	**5.6**	NR
16305	**4.9**	NR
16130	NR	NR
15960	NR	NR
15745	NR	NR

NR: WATER SURFACE DOES NOT REACH THE BANK

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M E M O R A N D U M

Date: May 8, 2006

To: Glenn Adamick, Newhall Land

From: Mark E. Krebs, P.E.

Re: Landmark EIR - Newhall Ranch Santa Clara River LA County & FEMA Updated Floodplain and Floodway Studies # 7841E

As per Newhall's request, PACE has prepared the following summary of the above subject issue. The following summary is based upon our review of the public notifications and subsequent phone conversations with Mr. Bruce Hamamoto at LACDPW.

As a result of the tremendous damage from the Rita and Katrina Hurricanes in 2005, Congress has allocated significant funding to FEMA (Federal Emergency Management Agency) to study and identify flood hazard areas throughout the U.S. (particularly in and around large population centers). The Santa Clara River and its major tributaries have been identified as a study area from the headwaters in Acton to the Pacific Ocean.

FEMA and their contracted consultants are heading the effort with Los Angeles and Ventura counties to update the floodplain and floodway for the Santa Clara River and the major tributaries. The floodplain is determined as the peak limits of flooding of a river, channel, etc. during a particular design storm event. The floodway limits are typically inside the floodplain for each design storm event. The floodway is a theoretical limit line where the insignificant (non flow caring) floodplain fringe is eliminated. By definition, the floodway is the encroachment of the floodplain from both directions to raise the water surface up to 1.0 foot.

In the case of the Santa Clara River at the Newhall Ranch study area; there are two sets of floodplain limit lines. The FEMA Flood Insurance Rate Maps for the 100-year event (± 60,000 cfs) were recently (2002) updated and adopted by FEMA. FEMA has not mapped a 100-year floodway in this reach of the river. However, LACDPW has a mapped floodplain and floodway for the Santa Clara River for the Capital Flood event (± 140,000 cfs) which is the LACDPW design storm event.

All of the Newhall Ranch Santa Clara River designs provided by Newhall consultants have been to meet the higher (± 140,000 cfs) capital flood event. The Capital flood flow rate is ± 2.5 times greater than the FEMA 100-year flow rate and therefore the design criteria required to meet the LADPW capital storm is much more conservative and will meet/exceed the 100-year FEMA criteria.

It is our understanding that FEMA has contracted with HDR Engineering to provide the updated floodplain and floodway mapping of the Santa Clara River and Tributaries in Los Angeles County. Updated hydrology (run-off flow rate) will be reevaluated and the 1995 Joint LA and Ventura County

Study is being considered as the basis (these study results were similar to the existing FEMA 100-year flow rate of ± 60,000 cfs). LACDPW has stated to FEMA that Newhall has provided updated Capital Floodplain Modeling results and LACDPW has approved the results for the existing condition. As part of the Newhall Ranch project, a detailed floodplain and floodway analysis will be prepared for the updated existing conditions and the proposed Newhall Ranch development. It is our understanding that this information will ultimately be adopted by FEMA for use as the published floodplain and floodway for the River in this reach.

In summary, we do not expect that the newly defined FEMA initiative to reevaluate the flood hazards (floodway and floodplain) along the Santa Clara River will impact any of the proposed Newhall Ranch development projects. As part of the Newhall Ranch development effort, updated floodplain and floodway mapping will be provided to LACDPW and FEMA for review and approval.

PACE

PACIFIC ADVANCED CIVIL ENGINEERING, INC.

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M E M O R A N D U M

Date: May 9, 2006

To: Glenn Adamick, Newhall Land

From: Mark E. Krebs, P.E.

Re: LACDPW Review and Approval of the Newhall Ranch Santa Clara River HEC-RAS and Fluvial Study Approval Summary (LACDPW Approval Letter dated April 18, 2006) # 7841E

As per Newhall's request, PACE has prepared the following summary of the above subject topic. As part of the overall Newhall Ranch project review by LACDPW, it was determined that a comprehensive fluvial analysis be completed for the Newhall Ranch portion of the Santa Clara River. A river fluvial analysis is the study of the river bed and bank sediment movement over time and as a result of flow in the river and changes in the tributary watershed.

The fluvial analysis has three distinct components:

1) Long term trends of river bed and bank sediment build-up (aggregation) or removal (degredation). The ± 80 years of available historic topographic mapping of the river indicate no real trend of aggredation or degredation in the study reach.

2) General (capital storm event) aggredation/degredation calculations to determine the expected fluvial response of the river to the LACDPW design storm event (± 140,000 cfs). US Army Corps of Engineers computer modeling software (SAM) is used to evaluate existing and proposed project conditions. Only minor variations in the fluvial response are shown in the modeling.

3) Local aggredation/degredation resulting from river curvature, bridges, river bed material and various other components are considered and estimates of aggredation and degredation are calculated.

To complete the fluvial analysis (Chapter 7 and 8) these three (long term, general and local) aggredation/degredation components are added together to obtain the total aggredation/degredation for each river section.

LACDPW had three stated purposes for requesting the Newhall Ranch Santa Clara River fluvial analysis:

1) Verify applicability of the LA County Design Manual (and Hydrology and Sedimentation Manual) top and toe elevation calculations for this reach of the Santa Clara River.

2) Establish proposed river bank protection horizontal and vertical (top and toe elevations of the bank protection) alignments to facilitate complete review of the various Newhall Ranch Project Tentative Map Submittal.

3) Provide level of understanding of the Newhall Ranch Santa Clara River reach fluvial mechanics as related to existing conditions and the proposed Newhall Ranch development conditions to identify any major project impacts.

The approved study has concluded the following for the above three objections:

1) The LA County Design Manual was found to be applicable as related to calculations of the bank protection top and toe elevations. In nearly all locations the fluvial study calculated top and toe elevations less than the Design Manual values.

2) As part of the LACDPW April 18, 2006 letter approving the fluvial study, an attached river bank protection exhibit identifies the proposed bank protection and where the horizontal and vertical alignments have been established.

3) Figure 1.0 and Table of the approved fluvial study shows existing and proposed conditions Santa Clara River general aggredation (raising of river bed sediment) and general degredation (lowering of river bed sediment) for the study reach of the river and only one of the sixteen sub-reaches indicates an aggredation/degredation change of more than 1.0 foot. Therefore the analysis indicates that there is only minor impact to the fluvial mechanics of the river due to the proposed project bank stabilization.

In addition to the approval of the fluvial analysis, the April 18, 2006 LACDPW Approval Letter also approves the related HEC-RAS model and revised existing condition capital floodplain. This model will be used to submit formal floodplain and floodway map revisions to LACDPW.

Newhall Ranch

River Fluvial Study

PHASE 1 | FINAL DRAFT

SANTA CLARA RIVER

Prepared for:

NEWHALL LAND
A LENNAR/LNR COMPANY

Prepared by:

PACE
PACIFIC ADVANCED CIVIL ENGINEERING, INC.

March 9, 2006 Revised
December 9, 2005 Revised
September 19, 2005 Revised
July14, 2005
#8197E

PACIFIC ADVANCED CIVIL ENGINEERING, INC.

17520 Newhope Street, Suite 200 ▪ Fountain Valley, California 92708 ▪ 714.481.7300 ▪ fax: 714.481.7299

March 6, 2006

Ben Willardson
LACDPW
Water Resources Division
900 South Fremont, 3rd Floor
Alhambra, CA 91803
(626) 458-6117

Re: Santa Clara River Fluvial Study, January 2006 #8197E

Dear Mr. Willardson;

Pacific Advanced Civil Engineering, Inc. (PACE) is pleased to provide the following responses to the Los Angeles County Department of Public Works for the above-referenced project. The responses from PACE are as follows:

General Comments

1. *The HEC-RAS models approved by the separate hydraulic model review should be the only models used in this study. The only exception will be the data used for SAM, which is converted from the approved HEC-RAS data. The SAM data however must also be based on the approved HEC-RAS models. The calculations should be carried consistently through all tables, charts, text, and figures. All referenced models should be included in the report and on the CD in Appendix 4.3. The models must include the Existing and Proposed Conditions for the n=0.025 and n=0.085 models using the Capital Flood in the mixed flow regime. The two-year Proposed Condition, n=0.085 should also be included in the report and CD to verify the bottom width column of Appendix Ch 6.2.*

   PACE Response:
   Calculations in the present draft of the report are based on the approved HEC-RAS model. SAM numerical modeling is converted from the approved model. All models utilized in this report are included in the CD-ROM in the Appendix.

2. *All relevant general comments from the Castaic Creek review that affect the body of text need to be included in the Santa Clara River report.*

   PACE Response:
   Comments from the previously reviewed Castaic Creek First Phase Fluvial Study were reviewed and comments that pertained to the present report were included here.

Technical Comments

1. *PACE response to Comment 3 from the previous review, no changes were observed in the text on page 2. The comment still applies. All of the other previous comments have been adequately addressed.*

   PACE Response:
   The text has been updated to include the previous response.

2. *Page ii, the third sentence of the second paragraph states that the 2004 Sikand study relied on previous work conducted by SLA. PACE response to previous Comment 4 states that the "HEC-6 Sediment Transport Analysis..." was conducted by Sikand not SLA. Then in Section 2.1 the last sentence of the first paragraph states that the [2004] Sikand study relied on previous work conducted by Sikand. Rectify the apparent discrepancy.*

   PACE Response:
   The text has been updated to adequately differentiate the Sikand and SLA studies.

3. *Page ii, the ninth line of the third paragraph states that the average D50 value for all the SCR samples was 1.12 mm. This is not correct, the average of the D50 values is 1.18 for the 18 SCR samples or 1.09 mm for all 23 samples. According to Figure 3.2B the D50 of the average gradation is more like 0.79 mm by observation. Please note that an average of the individual D50 values will not give a valid D50 for the average gradation. The average of individual D50's and the D50 of the average gradation do not represent the same value. Calculating the D50 of the average gradation requires a geometric mean since the values are averaged on a logarithmic scale.*

   PACE Response:
   Based on conversations with LACDPW personnel (B. Willardson, February 22, 2006) Geometric mean calculations were determined not to be the appropriate method for determining average D_{50} values. In previous versions of this report, D_{50} was determined by averaging the values provided by Seward Engineering Geology. In this draft of the report, D_{50} is read directly from the semi-log plots presented in Chapter 3. The values in the text and tables have been updated to reflect change in methodology. It is important to note that the change in values was small in every case and did not require changing the transport function selected to determine transport potential.

4. *Page iii, the thirteenth line of the second paragraph states that the County approved the Sikand project. As stated previously, the County did not approve the Sikand project and models. The models have been significantly altered by PACE and are under final review for approval.*

   PACE Response:
   The text has been updated as per instructions given in the Castaic Creek Fluvial Study Phase 1 Final Draft.

5. *Page 4, last sentence of the first paragraph, clarify according to Comment 2 above.*

PACE Response:
The text has been updated to adequately differentiate the Sikand and SLA studies.

6. *Page 7, Table 3.1, update the D50 values according to Comment 3 above. According to the SAM output data the D50 values for the reaches are as follows: A,B 0.523; C 0.976; D 1.042; E 1.072. Also add another column called "Used for SAM Reach" that will show for which reach the sediment data was applied to in the SAM analysis.*

PACE Response:
The D_{50} values have been updated based upon the response to Comment 3. Additionally, Table 3.1 indicates the reaches where the respective gradation data is applied.

7. *Page 17, Table 4.3, SRB2, for Delta (ft) does not add up, see General Comment 4 above.*

PACE Response:
The table has been updated to resolve any round-off issues. Please see response to general Comment 4.

8. *Page 19, Table 4.4, the 1/11/06 submittal did not include any of the recent changes in calculations either for SAM on 1/6/06 or EC n=0.025 on 1/11/06. Update Existing Conditions LACH&SM column according to changes submitted on 1/11/06. Update SAM columns according to changes submitted on 1/6/06.*

PACE Response:
The table has been updated according to the latest SAM data.

9. *Page 21, Tables 5.1A-B, include the 1963 Area in the 1947 column with footnote for SRA1 according to previous discussions.*

PACE Response:
The table has been updated to reflect this comment.

10. *Page 22, eighth line of the first paragraph, replace "overbanks" with "sides" or similar wording because the left bank is 35' high and cannot be overtopped. Also add discussion about the loss of significant bank material in 2005 of the Magic Mountain parking area as shown in Figure 5.2A (150' lateral migration). If there is other bank armoring besides the treatment plant, please add the information.*

PACE Response:
Based on phone conversations with LACDPW (B. Willardson, February 22, 2006) the developed area is now referred to as banks. Additional information is provided discussing the loss of parking area at the theme park.

11. *Page 23, first sentence of the second paragraph, the "spike at station 200" is not evident to the reviewer. Please add more discussion to clarify.*

    PACE Response:
    A spike in the1999 topography is present from station 200 to station 300. Because the spike is in the 1999 topography, the reference has been removed. As noted in personal communication with County personnel (B. Willardson, February 22, 2006) the radar sampling technique used in creating the 1999 topography has difficulty in discerning the difference between dense woody brush and solid ground. The feature addressed in this comment, as well as similar comments, are a result of the surveying technique. The text has been updated in several locations to address where dense vegetation has been misinterpreted in the sampling.

12. *Page 23, the fourteenth line of the second paragraph states that the poor quality of the 1930 topography "renders a direct comparison difficult." If the topography is too poor to make a comparison it should not be included. If it does contribute some value, then the inaccuracies or shortcomings must be discussed further to show the reader what confidence is given to the data. This is true for any questionable data.*

    PACE Response:
    This data is included in the report based on a previous request by the County to include the complete record. Based on personal commutation with County personnel (B. Willardson, February 22, 2006) the text has been updated to improve readability.

13. *Page 24, second paragraph, discuss the presence of berms in the 2004 and 2005 data and the problems with the 1930 data for section 23000. More discussion is needed on how the canyon tributaries "may have played a role."*

    PACE Response:
    The text has been updated to the following:

    > **Sections 23000 (SRC4) and 20845 (SRD1) are the first historically aggradational sections analyzed (Figure 5.2J and 5.2K, respectively). Section 23000 is adjacent to the Chiquito Canyon Creek and Long Canyon Creek tributaries at the west end of the proposed Landmark development and between two historic agricultural production areas. Section 20845 is downstream of the proposed Landmark site and the left overbank has historically been used for agriculture. Both banks of section 20885 are tree-lined. Both sections are relatively wide and straight with braided channel beds. Both sections have aggraded over the period of historic record: 1.9 and 1.4 feet, respectively. In the most recent short term, however, section 23000 has aggraded 0.7 feet while section 20845 has degraded 0.5 feet. Section 23000 shows some incising below the 1930 historical bed although the average bed elevation is higher now than in the past. The dominant change in bed elevation between 2004 and 2005 at section 20845 occurred to the left of station 2600, while**

the remaining portion remained stable. It is not clear why this occurred, although agricultural practices or high discharges from the Chiquito and Long tributaries may have played a role. Agricultural practices may have stabilized the bank position and height while the creeks may influence the bed by discharging high volumes of water and sediments that have the dual ability to erode or deposit at this location. It should be noted that the topographic artifact between station 2600 and 3000 in the 1999 topography is a function of topographic sampling. As noted above, the dense brush in this and other woody sections may make the topography appear to be at a higher elevation than is actually present and results from the aerial survey technology used to create the topography.

14. *Page 24, last sentence of the second paragraph, the large inaccuracy in the 1999 data for section 20845 cannot be left as-is and explained only as a function of topographic conversion. This data appears inconsistent with the cross-section used in the HEC-RAS analysis. Similar to Comment 12 above, if the data is bad it should be thrown out or fixed. If it is good, the presence of this mound only in the 1999 topography needs to be explained. If an assumed cross-section was used it should be explained why this value should be accepted as reliable.*

<u>PACE Response:</u>
The text has been updated to reflect this comment. Please see response to Comment 13.

15. *Page 24, third paragraph, more discussion is needed on the four cross-sections. Section 14315 appears very active over the period of record. Sections 16305 &12195 both show a 1.1 foot average degradation between 2004 and 2005 as mentioned; only two other subreaches degrade more. The first sentence makes it sound like the general trend is for an inactive area, but it is observed to have pretty dramatic oscillations and rearrangements of sediment up to 8-feet plus of elevation difference. Mention should also be made of the diversion through sections 16305 and 14315 to the north near the 126 highway.*

<u>PACE Response:</u>
The text has been updated to the following:

Sections 18650 (SRD2), 16305 (SRD3), 14315 (SRE1), and 12195 (SRE2) all exhibit very mild long-term degradation (one foot or less) between 1947 and 2005 (Table 5.1). Additionally, short-term adjustment for all of these sections ranges between -0.6 and -1.2 feet between 2004 and 2005. Sections 16305 and 12195 exhibit 1.2 and 1.1 feet of degradation, respectively, and are among the five highest single season changes in bed elevation of the sections examined. Sections in SRA3 and SRB1 degrade significantly more with -2.3 and -1.7 feet, respectively. All of the sections from 18650 to 12195 are recovering from the 1928 dam break event, the sections low elevations, and all sections exhibit oscillations in bed elevation over the historic record (Figure 5.2L though 5.2O, respectively). These sections have in common a relatively wide, straight and braided bed. Grande Canyon Creek and Potrero Canyon Creek confluence with the River at near section 17000. The influence of the confluences is not immediately evident but may include some of the observed fluctuations in bed elevation as well as affecting the wide historic meandering

between the north and south bank (Figure 5.1). The observed features in the 1999 and 2004 topographies in section 16305 at stations 425 and 850 appear to be the south and north low-flow banks, respectively. Several of the features in the 1999 bed at section 14315 appear to correlate to the presence of vegetation on the bank and relate to surveying methodology, as noted above.

16. *Figure 5.2B, add more discussion of the 800' of bank migration from 1963 to1999.*

<u>PACE Response:</u>
The text has been updated to the following:

Section 42215 (SRA2) appears to have greatly down cut and widened since 1947, degrading an average 8.1 feet along the section. Some of the observed long-term change may be related to the presence of the theme park and water treatment facility on the bank at this location. In recent years (1999-2005), the creek appears to have become relatively stable: area has increased from 17946 to 17101 over the period (Figure 5.2B). The River is relatively wide at this location although a bend is present. Development has occurred on both banks with agricultural development on the north bank and the Magic Mountain theme park on the south bank. Historical development may have led to the observed degradation, although at present the bed appears to be stable or degrading only slightly. The impacts of woody vegetation in this section may have played a role in the recent degradation. Finally, the 2004-2005 winter was very wet and high flows were present on the River. During the heavy storms of December 2004 and January 2005, approximately 4.4 acres of the south bank was lost to the Santa Clara River. Some of the single-season degradation may possibly be attributed to this event. The features located at station 775 and 1325 in the 1999 topography are expected to be related the aerial surveying methodology, as noted above.

17. *Figure 5.2C, discuss the apparent berms/hills at stations 775 and 1325 in the 1999 topography, and the movement of the thalweg adjacent to the south bank.*

<u>PACE Response:</u>
The text has been updated to the following:

Similar to the other sections in Reach A, section 40825 (SRA3) is also degrading. The section has degraded 5.2 feet on average over the period of record (Table 5.1B). The 1963 data is insufficient in this section as indicated by the flat portions of the section, although the other years sufficiently indicate the trend. The 2005 thalweg is at the approximate elevation of the 1930 thalweg, although the present channel is more incised than the historic channel. The presently observed channel widening may possibly be attributed to recent high discharges, and migration of the channel may be related to these discharges. Features in the 1999 topography at stations 775 and 1325 are expected to be related to the aerial surveying methodology, as noted above.

18. *Figure 5.2E, correct the stationing between 0 and 200. Include discussion of any existing bank stabilization for the trailer park in this reach.*

    PACE Response:
    The figure has been updated to reflect this comment.

19. *Figure 5.2J, show assumptions for the northwest bank on all data sets. If there is a defined bank beyond the limit of the viewport expand the view to include it. The area for 2004 should end at the berm at station 1325, if there is a reason for not doing this state it, similarly with the berm in the 2005 data. The 1930 data does not show a thalweg, it continues to decline out–of-sight. It needs to be removed if the data is bad.*

    PACE Response:
    The viewport has been expanded to show a greater portion of the section.

20. *Figure 5.2M, discuss apparent berms in 1999 and 2004 data at stations 425 and 850.*

    PACE Response:
    The text has been updated to reflect this comment. Please see response to Comment 13.

21. *Figure 5.2N, discuss large migrations and sediment depositions according to Comment 14 above.*

    PACE Response:
    The text has been updated to reflect this comment. Please see response to Comment 13.

22. *Figure 5.2P, discuss the apparent berms in the 1999 and 2004 data at station 625.*

    PACE Response:
    The text has been updated to reflect this comment.

23. *Page 27, the twenty-fifth line makes a comparison between the existing and proposed conditions for total adjustment. This needs to be presented in tabular format as a new table or an addition to 7.1B & D.*

    PACE Response:
    As per personal communication with County personnel (B. Willardson, March 3, 2006) a reference has been added to refer to Appendix 6.1 and Table 8.

24. *Page 30-32, Tables 7.2A-D, add another column to show the difference between the two methodologies, a negative value corresponding to LACH&SM governance.*

<u>PACE Response:</u>
The table has been updated to reflect this comment.

25. *Page 30, second to last line, clarify the "existing" minimum bed elevation. It is assumed this is not the "Existing Conditions" bed which is based on the 1999 topography, but rather the 2005 topography.*

<u>PACE Response:</u>
The text has been updated to reflect this comment.

26. *Figures 7.2A-D, currently the downstream end of the toe-down elevation data is shown as ascending to meet the model bed at the county line. Since Newhall Ranch is responsible for levees all the way to the county line, the toe-down should continue at the depth of the final cross section and parallel to the model bed.*

<u>PACE Response:</u>
The figure has been updated to reflect this comment.

27. *Figures 7.3A-D, the 1999 minimum model bed does not match the same for Figures 7.2A-D near section 31000. Also, change to design toe-down as discussed in the January meeting.*

<u>PACE Response:</u>
Both figures employ the same data to create the model bed representation. The line types have been changed in an attempt to have the figures represent the bed data in a more uniform manner.

28. *Page 34-35, section 8, update section as previously discussed to include the more conservative method between the LACFCDDM and the LACH&SM with SAM calculations for general scour. Also include a new figure in Section 8 similar to Figure 7.3 that will show the most conservative toe-down, the 1999 minimum (model bed) and the 2005 minimum bed elevations.*

<u>PACE Response:</u>
The text has been updated so that the deeper of the LACFCDDM and the LACH&SM methodologies is used for total toe-down.

29. *Table 8, update toe-down depths and elevations to show the hydrology manual standard practice, including the LACFCDDM. This change is in accordance with discussions at Public Works between PACE, the County, and Newhall Land. Also as discussed move the old version to the appendices. The new Table 8 will be used to check levee elevations during the Tentative Tract Map review and possibly final design, depending on the Phase 2 study.*

<u>PACE Response:</u>
The table has been updated to reflect discussions between the County, PACE and Newhall Land.

Formatting Comments

1. *The memorandum should be proof-read for typographic errors that were not caught by this review.*

   PACE Response:
   Additional proof-reading has been completed for the text, tables and figures.

2. *Many small errors were observed in the tables, apparently as a result of rounding decimals not shown in the table. For example 13.1 – 5.1 = 8.1. As previously discussed with Ben Willardson of the County, figures should be truncated to the level of confidence. If the data is only good to the nearest tenth, then any calculations done with that data can only be good to the nearest tenth (and maybe less). All tables should be corrected to calculate and show significant figures. All values in a table should be consistently rounded to the same decimal place.*

   PACE Response:
   In previous drafts of this report, all tables used the appropriate number of decimal places. In the present draft, the tables have been edited to remove any rounding errors.

3. *Verify the measurement scale of all maps, even reduced maps must have a scale corrected for the reduction factor.*

   PACE Response:
   Previous map scales were applied correctly; however, some maps were printed at half scale. The present drafts include scales based on the print size.

4. *Where references are made to an appendix, use the full appendix designation. For example Appendix Chapter 3.2 not Appendix Chapter 3.*

   PACE Response:
   Appendix references have been updated.

5. *Fully justify the whole body of text.*

   PACE Response:
   The formatting of the report has been updated to reflect this comment.

6. *Figure 1, the Q_{cap} labels are of the old LADPW flow rate. Revise to show the new flow rates used to develop the mapped floodplain. (This error was also observed in the HEC-RAS study map).*

   PACE Response:
   The figure has been updated to reflect this comment.

7. *Page iii, a typo in the first line of the third paragraph, delete "form."*

   PACE Response:
   The formatting of the report has been updated to reflect this comment.

8. *Page iii, a typo in the third line of the fourth paragraph, delete "presented in," which occurs twice.*

   PACE Response:
   The formatting of the report has been updated to reflect this comment.

9. *Page iv, first through third lines of the page, all of the maximum and minimum adjustment values need to be updated to reflect changes in their respective tables (8 values in total).*

   PACE Response:
   The formatting of the report has been updated to reflect this comment.

10. *Page iv, fifth line of the second paragraph states that all of the cross sectional areas were used to calculate the average change in bed elevation over time. In fact, only the 1947, 2004 and 2005 areas were analyzed and only the 1947 and 2005 data were used to determine the long-term degradation.*

    PACE Response:
    The text has been updated to reflect this comment.

11. *Page v, the first paragraph lists the components of other scour but then presents the data in a confusing manner. Rearrange the sentences to follow the order that the subcategories are listed in. Include the results for the bend scour in existing conditions. Update the maximum value for bed form height to be consistent with the calculated values in Appendix 6.*

    PACE Response:
    The text has been updated to reflect this comment.

12. *Page v, last line of the first paragraph, replace "creek crossings" with "river crossings."*

    PACE Response:
    The text has been updated to reflect this comment.

13. *Page v, a typo in the second line of the second paragraph, "LACH&SM" is misspelled.*

    PACE Response:
    The text has been updated to reflect this comment.

14. *Page v, sixth through ninth lines of the second paragraph, reports the findings of the general bed adjustment. These figures need to be corrected for updates to Tables 7.2 A-D (8 values in total).*

    PACE Response:
    The text has been updated to reflect this comment.

15. Page v, a typo in the tenth line of the third paragraph, "adjustment" is misspelled.

    PACE Response:
    The text has been updated to reflect this comment.

16. *Page v, third sentence of the third paragraph, state whether the referenced calculations for SRC2 are proposed or existing conditions.*

    PACE Response:
    The text has been updated to reflect this comment.

17. *Page v, fifth line of the last paragraph, the freeboard values need to be corrected for updates to Tables 7.3A-D.*

    PACE Response:
    The text has been updated to reflect this comment.

18. *Page vi, third line, the toe-down values need to be corrected for updates to table 8.*

    PACE Response:
    The text has been updated to reflect this comment.

19. *Figure 1.1, clarify the subreach boundaries graphically, especially at the end of SRE3, the beginning of SRA1, and the SRA1/SRA2 interface. Use "SRA1" labels in place of "RA1." Graphically depict which cross-sections were used in the long term analysis. Graphically depict which cross sections were used in the SAM analysis. Show approximate locations of sediment samples. Fix the scale.*

    PACE Response:
    The figure has been updated to reflect this comment. Also, please see response to formatting Comment 3.

20. *Page 4, first sentence of the second paragraph, spell out "Simons, Li and Associates", (SLA).*

PACE Response:
The text has been updated to reflect this comment.

21. *Page 4, a typo in the second sentence of the second paragraph, should read "quantitative ~~and~~ analysis."*

PACE Response:
The text has been updated to reflect this comment.

22. *Page 5, delete last line of the first paragraph, "The text has been updated to reflect this."*

PACE Response:
The text has been updated to reflect this comment.

23. *Page 7, second line of the second paragraph, 18 samples were collected on the river and 23 total including the tributaries. Correct the text which says "17 samples."*

PACE Response:
The text has been updated to reflect this comment.

24. *Page 7, Table 3.1, the first station should read "37135 ~~8~~".*

PACE Response:
The text has been updated to reflect this comment.

25. *Page 8, second paragraph, update all D50 values according to Technical Comment 3 above.*

PACE Response:
The text has been updated to reflect this comment.

26. *Page 8, a typo in the seventh line of the third paragraph, "…variation ~~of~~ in..."*

PACE Response:
The text has been updated to reflect this comment.

27. *Figures 3.1A-E, update D50 values according to Technical Comment 3 above. Also clean up stray lines near No. 4 line and between Nos. 8 & 16, and add dashed lines for Nos. 30 & 50.*

PACE Response:
The figure has been updated to reflect this comment.

28. *Figures 3.2A, clean up stray lines, label the same sieve sizes as Figure 3.1, cleanup the axes. Also make a reference to the fact that reaches A & B use exactly the same data.*

    PACE Response:
    The figure has been updated to reflect this comment. Also, please see response to technical Comment 6.

29. *Figure 3.2B, clean up stray lines as above, update D50 value according to Technical Comment 3.*

    PACE Response:
    The figure has been updated to reflect this comment.

30. *Page 17, second line of the second paragraph, update range of proposed conditions general adjustment.*

    PACE Response:
    The text has been updated to reflect this comment.

31. *Page 17, Tables 4.2A-B, a typo in the heading, "Conditions" is misspelled.*

    PACE Response:
    The table has been updated to reflect this comment.

32. *Figures 4.1A-B, delete "Outside Curved Reach" from the heading because there is no "inside" figure and the distinction is not necessary. Eliminate the first point of each series because it does not represent actual data. Change the symbol for one of the series to a filled, solid symbol making the two series easier to distinguish visually.*

    PACE Response:
    The figure has been updated to reflect this comment.

33. *Page 20, fifth line of the first paragraph, revise to say "…creating contour lines ~~of equal ground surface elevation~~…"*

    PACE Response:
    The text has been updated to reflect this comment.

34. *Page 20, a typo in the thirteenth line of the first paragraph, "STA 42215."*

    PACE Response:
    The text has been updated to reflect this comment.

35. *Page 21, Tables 5.1A-B, increase the font of the footnotes to make them more legible. Also fix the rounding errors according to Formatting Comment 2 above.*

    PACE Response:
    The table has been updated to reflect this comment.

36. *Pages 22-24, update the references to Figures 5.2 A-P according to their reordering. Also, as in the Castaic Creek study, a differentiation must be made between the longitudinal and cross-sectional stationing for all of Long-term Degradation, Section 5.*

    PACE Response:
    The text has been updated to reflect this comment.

37. *Page 23, first line of the second paragraph, update "SRB1" to "SRA4".*

    PACE Response:
    The text has been updated to reflect this comment. "As applied to…" is added.

38. *Page 23, fourth line of the second paragraph, insert "degraded" to read, "the section has degraded 3.2…"*

    PACE Response:
    The text has been updated to reflect this comment.

39. *Page 23, ninth line of the second paragraph, insert words to read, "single season degradation may be possibly attributed to the woody nature…"*

    PACE Response:
    The text has been updated to reflect this comment.

40. *Page 23, a typo in the sixteenth line of the second paragraph, "considered"*

    PACE Response:
    The text has been updated to reflect this comment.

41. *Page 24, a typo in the second line of the third paragraph, "less_between."*

    PACE Response:
    The text has been updated to reflect this comment.

42. *Page 24, second to last sentence of the third paragraph, Grande Canyon confluences with the River near Section 17000 not 15335 as stated.*

    PACE Response:
    The text has been updated to reflect this comment.

43. *Figure 5.1, use "SRA1" labels instead of "RA1." Correct the scale.*

    PACE Response:
    The figure has been updated to reflect this comment. Also, please see response to formatting Comment 3.

44. *Figure 5.2K, expand the viewport to include both banks (at least to the top width line) and the proposed levee. Correct the 1999 data as stated in Technical Comment 14 above.*

    PACE Response:
    The figure has been updated to reflect this comment.

45. *Page 25, seventeenth line, update the ranges of SAM aggradation and degradation.*

    PACE Response:
    The text has been updated to reflect this comment.

46. *Page 25, a typo in the twentieth line, "is observed to have the opposite trend than that predicted…"*

    PACE Response:
    The text has been updated to reflect this comment.

47. *Page 26, typos in the second to last sentence of the last paragraph, "height ranges from 0.5 to ~~and~~ 9.1…" and "from 0.5 to ~~and~~ 8.3…" Also update the values in the last paragraph according to the appropriate tables.*

    PACE Response:
    The text has been updated to reflect this comment.

48. *Page 27, the second sentence states that SAM analysis represents a long-term trend. SAM is not a long-term analysis tool since it only utilizes one storm flow for calculations. Correct the text accordingly.*

    PACE Response:
    The text has been updated to reflect this comment. Punctuation is added to clarify the

meaning of the text.

49. *Page 27, discussion of the content found in Tables 7.1 A-D needs to be presented in the order in which the tables are presented to avoid confusion. Also references made on page 27 to these and other tables need to be updated based on the final approved models.*

    PACE Response:
    The text has been updated to reflect this comment.

50. *Page 27, nineteenth line, references to stations do not use the STA designation. Add it for consistency.*

    PACE Response:
    The text has been updated to reflect this comment.

51. *Page 27, twenty-second line update the range of degradation depths, and include STA 24795 which also has the same depth as STA 13030.*

    PACE Response:
    The text has been updated to reflect this comment.

52. *Page 27, a typo in the twenty-ninth line, "components ~~are~~ differ significantly…"*

    PACE Response:
    The text has been updated to reflect this comment.

53. *Page 28, Table 7.1A, a new table was not included with the 1/11/06 .pdf files. Make sure it is updated according to the changes in Appendix Chapter 6.1A.*

    PACE Response:
    The table has been updated to reflect this comment.

54. *Figures 7.1A-D, use points instead of lines to depict adjustments. Use symbols that are easily distinguishable. Remove the first data point near STA 9000 because it does not represent a real data point. Also on Figure 7.1A correct the typo "Bed Adjustment" on the Y-axis.*

    PACE Response:
    The figure has been updated to reflect this comment.

55. *Page 30, Table 7.1A, update the LACFCDDM values to reflect the most recent changes, especially SRA3, SRC1, SRD2, and SRE1.*

PACE Response:
The table has been updated to reflect this comment.

56. *Page 31, Table 7.1C, update the LACFCDDM values to reflect the most recent changes, especially SRC1, SRD2, and SRE1.*

    PACE Response:
    The table has been updated to reflect this comment.

57. *Page 32, fourth line of the first paragraph, update the range of values for LACFCDDM, from "8 ~~10~~ to 21," or as necessary according to the approved, updated models.*

    PACE Response:
    The text has been updated to reflect this comment.

58. *Figure 7.3C, The calculated toe-down including SAM needs to be updated according to the latest figures.*

    PACE Response:
    The text has been updated to reflect this comment.

59. *Page 34, sixth line of the second paragraph, specify the trend of general adjustment, aggradation or degradation.*

    PACE Response:
    The text has been updated to reflect this comment.

60. *Page 34, a typo in the tenth line of the second paragraph, "aggradation ~~iton.~~"*

    PACE Response:
    The text has been updated to reflect this comment.

61. *Page 34, sixth line of the third paragraph, update the range of general adjustment. Also, seventh line of the third paragraph, update the range of other adjustment to include the straight and inside curve values (4.9 minimum). Also, tenth line of the third paragraph, update the range of total toe-down to include the straight and inside curve values (7.5 minimum).*

    PACE Response:
    The text has been updated to reflect this comment.

62. *Page 34, a typo in the first line of the fourth paragraph, "four ~~three~~ subreaches."*

    PACE Response:
    The text has been updated to reflect this comment.

63. *Page 35, fifth line of the first paragraph, update the range of general adjustment. Also, eighth line of the first paragraph, update the range of other adjustment to include straight and inside curve values (3.9 minimum). Also, tenth line of the first paragraph, update the range of total toe-down to include the straight and inside curve values (4.5 minimum).*

    PACE Response:
    The text has been updated to reflect this comment.

64. *Page 35, eighth line of the second paragraph, update the range of other adjustment (-4.6 minimum). In the tenth line of the second paragraph, update the local scour of the bridge piers at section 15335, "12.7 ~~12.5~~ feet." Also, last line of the second paragraph, include section 18830 which has the maximum freeboard of 4.2 feet as well as section 19050.*

    PACE Response:
    The text has been updated to reflect this comment.

65. *Page 35, seventh line of the third paragraph, update the other adjustment to include straight and inside curve values (-4.7 minimum).*

    PACE Response:
    The text has been updated to reflect this comment.

66. *Appendix 4.1, include the most current and approved HEC-RAS output for the Existing Conditions model with n=0.085 and n=0.025.*

    PACE Response:
    The appendix has been updated to reflect this comment.

67. *Appendix 4.2, include the most current and approved HEC-RAS output for the Proposed Conditions model with n=0.085 and n=0.025.*

    PACE Response:
    The appendix has been updated to reflect this comment.

68. *Appendix 4.3, include the most current and approved HEC-RAS models for all relevant 'n-values'.*

PACE Response:
The appendix has been updated to reflect this comment.

69. *Appendix 4.4, update using the most current and approved HEC-RAS model and output. Also state which 'n-value' is being used for the output.*

PACE Response:
The appendix has been updated to reflect this comment.

70. *Appendix 4.6, Figures A4.6A and B update using the most current and approved HEC-RAS model and output. Convert this output again to HEC-2 and SAM input. Use comma delimiting for transport volumes to emphasize differences in magnitude. Make rounding consistent in the width column.*

PACE Response:
The appendix has been updated to reflect this comment.

71. *Appendix 6.1, Figures A6.1A-F, update according to the most current and approved HEC-RAS model and output. Include changes made to pier width for the proposed conditions. Revise the text under "general" heading which states that the maximum velocity allowed by the table is 20-fps. Many velocities are higher than 20. Also revise the typo "LACDPW ~~DWP~~". Also update the pier widths and locations according to the approved proposed models.*

PACE Response:
The appendix has been updated to reflect this comment.

72. *Appendix 6.2, Figures A6.2A-B, update according to the most current and approved HEC-RAS model and output.*

PACE Response:
The appendix has been updated to reflect this comment.

If you have any questions regarding the above responses, please do not hesitate to contact us at (714) 481-7300.

Sincerely,
PACIFIC ADVANCED CIVIL ENGINEERING, INC. (PACE)

David A. Jaffe, Ph.D., P.E.
Project Engineer – Stormwater Division

DAJ/as

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PACIFIC ADVANCED CIVIL ENGINEERING, INC.

17520 Newhope Street, Suite 200 ▪ Fountain Valley, California 92708 ▪ 714.481.7300 ▪ fax: 714.481.7299

December 9, 2005

Ben Willardson
LACDPW
Water Resources Division
900 South Fremont, 3rd Floor
Alhambra, CA 91803
(626) 458-4974

Re: Newhall Ranch -- Santa Clara River Fluvial Study #8197E

Dear Mr. Willardson,

Pacific Advanced Civil Engineering, Inc. (PACE) is pleased to provide the following responses to the Los Angeles County Department of Public Works comment letter dated October 13, 2005, for the above-referenced project. The responses from PACE are as follows:

Previous Comments

4. *Page 7, discussion of sediment gradation size is included in both paragraphs. The bore logs from the Simons, Li, and Associates study show cobbles at certain depths. However, no cobbles are found in any of the gradations used for this study. Many of the cobbles were found below the depths sampled by Seward Engineering Geology. Large flow rates will carry cobbles and the reasons for not including cobbles in the gradations should be included in the discussion. (The upper foot of sediment is most likely not the active bed in the Santa Clara River as shown by Table 5.1. The bed elevation changed by 1 to 2 feet in the period from 2004 to 2005. The portion of the bed moving during peak flows may actually be much deeper. Although the second sampling set collected by Seward may be adequate for SAM analysis, there is some uncertainty in the gradation and distribution as shown by other studies. See comment 6 below.)*

   PACE Response:
   The County has noted that cobbles are present in the SLA study boring logs, which is true. Cobbles are not present in any of the grain size distribution curves in the SLA study (particularly in the Landmark study reach), however, and a careful review of the boring logs down to approximately 10 feet (approximately five times the SAM single event depth) notes only sporadic cobble observances, generally less than 5% and rarely as much as 10%. More importantly, is the fact that at sample location 11 (in the Landmark Village study reach), p. B.5, not until 8.5 feet are any cobbles observed. Because of the lack of cobble occurrence in the

both the boring logs and their depth below the SAM single event depth, taken here as the active depth, PACE believes that the sampling data collected by Seward is representative of the active bed. The text has been updated to reflect this comment.

Present Comments

1. *Page 2, the second set of bullets, number 1, indicates that field investigations were performed for the Santa Clara River. Were other field investigations conducted besides the bed sample collection? If so, the investigation needs to be added.*

   PACE Response:
   Photos of a previous field investigation are included in Appendix Chapter 3.

2. *Page 2, the second set of bullets, number 2, indicates cross-sections were determined to provide adequate representation of channel geometry. Was this done by PACE, or were the cross-sections based on the Sikand study and model?*

   PACE Response:
   An RMS file was provided by Sikand, which was exported to HEC-RAS. In addition to review of the Sikand base line HEC-RAS model, PACE prepared the proposed condition model geometry file modification to model the proposed bridges and bank protection associated with the proposed Newhall Ranch Project.

3. *Page 2, the second set of bullets, number 3, indicates a baseline hydraulic model. The year for the baseline needs to be specified.*

   PACE Response:
   The base topography is from 1999. The text has been updated to reflect this response.

4. *Page 4, the first paragraph states that Sikand relied on previous work conducted by Simons, Li, and Associates and submitted June 1998. Who was the SLA study submitted to?*

   PACE Response:
   The study in question, *HEC-6 Sediment Transport Analysis for ACOE General Permit on Santa Clara River (from Castaic Creek to Cottonwood Avenue) and San Francisquito Creek (from Santa Clara River to 15000' Northerly,* was prepared by Sikand Engineering, not by SLA. The text does not mention to whom the report was submitted. The text has been updated to reflect this comment.

5. *Page 4, the second to last paragraph states that 1500 cfs was required to generate sediment transport. This number is too high since sediment transport has been observed at much lower flow rates. This number should be compared to measured sediment transport data from the USGS. Sediment transport at lower rates may affect braiding and low flow channel armoring.*

   PACE Response:
   USGS data (*Sediment Discharge in The Santa Clara River Basin, Ventura and Los Angeles Counties, California*) notes in Table 3 that in 1971 at 1470 cfs 99% of the transport was silt at the County Line. It is important to note that PACE is citing the SLA study and not making the claim. PACE does not model silt in the present study since it is generally transported as wash load and is not pertinent to the present study's goals. The text has been updated to reflect this.

6. *Page 6, the sediment data represented in Section 3 are not the same as the data submitted in the previous version of the Santa Clara River Fluvial Study. As discussed in previous comment 4 from the previous review, the active bed is not one foot deep. The previous study from Seward, dated January 25, 2005, had sediment taken at depths of 25 feet below the surface. No discussion is made on why the February 25, 2005, sampling by Seward replaced the January 25, 2005, sampling. Both sets of data may be valuable and provide insight into the river behavior. More discussion needs to be added to the report on why the previous set of data was discarded if it was found to be inadequate. If not, both sets of data should be compared and analyzed.*

   PACE Response:
   A careful review of the data reveals that most of the sampling for the January report provided by Seward was for upland and tributary locations. Some of the samples in that report included River sample sites, however, only including single grabs. The February report includes multiple grabs at each sample location providing a much greater degree of confidence in the data in the form of being able to spot outliers (here in the statistical sense), and at several locations within the River bed. Because there is no way to independently determine the efficacy of the samples in the January report, the values were replaced with more verifiable data.

7. *Page 7, Section 3.3 discusses sediment characterization. The current study uses the same sediment gradation for both existing and proposed conditions. Modeling with HEC-6 will require that changes in sediment production also be considered. Some of these changes should be discussed in Section 5 that is looking at long-term historical trends.*

   PACE Response:
   As per a personal communication of 10/17/05 with Ben Willardson of the County, any and all HEC-6 related comments and responses will be delayed

until the second phase of the fluvial analysis following the approval of the Tentative Tract Map(s).

8. *Page 8, the reference to HEC-6 in this section should be removed as discussed in the response to comments from Castaic Creek. Other typographical errors in general sections of the fluvial studies can be corrected as discussed in the Castaic Creek comments from 08/23/05.*

   PACE Response:
   The text has been updated to reflect this comment.

9. *Page 10, the Sikand models discussed were modified significantly since they were developed. The reference should indicate that PACE has updated these models to meet Public Works standards.*

   PACE Response:
   The text has been updated to reflect this comment.

10. *Page 13, the second paragraph discusses outliers for sediment transport capacity calculations. More discussion needs to be added on how outliers are determined. The entire section should be updated as discussed in the Castaic Creek comments.*

    PACE Response:
    Outliers are values under analysis in a data set that reside far outside most other values in a data set. In this case, when the one of the results of a SAM.SED calculation that is three orders of magnitude or more different from the median, the data is excluded from analysis and noted as an outlier. The raw data is presented in Appendix Chapter 4.6. The text has been updated to reflect this response.

11. *Page 18, The HEC-6 study outlines for both Castaic Creek and the Santa Clara River should be similar. There are some differences in available data. These can be discussed once the SAM and long-term historic data are analyzed correctly and the tentative map approval is moving forward.*

    PACE Response:
    Please see PACE Response to Present Comment 7, above.

12. *Page 18, information needs to be provided regarding changes to sediment inflow based on the development of the watershed for the proposed conditions.*

    PACE Response:
    Please see PACE Response to Present Comment 7, above.

13. *The HEC-6 studies need to include historic cross-sections for comparison during the model calibration phase.*

    <u>PACE Response:</u>
    Please see PACE Response to Present Comment 7, above.

14. *Table 5.1 is not the same in the Santa Clara River and Castaic Creek studies. The same methodology should be used for both. More analysis and discussion of the river system needs to be added. An example of this type of analysis is provided as a guide: Station 11015 mean elevations from 1930, 1947, 1960, 1999, 2004, and 2005 are respectively 827.8, 831.3, 828.4, 832.1, 832.8, and 832.3. This cross-section appears to be fairly stable over time. Station 25000 mean elevations from 1930, 1947, 1960, 1999, 2004, and 2005 are respectively 915.1, 912.7, 912.1, 911.8, 910.3, and 909.5. This cross-section appears to be degrading over time. The cause of this long-term degradation may be the installation of the dam on Castaic Creek in 1971. More of this type of analysis is required. Some portions of the river fluctuate over the time period studied, while others aggrade or degrade. The trends in the river are shown by the mean elevations. These trends may be impacted as sediment production from some of the major tributaries are restricted by development. These issues need to be analyzed and discussed. The analysis and discussions can be validated using the HEC-6 model during the next phase. An understanding of the river system and changes must be portrayed and related to the top-of-levee heights and toe-down depths determined for the tentative map.*

    <u>PACE Response:</u>
    In the current draft of the report the historic thalweg analysis has been replaced with a historic cross-section analysis. The sections provide a more clear and complete picture of the trends of the creek bed in a given section. An analysis of the trends of the various sections is included in Chapter 5. This analysis separately considers the periods immediately following (1930) and later following (1947 and after) the failure of the St. Francis Dam in 1928. The data from the thalweg analysis is included for completeness in Appendix Chapter 5.

15. *Page 21, the comments in the second paragraph should be checked against Table 5.1. These assumptions do not appear to be correct now that the calculation procedures have been corrected.*

    <u>PACE Response:</u>
    Please see PACE Response to Present Comment 14, above.

16. *Figure 5.4 and Table 5.5 should use mean bed elevations for comparison of changes in the time period between 2004 and 2005. Comparison of the 1999, 2004, and 2005 data may provide more information. All tables should have the same station order as the to facilitate comparison, i.e., 9042 to 46195 or 46195 to*

9042. Again, general sections and comments in the fluvial studies for Castaic Creek and the Santa Clara River should be consistent. Both studies need to provide more analysis of data provided by the models. The analysis should include discussion on how the model results relate to toe-down, top-of-levee, and protection of other property owners.

PACE Response:
The purpose of the '04-'05 single season analysis is to illustrate bed changes that occur over a single season or single event. Including the 1999 data in this section does not offer any insight into the kinds of changes that occur during the '04-'05 rainy season or any other single event or season. Also, please see PACE Response to Present Comment 14, above.

If you have any questions regarding the above responses, please do not hesitate to contact us.

Sincerely,
PACIFIC ADVANCED CIVIL ENGINEERING, INC. (PACE)

David A. Jaffe, Ph.D., P.E.
Project Engineer – Stormwater Division

CC: Steve Sheridan/LACDPW
Mo Kajbaf/ LACDPW
Mark Subbotin/NLF
Glen Adamick/NLF

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PACIFIC ADVANCED CIVIL ENGINEERING, INC.

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August 10, 2005

Mo Kajbaf
LACDPW
Land Development
900 South Fremont, 3rd Floor
Alhambra, CA 91803

(626) 458-4974

Re: Santa Clara River Fluvial Study

Dear: Mr. Kajbaf

Pacific Advanced Civil Engineering, Inc. (PACE) is pleased to provide the following responses to the Los Angeles County Department of Public Works for the above-referenced project. The responses from PACE are as follows:

1. *Page 4, the reference to the Sikand Study for the Santa Clara River should indicate that the results were not accepted by Public Works. The comments on the last review of the study in 2004 were not addressed.*

   PACE Response:

   The text was updated to reflect this comment in a previous partial draft sent to Public Works.

2. *Page 5, the Simons, Li, and Associates study references sediment gradation data and boring logs that are available in the copy of the report provided to PACE and available at LADPW Headquarters Technical Library.*

   PACE Response:

   The text has been updated to reflect the D_{50} for the two gradation curves in the SLA study and in the present study reach. While the boring logs are present, no map of the location of the borings is present in the PACE copy of the study. If a map showing the locations of the borings becomes available, PACE will further update the report to account for the boring data.

3. *Page 7, the second paragraph refers to Figures 3.2A-E, but only 3.2A and 3.2B are included in the report.*

   PACE Response:

   The text should refer to Figures 3.2A-B. The text has been updated to reflect this correction.

4. *Page 7, discussion of sediment gradation size is included in both paragraphs. The bore logs from the Simons, Li, and Associates study show cobbles at certain depths. However, no cobbles are found in any of the gradations used for this study. Many of the cobbles were found below the depths sampled by Seward Engineering Geology. Large flow rates will carry cobbles and the reasons for not including cobbles in the gradations should be included in the discussion.*

   PACE Response:

   Seward sampling was conducted on approximately the upper foot (recently active layer) of the bed. To be conservative no armoring layer (cobble layer) depth is assumed in sampling which allows the bed to fluctuate freely in numerical modeling. Additionally, the true armoring layer has not been observed in field measurements including Seward field studies and SLA boring logs. This study assumes that the grab sampling at the surface represents the below-surface bed. While the SLA boring logs do show vertical variation of in grain size distribution, a consistent grain size vertical distribution is not evident.

   The text has been revised to reflect this comment.

5. *Page 10, section 4.1.2, discusses correlation between hydraulic parameters and location along the channel. River stationing does not necessarily determine hydraulic parameters. Correlation between flow or velocity at a location, and the parameters such as depth, width, and slopes is more reasonable. Several different relationships were used for the reaches (A-F) to determine sub-reaches. Correlation of one hydraulic variable with a fairly constant correlation variable would make more sense. A few of the correlation calculations show velocity versus hydraulic parameters, but this is only done for approximately 20% of the analyzed reaches. No explanation is provided on why either of these methods was used.*

   PACE Response:

   SAM modeling is based on channel subreaches determined by correlating hydraulic characteristics with longitudinal cross-section location to preserve the along-stream character of the flow. The hydraulic parameters examined are discharge, energy slope, bed slope, Froude number, top width, hydraulic velocity and flow area based on the 100-year discharge. First, correlation coefficients are calculated for each station against the hydraulic parameters. The hydraulic parameter that produces the greatest correlation is plotted against cross-section location. Subreaches are then selected in a manner that preserves the trend of the hydraulic parameter as well as produces approximately equal subreach lengths, which are generally 1000 feet long. This methodology seeks to maintain continuity of analysis by producing similar length subreachs while analyzing the hydraulic parameters that largely control sediment transport.

   The text was updated to reflect this comment in a previous partial draft sent to Public Works. The correlation calculations for velocity versus hydraulic parameters produced low correlation relative to channel position and have been removed from the text.

6. Pages 11-13, references to the MPM method that are spelled out should be written as Meyer-Peter and Muller, rather than Meyer, Peter, and Muller.

PACE Response:

This typographical error has been corrected in the text.

7. *Pages 11-14, more discussion needs to be added on why the MPM method was chosen for modeling sediment transport in the study area. MPM is a gravel transport equation. Although the sediment transport capacity appears reasonable for a zero dimension model, the measured transport through the downstream reach exceeds the transport specified by MPM at lower flows.*

PACE Response:

The MPM equation was found to be the representative transport equation for all subreaches for the existing and proposed conditions. This is because transport estimates based on other transport equations (i.e. Yang), when used to estimate general adjustment and transport, produced values in excess of both historical values of general adjustment (as much as approximately 15 feet) and values of general adjustment that might be physically expected during a single event (over approximately 20 feet). In other cases some transport equations (i.e. Brownlie D_{50}) estimated sediment transport that produced general adjustment calculations much smaller than expected (as little as approximately 1 foot).

The text was updated to reflect this comment in a previous partial draft sent to Public Works.

8. *Pages 21-22, these pages discuss the long-term trends in the river. The earliest topography is 1930, two years after the St. Francis Dam failure. This event released a flood wave with a peak flow of 1.3 million cfs measured 1.4 miles downstream of the dam. This flow made its way down San Francisquito Canyon and into the Santa Clara River. It seems that this flow may have created the river channel shown in the 1930 topography. The scour from this flood wave may have resulted in the lower elevations in 1930. It appears that areas with 1930 elevations higher than the elevations shown in other years are near the outlets of major watersheds, such as Castaic Creek. The channel in the last 50-years may be reworking itself to reach a more stable state than that caused by the dam failure. Inclusion of the 2005 topographic data will provide valuable insight into the channel response since the events of the last storm year were very significant for sediment transport.*

PACE Response:

It is important to note that the failure of the St. Francis Dam in March, 1928, is likely captured in Figure 5.3. The 1930 thalweg generally represents the lowest bed elevation over the period of record except between STA 30000 to STA 32000 (Castaic Creek confluence). The scour resulting from the flood wave progression is believed account for the lower than average bed elevations observed in the historical topography. The high point at Castaic Creek may represent the sediment transport from the Creek into the River in the period following the Dam failure.

The text was updated to reflect this comment. Topography from 2005 had become available to PACE within the last week. Analysis of the 2004-2005 water year

events bed change and a continued historical evaluation with this data will be included in the final draft of the report once the data has been analyzed.

9. *In general, most of the technical background work is in place. More discussion needs to be added on the methods followed so that future readers can understand the processes and procedures used to develop the results for this study.*

   PACE Response:

   PACE will continue to work closely with Public Works to update the discussion in the text. These updates will be available in the final draft of the report.

Items Completed After Meetings and Phone Conversations

1. The SAM sediment input gradation data was incorrect for several sub-reaches due to a data conversion process error. The data have been corrected and the models have been re-run to provide correct information and figures.

2. Calculations for whether the channel was aggrading or degrading were reversed. The previous calculations showed that if transport capacity upstream was more than the transport in the reach downstream, the bed degraded. This is backwards based on the volume continuity equation $I - O = \Delta S$. If inflow (sediment transport capacity from upstream) is greater than the outflow (transport capacity in the reach downstream) the change in storage is positive. Positive storage is aggradation, negative storage is degradation. These calculations have been updated by PACE.

3. Reach D of the proposed conditions from HEC-2 did not match the data in SAM. This was corrected when the model was run with the sediment gradation corrections.

If you have any questions regarding the above responses, please do not hesitate to contact us at (714) 481-7300.

Sincerely,
PACIFIC ADVANCED CIVIL ENGINEERING, INC.

David A. Jaffe, Ph.D., P.E.
Project Engineer – Stormwater Division

DAJ

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River Fluvial Study – Phase 1 Final Draft

Newhall Ranch
Santa Clara River

March 6, 2006

Prepared For Submittal to:

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#8197E

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Executive Summary

This technical study provides an evaluation of the existing and proposed fluvial characteristics and long-term stability of Santa Clara River between Interstate 5 and an area generally west of the Los Angeles/Ventura County line in the vicinity of the Newhall Ranch Specific Plan. Development along the River within the study area has the potential to modify the fluvial mechanics of the River. The proposed buried soil cement bank protection on both the north and south banks of the River is intended to provide long-term erosion protection from lateral migration of the bank and flood protection for the adjacent proposed development areas. This analysis evaluates impacts from build-out of Newhall Ranch from (1) fluvial modifications of the river bed from single hypothetical storm events, and (2) changes in the floodplain fluvial operation over the long-term.

Three sediment transport studies were previously conducted within the study reach in the last 25 years. The first study conducted by Sikand Engineering (June 2000, and revised November 2004) was to provide HEC-6 sediment transport analysis for the Santa Clara River and to determine the possible effects of the Newhall Ranch Development on river bed stability. The study relied on previous work conducted by Simons, Li & Associates (SLA) (June 1998). The second study, produced by SLA (November 1990), sought to provide information for flood and fluvial process management in the Santa Clara River. The SLA report was reviewed in detail by LADPW and response to comments made, however, the report was not revised to obtain final LADPW approval. The final study was conducted by USGS, whereby the study collected sediment data from 1967 to 1975 at three sites in the Santa Clara River basin including the Los Angeles-Ventura County line. The study estimated long-term sediment discharge by applying the sediment and water discharge relationship observed from 1967 to 1975 to long-term records of water discharge (1928-1975).

Sediment data collection for the Santa Clara River along the study reach was conducted by Allan E. Seward Engineering Geology Inc. Eighteen samples were collected at six different locations positioned along River subreaches. All sampling was conducted using grab samples of the upper foot of the active or recently active portion of the bed. No fine material is included in the sediment analysis because fine material is generally transported as wash load. A review of the raw gradation curves indicates that most samples are comprised of poorly graded sands with gravels and silts. The D_{50} values for all samples ranged from 0.25 to 4.67 mm with an average of 0.8 mm. Additionally, previous studies noted above also found similar sandy characteristics. No cobbles are present in the Seward study and sampling was not conducted for cobble grain sizes. Cobbles are not present in any of the grain size distribution curves in the heretofore discussed SLA study (particularly in the Landmark study reach), and a careful review of the boring logs down to approximately 10 feet (approximately five times the SAM single event depth) notes only sporadic cobble observances, generally less than 5% and rarely as much as 10%. More important is the fact that at sample location 11 (in the Landmark Village study reach), p. B.5, not until 8.5 feet are any cobbles observed. Because of the paucity of cobble occurrence in the both the boring logs and their depth below the SAM single event depth, taken here as the active depth, PACE believes that the sampling data collected by Seward is representative of the active bed.

Modifications to the river bed are measured as bed adjustment in feet. Positive adjustment indicates aggradation and negative adjustment indicates degradation. Several types of adjustment are considered in this study including general adjustment, long-term adjustment, and other scour. General adjustment is scour that occurs in an individual discharge event and is calculated as the difference between sediment inflow and outflow of a given River reach. Long-term adjustment consists of fluvial processes that occur over several years. Other scour is made up of local scour, bend scour, low-flow incisement, and bedform formation.

General adjustment was estimated in this study using the US Army Corps of Engineers (ACOE) SAM steady-state zero-dimensional numerical model. SAM is utilized to provide a first approximation of sediment transport potential for subreaches within Santa Clara River. The SAM numerical model is built upon hydraulic and fluvial representations of the study bed. The hydraulic component includes representations of bed characteristics and discharge. The fluvial component includes representation of bed gradation and sediment transport functions. SAM's hydraulic component utilized average cross-section data imported from HEC-2 numerical models of the river converted from HEC-RAS numerical models. The conversion process modifies the original numerical model, as discussed in Chapter 4, so some differences in numerical models are created. Both the existing and proposed conditions HEC-RAS models were originally developed by Sikand Engineering in the *Newhall Ranch Santa Clara River HEC-RAS Study* (June 2000) and submitted as part of the Newhall Ranch Specific Plan. The HEC-RAS model that is the basis of the SAM modeling, and will be the basis for the HEC-6 model, has been refined by PACE and has been submitted (concurrently with this Fluvial Study) to LADPW for review and approval. The current model resembles the Sikand model but has been refined to address current LACDPW modeling standards and updated proposed project conditions. River subreaches that make up the SAM model are determined by examining the hydraulic parameters of the individual HEC-RAS cross-sections and identifying correlations between those hydraulic parameters and the longitudinal position in the channel.

Representation of sediment grain size distribution in SAM is percent finer data obtained from sieve analysis of channel sediment samples. At each sample location, multiple samples are collected and the average data is input into the model. Sediment transport equations used in all SAM modeling were chosen with the assistance of the Army Corps' SAM.AID subroutine. The SAM.AID subroutine determines the most representative transport function based on the hydraulic parameters and percent finer data by comparing model data with peer-reviewed sediment transport studies. The study found that Meyer-Peter and Muller (MPM) was the representative transport function for all subreaches for both existing and proposed conditions because it produced adjustment values within physical reason.

SAM was run for all River reaches and bed stability was estimated based on the change in potential transport between adjacent channel subreaches for the Q_{CAP} discharge. General adjustment based on SAM modeling is presented in Chapter 4. General adjustment was also calculated using the equation specified in the Los Angeles County Hydrology and Sedimentation Manual (LACH&SM). The LACH&SM general adjustment calculation is based only on flow mean velocity. In most circumstances, adjustment predicted by the LACH&SM is greater (more scour) than that predicted by SAM for both the existing and proposed conditions. SAM results predict general adjustment from -2.9 to +2.3 feet for the existing condition, and -1.6 and +2.1 feet for the proposed condition. LACH&SM methodology predicts general adjustment from -2.1 to -8.1 feet for the existing and -1.8 to -7.6 feet for the proposed condition, both outside of curves. In this report the outside of the curve values and inside of curve values are considered separately, as per LACDPW criteria, since outsides of curves tend to degrade while insides of curves tend to aggrade. It is not presently clear if the changes in general adjustment result from the alteration of the hydrology caused by full build-out, or from changes in the velocity in the River associated with specific individual project improvements. It is expected that various Newhall related impacts will be localized, and, with respect to implementation of the proposed improvements, that the River will continue to behave fluvially as it did prior to construction of these proposed improvements. Long-term changes to hydrology and sediment production are not addressed in the first phase report, but may be addressed in the second phase HEC-6 numerical modeling. Finally, the general trend in general adjustment for the study reach as indicated by SAM modeling is not apparent for either the existing or proposed condition.

Long-term adjustment was calculated based on historical records in the form of topographic data. Topographic data dating from 1930, 1947, 1963, 1999, 2004 and 2005, was digitized. Cross-sections were cut at the locations of select HEC-RAS sections for each historical topography. At least one cross-section was chosen for each subreach established in Chapter 4. Areas of the 1947, 1963, 1999, 2004 and 2005 sections are calculated and the areas of the 1947, 2004 and 2005 bed are used to calculate the average change in bed elevation over time. The 1930 topography is not used to calculate average change in bed because the trends in bed change that occurred during this year occurred immediately following the failure of the St. Francis Dam upstream of the project site. Several events within the available historical record (1930 to present) have had an impact on the River bed and fluvial mechanics. These events include failure of the upstream dam, construction of bridges spanning the River, agricultural infill along the River banks, and periodic burning of surrounding vegetation during forest fires. The most significant historical event in the formation of the present bed condition was the failure of the Dam. Within the project reach, the failure of the Dam appears to have resulted in the abrupt scour of the bed. The sectional analysis finds that some historical sections (SRD2, SRD3, SRE1, SRE2) show little change between 1947 and 2005 suggesting an approximate equilibrium state for these subreaches. Between 1947 and 2005, 0.5, 0.7, 1.0, and 0.8 feet, respectively, of cumulative degradation appears to have occurred on these sections. Upstream sections SRA1 to SRC3 show continuous degradation over the period of record from 1947 to the present. Three sections, SRC4, SRD1 and SRE3 aggraded cumulatively between 1947 and 2005 by 1.9, 1.4, and 3.1 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 the Summer of 2004 and the heavy rains of the 2004/2005 rainy season. This combination had the potential to produce high sediment runoff loading into the River. Degradation seems to be more prevalent on the upper half of the study reach while mild fluctuations about a mean are more apparent on the lower half. This appears to result from the relatively steep, narrow, winding upper portion of the study reach versus the relatively flat, wide, braided channel in the lower portion of the study reach of the River. Agricultural activities occurred, primarily in downstream sections but in upstream sections as well, so some of the observed channelization may have resulted from these activities.

Other scour considered in this study is comprised of four sub-categories: local scour, bend scour, low-flow incisement, and bedform height. Local scour occurs in the vicinity of flow obstructions including piers and abutments. Bend scour occurs because of velocity gradients around curves in fluvial systems. Three distinct bends are located in the study reach. Low flow incisement is included to represent thalweg or low flow channel depth. On-site inspection and review of historic data of this feature suggest a thalweg depth of approximately two feet. Finally, bedform height represents the dunes and anti-dunes that develop in active soft-bottomed channels during flow events. In this study, bedform height has been limited after Kennedy (1963). Local scour ranges from 0.0 to 17.4 feet in the proposed conditions at the various river crossings. Results of calculations of bend scour vary from 0.0 to 11.3 feet for the existing condition and 0.0 to 8.9 feet for the proposed condition. For both the existing condition and the proposed condition, the bedform height ranges from 0.5 to 8.3 feet. Changes between the existing and proposed conditions are a reflection primarily of the change in velocity brought about by the proposed condition.

General adjustment, long-term adjustment, and other scour are summed to determine total potential bed adjustment following LACH&SM methodology. For cross-sections where SAM modeling predicts aggradation, the general adjustment contribution to total bed adjustment is not included for degradation calculations. The existing condition is predicted to have a combined bed adjustment of approximately -6.9 to -19.7 feet for the outside of curved reaches and -6.2 to -15.4 feet for the inside of curved and straight reaches. Calculations in the proposed condition predict that the combined bed adjustment ranges from approximately -6.7 to -26.2 feet for both the outside of curved reaches and for the inside of curved and straight reaches.

A comparison of total bed adjustment estimated by both the summed methodology and the LACFCDDM methodology shows that the more intensive LACH&SM methodology using SAM for general adjustment and historical analysis for long-term adjustment predicts a shallower toe-down for both the existing and proposed conditions than does the LACFCDDM methodology except for sections in the vicinity of subreach SRA2, SRB1, SRC2, and SRE1. In subreach SRA2 section 43820, very high long-term adjustment causes LACH&SM calculations of this section to exceed LACFCDDM calculations by 1.4 feet for both outside of curved reaches and straight or inside of curved reaches in the existing and proposed conditions. In SRC2 section 29140, higher general adjustment and higher bedform height cause LACH&SM calculations of this section to exceed LACFCDDM calculations by 0.6 feet in outside curved reaches and 1.2 feet in straight and inside of curved reaches. In SRB1 section 36080 and SRE1 section 15125, the presence of proposed bridges causes LACH&SM calculations of this section to greatly exceed LACFCDDM calculations, by more than 10 feet. LACH&SM methodology utilizing SAM calculations predicts a deeper toe-down than does the LACFCDDM at these locations methodology because the LACFCDDM does not account for the effects of local degradation as effectively.

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. Freeboard elevation is calculated in this study based on LACH&SM Chapter 5A-3, and includes LACFCDDM calculations. The freeboard for the River ranges from approximately 2.5 to 5.2 feet for both outside of curved and straight or inside of curved reaches in the proposed condition. Maximum total toe-down, total freeboard, toe-down elevation and freeboard elevation are presented in Table 8.

Previous studies estimated that a toe-down of 12.5 feet would be required for adequate protection. The results of this study, however, suggest that a variable toe-down from approximately 5 to 27 feet based on SAM modeling, or 8 to 21 feet based on LACFCDDM. A large portion of this difference can be attributed to the difference in general adjustment. It is expected that HEC-6 modeling will be on the order of 1 to 5 feet general adjustment.

1 Introduction

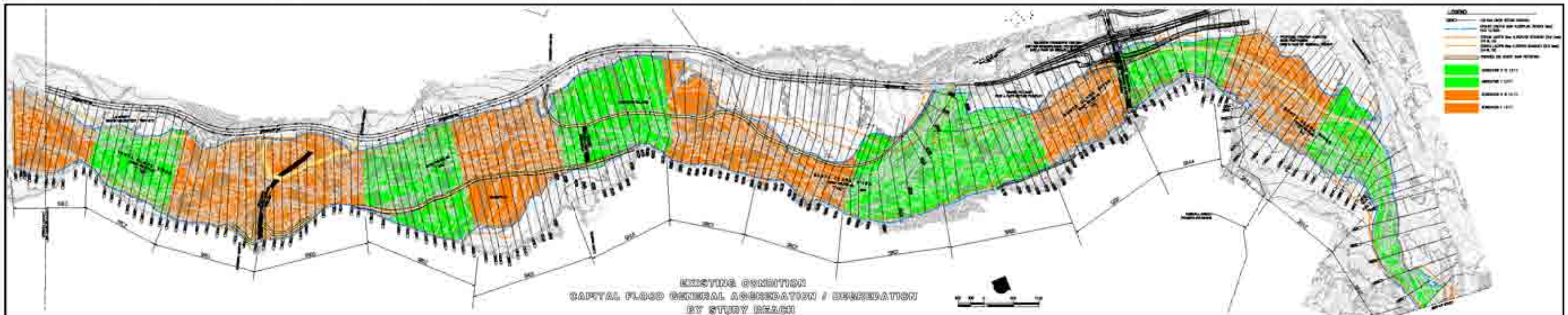
The following technical investigation provides a detailed and focused evaluation of the fluvial characteristics and long-term stability of the Santa Clara River for the reach including all of Newhall Lands' proposed Newhall Ranch and Phase 1 Landmark Village development. The River study reach is located from Interstate 5 on the east and to a point directly downstream of the Ventura County/Los Angeles County line (Figure 1.1). This reach includes the Newhall Ranch Specific Plan and the proposed Entrada project. The first phase of the Newhall Ranch Specific Plan (Landmark Village) is bounded by the River on the south, State Highway 126 on the north, Castaic Creek on the east, and Grande Canyon on the west (Figure 1.1). The Santa Clara River fluvial system extends from Acton, California in the east to the Pacific Ocean, the River's natural terminus, in the west. Adjacent development along the River within the study reach has the potential to modify the fluvial response of the watershed through changes in the runoff and reduction in the sediment supply from the developed areas. The proposed buried soil cement bank protection on both the north and south banks of the River within the study reach is intended to provide long-term erosion protection from lateral migration of the bank and flood protection for the adjacent proposed development areas. These modifications to the river system have the potential to modify the fluvial operation of the floodplain and cause changes to the stream mechanics. The intent of this analysis is to evaluate these impacts from (1) fluvial modifications of the river bed from single hypothetical storm events, (2) changes in the floodplain fluvial operation over the long-term; and, (3) to determine the top and toe of the proposed bank protection.

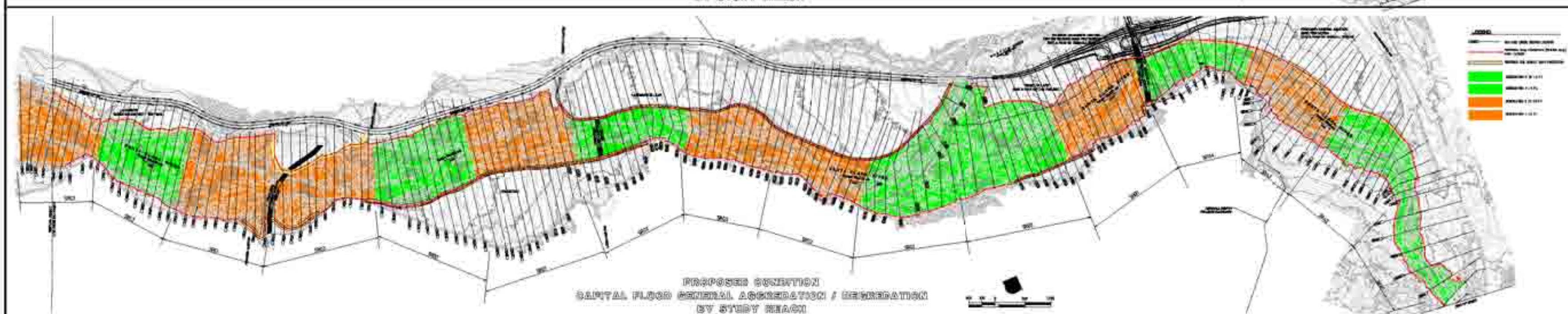
1.1 Types of Adjustment

Modifications to the river system are measured as bed adjustment in feet. Positive adjustment indicates bed aggradation while negative adjustment indicates bed degradation. Several types of adjustment are considered in this study including general adjustment, long-term adjustment, and other scour. General adjustment consists of scour that occurs in an individual discharge event, and may be considered as the difference between sediment inflow and outflow. That is, if sediment inflow into a given reach is higher than sediment outflow for the same reach, aggradation will occur. In contrast, if sediment outflow exceeds inflow for a given reach, degradation in the form of scour will occur in the reach. Long-term adjustment consists of fluvial processes that occur over many rainy seasons and contribute fluctuation of bed elevation of a river or creek. Other scour is comprised of local scour, bend scour, low-flow incisement, and bedform formation. These are discussed in detail, below.

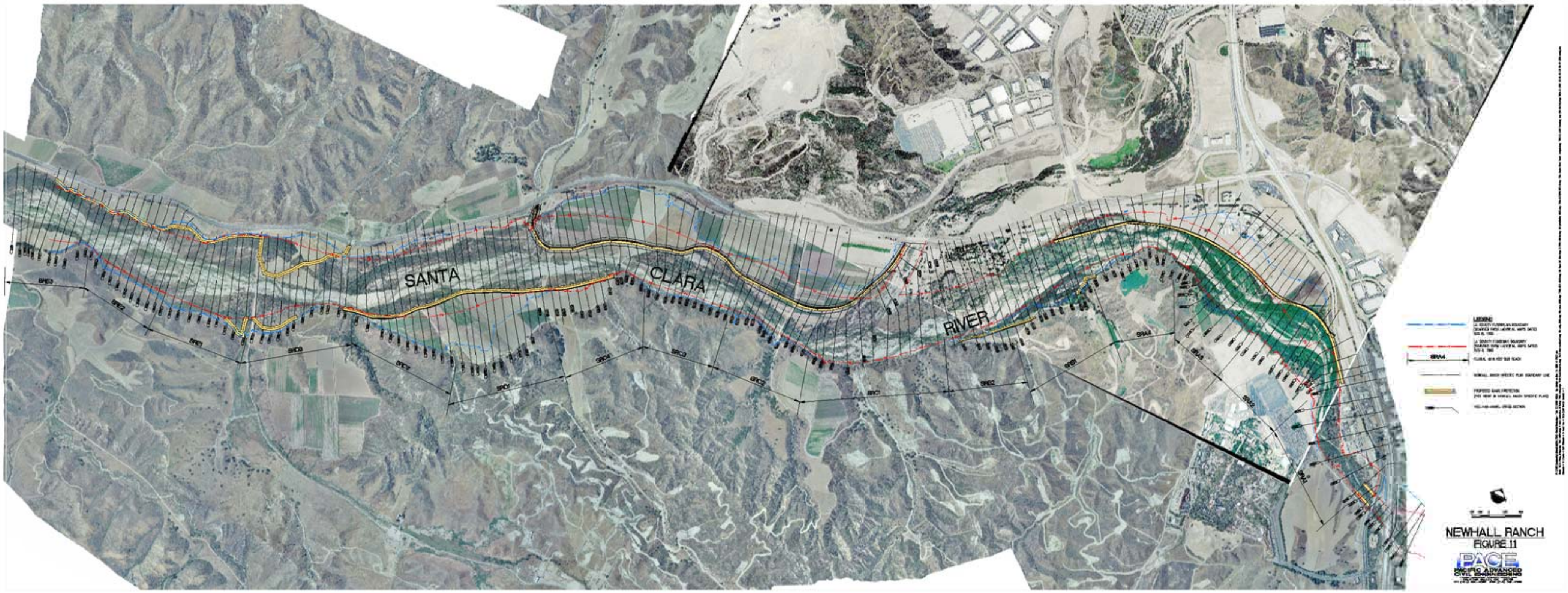
1.1.1 Study Objectives

The primary objective of this report is to develop the technical engineering analysis to assess river bed impacts from potential modifications of fluvial operation from proposed development west of Interstate 5, including the Newhall Ranch Specific Plan. The intent is to provide a comprehensive assessment of short- and long-term bed adjustment. This report provides technical analysis for (1) general adjustment, (2) long-term adjustment, (3) other scour, (4) study reach gradation, (5) SAM modeling and analysis, (6) HEC-6 modeling and





CAPITAL FLOOD SAM RESULTS GENERAL AGGREDATION / DEGREDATION FOR EXISTING & PROPOSED CONDITION CITY OF SANTA CLARITA	PACIFIC ADVANCED CIVIL ENGINEERING	NEWHALL RANCH SANTA CLARA RIVER PHASE 1 FLUVIAL STUDY	01


SANTA
CLARA
RIVER
LEGEND
NEWHALL RANCH
FIGURE 11
PACE
PACIFIC ADVANCED
CIVIL ENGINEERING

analysis, and (7) total soil cement bank protection toe-down design. The objectives of the fluvial assessment for the proposed development project include the following:

1. Quantify the fluvial parameters that are representative of the river bed characteristics.
2. Model the existing and proposed conditions river bed and fluvial processes.
3. Provide preliminary assessment of the streambed stability through determination of the sediment transport capacities within different reaches of the floodplain.
4. Provide toe-down depth assessment throughout the study reach.
5. Provide freeboard height assessment throughout the study reach.
6. Determine any impacts to off-site properties.

A variety of engineering analysis and tasks were associated with both the different aspects of the watershed hydrology and floodplain hydraulics. A technical framework was developed to guide the analysis of the system. These major task areas of study reflected the various objectives of the study and included the following:

1. Floodplain field investigations – Perform field reconnaissance of the existing watershed conditions as well as ground photo survey along the entire existing creek system within the fluvial study boundary.
2. Baseline digital floodplain cross-section geometry – Layout appropriate spacing and location of cross-sections to establish the representative channel geometry. Digitally develop extremely accurate cross-section coordinate points using topographic digital terrain models (DTM) and CAD subroutines suitable for hydraulic model format. Adjust cross-section data to include horizontal variation of roughness and other attributes.
3. Baseline HEC-RAS hydraulic model – Prepare floodplain model in HEC-RAS based on the 1999 digital geometry and existing condition flowrates. Evaluation based on single storm event and steady flow conditions.
4. HEC-2 model creation – Conversion of HEC model formats for use in SAM and HEC-6 modeling.
5. Floodplain reach characterization and parameter estimation – Prepare an assessment of the hydraulic parameters and evaluate the statistics. Determine hydraulic subreaches based on hydraulic statistics. The analysis involves determining the average hydraulic properties for each reach and then applying the appropriate sediment transport relationship to each grain size fraction.
6. Sediment transport capacity analysis – Prepare steady state sediment transport capacity analysis through dividing the channel system into different reaches and comparing the capacity within each reach.

7. Analyze historic trends in river bed adjustment – Consider available historic data to gain insight into changes in bed characteristics throughout the period of record.
8. Analysis of local bed adjustment components – Study of the individual components of local bed adjustment.
9. Calculate toe-down depth – Calculate the total toe-down depth of proposed soil cement bank protection based on the analysis of individual bed adjustment components.

2 Previous Fluvial Analyses for Study Reach

2.1 Introduction

Three sediment transport studies have been conducted within the study reach between Interstate 5 and the Los Angeles/Ventura County line in the last 25 years. The first study conducted by Sikand Engineering was submitted in June 2000, and revised November 2004. The purpose of the Sikand study was to provide HEC-6 sediment transport analysis for the Santa Clara River to determine the possible effects of the Newhall Ranch Development on river bed stability. The Sikand study relied on previous work conducted by SLA which was submitted June 1998 in *HEC-6 Sediment Transport Analysis for ACOE General Permit on Santa Clara River (from Castaic Creek to Cottonwood Avenue) and San Francisquito Creek (from Santa Clara River to 15000' Northerly)*.

The second study produced by Simons, Li, and Associates and submitted November 1990, sought to provide information for flood and fluvial process management in the Santa Clara River from Soledad Canyon to Castaic Creek. The study included multiple tasks including data collection, quantitative analysis and mathematical modeling, alternatives evaluation and other assignments.

The final study was conducted by the United States Geological Survey and completed in August 1979. The study sought to determine the sediment discharge in the Santa Clara River Basin in Los Angeles and Ventura Counties using sediment trap (1968-1975) and historical data (1928-1975). Sediment data was collected for the period 1967 to 1975 at the Los Angeles/Ventura County line.

2.2 Sikand Engineering Associates, 2004

The Sikand study covers the portion of Santa Clara River from Interstate 5 to the Los Angeles/Ventura County line. The study utilized the ACOE HEC-6 model to assess how improvements in the River as part of the Newhall Ranch Development will alter sediment transport. The primary focus of the study was the long-term degradation of the river bed and the toe-down depth required for proposed improvements. Both the existing and proposed model conditions were developed in HEC-RAS and the only differences between the models was the incorporation of proposed levees. Soils data was taken from the SLA study in Chapter 4 of the Interim Report, Existing Conditions Data Collection. Grain size distribution plots indicate poorly graded sand with gravel and a D_{50} of approximately 1 mm in the vicinity of the Castaic Creek confluence. Only HEC-6 input files offer sediment information. The inflow sediment boundary condition and grain size distribution was also taken from the SLA study. Conversions from tons sediment per day to feet of scour was calculated by assuming a four day duration and sediment specific gravity of 2.65. Several discharges were run in the numerical modeling including the Capital and 100-year storm events. The report does not specifically note the discharge of either event.

The study found that for seven subreaches in the present condition, the bed is in steady state, but that the proposed conditions are expected to cause minimal degradation (an average of one foot) in some subreaches and minimal aggradation (an average of three feet) in some subreaches. The study also analyzed the historical record of gage data at the county line from 1953 to 1993, and determined that a 1500 cfs minimum discharge was required to generate sediment transport. By comparison, USGS data (*Sediment Discharge in The Santa Clara River Basin, Ventura and Los Angeles Counties, California*) notes in Table 3 that in 1971 at 1470 cfs, 99% of the transport was silt at the county line. It is important to note that PACE is citing the SLA study and not making the claim. PACE does not model silt in the present study since it is generally transported as wash load and is not pertinent to the present study's goals.

It is important to note that the results of this study were not accepted by Los Angeles County Department of Public Works, and the comments on the last review of the study in 2004 were not addressed.

2.3 Simons, Li & Associates, 1990

The SLA study is broad in reach and included use of the proprietary QUASED numerical model for fluvial analysis. At present, it is not clear if this model is still applicable or how it compares to other fluvial modeling software such as HEC-6. The study included a large volume of data analysis including flood flow frequency analysis, HEC-2 numerical modeling, historic photograph analysis, and sediment yield calculation. Supplemental design criteria are provided for subsequent studies. Sediment gradation data was presented in an interim report that indicates an average D_{50} of approximately 1.3 mm below Interstate 5. Boring logs are present in the SLA study. There is no apparent consistent vertical distribution of sediment grain size between boring logs.

The study suggests a 100-year return period discharge in the River of 47,100 cfs in the vicinity of the Interstate 5 bridge. For the portion of the River downstream of Interstate 5, the bed was found to be adjusting between -0.1 to +1.0 feet. The study notes that the River appears to be in "pseudo-equilibrium" and "shows no trend toward either aggradation or degradation and significant lateral migration of the channel is not apparent." QUASED modeling suggests that some reaches increase degradation potential as the result of encroachment by improvements as compared to the existing condition. For the portion of the River downstream of Interstate 5, some portions of the bed are expected to aggrade more, while others are expected to degrade more. Downstream of Mint Canyon on the River toe-down, design depth of 12.50 feet is recommended with a general scour of 2.68 feet, a bed form height of 4.92 feet, a low flow incisement of 2 feet, and a total scour of 7.14 feet (Table 3.20, p. 3-54).

The SLA report was reviewed in detail by LADPW and response to comments made, however, the report was not revised to obtain final LADPW approval.

2.4 USGS, 1979

The USGS study collected sediment data from 1967 to 1975 at three sites in the Santa Clara River basin including the Los Angeles-Ventura County line. The study estimated long-term sediment discharge by applying the sediment and water discharge relationship observed from 1967 to 1975 to long-term records of water discharge (1928-1975).

During the short-term period (1968-1975), total sediment discharge was 63.5 million tons, 59.5 million tons of which was carried in suspension. Coarse sediment accounted for 28% of the total sediment discharge (17.7 million tons). Transport of the majority of sediment occurred during only a few days of flood flow each year (55% of the total sediment within 2 days and 92% within 53 days).

Sediment deposited in reservoirs (Lake Piru and Pyramid Lake) resulted in a 6% reduction of sediment to the River basin during the historical period (1928-1975) and 12% during the period most affected by dams (1953-1975). Castaic Creek interception of sediment reduced the amount of sediment in the River by another 2% from 1928-1975 and 4% from 1953-1975. It is not clear how these reductions are directly related the completion of the Castaic Creek Dam because it was not completed until 1971.

3 Sediment Characterization and Analysis

3.1 Sediment Data Collection

To characterize the sediment of the river bed and by extension the possible bed load of sediment during discharge events, a sediment grain size analysis was conducted. The goal of the analysis is to gain a statistical representation of the size distribution of soil components of the river bed. Grain size distribution analysis is a powerful tool because the results can represent both a qualitative description of soil make up as well as quantitative input for further predictive measures, such as fluvial modeling.

Sediment collection for the Santa Clara River along the study reach was conducted by Allen Seward Engineering Geology, Inc. Eighteen samples were collected along the river with a total of 23 including samples taken at the tributaries. The relevant sampling locations are compiled in Table 3.1. All sampling was conducted using grab samples of the upper foot of the active or recently active portion of the bed. At least three samples at different locations within a sampling station were taken at each River sampling location. Sampling locations for the study are presented in a February 14, 2005 report, reproduced in Appendix Chapter 3.2.

Table 3.1: Santa Clara River Location and Average D_{50} of Sediment Samples

Reach	Station	Sample Number	Reach Average D_{50} (mm)[1]
A & B	37135	CB1	0.5
	37135	CB2	
	36515	CB3	
C	28500	HR1	0.95
	28500	HR2	
	28500	HR3	
	24115	LC1	
	24115	LC2	
	24115	LC3	
D	22195	AC1	1.0
	22195	AC2	
	22195	AC3	
D & E	15335	MC1	1.0
	15335	MC2	
	15335	MC3	

1: Reach average is the average of all samples I the reach.

3.2 Sediment Gradation Analysis

Generally, grain size distribution analysis is broken down into three distinct steps. The first step is to dry the samples. Drying is accomplished in a desiccator or similar apparatus. The second step is to sieve or otherwise separate the sediment by particle size. Finally, fine material (smaller than standard mesh 200) is analyzed using hydrometric techniques. The sediment distributions are plotted on semi-log plots by percent finer for a given sample size. For this study, no fine material is included in analysis because fine material is generally transported as wash load, which is not of concern here. Distribution data has been averaged on a station by station basis. Averaging is accomplished by taking the mean of the three samples from a given station. Averaging provides a single representative sediment grain size distribution for a given station that can be used for numerical modeling or other analysis. Plots of the mean grain size distribution for each sampling station are presented in Figure 3.1A-E. Raw grain size distribution plots for the study are presented in the February 14, 2005 Seward report, reproduced in Appendix Chapter 3.2.

3.3 Sediment Characterization

A review of the raw gradation curves indicates that most samples are comprised of poorly graded sands with gravels and silts. The D_{50} values for all samples ranged from 0.25 to 4.67 mm with an average of 0.8 mm. A comparison with Figure 3.2A-B indicates that averaging retains the sandy character of the sampled soil. The averaged D_{50} values range from 0.5 to 1.0 mm. Additionally, previous SLA study noted above also found similar sandy characteristics, however, the average grain size was found to be approximately D_{50}=1.3 mm, somewhat more coarse that the current sampling.

Seward sampling was conducted on approximately the upper foot (recently active layer) of the bed, as noted above. To be conservative, no armoring layer (cobble layer) depth is assumed in sampling which allows the bed to fluctuate freely in numerical modeling. Additionally, the true armoring layer has not been observed in field measurements including Seward field studies and SLA boring logs. This study assumes that the grab sampling at the surface represents the below-surface bed. While the SLA boring logs do show vertical variation in grain size distribution, a consistent grain size vertical distribution is not evident.

The County has noted that cobbles are present in the SLA study boring logs, which is true. Cobbles are not present in any of the grain size distribution curves in the SLA study (particularly in the Landmark study reach), however, careful review of the boring logs down to approximately 10 feet (approximately five times the SAM single event depth) notes only sporadic cobble observances, generally less than 5% and rarely as much as 10%. More importantly, is the fact that at sample location 11 (in the Landmark Village study reach, p. B.5) no cobbles are observed until 8.5 feet. Because of the paucity of cobble occurrence in both the boring logs and their depth below the SAM single event depth, taken as the active depth, PACE believes that the sampling data collected by Seward is representative of the active bed.

LACDPW has noted that previous versions of this report included different sediment gradation data than is present currently. Careful review of the data reveals that most of the sampling for the January 2005 PACE draft report, compiled by Seward, was for upland and tributary locations, many at the proposed Landmark site. Some of the samples in that report included River sample sites; however, only single grabs were included. The February 2005 PACE draft report includes multiple grabs by Seward at each River sample location providing a much greater degree of confidence in the data by being able to spot outliers (here in the statistical sense). Because there is no way to independently determine the efficacy of the samples in the January 2005 report, the gradation data was replaced with more verifiable data. The January 2005 data is not included in this draft.

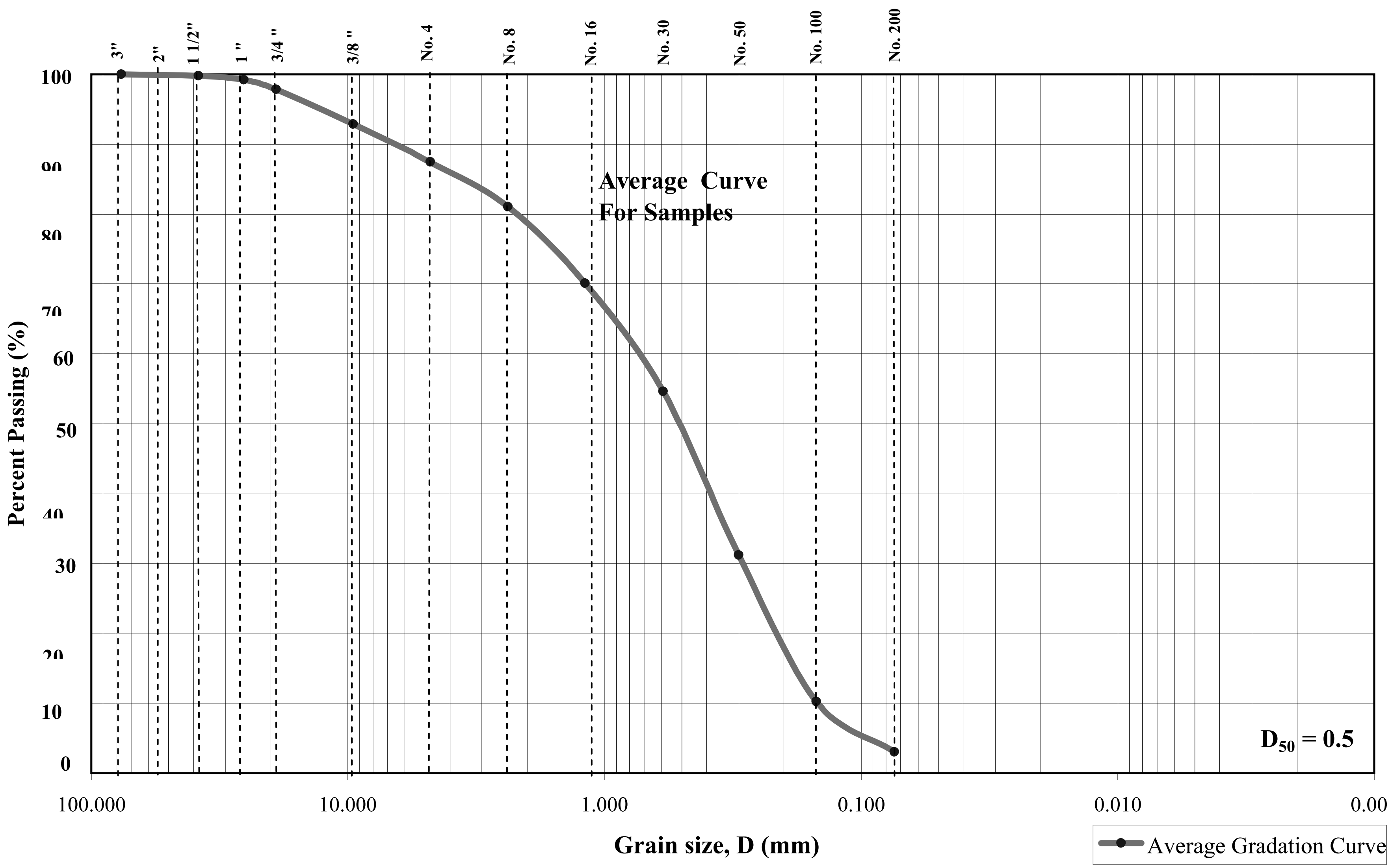


Figure 3.1A. Santa Clara River Reach A Average Gradation Curve

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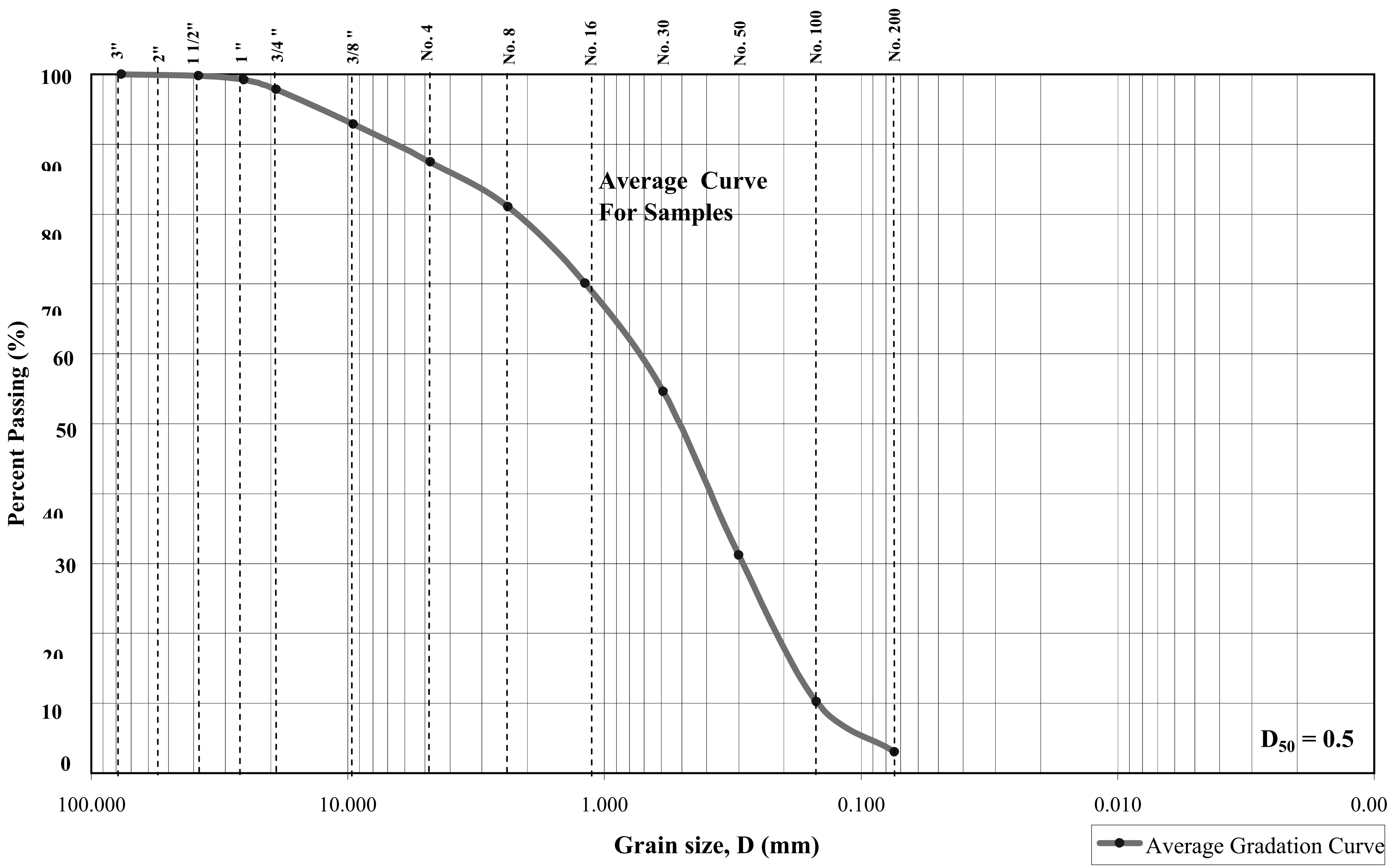

Figure 3.1B. Santa Clara River Reach B Average Gradation Curve

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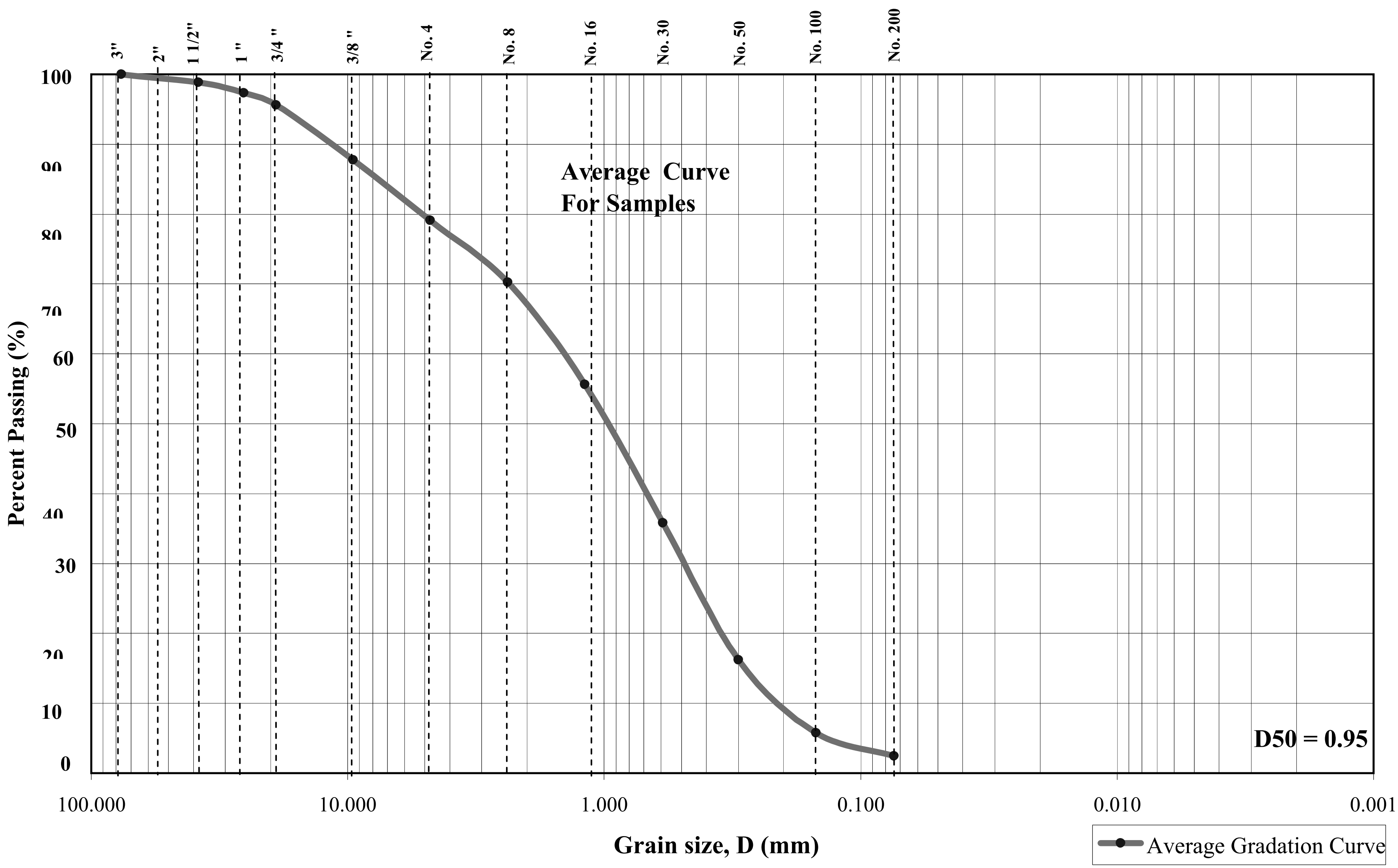

Figure 3.1C. Santa Clara River Reach C Average Gradation Curve

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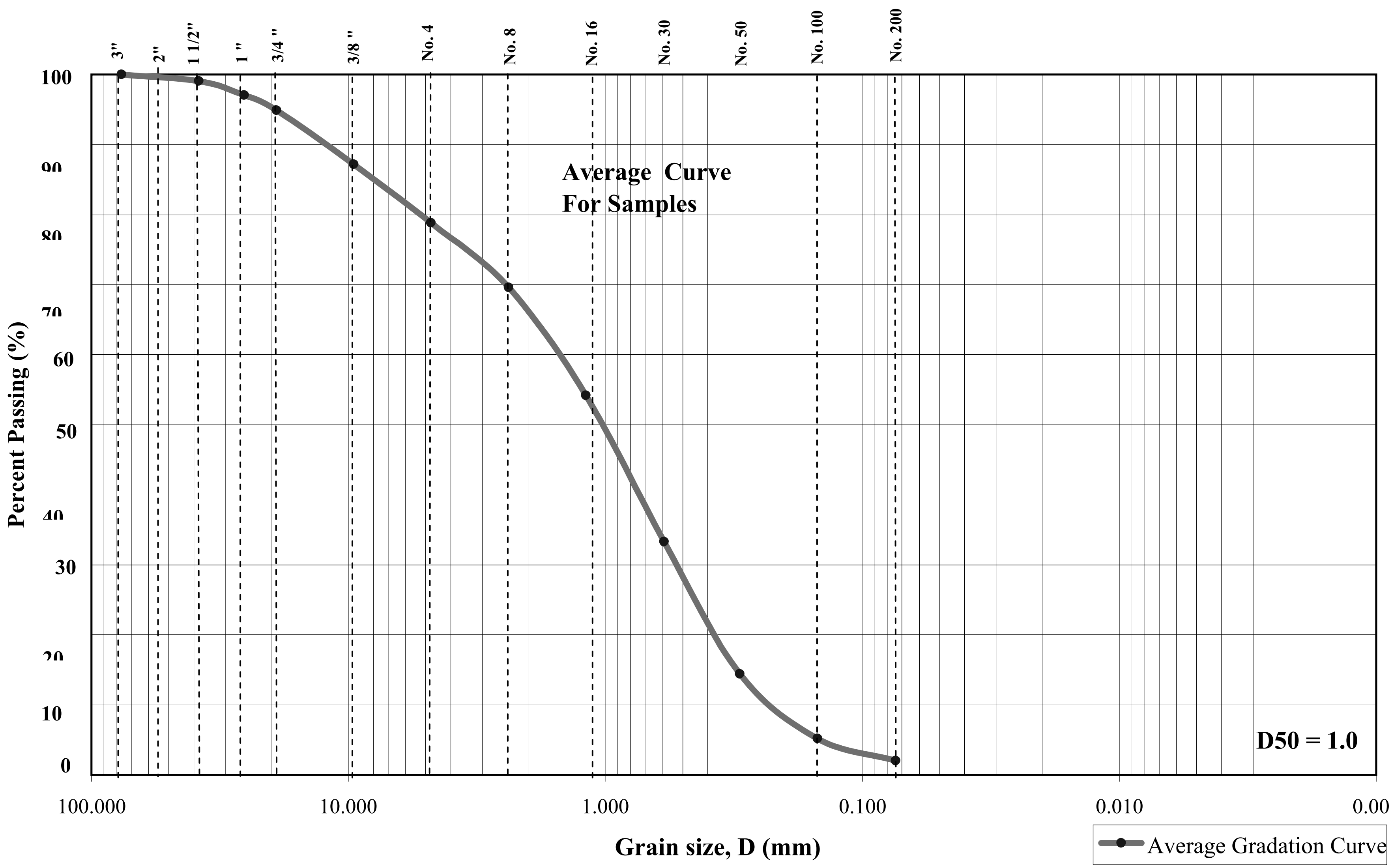

Figure 3.1D. Santa Clara River Reach D Average Gradation Curve

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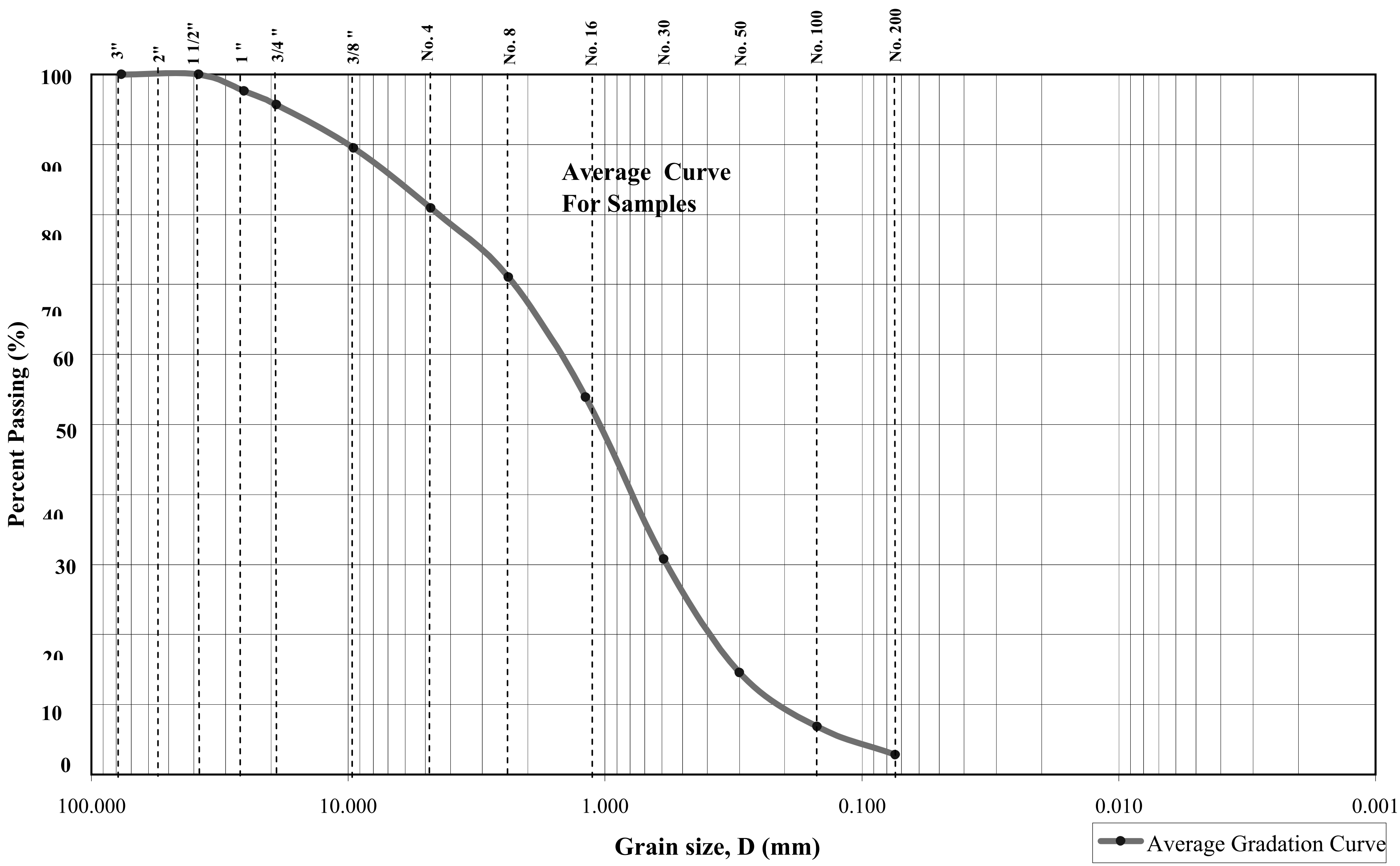

Figure 3.1E. Santa Clara River Reach E Average Gradation Curve

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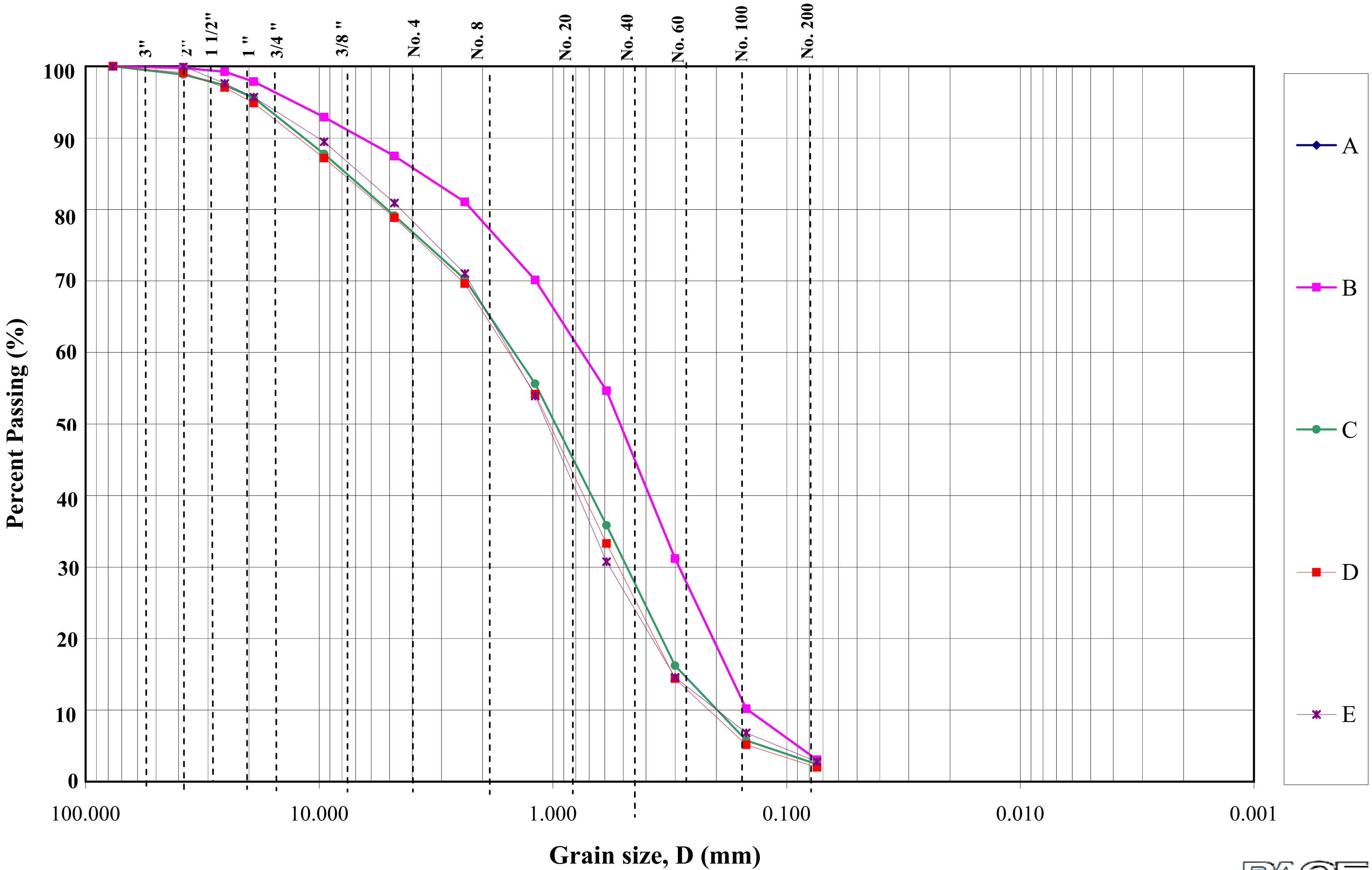

Figure 3.2A. Santa Clara River Streambed Grain Size

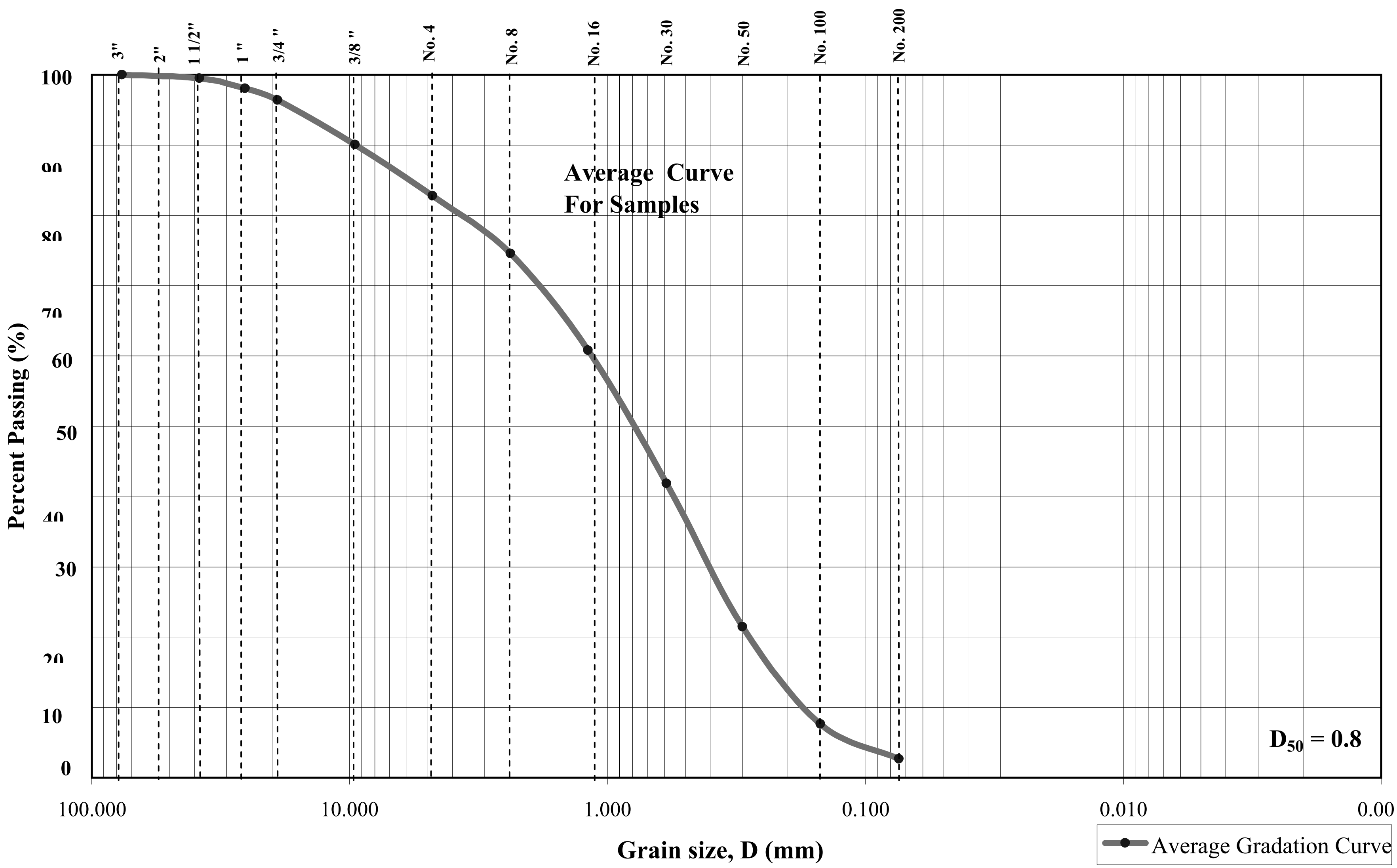

Figure 3.2B. Santa Clara River Average Gradation Curve

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4 General Adjustment

4.1 SAM Model

General adjustment was estimated in this study using the US Army Corps of Engineers (ACOE) SAM steady-state numerical model. Here, SAM was employed to provide a first calculation of sediment transport potential for multiple subreaches within the Santa Clara River (SCR). The SAM Sediment Hydraulic Package is an integrated system of programs developed through the Flood Damage Reduction and Stream Restoration Research Program to aid in the analyses associated with designing, operating, and maintaining flood control channels and stream restoration projects. SAM combines the hydraulic information and the bed material gradation information to compute the sediment transport capacity for a given channel or floodplain hydraulic cross-section for a given discharge at a single point in time. A number of sediment transport functions are available for this analysis and SAM has the ability to assist in selecting the most appropriate sediment transport equation.

The three primary fluvial components of SAM are SAM.HYD, SAM.SED and SAM.AID. SAM.HYD provides a steady state, normal-depth, one-dimensional representation of channel hydraulics. The SAM.SED module combines the hydraulic parameters with the bed material gradation curve to compute bed material discharge rating curves by size classification. The SAM.AID module provides the user with recommended sediment transport equations based on the best matches between hydraulic parameters and grain size distribution of the study reach with parameters of from widely accepted and published research.

4.1.1.a SAM Model Theory and Limitations

The SAM numerical model is built upon hydraulic and fluvial components. The hydraulic components include representations of river bed characteristics that are input into an analytical procedure. The fluvial component includes representation of bed gradation as percent finer statistics and a selection of up to twenty sediment transport equations. SAM's hydraulic component will accept either average reach parameters or cross-section data imported from HEC-2/HEC-6 models. Hydraulic modeling is based on a uniform flow equation where discharge is the dependent variable such that,

$$Q = f(D, n, W, z, S)$$

where Q is discharge in cfs, D is flow depth in feet, n is the Manning's number, W is bottom width in feet, z is the channel side slope, and S is the energy slope. The bottom width is representative of the total moveable bed width of the channel and Manning's number is a composite value. Normal depth is calculated using Manning's equation, and effective values of width and depth are calculated following normal depth calculations. In cases where HEC-2 cross-sections are used for modeling, as in this study, the effective depth and width are calculated from the cross-section data based on the channel hydraulics.

The fluvial component is based on sediment transport functions to calculate the bed portion of the sediment discharge-rating curve.

The sediment transport equations are of the form,

$$GS_i=f(V, D, S_e, B_e, d_e, \rho_s, G_{sf}, d_s, i_b, \rho_f, T)$$

where GS_i is the transport rate for sediment size class i; the hydraulic terms V, D, S_e, and B_e, are the average velocity, effective flow depth, energy slope, and effective flow width, respectively; the sediment particle parameters d_e, ρ_s, and G_{sf} are the effective particle size, particle density, and grain size shape factor, respectively; the sediment mixture properties, d_s and i_b are the geometric mean particle size of sediment class i and fraction of class i in the bed, respectively; and the fluid properties ρ_f, and T, the water density and temperature, respectively. Twenty well known, published, peer-reviewed transport equations are available including Ackers-White, Colby, Laursen-Copeland, Laursen–Madden, MPM, Toffaleti, Yang, Van Rijn and others. Once the data assembly is complete, the SAM.SED module can be used to create a sediment discharge-rating curve based on grain size distribution. The reader is referred to the SAM user's documentation for further reference.

It is important to note that the SAM model is a zero-dimensional computational package that is only based on a single cross-section at a particular point in time. As such, SAM simulations can only represent a reach average during a steady state discharge. Because SAM applies sediment transport to a point, no variability in size distribution in either space or time is calculated. With these limitations in mind, in this study SAM is intended to provide a first approximation to sediment transport to which other more sensitive calculations can be compared.

4.1.1.b SAM Model Assembly

In this study, hydraulic representation of the river bed is accomplished in several distinct steps. First, the HEC-RAS numerical model (1999 base topography) is thinned to no more than 100 stations per cross-section using HEC-RAS's cross-section points filter. Second, the HEC-RAS geometry is converted to HEC-2 format using the Army Corps RAS2UNET software. Next, the HEC-2 model deck is arranged to run in sub critical mode and all features, such as ineffective flow areas and levees, are added. Once the HEC-2 model is complete, it is re-imported into HEC-RAS and compared to the original model. Any cross-sectional differences between the RAS and 2 models are resolved. Once the original and re-imported models match, the HEC-2 model is run to produce the Army Corps' T95 binary hydraulic simulation output file. Next, the T95 file is then read directly into SAM using the SAM model's M95 subroutine using the reach length option. Sections are chosen based on the reach characterization described below. A comparison of output and discussion is presented in Appendix Chapter 4.4.

This conversion methodology is powerful because it ensures that data created for, and analyzed using HEC-RAS and HEC-2 hydraulic software, is fully compatible with, and implemented in, SAM fluvial analyses. Copies of the HEC-RAS and HEC-2 models for both the existing and proposed conditions are included in Appendix Chapter 4.3. A table comparing the velocity and depth of the different models used in each phase of the project described previously is also included in Appendix Chapter 4.4. Both the existing and proposed conditions HEC-RAS model were originally developed by Sikand Engineering in *Newhall Ranch Santa Clara River HEC-RAS Study* (June 2000) and submitted as part of the Newhall Ranch Specific Plan. The Sikand model was further modified by PACE to create a model that was reviewed and accepted by LACDPW. The newest model Q_{CAP} discharge was approved by LACDPW for this study in 2005. Slight differences exist between the PACE and Sikand models in terms of discharge and stationing and have been made to meet LACDPW criteria, otherwise the models are the same. Otherwise, the only changes made to the HEC-RAS model occur in the proposed condition where the alignment of soil cement bank protection was revised to reflect the most current proposed condition, and the afore mentioned Q_{CAP} discharge. The current position of the bank protection avoids River jurisdictional areas and is further outside the River than the bank protection originally proposed in the Sikand model. The HEC-RAS model discharges in the present models were originally included in the Sikand model, except for the revised Q_{CAP} discharge, which was provided by LACDPW, as noted above. Finally, subreaches within the SAM model are specified and average hydraulic parameters are calculated for those subreaches. Subreaches are determined by examining the hydraulic parameters of the individual HEC-RAS cross-sections and identifying correlations between those hydraulic parameters and the longitudinal position in the channel of the individual cross-section. This process is presented in Appendix Chapter 4.5.

4.1.2 Reach-by-Reach Channel Hydraulic Characterization

Reaches are defined by changes in discharge within Santa Clara River. These changes occur at HEC-RAS sections STA 46195, STA 36080, STA 32265, STA 22195, and STA 15125, as shown in Figure 1.1. As noted above, SAM modeling is based on channel subreaches determined by correlating hydraulic characteristics with longitudinal cross-section location to preserve the along-stream character of the flow. The hydraulic parameters examined are discharge, energy slope, bed slope, Froude number, top width, hydraulic velocity, and flow area based on the Q_{CAP} discharge. First, correlation coefficients are calculated for each section against the hydraulic parameters. The hydraulic parameter that produces the greatest correlation is plotted against cross-section location. Subreaches are then selected in a manner that preserves the trend of the hydraulic parameter as well as produces approximately equal subreach lengths, which are generally 1000 feet long. This methodology seeks to maintain continuity of analysis by producing similar length subreaches while analyzing the hydraulic parameters that largely control sediment transport. Correlation values typically vary from r=±0.25 to r=±0.82. In the case of the Santa Clara River, all subreaches have been defined based on locations of trend changes within the River. Subreaches are defined in Table 4.1A-B and shown in Figure 1.1. Both the existing and proposed conditions models employ identical subreach lengths and locations. However, because the HEC-RAS models were created separately by Sikand, slight differences in the model hydrology occur. These minor differences are not expected to significantly alter comparisons between the two models. The use of identical subreaches was employed for two reasons: to ensure consistency between existing and proposed conditions analysis, and because correlation values between sections and various hydraulic parameters for both the existing and proposed conditions are similar. Statistical analysis of the reaches for both the existing and proposed conditions is shown in Appendix Chapter 4.5.

Table 4.1A: Santa Clara River Existing Conditions Sub-Reach Stationing

Subreach	US Sta	DS Sta	Transport Equation[1]
SRA1	46195	44210	MPM
SRA2	43820	41460	MPM
SRA3	41280	38925	MPM
SRA4	33880	36265	MPM
SRB1	36080	29385	MPM
SRB2	33880	32605	MPM
SRC1	32265	29385	MPM
SRC2	29140	27155	MPM
SRC3	26990	25000	MPM
SRC4	24795	22415	MPM
SRD1	22195	20070	MPM
SRD2	19855	17785	MPM
SRD3	17510	15335	MPM
SRE1	15125	13190	MPM
SRE2	13030	11180	MPM
SRE3	11015	9025	MPM

1: MPM - Meyer, Peter and Muller, 1948

Table 4.1B: Santa Clara River Proposed Conditions Sub-Reach Stationing

Subreach	US Sta	DS Sta	Transport Equation[1]
SRA1	46195	44210	MPM
SRA2	43820	41460	MPM
SRA3	41280	38925	MPM
SRA4	38710	36265	MPM
SRB1	36080	34090	MPM
SRB2	33880	32605	MPM
SRC1	32265	29385	MPM
SRC2	29140	27155	MPM
SRC3	26990	25000	MPM
SRC4	24795	22415	MPM
SRD1	22195	20070	MPM
SRD2	19855	17785	MPM
SRD3	17510	15335	MPM
SRE1	15125	13190	MPM
SRE2	13030	11180	MPM
SRE3	11015	9025	MPM

1: MPM - Meyer, Peter and Muller, 1948

4.1.3 Input Data and Selection of Transport Functions

Representation of sediment grain size distribution in SAM takes the form of percent finer data obtained from sieve analysis of channel sediment grab samples. At each sampling location, multiple samples are collected and analyzed, and the average data is input into the model. All sampling and sieve analysis was conducted by Seward Engineering Geology, and sample locations were chosen based on either the presence of recently active alluvium or the presence of adjacent/underlying older alluvium commonly incorporated into stream sediment load during major events. Environmental constraints on subsurface investigations in active drainages limited sampling locations in some instances, and in these cases the most representative, obtainable data is used as previously described in Chapter 3.

4.1.3.a SAM.AID Application and Theory

Sediment transport equations used in all SAM modeling were chosen with the assistance of the Army Corps' SAM.AID subroutine. The SAM.AID subroutine determines the most representative transport function based on the hydraulic parameters and percent finer data for each subreach by comparing model data with the results of 20 peer-reviewed and widely acknowledged sediment transport studies. This case-by-case transport equation selection is more likely to provide a robust representation of channel sediment transport than choosing an individual transport equation for all reaches.

Application of different transport functions to an individual channel reach may provide significantly differing model output. This is because the parameters of a given study from which the function is derived, vary greatly. To accomplish the task of guiding the user in selecting an appropriate transport function, SAM.AID assumes that the function that best represents sediment transport in a gauged stream would also best represent transport in an ungauged stream with similar sediment and hydraulic characteristics. SAM.AID begins by comparing study parameters (V, D, S_e, B_e, D_{50}) with parameters in the transport function database. Comparison begins by determining if D_{50} falls within one of the ranges identified in the database. Once the initial matches have been made in the database, the three best-matched sediment transport functions for the study reach are listed along with the parameters that matched the data set.

Once the best transport equation matches have been determined by SAM.AID, the most representative equations are run in SAM.SED for each subreach. Yang (Yang, 1984) and MPM (Meyer-Peter and Muller, 1948) equations are added to all simulations where they are not explicitly matched by SAM.AID so that there is a continuity of comparison between subreaches. Following SAM.SED computations sediment transport potential for each subreach can then be estimated by reviewing the calculations from each equation and analyzing the results. Any SAM.SED calculation outliers are excluded and calculations of bed adjustment are made using mean estimate of transport potential. Outliers are values under analysis in a data set that reside far outside most other values in a data set. In this case, when one of the results of a SAM.SED calculation is three orders of magnitude or more different from the median, the data is excluded from analysis and noted as an outlier. The raw data is presented in Appendix Chapter 4.6.

The MPM equation was found to be the representative transport equation for all subreaches for the existing and proposed conditions. This is because transport estimates based on other transport equations (i.e. Yang), when used to estimate general adjustment and transport, produced degradation values in excess of both historical values of general adjustment (as much as approximately 15 feet) and values of general adjustment that might be physically expected during a single event (over approximately 20 feet). In other cases, some transport equations (i.e. Brownlie D_{50}) estimated sediment transport that produced general adjustment calculations much smaller than expected (as little as approximately 0.1 feet). The full summary of transport potential by subreach for the various transport equations for both existing and proposed conditions is provided in Appendix Chapter 4.6. Since the D_{50} for a given reach is the same for both the existing and proposed conditions models, the differences in transport function applicability is related to hydraulic differences between the two conditions.

4.1.4 SAM Bed Stability

Bed stability can be examined based on the change in potential transport between channel subreaches. Subreaches are readily determined from changes in hydraulic parameters, and frequently the most significant hydraulic parameter in terms of impact on stream stability is discharge (volume per unit time). If a channel subreach has equal potential transport both entering and exiting the reach, then the subreach is said to be in equilibrium. Frequently, however, channel subreaches are either in an aggrading or degrading condition. For the purposes of this study, aggrading reaches are those whereby the potential transport entering the reach (the potential transport of the subreach upstream of that under immediate consideration) is higher than the potential transport leaving the subreach (the potential transport of the subreach under immediate consideration). In degrading subreaches, the opposite is true and potential transport entering the reach is lower than that leaving the subreach. While it would appear that downstream subreaches would degrade constantly because discharge generally increases in downstream subreaches and in turn increases the transport potential as one moves downstream, other factors such as hydraulic depth, mean subreach velocity, hydraulic top width, and bed slope contribute significantly to potential transport.

Bed stability was determined by calculating the difference between subreach upstream and downstream sediment potential transport for the Q_{CAP} discharge. Transport potential for each reach is shown in Table 4.2A-B. The table shows no clear trend in transport potential as a function of subreach. The difference in transport potential, ΔTP (ton/day) between two cross-sections, was converted to bed adjustment, *GA* (feet), as:

$$GA = \frac{\Delta TP}{\rho b RL} day$$

where ρ is density in tons per cubic feet, *b* is channel width in feet, *day* denotes one day's time, and *RL* is reach length in feet. Density has been taken as 165.36 lb/ft^3. A summary of the adjustment for each reach is shown in Table 4.3.

General adjustment is based on SAM modeling presented in Figure 4.1A-B and Table 4.4A-B for the existing and proposed conditions, respectively. It is important to note that no apparent pattern of aggradation/degradation is apparent between cross-sections in the figure. General adjustment calculated using the equation presented in the Los Angeles County Hydrology and Sedimentation Manual (LACH&SM) is also shown in the figures. This latter calculation methodology is only based on flow mean velocity at a given channel section as computed by the HEC-RAS model of the system. In most circumstances, scour predicted by the LACH&SM is greater than that predicted by SAM for both the existing and proposed conditions except at Commerce Center Bridge. It should be noted that scour predicted by the ACOE HEC-6 numerical model is expected to be approximately the same as or shallower than SAM predictions in terms of depth, although some longitudinal deviation from SAM results is expected.

The tables and figures indicate the general adjustment ranges from -2.9 to +2.3 feet for the existing condition, and -1.6 to +2.1 for the proposed condition. In Reach A (SRA1 to SRA4), the general adjustment does not vary by more than ±0.2 feet between the existing and proposed condition. SRA1 is predicted to have no change in general adjustment between the two conditions, and only SRA3 is expected to decrease degradation. The remaining sections are expected to decrease aggradation. In Reach B, either a minor increase in degradation between the existing and proposed general adjustment (0.1 feet ,SRB1) or minor increase in aggradation (0.2 feet, SRB2), is expected. In Reach C, no change between the existing and proposed condition is expected in SRC1 or SRC4, while SRC2 and SRC3 have 1.3 and 0.9 feet of decreased and increased degradation, respectively. No pattern of aggradation or degradation change in Reach D is observable. The subreaches in Reach D decrease degradation, increase aggradation, and increase degradation in subreaches SRD1 to SRD3 respectively. Reach E also has no pattern of aggradation or degradation change between the existing and proposed conditions ranging from 0.2 feet of decreased aggradation in SRE2 to 0.1 feet of increased degradation in SRE3. Finally, the general trend in general adjustment for the study reach as indicated by SAM modeling is not apparent for either the existing condition or proposed condition. It is not expected that short reaches (on the order of 500 feet) with minor lateral changes (on the order of 100 feet) in the positions of the proposed conditions improvements will affect these results significantly except where velocity changes are greater than approximately 25 percent.

Table 4.2A: Santa Clara River Existing Conditions Bed Stability

Subreach	US Sta	DS Sta	Trans Eq	Transport (ton)	Top Width (ft)	Depth (ft)	A/D	Grade Change (ft)
SRA1	46195	44210	MPM	403,938	525.6	0.6		0.6
SRA2	43820	41460	MPM	330,678	977.0	0.4	AGGRADE	0.4
SRA3	41280	38925	MPM	401,167	1,242.2	0.3	DEGRADE	-0.3
SRA4	38710	36265	MPM	343,735	952.0	0.3	AGGRADE	0.3
SRB1	36080	34090	MPM	483,359	1,389.0	0.6	DEGRADE	-0.6
SRB2	33880	32605	MPM	488,063	1,650.3	0.0	DEGRADE	0.0
SRC1	32265	29385	MPM	101,035	1,965.8	0.8	AGGRADE	0.8
SRC2	29140	27155	MPM	470,866	780.8	2.9	DEGRADE	-2.9
SRC3	26990	25000	MPM	558,797	1,492.1	0.4	DEGRADE	-0.4
SRC4	24795	22415	MPM	468,697	2,008.5	0.2	AGGRADE	0.2
SRD1	22195	20070	MPM	675,434	2,009.0	0.6	DEGRADE	-0.6
SRD2	19855	17785	MPM	241,344	1,936.3	1.3	AGGRADE	1.3
SRD3	17510	15335	MPM	623,943	1,812.5	1.2	DEGRADE	-1.2
SRE1	15125	13190	MPM	796,646	1,878.9	0.6	DEGRADE	-0.6
SRE2	13030	11180	MPM	307,423	1,372.4	2.3	AGGRADE	2.3
SRE3	11015	9025	MPM	624,904	1,390.6	1.4	DEGRADE	-1.4

Table 4.2B: Santa Clara River Proposed Conditions Bed Stability

Subreach	US Sta	DS Sta	Trans Eq	Transport (ton)	Top Width (ft)	Depth (ft)	A/D	Grade Change (ft)
SRA1	46195	44210	MPM	403,938	525.6	0.6		0.6
SRA2	43820	41460	MPM	359,566	958.6	0.2	AGGRADE	0.2
SRA3	41280	38925	MPM	385,857	1,022.2	0.1	DEGRADE	-0.1
SRA4	38710	36265	MPM	370,217	797.6	0.1	AGGRADE	0.1
SRB1	36080	34090	MPM	534,683	1,376.0	0.7	DEGRADE	-0.7
SRB2	33880	32605	MPM	494,553	1,709.1	0.2	AGGRADE	0.2
SRC1	32265	29385	MPM	147,697	1,859.8	0.8	AGGRADE	0.8
SRC2	29140	27155	MPM	389,467	899.2	1.6	DEGRADE	-1.6
SRC3	26990	25000	MPM	633,550	1,159.3	1.3	DEGRADE	-1.3
SRC4	24795	22415	MPM	603,656	860.1	0.2	AGGRADE	0.2
SRD1	22195	20070	MPM	661,922	1,511.4	0.2	DEGRADE	-0.2
SRD2	19855	17785	MPM	319,200	1,431.8	1.4	AGGRADE	1.4
SRD3	17510	15335	MPM	620,768	1,274.3	1.3	DEGRADE	-1.3
SRE1	15125	13190	MPM	731,941	1,588.9	0.4	DEGRADE	-0.4
SRE2	13030	11180	MPM	291,031	1,375.5	2.1	AGGRADE	2.1
SRE3	11015	9025	MPM	635,705	1,399.4	1.5	DEGRADE	-1.5

Table 4.3: Santa Clara River SAM Existing vs Proposed Conditions Bed Stability

Subreach	US Sta	Existing Conditions Grade Change (ft)	Proposed Conditions Grade Change (ft)	Delta (ft)	Result
SRA1	46195	0.6	0.6	0.0	NO CHANGE
SRA2	43820	0.4	0.2	0.2	DECREASE AGG
SRA3	41280	-0.3	-0.1	-0.2	DECREASE DEG
SRA4	38710	0.3	0.1	0.2	DECREASE AGG
SRB1	36080	-0.6	-0.7	0.1	INCREASE DEG
SRB2	33880	0.0	0.2	-0.2	INCREASE AGG
SRC1	32265	0.8	0.8	0.0	NO CHANGE
SRC2	29140	-2.9	-1.6	-1.3	DECREASE DEG
SRC3	26990	-0.4	-1.3	0.9	INCREASE DEG
SRC4	24795	0.2	0.2	0.0	NO CHANGE
SRD1	22195	-0.6	-0.2	-0.4	DECREASE DEG
SRD2	19855	1.3	1.4	-0.1	INCREASE AGG
SRD3	17510	-1.2	-1.3	0.1	INCREASE DEG
SRE1	15125	-0.6	-0.4	-0.2	DECREASE DEG
SRE2	13030	2.3	2.1	0.2	DECREASE AGG
SRE3	11015	-1.4	-1.5	0.1	INCREASE DEG

Figure 4.1A: Santa Clara River Existing Conditions General Adjustment

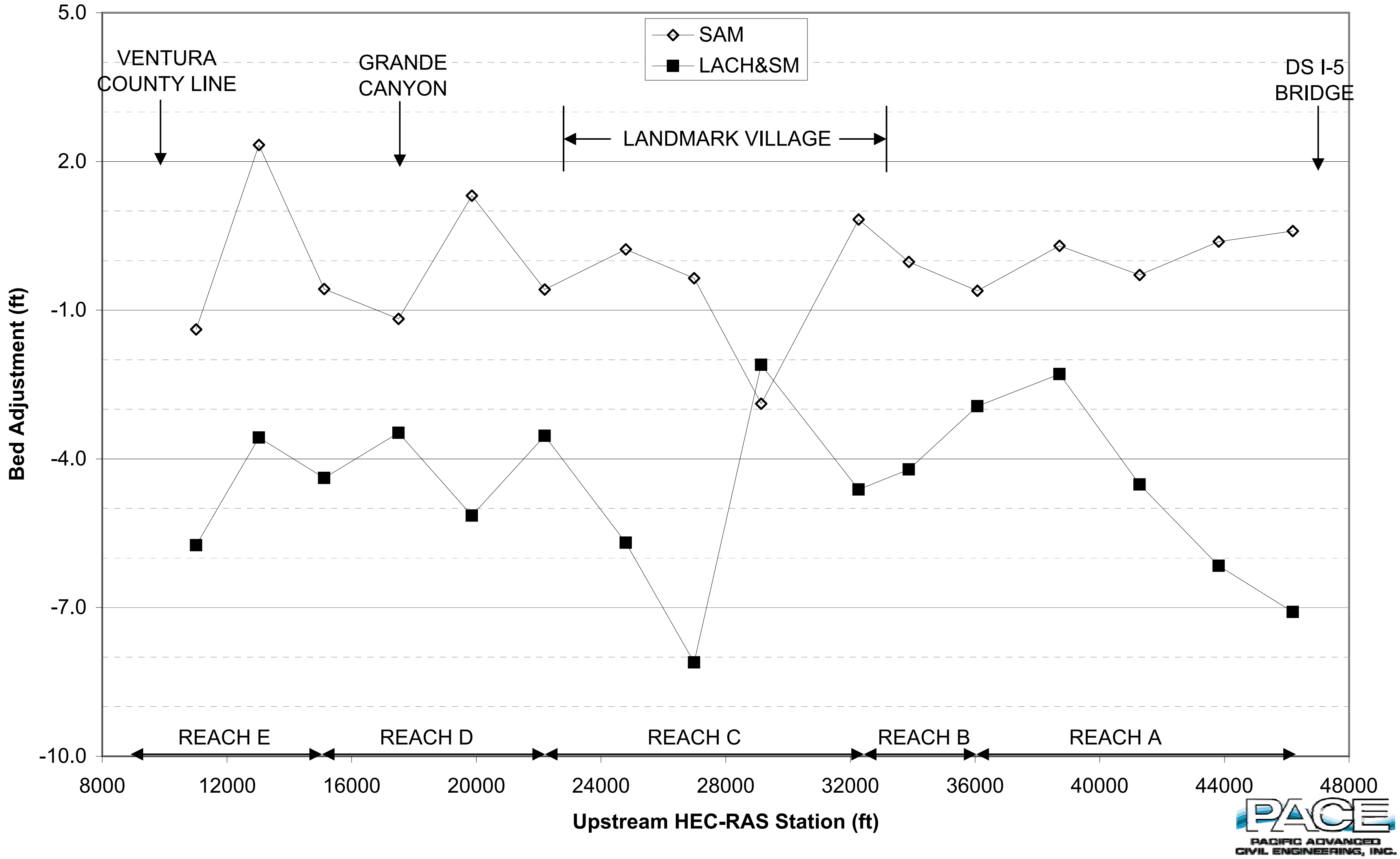

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Figure 4.1B: Santa Clara River Proposed Conditions General Adjustment

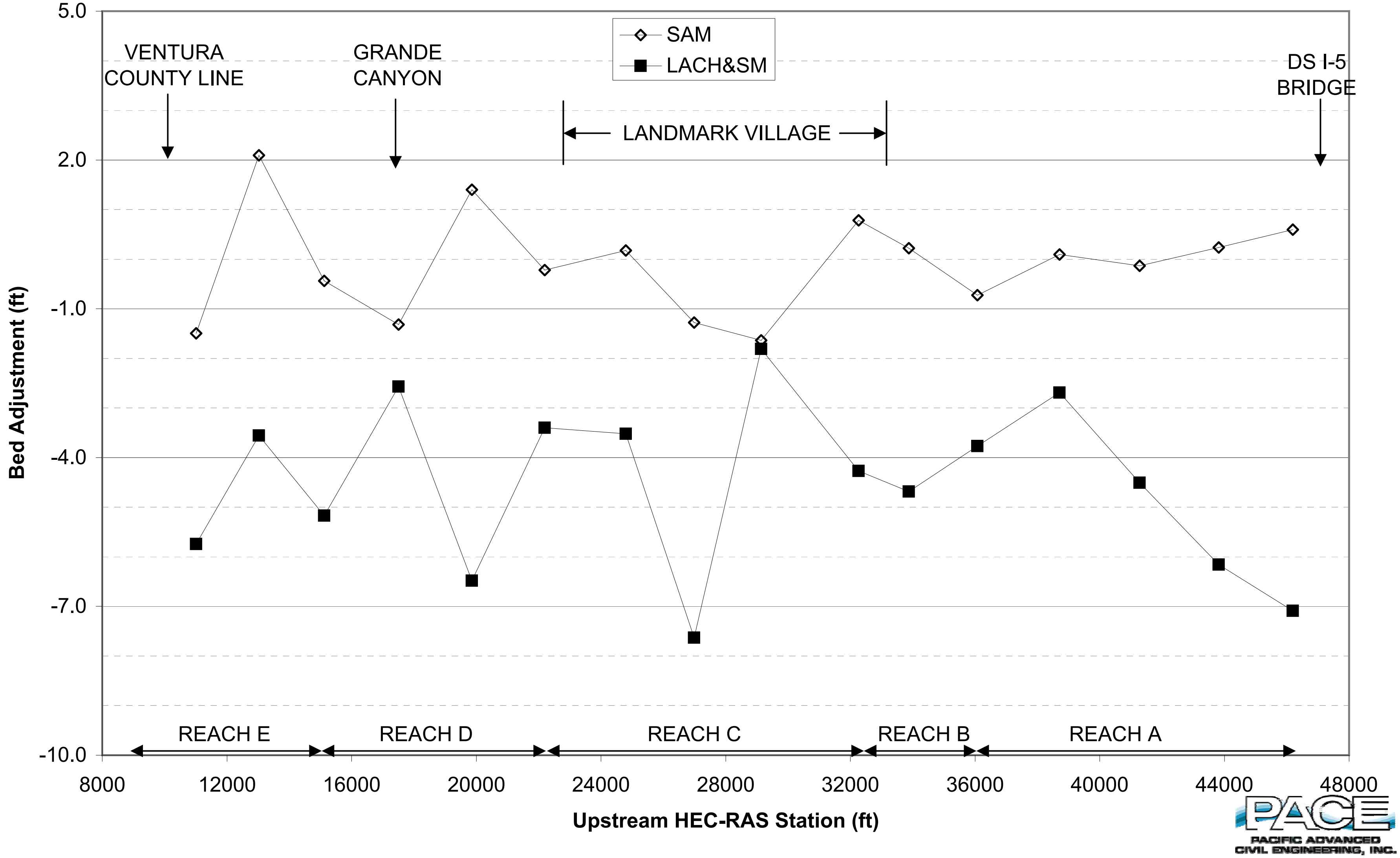


Table 4.4: Santa Clara River SAM & LACH&SM General Adjustment Comparison (ft)

Subreach	US Sta	Existing Conditions		Proposed Conditions	
		SAM[1]	LACH&SM[2]	SAM[1]	LACH&SM[2]
SRA1	46195	0.6	-7.1	0.6	-7.1
SRA2	43820	0.4	-6.2	0.2	-6.2
SRA3	41280	-0.3	-4.5	-0.1	-4.5
SRA4	38710	0.3	-2.3	0.1	-2.7
SRB1	36080	-0.6	-2.9	-0.7	-3.8
SRB2	33880	0.0	-4.2	0.2	-4.7
SRC1	32265	0.8	-4.6	0.8	-4.3
SRC2	29140	-2.9	-2.1	-1.6	-1.8
SRC3	26990	-0.4	-8.1	-1.3	-7.6
SRC4	24795	0.2	-5.7	0.2	-3.5
SRD1	22195	-0.6	-3.5	-0.2	-3.4
SRD2	19855	1.3	-5.1	1.4	-6.5
SRD3	17510	-1.2	-3.5	-1.3	-2.6
SRE1	15125	-0.6	-4.4	-0.4	-5.2
SRE2	13030	2.3	-3.6	2.1	-3.6
SRE3	11015	-1.4	-5.7	-1.5	-5.7

1: Sam calculations represent an entire subreach

2: LACH&SM calculations represent one cross-section

4.2 HEC-6

The ACOE HEC-6 model is a one-dimensional moveable bed open channel hydraulic and sediment transport model. The model was designed to simulate change in river bed profiles resulting from sediment scour and deposition over long periods of time. The model segments hydrograph data into a progression of steady flow events with varied discharge and duration. Every segment of flow is used to calculate a water surface profile and associated hydraulic parameters (e.g. velocity, depth, etc.). From the hydraulic parameters, potential sediment transport rates are estimated for each model reach and scour or deposition is next estimated so that cross-section shape can be updated. Sediment calculations are based on grain size distribution so that sorting and armoring can be considered.

A one dimensional energy approximation to the equations of motion is used for hydraulic calculations in HEC-6. Manning's equation is utilized to incorporate bed friction. The model also uses both an up- and down-stream boundary condition with internal conditions optional. Krone's method is for deposition of fines and Ariathurai and Krone's method is used for scour. Sediment transport functions are user selectable and 13 different equations are possible. Colby's method is used to adjust transport potential and armoring is simulated using Gessler's method. Sediment boundary conditions operate such that inflowing sediment load is a function of inflow discharge.

At this date the "T" enhancement of the HEC-6 program, created by Mobile Boundary Hydraulics, is expected to be used.

5 Long-Term Adjustment

Long-term adjustment was calculated based on historical records in the form of topographic data. First, topographic data, provided by Allan E. Seward Engineering Geology dating from 1930, 1947, 1963, 1999, 2004 and 2005, was digitized (See Appendix Chapter 5.1). This was accomplished by determining a common coordinate system and creating contour lines within the study area. Topographic data was available in several formats including digital elevation maps (1999, 2004, 2005), topographic surveys (1963) and quad maps (1930, 1947). Digital elevation maps were only adjusted for horizontal location. Cross-sections were next cut at the locations of select HEC-RAS sections for each historical topography (shown in Figure 5.1). At least one cross-section was chosen for each subreach established in Chapter 4 based on engineering interest. The sections chosen are section 10390, section 12195, section 14315, section 16305, section 18650, section 20845, section 23000, section 25965, section 27925, section 30445, section 33500, section 34720, section 36080, section 40825, section 42215, and section 44585. Section 36080 is actually in SRB1 not SRA4, although it was chosen since it is directly upstream of a tributary and near the proposed Commerce Center Drive Bridge. Areas of the 1947, 1963, 1999, 2004 and 2005 sections are calculated and these areas are used to calculate the average change in bed elevation over time. The other topography (1930) is not used to calculate average change in bed because of the impacts of the failure of the St. Francis Dam in 1928, as discussed below. To calculate the area of a given cross-section the lowest historical point on the section is determined and the area of each vertical foot of the section in one-foot intervals is calculated, as shown in Figure 5.2A-P, for each topography. The area of a section is the sum of the one-foot area intervals, also shown in Figure 5.2A-P. All areas for a given section have a common toe and top from which the area is calculated. In cases where available topography ends abruptly, areas are calculated assuming a vertical wall at the end. The relative average change in depth for a given section and topography is calculated as the area divided by the top width, where the top width is taken as the width of the upper most one-foot area. The top width in this sense is not a hydraulic characteristic but a physical one, which along with the sectional area determines the maximum capacity of the section. Moreover, the calculated depth is a relative physical value based on the section area and represents an average physical characteristic of the section as a whole.

Several events within the available historical record (1930 to present) have had an impact on the River bed and fluvial mechanics. These events include failure of the upstream St. Francis Dam, construction of bridges spanning the River, agricultural infill along the River banks, and periodic burning of surrounding vegetation during forest fires. These different historical events can be placed into two categories: the St. Francis Dam failure in 1928, and those that occurred both prior to and following Dam failure. The most significant historical event in the formation of the present bed condition was the aforementioned failure of the Dam. The consequence of this event is tied to the River's recovery from the erosion caused by the extremely high flow of floodwater. Within the project reach, the failure of the Dam appears to have resulted in the severe scouring of the bed, detailed below. In its current state, the River bed appears to have mostly recovered from dam flood scour as evidenced by the cross-sections presented in this chapter. Placement of the bridges does not appear to have had a measurable impact on long-term bed characteristics, except for very local

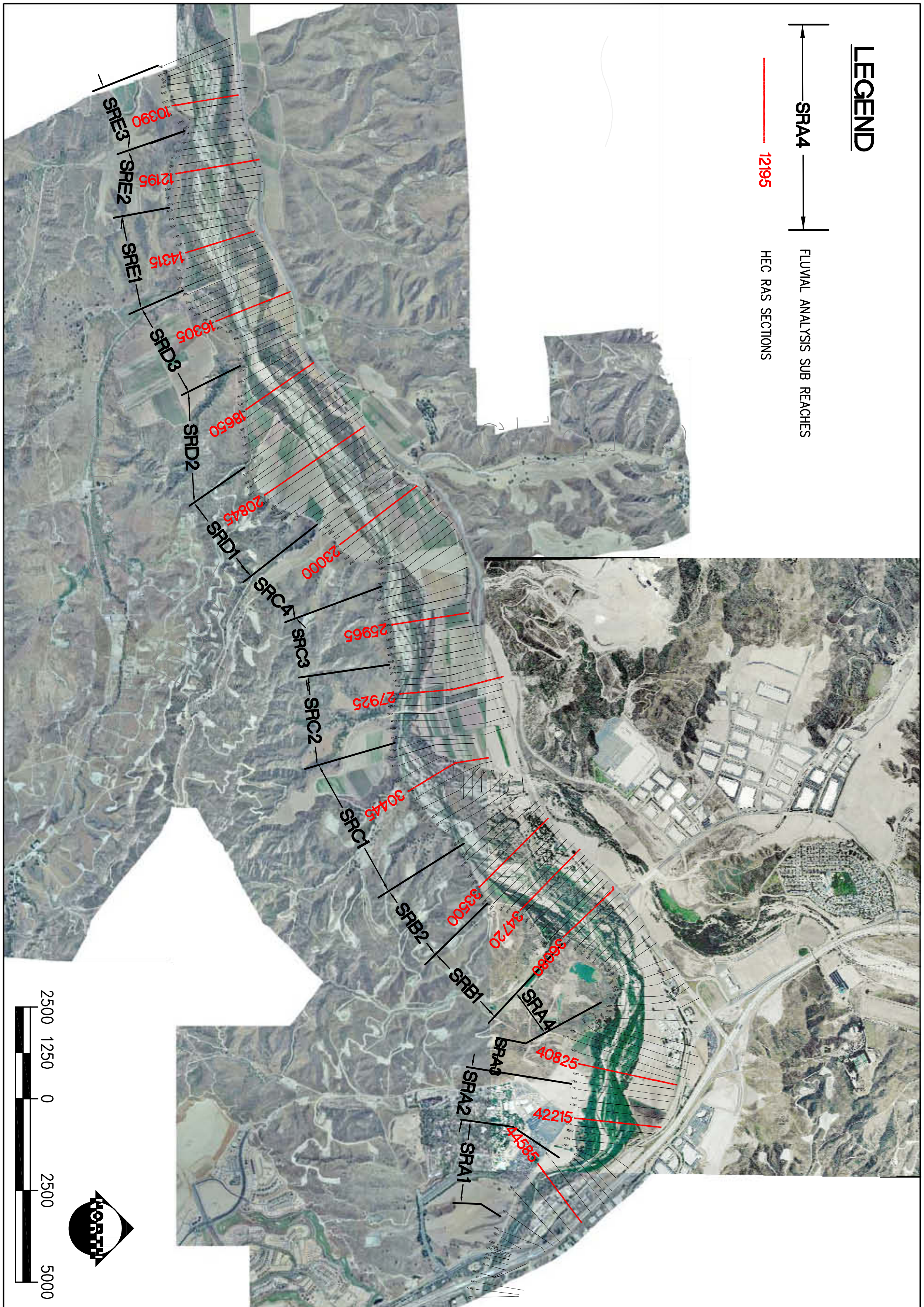


FIGURE 5.1

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1"= 2500'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	D.J.
DATE	09/17/05
JOB NO.	8197E

JOB

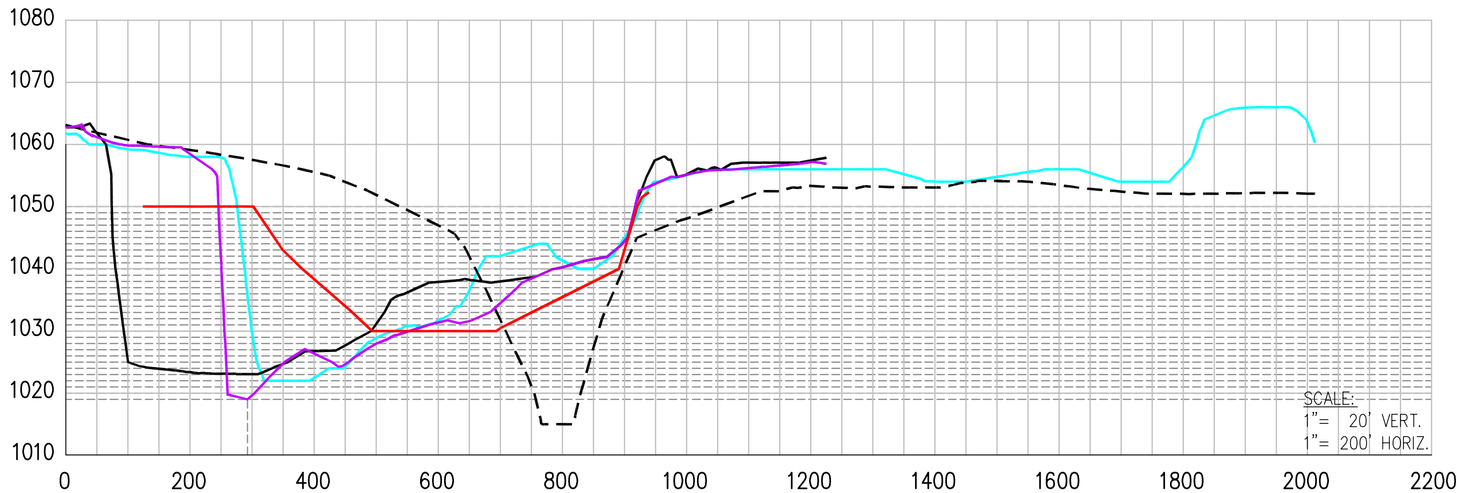
NEWHALL RANCH
SANTA CLARA RIVER
FLUVIAL STUDY

LOS ANGELES COUNTY CA

TITLE

SANTA CLARA RIVER
HISTORIC SECTIONS
ANALYSIS LOCATION MAP

P:\8197E\Engineering\GlobalExhibits\8197-EXH--02.dwg - Tab: 11x17 By: ddrahn on Mar. 14, 2006 at 04:10 pm



SUBREACH SRA1 SECTION 44585

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 44585 (sf)					
ELEV	1947	1963	1999	2004	2005
1020.0	NA	0.0	0.0	25.2	0.0
1021.0	NA	0.0	0.0	48.3	0.0
1022.0	NA	0.0	0.0	58.2	0.0
1023.0	NA	0.0	83.5	68.1	0.0
1024.0	NA	0.0	102.1	78.5	124.2
1025.0	NA	0.0	141.9	100.6	228.6
1026.0	NA	0.0	154.8	146.6	266.3
1027.0	NA	0.0	165.8	197.4	293.6
1028.0	NA	0.0	176.8	234.9	350.0
1029.0	NA	0.0	191.6	257.0	369.4
1030.0	NA	0.0	213.6	282.0	388.9
1031.0	NA	212.3	248.9	313.8	402.9
1032.0	NA	243.0	298.2	370.3	411.2
1033.0	NA	274.0	318.5	417.1	419.4
1034.0	NA	304.8	329.7	435.2	427.0
1035.0	NA	336.3	344.1	446.8	433.5
1036.0	NA	368.0	351.4	458.4	446.7
1037.0	NA	399.7	357.9	469.9	471.9
1038.0	NA	431.4	363.6	480.9	500.6
1039.0	NA	463.1	369.0	500.5	645.2
1040.0	NA	494.8	374.5	523.6	693.5
1041.0	NA	517.3	422.7	558.1	728.9
1042.0	NA	530.4	463.2	598.0	769.2
1043.0	NA	543.6	528.6	628.9	800.6
1044.0	NA	555.1	568.3	641.8	813.9
1045.0	NA	564.8	613.8	652.1	824.5
1046.0	NA	574.6	621.8	658.1	830.6
1047.0	NA	584.3	629.2	661.0	833.3
1048.0	NA	594.1	636.3	663.9	836.0
1049.0	NA	603.8	642.2	666.8	838.6
1050.0	NA	613.6	646.7	669.6	841.2
Area	NA	9208.9	10358.4	12311.6	14989.6

LEGEND:

- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

TITLE
HISTORICAL CROSS SECTIONS BY STATION

JOB
SANTA CLARA RIVER FLUVIAL STUDY
LOS ANGELES COUNTY CA

SCALE	AS NOTED
DESIGNED	DAJ
DRAWN	DEP
CHECKED	MEK
DATE	12/20/05
JOB NO.	8197E

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

FIGURE
5.2A

Xrefs: 8197 – 2004 CONTOURS.dwg; 8197 – 2005 CONTOURS.dwg; 8197 – 1999 CONTOURS.dwg; 8197 – 1963 CONTOURS.dwg; 8197 – 1947 CONTOURS.dwg; 8197 – 1930 CONTOURS.dwg; 8065–Lining.dwg; 8197–SANTA CLARA TITLE BLOCK.dwg; 7104E–COPY OF–7904–E–WRP soil cement bank (NEW 8–11–
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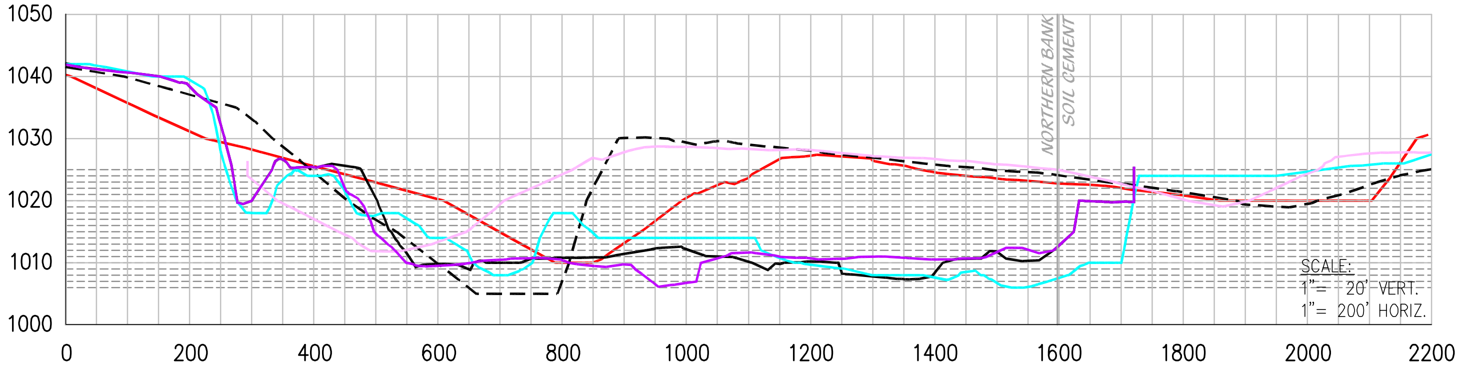

SUBREACH SRA2 SECTION 42215

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 42215 (sf)					
ELEV	1947	1963	1999	2004	2005
1007.0	0.0	0.0	58.7	31.4	0.0
1008.0	0.0	0.0	112.6	79.5	95.4
1009.0	0.0	0.0	370.2	95.4	148.4
1010.0	0.0	0.0	502.0	183.9	223.1
1011.0	0.0	80.5	641.6	412.8	588.7
1012.0	7.2	114.1	679.1	920.5	898.3
1013.0	86.6	146.5	709.3	1055.3	1028.1
1014.0	136.6	178.9	736.3	1093.5	1073.1
1015.0	181.3	211.3	1041.4	1115.8	1090.6
1016.0	222.4	243.5	1067.9	1129.1	1104.3
1017.0	254.2	274.7	1099.1	1134.2	1110.1
1018.0	286.0	305.7	1143.3	1140.1	1115.7
1019.0	317.8	336.6	1284.1	1146.4	1121.9
1020.0	395.8	367.6	1309.9	1159.8	1133.8
1021.0	509.5	692.9	1326.8	1263.7	1245.8
1022.0	601.5	843.7	1341.2	1301.3	1260.7
1023.0	700.1	1008.7	1357.4	1315.9	1275.2
1024.0	802.4	1236.4	1380.0	1329.3	1289.6
1025.0	1107.8	1398.5	1697.5	1342.9	1304.2
Area	5609.2	7439.6	17858.4	17250.9	17107.1

LEGEND:

- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

TITLE	HISTORICAL CROSS SECTIONS BY STATION
JOB	SANTA CLARA RIVER FLUVIAL STUDY — LOS ANGELES COUNTY, CA
SCALE	AS NOTED
DESIGNED	DAJ
DRAWN	DEP
CHECKED	MEK
DATE	12/20/05
JOB NO.	8197E
FIGURE	5.2B

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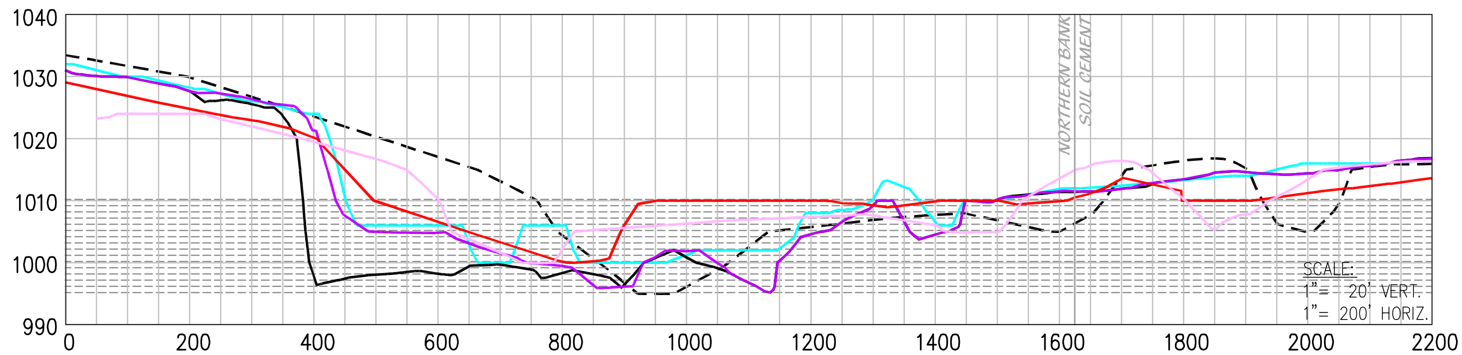

SUBREACH SRA3 SECTION 40825

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 40825 (sf)					
ELEV	1947	1963	1999	2004	2005
996.2	0.0	0.0	0.0	9.7	12.9
997.2	0.0	0.0	0.0	69.9	67.0
998.2	0.0	0.0	0.0	86.7	188.6
999.2	0.0	0.0	0.0	103.3	456.3
1000.2	11.9	15.1	37.4	154.0	625.4
1001.2	70.2	98.4	217.6	218.8	708.1
1002.2	98.7	132.7	282.6	423.1	759.7
1003.2	128.3	167.0	414.0	510.9	783.1
1004.2	158.0	201.3	437.1	551.2	796.9
1005.2	214.6	235.7	454.0	674.5	863.0
1006.2	409.0	270.0	518.5	838.5	930.2
1007.2	639.8	304.0	749.3	880.3	958.5
1008.2	938.6	338.0	779.8	921.8	987.0
1009.2	1028.9	371.7	862.1	958.0	1016.8
1010.2	1063.6	695.0	918.3	1002.5	1056.7
Area	4761.4	2829.0	5670.9	7403.2	10210.2

LEGEND:

- 2005 TERRAIN (solid black)
- 2004 TERRAIN (purple)
- 1999 TERRAIN (cyan)
- 1963 TERRAIN (red)
- 1947 TERRAIN (pink)
- 1930 TERRAIN (dashed black)

TITLE	HISTORICAL CROSS SECTIONS BY STATION
JOB	SANTA CLARA RIVER FLUVIAL STUDY — LOS ANGELES COUNTY, CA
SCALE	AS NOTED
DESIGNED	DAJ
DRAWN	DEP
CHECKED	MEK
DATE	12/20/05
JOB NO.	8197E
FIGURE	5.2C

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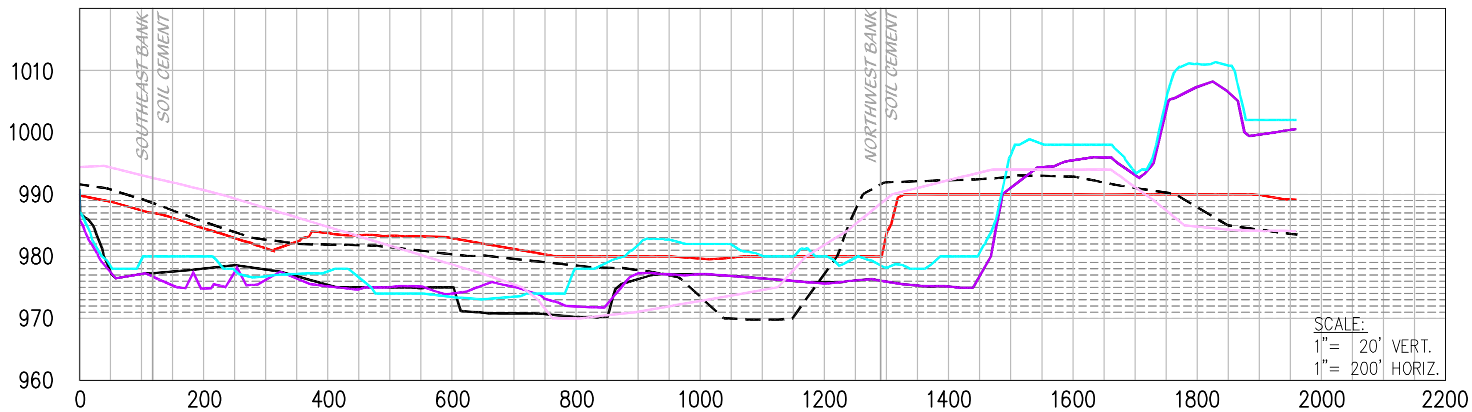
Dimscale = 200; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1



SUBREACH SRA4 SECTION 36080

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 36080 (sf)					
ELEV	1947	1963	1999	2004	2005
971.0	93.7	0.0	0.0	0.0	91.0
972.0	174.6	0.0	0.0	10.6	239.1
973.0	239.8	0.0	0.0	82.2	246.8
974.0	307.3	0.0	102.4	115.5	252.5
975.0	377.1	0.0	304.6	222.6	263.0
976.0	430.9	0.0	324.4	671.8	605.5
977.0	468.8	0.0	354.8	1056.6	910.2
978.0	508.6	0.0	494.3	1374.2	1221.1
979.0	550.5	0.0	716.4	1418.3	1387.9
980.0	592.7	31.1	856.6	1431.8	1423.4
981.0	638.7	556.0	1187.3	1440.9	1430.6
982.0	687.7	651.4	1265.1	1448.5	1435.4
983.0	736.8	762.1	1397.2	1456.8	1441.2
984.0	785.7	978.5	1448.0	1463.4	1447.0
985.0	833.2	1103.9	1456.6	1469.3	1452.5
986.0	878.1	1137.3	1465.1	1473.5	1460.6
987.0	923.4	1171.0	1472.8	1476.4	1467.8
988.0	968.8	1217.1	1477.5	1479.2	1472.7
989.0	1014.1	1254.0	1480.3	1482.1	1477.6
990.0	1059.5	1281.8	1483.1	1485.0	1482.5
Area	12270.0	10144.3	17286.2	21058.6	21208.4

LEGEND:

- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

TITLE: HISTORICAL CROSS SECTIONS BY STATION

JOB: SANTA CLARA RIVER FLUVIAL STUDY

LOS ANGELES COUNTY CA

SCALE: AS NOTED
DESIGNED: DAJ
DRAWN: DEP
CHECKED: MEK
DATE: 12/20/05
JOB NO. 8197E

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FIGURE 5.2D

P:\8197E\Engineering\GlobalExhibits\8197 Santa Clara River HEC Cross Sections and End Area Data.dwg - Tab: HEC 36080 - 5.2D By: ddrahn on Mar. 14, 2006 at 05:08 pm

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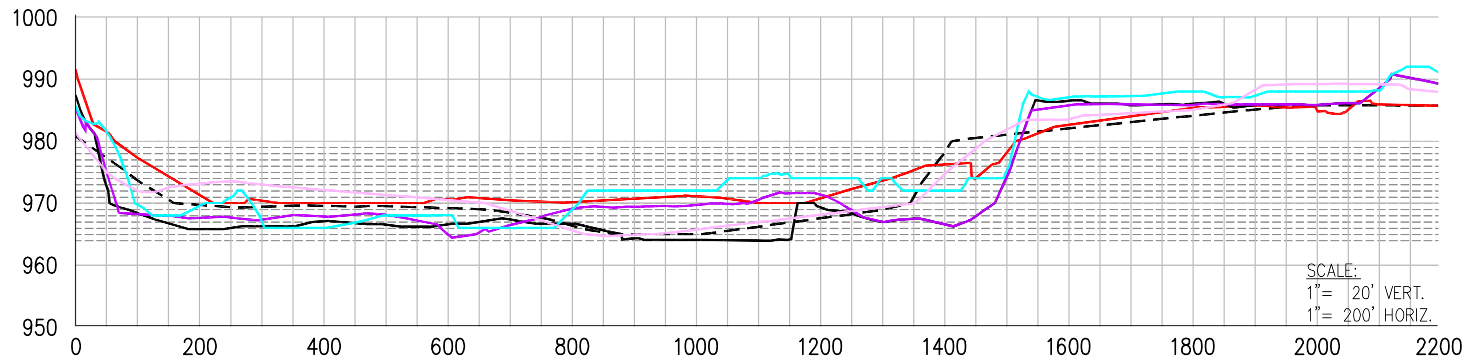

SUBREACH SRB1 SECTION 34720

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 34720 (sf)					
ELEV	1947	1963	1999	2004	2005
965.0	9.7	0.0	0.0	10.3	231.3
966.0	168.0	0.0	0.0	65.0	303.0
967.0	282.7	0.0	271.2	135.7	634.9
968.0	401.3	0.0	351.3	398.2	1136.8
969.0	514.8	0.0	551.0	863.0	1275.0
970.0	628.3	0.0	609.6	1066.6	1366.9
971.0	750.5	597.2	679.8	1291.9	1426.6
972.0	885.8	1013.8	712.6	1369.9	1433.7
973.0	1075.3	1075.4	1046.2	1433.9	1440.6
974.0	1275.9	1129.0	1106.4	1441.5	1448.6
975.0	1340.0	1190.1	1370.2	1449.0	1455.7
976.0	1361.8	1247.1	1421.8	1456.0	1462.2
977.0	1382.1	1349.4	1429.3	1462.3	1468.0
978.0	1402.4	1401.4	1435.1	1468.7	1473.5
979.0	1422.7	1421.1	1441.6	1474.9	1479.0
980.0	1443.0	1440.7	1448.8	1481.0	1484.6
Area	14344.4	11865.3	13874.8	16867.7	19520.2

LEGEND:

- 2005 TERRAIN (solid black)
- 2004 TERRAIN (purple)
- 1999 TERRAIN (cyan)
- 1963 TERRAIN (red)
- 1947 TERRAIN (pink)
- 1930 TERRAIN (dashed black)

SCALE	AS NOTED
DESIGNED	DAJ
DRAWN	DEP
CHECKED	MEK
DATE	12/20/05
JOB NO.	8197E

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17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
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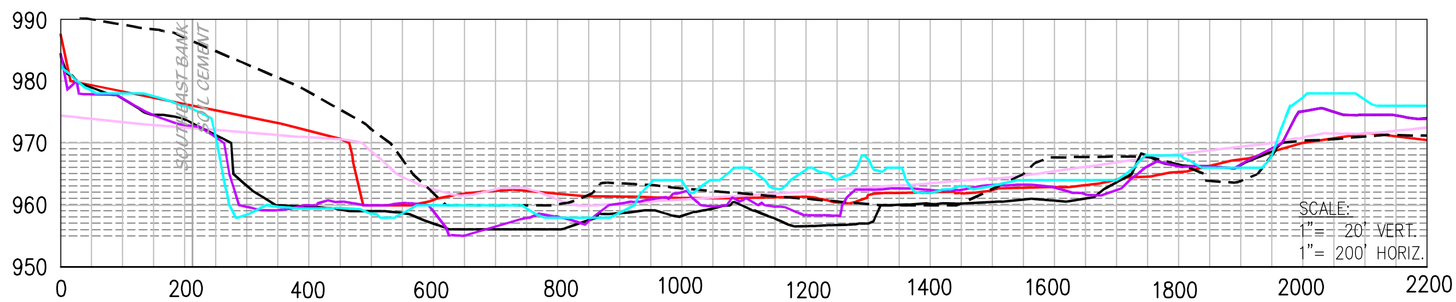
FIGURE
5.2E

JOB
SANTA CLARA RIVER
FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
HISTORICAL CROSS SECTIONS BY STATION

P:\8197E\Engineering\GlobalExhibits\8197 Santa Clara River HEC Cross Sections and End Area Data.dwg - Tab: HEC 34720 - 5.2E By: ddrahn on Mar. 14, 2006 at 05:08 pm



SUBREACH SRB2 SECTION 33500

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 33500 (sf)					
ELEV	1947	1963	1999	2004	2005
956.1	0.0	0.0	0.0	41.8	0.0
957.1	0.0	0.0	0.0	82.3	240.8
958.1	0.0	0.0	9.0	155.0	418.0
959.1	0.0	0.0	197.7	297.4	554.4
960.1	4.4	6.4	392.5	452.2	853.2
961.1	140.8	138.3	656.4	807.3	1176.6
962.1	341.9	580.7	666.0	956.7	1345.8
963.1	613.6	1022.2	767.1	1103.1	1374.8
964.1	831.7	1194.0	932.7	1424.0	1404.0
965.1	980.6	1263.3	1230.8	1454.8	1433.7
966.1	1074.3	1339.2	1352.6	1469.8	1449.3
967.1	1154.5	1388.8	1565.6	1593.4	1454.5
968.1	1236.3	1440.9	1618.0	1651.7	1459.8
969.1	1329.6	1481.3	1697.5	1673.1	1671.6
970.1	1424.1	1517.7	1702.9	1694.4	1686.9
Area	9131.9	11372.7	12788.7	14857.0	16523.3

LEGEND:

- (solid black) 2005 TERRAIN
- (solid purple) 2004 TERRAIN
- (solid cyan) 1999 TERRAIN
- (solid red) 1963 TERRAIN
- (solid pink) 1947 TERRAIN
- (dashed black) 1930 TERRAIN

TITLE: HISTORICAL CROSS SECTIONS BY STATION

JOB: SANTA CLARA RIVER FLUVIAL STUDY

LOS ANGELES COUNTY CA

SCALE	AS NOTED
DESIGNED	DAJ
DRAWN	DEP
CHECKED	MEK
DATE	12/20/05
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PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
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FIGURE 5.2F

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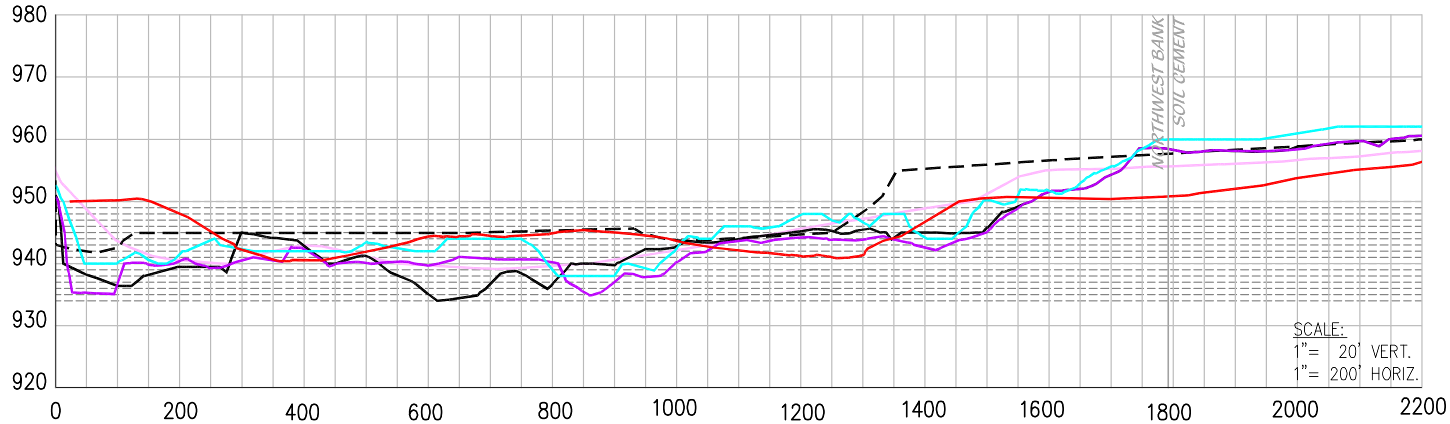

SUBREACH SRC1 SECTION 30445

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 30445 (sf)					
ELEV	1947	1963	1999	2004	2005
935.0	0.0	0.0	0.0	0.0	43.9
936.0	0.0	0.0	0.0	82.0	90.9
937.0	0.0	0.0	0.0	133.4	149.9
938.0	0.0	0.0	97.2	166.4	247.4
939.0	0.0	0.0	142.4	241.3	367.5
940.0	139.1	0.0	190.2	313.7	518.4
941.0	399.9	46.1	303.6	707.6	703.1
942.0	551.9	274.3	146.9	964.2	785.1
943.0	712.0	473.6	667.1	1049.7	852.0
944.0	847.3	610.9	817.6	1187.7	943.5
945.0	916.0	849.6	1073.7	1450.1	1115.0
946.0	980.4	1114.6	1131.3	1490.5	1446.4
947.0	1048.6	1167.4	1261.1	1502.5	1499.6
948.0	1122.7	1201.3	1347.1	1518.1	1509.8
949.0	1189.5	1240.3	1461.8	1536.3	1526.3
950.0	1264.9	1280.2	1484.2	1554.1	1552.1
Area	9172.4	8258.3	10124.1	13897.6	13350.9

LEGEND:

- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

TITLE
HISTORICAL CROSS SECTIONS BY STATION

JOB
SANTA CLARA RIVER
FLUVIAL STUDY
LOS ANGELES COUNTY CA

SCALE AS NOTED
DESIGNED DAJ
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DATE 12/20/05
JOB NO. 8197E

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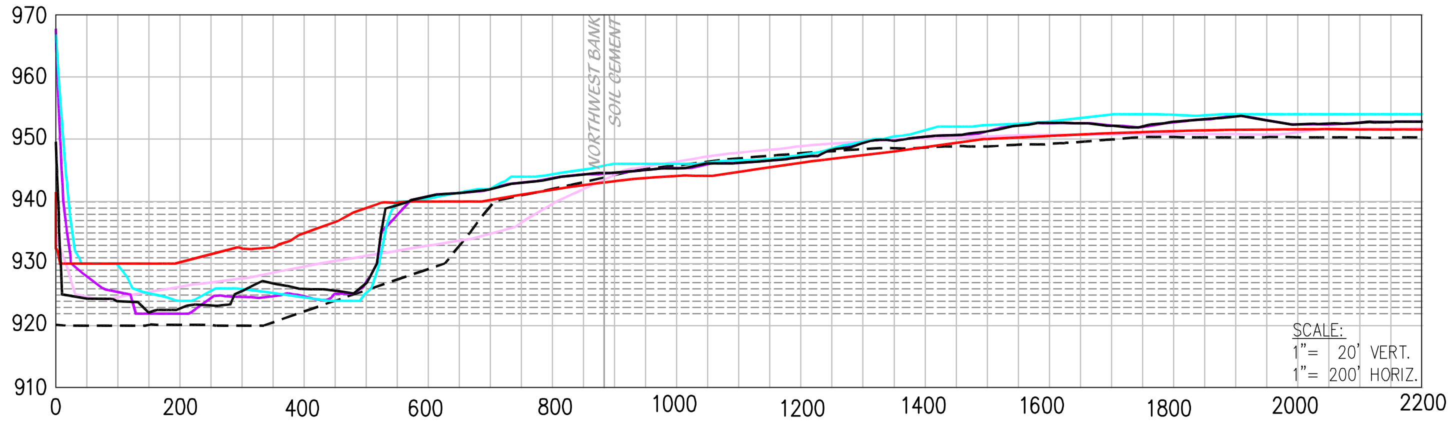
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

FIGURE
5.2G



SUBREACH SRC2 SECTION 27925

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 27925 (sf)					
ELEV	1947	1963	1999	2004	2005
922.9	0.0	0.0	0.0	93.2	24.2
923.9	0.0	0.0	0.0	110.4	116.8
924.9	31.0	0.0	116.9	153.2	224.6
925.9	116.8	0.0	265.7	369.4	307.0
926.9	181.8	0.0	383.0	424.8	430.6
927.9	259.0	0.0	396.4	445.0	491.4
928.9	322.5	0.0	405.9	464.7	500.1
929.9	375.5	0.0	416.7	482.0	505.7
930.9	433.3	181.2	475.3	493.3	509.8
931.9	498.0	244.8	488.5	495.7	511.7
932.9	562.7	308.8	494.8	498.4	513.5
933.9	627.2	368.6	498.3	501.2	515.3
934.9	689.3	388.8	501.7	504.0	517.1
935.9	730.7	413.1	505.0	511.1	519.0
936.9	745.7	441.0	508.7	521.1	521.1
937.9	761.4	464.1	512.9	531.0	523.2
938.9	778.5	485.0	518.0	541.1	525.4
939.9	795.6	514.3	524.0	551.2	545.5
AREA	7908.8	3809.7	7011.7	7690.7	7801.9

LEGEND:

- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

TITLE	HISTORICAL CROSS SECTIONS BY STATION
JOB	SANTA CLARA RIVER FLUVIAL STUDY — LOS ANGELES COUNTY, CA
SCALE	AS NOTED
DESIGNED	DAJ
DRAWN	DEP
CHECKED	MEK
DATE	12/20/05
JOB NO.	8197E
FIGURE	5.2H

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PACIFIC ADVANCED CIVIL ENGINEERING
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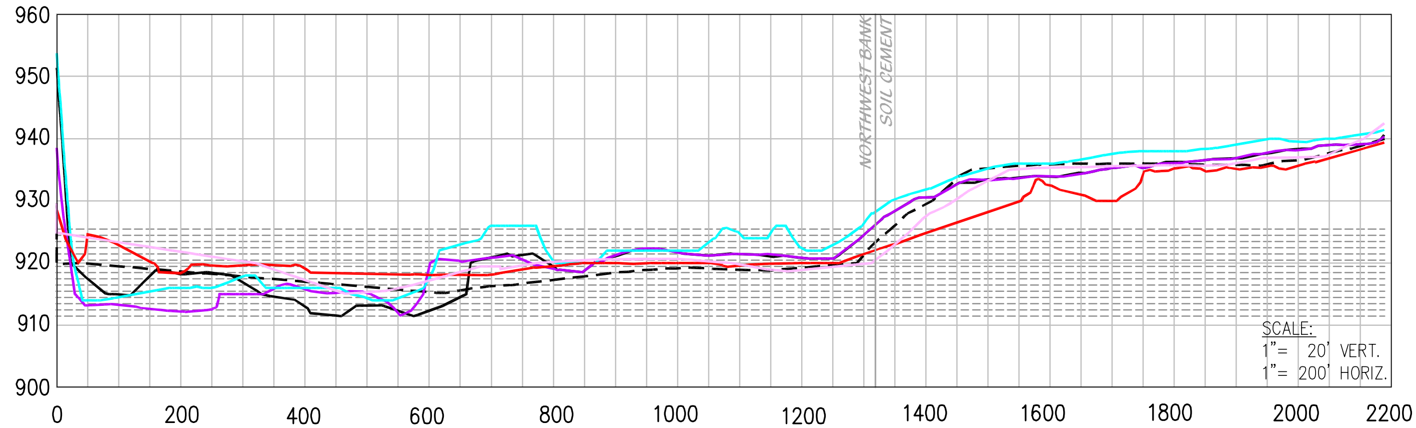

SUBREACH SRC3 SECTION 25965

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 25965 (sf)					
ELEV	1947	1963	1999	2004	2005
912.5	0.0	0.0	0.0	26.8	76.8
913.5	0.0	0.0	0.0	174.7	177.5
914.5	0.0	0.0	42.0	278.4	257.8
915.5	16.2	0.0	174.6	366.4	347.7
916.5	113.4	0.0	358.1	522.6	408.7
917.5	183.8	0.0	511.8	566.9	449.5
918.5	250.0	84.3	557.3	572.3	504.1
919.5	384.0	396.2	577.2	619.3	662.5
920.5	689.2	884.8	615.7	690.5	722.9
921.5	1050.0	1150.5	669.2	915.0	893.2
922.5	1149.7	1199.2	778.9	1191.1	1195.9
923.5	1226.4	1249.5	947.5	1263.7	1261.5
924.5	1303.6	1304.0	1043.2	1278.3	1274.7
925.5	1367.8	1394.3	1121.5	1291.0	1286.5
Area	7734.2	7662.7	7397.0	9757.0	9519.2

LEGEND:
- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

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FIGURE 5.21

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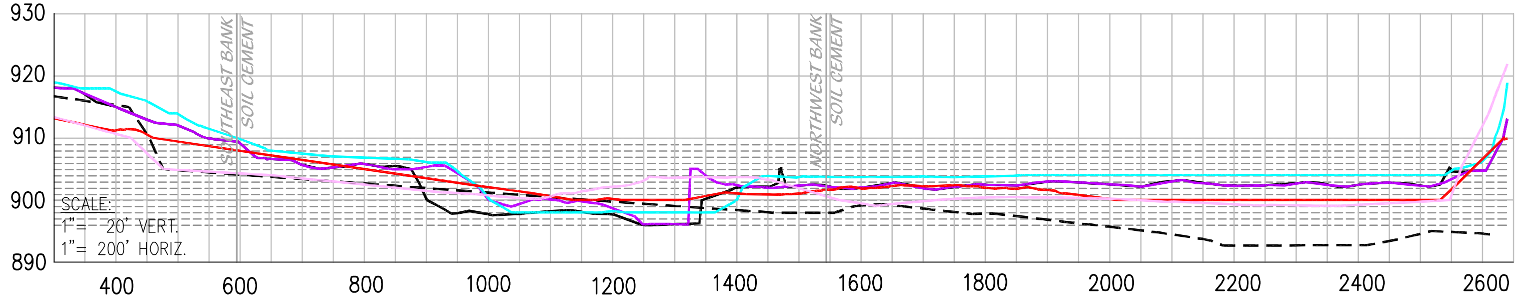

SUBREACH SRC4 SECTION 23000

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 23000 (sf)					
ELEV	1947	1963	1999	2004	2005
896.9	0.0	0.0	0.0	61.7	89.1
897.9	0.0	0.0	0.0	89.8	153.8
898.9	0.0	0.0	313.2	116.0	381.3
899.9	302.5	0.0	377.5	156.1	430.9
900.9	926.6	725.1	402.7	319.0	456.6
901.9	1278.1	1110.9	415.2	339.4	489.5
902.9	1487.7	1518.6	436.0	909.3	558.9
903.9	1706.5	1663.0	468.2	1544.6	582.8
904.9	1990.7	1740.8	1540.7	1609.7	589.5
905.9	2094.6	1818.6	1634.9	1814.1	1822.6
906.9	2110.3	1896.4	1732.9	1946.9	1946.9
907.9	2125.8	1974.1	1903.3	2000.1	2000.1
908.9	2141.4	2051.6	1979.2	2016.7	2016.7
909.9	2156.9	2129.0	2008.1	2044.7	2044.7
Area	18321.2	16628.1	13211.7	14968.1	13563.3

LEGEND:

- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

TITLE: HISTORICAL CROSS SECTIONS BY STATION

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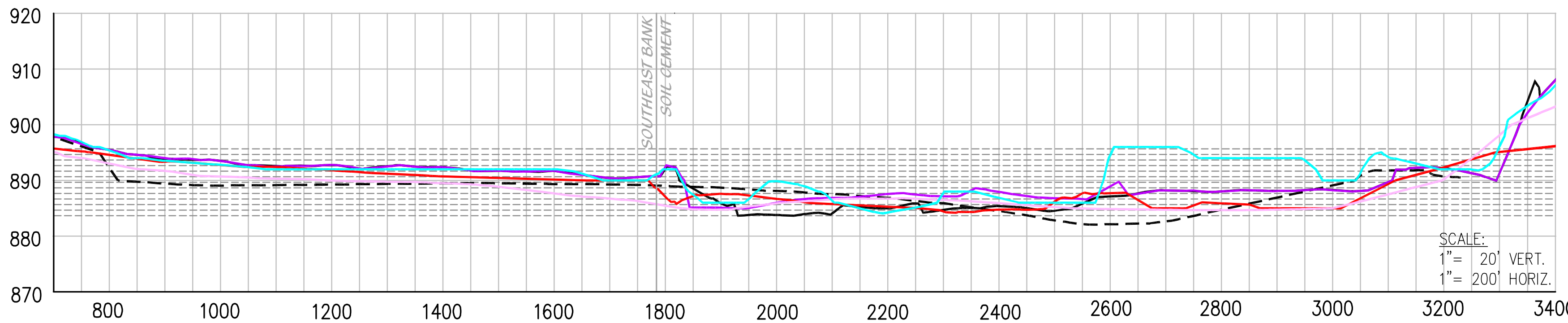
FIGURE 5.2J



SUBREACH SRD1 SECTION 20845

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 20845 (sf)					
ELEV	1947	1963	1999	2004	2005
884.7	0.0	24.3	19.2	0.0	150.4
885.7	452.5	415.1	108.7	73.4	442.9
886.7	691.1	825.4	339.0	171.1	658.8
887.7	1429.9	1056.2	496.3	461.1	733.8
888.7	1566.1	1284.4	615.1	956.0	1015.0
889.7	1707.6	1319.7	689.2	1235.6	1247.2
890.7	2042.6	1505.0	861.5	1298.3	1289.4
891.7	2272.0	1843.3	974.7	1484.4	1486.8
892.7	2377.0	2063.6	1499.5	1854.8	1853.7
893.7	2445.9	2286.8	1891.4	2282.6	2283.6
894.7	2514.1	2433.1	2192.5	2417.1	2427.1
895.7	2569.9	2558.2	2348.7	2502.7	2502.7
Area	20068.6	17615.1	12035.8	14737.0	16091.2

LEGEND:

- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

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FIGURE 5.2K

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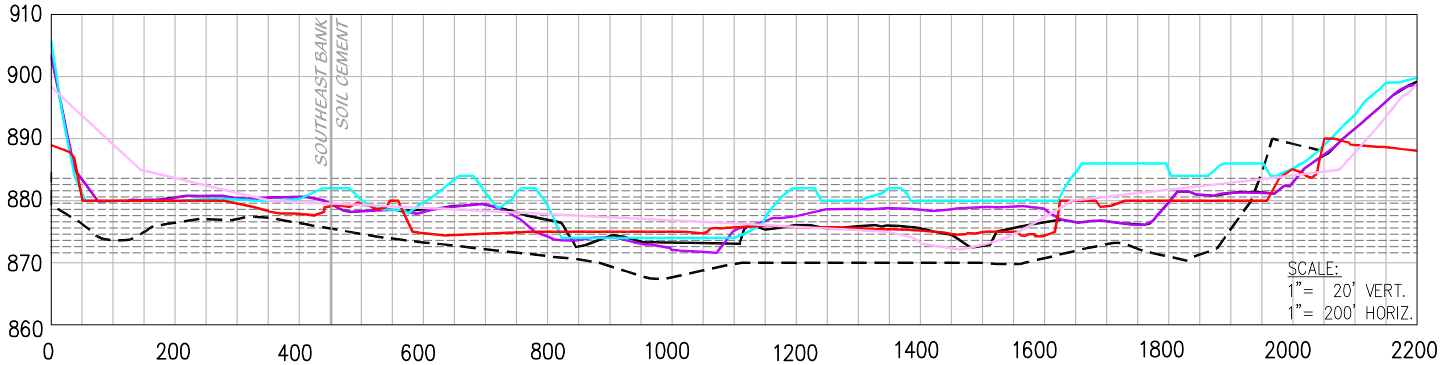
TITLE
HISTORICAL CROSS SECTIONS BY STATION

Dimscale = 200; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1



SUBREACH SRD2 SECTION 18650

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 18650 (sf)					
ELEV	1947	1963	1999	2004	2005
872.6	14.7	0.0	0.0	63.6	1.7
873.6	102.7	0.0	0.0	133.2	134.8
874.6	158.5	10.7	180.4	265.4	310.8
875.6	247.2	556.7	307.9	322.1	405.3
876.6	441.9	1011.6	328.6	386.3	694.8
877.6	654.2	1048.1	340.5	566.5	980.3
878.6	869.6	1120.0	359.9	726.4	1064.1
879.6	1094.1	1248.2	443.3	1236.2	1285.5
880.6	1300.2	1706.9	906.3	1457.7	1456.8
881.6	1437.6	1915.9	1293.2	1805.3	1802.1
882.6	1569.2	1923.4	1474.1	1925.6	1925.6
883.6	1699.4	1930.9	1556.6	1949.4	1949.4
Area	9589.2	12472.3	7190.7	10837.7	12011.1

LEGEND:

- 2005 TERRAIN (black solid)
- 2004 TERRAIN (purple)
- 1999 TERRAIN (cyan)
- 1963 TERRAIN (red)
- 1947 TERRAIN (pink)
- 1930 TERRAIN (black dashed)

TITLE: HISTORICAL CROSS SECTIONS BY STATION

JOB: SANTA CLARA RIVER FLUVIAL STUDY

LOS ANGELES COUNTY CA

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FIGURE 5.2L

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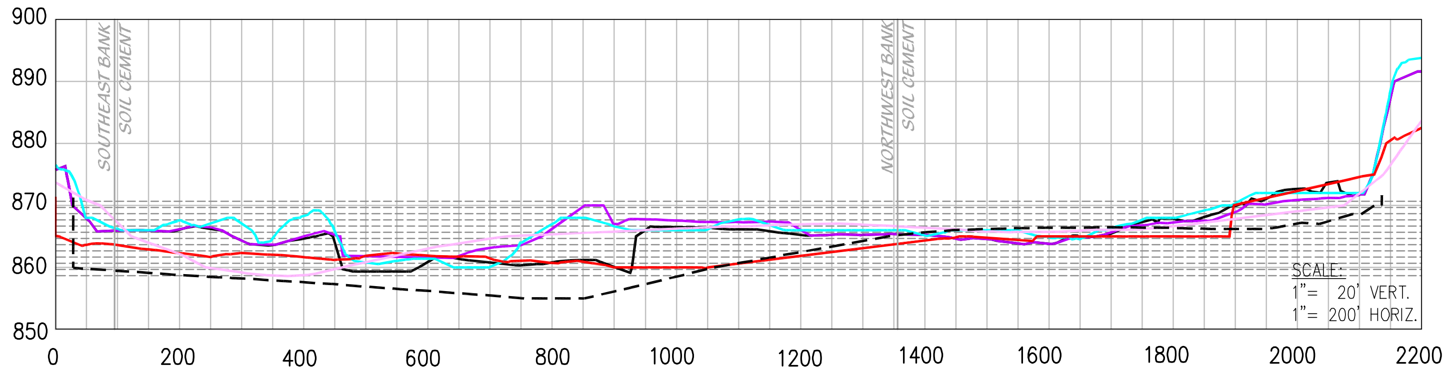

SUBREACH RD3 SECTION 16305

LOOKING DOWNSTREAM

LEGEND:

- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

CROSS SECTIONAL AREAS AT STA 16305 (sf)					
ELEV	1947	1963	1999	2004	2005
859.6	116.8	0.0	0.0	0.0	36.9
860.6	225.0	121.1	44.8	0.0	170.0
861.6	293.0	414.5	183.6	0.0	369.2
862.6	358.9	892.9	268.2	180.1	475.4
863.6	432.1	1172.9	282.0	243.7	481.4
864.6	521.6	1363.3	307.5	444.6	628.8
865.6	643.2	1755.6	434.3	778.8	966.6
866.6	1122.9	1892.0	921.7	1157.1	1432.7
867.6	1681.2	1893.0	1359.0	1424.1	1691.5
868.6	1833.9	1894.1	1668.7	1759.2	1796.9
869.6	1924.7	1895.9	1793.3	1820.6	1842.8
870.6	2005.0	1906.3	1846.8	1896.1	1880.2
Area	11158.2	15201.5	9110.0	9704.3	11772.3

TITLE	HISTORICAL CROSS SECTIONS BY STATION
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FIGURE	5.2M

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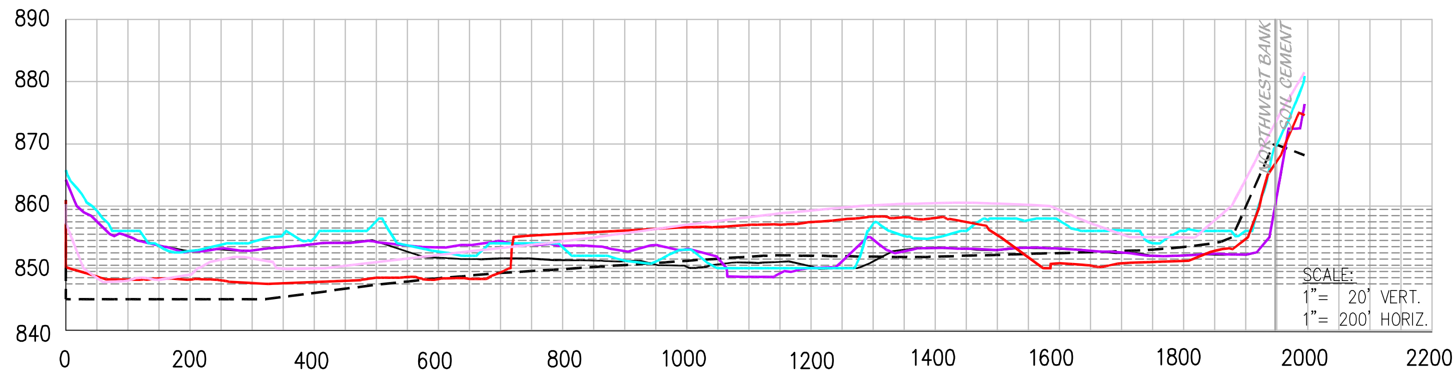
Dimscale = 200; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1



SUBREACH SRE1 SECTION 14315

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 14315 (sf)

ELEV	1947	1963	1999	2004	2005
848.5	43.7	241.8	0.0	0.0	0.0
849.5	153.8	650.6	0.0	71.9	0.0
850.5	237.3	718.0	107.7	143.8	55.0
851.5	384.3	892.6	274.1	193.5	347.3
852.5	556.7	998.3	398.1	286.3	800.8
853.5	659.2	1047.6	604.4	807.3	1273.6
854.5	758.3	1090.6	828.5	1592.4	1703.6
855.5	899.6	1132.2	1081.0	1830.5	1835.8
856.5	1065.8	1302.0	1398.1	1873.9	1873.9
857.5	1183.6	1555.3	1662.9	1886.2	1886.2
858.5	1301.7	1798.4	1792.2	1898.3	1898.3
859.5	1425.5	1918.4	1865.8	1915.1	1915.1
Area	8669.5	13345.8	10012.7	12499.2	13589.6

LEGEND:

- 2005 TERRAIN (solid black)
- 2004 TERRAIN (purple)
- 1999 TERRAIN (cyan)
- 1963 TERRAIN (red)
- 1947 TERRAIN (pink)
- 1930 TERRAIN (dashed black)

SCALE	AS NOTED
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TITLE: HISTORICAL CROSS SECTIONS BY STATION

FIGURE 5.2N

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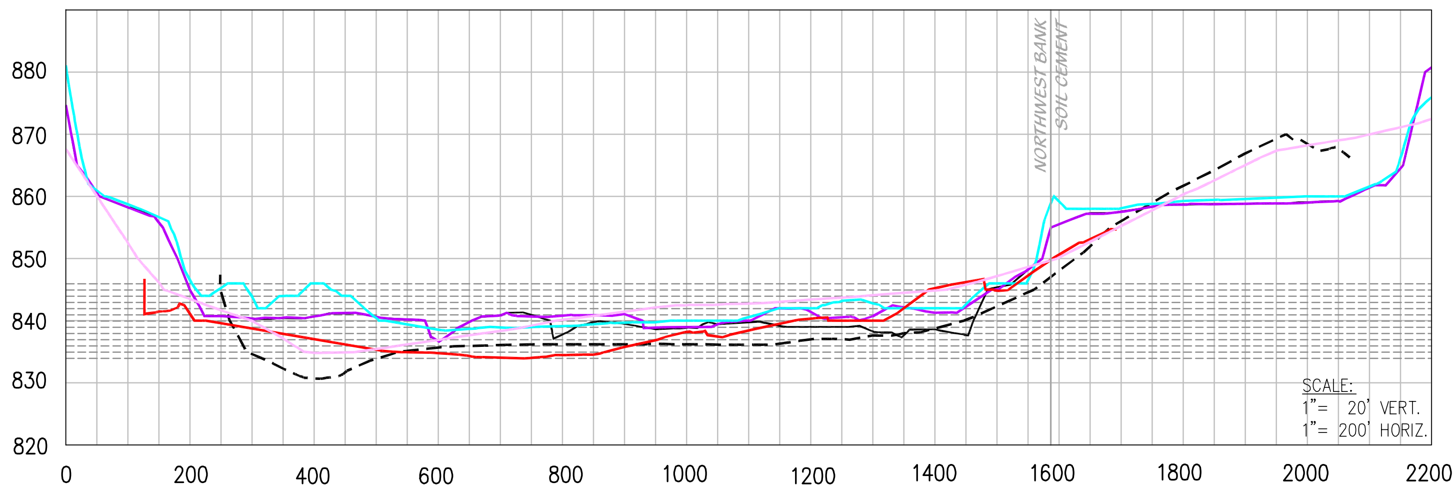

SUBREACH SRE2 SECTION 12195

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 12195 (sf)					
ELEV	1947	1963	1999	2004	2005
834.9	0.0	158.7	0.0	0.0	0.0
835.9	119.1	387.7	0.0	0.0	0.0
836.9	204.3	492.5	0.0	1.0	1.0
837.9	289.0	605.3	0.0	22.5	35.3
838.9	375.4	768.6	25.4	41.9	183.8
839.9	450.2	884.2	300.2	179.4	571.9
840.9	533.1	1086.7	583.8	422.2	914.9
841.9	638.1	1143.6	641.8	923.4	1217.1
842.9	779.7	1205.6	881.3	1221.6	1258.1
843.9	1003.2	1232.1	1009.7	1258.5	1268.5
844.9	1167.2	1249.6	1127.4	1279.4	1279.0
845.9	1279.6	1280.2	1201.1	1307.6	1304.0
Area	6838.7	10494.9	5770.7	6657.4	8033.7

LEGEND:

- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

Dimscale = 200; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

TITLE: HISTORICAL CROSS SECTIONS BY STATION

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FIGURE 5.20

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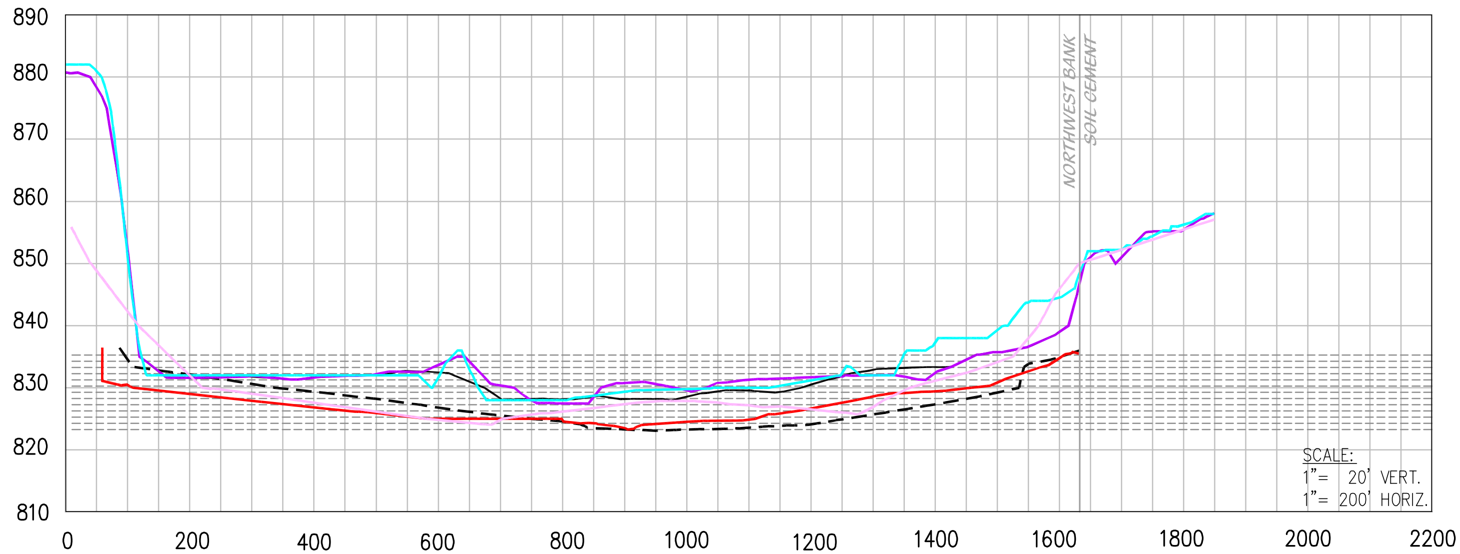
Dimscale = 200; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1



SUBREACH SRE3 SECTION 10390

LOOKING DOWNSTREAM

CROSS SECTIONAL AREAS AT STA 10390 (sf)					
ELEV	1947	1963	1999	2004	2005
824.3	3.9	43.1	0.0	0.0	0.0
825.3	94.2	315.5	0.0	0.0	0.0
826.3	252.1	633.1	0.0	0.0	0.0
827.3	533.3	801.6	0.0	0.0	0.0
828.3	853.0	945.9	36.7	73.0	24.6
829.3	1015.2	1093.0	184.0	114.7	306.3
830.3	1109.9	1302.8	345.4	169.4	475.5
831.3	1174.3	1422.9	529.3	332.7	554.3
832.3	1223.3	1464.8	739.8	793.6	816.8
833.3	1269.3	1494.6	1147.2	1159.9	1125.6
834.3	1308.6	1524.2	1180.8	1247.2	1296.9
835.3	1346.9	1541.5	1201.4	1314.9	1332.6
Area	10183.9	12582.9	5364.7	5205.4	5932.6

LEGEND:

- 2005 TERRAIN
- 2004 TERRAIN
- 1999 TERRAIN
- 1963 TERRAIN
- 1947 TERRAIN
- 1930 TERRAIN

TITLE: HISTORICAL CROSS SECTIONS BY STATION

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FIGURE 5.2P

P:\8197E\Engineering\GlobalExhibits\8197 Santa Clara River HEC Cross Sections and End Area Data.dwg - Tab: HEC 10390 - 5.2P By: ddrahn on Mar. 14, 2006 at 05:07 pm characteristics. The Interstate 5 Bridge 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 River as a whole. Periodic fires have burned the flora of the watershed historically, and as recently as the summer of 2004. Fires are important to changes of the River bed because these fires deplete vegetation stalks and root systems that hold soil in upland areas, thereby leading to increased erosion on slopes and increased sediment delivery to creeks and rivers. Agricultural fills are also important to the historic River fluvial mechanics because the fills limit the extent to which the River may migrate, and in turn cause vertical erosion of the creek bed. LACDPW has noted that lateral erosion of agricultural fill has occurred periodically although no data is 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 River can transport over 730,000 tons (approximately 327,000 cubic yards) of sediment per day in some sections. LACDPW has indicated that the constraining of the lateral erosion at the agricultural infill locations may exacerbate or exceed background erosion downstream.

Table 5.1A shows the long-term historical cross-sections area from 1947 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. 1947 section 23000 area – 2005 section 23000 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 the vertical elevation for each section is the same.

Table 5.1A: Santa Clara River Long-term Historical Cross-Section Area & Area Change 1947-2005

Subreach	Station	Area by Year (sf)			Δ Area by Year (sf)			
		1947	2004	2005	47-05	Change	04-05	Change
SRA1	44585 [1,3]	9209	12312	14990	-5781	DEGRADE	-2678	DEGRADE
SRA2	42215	5609	17251	17107	-11498	DEGRADE	144	AGGRADE
SRA3	40825	4761	7403	10210	-5449	DEGRADE	-2807	DEGRADE
SRA4	36080 [2]	12270	21059	21208	-8938	DEGRADE	-149	DEGRADE
SRB1	34720	14344	16868	19520	-5176	DEGRADE	-2652	DEGRADE
SRB2	33500	9132	14857	16523	-7391	DEGRADE	-1666	DEGRADE
SRC1	30445	9172	13898	13351	-4179	DEGRADE	547	AGGRADE
SRC2	27925	7909	7691	7802	107	AGGRADE	-111	DEGRADE
SRC3	25965	7734	9757	9519	-1785	DEGRADE	238	AGGRADE
SRC4	23000	18321	14968	13563	4758	AGGRADE	1405	AGGRADE
SRD1	20845	20069	14737	16091	3978	AGGRADE	-1354	DEGRADE
SRD2	18650	9589	10838	12011	-2422	DEGRADE	-1173	DEGRADE
SRD3	16305	11158	9704	11772	-614	DEGRADE	-2068	DEGRADE
SRE1	14315	8670	12499	13590	-4920	DEGRADE	-1091	DEGRADE
SRE2	12195	6839	6657	8034	-1195	DEGRADE	-1377	DEGRADE
SRE3	10390	10184	5205	5933	4251	AGGRADE	-728	DEGRADE

1 - Long-term change analyzed using 1963 data instead of 1947 data because 1947 data is unavailable at this section

2 - STA 36080 was chosen to represent sra4 because the downstream confluence is of particular engineering interest to that subreach

3- STA 44585 1947 area uses 1963 data since 1947 data is not available.

Table 5.1B: Santa Clara River Historical Cross-Section Average Depth & Average Depth Change Aggradation/Degradation Change 1947-2005								
Subreach	Station	Average Depth by Year = Area/Top Width (ft)			Δ Average Depth by Year (ft)			
		1947	2004	2005	47-05	Change	04-05	Change
SRA1	44585 [1,3]	16.0	18.4	17.8	-2.8	DEGRADE	0.6	AGGRADE
SRA2	42215	5.1	12.8	13.1	-8.0	DEGRADE	-0.3	DEGRADE
SRA3	40825	4.5	7.4	9.7	-5.2	DEGRADE	-2.3	DEGRADE
SRA4	36080 [2]	11.6	14.2	14.3	-2.7	DEGRADE	-0.1	DEGRADE
SRB1	34720	9.9	11.4	13.1	-3.2	DEGRADE	-1.7	DEGRADE
SRB2	33500	6.4	8.8	9.8	-3.4	DEGRADE	-1.0	DEGRADE
SRC1	30445	7.3	8.9	8.6	-1.3	DEGRADE	0.3	AGGRADE
SRC2	27925	9.9	14.0	14.3	-4.4	DEGRADE	-0.3	DEGRADE
SRC3	25965	5.7	7.6	7.4	-1.7	DEGRADE	0.2	AGGRADE
SRC4	23000	8.5	7.3	6.6	1.9	AGGRADE	0.7	AGGRADE
SRD1	20845	7.8	5.9	6.4	1.4	AGGRADE	-0.5	DEGRADE
SRD2	18650	5.6	5.6	6.2	-0.6	DEGRADE	-0.6	DEGRADE
SRD3	16305	5.6	5.1	6.3	-0.7	DEGRADE	-1.2	DEGRADE
SRE1	14315	6.1	6.5	7.1	-1.0	DEGRADE	-0.6	DEGRADE
SRE2	12195	5.3	5.1	6.2	-0.9	DEGRADE	-1.1	DEGRADE
SRE3	10390	7.6	4.0	4.5	3.1	AGGRADE	-0.5	DEGRADE

1 - Long-term change analyzed using 1963 data instead of 1947 data because 1947 data is unavailable at this section

2 - STA 36080 was chosen to represent sra4 because the downstream confluence is of particular engineering interest to that subreach

3- STA 44585 1947 area uses 1963 data since 1947 data is not available.

Section 44585 (SRA1) shows a gradual shifting of the thalweg toward the left (looking downstream) bank (Figure 5.2A) over the period of record. Topographic data is not available for this section for 1947, however, between 1963 and 2005, 2.8 feet of degradation has occurred (Table 5.1A-B), although the thalweg elevation increased between 1999 and 2005. Between 2004 and 2005, 0.6 feet of aggradation appears to have occurred (Table 5.1A-B) on the section as a whole. This portion of the River is narrower than most other portions and is slightly bent. Development has occurred on both banks, and this development along with the increased runoff from increased impervious area may have caused the observed degradation. A great deal of woody brush was present in the recent past, which may have rendered some portions of the bed more resistant to erosion, leading to some natural incising of the channel. It is also important to note that the dense brush in this and other woody sections may make the topography appear to be at higher elevation than is actually present. This difference results from the aerial survey technology used to create the topography, and is mostly evident in some portions of the 1999 topography.

Section 42215 (SRA2) appears to have greatly down cut and widened since 1947, degrading an average 8.1 feet along the section. Some of the observed long-term change may be related to the presence of the theme park and water treatment facility on the bank at this location. In recent years (1999-2005), the creek appears to have become relatively stable: area has increased from 17946 to 17101 over the period (Figure 5.2B). The River is relatively wide at this location although a bend is present. Development has occurred on both banks with agricultural development on the north bank and the Magic Mountain theme park on the south bank. Historical development may have led to the observed degradation, although at present the bed appears to be stable or degrading only slightly. The impacts of woody vegetation in this section may have played a role in the recent degradation. Finally, the 2004-2005 winter was very wet and high flows were present on the River. During the heavy storms of December 2004 and January 2005, approximately 4.4 acres of the south bank was lost to the Santa Clara River. Some of the single-season degradation may possibly be attributed to this event. The features located at station 775 and 1325 in the 1999 topography are expected to be related the aerial surveying methodology, as noted above.

Similar to the other sections in Reach A, section 40825 (SRA3) is also degrading. The section has degraded 5.2 feet on average over the period of record (Table 5.1B). The 1963 data is insufficient in this section as indicated by the flat portions of the section, although the other years sufficiently indicate the trend. The 2005 thalweg is at the approximate elevation of the 1930 thalweg, although the present channel is more incised than the historic channel. The presently observed channel widening may possibly be attributed to recent high discharges, and migration of the channel may be related to these discharges. Features in the 1999 topography at stations 775 and 1325 are expected to be related to the aerial surveying methodology, as noted above.

Section 36080 (as applied to SRB1) borders the SRA4 and SRB1 subreaches. The section is adjacent to a local confluence in the River. The section shows consistent degradation over the period of record amounting to 2.7 feet, on average. The 1930 and 1963 topographies are insufficient in this section; however, widening of the channel in this location is readily apparent (Figure 5.2D). Little or no degradation is observed over the period of record, although a slight increase in the depth of the thalweg is observed during the 2004-2005 rainy season. Agriculture is present on the north overbank of the section although it is not clear how the history of farming practice may have affected the section.

The 1930 and 1963 topographic data of sections 34720 (SRB1) and 33500 (SRB2) is insufficient, as indicated by the long, straight portions of the section. Despite these difficulties, the data illustrate a clear degradational trend in the historic bed. Over the period of record, the section has degraded 3.2 and 3.4 feet, on average respectively, and 1.8 and 1.0 feet, on average respectively, during the 2004-2005 rainy season (Table 5.1). The River is broad and woody in this reach, with the northern end of the Travel Village development occupying the right overbank. It is unclear why a wide, straight portion of the River such as this would be subject to the observed degradation. Some of the long-term and single season may possibly be attributed to the woody nature of the bed and the large recent discharges, respectively. It should be noted that the present thalweg appears to be at an elevation similar to the 1930 thalweg on section 34720, while the thalweg of the 2005 topography at section 33500 may or may not be lower than the 1930 topography. As with other portions of historic topography, features often present at the time of surveying are not highly resolved. When this occurs, historic topography is included for completeness. The degradation of these reaches may also be reflective of the large changes in development along the River upstream of the study area. This may apply to other sections considered as well, although currently it is not clear.

Section 30445 (SRC1) is downstream of two major tributaries, the larger being Castaic Creek, which is discussed in the companion Castaic Creek Fluvial Study, submitted separately. The section is also adjacent to a historic agricultural area and the proposed Landmark project. Historical analysis indicates 1.4 feet of degradation over the historic record, but 0.3 feet of aggradation during the 2004-2005 rainy season

(Table 5.1B). The aggradation appears to be the result of build up of sediments on the Castaic Creek side of the channel. If Castaic Creek contributed to the bed in this location, it may be the result of forest fires during the summer of 2004 and subsequent heavy rains of that winter, as discussed in the Castaic Creek report. It should be noted that some problems exist with the 1947 topography in this section below station 300.

At sections 27925 (SRC2) and 25965 (SRC3), the upstream degradational trends diminish and historic topographic data begin to indicate a bed that is fluctuating about a mean (Figures 5.2H and 5.2I, respectively). Section 27925 is quite narrow and adjacent to historic agricultural practice. The channel at this section is confined between steep bluffs on the left bank and tree-lined agricultural embankments on the right. Data in Table 5.1 indicate that the section has degraded 4.4 feet over the period of record and 0.3 feet during the most recent season. A relatively low-radius bend in the River is also present here. At section 25965, in contrast, the less narrow, although similarly confined and more gradually bending channel, takes an increasingly braided form with only 1.7 feet of degradation over the period of record. Data in Table 5.1 also indicate the most recent trend in this section is 0.2 feet of aggradation.

Sections 23000 (SRC4) and 20845 (SRD1) are the first historically aggradational sections analyzed (Figure 5.2J and 5.2K, respectively). Section 23000 is adjacent to the Chiquito Canyon Creek and Long Canyon Creek tributaries at the west end of the proposed Landmark development and between two historic agricultural production areas. Section 20845 is downstream of the proposed Landmark site and the left overbank has historically been used for agriculture. Both banks of section 20885 are tree-lined. Both sections are relatively wide and straight with braided channel beds. Both sections have aggraded over the period of historic record: 1.9 and 1.4 feet, respectively. In the most recent short term, however, section 23000 has aggraded 0.7 feet while section 20845 has degraded 0.5 feet. Section 23000 shows some incising below the 1930 historical bed although the average bed elevation is higher now than in the past. The dominant change in bed elevation between 2004 and 2005 at section 20845 occurred to the left of station 2600, while the remaining portion remained stable. It is not clear why this occurred, although agricultural practices or high discharges from the Chiquito and Long tributaries may have played a role. Agricultural practices may have stabilized the bank position and height while the creeks may influence the bed by discharging high volumes of water and sediments that have the dual ability to erode or deposit at this location. It should be noted that the topographic artifact between station 2600 and 3000 in the 1999 topography is a function of topographic sampling. As noted above, the dense brush in this and other woody sections may make the topography appear to be at a higher elevation than is actually present and results from the aerial survey technology used to create the topography.

Sections 18650 (SRD2), 16305 (SRD3), 14315 (SRE1), and 12195 (SRE2) all exhibit very mild long-term degradation (one foot or less) between 1947 and 2005 (Table 5.1). Additionally, short-term adjustment for all of these sections ranges between -0.6 and -1.2 feet between 2004 and 2005. Sections 16305 and 12195 exhibit 1.2 and 1.1 feet of degradation, respectively, and are among the five highest single season changes in bed elevation of the sections examined. Sections in SRA3 and SRB1 degrade significantly more with -2.3 and -1.7 feet, respectively. All of the sections from 18650 to 12195 are recovering from the 1928 dam break event, the sections low elevations, and all sections exhibit oscillations in bed elevation over the historic record (Figure

5.2L though 5.2O, respectively). These sections have in common a relatively wide, straight and braided bed. Grande Canyon Creek and Potrero Canyon Creek confluence with the River at near section 17000. The influence of the confluences is not immediately evident but may include some of the observed fluctuations in bed elevation as well as affecting the wide historic meandering between the north and south bank (Figure 5.1). The observed features in the 1999 and 2004 topographies in section 16305 at stations 425 and 850 appear to be the south and north low-flow banks, respectively. Several of the features in the 1999 bed at section 14315 appear to correlate to the presence of vegetation on the bank and relate to surveying methodology, as noted above.

Section 10390 (SRE3) illustrates 3.1 feet of aggradation from 1947 to 2005 and 0.5 feet of degradation between 2004 and 2005 (Table 5.1). In this subreach, the River is relatively very wide and braided. Little woody vegetation is observed on the banks and steep bluffs dominate both banks, although a small farm plot sets the bluff on the right bank back. Figure 5.2P indicates that the bed is recovering from scouring related to the 1928 dam break. The observed feature in the 1999 and 2004 topographies at station 625 appears to be the south bank of the thalweg.

Based on the above analysis and Table 5.1, sections above approximately 25965 appear to be degrading, while sections below appear to be stable or fluctuating around a mean elevation. This may be the result of historic development within the overbank areas or owing to the presence of the generally narrower, winding channel bed in the upstream portion of the study reach. The lower portion of the study reach is relatively flat, broad and straight. Data in Appendix Chapter 4.5 indicate that for reaches A through E the slope decreases as S_0=0.0061, 0.0060, 0.0055, 0.0055, and 0.0054, respectively.

5.1 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 Santa Clara River with strong rain events occurring on already saturated soils both in December 2004 and January 2005. These events produced very high discharges on the River. 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-P. The table and figures illustrate that the bed elevations show alternating degradation and aggradation. Degradation ranges from 0.1 to 2.3 feet, on average, with most degrading sections changing less than one foot, on average. Aggrading sections change from 0.2 to 0.7 feet, on average. More sections degrade than aggrade. The pattern of aggradation and degradation over the single season does not appear to be a function of proximity to a river confluence. For comparison, aggradation predicted by SAM in the proposed condition (Table 4.2B) ranges from 0.0 to 2.1 feet, while degradation ranges from 0.0 to 1.6 feet. The values of bed change estimated by SAM vary similar to those observed in the topographic datasets. These differences can be attributed to the discontinuous nature of the zero-dimensional SAM model.

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 five 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 differential velocity gradients around curves in open channel flow. Three distinct bends are located in the River between Interstate 5 and the end of the study area near the Los Angeles/Ventura County line. These bends have radii of 9,000, 3,000, and 17,000 feet from east to west in the River, respectively. The bends can be seen in Figure 1.1. 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, bedform height represents the dunes and anti-dunes that develop in active soft-bottomed channels during flow events. Because no observations are available, bedform height has been limited after Kennedy (1963).

Bend scour and bedform height have been calculated based on 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. Bedform height is given by equation Q-8 of the manual, given as:

$$h = 0.027V^2$$

where h is bedform height.

Results of calculations of other scour components are summarized in Table 6 as well as in LACH&SM calculations tables in Appendix Chapter 6.1 for both the existing and proposed conditions. Pier scour is zero in the existing condition and ranges from 0.0 to 17.4 in the proposed condition. The tables show that in the existing and proposed conditions bend scour ranges from 0.0 to 11.3 feet and 0.0 to 8.9 feet, respectively. Observed changes result from changes to river hydraulics in the study reach. For both the existing and proposed conditions, the table also shows that bed form height ranges from 0.5 to 8.3 feet in both the existing and proposed conditions.

Table 6: Santa Clara River Summary of Other Scour (ft)							
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	46195	8.3	8.3	8.3	8.3	0.0	0.0
	46020	9.9	9.9	9.9	9.9	0.0	0.0
	45545	7.6	7.6	7.6	7.6	0.0	0.0
	45030	10.3	10.3	10.3	10.3	0.0	0.0
	44585	7.0	7.0	7.0	7.0	0.0	0.0
	44210	9.7	9.7	9.7	9.7	0.0	0.0
SRA2	43820	7.3	7.3	7.3	7.3	0.0	0.0
	43610	8.9	8.9	8.9	8.9	0.0	0.0
	43410	7.7	7.7	7.7	7.7	0.0	0.0
	43200	8.2	8.2	8.2	8.2	0.0	0.0
	42975	7.4	7.4	7.4	7.4	0.0	0.0
	42815	7.3	7.3	7.4	7.4	0.1	0.1
	42590	6.9	6.5	7.0	6.6	0.1	0.1
	42430	7.0	6.8	7.3	7.2	0.3	0.4
	42215	5.0	3.5	7.1	6.6	2.1	3.1
	41940	5.4	3.8	5.3	3.8	-0.1	0.0
	41730	5.2	3.9	5.1	3.9	-0.1	0.0
	41460	5.7	3.8	4.7	3.8	-1.0	0.0
SRA3	41280	5.7	5.7	5.6	5.6	-0.1	-0.1
	41080	7.3	7.3	7.4	7.4	-0.1	0.1
	40825	6.9	6.4	6.9	6.4	0.0	0.0
	40585	6.3	5.9	6.3	5.9	0.0	0.0
	40335	5.9	3.7	4.9	3.5	-1.0	-0.2
	40130	6.5	3.7	5.0	3.7	-1.5	0.0
	39945	6.4	3.4	4.9	3.6	-1.5	0.2
	39755	6.7	5.2	5.7	5.7	-1.0	0.5
	39605	7.9	7.1	7.2	7.2	-0.7	0.1
	39310	6.7	5.5	5.9	5.7	-0.8	0.2
	39100	5.7	4.1	7.2	7.2	1.5	3.1
	38925	4.9	3.8	4.2	4.2	-0.6	0.4
SRA4	38710	4.2	3.5	4.0	4.0	-0.2	0.5
	38475	6.3	6.3	6.3	6.3	0.0	0.0
	38300	6.9	6.9	7.1	7.1	-0.2	0.2
	38065	4.7	4.7	4.9	4.9	-0.2	0.2
	37810	6.5	6.5	6.5	6.5	0.0	0.0
	37655	7.1	7.1	7.3	7.3	-0.2	0.2
	37390	5.1	5.1	5.3	5.3	-0.2	0.2
	37135	6.4	5.9	5.7	5.7	-0.7	-0.2
	36930	6.5	5.9	6.1	6.1	-0.4	0.2
	36735	5.9	5.0	5.5	5.5	-0.4	0.5
	36515	7.0	5.8	4.6	4.2	-2.4	-1.6
	36265	5.7	4.3	5.0	4.1	-0.7	-0.2
SRB1	36080	5.7	4.1	19.1	18.2	13.4	14.1
	35845	5.7	3.6	5.3	3.6	-0.4	0.0
	35725	7.0	4.9	6.8	5.0	-0.2	0.1
	35515	7.7	5.9	7.7	5.9	0.0	0.0
	35245	7.2	4.8	7.6	6.0	0.4	1.2
	35040	8.8	7.1	8.9	7.2	0.1	0.1
	34860	7.8	6.4	7.8	6.6	0.0	0.2
	34720	7.9	6.4	8.0	6.6	0.1	0.2
	34495	7.4	6.4	7.1	6.1	-0.3	-0.3
	34310	7.3	6.2	7.0	5.8	-0.3	-0.4
	34090	6.9	6.0	6.9	5.9	0.0	-0.1
SRB2	33880	6.5	5.3	6.9	5.7	-0.4	0.4
	33710	6.9	5.7	6.5	5.2	-0.4	-0.5
	33500	6.9	5.4	7.1	5.5	-0.2	0.1
	33310	7.5	5.4	7.5	5.4	0.0	0.0
	33115	6.7	5.3	5.6	3.4	-1.1	-1.9
	32795	6.3	4.0	6.6	4.3	-0.3	0.3
	32605	6.1	4.7	7.1	4.8	-1.0	0.1
SRC1	32265	8.2	5.8	7.9	5.4	-0.3	-0.4
	31875	6.9	3.6	7.1	4.1	-0.2	0.5
	31585	8.6	5.7	6.6	3.6	-2.0	-2.1
	31360	6.3	3.3	6.3	3.4	0.0	0.1
	31060	5.6	2.8	5.5	2.9	-0.1	0.1
	30720	6.1	2.6	5.9	2.6	-0.2	0.0
	30445	6.0	2.5	5.9	2.5	-0.1	0.0
	30095	6.7	2.6	6.1	2.6	-0.6	0.0
	29815	7.1	2.8	5.7	2.8	-1.4	0.0
	29565	7.4	2.7	5.1	2.7	-2.3	0.0
	29385	7.8	3.0	5.0	2.9	-2.8	-0.1
SRC2	29140	7.8	3.4	4.4	3.1	-3.4	-0.3
	28895	8.8	7.2	7.5	6.8	-1.3	-0.4
	28695	10.0	10.0	9.0	9.0	-1.0	-1.0
	28500	8.8	8.8	8.8	8.8	0.0	0.0
	28280	7.9	7.9	7.6	7.4	-0.3	-0.5
	28080	7.7	7.7	3.9	3.7	-3.8	-4.0
	27925	6.3	6.3	4.3	4.3	-2.0	-2.0
	27725	7.7	7.7	6.9	6.9	-0.8	-0.8
	27545	8.6	8.6	9.0	9.0	0.4	0.4
	27335	8.0	8.0	8.2	8.2	0.2	0.2
	27155	8.6	8.6	6.9	6.9	-1.7	-1.7
SRC3	26990	8.1	7.6	7.9	7.7	-0.2	0.1
	26780	8.5	7.5	8.3	7.6	-0.2	0.1
	26575	12.8	7.5	12.7	7.6	-0.1	0.1
	26355	12.4	5.4	12.1	5.4	-0.3	0.0
	26170	14.1	6.4	13.3	5.9	-0.8	-0.5
	25965	13.7	6.3	13.8	6.5	0.1	0.2
	25785	14.2	7.2	13.4	6.8	-0.8	-0.4
	25600	16.0	7.6	12.6	6.6	-3.4	-1.0
	25425	16.1	7.4	11.8	6.5	-4.3	-0.9
	25215	13.9	4.8	10.7	4.7	-3.2	-0.1
	25000	16.6	6.1	10.4	4.3	-6.2	-1.8
SRC4	24795	17.7	6.9	10.3	4.7	-7.4	-2.2
	24550	17.6	7.4	10.4	5.1	-7.2	-2.3
	24335	15.0	4.8	11.0	6.5	-4.0	1.7
	24115	15.5	6.8	11.5	7.4	-5.0	0.7
	23975	14.6	6.9	11.9	7.8	-2.7	0.9
	23755	13.8	5.8	11.2	6.4	-2.6	0.6
	23565	14.1	4.8	12.5	7.5	-1.6	2.7
	23365	13.3	5.9	12.3	6.6	-1.0	0.7
	23180	13.5	4.3	13.8	8.3	0.3	4.0
	23000	11.0	3.1	11.0	7.6	0.0	4.5
	22790	11.0	3.2	24.8	21.0	13.8	17.8
	22600	13.0	3.7	12.8	7.3	-0.2	3.6
	22415	12.6	3.9	12.0	7.4	-0.6	3.5

Table 6: Santa Clara River Summary of Other Scour (ft) continued

Subreach	Section	Existing Condition		Proposed Condition		Δ Curved	Δ Straight
		Outside Curved Reach	Straight-Inside Curved Reach	Outside Curved Reach	Straight-Inside Curved Reach		
SRD1	22195	11.8	4.7	11.1	4.5	-0.7	-0.2
	22010	13.6	5.5	13.1	5.5	-0.5	0.0
	21790	13.1	7.2	13.1	7.2	0.0	0.0
	21615	10.4	6.3	10.3	6.3	-0.1	0.0
	21440	13.4	6.8	11.9	6.1	-1.5	-0.7
	21225	16.9	7.1	14.1	6.4	-2.8	-0.7
	21020	12.9	6.4	10.4	6.9	-2.5	0.5
	20845	15.5	5.9	13.0	5.1	-2.5	-0.8
	20595	15.4	5.1	11.9	4.1	-3.5	-1.0
	20435	15.6	4.3	12.2	4.0	-3.4	-0.3
	20280	15.6	4.6	13.2	5.3	-2.4	-0.7
	20070	13.3	6.6	14.6	7.0	1.3	0.4
SRD2	19855	14.2	6.3	12.5	7.1	-1.7	0.8
	19630	12.9	6.3	10.3	6.4	-2.6	0.1
	19440	12.8	3.9	10.2	4.3	-2.6	0.4
	19240	13.3	4.6	11.0	5.4	-2.3	0.8
	19050	12.7	3.6	12.1	6.8	-0.6	3.2
	18830	13.6	3.5	12.5	4.4	-1.1	0.9
	18650	13.5	3.3	12.7	4.0	-0.8	0.7
	18475	12.6	2.9	11.6	3.1	-1.0	0.2
	18290	12.9	3.0	12.1	3.3	-0.8	0.3
	18025	2.8	2.8	2.8	2.8	0.0	0.0
	17785	3.0	3.0	3.0	3.0	0.0	0.0
SRD3	17510	4.6	4.6	3.6	3.6	-1.0	-1.0
	17360	5.9	5.9	5.9	5.9	0.0	0.0
	17110	8.4	8.4	8.7	8.7	0.3	0.3
	16970	8.8	8.8	8.8	8.8	0.0	0.0
	16720	6.5	6.5	6.6	6.6	0.1	0.1
	16515	6.8	6.8	7.1	7.1	0.3	0.3
	16305	7.1	6.8	3.8	3.8	-3.3	-3.0
	16130	6.0	5.5	5.3	5.3	-0.7	-0.2
	15960	6.1	5.4	6.2	6.2	0.1	0.8
	15745	4.5	3.6	4.0	4.0	-0.5	0.4
	15540	4.6	3.6	3.5	3.5	-1.1	-0.1
	15335	5.1	4.2	5.5	5.5	0.4	1.3
SRE1	15125	5.5	5.5	23.7	23.7	18.2	18.2
	14900	4.9	4.9	6.9	6.9	2.0	2.0
	14720	6.0	5.8	6.5	6.4	0.5	0.6
	14480	5.0	4.7	6.5	6.4	1.5	1.7
	14315	5.2	5.0	5.0	4.6	-0.2	-0.4
	14090	4.7	4.6	4.9	4.8	0.2	0.2
	13850	5.4	5.3	4.3	4.2	-1.1	-1.1
	13635	5.2	5.2	5.3	5.2	0.1	0.0
	13425	6.3	6.0	6.2	5.9	-0.1	-0.1
	13190	4.3	4.0	4.3	4.0	0.0	0.0
SRE2	13030	4.9	4.7	4.9	4.7	0.0	0.0
	12835	4.4	4.4	4.4	4.4	0.0	0.0
	12615	4.1	4.1	4.1	4.1	0.0	0.0
	12395	4.0	4.0	4.0	4.0	0.0	0.0
	12195	3.5	3.5	3.5	3.5	0.0	0.0
	11995	4.2	4.2	4.2	4.2	0.0	0.0
	11780	4.1	4.1	4.1	4.1	0.0	0.0
	11605	4.7	4.7	4.6	4.6	-0.1	-0.1
	11405	4.3	4.3	4.3	4.3	0.0	0.0
	11180	5.7	5.7	5.7	5.7	0.0	0.0
SRE3	11015	6.9	6.9	6.9	6.9	0.0	0.0
	10835	7.4	7.4	7.4	7.4	0.0	0.0
	10575	5.7	5.7	5.7	5.7	0.0	0.0
	10390	6.4	6.4	6.4	6.4	0.0	0.0
	10225	6.3	6.3	6.3	6.3	0.0	0.0
	10000	5.0	5.0	5.0	5.0	0.0	0.0
	9820	6.7	6.7	6.7	6.7	0.0	0.0
	9595	4.9	4.9	4.9	4.9	0.0	0.0
	9385	5.5	5.4	5.5	5.4	0.0	0.0
	9220	5.8	5.6	5.8	5.6	0.0	0.0
	9025	5.5	5.4	5.5	5.4	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 represent 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 5.2 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. 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. The figure shows that total bed degradation on the outside bank of curved reaches ranges from approximately -6.9 to -19.7 feet in the existing condition at sections 38710/13030 and section 24795, respectively. In the proposed condition, total bed degradation outside of curved reaches range from approximately -6.7 to -26.1 feet at section 38710 and section 15125, respectively. In straight and inside bank of curved reaches in the existing condition, total degradation ranges from -6.2 to -15.4 feet at section 38710 and section 43820, respectively. In straight and inside of curved reaches in the proposed condition, total degradation ranges from -6.7 feet at multiple sections to -26.2 feet at section 15125, respectively. The largest adjustment for both conditions is in the vicinity of the Grande and Portrero confluences. The existing and proposed conditions closely match ($\Delta \leq 1.0$) at all subreaches except at SRC2, SRC4, and SRD2 where the proposed condition total adjustment is shallower than that in the existing condition, and at SRB1 and SRE1 where the proposed condition total adjustment is deeper than the existing condition. In the cases of SRB1 and SRE1, the total degradation in the proposed condition is deeper due to proposed bridges at these locations. In the other cases where total degradation in the existing condition is deeper, general adjustment and other components differ significantly between the existing and proposed conditions. It is important to note that the total toe-down is primarily a function of the large other components, which greatly exceed the general adjustment and long-term degradation components.

Table 7.1A: Santa Clara River Existing Conditions Outside Curved Reach Summary of Degradation Components (ft)

Subreach	US Station	Z_{DEG}	Z_{GS} (SAM)*	Z_{OTHER}	Z_{TOTAL}
SRA1	46195	-2.8	0.6	-8.3	-11.1
SRA2	43820	-8.1	0.4	-7.3	-15.4
SRA3	41280	-5.2	-0.3	-5.7	-11.1
SRA4	38710	-2.7	0.3	-4.2	-6.9
SRB1	36080	-3.2	-0.6	-5.7	-9.5
SRB2	33880	-3.4	0.0	-6.5	-10.0
SRC1	32265	-2.0	0.8	-8.2	-10.2
SRC2	29140	-4.4	-2.9	-7.8	-15.1
SRC3	26990	-2.0	-0.4	-8.1	-10.4
SRC4	24795	-2.0	0.2	-17.7	-19.7
SRD1	22195	-2.0	-0.6	-11.8	-14.3
SRD2	19855	-2.0	1.3	-14.2	-16.2
SRD3	17510	-2.0	-1.2	-4.6	-7.8
SRE1	15125	-2.0	-0.6	-5.5	-8.1
SRE2	13030	-2.0	2.3	-4.9	-6.9
SRE3	11015	-2.0	-1.4	-6.9	-10.3

*Positive values in Z_{GS} represent aggradation

Table 7.1B: Santa Clara River Proposed Conditions Outside Curved Reach Summary of Degradation Components (ft)

Subreach	US Station	Z_{DEG}	Z_{GS} (SAM)*	Z_{OTHER}	Z_{TOTAL}
SRA1	46195	-2.8	0.6	-8.3	-11.1
SRA2	43820	-8.1	0.2	-7.3	-15.4
SRA3	41280	-5.2	-0.1	-5.6	-11.0
SRA4	38710	-2.7	0.1	-4.0	-6.7
SRB1	36080	-3.2	-0.7	-19.1	-23.0
SRB2	33880	-3.4	0.2	-6.9	-10.3
SRC1	32265	-2.0	0.8	-7.9	-9.9
SRC2	29140	-4.4	-1.6	-4.4	-10.4
SRC3	26990	-2.0	-1.3	-7.9	-11.1
SRC4	24795	-2.0	0.2	-10.3	-12.3
SRD1	22195	-2.0	-0.2	-11.1	-13.4
SRD2	19855	-2.0	1.4	-12.5	-14.5
SRD3	17510	-2.0	-1.3	-3.6	-6.9
SRE1	15125	-2.0	-0.4	-23.7	-26.2
SRE2	13030	-2.0	2.1	-4.9	-6.9
SRE3	11015	-2.0	-1.5	-6.9	-10.4

*Positive values in Z_{GS} represent aggradation

Table 7.1C: Santa Clara River Existing Conditions Straight-Inside Curved Reach Summary of Degradation Components (ft)

Subreach	US Station	Z_{DEG}	Z_{GS} (SAM)*	Z_{OTHER}	Z_{TOTAL}
SRA1	46195	-2.8	0.6	-8.3	-11.1
SRA2	43820	-8.1	0.4	-7.3	-15.4
SRA3	41280	-5.2	-0.3	-5.7	-11.1
SRA4	38710	-2.7	0.3	-3.5	-6.2
SRB1	36080	-3.2	-0.6	-4.1	-7.9
SRB2	33880	-3.4	0.0	-5.3	-8.8
SRC1	32265	-2.0	0.8	-5.8	-7.8
SRC2	29140	-4.4	-2.9	-3.4	-10.6
SRC3	26990	-2.0	-0.4	-7.6	-9.9
SRC4	24795	-2.0	0.2	-6.9	-8.9
SRD1	22195	-2.0	-0.6	-4.7	-7.3
SRD2	19855	-2.0	1.3	-6.3	-8.3
SRD3	17510	-2.0	-1.2	-4.6	-7.8
SRE1	15125	-2.0	-0.6	-5.5	-8.1
SRE2	13030	-2.0	2.3	-4.7	-6.7
SRE3	11015	-2.0	-1.4	-6.9	-10.3

*Positive values in Z_{GS} represent aggradation

Table 7.1D: Santa Clara River Proposed Conditions Straight-Inside Curved Reach Summary of Degradation Components (ft)

Subreach	US Station	Z_{DEG}	Z_{GS} (SAM)*	Z_{OTHER}	Z_{TOTAL}
SRA1	46195	-2.8	0.6	-8.3	-11.1
SRA2	43820	-8.1	0.2	-7.3	-15.4
SRA3	41280	-5.2	-0.1	-5.6	-11.0
SRA4	38710	-2.7	0.1	-4.0	-6.7
SRB1	36080	-3.2	-0.7	-18.2	-22.1
SRB2	33880	-3.4	0.2	-5.7	-9.1
SRC1	32265	-2.0	0.8	-5.4	-7.4
SRC2	29140	-4.4	-1.6	-3.1	-9.2
SRC3	26990	-2.0	-1.3	-7.7	-11.0
SRC4	24795	-2.0	0.2	-4.7	-6.7
SRD1	22195	-2.0	-0.2	-4.5	-6.7
SRD2	19855	-2.0	1.4	-7.1	-9.1
SRD3	17510	-2.0	-1.3	-3.6	-6.9
SRE1	15125	-2.0	-0.4	-23.7	-26.2
SRE2	13030	-2.0	2.1	-4.7	-6.7
SRE3	11015	-2.0	-1.5	-6.9	-10.4

*Positive values in Z_{GS} represent aggradation

Figure 7.2A-D presents a comparison of total bed adjustment for the summed methodology, presented previously, 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

Figure 7.1A: Santa Clara River Existing Conditions Outside Curved Reach Summary of Degradation Components

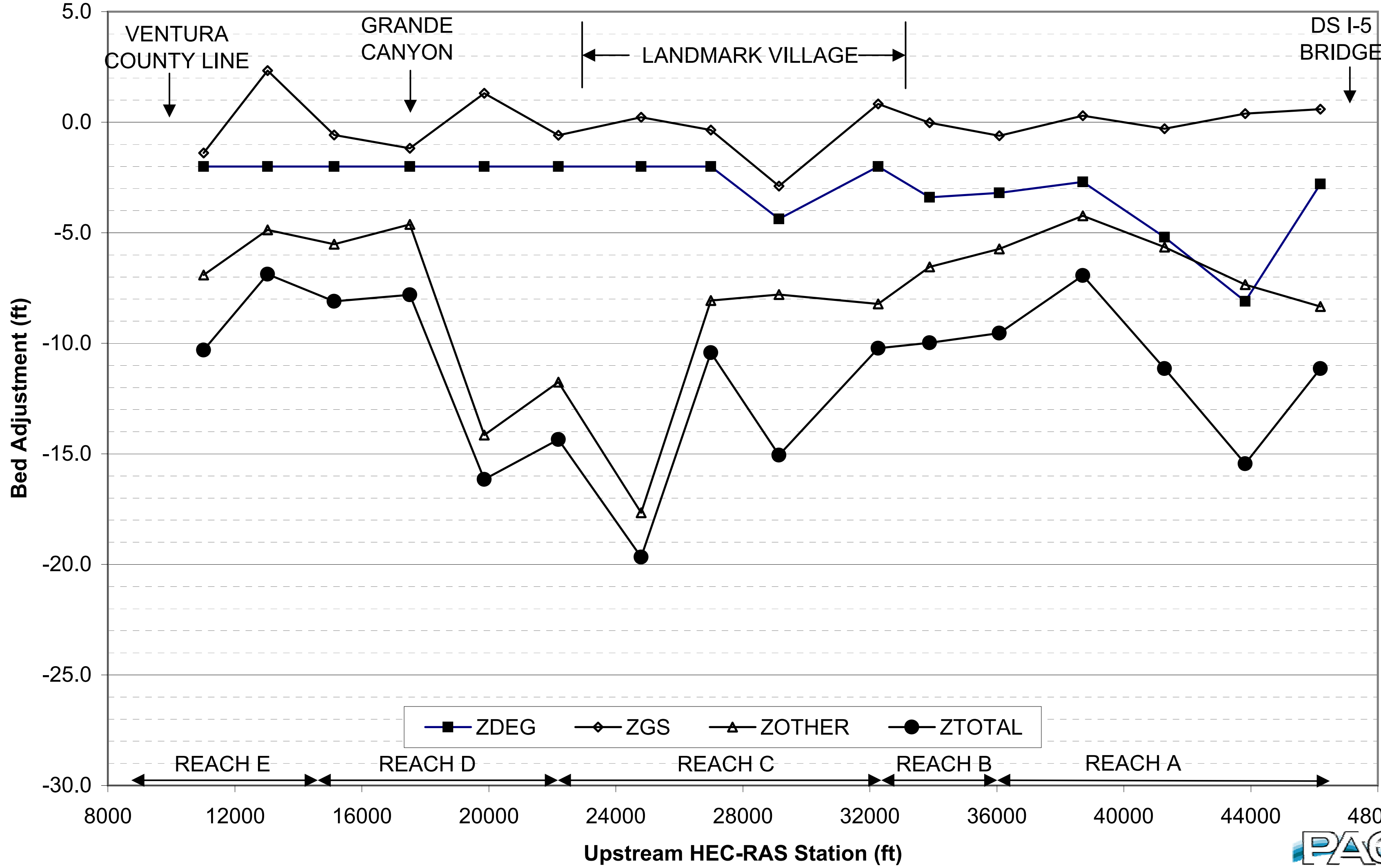

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Figure 7.1B: Santa Clara River Proposed Conditions Outside Curved Reach Summary of Degradation Components

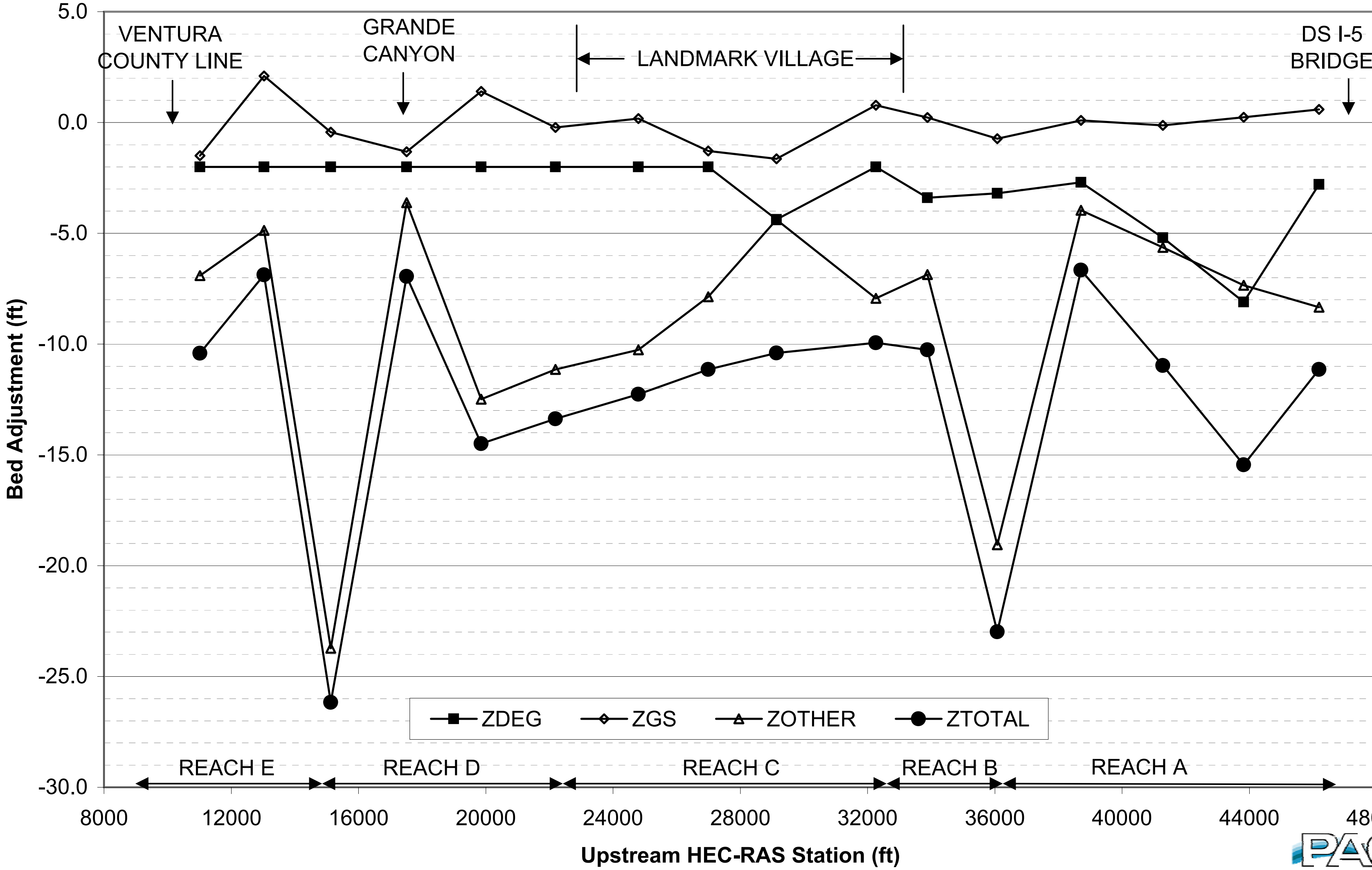

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Figure 7.1C: Santa Clara River Existing Conditions Straight-Inside Curved Reach Summary of Degradation Components

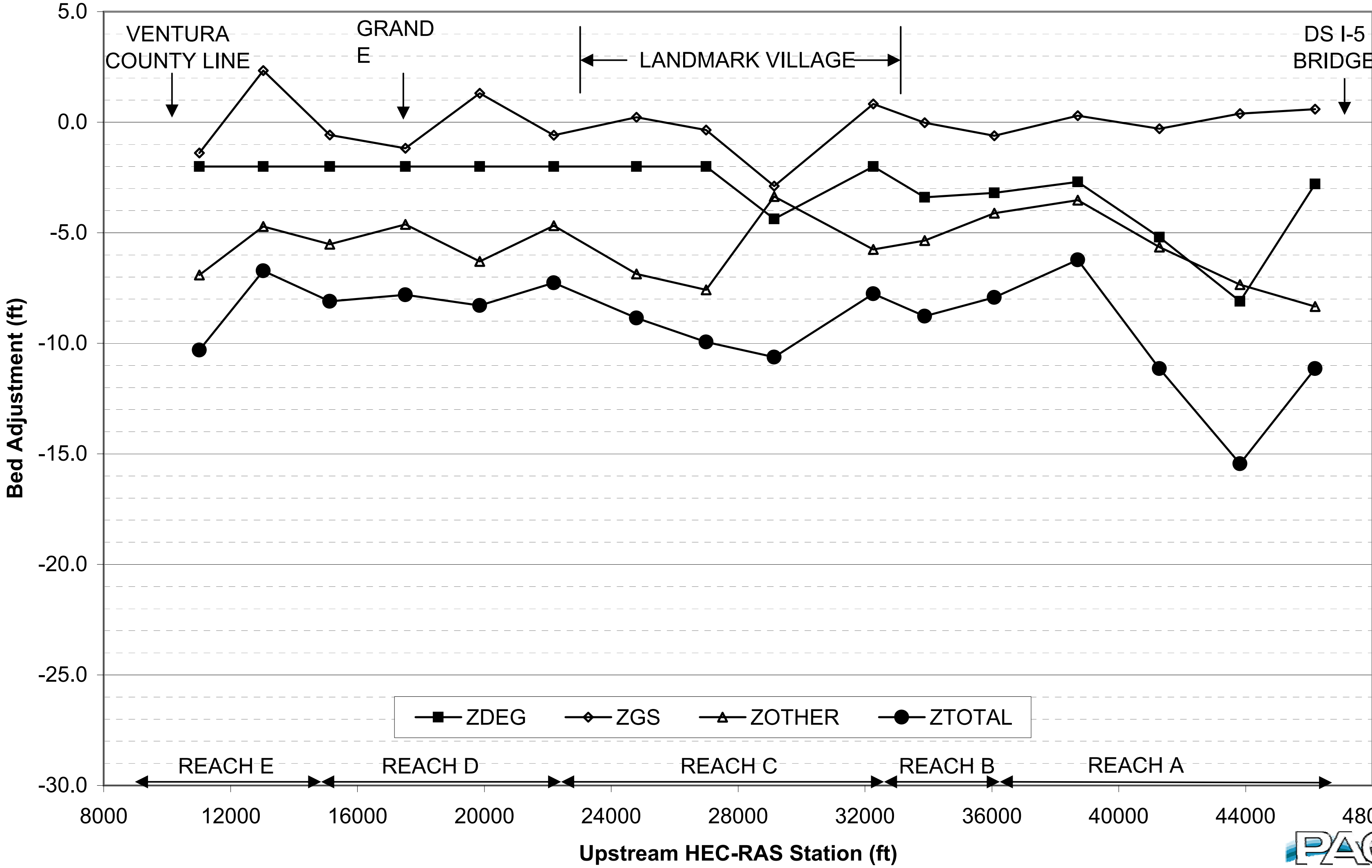

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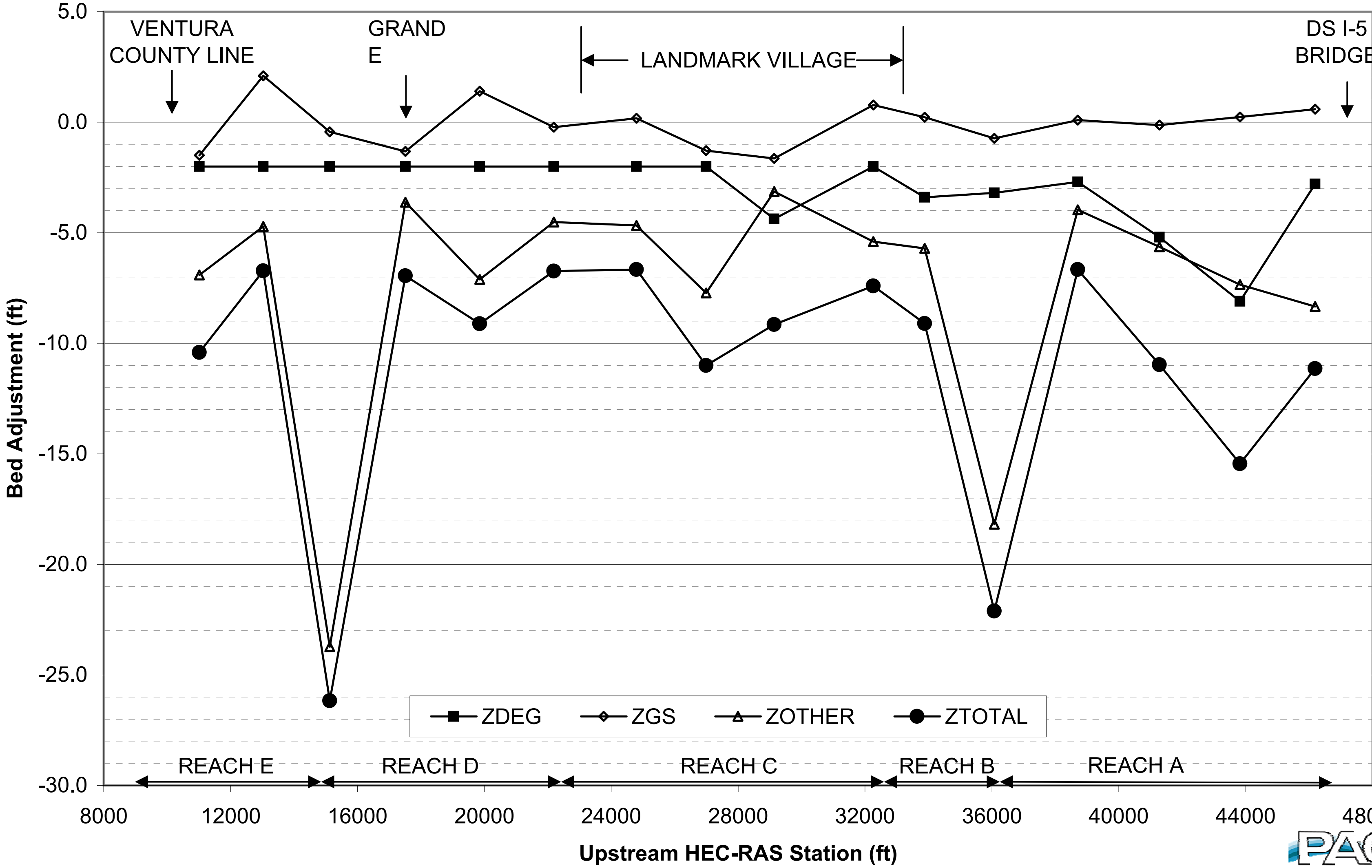
Figure 7.1D: Santa Clara River Proposed Conditions Straight-Inside Curved Reach Summary of Degradation Components



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LACFCDDM is the most conservative among all total scour methodologies. Figure 7.2A-D shows that the more intensive LACH&SM methodology generally predicts a shallower toe-down in both the existing and proposed conditions than does the LACFCDDM methodology for most sections. At section 43820, LACH&SM predicts 1.4 feet deeper toe-down than does the LACFCDDM for both existing and proposed conditions and outside of curved and straight or inside of curved reaches because of very high long-term adjustment. At section 29140 in straight or inside of curved reaches for both existing and proposed conditions, LACH&SM predicts 0.6 and 1.2 feet, respectively, deeper toe-down than does the LACFCDDM because of higher long-term adjustment combined with moderate bedform height in this reach. At section 36080 and section 15125 in the proposed condition, LACH&SM predicts more than 10 feet deeper toe-down than does LACFCDDM due to proposed bridges at these locations. 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-D shows the 1999 (model) minimum bed elevation as previously discussed in Chapter 4, the existing bed minimum elevation (2005), and the calculated project toe-down from Figure 7.2A-D. Figure 7.3A-D shows that the calculated toe-down is below the 1999 model and existing 2005 minimum bed elevation at every section examined by approximately 6 to 26 feet, depending on the section.

Table 7.2A: Santa Clara River Existing Conditions Outside Curved Reach Toe-down Summary by Methodology (ft)

Subreach	US Station	HEC-RAS Model (1999) Elevation	LACH&SM (SAM)	LACH&SM Toe-down Elevation	LACFCDDM	LACFCDDM Toe-down Elevation	Δ (LACH&SM-LACFCDDM)
SRA1	46195	1034.6	-11.1	1023.4	-14.0	1020.6	2.9
SRA2	43820	1018.0	-15.4	1002.6	-14.0	1004.0	-1.4
SRA3	41280	1002.0	-11.1	990.9	-12.5	989.5	1.4
SRA4	38710	988.0	-6.9	981.1	-15.0	973.0	8.1
SRB1	36080	973.2	-9.5	963.6	-15.0	958.2	5.5
SRB2	33880	960.0	-10.0	950.0	-18.0	942.0	8.0
SRC1	32265	951.4	-10.2	941.2	-18.0	933.4	7.8
SRC2	29140	932.0	-15.1	916.9	-15.0	917.0	-0.1
SRC3	26990	920.0	-10.4	909.6	-21.0	899.0	10.6
SRC4	24795	908.0	-19.7	888.3	-21.0	887.0	1.3
SRD1	22195	894.0	-14.3	879.7	-15.0	879.0	0.7
SRD2	19855	880.1	-16.2	863.9	-18.0	862.1	1.8
SRD3	17510	868.0	-7.8	860.2	-10.0	858.0	2.2
SRE1	15125	854.0	-8.1	845.9	-12.5	841.5	4.4
SRE2	13030	843.3	-6.9	836.4	-15.0	828.3	8.1
SRE3	11015	832.0	-10.3	821.7	-14.0	818.0	3.7

Table 7.2B: Santa Clara River Proposed Conditions Outside Curved Reach Toe-down Summary by Methodology (ft)

Subreach	US Station	HEC-RAS Model (1999) Elevation	LACH&SM (SAM)	LACH&SM Toe-down Elevation	LACFCDDM	LACFCDDM Toe-down Elevation	Δ (LACH&SM-LACFCDDM)
SRA1	46195	1034.6	-11.1	1023.4	-14.0	1020.6	2.9
SRA2	43820	1018.0	-15.4	1002.6	-14.0	1004.0	-1.4
SRA3	41280	1002.0	-11.0	991.0	-12.5	989.5	1.5
SRA4	38710	988.0	-6.7	981.3	-10.0	978.0	3.3
SRB1	36080	973.2	-23.0	950.2	-15.0	958.2	-8.0
SRB2	33880	960.0	-10.3	949.7	-18.0	942.0	7.7
SRC1	32265	951.4	-9.9	941.4	-18.0	933.4	8.1
SRC2	29140	932.0	-10.4	921.6	-12.0	920.0	1.6
SRC3	26990	920.0	-11.1	908.9	-21.0	899.0	9.9
SRC4	24795	908.0	-12.3	895.7	-15.0	893.0	2.7
SRD1	22195	894.0	-13.4	880.6	-15.0	879.0	1.6
SRD2	19855	880.1	-14.5	865.6	-21.0	859.1	6.5
SRD3	17510	868.0	-6.9	861.1	-10.0	858.0	3.1
SRE1	15125	854.0	-26.2	827.8	-12.5	841.5	-13.7
SRE2	13030	843.3	-6.9	836.4	-15.0	828.3	8.1
SRE3	11015	832.0	-10.4	821.6	-14.0	818.0	3.6

Table 7.2C: Santa Clara River Existing Conditions Straight-Inside Curved Reach Toe-down Summary by Methodology (ft)

Subreach	US Station	HEC-RAS Model (1999) Elevation	LACH&SM (SAM)	LACH&SM Toe-down Elevation	LACFCDDM	LACFCDDM Toe-down Elevation	Δ (LACH&SM-LACFCDDM)
SRA1	46195	1034.6	-11.1	1023.4	-14.0	1020.6	2.9
SRA2	43820	1018.0	-15.4	1002.6	-14.0	1004.0	-1.4
SRA3	41280	1002.0	-11.1	990.9	-12.5	989.5	1.4
SRA4	38710	988.0	-6.2	981.8	-10.0	978.0	3.8
SRB1	36080	973.2	-7.9	965.3	-10.0	963.2	2.1
SRB2	33880	960.0	-8.8	951.2	-12.5	947.5	3.7
SRC1	32265	951.4	-7.8	943.6	-12.5	938.9	4.7
SRC2	29140	932.0	-10.6	921.4	-10.0	922.0	-0.6
SRC3	26990	920.0	-9.9	910.1	-14.0	906.0	4.1
SRC4	24795	908.0	-8.9	899.1	-14.0	894.0	5.1
SRD1	22195	894.0	-7.3	886.7	-10.0	884.0	2.7
SRD2	19855	880.1	-8.3	871.8	-12.5	867.6	4.2
SRD3	17510	868.0	-7.8	860.2	-10.0	858.0	2.2
SRE1	15125	854.0	-8.1	845.9	-12.5	841.5	4.4
SRE2	13030	843.3	-6.7	836.5	-10.0	833.3	3.3
SRE3	11015	832.0	-10.3	821.7	-14.0	818.0	3.7

Figure 7.2A: Santa Clara River Existing Conditions Outside Curved Reach Toe-down Depths by Methodology

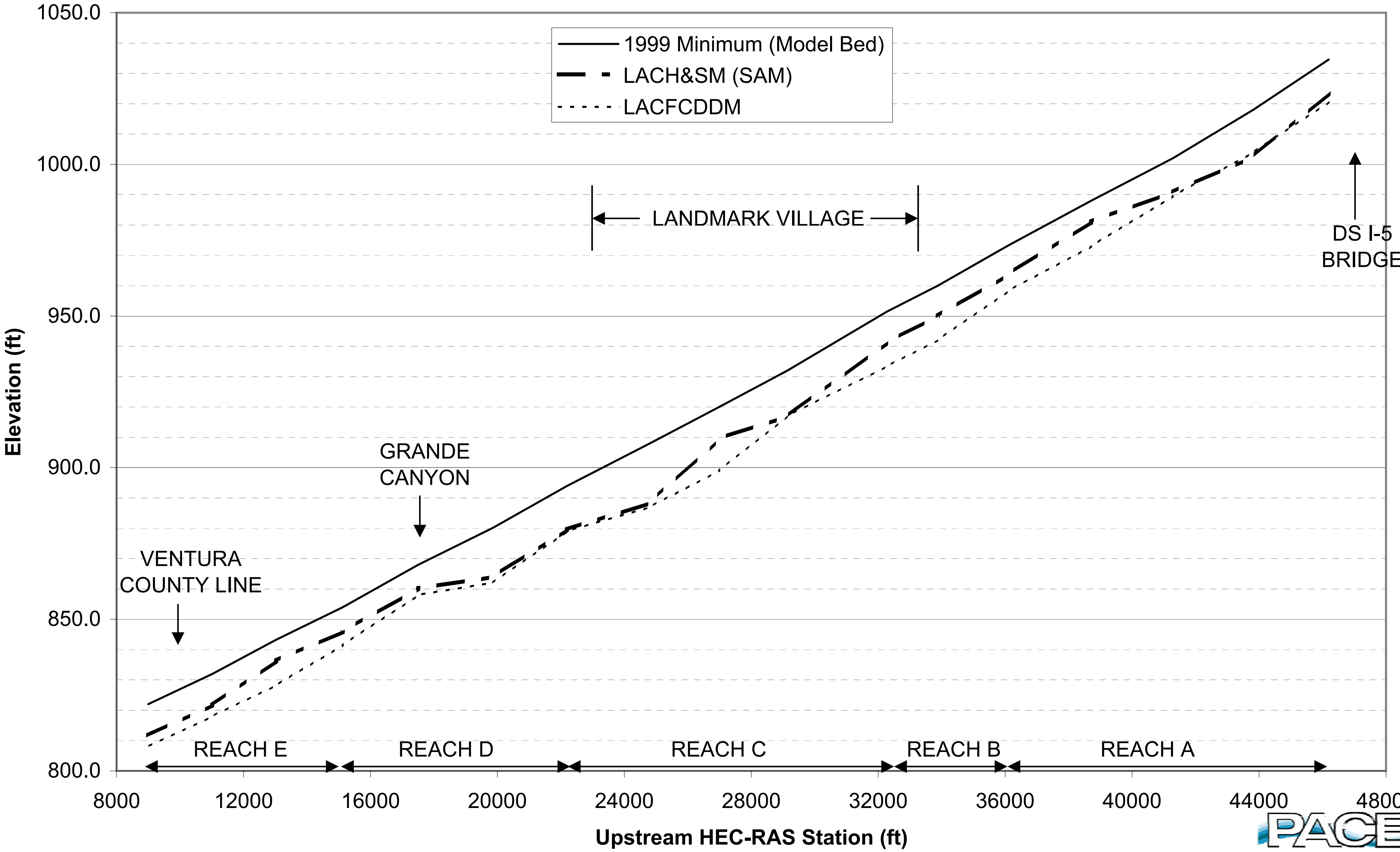

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Figure 7.2B: Santa Clara River Proposed Conditions Outside Curved Reach Toe-down Depths by Methodology

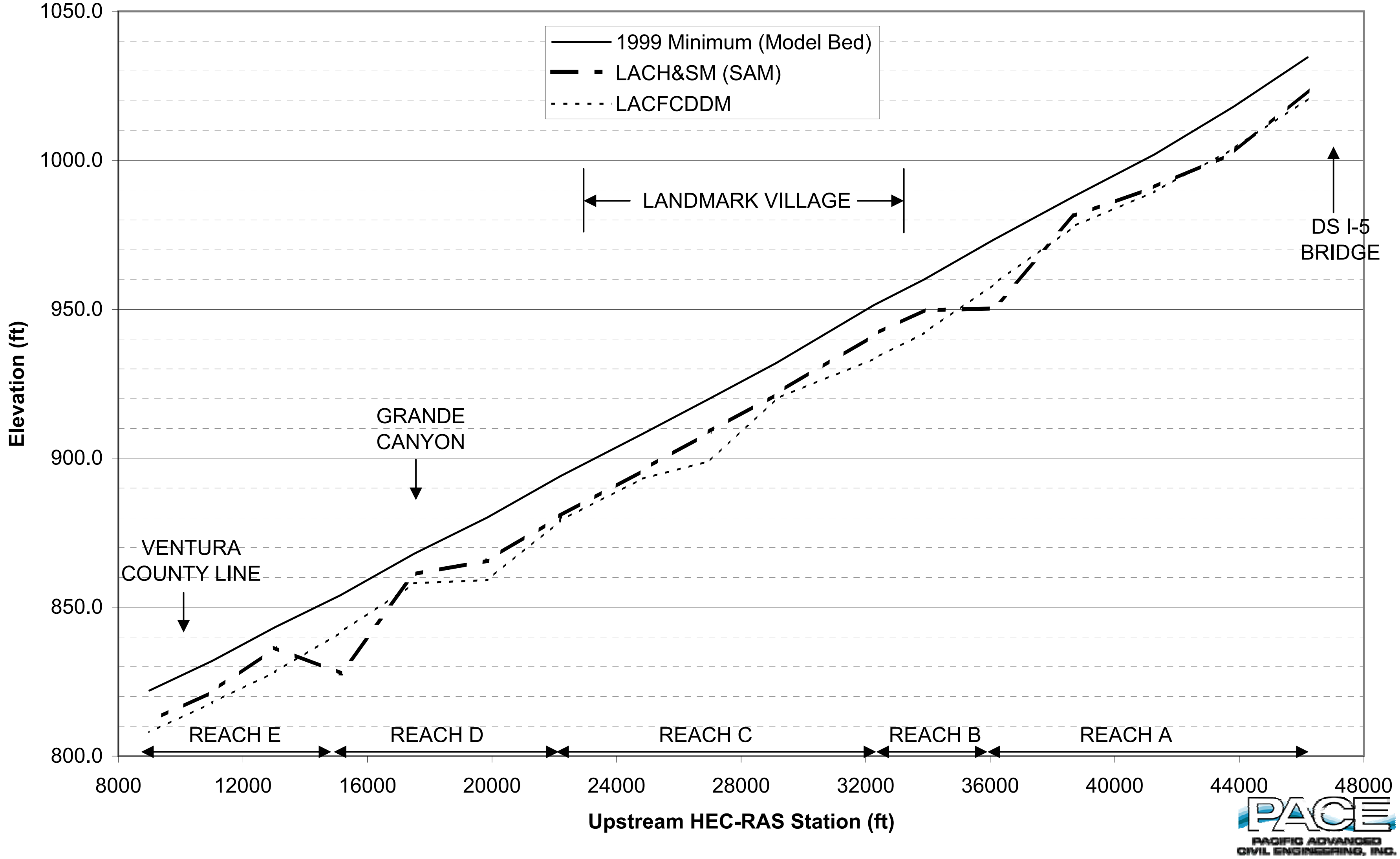

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Figure 7.2C: Santa Clara River Existing Conditions Straight-Inside Curved Reach Toe-down Depths by Methodology

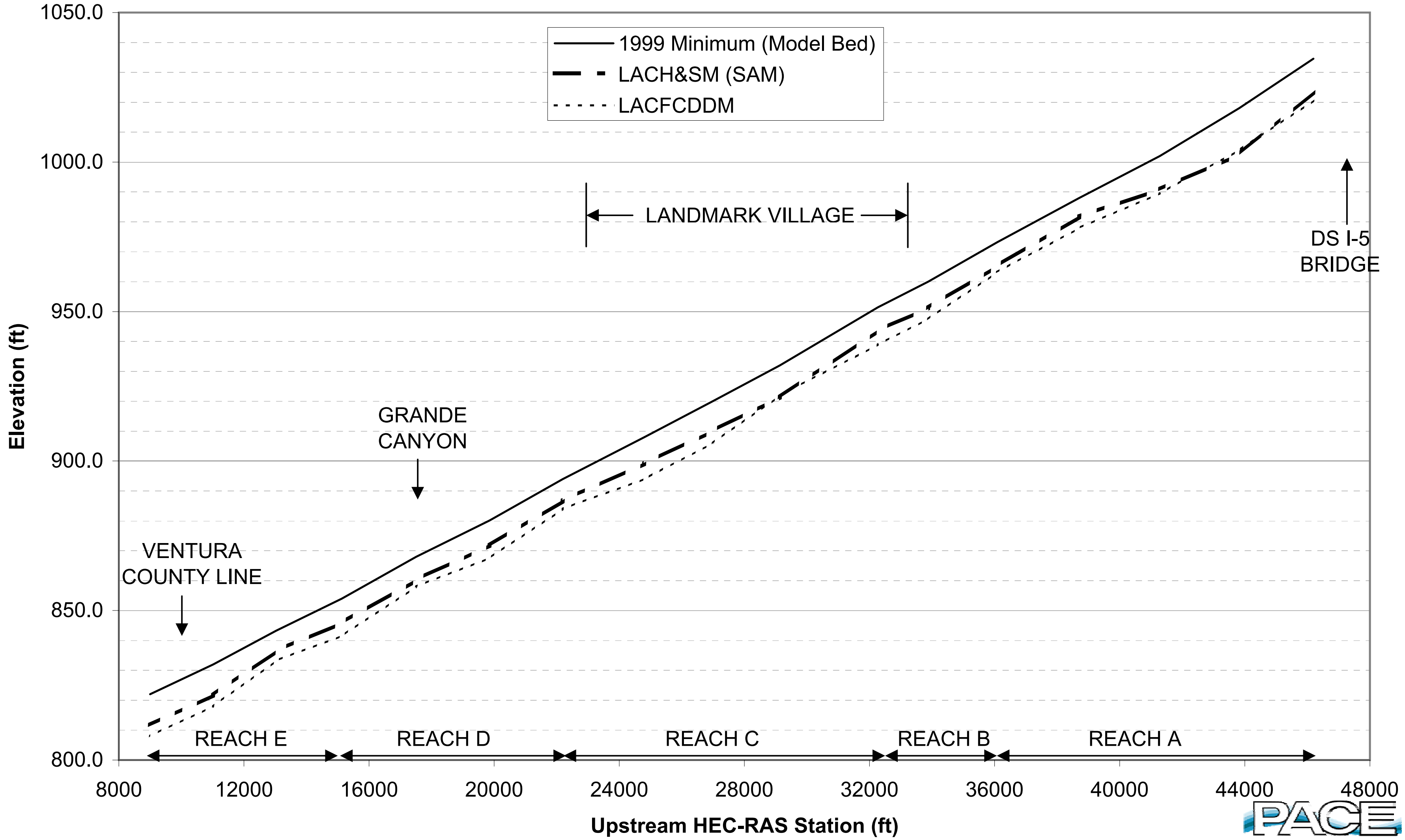

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Figure 7.2D: Santa Clara River Proposed Conditions Straight-Inside Curved Reach Toe-down Depths by Methodology

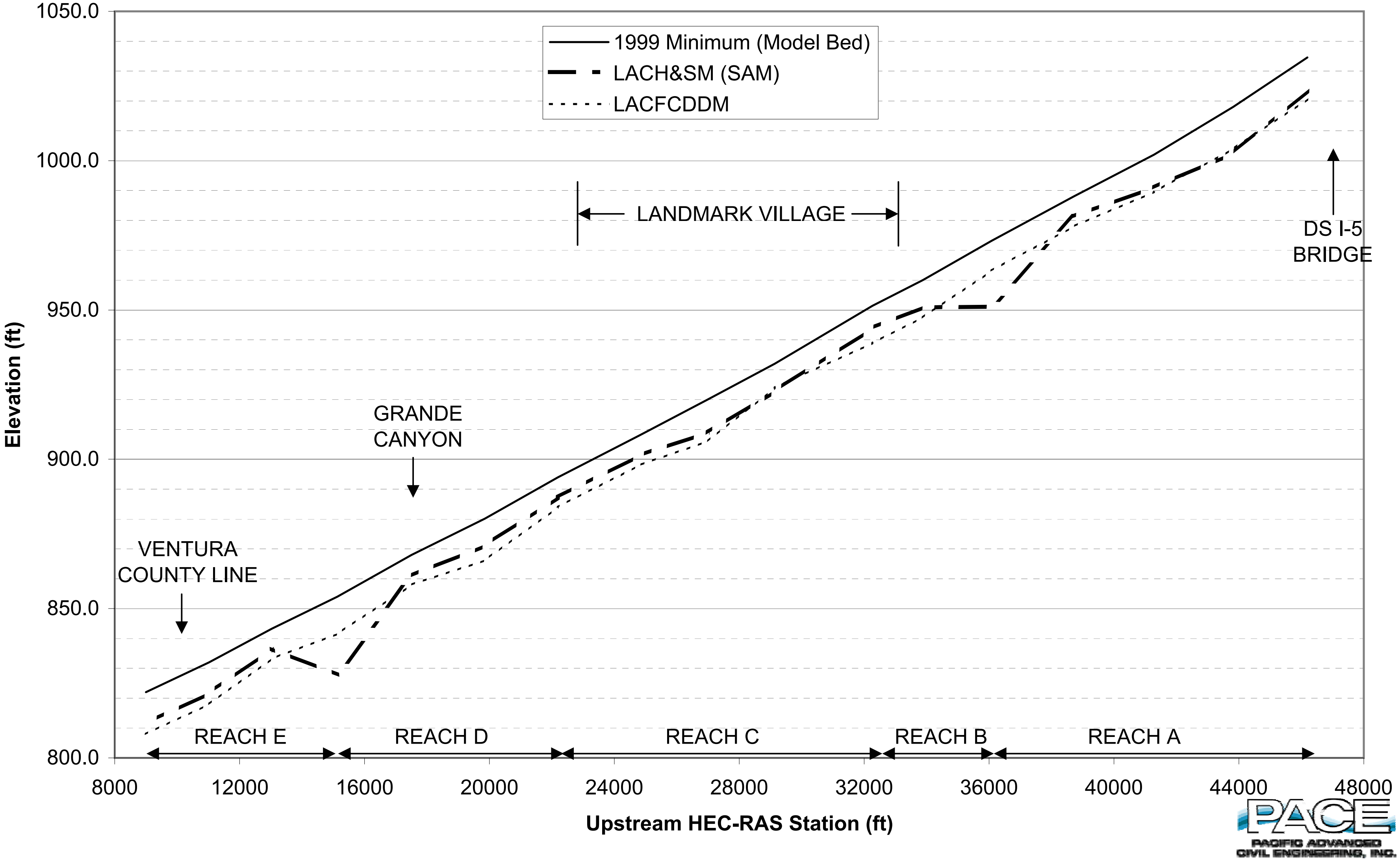

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Figure 7.3A: Santa Clara River Outside Curved Reach Existing, Historic Minimum, and Existing Conditions Toe-down Elevation

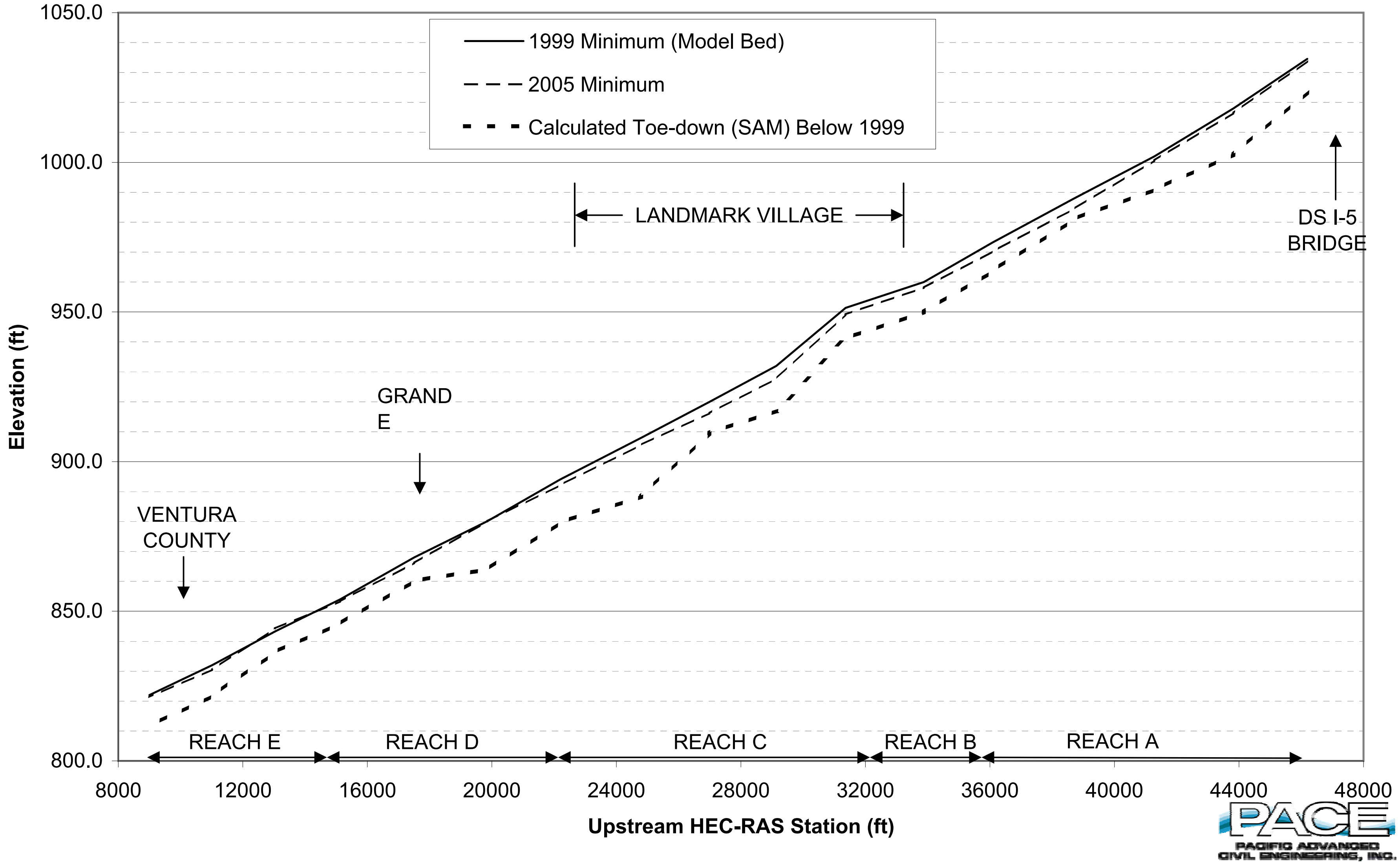

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Figure 7.3B: Santa Clara River Outside Curved Reach Existing, Historic Minimum, and Proposed Conditions Toe-down Elevation

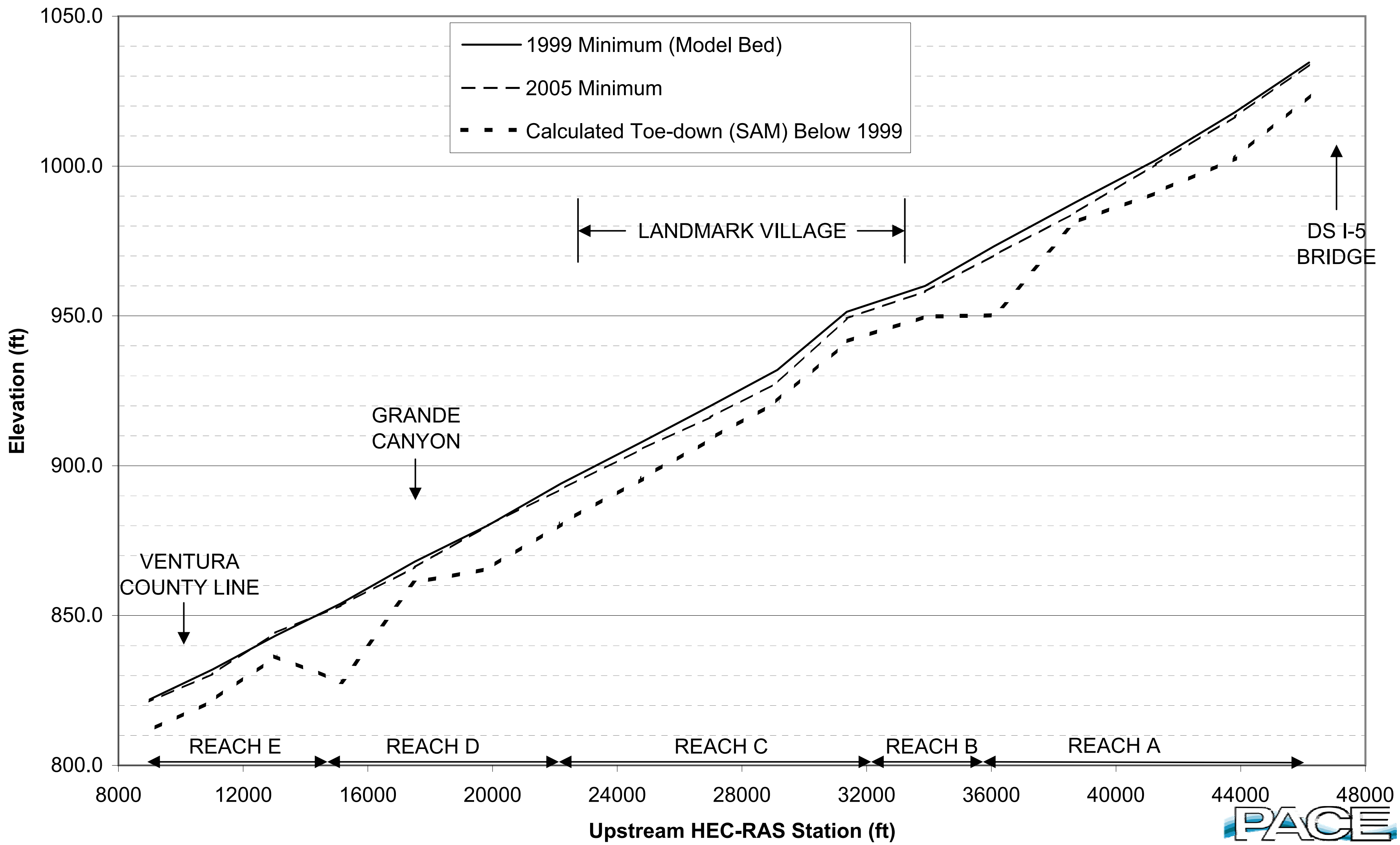

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Figure 7.3C: Santa Clara River Straight-Inside Curved Reach Existing, Historic Minimum, and Existing Conditions Toe-down Elevation

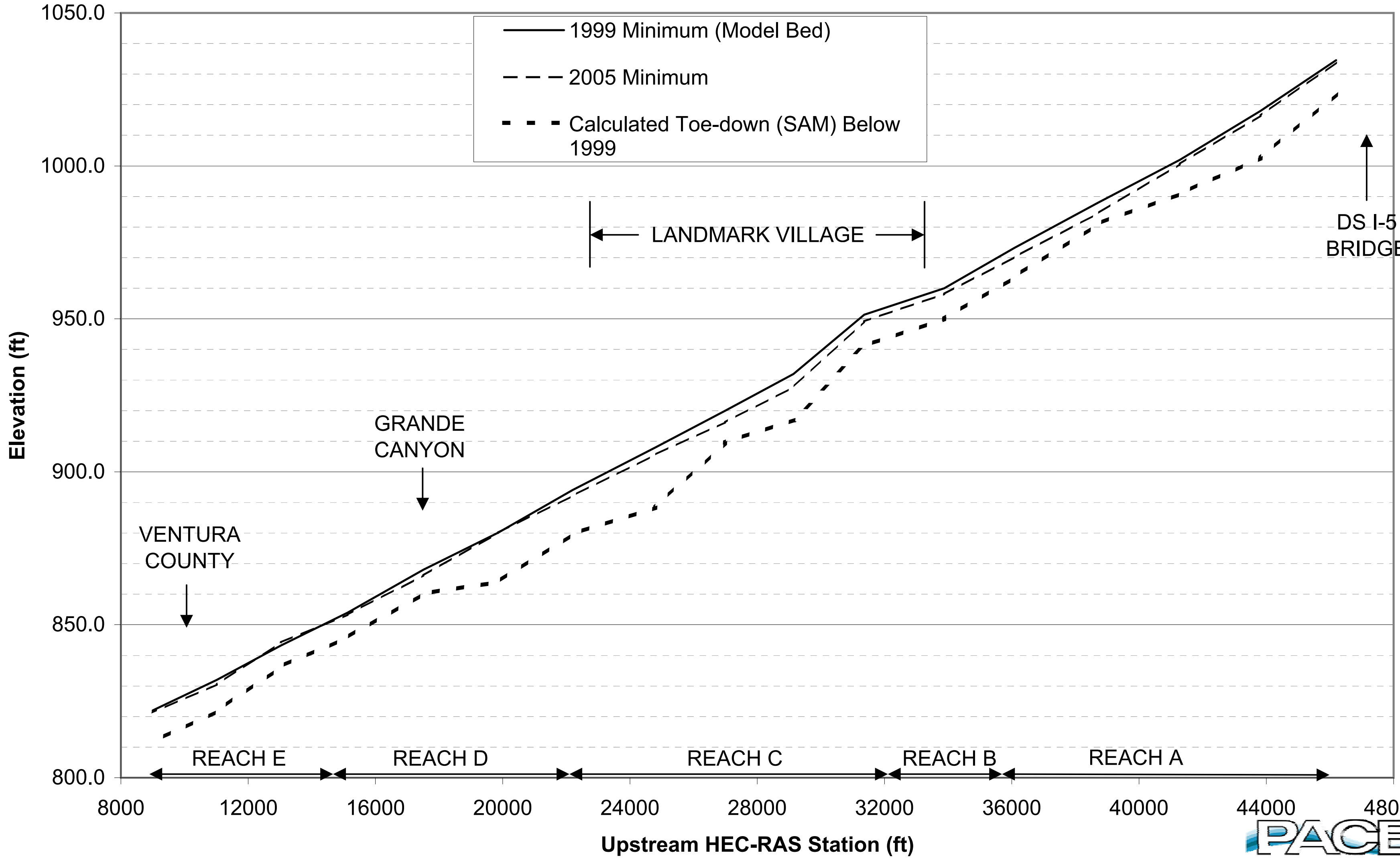

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Figure 7.3D: Santa Clara River Straight-Inside Curved Reach Existing, Historic Minimum, and Proposed Conditions Toe-down Elevation

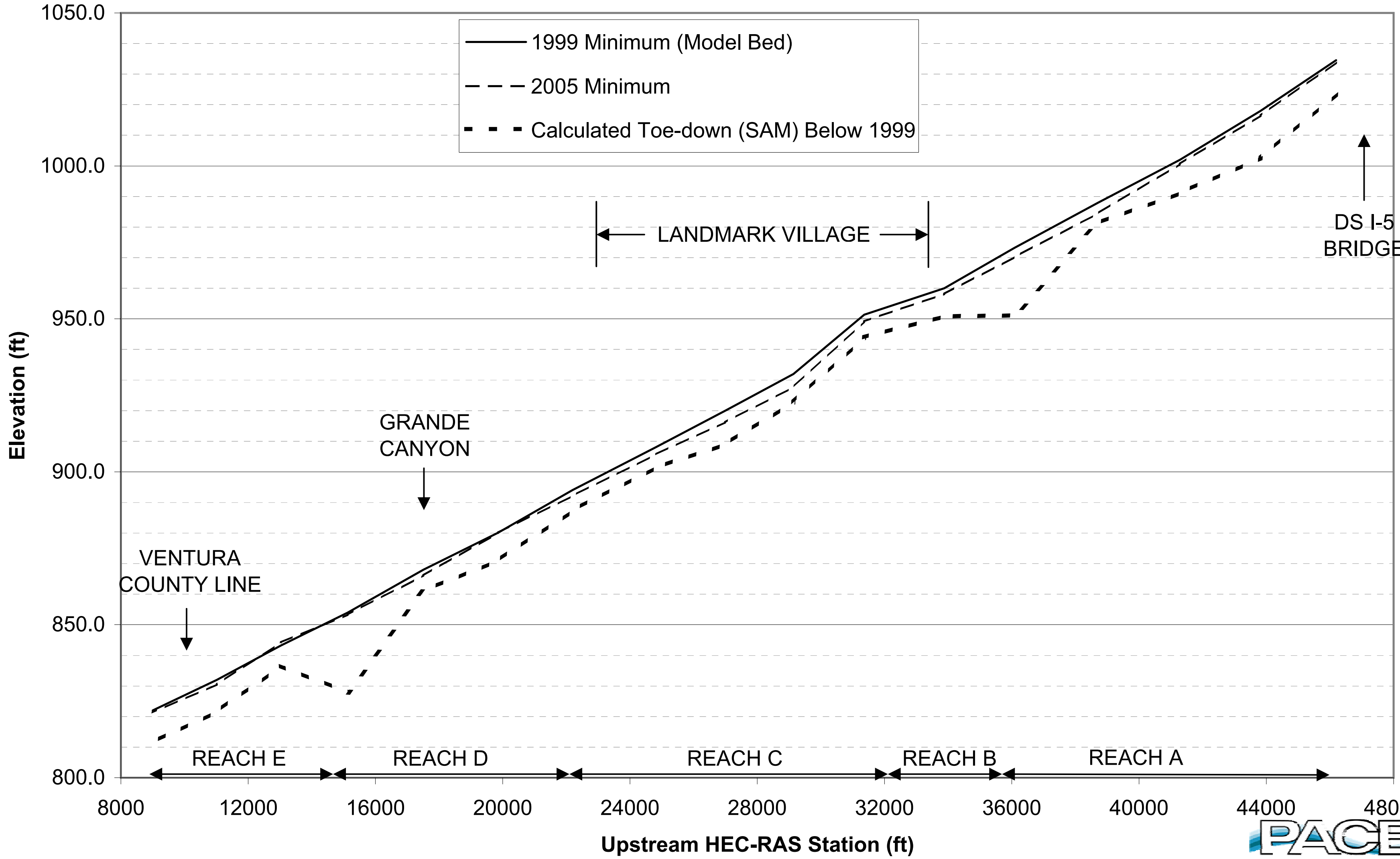

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Table 7.2D: Santa Clara River Proposed Conditions Straight-Inside Curved Reach Toe-down Summary by Methodology (ft)

Subreach	US Station	HEC-RAS Model (1999) Elevation	LACH&SM (SAM)	LACH&SM Toe-down Elevation	LACFCDDM	LACFCDDM Toe-down Elevation	Δ (LACH&SM-LACFCDDM)
SRA1	46195	1034.6	-11.1	1023.4	-14.0	1020.6	2.9
SRA2	43820	1018.0	-15.4	1002.6	-14.0	1004.0	-1.4
SRA3	41280	1002.0	-11.0	991.0	-12.5	989.5	1.5
SRA4	38710	988.0	-6.7	981.3	-10.0	978.0	3.3
SRB1	36080	973.2	-22.1	951.1	-10.0	963.2	-12.1
SRB2	33880	960.0	-9.1	950.9	-12.5	947.5	3.4
SRC1	32265	951.4	-7.4	944.0	-12.5	938.9	5.1
SRC2	29140	932.0	-9.2	922.8	-8.0	924.0	-1.2
SRC3	26990	920.0	-11.0	909.0	-14.0	906.0	3.0
SRC4	24795	908.0	-6.7	901.3	-10.0	898.0	3.3
SRD1	22195	894.0	-6.7	887.3	-10.0	884.0	3.3
SRD2	19855	880.1	-9.1	871.0	-14.0	866.1	4.9
SRD3	17510	868.0	-6.9	861.1	-10.0	858.0	3.1
SRE1	15125	854.0	-26.2	827.8	-12.5	841.5	-13.7
SRE2	13030	843.3	-6.7	836.5	-10.0	833.3	3.3
SRE3	11015	832.0	-10.4	821.6	-14.0	818.0	3.6

Previous studies presented in Chapter 2 found that a toe-down of 12.5 feet would be required for adequate protection of structures within the sphere of the river bed. The results of this study, however, suggest that a variable toe-down from approximately 5 to 27 feet based on SAM modeling, or 8 to 21 feet based on LACFCDDM is appropriate. A large portion of this difference can be attributed to the difference in other adjustment, which in this study was as much as 17.4 feet.

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 bedform 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 Chapter 6.2. 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. Table 7.3A-B summarizes the freeboard calculations for both outside of curved reaches and inside of curved or straight reaches. The table shows that long-term aggradation is generally set to one foot. General aggradation ranges from 0 to 2.1 feet with the maximum general aggradation occurring in subreach SRE2. In all cases, either long-term aggradation or bedform height accounts for the largest component of freeboard except in subreach SRD2 and SRE2 where general adjustment dominates. The table also compares the freeboard based on LACH&SM and LACFCDDM methodologies. At the majority of locations, the LACFCDDM values are more conservative and the maximum calculated freeboard based on the two methodologies range from 2.5 to 5.2 feet for either type of reaches.

Table 7.3A: Santa Clara River Proposed Conditions Outside Curved Reach Freeboard Summary (ft)

Subreach	HEC-RAS Station	Y_{AGG}+	Y_{GA}+	Y_{SE}+	H/2	$Y_{H\&SM}$	Y_{DM}	Y_{MAX}
SRA1	46195	1.0	0.6	0.0	1.5	3.1	2.5	3.1
SRA2	43820	1.0	0.2	0.0	2.7	3.9	2.5	3.9
SRA3	41280	1.0	0.0	0.1	1.0	2.1	2.5	2.5
SRA4	38710	1.0	0.1	0.0	0.9	2.0	2.5	2.5
SRB1	36080	1.0	0.0	0.0	0.8	1.9	2.5	2.5
SRB2	33880	1.0	0.2	0.1	0.7	2.0	2.5	2.5
SRC1	32265	1.0	0.8	0.0	0.4	2.2	2.5	2.5
SRC2	29140	1.0	0.0	0.0	0.8	1.9	2.5	2.5
SRC3	26990	1.0	0.0	0.1	1.2	2.3	2.5	2.5
SRC4	24795	1.9	0.2	0.3	1.3	3.7	2.5	3.7
SRD1	22195	1.4	0.0	0.3	0.8	2.4	2.5	2.5
SRD2	19855	1.0	1.4	0.1	0.5	3.0	2.5	3.0
SRD3	17510	1.0	0.0	0.0	0.7	1.7	2.5	2.5
SRE1	15125	1.0	0.0	0.0	0.4	1.4	2.5	2.5
SRE2	13030	1.0	2.1	0.1	1.0	4.2	2.5	4.2
SRE3	11015	3.1	0.0	0.0	0.7	3.8	2.5	3.8

Table 7.3B: Santa Clara River Proposed Conditions Straight-Inside Curved Reach Freeboard Summary (ft)

Subreach	HEC-RAS Station	Y_{AGG}+	Y_{GA}+	Y_{SE}+	H/2	$Y_{H\&SM}$	Y_{DM}	Y_{MAX}
SRA1	46195	1.0	0.6	0.0	1.5	3.1	2.5	3.1
SRA2	43820	1.0	0.2	0.0	2.7	3.9	2.5	3.9
SRA3	41280	1.0	0.0	0.0	1.0	2.0	2.5	2.5
SRA4	38710	1.0	0.1	0.0	0.9	2.0	2.5	2.5
SRB1	36080	1.0	0.0	0.0	0.8	1.8	2.5	2.5
SRB2	33880	1.0	0.2	0.0	0.7	1.9	2.5	2.5
SRC1	32265	1.0	0.8	0.0	0.4	2.2	2.5	2.5
SRC2	29140	1.0	0.0	0.0	0.8	1.8	2.5	2.5
SRC3	26990	1.0	0.0	0.0	1.2	2.2	2.5	2.5
SRC4	24795	1.9	0.2	0.0	1.3	3.4	2.5	3.4
SRD1	22195	1.4	0.0	0.0	0.8	2.2	2.5	2.5
SRD2	19855	1.0	1.4	0.0	0.5	2.9	2.5	2.9
SRD3	17510	1.0	0.0	0.0	0.7	1.7	2.5	2.5
SRE1	15125	1.0	0.0	0.0	0.4	1.4	2.5	2.5
SRE2	13030	1.0	2.1	0.0	1.0	4.1	2.5	4.1
SRE3	11015	3.1	0.0	0.0	0.7	3.8	2.5	3.8

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 LACFCDDM 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.

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 of curved reaches and inside of curved or straight reaches. The table shows the maximum 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.

Reach A: Reach A is comprised of four subreaches that extend from below Interstate 5 to Commerce Center Drive. Relatively steep, narrow, winding channels lined with woody brush highlight the channel in this section of the river. The north overbank of the channel is primarily occupied by agriculture and on the south overbank is the Magic Mountain theme park and tentatively proposed development. In these subreaches, long-term degradation ranges from approximately -2 to -8 feet, with a maximum of 8.1 feet in SRA2, and it is likely that the physical parameters of the channel listed above lead to this change. SAM modeling in this reach predicts a general adjustment of -0.1 to +0.6 feet (Table 4.2) with the predominant trend in the reach being mild aggradation. Other adjustment dominates the toe-down, ranging from -4.0 to -8.3 feet for both curved and straight reaches (Table 7.1). Like the long-term adjustment, local effects are likely the result of river bed physical characteristics in this reach. One proposed bridge is located in this reach at section 36265 with a pier scour of -13.3 feet (Appendix Chapter 6.1). At section 43820, LACH&SM estimates of toe-down exceed that estimated by LACFCDDM calculations; for other sections, LACFCDDM calculations are deeper. Maximum total toe-down based on the LACH&SM and LACFCDDM methodologies ranges from -14.0 to -21.0 feet at section 40825 for outside of curved reaches (Table 8). For straight or inside of curved reaches, maximum total toe-down ranges from -10.0 to -17.0 feet at section 43610 (Table 8). Freeboard in this reach ranges from +2.5 to +4.0 feet with a maximum at section 43610 for both curved and straight reaches.

Reach B: Reach B is comprised of two subreaches. The north overbank is occupied by the existing Travel Village development and steep bluffs mark the south bank. Castaic Creek confluences at the southern terminus of the reach. Reach B is relatively narrow and steep, although it is more braided and less woody than Reach A, possibly owing to the development on the north bank. General adjustment on Reach B ranges from -0.7 to +0.2 feet (Table 4.2) and long-term adjustment ranges from -3.2 to -3.4 feet (Table 5.1). Other adjustment (Table 7.1) ranges from -6.9 to -19.1 feet for outside of curved reaches and from -5.7 to -18.2 for straight or inside of curved reaches. Like Reach A, other adjustment dominates the total potential adjustment. LACFCDDM estimates of total toe-down are greater than LACH&SM estimates in this reach. Maximum total toe-down ranges from -15.0 to -22.9 feet at section 36080 for outside of curved reaches and ranges from -10.0 to -22.0 feet at section 36080 for straight or inside of curved reaches (Table 8). Freeboard in this reach is +2.5 feet for both types of reaches.

Reach C: Reach C is comprised or four subreaches. The reach contains the confluences of Castaic Creek at its upstream end, the proposed Landmark development on the north overbank, and steep bluffs on the south bank. The channel is relatively steep and narrow, although some braiding is present in the channel. The north bank of this reach is relatively woody. Historically, the north overbank has been the location of agriculture, and some agricultural fill has been placed in the River. Long Canyon Creek confluences at the downstream terminus of this reach. General adjustment on Reach C ranges from -1.6 to +0.8 feet (Table 4.2) and generally the reach is predicted to degrade. Long-term adjustment ranges from -4.4 to +1.9 feet (Table 5.1). Other adjustment (Table 7.1) is moderate in Reach C and ranges from -4.4 to -10.3 feet for outside of curved reaches and ranges from -3.1 to -7.7 feet for straight or inside of curved reaches. A proposed bridge at section 23000 is expected to have -14.7 feet of pier scour. Maximum total toe-down ranges from -12.0 to -26.8 feet at section 22790 for outside of curved reaches and ranges from -8.0 to -23.0 at section 22790 for straight or inside of curved reaches (Table 8). Freeboard in this reach is from +2.5 to +4.8 feet for outside of curved reaches and from +2.5 to +4.7 feet for straight or inside of curved reaches with maximum freeboard at section 28895.

Reach D: Reach D is relatively flatter and wider than more upstream reaches analyzed in this study. The bank is generally braided with woody vegetation on the banks. Reach D resides between the Long and Chiquito tributaries to the east and the Grande and Potrero tributaries to the west. Historical agriculture has occupied both overbanks. Reach D is comprised of three subreaches. General adjustment on Reach D ranges from -0.4 to +0.1 feet (Table 4.2) and generally the reach is predicted to be in balance. Long-term adjustment ranges from -0.7 to +1.4 feet (Table 5.1). Other adjustment (Table 7.1) is varied in Reach D and ranges from -3.6 to -12.5 feet for outside of curved reaches and ranges from -3.6 to -7.1 feet for straight or inside of curved reaches. Maximum total toe-down ranges from -8.0 to -21.0 feet for outside of curved reaches and ranges from -8.0 to -14.0 feet for straight or inside of curved reaches (Table 8). Freeboard in this reach is from +2.5 to +4.1 feet with a maximum freeboard at section 19050 for both types of reaches.

Reach E: Reach E is the most downstream in the study with a relatively mild slope and a wide braided channel. The banks have sparse to moderate woody vegetation and steep bluffs and some minor agriculture dominate the overbanks. There are three subreaches in Reach E. General adjustment on Reach E ranges from -1.5 to +2.1 feet (Table 4.2) and generally the reach is predicted to be slightly aggrading or in balance. Long-term adjustment ranges from -1.0 to +3.1 feet (Table 5.1). Other adjustment (Table 7.1) is relatively small in Reach E except at the proposed bridge and ranges from -4.9 to -23.7 feet for outside of curved reaches and from -4.7 to -23.7 feet for straight or inside of curved reaches. LACFCDDM estimates of total toe-down are greater than LACH&SM estimates in this reach. Maximum total toe-down ranges from -10.0 to -26.1 feet at section 15125 (Table 8), while freeboard in this reach ranges from +2.5 feet to +5.2 feet with a maximum freeboard at section 12615 for both types of reaches.

Table 8: Santa Clara River Summary of Maximum Proposed Toe-down & Freeboard (ft)											
			Outside Curved Reach		Straight-Inside Curved Reach			Outside Curved Reach		Straight-Inside Curved Reach	
Subreach	HEC-RAS Section	Z_{99} [2]	Maximum Total Degradation [3]	Proposed Toe-down Elevation [1,4]	Maximum Total Degradation [3]	Proposed Toe-down Elevation [1,4]	WSE	Maximum Total Freeboard [3]	Proposed Top of Levee Elevation [1]	Maximum Total Freeboard [3]	Proposed Top of Levee Elevation [1]
SRA1	46195	1035.0	14.0	1021.0	14.0	1021.0	1063.1	3.1	1066.3	3.1	1066.3
	46020	1032.0	14.0	1018.0	14.0	1018.0	1062.0	3.0	1065.0	3.0	1065.0
	45545	1030.0	14.0	1016.0	14.0	1016.0	1057.9	3.4	1061.3	3.4	1061.3
	45030	1025.0	14.0	1011.0	14.0	1011.0	1054.2	3.0	1057.3	3.0	1057.3
	44585	1022.0	14.0	1008.0	14.0	1008.0	1050.6	3.2	1053.8	3.2	1053.8
	44210	1020.0	14.0	1006.0	14.0	1006.0	1047.8	2.9	1050.8	2.9	1050.8
SRA2	43820	1018.0	15.4	1002.6	15.4	1002.6	1042.1	3.9	1046.0	3.9	1046.0
	43610	1017.0	17.0	1000.0	17.0	1000.0	1038.3	4.0	1042.2	4.0	1042.2
	43410	1016.0	15.8	1000.2	15.8	1000.2	1035.8	3.6	1039.4	3.6	1039.4
	43200	1014.0	16.3	997.7	16.3	997.7	1033.2	3.5	1036.7	3.5	1036.7
	42975	1012.0	15.5	996.5	15.5	996.5	1031.0	2.9	1033.8	2.7	1033.7
	42815	1011.0	15.5	995.5	15.5	995.5	1029.7	2.5	1032.2	2.5	1032.2
	42590	1010.0	21.0	989.0	14.7	995.3	1028.4	2.5	1030.9	2.5	1030.9
	42430	1008.0	21.0	987.0	15.3	992.7	1027.5	2.5	1030.0	2.5	1030.0
	42215	1006.0	21.0	985.0	14.7	991.3	1026.7	2.5	1029.2	2.5	1029.2
	41940	1005.0	15.0	990.0	11.9	993.1	1025.6	2.5	1028.1	2.5	1028.1
	41730	1004.0	15.0	989.0	12.0	992.0	1024.6	2.5	1027.1	2.5	1027.1
	41460	1002.0	15.0	987.0	11.9	990.1	1023.2	2.5	1025.7	2.5	1025.7
SRA3	41280	1001.0	12.5	988.5	12.5	988.5	1021.8	2.5	1024.3	2.5	1024.3
	41080	1000.0	14.0	986.0	14.0	986.0	1020.5	2.5	1023.0	2.5	1023.0
	40825	999.5	21.0	978.5	14.0	985.5	1019.3	2.5	1021.8	2.5	1021.8
	40585	998.0	18.0	980.0	12.5	985.5	1018.3	2.5	1020.8	2.5	1020.8
	40335	996.0	15.0	981.0	10.0	986.0	1017.4	2.5	1019.9	2.5	1019.9
	40130	995.0	15.0	980.0	10.0	985.0	1016.6	2.5	1019.1	2.5	1019.1
	39945	994.0	15.0	979.0	10.0	984.0	1015.9	2.5	1018.4	2.5	1018.4
	39755	994.0	12.5	981.5	12.5	981.5	1014.6	2.5	1017.1	2.5	1017.1
	39605	993.0	14.0	979.0	14.0	979.0	1013.7	2.5	1016.2	2.5	1016.2
	39310	992.0	18.0	974.0	12.5	979.5	1012.2	2.5	1014.7	2.5	1014.7
	39100	990.0	14.0	976.0	14.0	976.0	1011.1	2.5	1013.6	2.5	1013.6
	38925	989.5	10.0	979.5	10.0	979.5	1010.3	2.5	1012.8	2.5	1012.8
SRA4	38710	988.0	10.0	978.0	10.0	978.0	1009.2	2.5	1011.7	2.5	1011.7
	38475	986.0	12.5	973.5	12.5	973.5	1007.0	2.6	1009.5	2.6	1009.5
	38300	985.5	14.0	971.5	14.0	971.5	1005.8	2.5	1008.3	2.5	1008.3
	38065	984.0	10.0	974.0	10.0	974.0	1004.1	2.5	1006.6	2.5	1006.6
	37810	983.0	14.0	969.0	14.0	969.0	1001.4	2.8	1004.2	2.8	1004.2
	37655	982.0	14.0	968.0	14.0	968.0	999.9	2.6	1002.5	2.6	1002.5
	37390	981.0	14.0	967.0	14.0	967.0	998.5	2.5	1001.0	2.5	1001.0
	37135	980.0	12.5	967.5	12.5	967.5	996.8	2.5	999.3	2.5	999.3
	36930	978.0	14.0	964.0	14.0	964.0	995.7	2.5	998.2	2.5	998.2
	36735	977.0	12.5	964.5	12.5	964.5	994.6	2.5	997.1	2.5	997.1
	36515	975.0	15.0	960.0	10.0	965.0	993.6	2.5	996.1	2.5	996.1
	36265	974.0	15.0	959.0	10.0	964.0	992.3	2.5	994.8	2.5	994.8
SRB1	36080	973.0	22.9	950.1	22.0	951.0	990.6	2.5	993.1	2.5	993.1
	35845	971.0	15.0	956.0	10.0	961.0	989.1	2.5	991.6	2.5	991.6
	35725	970.0	15.0	955.0	10.0	960.0	988.3	2.5	990.8	2.5	990.8
	35515	969.0	18.0	951.0	12.5	956.5	986.9	2.5	989.4	2.5	989.4
	35245	968.0	18.0	950.0	12.5	955.5	985.0	2.5	987.5	2.5	987.5
	35040	967.0	21.0	946.0	14.0	953.0	983.6	2.5	986.1	2.5	986.1
	34860	966.0	21.0	945.0	14.0	952.0	982.3	2.5	984.8	2.5	984.8
	34720	965.5	21.0	944.5	14.0	951.5	981.3	2.5	983.8	2.5	983.8
	34495	964.0	18.0	946.0	12.5	951.5	979.7	2.5	982.2	2.5	982.2
	34310	963.0	18.0	945.0	12.5	950.5	978.4	2.5	980.9	2.5	980.9
	34090	962.0	18.0	944.0	12.5	949.5	977.0	2.5	979.5	2.5	979.5
SRB2	33880	960.0	18.0	942.0	12.5	947.5	975.7	2.5	978.2	2.5	978.2
	33710	959.0	18.0	941.0	12.5	946.5	974.6	2.5	977.1	2.5	977.1
	33500	958.0	18.0	940.0	12.5	945.5	973.3	2.5	975.8	2.5	975.8
	33310	957.0	18.0	939.0	12.5	944.5	972.3	2.5	974.8	2.5	974.8
	33115	956.0	15.0	941.0	10.0	946.0	971.4	2.5	973.9	2.5	973.9
	32795	954.0	15.0	939.0	10.0	944.0	969.7	2.5	972.2	2.5	972.2
	32605	952.0	15.0	937.0	10.0	942.0	968.7	2.5	971.2	2.5	971.2
SRC1	32265	950.0	18.0	932.0	12.5	937.5	967.2	2.5	969.7	2.5	969.7
	31875	949.0	15.0	934.0	10.0	939.0	965.6	2.5	968.1	2.5	968.1
	31585	946.0	15.0	931.0	10.0	936.0	964.7	2.5	967.2	2.5	967.2
	31360	944.0	15.0	929.0	10.0	934.0	963.9	2.5	966.4	2.5	966.4
	31060	942.0	12.0	930.0	8.0	934.0	963.2	2.5	965.7	2.5	965.7
	30720	940.0	12.0	928.0	8.0	932.0	962.5	2.5	965.0	2.5	965.0
	30445	938.0	12.0	926.0	8.0	930.0	962.1	2.5	964.6	2.5	964.6
	30095	936.0	12.0	924.0	8.0	928.0	961.5	2.5	964.0	2.5	964.0
	29815	935.0	12.0	923.0	8.0	927.0	960.8	2.5	963.3	2.5	963.3
	29565	934.0	12.0	922.0	8.0	926.0	960.3	2.5	962.8	2.5	962.8
	29385	933.0	12.0	921.0	8.0	925.0	959.6	2.5	962.1	2.5	962.1
SRC2	29140	932.0	12.0	920.0	9.1	922.9	958.4	2.5	960.9	2.5	960.9
	28895	930.0	21.0	909.0	14.0	916.0	953.8	4.8	958.6	4.7	958.5
	28695	928.0	15.0	913.0	15.0	913.0	952.9	2.5	955.4	2.5	955.4
	28500	927.5	14.7	912.8	14.7	912.8	950.5	3.1	953.5	2.9	953.4
	28280	926.0	21.0	905.0	14.0	912.0	949.8	2.5	952.3	2.5	952.3
	28080	925.0	15.0	910.0	10.0	915.0	949.1	2.5	951.6	2.5	951.6
	27925	924.0	10.3	913.7	10.3	913.7	948.1	2.5	950.6	2.5	950.6
	27725	923.0	14.0	909.0	14.0	909.0	946.1	2.9	949.0	2.9	949.0
	27545	922.0	15.0	907.0	15.0	907.0	944.3	3.1	947.4	3.1	947.4
	27335	921.0	14.1	906.9	14.1	906.9	943.0	2.7	945.7	2.6	945.6
	27155	920.5	14.0	906.5	14.0	906.5	941.5	2.9	944.4	2.8	944.2
SRC3	26990	920.0	21.0	899.0	14.0	906.0	940.4	2.5	942.9	2.5	942.9
	26780	918.0	21.0	897.0	14.0	904.0	939.3	2.5	941.8	2.5	941.8
	26575	917.0	21.0	896.0	14.0	903.0	938.5	2.5	941.0	2.5	941.0
	26355	916.0	18.0	898.0	12.5	903.5	937.6	2.5	940.1	2.5	940.1
	26170	915.0	18.0	897.0	12.5	902.5	936.9	2.5	939.4	2.5	939.4
	25965	914.0	21.0	893.0	14.0	900.0	936.2	2.6	938.8	2.5	938.7
	25785	913.5	21.0	892.5	14.0	899.5	935.5	2.7	938.2	2.5	938.0
	25600	912.5	21.0	891.5	14.0	898.5	934.8	2.5	937.3	2.5	937.3
	25425	911.0	21.0	890.0	14.0	897.0	934.1	2.5	936.7	2.5	936.6
	25215	910.0	15.0	895.0	10.0	900.0	933.3	2.5	935.8	2.5	935.8
	25000	909.0	15.0	894.0	10.0	899.0	932.5	2.5	935.0	2.5	935.0
SRC4	24795	908.0	15.0	893.0	10.0	898.0	931.5	3.7	935.2	3.4	934.9
	24550	906.0	18.0	888.0	12.5	893.5	930.1	3.6	933.6	3.3	933.4
	24335	905.0	21.0	884.0	14.0	891.0	928.5	3.9	932.4	3.6	932.1
	24115	904.0	21.0	883.0	14.0	890.0	927.0	3.8	930.8	3.5	930.5
	23975	903.5	21.0	882.5	14.0	889.5	926.1	3.5	929.7	3.3	929.4
	23755	902.0	21.0	881.0	14.0	888.0	924.7	3.2	927.9	3.1	927.8
	23565	900.0	21.0	879.0	14.0	886.0	923.6	3.7	927.3	3.4	927.0
	23365	900.0	21.0	879.0	14.0	886.0	922.4	3.5	925.9	3.2	925.6
	23180	899.0	21.0	878.0	14.0	885.0	921.5	3.2	924.6	3.0	924.4
	23000	898.0	21.0	877.0	14.0	884.0	920.0	3.3	923.3	3.0	923.0
	22790	897.5	26.8	870.7	23.0	874.5	917.5	3.1	920.6	3.0	920.5
	22600	896.0	21.0	875.0	14.0	882.0	915.8	3.2	919.0	2.9	918.7
	22415	895.5	21.0	874.5	14.0	881.5	914.4	3.2	917.6	2.9	917.4

1 - Phase 1 Analysis, see end note

2 - Minimum 1999 Bed Elevation

3 - 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

4 - Values at bridges are approxmiate. Final design of levee at bridge locations will include detailed bridge analysis

Table 8: Santa Clara River Summary of Proposed Toe-down & Freeboard (ft) continued

			Outside Curved Reach		Straight-Inside Curved Reach			Outside Curved Reach		Straight-Inside Curved Reach	
Subreach	HEC-RAS Section	Z_{99} [2]	Maximum Total Degradation [3]	Proposed Toe-down Elevation [1,4]	Maximum Total Degradation [3]	Proposed Toe-down Elevation [1,4]	WSE	Maximum Total Freeboard [3]	Proposed Top of Levee Elevation [1]	Maximum Total Freeboard [3]	Proposed Top of Levee Elevation [1]
SRD1	22195	894.0	15.0	879.0	10.0	884.0	913.1	2.5	915.6	2.5	915.6
	22010	892.0	18.0	874.0	12.5	879.5	911.4	2.5	913.9	2.5	913.9
	21790	891.5	21.0	870.5	14.0	877.5	909.9	2.6	912.6	2.5	912.4
	21615	892.0	21.0	871.0	14.0	878.0	908.9	2.6	911.5	2.5	911.4
	21440	890.0	18.0	872.0	12.5	877.5	907.8	2.5	910.3	2.5	910.3
	21225	888.0	21.0	867.0	14.0	874.0	906.7	2.5	909.2	2.5	909.2
	21020	887.0	21.0	866.0	14.0	873.0	905.6	2.5	908.1	2.5	908.1
	20845	886.0	18.0	868.0	12.5	873.5	904.7	2.5	907.2	2.5	907.2
	20595	885.0	15.0	870.0	10.0	875.0	903.6	2.5	906.1	2.5	906.1
	20435	884.0	15.0	869.0	10.0	874.0	902.8	2.5	905.3	2.5	905.3
	20280	883.7	18.0	865.7	12.5	871.2	901.8	2.5	904.3	2.5	904.3
	20070	882.0	21.0	861.0	14.0	868.0	900.6	2.5	903.1	2.5	903.1
SRD2	19855	880.5	21.0	859.5	14.0	866.5	899.6	3.0	902.6	2.9	902.5
	19630	880.0	21.0	859.0	14.0	866.0	898.6	2.9	901.5	2.9	901.5
	19440	878.0	15.0	863.0	10.0	868.0	897.9	3.0	900.8	3.0	900.8
	19240	877.5	18.0	859.5	12.5	865.0	896.9	3.4	900.3	3.4	900.2
	19050	876.0	21.0	855.0	14.0	862.0	896.2	4.1	900.3	4.1	900.3
	18830	874.0	15.0	859.0	10.0	864.0	895.4	4.1	899.4	4.0	899.4
	18650	873.5	15.0	858.5	10.0	863.5	894.7	4.0	898.7	4.0	898.7
	18475	872.0	13.6	858.4	8.0	864.0	894.3	3.4	897.6	3.4	897.6
	18290	871.5	14.1	857.4	8.0	863.5	893.6	3.2	896.8	3.2	896.8
	18025	870.0	8.0	862.0	8.0	862.0	892.9	3.1	895.9	3.1	895.9
	17785	868.0	8.0	860.0	8.0	860.0	892.0	3.2	895.2	3.2	895.2
SRD3	17510	868.0	10.0	858.0	10.0	858.0	890.4	2.5	892.9	2.5	892.9
	17360	868.0	12.5	855.5	12.5	855.5	888.3	2.5	890.8	2.5	890.8
	17110	864.0	14.0	850.0	14.0	850.0	885.5	2.5	888.0	2.5	888.0
	16970	863.7	14.0	849.7	14.0	849.7	884.0	2.5	886.5	2.5	886.5
	16720	863.5	14.0	849.5	14.0	849.5	882.3	2.5	884.8	2.5	884.8
	16515	862.0	14.0	848.0	14.0	848.0	881.2	2.5	883.7	2.5	883.7
	16305	860.0	10.0	850.0	10.0	850.0	880.4	2.5	882.9	2.5	882.9
	16130	860.0	12.5	847.5	12.5	847.5	879.4	2.5	881.9	2.5	881.9
	15960	859.0	12.5	846.5	12.5	846.5	878.6	2.5	881.1	2.5	881.1
	15745	858.0	10.0	848.0	10.0	848.0	877.6	2.5	880.1	2.5	880.1
	15540	857.5	10.0	847.5	10.0	847.5	876.7	2.5	879.2	2.5	879.2
	15335	856.0	12.5	843.5	12.5	843.5	874.8	2.5	877.3	2.5	877.3
SRE1	15125	854.0	26.1	827.9	26.1	827.9	872.0	2.5	874.5	2.5	874.5
	14900	853.0	14.0	839.0	14.0	839.0	869.7	2.5	872.2	2.5	872.2
	14720	852.0	21.0	831.0	14.0	838.0	868.4	2.5	870.9	2.5	870.9
	14480	850.5	21.0	829.5	14.0	836.5	866.9	2.5	869.4	2.5	869.4
	14315	850.0	15.0	835.0	10.0	840.0	866.0	2.5	868.5	2.5	868.5
	14090	850.0	15.0	835.0	10.0	840.0	864.8	2.5	867.3	2.5	867.3
	13850	848.0	15.0	833.0	10.0	838.0	863.6	2.5	866.1	2.5	866.1
	13635	846.0	18.0	828.0	12.5	833.5	862.5	2.5	865.0	2.5	865.0
	13425	845.0	21.0	824.0	14.0	831.0	861.8	2.5	864.3	2.5	864.3
	13190	844.0	15.0	829.0	10.0	834.0	861.1	2.5	863.6	2.5	863.6
SRE2	13030	843.0	15.0	828.0	10.0	833.0	860.6	4.2	864.8	4.1	864.8
	12835	842.0	10.0	832.0	10.0	832.0	860.0	4.7	864.7	4.6	864.7
	12615	841.0	10.0	831.0	10.0	831.0	859.3	5.2	864.6	5.2	864.6
	12395	840.0	10.0	830.0	10.0	830.0	858.7	5.1	863.8	5.1	863.8
	12195	839.0	10.0	829.0	10.0	829.0	858.1	4.2	862.3	4.2	862.3
	11995	837.0	10.0	827.0	10.0	827.0	857.3	4.1	861.4	4.1	861.4
	11780	836.0	10.0	826.0	10.0	826.0	856.6	4.0	860.5	4.0	860.5
	11605	835.5	10.0	825.5	10.0	825.5	855.8	4.0	859.8	4.0	859.8
	11405	834.0	10.0	824.0	10.0	824.0	854.6	3.9	858.6	3.9	858.6
	11180	833.0	12.5	820.5	12.5	820.5	852.7	3.9	856.6	3.9	856.6
SRE3	11015	831.5	14.0	817.5	14.0	817.5	850.2	3.8	854.0	3.8	854.0
	10835	831.0	14.0	817.0	14.0	817.0	848.1	3.7	851.8	3.7	851.8
	10575	830.0	14.0	816.0	14.0	816.0	846.1	3.8	849.9	3.8	849.9
	10390	828.0	14.0	814.0	14.0	814.0	845.1	3.1	848.2	3.1	848.2
	10225	827.5	12.5	815.0	12.5	815.0	844.1	3.1	847.2	3.1	847.2
	10000	826.0	10.0	816.0	10.0	816.0	842.6	3.1	845.7	3.1	845.7
	9820	824.0	14.0	810.0	14.0	810.0	841.4	3.1	844.5	3.1	844.5
	9595	823.8	10.0	813.8	10.0	813.8	839.9	3.1	843.0	3.1	843.0
	9385	823.0	18.0	805.0	12.5	810.5	838.6	3.1	841.7	3.1	841.7
	9220	822.0	18.0	804.0	12.5	809.5	837.6	3.1	840.7	3.1	840.7
	9025	821.0	18.0	803.0	12.5	808.5	836.6	3.1	839.7	3.1	839.7

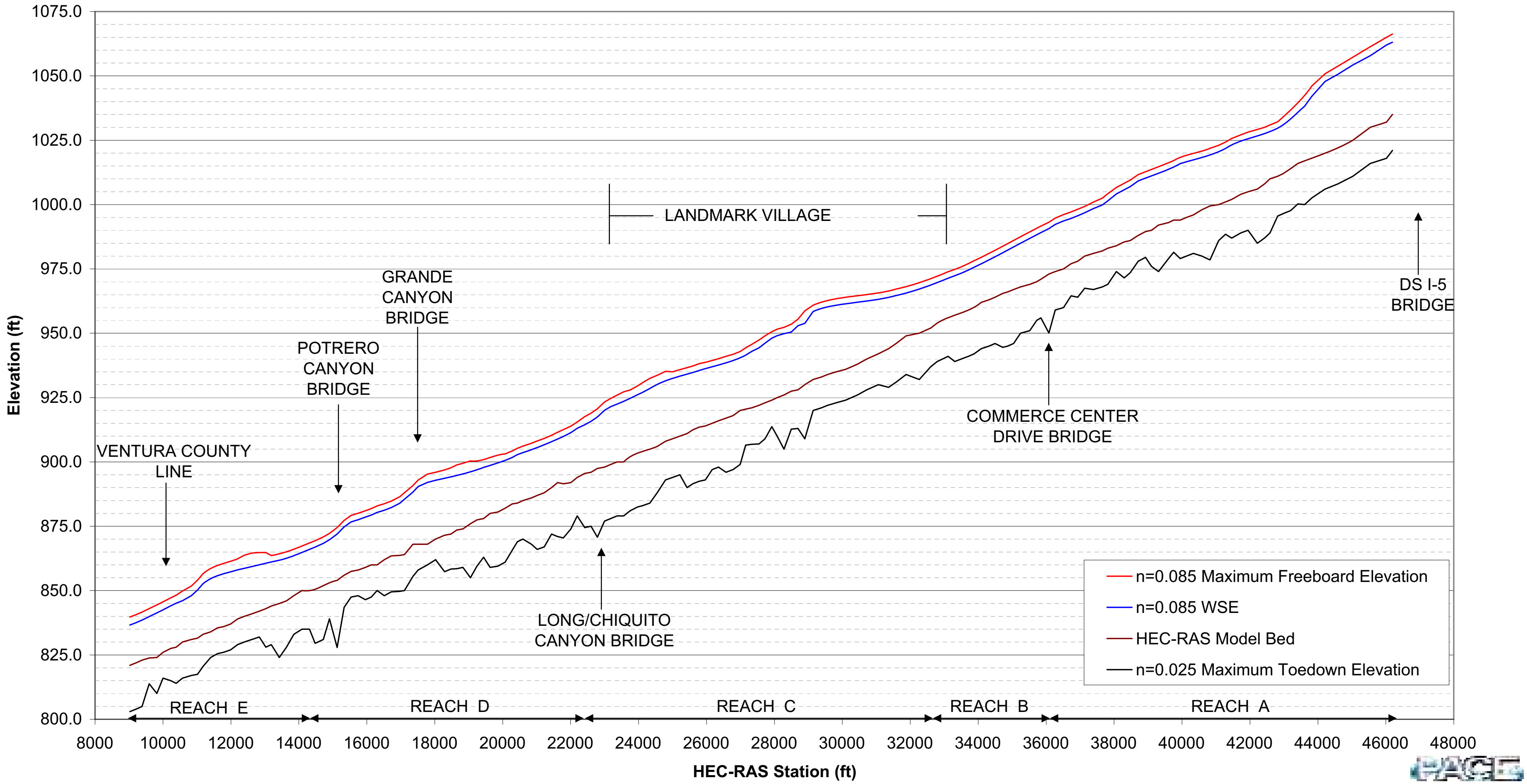
1 - Phase 1 Analysis, see end note

2 - Minimum 1999 Bed Elevation

3 - 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

4 - Values at bridges are approxmiate. Final design of levee at bridge locations will include detailed bridge analysis

Figure 8: Santa Clara River Proposed Conditions Outside Curved Reach Maximum Toedown & Freeboard Summary



P:\8197E\5-Administrative\Reports\Fluvial Report\Fluvial Spreadsheets\Table 8 Summary Proposed Toe & Top 02-22-06

9 References

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

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Santa Clara River Fluvial Study

APPENDIX CHAPTER 3.1

Site Visit Photos

PACIFIC ADVANCED CIVIL ENGINEERING, INC.

Photo 1. Santa Clara River looking upstream from I-5.

Photo 2. Santa Clara River immediately upstream of I-5.

Photo 3. Upstream of I-5 Bridge at Santa Clara River Crossing

Photo 4. Santa Clara River downstream of the Old Rd. Bridge

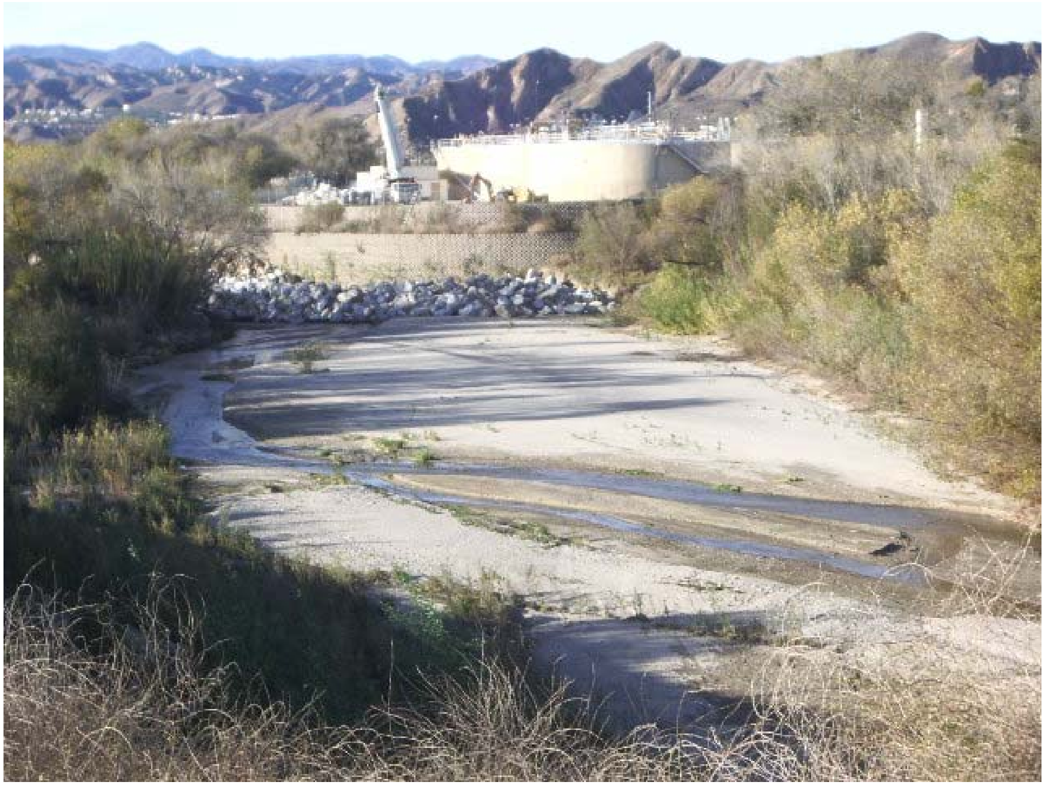


Photo 5. Approximately 1000 ft. downstream of Old Rd. Crossing.

Photo 6. Looking downstream from Magic Mountain Overflow Parking Facility.

Photo 7. Looking downstream from Magic Mountain Overflow Parking Facility (Storm damage to left bank).

Photo 8. Looking upstream at Castaic Junction.

Photo 9. Looking upstream from Feed Mill Rd. approximately 1000 ft. downstream of Magic Mountain Overflow Parking Facility.

Photo 10. Santa Clara River and Castaic Creek confluence looking upstream.

Photo 11 . Santa Clara River and Castaic Creek confluence looking downstream.

Photo 12. Santa Clara River downstream of Potrero Canyon.

Photo13. Santa Clara River downstream of Potrero Canyon looking downstream.

Photo 14. Santa Clara River looking upstream at Ventura County Line. Photo 24.

Santa Clara River Fluvial Study

APPENDIX CHAPTER 3.2

Allan Seward Sampling Study

PACIFIC ADVANCED CIVIL ENGINEERING, INC.

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

February 14, 2005 Job No: 05-1155BE-9 (2)

Pacific Advanced Civil Engineering, Inc. (PACE)
17520 Newhope Street
Suite 200
Fountain Valley, CA 92708

Attn: Mr. Bruce Phillips

Subject: **NEW SEDIMENT GRADATION TEST DATA**
Fluvial Analysis of Santa Clara River and Tributaries

Project: Newhall Ranch
Los Angeles County, California

Dear Mr. Phillips:

Per your request, we completed gradation tests on sediment samples to assist PACE in completing a fluvial study of the Santa Clara River and its major tributaries on Newhall Ranch. A total of 17 samples were collected adjacent to six different crossings located on various reaches of the Santa Clara River on Newhall Ranch and to the west. Six additional samples were collected from selected tributary canyons as requested. All of the samples were collected by hand from the upper foot of the active or recently active portion of the subject channels. The location and designation of each sample collected are illustrated on the attached Sample Location Map. Particle size distribution test reports and backup data sheets for each sample are attached for your use.

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

REGISTERED GEOLOGIST
BRIAN J. SWANSON
No. 2055
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

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

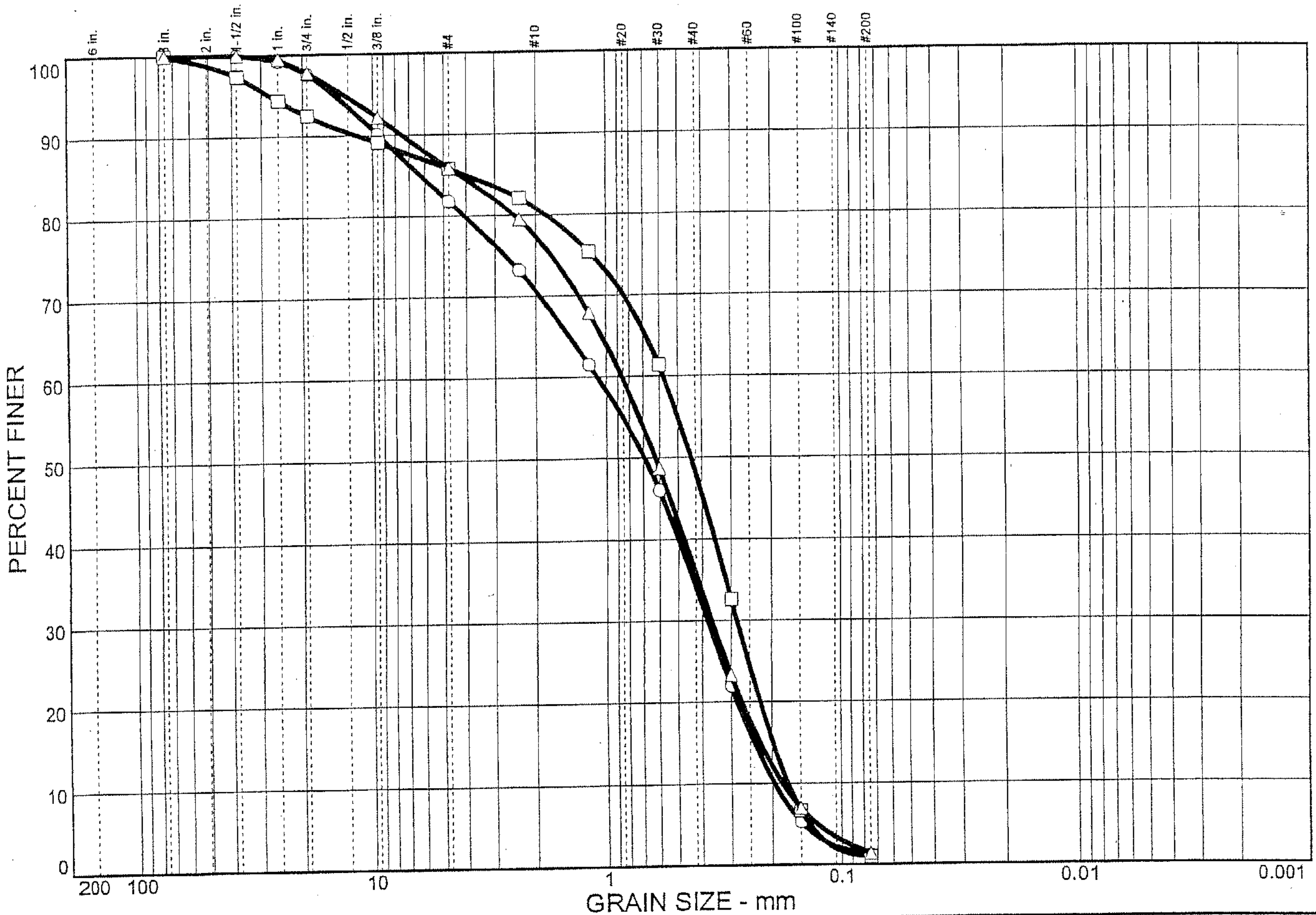
REGISTERED GEOLOGIST
Eric J. Seward
NO. 2110
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

The following attachments complete this report.

Particle Size Distribution Test Reports — Figures 1-8
Laboratory Back up Data Sheets for each Test (23 Total)
Sample Location Map and Summary Table (Revised) — Plate I

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

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	2.4	15.8	11.1	36.4	33.1	1.2	
□	0.0	7.5	6.7	4.9	32.6	47.3	1.0	
△	0.0	2.2	11.9	8.5	41.5	34.5	1.4	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	DESCRIPTION	USCS
○	SC-1		0-1'	Poorly graded SAND with gravel	SP
□	SC-2		0-1'	Poorly graded SAND	SP
△	SC-3		0-1'	Poorly graded SAND	SP

PARTICLE SIZE DISTRIBUTION TEST REPORT

ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.

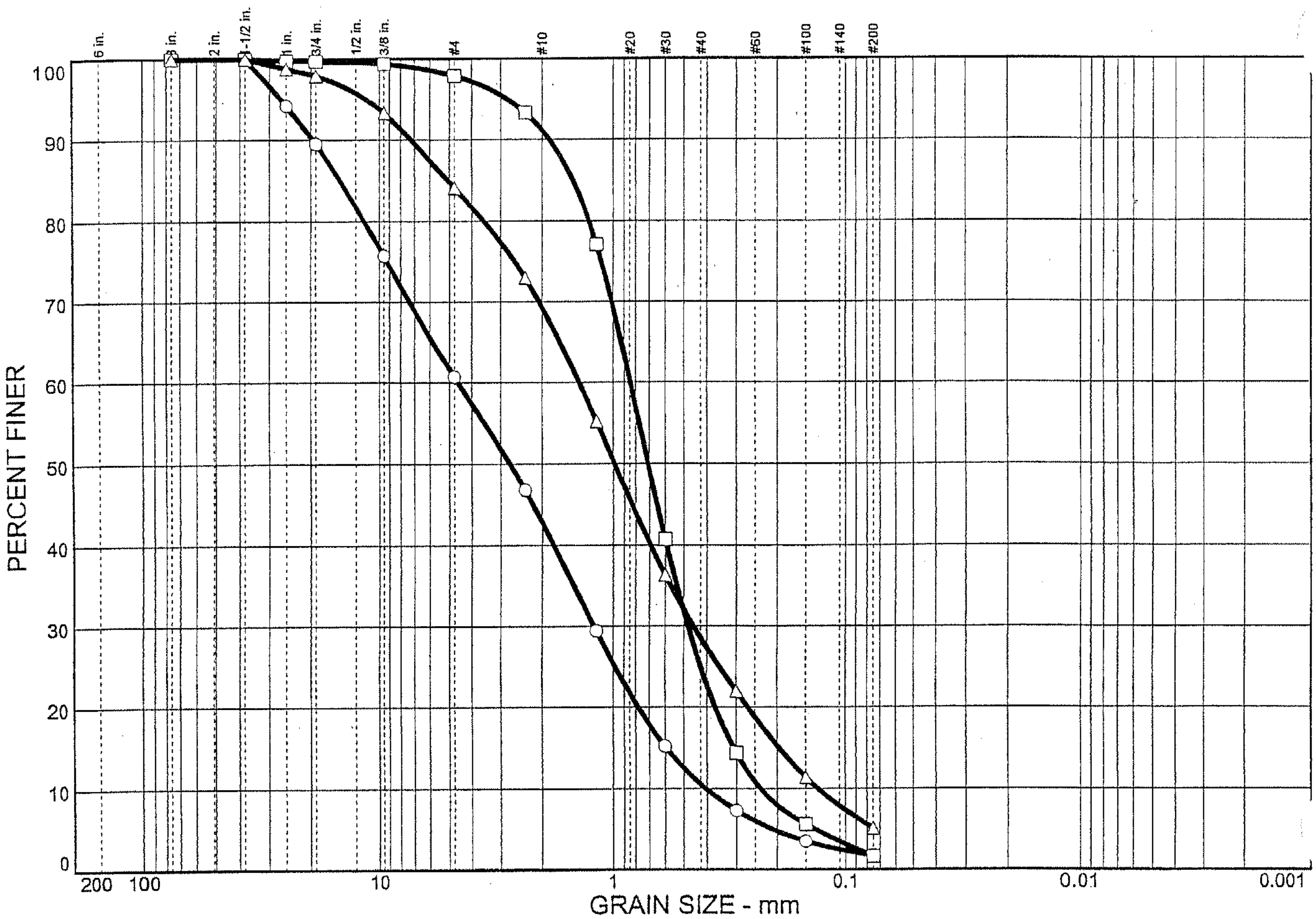
Client: The Newhall Land & Farming Company

Project: PACE Fluvial Study of Santa Clara River and Tributaries

Project No.: 05-1155BE-9(2)

Figure 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	10.5	28.8	17.8	32.4	8.8	1.7	
□	0.0	0.3	1.8	6.7	66.1	23.5	1.6	
△	0.0	2.1	13.8	14.7	40.8	23.5	5.1	

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	DESCRIPTION	USCS
○	MC-1		0-1'	Poorly graded SAND with gravel	SP
□	MC-2		0-1'	Poorly graded SAND	SP
△	MC-3		0-1'	Well graded SAND with silt and gravel	SW-SM

PARTICLE SIZE DISTRIBUTION TEST REPORT

ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.

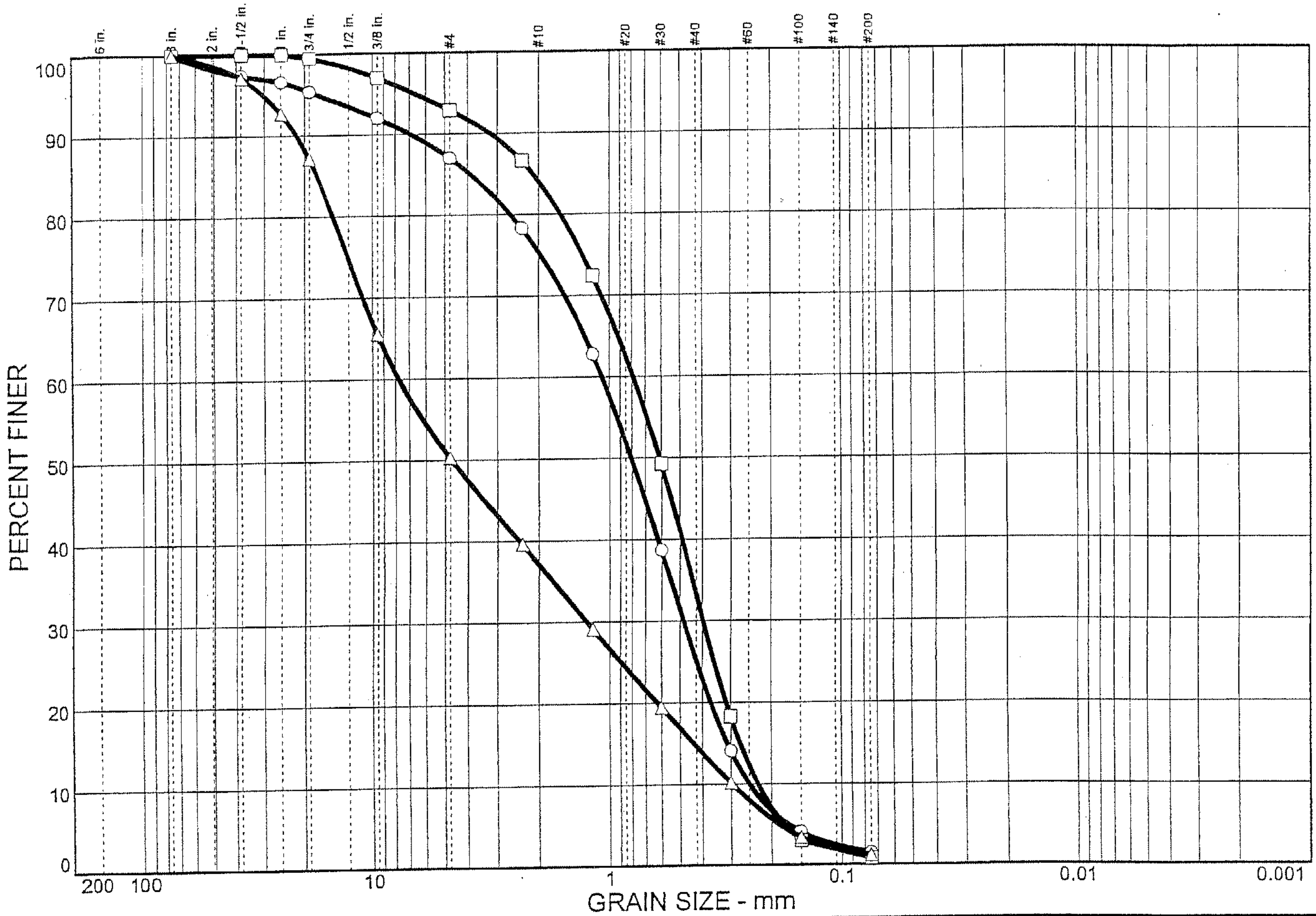
Client: The Newhall Land & Farming Company

Project: PACE Fluvial Study of Santa Clara River and Tributaries

Project No.: 05-1155BE-9(2)

Figure 2

PARTICLE SIZE DISTRIBUTION TEST REPORT



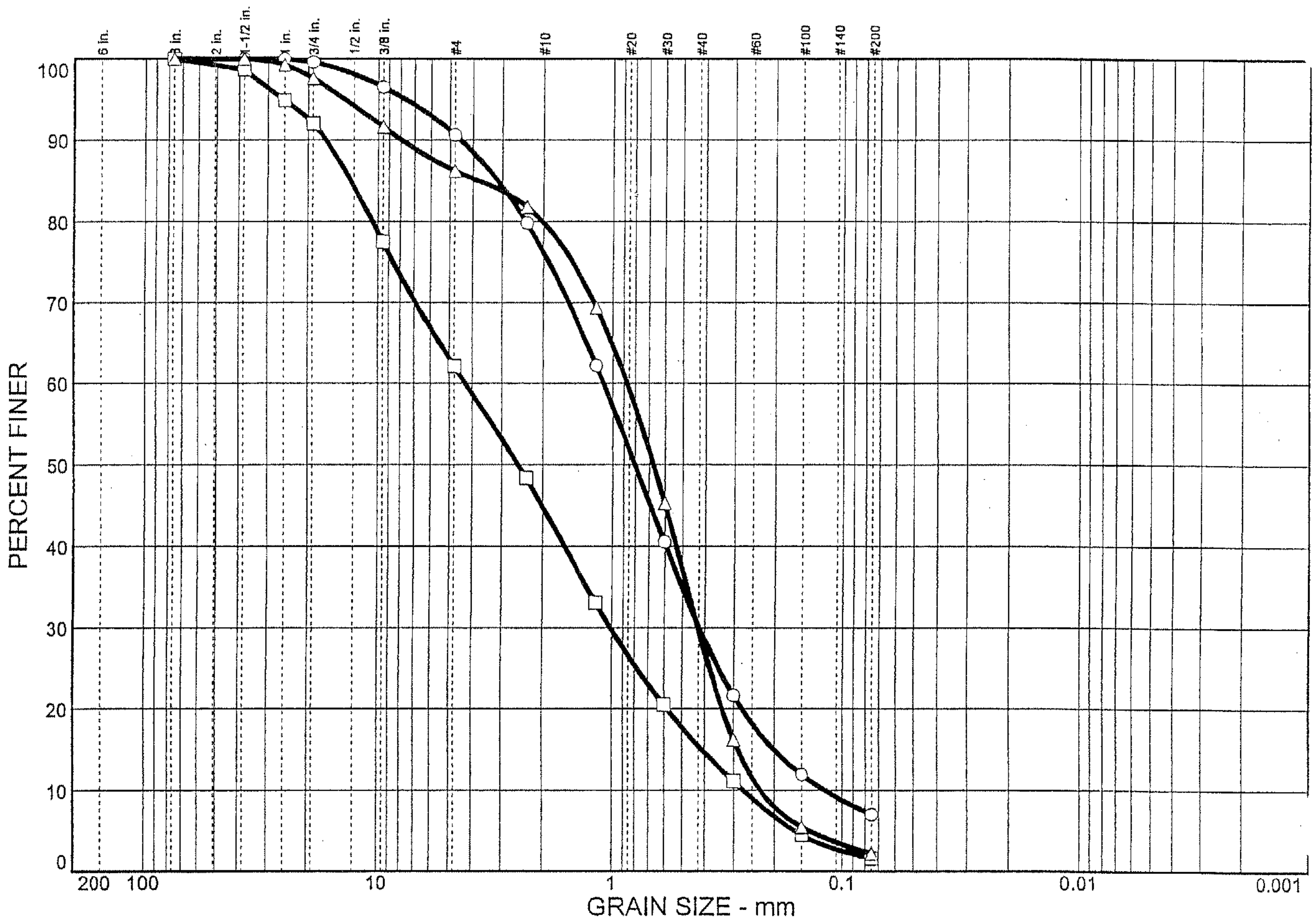
	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	4.6	8.4	11.6	50.1	23.8	1.5	
□	0.0	0.5	6.6	8.9	50.7	32.5	0.8	
△	0.0	12.9	36.8	13.2	22.4	13.5	1.2	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	DESCRIPTION	USCS
○	AC-1		0-1'	Poorly graded SAND	SP
□	AC-2		0-1'	Poorly graded SAND	SP
△	AC-3		0-1'	Poorly graded GRAVEL with sand	GP

PARTICLE SIZE DISTRIBUTION TEST REPORT **ALLAN E. SEWARD** **ENGINEERING GEOLOGY, INC.**	**Client:** The Newhall Land & Farming Company **Project:** PACE Fluvial Study of Santa Clara River and Tributaries **Project No.:** 05-1155BE-9(2) **Figure** 3

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.4	9.0	14.4	46.1	23.1	7.0	
□	0.0	8.0	29.9	17.3	29.4	13.8	1.6	
△	0.0	2.4	11.4	6.3	50.2	27.5	2.2	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	DESCRIPTION	USCS
○	LC-1		0-1'	Well graded SAND with silt	SW-SM
□	LC-2		0-1'	Poorly graded SAND with gravel	SP
△	LC-3		0-1'	Poorly graded SAND	SP

PARTICLE SIZE DISTRIBUTION TEST REPORT

ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.

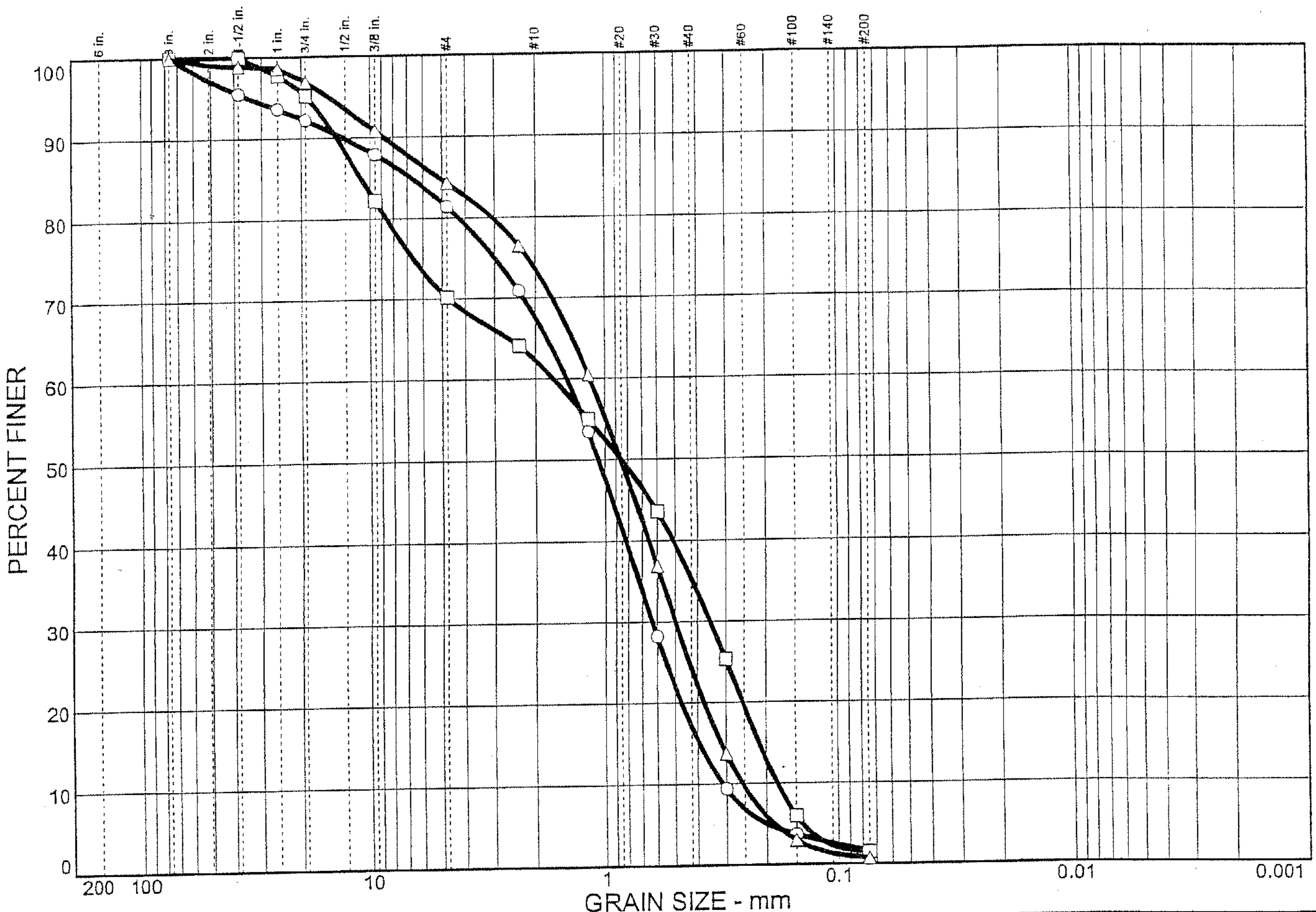
Client: The Newhall Land & Farming Company

Project: PACE Fluvial Study of Santa Clara River and Tributaries

Project No.: 05-1155BE-9(2)

Figure 4

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	7.8	10.8	13.8	50.4	15.6	1.6	
□	0.0	4.8	25.0	7.9	26.9	33.9	1.5	
△	0.0	3.1	12.6	10.7	49.2	23.7	0.7	

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	DESCRIPTION	USCS
○	HR-1		0-1'	Poorly graded SAND with gravel	SP
□	HR-2		0-1'	Poorly graded SAND with gravel	SP
△	HR-3		0-1'	Poorly graded SAND with gravel	SP

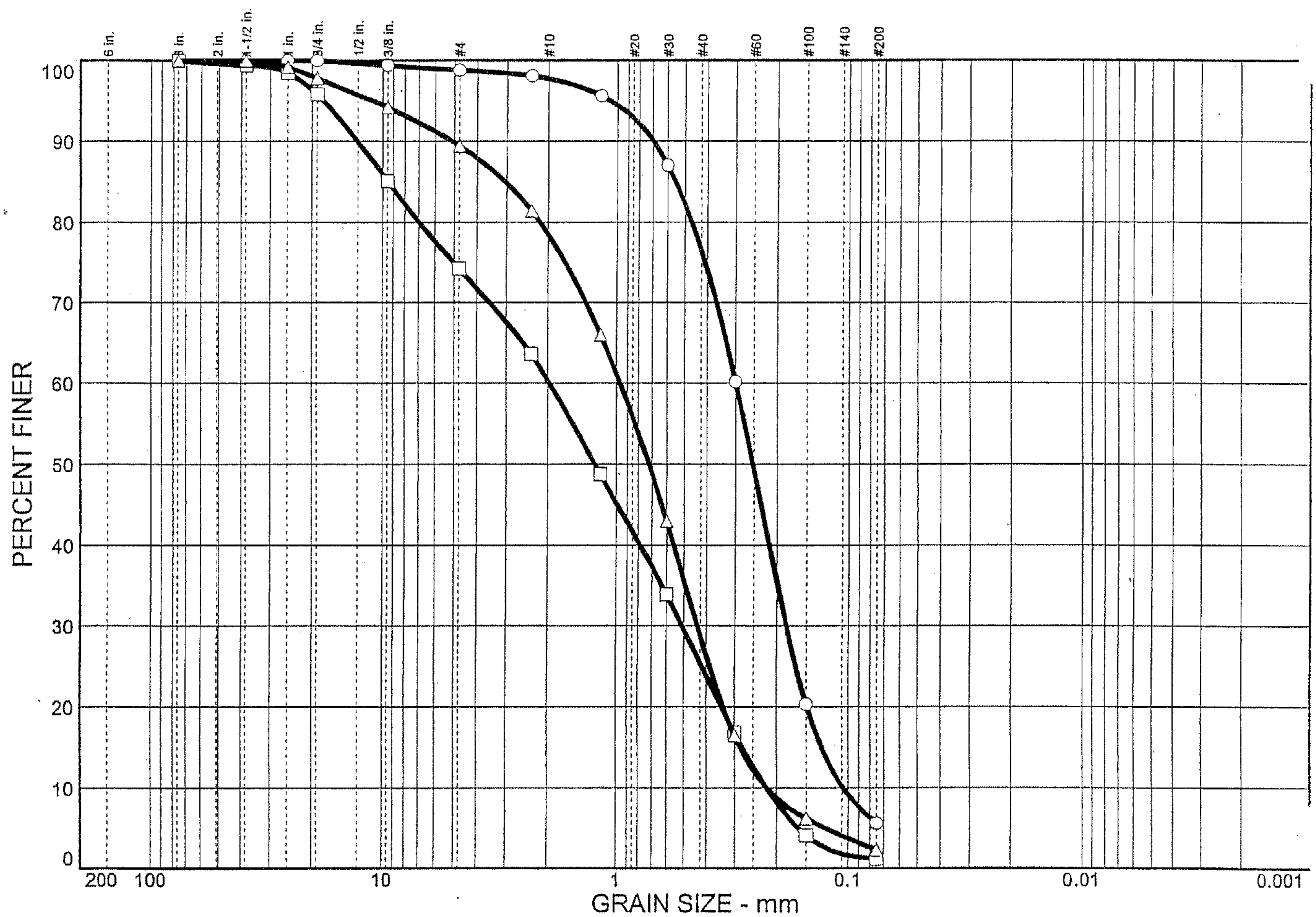
PARTICLE SIZE DISTRIBUTION TEST REPORT

ALLAN E. SEWARD
ENGINEERING GEOLOGY, INC.

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project No.: 05-1155BE-9(2)

Figure 5

PARTICLE SIZE DISTRIBUTION TEST REPORT



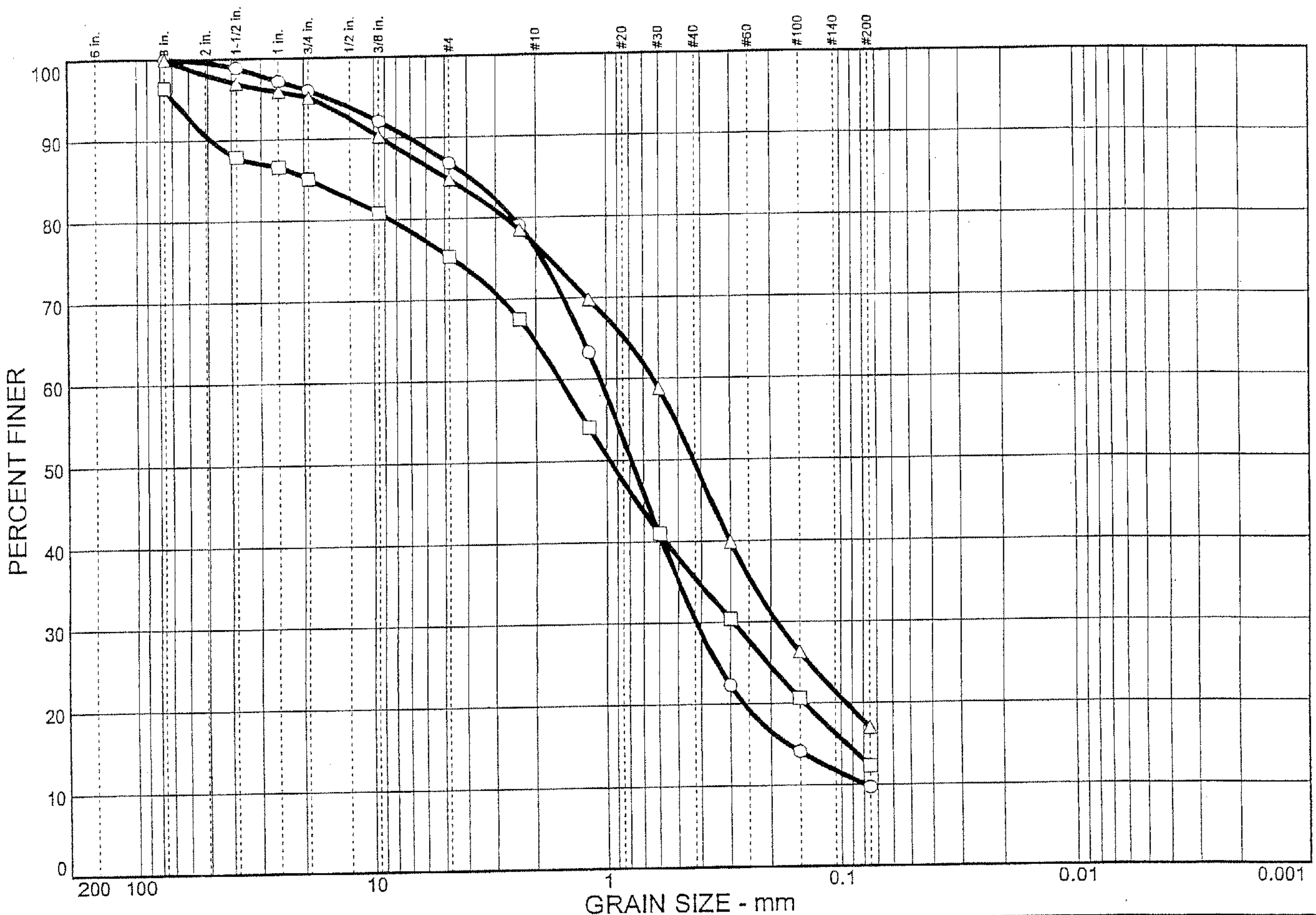
	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	1.2	1.0	21.2	71.0	5.6	
□	0.0	4.2	21.6	13.8	35.0	24.2	1.2	
△	0.0	2.2	8.4	10.9	49.7	26.5	2.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	DESCRIPTION	USCS
○	CB-1		0-1'	Poorly graded SAND with silt	SP-SM
□	CB-2		0-1'	Poorly graded SAND with gravel	SP
△	CB-3		0-1'	Poorly graded SAND	SP

PARTICLE SIZE DISTRIBUTION TEST REPORT **ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.**	**Client:** The Newhall Land & Farming Company **Project:** PACE Fluvial Study of Santa Clara River and Tributaries **Project No.:** 05-1155BE-9(2) **Figure** 6

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	4.0	9.2	10.7	45.7	20.7	9.7	
□	3.5	11.4	9.8	10.6	29.2	23.2	12.3	
△	0.0	4.9	10.3	8.2	27.0	32.6	17.0	

SOIL DATA

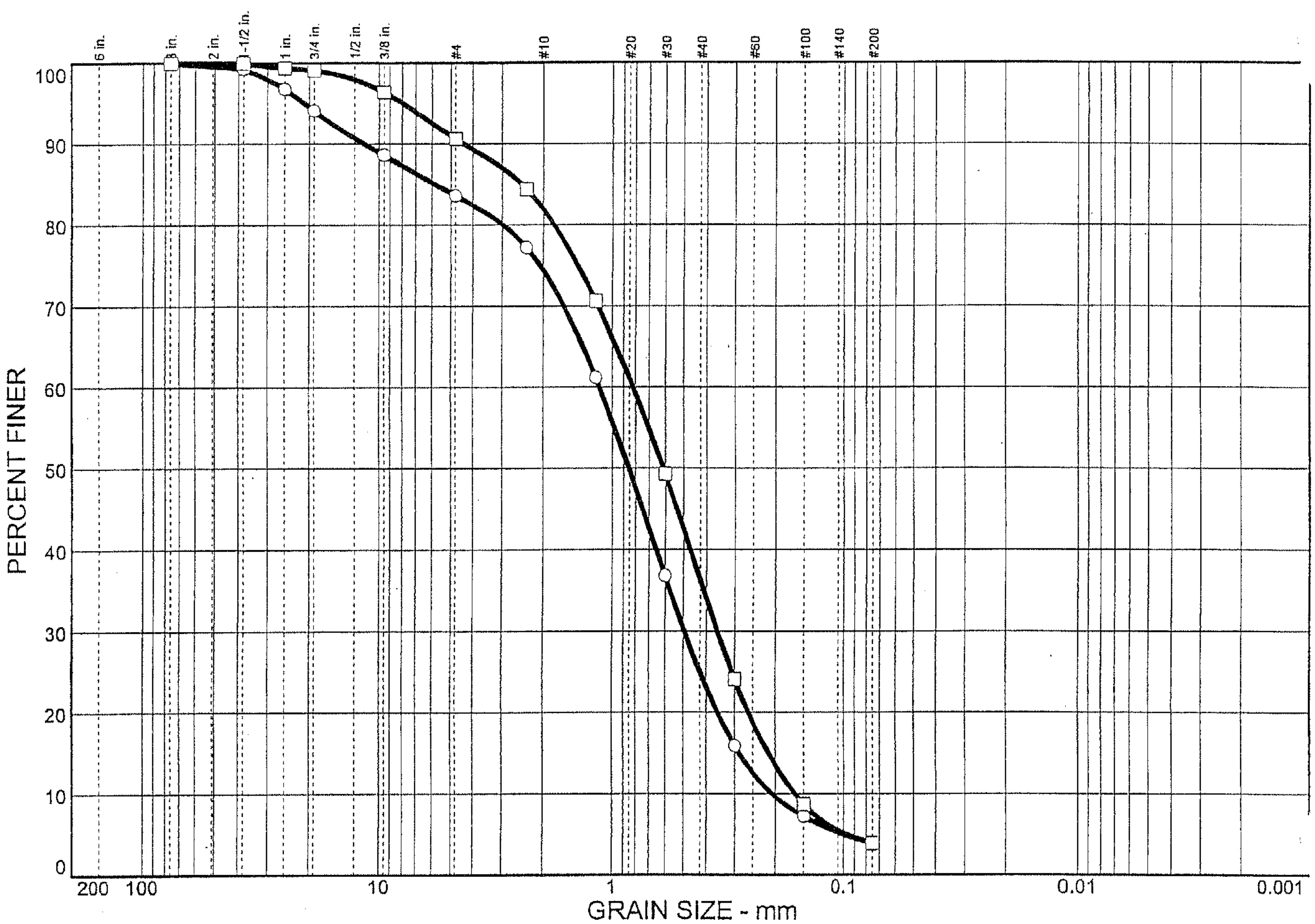
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	DESCRIPTION	USCS
○	SM-1		0-1'	Well graded SAND with silt	SW-SM
□	SM-2		0-1'	Silty SAND with gravel	SM
△	SM-3		0-1'	Silty SAND with gravel	SM

PARTICLE SIZE DISTRIBUTION TEST REPORT
ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project No.: 05-1155BE-9(2)

Figure 7

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	5.9	10.5	9.1	49.4	21.3	3.8	
□	0.0	0.9	8.5	8.6	45.6	32.5	3.9	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	DESCRIPTION	USCS
○	CC-1		0-1'	Poorly graded SAND with gravel	SP
□	Lion-1		0-1'	Poorly graded SAND	SP

PARTICLE SIZE DISTRIBUTION TEST REPORT

ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.

Client: The Newhall Land & Farming Company

Project: PACE Fluvial Study of Santa Clara River and Tributaries

Project No.: 05-1155BE-9(2)

Figure 8

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River
and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: SC-1
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded SAND with gravel
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	17433.60
Tare =	0.00
Dry sample weight =	17433.60

Sample split on number 4 sieve
Split sample data:
Sample and tare = 823.18 Tare = .00 Sample weight = 823.18
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	141.95	99.2
3/4 inch	410.74	97.6
3/8 inch	1731.78	90.1
# 4	3171.78	81.8
# 8	86.53	73.2
# 16	204.60	61.5
# 30	360.50	46.0
# 50	602.30	21.9
# 100	769.92	5.3
# 200	811.58	1.2

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 18.2 (% coarse = 2.4 % fine = 15.8)
% SAND = 80.6 (% coarse = 11.1 % medium = 36.4 % fine = 33.1)
% FINES = 1.2

D_{85}= 6.25 D_{60}= 1.09 D_{50}= 0.69
D_{30}= 0.38 D_{15}= 0.24 D_{10}= 0.20
C_c= 0.6717 C_u= 5.5821

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: SC-2
Sample No.:
Elev. or Depth: 0-1' **Sample Length(in./cm.):**
Location:
Description: Poorly graded SAND
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	17660.60
Tare =	0.00
Dry sample weight =	17660.60

Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 839.37 **Tare =** .00 **Sample weight =** 839.37
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	459.98	97.4
1 inch	989.08	94.4
3/4 inch	1326.98	92.5
3/8 inch	1926.73	89.1
# 4	2512.85	85.8
# 8	36.20	82.1
# 16	101.65	75.4
# 30	238.79	61.4
# 50	520.23	32.6
# 100	773.42	6.7
# 200	829.99	1.0

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 **% GRAVEL =** 14.2 **(% coarse =** 7.5 **% fine =** 6.7)
% SAND = 84.8 **(% coarse =** 4.9 **% medium =** 32.6 **% fine =** 47.3)
% FINES = 1.0

D_{85}= 4.00 D_{60}= 0.57 D_{50}= 0.44
D_{30}= 0.28 D_{15}= 0.20 D_{10}= 0.17
C_c= 0.8205 C_u= 3.3796

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: SC-3
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded SAND
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	17388.20
Tare =	0.00
Dry sample weight =	17388.20

Sample split on number 4 sieve
Split sample data:
Sample and tare = 760.52 Tare = .00 Sample weight = 760.52
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	78.55	99.5
3/4 inch	381.54	97.8
3/8 inch	1356.34	92.2
# 4	2446.02	85.9
# 8	57.04	79.5
# 16	159.19	67.9
# 30	328.93	48.7
# 50	553.86	23.3
# 100	698.78	7.0
# 200	748.36	1.4

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 14.1 (% coarse = 2.2 % fine = 11.9)
% SAND = 84.5 (% coarse = 8.5 % medium = 41.5 % fine = 34.5)
% FINES = 1.4

D_{85}= 4.26 D_{60}= 0.86 D_{50}= 0.62
D_{30}= 0.36 D_{15}= 0.23 D_{10}= 0.18
C_c= 0.8545 C_u= 4.789

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River
and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: MC-1
Sample No.:
Elev. or Depth: 0-1' **Sample Length(in./cm.):**
Location:
Description: Poorly graded SAND with gravel
USCS: SP

Mechanical Analysis Data

Initial
Dry sample and tare= 22700.00
Tare = 0.00
Dry sample weight = 22700.00
Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 805.67 **Tare** = .00 **Sample weight** = 805.67
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	1308.63	94.2
3/4 inch	2378.82	89.5
3/8 inch	5513.99	75.7
# 4	8911.63	60.7
# 8	184.41	46.8
# 16	415.41	29.4
# 30	603.77	15.2
# 50	708.14	7.3
# 100	759.62	3.5
# 200	782.57	1.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% **COBBLES** = 0.0 % **GRAVEL** = 39.3 (% **coarse** = 10.5 % **fine** = 28.8)
% **SAND** = 59.0 (% **coarse** = 17.8 % **medium** = 32.4 % **fine** = 8.8)
% **FINES** = 1.7

D_{85}= 14.93 D_{60}= 4.59 D_{50}= 2.74
D_{30}= 1.21 D_{15}= 0.59 D_{10}= 0.40
C_c= 0.7875 C_u= 11.3357

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: MC-2
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded SAND
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	17569.80
Tare =	0.00
Dry sample weight =	17569.80

Sample split on number 4 sieve
Split sample data:
Sample and tare = 651.07 Tare = .00 Sample weight = 651.07
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	41.15	99.8
3/4 inch	57.09	99.7
3/8 inch	113.76	99.4
# 4	361.27	97.9
# 8	30.69	93.3
# 16	138.31	77.1
# 30	380.43	40.7
# 50	555.53	14.4
# 100	614.15	5.6
# 200	640.41	1.6

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 2.1 (% coarse = 0.3 % fine = 1.8)
% SAND = 96.3 (% coarse = 6.7 % medium = 66.1 % fine = 23.5)
% FINES = 1.6

D_{85}= 1.48 D_{60}= 0.84 D_{50}= 0.71
D_{30}= 0.48 D_{15}= 0.31 D_{10}= 0.24
C_c= 1.152 C_u= 3.5686

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: MC-3
Sample No.:
Elev. or Depth: 0-1' **Sample Length(in./cm.):**
Location:
Description: Well graded SAND with silt and gravel
USCS: SW-SM

Mechanical Analysis Data

	Initial
Dry sample and tare=	21565.00
Tare =	0.00
Dry sample weight =	21565.00

Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 839.76 **Tare =** .00 **Sample weight =** 839.76
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	250.80	98.8
3/4 inch	448.46	97.9
3/8 inch	1443.29	93.3
# 4	3437.57	84.1
# 8	110.41	73.0
# 16	288.71	55.2
# 30	477.58	36.3
# 50	619.89	22.0
# 100	725.46	11.4
# 200	788.40	5.1

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% **COBBLES =** 0.0 % **GRAVEL =** 15.9 (% **coarse =** 2.1 % **fine =** 13.8)
% **SAND =** 79.0 (% **coarse =** 14.7 % **medium =** 40.8 % **fine =** 23.5)
% **FINES =** 5.1

D_{85}= 5.06 D_{60}= 1.40 D_{50}= 0.99
D_{30}= 0.46 D_{15}= 0.20 D_{10}= 0.13
C_c= 1.1213 C_u= 10.5481

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: Mesas Area
Alluvial Sediment Gradation Area
Project Number: 05-1155BE-9

Sample Data

Source: AC-1
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded SAND
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	17978.40
Tare =	0.00
Dry sample weight =	17978.40

Sample split on number 4 sieve
Split sample data:
Sample and tare = 728.55 Tare = .00 Sample weight = 728.55
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	458.72	97.4
1 inch	612.11	96.6
3/4 inch	825.84	95.4
3/8 inch	1435.77	92.0
# 4	2338.67	87.0
# 8	73.03	78.3
# 16	202.51	62.8
# 30	404.22	38.7
# 50	610.16	14.1
# 100	694.19	4.1
# 200	716.13	1.5

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 13.0 (% coarse = 4.6 % fine = 8.4)
% SAND = 85.5 (% coarse = 11.6 % medium = 50.1 % fine = 23.8)
% FINES = 1.5

D_{85}= 3.89 D_{60}= 1.08 D_{50}= 0.81
D_{30}= 0.48 D_{15}= 0.31 D_{10}= 0.25
C_c= 0.8622 C_u= 4.3201

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: AC-2
Sample No.:
Elev. or Depth: 0-1' **Sample Length(in./cm.):**
Location:
Description: Poorly graded SAND
USCS: SP

Mechanical Analysis Data

Initial
Dry sample and tare= 19703.60
Tare = 0.00
Dry sample weight = 19703.60
Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 721.09 **Tare =** .00 **Sample weight =** 721.09
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	0.00	100.0
3/4 inch	89.11	99.5
3/8 inch	596.94	97.0
# 4	1405.78	92.9
# 8	49.21	86.6
# 16	159.34	72.4
# 30	338.55	49.3
# 50	579.17	18.3
# 100	697.99	3.0
# 200	714.85	0.8

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% **COBBLES =** 0.0 % **GRAVEL =** 7.1 (% **coarse =** 0.5 % **fine =** 6.6)
% **SAND =** 92.1 (% **coarse =** 8.9 % **medium =** 50.7 % **fine =** 32.5)
% **FINES =** 0.8

D_{85}= 2.12 D_{60}= 0.79 D_{50}= 0.61
D_{30}= 0.40 D_{15}= 0.27 D_{10}= 0.23
C_c= 0.8691 C_u= 3.4521

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: AC-3
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded GRAVEL with sand
USCS: GP

Mechanical Analysis Data

	Initial
Dry sample and tare=	23244.80
Tare =	0.00
Dry sample weight =	23244.80

Sample split on number 4 sieve
Split sample data:
Sample and tare = 878.11 Tare = .00 Sample weight = 878.11
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	680.15	97.1
1 inch	1686.19	92.7
3/4 inch	2999.30	87.1
3/8 inch	8019.45	65.5
# 4	11551.23	50.3
# 8	187.43	39.6
# 16	369.78	29.1
# 30	537.89	19.5
# 50	700.54	10.2
# 100	817.98	3.4
# 200	856.95	1.2

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 49.7 (% coarse = 12.9 % fine = 36.8)
% SAND = 49.1 (% coarse = 13.2 % medium = 22.4 % fine = 13.5)
% FINES = 1.2

D_{85}= 17.59 D_{60}= 7.75 D_{50}= 4.67
D_{30}= 1.25 D_{15}= 0.43 D_{10}= 0.30
C_c= 0.6872 C_u= 26.2488

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: Mesas Area
Alluvial Sediment Gradation Area
Project Number: 05-1155BE-9

Sample Data

Source: LC-1
Sample No.:
Elev. or Depth: 0-1' **Sample Length(in./cm.):**
Location:
Description: Well graded SAND with silt
USCS: SW-SM

Mechanical Analysis Data

Initial
Dry sample and tare= 15209.00
Tare = 0.00
Dry sample weight = 15209.00
Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 763.95 **Tare =** .00 **Sample weight =** 763.95
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	0.00	100.0
3/4 inch	54.29	99.6
3/8 inch	530.62	96.5
# 4	1422.64	90.6
# 8	90.96	79.8
# 16	239.41	62.2
# 30	422.48	40.5
# 50	581.66	21.6
# 100	663.72	11.9
# 200	705.30	7.0

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% **COBBLES** = 0.0 % **GRAVEL** = 9.4 (% **coarse** = 0.4 % **fine** = 9.0)
% **SAND** = 83.6 (% **coarse** = 14.4 % **medium** = 46.1 % **fine** = 23.1)
% **FINES** = 7.0

D_{85}= 3.14 D_{60}= 1.10 D_{50}= 0.80
D_{30}= 0.42 D_{15}= 0.20 D_{10}= 0.12
C_c= 1.3693 C_u= 9.2286

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
›ject: PACE Fluvial Study of Santa Clara River
and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: LC-2
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded SAND with gravel
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	18387.00
Tare =	0.00
Dry sample weight =	18387.00

Sample split on number 4 sieve
Split sample data:
Sample and tare = 832.53 Tare = .00 Sample weight = 832.53
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	242.95	98.7
1 inch	937.81	94.9
3/4 inch	1474.70	92.0
3/8 inch	4129.38	77.5
# 4	6963.31	62.1
# 8	183.83	48.4
# 16	388.23	33.1
# 30	557.04	20.5
# 50	684.35	11.1
# 100	771.61	4.5
# 200	810.78	1.6

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 37.9 (% coarse = 8.0 % fine = 29.9)
% SAND = 60.5 (% coarse = 17.3 % medium = 29.4 % fine = 13.8)
% FINES = 1.6

D_{85}= 13.07 D_{60}= 4.27 D_{50}= 2.55
D_{30}= 1.02 D_{15}= 0.41 D_{10}= 0.27
C_c= 0.8867 C_u= 15.6708

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: LC-3
Sample No.:
Elev. or Depth: 0-1' **Sample Length (in./cm.):**
Location:
Description: Poorly graded SAND
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	17115.80
Tare =	0.00
Dry sample weight =	17115.80

Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 784.67 **Tare =** .00 **Sample weight =** 784.67
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	123.98	99.3
3/4 inch	416.69	97.6
3/8 inch	1442.97	91.6
# 4	2356.78	86.2
# 8	40.11	81.8
# 16	152.53	69.4
# 30	372.23	45.3
# 50	636.75	16.2
# 100	734.31	5.5
# 200	764.19	2.2

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 **% GRAVEL =** 13.8 (**% coarse =** 2.4 **% fine =** 11.4)
% SAND = 84.0 (**% coarse =** 6.3 **% medium =** 50.2 **% fine =** 27.5)
% FINES = 2.2

D_{85}= 3.78 D_{60}= 0.87 D_{50}= 0.67
D_{30}= 0.43 D_{15}= 0.29 D_{10}= 0.23
C_c= 0.9172 C_u= 3.7901

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River
and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: HR-1
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded SAND with gravel
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	18704.80
Tare =	0.00
Dry sample weight =	18704.80

Sample split on number 4 sieve
Split sample data:
Sample and tare = 807.10 Tare = .00 Sample weight = 807.10
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	841.69	95.5
1 inch	1202.99	93.6
3/4 inch	1450.16	92.2
3/8 inch	2271.86	87.9
# 4	3483.16	81.4
# 8	104.06	70.9
# 16	276.70	53.5
# 30	527.54	28.2
# 50	713.86	9.4
# 100	770.09	3.7
# 200	791.09	1.6

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 18.6 (% coarse = 7.8 % fine = 10.8)
% SAND = 79.8 (% coarse = 13.8 % medium = 50.4 % fine = 15.6)
% FINES = 1.6

D_{85}= 6.71 D_{60}= 1.46 D_{50}= 1.07
D_{30}= 0.63 D_{15}= 0.39 D_{10}= 0.31
C_c= 0.8748 C_u= 4.7071

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River
and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: HR-2
Sample No.:
Elev. or Depth: 0-1' **Sample Length(in./cm.):**
Location:
Description: Poorly graded SAND with gravel
USCS: SP

Mechanical Analysis Data

Initial
Dry sample and tare= 18704.80
Tare = 0.00
Dry sample weight = 18704.80
Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 733.34 **Tare =** .00 **Sample weight =** 733.34
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	433.01	97.7
3/4 inch	899.34	95.2
3/8 inch	3322.51	82.2
# 4	5573.90	70.2
# 8	63.23	64.1
# 16	158.38	55.0
# 30	277.62	43.6
# 50	468.94	25.3
# 100	670.63	6.0
# 200	717.39	1.5

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% **COBBLES =** 0.0 % **GRAVEL =** 29.8 (% **coarse =** 4.8 % **fine =** 25.0)
% **SAND =** 68.7 (% **coarse =** 7.9 % **medium =** 26.9 % **fine =** 33.9)
% **FINES =** 1.5

D_{85}= 10.86 D_{60}= 1.67 D_{50}= 0.85
D_{30}= 0.35 D_{15}= 0.22 D_{10}= 0.18
C_c= 0.4086 C_u= 9.2675

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: HR-3
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded SAND with gravel
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	17660.60
Tare =	0.00
Dry sample weight =	17660.60

Sample split on number 4 sieve
Split sample data:
Sample and tare = 740.55 Tare = .00 Sample weight = 740.55
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	195.94	98.9
1 inch	253.36	98.6
3/4 inch	552.46	96.9
3/8 inch	1620.08	90.8
# 4	2777.78	84.3
# 8	68.28	76.5
# 16	209.20	60.5
# 30	416.09	36.9
# 50	620.47	13.7
# 100	713.88	3.0
# 200	734.13	0.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 15.7 (% coarse = 3.1 % fine = 12.6)
% SAND = 83.6 (% coarse = 10.7 % medium = 49.2 % fine = 23.7)
% FINES = 0.7

D_{85}= 5.13 D_{60}= 1.16 D_{50}= 0.86
D_{30}= 0.50 D_{15}= 0.32 D_{10}= 0.26
C_c= 0.8384 C_u= 4.5513

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: CB-1
Sample No.:
Elev. or Depth: 0-1' **Sample Length(in./cm.):**
Location:
Description: Poorly graded SAND with silt
USCS: SP-SM

Mechanical Analysis Data

	Initial
Dry sample and tare=	17933.00
Tare =	0.00
Dry sample weight =	17933.00

Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 742.07 **Tare =** .00 **Sample weight =** 742.07
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	0.00	100.0
3/4 inch	0.00	100.0
3/8 inch	103.36	99.4
# 4	223.16	98.8
# 8	5.50	98.1
# 16	23.81	95.6
# 30	88.78	87.0
# 50	289.75	60.2
# 100	589.56	20.3
# 200	700.18	5.6

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 **% GRAVEL =** 1.2 **(% coarse =** 0.0 **% fine =** 1.2)
% SAND = 93.2 **(% coarse =** 1.0 **% medium =** 21.2 **% fine =** 71.0)
% FINES = 5.6

D_{85}= 0.55 D_{60}= 0.30 D_{50}= 0.25
D_{30}= 0.18 D_{15}= 0.13 D_{10}= 0.11
C_c= 1.0559 C_u= 2.8469

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: CB-2
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded SAND with gravel
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	18114.60
Tare =	0.00
Dry sample weight =	18114.60

Sample split on number 4 sieve
Split sample data:
Sample and tare = 745.01 Tare = .00 Sample weight = 745.01
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	101.07	99.4
1 inch	275.52	98.5
3/4 inch	759.46	95.8
3/8 inch	2699.95	85.1
# 4	4680.48	74.2
# 8	106.40	63.6
# 16	255.04	48.8
# 30	405.03	33.9
# 50	576.15	16.8
# 100	703.88	4.1
# 200	732.85	1.2

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 25.8 (% coarse = 4.2 % fine = 21.6)
% SAND = 73.0 (% coarse = 13.8 % medium = 35.0 % fine = 24.2)
% FINES = 1.2

D_{85}= 9.47 D_{60}= 1.96 D_{50}= 1.25
D_{30}= 0.51 D_{15}= 0.28 D_{10}= 0.22
C_c= 0.6048 C_u= 8.9372

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: CB-3
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded SAND
USCS: SP

Mechanical Analysis Data

Initial
Dry sample and tare= 19022.60
Tare = 0.00
Dry sample weight = 19022.60
Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 824.36 **Tare =** .00 **Sample weight =** 824.36
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	155.86	99.2
3/4 inch	413.72	97.8
3/8 inch	1112.62	94.2
# 4	2022.57	89.4
# 8	74.07	81.4
# 16	215.58	66.0
# 30	428.05	43.0
# 50	672.06	16.5
# 100	767.22	6.2
# 200	802.70	2.3

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 **% GRAVEL =** 10.6 **(% coarse =** 2.2 **% fine =** 8.4)
% SAND = 87.1 **(% coarse =** 10.9 **% medium =** 49.7 **% fine =** 26.5)
% FINES = 2.3

D_{85}= 3.05 D_{60}= 0.97 D_{50}= 0.72
D_{30}= 0.44 D_{15}= 0.28 D_{10}= 0.22
C_c= 0.9072 C_u= 4.4031

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: Mesas Area
Alluvial Sediment Gradation Area
Project Number: 05-1155BE-9

Sample Data

Source: SM-1
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Well graded SAND with silt
USCS: SW-SM

Mechanical Analysis Data

	Initial
Dry sample and tare=	23017.80
Tare =	0.00
Dry sample weight =	23017.80

Sample split on number 4 sieve
Split sample data:
Sample and tare = 731.81 Tare = .00 Sample weight = 731.81
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	264.51	98.9
1 inch	644.65	97.2
3/4 inch	909.55	96.0
3/8 inch	1825.48	92.1
# 4	3038.96	86.8
# 8	65.91	79.0
# 16	198.29	63.3
# 30	387.07	40.9
# 50	543.90	22.3
# 100	613.20	14.1
# 200	649.63	9.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 13.2 (% coarse = 4.0 % fine = 9.2)
% SAND = 77.1 (% coarse = 10.7 % medium = 45.7 % fine = 20.7)
% FINES = 9.7

D_{85}= 3.87 D_{60}= 1.06 D_{50}= 0.79
D_{30}= 0.42 D_{15}= 0.17 D_{10}= 0.08
C_c= 2.0885 C_u= 13.4193

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: SM-2
Sample No.:
Elev. or Depth: 0-1' **Sample Length(in./cm.):**
Location:
Description: Silty SAND with gravel
USCS: SM

Mechanical Analysis Data

	Initial
Dry sample and tare=	60245.80
Tare =	0.00
Dry sample weight =	60245.80

Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 957.88 **Tare =** .00 **Sample weight =** 957.88
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	2121.72	96.5
1-1/2 inch	7269.59	87.9
1 inch	8084.04	86.6
3/4 inch	8958.31	85.1
3/8 inch	11591.67	80.8
# 4	14891.85	75.3
# 8	99.38	67.5
# 16	269.61	54.1
# 30	436.80	41.0
# 50	571.38	30.4
# 100	695.68	20.6
# 200	801.50	12.3

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% **COBBLES =** 3.5 % **GRAVEL =** 21.2 (% **coarse =** 11.4 % **fine =** 9.8)
% **SAND =** 63.0 (% **coarse =** 10.6 % **medium =** 29.2 % **fine =** 23.2)
% **FINES =** 12.3

D_{85}= 18.73 D_{60}= 1.57 D_{50}= 0.97
D_{30}= 0.29 D_{15}= 0.09

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: PACE Fluvial Study of Santa Clara River
and Tributaries
Project Number: 05-1155BE-9(2)

Sample Data

Source: SM-3
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Silty SAND with gravel
USCS: SM

Mechanical Analysis Data

	Initial
Dry sample and tare=	16207.80
Tare =	0.00
Dry sample weight =	16207.80

Sample split on number 4 sieve
Split sample data:
Sample and tare = 751.27 Tare = .00 Sample weight = 751.27
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	483.46	97.0
1 inch	671.79	95.9
3/4 inch	799.18	95.1
3/8 inch	1583.39	90.2
# 4	2469.85	84.8
# 8	55.59	78.5
# 16	132.52	69.8
# 30	230.47	58.8
# 50	397.47	39.9
# 100	518.21	26.3
# 200	600.30	17.0

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 15.2 (% coarse = 4.9 % fine = 10.3)
% SAND = 67.8 (% coarse = 8.2 % medium = 27.0 % fine = 32.6)
% FINES = 17.0

D_{85}= 4.87 D_{60}= 0.63 D_{50}= 0.43
D_{30}= 0.19

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: Mesas Area
Alluvial Sediment Gradation Area
Project Number: 05-1155BE-9

Sample Data

Source: CC-1
Sample No.:
Elev. or Depth: 0-1' **Sample Length(in./cm.):**
Location:
Description: Poorly graded SAND with gravel
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	18477.80
Tare =	0.00
Dry sample weight =	18477.80

Sample split on number 4 **sieve**
Split sample data:
Sample and tare = 779.92 **Tare =** .00 **Sample weight =** 779.92
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	135.00	99.3
1 inch	584.04	96.8
3/4 inch	1088.55	94.1
3/8 inch	2113.98	88.6
# 4	3032.35	83.6
# 8	60.03	77.2
# 16	209.43	61.2
# 30	436.82	36.8
# 50	631.92	15.9
# 100	713.17	7.2
# 200	744.09	3.8

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% **COBBLES =** 0.0 % **GRAVEL =** 16.4 (% **coarse =** 5.9 % **fine =** 10.5)
% **SAND =** 79.8 (% **coarse =** 9.1 % **medium =** 49.4 % **fine =** 21.3)
% **FINES =** 3.8

D_{85}= 5.81 D_{60}= 1.14 D_{50}= 0.86
D_{30}= 0.49 D_{15}= 0.29 D_{10}= 0.21
C_c= 1.0418 C_u= 5.5003

GRAIN SIZE DISTRIBUTION TEST DATA

Client: The Newhall Land & Farming Company
Project: Mesas Area
Alluvial Sediment Gradation Area
Project Number: 05-1155BE-9

Sample Data

Source: Lion-1
Sample No.:
Elev. or Depth: 0-1'
Sample Length(in./cm.):
Location:
Description: Poorly graded SAND
USCS: SP

Mechanical Analysis Data

	Initial
Dry sample and tare=	17660.60
Tare =	0.00
Dry sample weight =	17660.60

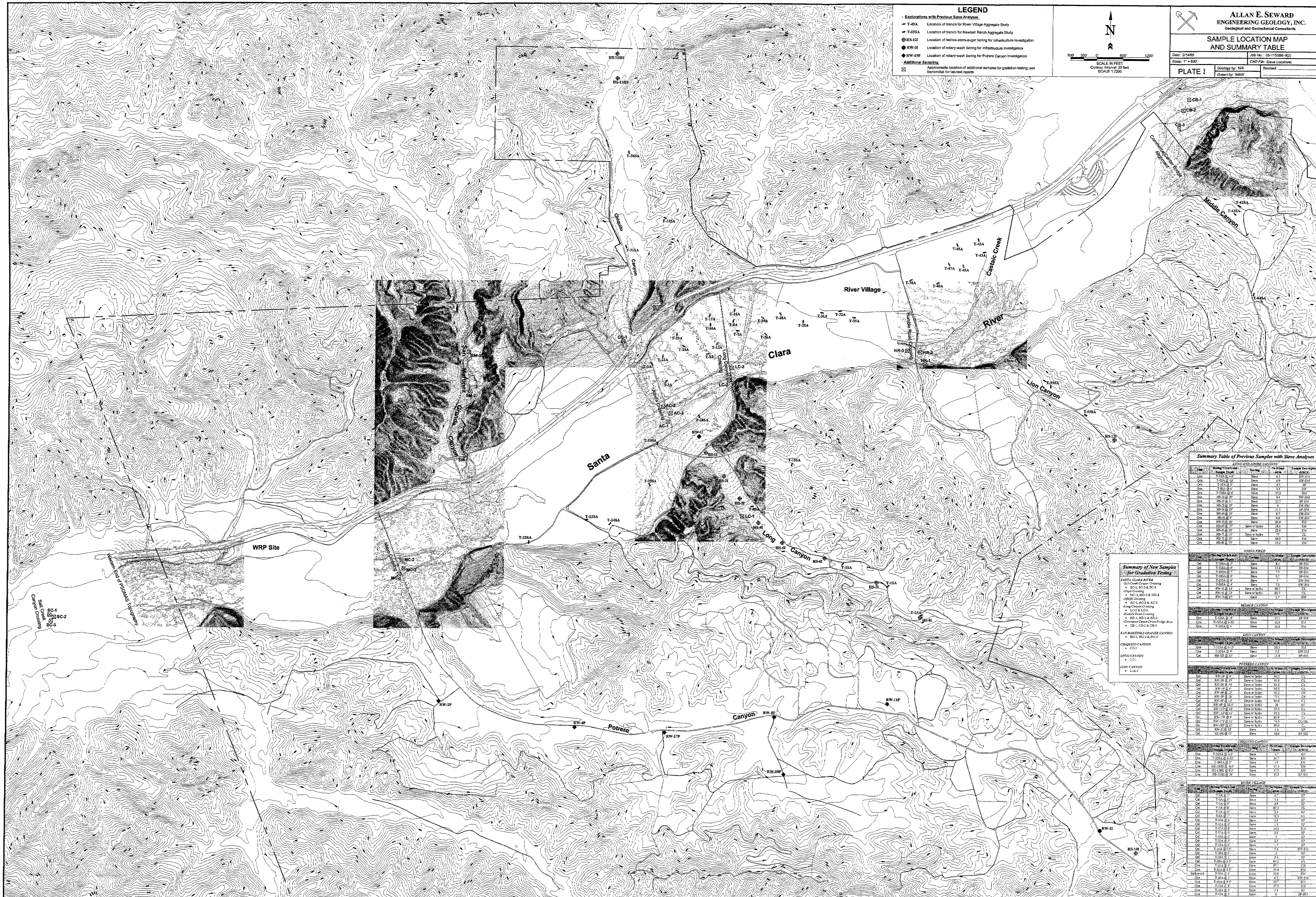
Sample split on number 4 sieve
Split sample data:
Sample and tare = 683.31 Tare = .00 Sample weight = 683.31
Cumulative weight retained tare= .00
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
3 inch	0.00	100.0
1-1/2 inch	0.00	100.0
1 inch	106.88	99.4
3/4 inch	150.98	99.1
3/8 inch	627.92	96.4
# 4	1659.02	90.6
# 8	46.53	84.4
# 16	150.65	70.6
# 30	311.37	49.3
# 50	501.22	24.1
# 100	617.55	8.7
# 200	653.55	3.9

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = 0.0 % GRAVEL = 9.4 (% coarse = 0.9 % fine = 8.5)
% SAND = 86.7 (% coarse = 8.6 % medium = 45.6 % fine = 32.5)
% FINES = 3.9

D_{85}= 2.48 D_{60}= 0.82 D_{50}= 0.61
D_{30}= 0.36 D_{15}= 0.21 D_{10}= 0.16
C_c= 0.9476 C_u= 4.9895



LEGEND

- Explorations with Previous Sieve Analyses
- T-49A Location of trench for River Village Aggregate Study
- T-55SA Location of trench for Newhall Ranch Aggregate Study
- HS-12I Location of hollow-stem-auger boring for Infrastructure Investigation
- RW-2I Location of rotary-wash boring for Infrastructure Investigation
- RW-17P Location of rotary-wash boring for Potrero Canyon Investigation
- Additional Sampling
- ⊠ Approximate location of additional samples for gradation testing; see transmittal for lab-test reports

N

SCALE IN FEET
Contour Interval: 25 feet
SCALE 1:7200

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

SAMPLE LOCATION MAP AND SUMMARY TABLE

Date: 2/14/05	Job No.: 05-1155BE-9(2)
Scale: 1" = 600'	CAD File: Sieve Locations
PLATE I	Geology by: N/A
	Drawn by: MBW
	Revised:

Summary of New Samples for Gradation Testing

SANTA CLARA RIVER
- Salt Creek Canyon Crossing
  - SC-1, SC-2 & SC-3
- Magic Crossing
  - MC-1, MC-2 & MC-3
- Airfield Crossing
  - AC-1, AC-2 & AC-3
- Long Canyon Crossing
  - LC-1, LC-2 & LC-3
- Humble Road Crossing
  - HR-1, HR-2 & HR-3
- Commerce Center Drive Bridge Area
  - CB-1, CB-2 & CB-3

SAN MARTINEZ GRANDE CANYON
- SM-1, SM-2 & SM-3

CHIQUITO CANYON
- CC-1

LONG CANYON
- LC-1

LION CANYON
- Lion-1

Summary Table of Previous Samples with Sieve Analyses

LONG AND ADOBE CANYONS

Map	Boring/Trench and Sample Depth	Testing	% Minus #200	Sample Description (USCS)
Qoa	T-30A @ 4'	Sieve	8.1	SW-SM
Qoa	T-25A @ 12'	Sieve	6.9	SW-SM
Qoa	T-35A @ 5'	Sieve	4.7	SP
Qoa	T-8SA @ 6'	Sieve	3.4	SW
Qoa	T-158A @ 6'	Sieve	37.3	SM
Qoa	HS-1I @ 20'	Sieve	8.4	SW-SM
Qoa	HS-2I @ 5'	Sieve	11.7	SP-SM
Qoa	HS-2I @ 20'	Sieve	6	SW-SM
Qoa	HS-3I @ 30'	Sieve	11.1	SP-SM
Qoa	HS-4I @ 25'	Sieve	9.7	SW-SM
Qoa	HS-4I @ 35'	Sieve	6.6	SW-SM
Qoa	HS-5I @ 20'	Sieve	20.9	SM
Qoa	HS-6I @ 5'	Sieve w/ hydro	18.4	SM
Qoa	HS-6I @ 25'	Sieve	22.9	SM
Qoa	HS-7I @ 5'	Sieve w/ hydro	77	CL
Qoa	HS-7I @ 25'	Sieve	39.9	SM
Qoa	HS-8I @ 15'	Sieve	13.2	SM

ONION FIELD

Map	Boring/Trench and Sample Depth	Testing	% Minus #200	Sample Description (USCS)
Qal	T-195A @ 5'	Sieve	8.4	SP-SM
Qal	T-225A @ 4'	Sieve	11.4	SP-SM
Qal	T-235A @ 6'	Sieve	7.5	SP-SM
Qal	T-245A @ 5'	Sieve	5.7	SP-SM
Qal	T-255A @ 5'	Sieve	3	SW-SM
Qal	T-285A @ 4'	Sieve	5.3	SW-SM
Qal	RW-1I @ 14'	Sieve w/ hydro	58.7	CL
Qal	RW-1I @ 30'	Sieve w/ hydro	92.7	CL
Qal	RW-1I @ 57'	Sieve	2.7	GW

MIDDLE CANYON

Map	Boring/Trench and Sample Depth	Testing	% Minus #200	Sample Description (USCS)
Qoa	T-42SA @ 5'	Sieve	11.1	SP-SM
Qoa	T-43SA @ 10'	Sieve	43.3	SM
Qoa	T-44SA @ 6'	Sieve	13.3	SM

LION CANYON

Map	Boring/Trench and Sample Depth	Testing	% Minus #200	Sample Description (USCS)
Qoa	T-55SA @ 5'	Sieve	20.3	SM
Qoa	T-55SA @ 4'	Sieve	7.3	SW-SM
Qal	HS-12I @ 10'	Sieve	11.9	SP-SM

POTRERO CANYON

Map	Boring/Trench and Sample Depth	Testing	% Minus #200	Sample Description (USCS)
Qal	RW-2P @ 5'	Sieve w/ hydro	91.2	CL
Qal	RW-2P @ 15'	Sieve w/ hydro	60.7	CL
Qal	RW-2P @ 30'	Sieve w/ hydro	93.2	CL
Qal	RW-4P @ 5'	Sieve w/ hydro	89.8	CL
Qal	RW-4P @ 10'	Sieve w/ hydro	92.2	CH
Qal	RW-4P @ 35'	Sieve w/ hydro	73.1	CH
Qal	RW-8P @ 10'	Sieve w/ hydro	84.8	CL
Qal	RW-8P @ 28.5'	Sieve w/ hydro	28	SC
Qal	RW-11P @ 10'	Sieve w/ hydro	93.3	CL
Qal	RW-11P @ 20'	Sieve w/ hydro	92.2	CL
Qal	RW-17P @ 5'	Sieve w/ hydro	89.9	CL
Qal	RW-17P @ 25'	Sieve w/ hydro	74.9	CL-ML
Qal	RW-18P @ 25'	Sieve w/ hydro	99.1	CL
Qal	HS-10I @ 5'	Sieve	1.3	GP
Qal	HS-10I @ 15'	Sieve	10.6	SP-SM

CHIQUITO CANYON

Map	Boring/Trench and Sample Depth	Testing	% Minus #200	Sample Description (USCS)
Qoa	T-31SA @ 3.5'	Sieve	6.7	SP
Qoa	T-32SA @ 3.5'	Sieve	16.1	SM
Qoa	T-36SA @ 5'	Sieve	3.9	SW
Qoa	HS-13RS @ 6.5'	Sieve	17.4	SM
Qoa	HS-13RS @ 6.0'	Sieve	17.8	SM
Qoa	HS-11RS @ 10'	Sieve	10.3	SP-SM

RIVER VILLAGE

[illegible]

Santa Clara River Fluvial Study

APPENDIX CHAPTER 4.1

Existing Condition HEC-RAS Output

Plan	***Description***
FinalEx025	*Fluvial Model, Existing Conditions, n=0.025, subcritical flow*
Exist025	*Approved Model, Existing Conditions, n=0.025, mixed flow*
Exist085	*Approved Model, Existing Conditions, n=0.085, mixed flow*

HEC-RAS model modified for fluvial use. See section 4.1.1B for model assembly. For unmodified, mixed flow regimes used in report, refer also to HEC-RAS Modeling Report prepared by PACE, concurrently submitted to LACDPW.

PACE
PACIFIC ADVANCED CIVIL ENGINEERING, INC.

HEC-RAS Plan: FinalEx025 River: Reach #1 Reach: SCR Profile: Rev BB FP

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SCR	46195	Rev BB FP	115111.00	1035.00	1054.30	1054.30	1060.32	0.004006	19.69	5847.54	483.37	1.00
SCR	46020	Rev BB FP	115111.00	1032.00	1052.44	1052.44	1058.13	0.004154	19.14	6013.48	531.51	1.00
SCR	45545	Rev BB FP	115111.00	1030.00	1049.24	1049.24	1055.65	0.004022	20.32	5664.11	446.75	1.01
SCR	45030	Rev BB FP	115111.00	1025.00	1045.55	1044.56	1050.46	0.003176	17.78	6472.94	521.47	0.89
SCR	44585	Rev BB FP	115111.00	1022.00	1043.05	1043.05	1048.75	0.004191	19.17	6003.55	531.86	1.01
SCR	44210	Rev BB FP	115111.00	1020.00	1041.58	1038.72	1044.97	0.001990	14.77	7793.11	585.85	0.71
SCR	43820	Rev BB FP	115111.00	1018.00	1037.47	1037.47	1043.62	0.004071	19.90	5785.45	476.53	1.01
SCR	43610	Rev BB FP	115111.00	1017.00	1034.08	1034.08	1040.13	0.004047	19.74	5832.16	483.68	1.00
SCR	43410	Rev BB FP	115111.00	1016.00	1030.73	1030.73	1035.85	0.004290	18.16	6338.30	623.33	1.00
SCR	43200	Rev BB FP	115111.00	1014.00	1029.28	1029.28	1033.94	0.004388	17.31	6660.68	737.19	1.00
SCR	42975	Rev BB FP	115111.00	1012.00	1026.11	1026.11	1030.25	0.004610	16.33	7050.19	860.39	1.01
SCR	42815	Rev BB FP	115111.00	1011.00	1024.28	1024.28	1027.89	0.004790	15.25	7548.64	1051.01	1.00
SCR	42590	Rev BB FP	115111.00	1010.00	1021.27	1021.27	1024.75	0.004840	14.96	7695.66	1112.88	1.00
SCR	42430	Rev BB FP	115111.00	1008.00	1019.61	1019.61	1023.32	0.004688	15.45	7449.45	1001.02	1.00
SCR	42215	Rev BB FP	115111.00	1006.00	1020.41	1017.69	1022.03	0.001689	10.21	11269.54	1312.59	0.61
SCR	41940	Rev BB FP	115111.00	1005.00	1019.50	1017.71	1021.46	0.002356	11.22	10258.18	1332.54	0.71
SCR	41730	Rev BB FP	115111.00	1004.00	1018.92	1016.50	1020.95	0.002293	11.42	10078.82	1249.08	0.71
SCR	41460	Rev BB FP	115111.00	1002.00	1018.33	1015.19	1020.31	0.002413	11.29	10198.64	1335.15	0.72
SCR	41280	Rev BB FP	115111.00	1001.00	1015.32	1015.32	1019.50	0.004619	16.41	7014.27	851.93	1.01
SCR	41080	Rev BB FP	115111.00	1000.00	1013.55	1013.55	1017.58	0.004646	16.10	7149.54	899.03	1.01
SCR	40825	Rev BB FP	115111.00	999.50	1012.18	1012.18	1015.60	0.004898	14.84	7757.40	1146.76	1.01
SCR	40585	Rev BB FP	115111.00	998.00	1010.63	1010.63	1014.02	0.004921	14.79	7785.23	1161.38	1.01
SCR	40335	Rev BB FP	115111.00	996.00	1010.35	1008.85	1012.23	0.002580	11.01	10452.09	1494.47	0.73
SCR	40130	Rev BB FP	115111.00	995.00	1009.98	1008.43	1011.66	0.002378	10.38	11087.02	1631.34	0.70
SCR	39945	Rev BB FP	115111.00	994.00	1009.80	1007.56	1011.20	0.001767	9.48	12146.73	1639.30	0.61
SCR	39755	Rev BB FP	115111.00	994.00	1007.25	1007.25	1010.49	0.004940	14.43	7974.76	1237.97	1.00
SCR	39605	Rev BB FP	115111.00	993.00	1005.69	1005.69	1009.04	0.004873	14.70	7830.63	1171.12	1.00
SCR	39310	Rev BB FP	115111.00	992.00	1004.14	1004.14	1007.48	0.004928	14.68	7841.97	1184.07	1.01
SCR	39100	Rev BB FP	115111.00	990.00	1004.20	1001.97	1006.14	0.002266	11.20	10276.12	1302.03	0.70
SCR	38925	Rev BB FP	115111.00	989.50	1003.90	1001.28	1005.76	0.001836	10.94	10519.67	1177.05	0.65
SCR	38710	Rev BB FP	115111.00	988.00	1003.69	999.99	1005.37	0.001311	10.39	11078.47	1039.00	0.56
SCR	38475	Rev BB FP	115111.00	986.00	1000.24	1000.24	1004.59	0.004502	16.74	6875.81	795.53	1.00
SCR	38300	Rev BB FP	115111.00	985.50	998.05	997.52	1002.29	0.003650	16.53	6965.85	701.78	0.92
SCR	38065	Rev BB FP	115111.00	984.00	998.22	995.71	1001.31	0.002051	14.09	8168.84	678.40	0.72
SCR	37810	Rev BB FP	115111.00	983.00	995.21	995.21	1000.37	0.004314	18.21	6319.82	622.08	1.01
SCR	37655	Rev BB FP	115111.00	982.00	994.15	994.15	998.54	0.004123	16.80	6851.08	789.42	1.01
SCR	37390	Rev BB FP	115111.00	981.00	989.86	989.86	993.67	0.004341	15.72	7414.85	986.73	0.98
SCR	37135	Rev BB FP	115111.00	980.00	988.56	988.56	992.08	0.004805	15.06	7645.53	1091.59	1.00
SCR	36930	Rev BB FP	115111.00	978.00	987.71	986.88	990.46	0.003082	13.31	8648.06	1125.51	0.85
SCR	36735	Rev BB FP	115111.00	977.00	986.38	986.38	989.70	0.004220	14.61	7881.46	1194.24	1.00
SCR	36515	Rev BB FP	115111.00	975.00	986.32	985.26	988.59	0.002509	12.09	9521.48	1325.55	0.79
SCR	36265	Rev BB FP	115111.00	974.00	985.17	984.78	987.82	0.003492	13.07	8806.95	1373.08	0.91
SCR	36080	Rev BB FP	116236.00	973.00	984.11	984.11	987.01	0.005036	13.69	8492.54	1450.39	1.00
SCR	35845	Rev BB FP	116236.00	971.00	983.85	982.83	985.95	0.002440	11.61	10013.52	1478.08	0.79
SCR	35725	Rev BB FP	116236.00	970.00	982.55	982.55	985.50	0.003815	13.77	8438.90	1427.85	1.00
SCR	35515	Rev BB FP	116236.00	969.00	981.34	981.34	984.38	0.003984	13.99	8309.50	1362.77	1.00
SCR	35245	Rev BB FP	116236.00	968.00	980.14	980.14	983.10	0.004877	13.82	8434.21	1553.42	0.99
SCR	35040	Rev BB FP	116236.00	967.00	978.39	978.32	981.35	0.004794	13.81	8428.24	1401.79	0.98
SCR	34860	Rev BB FP	116236.00	966.00	977.44	977.44	980.48	0.004989	13.99	8307.51	1362.96	1.00
SCR	34720	Rev BB FP	116236.00	965.50	976.17	976.17	979.16	0.005117	13.87	8382.47	1419.56	1.01
SCR	34495	Rev BB FP	116236.00	964.00	974.28	974.28	977.32	0.004209	13.98	8313.86	1380.43	1.00
SCR	34310	Rev BB FP	116236.00	963.00	972.65	972.65	975.83	0.004062	14.32	8114.63	1297.65	1.01
SCR	34090	Rev BB FP	116236.00	962.00	971.64	971.64	974.82	0.004044	14.31	8123.85	1281.00	1.00
SCR	33880	Rev BB FP	116236.00	960.00	970.45	970.45	973.58	0.004005	14.20	8187.96	1320.08	1.00
SCR	33710	Rev BB FP	116236.00	959.00	969.26	969.26	972.35	0.004225	14.11	8238.14	1363.23	1.01
SCR	33500	Rev BB FP	116236.00	958.00	968.15	968.15	970.81	0.003739	13.10	8872.21	1690.39	1.01
SCR	33310	Rev BB FP	116236.00	957.00	967.01	967.01	969.61	0.003786	12.93	8986.36	1751.52	1.01
SCR	33115	Rev BB FP	116236.00	956.00	966.35	965.60	968.34	0.003605	11.33	10261.76	1811.54	0.84
SCR	32795	Rev BB FP	116236.00	954.00	964.95	964.63	967.26	0.003022	12.20	9528.82	1732.86	0.92
SCR	32605	Rev BB FP	116236.00	952.00	963.45	963.45	966.51	0.004030	14.05	8272.67	1344.60	1.00
SCR	32265	Rev BB FP	140776.00	950.00	961.37	961.37	964.12	0.004005	13.31	10579.17	1944.94	1.01
SCR	31875	Rev BB FP	140776.00	949.00	960.00	960.00	961.85	0.003750	10.91	12908.13	2482.20	0.84
SCR	31585	Rev BB FP	140776.00	946.00	957.67	956.99	959.64	0.003504	11.25	12511.05	2181.08	0.83
SCR	31360	Rev BB FP	140776.00	944.00	957.21	955.40	958.92	0.002285	10.51	13391.47	1875.23	0.69
SCR	31060	Rev BB FP	140776.00	942.00	957.24	953.29	958.34	0.000890	8.41	16729.49	1706.23	0.47
SCR	30720	Rev BB FP	140776.00	940.00	957.27	951.33	957.99	0.000542	6.81	20683.35	1886.90	0.36
SCR	30445	Rev BB FP	140776.00	938.00	957.20	949.57	957.83	0.000402	6.38	22074.12	1777.56	0.32
SCR	30095	Rev BB FP	140776.00	936.00	956.95	947.93	957.67	0.000462	6.82	20641.04	1666.43	0.34
SCR	29815	Rev BB FP	140776.00	935.00	956.59	948.10	957.51	0.000632	7.66	18372.99	1572.98	0.40
SCR	29565	Rev BB FP	140776.00	934.00	956.46	947.27	957.34	0.000612	7.51	18750.19	1613.45	0.39
SCR	29385	Rev BB FP	140776.00	933.00	956.05	948.99	957.18	0.000905	8.52	16517.20	1577.58	0.46
SCR	29140	Rev BB FP	140776.00	932.00	954.74	950.98	956.78	0.001928	11.47	12276.15	1324.48	0.66
SCR	28895	Rev BB FP	140776.00	930.00	951.63	951.63	955.99	0.002780	16.75	8402.32	965.72	1.00
SCR	28695	Rev BB FP	140776.00	928.00	947.85	947.85	953.31	0.004258	18.75	7507.53	701.05	1.01
SCR	28500	Rev BB FP	140776.00	927.50	945.09	945.09	951.16	0.003848	19.77	7160.17	654.24	0.99
SCR	28280	Rev BB FP	140776.00	926.00	941.65	941.65	947.91	0.004004	20.08	7009.50	562.69	1.00
SCR	28080	Rev BB FP	140776.00	925.00	942.26	940.11	946.59	0.002276	16.70	8441.98	682.92	0.80
SCR	27925	Rev BB FP	140776.00	924.00	940.35	939.49	946.04	0.003135	19.14	7355.35	549.81	0.92

HEC-RAS Plan: FinalEx025 River: Reach #1 Reach: SCR Profile: Rev BB FP (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SCR	27725	Rev BB FP	140776.00	923.00	939.27	939.27	945.37	0.003256	19.81	7106.64	586.68	1.00
SCR	27545	Rev BB FP	140776.00	922.00	937.65	937.65	943.27	0.003489	19.04	7395.60	656.47	1.00
SCR	27335	Rev BB FP	140776.00	921.00	936.22	936.22	940.84	0.003040	17.25	8160.86	887.01	1.00
SCR	27155	Rev BB FP	140776.00	920.50	935.43	935.43	939.62	0.003289	16.42	8571.55	1033.54	1.01
SCR	26990	Rev BB FP	140776.00	920.00	933.74	933.74	937.63	0.003639	15.83	8895.76	1147.56	1.00
SCR	26780	Rev BB FP	140776.00	918.00	931.35	931.35	935.09	0.003642	15.50	9080.65	1213.45	1.00
SCR	26575	Rev BB FP	140776.00	917.00	930.61	929.96	933.73	0.003645	14.19	9923.76	1259.87	0.89
SCR	26355	Rev BB FP	140776.00	916.00	929.17	929.17	932.77	0.004708	15.22	9247.19	1278.41	1.00
SCR	26170	Rev BB FP	140776.00	915.00	928.86	928.12	931.70	0.003430	13.53	10408.48	1352.53	0.86
SCR	25965	Rev BB FP	140776.00	914.00	927.22	927.22	930.82	0.004764	15.21	9254.71	1290.20	1.00
SCR	25785	Rev BB FP	140776.00	913.50	926.05	926.05	929.53	0.004772	14.97	9402.31	1344.86	1.00
SCR	25600	Rev BB FP	140776.00	912.50	924.93	924.89	927.92	0.004891	13.87	10151.10	1661.55	0.99
SCR	25425	Rev BB FP	140776.00	911.00	925.37	923.83	927.03	0.001843	10.34	13664.53	2021.56	0.69
SCR	25215	Rev BB FP	140776.00	910.00	923.33	923.33	926.30	0.005117	13.83	10181.28	1732.15	1.01
SCR	25000	Rev BB FP	140776.00	909.00	922.13	922.13	924.61	0.003543	12.64	11135.49	2284.18	1.01
SCR	24795	Rev BB FP	140776.00	908.00	920.36	920.36	922.81	0.003986	12.56	11204.68	2315.50	1.01
SCR	24550	Rev BB FP	140776.00	906.00	919.48	917.96	920.95	0.001944	9.74	14446.28	2238.32	0.68
SCR	24335	Rev BB FP	140776.00	905.00	917.62	917.62	920.25	0.004333	12.99	10833.43	2087.54	1.01
SCR	24115	Rev BB FP	140776.00	904.00	915.93	915.93	918.60	0.005232	13.09	10751.27	2018.76	1.00
SCR	23975	Rev BB FP	140776.00	903.50	914.60	914.60	917.35	0.004636	13.31	10577.23	1919.34	1.00
SCR	23755	Rev BB FP	140776.00	902.00	913.25	913.24	916.01	0.004627	13.32	10567.82	1938.03	1.01
SCR	23565	Rev BB FP	140776.00	900.00	912.40	912.40	915.10	0.004610	13.17	10691.96	2036.28	1.01
SCR	23365	Rev BB FP	140776.00	900.00	911.13	911.13	914.01	0.004622	13.63	10329.86	1783.88	1.00
SCR	23180	Rev BB FP	140776.00	899.00	910.96	909.39	912.53	0.001984	10.05	14012.48	2086.48	0.68
SCR	23000	Rev BB FP	140776.00	898.00	910.89	908.39	912.14	0.001366	8.95	15727.65	2065.37	0.57
SCR	22790	Rev BB FP	140776.00	897.50	910.43	908.15	911.83	0.001448	9.49	14833.41	1946.22	0.61
SCR	22600	Rev BB FP	140776.00	896.00	910.14	907.56	911.55	0.001434	9.52	14788.10	1866.40	0.60
SCR	22415	Rev BB FP	140776.00	895.50	909.67	906.93	911.25	0.001552	10.10	13933.69	1712.91	0.62
SCR	22195	Rev BB FP	141426.00	894.00	906.88	906.88	910.54	0.003786	15.36	9204.46	1262.71	1.00
SCR	22010	Rev BB FP	141426.00	892.00	906.16	906.16	909.69	0.003347	15.08	9380.50	1322.09	1.00
SCR	21790	Rev BB FP	141426.00	891.50	904.86	904.86	908.08	0.002972	14.39	9826.50	1586.66	1.00
SCR	21615	Rev BB FP	141426.00	892.00	903.09	903.09	906.00	0.003182	13.67	10342.23	1845.66	1.00
SCR	21440	Rev BB FP	141426.00	890.00	901.21	901.21	904.53	0.003865	14.61	9680.27	1773.54	1.00
SCR	21225	Rev BB FP	141426.00	888.00	899.81	899.81	902.28	0.003807	12.60	11221.48	2263.50	1.00
SCR	21020	Rev BB FP	141426.00	887.00	897.42	897.42	900.35	0.003921	13.75	10350.76	1908.44	0.99
SCR	20845	Rev BB FP	141426.00	886.00	897.00	897.00	899.41	0.003869	12.46	11348.13	2407.34	1.01
SCR	20595	Rev BB FP	141426.00	885.00	896.43	895.88	898.31	0.002651	10.99	12863.10	2527.28	0.86
SCR	20435	Rev BB FP	141426.00	884.00	896.19	895.33	897.84	0.002261	10.32	13709.67	2581.09	0.79
SCR	20280	Rev BB FP	141426.00	883.70	895.03	895.03	897.31	0.003977	12.14	11653.22	2572.83	1.00
SCR	20070	Rev BB FP	141426.00	882.00	892.74	892.74	895.13	0.003743	12.41	11394.63	2436.05	1.01
SCR	19855	Rev BB FP	141426.00	880.50	891.12	891.12	893.79	0.004114	13.12	10778.78	2072.85	1.01
SCR	19630	Rev BB FP	141426.00	880.00	889.83	889.73	892.52	0.003926	13.17	10735.19	1914.99	0.98
SCR	19440	Rev BB FP	141426.00	878.00	889.91	888.74	891.71	0.002179	10.75	13151.45	2083.68	0.75
SCR	19240	Rev BB FP	141426.00	877.50	888.85	888.46	891.14	0.003158	12.14	11650.49	2090.11	0.91
SCR	19050	Rev BB FP	141426.00	876.00	889.03	887.20	890.46	0.001682	9.60	14759.68	2167.39	0.64
SCR	18830	Rev BB FP	141426.00	874.00	888.73	886.52	890.09	0.001481	9.34	15134.89	2098.85	0.61
SCR	18650	Rev BB FP	141426.00	873.50	888.68	885.42	889.80	0.001016	8.50	16644.25	2025.07	0.52
SCR	18475	Rev BB FP	141426.00	872.00	888.66	884.58	889.58	0.000752	7.70	18373.58	1945.01	0.44
SCR	18290	Rev BB FP	141426.00	871.50	888.41	884.39	889.43	0.000811	8.11	17448.54	1844.66	0.46
SCR	18025	Rev BB FP	141426.00	870.00	888.32	882.81	889.21	0.000556	7.57	18674.68	1611.77	0.39
SCR	17785	Rev BB FP	141426.00	868.00	887.90	882.80	889.03	0.000782	8.54	16558.68	1418.63	0.44
SCR	17510	Rev BB FP	141426.00	867.50	886.20	883.72	888.57	0.002372	12.34	11457.08	1289.70	0.73
SCR	17360	Rev BB FP	141426.00	866.50	883.43	883.43	887.88	0.004458	16.92	8357.42	937.14	1.00
SCR	17110	Rev BB FP	141426.00	864.00	881.13	881.13	884.63	0.004863	15.00	9425.53	1362.48	1.01
SCR	16970	Rev BB FP	141426.00	863.70	879.71	879.71	882.95	0.004916	14.43	9799.49	1514.81	1.00
SCR	16720	Rev BB FP	141426.00	863.50	875.31	875.31	878.43	0.005042	14.17	9981.85	1620.98	1.01
SCR	16515	Rev BB FP	141426.00	862.00	873.47	873.47	876.26	0.005133	13.41	10549.67	1886.90	1.00
SCR	16305	Rev BB FP	141426.00	860.00	871.57	871.17	874.03	0.004195	12.59	11236.89	1898.55	0.91
SCR	16130	Rev BB FP	141426.00	860.00	870.50	870.50	873.24	0.004481	13.29	10641.43	1964.99	1.01
SCR	15960	Rev BB FP	141426.00	859.00	869.21	869.21	871.76	0.004764	12.82	11034.61	2192.96	1.01
SCR	15745	Rev BB FP	141426.00	858.00	868.55	867.80	870.41	0.003042	10.94	12927.79	2278.92	0.81
SCR	15540	Rev BB FP	141426.00	857.50	868.10	867.08	869.78	0.002644	10.40	13602.23	2324.38	0.76
SCR	15335	Rev BB FP	141426.00	856.00	866.54	866.54	868.99	0.004652	12.57	11254.13	2302.38	1.00
SCR	15125	Rev BB FP	142475.00	854.00	864.54	864.54	867.47	0.004356	13.74	10371.47	1768.96	1.00
SCR	14900	Rev BB FP	142475.00	853.00	863.28	863.28	866.30	0.005056	13.96	10205.62	1697.82	1.00
SCR	14720	Rev BB FP	142475.00	852.00	862.06	862.06	864.98	0.004688	13.72	10381.85	1810.00	1.01
SCR	14480	Rev BB FP	142475.00	850.50	860.54	860.53	863.45	0.004424	13.69	10409.04	1796.48	1.00
SCR	14315	Rev BB FP	142475.00	850.00	859.85	859.82	862.67	0.004566	13.47	10576.74	1874.03	1.00
SCR	14090	Rev BB FP	142475.00	849.71	858.68	858.68	861.60	0.004613	13.72	10387.90	1766.91	1.00
SCR	13850	Rev BB FP	142475.00	848.00	857.12	857.12	860.09	0.004634	13.84	10293.87	1731.37	1.00
SCR	13635	Rev BB FP	142475.00	846.00	855.96	855.96	859.00	0.004582	13.99	10182.29	1687.45	1.00
SCR	13425	Rev BB FP	142475.00	845.00	854.59	854.59	857.38	0.004390	13.41	10627.77	1893.46	1.00
SCR	13190	Rev BB FP	142475.00	844.00	853.13	852.76	855.64	0.003872	12.71	11213.28	1844.92	0.91
SCR	13030	Rev BB FP	142475.00	843.00	852.67	851.98	855.02	0.003287	12.32	11565.85	1764.20	0.85
SCR	12835	Rev BB FP	142475.00	842.00	852.13	851.03	854.41	0.002756	12.10	11770.00	1607.56	0.79
SCR	12615	Rev BB FP	142475.00	841.00	851.84	849.84	853.81	0.001933	11.27	12646.02	1470.54	0.68
SCR	12395	Rev BB FP	142475.00	840.00	851.49	849.20	853.39	0.001707	11.07	12874.21	1438.10	0.65
SCR	12195	Rev BB FP	142475.00	838.98	851.43	848.08	853.01	0.001240	10.08	14130.68	1388.77	0.56

HEC-RAS Plan: FinalEx025 River: Reach #1 Reach: SCR Profile: Rev BB FP (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SCR	11995	Rev BB FP	142475.00	837.00	850.69	848.07	852.68	0.001558	11.32	12590.58	1281.38	0.64
SCR	11780	Rev BB FP	142475.00	836.00	850.53	847.67	852.30	0.001399	10.65	13373.20	1402.92	0.61
SCR	11605	Rev BB FP	142475.00	835.50	849.74	847.20	851.99	0.001650	12.04	11832.96	1304.15	0.70
SCR	11405	Rev BB FP	142475.00	834.00	849.43	846.23	851.67	0.001422	12.02	11855.13	1132.15	0.65
SCR	11180	Rev BB FP	142475.00	833.00	847.64	845.64	851.13	0.002642	14.99	9504.91	868.52	0.80
SCR	11015	Rev BB FP	142475.00	831.50	844.84	844.84	850.40	0.003841	18.92	7530.61	680.33	1.00
SCR	10835	Rev BB FP	142475.00	831.00	843.79	843.79	848.64	0.003827	17.68	8059.61	834.48	1.00
SCR	10575	Rev BB FP	142475.00	830.00	840.17	840.17	844.13	0.004307	15.98	8918.16	1127.52	1.00
SCR	10390	Rev BB FP	142475.00	828.00	839.47	838.56	842.17	0.002692	13.18	10811.18	1390.10	0.83
SCR	10225	Rev BB FP	142475.00	827.50	838.21	838.21	841.57	0.004024	14.72	9676.62	1447.21	1.00
SCR	10000	Rev BB FP	142475.00	826.00	837.11	837.11	840.43	0.004013	14.62	9744.75	1487.06	1.01
SCR	9820	Rev BB FP	142475.00	824.00	835.35	835.35	838.82	0.004324	14.95	9530.31	1373.15	1.00
SCR	9595	Rev BB FP	142475.00	823.80	834.12	834.12	837.42	0.004911	14.58	9769.14	1619.44	1.00
SCR	9385	Rev BB FP	142475.00	823.00	833.11	833.11	836.03	0.005066	13.73	10378.48	1773.73	1.00
SCR	9220	Rev BB FP	142475.00	822.00	831.81	831.81	834.72	0.004539	13.68	10412.72	1813.72	1.01
SCR	9025	Rev BB FP	142475.00	821.00	830.41	830.41	833.36	0.004214	13.77	10347.97	1751.71	1.00

HEC-RAS Plan: Exist025 River: Reach #1 Reach: SCR Profile: Rev BB FP

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SCR	46195	Rev BB FP	115111.00	1035.00	1053.14	1054.04	1060.43	0.005006	21.67	5313.11	452.97	1.11
SCR	46020	Rev BB FP	115111.00	1032.00	1050.08	1052.47	1059.13	0.008742	24.14	4768.34	520.89	1.41
SCR	45545	Rev BB FP	115111.00	1030.00	1049.23	1049.27	1055.65	0.004028	20.33	5661.33	446.68	1.01
SCR	45030	Rev BB FP	115111.00	1025.00	1041.51	1044.56	1052.09	0.010535	26.10	4410.21	492.54	1.54
SCR	44585	Rev BB FP	115111.00	1022.00	1043.05	1043.07	1048.75	0.004190	19.17	6004.20	531.91	1.01
SCR	44210	Rev BB FP	115111.00	1020.00	1035.36	1038.72	1045.99	0.009463	26.16	4399.47	452.62	1.48
SCR	43820	Rev BB FP	115111.00	1018.00	1037.47	1037.48	1043.62	0.004072	19.90	5785.33	476.53	1.01
SCR	43610	Rev BB FP	115111.00	1017.00	1030.80	1034.06	1041.87	0.010066	26.70	4311.38	450.58	1.52
SCR	43410	Rev BB FP	115111.00	1016.00	1027.33	1031.12	1039.61	0.011140	28.77	4308.74	583.44	1.61
SCR	43200	Rev BB FP	115111.00	1014.00	1026.42	1029.64	1036.81	0.010596	26.11	4615.54	689.15	1.54
SCR	42975	Rev BB FP	115111.00	1012.00	1022.84	1026.28	1033.82	0.016328	26.63	4368.50	735.12	1.82
SCR	42815	Rev BB FP	115111.00	1011.00	1021.61	1024.35	1030.50	0.016385	24.07	4833.92	878.46	1.78
SCR	42590	Rev BB FP	115111.00	1010.00	1018.93	1021.36	1026.81	0.014228	22.59	5182.81	1023.20	1.67
SCR	42430	Rev BB FP	115111.00	1008.00	1017.64	1019.62	1024.35	0.011522	20.83	5543.00	940.48	1.51
SCR	42215	Rev BB FP	115111.00	1006.00	1020.27	1017.68	1021.96	0.001717	10.44	11089.91	1310.38	0.62
SCR	41940	Rev BB FP	115111.00	1005.00	1019.29	1017.71	1021.37	0.002407	11.57	9983.36	1321.54	0.72
SCR	41730	Rev BB FP	115111.00	1004.00	1018.72	1016.50	1020.86	0.002272	11.75	9825.95	1229.51	0.71
SCR	41460	Rev BB FP	115111.00	1002.00	1018.21	1015.19	1020.27	0.002042	11.52	10032.38	1329.00	0.68
SCR	41280	Rev BB FP	115111.00	1001.00	1015.33	1015.33	1019.53	0.004491	16.45	7022.85	852.07	1.00
SCR	41080	Rev BB FP	115111.00	1000.00	1012.07	1013.56	1018.19	0.007468	19.90	5831.66	874.23	1.27
SCR	40825	Rev BB FP	115111.00	999.50	1010.96	1012.05	1016.00	0.007253	18.03	6438.62	1039.92	1.22
SCR	40585	Rev BB FP	115111.00	998.00	1009.71	1010.43	1014.18	0.006366	16.97	6789.33	1005.89	1.15
SCR	40335	Rev BB FP	115111.00	996.00	1010.45	1008.78	1012.35	0.002164	11.11	10609.98	1504.81	0.69
SCR	40130	Rev BB FP	115111.00	995.00	1010.11	1008.56	1011.91	0.001844	11.15	11289.76	1636.51	0.65
SCR	39945	Rev BB FP	115111.00	994.00	1010.06	1007.77	1011.51	0.001383	10.26	12565.23	1648.10	0.57
SCR	39755	Rev BB FP	115111.00	994.00	1007.49	1007.49	1010.91	0.003380	15.35	8268.30	1251.38	0.88
SCR	39605	Rev BB FP	115111.00	993.00	1004.42	1005.91	1010.00	0.006738	19.35	6391.72	1100.64	1.21
SCR	39310	Rev BB FP	115111.00	992.00	1004.42	1004.43	1007.98	0.003512	16.00	8178.22	1204.45	0.90
SCR	39100	Rev BB FP	115111.00	990.00	1004.09	1002.13	1006.32	0.001898	12.37	10137.42	1294.76	0.67
SCR	38925	Rev BB FP	115111.00	989.50	1003.99	1001.39	1005.92	0.001609	11.40	10622.64	1181.25	0.62
SCR	38710	Rev BB FP	115111.00	988.00	1003.86	1000.10	1005.55	0.001174	10.64	11255.51	1043.10	0.54
SCR	38475	Rev BB FP	115111.00	986.00	999.95	999.95	1004.77	0.004258	17.75	6650.60	755.44	1.00
SCR	38300	Rev BB FP	115111.00	985.50	995.32	997.52	1003.33	0.010251	22.72	5066.81	688.08	1.48
SCR	38065	Rev BB FP	115111.00	984.00	998.22	995.71	1001.30	0.002055	14.10	8164.12	678.33	0.72
SCR	37810	Rev BB FP	115111.00	983.00	995.23	995.23	1000.37	0.004288	18.18	6332.08	622.26	1.00
SCR	37655	Rev BB FP	115111.00	982.00	992.29	994.08	999.27	0.008545	21.19	5432.74	735.92	1.37
SCR	37390	Rev BB FP	115111.00	981.00	987.15	989.88	996.01	0.016577	23.93	4834.54	892.17	1.79
SCR	37135	Rev BB FP	115111.00	980.00	987.96	988.63	992.27	0.005950	17.03	6995.53	1088.87	1.12
SCR	36930	Rev BB FP	115111.00	978.00	985.90	987.06	990.89	0.006968	18.32	6620.06	1112.00	1.22
SCR	36735	Rev BB FP	115111.00	977.00	986.56	986.56	989.87	0.003887	15.01	8085.46	1195.65	0.95
SCR	36515	Rev BB FP	115111.00	975.00	984.57	985.42	988.79	0.005510	16.72	7222.58	1306.12	1.15
SCR	36265	Rev BB FP	115111.00	974.00	985.18	984.77	987.82	0.003461	13.04	8831.00	1373.13	0.91
SCR	36080	Rev BB FP	116236.00	973.00	984.66	984.08	987.09	0.003700	12.52	9300.75	1455.39	0.87
SCR	35845	Rev BB FP	116236.00	971.00	984.52	982.90	986.31	0.001825	10.87	11007.98	1496.24	0.68
SCR	35725	Rev BB FP	116236.00	970.00	982.95	982.95	985.91	0.003125	14.70	9008.65	1431.18	0.89
SCR	35515	Rev BB FP	116236.00	969.00	980.94	981.76	985.02	0.004605	17.09	7764.83	1353.35	1.05
SCR	35245	Rev BB FP	116236.00	968.00	980.49	980.49	983.46	0.003192	14.46	8982.03	1555.54	0.88
SCR	35040	Rev BB FP	116236.00	967.00	977.69	978.97	982.44	0.005403	19.45	7455.95	1355.85	1.12
SCR	34860	Rev BB FP	116236.00	966.00	976.05	977.44	981.12	0.008289	18.06	6434.79	1338.93	1.45
SCR	34720	Rev BB FP	116236.00	965.50	974.77	976.17	979.89	0.008895	18.15	6402.85	1411.51	1.50
SCR	34495	Rev BB FP	116236.00	964.00	972.85	974.28	977.92	0.008678	18.08	6430.24	1277.15	1.42
SCR	34310	Rev BB FP	116236.00	963.00	971.99	973.01	976.49	0.005449	17.60	7261.34	1280.76	1.11
SCR	34090	Rev BB FP	116236.00	962.00	970.59	971.64	975.16	0.006767	17.15	6777.33	1267.83	1.31
SCR	33880	Rev BB FP	116236.00	960.00	969.84	970.46	973.69	0.005376	15.75	7378.62	1310.60	1.17
SCR	33710	Rev BB FP	116236.00	959.00	968.38	969.29	972.62	0.006666	16.53	7033.51	1355.12	1.28
SCR	33500	Rev BB FP	116236.00	958.00	967.50	968.41	971.14	0.005805	15.77	7888.10	1474.27	1.09
SCR	33310	Rev BB FP	116236.00	957.00	966.06	967.01	969.97	0.006404	15.86	7329.57	1744.50	1.36
SCR	33115	Rev BB FP	116236.00	956.00	964.72	965.60	968.46	0.008533	15.52	7488.40	1573.15	1.25
SCR	32795	Rev BB FP	116236.00	954.00	964.95	964.63	967.26	0.003022	12.20	9528.82	1732.86	0.92
SCR	32605	Rev BB FP	116236.00	952.00	963.45	963.45	966.51	0.004030	14.05	8272.67	1344.60	1.00
SCR	32265	Rev BB FP	140776.00	950.00	960.23	961.30	964.55	0.007315	16.68	8441.17	1829.94	1.37
SCR	31875	Rev BB FP	140776.00	949.00	960.00	960.00	961.85	0.003638	10.91	12908.13	2482.20	0.84
SCR	31585	Rev BB FP	140776.00	946.00	955.82	956.99	960.09	0.008524	16.58	8491.87	2120.30	1.46
SCR	31360	Rev BB FP	140776.00	944.00	957.86	955.39	959.33	0.001452	9.77	14613.64	1884.43	0.60
SCR	31060	Rev BB FP	140776.00	942.00	957.92	953.29	958.88	0.000719	7.87	17898.38	1711.46	0.43
SCR	30720	Rev BB FP	140776.00	940.00	957.97	951.33	958.60	0.000397	6.40	22006.92	1891.72	0.33
SCR	30445	Rev BB FP	140776.00	938.00	957.92	949.57	958.49	0.000300	6.03	23359.04	1783.69	0.29
SCR	30095	Rev BB FP	140776.00	936.00	957.70	947.93	958.38	0.000278	6.61	21917.00	1730.34	0.28
SCR	29815	Rev BB FP	140776.00	935.00	957.38	948.10	958.27	0.000356	7.69	19642.02	1675.19	0.32
SCR	29565	Rev BB FP	140776.00	934.00	957.34	947.27	958.16	0.000326	7.37	20205.72	1717.44	0.32
SCR	29385	Rev BB FP	140776.00	933.00	956.99	948.97	958.07	0.000447	8.49	18042.34	1675.09	0.37
SCR	29140	Rev BB FP	140776.00	932.00	956.33	950.98	957.88	0.000774	10.06	14550.84	1557.60	0.50
SCR	28895	Rev BB FP	140776.00	930.00	952.39	952.39	957.25	0.002389	19.66	9168.94	1062.28	0.82
SCR	28695	Rev BB FP	140776.00	928.00	943.96	947.96	955.72	0.008766	27.52	5115.18	544.92	1.58
SCR	28500	Rev BB FP	140776.00	927.50	941.05	945.12	953.77	0.010388	28.62	4919.56	503.65	1.61
SCR	28280	Rev BB FP	140776.00	926.00	937.77	941.83	951.33	0.011163	29.67	4853.18	549.28	1.63
SCR	28080	Rev BB FP	140776.00	925.00	936.42	940.05	948.69	0.011257	28.14	5027.76	547.57	1.61
SCR	27925	Rev BB FP	140776.00	924.00	941.45	939.47	946.43	0.002376	17.95	7989.60	612.66	0.80

HEC-RAS Plan: Exist025 River: Reach #1 Reach: SCR Profile: Rev BB FP (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SCR	27725	Rev BB FP	140776.00	923.00	939.31	939.31	945.73	0.003230	20.54	7126.85	587.11	0.93
SCR	27545	Rev BB FP	140776.00	922.00	935.22	937.81	944.62	0.006843	24.72	5836.41	613.02	1.30
SCR	27335	Rev BB FP	140776.00	921.00	932.95	936.26	942.99	0.008302	25.48	5614.41	691.02	1.43
SCR	27155	Rev BB FP	140776.00	920.50	933.67	935.89	940.99	0.005311	22.28	6835.79	856.59	1.15
SCR	26990	Rev BB FP	140776.00	920.00	931.16	933.85	939.67	0.010073	23.47	6088.49	1008.19	1.60
SCR	26780	Rev BB FP	140776.00	918.00	929.02	931.73	937.60	0.009537	23.94	6335.41	1131.68	1.49
SCR	26575	Rev BB FP	140776.00	917.00	928.01	929.98	934.86	0.012746	21.01	6701.47	1216.43	1.57
SCR	26355	Rev BB FP	140776.00	916.00	929.42	929.42	933.07	0.003461	15.83	9559.47	1282.38	0.93
SCR	26170	Rev BB FP	140776.00	915.00	927.98	928.71	932.32	0.003988	17.96	9212.09	1347.94	0.97
SCR	25965	Rev BB FP	140776.00	914.00	927.00	927.74	931.48	0.004061	17.92	8960.72	1288.34	0.98
SCR	25785	Rev BB FP	140776.00	913.50	925.20	926.55	930.53	0.005499	19.54	8264.34	1336.94	1.12
SCR	25600	Rev BB FP	140776.00	912.50	923.79	925.47	929.42	0.006077	20.55	8274.40	1596.52	1.22
SCR	25425	Rev BB FP	140776.00	911.00	922.33	924.23	928.17	0.007953	20.02	7791.92	1773.81	1.45
SCR	25215	Rev BB FP	140776.00	910.00	923.61	923.61	926.64	0.003392	14.51	10667.78	1748.60	0.91
SCR	25000	Rev BB FP	140776.00	909.00	921.22	922.50	925.58	0.005503	17.42	9139.37	2103.24	1.17
SCR	24795	Rev BB FP	140776.00	908.00	919.43	920.87	924.26	0.006914	18.97	9060.11	2311.66	1.32
SCR	24550	Rev BB FP	140776.00	906.00	916.77	918.41	922.31	0.009115	21.33	8402.41	2227.03	1.61
SCR	24335	Rev BB FP	140776.00	905.00	918.13	918.13	920.69	0.003234	14.49	11895.55	2089.54	0.88
SCR	24115	Rev BB FP	140776.00	904.00	915.09	916.28	919.48	0.007920	18.83	9045.64	2015.76	1.28
SCR	23975	Rev BB FP	140776.00	903.50	913.66	914.88	918.15	0.008173	19.03	8772.57	1913.65	1.36
SCR	23755	Rev BB FP	140776.00	902.00	912.91	913.54	916.35	0.005642	16.73	9905.28	1935.37	1.16
SCR	23565	Rev BB FP	140776.00	900.00	912.71	912.71	915.32	0.003871	14.47	11321.84	2039.50	0.98
SCR	23365	Rev BB FP	140776.00	900.00	910.76	911.37	914.32	0.005655	17.04	9677.26	1781.35	1.14
SCR	23180	Rev BB FP	140776.00	899.00	910.83	909.87	912.71	0.002065	13.16	13743.03	2084.20	0.71
SCR	23000	Rev BB FP	140776.00	898.00	911.00	908.40	912.22	0.001301	8.88	15943.92	2069.07	0.55
SCR	22790	Rev BB FP	140776.00	897.50	910.57	908.15	911.92	0.001363	9.35	15109.43	1949.00	0.58
SCR	22600	Rev BB FP	140776.00	896.00	910.06	907.78	911.63	0.001473	11.36	14637.21	1865.20	0.62
SCR	22415	Rev BB FP	140776.00	895.50	909.56	907.11	911.33	0.001596	11.77	13743.30	1705.56	0.65
SCR	22195	Rev BB FP	141426.00	894.00	907.70	906.79	910.76	0.002704	14.10	10265.56	1322.24	0.83
SCR	22010	Rev BB FP	141426.00	892.00	906.38	906.38	910.15	0.003030	15.99	9665.26	1328.02	0.87
SCR	21790	Rev BB FP	141426.00	891.50	903.07	904.87	909.03	0.005884	19.68	7429.43	1145.70	1.16
SCR	21615	Rev BB FP	141426.00	892.00	900.50	903.04	907.59	0.010112	21.40	6678.16	1161.25	1.52
SCR	21440	Rev BB FP	141426.00	890.00	899.69	901.59	905.74	0.007634	20.12	7633.81	1574.63	1.29
SCR	21225	Rev BB FP	141426.00	888.00	898.62	900.27	903.89	0.007531	19.45	8509.78	2217.71	1.27
SCR	21020	Rev BB FP	141426.00	887.00	895.89	897.85	902.14	0.008670	20.80	7679.38	1676.42	1.37
SCR	20845	Rev BB FP	141426.00	886.00	896.38	897.38	900.20	0.005510	17.07	9870.72	2369.34	1.13
SCR	20595	Rev BB FP	141426.00	885.00	895.93	896.42	898.91	0.003386	15.17	11611.25	2463.72	0.88
SCR	20435	Rev BB FP	141426.00	884.00	896.23	895.77	898.29	0.002186	12.93	13821.87	2582.65	0.72
SCR	20280	Rev BB FP	141426.00	883.70	895.55	895.55	897.86	0.002944	13.96	13014.40	2589.59	0.82
SCR	20070	Rev BB FP	141426.00	882.00	891.22	893.00	896.57	0.008994	20.19	8211.27	1767.50	1.37
SCR	19855	Rev BB FP	141426.00	880.50	890.43	891.49	894.67	0.005944	17.83	9393.73	1975.10	1.14
SCR	19630	Rev BB FP	141426.00	880.00	888.94	890.05	893.30	0.006239	17.86	9074.12	1836.22	1.18
SCR	19440	Rev BB FP	141426.00	878.00	890.13	889.11	892.07	0.001973	11.94	13611.33	2095.28	0.70
SCR	19240	Rev BB FP	141426.00	877.50	888.88	888.88	891.51	0.003097	13.92	11714.43	2091.68	0.88
SCR	19050	Rev BB FP	141426.00	876.00	888.85	887.51	890.49	0.001803	10.96	14382.18	2160.84	0.67
SCR	18830	Rev BB FP	141426.00	874.00	888.56	886.80	890.10	0.001579	10.67	14781.82	2094.37	0.64
SCR	18650	Rev BB FP	141426.00	873.50	888.48	886.00	889.80	0.001087	9.89	16256.74	2022.74	0.53
SCR	18475	Rev BB FP	141426.00	872.00	888.57	884.72	889.53	0.000774	8.07	18194.47	1944.40	0.45
SCR	18290	Rev BB FP	141426.00	871.50	888.27	884.54	889.37	0.000832	8.69	17186.39	1843.67	0.47
SCR	18025	Rev BB FP	141426.00	870.00	888.21	882.91	889.13	0.000573	7.83	18485.26	1610.91	0.40
SCR	17785	Rev BB FP	141426.00	868.00	887.78	882.81	888.95	0.000788	8.71	16382.46	1417.47	0.44
SCR	17510	Rev BB FP	141426.00	867.50	885.46	883.72	888.44	0.001981	13.95	10512.58	1243.63	0.75
SCR	17360	Rev BB FP	141426.00	866.50	883.40	883.40	887.90	0.003623	17.03	8326.59	936.59	1.00
SCR	17110	Rev BB FP	141426.00	864.00	879.37	881.59	886.46	0.006287	21.70	7106.91	1274.30	1.26
SCR	16970	Rev BB FP	141426.00	863.70	877.33	880.05	885.35	0.008185	22.92	6449.08	1125.59	1.47
SCR	16720	Rev BB FP	141426.00	863.50	872.47	875.45	882.24	0.018432	25.15	5735.17	1404.63	2.00
SCR	16515	Rev BB FP	141426.00	862.00	871.52	873.72	878.33	0.012326	21.45	7010.27	1622.64	1.67
SCR	16305	Rev BB FP	141426.00	860.00	869.61	871.44	875.64	0.011136	21.47	7604.36	1812.82	1.64
SCR	16130	Rev BB FP	141426.00	860.00	870.19	870.71	873.47	0.005291	16.06	10039.66	1945.14	1.17
SCR	15960	Rev BB FP	141426.00	859.00	868.27	869.21	872.12	0.010630	15.80	8986.11	2180.88	1.37
SCR	15745	Rev BB FP	141426.00	858.00	868.57	867.78	870.42	0.002999	10.93	12967.71	2278.98	0.82
SCR	15540	Rev BB FP	141426.00	857.50	868.06	867.17	869.80	0.002688	11.03	13523.49	2324.20	0.78
SCR	15335	Rev BB FP	141426.00	856.00	866.50	866.50	869.00	0.004731	12.68	11164.20	2302.06	1.01
SCR	15125	Rev BB FP	142475.00	854.00	863.64	864.54	867.69	0.006528	16.15	8838.57	1618.47	1.21
SCR	14900	Rev BB FP	142475.00	853.00	863.42	863.42	866.43	0.004130	14.54	10443.91	1704.50	0.99
SCR	14720	Rev BB FP	142475.00	852.00	861.25	862.19	865.34	0.007984	16.84	8931.26	1763.49	1.25
SCR	14480	Rev BB FP	142475.00	850.50	860.73	860.73	863.62	0.004264	14.25	10759.99	1801.68	0.95
SCR	14315	Rev BB FP	142475.00	850.00	859.35	859.82	862.74	0.006080	14.79	9631.06	1868.05	1.15
SCR	14090	Rev BB FP	142475.00	849.71	858.67	858.67	861.61	0.004639	13.75	10362.56	1766.78	1.00
SCR	13850	Rev BB FP	142475.00	848.00	856.44	857.11	860.23	0.006745	15.61	9128.71	1727.26	1.20
SCR	13635	Rev BB FP	142475.00	846.00	856.32	856.32	859.30	0.003797	15.41	10784.75	1691.89	0.92
SCR	13425	Rev BB FP	142475.00	845.00	853.32	854.58	857.95	0.009231	17.28	8245.16	1854.35	1.44
SCR	13190	Rev BB FP	142475.00	844.00	853.50	852.81	855.77	0.003210	12.22	11882.13	1847.29	0.83
SCR	13030	Rev BB FP	142475.00	843.00	852.58	852.27	855.21	0.003375	14.20	11409.44	1763.01	0.87
SCR	12835	Rev BB FP	142475.00	842.00	852.13	851.23	854.54	0.002745	13.33	11764.70	1607.52	0.79
SCR	12615	Rev BB FP	142475.00	841.00	851.89	850.08	853.94	0.001885	12.39	12717.39	1471.01	0.67
SCR	12395	Rev BB FP	142475.00	840.00	851.51	849.52	853.56	0.001691	12.30	12903.96	1438.40	0.65
SCR	12195	Rev BB FP	142475.00	838.98	851.52	848.24	853.15	0.001176	10.57	14261.92	1389.31	0.54

HEC-RAS Plan: Exist025 River: Reach #1 Reach: SCR Profile: Rev BB FP (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SCR	11995	Rev BB FP	142475.00	837.00	850.66	848.45	852.83	0.001570	12.69	12550.93	1281.09	0.63
SCR	11780	Rev BB FP	142475.00	836.00	850.43	848.15	852.47	0.001415	12.50	13224.83	1400.85	0.61
SCR	11605	Rev BB FP	142475.00	835.50	849.24	847.41	852.11	0.001889	14.05	11187.38	1282.91	0.70
SCR	11405	Rev BB FP	142475.00	834.00	849.07	846.17	851.69	0.001520	13.18	11445.85	1130.21	0.64
SCR	11180	Rev BB FP	142475.00	833.00	846.89	845.65	851.10	0.002564	16.60	8864.64	835.68	0.82
SCR	11015	Rev BB FP	142475.00	831.50	844.78	844.78	850.43	0.003842	19.08	7493.10	679.39	0.99
SCR	10835	Rev BB FP	142475.00	831.00	841.87	843.71	849.32	0.007252	21.91	6502.00	790.38	1.35
SCR	10575	Rev BB FP	142475.00	830.00	837.48	840.15	846.52	0.015561	24.13	5904.16	1108.84	1.84
SCR	10390	Rev BB FP	142475.00	828.00	836.77	839.07	843.84	0.008394	22.72	7222.47	1247.06	1.37
SCR	10225	Rev BB FP	142475.00	827.50	837.04	837.97	841.97	0.006870	17.83	8045.11	1373.79	1.26
SCR	10000	Rev BB FP	142475.00	826.00	837.14	837.14	840.54	0.003943	14.90	9785.52	1488.00	0.96
SCR	9820	Rev BB FP	142475.00	824.00	833.97	835.33	839.34	0.008494	18.59	7663.39	1336.56	1.37
SCR	9595	Rev BB FP	142475.00	823.80	834.13	834.13	837.42	0.004885	14.56	9782.42	1619.67	1.00
SCR	9385	Rev BB FP	142475.00	823.00	832.49	833.19	836.23	0.006100	15.78	9290.53	1770.37	1.19
SCR	9220	Rev BB FP	142475.00	822.00	830.86	831.81	835.03	0.007826	16.39	8703.86	1771.40	1.29
SCR	9025	Rev BB FP	142475.00	821.00	829.91	830.57	833.69	0.005308	15.90	9468.27	1736.85	1.09

HEC-RAS Plan: Exist085 River: Reach #1 Reach: SCR Profile: Rev BB FP

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SCR	46195	Rev BB FP	115111.00	1035.00	1063.12	1054.04	1064.77	0.006261	10.67	11871.29	750.83	0.40
SCR	46020	Rev BB FP	115111.00	1032.00	1062.02	1052.44	1063.64	0.006544	10.21	11277.79	570.22	0.40
SCR	45545	Rev BB FP	115111.00	1030.00	1057.85	1049.24	1059.95	0.008982	11.63	9899.97	524.21	0.47
SCR	45030	Rev BB FP	115111.00	1025.00	1054.23	1044.56	1055.89	0.006629	10.33	11145.02	557.97	0.41
SCR	44585	Rev BB FP	115111.00	1022.00	1050.60	1043.05	1052.39	0.009283	10.74	10717.84	654.38	0.47
SCR	44210	Rev BB FP	115111.00	1020.00	1047.82	1038.72	1049.37	0.006715	9.97	11549.51	619.95	0.41
SCR	43820	Rev BB FP	115111.00	1018.00	1042.08	1037.47	1045.21	0.017543	14.19	8110.90	528.66	0.64
SCR	43610	Rev BB FP	115111.00	1017.00	1038.23	1034.06	1041.46	0.018865	14.41	7990.36	536.80	0.66
SCR	43410	Rev BB FP	115111.00	1016.00	1035.79	1031.12	1038.20	0.012067	13.28	9810.14	728.75	0.55
SCR	43200	Rev BB FP	115111.00	1014.00	1033.10	1029.61	1035.55	0.014949	13.11	9560.66	778.14	0.59
SCR	42975	Rev BB FP	115111.00	1012.00	1030.64	1026.26	1032.42	0.011936	11.00	11112.26	949.35	0.52
SCR	42815	Rev BB FP	115111.00	1011.00	1029.16	1024.33	1030.46	0.009556	9.36	12874.92	1127.61	0.46
SCR	42590	Rev BB FP	115111.00	1010.00	1027.80	1021.36	1028.70	0.005956	7.80	15371.44	1205.17	0.37
SCR	42430	Rev BB FP	115111.00	1008.00	1026.93	1019.62	1027.77	0.005204	7.44	16206.52	1593.65	0.35
SCR	42215	Rev BB FP	115111.00	1006.00	1026.19	1017.68	1026.77	0.003645	6.26	20044.60	1904.81	0.29
SCR	41940	Rev BB FP	115111.00	1005.00	1025.09	1017.71	1025.71	0.004124	6.42	19333.12	2049.42	0.31
SCR	41730	Rev BB FP	115111.00	1004.00	1024.06	1016.50	1024.77	0.004683	6.87	18440.44	2164.96	0.33
SCR	41460	Rev BB FP	115111.00	1002.00	1022.64	1015.18	1023.41	0.005518	7.24	17710.12	2183.35	0.35
SCR	41280	Rev BB FP	115111.00	1001.00	1021.22	1015.33	1022.26	0.007076	8.63	16094.58	2294.98	0.40
SCR	41080	Rev BB FP	115111.00	1000.00	1019.74	1013.55	1020.85	0.006827	8.89	15634.13	2172.37	0.40
SCR	40825	Rev BB FP	115111.00	999.50	1018.37	1012.05	1019.19	0.005782	7.57	17645.24	2239.26	0.36
SCR	40585	Rev BB FP	115111.00	998.00	1017.08	1010.42	1017.84	0.005226	7.28	17989.01	2061.94	0.34
SCR	40335	Rev BB FP	115111.00	996.00	1016.13	1008.78	1016.69	0.003834	6.20	20457.69	2218.13	0.29
SCR	40130	Rev BB FP	115111.00	995.00	1015.32	1008.56	1015.88	0.003905	6.45	20672.41	2115.35	0.30
SCR	39945	Rev BB FP	115111.00	994.00	1014.62	1007.77	1015.16	0.003858	6.47	20759.36	2018.84	0.30
SCR	39755	Rev BB FP	115111.00	994.00	1013.33	1007.49	1014.22	0.005833	8.18	16831.67	1788.58	0.37
SCR	39605	Rev BB FP	115111.00	993.00	1012.55	1005.91	1013.37	0.005051	7.89	17084.59	1638.17	0.35
SCR	39310	Rev BB FP	115111.00	992.00	1011.07	1004.44	1011.82	0.004731	7.73	18174.40	1730.23	0.34
SCR	39100	Rev BB FP	115111.00	990.00	1010.28	1002.13	1010.91	0.003664	6.80	19174.54	1585.97	0.30
SCR	38925	Rev BB FP	115111.00	989.50	1009.52	1001.39	1010.21	0.004043	6.99	18003.52	1446.05	0.31
SCR	38710	Rev BB FP	115111.00	988.00	1008.51	1000.08	1009.31	0.004299	7.44	16801.26	1304.10	0.32
SCR	38475	Rev BB FP	115111.00	986.00	1006.48	999.95	1007.90	0.007873	9.88	12669.19	1018.58	0.43
SCR	38300	Rev BB FP	115111.00	985.50	1005.29	997.52	1006.56	0.006503	9.17	13133.02	960.65	0.40
SCR	38065	Rev BB FP	115111.00	984.00	1003.52	995.71	1004.95	0.007045	9.63	12273.74	874.51	0.41
SCR	37810	Rev BB FP	115111.00	983.00	1000.30	995.23	1002.47	0.012995	11.87	9947.29	823.90	0.55
SCR	37655	Rev BB FP	115111.00	982.00	998.34	994.09	1000.34	0.013555	11.43	10339.29	894.21	0.55
SCR	37390	Rev BB FP	115111.00	981.00	996.69	989.88	997.72	0.006129	8.27	14332.26	1035.91	0.38
SCR	37135	Rev BB FP	115111.00	980.00	995.19	988.63	996.12	0.005987	7.92	14972.85	1117.41	0.37
SCR	36930	Rev BB FP	115111.00	978.00	994.19	987.06	995.00	0.004805	7.46	16289.70	1209.91	0.34
SCR	36735	Rev BB FP	115111.00	977.00	993.22	986.56	994.02	0.005066	7.43	16245.29	1249.96	0.35
SCR	36515	Rev BB FP	115111.00	975.00	992.29	985.40	992.98	0.004355	6.91	17517.05	1353.36	0.32
SCR	36265	Rev BB FP	115111.00	974.00	991.10	984.77	991.81	0.005105	6.78	16998.81	1387.76	0.34
SCR	36080	Rev BB FP	116236.00	973.00	990.12	984.08	990.82	0.005500	6.74	17361.72	1498.29	0.34
SCR	35845	Rev BB FP	116236.00	971.00	988.91	982.89	989.59	0.004952	6.77	17844.10	1607.80	0.34
SCR	35725	Rev BB FP	116236.00	970.00	988.13	982.95	988.93	0.005766	7.75	16788.09	1538.48	0.37
SCR	35515	Rev BB FP	116236.00	969.00	986.78	981.76	987.67	0.006368	8.25	16123.33	1500.16	0.39
SCR	35245	Rev BB FP	116236.00	968.00	984.99	980.49	985.88	0.006898	8.13	16034.87	1580.23	0.40
SCR	35040	Rev BB FP	116236.00	967.00	983.56	978.97	984.47	0.006715	8.80	15960.86	1491.62	0.40
SCR	34860	Rev BB FP	116236.00	966.00	982.28	977.44	983.21	0.007849	7.71	15078.16	1431.69	0.42
SCR	34720	Rev BB FP	116236.00	965.50	981.27	976.17	982.13	0.007058	7.40	15699.07	1450.12	0.40
SCR	34495	Rev BB FP	116236.00	964.00	979.81	974.28	980.61	0.006439	7.20	16154.47	1462.53	0.38
SCR	34310	Rev BB FP	116236.00	963.00	978.54	973.01	979.43	0.006027	8.07	15893.00	1355.84	0.37
SCR	34090	Rev BB FP	116236.00	962.00	977.14	971.64	978.04	0.006788	7.61	15265.48	1316.20	0.39
SCR	33880	Rev BB FP	116236.00	960.00	975.73	970.46	976.59	0.006962	7.46	15582.75	1451.55	0.40
SCR	33710	Rev BB FP	116236.00	959.00	974.64	969.23	975.40	0.006435	6.97	16665.52	1616.75	0.38
SCR	33500	Rev BB FP	116236.00	958.00	973.40	968.41	974.09	0.005844	7.08	17819.12	1720.16	0.36
SCR	33310	Rev BB FP	116236.00	957.00	972.42	967.01	973.03	0.005153	6.27	18547.85	1783.33	0.34
SCR	33115	Rev BB FP	116236.00	956.00	971.47	965.60	972.01	0.004945	5.92	19667.02	1895.57	0.32
SCR	32795	Rev BB FP	116236.00	954.00	969.69	964.63	970.32	0.005717	6.40	18225.40	1917.68	0.36
SCR	32605	Rev BB FP	116236.00	952.00	968.69	963.45	969.24	0.005196	6.07	20132.55	2407.26	0.34
SCR	32265	Rev BB FP	140776.00	950.00	967.14	961.37	967.61	0.004485	5.50	25619.94	2839.88	0.32
SCR	31875	Rev BB FP	140776.00	949.00	965.55	960.00	965.98	0.003821	5.24	27028.75	2630.09	0.28
SCR	31585	Rev BB FP	140776.00	946.00	964.67	956.96	965.05	0.002681	4.95	28485.89	2405.38	0.25
SCR	31360	Rev BB FP	140776.00	944.00	963.99	955.41	964.44	0.002664	5.44	26576.91	1962.49	0.25
SCR	31060	Rev BB FP	140776.00	942.00	963.32	953.29	963.71	0.002122	5.02	28168.09	2195.09	0.24
SCR	30720	Rev BB FP	140776.00	940.00	962.76	951.33	963.08	0.001535	4.52	31325.84	2122.23	0.20
SCR	30445	Rev BB FP	140776.00	938.00	962.37	949.57	962.68	0.001361	4.49	32047.45	2314.72	0.19
SCR	30095	Rev BB FP	140776.00	936.00	961.79	947.93	962.18	0.001460	5.12	30221.52	2339.56	0.20
SCR	29815	Rev BB FP	140776.00	935.00	961.20	948.10	961.71	0.001932	5.96	27202.58	2243.56	0.23
SCR	29565	Rev BB FP	140776.00	934.00	960.71	947.27	961.22	0.001942	5.88	26958.88	2280.34	0.23
SCR	29385	Rev BB FP	140776.00	933.00	960.13	948.97	960.79	0.002694	6.78	24110.69	2215.01	0.27
SCR	29140	Rev BB FP	140776.00	932.00	958.97	950.98	959.94	0.004808	8.05	19093.65	1894.25	0.36
SCR	28895	Rev BB FP	140776.00	930.00	955.75	952.39	958.06	0.011883	14.28	13601.27	1544.41	0.55
SCR	28695	Rev BB FP	140776.00	928.00	954.27	947.96	955.72	0.009038	9.67	14565.01	1446.39	0.54
SCR	28500	Rev BB FP	140776.00	927.50	952.08	945.08	953.95	0.008598	11.42	14381.67	1474.34	0.47
SCR	28280	Rev BB FP	140776.00	926.00	950.52	941.85	952.30	0.006462	11.35	15008.82	1365.30	0.42
SCR	28080	Rev BB FP	140776.00	925.00	949.28	940.04	951.00	0.006263	10.94	14982.78	1251.50	0.41
SCR	27925	Rev BB FP	140776.00	924.00	947.70	939.47	949.86	0.007984	12.13	13253.13	1194.87	0.46

HEC-RAS Plan: Exist085 River: Reach #1 Reach: SCR Profile: Rev BB FP (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SCR	27725	Rev BB FP	140776.00	923.00	945.26	939.31	947.94	0.010900	13.69	11869.05	1095.99	0.53
SCR	27545	Rev BB FP	140776.00	922.00	943.64	937.81	945.96	0.010086	12.76	12472.57	1144.65	0.51
SCR	27335	Rev BB FP	140776.00	921.00	942.09	936.26	943.91	0.008367	11.43	13966.56	1090.51	0.46
SCR	27155	Rev BB FP	140776.00	920.50	940.45	935.90	942.27	0.009256	11.73	14150.62	1201.24	0.48
SCR	26990	Rev BB FP	140776.00	920.00	939.34	933.85	940.67	0.008023	9.51	15709.68	1279.99	0.44
SCR	26780	Rev BB FP	140776.00	918.00	938.08	931.73	939.15	0.005879	8.93	17692.21	1339.59	0.38
SCR	26575	Rev BB FP	140776.00	917.00	936.99	929.98	937.93	0.005756	7.85	18224.55	1342.33	0.36
SCR	26355	Rev BB FP	140776.00	916.00	935.58	929.42	936.61	0.006173	8.54	17754.09	1376.67	0.39
SCR	26170	Rev BB FP	140776.00	915.00	934.47	928.71	935.49	0.006034	8.90	18074.60	1385.31	0.38
SCR	25965	Rev BB FP	140776.00	914.00	932.91	927.74	934.11	0.007349	9.58	16859.15	1407.92	0.42
SCR	25785	Rev BB FP	140776.00	913.50	931.49	926.55	932.67	0.007808	9.64	17323.82	1620.23	0.43
SCR	25600	Rev BB FP	140776.00	912.50	930.39	925.47	931.28	0.006236	8.59	19924.65	1924.40	0.39
SCR	25425	Rev BB FP	140776.00	911.00	929.54	924.28	930.20	0.005044	7.06	22168.16	2056.40	0.34
SCR	25215	Rev BB FP	140776.00	910.00	927.82	923.53	928.79	0.008126	8.48	18780.94	2121.76	0.43
SCR	25000	Rev BB FP	140776.00	909.00	926.32	922.50	927.11	0.006991	7.83	20977.36	2377.04	0.40
SCR	24795	Rev BB FP	140776.00	908.00	924.94	920.87	925.64	0.006301	7.42	21853.30	2329.84	0.38
SCR	24550	Rev BB FP	140776.00	906.00	923.85	918.41	924.38	0.004427	6.44	24258.73	2252.87	0.32
SCR	24335	Rev BB FP	140776.00	905.00	922.58	918.12	923.30	0.006264	7.63	21215.25	2105.65	0.38
SCR	24115	Rev BB FP	140776.00	904.00	921.37	916.28	922.04	0.005674	7.22	21770.86	2035.28	0.35
SCR	23975	Rev BB FP	140776.00	903.50	920.41	914.88	921.07	0.005319	7.00	21786.51	1940.51	0.35
SCR	23755	Rev BB FP	140776.00	902.00	919.31	913.54	919.93	0.004854	6.81	22570.77	2021.77	0.33
SCR	23565	Rev BB FP	140776.00	900.00	918.41	912.73	919.00	0.004714	6.64	23145.30	2111.49	0.33
SCR	23365	Rev BB FP	140776.00	900.00	917.59	911.37	918.13	0.004130	6.49	24160.49	2110.81	0.31
SCR	23180	Rev BB FP	140776.00	899.00	916.98	909.87	917.43	0.002980	6.28	26872.75	2188.46	0.27
SCR	23000	Rev BB FP	140776.00	898.00	916.50	908.40	916.91	0.002668	5.18	27717.50	2208.07	0.25
SCR	22790	Rev BB FP	140776.00	897.50	915.82	908.15	916.30	0.003103	5.58	25614.63	2052.66	0.27
SCR	22600	Rev BB FP	140776.00	896.00	915.10	907.78	915.65	0.003568	6.61	24212.95	1944.52	0.30
SCR	22415	Rev BB FP	140776.00	895.50	914.24	907.11	914.91	0.004404	7.19	22223.89	1868.49	0.33
SCR	22195	Rev BB FP	141426.00	894.00	912.53	906.79	913.67	0.007227	8.75	17295.44	1597.29	0.42
SCR	22010	Rev BB FP	141426.00	892.00	910.70	906.38	912.13	0.009118	10.16	15737.52	1819.81	0.47
SCR	21790	Rev BB FP	141426.00	891.50	908.38	904.87	909.95	0.010764	10.65	15383.26	2121.00	0.50
SCR	21615	Rev BB FP	141426.00	892.00	907.07	903.04	908.13	0.008280	8.76	18572.14	2207.92	0.44
SCR	21440	Rev BB FP	141426.00	890.00	905.72	901.59	906.68	0.007672	8.62	19330.02	2168.70	0.42
SCR	21225	Rev BB FP	141426.00	888.00	904.25	900.27	905.04	0.007187	8.16	22063.44	2868.73	0.40
SCR	21020	Rev BB FP	141426.00	887.00	903.17	897.78	903.78	0.004839	7.21	24970.26	2894.26	0.33
SCR	20845	Rev BB FP	141426.00	886.00	902.34	897.38	902.89	0.004944	6.90	25539.38	2955.11	0.34
SCR	20595	Rev BB FP	141426.00	885.00	901.14	896.42	901.71	0.004763	7.07	25535.02	2931.69	0.33
SCR	20435	Rev BB FP	141426.00	884.00	900.30	895.77	900.90	0.005083	7.27	24746.88	2825.53	0.34
SCR	20280	Rev BB FP	141426.00	883.70	899.33	895.55	899.99	0.006412	7.64	23039.58	2730.97	0.38
SCR	20070	Rev BB FP	141426.00	882.00	898.37	893.00	898.90	0.004321	6.63	25460.53	2597.82	0.31
SCR	19855	Rev BB FP	141426.00	880.50	897.57	891.50	898.03	0.003550	6.27	27221.95	2688.90	0.29
SCR	19630	Rev BB FP	141426.00	880.00	896.84	890.05	897.28	0.003165	6.01	28170.25	2778.54	0.27
SCR	19440	Rev BB FP	141426.00	878.00	896.29	889.11	896.70	0.002745	5.70	29140.07	2906.48	0.26
SCR	19240	Rev BB FP	141426.00	877.50	895.68	888.88	896.12	0.003010	5.84	27751.57	2599.60	0.27
SCR	19050	Rev BB FP	141426.00	876.00	895.20	887.51	895.59	0.002518	5.36	29006.32	2425.30	0.25
SCR	18830	Rev BB FP	141426.00	874.00	894.61	886.80	895.03	0.002641	5.53	27892.40	2225.08	0.25
SCR	18650	Rev BB FP	141426.00	873.50	894.15	886.00	894.58	0.002435	5.66	27923.98	2093.66	0.25
SCR	18475	Rev BB FP	141426.00	872.00	893.77	884.72	894.16	0.002201	5.13	28384.30	1978.73	0.23
SCR	18290	Rev BB FP	141426.00	871.50	893.26	884.54	893.72	0.002543	5.62	26476.96	1877.78	0.25
SCR	18025	Rev BB FP	141426.00	870.00	892.57	882.91	893.05	0.002398	5.66	25578.77	1642.50	0.25
SCR	17785	Rev BB FP	141426.00	868.00	891.70	882.82	892.35	0.003488	6.51	22017.32	1458.06	0.29
SCR	17510	Rev BB FP	141426.00	867.50	889.57	883.72	890.92	0.007690	9.58	15878.49	1354.91	0.44
SCR	17360	Rev BB FP	141426.00	866.50	887.45	883.40	889.41	0.012589	11.39	13139.27	1272.15	0.55
SCR	17110	Rev BB FP	141426.00	864.00	884.24	881.59	886.16	0.013233	11.94	13804.07	1428.48	0.56
SCR	16970	Rev BB FP	141426.00	863.70	881.85	880.06	883.98	0.016799	12.41	13059.54	1534.19	0.63
SCR	16720	Rev BB FP	141426.00	863.50	879.51	875.45	880.65	0.009318	8.94	17147.30	1726.61	0.46
SCR	16515	Rev BB FP	141426.00	862.00	878.00	873.72	878.88	0.007623	7.94	19233.76	1934.26	0.41
SCR	16305	Rev BB FP	141426.00	860.00	876.79	871.44	877.46	0.005570	7.17	22049.88	2111.77	0.36
SCR	16130	Rev BB FP	141426.00	860.00	875.68	870.71	876.37	0.006258	7.02	21366.03	2125.00	0.38
SCR	15960	Rev BB FP	141426.00	859.00	874.73	869.21	875.30	0.005341	6.12	23312.65	2250.07	0.33
SCR	15745	Rev BB FP	141426.00	858.00	873.76	867.77	874.26	0.004319	5.66	24841.35	2297.25	0.31
SCR	15540	Rev BB FP	141426.00	857.50	872.83	867.17	873.34	0.004545	5.91	24661.45	2348.37	0.32
SCR	15335	Rev BB FP	141426.00	856.00	871.75	866.50	872.32	0.005341	6.09	23340.41	2337.46	0.34
SCR	15125	Rev BB FP	142475.00	854.00	870.49	864.50	871.17	0.005517	6.68	21922.78	2195.20	0.35
SCR	14900	Rev BB FP	142475.00	853.00	869.11	863.42	869.84	0.006090	7.34	21835.14	2363.67	0.37
SCR	14720	Rev BB FP	142475.00	852.00	868.11	862.17	868.79	0.005661	7.00	22080.85	2123.96	0.35
SCR	14480	Rev BB FP	142475.00	850.50	866.84	860.73	867.50	0.005032	6.80	22113.92	1903.92	0.33
SCR	14315	Rev BB FP	142475.00	850.00	866.05	859.82	866.68	0.004845	6.37	22413.72	1938.14	0.33
SCR	14090	Rev BB FP	142475.00	849.71	864.84	858.67	865.53	0.005192	6.69	21422.24	1813.83	0.34
SCR	13850	Rev BB FP	142475.00	848.00	863.69	857.11	864.36	0.004758	6.57	21800.31	1769.55	0.33
SCR	13635	Rev BB FP	142475.00	846.00	862.65	856.32	863.33	0.004705	7.28	21990.27	1806.91	0.33
SCR	13425	Rev BB FP	142475.00	845.00	861.91	854.58	862.43	0.003526	5.80	24660.66	1936.16	0.28
SCR	13190	Rev BB FP	142475.00	844.00	861.23	852.81	861.68	0.002766	5.48	26772.91	2028.03	0.25
SCR	13030	Rev BB FP	142475.00	843.00	860.75	852.27	861.22	0.002892	6.09	26656.37	2060.86	0.26
SCR	12835	Rev BB FP	142475.00	842.00	860.14	851.23	860.64	0.002947	6.23	26293.16	2064.81	0.27
SCR	12615	Rev BB FP	142475.00	841.00	859.40	850.08	859.97	0.003127	6.72	24621.62	1866.17	0.28
SCR	12395	Rev BB FP	142475.00	840.00	858.68	849.52	859.30	0.003225	6.93	23816.79	1753.66	0.28
SCR	12195	Rev BB FP	142475.00	838.98	858.07	848.24	858.68	0.002883	6.53	23531.59	1569.29	0.27

HEC-RAS Plan: Exist085 River: Reach #1 Reach: SCR Profile: Rev BB FP (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SCR	11995	Rev BB FP	142475.00	837.00	857.33	848.45	858.03	0.003457	7.35	21781.52	1445.69	0.30
SCR	11780	Rev BB FP	142475.00	836.00	856.60	848.15	857.30	0.003393	7.35	22101.86	1459.15	0.29
SCR	11605	Rev BB FP	142475.00	835.50	855.77	847.41	856.63	0.004096	8.01	20215.42	1423.31	0.32
SCR	11405	Rev BB FP	142475.00	834.00	854.64	846.17	855.71	0.004789	8.61	17818.79	1156.11	0.35
SCR	11180	Rev BB FP	142475.00	833.00	852.65	845.62	854.33	0.007767	10.74	14423.92	1022.07	0.44
SCR	11015	Rev BB FP	142475.00	831.50	850.24	844.78	852.64	0.011974	12.57	11808.85	850.99	0.54
SCR	10835	Rev BB FP	142475.00	831.00	848.06	843.71	850.34	0.013460	12.24	12146.95	1068.77	0.57
SCR	10575	Rev BB FP	142475.00	830.00	846.12	840.16	847.40	0.007982	9.13	15863.63	1311.49	0.43
SCR	10390	Rev BB FP	142475.00	828.00	845.08	839.07	846.06	0.005761	8.70	18840.71	1492.14	0.37
SCR	10225	Rev BB FP	142475.00	827.50	844.10	838.16	845.05	0.006398	7.95	18566.19	1545.15	0.38
SCR	10000	Rev BB FP	142475.00	826.00	842.55	837.14	843.54	0.006984	8.14	18351.28	1626.01	0.40
SCR	9820	Rev BB FP	142475.00	824.00	841.35	835.33	842.31	0.006527	7.91	18387.28	1648.84	0.39
SCR	9595	Rev BB FP	142475.00	823.80	839.87	834.13	840.80	0.006938	7.76	18438.71	1719.61	0.39
SCR	9385	Rev BB FP	142475.00	823.00	838.58	833.19	839.36	0.006233	7.21	20157.16	1799.30	0.37
SCR	9220	Rev BB FP	142475.00	822.00	837.62	831.80	838.34	0.005586	6.82	21094.14	1853.43	0.35
SCR	9025	Rev BB FP	142475.00	821.00	836.62	830.57	837.33	0.005004	7.02	21529.03	1822.90	0.34

Santa Clara River Fluvial Study

APPENDIX CHAPTER 4.2

Proposed Condition HEC-RAS Output

Plan	***Description***
FinalProp025	***Fluvial Model, Proposed Conditions, n=0.025, subcritical flow***
FinalProp085	***Fluvial Model, Proposed Conditions, n=0.085, subcritical flow***
Pr025LevCode	***Approved Model, Proposed Conditions, n=0.025, mixed flow***
Pr085LevCode	***Approved Model, Proposed Conditions, n=0.085, mixed flow***
FinalPr085Q2	***Approved Model, Proposed Conditions, n=0.085, mixed flow***

HEC-RAS model modified for fluvial use. See section 4.1.1B for model assembly. For unmodified, mixed flow regimes used in report, refer also to HEC-RAS Modeling Report prepared by PACE, concurrently submitted to LACDPW.

PACE
PACIFIC ADVANCED CIVIL ENGINEERING, INC.

HEC-RAS Plan: FinalProp025 River: SCR Reach: Project Profile: Rev BB

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	46195	Rev BB	115111.00	1035.00	1054.30	1054.30	1060.32	0.004006	19.69	5847.54	483.37	1.00
Project	46020	Rev BB	115111.00	1032.00	1052.44	1052.44	1058.13	0.004154	19.14	6013.48	531.51	1.00
Project	45545	Rev BB	115111.00	1030.00	1049.24	1049.24	1055.65	0.004022	20.32	5664.17	446.75	1.01
Project	45030	Rev BB	115111.00	1025.00	1045.55	1044.56	1050.46	0.003177	17.78	6472.44	521.46	0.89
Project	44585	Rev BB	115111.00	1022.00	1043.05	1043.05	1048.75	0.004190	19.17	6004.20	531.91	1.01
Project	44210	Rev BB	115111.00	1020.00	1041.58	1038.72	1044.97	0.001990	14.77	7793.25	585.85	0.71
Project	43820	Rev BB	115111.00	1018.00	1037.47	1037.47	1043.62	0.004072	19.90	5785.10	476.52	1.01
Project	43610	Rev BB	115111.00	1017.00	1034.08	1034.08	1040.13	0.004047	19.74	5832.04	483.67	1.00
Project	43410	Rev BB	115111.00	1016.00	1030.73	1030.73	1035.85	0.004279	18.14	6344.39	623.58	1.00
Project	43200	Rev BB	115111.00	1014.00	1029.33	1029.33	1033.92	0.004457	17.19	6697.33	738.00	1.01
Project	42975	Rev BB	115111.00	1012.00	1026.13	1026.13	1030.25	0.004579	16.29	7064.89	860.57	1.00
Project	42815	Rev BB	115111.00	1011.00	1024.36	1024.36	1028.02	0.004808	15.35	7496.97	1037.15	1.01
Project	42590	Rev BB	115111.00	1010.00	1021.50	1021.50	1025.01	0.004851	15.05	7649.36	1098.81	1.01
Project	42430	Rev BB	115111.00	1008.00	1020.26	1020.26	1024.03	0.004681	15.58	7396.51	1011.86	1.00
Project	42215	Rev BB	115111.00	1006.00	1019.73	1018.65	1022.25	0.003063	12.73	9040.32	1182.74	0.81
Project	41940	Rev BB	115111.00	1005.00	1019.28	1017.68	1021.36	0.002488	11.57	9945.28	1284.28	0.73
Project	41730	Rev BB	115111.00	1004.00	1018.65	1016.46	1020.82	0.002417	11.83	9727.36	1189.05	0.73
Project	41460	Rev BB	115111.00	1002.00	1018.12	1015.18	1020.22	0.001971	11.65	9876.94	1057.29	0.67
Project	41280	Rev BB	115111.00	1001.00	1015.34	1015.34	1019.50	0.004582	16.37	7032.47	852.22	1.00
Project	41080	Rev BB	115111.00	1000.00	1013.58	1013.58	1017.58	0.004593	16.04	7175.77	899.51	1.00
Project	40825	Rev BB	115111.00	999.50	1012.10	1012.10	1015.60	0.004938	15.00	7673.93	1122.98	1.01
Project	40585	Rev BB	115111.00	998.00	1010.59	1010.59	1014.03	0.004892	14.87	7741.09	1139.82	1.01
Project	40335	Rev BB	115111.00	996.00	1010.95	1008.70	1012.73	0.001840	10.69	10770.98	1248.81	0.64
Project	40130	Rev BB	115111.00	995.00	1010.41	1008.27	1012.32	0.001960	11.09	10380.24	1194.95	0.66
Project	39945	Rev BB	115111.00	994.00	1010.17	1007.59	1011.94	0.001684	10.67	10785.01	1172.47	0.62
Project	39755	Rev BB	115111.00	994.00	1007.18	1007.18	1011.21	0.004631	16.12	7140.66	893.31	1.00
Project	39605	Rev BB	115111.00	993.00	1005.78	1005.78	1009.87	0.004594	16.23	7091.77	873.24	1.00
Project	39310	Rev BB	115111.00	992.00	1004.36	1004.36	1008.29	0.004683	15.92	7232.22	929.34	1.01
Project	39100	Rev BB	115111.00	990.00	1003.74	1002.09	1006.89	0.002587	14.23	8088.07	788.26	0.78
Project	38925	Rev BB	115111.00	989.50	1003.74	1001.54	1006.30	0.002114	12.85	8958.42	873.34	0.71
Project	38710	Rev BB	115111.00	988.00	1003.55	1000.32	1005.82	0.001584	12.07	9534.83	820.16	0.62
Project	38475	Rev BB	115111.00	986.00	1000.04	1000.04	1004.98	0.004338	17.83	6455.50	659.76	1.00
Project	38300	Rev BB	115111.00	985.50	997.87	997.87	1002.71	0.004334	17.65	6520.77	677.19	1.00
Project	38065	Rev BB	115111.00	984.00	998.04	995.74	1001.32	0.002212	14.54	7917.91	658.42	0.74
Project	37810	Rev BB	115111.00	983.00	995.22	995.22	1000.37	0.004276	18.21	6321.28	618.24	1.00
Project	37655	Rev BB	115111.00	982.00	994.10	994.10	998.80	0.004442	17.39	6619.75	713.56	1.01
Project	37390	Rev BB	115111.00	981.00	991.46	990.10	994.58	0.002779	14.17	8124.66	840.59	0.80
Project	37135	Rev BB	115111.00	980.00	989.31	989.31	993.58	0.004549	16.58	6941.62	821.44	1.01
Project	36930	Rev BB	115111.00	978.00	987.92	987.46	991.71	0.003820	15.63	7364.69	834.69	0.93
Project	36735	Rev BB	115111.00	977.00	986.85	986.85	990.85	0.004582	16.06	7167.57	896.97	1.00
Project	36515	Rev BB	115111.00	975.00	987.04	985.39	989.58	0.002466	12.79	8997.40	994.80	0.75
Project	36265	Rev BB	115111.00	974.00	986.48	985.22	988.84	0.003073	12.33	9335.36	1176.00	0.77
Project	36080	Rev BB	116236.00	973.00	984.63	984.63	987.98	0.005710	14.69	7914.07	1176.00	1.00
Project	35845	Rev BB	116236.00	971.00	984.09	982.87	986.24	0.002731	11.74	9897.11	1385.15	0.76
Project	35725	Rev BB	116236.00	970.00	982.61	982.61	985.70	0.004997	14.11	8236.80	1374.87	1.00
Project	35515	Rev BB	116236.00	969.00	981.34	981.34	984.38	0.003984	14.00	8305.35	1363.56	1.00
Project	35245	Rev BB	116236.00	968.00	980.17	980.17	983.10	0.005053	13.71	8476.11	1553.65	1.00
Project	35040	Rev BB	116236.00	967.00	978.33	978.33	981.35	0.005109	13.94	8335.53	1400.46	1.01
Project	34860	Rev BB	116236.00	966.00	977.40	977.40	980.48	0.004124	14.07	8261.68	1362.38	1.01
Project	34720	Rev BB	116236.00	965.50	976.17	976.17	979.16	0.004168	13.87	8382.56	1419.56	1.01
Project	34495	Rev BB	116236.00	964.00	974.28	974.28	977.32	0.004209	13.98	8314.11	1380.43	1.00
Project	34310	Rev BB	116236.00	963.00	972.64	972.64	975.81	0.005099	14.28	8141.11	1311.42	1.01
Project	34090	Rev BB	116236.00	962.00	971.59	971.59	974.73	0.004069	14.21	8178.26	1312.61	1.00
Project	33880	Rev BB	116236.00	960.00	970.25	970.25	973.34	0.004192	14.12	8232.70	1343.51	1.01
Project	33710	Rev BB	116236.00	959.00	969.25	969.25	972.29	0.004184	14.00	8301.62	1377.88	1.01
Project	33500	Rev BB	116236.00	958.00	968.06	968.06	970.72	0.005489	13.08	8884.50	1720.67	1.01
Project	33310	Rev BB	116236.00	957.00	966.96	966.96	969.53	0.003818	12.88	9026.38	1780.29	1.01
Project	33115	Rev BB	116236.00	956.00	966.60	965.32	968.27	0.002770	10.36	11217.64	1847.27	0.74
Project	32795	Rev BB	116236.00	954.00	964.56	964.56	967.18	0.003570	12.99	8949.41	1735.59	1.01
Project	32605	Rev BB	116236.00	952.00	963.61	963.61	966.27	0.003728	13.08	8889.37	1766.10	1.00
Project	32265	Rev BB	140776.00	950.00	961.33	961.33	964.12	0.004082	13.40	10505.64	1941.10	1.02
Project	31875	Rev BB	140776.00	949.00	959.38	959.38	961.76	0.005507	12.38	11368.08	2409.14	1.00
Project	31585	Rev BB	140776.00	946.00	957.27	956.99	959.54	0.004462	12.10	11630.56	2178.50	0.92
Project	31360	Rev BB	140776.00	944.00	956.57	955.40	958.64	0.003098	11.54	12197.85	1866.19	0.80
Project	31060	Rev BB	140776.00	942.00	956.59	953.29	957.85	0.001200	9.01	15628.46	1701.29	0.52
Project	30720	Rev BB	140776.00	940.00	956.60	951.33	957.42	0.000665	7.25	19427.36	1882.31	0.40
Project	30445	Rev BB	140776.00	938.00	956.52	949.57	957.23	0.000483	6.75	20869.51	1771.80	0.35
Project	30095	Rev BB	140776.00	936.00	956.31	947.93	957.06	0.000474	6.95	20255.18	1619.47	0.35
Project	29815	Rev BB	140776.00	935.00	955.93	948.10	956.89	0.000611	7.87	17894.76	1430.05	0.39
Project	29565	Rev BB	140776.00	934.00	955.81	947.31	956.74	0.000520	7.74	18197.69	1320.30	0.37
Project	29385	Rev BB	140776.00	933.00	955.46	949.39	956.61	0.000672	8.60	16378.75	1233.03	0.42
Project	29140	Rev BB	140776.00	932.00	954.76	949.95	956.37	0.000994	10.18	13831.13	1082.52	0.50
Project	28895	Rev BB	140776.00	930.00	951.29	951.29	955.65	0.004486	16.75	8406.99	966.73	1.00
Project	28695	Rev BB	140776.00	928.00	948.27	945.72	951.01	0.001962	13.28	10604.18	929.93	0.69

HEC-RAS Plan: FinalProp025 River: SCR Reach: Project Profile: Rev BB (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	28500	Rev BB	140776.00	927.50	945.99	945.99	950.30	0.004557	16.65	8456.66	998.18	1.01
Project	28280	Rev BB	140776.00	926.00	943.37	939.86	945.58	0.001474	11.94	11789.80	976.23	0.61
Project	28080	Rev BB	140776.00	925.00	943.39	938.17	945.23	0.001004	10.88	12937.54	923.44	0.51
Project	27925	Rev BB	140776.00	924.00	942.60	938.71	944.99	0.001424	12.41	11347.95	863.96	0.60
Project	27725	Rev BB	140776.00	923.00	939.26	939.26	944.27	0.004292	17.96	7836.66	784.78	1.00
Project	27545	Rev BB	140776.00	922.00	937.62	937.62	943.27	0.004131	19.08	7378.13	656.25	1.00
Project	27335	Rev BB	140776.00	921.00	936.15	936.15	940.86	0.004392	17.42	8079.14	865.36	1.00
Project	27155	Rev BB	140776.00	920.50	935.27	935.27	939.88	0.004380	17.23	8170.77	888.23	1.00
Project	26990	Rev BB	140776.00	920.00	933.70	933.70	938.05	0.004510	16.73	8413.85	976.89	1.00
Project	26780	Rev BB	140776.00	918.00	931.32	931.32	935.44	0.004591	16.27	8650.56	1062.31	1.00
Project	26575	Rev BB	140776.00	917.00	930.42	929.95	933.79	0.003886	14.72	9560.94	1203.73	0.92
Project	26355	Rev BB	140776.00	916.00	929.13	929.13	932.81	0.004778	15.40	9144.23	1256.77	1.01
Project	26170	Rev BB	140776.00	915.00	928.17	928.16	931.80	0.004729	15.28	9212.38	1267.86	1.00
Project	25965	Rev BB	140776.00	914.00	927.26	927.21	930.82	0.004663	15.15	9292.56	1281.80	0.99
Project	25785	Rev BB	140776.00	913.50	926.78	926.18	929.97	0.003660	14.35	9809.35	1224.04	0.89
Project	25600	Rev BB	140776.00	912.50	925.76	925.21	929.25	0.003734	15.00	9384.78	1112.87	0.91
Project	25425	Rev BB	140776.00	911.00	925.28	924.40	928.57	0.003288	14.56	9667.52	1090.05	0.86
Project	25215	Rev BB	140776.00	910.00	924.72	923.65	927.87	0.003073	14.23	9894.10	1097.30	0.84
Project	25000	Rev BB	140776.00	909.00	924.47	922.49	927.15	0.002252	13.13	10725.52	1062.40	0.73
Project	24795	Rev BB	140776.00	908.00	923.60	921.79	926.64	0.002430	13.99	10061.45	957.43	0.76
Project	24550	Rev BB	140776.00	906.00	922.49	920.91	925.97	0.002629	14.97	9403.51	856.09	0.80
Project	24335	Rev BB	140776.00	905.00	920.03	920.03	925.11	0.004254	18.10	7779.37	764.96	1.00
Project	24115	Rev BB	140776.00	904.00	918.66	918.66	923.80	0.004273	18.20	7736.79	757.86	1.00
Project	23975	Rev BB	140776.00	903.50	917.68	917.68	922.69	0.004306	17.96	7837.58	789.45	1.00
Project	23755	Rev BB	140776.00	902.00	916.75	916.75	921.65	0.004327	17.75	7930.29	816.51	1.00
Project	23565	Rev BB	140776.00	900.00	915.57	915.57	920.26	0.004363	17.38	8100.02	867.04	1.00
Project	23365	Rev BB	140776.00	900.00	914.40	914.40	918.85	0.004458	16.92	8320.34	939.52	1.00
Project	23180	Rev BB	140776.00	899.00	913.20	912.61	917.17	0.003607	15.99	8806.14	926.00	0.91
Project	23000	Rev BB	140776.00	898.00	912.81	911.12	916.46	0.003290	15.34	9177.96	784.00	0.79
Project	22790	Rev BB	140776.00	897.50	910.47	910.47	915.48	0.005111	17.96	7838.51	784.00	1.00
Project	22600	Rev BB	140776.00	896.00	909.60	909.60	913.89	0.004591	16.62	8469.77	1007.62	1.01
Project	22415	Rev BB	140776.00	895.50	907.97	907.97	912.10	0.004576	16.31	8630.14	1052.83	1.00
Project	22195	Rev BB	141426.00	894.00	907.47	906.87	910.61	0.003724	14.21	9951.36	1281.58	0.90
Project	22010	Rev BB	141426.00	892.00	906.10	906.10	909.78	0.004698	15.38	9195.89	1252.29	1.00
Project	21790	Rev BB	141426.00	891.50	904.77	904.77	908.11	0.004855	14.67	9642.87	1507.80	1.00
Project	21615	Rev BB	141426.00	892.00	902.80	902.80	906.20	0.004803	14.80	9557.40	1401.11	1.00
Project	21440	Rev BB	141426.00	890.00	901.57	901.57	905.07	0.004769	15.01	9424.54	1342.59	1.00
Project	21225	Rev BB	141426.00	888.00	900.52	900.52	903.69	0.004968	14.30	9886.64	1563.91	1.00
Project	21020	Rev BB	141426.00	887.00	899.97	898.94	902.33	0.003046	12.34	11464.58	1568.45	0.80
Project	20845	Rev BB	141426.00	886.00	898.39	898.39	901.57	0.004961	14.31	9883.42	1561.02	1.00
Project	20595	Rev BB	141426.00	885.00	898.33	896.46	900.25	0.002128	11.13	12703.95	1548.09	0.68
Project	20435	Rev BB	141426.00	884.00	898.08	895.80	899.89	0.001872	10.78	13124.39	1524.83	0.65
Project	20280	Rev BB	141426.00	883.70	896.01	896.01	899.29	0.005069	14.53	9735.55	1527.35	1.01
Project	20070	Rev BB	141426.00	882.00	894.29	894.29	897.53	0.005010	14.44	9793.63	1537.65	1.01
Project	19855	Rev BB	141426.00	880.50	892.65	892.65	895.81	0.005043	14.26	9916.93	1593.11	1.01
Project	19630	Rev BB	141426.00	880.00	891.48	890.46	894.67	0.003143	14.35	9854.55	1098.59	0.84
Project	19440	Rev BB	141426.00	878.00	891.37	889.68	893.96	0.002469	12.92	10950.06	1194.62	0.75
Project	19240	Rev BB	141426.00	877.50	889.40	889.40	893.18	0.004749	15.60	9068.42	1219.41	1.01
Project	19050	Rev BB	141426.00	876.00	889.38	887.89	891.70	0.002632	12.21	11580.60	1442.64	0.76
Project	18830	Rev BB	141426.00	874.00	888.82	887.50	891.10	0.002798	12.12	11667.44	1538.23	0.78
Project	18650	Rev BB	141426.00	873.50	888.72	886.68	890.53	0.002006	10.78	13119.62	1607.26	0.66
Project	18475	Rev BB	141426.00	872.00	888.91	885.02	890.10	0.001016	8.76	16151.21	1621.67	0.49
Project	18290	Rev BB	141426.00	871.50	888.50	885.07	889.87	0.001262	9.40	15041.49	1594.70	0.54
Project	18025	Rev BB	141426.00	870.00	888.57	882.91	889.51	0.000633	7.79	18154.44	1520.48	0.40
Project	17785	Rev BB	141426.00	868.00	888.25	882.79	889.34	0.000722	8.38	16870.97	1398.41	0.43
Project	17510	Rev BB	141426.00	868.00	887.46	883.42	889.03	0.001273	10.07	14045.60	1353.64	0.55
Project	17360	Rev BB	141426.00	868.00	883.98	883.98	888.42	0.004472	16.91	8364.98	944.54	1.00
Project	17110	Rev BB	141426.00	864.00	881.08	881.08	884.88	0.004682	15.65	9039.19	1191.88	1.00
Project	16970	Rev BB	141426.00	863.70	879.57	879.57	883.40	0.004698	15.72	8997.01	1180.24	1.00
Project	16720	Rev BB	141426.00	863.50	875.41	875.41	879.35	0.004709	15.94	8873.56	1146.54	1.01
Project	16515	Rev BB	141426.00	862.00	873.88	873.85	877.54	0.004720	15.36	9209.61	1259.97	1.00
Project	16305	Rev BB	141426.00	860.00	874.53	872.03	876.44	0.001769	11.08	12765.90	1360.42	0.64
Project	16130	Rev BB	141426.00	860.00	872.23	872.23	875.79	0.004840	15.15	9332.88	1325.97	1.01
Project	15960	Rev BB	141426.00	859.00	871.57	870.96	874.47	0.003673	13.67	10347.30	1395.60	0.88
Project	15745	Rev BB	141426.00	858.00	871.32	869.77	873.67	0.002505	12.30	11500.92	1363.87	0.75
Project	15540	Rev BB	141426.00	857.50	871.22	868.50	872.95	0.001594	10.54	13415.28	1426.97	0.61
Project	15335	Rev BB	141426.00	856.00	868.08	868.08	872.16	0.005518	16.21	8723.27	1064.14	1.00
Project	15125	Rev BB	142475.00	854.00	866.25	866.25	870.52	0.005571	16.58	8594.49	1005.21	1.00
Project	14900	Rev BB	142475.00	853.00	864.18	864.18	868.31	0.004518	16.29	8744.60	1681.96	1.00
Project	14720	Rev BB	142475.00	852.00	863.25	863.25	867.16	0.004589	15.87	8988.33	1754.84	1.00
Project	14480	Rev BB	142475.00	850.50	860.78	860.75	864.04	0.004765	14.50	9824.86	1761.86	0.99
Project	14315	Rev BB	142475.00	850.00	860.12	860.12	863.17	0.004972	14.01	10170.99	1883.64	1.00
Project	14090	Rev BB	142475.00	850.00	858.71	858.71	861.64	0.005088	13.74	10369.15	1774.74	1.00
Project	13850	Rev BB	142475.00	848.00	857.10	857.10	860.08	0.005085	13.85	10284.52	1738.35	1.00

HEC-RAS Plan: FinalProp025 River: SCR Reach: Project Profile: Rev BB (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	13635	Rev BB	142475.00	846.00	855.96	855.96	858.98	0.004582	13.95	10211.78	1703.12	1.00
Project	13425	Rev BB	142475.00	845.00	854.24	854.24	857.06	0.004529	13.47	10578.16	1897.18	1.01
Project	13190	Rev BB	142475.00	844.00	853.32	852.74	855.68	0.003742	12.34	11549.85	1846.11	0.87
Project	13030	Rev BB	142475.00	843.00	852.86	851.95	855.08	0.003185	11.96	11909.27	1766.79	0.81
Project	12835	Rev BB	142475.00	842.00	852.34	851.01	854.49	0.002668	11.77	12100.72	1610.12	0.76
Project	12615	Rev BB	142475.00	841.00	852.03	849.82	853.92	0.001904	11.02	12926.14	1472.31	0.66
Project	12395	Rev BB	142475.00	840.00	851.67	849.16	853.50	0.001752	10.85	13135.39	1440.65	0.63
Project	12195	Rev BB	142475.00	838.98	851.58	848.08	853.12	0.001248	9.95	14313.41	1384.21	0.55
Project	11995	Rev BB	142475.00	837.00	850.88	848.04	852.79	0.001627	11.11	12823.25	1283.08	0.62
Project	11780	Rev BB	142475.00	836.00	850.70	847.66	852.39	0.001520	10.44	13642.49	1424.15	0.59
Project	11605	Rev BB	142475.00	835.50	849.96	847.34	852.05	0.001993	11.60	12285.52	1341.91	0.68
Project	11405	Rev BB	142475.00	834.00	849.37	846.23	851.65	0.001801	12.11	11766.04	1116.35	0.66
Project	11180	Rev BB	142475.00	833.00	847.48	845.64	851.07	0.002263	15.22	9359.01	861.14	0.81
Project	11015	Rev BB	142475.00	831.50	844.86	844.86	850.40	0.003816	18.88	7546.81	680.73	1.00
Project	10835	Rev BB	142475.00	831.00	843.79	843.79	848.64	0.003827	17.68	8059.51	834.48	1.00
Project	10575	Rev BB	142475.00	830.00	840.16	840.16	844.13	0.004323	15.99	8907.77	1127.45	1.00
Project	10390	Rev BB	142475.00	828.00	839.75	838.53	842.26	0.002882	12.70	11218.28	1408.98	0.79
Project	10225	Rev BB	142475.00	827.50	838.21	838.21	841.57	0.004878	14.72	9676.62	1447.21	1.00
Project	10000	Rev BB	142475.00	826.00	837.14	837.14	840.43	0.003961	14.56	9788.33	1488.06	1.00
Project	9820	Rev BB	142475.00	824.00	835.36	835.36	838.82	0.004314	14.94	9537.68	1450.92	1.00
Project	9595	Rev BB	142475.00	823.80	834.15	834.15	837.42	0.004846	14.53	9808.52	1620.11	1.00
Project	9385	Rev BB	142475.00	823.00	833.09	833.09	836.04	0.005132	13.78	10337.67	1773.60	1.01
Project	9220	Rev BB	142475.00	822.00	831.82	831.82	834.72	0.004516	13.66	10429.99	1814.14	1.00
Project	9025	Rev BB	142475.00	821.00	830.39	830.39	833.36	0.004263	13.82	10307.78	1751.03	1.00

HEC-RAS Plan: FinalProp085 River: SCR Reach: Project Profile: Rev BB

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	46195	Rev BB	115111.00	1035.00	1063.47	1054.30	1064.87	0.007341	9.49	12131.56	752.82	0.42
Project	46020	Rev BB	115111.00	1032.00	1062.02	1052.44	1063.64	0.006543	10.21	11278.49	570.25	0.40
Project	45545	Rev BB	115111.00	1030.00	1057.85	1049.24	1059.95	0.008978	11.63	9901.38	524.22	0.47
Project	45030	Rev BB	115111.00	1025.00	1054.23	1044.56	1055.89	0.006624	10.33	11148.02	558.00	0.41
Project	44585	Rev BB	115111.00	1022.00	1050.61	1043.05	1052.40	0.009260	10.73	10726.47	654.45	0.47
Project	44210	Rev BB	115111.00	1020.00	1047.85	1038.72	1049.39	0.006689	9.95	11564.12	620.11	0.41
Project	43820	Rev BB	115111.00	1018.00	1042.18	1037.47	1045.27	0.017205	14.10	8166.67	530.01	0.63
Project	43610	Rev BB	115111.00	1017.00	1038.67	1034.08	1041.71	0.017230	13.99	8227.50	539.45	0.63
Project	43410	Rev BB	115111.00	1016.00	1036.61	1030.73	1038.51	0.011821	11.06	10407.01	734.51	0.52
Project	43200	Rev BB	115111.00	1014.00	1033.78	1029.33	1035.80	0.014294	11.41	10091.65	785.15	0.56
Project	42975	Rev BB	115111.00	1012.00	1031.27	1026.13	1032.77	0.011383	9.83	11714.26	961.37	0.50
Project	42815	Rev BB	115111.00	1011.00	1029.95	1024.36	1031.07	0.008590	8.49	13555.60	1123.09	0.43
Project	42590	Rev BB	115111.00	1010.00	1028.69	1021.50	1029.49	0.005332	7.17	16066.51	1248.66	0.35
Project	42430	Rev BB	115111.00	1008.00	1027.84	1020.26	1028.57	0.005587	6.91	17118.29	1596.16	0.35
Project	42215	Rev BB	115111.00	1006.00	1026.89	1018.65	1027.51	0.004188	6.31	18233.84	1375.77	0.31
Project	41940	Rev BB	115111.00	1005.00	1025.82	1017.68	1026.42	0.003813	6.23	18490.49	1328.21	0.29
Project	41730	Rev BB	115111.00	1004.00	1024.84	1016.46	1025.54	0.004347	6.69	17201.33	1222.58	0.31
Project	41460	Rev BB	115111.00	1002.00	1023.44	1015.18	1024.26	0.005190	7.30	15773.56	1122.33	0.34
Project	41280	Rev BB	115111.00	1001.00	1022.21	1015.34	1023.16	0.007140	7.84	14689.39	1195.76	0.39
Project	41080	Rev BB	115111.00	1000.00	1020.85	1013.58	1021.79	0.006509	7.77	14810.43	1139.40	0.38
Project	40825	Rev BB	115111.00	999.50	1019.54	1012.10	1020.30	0.004962	6.98	16487.71	1214.08	0.33
Project	40585	Rev BB	115111.00	998.00	1018.42	1010.59	1019.12	0.004550	6.73	17110.93	1249.11	0.32
Project	40335	Rev BB	115111.00	996.00	1017.57	1008.70	1018.14	0.003259	6.01	19166.52	1289.69	0.27
Project	40130	Rev BB	115111.00	995.00	1016.78	1008.27	1017.40	0.003782	6.33	18185.41	1266.60	0.29
Project	39945	Rev BB	115111.00	994.00	1016.05	1007.59	1016.70	0.003847	6.47	17791.94	1214.29	0.30
Project	39755	Rev BB	115111.00	994.00	1014.76	1007.18	1015.73	0.006323	7.91	14562.19	1096.92	0.38
Project	39605	Rev BB	115111.00	993.00	1013.91	1005.78	1014.86	0.005477	7.85	14763.11	1083.20	0.36
Project	39310	Rev BB	115111.00	992.00	1012.32	1004.36	1013.25	0.005319	7.77	14818.98	977.78	0.35
Project	39100	Rev BB	115111.00	990.00	1011.14	1002.09	1012.17	0.005052	8.16	14158.82	850.63	0.35
Project	38925	Rev BB	115111.00	989.50	1010.35	1001.54	1011.28	0.004789	7.75	14843.71	906.85	0.34
Project	38710	Rev BB	115111.00	988.00	1009.19	1000.32	1010.20	0.005036	8.09	14224.74	844.23	0.35
Project	38475	Rev BB	115111.00	986.00	1006.99	1000.04	1008.64	0.008697	10.31	11167.84	695.45	0.45
Project	38300	Rev BB	115111.00	985.50	1005.78	997.87	1007.19	0.007044	9.56	12043.94	716.83	0.41
Project	38065	Rev BB	115111.00	984.00	1004.14	995.74	1005.56	0.006775	9.56	12036.74	691.32	0.40
Project	37810	Rev BB	115111.00	983.00	1001.39	995.22	1003.36	0.010602	11.26	10228.44	648.53	0.50
Project	37655	Rev BB	115111.00	982.00	999.90	994.10	1001.66	0.010464	10.62	10834.10	739.02	0.49
Project	37390	Rev BB	115111.00	981.00	998.49	990.10	999.52	0.005339	8.15	14131.07	869.25	0.36
Project	37135	Rev BB	115111.00	980.00	996.84	989.31	998.01	0.006512	8.67	13273.15	864.25	0.39
Project	36930	Rev BB	115111.00	978.00	995.75	987.46	996.75	0.005471	8.01	14378.93	926.41	0.36
Project	36735	Rev BB	115111.00	977.00	994.66	986.85	995.64	0.005652	7.97	14443.30	963.48	0.36
Project	36515	Rev BB	115111.00	975.00	993.64	985.37	994.48	0.004699	7.33	15700.20	1032.84	0.33
Project	36265	Rev BB	115111.00	974.00	992.27	985.22	993.06	0.006888	7.13	16149.47	1176.00	0.34
Project	36080	Rev BB	116236.00	973.00	990.65	984.63	991.59	0.008983	7.75	14999.86	1176.00	0.38
Project	35845	Rev BB	116236.00	971.00	989.14	982.87	989.89	0.005586	6.95	16718.71	1512.86	0.35
Project	35725	Rev BB	116236.00	970.00	988.33	982.61	989.15	0.006539	7.30	15919.91	1489.98	0.38
Project	35515	Rev BB	116236.00	969.00	987.05	981.34	987.85	0.005995	7.20	16145.45	1503.16	0.37
Project	35245	Rev BB	116236.00	968.00	985.20	980.17	986.04	0.007449	7.36	15792.43	1581.24	0.39
Project	35040	Rev BB	116236.00	967.00	983.73	978.33	984.52	0.007010	7.17	16215.62	1493.00	0.38
Project	34860	Rev BB	116236.00	966.00	982.28	977.40	983.21	0.007849	7.71	15077.98	1431.69	0.42
Project	34720	Rev BB	116236.00	965.50	981.27	976.17	982.13	0.007059	7.40	15698.80	1450.12	0.40
Project	34495	Rev BB	116236.00	964.00	979.81	974.28	980.61	0.006440	7.20	16154.11	1462.52	0.38
Project	34310	Rev BB	116236.00	963.00	978.58	972.64	979.39	0.006581	7.21	16112.75	1388.30	0.37
Project	34090	Rev BB	116236.00	962.00	977.05	971.59	977.93	0.006750	7.49	15517.16	1371.20	0.39
Project	33880	Rev BB	116236.00	960.00	975.68	970.25	976.50	0.006734	7.27	15989.40	1483.22	0.39
Project	33710	Rev BB	116236.00	959.00	974.59	969.25	975.34	0.006419	6.93	16763.53	1638.24	0.38
Project	33500	Rev BB	116236.00	958.00	973.35	968.06	974.00	0.006109	6.43	18080.31	1755.79	0.35
Project	33310	Rev BB	116236.00	957.00	972.33	966.96	972.93	0.005176	6.21	18719.75	1828.22	0.34
Project	33115	Rev BB	116236.00	956.00	971.42	965.32	971.93	0.004618	5.75	20262.43	1927.27	0.31
Project	32795	Rev BB	116236.00	954.00	969.71	964.56	970.33	0.005520	6.33	18411.74	1921.08	0.36
Project	32605	Rev BB	116236.00	952.00	968.73	963.61	969.28	0.005123	6.04	20231.14	2407.57	0.34
Project	32265	Rev BB	140776.00	950.00	967.22	961.33	967.68	0.004388	5.45	25825.19	2840.45	0.32
Project	31875	Rev BB	140776.00	949.00	965.64	959.38	966.07	0.003807	5.22	27033.89	2594.16	0.28
Project	31585	Rev BB	140776.00	946.00	964.73	956.99	965.10	0.002884	4.92	28606.50	2377.72	0.25
Project	31360	Rev BB	140776.00	944.00	964.01	955.40	964.44	0.002856	5.30	26583.39	1959.81	0.25
Project	31060	Rev BB	140776.00	942.00	963.24	953.29	963.64	0.002469	5.05	27851.26	1976.23	0.24
Project	30720	Rev BB	140776.00	940.00	962.60	951.33	962.93	0.001689	4.57	30819.70	1911.83	0.20
Project	30445	Rev BB	140776.00	938.00	962.16	949.57	962.48	0.001559	4.53	31093.12	1842.15	0.19
Project	30095	Rev BB	140776.00	936.00	961.53	947.93	961.90	0.001737	4.90	28752.99	1637.52	0.21
Project	29815	Rev BB	140776.00	935.00	960.83	948.10	961.33	0.002377	5.64	24945.23	1445.25	0.24
Project	29565	Rev BB	140776.00	934.00	960.18	947.31	960.72	0.002432	5.87	24002.03	1334.60	0.24
Project	29385	Rev BB	140776.00	933.00	959.53	949.39	960.20	0.003234	6.57	21423.61	1248.62	0.28
Project	29140	Rev BB	140776.00	932.00	958.17	949.95	959.17	0.005290	8.02	17548.01	1094.18	0.35
Project	28895	Rev BB	140776.00	930.00	954.62	951.29	956.89	0.017865	12.08	11651.29	981.60	0.62
Project	28695	Rev BB	140776.00	928.00	953.10	945.72	954.44	0.007151	9.29	15147.15	952.31	0.41

HEC-RAS Plan: FinalProp085 River: SCR Reach: Project Profile: Rev BB (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	28500	Rev BB	140776.00	927.50	951.00	945.99	952.67	0.011472	10.35	13606.97	1041.16	0.50
Project	28280	Rev BB	140776.00	926.00	950.17	939.86	951.07	0.003943	7.60	18528.58	1005.15	0.31
Project	28080	Rev BB	140776.00	925.00	949.41	938.17	950.31	0.003613	7.58	18572.27	946.60	0.30
Project	27925	Rev BB	140776.00	924.00	948.51	938.71	949.63	0.004894	8.52	16518.98	886.47	0.35
Project	27725	Rev BB	140776.00	923.00	946.74	939.26	948.35	0.007913	10.18	13823.56	814.27	0.44
Project	27545	Rev BB	140776.00	922.00	944.98	937.62	946.75	0.009932	10.70	13156.60	854.99	0.48
Project	27335	Rev BB	140776.00	921.00	943.42	936.15	944.83	0.007683	9.56	14721.97	939.21	0.43
Project	27155	Rev BB	140776.00	920.50	941.86	935.27	943.34	0.008754	9.78	14398.34	980.49	0.45
Project	26990	Rev BB	140776.00	920.00	940.62	933.70	941.93	0.007507	9.18	15333.37	1021.74	0.42
Project	26780	Rev BB	140776.00	918.00	939.53	931.32	940.52	0.005306	8.01	17571.72	1107.51	0.35
Project	26575	Rev BB	140776.00	917.00	938.72	929.95	939.51	0.004216	7.14	19724.69	1244.26	0.32
Project	26355	Rev BB	140776.00	916.00	937.83	929.13	938.58	0.004073	6.95	20261.90	1295.29	0.31
Project	26170	Rev BB	140776.00	915.00	937.12	928.16	937.83	0.003833	6.80	20700.37	1301.90	0.30
Project	25965	Rev BB	140776.00	914.00	936.38	927.21	937.07	0.003632	6.67	21119.28	1313.87	0.29
Project	25785	Rev BB	140776.00	913.50	935.72	926.18	936.42	0.003567	6.74	20899.07	1257.60	0.29
Project	25600	Rev BB	140776.00	912.50	934.94	925.21	935.73	0.003778	7.12	19783.70	1150.59	0.30
Project	25425	Rev BB	140776.00	911.00	934.27	924.40	935.07	0.003763	7.16	19676.46	1139.17	0.30
Project	25215	Rev BB	140776.00	910.00	933.49	923.65	934.28	0.003774	7.15	19675.54	1134.33	0.30
Project	25000	Rev BB	140776.00	909.00	932.66	922.49	933.46	0.003681	7.20	19553.49	1094.28	0.30
Project	24795	Rev BB	140776.00	908.00	931.68	921.79	932.64	0.004300	7.85	17926.30	987.02	0.32
Project	24550	Rev BB	140776.00	906.00	930.28	920.91	931.46	0.005239	8.69	16197.81	887.76	0.36
Project	24335	Rev BB	140776.00	905.00	928.76	920.03	930.20	0.006433	9.63	14619.51	801.23	0.40
Project	24115	Rev BB	140776.00	904.00	927.27	918.66	928.75	0.006654	9.77	14414.92	794.39	0.40
Project	23975	Rev BB	140776.00	903.50	926.43	917.68	927.81	0.006247	9.43	14928.26	829.53	0.39
Project	23755	Rev BB	140776.00	902.00	925.02	916.75	926.36	0.006964	9.29	15158.33	941.12	0.41
Project	23565	Rev BB	140776.00	900.00	923.80	915.57	925.07	0.006358	9.02	15604.61	942.91	0.39
Project	23365	Rev BB	140776.00	900.00	922.66	914.40	923.82	0.005909	8.65	16278.47	988.72	0.38
Project	23180	Rev BB	140776.00	899.00	921.68	912.61	922.76	0.005147	8.35	16869.25	976.84	0.35
Project	23000	Rev BB	140776.00	898.00	920.17	911.12	921.55	0.008753	9.42	14947.76	784.00	0.38
Project	22790	Rev BB	140776.00	897.50	917.71	910.47	919.39	0.011776	10.42	13511.74	784.00	0.44
Project	22600	Rev BB	140776.00	896.00	916.14	909.60	917.47	0.008004	9.25	15211.94	1052.34	0.43
Project	22415	Rev BB	140776.00	895.50	914.82	907.97	916.03	0.007157	8.81	15982.03	1093.93	0.41
Project	22195	Rev BB	141426.00	894.00	913.51	906.87	914.43	0.006693	7.70	18363.87	1466.03	0.38
Project	22010	Rev BB	141426.00	892.00	911.96	906.10	913.01	0.008584	8.23	17188.55	1803.93	0.43
Project	21790	Rev BB	141426.00	891.50	910.41	904.77	911.26	0.006915	7.52	19320.02	1781.74	0.39
Project	21615	Rev BB	141426.00	892.00	909.33	902.80	910.10	0.006037	7.05	20056.92	1690.87	0.36
Project	21440	Rev BB	141426.00	890.00	908.27	901.57	909.05	0.005983	7.09	19960.76	1656.11	0.36
Project	21225	Rev BB	141426.00	888.00	907.08	900.52	907.83	0.005424	6.97	20279.11	1603.39	0.35
Project	21020	Rev BB	141426.00	887.00	906.08	898.94	906.78	0.004697	6.68	21188.20	1610.45	0.32
Project	20845	Rev BB	141426.00	886.00	905.18	898.39	905.90	0.005127	6.85	20644.44	1607.47	0.34
Project	20595	Rev BB	141426.00	885.00	904.07	896.46	904.73	0.004338	6.51	21721.47	1608.91	0.31
Project	20435	Rev BB	141426.00	884.00	903.31	895.80	903.99	0.004686	6.63	21321.67	1627.73	0.32
Project	20280	Rev BB	141426.00	883.70	902.35	896.01	903.15	0.006133	7.17	19767.98	1749.06	0.36
Project	20070	Rev BB	141426.00	882.00	901.17	894.29	901.87	0.005844	6.74	20986.95	1849.69	0.35
Project	19855	Rev BB	141426.00	880.50	900.16	892.65	900.78	0.004249	6.33	22462.36	1851.55	0.31
Project	19630	Rev BB	141426.00	880.00	899.23	890.46	899.83	0.004178	6.23	22797.11	1871.07	0.30
Project	19440	Rev BB	141426.00	878.00	898.40	889.68	898.98	0.004680	6.12	23122.45	2019.07	0.32
Project	19240	Rev BB	141426.00	877.50	897.28	889.40	897.97	0.005271	6.69	21152.97	1747.11	0.34
Project	19050	Rev BB	141426.00	876.00	896.50	887.89	897.09	0.003878	6.16	22999.78	1762.81	0.30
Project	18830	Rev BB	141426.00	874.00	895.62	887.50	896.22	0.004004	6.23	22683.43	1690.74	0.30
Project	18650	Rev BB	141426.00	873.50	894.96	886.68	895.53	0.003602	6.04	23403.52	1688.66	0.29
Project	18475	Rev BB	141426.00	872.00	894.47	885.02	894.95	0.002736	5.59	25295.13	1667.77	0.25
Project	18290	Rev BB	141426.00	871.50	893.84	885.07	894.40	0.003329	5.98	23665.47	1633.61	0.28
Project	18025	Rev BB	141426.00	870.00	893.11	882.91	893.60	0.002558	5.62	25143.79	1559.41	0.25
Project	17785	Rev BB	141426.00	868.00	892.29	882.79	892.90	0.003271	6.25	22632.10	1447.29	0.28
Project	17510	Rev BB	141426.00	868.00	890.81	883.42	891.70	0.005886	7.59	18654.98	1414.71	0.36
Project	17360	Rev BB	141426.00	868.00	888.82	883.98	890.35	0.013569	9.95	14215.52	1305.45	0.53
Project	17110	Rev BB	141426.00	864.00	885.85	881.08	887.26	0.010933	9.55	14814.13	1232.51	0.49
Project	16970	Rev BB	141426.00	863.70	884.19	879.57	885.67	0.011338	9.76	14491.26	1196.81	0.49
Project	16720	Rev BB	141426.00	863.50	882.37	875.41	883.44	0.006539	8.31	17010.13	1187.95	0.39
Project	16515	Rev BB	141426.00	862.00	881.31	873.85	882.19	0.005350	7.54	18766.93	1306.21	0.35
Project	16305	Rev BB	141426.00	860.00	880.45	872.03	881.16	0.004085	6.76	20922.92	1395.94	0.31
Project	16130	Rev BB	141426.00	860.00	879.49	872.23	880.34	0.005368	7.40	19112.35	1369.50	0.35
Project	15960	Rev BB	141426.00	859.00	878.70	870.96	879.45	0.004570	6.91	20452.81	1438.39	0.32
Project	15745	Rev BB	141426.00	858.00	877.73	869.77	878.48	0.004476	6.94	20373.34	1402.37	0.32
Project	15540	Rev BB	141426.00	857.50	876.91	868.50	877.56	0.004066	6.49	22408.43	2361.93	0.30
Project	15335	Rev BB	141426.00	856.00	875.11	868.08	876.29	0.009480	8.73	16198.42	1064.14	0.39
Project	15125	Rev BB	142475.00	854.00	872.68	866.25	874.03	0.011555	9.34	15249.43	1053.51	0.43
Project	14900	Rev BB	142475.00	853.00	870.38	864.18	871.63	0.009216	8.97	15881.59	2238.73	0.45
Project	14720	Rev BB	142475.00	852.00	868.64	863.25	869.90	0.010452	9.02	15810.26	2022.13	0.47
Project	14480	Rev BB	142475.00	850.50	867.05	860.75	867.91	0.006131	7.43	19187.13	1853.66	0.37
Project	14315	Rev BB	142475.00	850.00	866.10	860.12	866.88	0.005923	7.08	20111.41	1942.36	0.36
Project	14090	Rev BB	142475.00	850.00	864.88	858.71	865.56	0.005375	6.64	21464.46	1816.59	0.34
Project	13850	Rev BB	142475.00	848.00	863.69	857.10	864.35	0.004893	6.52	21855.87	1775.36	0.33

HEC-RAS Plan: FinalProp085 River: SCR Reach: Project Profile: Rev BB (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	13635	Rev BB	142475.00	846.00	862.66	855.96	863.31	0.004619	6.49	22131.17	1820.37	0.32
Project	13425	Rev BB	142475.00	845.00	861.97	854.24	862.46	0.003252	5.61	25397.52	1936.85	0.27
Project	13190	Rev BB	142475.00	844.00	861.29	852.74	861.74	0.002835	5.37	26541.57	1912.15	0.25
Project	13030	Rev BB	142475.00	843.00	860.83	851.95	861.29	0.002789	5.40	26405.92	1864.73	0.25
Project	12835	Rev BB	142475.00	842.00	860.25	851.01	860.73	0.002859	5.54	25707.76	1777.11	0.26
Project	12615	Rev BB	142475.00	841.00	859.56	849.82	860.09	0.002907	5.85	24347.79	1569.00	0.26
Project	12395	Rev BB	142475.00	840.00	858.89	849.16	859.44	0.003000	5.97	23856.91	1549.44	0.27
Project	12195	Rev BB	142475.00	838.98	858.30	848.08	858.85	0.002869	5.98	23808.84	1469.16	0.26
Project	11995	Rev BB	142475.00	837.00	857.55	848.04	858.19	0.003608	6.44	22107.60	1450.22	0.29
Project	11780	Rev BB	142475.00	836.00	856.80	847.66	857.43	0.003467	6.35	22449.24	1462.33	0.29
Project	11605	Rev BB	142475.00	835.50	856.01	847.34	856.75	0.004360	6.88	20711.16	1419.08	0.32
Project	11405	Rev BB	142475.00	834.00	854.76	846.23	855.75	0.005373	7.98	17861.03	1145.60	0.36
Project	11180	Rev BB	142475.00	833.00	852.84	845.64	854.31	0.007515	9.72	14662.38	1010.63	0.45
Project	11015	Rev BB	142475.00	831.50	850.47	844.86	852.66	0.011939	11.87	12004.65	852.64	0.56
Project	10835	Rev BB	142475.00	831.00	848.29	843.79	850.42	0.013047	11.76	12400.58	1074.47	0.57
Project	10575	Rev BB	142475.00	830.00	846.33	840.16	847.54	0.007986	8.84	16140.29	1323.35	0.43
Project	10390	Rev BB	142475.00	828.00	845.30	838.53	846.14	0.005968	7.35	19375.22	1517.90	0.36
Project	10225	Rev BB	142475.00	827.50	844.20	838.21	845.10	0.006835	7.61	18716.44	1545.61	0.39
Project	10000	Rev BB	142475.00	826.00	842.62	837.11	843.54	0.006877	7.72	18453.52	1626.59	0.40
Project	9820	Rev BB	142475.00	824.00	841.41	835.36	842.34	0.006465	7.71	18478.98	1650.05	0.39
Project	9595	Rev BB	142475.00	823.80	839.92	834.15	840.84	0.006985	7.70	18513.50	1720.36	0.39
Project	9385	Rev BB	142475.00	823.00	838.61	833.09	839.38	0.006487	7.05	20207.47	1799.40	0.37
Project	9220	Rev BB	142475.00	822.00	837.64	831.82	838.35	0.005584	6.74	21127.86	1853.53	0.35
Project	9025	Rev BB	142475.00	821.00	836.65	830.39	837.32	0.005004	6.60	21582.88	1823.02	0.34

HEC-RAS Plan: Pr025LevCode River: SCR Reach: Project Profile: Rev BB

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	46195	Rev BB	115111.00	1035.00	1053.14	1054.04	1060.43	0.005006	21.67	5313.11	452.97	1.11
Project	46020	Rev BB	115111.00	1032.00	1050.08	1052.47	1059.13	0.008742	24.14	4768.34	520.89	1.41
Project	45545	Rev BB	115111.00	1030.00	1049.23	1049.27	1055.65	0.004027	20.33	5661.39	446.68	1.01
Project	45030	Rev BB	115111.00	1025.00	1041.51	1044.56	1052.09	0.010535	26.10	4410.21	492.54	1.54
Project	44585	Rev BB	115111.00	1022.00	1043.05	1043.07	1048.75	0.004190	19.17	6004.20	531.91	1.01
Project	44210	Rev BB	115111.00	1020.00	1035.36	1038.72	1045.99	0.009463	26.16	4399.47	452.62	1.48
Project	43820	Rev BB	115111.00	1018.00	1037.47	1037.48	1043.62	0.004072	19.90	5785.33	476.53	1.01
Project	43610	Rev BB	115111.00	1017.00	1030.80	1034.06	1041.87	0.010066	26.70	4311.38	450.58	1.52
Project	43410	Rev BB	115111.00	1016.00	1027.33	1031.12	1039.61	0.011140	28.76	4308.81	583.44	1.61
Project	43200	Rev BB	115111.00	1014.00	1026.42	1029.64	1036.81	0.010596	26.11	4615.62	689.16	1.54
Project	42975	Rev BB	115111.00	1012.00	1022.84	1026.28	1033.82	0.016327	26.63	4368.54	735.12	1.82
Project	42815	Rev BB	115111.00	1011.00	1021.72	1024.45	1030.58	0.015830	23.92	4840.30	864.26	1.76
Project	42590	Rev BB	115111.00	1010.00	1019.24	1021.61	1026.97	0.013663	22.43	5239.45	1013.12	1.64
Project	42430	Rev BB	115111.00	1008.00	1018.67	1020.25	1024.62	0.009146	19.57	5880.86	915.78	1.36
Project	42215	Rev BB	115111.00	1006.00	1017.22	1018.65	1022.53	0.008689	18.48	6228.87	1018.99	1.32
Project	41940	Rev BB	115111.00	1005.00	1019.27	1017.69	1021.36	0.002429	11.60	9938.85	1284.24	0.73
Project	41730	Rev BB	115111.00	1004.00	1018.69	1016.46	1020.85	0.002298	11.79	9782.67	1190.92	0.71
Project	41460	Rev BB	115111.00	1002.00	1018.18	1015.18	1020.26	0.002007	11.56	9955.93	1093.49	0.68
Project	41280	Rev BB	115111.00	1001.00	1015.35	1015.35	1019.53	0.004463	16.42	7036.47	852.28	1.00
Project	41080	Rev BB	115111.00	1000.00	1012.06	1013.54	1018.19	0.007501	19.93	5822.75	874.06	1.27
Project	40825	Rev BB	115111.00	999.50	1010.97	1012.14	1016.00	0.007233	18.02	6444.40	1040.35	1.22
Project	40585	Rev BB	115111.00	998.00	1009.70	1010.42	1014.18	0.006378	16.98	6785.22	1005.81	1.15
Project	40335	Rev BB	115111.00	996.00	1011.09	1008.70	1012.81	0.001736	10.54	10937.81	1249.57	0.63
Project	40130	Rev BB	115111.00	995.00	1010.49	1008.34	1012.42	0.001793	11.30	10477.71	1195.64	0.64
Project	39945	Rev BB	115111.00	994.00	1010.29	1007.73	1012.07	0.001542	11.00	10919.88	1173.27	0.60
Project	39755	Rev BB	115111.00	994.00	1007.28	1007.28	1011.39	0.004003	16.46	7234.94	894.45	0.96
Project	39605	Rev BB	115111.00	993.00	1004.51	1005.87	1010.45	0.006872	19.70	6001.74	849.68	1.23
Project	39310	Rev BB	115111.00	992.00	1004.65	1004.65	1008.62	0.003630	16.53	7501.51	931.10	0.92
Project	39100	Rev BB	115111.00	990.00	1000.40	1002.12	1007.21	0.008939	20.94	5496.16	761.14	1.37
Project	38925	Rev BB	115111.00	989.50	1003.76	1001.55	1006.31	0.002096	12.82	8981.87	873.49	0.70
Project	38710	Rev BB	115111.00	988.00	1003.58	1000.32	1005.83	0.001571	12.04	9558.11	820.29	0.62
Project	38475	Rev BB	115111.00	986.00	1000.04	1000.04	1005.00	0.004280	17.89	6451.15	659.72	1.00
Project	38300	Rev BB	115111.00	985.50	995.78	997.87	1003.64	0.009518	22.51	5114.38	666.28	1.43
Project	38065	Rev BB	115111.00	984.00	998.04	995.74	1001.32	0.002214	14.54	7914.65	658.41	0.74
Project	37810	Rev BB	115111.00	983.00	995.22	995.22	1000.37	0.004276	18.21	6321.20	618.24	1.00
Project	37655	Rev BB	115111.00	982.00	992.54	994.10	999.31	0.008065	20.88	5511.72	706.72	1.32
Project	37390	Rev BB	115111.00	981.00	987.53	990.11	996.27	0.015047	23.73	4850.91	823.78	1.72
Project	37135	Rev BB	115111.00	980.00	989.30	989.33	993.58	0.004550	16.58	6941.42	821.44	1.01
Project	36930	Rev BB	115111.00	978.00	986.10	987.49	992.18	0.008097	19.79	5815.33	812.44	1.30
Project	36735	Rev BB	115111.00	977.00	986.84	986.84	990.86	0.004540	16.10	7161.17	896.91	1.00
Project	36515	Rev BB	115111.00	975.00	987.02	985.36	989.58	0.002443	12.85	8981.37	994.69	0.75
Project	36265	Rev BB	115111.00	974.00	986.48	985.22	988.84	0.003072	12.33	9335.94	1176.00	0.77
Project	36080	Rev BB	116236.00	973.00	984.63	984.63	987.98	0.005713	14.69	7912.71	1176.00	1.00
Project	35845	Rev BB	116236.00	971.00	984.64	982.88	986.50	0.002139	10.95	10632.07	1401.71	0.68
Project	35725	Rev BB	116236.00	970.00	982.95	982.95	986.05	0.003627	14.96	8689.93	1377.89	0.90
Project	35515	Rev BB	116236.00	969.00	981.00	981.77	985.11	0.004566	17.10	7670.88	1354.77	1.04
Project	35245	Rev BB	116236.00	968.00	979.34	980.44	983.69	0.005894	17.32	7329.53	1328.31	1.12
Project	35040	Rev BB	116236.00	967.00	977.65	978.97	982.46	0.005549	19.57	7402.76	1354.78	1.13
Project	34860	Rev BB	116236.00	966.00	975.96	977.40	981.22	0.008614	18.40	6315.84	1285.71	1.46
Project	34720	Rev BB	116236.00	965.50	974.72	976.17	979.96	0.009180	18.37	6328.08	1411.20	1.53
Project	34495	Rev BB	116236.00	964.00	973.04	974.28	977.75	0.009172	17.42	6673.93	1283.85	1.35
Project	34310	Rev BB	116236.00	963.00	972.28	973.00	976.33	0.004852	16.76	7668.82	1308.50	1.03
Project	34090	Rev BB	116236.00	962.00	970.57	971.59	975.05	0.006730	16.98	6843.72	1295.50	1.30
Project	33880	Rev BB	116236.00	960.00	969.33	970.25	973.60	0.006606	16.57	7013.99	1318.43	1.27
Project	33710	Rev BB	116236.00	959.00	968.71	969.25	972.38	0.005499	15.39	7555.15	1372.11	1.16
Project	33500	Rev BB	116236.00	958.00	967.26	967.96	971.11	0.006549	16.18	7665.86	1495.98	1.14
Project	33310	Rev BB	116236.00	957.00	966.03	966.96	969.89	0.006423	15.77	7371.77	1770.35	1.36
Project	33115	Rev BB	116236.00	956.00	966.60	965.32	968.27	0.002770	10.36	11217.41	1847.27	0.74
Project	32795	Rev BB	116236.00	954.00	964.56	964.56	967.18	0.003570	12.99	8949.52	1735.59	1.01
Project	32605	Rev BB	116236.00	952.00	963.12	963.61	966.33	0.004754	14.38	8080.57	1699.92	1.13
Project	32265	Rev BB	140776.00	950.00	960.46	961.32	964.38	0.006433	15.88	8862.89	1853.19	1.28
Project	31875	Rev BB	140776.00	949.00	959.38	959.38	961.76	0.005505	12.38	11368.96	2409.15	1.00
Project	31585	Rev BB	140776.00	946.00	957.85	956.96	959.70	0.003160	10.91	12900.93	2182.22	0.79
Project	31360	Rev BB	140776.00	944.00	957.45	955.41	959.09	0.001898	10.28	13848.11	1878.67	0.64
Project	31060	Rev BB	140776.00	942.00	957.49	953.29	958.54	0.000883	8.20	17165.15	1708.18	0.46
Project	30720	Rev BB	140776.00	940.00	957.52	951.33	958.21	0.000503	6.65	21153.55	1888.61	0.35
Project	30445	Rev BB	140776.00	938.00	957.46	949.57	958.06	0.000373	6.25	22524.41	1779.71	0.31
Project	30095	Rev BB	140776.00	936.00	957.25	947.93	957.94	0.000304	6.72	21778.32	1622.72	0.29
Project	29815	Rev BB	140776.00	935.00	956.93	948.10	957.82	0.000390	7.74	19323.91	1433.15	0.33
Project	29565	Rev BB	140776.00	934.00	956.88	947.30	957.70	0.000380	7.40	19609.21	1323.79	0.32
Project	29385	Rev BB	140776.00	933.00	956.59	949.37	957.61	0.000483	8.28	17777.02	1237.37	0.36
Project	29140	Rev BB	140776.00	932.00	956.13	949.97	957.44	0.000712	9.19	15319.17	1087.20	0.43
Project	28895	Rev BB	140776.00	930.00	952.50	952.50	956.86	0.002171	18.80	9575.46	972.12	0.78
Project	28695	Rev BB	140776.00	928.00	942.01	945.73	954.96	0.024913	28.87	4876.24	899.40	2.18

HEC-RAS Plan: Pr025LevCode River: SCR Reach: Project Profile: Rev BB (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	28500	Rev BB	140776.00	927.50	943.62	946.10	951.41	0.005568	22.39	6287.19	552.17	1.17
Project	28280	Rev BB	140776.00	926.00	936.76	940.42	949.18	0.012736	29.59	5431.96	944.52	1.71
Project	28080	Rev BB	140776.00	925.00	944.09	938.55	945.83	0.000816	11.26	13583.41	926.37	0.48
Project	27925	Rev BB	140776.00	924.00	943.26	939.25	945.62	0.001091	13.09	11919.32	866.57	0.55
Project	27725	Rev BB	140776.00	923.00	939.71	939.71	945.00	0.002680	19.03	8197.14	786.61	0.85
Project	27545	Rev BB	140776.00	922.00	936.05	937.70	944.07	0.005424	22.89	6357.92	643.23	1.16
Project	27335	Rev BB	140776.00	921.00	933.30	936.32	942.60	0.007749	24.55	5857.59	703.53	1.35
Project	27155	Rev BB	140776.00	920.50	935.29	935.76	940.56	0.003283	19.09	8183.45	888.43	0.92
Project	26990	Rev BB	140776.00	920.00	931.45	933.72	939.36	0.010995	22.60	6251.25	922.34	1.51
Project	26780	Rev BB	140776.00	918.00	929.28	931.66	937.27	0.009096	23.11	6501.43	1043.32	1.42
Project	26575	Rev BB	140776.00	917.00	928.11	929.98	934.77	0.011845	20.70	6801.06	1187.27	1.52
Project	26355	Rev BB	140776.00	916.00	929.39	929.39	933.05	0.003824	15.86	9475.99	1260.40	0.93
Project	26170	Rev BB	140776.00	915.00	928.48	928.73	932.37	0.003357	16.99	9605.44	1269.04	0.90
Project	25965	Rev BB	140776.00	914.00	926.88	927.72	931.53	0.004261	18.22	8811.74	1281.32	1.00
Project	25785	Rev BB	140776.00	913.50	925.60	926.63	930.65	0.004882	18.93	8376.91	1219.65	1.07
Project	25600	Rev BB	140776.00	912.50	924.93	925.64	929.69	0.004574	18.53	8467.08	1109.36	1.03
Project	25425	Rev BB	140776.00	911.00	923.47	924.43	928.67	0.006886	18.30	7702.49	1082.21	1.20
Project	25215	Rev BB	140776.00	910.00	924.72	923.68	927.87	0.003051	14.27	9886.47	1097.27	0.83
Project	25000	Rev BB	140776.00	909.00	924.48	922.49	927.16	0.002226	13.17	10726.62	1062.41	0.73
Project	24795	Rev BB	140776.00	908.00	923.60	921.80	926.66	0.002399	14.05	10060.99	957.43	0.76
Project	24550	Rev BB	140776.00	906.00	922.50	920.91	926.00	0.002585	15.05	9407.90	856.12	0.79
Project	24335	Rev BB	140776.00	905.00	920.00	920.00	925.14	0.004222	18.23	7758.55	764.84	1.00
Project	24115	Rev BB	140776.00	904.00	917.79	918.66	923.97	0.005627	19.97	7075.98	754.15	1.14
Project	23975	Rev BB	140776.00	903.50	916.36	917.71	923.05	0.006734	20.79	6802.82	783.24	1.23
Project	23755	Rev BB	140776.00	902.00	916.70	916.70	921.73	0.004144	18.07	7883.57	815.66	0.99
Project	23565	Rev BB	140776.00	900.00	914.30	915.55	920.61	0.006682	20.21	7009.72	850.93	1.22
Project	23365	Rev BB	140776.00	900.00	914.27	914.69	919.18	0.004225	18.44	8193.99	939.03	1.00
Project	23180	Rev BB	140776.00	899.00	911.64	913.14	918.15	0.005198	21.91	7362.50	916.60	1.13
Project	23000	Rev BB	140776.00	898.00	909.26	911.13	916.78	0.010007	22.01	6396.83	784.00	1.36
Project	22790	Rev BB	140776.00	897.50	910.49	910.49	915.48	0.005082	17.93	7853.44	784.00	1.00
Project	22600	Rev BB	140776.00	896.00	908.75	909.83	914.38	0.005814	19.84	7611.16	998.99	1.15
Project	22415	Rev BB	140776.00	895.50	906.26	907.97	912.91	0.009659	21.28	6839.61	1039.08	1.42
Project	22195	Rev BB	141426.00	894.00	907.98	906.82	910.85	0.002733	13.64	10506.24	1309.62	0.79
Project	22010	Rev BB	141426.00	892.00	906.34	906.34	910.19	0.003231	16.12	9490.52	1254.05	0.88
Project	21790	Rev BB	141426.00	891.50	903.06	904.80	909.04	0.005997	19.71	7416.01	1144.54	1.16
Project	21615	Rev BB	141426.00	892.00	900.54	902.67	907.53	0.011263	21.25	6724.20	1162.96	1.50
Project	21440	Rev BB	141426.00	890.00	900.97	901.64	905.59	0.004781	17.47	8486.12	1286.09	1.04
Project	21225	Rev BB	141426.00	888.00	899.73	900.84	904.50	0.005437	18.05	8659.23	1558.99	1.10
Project	21020	Rev BB	141426.00	887.00	896.71	898.87	903.05	0.007282	20.26	7028.37	902.97	1.26
Project	20845	Rev BB	141426.00	886.00	898.73	898.73	902.00	0.003234	15.09	10415.32	1563.68	0.87
Project	20595	Rev BB	141426.00	885.00	898.44	896.85	900.55	0.001741	12.43	12879.93	1548.78	0.65
Project	20435	Rev BB	141426.00	884.00	898.29	896.35	900.24	0.001485	12.07	13441.56	1528.26	0.61
Project	20280	Rev BB	141426.00	883.70	896.49	896.49	899.77	0.003240	15.58	10469.12	1531.27	0.87
Project	20070	Rev BB	141426.00	882.00	893.08	894.65	898.66	0.006088	19.34	7950.22	1526.62	1.17
Project	19855	Rev BB	141426.00	880.50	890.72	892.94	897.11	0.007654	20.60	7256.29	1205.44	1.29
Project	19630	Rev BB	141426.00	880.00	888.85	890.50	895.26	0.008984	20.59	7022.63	1060.31	1.37
Project	19440	Rev BB	141426.00	878.00	891.37	889.70	894.01	0.002361	13.14	10944.01	1194.54	0.74
Project	19240	Rev BB	141426.00	877.50	889.35	889.35	893.26	0.004288	15.89	9009.98	1216.93	0.97
Project	19050	Rev BB	141426.00	876.00	886.51	887.89	891.96	0.009085	18.83	7609.36	1321.43	1.35
Project	18830	Rev BB	141426.00	874.00	888.57	887.55	891.15	0.002730	13.26	11286.43	1531.54	0.79
Project	18650	Rev BB	141426.00	873.50	888.51	886.84	890.60	0.001837	12.07	12773.93	1604.48	0.66
Project	18475	Rev BB	141426.00	872.00	888.89	885.04	890.10	0.001001	8.89	16125.18	1621.53	0.49
Project	18290	Rev BB	141426.00	871.50	888.43	885.13	889.87	0.001213	9.80	14922.77	1594.15	0.54
Project	18025	Rev BB	141426.00	870.00	888.54	882.94	889.50	0.000621	7.92	18109.90	1520.22	0.40
Project	17785	Rev BB	141426.00	868.00	888.22	882.78	889.33	0.000704	8.45	16839.22	1398.14	0.42
Project	17510	Rev BB	141426.00	868.00	887.23	883.27	889.02	0.001136	10.97	13735.28	1350.70	0.54
Project	17360	Rev BB	141426.00	868.00	883.91	883.91	888.45	0.004427	17.10	8296.49	943.23	1.00
Project	17110	Rev BB	141426.00	864.00	879.19	881.42	886.72	0.007499	22.29	6796.11	1175.37	1.30
Project	16970	Rev BB	141426.00	863.70	877.25	879.83	885.42	0.010272	23.07	6337.44	1066.97	1.48
Project	16720	Rev BB	141426.00	863.50	872.70	875.43	881.94	0.018711	24.39	5801.39	1122.93	1.88
Project	16515	Rev BB	141426.00	862.00	872.36	873.86	878.20	0.010048	19.44	7302.33	1249.88	1.41
Project	16305	Rev BB	141426.00	860.00	874.55	872.14	876.49	0.001716	11.59	12787.87	1360.53	0.64
Project	16130	Rev BB	141426.00	860.00	872.31	872.31	875.86	0.004579	15.67	9439.97	1326.45	0.99
Project	15960	Rev BB	141426.00	859.00	869.97	870.98	874.69	0.008166	17.65	8113.94	1385.96	1.27
Project	15745	Rev BB	141426.00	858.00	871.32	869.77	873.67	0.002505	12.30	11500.58	1363.87	0.75
Project	15540	Rev BB	141426.00	857.50	871.22	868.50	872.95	0.001597	10.55	13406.47	1426.61	0.61
Project	15335	Rev BB	141426.00	856.00	868.08	868.08	872.16	0.005521	16.21	8721.97	1064.14	1.00
Project	15125	Rev BB	142475.00	854.00	865.62	866.25	870.59	0.007031	17.89	7966.16	1000.47	1.12
Project	14900	Rev BB	142475.00	853.00	862.77	864.23	868.54	0.008996	19.28	7389.85	1626.46	1.35
Project	14720	Rev BB	142475.00	852.00	861.80	862.97	866.83	0.007951	18.07	7995.80	1722.27	1.27
Project	14480	Rev BB	142475.00	850.50	859.35	860.83	864.69	0.009831	19.03	7857.43	1726.69	1.39
Project	14315	Rev BB	142475.00	850.00	859.90	859.99	862.93	0.005287	13.99	10186.13	1880.98	1.02
Project	14090	Rev BB	142475.00	850.00	858.47	858.71	861.66	0.005810	14.34	9937.41	1772.81	1.06
Project	13850	Rev BB	142475.00	848.00	857.69	857.10	860.17	0.003694	12.62	11299.46	1741.62	0.87

HEC-RAS Plan: Pr025LevCode River: SCR Reach: Project Profile: Rev BB (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	13635	Rev BB	142475.00	846.00	856.29	856.29	859.29	0.003837	15.47	10777.84	1705.84	0.93
Project	13425	Rev BB	142475.00	845.00	852.82	854.24	857.85	0.010659	18.00	7915.99	1850.66	1.53
Project	13190	Rev BB	142475.00	844.00	853.52	852.80	855.78	0.003254	12.17	11923.29	1847.43	0.82
Project	13030	Rev BB	142475.00	843.00	852.58	852.23	855.21	0.003379	14.20	11406.11	1762.99	0.87
Project	12835	Rev BB	142475.00	842.00	852.13	851.20	854.54	0.002769	13.31	11761.95	1607.50	0.79
Project	12615	Rev BB	142475.00	841.00	851.86	850.10	853.94	0.001918	12.46	12681.30	1470.78	0.68
Project	12395	Rev BB	142475.00	840.00	851.49	849.52	853.55	0.001708	12.32	12873.68	1438.10	0.65
Project	12195	Rev BB	142475.00	838.98	851.49	848.24	853.14	0.001192	10.62	14191.69	1383.66	0.55
Project	11995	Rev BB	142475.00	837.00	850.60	848.45	852.80	0.001625	12.80	12474.09	1280.52	0.64
Project	11780	Rev BB	142475.00	836.00	850.37	848.11	852.44	0.001447	12.59	13173.69	1422.19	0.61
Project	11605	Rev BB	142475.00	835.50	849.29	847.46	852.08	0.001869	13.90	11381.14	1325.50	0.69
Project	11405	Rev BB	142475.00	834.00	849.07	846.17	851.69	0.001519	13.18	11428.21	1114.61	0.64
Project	11180	Rev BB	142475.00	833.00	846.89	845.65	851.10	0.002564	16.60	8864.64	835.68	0.82
Project	11015	Rev BB	142475.00	831.50	844.78	844.78	850.43	0.003842	19.08	7493.10	679.39	0.99
Project	10835	Rev BB	142475.00	831.00	841.87	843.71	849.32	0.007252	21.91	6502.00	790.38	1.35
Project	10575	Rev BB	142475.00	830.00	837.47	840.16	846.52	0.015567	24.13	5903.48	1108.84	1.84
Project	10390	Rev BB	142475.00	828.00	836.77	839.04	843.84	0.008452	22.72	7220.95	1247.02	1.37
Project	10225	Rev BB	142475.00	827.50	837.05	838.17	841.96	0.006830	17.80	8061.12	1374.14	1.26
Project	10000	Rev BB	142475.00	826.00	837.14	837.14	840.54	0.003942	14.90	9785.79	1488.00	0.96
Project	9820	Rev BB	142475.00	824.00	833.98	835.33	839.33	0.008466	18.57	7671.79	1402.32	1.37
Project	9595	Rev BB	142475.00	823.80	834.12	834.12	837.42	0.004905	14.58	9770.14	1619.46	1.00
Project	9385	Rev BB	142475.00	823.00	832.49	833.15	836.23	0.006101	15.78	9289.78	1770.37	1.19
Project	9220	Rev BB	142475.00	822.00	830.86	831.81	835.03	0.007824	16.39	8704.29	1771.41	1.29
Project	9025	Rev BB	142475.00	821.00	829.91	830.56	833.69	0.005307	15.90	9468.91	1736.86	1.09

HEC-RAS Plan: Pr085LevCode River: SCR Reach: Project Profile: Rev BB

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	46195	Rev BB	115111.00	1035.00	1063.12	1054.04	1064.77	0.006261	10.67	11871.29	750.83	0.40
Project	46020	Rev BB	115111.00	1032.00	1062.02	1052.44	1063.64	0.006544	10.21	11277.79	570.22	0.40
Project	45545	Rev BB	115111.00	1030.00	1057.85	1049.24	1059.95	0.008982	11.63	9900.10	524.21	0.47
Project	45030	Rev BB	115111.00	1025.00	1054.23	1044.56	1055.89	0.006629	10.33	11145.16	557.97	0.41
Project	44585	Rev BB	115111.00	1022.00	1050.60	1043.05	1052.39	0.009283	10.74	10717.92	654.38	0.47
Project	44210	Rev BB	115111.00	1020.00	1047.83	1038.72	1049.37	0.006714	9.97	11549.74	619.95	0.41
Project	43820	Rev BB	115111.00	1018.00	1042.08	1037.47	1045.21	0.017534	14.19	8112.26	528.70	0.64
Project	43610	Rev BB	115111.00	1017.00	1038.25	1034.06	1041.46	0.018806	14.39	7998.42	536.89	0.66
Project	43410	Rev BB	115111.00	1016.00	1035.83	1031.12	1038.22	0.011970	13.25	9837.37	729.14	0.54
Project	43200	Rev BB	115111.00	1014.00	1033.24	1029.61	1035.63	0.014478	12.98	9662.58	779.49	0.58
Project	42975	Rev BB	115111.00	1012.00	1030.98	1026.26	1032.66	0.010954	10.71	11432.61	955.76	0.50
Project	42815	Rev BB	115111.00	1011.00	1029.67	1024.43	1030.90	0.008589	9.10	13242.80	1120.79	0.44
Project	42590	Rev BB	115111.00	1010.00	1028.42	1021.61	1029.28	0.005536	7.65	15735.26	1230.66	0.36
Project	42430	Rev BB	115111.00	1008.00	1027.53	1020.25	1028.39	0.005373	7.55	15955.86	1334.91	0.35
Project	42215	Rev BB	115111.00	1006.00	1026.68	1018.65	1027.34	0.004067	6.60	17936.38	1374.62	0.31
Project	41940	Rev BB	115111.00	1005.00	1025.62	1017.69	1026.25	0.003871	6.38	18230.06	1327.03	0.30
Project	41730	Rev BB	115111.00	1004.00	1024.63	1016.46	1025.35	0.004429	6.86	16939.62	1221.47	0.32
Project	41460	Rev BB	115111.00	1002.00	1023.17	1015.18	1024.03	0.005512	7.43	15483.49	1120.97	0.35
Project	41280	Rev BB	115111.00	1001.00	1021.79	1015.35	1022.90	0.006803	8.69	14194.24	1193.24	0.40
Project	41080	Rev BB	115111.00	1000.00	1020.52	1013.58	1021.61	0.006027	8.64	14443.03	1136.84	0.38
Project	40825	Rev BB	115111.00	999.50	1019.34	1012.13	1020.15	0.004966	7.34	16245.37	1212.96	0.34
Project	40585	Rev BB	115111.00	998.00	1018.25	1010.42	1018.99	0.004404	7.05	16893.35	1247.23	0.32
Project	40335	Rev BB	115111.00	996.00	1017.43	1008.70	1018.01	0.003313	6.09	18980.28	1288.56	0.28
Project	40130	Rev BB	115111.00	995.00	1016.61	1008.34	1017.27	0.003693	6.64	17974.92	1264.54	0.30
Project	39945	Rev BB	115111.00	994.00	1015.89	1007.73	1016.57	0.003832	6.82	17605.07	1212.34	0.30
Project	39755	Rev BB	115111.00	994.00	1014.56	1007.28	1015.64	0.005781	8.58	14340.28	1088.09	0.37
Project	39605	Rev BB	115111.00	993.00	1013.74	1005.87	1014.80	0.005317	8.49	14586.36	1074.69	0.36
Project	39310	Rev BB	115111.00	992.00	1012.22	1004.65	1013.22	0.005130	8.42	14723.69	977.30	0.35
Project	39100	Rev BB	115111.00	990.00	1011.11	1002.09	1012.15	0.005092	8.18	14069.44	831.46	0.35
Project	38925	Rev BB	115111.00	989.50	1010.31	1001.54	1011.25	0.004818	7.77	14815.54	906.70	0.34
Project	38710	Rev BB	115111.00	988.00	1009.15	1000.32	1010.17	0.005022	8.12	14194.81	844.08	0.35
Project	38475	Rev BB	115111.00	986.00	1006.95	1000.04	1008.63	0.008448	10.43	11138.93	695.26	0.45
Project	38300	Rev BB	115111.00	985.50	1005.77	997.87	1007.19	0.007052	9.56	12039.52	716.81	0.41
Project	38065	Rev BB	115111.00	984.00	1004.13	995.74	1005.55	0.006785	9.57	12028.87	691.25	0.40
Project	37810	Rev BB	115111.00	983.00	1001.38	995.22	1003.35	0.010638	11.27	10217.52	648.42	0.50
Project	37655	Rev BB	115111.00	982.00	999.88	994.10	1001.64	0.010523	10.64	10815.11	738.91	0.49
Project	37390	Rev BB	115111.00	981.00	998.45	990.10	999.49	0.005379	8.16	14098.28	869.10	0.36
Project	37135	Rev BB	115111.00	980.00	996.79	989.31	997.96	0.006585	8.70	13225.00	863.67	0.39
Project	36930	Rev BB	115111.00	978.00	995.67	987.49	996.71	0.005428	8.25	14200.96	923.68	0.36
Project	36735	Rev BB	115111.00	977.00	994.61	986.84	995.61	0.005534	8.08	14397.32	963.18	0.36
Project	36515	Rev BB	115111.00	975.00	993.62	985.36	994.47	0.004637	7.39	15678.21	1032.73	0.33
Project	36265	Rev BB	115111.00	974.00	992.27	985.22	993.06	0.006897	7.13	16142.37	1176.00	0.34
Project	36080	Rev BB	116236.00	973.00	990.64	984.63	991.58	0.009003	7.75	14989.02	1176.00	0.38
Project	35845	Rev BB	116236.00	971.00	989.14	982.87	989.89	0.005531	6.98	16713.90	1512.83	0.35
Project	35725	Rev BB	116236.00	970.00	988.29	982.95	989.16	0.006293	8.01	15871.91	1488.92	0.38
Project	35515	Rev BB	116236.00	969.00	986.85	981.77	987.82	0.006633	8.45	15243.73	1501.04	0.39
Project	35245	Rev BB	116236.00	968.00	984.99	980.44	985.93	0.007356	8.26	15487.04	1580.25	0.40
Project	35040	Rev BB	116236.00	967.00	983.55	978.97	984.46	0.006763	8.81	15947.66	1491.55	0.40
Project	34860	Rev BB	116236.00	966.00	982.27	977.40	983.19	0.007889	7.72	15053.43	1431.50	0.42
Project	34720	Rev BB	116236.00	965.50	981.25	976.17	982.11	0.007109	7.42	15663.31	1449.93	0.40
Project	34495	Rev BB	116236.00	964.00	979.74	974.28	980.55	0.006712	7.24	16056.04	1461.49	0.38
Project	34310	Rev BB	116236.00	963.00	978.44	973.00	979.33	0.006216	8.12	15915.74	1384.94	0.38
Project	34090	Rev BB	116236.00	962.00	977.04	971.59	977.91	0.006781	7.50	15494.22	1371.03	0.39
Project	33880	Rev BB	116236.00	960.00	975.66	970.25	976.48	0.006784	7.29	15950.57	1482.88	0.39
Project	33710	Rev BB	116236.00	959.00	974.55	969.25	975.30	0.006495	6.96	16700.10	1637.90	0.38
Project	33500	Rev BB	116236.00	958.00	973.31	967.96	973.99	0.005863	6.99	17999.09	1755.45	0.35
Project	33310	Rev BB	116236.00	957.00	972.33	966.96	972.92	0.005184	6.21	18709.82	1828.18	0.34
Project	33115	Rev BB	116236.00	956.00	971.41	965.32	971.93	0.004628	5.75	20248.08	1927.09	0.31
Project	32795	Rev BB	116236.00	954.00	969.69	964.56	970.32	0.005544	6.34	18385.59	1920.75	0.36
Project	32605	Rev BB	116236.00	952.00	968.71	963.61	969.26	0.005158	6.06	20182.80	2407.42	0.34
Project	32265	Rev BB	140776.00	950.00	967.18	961.33	967.65	0.004429	5.48	25728.28	2840.18	0.32
Project	31875	Rev BB	140776.00	949.00	965.59	959.38	966.01	0.003875	5.25	26887.78	2593.08	0.28
Project	31585	Rev BB	140776.00	946.00	964.66	956.96	965.04	0.002932	4.96	28433.09	2377.46	0.25
Project	31360	Rev BB	140776.00	944.00	963.92	955.41	964.37	0.002797	5.46	26418.22	1959.45	0.25
Project	31060	Rev BB	140776.00	942.00	963.17	953.29	963.57	0.002504	5.08	27711.47	1975.93	0.24
Project	30720	Rev BB	140776.00	940.00	962.52	951.33	962.85	0.001709	4.59	30668.14	1911.53	0.20
Project	30445	Rev BB	140776.00	938.00	962.08	949.57	962.41	0.001527	4.58	30947.53	1841.84	0.19
Project	30095	Rev BB	140776.00	936.00	961.46	947.93	961.86	0.001543	5.18	28649.25	1637.30	0.20
Project	29815	Rev BB	140776.00	935.00	960.83	948.10	961.36	0.002089	6.05	24935.54	1445.23	0.23
Project	29565	Rev BB	140776.00	934.00	960.26	947.30	960.81	0.002264	6.03	24109.24	1334.86	0.24
Project	29385	Rev BB	140776.00	933.00	959.64	949.37	960.33	0.003009	6.82	21565.54	1249.05	0.28
Project	29140	Rev BB	140776.00	932.00	958.42	949.97	959.39	0.005030	7.90	17821.87	1095.03	0.35
Project	28895	Rev BB	140776.00	930.00	953.81	952.50	957.09	0.017778	16.50	10852.34	977.96	0.66
Project	28695	Rev BB	140776.00	928.00	952.93	945.73	954.30	0.007405	9.39	14984.17	951.56	0.42

HEC-RAS Plan: Pr085LevCode River: SCR Reach: Project Profile: Rev BB (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	28500	Rev BB	140776.00	927.50	950.46	946.10	952.50	0.010938	11.99	13039.30	1039.52	0.51
Project	28280	Rev BB	140776.00	926.00	949.82	940.43	950.81	0.003962	8.71	18177.10	1003.89	0.32
Project	28080	Rev BB	140776.00	925.00	949.08	938.55	950.03	0.003667	8.32	18252.46	945.35	0.31
Project	27925	Rev BB	140776.00	924.00	948.08	939.25	949.34	0.004899	9.61	16137.12	884.88	0.36
Project	27725	Rev BB	140776.00	923.00	946.11	939.71	948.04	0.007805	11.87	13307.67	811.81	0.45
Project	27545	Rev BB	140776.00	922.00	944.30	937.76	946.51	0.009174	12.41	12580.74	852.53	0.49
Project	27335	Rev BB	140776.00	921.00	943.00	936.32	944.66	0.007204	10.87	14331.54	937.22	0.43
Project	27155	Rev BB	140776.00	920.50	941.47	935.68	943.23	0.008132	11.39	14013.66	978.05	0.45
Project	26990	Rev BB	140776.00	920.00	940.42	933.69	941.79	0.007553	9.43	15133.02	1020.89	0.42
Project	26780	Rev BB	140776.00	918.00	939.32	931.66	940.39	0.005229	8.76	17337.33	1106.54	0.36
Project	26575	Rev BB	140776.00	917.00	938.54	929.98	939.36	0.004267	7.26	19508.54	1243.55	0.32
Project	26355	Rev BB	140776.00	916.00	937.64	929.39	938.43	0.004072	7.43	20021.06	1294.51	0.32
Project	26170	Rev BB	140776.00	915.00	936.93	928.73	937.71	0.003759	7.69	20464.75	1301.20	0.31
Project	25965	Rev BB	140776.00	914.00	936.21	927.72	936.96	0.003524	7.51	20897.77	1313.23	0.30
Project	25785	Rev BB	140776.00	913.50	935.53	926.61	936.29	0.003475	7.49	20670.97	1256.91	0.30
Project	25600	Rev BB	140776.00	912.50	934.78	925.61	935.61	0.003744	7.77	19592.25	1149.92	0.31
Project	25425	Rev BB	140776.00	911.00	934.12	924.40	934.93	0.003804	7.28	19499.23	1138.28	0.31
Project	25215	Rev BB	140776.00	910.00	933.33	923.65	934.14	0.003786	7.28	19489.43	1133.64	0.31
Project	25000	Rev BB	140776.00	909.00	932.49	922.49	933.32	0.003701	7.33	19370.94	1093.78	0.30
Project	24795	Rev BB	140776.00	908.00	931.50	921.80	932.49	0.004350	8.01	17745.99	986.47	0.33
Project	24550	Rev BB	140776.00	906.00	930.07	920.91	931.29	0.005312	8.89	16012.83	887.13	0.36
Project	24335	Rev BB	140776.00	905.00	928.51	920.00	930.01	0.006539	9.87	14423.97	800.25	0.40
Project	24115	Rev BB	140776.00	904.00	927.00	918.67	928.55	0.006726	10.04	14198.88	793.23	0.41
Project	23975	Rev BB	140776.00	903.50	926.14	917.71	927.59	0.006337	9.71	14687.95	828.21	0.40
Project	23755	Rev BB	140776.00	902.00	924.71	916.73	926.18	0.006617	9.86	14864.52	939.24	0.41
Project	23565	Rev BB	140776.00	900.00	923.57	915.55	924.91	0.006257	9.40	15381.71	941.49	0.39
Project	23365	Rev BB	140776.00	900.00	922.44	914.69	923.69	0.005846	9.37	16064.14	987.42	0.38
Project	23180	Rev BB	140776.00	899.00	921.46	913.15	922.64	0.005042	9.55	16653.38	975.52	0.36
Project	23000	Rev BB	140776.00	898.00	920.04	911.13	921.44	0.008933	9.48	14845.64	784.00	0.38
Project	22790	Rev BB	140776.00	897.50	917.49	910.49	919.22	0.012226	10.55	13340.82	784.00	0.45
Project	22600	Rev BB	140776.00	896.00	915.78	909.80	917.24	0.008268	10.17	14841.19	1050.23	0.45
Project	22415	Rev BB	140776.00	895.50	914.43	908.00	915.72	0.007649	9.33	15555.24	1091.58	0.42
Project	22195	Rev BB	141426.00	894.00	913.05	906.82	914.10	0.006704	8.42	17691.91	1463.96	0.39
Project	22010	Rev BB	141426.00	892.00	911.36	906.34	912.70	0.008118	9.77	15883.23	1735.05	0.44
Project	21790	Rev BB	141426.00	891.50	909.92	904.80	911.00	0.006786	9.03	18446.60	1778.41	0.40
Project	21615	Rev BB	141426.00	892.00	908.91	902.67	909.82	0.005937	7.96	19349.10	1687.67	0.37
Project	21440	Rev BB	141426.00	890.00	907.84	901.64	908.76	0.005947	8.18	19246.72	1652.97	0.37
Project	21225	Rev BB	141426.00	888.00	906.65	900.86	907.52	0.005590	8.04	19593.15	1600.82	0.36
Project	21020	Rev BB	141426.00	887.00	905.64	898.87	906.47	0.004588	7.78	20476.53	1607.44	0.33
Project	20845	Rev BB	141426.00	886.00	904.74	898.73	905.59	0.005266	7.87	19957.19	1605.07	0.35
Project	20595	Rev BB	141426.00	885.00	903.62	896.85	904.38	0.004470	7.54	20997.42	1600.38	0.33
Project	20435	Rev BB	141426.00	884.00	902.82	896.35	903.63	0.004789	7.88	20533.92	1613.47	0.34
Project	20280	Rev BB	141426.00	883.70	901.75	896.49	902.72	0.006590	8.68	18742.02	1636.29	0.39
Project	20070	Rev BB	141426.00	882.00	900.58	894.65	901.48	0.005609	8.31	19907.01	1797.75	0.37
Project	19855	Rev BB	141426.00	880.50	899.60	892.94	900.37	0.004492	7.67	21440.38	1809.58	0.33
Project	19630	Rev BB	141426.00	880.00	898.64	890.50	899.40	0.004164	7.38	21715.34	1833.73	0.32
Project	19440	Rev BB	141426.00	878.00	897.86	889.68	898.60	0.004126	7.19	22046.05	1986.11	0.31
Project	19240	Rev BB	141426.00	877.50	896.87	889.35	897.70	0.004758	7.58	20444.11	1737.98	0.34
Project	19050	Rev BB	141426.00	876.00	896.19	887.89	896.86	0.003748	6.72	22459.06	1753.41	0.30
Project	18830	Rev BB	141426.00	874.00	895.35	887.44	896.02	0.003931	6.84	22235.02	1684.04	0.31
Project	18650	Rev BB	141426.00	873.50	894.72	886.84	895.34	0.003526	6.73	22990.32	1686.19	0.29
Project	18475	Rev BB	141426.00	872.00	894.25	885.04	894.75	0.002797	5.78	24928.99	1665.89	0.26
Project	18290	Rev BB	141426.00	871.50	893.60	885.13	894.19	0.003383	6.31	23260.68	1631.88	0.28
Project	18025	Rev BB	141426.00	870.00	892.85	882.94	893.37	0.002605	5.82	24748.10	1557.41	0.25
Project	17785	Rev BB	141426.00	868.00	892.02	882.78	892.66	0.003309	6.43	22237.59	1444.07	0.28
Project	17510	Rev BB	141426.00	868.00	890.43	883.27	891.45	0.005785	8.40	18121.15	1398.94	0.37
Project	17360	Rev BB	141426.00	868.00	888.28	883.91	890.13	0.012863	11.10	13512.13	1303.31	0.53
Project	17110	Rev BB	141426.00	864.00	885.50	881.46	887.17	0.010479	11.03	14389.15	1229.58	0.50
Project	16970	Rev BB	141426.00	863.70	883.96	879.78	885.60	0.010995	10.74	14212.17	1195.98	0.50
Project	16720	Rev BB	141426.00	863.50	882.28	875.41	883.38	0.006484	8.47	16891.55	1182.04	0.39
Project	16515	Rev BB	141426.00	862.00	881.23	873.86	882.13	0.005324	7.67	18660.39	1303.83	0.35
Project	16305	Rev BB	141426.00	860.00	880.38	872.14	881.10	0.004083	7.10	20814.07	1395.48	0.31
Project	16130	Rev BB	141426.00	860.00	879.38	872.31	880.25	0.005470	7.68	18966.94	1368.87	0.35
Project	15960	Rev BB	141426.00	859.00	878.56	870.96	879.32	0.004714	7.06	20250.69	1437.55	0.33
Project	15745	Rev BB	141426.00	858.00	877.56	869.77	878.32	0.004657	7.03	20125.55	1401.31	0.33
Project	15540	Rev BB	141426.00	857.50	876.69	868.51	877.36	0.004308	6.61	21873.23	2361.20	0.31
Project	15335	Rev BB	141426.00	856.00	874.77	868.08	876.01	0.010129	8.92	15846.59	1064.14	0.41
Project	15125	Rev BB	142475.00	854.00	871.99	866.25	873.49	0.013374	9.80	14531.32	1053.51	0.47
Project	14900	Rev BB	142475.00	853.00	869.74	864.23	870.94	0.008488	8.83	16644.53	2233.10	0.43
Project	14720	Rev BB	142475.00	852.00	868.35	862.97	869.45	0.008069	8.54	17440.60	2020.85	0.42
Project	14480	Rev BB	142475.00	850.50	866.91	860.83	867.72	0.005898	7.39	19912.22	1851.81	0.36
Project	14315	Rev BB	142475.00	850.00	866.04	859.99	866.75	0.005537	6.77	21071.02	1944.13	0.35
Project	14090	Rev BB	142475.00	850.00	864.80	858.71	865.50	0.005413	6.72	21309.57	1816.18	0.34
Project	13850	Rev BB	142475.00	848.00	863.60	857.10	864.27	0.004956	6.60	21684.38	1774.85	0.33

HEC-RAS Plan: Pr085LevCode River: SCR Reach: Project Profile: Rev BB (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	13635	Rev BB	142475.00	846.00	862.52	856.29	863.21	0.004839	7.34	21858.75	1817.99	0.34
Project	13425	Rev BB	142475.00	845.00	861.81	854.24	862.31	0.003346	5.70	25084.97	1936.05	0.28
Project	13190	Rev BB	142475.00	844.00	861.11	852.80	861.58	0.002886	5.56	26195.39	1911.13	0.26
Project	13030	Rev BB	142475.00	843.00	860.64	852.23	861.12	0.002842	6.01	26034.42	1863.68	0.26
Project	12835	Rev BB	142475.00	842.00	860.03	851.20	860.54	0.002909	6.16	25313.27	1775.13	0.27
Project	12615	Rev BB	142475.00	841.00	859.33	850.10	859.90	0.002952	6.51	23997.77	1566.52	0.27
Project	12395	Rev BB	142475.00	840.00	858.66	849.52	859.26	0.003032	6.71	23513.12	1542.96	0.28
Project	12195	Rev BB	142475.00	838.98	858.07	848.24	858.67	0.002825	6.46	23478.39	1463.74	0.27
Project	11995	Rev BB	142475.00	837.00	857.31	848.45	858.03	0.003521	7.40	21763.81	1448.52	0.30
Project	11780	Rev BB	142475.00	836.00	856.59	848.11	857.28	0.003385	7.33	22140.13	1460.82	0.29
Project	11605	Rev BB	142475.00	835.50	855.78	847.45	856.62	0.004035	7.93	20373.82	1417.47	0.32
Project	11405	Rev BB	142475.00	834.00	854.62	846.17	855.70	0.004843	8.65	17696.63	1144.88	0.35
Project	11180	Rev BB	142475.00	833.00	852.66	845.62	854.32	0.007682	10.68	14475.94	1009.18	0.44
Project	11015	Rev BB	142475.00	831.50	850.24	844.78	852.64	0.011984	12.57	11805.37	850.96	0.54
Project	10835	Rev BB	142475.00	831.00	848.05	843.71	850.33	0.013479	12.24	12146.77	1072.95	0.57
Project	10575	Rev BB	142475.00	830.00	846.10	840.15	847.39	0.008015	9.14	15843.91	1322.18	0.43
Project	10390	Rev BB	142475.00	828.00	845.09	839.04	846.04	0.005680	8.63	19054.95	1516.98	0.37
Project	10225	Rev BB	142475.00	827.50	844.10	838.16	845.05	0.006403	7.96	18553.74	1543.40	0.39
Project	10000	Rev BB	142475.00	826.00	842.55	837.14	843.54	0.006984	8.14	18351.48	1626.01	0.40
Project	9820	Rev BB	142475.00	824.00	841.35	835.33	842.31	0.006527	7.91	18387.37	1648.84	0.39
Project	9595	Rev BB	142475.00	823.80	839.87	834.12	840.80	0.006938	7.76	18438.52	1719.61	0.39
Project	9385	Rev BB	142475.00	823.00	838.58	833.15	839.36	0.006233	7.21	20157.06	1799.30	0.37
Project	9220	Rev BB	142475.00	822.00	837.62	831.81	838.34	0.005586	6.82	21094.14	1853.43	0.35
Project	9025	Rev BB	142475.00	821.00	836.62	830.56	837.33	0.005004	7.02	21529.03	1822.90	0.34

HEC-RAS Plan: FinalPr085Q2 River: SCR Reach: Project Profile: Old 2-Year

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	46195	Old 2-Year	1890.00	1035.00	1037.91	1036.89	1038.13	0.015238	3.78	500.66	215.66	0.44
Project	46020	Old 2-Year	1890.00	1032.00	1036.93		1037.04	0.003252	2.65	712.22	162.70	0.22
Project	45545	Old 2-Year	1890.00	1030.00	1033.60		1033.93	0.018551	4.61	409.79	151.31	0.49
Project	45030	Old 2-Year	1890.00	1025.00	1029.15		1029.27	0.005278	2.71	696.88	222.55	0.27
Project	44585	Old 2-Year	1890.00	1022.00	1026.44		1026.61	0.006748	3.30	573.02	163.72	0.31
Project	44210	Old 2-Year	1890.00	1020.00	1024.34		1024.46	0.004860	2.74	690.38	204.32	0.26
Project	43820	Old 2-Year	1890.00	1018.00	1022.15		1022.28	0.006434	2.95	639.61	207.81	0.30
Project	43610	Old 2-Year	1890.00	1017.00	1020.53		1020.69	0.009508	3.13	604.25	242.11	0.35
Project	43410	Old 2-Year	1890.00	1016.00	1018.91		1019.01	0.007189	2.60	728.11	312.76	0.30
Project	43200	Old 2-Year	1890.00	1014.00	1017.48		1017.58	0.006627	2.55	741.60	308.38	0.29
Project	42975	Old 2-Year	1890.00	1012.00	1016.15		1016.22	0.005389	2.14	885.14	410.54	0.26
Project	42815	Old 2-Year	1890.00	1011.00	1014.97		1015.07	0.009716	2.63	718.89	380.39	0.34
Project	42590	Old 2-Year	1890.00	1010.00	1012.84		1012.93	0.009456	2.44	776.10	451.85	0.33
Project	42430	Old 2-Year	1890.00	1008.00	1011.51		1011.59	0.007090	2.25	841.78	445.90	0.29
Project	42215	Old 2-Year	1890.00	1006.00	1010.16		1010.23	0.005773	2.03	931.90	493.19	0.26
Project	41940	Old 2-Year	1890.00	1005.00	1008.54		1008.61	0.006087	2.13	887.58	454.20	0.27
Project	41730	Old 2-Year	1890.00	1004.00	1007.19		1007.27	0.006523	2.28	829.64	404.14	0.28
Project	41460	Old 2-Year	1890.00	1002.00	1005.76		1005.83	0.004561	2.13	887.64	365.67	0.24
Project	41280	Old 2-Year	1890.00	1001.00	1005.01		1005.07	0.003862	2.08	909.07	342.38	0.22
Project	41080	Old 2-Year	1890.00	1000.00	1004.20		1004.26	0.004239	1.95	967.43	429.50	0.23
Project	40825	Old 2-Year	1890.00	999.50	1003.20		1003.25	0.003716	1.88	1004.29	426.62	0.22
Project	40585	Old 2-Year	1890.00	998.00	1001.67		1001.78	0.011310	2.69	703.54	404.25	0.36
Project	40335	Old 2-Year	1890.00	996.00	1000.27		1000.32	0.003588	1.92	986.15	397.20	0.21
Project	40130	Old 2-Year	1890.00	995.00	999.43		999.51	0.004294	2.23	848.05	311.26	0.24
Project	39945	Old 2-Year	1890.00	994.00	998.41		998.51	0.006997	2.64	715.84	293.75	0.30
Project	39755	Old 2-Year	1890.00	994.00	997.40		997.48	0.004217	2.26	836.14	296.67	0.24
Project	39605	Old 2-Year	1890.00	993.00	996.67		996.75	0.005898	2.34	806.62	348.84	0.27
Project	39310	Old 2-Year	1890.00	992.00	994.61		994.72	0.007964	2.64	715.15	323.42	0.31
Project	39100	Old 2-Year	1890.00	990.00	993.54		993.60	0.003849	1.89	1002.44	436.50	0.22
Project	38925	Old 2-Year	1890.00	989.50	992.72		992.79	0.005552	2.13	886.43	422.32	0.26
Project	38710	Old 2-Year	1890.00	988.00	991.78		991.83	0.003563	1.92	986.07	394.93	0.21
Project	38475	Old 2-Year	1890.00	986.00	990.40		990.51	0.010472	2.70	698.92	375.05	0.35
Project	38300	Old 2-Year	1890.00	985.50	988.59		988.70	0.010144	2.59	729.16	407.55	0.34
Project	38065	Old 2-Year	1890.00	984.00	987.34		987.38	0.003437	1.64	1152.45	569.04	0.20
Project	37810	Old 2-Year	1890.00	983.00	986.36		986.41	0.004187	1.77	1069.34	546.75	0.22
Project	37655	Old 2-Year	1890.00	982.00	984.96		985.14	0.020993	3.43	551.19	348.91	0.48
Project	37390	Old 2-Year	1890.00	981.00	983.18		983.21	0.003538	1.44	1311.43	803.34	0.20
Project	37135	Old 2-Year	1890.00	980.00	981.39		981.50	0.017325	2.67	706.87	564.00	0.42
Project	36930	Old 2-Year	1890.00	978.00	980.01		980.05	0.003777	1.55	1222.97	708.31	0.21
Project	36735	Old 2-Year	1890.00	977.00	978.86		978.93	0.009234	2.11	894.38	633.76	0.31
Project	36515	Old 2-Year	1890.00	975.00	977.99		978.03	0.002321	1.50	1262.13	532.09	0.17
Project	36265	Old 2-Year	1890.00	974.00	977.31	975.21	977.36	0.003084	1.87	1012.76	358.97	0.20
Project	36080	Old 2-Year	2560.00	973.00	976.09	974.81	976.25	0.011403	3.25	786.96	326.32	0.37
Project	35845	Old 2-Year	2560.00	971.00	974.77	972.71	974.85	0.003562	2.21	1159.46	376.20	0.22
Project	35725	Old 2-Year	2560.00	970.00	974.29	972.29	974.37	0.004300	2.33	1098.42	378.19	0.24
Project	35515	Old 2-Year	2560.00	969.00	973.38	971.33	973.47	0.004507	2.37	1080.19	379.27	0.25
Project	35245	Old 2-Year	2560.00	968.00	971.89	970.49	971.99	0.006692	2.57	997.32	414.32	0.29
Project	35040	Old 2-Year	2560.00	967.00	970.93		970.99	0.003523	2.07	1239.42	440.94	0.22
Project	34860	Old 2-Year	2560.00	966.00	969.93		970.05	0.009090	2.76	926.06	432.92	0.33
Project	34720	Old 2-Year	2560.00	965.50	968.74		968.83	0.007930	2.47	1036.23	545.61	0.32
Project	34495	Old 2-Year	2560.00	964.00	966.78		966.89	0.009606	2.75	931.32	504.60	0.36
Project	34310	Old 2-Year	2560.00	963.00	965.77		965.81	0.003675	1.75	1458.94	684.48	0.21
Project	34090	Old 2-Year	2560.00	962.00	964.74		964.80	0.006084	1.93	1325.42	787.51	0.26
Project	33880	Old 2-Year	2560.00	960.00	963.55		963.61	0.005405	1.89	1354.42	761.04	0.25
Project	33710	Old 2-Year	2560.00	959.00	962.24		962.33	0.010559	2.36	1084.35	719.21	0.34
Project	33500	Old 2-Year	2560.00	958.00	960.64		960.70	0.005886	2.04	1255.57	666.42	0.26
Project	33310	Old 2-Year	2560.00	957.00	959.35		959.43	0.007811	2.31	1108.79	609.86	0.30
Project	33115	Old 2-Year	2560.00	956.00	958.44		958.48	0.003169	1.69	1512.33	667.75	0.20
Project	32795	Old 2-Year	2560.00	954.00	957.22		957.27	0.004740	1.88	1359.22	697.56	0.24
Project	32605	Old 2-Year	2560.00	952.00	956.11	954.72	956.18	0.006829	2.15	1189.09	652.84	0.28
Project	32265	Old 2-Year	2579.00	950.00	953.86		953.93	0.006524	2.14	1205.44	650.99	0.28
Project	31875	Old 2-Year	2579.00	949.00	951.51		951.58	0.005551	2.15	1196.97	562.04	0.26
Project	31585	Old 2-Year	2579.00	946.00	949.72		949.80	0.006960	2.22	1162.94	619.45	0.29
Project	31360	Old 2-Year	2579.00	944.00	948.39		948.45	0.005040	1.95	1324.53	672.21	0.24
Project	31060	Old 2-Year	2579.00	942.00	946.38		946.44	0.009465	2.04	1261.20	954.95	0.31
Project	30720	Old 2-Year	2579.00	940.00	944.28		944.33	0.004358	1.76	1462.57	772.68	0.23
Project	30445	Old 2-Year	2579.00	938.00	942.33		942.43	0.012745	2.53	1019.12	700.89	0.37
Project	30095	Old 2-Year	2579.00	936.00	940.09		940.14	0.003925	1.87	1379.29	617.14	0.22
Project	29815	Old 2-Year	2579.00	935.00	938.67		938.75	0.006532	2.28	1131.43	551.12	0.28
Project	29565	Old 2-Year	2579.00	934.00	937.89		937.94	0.001867	1.68	1535.99	461.78	0.16
Project	29385	Old 2-Year	2579.00	933.00	937.50		937.56	0.002342	1.94	1329.77	381.52	0.18
Project	29140	Old 2-Year	2579.00	932.00	936.43		936.61	0.007369	3.43	752.83	217.19	0.32
Project	28895	Old 2-Year	2579.00	930.00	934.06		934.32	0.012370	4.12	625.43	201.92	0.41
Project	28695	Old 2-Year	2579.00	928.00	932.41		932.55	0.006312	3.00	858.70	269.57	0.30

HEC-RAS Plan: FinalPr085Q2 River: SCR Reach: Project Profile: Old 2-Year (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	28500	Old 2-Year	2579.00	927.50	930.64		930.83	0.013053	3.46	744.75	326.01	0.40
Project	28280	Old 2-Year	2579.00	926.00	929.34		929.42	0.003716	2.24	1153.51	379.14	0.23
Project	28080	Old 2-Year	2579.00	925.00	928.39		928.49	0.005850	2.47	1045.43	416.63	0.27
Project	27925	Old 2-Year	2579.00	924.00	927.29		927.41	0.008266	2.78	929.01	401.99	0.32
Project	27725	Old 2-Year	2579.00	923.00	926.41		926.48	0.002905	2.06	1251.38	386.18	0.20
Project	27545	Old 2-Year	2579.00	922.00	925.57		925.68	0.007542	2.68	962.13	409.60	0.31
Project	27335	Old 2-Year	2579.00	921.00	924.70		924.76	0.002863	1.98	1303.00	422.52	0.20
Project	27155	Old 2-Year	2579.00	920.50	924.11		924.18	0.003567	2.06	1253.19	452.43	0.22
Project	26990	Old 2-Year	2579.00	920.00	923.23		923.34	0.007365	2.58	998.42	440.86	0.30
Project	26780	Old 2-Year	2579.00	918.00	922.06		922.12	0.004625	2.09	1232.77	527.47	0.24
Project	26575	Old 2-Year	2579.00	917.00	921.36		921.41	0.002731	1.80	1428.90	513.48	0.19
Project	26355	Old 2-Year	2579.00	916.00	920.25		920.35	0.010678	2.55	1010.81	601.37	0.35
Project	26170	Old 2-Year	2579.00	915.00	918.95		919.03	0.004998	2.26	1138.73	457.77	0.25
Project	25965	Old 2-Year	2579.00	914.00	917.91		917.98	0.005300	2.11	1219.50	568.37	0.25
Project	25785	Old 2-Year	2579.00	913.50	916.92		916.99	0.005668	2.19	1180.20	550.88	0.26
Project	25600	Old 2-Year	2579.00	912.50	915.89		915.97	0.005355	2.27	1134.24	478.13	0.26
Project	25425	Old 2-Year	2579.00	911.00	915.17		915.24	0.003240	2.10	1227.81	399.76	0.21
Project	25215	Old 2-Year	2579.00	910.00	914.27		914.36	0.005813	2.40	1074.83	444.58	0.27
Project	25000	Old 2-Year	2579.00	909.00	912.98		913.07	0.005874	2.39	1079.92	453.08	0.27
Project	24795	Old 2-Year	2579.00	908.00	911.61		911.73	0.007563	2.73	944.18	391.43	0.31
Project	24550	Old 2-Year	2579.00	906.00	910.48		910.55	0.003221	2.25	1145.29	334.03	0.21
Project	24335	Old 2-Year	2579.00	905.00	909.47		909.59	0.006748	2.80	921.17	337.18	0.30
Project	24115	Old 2-Year	2579.00	904.00	908.17		908.26	0.005327	2.38	1081.54	422.65	0.26
Project	23975	Old 2-Year	2579.00	903.50	907.53		907.62	0.004000	2.35	1097.95	354.12	0.24
Project	23755	Old 2-Year	2579.00	902.00	906.40		906.52	0.006481	2.78	927.91	333.89	0.29
Project	23565	Old 2-Year	2579.00	900.00	905.26		905.37	0.005523	2.69	959.86	322.21	0.27
Project	23365	Old 2-Year	2579.00	900.00	903.62		903.79	0.012255	3.38	762.28	329.38	0.39
Project	23180	Old 2-Year	2579.00	899.00	902.44		902.52	0.004160	2.26	1140.20	400.70	0.24
Project	23000	Old 2-Year	2579.00	898.00	901.59	899.90	901.68	0.005269	2.36	1092.83	407.55	0.25
Project	22790	Old 2-Year	2579.00	897.50	900.64	898.70	900.71	0.004049	2.14	1205.95	425.48	0.22
Project	22600	Old 2-Year	2579.00	896.00	899.82		899.90	0.004491	2.35	1098.28	386.74	0.25
Project	22415	Old 2-Year	2579.00	895.50	898.79		898.89	0.006713	2.56	1008.46	422.32	0.29
Project	22195	Old 2-Year	2615.00	894.00	897.39	895.49	897.50	0.006042	2.62	997.20	371.33	0.28
Project	22010	Old 2-Year	2615.00	892.00	896.38	894.30	896.46	0.005123	2.27	1152.71	471.79	0.26
Project	21790	Old 2-Year	2615.00	891.50	895.21	893.51	895.28	0.005615	2.19	1192.80	549.87	0.26
Project	21615	Old 2-Year	2615.00	892.00	894.04	892.93	894.13	0.007898	2.41	1086.74	563.09	0.31
Project	21440	Old 2-Year	2615.00	890.00	893.15	891.46	893.20	0.003663	1.81	1441.09	638.87	0.21
Project	21225	Old 2-Year	2615.00	888.00	891.23		891.51	0.028226	4.25	615.04	352.44	0.57
Project	21020	Old 2-Year	2615.00	887.00	890.38		890.41	0.001985	1.48	1767.94	674.99	0.16
Project	20845	Old 2-Year	2615.00	886.00	889.71		889.79	0.007590	2.30	1137.99	613.69	0.30
Project	20595	Old 2-Year	2615.00	885.00	888.64		888.68	0.002939	1.60	1635.44	744.48	0.19
Project	20435	Old 2-Year	2615.00	884.00	888.20		888.24	0.002508	1.55	1694.90	765.16	0.18
Project	20280	Old 2-Year	2615.00	883.70	887.45		887.56	0.008806	2.74	953.06	439.60	0.33
Project	20070	Old 2-Year	2615.00	882.00	885.67		885.76	0.008458	2.39	1093.59	602.40	0.31
Project	19855	Old 2-Year	2615.00	880.50	883.89		883.98	0.008030	2.38	1098.93	585.89	0.31
Project	19630	Old 2-Year	2615.00	880.00	882.69		882.75	0.003932	1.86	1405.32	634.15	0.22
Project	19440	Old 2-Year	2615.00	878.00	881.58		881.67	0.008585	2.52	1038.97	536.33	0.32
Project	19240	Old 2-Year	2615.00	877.50	880.22		880.31	0.005501	2.37	1102.54	445.37	0.27
Project	19050	Old 2-Year	2615.00	876.00	879.24		879.32	0.004990	2.36	1106.97	418.07	0.26
Project	18830	Old 2-Year	2615.00	874.00	878.02		878.13	0.005974	2.71	964.36	338.85	0.28
Project	18650	Old 2-Year	2615.00	873.50	877.00		877.11	0.005378	2.62	996.29	339.65	0.27
Project	18475	Old 2-Year	2615.00	872.00	876.05		876.16	0.005337	2.63	995.12	336.63	0.27
Project	18290	Old 2-Year	2615.00	871.50	874.69		874.84	0.010316	3.10	843.58	365.13	0.36
Project	18025	Old 2-Year	2615.00	870.00	873.68		873.73	0.002122	1.89	1380.64	380.36	0.18
Project	17785	Old 2-Year	2615.00	868.00	872.98		873.06	0.003941	2.26	1154.93	389.34	0.23
Project	17510	Old 2-Year	2615.00	868.00	872.05		872.13	0.002996	2.24	1169.03	326.32	0.21
Project	17360	Old 2-Year	2615.00	868.00	871.07		871.31	0.012005	3.93	665.30	223.64	0.40
Project	17110	Old 2-Year	2615.00	864.00	868.91		869.08	0.006728	3.29	795.78	228.67	0.31
Project	16970	Old 2-Year	2615.00	863.70	868.19		868.31	0.004247	2.83	925.23	235.74	0.25
Project	16720	Old 2-Year	2615.00	863.50	866.70		866.87	0.008244	3.32	788.14	259.99	0.34
Project	16515	Old 2-Year	2615.00	862.00	865.03		865.19	0.008355	3.16	827.01	296.50	0.33
Project	16305	Old 2-Year	2615.00	860.00	864.16		864.24	0.002729	2.23	1170.34	304.58	0.20
Project	16130	Old 2-Year	2615.00	860.00	863.65		863.73	0.003146	2.28	1149.27	323.40	0.21
Project	15960	Old 2-Year	2615.00	859.00	862.83		862.96	0.006569	2.95	886.96	294.64	0.30
Project	15745	Old 2-Year	2615.00	858.00	861.57		861.69	0.005376	2.77	942.80	295.79	0.27
Project	15540	Old 2-Year	2615.00	857.50	860.42		860.54	0.005933	2.69	973.68	344.87	0.28
Project	15335	Old 2-Year	2615.00	856.00	858.93	857.51	859.06	0.008876	2.96	883.23	348.62	0.33
Project	15125	Old 2-Year	2860.00	854.00	857.46	855.66	857.55	0.005871	2.47	1157.62	437.27	0.27
Project	14900	Old 2-Year	2860.00	853.00	856.46	854.54	856.52	0.003502	1.93	1485.15	584.08	0.21
Project	14720	Old 2-Year	2860.00	852.00	855.59	853.72	855.68	0.006668	2.42	1180.14	532.85	0.29
Project	14480	Old 2-Year	2860.00	850.50	854.75	852.03	854.79	0.002326	1.49	1922.76	819.84	0.17
Project	14315	Old 2-Year	2860.00	850.00	854.21	851.61	854.25	0.004653	1.68	1700.67	1014.44	0.23
Project	14090	Old 2-Year	2860.00	850.00	852.66		852.75	0.010069	2.35	1218.98	787.44	0.33
Project	13850	Old 2-Year	2860.00	848.00	850.86		850.94	0.006075	2.27	1257.27	582.65	0.27

HEC-RAS Plan: FinalPr085Q2 River: SCR Reach: Project Profile: Old 2-Year (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project	13635	Old 2-Year	2860.00	846.00	849.24		849.34	0.009079	2.49	1150.83	631.20	0.32
Project	13425	Old 2-Year	2860.00	845.00	847.99		848.06	0.004376	2.08	1376.44	576.31	0.24
Project	13190	Old 2-Year	2860.00	844.00	846.80		846.87	0.005939	2.08	1372.94	713.93	0.26
Project	13030	Old 2-Year	2860.00	843.00	845.94		846.00	0.004971	1.98	1447.37	712.89	0.24
Project	12835	Old 2-Year	2860.00	842.00	844.65		844.73	0.008829	2.24	1275.31	799.35	0.31
Project	12615	Old 2-Year	2860.00	841.00	843.18		843.24	0.005214	2.01	1441.76	741.83	0.25
Project	12395	Old 2-Year	2860.00	840.00	842.18		842.23	0.004143	1.84	1550.30	738.12	0.22
Project	12195	Old 2-Year	2860.00	838.98	841.22		841.27	0.005672	1.80	1586.99	990.77	0.25
Project	11995	Old 2-Year	2860.00	837.00	840.22		840.29	0.004132	2.02	1417.82	589.38	0.23
Project	11780	Old 2-Year	2860.00	836.00	839.08		839.17	0.006773	2.34	1223.34	590.36	0.29
Project	11605	Old 2-Year	2860.00	835.50	837.77		837.86	0.008568	2.51	1137.88	587.56	0.32
Project	11405	Old 2-Year	2860.00	834.00	836.57		836.64	0.004482	2.08	1372.55	579.74	0.24
Project	11180	Old 2-Year	2860.00	833.00	835.42		835.50	0.006001	2.27	1257.17	580.18	0.27
Project	11015	Old 2-Year	2860.00	831.50	834.75		834.81	0.002883	1.91	1494.85	519.83	0.20
Project	10835	Old 2-Year	2860.00	831.00	834.02		834.10	0.005665	2.35	1216.98	510.40	0.27
Project	10575	Old 2-Year	2860.00	830.00	831.82		831.96	0.013152	2.97	962.14	534.53	0.39
Project	10390	Old 2-Year	2860.00	828.00	831.18		831.22	0.001762	1.55	1842.61	598.09	0.16
Project	10225	Old 2-Year	2860.00	827.50	830.73		830.80	0.004206	2.00	1427.18	606.87	0.23
Project	10000	Old 2-Year	2860.00	826.00	829.55		829.62	0.006592	2.18	1309.06	685.26	0.28
Project	9820	Old 2-Year	2860.00	824.00	828.47	826.85	828.53	0.005488	1.97	1449.29	773.35	0.25
Project	9595	Old 2-Year	2860.00	823.80	827.53	825.68	827.58	0.003431	1.78	1604.52	698.10	0.21
Project	9385	Old 2-Year	2860.00	823.00	826.62		826.68	0.005423	2.05	1395.31	693.99	0.25
Project	9220	Old 2-Year	2860.00	822.00	825.09		825.22	0.015979	2.92	979.72	645.06	0.42
Project	9025	Old 2-Year	2860.00	821.00	823.54	822.03	823.62	0.005003	2.22	1290.81	537.58	0.25

Santa Clara River Fluvial Study

APPENDIX CHAPTER 4.3

Modeling CD-ROM

1) HEC-RAS Existing Conditions In/Out File
2) HEC-RAS Proposed Conditions In/Out File
3) HEC-2 Existing Conditions In/Out File
4) HEC-2 Proposed Conditions In/Out File
5) SAM Existing Conditions In/Out File
10) SAM Proposed Conditions In/Out File
11) WSE at Santa Clara River Confluence Existing
12) WSE at Santa Clara River Confluence Proposed

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Santa Clara River Fluvial Study

APPENDIX CHAPTER 4.4

Existing & Proposed Conditions HEC-RAS Velocity And Water Surface Elevation

Proposed Conditions HEC-RAS To SAM Conversion Analysis

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It has been noted in the text that the conversion process from HEC-RAS to SAM is a powerful tool for fluvial analysis. This appendix presents, in part, the proposed conditions HEC-RAS to SAM conversion analysis in table format (Table A4.4B1-2). The tables compare the velocity and water surface elevation for the HEC-RAS mixed flow model, the HEC-RAS subcritical flow model, the HEC-RAS model processed for HEC-2 conversion, the HEC-2 model, and the HEC-2 model imported into HEC-RAS. At most sections the differences between steps in the conversion process is only a few percent. The few locations where the difference between steps is high generally result from the supercritical nature of the flow in the HEC-RAS mixed flow model. Several pertinent points should be addressed here. First, the observed differences are a result of the conversion process itself. The most appropriate use of SAM is to include the available data from the hydraulic modeling. As noted in Section 4.1.1, the T95 file produced by HEC-2 is read directly into the SAM model. This is preferable to attempting to consider each section as hydraulically independent from others in the system. A T95 file is not produced in HEC-RAS so the RAS model that is used for hydraulic analysis is down converted to HEC-2 format, as described above. Second, the supercritical nature of the model is the result of the low Manning's number (n=0.025) used, as required by LACDPW criteria. In the River during an actual event a Manning's number this low is not expected for an entire cross-section or an entire reach. In instances where the Manning's number exceeds approximately n=0.035 supercritical flow does not occur in the River for the Q_{CAP} discharge, and Manning's values in the River are expected to be at least n=0.035 or higher during an actual event. Finally, in the final phase of the analysis HEC-6 numerical modeling will be employed to analyze the fluvial mechanics of the River system. The affect of this modeling is to fine tune the SAM analysis presented in the present phase, and HEC-6 modeling will use expected Manning's values as parameters. For these reasons, any differences in water surface elevation or velocity resulting from modeled flow regime presented in Table A4.4B1-2 are not expected to impact analysis or final design.

Table A4.4A: Santa Clara River Existing & Proposed Conditions HEC-RAS Velocity & WSE [1]					
Subreach	HEC-RAS	Existing (QCAP)		Proposed (QCAP)	
	Station	Velocity (fps)	WSE (ft)	Velocity (fps)	WSE (ft)
SRA1	46195	19.7	1054.3	19.7	1054.3
	46020	19.1	1052.4	19.1	1052.4
	45545	20.3	1049.2	20.3	1049.2
	45030	17.8	1045.6	17.8	1045.6
	44585	19.2	1043.1	19.2	1043.1
	44210	14.8	1041.6	14.8	1041.6
SRA2	43820	19.9	1037.5	19.9	1037.5
	43610	19.7	1034.1	19.7	1034.1
	43410	18.2	1030.7	18.1	1030.7
	43200	17.3	1029.3	17.2	1029.3
	42975	16.3	1026.1	16.3	1026.1
	42815	15.3	1024.3	15.4	1024.4
	42590	15.0	1021.3	15.1	1021.5
	42430	15.5	1019.6	15.6	1020.3
	42215	10.2	1020.4	12.7	1019.7
	41940	11.2	1019.5	11.6	1019.3
	41730	11.4	1018.9	11.8	1018.7
	41460	11.3	1018.3	11.7	1018.1
SRA3	41280	16.4	1015.3	16.4	1015.3
	41080	16.1	1013.6	16.0	1013.6
	40825	14.8	1012.2	15.0	1012.1
	40585	14.8	1010.6	14.9	1010.6
	40335	11.0	1010.4	10.7	1011.0
	40130	10.4	1010.0	11.1	1010.4
	39945	9.5	1009.8	10.7	1010.2
	39755	14.4	1007.3	16.1	1007.2
	39605	14.7	1005.7	16.2	1005.8
	39310	14.7	1004.1	15.9	1004.4
	39100	11.2	1004.2	14.2	1003.7
	38925	10.9	1003.9	12.9	1003.7
SRA4	38710	10.4	1003.7	12.1	1003.6
	38475	16.7	1000.2	17.8	1000.0
	38300	16.5	998.1	17.7	997.9
	38065	14.1	998.2	14.5	998.0
	37810	18.2	995.2	18.2	995.2
	37655	16.8	994.2	17.4	994.1
	37390	15.7	989.9	14.2	991.5
	37135	15.1	988.6	16.6	989.3
	36930	13.3	987.7	15.6	987.9
	36735	14.6	986.4	16.1	986.9
	36515	12.1	986.3	12.8	987.0
	36265	13.1	985.2	12.3	986.5
SRB1	36080	13.7	984.1	14.7	984.6
	35845	11.6	983.9	11.7	984.1
	35725	13.8	982.6	14.1	982.6
	35515	14.0	981.3	14.0	981.3
	35245	13.8	980.1	13.7	980.2
	35040	13.8	978.4	13.9	978.3
	34860	14.0	977.4	14.1	977.4
	34720	13.9	976.2	13.9	976.2
	34495	14.0	974.3	14.0	974.3
	34310	14.3	972.7	14.3	972.6
	34090	14.3	971.6	14.2	971.6
SRB2	33880	14.2	970.5	14.1	970.3
	33710	14.1	969.3	14.0	969.3
	33500	13.1	968.2	13.1	968.1
	33310	12.9	967.0	12.9	967.0

1 - Velocities & WSEs reflect HEC-RAS model modified for fluvial purposes at subcritical flow

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Table A4.4A: Santa Clara River Existing & Proposed Conditions HEC-RAS Velocity & WSE [1] (ctd)

	33115	11.3	966.4	10.4	966.6
	32795	12.2	965.0	13.0	964.6
	32605	14.1	963.5	13.1	963.6
SRC1	32265	13.3	961.4	13.4	961.3
	31875	10.9	960.0	12.4	959.4
	31585	11.3	957.7	12.1	957.3
	31360	10.5	957.2	11.5	956.6
	31060	8.4	957.2	9.0	956.6
	30720	6.8	957.3	7.3	956.6
	30445	6.4	957.2	6.8	956.5
	30095	6.8	957.0	7.0	956.3
	29815	7.7	956.6	7.9	955.9
	29565	7.5	956.5	7.7	955.8
	29385	8.5	956.1	8.6	955.5
SRC2	29140	11.5	954.7	10.2	954.8
	28895	16.8	951.6	16.8	951.3
	28695	18.8	947.9	13.3	948.3
	28500	19.8	945.1	16.7	946.0
	28280	20.1	941.7	11.9	943.4
	28080	16.7	942.3	10.9	943.4
	27925	19.1	940.4	12.4	942.6
	27725	19.8	939.3	18.0	939.3
	27545	19.0	937.7	19.1	937.6
	27335	17.3	936.2	17.4	936.2
	27155	16.4	935.4	17.2	935.3
SRC3	26990	15.8	933.7	16.7	933.7
	26780	15.5	931.4	16.3	931.3
	26575	14.2	930.6	14.7	930.4
	26355	15.2	929.2	15.4	929.1
	26170	13.5	928.9	15.3	928.2
	25965	15.2	927.2	15.2	927.3
	25785	15.0	926.1	14.4	926.8
	25600	13.9	924.9	15.0	925.8
	25425	10.3	925.4	14.6	925.3
	25215	13.8	923.3	14.2	924.7
	25000	12.6	922.1	13.1	924.5
SRC4	24795	12.6	920.4	14.0	923.6
	24550	9.7	919.5	15.0	922.5
	24335	13.0	917.6	18.1	920.0
	24115	13.1	915.9	18.2	918.7
	23975	13.3	914.6	18.0	917.7
	23755	13.3	913.3	17.8	916.8
	23565	13.2	912.4	17.4	915.6
	23365	13.6	911.1	16.9	914.4
	23180	10.1	911.0	16.0	913.2
	23000	9.0	910.9	15.3	912.8
	22790	9.5	910.4	18.0	910.5
	22600	9.5	910.1	16.6	909.6
	22415	10.1	909.7	16.3	908.0
SRD1	22195	15.4	906.9	14.2	907.5
	22010	15.1	906.2	15.4	906.1
	21790	14.4	904.9	14.7	904.8
	21615	13.7	903.1	14.8	902.8
	21440	14.6	901.2	15.0	901.6
	21225	12.6	899.8	14.3	900.5
	21020	13.8	897.4	12.3	900.0
	20845	12.5	897.0	14.3	898.4
	20595	11.0	896.4	11.1	898.3

1 - Velocities & WSEs reflect HEC-RAS model modified for fluvial purposes at subcritical flow

Table A4.4A: Santa Clara River Existing & Proposed Conditions HEC-RAS Velocity & WSE [1] (ctd)					
	20435	10.3	896.2	10.8	898.1
	20280	12.1	895.0	14.5	896.0
	20070	12.4	892.7	14.4	894.3
SRD2	19855	13.1	891.1	14.3	892.7
	19630	13.2	889.8	14.4	891.5
	19440	10.8	889.9	12.9	891.4
	19240	12.1	888.9	15.6	889.4
	19050	9.6	889.0	12.2	889.4
	18830	9.3	888.7	12.1	888.8
	18650	8.5	888.7	10.8	888.7
	18475	7.7	888.7	8.8	888.9
	18290	8.1	888.4	9.4	888.5
	18025	7.6	888.3	7.8	888.6
	17785	8.5	887.9	8.4	888.3
SRD3	17510	12.3	886.2	10.1	887.5
	17360	16.9	883.4	16.9	884.0
	17110	15.0	881.1	15.7	881.1
	16970	14.4	879.7	15.7	879.6
	16720	14.2	875.3	15.9	875.4
	16515	13.4	873.5	15.4	873.9
	16305	12.6	871.6	11.1	874.5
	16130	13.3	870.5	15.2	872.2
	15960	12.8	869.2	13.7	871.6
	15745	10.9	868.6	12.3	871.3
	15540	10.4	868.1	10.5	871.2
	15335	12.6	866.5	16.2	868.1
SRE1	15125	13.7	864.5	16.6	866.3
	14900	14.0	863.3	16.3	864.2
	14720	13.7	862.1	15.9	863.3
	14480	13.7	860.5	14.5	860.8
	14315	13.5	859.9	14.0	860.1
	14090	13.7	858.7	13.7	858.7
	13850	13.8	857.1	13.9	857.1
	13635	14.0	856.0	14.0	856.0
	13425	13.4	854.6	13.5	854.2
	13190	12.7	853.1	12.3	853.3
SRE2	13030	12.3	852.7	12.0	852.9
	12835	12.1	852.1	11.8	852.3
	12615	11.3	851.8	11.0	852.0
	12395	11.1	851.5	10.9	851.7
	12195	10.1	851.4	10.0	851.6
	11995	11.3	850.7	11.1	850.9
	11780	10.7	850.5	10.4	850.7
	11605	12.0	849.7	11.6	850.0
	11405	12.0	849.4	12.1	849.4
	11180	15.0	847.6	15.2	847.5
SRE3	11015	18.9	844.8	18.9	844.9
	10835	17.7	843.8	17.7	843.8
	10575	16.0	840.2	16.0	840.2
	10390	13.2	839.5	12.7	839.8
	10225	14.7	838.2	14.7	838.2
	10000	14.6	837.1	14.6	837.1
	9820	15.0	835.4	14.9	835.4
	9595	14.6	834.1	14.5	834.2
	9385	13.7	833.1	13.8	833.1
	9220	13.7	831.8	13.7	831.8
	9025	13.8	830.4	13.8	830.4

1 - Velocities & WSEs reflect HEC-RAS model modified for fluvial purposes at subcritical flow

Table A4.4B1 Santa Clara River Proposed Condition HEC-RAS to HEC-2 Conversion n=0.025

	HEC-RAS Station	HEC-RAS Mixed Depth (ft)	HEC-RAS Subcritical Depth (ft)	Fluvial HEC-RAS Subcritical Depth (ft)	Δ (%) Depth (ft %)	Fluvial HEC2 Depth (ft)	Δ (%) Depth (ft %)	Fluvial HEC2 IMPORT Subcritical Depth (ft)	Δ (%) Depth (ft %)
SRA1	46195	18.1	19.0	19.3	**-1%**	19.3	**0%**	19.3	**0%**
	46020	18.1	20.4	20.4	**0%**	20.3	**1%**	20.4	**-1%**
	45545	19.2	19.2	19.2	**0%**	19.2	**0%**	19.2	**0%**
	45030	16.5	20.6	20.6	**0%**	20.3	**1%**	20.5	**-1%**
	44585	21.1	21.1	21.1	**0%**	21.1	**0%**	21.1	**0%**
	44210	15.4	21.6	21.6	**0%**	21.1	**2%**	21.6	**-2%**
SRA2	43820	19.5	19.5	19.5	**0%**	19.5	**0%**	19.5	**0%**
	43610	13.8	17.1	17.1	**0%**	17.1	**0%**	17.1	**0%**
	43410	11.3	15.1	14.7	**3%**	14.8	**0%**	14.7	**0%**
	43200	12.4	15.6	15.3	**2%**	15.3	**0%**	15.3	**0%**
	42975	10.8	14.3	14.1	**1%**	14.1	**1%**	14.1	**-1%**
	42815	10.7	13.4	13.4	**1%**	13.3	**0%**	13.4	**0%**
	42590	9.2	11.6	11.5	**1%**	11.5	**0%**	11.5	**0%**
	42430	10.7	12.3	12.3	**0%**	12.3	**0%**	12.3	**0%**
	42215	11.2	13.7	13.7	**0%**	13.3	**3%**	13.7	**-3%**
	41940	14.3	14.3	14.3	**0%**	14.0	**2%**	14.3	**-2%**
	41730	14.7	14.7	14.7	**0%**	14.3	**3%**	14.7	**-3%**
	41460	16.2	16.2	16.1	**0%**	15.8	**2%**	16.1	**-2%**
SRA3	41280	14.4	14.4	14.3	**0%**	14.3	**1%**	14.3	**-1%**
	41080	12.1	13.6	13.6	**0%**	13.5	**1%**	13.6	**-1%**
	40825	11.5	12.6	12.6	**0%**	12.6	**0%**	12.6	**0%**
	40585	11.7	12.4	12.6	**-1%**	12.6	**0%**	12.6	**0%**
	40335	15.1	15.1	15.0	**1%**	14.7	**2%**	15.0	**-2%**
	40130	15.5	15.5	15.4	**1%**	15.1	**2%**	15.4	**-2%**
	39945	16.3	16.3	16.2	**1%**	15.9	**2%**	16.2	**-2%**
	39755	13.3	13.3	13.2	**1%**	13.1	**0%**	13.2	**0%**
	39605	11.5	12.9	12.8	**1%**	12.7	**0%**	12.8	**0%**
	39310	12.7	12.7	12.4	**2%**	12.4	**0%**	12.4	**0%**
	39100	10.4	13.8	13.7	**0%**	12.6	**8%**	13.7	**-9%**
	38925	14.3	14.3	14.2	**0%**	13.7	**4%**	14.2	**-4%**
SRA4	38710	15.6	15.6	15.6	**0%**	15.2	**2%**	15.6	**-3%**
	38475	14.0	14.0	14.0	**0%**	14.1	**0%**	14.0	**0%**
	38300	10.3	12.4	12.4	**0%**	12.3	**0%**	12.4	**0%**
	38065	14.0	14.0	14.0	**0%**	13.7	**2%**	14.0	**-2%**
	37810	12.2	12.2	12.2	**0%**	12.2	**0%**	12.2	**0%**
	37655	10.5	12.1	12.1	**0%**	12.1	**0%**	12.1	**0%**
	37390	6.5	10.5	10.5	**0%**	10.2	**2%**	10.5	**-2%**
	37135	9.3	9.3	9.3	**0%**	9.3	**0%**	9.3	**0%**
	36930	8.1	9.7	9.9	**-3%**	9.9	**1%**	9.9	**0%**
	36735	9.8	9.8	9.9	**0%**	9.8	**0%**	9.9	**0%**
	36515	12.0	12.0	12.0	**0%**	11.5	**5%**	11.7	**-2%**
	36265	12.5	12.5	12.5	**0%**	12.1	**3%**	12.2	**-1%**
SRB1	36080	11.6	11.6	11.6	**0%**	11.5	**2%**	11.5	**-1%**
	35845	13.6	13.6	13.1	**4%**	12.9	**1%**	13.1	**-1%**
	35725	13.0	13.0	12.6	**3%**	12.5	**1%**	12.6	**-1%**
	35515	12.0	12.8	12.3	**3%**	12.6	**-2%**	12.5	**1%**
	35245	11.3	12.4	12.2	**2%**	12.1	**1%**	12.2	**-1%**
	35040	10.7	12.0	11.3	**5%**	11.5	**-2%**	11.5	**0%**
	34860	10.0	11.4	11.4	**0%**	11.4	**0%**	11.4	**0%**
	34720	9.2	10.7	10.7	**0%**	10.6	**0%**	10.7	**0%**
	34495	9.0	10.3	10.3	**0%**	10.2	**0%**	10.3	**0%**
	34310	9.3	10.0	9.6	**4%**	9.8	**-1%**	9.7	**0%**
	34090	8.6	9.6	9.6	**0%**	9.5	**0%**	9.6	**0%**
SRB2	33880	9.3	10.3	10.3	**0%**	10.2	**0%**	10.2	**0%**
	33710	9.7	10.3	10.3	**0%**	10.3	**0%**	10.2	**0%**
	33500	9.3	10.0	10.1	**-1%**	10.1	**0%**	10.1	**0%**
	33310	9.0	10.0	10.0	**0%**	10.0	**0%**	10.0	**0%**
	33115	10.6	10.6	10.6	**0%**	10.6	**0%**	10.7	**-1%**
	32795	10.6	10.6	10.6	**0%**	10.9	**-3%**	11.0	**-1%**
	32605	11.1	11.6	11.6	**0%**	11.6	**0%**	11.6	**0%**
SRC1	32265	10.5	11.3	11.3	**0%**	11.2	**1%**	11.3	**-1%**
	31875	10.4	10.4	10.4	**0%**	10.3	**1%**	10.4	**-1%**
	31585	11.9	11.9	11.3	**5%**	11.2	**1%**	11.3	**-1%**
	31360	13.5	13.5	12.6	**7%**	11.4	**9%**	12.6	**-10%**
	31060	15.5	15.5	14.6	**6%**	14.1	**4%**	14.6	**-4%**
	30720	17.5	17.5	16.6	**5%**	16.3	**2%**	16.6	**-2%**
	30445	19.5	19.5	18.5	**5%**	18.2	**2%**	18.5	**-2%**
	30095	21.3	21.3	20.3	**4%**	20.0	**2%**	20.3	**-2%**
	29815	21.9	21.9	20.9	**5%**	20.6	**2%**	20.9	**-2%**
	29565	22.9	22.9	21.8	**5%**	21.5	**1%**	21.8	**-1%**
	29385	23.6	23.6	22.5	**5%**	22.2	**1%**	22.5	**-1%**
SRC2	29140	24.1	24.1	22.8	**6%**	22.4	**1%**	22.8	**-1%**
	28895	22.5	22.5	21.3	**5%**	21.1	**1%**	21.3	**-1%**
	28695	14.0	21.1	20.3	**4%**	20.0	**1%**	20.3	**-1%**
	28500	16.1	18.6	18.5	**1%**	18.5	**0%**	18.5	**0%**
	28280	10.8	18.0	17.4	**3%**	16.8	**3%**	17.4	**-3%**
	28080	19.1	19.1	18.4	**4%**	18.0	**2%**	18.4	**-2%**
	27925	19.3	19.3	18.6	**3%**	18.2	**2%**	18.6	**-2%**
	27725	16.7	16.7	16.3	**3%**	16.2	**1%**	16.3	**-1%**
	27545	14.1	15.8	15.6	**1%**	15.5	**1%**	15.6	**-1%**
	27335	12.3	15.3	15.2	**1%**	15.1	**0%**	15.2	**0%**
	27155	14.8	15.2	14.8	**3%**	14.7	**0%**	14.8	**0%**
SRC3	26990	11.5	13.7	13.7	**0%**	13.7	**0%**	13.7	**0%**
	26780	11.3	13.7	13.3	**2%**	13.3	**0%**	13.3	**0%**
	26575	11.1	13.9	13.4	**3%**	13.4	**0%**	13.4	**0%**
	26355	13.4	13.4	13.1	**2%**	13.1	**0%**	13.1	**0%**
	26170	13.5	13.7	13.2	**4%**	13.2	**0%**	13.2	**0%**
	25965	12.9	13.7	13.3	**3%**	13.2	**1%**	13.3	**-1%**
	25785	12.1	13.1	13.3	**-1%**	13.2	**1%**	13.3	**-1%**
	25600	12.4	13.1	13.3	**-1%**	12.9	**3%**	13.3	**-3%**
	25425	12.5	14.3	14.3	**0%**	14.0	**2%**	14.3	**-2%**
	25215	14.7	14.7	14.7	**0%**	14.1	**4%**	14.7	**-5%**
	25000	15.5	15.5	15.5	**0%**	15.3	**1%**	15.5	**-2%**

Table A4.4B1 HEC-RAS to HEC-2 Conversion SCR Proposed n=0.025 continued

Subreach	HEC-RAS Station	HEC-RAS Mixed Depth (ft)	HEC-RAS Subcritical Depth (ft)	Fluvial HEC-RAS Subcritical Depth (ft)	Δ (%) Depth (ft %)	Fluvial HEC2 Depth (ft)	Δ (%) Depth (ft %)	Fluvial HEC2 IMPORT Subcritical Depth (ft)	Δ (%) Depth (ft %)
SRC4	24795	15.6	15.6	15.6	**0%**	15.4	**2%**	15.6	**-2%**
	24550	16.5	16.5	16.5	**0%**	16.2	**2%**	16.5	**-2%**
	24335	15.0	15.0	15.0	**0%**	15.0	**1%**	15.0	**-1%**
	24115	13.8	14.7	14.7	**0%**	14.6	**0%**	14.7	**0%**
	23975	12.9	14.2	14.2	**0%**	14.2	**0%**	14.2	**0%**
	23755	14.7	14.7	14.8	**0%**	14.7	**0%**	14.8	**0%**
	23565	14.3	15.6	15.6	**0%**	15.5	**0%**	15.6	**0%**
	23365	14.3	14.7	14.4	**2%**	14.3	**1%**	14.4	**-1%**
	23180	12.6	14.1	14.2	**0%**	13.6	**4%**	13.6	**0%**
	23000	11.3	14.8	14.8	**0%**	14.0	**5%**	14.2	**-2%**
	22790	13.0	13.0	13.0	**0%**	12.8	**1%**	12.9	**-1%**
	22600	12.8	13.8	13.6	**1%**	13.6	**0%**	13.6	**0%**
	22415	10.8	12.5	12.5	**0%**	12.4	**0%**	12.5	**0%**
SRD1	22195	14.0	14.0	13.5	**4%**	13.3	**1%**	13.5	**-1%**
	22010	14.3	14.3	14.1	**2%**	14.0	**1%**	14.1	**-1%**
	21790	11.6	13.3	13.3	**0%**	13.2	**1%**	13.3	**-1%**
	21615	8.5	10.7	10.8	**-1%**	10.8	**0%**	10.8	**0%**
	21440	11.0	11.6	11.6	**1%**	11.5	**1%**	11.6	**-1%**
	21225	11.7	12.9	12.5	**3%**	12.5	**0%**	12.5	**0%**
	21020	9.7	12.2	13.0	**-6%**	12.8	**1%**	13.0	**-1%**
	20845	12.7	12.7	12.4	**3%**	12.3	**1%**	12.3	**0%**
	20595	13.4	13.4	13.3	**1%**	13.1	**2%**	13.3	**-2%**
	20435	14.3	14.3	14.1	**1%**	13.9	**2%**	14.1	**-2%**
	20280	12.8	12.8	12.3	**4%**	12.3	**0%**	12.3	**0%**
	20070	11.1	12.7	12.3	**3%**	12.3	**0%**	12.3	**0%**
SRD2	19855	10.2	12.4	12.2	**2%**	12.1	**0%**	12.2	**0%**
	19630	8.9	11.4	11.5	**-1%**	10.6	**8%**	11.5	**-8%**
	19440	13.4	13.4	13.4	**0%**	13.2	**2%**	13.4	**-2%**
	19240	11.9	11.9	11.9	**0%**	11.9	**0%**	11.9	**0%**
	19050	10.5	13.3	13.4	**-1%**	13.2	**1%**	13.4	**-1%**
	18830	14.6	14.6	14.8	**-2%**	13.4	**10%**	14.8	**-11%**
	18650	15.0	15.0	15.2	**-1%**	14.2	**7%**	15.2	**-7%**
	18475	16.9	16.9	16.9	**0%**	16.4	**3%**	16.9	**-3%**
	18290	16.9	16.9	17.0	**0%**	16.5	**3%**	17.0	**-3%**
	18025	18.5	18.5	18.6	**0%**	18.2	**2%**	18.6	**-2%**
	17785	20.2	20.2	20.3	**0%**	19.9	**2%**	20.3	**-2%**
SRD3	17510	19.2	19.2	19.5	**-1%**	19.1	**2%**	19.5	**-2%**
	17360	15.9	15.9	16.0	**0%**	16.0	**0%**	16.0	**0%**
	17110	15.2	17.5	17.1	**2%**	17.0	**1%**	17.1	**-1%**
	16970	13.6	16.1	15.9	**1%**	15.8	**1%**	15.9	**-1%**
	16720	9.2	11.9	11.9	**0%**	11.9	**0%**	11.9	**0%**
	16515	10.4	11.9	11.9	**0%**	11.8	**1%**	11.9	**-1%**
	16305	14.6	14.6	14.5	**0%**	14.3	**2%**	14.5	**-2%**
	16130	12.3	12.3	12.2	**1%**	12.3	**0%**	12.2	**0%**
	15960	11.0	12.6	12.6	**0%**	12.0	**5%**	12.1	**-1%**
	15745	13.3	13.3	13.3	**0%**	11.7	**12%**	12.6	**-8%**
	15540	13.7	13.7	13.7	**0%**	12.9	**6%**	13.2	**-2%**
	15335	12.1	12.1	12.1	**0%**	11.8	**2%**	11.9	**-1%**
SRE1	15125	11.6	12.3	12.3	**0%**	11.9	**3%**	12.0	**0%**
	14900	9.8	11.2	11.2	**0%**	11.1	**0%**	11.2	**0%**
	14720	9.8	11.0	11.3	**-3%**	11.2	**1%**	11.3	**-1%**
	14480	8.9	10.3	10.3	**0%**	10.1	**1%**	10.2	**-1%**
	14315	9.9	10.0	10.1	**-1%**	9.9	**2%**	9.9	**0%**
	14090	8.5	8.7	8.7	**0%**	8.7	**0%**	8.7	**0%**
	13850	9.7	9.7	9.1	**6%**	9.2	**-1%**	9.1	**0%**
	13635	10.3	10.3	10.0	**3%**	9.9	**0%**	10.0	**0%**
	13425	7.8	9.2	9.2	**0%**	9.3	**0%**	9.2	**0%**
	13190	9.5	9.5	9.3	**2%**	9.1	**3%**	9.3	**-3%**
SRE2	13030	9.6	9.6	9.9	**-3%**	9.6	**3%**	9.9	**-3%**
	12835	10.1	10.1	10.3	**-2%**	9.9	**5%**	10.4	**-5%**
	12615	10.9	10.9	11.0	**-2%**	10.7	**3%**	11.1	**-4%**
	12395	11.5	11.5	11.7	**-2%**	11.3	**4%**	11.7	**-4%**
	12195	12.5	12.5	12.6	**-1%**	12.3	**2%**	12.7	**-3%**
	11995	13.6	13.6	13.9	**-2%**	13.6	**2%**	14.0	**-3%**
	11780	14.4	14.4	14.7	**-2%**	14.5	**1%**	14.8	**-2%**
	11605	13.8	13.8	14.5	**-5%**	14.2	**2%**	14.6	**-3%**
	11405	15.1	15.1	15.4	**-2%**	15.1	**2%**	15.5	**-3%**
	11180	13.9	13.9	14.5	**-4%**	14.2	**2%**	14.7	**-3%**
SRE3	11015	13.3	13.3	13.4	**-1%**	13.2	**1%**	13.4	**-1%**
	10835	10.9	12.7	12.8	**-1%**	12.8	**0%**	12.8	**0%**
	10575	7.5	10.2	10.2	**0%**	10.2	**0%**	10.2	**0%**
	10390	8.8	11.0	11.8	**-6%**	11.6	**1%**	11.8	**-1%**
	10225	9.5	10.7	10.7	**0%**	10.7	**0%**	10.7	**0%**
	10000	11.1	11.1	11.1	**0%**	11.2	**0%**	11.1	**0%**
	9820	10.0	11.3	11.4	**0%**	11.3	**1%**	11.4	**-1%**
	9595	10.3	10.3	10.4	**0%**	10.3	**1%**	10.4	**-1%**
	9385	9.5	10.2	10.1	**1%**	10.0	**0%**	10.1	**0%**
	9220	8.9	9.8	9.8	**0%**	9.8	**0%**	9.8	**0%**
	9025	8.9	9.6	9.4	**2%**	9.4	**0%**	9.4	**0%**

Table A4.4B2 Santa Clara River Proposed Condition HEC-RAS to HEC-2 Conversion n=0.025

		HEC-RAS Mixed	HEC-RAS Subcritical	Fluvial HEC-RAS Subcritical	Δ (%)	Fluvial HEC2	Δ (%)	Fluvial HEC2 IMPORT Subcritical	Δ (%)
	HEC-RAS Station	Vel Chnl (ft/s)	Vel Chnl (ft/s)	Vel Chnl (ft/s)	Vel Chnl (ft/s %)	Vel Chnl (ft/s)	Vel Chnl (ft/s %)	Vel Chnl (ft/s)	Vel Chnl (ft/s %)
SRA1	46195	21.7	20.1	19.7	2%	19.6	0%	19.7	0%
	46020	24.1	19.1	19.1	0%	19.3	-1%	19.1	1%
	45545	20.3	20.3	20.3	0%	20.4	0%	20.3	0%
	45030	26.1	17.8	17.8	0%	18.1	-2%	17.8	1%
	44585	19.2	19.2	19.2	0%	19.1	0%	19.1	0%
	44210	26.2	14.8	14.8	0%	15.3	-4%	14.8	3%
SRA2	43820	19.9	19.9	19.9	0%	19.9	0%	19.9	0%
	43610	26.7	19.8	19.7	0%	19.7	0%	19.7	0%
	43410	28.8	19.2	18.1	6%	18.1	0%	18.1	0%
	43200	26.1	18.0	17.2	4%	17.2	0%	17.2	0%
	42975	26.6	16.7	16.3	2%	16.5	-1%	16.3	1%
	42815	23.9	15.7	15.4	2%	15.5	-1%	15.4	1%
	42590	22.4	15.3	15.1	2%	15.2	-1%	15.1	1%
	42430	19.6	15.6	15.6	0%	15.6	0%	15.6	0%
	42215	18.5	12.9	12.7	1%	13.5	-6%	12.7	6%
	41940	11.6	11.6	11.6	0%	12.0	-3%	11.6	3%
	41730	11.8	11.8	11.8	0%	12.4	-5%	11.8	5%
	41460	11.6	11.6	11.7	-1%	12.1	-4%	11.7	3%
SRA3	41280	16.4	16.4	16.4	0%	16.6	-1%	16.4	1%
	41080	19.9	16.5	16.0	3%	16.2	-1%	16.0	1%
	40825	18.0	15.3	15.0	2%	15.0	0%	15.0	0%
	40585	17.0	15.3	14.9	3%	15.0	-1%	14.8	1%
	40335	10.5	10.5	10.7	-1%	11.0	-3%	10.7	3%
	40130	11.3	11.3	11.1	2%	11.5	-4%	11.1	4%
	39945	11.0	11.0	10.7	3%	11.1	-4%	10.7	3%
	39755	16.5	16.5	16.1	2%	16.2	-1%	16.1	1%
	39605	19.7	16.6	16.2	2%	16.3	-1%	16.2	1%
	39310	16.5	16.5	15.9	4%	15.9	0%	15.9	0%
	39100	20.9	14.2	14.2	0%	16.0	-12%	14.2	11%
	38925	12.8	12.8	12.9	0%	13.6	-6%	12.9	5%
SRA4	38710	12.0	12.0	12.1	0%	12.5	-3%	12.1	3%
	38475	17.9	17.9	17.8	0%	17.8	0%	17.8	0%
	38300	22.5	17.7	17.7	0%	17.7	0%	17.7	0%
	38065	14.5	14.5	14.5	0%	15.0	-3%	14.5	3%
	37810	18.2	18.2	18.2	0%	18.2	0%	18.2	0%
	37655	20.9	17.4	17.4	0%	17.4	0%	17.4	0%
	37390	23.7	14.2	14.2	0%	14.5	-3%	14.2	3%
	37135	16.6	16.6	16.6	0%	16.6	0%	16.6	0%
	36930	19.8	16.3	15.6	4%	15.7	-1%	15.7	0%
	36735	16.1	16.1	16.1	0%	16.1	0%	16.1	1%
	36515	12.9	12.9	12.8	0%	13.7	-7%	13.3	3%
	36265	12.3	12.3	12.3	0%	12.8	-3%	12.5	2%
SRB1	36080	14.7	14.7	14.7	0%	14.8	-1%	14.6	1%
	35845	11.0	11.0	11.7	-7%	12.0	-2%	11.7	2%
	35725	15.0	15.0	14.1	6%	14.3	-1%	14.1	1%
	35515	17.1	15.2	14.0	8%	13.4	4%	13.6	-1%
	35245	17.3	14.5	13.7	6%	13.9	-1%	13.7	1%
	35040	19.6	15.6	13.9	11%	13.5	3%	13.6	0%
	34860	18.4	14.1	14.1	0%	14.2	-1%	14.1	1%
	34720	18.4	13.9	13.9	0%	14.0	-1%	13.9	1%
	34495	17.4	14.0	14.0	0%	14.1	-1%	14.0	1%
	34310	16.8	15.0	14.3	5%	14.0	2%	14.1	-1%
	34090	17.0	14.2	14.2	0%	14.3	-1%	14.2	1%
SRB2	33880	16.6	14.1	14.1	0%	14.2	-1%	14.1	0%
	33710	15.4	14.0	14.0	0%	14.0	0%	14.0	0%
	33500	16.2	14.3	13.1	8%	13.0	0%	13.1	0%
	33310	15.8	12.9	12.9	0%	12.8	1%	12.8	0%
	33115	10.4	10.4	10.4	0%	10.3	0%	10.2	1%
	32795	13.0	13.0	13.0	0%	12.2	6%	12.1	1%
	32605	14.4	13.1	13.1	0%	13.1	0%	13.1	0%
SRC1	32265	15.9	13.4	13.4	0%	13.7	-2%	13.4	2%
	31875	12.4	12.4	12.4	0%	12.6	-2%	12.4	2%
	31585	10.9	10.9	12.1	-11%	12.3	-1%	12.1	1%
	31360	10.3	10.3	11.5	-12%	13.9	-20%	11.5	17%
	31060	8.2	8.2	9.0	-10%	9.6	-6%	9.0	6%
	30720	6.7	6.7	7.3	-9%	7.5	-3%	7.3	3%
	30445	6.3	6.3	6.8	-8%	6.9	-3%	6.7	3%
	30095	6.7	6.7	7.0	-3%	7.1	-3%	7.0	3%
	29815	7.7	7.7	7.9	-2%	8.1	-3%	7.9	2%
	29565	7.4	7.4	7.7	-5%	7.9	-2%	7.7	2%
	29385	8.3	8.3	8.6	-4%	8.8	-2%	8.6	2%
SRC2	29140	9.2	9.2	10.2	-11%	10.4	-3%	10.2	2%
	28895	18.8	18.8	16.8	11%	17.1	-2%	16.8	2%
	28695	28.9	12.4	13.3	-7%	13.6	-2%	13.3	2%
	28500	22.4	17.7	16.7	6%	16.7	0%	16.6	1%
	28280	29.6	13.0	11.9	8%	12.5	-5%	11.9	5%
	28080	11.3	11.3	10.9	3%	11.2	-3%	10.9	3%
	27925	13.1	13.1	12.4	5%	12.8	-3%	12.4	3%
	27725	19.0	19.0	18.0	6%	18.1	-1%	18.0	1%
	27545	22.9	19.7	19.1	3%	19.2	-1%	19.1	1%
	27335	24.6	18.3	17.4	5%	17.5	-1%	17.4	1%
	27155	19.1	18.4	17.2	6%	17.4	-1%	17.2	1%
SRC3	26990	22.6	16.9	16.7	1%	16.8	-1%	16.7	1%
	26780	23.1	16.9	16.3	4%	16.4	-1%	16.3	1%
	26575	20.7	13.9	14.7	-6%	14.8	-1%	14.8	0%
	26355	15.9	15.9	15.4	3%	15.5	-1%	15.4	1%
	26170	17.0	16.5	15.3	7%	15.3	0%	15.3	0%
	25965	18.2	16.3	15.2	7%	15.4	-1%	15.2	1%
	25785	18.9	16.5	14.4	13%	14.6	-2%	14.4	1%
	25600	18.5	17.0	15.0	12%	15.7	-4%	15.0	4%
	25425	18.3	14.6	14.6	0%	15.1	-3%	14.6	3%
	25215	14.3	14.3	14.2	0%	15.3	-8%	14.2	7%
	25000	13.2	13.2	13.1	0%	13.4	-2%	13.1	2%

Table A4.4B2 HEC-RAS to HEC-2 Conversion SCR Proposed n=0.025 continued

Subreach	HEC-RAS Station	HEC-RAS Mixed Vel Chnl (ft/s)	HEC-RAS Subcritical Vel Chnl (ft/s)	Fluvial HEC-RAS Subcritical Vel Chnl (ft/s)	Δ (%) Vel Chnl (ft/s %)	Fluvial HEC2 Vel Chnl (ft/s)	Δ (%) Vel Chnl (ft/s %)	Fluvial HEC2 IMPORT Subcritical Vel Chnl (ft/s)	Δ (%) Vel Chnl (ft/s %)
SRC4	24795	14.1	14.1	14.0	**0%**	14.3	**-2%**	14.0	**2%**
	24550	15.1	15.1	15.0	**1%**	15.4	**-3%**	15.0	**3%**
	24335	18.2	18.2	18.1	**1%**	18.2	**-1%**	18.1	**1%**
	24115	20.0	18.3	18.2	**0%**	18.3	**0%**	18.2	**0%**
	23975	20.8	18.0	18.0	**0%**	17.9	**0%**	18.0	**0%**
	23755	18.1	18.0	17.8	**1%**	17.8	**-1%**	17.8	**1%**
	23565	20.2	17.6	17.4	**1%**	17.5	**-1%**	17.4	**1%**
	23365	18.4	17.6	16.9	**4%**	17.1	**-1%**	16.9	**1%**
	23180	21.9	18.5	16.0	**13%**	17.0	**-6%**	17.0	**0%**
	23000	22.0	15.4	15.3	**0%**	16.2	**-5%**	15.8	**2%**
	22790	17.9	17.9	18.0	**0%**	17.9	**0%**	17.8	**1%**
	22600	19.8	17.4	16.6	**5%**	16.6	**0%**	16.6	**0%**
	22415	21.3	16.8	16.3	**3%**	16.4	**-1%**	16.3	**1%**
SRD1	22195	13.6	13.6	14.2	**-4%**	14.5	**-2%**	14.2	**2%**
	22010	16.1	16.1	15.4	**5%**	15.6	**-1%**	15.4	**1%**
	21790	19.7	15.9	14.7	**8%**	14.9	**-1%**	14.7	**1%**
	21615	21.3	15.6	14.8	**5%**	14.9	**-1%**	14.8	**1%**
	21440	17.5	16.1	15.0	**6%**	15.1	**-1%**	15.0	**1%**
	21225	18.1	15.2	14.3	**6%**	14.3	**0%**	14.4	**-1%**
	21020	20.3	14.9	12.3	**17%**	12.6	**-2%**	12.3	**2%**
	20845	15.1	15.1	14.3	**5%**	14.5	**-1%**	14.4	**1%**
	20595	12.4	12.4	11.1	**10%**	11.5	**-3%**	11.1	**3%**
	20435	12.1	12.1	10.8	**11%**	11.1	**-3%**	10.8	**3%**
	20280	15.6	15.6	14.5	**7%**	14.5	**0%**	14.5	**0%**
	20070	19.3	15.4	14.4	**6%**	14.4	**0%**	14.5	**0%**
SRD2	19855	20.6	15.2	14.3	**6%**	14.3	**0%**	14.2	**1%**
	19630	20.6	14.8	14.4	**3%**	15.9	**-11%**	14.4	**10%**
	19440	13.1	13.1	12.9	**2%**	13.2	**-2%**	12.9	**2%**
	19240	15.9	15.9	15.6	**2%**	15.6	**0%**	15.6	**0%**
	19050	18.8	12.7	12.2	**4%**	12.5	**-2%**	12.2	**2%**
	18830	13.3	13.3	12.1	**9%**	14.8	**-22%**	12.1	**18%**
	18650	12.1	12.1	10.8	**11%**	12.3	**-14%**	10.8	**12%**
	18475	8.9	8.9	8.8	**1%**	9.2	**-5%**	8.8	**5%**
	18290	9.8	9.8	9.4	**4%**	10.0	**-6%**	9.4	**6%**
	18025	7.9	7.9	7.8	**2%**	8.0	**-3%**	7.8	**3%**
	17785	8.5	8.5	8.4	**1%**	8.6	**-3%**	8.4	**3%**
SRD3	17510	11.0	11.0	10.1	**8%**	10.5	**-4%**	10.1	**4%**
	17360	17.1	17.1	16.9	**1%**	16.9	**0%**	16.9	**0%**
	17110	22.3	16.6	15.7	**6%**	15.9	**-1%**	15.7	**1%**
	16970	23.1	16.4	15.7	**4%**	16.0	**-2%**	15.7	**2%**
	16720	24.4	16.0	15.9	**0%**	15.9	**0%**	15.9	**0%**
	16515	19.4	15.4	15.4	**0%**	15.5	**-1%**	15.4	**1%**
	16305	11.6	11.6	11.1	**4%**	11.4	**-3%**	11.1	**3%**
	16130	15.7	15.7	15.2	**3%**	15.1	**0%**	15.2	**0%**
	15960	17.7	13.8	13.7	**1%**	14.8	**-9%**	14.7	**1%**
	15745	12.3	12.3	12.3	**0%**	15.1	**-23%**	13.4	**11%**
	15540	10.6	10.6	10.5	**0%**	11.5	**-9%**	11.2	**3%**
	15335	16.2	16.2	16.2	**0%**	16.2	**0%**	16.0	**1%**
SRE1	15125	17.9	16.6	16.6	**0%**	16.5	**1%**	16.4	**1%**
	14900	19.3	15.6	16.3	**-4%**	16.4	**-1%**	16.3	**1%**
	14720	18.1	15.1	15.9	**-5%**	16.1	**-1%**	15.9	**1%**
	14480	19.0	14.7	14.5	**1%**	14.6	**0%**	14.5	**1%**
	14315	14.0	13.8	14.0	**-2%**	13.8	**2%**	13.8	**0%**
	14090	14.3	13.8	13.7	**0%**	13.8	**-1%**	13.7	**1%**
	13850	12.6	12.6	13.9	**-10%**	13.7	**1%**	13.8	**0%**
	13635	15.5	15.5	14.0	**10%**	14.0	**-1%**	14.0	**1%**
	13425	18.0	13.5	13.5	**0%**	13.4	**0%**	13.5	**0%**
	13190	12.2	12.2	12.3	**-1%**	12.9	**-4%**	12.3	**4%**
SRE2	13030	14.2	14.2	12.0	**16%**	12.5	**-5%**	11.9	**5%**
	12835	13.3	13.3	11.8	**12%**	12.6	**-7%**	11.7	**7%**
	12615	12.5	12.5	11.0	**12%**	11.5	**-4%**	11.0	**5%**
	12395	12.3	12.3	10.9	**12%**	11.4	**-5%**	10.8	**5%**
	12195	10.6	10.6	10.0	**6%**	10.2	**-3%**	9.9	**3%**
	11995	12.8	12.8	11.1	**13%**	11.4	**-3%**	11.0	**4%**
	11780	12.6	12.6	10.4	**17%**	10.7	**-2%**	10.4	**3%**
	11605	13.9	13.9	11.6	**17%**	11.9	**-3%**	11.4	**4%**
	11405	13.2	13.2	12.1	**8%**	12.4	**-3%**	11.9	**4%**
	11180	16.6	16.6	15.2	**8%**	15.6	**-3%**	14.9	**4%**
SRE3	11015	19.1	19.1	18.9	**1%**	19.1	**-1%**	18.9	**1%**
	10835	21.9	17.9	17.7	**1%**	17.8	**0%**	17.7	**0%**
	10575	24.1	16.0	16.0	**0%**	16.0	**0%**	16.0	**0%**
	10390	22.7	16.3	12.7	**22%**	13.0	**-2%**	12.7	**2%**
	10225	17.8	15.0	14.7	**2%**	14.8	**-1%**	14.7	**1%**
	10000	14.9	14.9	14.6	**2%**	14.4	**1%**	14.6	**-1%**
	9820	18.6	15.0	14.9	**0%**	15.1	**-1%**	14.9	**1%**
	9595	14.6	14.6	14.5	**0%**	14.7	**-1%**	14.5	**1%**
	9385	15.8	14.0	13.8	**2%**	13.9	**-1%**	13.8	**1%**
	9220	16.4	13.7	13.7	**1%**	13.8	**-1%**	13.7	**1%**
	9025	15.9	14.3	13.8	**3%**	13.8	**0%**	13.8	**0%**

Santa Clara River Fluvial Study

APPENDIX CHAPTER 4.5

Existing & Proposed Conditions Hydraulic Subreach Analysis

PACIFIC ADVANCED CIVIL ENGINEERING, INC.

Table A4.5A1: Santa Clara River Existing Conditions Hec-Ras Output and Parameter Correlation: Reach A

Subreach	River Sta	Q Total	Min Ch El ft	W.S. Elev ft	Crit W.S. ft	E.G. Elev ft	E.G. Slope	Vel Chnl fps	Flow Area sq ft	Top Width ft	Froude #	bedslope 1	bedslope 2	bedslope 3
SRA1	**46195**	115111	1035.0	1054.3	1054.3	1060.3	0.004	19.7	5847.5	483.4	1.00			
	46020	115111	1032.0	1052.4	1052.4	1058.1	0.004	19.1	6013.5	531.5	1.00	0.017		
	45545	115111	1030.0	1049.2	1049.2	1055.7	0.004	20.3	5664.1	446.8	1.01	0.004	0.008	
	45030	115111	1025.0	1045.6	1044.6	1050.5	0.003	17.8	6472.9	521.5	0.89	0.010	0.007	0.009
	44585	115111	1022.0	1043.1	1043.1	1048.8	0.004	19.2	6003.6	531.9	1.01	0.007	0.008	0.007
	44210	115111	1020.0	1041.6	1038.7	1045.0	0.002	14.8	7793.1	585.9	0.71	0.005	0.006	0.007
SRA2	**43820**	115111	1018.0	1037.5	1037.5	1043.6	0.004	19.9	5785.5	476.5	1.01	0.005	0.005	0.006
	43610	115111	1017.0	1034.1	1034.1	1040.1	0.004	19.7	5832.2	483.7	1.00	0.005	0.005	0.005
	43410	115111	1016.0	1030.7	1030.7	1035.9	0.004	18.2	6338.3	623.3	1.00	0.005	0.005	0.005
	43200	115111	1014.0	1029.3	1029.3	1033.9	0.004	17.3	6660.7	737.2	1.00	0.010	0.007	0.006
	42975	115111	1012.0	1026.1	1026.1	1030.3	0.005	16.3	7050.2	860.4	1.01	0.009	0.009	0.008
	42815	115111	1011.0	1024.3	1024.3	1027.9	0.005	15.3	7548.6	1051.0	1.00	0.006	0.008	0.008
	42590	115111	1010.0	1021.3	1021.3	1024.8	0.005	15.0	7695.7	1112.9	1.00	0.004	0.005	0.007
	42430	115111	1008.0	1019.6	1019.6	1023.3	0.005	15.5	7449.5	1001.0	1.00	0.013	0.008	0.007
	42215	115111	1006.0	1020.4	1017.7	1022.0	0.002	10.2	11269.5	1312.6	0.61	0.009	0.011	0.008
	41940	115111	1005.0	1019.5	1017.7	1021.5	0.002	11.2	10258.2	1332.5	0.71	0.004	0.006	0.008
	41730	115111	1004.0	1018.9	1016.5	1021.0	0.002	11.4	10078.8	1249.1	0.71	0.005	0.004	0.006
	41460	115111	1002.0	1018.3	1015.2	1020.3	0.002	11.3	10198.6	1335.2	0.72	0.007	0.006	0.005
SRA3	**41280**	115111	1001.0	1015.3	1015.3	1019.5	0.005	16.4	7014.3	851.9	1.01	0.006	0.007	0.006
	41080	115111	1000.0	1013.6	1013.6	1017.6	0.005	16.1	7149.5	899.0	1.01	0.005	0.005	0.006
	40825	115111	999.5	1012.2	1012.2	1015.6	0.005	14.8	7757.4	1146.8	1.01	0.002	0.003	0.004
	40585	115111	998.0	1010.6	1010.6	1014.0	0.005	14.8	7785.2	1161.4	1.01	0.006	0.004	0.004
	40335	115111	996.0	1010.4	1008.9	1012.2	0.003	11.0	10452.1	1494.5	0.73	0.008	0.007	0.005
	40130	115111	995.0	1010.0	1008.4	1011.7	0.002	10.4	11087.0	1631.3	0.70	0.005	0.007	0.006
	39945	115111	994.0	1009.8	1007.6	1011.2	0.002	9.5	12146.7	1639.3	0.61	0.005	0.005	0.006
	39755	115111	994.0	1007.3	1007.3	1010.5	0.005	14.4	7974.8	1238.0	1.00	0.000	0.003	0.003
	39605	115111	993.0	1005.7	1005.7	1009.0	0.005	14.7	7830.6	1171.1	1.00	0.007	0.003	0.004
	39310	115111	992.0	1004.1	1004.1	1007.5	0.005	14.7	7842.0	1184.1	1.01	0.003	0.004	0.003
	39100	115111	990.0	1004.2	1002.0	1006.1	0.002	11.2	10276.1	1302.0	0.70	0.010	0.006	0.006
	38925	115111	989.5	1003.9	1001.3	1005.8	0.002	10.9	10519.7	1177.1	0.65	0.003	0.006	0.005
SRA4	**38710**	115111	988.0	1003.7	1000.0	1005.4	0.001	10.4	11078.5	1039.0	0.56	0.007	0.005	0.007
	38475	115111	986.0	1000.2	1000.2	1004.6	0.005	16.7	6875.8	795.5	1.00	0.009	0.008	0.006
	38300	115111	985.5	998.1	997.5	1002.3	0.004	16.5	6965.9	701.8	0.92	0.003	0.006	0.006
	38065	115111	984.0	998.2	995.7	1001.3	0.002	14.1	8168.8	678.4	0.72	0.006	0.005	0.006
	37810	115111	983.0	995.2	995.2	1000.4	0.004	18.2	6319.8	622.1	1.01	0.004	0.005	0.005
	37655	115111	982.0	994.2	994.2	998.5	0.004	16.8	6851.1	789.4	1.01	0.006	0.005	0.005
	37390	115111	981.0	989.9	989.9	993.7	0.004	15.7	7414.9	986.7	0.98	0.004	0.005	0.004
	37135	115111	980.0	988.6	988.6	992.1	0.005	15.1	7645.5	1091.6	1.00	0.004	0.004	0.004
	36930	115111	978.0	987.7	986.9	990.5	0.003	13.3	8648.1	1125.5	0.85	0.010	0.007	0.006
	36735	115111	977.0	986.4	986.4	989.7	0.004	14.6	7881.5	1194.2	1.00	0.005	0.008	0.006
	36515	115111	975.0	986.3	985.3	988.6	0.003	12.1	9521.5	1325.6	0.79	0.009	0.007	0.008
	36265	115111	974.0	985.2	984.8	987.8	0.003	13.1	8807.0	1373.1	0.91	0.004	0.006	0.006
corr(x,v)=	0.486087													
corr(x,a)=	-0.393283													
corr(x,b)=	**-0.5195**													
corr(x,m1)=	0.287884													
corr(x,m2)=	0.270636													
corr(x,m3)=	0.366906													

Figure A4.5A1: Santa Clara River Existing Conditions HEC-RAS Reach A - Station vs Top Width

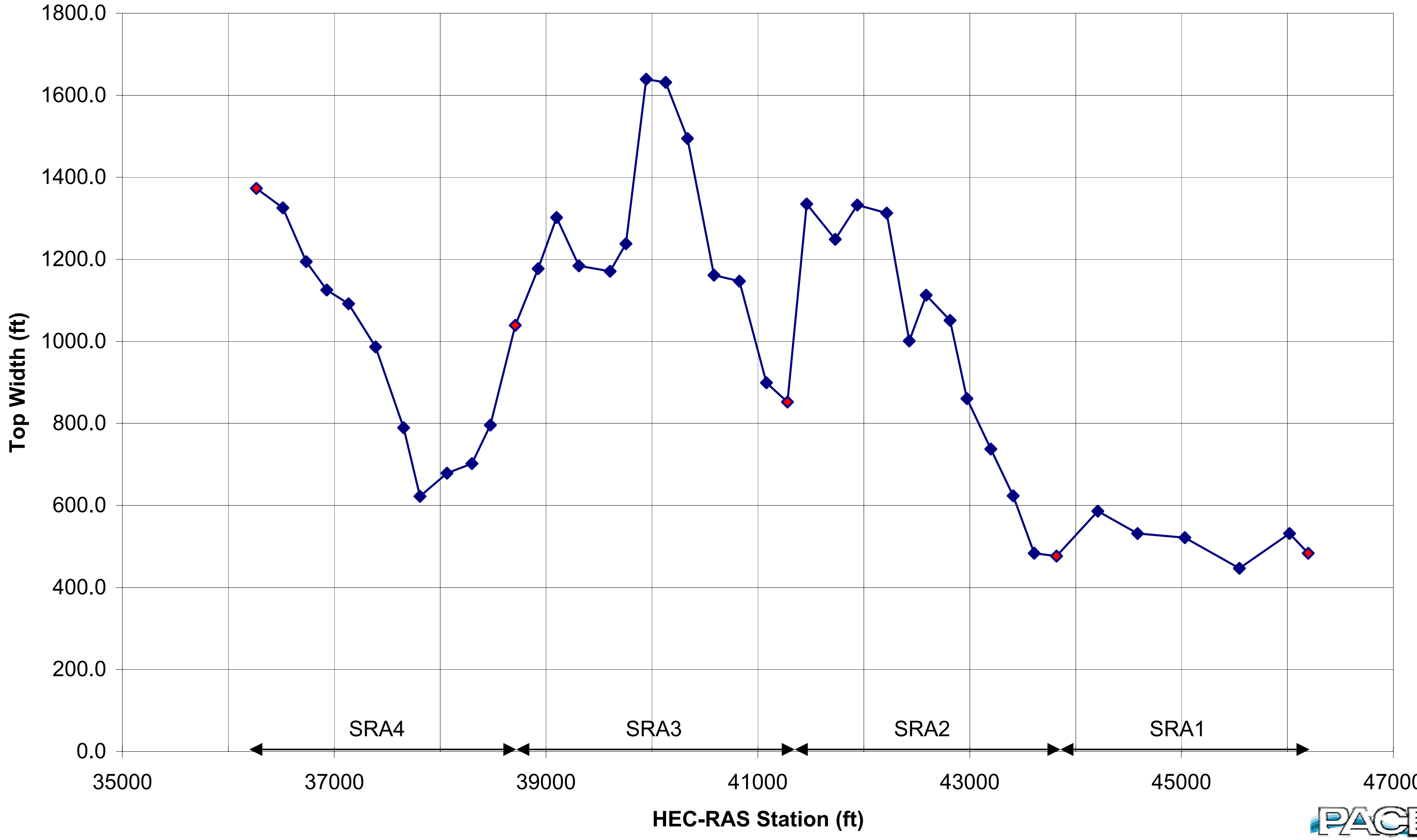

Table A4.5A2: Santa Clara River Existing Conditions Hec-Ras Output and Parameter Correlation: Reach B

Subreach	River Sta	Q Total	Min Ch El ft	W.S. Elev ft	Crit W.S. ft	E.G. Elev ft	E.G. Slope	Vel Chnl fps	Flow Area sq ft	Top Width ft	Froude #	bedslope 1	bedslope 2	bedslope 3
SRB1	**36080**	116236	973.0	984.1	984.1	987.0	0.005	13.7	8492.5	1450.4	1.00			
	35845	116236	971.0	983.9	982.8	986.0	0.002	11.6	10013.5	1478.1	0.79	0.009		
	35725	116236	970.0	982.6	982.6	985.5	0.004	13.8	8438.9	1427.9	1.00	0.008	0.008	
	35515	116236	969.0	981.3	981.3	984.4	0.004	14.0	8309.5	1362.8	1.00	0.005	0.006	0.007
	35245	116236	968.0	980.1	980.1	983.1	0.005	13.8	8434.2	1553.4	0.99	0.004	0.004	0.005
	35040	116236	967.0	978.4	978.3	981.4	0.005	13.8	8428.2	1401.8	0.98	0.005	0.004	0.004
	34860	116236	966.0	977.4	977.4	980.5	0.005	14.0	8307.5	1363.0	1.00	0.006	0.005	0.005
	34720	116236	965.5	976.2	976.2	979.2	0.005	13.9	8382.5	1419.6	1.01	0.004	0.005	0.005
	34495	116236	964.0	974.3	974.3	977.3	0.004	14.0	8313.9	1380.4	1.00	0.007	0.005	0.006
	34310	116236	963.0	972.7	972.7	975.8	0.004	14.3	8114.6	1297.7	1.01	0.005	0.006	0.005
	34090	116236	962.0	971.6	971.6	974.8	0.004	14.3	8123.9	1281.0	1.00	0.005	0.005	0.006
SRB2	**33880**	116236	960.0	970.5	970.5	973.6	0.004	14.2	8188.0	1320.1	1.00	0.010	0.007	0.007
	33710	116236	959.0	969.3	969.3	972.4	0.004	14.1	8238.1	1363.2	1.01	0.006	0.008	0.007
	33500	116236	958.0	968.2	968.2	970.8	0.004	13.1	8872.2	1690.4	1.01	0.005	0.005	0.007
	33310	116236	957.0	967.0	967.0	969.6	0.004	12.9	8986.4	1751.5	1.01	0.005	0.005	0.005
	33115	116236	956.0	966.4	965.6	968.3	0.004	11.3	10261.8	1811.5	0.84	0.005	0.005	0.005
	32795	116236	954.0	965.0	964.6	967.3	0.003	12.2	9528.8	1732.9	0.92	0.006	0.006	0.006
	32605	116236	952.0	963.5	963.5	966.5	0.004	14.1	8272.7	1344.6	1.00	0.011	0.008	0.007
corr(x,v)=	0.186906													
corr(x,a)=	-0.18573													
corr(x,b)=	**-0.37919**													
corr(x,m1)=	-0.14733													
corr(x,m2)=	-0.13339													
corr(x,m3)=	-0.33786													

PACE
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Figure A4.5A2: Santa Clara River Existing Conditions HEC-RAS Reach B - Station vs Top Width

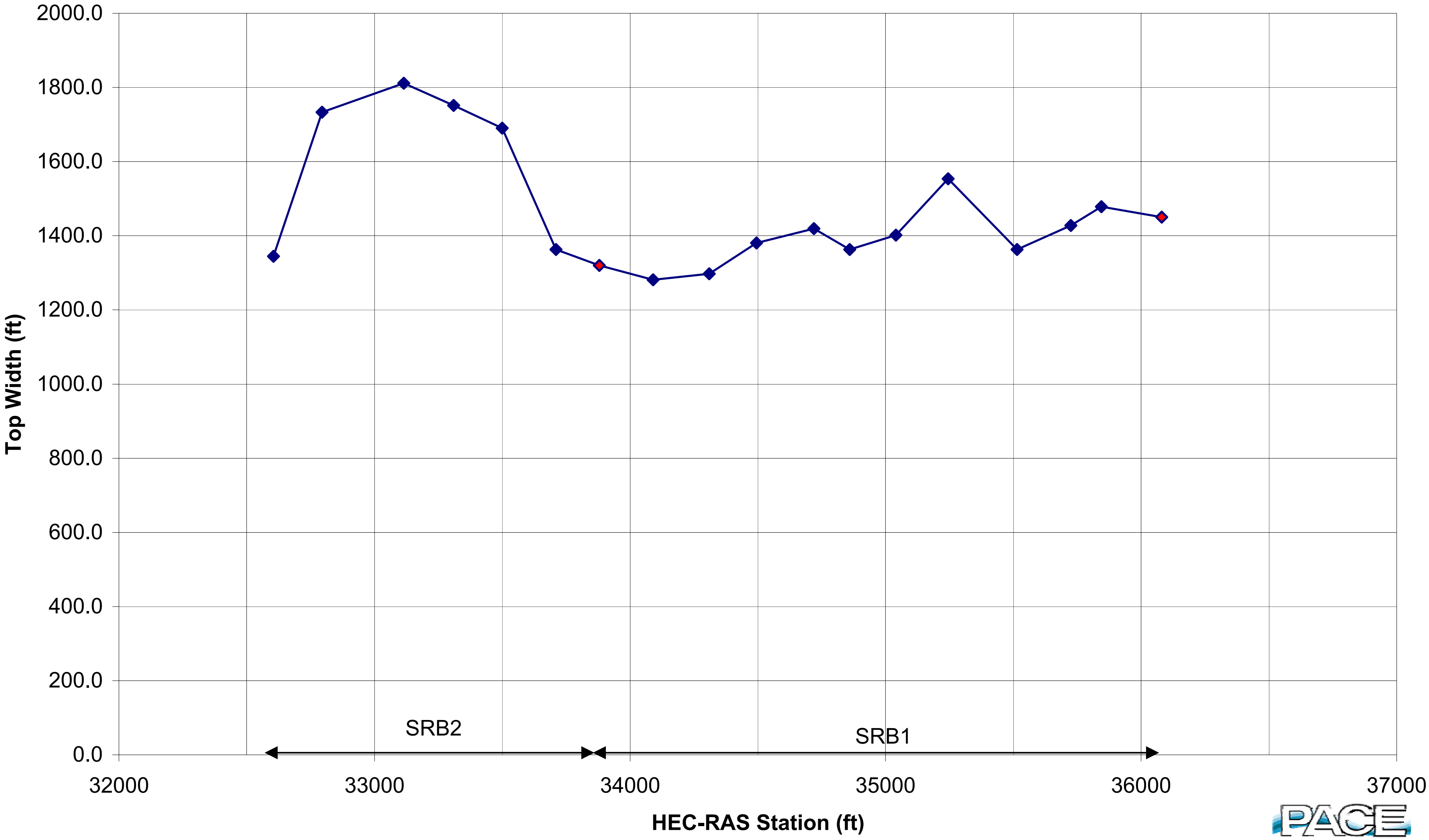


Table A4.5A3: Santa Clara River Existing Conditions Hec-Ras Output and Parameter Correlation: Reach C

Subreach	River Sta	Q Total	Min Ch El ft	W.S. Elev ft	Crit W.S. ft	E.G. Elev ft	E.G. Slope	Vel Chnl fps	Flow Area sq ft	Top Width ft	Froude #	bedslope 1	bedslope 2	bedslope 3
SRC1	**32265**	140776	950.0	961.4	961.4	964.1	0.004	13.3	10579.2	1944.9	1.01			
	31875	140776	949.0	960.0	960.0	961.9	0.004	10.9	12908.1	2482.2	0.84	0.003		
	31585	140776	946.0	957.7	957.0	959.6	0.004	11.3	12511.1	2181.1	0.83	0.010	0.006	
	31360	140776	944.0	957.2	955.4	958.9	0.002	10.5	13391.5	1875.2	0.69	0.009	0.010	0.007
	31060	140776	942.0	957.2	953.3	958.3	0.001	8.4	16729.5	1706.2	0.47	0.007	0.008	0.009
	30720	140776	940.0	957.3	951.3	958.0	0.001	6.8	20683.4	1886.9	0.36	0.006	0.006	0.007
	30445	140776	938.0	957.2	949.6	957.8	0.000	6.4	22074.1	1777.6	0.32	0.007	0.007	0.007
	30095	140776	936.0	957.0	947.9	957.7	0.000	6.8	20641.0	1666.4	0.34	0.006	0.006	0.006
	29815	140776	935.0	956.6	948.1	957.5	0.001	7.7	18373.0	1573.0	0.40	0.004	0.005	0.006
	29565	140776	934.0	956.5	947.3	957.3	0.001	7.5	18750.2	1613.5	0.39	0.004	0.004	0.005
	29385	140776	933.0	956.1	949.0	957.2	0.001	8.5	16517.2	1577.6	0.46	0.006	0.005	0.004
SRC2	**29140**	140776	932.0	954.7	951.0	956.8	0.002	11.5	12276.2	1324.5	0.66	0.004	0.005	0.004
	28895	140776	930.0	951.6	951.6	956.0	0.003	16.8	8402.3	965.7	1.00	0.008	0.006	0.006
	28695	140776	928.0	947.9	947.9	953.3	0.004	18.8	7507.5	701.1	1.01	0.010	0.009	0.007
	28500	140776	927.5	945.1	945.1	951.2	0.004	19.8	7160.2	654.2	0.99	0.003	0.006	0.007
	28280	140776	926.0	941.7	941.7	947.9	0.004	20.1	7009.5	562.7	1.00	0.007	0.005	0.007
	28080	140776	925.0	942.3	940.1	946.6	0.002	16.7	8442.0	682.9	0.80	0.005	0.006	0.005
	27925	140776	924.0	940.4	939.5	946.0	0.003	19.1	7355.4	549.8	0.92	0.006	0.006	0.006
	27725	140776	923.0	939.3	939.3	945.4	0.003	19.8	7106.6	586.7	1.00	0.005	0.006	0.005
	27545	140776	922.0	937.7	937.7	943.3	0.003	19.0	7395.6	656.5	1.00	0.006	0.005	0.006
	27335	140776	921.0	936.2	936.2	940.8	0.003	17.3	8160.9	887.0	1.00	0.005	0.005	0.005
	27155	140776	920.5	935.4	935.4	939.6	0.003	16.4	8571.6	1033.5	1.01	0.003	0.004	0.004
SRC3	**26990**	140776	920.0	933.7	933.7	937.6	0.004	15.8	8895.8	1147.6	1.00	0.003	0.003	0.004
	26780	140776	918.0	931.4	931.4	935.1	0.004	15.5	9080.7	1213.5	1.00	0.010	0.007	0.005
	26575	140776	917.0	930.6	930.0	933.7	0.004	14.2	9923.8	1259.9	0.89	0.005	0.007	0.006
	26355	140776	916.0	929.2	929.2	932.8	0.005	15.2	9247.2	1278.4	1.00	0.005	0.005	0.006
	26170	140776	915.0	928.9	928.1	931.7	0.003	13.5	10408.5	1352.5	0.86	0.005	0.005	0.005
	25965	140776	914.0	927.2	927.2	930.8	0.005	15.2	9254.7	1290.2	1.00	0.005	0.005	0.005
	25785	140776	913.5	926.1	926.1	929.5	0.005	15.0	9402.3	1344.9	1.00	0.003	0.004	0.004
	25600	140776	912.5	924.9	924.9	927.9	0.005	13.9	10151.1	1661.6	0.99	0.005	0.004	0.004
	25425	140776	911.0	925.4	923.8	927.0	0.002	10.3	13664.5	2021.6	0.69	0.009	0.007	0.006
	25215	140776	910.0	923.3	923.3	926.3	0.005	13.8	10181.3	1732.2	1.01	0.005	0.006	0.006
	25000	140776	909.0	922.1	922.1	924.6	0.004	12.6	11135.5	2284.2	1.01	0.005	0.005	0.006
SRC4	**24795**	140776	908.0	920.4	920.4	922.8	0.004	12.6	11204.7	2315.5	1.01	0.005	0.005	0.005
	24550	140776	906.0	919.5	918.0	921.0	0.002	9.7	14446.3	2238.3	0.68	0.008	0.007	0.006
	24335	140776	905.0	917.6	917.6	920.3	0.004	13.0	10833.4	2087.5	1.01	0.005	0.007	0.006
	24115	140776	904.0	915.9	915.9	918.6	0.005	13.1	10751.3	2018.8	1.00	0.005	0.005	0.006
	23975	140776	903.5	914.6	914.6	917.4	0.005	13.3	10577.2	1919.3	1.00	0.004	0.004	0.004
	23755	140776	902.0	913.3	913.2	916.0	0.005	13.3	10567.8	1938.0	1.01	0.007	0.006	0.005
	23565	140776	900.0	912.4	912.4	915.1	0.005	13.2	10692.0	2036.3	1.01	0.011	0.009	0.007
	23365	140776	900.0	911.1	911.1	914.0	0.005	13.6	10329.9	1783.9	1.00	0.000	0.005	0.006
	23180	140776	899.0	911.0	909.4	912.5	0.002	10.1	14012.5	2086.5	0.68	0.005	0.003	0.005
	23000	140776	898.0	910.9	908.4	912.1	0.001	9.0	15727.7	2065.4	0.57	0.006	0.005	0.004
	22790	140776	897.5	910.4	908.2	911.8	0.001	9.5	14833.4	1946.2	0.61	0.002	0.004	0.004
	22600	140776	896.0	910.1	907.6	911.6	0.001	9.5	14788.1	1866.4	0.60	0.008	0.005	0.005
	22415	140776	895.5	909.7	906.9	911.3	0.002	10.1	13933.7	1712.9	0.62	0.003	0.005	0.004
corr(x,v)=	-0.05991													
corr(x,a)=	0.2074													
corr(x,b)=	-0.22352													
corr(x,m1)=	0.195674													
corr(x,m2)=	0.31057													
corr(x,m3)=	**0.398648**													

Figure A4.5A3: Santa Clara River Existing Conditions HEC-RAS Reach C - Station vs Bedslope 3

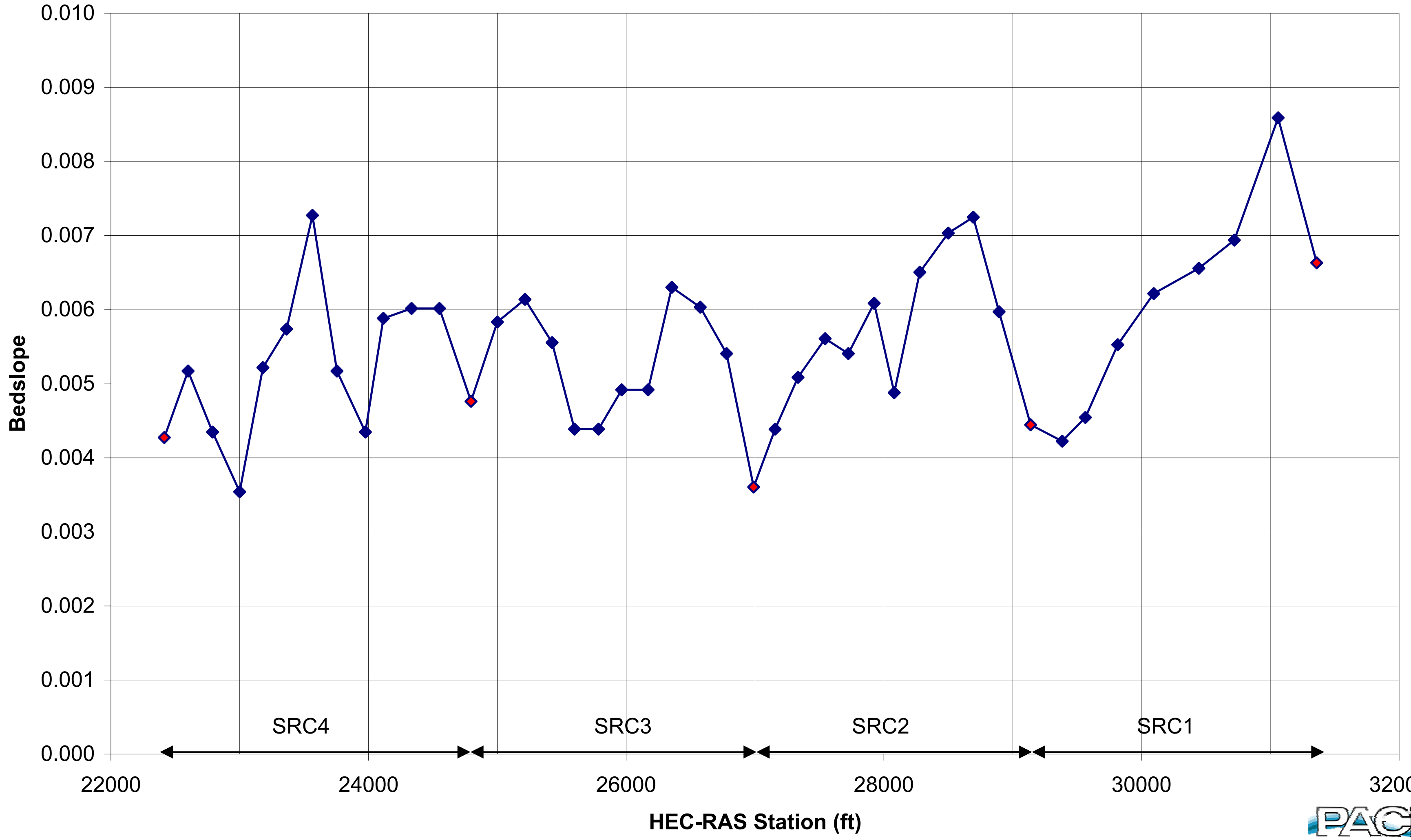


Table A4.5A4: Santa Clara River Existing Conditions Hec-Ras Output and Parameter Correlation: Reach D

Subreach	River Sta	Q Total	Min Ch El ft	W.S. Elev ft	Crit W.S. ft	E.G. Elev ft	E.G. Slope	Vel Chnl fps	Flow Area sq ft	Top Width ft	Froude #	bedslope 1	bedslope 2	bedslope 3
SRD1	**22195**	141426	894.0	906.9	906.9	910.5	0.004	15.4	9204.5	1262.7	1.00			
	22010	141426	892.0	906.2	906.2	909.7	0.003	15.1	9380.5	1322.1	1.00	0.011		
	21790	141426	891.5	904.9	904.9	908.1	0.003	14.4	9826.5	1586.7	1.00	0.002	0.006	
	21615	141426	892.0	903.1	903.1	906.0	0.003	13.7	10342.2	1845.7	1.00	-0.003	0.000	0.003
	21440	141426	890.0	901.2	901.2	904.5	0.004	14.6	9680.3	1773.5	1.00	0.011	0.004	0.004
	21225	141426	888.0	899.8	899.8	902.3	0.004	12.6	11221.5	2263.5	1.00	0.009	0.010	0.006
	21020	141426	887.0	897.4	897.4	900.4	0.004	13.8	10350.8	1908.4	0.99	0.005	0.007	0.008
	20845	141426	886.0	897.0	897.0	899.4	0.004	12.5	11348.1	2407.3	1.01	0.006	0.005	0.007
	20595	141426	885.0	896.4	895.9	898.3	0.003	11.0	12863.1	2527.3	0.86	0.004	0.005	0.005
	20435	141426	884.0	896.2	895.3	897.8	0.002	10.3	13709.7	2581.1	0.79	0.006	0.005	0.005
	20280	141426	883.7	895.0	895.0	897.3	0.004	12.1	11653.2	2572.8	1.00	0.002	0.004	0.004
	20070	141426	882.0	892.7	892.7	895.1	0.004	12.4	11394.6	2436.1	1.01	0.008	0.005	0.006
SRD2	**19855**	141426	880.5	891.1	891.1	893.8	0.004	13.1	10778.8	2072.9	1.01	0.007	0.008	0.006
	19630	141426	880.0	889.8	889.7	892.5	0.004	13.2	10735.2	1915.0	0.98	0.002	0.005	0.006
	19440	141426	878.0	889.9	888.7	891.7	0.002	10.8	13151.5	2083.7	0.75	0.011	0.006	0.006
	19240	141426	877.5	888.9	888.5	891.1	0.003	12.1	11650.5	2090.1	0.91	0.003	0.006	0.005
	19050	141426	876.0	889.0	887.2	890.5	0.002	9.6	14759.7	2167.4	0.64	0.008	0.005	0.007
	18830	141426	874.0	888.7	886.5	890.1	0.001	9.3	15134.9	2098.9	0.61	0.009	0.009	0.007
	18650	141426	873.5	888.7	885.4	889.8	0.001	8.5	16644.3	2025.1	0.52	0.003	0.006	0.007
	18475	141426	872.0	888.7	884.6	889.6	0.001	7.7	18373.6	1945.0	0.44	0.009	0.006	0.007
	18290	141426	871.5	888.4	884.4	889.4	0.001	8.1	17448.5	1844.7	0.46	0.003	0.006	0.005
	18025	141426	870.0	888.3	882.8	889.2	0.001	7.6	18674.7	1611.8	0.39	0.006	0.004	0.006
	17785	141426	868.0	887.9	882.8	889.0	0.001	8.5	16558.7	1418.6	0.44	0.008	0.007	0.006
SRD3	**17510**	141426	867.5	886.2	883.7	888.6	0.002	12.3	11457.1	1289.7	0.73	0.002	0.005	0.005
	17360	141426	866.5	883.4	883.4	887.9	0.004	16.9	8357.4	937.1	1.00	0.007	0.004	0.005
	17110	141426	864.0	881.1	881.1	884.6	0.005	15.0	9425.5	1362.5	1.01	0.010	0.009	0.006
	16970	141426	863.7	879.7	879.7	883.0	0.005	14.4	9799.5	1514.8	1.00	0.002	0.007	0.007
	16720	141426	863.5	875.3	875.3	878.4	0.005	14.2	9981.9	1621.0	1.01	0.001	0.001	0.005
	16515	141426	862.0	873.5	873.5	876.3	0.005	13.4	10549.7	1886.9	1.00	0.007	0.004	0.003
	16305	141426	860.0	871.6	871.2	874.0	0.004	12.6	11236.9	1898.6	0.91	0.010	0.008	0.006
	16130	141426	860.0	870.5	870.5	873.2	0.004	13.3	10641.4	1965.0	1.01	0.000	0.005	0.006
	15960	141426	859.0	869.2	869.2	871.8	0.005	12.8	11034.6	2193.0	1.01	0.006	0.003	0.005
	15745	141426	858.0	868.6	867.8	870.4	0.003	10.9	12927.8	2278.9	0.81	0.005	0.005	0.004
	15540	141426	857.5	868.1	867.1	869.8	0.003	10.4	13602.2	2324.4	0.76	0.002	0.004	0.004
	15335	141426	856.0	866.5	866.5	869.0	0.005	12.6	11254.1	2302.4	1.00	0.007	0.005	0.005
corr(x,v)=	**0.170227**													
corr(x,a)=	-0.15893													
corr(x,b)=	0.035906													
corr(x,m1)=	0.087873													
corr(x,m2)=	0.094747													
corr(x,m3)=	0.162424													

Figure A4.5A4: Santa Clara River Existing Conditions HEC-RAS Reach D - Station vs Channel Velocity

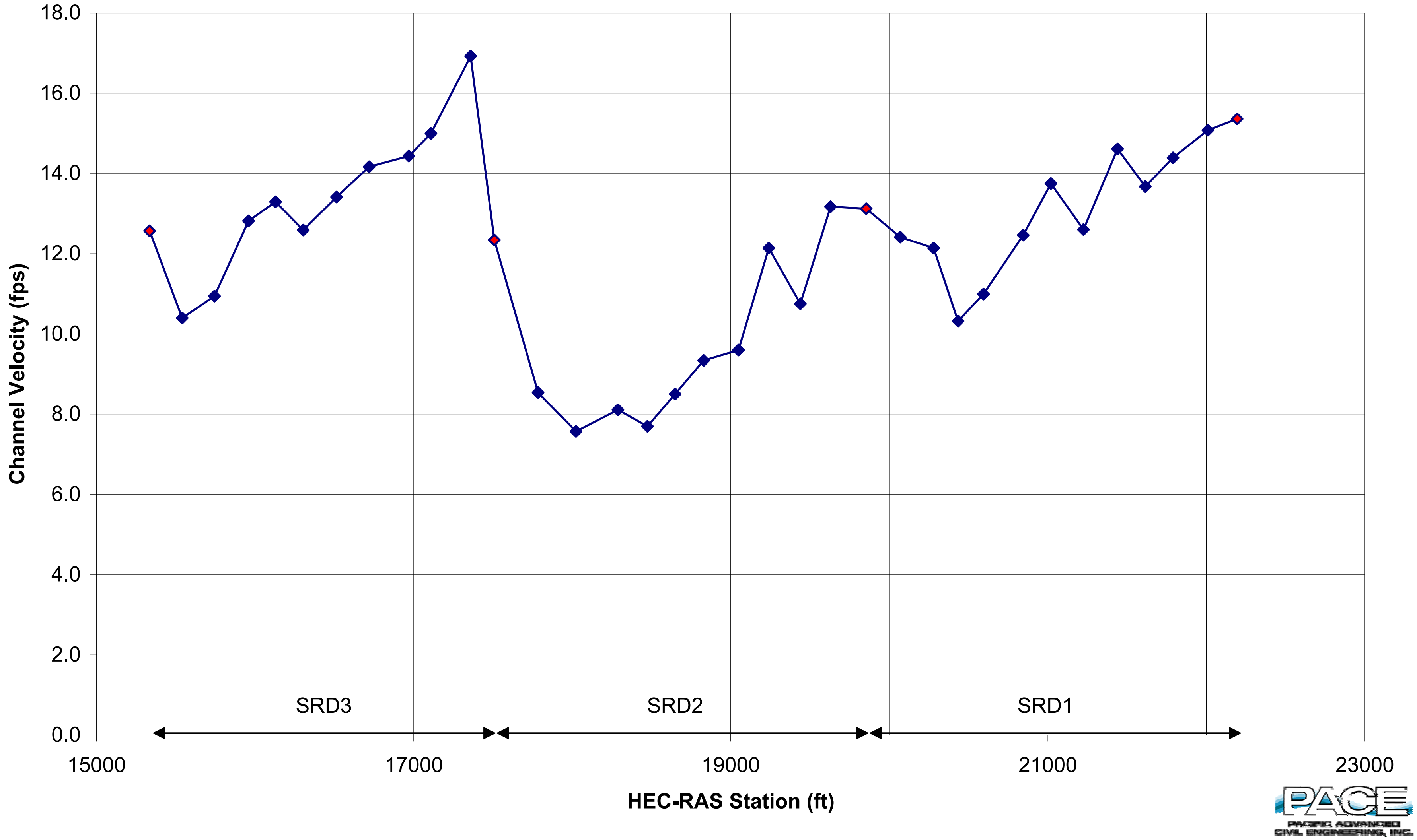


Table A4.5A5: Santa Clara River Existing Conditions Hec-Ras Output and Parameter Correlation: Reach E

Subreach	River Sta	Q Total	Min Ch El ft	W.S. Elev ft	Crit W.S. ft	E.G. Elev ft	E.G. Slope	Vel Chnl fps	Flow Area sq ft	Top Width ft	Froude #	bedslope 1	bedslope 2	bedslope 3
SRE1	**15125**	142475	854.0	864.5	864.5	867.5	0.004	13.7	10371.5	1769.0	1.00			
	14900	142475	853.0	863.3	863.3	866.3	0.005	14.0	10205.6	1697.8	1.00	0.004		
	14720	142475	852.0	862.1	862.1	865.0	0.005	13.7	10381.9	1810.0	1.01	0.006	0.005	
	14480	142475	850.5	860.5	860.5	863.5	0.004	13.7	10409.0	1796.5	1.00	0.006	0.006	0.005
	14315	142475	850.0	859.9	859.8	862.7	0.005	13.5	10576.7	1874.0	1.00	0.003	0.005	0.005
	14090	142475	849.7	858.7	858.7	861.6	0.005	13.7	10387.9	1766.9	1.00	0.001	0.002	0.004
	13850	142475	848.0	857.1	857.1	860.1	0.005	13.8	10293.9	1731.4	1.00	0.007	0.004	0.004
	13635	142475	846.0	856.0	856.0	859.0	0.005	14.0	10182.3	1687.5	1.00	0.009	0.008	0.006
	13425	142475	845.0	854.6	854.6	857.4	0.004	13.4	10627.8	1893.5	1.00	0.005	0.007	0.007
	13190	142475	844.0	853.1	852.8	855.6	0.004	12.7	11213.3	1844.9	0.91	0.004	0.004	0.006
SRE2	**13030**	142475	843.0	852.7	852.0	855.0	0.003	12.3	11565.9	1764.2	0.85	0.006	0.005	0.005
	12835	142475	842.0	852.1	851.0	854.4	0.003	12.1	11770.0	1607.6	0.79	0.005	0.006	0.005
	12615	142475	841.0	851.8	849.8	853.8	0.002	11.3	12646.0	1470.5	0.68	0.005	0.005	0.005
	12395	142475	840.0	851.5	849.2	853.4	0.002	11.1	12874.2	1438.1	0.65	0.005	0.005	0.005
	12195	142475	839.0	851.4	848.1	853.0	0.001	10.1	14130.7	1388.8	0.56	0.005	0.005	0.005
	11995	142475	837.0	850.7	848.1	852.7	0.002	11.3	12590.6	1281.4	0.64	0.010	0.008	0.006
	11780	142475	836.0	850.5	847.7	852.3	0.001	10.7	13373.2	1402.9	0.61	0.005	0.007	0.007
	11605	142475	835.5	849.7	847.2	852.0	0.002	12.0	11833.0	1304.2	0.70	0.003	0.004	0.006
	11405	142475	834.0	849.4	846.2	851.7	0.001	12.0	11855.1	1132.2	0.65	0.008	0.005	0.005
	11180	142475	833.0	847.6	845.6	851.1	0.003	15.0	9504.9	868.5	0.80	0.004	0.006	0.005
SRE3	**11015**	142475	831.5	844.8	844.8	850.4	0.004	18.9	7530.6	680.3	1.00	0.009	0.006	0.007
	10835	142475	831.0	843.8	843.8	848.6	0.004	17.7	8059.6	834.5	1.00	0.003	0.006	0.005
	10575	142475	830.0	840.2	840.2	844.1	0.004	16.0	8918.2	1127.5	1.00	0.004	0.003	0.005
	10390	142475	828.0	839.5	838.6	842.2	0.003	13.2	10811.2	1390.1	0.83	0.011	0.007	0.006
	10225	142475	827.5	838.2	838.2	841.6	0.004	14.7	9676.6	1447.2	1.00	0.003	0.007	0.006
	10000	142475	826.0	837.1	837.1	840.4	0.004	14.6	9744.8	1487.1	1.01	0.007	0.005	0.007
	9820	142475	824.0	835.4	835.4	838.8	0.004	15.0	9530.3	1373.2	1.00	0.011	0.009	0.007
	9595	142475	823.8	834.1	834.1	837.4	0.005	14.6	9769.1	1619.4	1.00	0.001	0.005	0.006
	9385	142475	823.0	833.1	833.1	836.0	0.005	13.7	10378.5	1773.7	1.00	0.004	0.002	0.005
	9220	142475	822.0	831.8	831.8	834.7	0.005	13.7	10412.7	1813.7	1.01	0.006	0.005	0.003
	9025	142475	821.0	830.4	830.4	833.4	0.004	13.8	10348.0	1751.7	1.00	0.005	0.006	0.005
corr(x,v)=	-0.248811													
corr(x,a)=	0.216874													
corr(x,b)=	**0.4079725**													
corr(x,m1)=	-0.076918													
corr(x,m2)=	-0.084312													
corr(x,m3)=	-0.104576													

Figure A4.5A5: Santa Clara River Existing Conditions HEC-RAS Reach E - Station vs Top Width

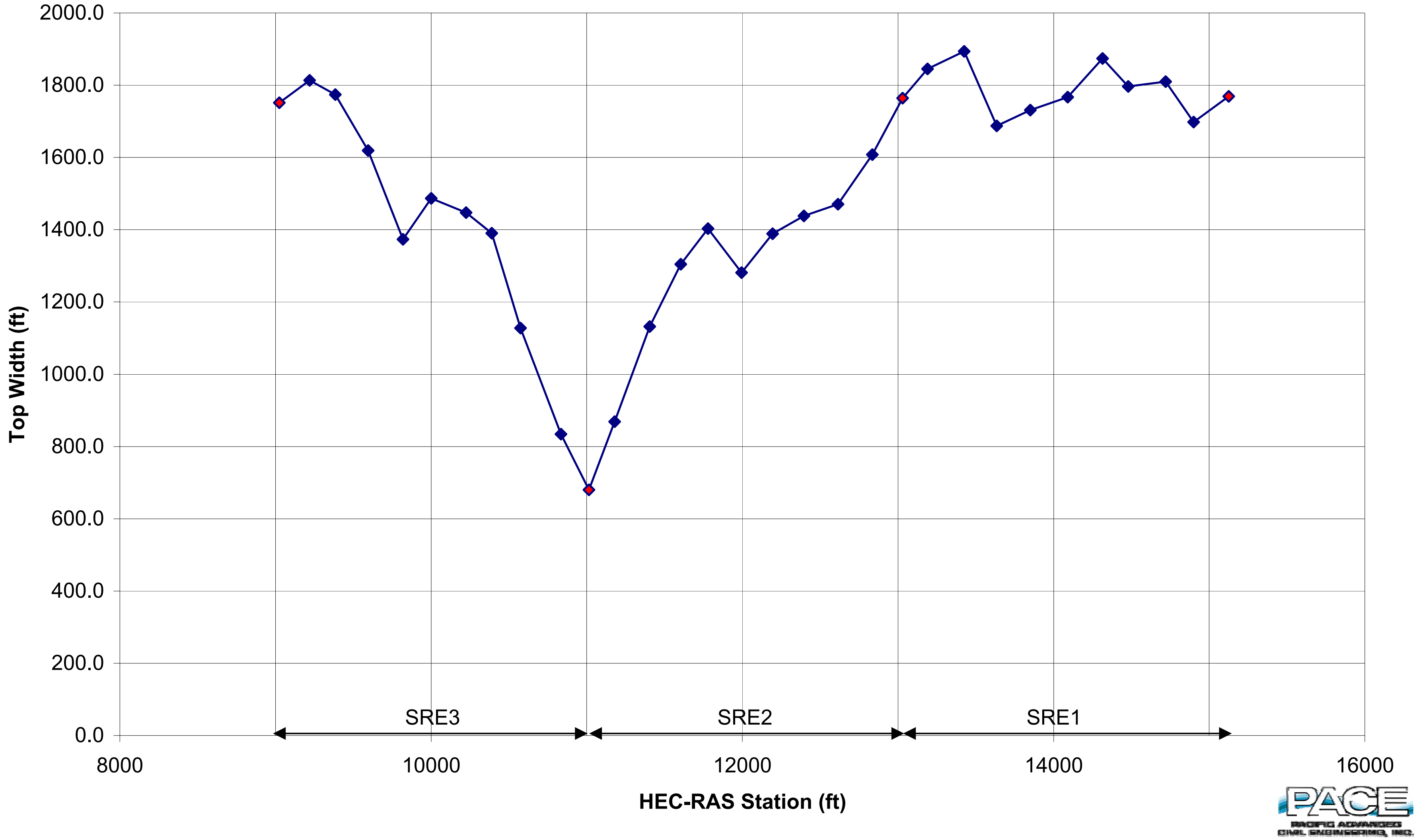


Table A4.5B1: Santa Clara River Proposed Conditions Hec-Ras Output and Parameter Correlation: Reach A

Subreach	River Sta	Q Total	Min Ch El ft	W.S. Elev ft	Crit W.S. ft	E.G. Elev ft	E.G. Slope	Vel Chnl fps	Flow Area sq ft	Top Width ft	Froude #	bedslope 1	bedslope 2	bedslope 3
SRA1	**46195**	115111	1035.0	1054.3	1054.3	1060.3	0.004	19.7	5847.5	483.4	1.00			
	46020	115111	1032.0	1052.4	1052.4	1058.1	0.004	19.1	6013.5	531.5	1.00	0.017		
	45545	115111	1030.0	1049.2	1049.2	1055.7	0.004	20.3	5664.2	446.8	1.01	0.004	0.008	
	45030	115111	1025.0	1045.6	1044.6	1050.5	0.003	17.8	6472.4	521.5	0.89	0.010	0.007	0.009
	44585	115111	1022.0	1043.1	1043.1	1048.8	0.004	19.2	6004.2	531.9	1.01	0.007	0.008	0.007
	44210	115111	1020.0	1041.6	1038.7	1045.0	0.002	14.8	7793.3	585.9	0.71	0.005	0.006	0.007
SRA2	**43820**	115111	1018.0	1037.5	1037.5	1043.6	0.004	19.9	5785.1	476.5	1.01	0.005	0.005	0.006
	43610	115111	1017.0	1034.1	1034.1	1040.1	0.004	19.7	5832.0	483.7	1.00	0.005	0.005	0.005
	43410	115111	1016.0	1030.7	1030.7	1035.9	0.004	18.1	6344.4	623.6	1.00	0.005	0.005	0.005
	43200	115111	1014.0	1029.3	1029.3	1033.9	0.004	17.2	6697.3	738.0	1.01	0.010	0.007	0.006
	42975	115111	1012.0	1026.1	1026.1	1030.3	0.005	16.3	7064.9	860.6	1.00	0.009	0.009	0.008
	42815	115111	1011.0	1024.4	1024.4	1028.0	0.005	15.4	7497.0	1037.2	1.01	0.006	0.008	0.008
	42590	115111	1010.0	1021.5	1021.5	1025.0	0.005	15.1	7649.4	1098.8	1.01	0.004	0.005	0.007
	42430	115111	1008.0	1020.3	1020.3	1024.0	0.005	15.6	7396.5	1011.9	1.00	0.013	0.008	0.007
	42215	115111	1006.0	1019.7	1018.7	1022.3	0.003	12.7	9040.3	1182.7	0.81	0.009	0.011	0.008
	41940	115111	1005.0	1019.3	1017.7	1021.4	0.002	11.6	9945.3	1284.3	0.73	0.004	0.006	0.008
	41730	115111	1004.0	1018.7	1016.5	1020.8	0.002	11.8	9727.4	1189.1	0.73	0.005	0.004	0.006
	41460	115111	1002.0	1018.1	1015.2	1020.2	0.002	11.7	9876.9	1057.3	0.67	0.007	0.006	0.005
SRA3	**41280**	115111	1001.0	1015.3	1015.3	1019.5	0.005	16.4	7032.5	852.2	1.00	0.006	0.007	0.006
	41080	115111	1000.0	1013.6	1013.6	1017.6	0.005	16.0	7175.8	899.5	1.00	0.005	0.005	0.006
	40825	115111	999.5	1012.1	1012.1	1015.6	0.005	15.0	7673.9	1123.0	1.01	0.002	0.003	0.004
	40585	115111	998.0	1010.6	1010.6	1014.0	0.005	14.9	7741.1	1139.8	1.01	0.006	0.004	0.004
	40335	115111	996.0	1011.0	1008.7	1012.7	0.002	10.7	10771.0	1248.8	0.64	0.008	0.007	0.005
	40130	115111	995.0	1010.4	1008.3	1012.3	0.002	11.1	10380.2	1195.0	0.66	0.005	0.007	0.006
	39945	115111	994.0	1010.2	1007.6	1011.9	0.002	10.7	10785.0	1172.5	0.62	0.005	0.005	0.006
	39755	115111	994.0	1007.2	1007.2	1011.2	0.005	16.1	7140.7	893.3	1.00	0.000	0.003	0.003
	39605	115111	993.0	1005.8	1005.8	1009.9	0.005	16.2	7091.8	873.2	1.00	0.007	0.003	0.004
	39310	115111	992.0	1004.4	1004.4	1008.3	0.005	15.9	7232.2	929.3	1.01	0.003	0.004	0.003
	39100	115111	990.0	1003.7	1002.1	1006.9	0.003	14.2	8088.1	788.3	0.78	0.010	0.006	0.006
	38925	115111	989.5	1003.7	1001.5	1006.3	0.002	12.9	8958.4	873.3	0.71	0.003	0.006	0.005
SRA4	**38710**	115111	988.0	1003.6	1000.3	1005.8	0.002	12.1	9534.8	820.2	0.62	0.007	0.005	0.007
	38475	115111	986.0	1000.0	1000.0	1005.0	0.004	17.8	6455.5	659.8	1.00	0.009	0.008	0.006
	38300	115111	985.5	997.9	997.9	1002.7	0.004	17.7	6520.8	677.2	1.00	0.003	0.006	0.006
	38065	115111	984.0	998.0	995.7	1001.3	0.002	14.5	7917.9	658.4	0.74	0.006	0.005	0.006
	37810	115111	983.0	995.2	995.2	1000.4	0.004	18.2	6321.3	618.2	1.00	0.004	0.005	0.005
	37655	115111	982.0	994.1	994.1	998.8	0.004	17.4	6619.8	713.6	1.01	0.006	0.005	0.005
	37390	115111	981.0	991.5	990.1	994.6	0.003	14.2	8124.7	840.6	0.80	0.004	0.005	0.004
	37135	115111	980.0	989.3	989.3	993.6	0.005	16.6	6941.6	821.4	1.01	0.004	0.004	0.004
	36930	115111	978.0	987.9	987.5	991.7	0.004	15.6	7364.7	834.7	0.93	0.010	0.007	0.006
	36735	115111	977.0	986.9	986.9	990.9	0.005	16.1	7167.6	897.0	1.00	0.005	0.008	0.006
	36515	115111	975.0	987.0	985.4	989.6	0.002	12.8	8997.4	994.8	0.75	0.009	0.007	0.008
	36265	115111	974.0	986.5	985.2	988.8	0.003	12.3	9335.4	1176.0	0.77	0.004	0.006	0.006
corr(x,v)=	**0.420839**													
corr(x,a)=	-0.34894													
corr(x,b)=	-0.35235													
corr(x,m1)=	0.287884													
corr(x,m2)=	0.270636													
corr(x,m3)=	0.366906													

Figure A4.5B1: Santa Clara River Proposed Conditions HEC-RAS Reach A - Station vs Channel Velocity

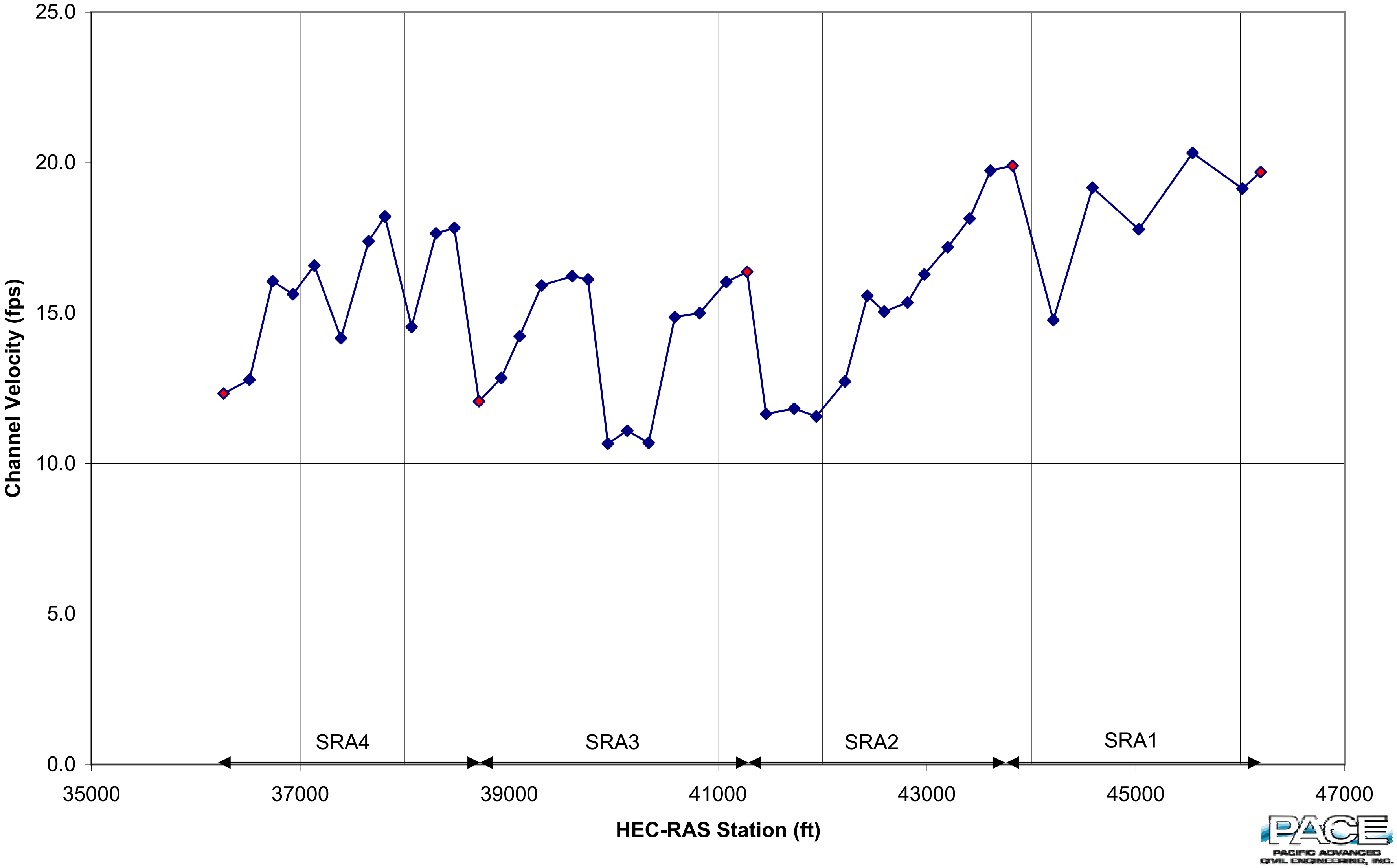


Table A4.5B2: Santa Clara River Proposed Conditions Hec-Ras Output and Parameter Correlation: Reach B

Subreach	River Sta	Q Total	Min Ch El ft	W.S. Elev ft	Crit W.S. ft	E.G. Elev ft	E.G. Slope	Vel Chnl fps	Flow Area sq ft	Top Width ft	Froude #	bedslope 1	bedslope 2	bedslope 3
SRB1	**36080**	116236	973.0	984.6	984.6	988.0	0.006	14.7	7914.1	1176.0	1.00			
	35845	116236	971.0	984.1	982.9	986.2	0.003	11.7	9897.1	1385.2	0.76	0.009		
	35725	116236	970.0	982.6	982.6	985.7	0.005	14.1	8236.8	1374.9	1.00	0.008	0.008	
	35515	116236	969.0	981.3	981.3	984.4	0.004	14.0	8305.4	1363.6	1.00	0.005	0.006	0.007
	35245	116236	968.0	980.2	980.2	983.1	0.005	13.7	8476.1	1553.7	1.00	0.004	0.004	0.005
	35040	116236	967.0	978.3	978.3	981.4	0.005	13.9	8335.5	1400.5	1.01	0.005	0.004	0.004
	34860	116236	966.0	977.4	977.4	980.5	0.004	14.1	8261.7	1362.4	1.01	0.006	0.005	0.005
	34720	116236	965.5	976.2	976.2	979.2	0.004	13.9	8382.6	1419.6	1.01	0.004	0.005	0.005
	34495	116236	964.0	974.3	974.3	977.3	0.004	14.0	8314.1	1380.4	1.00	0.007	0.005	0.006
	34310	116236	963.0	972.6	972.6	975.8	0.005	14.3	8141.1	1311.4	1.01	0.005	0.006	0.005
	34090	116236	962.0	971.6	971.6	974.7	0.004	14.2	8178.3	1312.6	1.00	0.005	0.005	0.006
SRB2	**33880**	116236	960.0	970.3	970.3	973.3	0.004	14.1	8232.7	1343.5	1.01	0.010	0.007	0.007
	33710	116236	959.0	969.3	969.3	972.3	0.004	14.0	8301.6	1377.9	1.01	0.006	0.008	0.007
	33500	116236	958.0	968.1	968.1	970.7	0.005	13.1	8884.5	1720.7	1.01	0.005	0.005	0.007
	33310	116236	957.0	967.0	967.0	969.5	0.004	12.9	9026.4	1780.3	1.01	0.005	0.005	0.005
	33115	116236	956.0	966.6	965.3	968.3	0.003	10.4	11217.6	1847.3	0.74	0.005	0.005	0.005
	32795	116236	954.0	964.6	964.6	967.2	0.004	13.0	8949.4	1735.6	1.01	0.006	0.006	0.006
	32605	116236	952.0	963.6	963.6	966.3	0.004	13.1	8889.4	1766.1	1.00	0.011	0.008	0.007
corr(x,v)=	0.387052													
corr(x,a)=	-0.3601													
corr(x,b)=	**-0.74378**													
corr(x,m1)=	-0.14733													
corr(x,m2)=	-0.13339													
corr(x,m3)=	-0.33786													

Figure A4.5B2: Santa Clara River Proposed Conditions HEC-RAS Reach B - Station vs Top Width

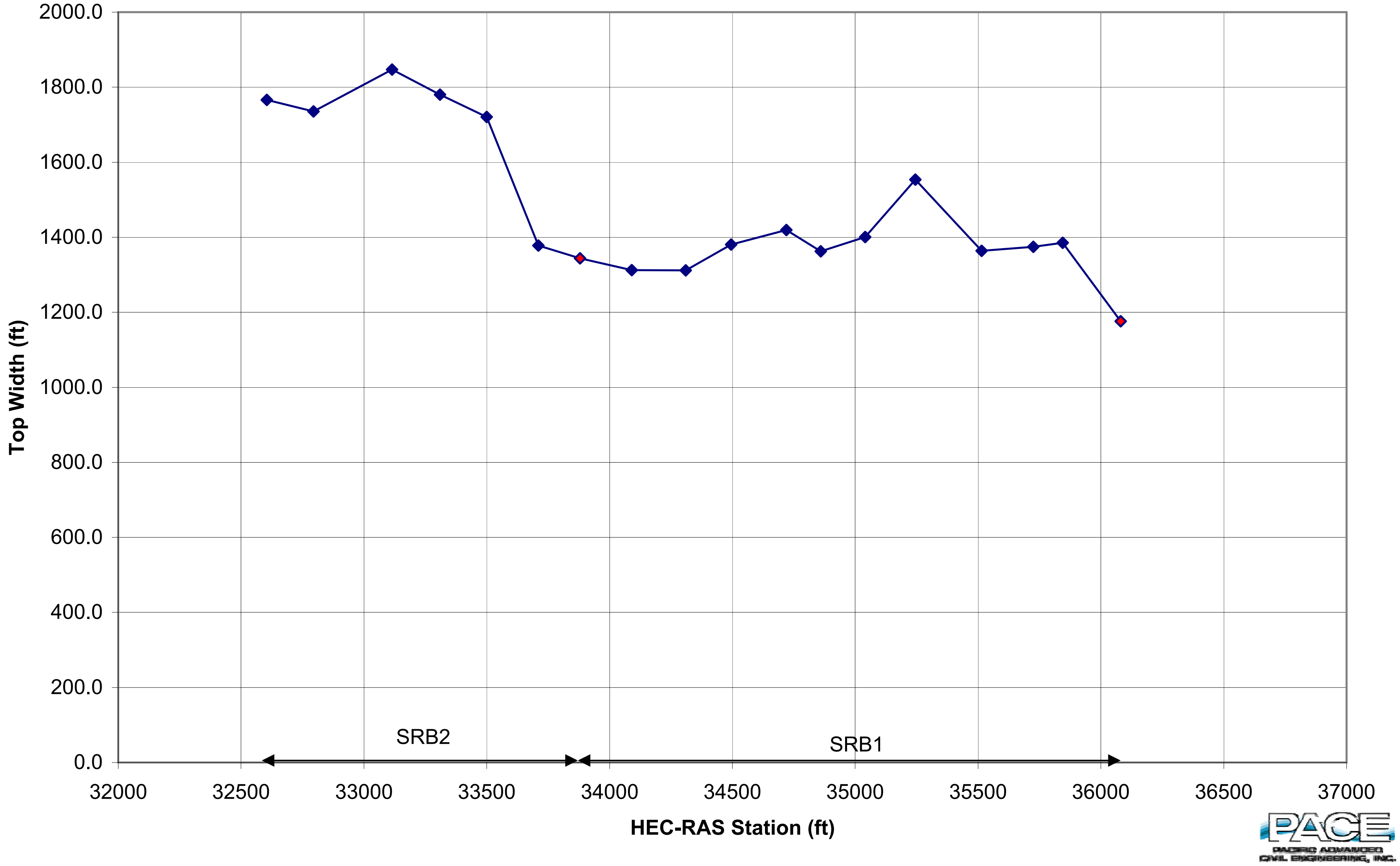


Table A4.5B3: Santa Clara River Proposed Conditions Hec-Ras Output and Parameter Correlation: Reach C

Subreach	River Sta	Q Total	Min Ch El ft	W.S. Elev ft	Crit W.S. ft	E.G. Elev ft	E.G. Slope	Vel Chnl fps	Flow Area sq ft	Top Width ft	Froude #	bedslope 1	bedslope 2	bedslope 3
SRC1	**32265**	140776	950.0	961.3	961.3	964.1	0.004	13.4	10505.6	1941.1	1.02	0.006	0.008	0.007
	31875	140776	949.0	959.4	959.4	961.8	0.006	12.4	11368.1	2409.1	1.00	0.003	0.004	0.005
	31585	140776	946.0	957.3	957.0	959.5	0.004	12.1	11630.6	2178.5	0.92	0.010	0.006	0.006
	31360	140776	944.0	956.6	955.4	958.6	0.003	11.5	12197.9	1866.2	0.80			
	31060	140776	942.0	956.6	953.3	957.9	0.001	9.0	15628.5	1701.3	0.52	0.007		
	30720	140776	940.0	956.6	951.3	957.4	0.001	7.3	19427.4	1882.3	0.40	0.006	0.006	
	30445	140776	938.0	956.5	949.6	957.2	0.000	6.8	20869.5	1771.8	0.35	0.007	0.007	0.007
	30095	140776	936.0	956.3	947.9	957.1	0.000	7.0	20255.2	1619.5	0.35	0.006	0.006	0.006
	29815	140776	935.0	955.9	948.1	956.9	0.001	7.9	17894.8	1430.1	0.39	0.004	0.005	0.006
	29565	140776	934.0	955.8	947.3	956.7	0.001	7.7	18197.7	1320.3	0.37	0.004	0.004	0.005
	29385	140776	933.0	955.5	949.4	956.6	0.001	8.6	16378.8	1233.0	0.42	0.006	0.005	0.004
SRC2	**29140**	140776	932.0	954.8	950.0	956.4	0.001	10.2	13831.1	1082.5	0.50	0.004	0.005	0.004
	28895	140776	930.0	951.3	951.3	955.7	0.004	16.8	8407.0	966.7	1.00	0.008	0.006	0.006
	28695	140776	928.0	948.3	945.7	951.0	0.002	13.3	10604.2	929.9	0.69	0.010	0.009	0.007
	28500	140776	927.5	946.0	946.0	950.3	0.005	16.7	8456.7	998.2	1.01	0.003	0.006	0.007
	28280	140776	926.0	943.4	939.9	945.6	0.001	11.9	11789.8	976.2	0.61	0.007	0.005	0.007
	28080	140776	925.0	943.4	938.2	945.2	0.001	10.9	12937.5	923.4	0.51	0.005	0.006	0.005
	27925	140776	924.0	942.6	938.7	945.0	0.001	12.4	11348.0	864.0	0.60	0.006	0.006	0.006
	27725	140776	923.0	939.3	939.3	944.3	0.004	18.0	7836.7	784.8	1.00	0.005	0.006	0.005
	27545	140776	922.0	937.6	937.6	943.3	0.004	19.1	7378.1	656.3	1.00	0.006	0.005	0.006
	27335	140776	921.0	936.2	936.2	940.9	0.004	17.4	8079.1	865.4	1.00	0.005	0.005	0.005
	27155	140776	920.5	935.3	935.3	939.9	0.004	17.2	8170.8	888.2	1.00	0.003	0.004	0.004
SRC3	**26990**	140776	920.0	933.7	933.7	938.1	0.005	16.7	8413.9	976.9	1.00	0.003	0.003	0.004
	26780	140776	918.0	931.3	931.3	935.4	0.005	16.3	8650.6	1062.3	1.00	0.010	0.007	0.005
	26575	140776	917.0	930.4	930.0	933.8	0.004	14.7	9560.9	1203.7	0.92	0.005	0.007	0.006
	26355	140776	916.0	929.1	929.1	932.8	0.005	15.4	9144.2	1256.8	1.01	0.005	0.005	0.006
	26170	140776	915.0	928.2	928.2	931.8	0.005	15.3	9212.4	1267.9	1.00	0.005	0.005	0.005
	25965	140776	914.0	927.3	927.2	930.8	0.005	15.2	9292.6	1281.8	0.99	0.005	0.005	0.005
	25785	140776	913.5	926.8	926.2	930.0	0.004	14.4	9809.4	1224.0	0.89	0.003	0.004	0.004
	25600	140776	912.5	925.8	925.2	929.3	0.004	15.0	9384.8	1112.9	0.91	0.005	0.004	0.004
	25425	140776	911.0	925.3	924.4	928.6	0.003	14.6	9667.5	1090.1	0.86	0.009	0.007	0.006
	25215	140776	910.0	924.7	923.7	927.9	0.003	14.2	9894.1	1097.3	0.84	0.005	0.006	0.006
	25000	140776	909.0	924.5	922.5	927.2	0.002	13.1	10725.5	1062.4	0.73	0.005	0.005	0.006
SRC4	**24795**	140776	908.0	923.6	921.8	926.6	0.002	14.0	10061.5	957.4	0.76	0.005	0.005	0.005
	24550	140776	906.0	922.5	920.9	926.0	0.003	15.0	9403.5	856.1	0.80	0.008	0.007	0.006
	24335	140776	905.0	920.0	920.0	925.1	0.004	18.1	7779.4	765.0	1.00	0.005	0.007	0.006
	24115	140776	904.0	918.7	918.7	923.8	0.004	18.2	7736.8	757.9	1.00	0.005	0.005	0.006
	23975	140776	903.5	917.7	917.7	922.7	0.004	18.0	7837.6	789.5	1.00	0.004	0.004	0.004
	23755	140776	902.0	916.8	916.8	921.7	0.004	17.8	7930.3	816.5	1.00	0.007	0.006	0.005
	23565	140776	900.0	915.6	915.6	920.3	0.004	17.4	8100.0	867.0	1.00	0.011	0.009	0.007
	23365	140776	900.0	914.4	914.4	918.9	0.004	16.9	8320.3	939.5	1.00	0.000	0.005	0.006
	23180	140776	899.0	913.2	912.6	917.2	0.004	16.0	8806.1	926.0	0.91	0.005	0.003	0.005
	23000	140776	898.0	912.8	911.1	916.5	0.003	15.3	9178.0	784.0	0.79	0.006	0.005	0.004
	22790	140776	897.5	910.5	910.5	915.5	0.005	18.0	7838.5	784.0	1.00	0.002	0.004	0.004
	22600	140776	896.0	909.6	909.6	913.9	0.005	16.6	8469.8	1007.6	1.01	0.008	0.005	0.005
	22415	140776	895.5	908.0	908.0	912.1	0.005	16.3	8630.1	1052.8	1.00	0.003	0.005	0.004
corr(x,v)=	-0.71507													
corr(x,a)=	**0.711145**													
corr(x,b)=	0.655976													
corr(x,m1)=	0.131527													
corr(x,m2)=	0.154975													
corr(x,m3)=	0.224278													

Figure A4.5B3: Santa Clara River Proposed Conditions HEC-RAS Reach C - Station vs Flow Area

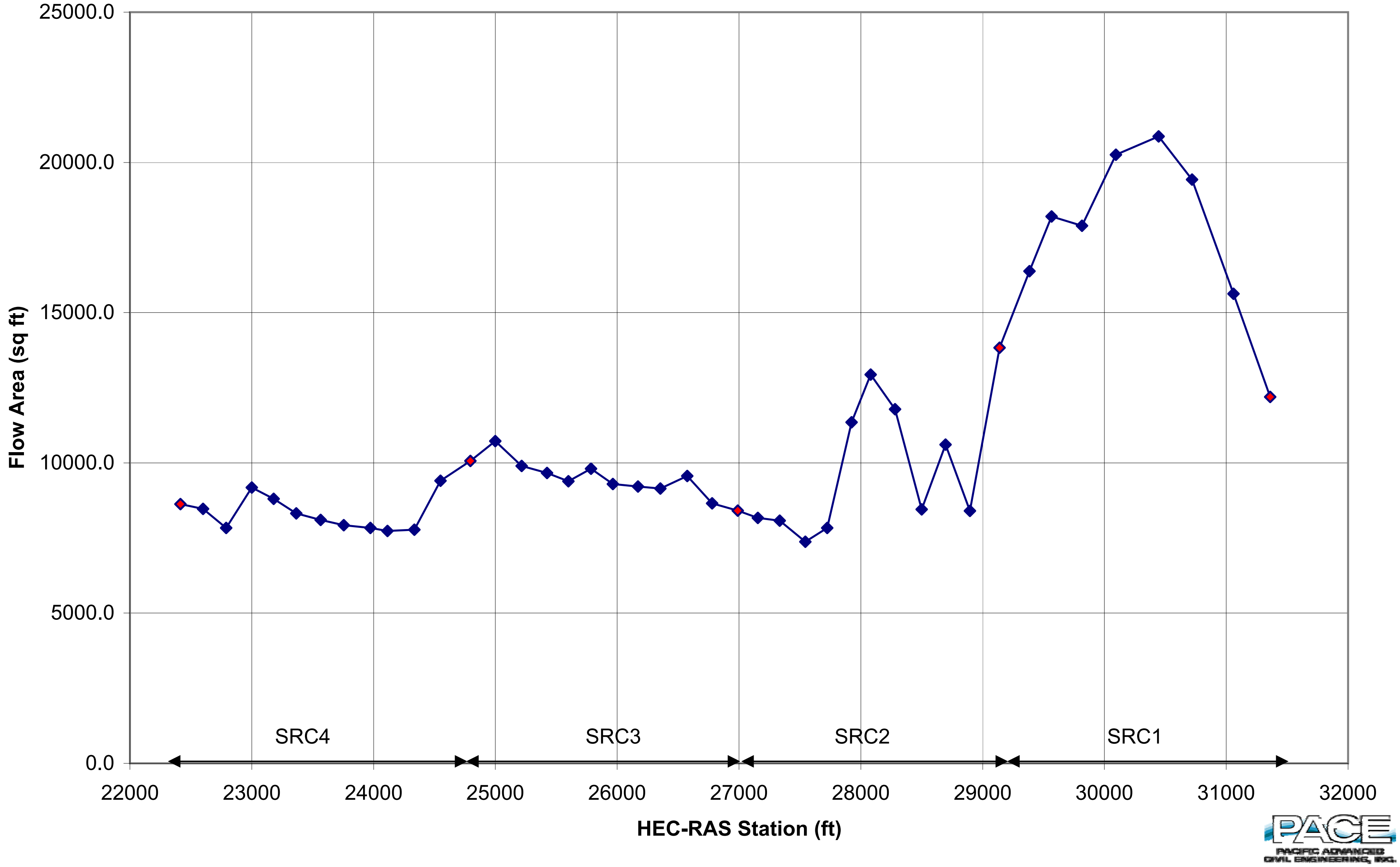


Table A4.5B4: Santa Clara River Proposed Conditions Hec-Ras Output and Parameter Correlation: Reach D

Subreach	River Sta	Q Total	Min Ch El ft	W.S. Elev ft	Crit W.S. ft	E.G. Elev ft	E.G. Slope	Vel Chnl fps	Flow Area sq ft	Top Width ft	Froude #	bedslope 1	bedslope 2	bedslope 3
SRD1	**22195**	141426	894.0	907.5	906.9	910.6	0.004	14.2	9951.4	1281.6	0.90			
	22010	141426	892.0	906.1	906.1	909.8	0.005	15.4	9195.9	1252.3	1.00	0.011		
	21790	141426	891.5	904.8	904.8	908.1	0.005	14.7	9642.9	1507.8	1.00	0.002	0.006	
	21615	141426	892.0	902.8	902.8	906.2	0.005	14.8	9557.4	1401.1	1.00	-0.003	0.000	0.003
	21440	141426	890.0	901.6	901.6	905.1	0.005	15.0	9424.5	1342.6	1.00	0.011	0.004	0.004
	21225	141426	888.0	900.5	900.5	903.7	0.005	14.3	9886.6	1563.9	1.00	0.009	0.010	0.006
	21020	141426	887.0	900.0	898.9	902.3	0.003	12.3	11464.6	1568.5	0.80	0.005	0.007	0.008
	20845	141426	886.0	898.4	898.4	901.6	0.005	14.3	9883.4	1561.0	1.00	0.006	0.005	0.007
	20595	141426	885.0	898.3	896.5	900.3	0.002	11.1	12704.0	1548.1	0.68	0.004	0.005	0.005
	20435	141426	884.0	898.1	895.8	899.9	0.002	10.8	13124.4	1524.8	0.65	0.006	0.005	0.005
	20280	141426	883.7	896.0	896.0	899.3	0.005	14.5	9735.6	1527.4	1.01	0.002	0.004	0.004
	20070	141426	882.0	894.3	894.3	897.5	0.005	14.4	9793.6	1537.7	1.01	0.008	0.005	0.006
SRD2	**19855**	141426	880.5	892.7	892.7	895.8	0.005	14.3	9916.9	1593.1	1.01	0.007	0.008	0.006
	19630	141426	880.0	891.5	890.5	894.7	0.003	14.4	9854.6	1098.6	0.84	0.002	0.005	0.006
	19440	141426	878.0	891.4	889.7	894.0	0.002	12.9	10950.1	1194.6	0.75	0.011	0.006	0.006
	19240	141426	877.5	889.4	889.4	893.2	0.005	15.6	9068.4	1219.4	1.01	0.003	0.006	0.005
	19050	141426	876.0	889.4	887.9	891.7	0.003	12.2	11580.6	1442.6	0.76	0.008	0.005	0.007
	18830	141426	874.0	888.8	887.5	891.1	0.003	12.1	11667.4	1538.2	0.78	0.009	0.009	0.007
	18650	141426	873.5	888.7	886.7	890.5	0.002	10.8	13119.6	1607.3	0.66	0.003	0.006	0.007
	18475	141426	872.0	888.9	885.0	890.1	0.001	8.8	16151.2	1621.7	0.49	0.009	0.006	0.007
	18290	141426	871.5	888.5	885.1	889.9	0.001	9.4	15041.5	1594.7	0.54	0.003	0.006	0.005
	18025	141426	870.0	888.6	882.9	889.5	0.001	7.8	18154.4	1520.5	0.40	0.006	0.004	0.006
	17785	141426	868.0	888.3	882.8	889.3	0.001	8.4	16871.0	1398.4	0.43	0.008	0.007	0.006
SRD3	**17510**	141426	868.0	887.5	883.4	889.0	0.001	10.1	14045.6	1353.6	0.55	0.000	0.004	0.004
	17360	141426	868.0	884.0	884.0	888.4	0.004	16.9	8365.0	944.5	1.00	0.000	0.000	0.003
	17110	141426	864.0	881.1	881.1	884.9	0.005	15.7	9039.2	1191.9	1.00	0.016	0.010	0.006
	16970	141426	863.7	879.6	879.6	883.4	0.005	15.7	8997.0	1180.2	1.00	0.002	0.011	0.008
	16720	141426	863.5	875.4	875.4	879.4	0.005	15.9	8873.6	1146.5	1.01	0.001	0.001	0.007
	16515	141426	862.0	873.9	873.9	877.5	0.005	15.4	9209.6	1260.0	1.00	0.007	0.004	0.003
	16305	141426	860.0	874.5	872.0	876.4	0.002	11.1	12765.9	1360.4	0.64	0.010	0.008	0.006
	16130	141426	860.0	872.2	872.2	875.8	0.005	15.2	9332.9	1326.0	1.01	0.000	0.005	0.006
	15960	141426	859.0	871.6	871.0	874.5	0.004	13.7	10347.3	1395.6	0.88	0.006	0.003	0.005
	15745	141426	858.0	871.3	869.8	873.7	0.003	12.3	11500.9	1363.9	0.75	0.005	0.005	0.004
	15540	141426	857.5	871.2	868.5	873.0	0.002	10.5	13415.3	1427.0	0.61	0.002	0.004	0.004
	15335	141426	856.0	868.1	868.1	872.2	0.006	16.2	8723.3	1064.1	1.00	0.007	0.005	0.005
corr(x,v)=	0.100396													
corr(x,a)=	-0.14163													
corr(x,b)=	**0.358193**													
corr(x,m1)=	0.081919													
corr(x,m2)=	0.060966													
corr(x,m3)=	0.113964													

Figure A4.5B4: Santa Clara River Proposed Conditions HEC-RAS Reach D - Station vs Top Width

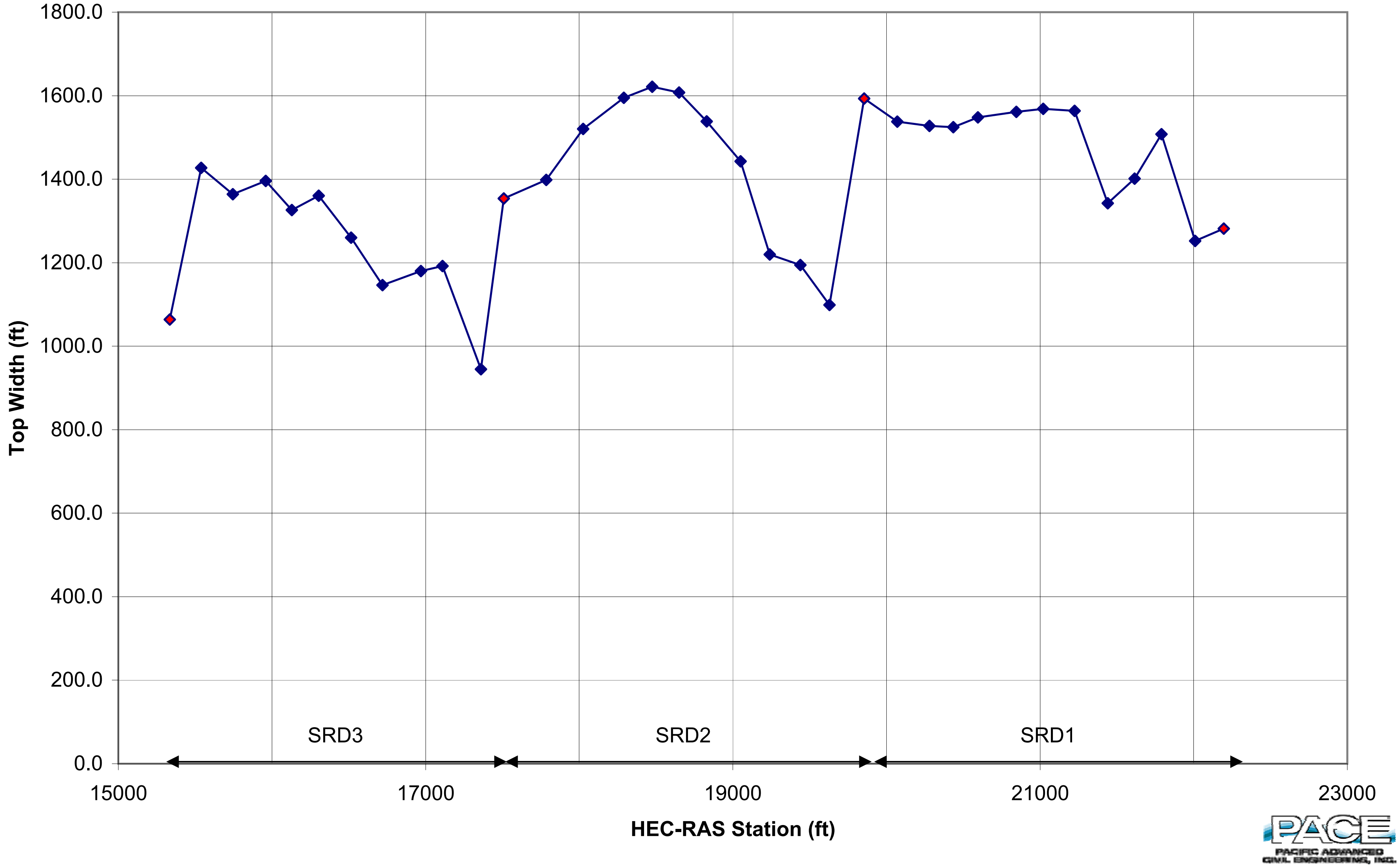
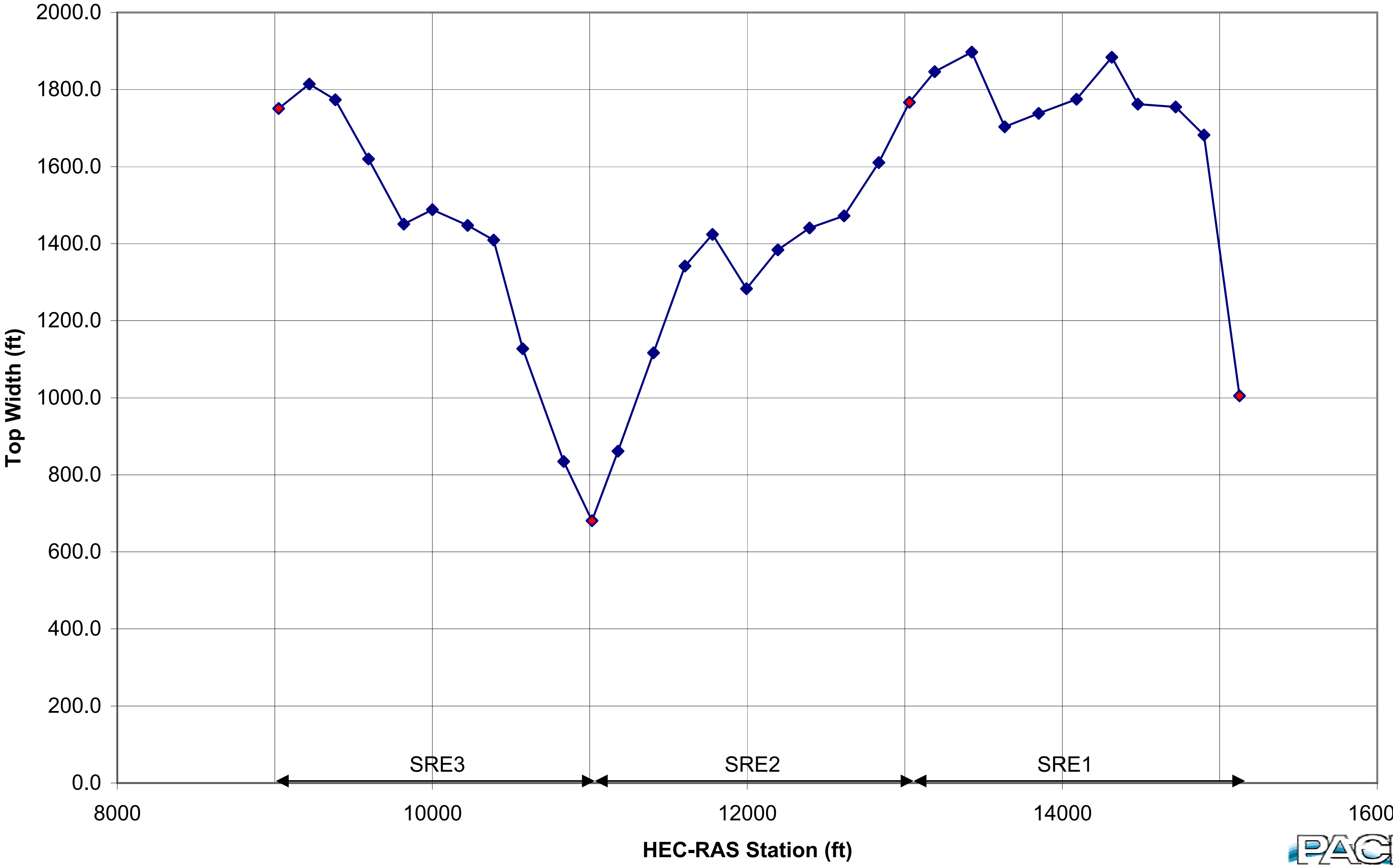


Table A4.5B5: Santa Clara River Proposed Conditions Hec-Ras Output and Parameter Correlation: Reach E

Subreach	River Sta	Q Total	Min Ch El ft	W.S. Elev ft	Crit W.S. ft	E.G. Elev ft	E.G. Slope	Vel Chnl fps	Flow Area sq ft	Top Width ft	Froude #	bedslope 1	bedslope 2	bedslope 3
SRE1	**15125**	142475	854.0	866.3	866.3	870.5	0.006	16.6	8594.5	1005.2	1.00			
	14900	142475	853.0	864.2	864.2	868.3	0.005	16.3	8744.6	1682.0	1.00	0.004		
	14720	142475	852.0	863.3	863.3	867.2	0.005	15.9	8988.3	1754.8	1.00	0.006	0.005	
	14480	142475	850.5	860.8	860.8	864.0	0.005	14.5	9824.9	1761.9	0.99	0.006	0.006	0.005
	14315	142475	850.0	860.1	860.1	863.2	0.005	14.0	10171.0	1883.6	1.00	0.003	0.005	0.005
	14090	142475	850.0	858.7	858.7	861.6	0.005	13.7	10369.2	1774.7	1.00	0.000	0.001	0.003
	13850	142475	848.0	857.1	857.1	860.1	0.005	13.9	10284.5	1738.4	1.00	0.008	0.004	0.004
	13635	142475	846.0	856.0	856.0	859.0	0.005	14.0	10211.8	1703.1	1.00	0.009	0.009	0.006
	13425	142475	845.0	854.2	854.2	857.1	0.005	13.5	10578.2	1897.2	1.01	0.005	0.007	0.008
	13190	142475	844.0	853.3	852.7	855.7	0.004	12.3	11549.9	1846.1	0.87	0.004	0.004	0.006
SRE2	**13030**	142475	843.0	852.9	852.0	855.1	0.003	12.0	11909.3	1766.8	0.81	0.006	0.005	0.005
	12835	142475	842.0	852.3	851.0	854.5	0.003	11.8	12100.7	1610.1	0.76	0.005	0.006	0.005
	12615	142475	841.0	852.0	849.8	853.9	0.002	11.0	12926.1	1472.3	0.66	0.005	0.005	0.005
	12395	142475	840.0	851.7	849.2	853.5	0.002	10.9	13135.4	1440.7	0.63	0.005	0.005	0.005
	12195	142475	839.0	851.6	848.1	853.1	0.001	10.0	14313.4	1384.2	0.55	0.005	0.005	0.005
	11995	142475	837.0	850.9	848.0	852.8	0.002	11.1	12823.3	1283.1	0.62	0.010	0.008	0.006
	11780	142475	836.0	850.7	847.7	852.4	0.002	10.4	13642.5	1424.2	0.59	0.005	0.007	0.007
	11605	142475	835.5	850.0	847.3	852.1	0.002	11.6	12285.5	1341.9	0.68	0.003	0.004	0.006
	11405	142475	834.0	849.4	846.2	851.7	0.002	12.1	11766.0	1116.4	0.66	0.008	0.005	0.005
	11180	142475	833.0	847.5	845.6	851.1	0.002	15.2	9359.0	861.1	0.81	0.004	0.006	0.005
SRE3	**11015**	142475	831.5	844.9	844.9	850.4	0.004	18.9	7546.8	680.7	1.00	0.009	0.006	0.007
	10835	142475	831.0	843.8	843.8	848.6	0.004	17.7	8059.5	834.5	1.00	0.003	0.006	0.005
	10575	142475	830.0	840.2	840.2	844.1	0.004	16.0	8907.8	1127.5	1.00	0.004	0.003	0.005
	10390	142475	828.0	839.8	838.5	842.3	0.003	12.7	11218.3	1409.0	0.79	0.011	0.007	0.006
	10225	142475	827.5	838.2	838.2	841.6	0.005	14.7	9676.6	1447.2	1.00	0.003	0.007	0.006
	10000	142475	826.0	837.1	837.1	840.4	0.004	14.6	9788.3	1488.1	1.00	0.007	0.005	0.007
	9820	142475	824.0	835.4	835.4	838.8	0.004	14.9	9537.7	1450.9	1.00	0.011	0.009	0.007
	9595	142475	823.8	834.2	834.2	837.4	0.005	14.5	9808.5	1620.1	1.00	0.001	0.005	0.006
	9385	142475	823.0	833.1	833.1	836.0	0.005	13.8	10337.7	1773.6	1.01	0.004	0.002	0.005
	9220	142475	822.0	831.8	831.8	834.7	0.005	13.7	10430.0	1814.1	1.00	0.006	0.005	0.003
	9025	142475	821.0	830.4	830.4	833.4	0.004	13.8	10307.8	1751.0	1.00	0.005	0.006	0.005
corr(x,v)=	-0.0153													
corr(x,a)=	0.022217													
corr(x,b)=	**0.248521**													
corr(x,m1)=	-0.07691													
corr(x,m2)=	-0.08554													
corr(x,m3)=	-0.10549													

Figure A4.5B5: Santa Clara River Proposed Conditions HEC-RAS Reach E - Station vs Top Width



Santa Clara River Fluvial Study

APPENDIX CHAPTER 4.6

Existing & Proposed Conditions SAM.AID Transport Equation Summary

PACIFIC ADVANCED CIVIL ENGINEERING, INC.

Table A4.6A: Santa Clara River Existing Conditions SAM Transport Potential Summary

Subreach	US Sta	DS Sta	Width (ft)	Yang	Ackers-White	MPM	Brownlie, d50	Laursen-Copeland	Laursen-Madden	Yang, d50	Ackers-White, d50	MPM, d50
SRA1	46195	44210	525.6	11,578,207		403,938	10,213,413		10,288,930		2,616,358	428,254
SRA2	43820	41460	977.0	7,019,537		330,678	5,396,854		7,428,092		1,828,759	
SRA3	41280	38925	1,242.2	8,423,927		401,167	5,999,501		8,661,182		2,114,228	
SRA4	38710	36265	952.0	7,472,957		343,735	5,760,137		7,762,680		1,917,288	
SRB1	36080	34090	1,389.0	10,501,440		483,359	7,166,304		10,291,797		2,506,537	
SRB2	33880	32605	1,650.3	9,981,533		488,063	6,529,088		10,032,043		2,427,273	
SRC1	32265	29385	1,965.8	549,651		101,035		3,776,574		445,251		
SRC2	29140	27155	780.8	6,114,881	103,813,640	470,866	5,607,809	59,236,428		3,144,927		
SRC3	26990	25000	1,492.1	6,112,071	72,451,720	558,797	4,709,391	56,391,164		3,062,371		
SRC4	24795	22415	2,008.5	4,354,715	38,238,164	468,697	3,139,686	37,428,088		2,332,338		
SRD1	22195	20070	2,009.0	6,555,626	68,813,664	675,434	4,673,919	60,892,464		3,226,039		
SRD2	19855	17785	1,936.3	1,702,374		241,344		12,902,746		1,141,649		
SRD3	17510	15335	1,812.5	6,123,644	66,058,544	623,943	4,496,810	56,559,088		3,077,924		
SRE1	15125	13190	1,878.9	9,343,788		796,646	6,294,619		9,559,064		1,623,079	
SRE2	13030	11180	1,372.4	2,942,931		307,423	2,244,769	23,642,152	3,819,590	1,718,088	681,086	
SRE3	11015	9025	1,390.6	7,526,579		624,904	5,541,755		7,915,211		1,347,439	

Table A4.6B: Santa Clara River Proposed Conditions SAM Transport Potential Summary

Subreach	US Sta	DS Sta	Width (ft)	Yang	Ackers-White	MPM	Brownlie, d50	Laursen-Copeland	Laursen-Madden	Yang, d50	Ackers-White, d50	MPM, d50
SRA1	46195	44210	525.6	11,578,207		403,938	10,213,413		10,288,930		2,616,358	428,254
SRA2	43820	41460	958.6	7,946,985		359,566	6,086,816		8,125,280		2,006,747	
SRA3	41280	38925	1,022.2	8,573,228		385,857	6,421,179		8,636,340		2,127,909	
SRA4	38710	36265	797.6	8,853,698		370,217	7,072,628		8,670,224		2,163,247	
SRB1	36080	34090	1,376.0	12,125,351		534,683	8,220,035		11,438,973		2,793,897	
SRB2	33880	32605	1,709.1	10,043,264		494,553	6,502,022		10,096,604		2,439,216	
SRC1	32265	29385	1,859.8	949,043		147,697		6,770,803		699,695		
SRC2	29140	27155	899.2	4,534,666		389,467		41,054,972		2,493,064		
SRC3	26990	25000	1,159.3	7,868,941	119,958,744	633,550	6,462,984	77,554,248		3,741,335		
SRC4	24795	22415	860.1	8,184,735		603,656		83,418,544		3,895,934		
SRD1	22195	20070	1,511.4	7,052,652	89,557,384	661,922	5,428,181	67,565,112		3,449,140		
SRD2	19855	17785	1,431.8	2,755,468		319,200		22,530,518		1,691,165		
SRD3	17510	15335	1,274.3	6,885,280	95,199,624	620,768	5,553,703	66,390,272		3,411,958		
SRE1	15125	13190	1,588.9	8,848,421	138,177,216	731,941	6,244,320	84,638,576		3,866,203		
SRE2	13030	11180	1,375.5	2,726,007		291,031		21,732,192		1,620,062		
SRE3	11015	9025	1,399.4	7,687,321	121,551,024	635,705	5,646,198	72,173,344		3,516,310		

Santa Clara River Fluvial Study

APPENDIX CHAPTER 5.1

Historical Topographic Maps

PACE
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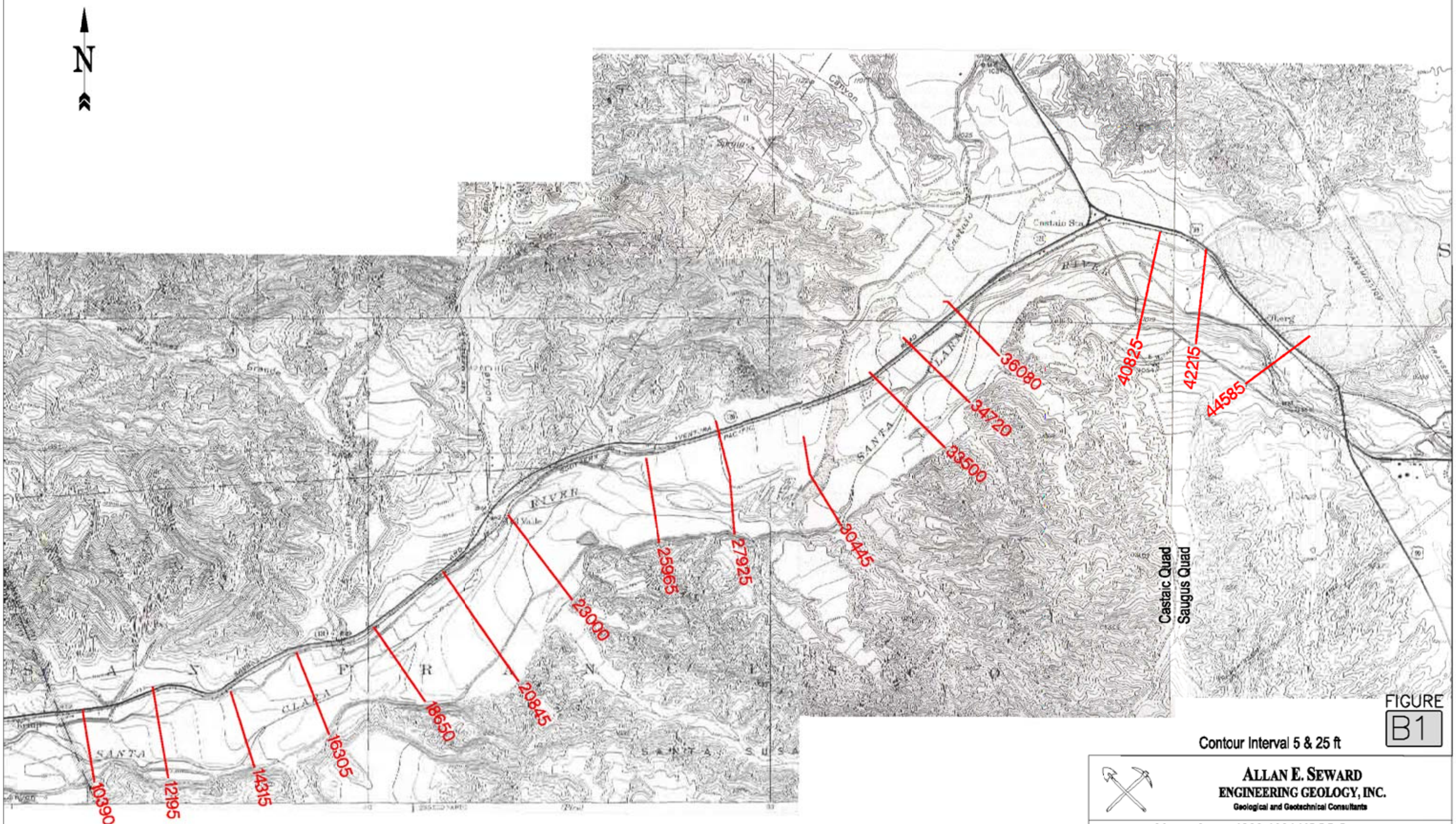

FIGURE B1

Contour Interval 5 & 25 ft

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

Mesas Area - 1929-1931 USGS Surveys
1940 Editions of Castaic and Saugus 6' Quads

Date: 5/24/05		Job No.: 04-1155BE-9	
Scale: 1" = ~2300'		CAD File: 1940 Quad	
PLATE T29.II	Geology by: N/A	Drawn by: N/A	Revised:

P:\8197E\Engineering\GlobalExhibits\8197 Figure B1 - 1930 Topography.dwg - Tab: Figure B1 By: tlin on Mar. 14, 2006 at 04:25 pm

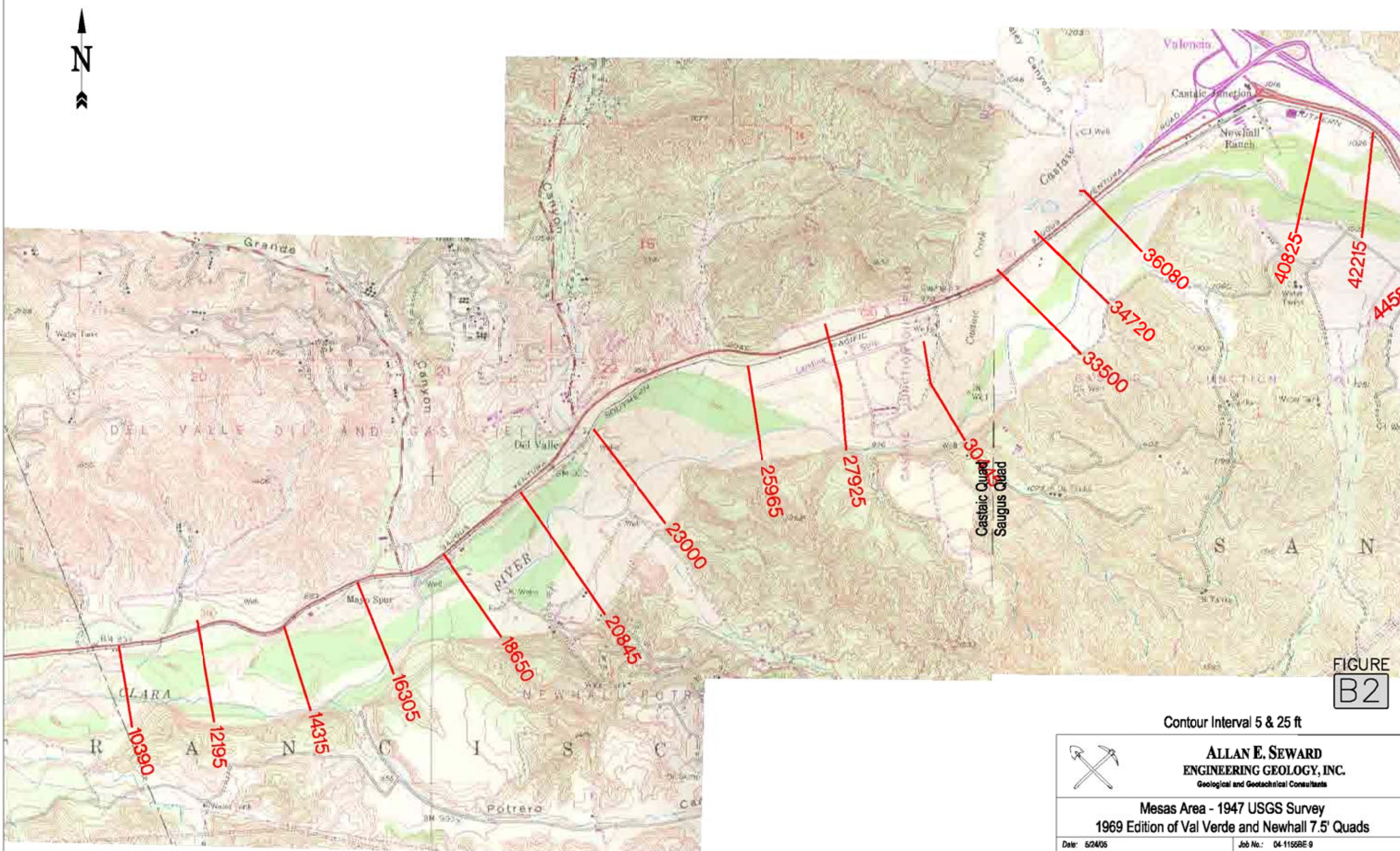

FIGURE
B2

Contour Interval 5 & 25 ft

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

Mesas Area - 1947 USGS Survey
1969 Edition of Val Verde and Newhall 7.5' Quads

Date: 5/24/05		Job No.: 04-1155BE-9	
Scale: 1" = 2000'		CAD File: 1969 Quad	
PLATE T47.II	Geology by: N/A	Revised:	
	Drawn by: N/A		

P:\8197E\Engineering\GlobalExhibits\8197 Figure B2 - 1947 Topography.dwg - Tab: Figure B2 By: tlin on Mar. 14, 2006 at 04:33 pm

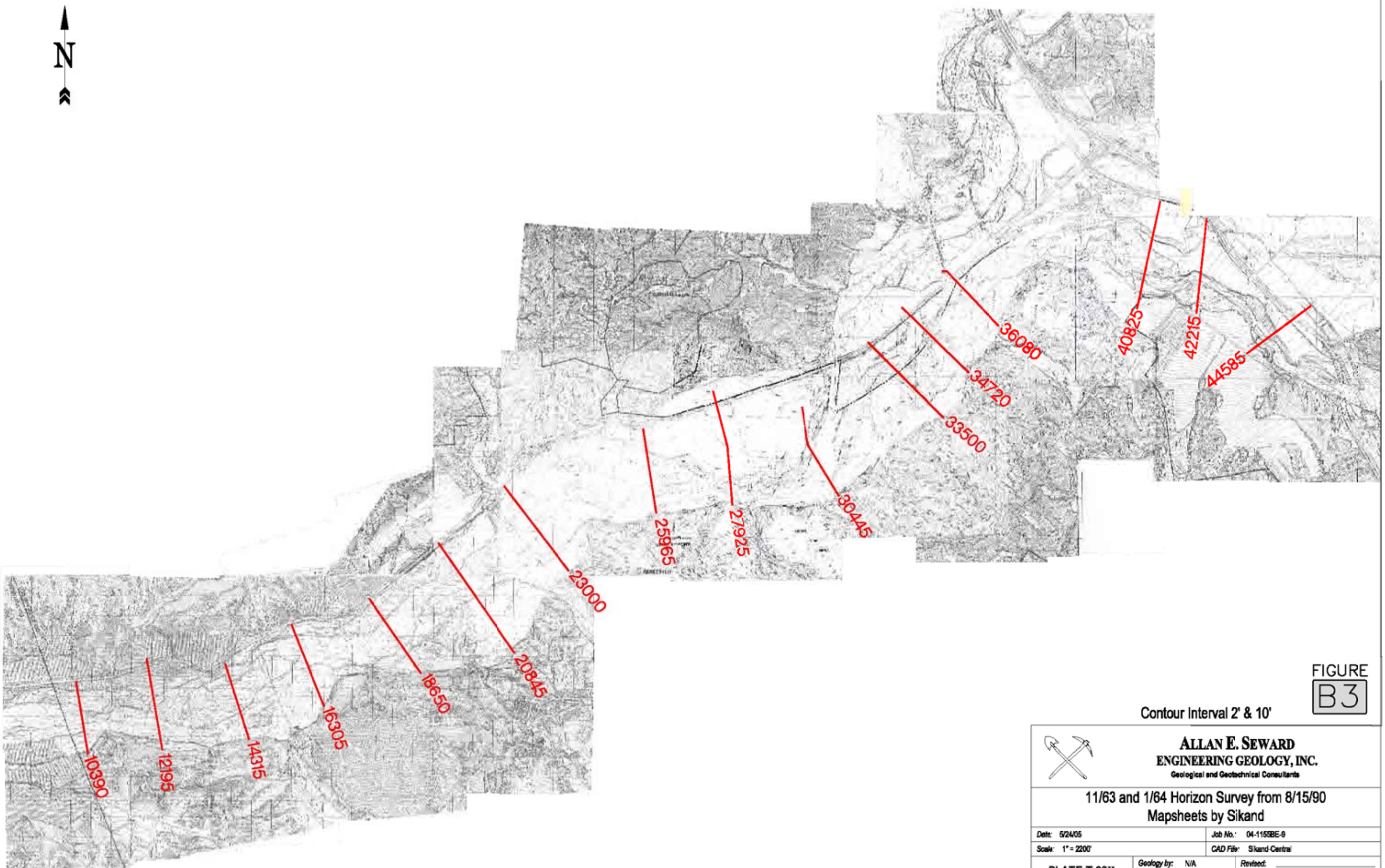

FIGURE B3

Contour Interval 2' & 10'

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

11/63 and 1/64 Horizon Survey from 8/15/90
Mapsheets by Sikand

Date: 5/24/05		Job No.: 04-1155BE-9	
Scale: 1" = 2200'		CAD File: Sikand-Central	
PLATE T.63II	Geology by: N/A Drawn by: N/A	Revised:	

FIGURE
B4

DIGITAL TOPOGRAPHY BY PSOMAS ENGINEERING
from Data Generated @1999

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

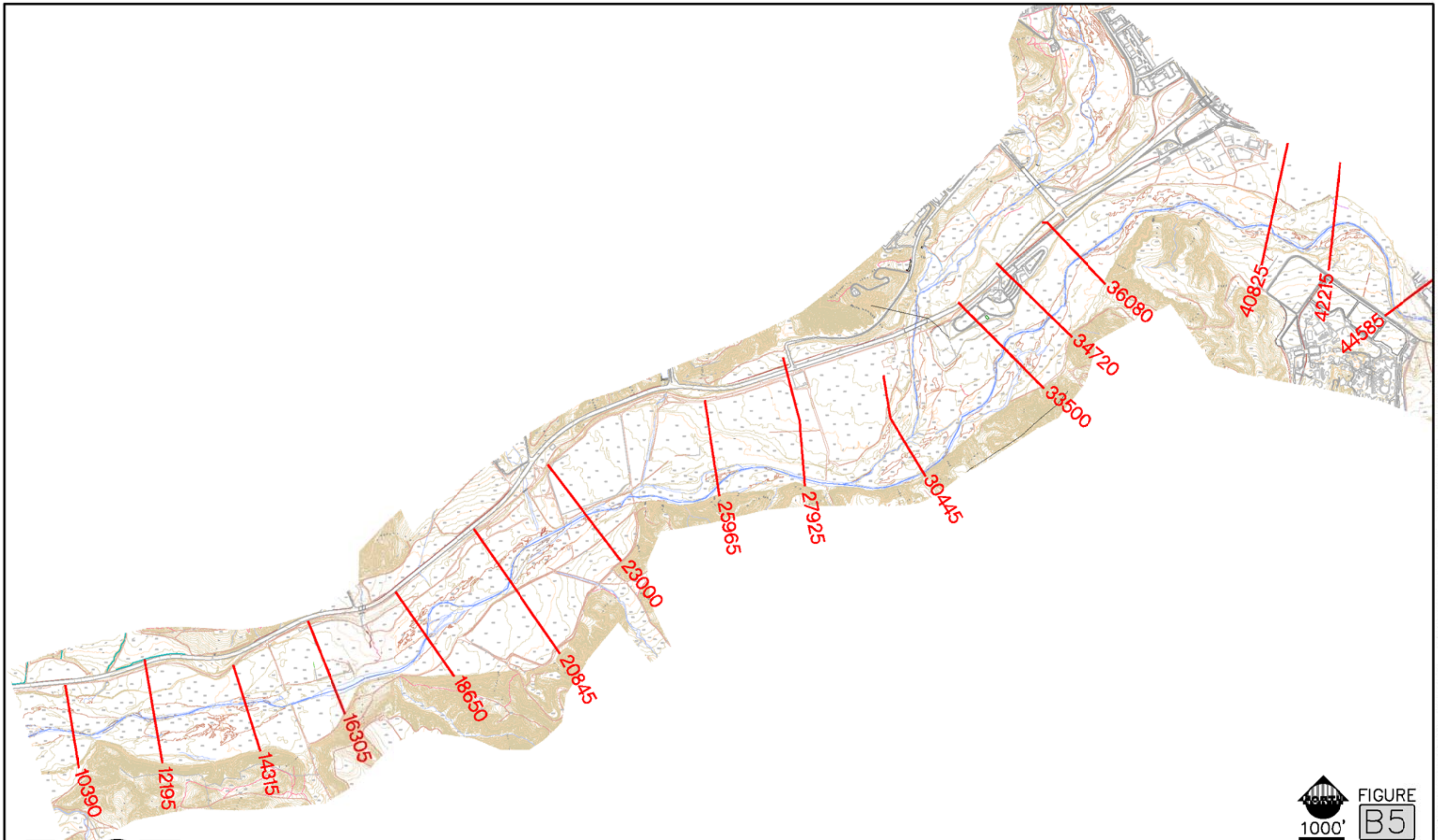

FIGURE
B5

PACE
PACIFIC ADVANCED
CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

DIGITAL TOPOGRAPHY BY McElhanney
from Data Generated @2004

FIGURE B6

DIGITAL TOPOGRAPHY BY McElhanney
from Data Generated @2005

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

P:\8197E\Engineering\GlobalExhibits\8197 Figure B6 - 2005 Topography.dwg - Tab: Figure B3 By: tlin on Mar. 14, 2006 at 04:24 pm

Santa Clara River Fluvial Study

APPENDIX CHAPTER 5.2

Historical Thalweg Analysis

Previous drafts of this report calculated long-term trends based on an analysis of historic thalweg data. Analysis of long-term data based on cross-sections has been found to more clearly portray the historic trends of the creek bed. The historic analysis is included here for completeness.

The thalwegs and an additional alignment were digitized from the historic topography shown in Chapter 5, and these alignments were overlain in every digitized data set. That is, the 1930 thalweg was overlain in the 1930, 1947, 1963, 1999, 2004 and 2005 topographies. This was repeated for the other thalwegs as well. Thalwegs were chosen because they served as a reference and generally represent the lowest portion of the riverbed cross-section for a given year. The additional alignment was positioned so that an even distribution of alignments was achieved over the width of the channel for the study reach. The alignments are shown in Figure A5.3.1. The bed elevations along all alignments for all years were determined and compared, and a historic mean bed elevation was determined. Calculations of the minimum and mean bed elevation for all stations for all years examined is presented in Table A5.3.1. The historic bed elevation data, as well as historic mean bed elevation, is presented in Figure 5.2A-B. The figure illustrates variation in bed elevations throughout the period of record.

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Table A5.2 Santa Clara River Thalweg Analysis Caluclation of Long Term Aggradation/Degradation Based on Historical Bed Analysis (ft)

Subreach	HEC-RAS	1930		1947		1963		1999		2004		2005		(1)MINIMUM OF	(1)MEAN OF	
	Station	Topo Mean	Topo Min	Topo Mean	Topo Min	Topo Mean	Topo Min	Topo Mean	Topo Min	Topo Mean	Topo Min	Topo Mean	Topo Min	ALL MINIMUMS	ALL MEANS	99 MEAN-ALL MEAN
	48025	1053.7	1053.5					1050.5	1049.1					**1049.1**	**1050.5**	**0.0**
	47850	1052.1	1051.8					1048.7	1046.0					**1046.0**	**1048.7**	**0.0**
	47670	1051.1	1050.3					1048.8	1044.4					**1044.4**	**1048.8**	**0.0**
	47510	1049.1	1049.1					1045.7	1044.0					**1044.0**	**1045.7**	**0.0**
	47440	1048.5	1048.5					1045.4	1044.0					**1044.0**	**1045.4**	**0.0**
	47180	1046.6	1045.9			1049.9	1049.6	1046.5	1042.0					**1042.0**	**1048.2**	**-1.7**
	47015	1046.9	1045.0			1048.9	1047.7	1046.7	1040.4					**1040.4**	**1047.8**	**-1.1**
	46890	1049.2	1043.5			1047.3	1046.5	1045.6	1040.0					**1040.0**	**1046.4**	**-0.8**
	46800	1047.0	1042.1			1046.3	1045.5	1042.0	1038.5					**1038.5**	**1044.1**	**-2.1**
	46760	1045.2	1041.5			1045.8	1045.1	1041.6	1039.4					**1039.4**	**1043.7**	**-2.1**
	46695	1043.7	1040.9			1045.3	1044.7	1040.9	1038.7					**1038.7**	**1043.1**	**-2.2**
	46550	1040.8	1038.9			1043.6	1043.3	1038.2	1037.1					**1037.1**	**1040.9**	**-2.7**
	46370	1042.8	1034.8			1043.1	1042.0	1036.9	1036.2	1039.6	1039.5			**1036.2**	**1039.9**	**-2.9**
SRA1	46195	1041.5	1032.2			1042.4	1041.6	1036.3	1034.6	1037.4	1032.3			**1032.3**	**1038.7**	**-2.4**
	46020	1029.4	1023.3			1040.1	1040.0	1032.9	1032.0	1031.7	1029.9	1034.6	1033.8	**1029.9**	**1034.8**	**-1.9**
	45545	1031.9	1017.5			1045.0	1040.0	1032.4	1030.0	1034.1	1027.6	1033.9	1030.7	**1027.6**	**1036.4**	**-3.9**
	45030	1038.7	1015.0			1034.0	1030.2	1028.8	1026.0	1028.6	1025.8	1027.2	1026.5	**1025.8**	**1029.7**	**-0.8**
	44585	1043.6	1015.0			1039.6	1030.0	1038.1	1022.0	1033.9	1019.2	1031.4	1023.0	**1019.2**	**1035.8**	**2.4**
	44210	1037.5	1015.0			1033.7	1026.7	1029.3	1020.0	1028.7	1017.3	1026.9	1020.9	**1017.3**	**1029.7**	**-0.3**
SRA2	43820	1017.8	1010.2			1023.0	1020.0	1018.4	1018.0	1017.2	1015.9	1017.5	1016.5	**1015.9**	**1019.0**	**-0.6**
	43610	1014.8	1010.0			1021.9	1020.0	1019.5	1016.7	1016.4	1014.4	1017.7	1016.1	**1014.4**	**1018.9**	**0.6**
	43410	1014.4	1010.0	1019.9	1019.9	1023.2	1020.0	1019.2	1015.7	1017.8	1013.5	1020.8	1014.8	**1013.5**	**1020.2**	**-1.0**
	43200	1018.2	1010.0	1023.3	1018.1	1025.2	1020.0	1021.4	1014.0	1020.2	1012.3	1024.4	1013.5	**1012.3**	**1022.9**	**-1.5**
	42975	1021.4	1010.0	1025.3	1016.9	1025.6	1020.0	1018.9	1012.0	1022.1	1011.0	1023.3	1013.0	**1011.0**	**1023.0**	**-4.1**
	42815	1019.9	1009.0	1026.8	1015.0	1024.7	1020.0	1017.5	1012.0	1021.4	1009.5	1024.2	1011.7	**1009.5**	**1022.9**	**-5.4**
	42590	1015.0	1006.5	1024.9	1015.0	1023.0	1017.9	1013.8	1010.0	1016.2	1008.8	1023.2	1009.3	**1008.8**	**1020.3**	**-6.4**
	42430	1012.5	1005.0	1023.1	1013.6	1020.1	1013.9	1012.3	1010.0	1012.9	1007.4	1013.3	1008.5	**1007.4**	**1016.3**	**-4.1**
	42215	1014.0	1005.0	1022.2	1012.1	1017.1	1010.0	1011.8	1008.0	1010.4	1006.6	1011.3	1007.5	**1006.6**	**1014.6**	**-2.7**
	41940	1008.8	1005.0	1020.0	1009.5	1013.5	1010.0	1010.4	1006.0	1006.2	1005.1	1008.6	1006.0	**1005.1**	**1011.7**	**-1.3**
	41730	1008.8	1002.6	1013.0	1008.0	1012.2	1010.0	1009.0	1004.0	1007.8	1003.5	1006.6	1003.5	**1003.5**	**1009.7**	**-0.7**
	41460	1010.1	999.5	1009.8	1006.7	1011.0	1009.7	1007.5	1002.0	1005.5	1000.9	1004.2	1002.5	**1000.9**	**1007.6**	**-0.1**
SRA3	41280	1010.0	998.2	1006.5	1004.0	1008.5	1006.7	1007.5	1002.0	1002.6	1000.4	1002.3	1000.6	**1000.4**	**1005.5**	**2.0**
	41080	1009.5	996.8	1004.1	1002.3	1004.6	1003.2	1003.7	1001.3	1000.5	999.1	999.8	998.8	**998.8**	**1002.5**	**1.1**
	40825	1005.0	995.0	1005.9	1000.0	1004.4	1000.0	1003.0	1000.0	1000.7	996.0	998.9	997.4	**996.0**	**1002.6**	**0.4**
	40585	1002.7	995.0	1003.3	1000.0	1003.5	1000.0	1003.3	998.0	999.7	995.5	996.9	995.6	**995.5**	**1001.3**	**2.0**
	40335	1005.4	995.0	1000.0	995.1	1002.3	1000.0	1001.2	996.0	997.4	992.7	994.8	994.2	**992.7**	**999.1**	**2.0**
	40130	1006.5	993.7	1001.2	992.5	1002.8	1000.0	999.8	996.0	997.0	992.1	994.0	993.2	**992.1**	**999.0**	**0.8**
	39945	1003.5	990.0	1000.0	991.3	1002.5	999.9	997.3	994.0	995.6	991.0	993.5	991.7	**991.0**	**997.8**	**-0.5**
	39755	999.2	990.0	993.5	988.6	1000.2	997.3	996.2	994.0	994.3	990.1	993.3	990.9	**988.6**	**995.5**	**0.7**
	39605	995.8	989.9	990.9	987.7	997.9	995.6	996.9	994.0	994.7	989.4	991.7	989.4	**987.7**	**994.4**	**2.5**
	39310	993.5	985.0	987.9	985.9	991.5	990.0	995.6	992.0	992.6	988.1	990.6	987.6	**985.9**	**991.6**	**3.9**
	39100	992.9	985.0	986.7	982.9	992.0	990.0	993.0	990.0	991.0	987.4	988.7	985.5	**982.9**	**990.3**	**2.8**
	38925	991.3	983.3	986.8	980.8	992.0	990.0	993.0	990.0	990.6	987.4	987.6	984.8	**980.8**	**990.0**	**3.0**
SRA4	38710	990.0	980.3	983.7	980.0	990.6	990.0	991.3	988.0	988.7	985.5	986.0	984.5	**980.0**	**988.1**	**3.3**
	38475	988.8	980.0	983.0	980.0	991.0	990.0	989.7	986.3	988.2	984.0	984.1	982.5	**980.0**	**987.2**	**2.5**
	38300	988.0	979.2	982.1	979.8	990.4	990.0	988.2	986.0	987.6	983.1	982.8	982.0	**979.8**	**986.2**	**2.0**
	38065	987.8	977.5	979.6	978.1	990.0	990.0	984.3	984.0	983.7	982.0	981.6	980.8	**978.1**	**983.8**	**0.5**
	37810	986.3	975.5	979.8	976.4	985.6	984.8	984.1	983.2	983.8	980.3	981.0	979.5	**976.4**	**982.9**	**1.2**
	37655	984.7	975.0	978.9	975.7	984.0	982.3	983.5	982.0	982.7	979.7	980.8	978.7	**975.7**	**982.0**	**1.5**
	37390	983.0	975.0	978.6	975.0	981.6	980.0	982.1	981.1	981.7	978.1	978.4	976.6	**975.0**	**980.5**	**1.6**
	37135	982.3	975.0	979.4	975.0	981.3	980.0	980.4	979.5	979.9	975.8	979.1	975.9	**975.0**	**980.0**	**0.4**
	36930	981.3	974.5	979.6	975.0	981.3	980.0	978.7	978.0	978.3	975.4	977.4	975.0	**975.0**	**979.1**	**-0.4**
	36735	980.8	973.1	977.3	974.9	980.6	980.0	977.7	976.3	977.4	974.6	976.0	973.7	**973.7**	**977.8**	**-0.1**
	36515	979.2	972.5	975.2	973.3	980.1	980.0	976.9	976.0	976.4	973.0	975.4	972.8	**972.8**	**976.8**	**0.1**
	36265	977.4	971.2	973.2	971.4	980.2	980.0	976.1	974.0	975.5	972.7	974.5	972.0	**971.4**	**975.9**	**0.2**
SRB1	36080	973.9	969.8	972.1	970.0	980.3	980.0	976.9	973.2	974.1	971.8	972.1	970.2	**970.0**	**975.1**	**1.8**
	35845	971.7	968.9	971.0	970.0	979.0	977.6	977.9	972.0	972.9	970.3	970.1	968.7	**968.7**	**974.2**	**3.7**
	35725	970.4	968.5	970.3	970.0	978.0	977.0	978.3	970.0	972.0	969.6	969.4	968.7	**968.7**	**973.6**	**4.7**
	35515	969.3	967.7	970.4	970.0	976.0	975.6	976.8	970.0	972.1	969.3	968.8	968.2	**968.2**	**972.8**	**4.0**
	35245	968.7	966.5	969.9	967.8	973.6	972.7	974.6	968.0	971.8	968.4	968.6	966.4	**966.4**	**971.7**	**2.9**
	35040	968.2	965.8	968.7	966.4	972.4	971.2	973.4	968.0	971.2	966.1	967.6	965.9	**965.9**	**970.7**	**2.8**
	34860	967.5	965.0	967.5	965.0	971.5	970.0	972.6	966.0	969.7	965.1	966.6	965.3	**965.0**	**969.6**	**3.1**
	34720	966.7	965.0	966.8	964.9	970.6	970.0	971.0	966.0	968.8	964.8	965.2	964.0	**964.0**	**968.5**	**2.5**
	34495	966.8	965.0	965.4	963.5	970.0	970.0	967.9	964.0	967.2	963.7	964.4	962.0	**962.0**	**967.0**	**0.9**
	34310	967.0	963.8	964.4	962.5	968.7	967.9	966.4	963.2	965.4	962.4	963.9	960.7	**960.7**	**965.8**	**0.7**
	34090	965.9	962.0	963.1	961.6	967.3	965.2	965.9	962.0	963.7	960.8	961.6	959.3	**959.3**	**964.3**	**1.6**
SRB2	33880	964.7	961.3	962.7	960.1	965.2	962.3	964.6	960.0	961.6	958.9	960.6	958.1	**958.1**	**962.9**	**1.6**
	33710	963.1	960.0	962.5	960.0	963.4	960.0	963.9	960.0	960.1	957.8	959.2	957.6	**957.6**	**961.8**	**2.1**
	33500	962.5	960.0	962.3	960.3	961.2	960.0	961.4	958.0	959.3	957.7	957.7	956.1	**956.1**	**960.4**	**1.0**
	33310	961.5	960.0	960.9	959.0	959.9	959.4	961.1	956.2	959.7	955.3	957.2	954.9	**954.9**	**959.8**	**1.3**
	33115	960.8	960.0	960.5	957.3	959.8	957.3	961.0	956.0	958.1	954.8	957.0	954.1	**954.1**	**959.3**	**1.7**
	32795	961.4	958.8	960.5	956.8	959.0	954.8	958.2	954.0	955.5	947.7	955.2	951.9	**947.7**	**957.7**	**0.5**
	32605	960.4	957.8	958.7	955.0	957.6	952.9	956.7	952.5	954.6	950.9	954.1	950.6	**950.6**	**956.3**	**0.4**
SRC1	32265	957.7	956.3	952.4	951.8	954.3	950.0	954.8	951.4	953.1	949.6	951.2	949.1	**949.1**	**953.2**	**1.6**
	31875	960.1	955.0	951.3	948.2	950.0	950.0	952.8	949.5	949.4	944.0	950.1	944.0	**944.0**	**950.7**	**2.1**
	31585	960.7	952.8	950.2	945.0	950.0	950.0	948.4	946.0	947.0	943.9	945.8	943.4	**943.4**	**948.3**	**0.1**
	31360	959.1	951.1	946.8	945.0	949.3	948.5	948.0	945.1	946.0	943.3	945.5	942.5	**942.5**	**947.1**	**0.9**
	31060	955.9	950.0	947.3	945.0	948.2	945.9	944.8	944.0	942.2	939.1	942.3	939.8	**939.1**	**945.0**	**-0.2**
	30720	950.7	945.0	946.8	942.2	946.1	942.7	943.0	940.0	939.8	936.2	940.9	938.7	**936.2**	**943.3**	**-0.4**
	30445	946.7	942.0	945.2	940.0	945.9	940.4	941.0	938.0	938.2	935.1	939.5	937.4	**935.1**	**942.0**	**-0.9**
	30095	946.1	944.1	940.4	937.3	943.6	940.0	939.1	936.8	935.8	933.4	935.0	931.6	**931.6**	**938.8**	**0.3**
	29815	942.0	936.7	939.3	935.9	940.5	940.0	937.0	936.0	933.8	931.0	933.6	933.0	**931.0**	**936.8**	**0.2**
	29565	938.9	934.3	939.1	933.9	940.0	940.0	935.1	934.0	933.2	930.0	931.9	930.5	**930.0**	**935.9**	**-0.8**
	29385	937.3	931.1	936.8	932.7	941.2	940.0	933.8	932.7	932.3	929.6	931.5	930.1	**929.6**	**935.1**	**-1.3**
SRC2	29140	936.9	930.4	933.4	931.2	940.0	940.0	933.5	932.0	929.0	926.8	928.9	927.6	**926.8**	**933.0**	**0.5**
	28895	925.0	924.4	930.4	930.0	937.9	937.6	931.6	930.0	927.7	926.1	928.4	926.9	**926.1**	**931.2**	**0.4**
	28695	923.9	923.7	930.4	929.5	934.5	932.7	932.1	928.0	929.8	925.0	930.4	925.7	**925.0**	**931.4**	**0.7**
	28500	922.9	922.5	928.6	927.0	932.3	930.3	929.9	928.0	926.2	924.0	928.0	924.6	**924.0**	**929.0**	**1.0**
	28280	922.0	921.6	926.7	925.0	931.7	930.0	929.9	926.0	927.2	922.7	926.1	923.2	**922.7**	**928.3**	**1.6**
	28080	921.6	920.5	927.0	925.0	931.0	930.0	928.5	926.0	926.2	921.8	925.0	923.2	**921.8**	**927.5**	**0.9**
	27925	920.0	920.0	925.5	925.0	930.2	930.0	927.1	924.7	924.2	921.9	923.4	922.1	**921.9**	**926.1**	**1.0**
	27725	919.5	919.4	924.2	923.8	928.6	928.3	924.0	924.0	920.8	920.4	921.9	920.5	**920.4**	**923.9**	**0.1**
	27545	919.3	919.1	923.1	922.8	927.9	927.3	923.2	922.5	920.0	919.3	920.6	919.4	**919.3**	**923.0**	**0.3**
	27335	919.0	918.6	922.0	921.4	926.6	925.9	922.0	922.0	919.6	918.7	920.0	918.3	**918.3**	**922.0**	**0.0**
	27155	918.8	918.3	921.0	920.3	925.7	924.3	921.2	920.5	919.5	918.0	919.1	918.0	**918.0**	**921.3**	**-0.1**
SRC3	26990	918.4	917.7	920.2	919.4	924.1	922.9	920.6	920.0	919.4	917.9	917.2	916.2	**916.2**	**920.3**	**0.3**
	26780	918.0	917.2	919.6	918.5	922.7	921.2	919.4	918.0	917.6	916.8	916.3	914.3	**914.3**	**919.1**	**0.2**
	26575	917.5	916.8	919.2	917.6	921.4	920.0	918.3	918.0	916.5	915.5	915.6	913.7	**913.7**	**918.2**	**0.1**
	26355	917.0	916.2	919.0	916.9	921.0	920.0	917.9	916.0	916.1	914.6	914.9	913.4	**913.4**	**917.8**	**0.2**
	26170	916.9	915.7	919.1	915.9	921.0	919.8	916.6	916.0	914.3	912.5	914.2	912.9	**912.5**	**917.0**	**-0.5**
	25965	917.1	915.3	918.3	915.0	919.2	918.1	916.4	914.1	915.1	912.3	913.8	911.6	**911.6**	**916.6**	**-0.2**
	25785	917.2	914.5	917.4	913.9	917.5	916.5	915.7	914.0	914.0	911.5	912.3	911.1	**911.1**	**915.4**	**0.3**
	25600	917.2	914.1	916.7	912.9	916.1	915.0	915.2	912.1	913.5	910.8	911.7	909.7	**909.7**	**914.6**	**0.6**
	25425	917.1	914.2	915.7	912.2	914.7	913.7	915.0	912.0	912.8	909.7	911.3	910.0	**909.7**	**913.9**	**1.1**
	25215	916.4	912.9	914.7	910.9	913.1	911.9	914.7	910.0	911.6	908.8	910.6	908.6	**908.6**	**912.9**	**1.8**
	25000	915.1	910.7	912.7	910.0	912.1	910.4	911.8	908.1	910.3	908.1	909.5	907.8	**907.8**	**911.3**	**0.5**
SRC4	24795	911.2	907.7	910.6	910.0	910.6	910.0	910.0	908.0	909.0	906.3	907.5	905.6	**905.6**	**909.5**	**0.5**
	24550	905.6	905.0	908.9	908.4	909.7	909.1	907.1	906.0	905.4	904.1	905.0	904.0	**904.0**	**907.2**	**-0.1**
	24335	904.6	902.2	908.7	906.3	908.3	907.9	906.5	906.0	904.7	903.5	904.2	903.2	**903.2**	**906.5**	**0.0**
	24115	904.2	899.1	905.7	904.7	907.0	906.7	905.1	904.0	903.2	902.6	902.8	901.8	**901.8**	**904.7**	**0.4**
	23975	903.8	897.5	904.8	904.2	906.1	905.8	903.9	903.5	903.2	901.6	901.7	901.2	**901.2**	**903.9**	**-0.1**
	23755	902.9	895.7	904.0	903.3	904.5	904.0	902.9	902.0	901.7	900.4	900.2	899.9	**899.9**	**902.7**	**0.2**
	23565	902.3	895.0	903.8	902.5	903.4	902.7	903.0	900.0	900.6	899.6	899.6	898.7	**898.7**	**902.1**	**0.9**
	23365	901.9	895.0	904.0	902.2	901.8	901.3	902.3	900.4	898.6	897.1	898.8	897.9	**897.1**	**901.1**	**1.2**
	23180	901.2	894.0	904.1	901.2	900.6	900.0	900.0	898.2	900.1	896.6	900.1	897.2	**896.6**	**901.0**	**-1.0**
	23000	900.5	892.7	902.8	900.3	900.2	900.0	898.0	898.0	898.4	896.1	896.7	896.0	**896.0**	**899.2**	**-1.2**
	22790	899.8	891.5	900.4	900.0	900.2	900.0	898.0	898.0	897.4	895.5	896.5	895.0	**895.0**	**898.5**	**-0.5**
	22600	898.8	890.0	899.4	898.9	899.1	898.4	899.8	896.0	898.3	894.8	896.7	894.5	**894.5**	**898.7**	**1.1**
	22415	897.3	890.0	898.2	897.5	897.5	896.7	898.2	894.8	897.0	894.1	896.5	893.3	**893.3**	**897.5**	**0.7**

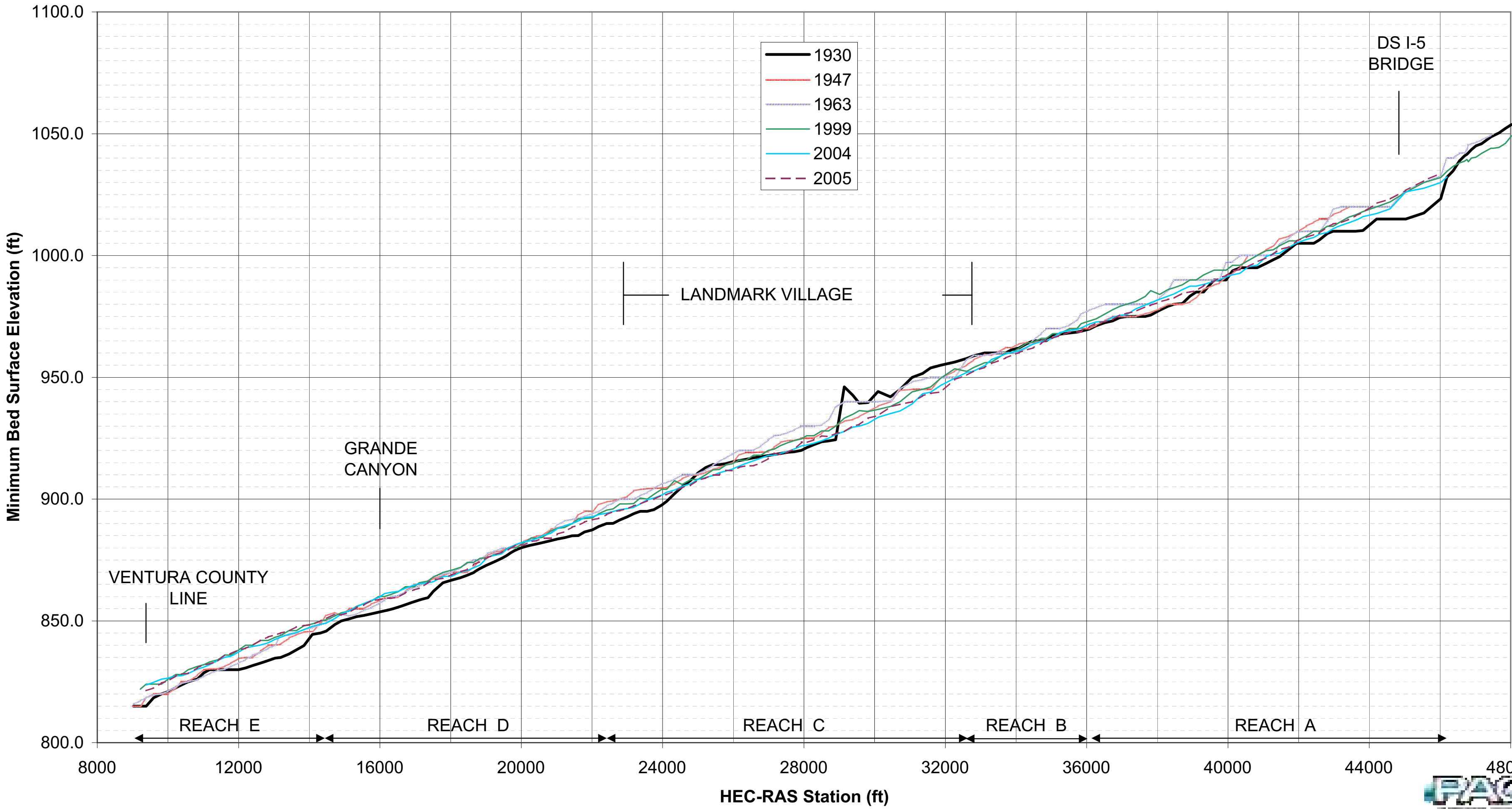
(1) "All years" excludes 1930

Table A5.2 Santa Clara River Thalweg Analysis Caluclation of Long Term Aggradation/Degradation Based on Historical Bed Analysis (ft) (continued)

Subreach	HEC-RAS	1930		1947		1963		1999		2004		2005		(1)MINIMUM OF	(1)MEAN OF	
	Station	Topo Mean	Topo Min	Topo Mean	Topo Min	Topo Mean	Topo Min	Topo Mean	Topo Min	Topo Mean	Topo Min	Topo Mean	Topo Min	ALL MINIMUMS	ALL MEANS	99 MEAN-ALL MEAN
SRD1	22195	895.9	888.8	896.9	896.1	895.3	894.7	896.2	894.0	895.7	893.6	895.3	892.1	**892.1**	**895.9**	**0.3**
	22010	894.9	887.4	895.6	894.5	894.3	893.8	894.3	892.3	894.3	892.5	893.4	891.5	**891.5**	**894.4**	**-0.1**
	21790	893.8	886.5	894.5	893.8	893.4	892.7	894.2	892.0	893.4	892.2	891.6	890.4	**890.4**	**893.5**	**0.8**
	21615	892.3	885.0	893.0	892.3	892.7	891.9	893.7	891.9	891.5	891.0	890.5	889.0	**889.0**	**892.3**	**1.4**
	21440	890.0	884.9	891.3	890.0	891.6	891.1	892.5	890.0	890.7	889.9	890.3	888.3	**888.3**	**891.3**	**1.2**
	21225	889.1	884.2	890.1	889.0	890.7	890.2	892.3	888.3	890.9	889.0	889.7	886.4	**886.4**	**890.7**	**1.5**
	21020	888.0	883.5	888.5	888.0	889.1	887.8	891.4	888.0	889.7	887.9	888.3	885.7	**885.7**	**889.4**	**2.0**
	20845	887.5	883.0	887.2	886.2	887.1	886.1	890.2	887.0	888.6	885.9	886.2	883.9	**883.9**	**887.9**	**2.3**
	20595	886.5	882.2	885.7	885.0	886.3	884.3	888.2	884.2	886.9	885.0	885.4	883.9	**883.9**	**886.5**	**1.7**
	20435	885.7	881.6	885.2	884.7	884.5	883.3	887.3	884.0	885.7	883.8	884.2	882.8	**882.8**	**885.4**	**1.9**
	20280	885.1	881.0	884.3	883.7	883.4	882.6	886.0	884.0	884.7	882.8	883.5	882.0	**882.0**	**884.4**	**1.6**
	20070	884.0	880.3	882.8	882.6	882.1	881.3	883.6	882.0	883.7	882.3	882.0	880.9	**880.9**	**882.9**	**0.8**
SRD2	19855	882.5	879.1	881.6	880.9	880.5	880.0	882.2	880.1	882.6	881.2	881.0	880.1	**880.0**	**881.6**	**0.6**
	19630	879.9	877.2	881.4	880.0	880.2	880.0	881.2	880.0	881.1	879.8	879.8	879.0	**879.0**	**880.7**	**0.5**
	19440	877.2	875.4	881.0	878.8	879.5	878.6	879.9	878.0	879.5	877.6	878.7	877.7	**877.6**	**879.7**	**0.1**
	19240	875.8	874.3	879.7	877.0	878.5	877.0	879.8	877.2	877.5	876.6	877.6	876.8	**876.6**	**878.6**	**1.2**
	19050	873.5	870.0	877.4	875.4	877.3	875.6	878.2	876.0	875.9	875.3	876.6	875.5	**875.3**	**877.1**	**1.1**
	18830	871.8	869.0	875.7	875.0	876.2	875.0	878.9	875.0	874.6	872.9	875.5	874.0	**872.9**	**876.2**	**2.7**
	18650	870.1	868.8	875.5	872.3	875.2	874.6	876.6	874.0	875.0	871.6	874.1	873.1	**871.6**	**875.3**	**1.3**
	18475	868.9	867.0	874.5	870.0	874.4	873.4	875.7	872.0	874.4	870.7	872.1	868.8	**868.8**	**874.2**	**1.5**
	18290	867.9	865.2	874.5	870.0	873.7	871.9	875.9	872.0	873.5	870.1	871.8	869.0	**869.0**	**873.9**	**2.0**
	18025	867.1	865.0	873.8	870.0	871.2	870.0	874.1	870.0	873.3	868.4	871.3	867.6	**867.6**	**872.7**	**1.3**
	17785	866.0	865.0	872.1	868.6	869.6	869.2	873.6	868.1	872.0	868.2	870.2	867.1	**867.1**	**871.5**	**2.1**
SRD3	17510	861.9	860.4	870.6	866.4	869.5	866.7	873.7	868.0	871.5	866.0	870.1	866.2	**866.0**	**871.1**	**2.6**
	17360	860.4	859.5	869.5	865.0	868.3	865.2	873.2	866.0	869.7	865.7	868.1	864.6	**864.6**	**869.8**	**3.4**
	17110	859.0	858.6	867.3	865.0	865.9	864.1	870.0	864.8	867.3	865.0	864.4	860.9	**860.9**	**867.0**	**3.0**
	16970	858.9	857.8	867.0	865.0	866.0	863.8	866.7	864.0	865.8	864.5	864.0	861.9	**861.9**	**865.9**	**0.8**
	16720	858.3	856.6	864.3	862.0	864.3	862.0	865.2	863.0	865.3	863.4	863.1	861.6	**861.6**	**864.5**	**0.8**
	16515	857.6	855.6	862.7	859.7	862.5	860.3	863.8	862.0	864.0	862.1	861.7	859.7	**859.7**	**862.9**	**0.8**
	16305	856.8	854.8	862.8	859.2	861.6	860.0	863.3	860.0	863.7	861.7	861.6	859.3	**859.2**	**862.6**	**0.7**
	16130	856.1	854.1	862.4	859.3	860.2	858.6	862.5	860.0	862.9	861.2	860.5	858.9	**858.6**	**861.7**	**0.8**
	15960	855.3	853.5	861.5	858.2	858.4	857.0	861.8	860.0	861.0	859.5	859.7	858.6	**857.0**	**860.5**	**1.3**
	15745	854.0	852.9	860.3	856.8	856.5	855.3	860.0	858.0	859.7	858.2	859.0	857.5	**855.3**	**859.1**	**0.9**
	15540	853.2	851.9	859.5	855.0	855.1	854.2	858.3	856.0	859.5	857.1	857.8	856.4	**854.2**	**858.0**	**0.3**
	15335	852.6	851.7	859.6	855.0	852.8	852.0	858.1	856.0	857.2	855.7	857.0	855.5	**852.0**	**857.0**	**1.1**
SRE1	15125	851.8	850.7	859.5	855.0	852.1	850.2	856.0	854.0	855.8	853.3	855.3	853.3	**850.2**	**855.7**	**0.2**
	14900	851.2	850.0	857.3	852.3	854.0	850.4	855.4	853.2	854.8	852.8	854.3	852.4	**850.4**	**855.2**	**0.2**
	14720	850.7	848.3	856.0	853.1	853.6	850.0	854.6	852.0	853.9	851.0	853.9	852.5	**850.0**	**854.4**	**0.2**
	14480	849.6	845.7	854.5	850.0	852.9	848.5	854.3	850.4	853.2	849.1	853.6	851.0	**848.5**	**853.7**	**0.6**
	14315	849.1	845.0	854.3	849.1	852.1	848.0	852.6	850.0	852.0	848.6	852.3	850.0	**848.0**	**852.7**	**-0.1**
	14090	848.3	844.2	852.0	845.0	851.3	847.2	851.6	848.6	850.6	847.8	850.7	848.5	**845.0**	**851.2**	**0.4**
	13850	845.8	839.9	850.7	845.0	850.2	846.4	850.8	848.0	849.2	846.4	849.5	848.1	**845.0**	**850.1**	**0.7**
	13635	843.4	837.9	849.4	844.3	847.7	845.0	850.0	846.0	848.0	845.2	848.8	847.6	**844.3**	**848.8**	**1.2**
	13425	843.5	836.4	847.7	842.5	846.2	843.2	848.1	846.0	847.2	844.5	847.6	845.9	**842.5**	**847.4**	**0.8**
	13190	841.7	835.0	845.7	840.4	844.6	841.7	846.4	844.0	845.8	843.3	846.1	845.0	**840.4**	**845.7**	**0.7**
SRE2	13030	840.1	834.7	844.0	840.0	842.5	840.0	846.1	843.3	844.8	842.4	845.3	844.2	**840.0**	**844.5**	**1.6**
	12835	838.0	833.7	841.8	840.0	841.1	838.5	844.4	842.0	843.7	841.0	844.0	842.9	**838.5**	**843.0**	**1.4**
	12615	836.5	832.5	840.4	837.1	839.8	837.0	843.6	841.5	842.3	840.1	842.5	841.6	**837.0**	**841.7**	**1.9**
	12395	835.8	831.7	839.2	835.0	838.7	835.9	841.9	840.0	841.7	839.5	841.4	840.0	**835.0**	**840.6**	**1.3**
	12195	834.7	830.7	839.2	835.0	836.4	834.0	841.1	839.0	840.0	838.9	840.1	838.7	**834.0**	**839.4**	**1.8**
	11995	833.4	830.0	839.2	834.6	836.3	832.6	839.6	838.0	838.7	837.2	839.1	838.1	**832.6**	**838.6**	**1.0**
	11780	831.8	830.0	837.7	832.6	834.8	831.2	837.7	836.0	837.2	835.5	837.7	836.1	**831.2**	**837.0**	**0.7**
	11605	831.1	830.0	836.5	831.3	833.5	830.1	837.1	836.0	836.5	834.8	836.6	834.2	**830.1**	**836.1**	**1.1**
	11405	830.2	830.0	834.5	830.0	831.8	829.7	834.8	834.0	835.5	833.7	835.0	832.8	**829.7**	**834.3**	**0.5**
	11180	829.1	828.4	832.5	828.4	828.9	828.3	833.4	832.5	833.5	831.8	833.6	832.4	**828.3**	**832.4**	**1.0**
SRE3	11015	827.8	827.1	831.3	826.6	828.4	827.3	832.1	832.0	832.8	831.0	832.3	830.5	**826.6**	**831.4**	**0.7**
	10835	826.4	825.7	829.9	825.0	827.6	825.7	832.3	830.0	832.2	830.2	831.5	829.4	**825.0**	**830.7**	**1.5**
	10575	825.4	825.0	827.6	825.0	826.2	825.0	831.3	830.0	831.0	828.3	830.1	828.4	**825.0**	**829.2**	**2.0**
	10390	824.1	823.7	826.1	825.0	824.6	823.5	829.7	828.0	830.2	827.5	829.0	828.1	**823.5**	**827.9**	**1.8**
	10225	823.3	822.6	825.2	822.6	823.5	822.4	828.7	828.0	828.6	827.3	827.9	827.4	**822.4**	**826.8**	**2.0**
	10000	823.9	820.9	822.2	820.0	821.5	821.0	827.3	826.0	828.0	826.4	825.4	824.3	**820.0**	**824.9**	**2.5**
	9820	823.0	820.0	821.2	820.0	820.9	820.0	826.3	824.0	827.6	826.0	825.4	823.7	**820.0**	**824.3**	**2.1**
	9595	822.9	818.5	820.3	819.3	819.9	819.1	825.8	824.0	826.5	824.8	824.3	822.3	**819.1**	**823.4**	**2.4**
	9385	822.5	815.0	819.4	816.7	818.9	818.3	825.5	824.0	825.2	823.7	823.7	821.3	**816.7**	**822.5**	**3.0**
	9220	821.6	815.0	818.0	815.0	818.0	816.9	824.2	822.0					**815.0**	**820.0**	**4.1**
	9025	820.0	815.0	816.1	815.0	816.5	815.8							**815.0**	**816.3**	

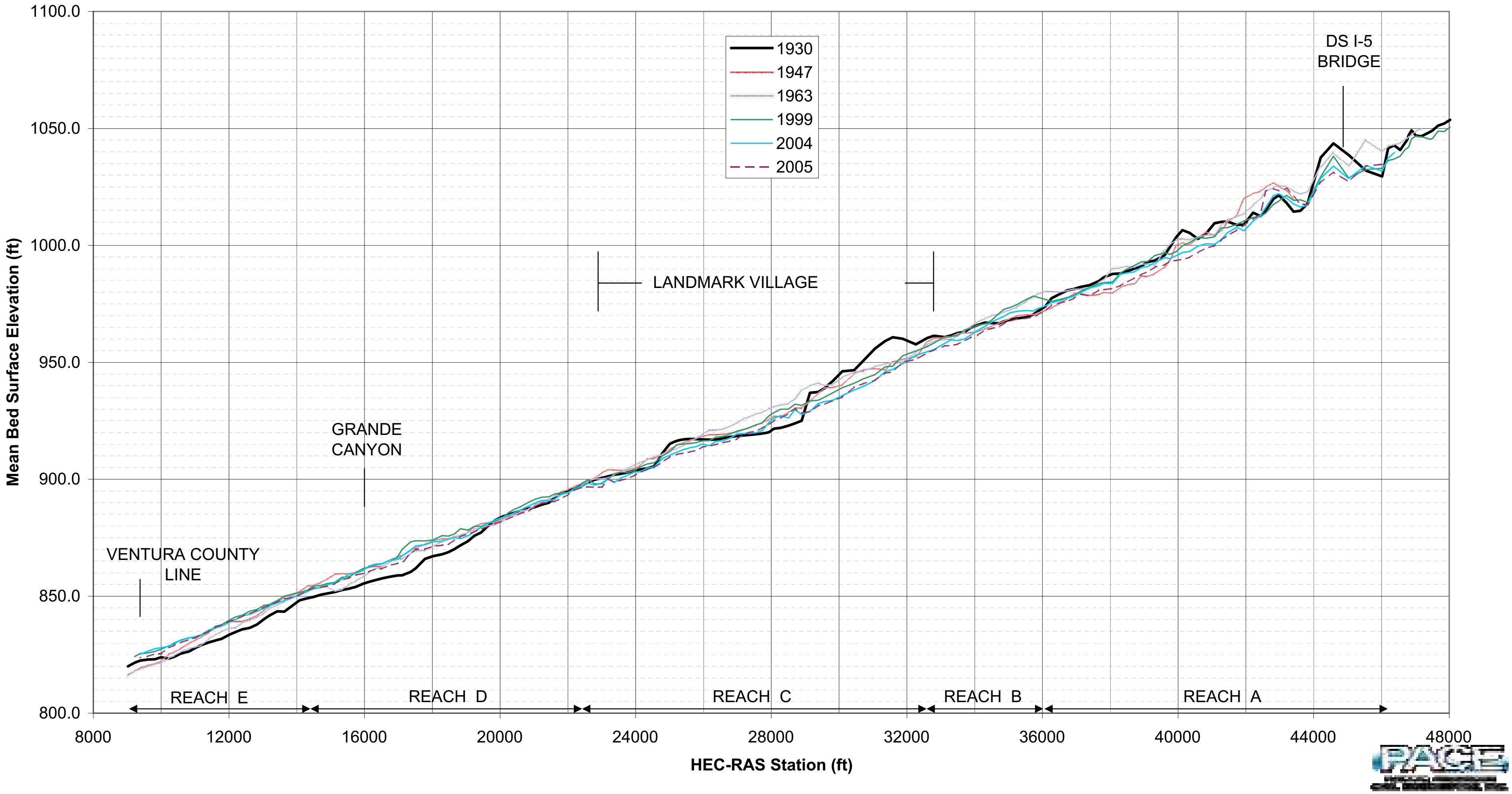
(1) "All years" excludes 1930

Figure A5.2.2A Santa Clara River Historical Minimum Bed Elevation



P:\8197E\5-Administrative\Reports\Fluvial Report\Fluvial Spreadsheets\Appendix 5.2 Min-Mean Thalweg by Year 11-02-05

Figure A5.2.2B Santa Clara River Historical Mean Bed Elevation



P:\8197E\5-Administrative\Reports\Fluvial Report\Fluvial Spreadsheets\Appendix 5.2 Min-Mean Thalweg by Year 11-02-05

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
Dimscale = 300; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

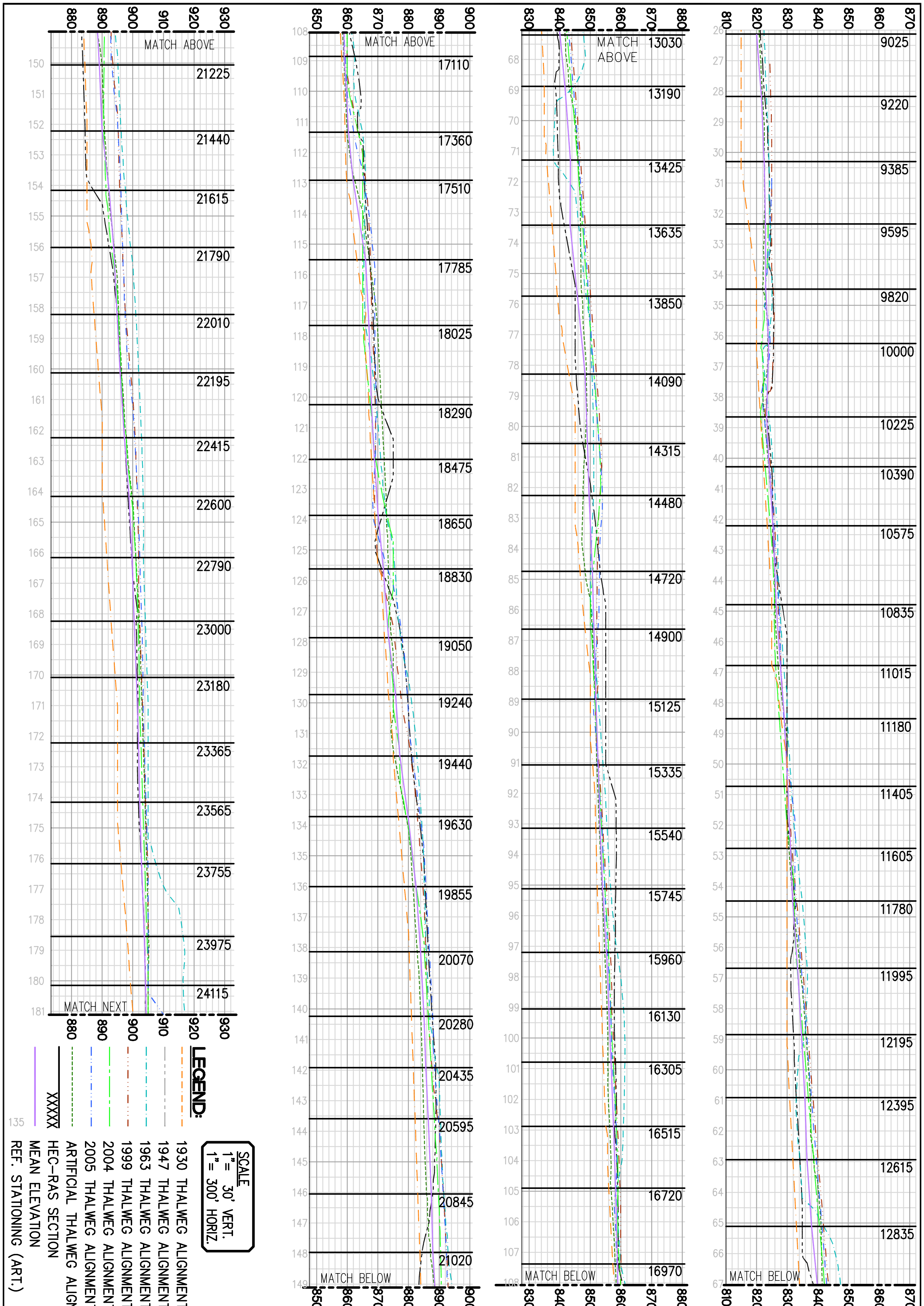


FIGURE A5.3.1A

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1"= 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

JOB
SANTA CLARA RIVER
FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER
HISTORIC BED
PROFILES (1930 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles - Santa Clara.dwg - Tab: A By: ddrahn on Mar. 14, 2006 at 05:05 pm

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
Dimscale = 300; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

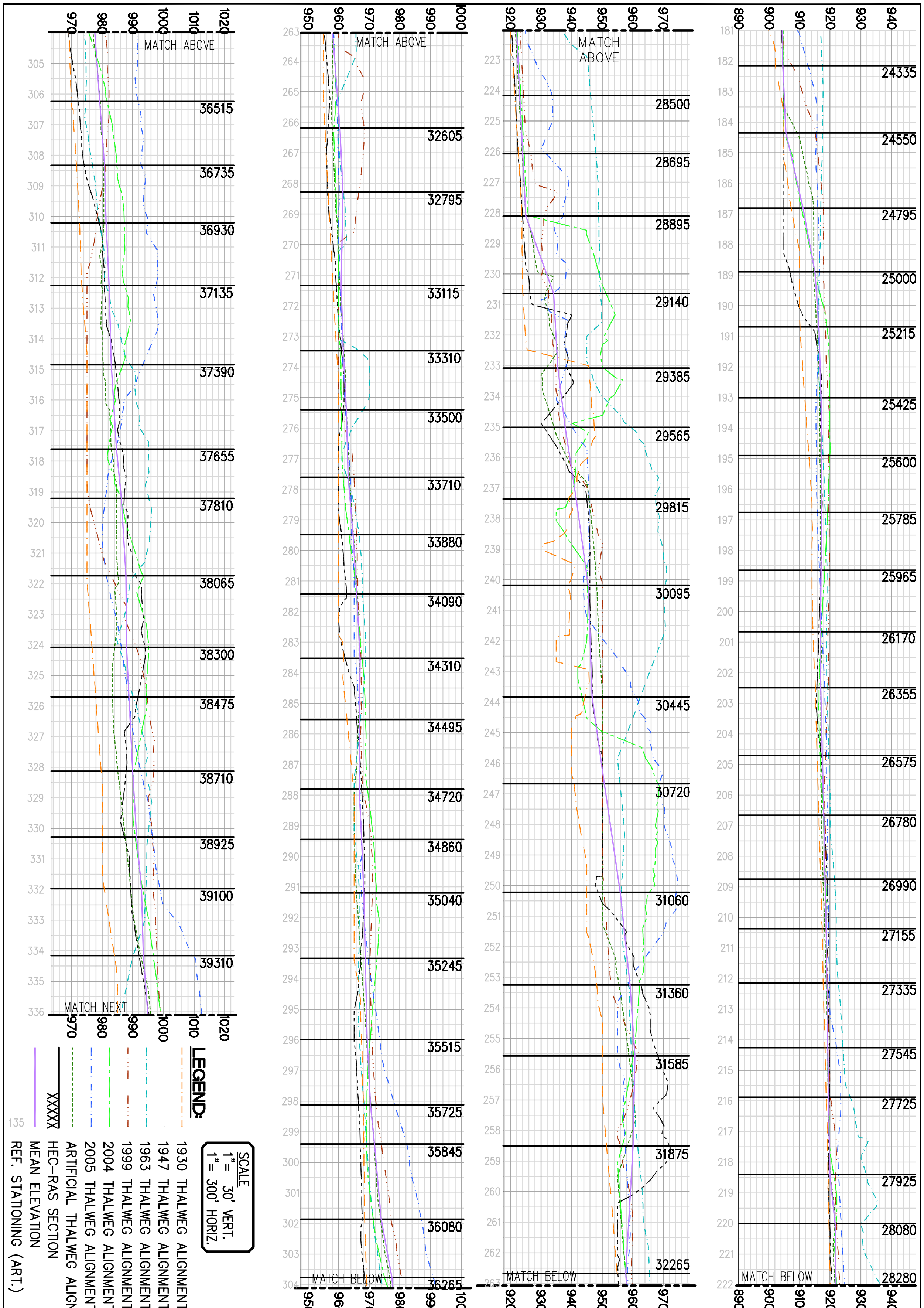


FIGURE A5.3.1B

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1" = 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

JOB
SANTA CLARA RIVER
FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER
HISTORIC BED
PROFILES (1930 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles - Santa Clara.dwg - Tab: B By: ddrahn on Mar. 14, 2006 at 05:05 pm

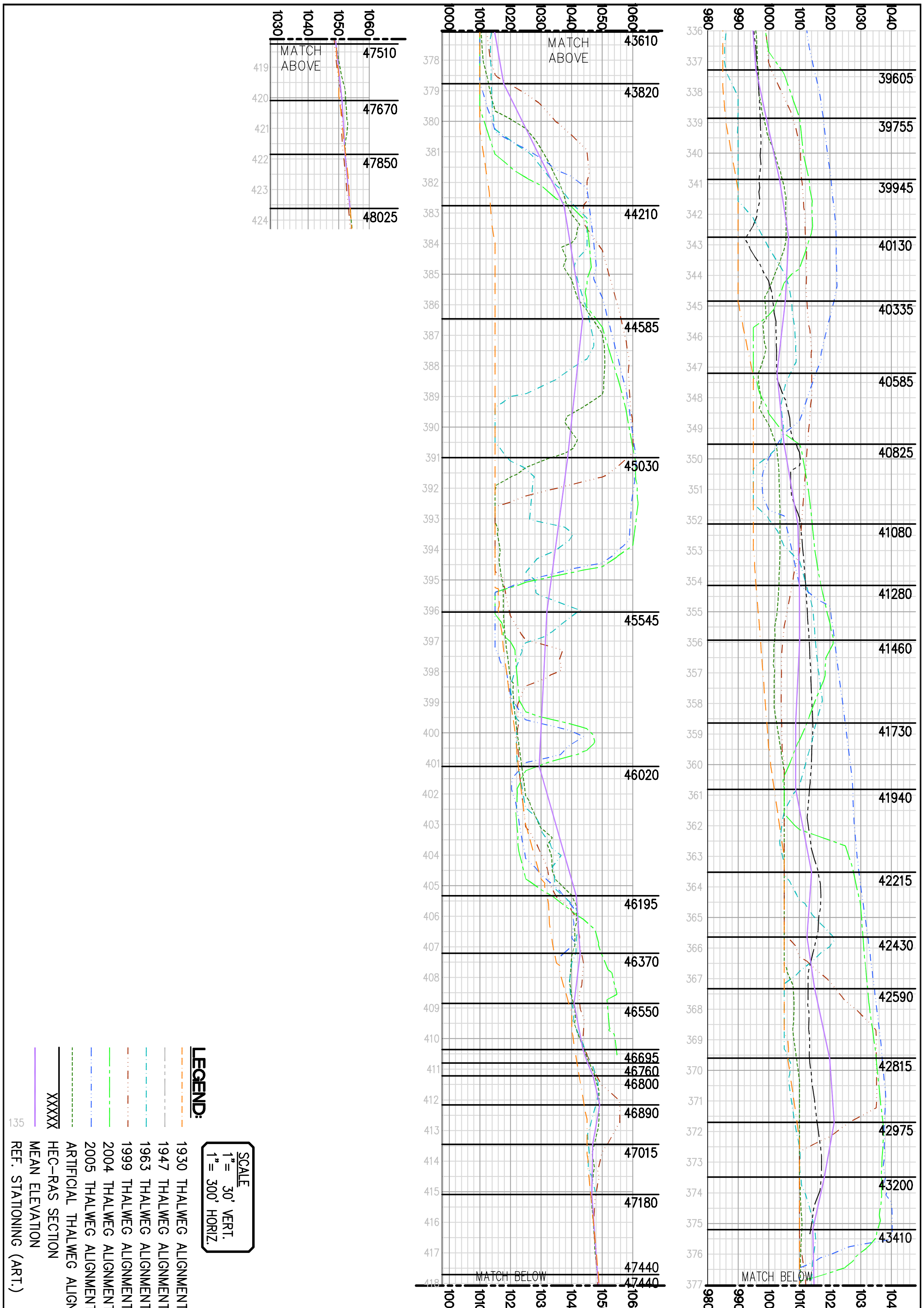


FIGURE A5.3.1G

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1" = 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

JOB
SANTA CLARA RIVER FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER HISTORIC BED PROFILES (1930 TOPO)

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
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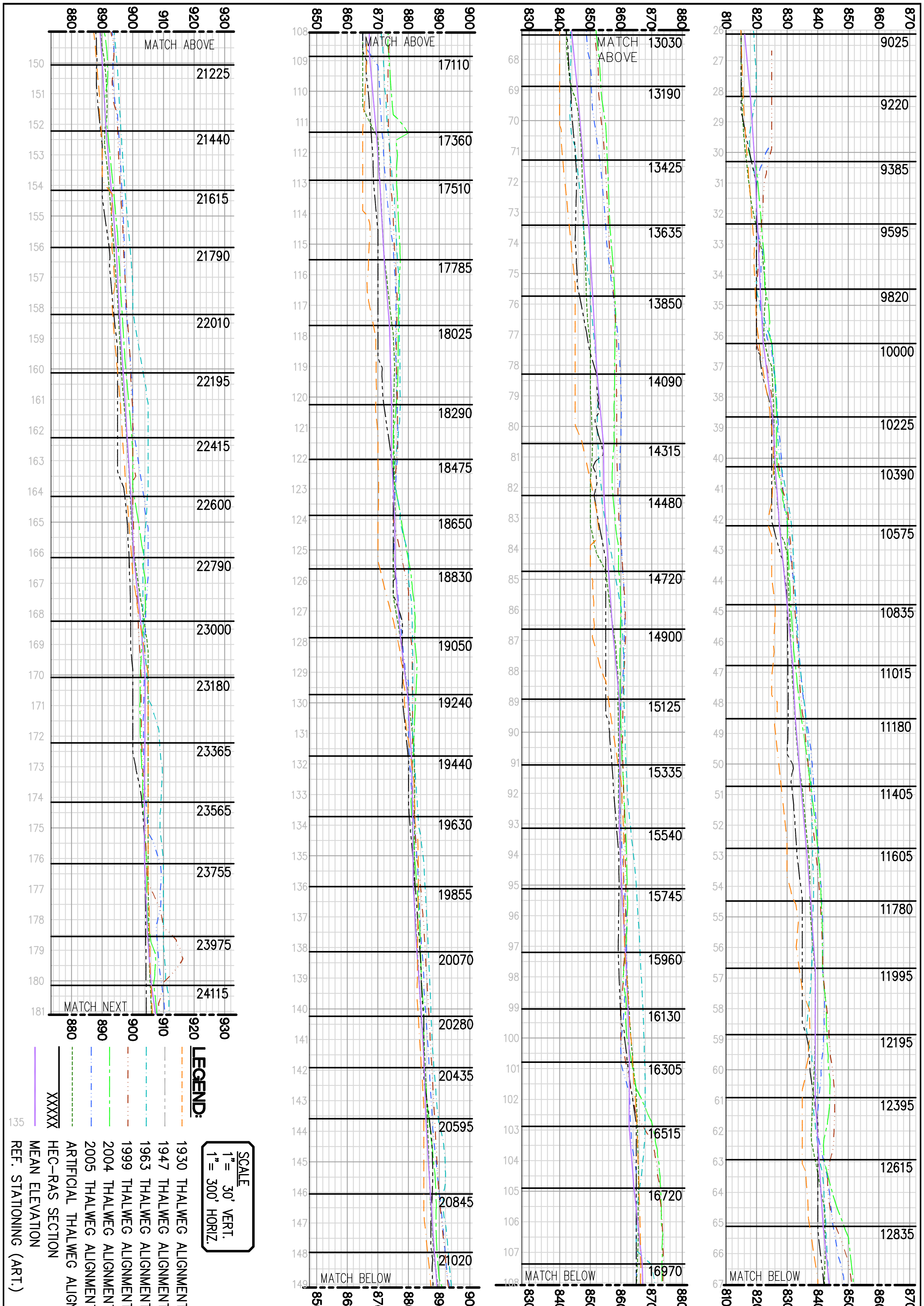

FIGURE **A5.3.1D**

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1" = 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

JOB
SANTA CLARA RIVER FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER HISTORIC BED PROFILES (1947 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles - Santa Clara.dwg - Tab: D By: ddrahn on Mar. 14, 2006 at 05:04 pm

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
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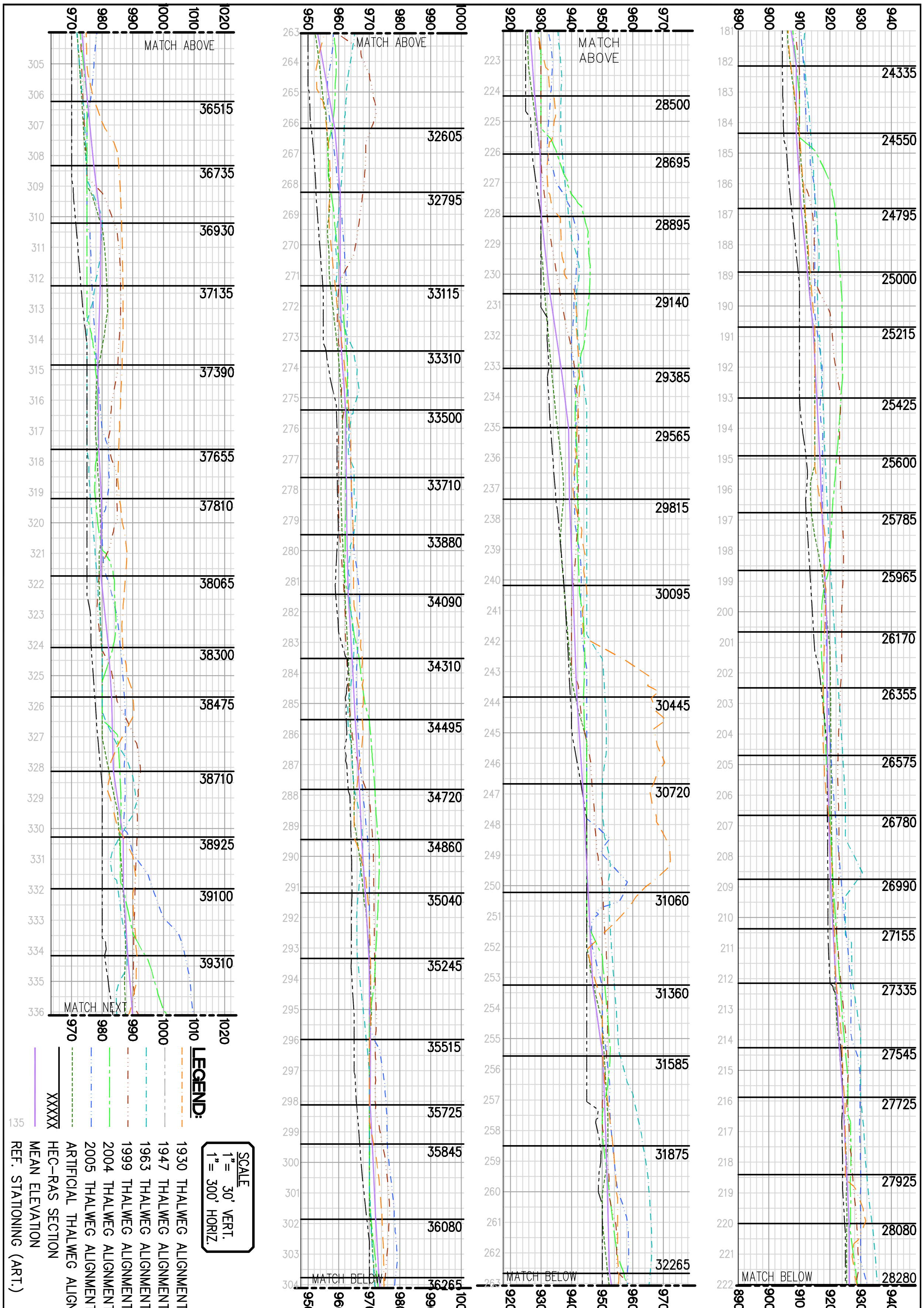

FIGURE	A5.3.1E
PACE — PACIFIC ADVANCED CIVIL ENGINEERING	17520 NEWHOPE STREET, SUITE 200, FOUNTAIN VALLEY, CA 92708, PH (714) 481-7300 FAX (714) 481-7299
SCALE	1"= 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E
JOB	SANTA CLARA RIVER FLUVIAL STUDY — LOS ANGELES COUNTY, CA
TITLE	SANTA CLARA RIVER HISTORIC BED PROFILES (1947 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles – Santa Clara.dwg – Tab: E By: ddrahn on Mar. 14, 2006 at 05:04 pm

Xrefs: 8197–SantaClara–Profiles.dwg; 8197–11x17Exh–Tblk.dwg
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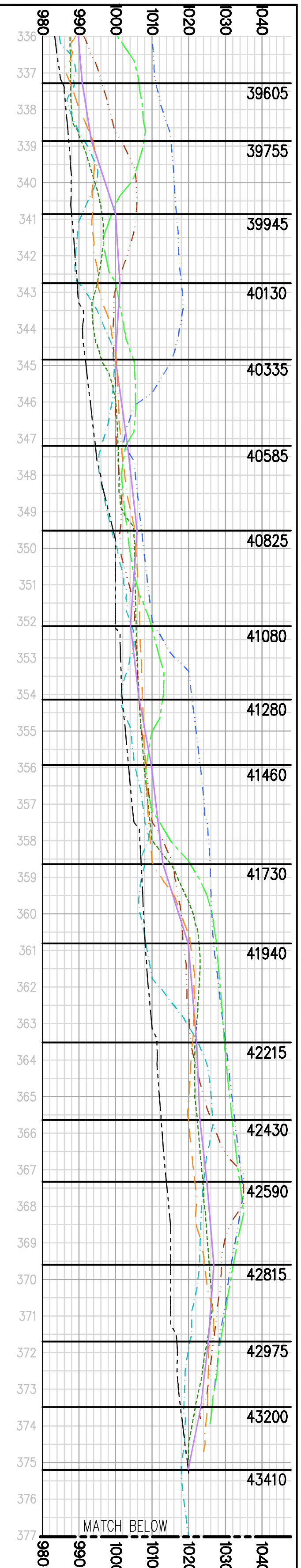

FIGURE	PACE — PACIFIC ADVANCED CIVIL ENGINEERING, 17520 NEWHOPE STREET, SUITE 200, FOUNTAIN VALLEY, CA 92708, PH (714) 481–7300 FAX (714) 481–7299		JOB	TITLE
A5.3.1F		SCALE: 1"= 300'	SANTA CLARA RIVER FLUVIAL STUDY	SANTA CLARA RIVER HISTORIC BED PROFILES (1947 TOPO)
		DESIGNED: DAJ	LOS ANGELES COUNTY CA	
		DRAWN: DAD		
		CHECKED: MEK		
		DATE: 09/13/05		
		JOB NO.: 8197E		

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles – Santa Clara.dwg – Tab: F By: ddrahn on Mar. 14, 2006 at 05:04 pm

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
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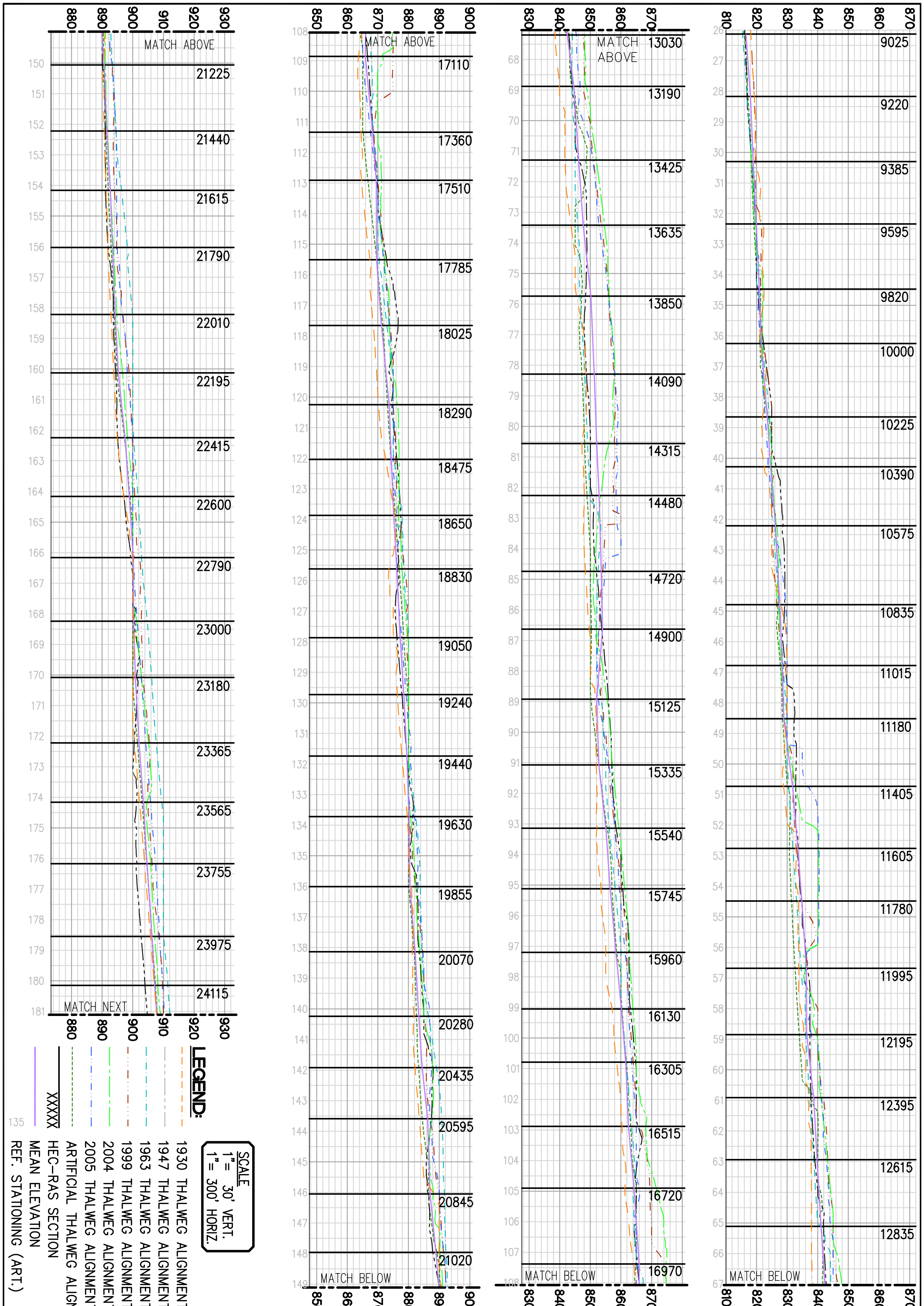

FIGURE A5.3.1G

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1"= 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

JOB
SANTA CLARA RIVER
FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER
HISTORIC BED
PROFILES (1963 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles - Santa Clara.dwg - Tab: G By: ddrahn on Mar. 14, 2006 at 05:04 pm

Xrefs: 8197–SantaClara–Profiles.dwg; 8197–11x17Exh–Tblk.dwg
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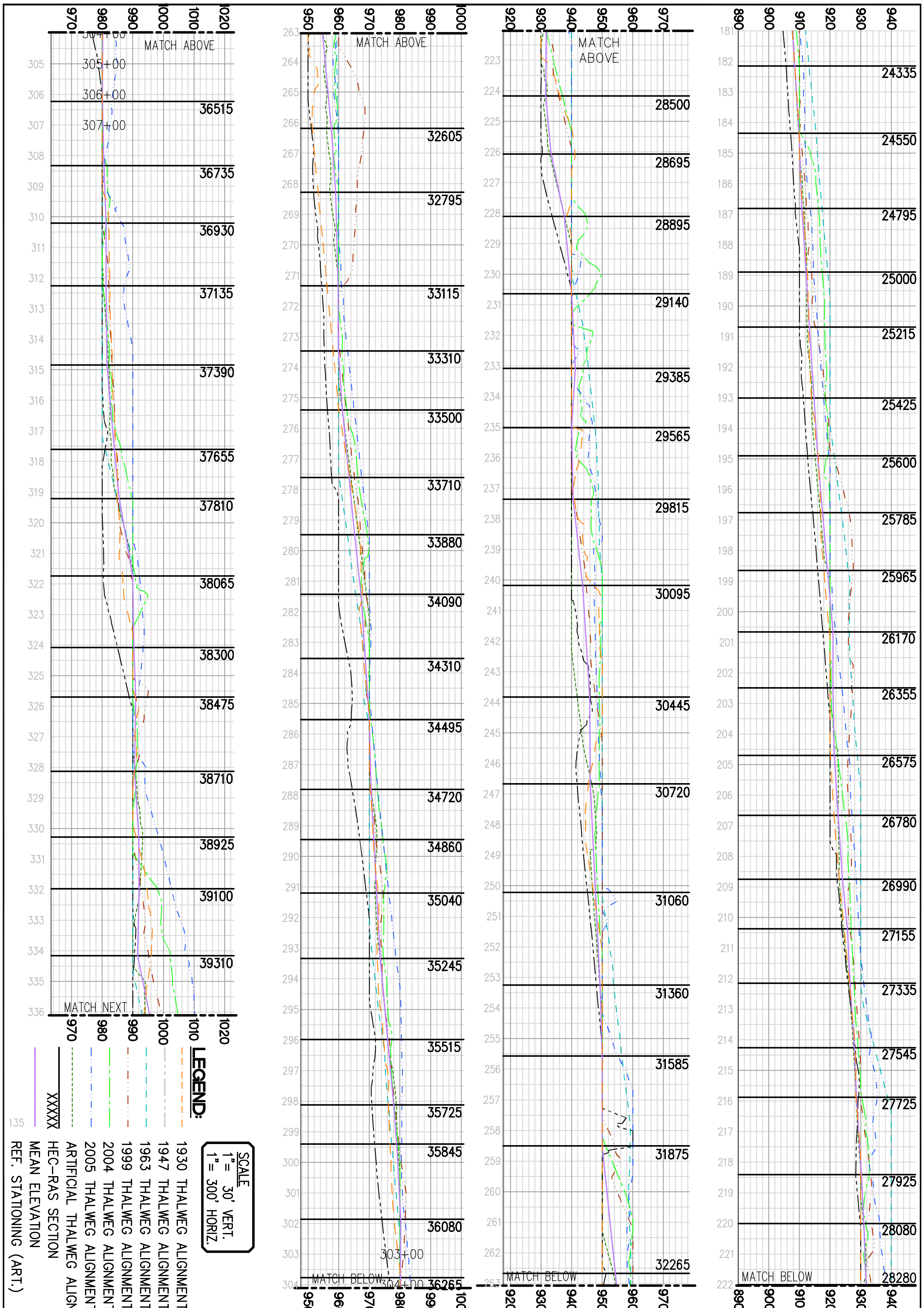


FIGURE A5.3.1H	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481–7300 FAX (714) 481–7299	SCALE 1"= 300' DESIGNED DAJ DRAWN DAD CHECKED MEK DATE 09/13/05 JOB NO. 8197E	JOB SANTA CLARA RIVER FLUVIAL STUDY LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER HISTORIC BED PROFILES (1963 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles – Santa Clara.dwg – Tab: H By: ddrahn on Mar. 14, 2006 at 05:04 pm

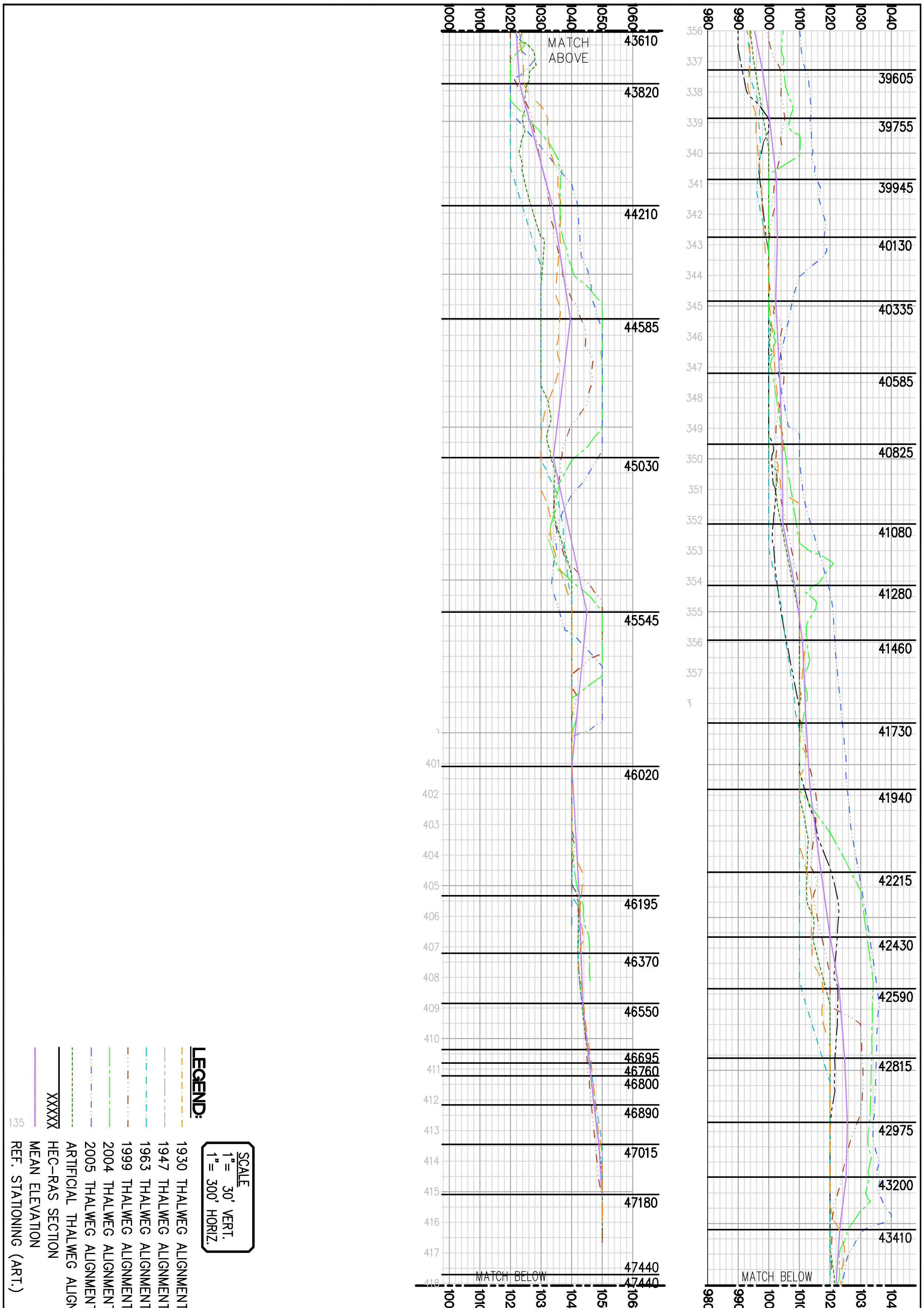


FIGURE A5.3.11	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 300' DESIGNED DAJ DRAWN DAD CHECKED MEK DATE 09/13/05 JOB NO. 8197E	JOB SANTA CLARA RIVER FLUVIAL STUDY LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER HISTORIC BED PROFILES (1963 TOPO)

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
Dimscale = 300; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

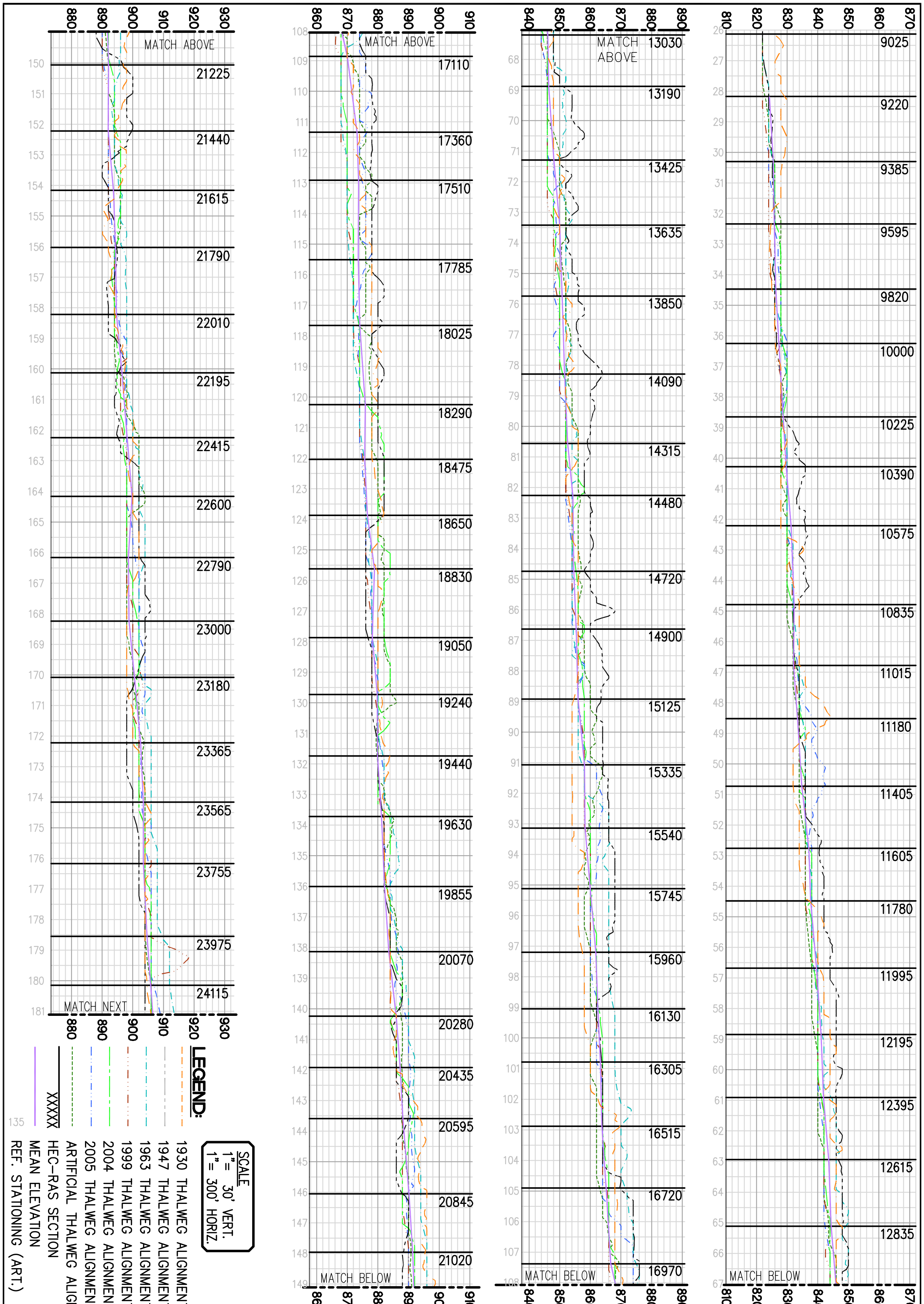


FIGURE **A5.3.1J**

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1"= 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

JOB
SANTA CLARA RIVER FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER HISTORIC BED PROFILES (1999 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles – Santa Clara.dwg – Tab: J By: ddrahn on Mar. 14, 2006 at 05:04 pm

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
Dimscale = 300; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

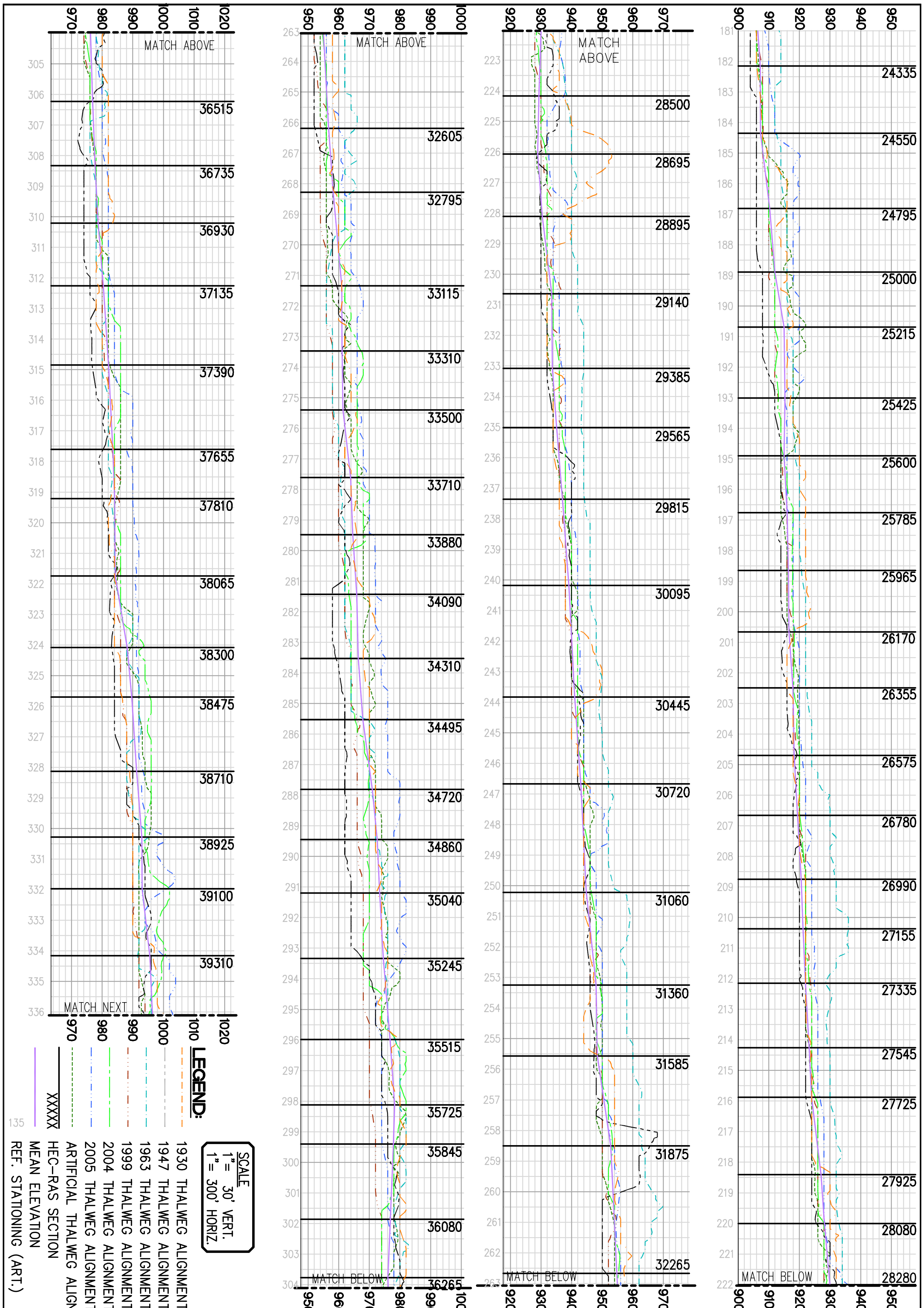


FIGURE A5.3.1K

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

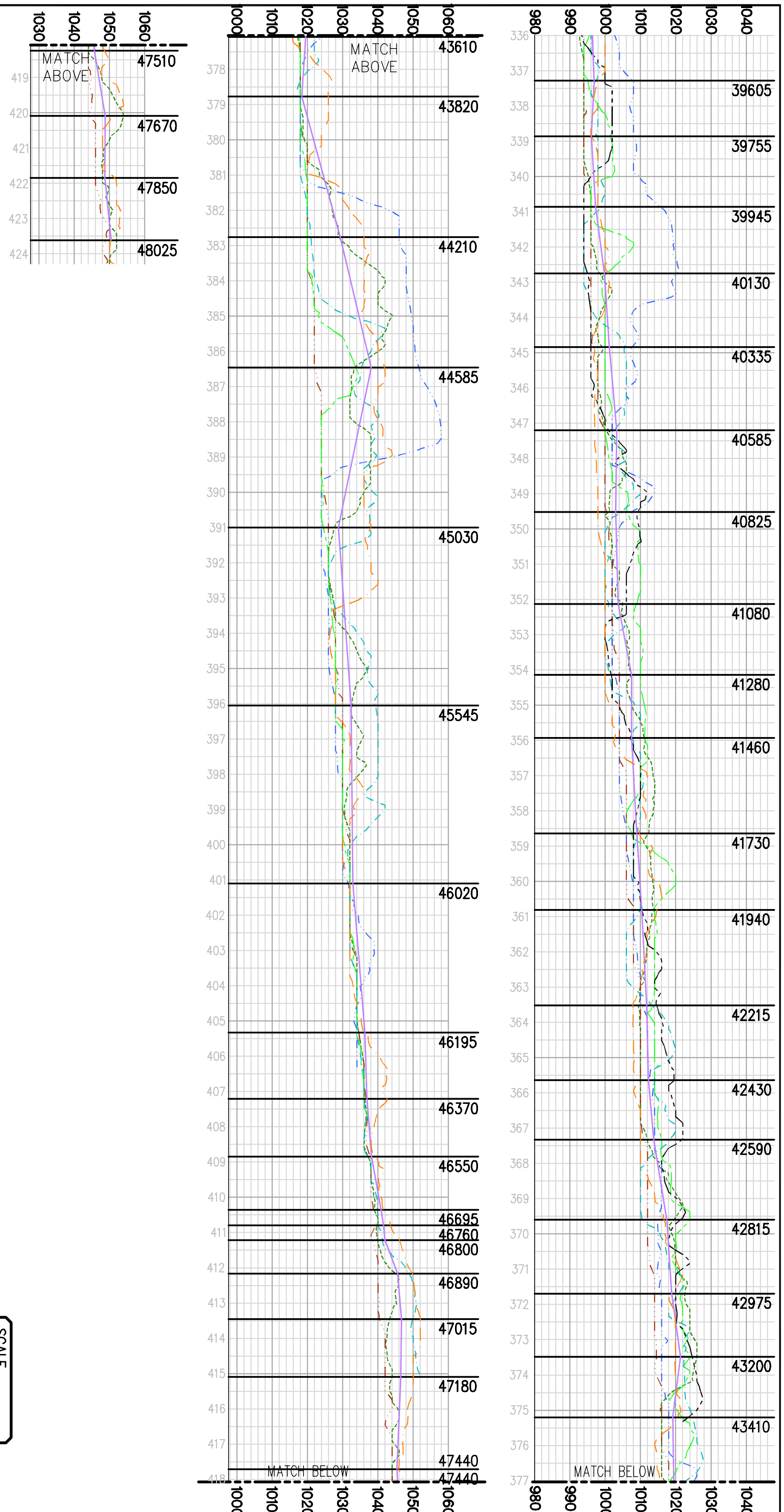
SCALE	1" = 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

JOB
SANTA CLARA RIVER
FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER
HISTORIC BED
PROFILES (1999 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles - Santa Clara.dwg - Tab: K By: ddrahn on Mar. 14, 2006 at 05:04 pm

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
Dimscale = 300; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1



LEGEND:

- 1930 THALWEG ALIGNMENT
- 1947 THALWEG ALIGNMENT
- 1963 THALWEG ALIGNMENT
- 1999 THALWEG ALIGNMENT
- 2004 THALWEG ALIGNMENT
- 2005 THALWEG ALIGNMENT
- ARTIFICIAL THALWEG ALIGN.
- XXXXX HEC-RAS SECTION
- MEAN ELEVATION
- 135 REF. STATIONING (ART.)

SCALE
1"= 30' VERT.
1"= 300' HORIZ.

FIGURE A5.3.1L

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1"= 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

JOB
SANTA CLARA RIVER
FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER
HISTORIC BED
PROFILES (1999 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles - Santa Clara.dwg - Tab: L By: ddrahn on Mar. 14, 2006 at 05:04 pm

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
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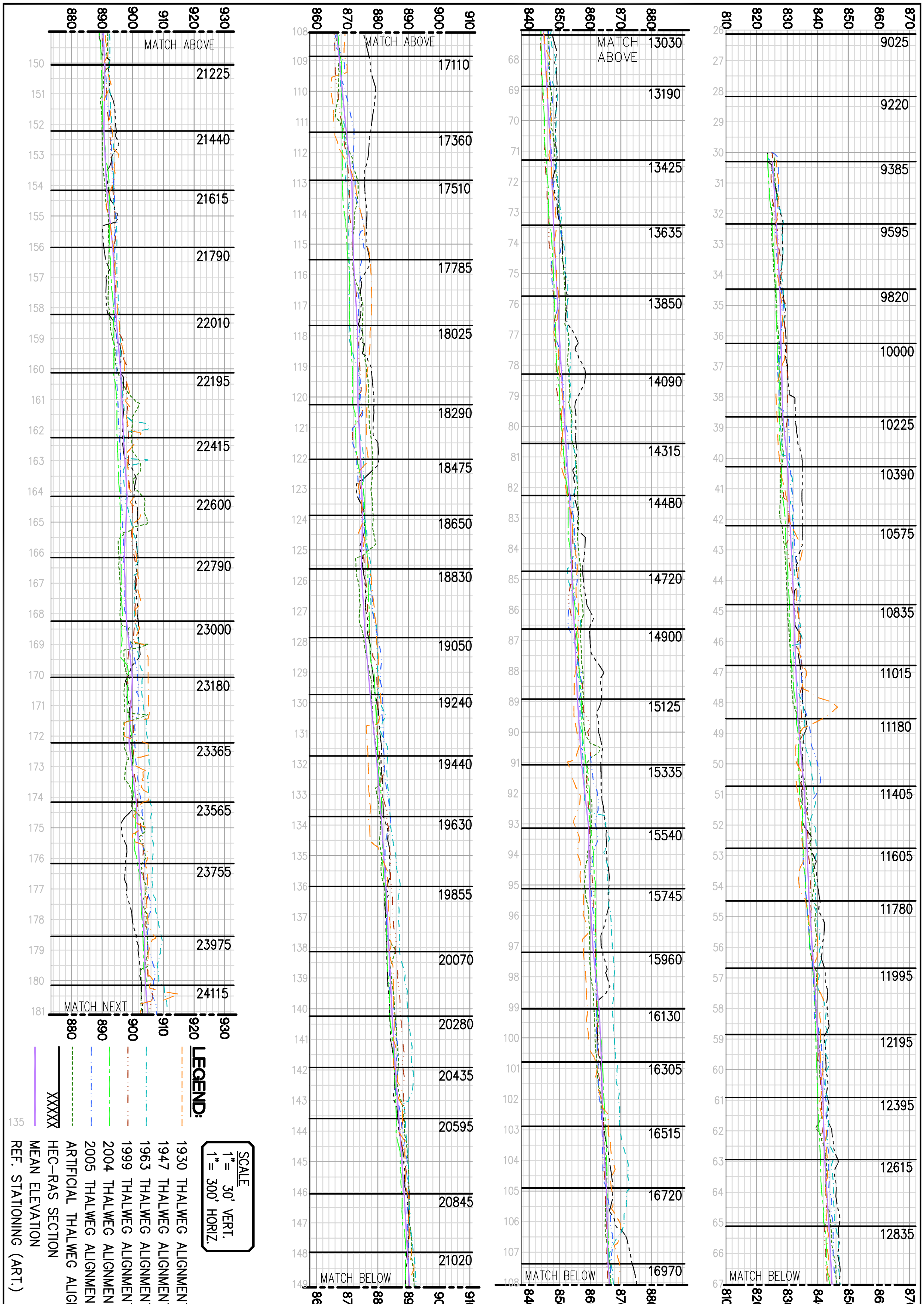

FIGURE A5.3.1M

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1" = 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

JOB
SANTA CLARA RIVER
FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER
HISTORIC BED
PROFILES (2004 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles - Santa Clara.dwg - Tab: M By: ddrahn on Mar. 14, 2006 at 05:03 pm

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
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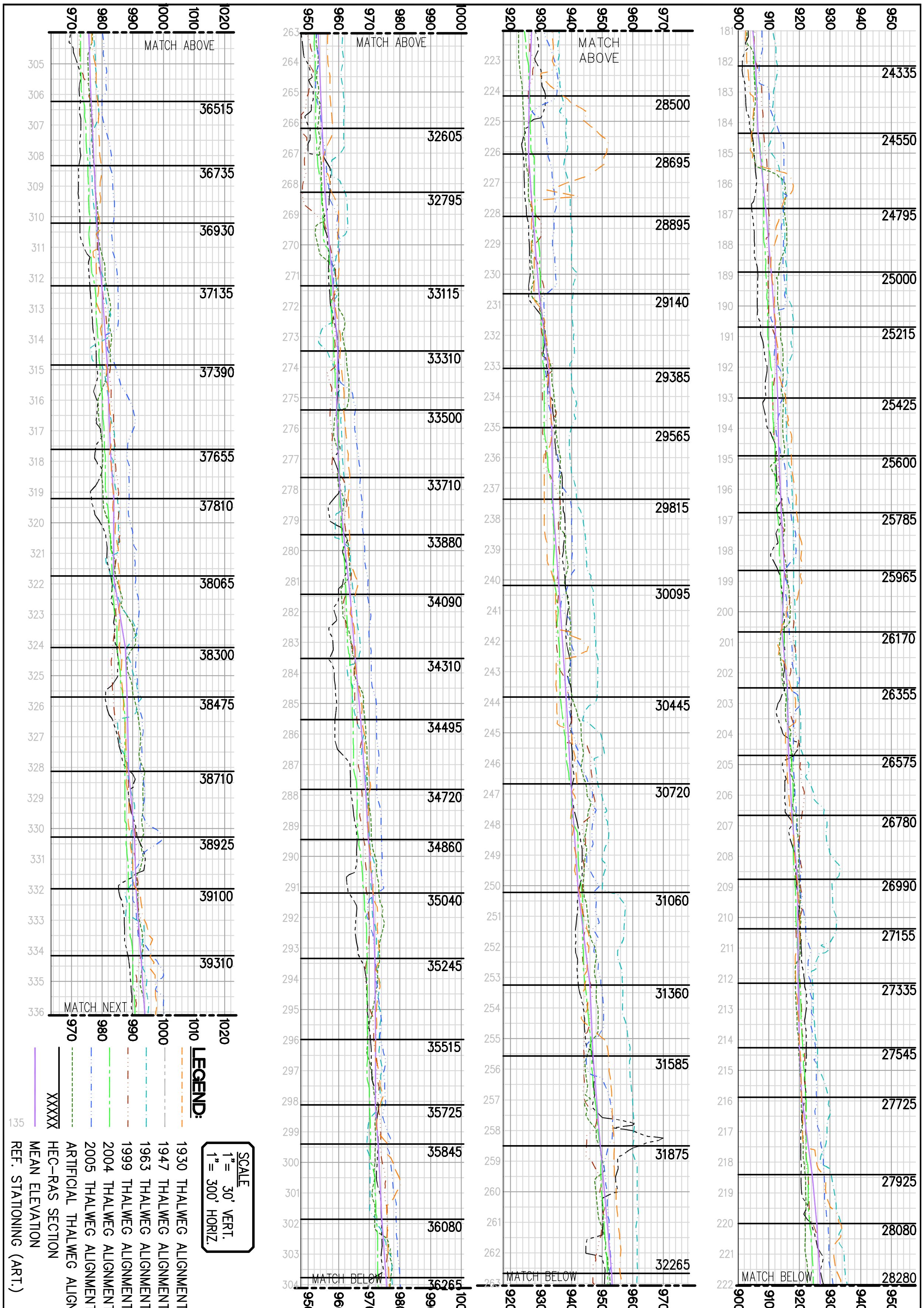
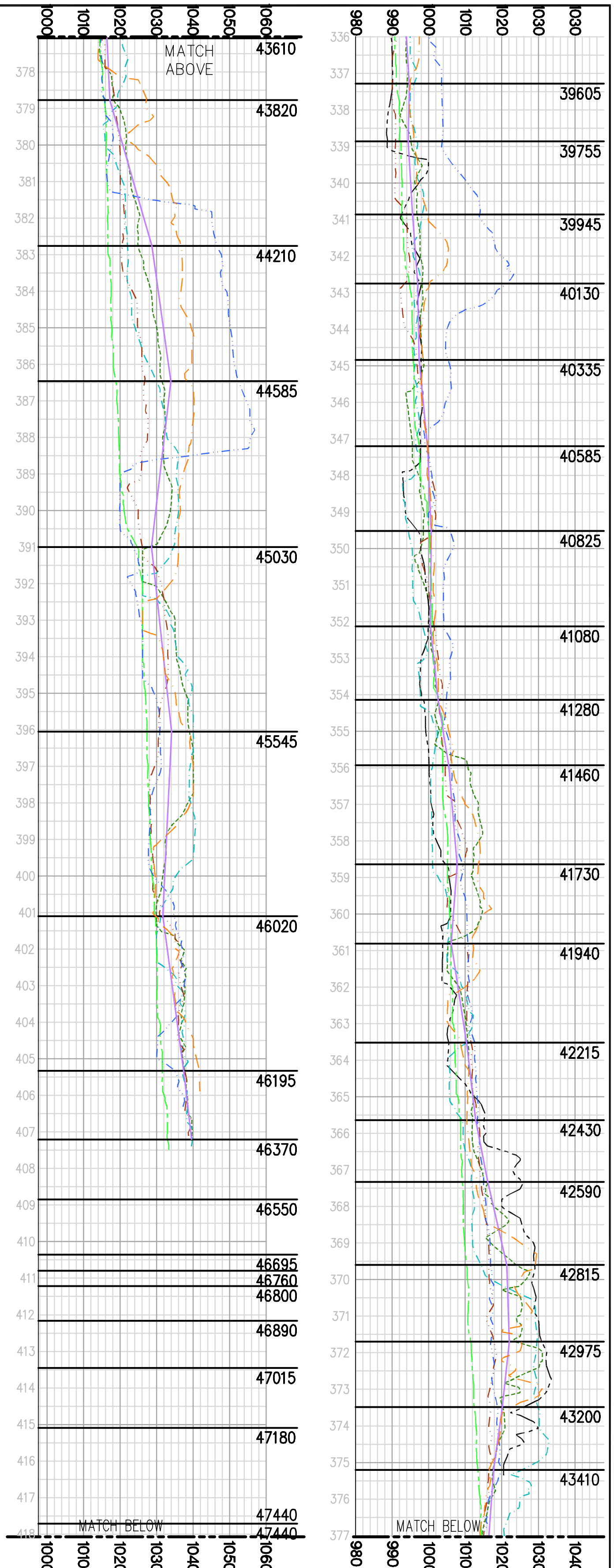


FIGURE A5.3.1N	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 300' DESIGNED DAJ DRAWN DAD CHECKED MEK DATE 09/13/05 JOB NO. 8197E	JOB: SANTA CLARA RIVER FLUVIAL STUDY LOS ANGELES COUNTY CA

TITLE: SANTA CLARA RIVER HISTORIC BED PROFILES (2004 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles - Santa Clara.dwg - Tab: N By: ddrahn on Mar. 14, 2006 at 05:03 pm

Xrefs: 8197–SantaClara–Profiles.dwg; 8197–11x17Exh–Tblk.dwg
Dimscale = 300; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1



LEGEND:

1930 THALWEG ALIGNMENT
1947 THALWEG ALIGNMENT
1963 THALWEG ALIGNMENT
1999 THALWEG ALIGNMENT
2004 THALWEG ALIGNMENT
2005 THALWEG ALIGNMENT
ARTIFICIAL THALWEG ALIGN.
XXXXX HEC-RAS SECTION
MEAN ELEVATION
135 REF. STATIONING (ART.)

SCALE
1" = 30' VERT.
1" = 300' HORIZ.

FIGURE A5.3.10

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

SCALE	1"= 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

JOB
SANTA CLARA RIVER
FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER
HISTORIC BED
PROFILES (2004 TOPO)

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles – Santa Clara.dwg – Tab: 0 By: ddrahn on Mar. 14, 2006 at 05:03 pm

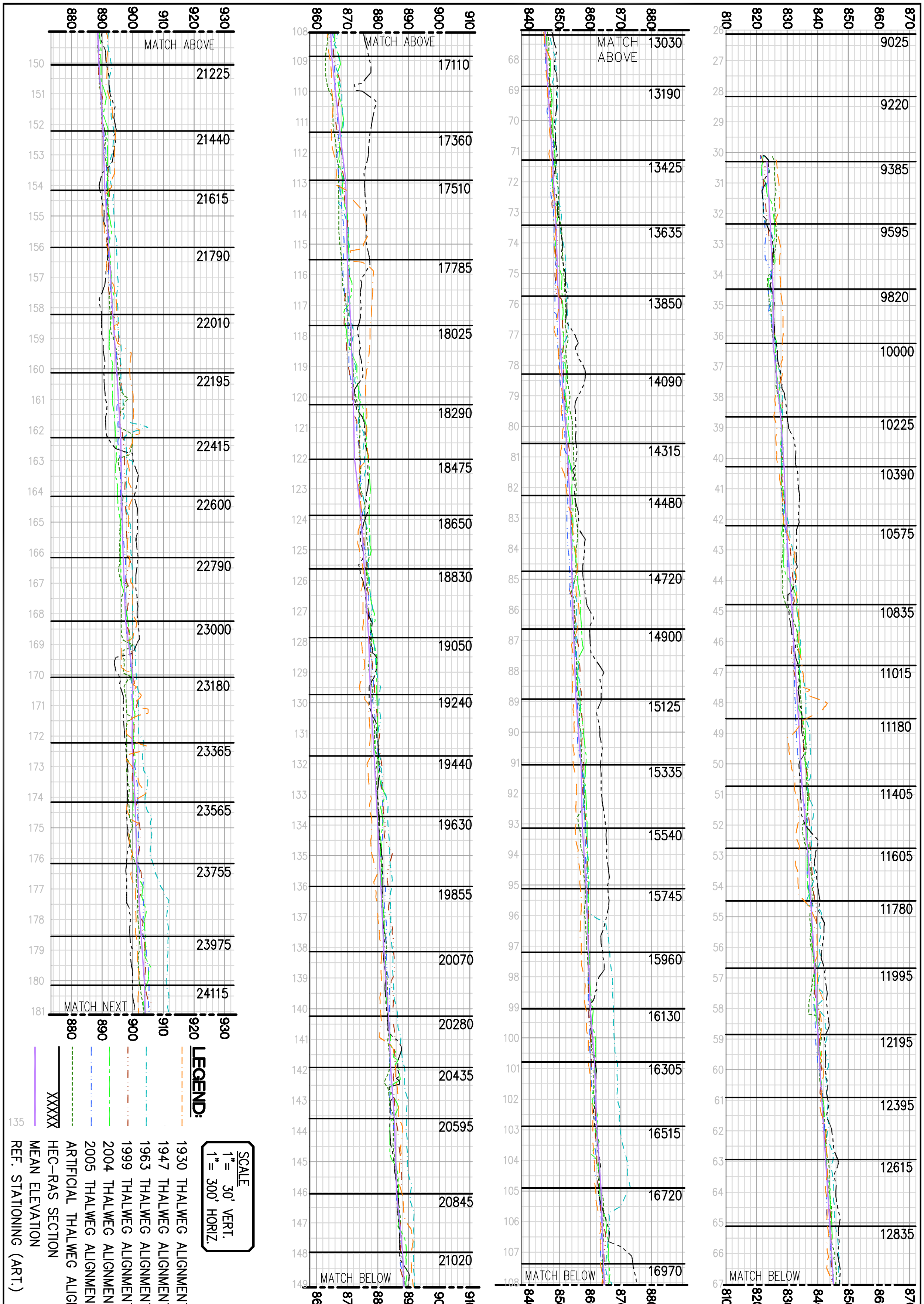


FIGURE	A5.3.1P
	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481–7300 FAX (714) 481–7299
SCALE	1"= 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E
JOB	SANTA CLARA RIVER FLUVIAL STUDY — LOS ANGELES COUNTY, CA
TITLE	SANTA CLARA RIVER HISTORIC BED PROFILES (2005 TOPO)

Xrefs: 8197-SantaClara-Profiles.dwg; 8197-11x17Exh-Tblk.dwg
Dimscale = 300; LTscale = 0.5; PSltscale = 1; Acad Ver. = 16.2s (LMS Tech); Visretain = 1

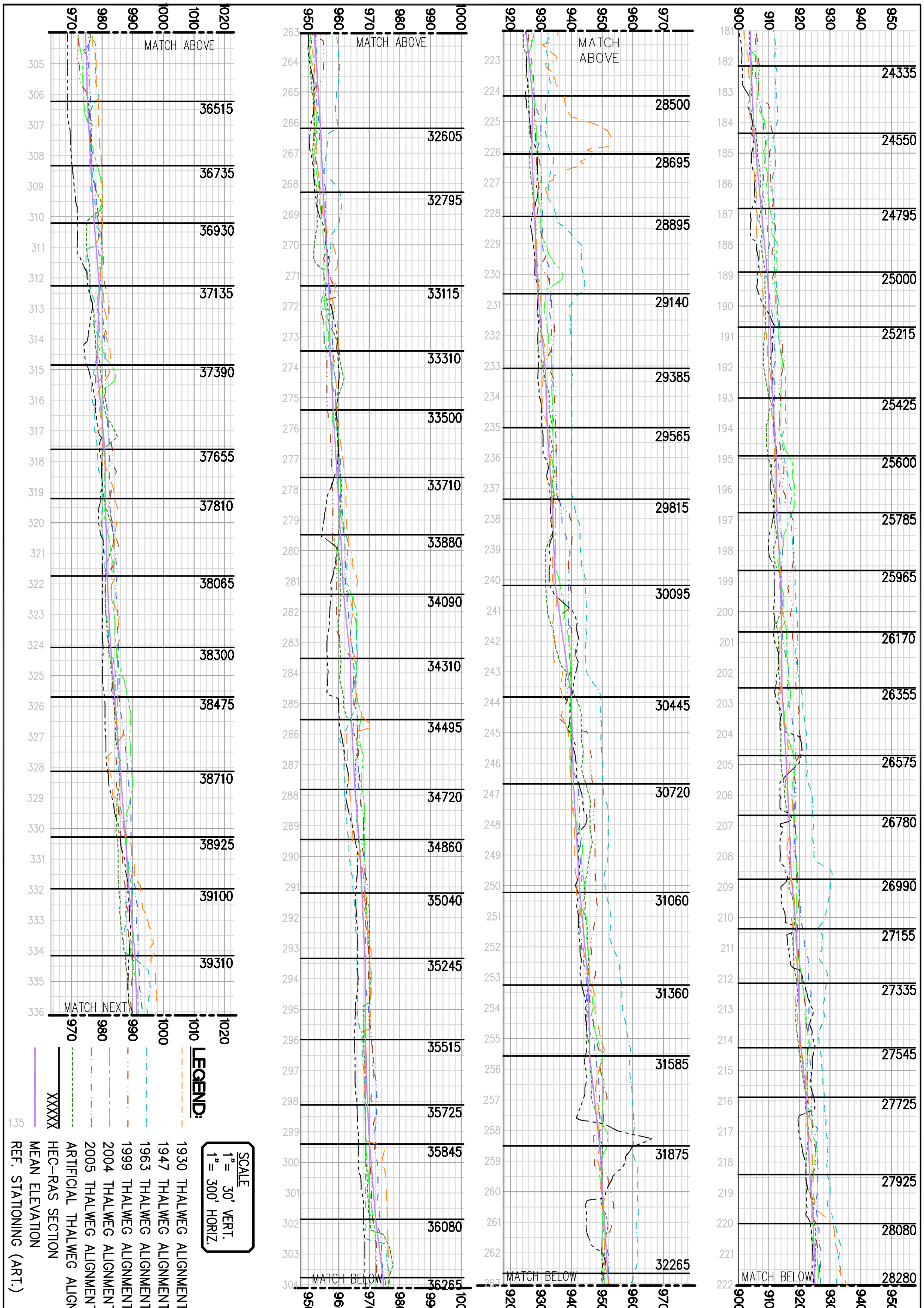
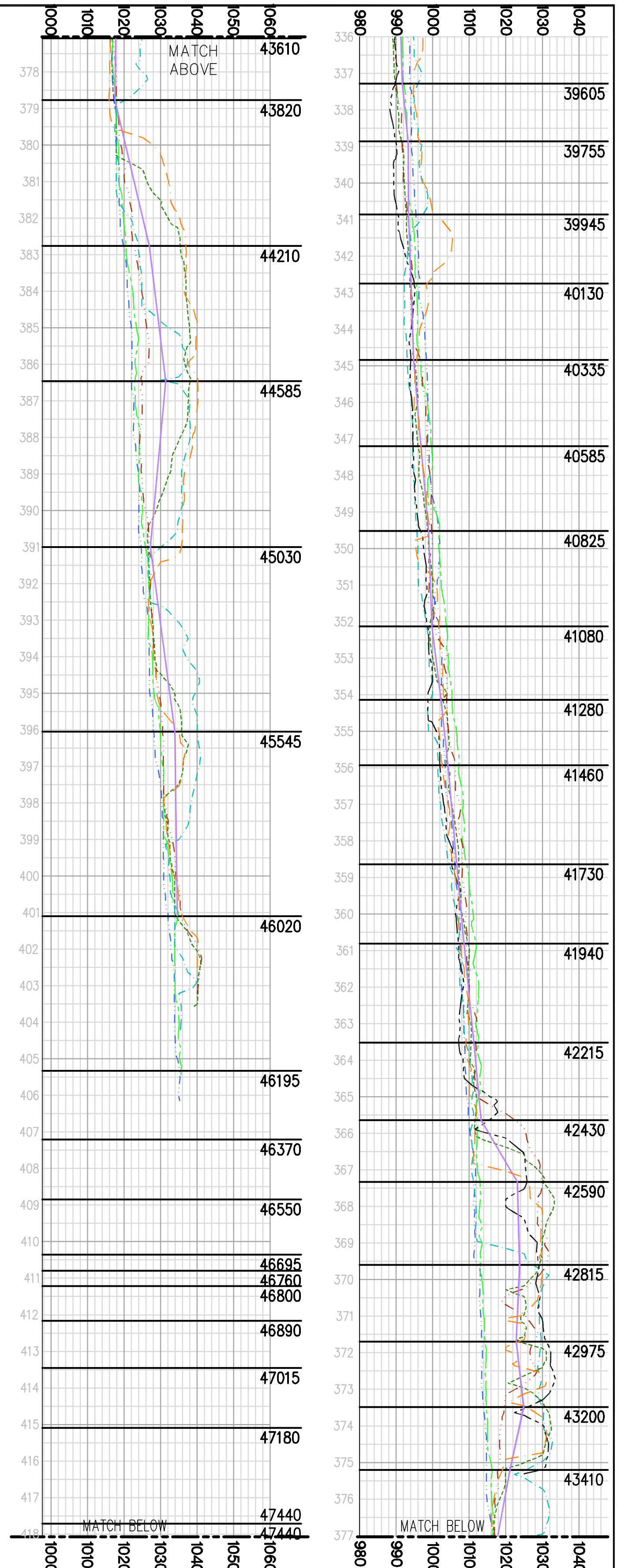


FIGURE A5.3.10	PACE PACIFIC ADVANCED CIVIL ENGINEERING 17520 NEWHOPE STREET, SUITE 200 FOUNTAIN VALLEY, CA 92708 PH (714) 481-7300 FAX (714) 481-7299	SCALE 1"= 300' DESIGNED DAJ DRAWN DAD CHECKED MEK DATE 09/13/05 JOB NO. 8197E	JOB: SANTA CLARA RIVER FLUVIAL STUDY — LOS ANGELES COUNTY, CA
TITLE	SANTA CLARA RIVER HISTORIC BED PROFILES (2005 TOPO)		

P:\8197E\Engineering\GlobalExhibits\8197 Historic Profiles - Santa Clara.dwg - Tab: Q By: ddrahn on Mar. 14, 2006 at 05:03 pm



LEGEND:

- 1930 THALWEG ALIGNMENT
- 1947 THALWEG ALIGNMENT
- 1963 THALWEG ALIGNMENT
- 1999 THALWEG ALIGNMENT
- 2004 THALWEG ALIGNMENT
- 2005 THALWEG ALIGNMENT
- ARTIFICIAL THALWEG ALIGN.
- XXXXX HEC-RAS SECTION
- MEAN ELEVATION
- 135 REF. STATIONING (ART.)

SCALE
1" = 30' VERT.
1" = 300' HORIZ.

FIGURE	A5.3.1R
SCALE	1"= 300'
DESIGNED	DAJ
DRAWN	DAD
CHECKED	MEK
DATE	09/13/05
JOB NO.	8197E

PACE
PACIFIC ADVANCED CIVIL ENGINEERING
17520 NEWHOPE STREET, SUITE 200
FOUNTAIN VALLEY, CA 92708
PH (714) 481-7300 FAX (714) 481-7299

JOB
SANTA CLARA RIVER
FLUVIAL STUDY
LOS ANGELES COUNTY CA

TITLE
SANTA CLARA RIVER
HISTORIC BED
PROFILES (2005 TOPO)

Santa Clara River Fluvial Study

APPENDIX CHAPTER 6.1A

LACH&SM Toe
Existing & Proposed Conditions
Curved & Straight Reaches

PACIFIC ADVANCED CIVIL ENGINEERING, INC.

CALCULATIONS FOR TOTAL TOE-DOWN BY INDIVIDUAL ADJUSTMENT COMPONENT BASED ON LACH&SM -- SANTA CLARA RIVER EXISTING CONDITIONS OUTSIDE CURVED REACH C_{CAP} n=0.025

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_I+	H/2	Z_{DM}=
46195	18.2	18.2	21.7	18.1	2.8	7.1	0	0.0	1	0.0	0	0.0	1	11.7	0.005	453.0	9000	0.0	2.0	6.3	14.0
46020	21.2	21.2	24.1	18.1	2.8	8.5	0	0.0	1	0.0	0	0.0	1	9.2	0.009	520.9	9000	0.0	2.0	7.9	14.0
45545	16.8	16.8	20.3	19.2	2.8	6.4	0	0.0	1	0.0	0	0.0	1	12.7	0.004	446.7	9000	0.0	2.0	5.6	14.0
45030	22.8	22.8	26.1	16.5	2.8	9.7	0	0.0	1	0.0	0	0.0	1	9.0	0.011	492.5	9000	0.0	2.0	8.3	14.0
44585	15.5	15.5	19.2	21.1	2.8	5.8	0	0.0	1	0.0	0	0.0	1	11.3	0.004	531.9	9000	0.0	2.0	5.0	14.0
44210	22.2	22.2	26.2	15.4	2.8	9.7	0	0.0	1	0.0	0	0.0	1	9.7	0.009	452.6	9000	0.0	2.0	7.7	14.0
43820	21.6	21.6	19.9	19.5	8.1	6.2	0	0.0	1	0.0	0	0.0	1	12.1	0.004	476.5	9000	0.0	2.0	5.3	14.0
43610	27.1	27.1	26.7	13.8	8.1	10.1	0	0.0	1	0.0	0	0.0	1	9.6	0.010	450.6	9000	0.0	2.0	6.9	14.0
43410	27.2	27.2	28.8	11.3	8.1	11.5	0	0.0	1	0.0	0	0.0	1	7.4	0.011	583.4	9000	0.0	2.0	5.7	14.0
43200	26.0	26.0	26.1	12.4	8.1	9.7	0	0.0	1	0.0	0	0.0	1	6.7	0.011	689.2	9000	0.0	2.0	6.2	14.0
42975	25.6	25.6	26.6	10.8	8.1	10.0	0	0.0	1	0.0	0	0.0	1	5.9	0.016	735.1	9000	0.0	2.0	5.4	14.0
42815	23.9	23.9	24.1	10.6	8.1	8.5	0	0.0	1	0.0	0	0.0	1	5.5	0.016	878.5	9000	0.0	2.0	5.3	14.0
42590	22.6	22.6	22.6	8.9	8.1	7.6	0	0.0	1	0.0	0	0.0	1	5.1	0.014	1023.2	9000	0.4	2.0	4.5	21.0
42430	21.7	21.7	20.8	9.6	8.1	6.6	0	0.0	1	0.0	0	0.0	1	5.9	0.012	940.5	9000	0.2	2.0	4.8	21.0
42215	15.3	15.3	10.4	14.3	8.1	2.2	0	0.0	1	0.0	0	0.0	1	8.5	0.002	1310.4	9000	1.5	2.0	1.5	15.0
41940	16.1	16.1	11.6	14.3	8.1	2.6	0	0.0	1	0.0	0	0.0	1	7.6	0.002	1321.5	9000	1.6	2.0	1.8	15.0
41730	16.0	16.0	11.8	14.7	8.1	2.7	0	0.0	1	0.0	0	0.0	1	8.0	0.002	1229.5	9000	1.3	2.0	1.9	15.0
41460	16.4	16.4	11.5	16.2	8.1	2.6	0	0.0	1	0.0	0	0.0	1	7.6	0.002	1329.0	9000	1.9	2.0	1.8	15.0
41280	15.4	15.4	16.5	14.3	5.2	4.5	0	0.0	1	0.0	0	0.0	1	8.2	0.004	852.1	9000	0.0	2.0	3.7	12.5
41080	18.7	18.7	19.9	12.1	5.2	6.2	0	0.0	1	0.0	0	0.0	1	6.7	0.007	874.2	9000	0.0	2.0	5.3	14.0
40825	21.0	17.4	18.0	11.5	5.2	5.2	0	0.0	1	0.0	0	0.0	1	6.2	0.007	1039.9	9000	0.5	2.0	4.4	21.0
40585	18.0	16.3	17.0	11.7	5.2	4.7	0	0.0	1	0.0	0	0.0	1	6.8	0.006	1005.9	9000	0.4	2.0	3.9	18.0
40335	15.0	13.5	11.1	14.5	5.2	2.4	0	0.0	1	0.0	0	0.0	1	7.1	0.002	1504.8	9000	2.2	2.0	1.7	15.0
40130	15.0	14.2	11.2	15.1	5.2	2.5	0	0.0	1	0.0	0	0.0	1	6.9	0.002	1636.5	9000	2.8	2.0	1.7	15.0
39945	15.0	13.8	10.3	16.1	5.2	2.2	0	0.0	1	0.0	0	0.0	1	7.6	0.001	1648.1	9000	3.0	2.0	1.4	15.0
39755	18.0	15.9	15.4	13.5	5.2	4.0	0	0.0	1	0.0	0	0.0	1	6.6	0.003	1251.4	9000	1.5	2.0	3.2	18.0
39605	21.0	19.0	19.4	11.4	5.2	5.9	0	0.0	1	0.0	0	0.0	1	5.8	0.007	1100.6	9000	0.8	2.0	5.1	21.0
39310	18.0	16.2	16.0	12.4	5.2	4.3	0	0.0	1	0.0	0	0.0	1	6.8	0.004	1204.5	9000	1.3	2.0	3.5	18.0
39100	15.0	13.8	12.4	14.1	5.2	2.9	0	0.0	1	0.0	0	0.0	1	7.8	0.002	1294.8	9000	1.6	2.0	2.1	15.0
38925	15.0	12.7	11.4	14.5	5.2	2.5	0	0.0	1	0.0	0	0.0	1	9.0	0.002	1181.3	9000	1.2	2.0	1.8	15.0
38710	15.0	9.2	10.6	15.9	2.7	2.3	0	0.0	1	0.0	0	0.0	1	10.8	0.001	1043.1	9000	0.7	2.0	1.5	15.0
38475	14.1	14.1	17.8	14.0	2.7	5.1	0	0.0	1	0.0	0	0.0	1	8.8	0.004	755.4	9000	0.0	2.0	4.3	12.5
38300	17.3	17.3	22.7	9.8	2.7	7.7	0	0.0	1	0.0	0	0.0	1	7.4	0.010	688.1	9000	0.0	2.0	4.9	14.0
38065	10.9	10.9	14.1	14.2	2.7	3.5	0	0.0	1	0.0	0	0.0	1	12.0	0.002	678.3	9000	0.0	2.0	2.7	10.0
37810	14.5	14.5	18.2	12.2	2.7	5.3	0	0.0	1	0.0	0	0.0	1	10.2	0.004	622.3	9000	0.0	2.0	4.5	14.0
37655	16.7	16.7	21.2	10.3	2.7	6.8	0	0.0	1	0.0	0	0.0	1	7.4	0.009	735.9	9000	0.0	2.0	5.1	14.0
37390	16.1	16.1	23.9	6.1	2.7	8.4	0	0.0	1	0.0	0	0.0	1	5.4	0.017	892.2	9000	0.0	2.0	3.1	14.0
37135	18.0	13.9	17.0	8.0	2.7	4.8	0	0.0	1	0.0	0	0.0	1	6.4	0.006	1088.9	9000	0.5	2.0	3.9	18.0
36930	21.0	14.6	18.3	7.9	2.7	5.4	0	0.0	1	0.0	0	0.0	1	6.0	0.007	1112.0	9000	0.6	2.0	3.9	21.0
36735	18.0	12.5	15.0	9.6	2.7	3.9	0	0.0	1	0.0	0	0.0	1	6.8	0.004	1195.7	9000	0.9	2.0	3.0	18.0
36515	18.0	14.3	16.7	9.6	2.7	4.6	0	0.0	1	0.0	0	0.0	1	5.5	0.006	1306.1	9000	1.2	2.0	3.8	18.0
36265	15.0	11.5	13.0	11.2	2.7	3.1	0	0.0	1	0.0	0	0.0	1	6.4	0.003	1373.1	9000	1.4	2.0	2.3	15.0
36080	15.0	11.8	12.5	11.7	3.2	2.9	0	0.0	1	0.0	0	0.0	1	6.4	0.004	1455.4	9000	1.6	2.0	2.1	15.0
35845	15.0	11.2	10.9	13.5	3.2	2.4	0	0.0	1	0.0	0	0.0	1	7.4	0.002	1496.2	9000	2.1	2.0	1.6	15.0
35725	15.0	13.9	14.7	13.0	3.2	3.8	0	0.0	1	0.0	0	0.0	1	6.3	0.003	1431.2	9000	2.1	2.0	2.9	15.0
35515	18.0	15.7	17.1	11.9	3.2	4.8	0	0.0	1	0.0	0	0.0	1	5.7	0.005	1353.4	9000	1.8	2.0	3.9	18.0
35245	15.0	14.1	14.5	12.5	3.2	3.7	0	0.0	1	0.0	0	0.0	1	5.8	0.003	1555.5	9000	2.4	2.0	2.8	15.0
35040	21.0	17.9	19.5	10.7	3.2	5.9	0	0.0	1	0.0	0	0.0	1	5.5	0.005	1355.9	9000	1.7	2.0	5.1	21.0
34860	21.0	16.2	18.1	10.1	3.2	5.3	0	0.0	1	0.0	0	0.0	1	4.8	0.008	1338.9	9000	1.3	2.0	4.4	21.0
34720	21.0	16.3	18.2	9.3	3.2	5.3	0	0.0	1	0.0	0	0.0	1	4.5	0.009	1411.5	9000	1.4	2.0	4.4	21.0
34495	21.0	15.8	18.1	8.9	3.2	5.3	0	0.0	1	0.0	0	0.0	1	5.0	0.009	1277.2	9000	1.0	2.0	4.4	21.0
34310	18.0	15.5	17.6	9.0	3.2	5.0	0	0.0	1	0.0	0	0.0	1	5.7	0.005	1280.8	9000	1.1	2.0	4.2	18.0
34090	18.0	14.9	17.2	8.6	3.2	4.8	0	0.0	1	0.0	0	0.0	1	5.4	0.007	1267.8	9000	1.0	2.0	4.0	18.0
33880	18.0	14.1	15.8	9.8	3.4	4.2	0	0.0	1	0.0	0	0.0	1	5.6	0.005	1310.6	9000	1.2	2.0	3.3	18.0
33710	18.0	14.9	16.5	9.4	3.4	4.6	0	0.0	1	0.0	0	0.0	1	5.2	0.007	1355.1	9000	1.3	2.0	3.7	18.0
33500	18.0	14.5	15.8	9.5	3.4	4.2	0	0.0	1	0.0	0	0.0	1	5.4	0.006	1474.3	9000	1.5	2.0	3.4	18.0
33310	18.0	15.1	15.9	9.1	3.4	4.3	0	0.0	1	0.0	0	0.0	1	4.2	0.006	1744.5	9000	2.1	2.0	3.4	18.0
33115	18.0	14.2	15.5	8.7	3.4	4.1	0	0.0	1	0.0	0	0.0	1	4.8	0.009	1573.2	9000	1.5	2.0	3.3	18.0
32795	15.0	12.5	12.2	11.0	3.4	2.8	0	0.0	1	0.0	0	0.0	1	5.5	0.003	1732.9	9000	2.3	2.0	2.0	15.0
32605	15.0	13.0	14.1	11.5	3.4	3.5	0	0.0	1	0.0	0	0.0	1	6.2	0.004	1344.6	9000	1.4	2.0	2.7	15.0
32265	18.0	14.8	16.7	10.2	2.0	4.6	0	0.0	1	0.0	0	0.0	1	4.6	0.007	1829.9	9000	2.5	2.0	3.8	18.0
31875	15.0	11.2	10.9	11.0	2.0	2.4	0	0.0	1	0.0	0	0.0	1	5.2	0.004	2482.2	9000	3.3	2.0	1.6	15.0
31585	18.0	15.2	16.6	9.8	2.0	4.6	0	0.0	1	0.0	0	0.0	1	4.0	0.009	2120.3	9000	2.9	2.0	3.7	18.0
31360	12.0	10.3	9.8	13.9	2.0	2.0	0	0.0	1	0.0	0	0.0	1	7.8	0.001	1884.4	9000	3.0	2.0	1.3	12.0
31060	12.0	9.0	7.9	15.9	2.0	1.5	0	0.0	1	0.0	0	0.0	1	10.5	0.001	1711.5	9000	2.7	2.0	0.8	12.0
30720	12.0	9.1	6.4	18.0	2.0	1.1	0	0.0	1	0.0	0	0.0	1	11.6	0.000	1891.7	9000	3.5	2.0	0.6	12.0
30445	12.0	9.0	6.0	19.9	2.0	1.0	0	0.0	1	0.0	0	0.0	1	13.1	0.000	1783.7	9000	3.5	2.0	0.5	12.0
30095	12.0	9.8	6.6	21.7	2.0	1.1	0	0.0	1	0.0	0	0.0	1	12.7	0.000	1730.3	9000	4.1	2.0	0.6	12.0
29815	12.0	10.5	7.7	22.4	2.0	1.4	0	0.0	1	0.0	0	0.0	1	11.7	0.000	1675.2	9000	4.3	2.0	0.8	12.0
29565	12.0	10.7	7.4	23.3	2.0	1.3	0	0.0	1	0.0	0	0.0	1	11.8	0.000	1717.4	9000	4.6	2.0	0.7	12.0
29385	12.0	11.4	8.5	24.0	2.0	1.6	0	0.0	1	0.0	0	0.0	1	10.8	0.000	1675.1	9000	4.8	2.0	1.0	12.0
29140	15.0	14.3	10.1	24.3	4.4	2.1	0	0.0	1	0.0	0	0.0	1	9.3	0.001	1557.6	9000	4.4	2.0	1.4	15.0
28895	21.0	19.2	19.7	22.4	4.4	6.0	0	0.0	1	0.0	0	0.0	1	8.6	0.002	1062.3	9000	1.6	2.0	5.2	21.0
28695	25.0	25.0	27.5	16.0	4.4	10.6	0	0.0	1	0.0	0	0.0	1	9.4	0.009	544.9	9000	0.0	2.0	8.0	14.0
28500	24.5	24.5	28.6	13.6	4.4	11.4	0	0.0	1	0.0	0	0.0	1	9.8	0.010	503.7	9000	0.0	2.0	6.8	14.0
28280	24.4	24.4	29.7	11.8	4.4	12.1	0	0.0	1	0.0	0	0.0	1	8.8	0.011	549.3	9000	0.0	2.0	5.9	14.0
28080	23.1	23.1	28.1	11.4	4.4	11.0	0	0.0	1	0.0	0	0.0	1	9.2	0.011	547.6	9000	0.0	2.0	5.7	14.0
27925	15.9	15.9	18.0	17.5	4.4	5.2	0	0.0	1	0.0	0	0.0	1	13.0	0.002	612.7	9000	0.0	2.0	4.3	12.5
27725	18.6	18.6	20.5	16.3	4.4	6.5	0	0.0	1	0.0	0	0.0	1	12.1	0.003	587.1	9000	0.0	2.0	5.7	14.0
27545	21.8	21.8	24.7	13.2	4.4	8.8	0	0.0	1	0.0	0	0.0	1	9.5	0.007	613.0	9000	0.0	2.0	6.6	14.0
27335	21.7	21.7	25.5	12.0	4.4	9.3	0	0.0	1	0.0	0	0.0	1	8.1	0.008	691.0	9000	0.0	2.0	6.0	14.0
27155	20.4	20.4	22.3	13.2	4.4	7.4	0	0.0	1	0.0	0	0.0	1	8.0	0.005	856.6	9000	0.0	2.0	6.6	14.0
26990	21.0	18.2	23.5	11.2	2.0	8.1	0	0.0	1	0.0	0	0.0	1	6.0	0.010	1008.2	9000	0.5	2.0	5.6	21.0
26780	21.0	18.9	23.9	11.0	2.0	8.4	0	0.0	1	0.0	0	0.0	1	5.6	0.010	1131.7	9000	1.0	2.0	5.5	21.0
26575	21.5	21.5	21.0	11.0	2.0	6.7	0	0.0	1	0.0	0	0.0	1	5.5	0.013	1216.4	3000	5.3	2.0	5.5	21.0
26355	18.6	18.6	15.8	13.4	2.0	4.2	0	0.0	1	0.0	0	0.0	1	7.5	0.003	1282.4	3000	7.0	2.0	3.4	18.0
26170	21.3	21.3	18.0	13.0	2.0	5.2	0	0.0	1	0.0	0	0.0	1	6.8	0.004	1347.9	3000	7.7	2.0	4.4	18.0

DEFINITIONS

V(FPS) =VELOCITY IN FEET PER SECOND
Z_{TOT}=TOTAL POTENTIAL VERTICAL ADJUSTMENT IN FEET
Z_{DEG}=LONG TERM DEGRADATION IN FEET
Z_{GS}=GENERAL SCOUR IN FEET
Z_{LS}=LOCAL SCOUR IN FEET
PIER TYPE=PIER SHAPE FACTOR; IF NO PIERS=**0**
1.0=SQUARE NOSE; **0.9** ROUND NOSE; **0.9** CYLINDER;
0.8 SHARP NOSE; **0.9** GROUP OF CYLINDERS
FLOW DEPTH=WATER DEPTH IN CHANNEL IN FEET
B=WIDTH OF PIERS IN FEET; NO PIER=0
ABUT TYPE=VERT WALL FACTOR; IF VERT=**2**; NON VERT=**1**
A=ABUTMENT PROTRUSION INTO FLOW PATH IN FEET
SOFT = SOFT BOTTOM AT A BRIDGE OR AN ABUTMENT
0 = HARD BOTTOM; **1** = SOFT BOTTOM
Z_{BS}=BEND SCOUR IN FEET
BEND COEFF=BEND COEFFICIENT; IF NO BEND=0, BEND=1
HYD DEPTH=HYDRAULIC DEPTH IN FEET
E SLOPE=ENERGY SLOPE, UNITLESS
TOP WIDTH=CHANNEL TOP WIDTH IN FEET
RADIUS=RADIUS OF CURVATURE TO CENTERLINE IN FEET
Z_I=LOW-FLOW INCISEMENT IN FEET, MEASURED OR 2'; VALUE **NOT LESS THAN 2'**
H=BEDFORM HEIGHT IN FEET, LIMITED TO FLOW DEPTH AFTER KENNEDY (1963)
Z_{DM}=CUT OFF DEPTH REQUIRED BY LACFCDDM

GENERAL

THIS SPREADSHEET IS DESIGNED TO CALCULATE SCOUR PROTECTION (TOE DOWN) BASED ON LADPW COUNTY HYDROLOGY MANUAL (1991) PAGES 5.2-5.8 AND ASSOCIATED APPENDICES (SEDIMENTATION MANUAL). ALL VELOCITIES ARE IN FPS, WITH A MAXIMUM VALUE LIMITED BY THE EQUATION. THE PRESENT VERSION (10/04) WILL CALCULATE UP TO 50 VELOCITIES AT ONE TIME. LONG TERM DEGRADATION IS USER SUPPLIED. GENERAL SCOUR IS TAKEN FROM APPENDIX Q3, INTERPOLATED. LOCAL SCOUR AT BENDS AND ABUTMENTS ARE BASED ON LADWP EQUATIONS FOUND IN APP Q12. BEND SCOUR IS BASED ON EQUATIONS IN APPENDIX Q12. A LONGITUDINAL EXTENT BASED ON SECONDARY CURRENTS IS NOT INCLUDED. BEDFORM HEIGHT IS BASED ON EQUATIONS IN APPENDIX Q13. JULY 2005 REVISION INCLUDES CALCULATION FOR CUT OFF DEPTH BASED ON LOS ANGELES COUNTY FLOOD CONTROL DISTRICT DESIGN MANUAL. THE CALCULATION DOES NOT CONSIDER ADJUSTMENTS TO CUT OFF DEPTH BASED ON TABLE F-06
THE OCTOBER 2005 REVISION INCLUDES ADDITIONAL TOEDOWN AT BRIDGES/ABUTMENTS WITH SOFT BOTTOMS.

COLOR CODES

OUTPUT
DATA FROM HEC-RAS
USER SUPPLIED DATA
INTERMEDIATE CALCULATIONS (INDIVIDUAL SHEETS ONLY)

DESIGNED BY DAVID A JAFFE, PHD, PE
PACIFIC ADVANCED CIVIL ENGINEERING, INC
OCTOBER, 2004
OCTOBER 2005, REVISED

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_t+	H/2	Z_{DM}=
25965	20.9	20.9	17.9	13.0	2.0	5.2	0	0.0	1	0.0	0	0.0	1	7.0	0.004	1288.3	3000	7.4	2.0	4.3	18.0
25785	22.1	22.1	19.5	11.7	2.0	6.0	0	0.0	1	0.0	0	0.0	1	6.2	0.005	1336.9	3000	7.0	2.0	5.2	21.0
25600	24.5	24.5	20.6	11.3	2.0	6.5	0	0.0	1	0.0	0	0.0	1	5.2	0.006	1596.5	3000	8.3	2.0	5.6	21.0
25425	24.3	24.3	20.0	11.3	2.0	6.2	0	0.0	1	0.0	0	0.0	1	4.4	0.008	1773.8	3000	8.7	2.0	5.4	21.0
25215	19.6	19.6	14.5	13.6	2.0	3.7	0	0.0	1	0.0	0	0.0	1	6.1	0.003	1748.6	3000	9.0	2.0	2.8	15.0
25000	23.5	23.5	17.4	12.2	2.0	5.0	0	0.0	1	0.0	0	0.0	1	4.4	0.006	2103.2	3000	10.5	2.0	4.1	18.0
24795	25.4	25.4	19.0	11.4	2.0	5.7	0	0.0	1	0.0	0	0.0	1	3.9	0.007	2311.7	3000	10.8	2.0	4.9	21.0
24550	26.5	26.5	21.3	10.8	2.0	6.9	0	0.0	1	0.0	0	0.0	1	3.8	0.009	2227.0	3000	10.2	2.0	5.4	21.0
24335	20.7	20.7	14.5	13.1	2.0	3.7	0	0.0	1	0.0	0	0.0	1	5.7	0.003	2089.5	3000	10.2	2.0	2.8	15.0
24115	23.1	23.1	18.8	11.1	2.0	5.6	0	0.0	1	0.0	0	0.0	1	4.5	0.008	2015.8	3000	8.7	2.0	4.8	21.0
23975	22.3	22.3	19.0	10.2	2.0	5.7	0	0.0	1	0.0	0	0.0	1	4.6	0.008	1913.7	3000	7.7	2.0	4.9	21.0
23755	20.4	20.4	16.7	10.9	2.0	4.6	0	0.0	1	0.0	0	0.0	1	5.1	0.006	1935.4	3000	8.0	2.0	3.8	18.0
23565	19.8	19.8	14.5	12.7	2.0	3.7	0	0.0	1	0.0	0	0.0	1	5.6	0.004	2039.5	3000	9.3	2.0	2.8	15.0
23365	20.1	20.1	17.0	10.8	2.0	4.8	0	0.0	1	0.0	0	0.0	1	5.4	0.006	1781.4	3000	7.4	2.0	3.9	18.0
23180	18.7	18.7	13.2	11.8	2.0	3.2	0	0.0	1	0.0	0	0.0	1	6.6	0.002	2084.2	3000	9.2	2.0	2.3	15.0
23000	14.7	14.7	8.9	13.0	2.0	1.7	0	0.0	1	0.0	0	0.0	1	7.7	0.001	2069.1	3000	7.9	2.0	1.1	12.0
22790	14.9	14.9	9.4	13.1	2.0	1.9	0	0.0	1	0.0	0	0.0	1	7.8	0.001	1949.0	3000	7.8	2.0	1.2	12.0
22600	17.6	17.6	11.4	14.1	2.0	2.5	0	0.0	1	0.0	0	0.0	1	7.9	0.001	1865.2	3000	9.3	2.0	1.7	15.0
22415	17.3	17.3	11.8	14.1	2.0	2.7	0	0.0	1	0.0	0	0.0	1	8.1	0.002	1705.6	3000	8.7	2.0	1.9	15.0
22195	17.3	17.3	14.1	13.7	2.0	3.5	0	0.0	1	0.0	0	0.0	1	7.8	0.003	1322.2	3000	7.1	2.0	2.7	15.0
22010	19.9	19.9	16.0	14.4	2.0	4.3	0	0.0	1	0.0	0	0.0	1	7.3	0.003	1328.0	3000	8.2	2.0	3.5	18.0
21790	21.2	21.2	19.7	11.6	2.0	6.0	0	0.0	1	0.0	0	0.0	1	6.5	0.006	1145.7	3000	5.9	2.0	5.2	21.0
21615	21.0	19.4	21.4	8.5	2.0	6.9	0	0.0	1	0.0	0	0.0	1	5.8	0.010	1161.3	3000	4.2	2.0	4.3	21.0
21440	21.7	21.7	20.1	9.7	2.0	6.3	0	0.0	1	0.0	0	0.0	1	5.0	0.008	1574.6	3000	6.6	2.0	4.8	21.0
21225	24.8	24.8	19.5	10.6	2.0	5.9	0	0.0	1	0.0	0	0.0	1	3.9	0.008	2217.7	3000	9.7	2.0	5.1	21.0
21020	21.5	21.5	20.8	8.9	2.0	6.6	0	0.0	1	0.0	0	0.0	1	4.6	0.009	1676.4	3000	6.5	2.0	4.4	21.0
20845	22.3	22.3	17.1	10.4	2.0	4.8	0	0.0	1	0.0	0	0.0	1	4.2	0.006	2369.3	3000	9.6	2.0	3.9	18.0
20595	21.4	21.4	15.2	10.9	2.0	4.0	0	0.0	1	0.0	0	0.0	1	4.7	0.003	2463.7	3000	10.3	2.0	3.1	18.0
20435	20.7	20.7	12.9	12.2	2.0	3.1	0	0.0	1	0.0	0	0.0	1	5.4	0.002	2582.7	3000	11.3	2.0	2.3	15.0
20280	21.1	21.1	14.0	11.8	2.0	3.5	0	0.0	1	0.0	0	0.0	1	5.0	0.003	2589.6	3000	11.0	2.0	2.6	15.0
20070	21.6	21.6	20.2	9.2	2.0	6.3	0	0.0	1	0.0	0	0.0	1	4.7	0.009	1767.5	3000	6.7	2.0	4.6	21.0
19855	21.3	21.3	17.8	9.9	2.0	5.1	0	0.0	1	0.0	0	0.0	1	4.8	0.006	1975.1	3000	7.9	2.0	4.3	18.0
19630	20.0	20.0	17.9	8.9	2.0	5.2	0	0.0	1	0.0	0	0.0	1	4.9	0.006	1836.2	3000	6.6	2.0	4.3	18.0
19440	17.5	17.5	11.9	12.1	2.0	2.7	0	0.0	1	0.0	0	0.0	1	6.5	0.002	2095.3	3000	8.9	2.0	1.9	15.0
19240	18.8	18.8	13.9	11.4	2.0	3.5	0	0.0	1	0.0	0	0.0	1	5.6	0.003	2091.7	3000	8.7	2.0	2.6	15.0
19050	17.1	17.1	11.0	12.9	2.0	2.4	0	0.0	1	0.0	0	0.0	1	6.7	0.002	2160.8	3000	9.1	2.0	1.6	15.0
18830	17.9	17.9	10.7	14.6	2.0	2.3	0	0.0	1	0.0	0	0.0	1	7.1	0.002	2094.4	3000	10.1	2.0	1.5	15.0
18650	17.5	17.5	9.9	15.0	2.0	2.1	0	0.0	1	0.0	0	0.0	1	8.0	0.001	2022.7	3000	10.1	2.0	1.3	12.0
18475	16.1	16.1	8.1	16.6	2.0	1.5	0	0.0	1	0.0	0	0.0	1	9.4	0.001	1944.4	3000	9.7	2.0	0.9	12.0
18290	16.6	16.6	8.7	16.8	2.0	1.7	0	0.0	1	0.0	0	0.0	1	9.3	0.001	1843.7	3000	9.9	2.0	1.0	12.0
18025	8.0	6.3	7.8	18.2	2.0	1.5	0	0.0	1	0.0	0	0.0	1	11.5	0.001	1610.9	17000	0.0	2.0	0.8	8.0
17785	8.0	6.7	8.7	19.8	2.0	1.7	0	0.0	1	0.0	0	0.0	1	11.6	0.001	1417.5	17000	0.0	2.0	1.0	8.0
17510	10.1	10.1	14.0	18.0	2.0	3.5	0	0.0	1	0.0	0	0.0	1	8.5	0.002	1243.6	17000	0.0	2.0	2.6	10.0
17360	12.7	12.7	17.0	16.9	2.0	4.8	0	0.0	1	0.0	0	0.0	1	8.9	0.004	936.6	17000	0.0	2.0	3.9	12.5
17110	17.5	17.5	21.7	15.4	2.0	7.1	0	0.0	1	0.0	0	0.0	1	5.6	0.006	1274.3	17000	0.0	2.0	6.4	14.0
16970	18.6	18.6	22.9	13.6	2.0	7.8	0	0.0	1	0.0	0	0.0	1	5.7	0.008	1125.6	17000	0.0	2.0	6.8	14.0
16720	17.6	17.6	25.2	9.0	2.0	9.1	0	0.0	1	0.0	0	0.0	1	4.1	0.018	1404.6	17000	0.0	2.0	4.5	14.0
16515	15.7	15.7	21.5	9.5	2.0	7.0	0	0.0	1	0.0	0	0.0	1	4.3	0.012	1622.6	17000	0.0	2.0	4.8	14.0
16305	21.0	16.1	21.5	9.6	2.0	7.0	0	0.0	1	0.0	0	0.0	1	4.2	0.011	1812.8	17000	0.3	2.0	4.8	21.0
16130	18.0	12.3	16.1	10.2	2.0	4.3	0	0.0	1	0.0	0	0.0	1	5.2	0.005	1945.1	17000	0.5	2.0	3.5	18.0
15960	18.0	12.3	15.8	9.3	2.0	4.2	0	0.0	1	0.0	0	0.0	1	4.1	0.011	2180.9	17000	0.7	2.0	3.4	18.0
15745	15.0	8.9	10.9	10.6	2.0	2.4	0	0.0	1	0.0	0	0.0	1	5.7	0.003	2279.0	17000	0.9	2.0	1.6	15.0
15540	15.0	9.0	11.0	10.6	2.0	2.4	0	0.0	1	0.0	0	0.0	1	5.8	0.003	2324.2	17000	1.0	2.0	1.6	15.0
15335	15.0	10.1	12.7	10.5	2.0	3.0	0	0.0	1	0.0	0	0.0	1	4.9	0.005	2302.1	17000	1.0	2.0	2.2	15.0
15125	12.5	11.9	16.2	9.6	2.0	4.4	0	0.0	1	0.0	0	0.0	1	5.5	0.007	1618.5	17000	0.0	2.0	3.5	12.5
14900	15.0	10.6	14.5	10.4	2.0	3.7	0	0.0	1	0.0	0	0.0	1	6.1	0.004	1704.5	17000	0.1	2.0	2.9	15.0
14720	18.0	12.7	16.8	9.3	2.0	4.7	0	0.0	1	0.0	0	0.0	1	5.1	0.008	1763.5	17000	0.1	2.0	3.8	18.0
14480	15.0	10.6	14.3	10.2	2.0	3.6	0	0.0	1	0.0	0	0.0	1	6.0	0.004	1801.7	17000	0.2	2.0	2.7	15.0
14315	15.0	11.1	14.8	9.4	2.0	3.8	0	0.0	1	0.0	0	0.0	1	5.2	0.006	1868.1	17000	0.3	2.0	3.0	15.0
14090	15.0	10.1	13.8	9.0	2.0	3.4	0	0.0	1	0.0	0	0.0	1	5.9	0.005	1766.8	17000	0.1	2.0	2.6	15.0
13850	18.0	11.5	15.6	8.4	2.0	4.2	0	0.0	1	0.0	0	0.0	1	5.3	0.007	1727.3	17000	0.1	2.0	3.3	18.0
13635	12.5	11.3	15.4	10.3	2.0	4.1	0	0.0	1	0.0	0	0.0	1	6.4	0.004	1691.9	17000	0.0	2.0	3.2	12.5
13425	18.0	13.2	17.3	8.3	2.0	4.9	0	0.0	1	0.0	0	0.0	1	4.5	0.009	1854.4	17000	0.3	2.0	4.0	18.0
13190	15.0	9.1	12.2	9.5	2.0	2.8	0	0.0	1	0.0	0	0.0	1	6.4	0.003	1847.3	17000	0.3	2.0	2.0	15.0
13030	15.0	10.4	14.2	9.6	2.0	3.6	0	0.0	1	0.0	0	0.0	1	6.5	0.003	1763.0	17000	0.2	2.0	2.7	15.0
12835	10.0	9.6	13.3	10.1	2.0	3.2	0	0.0	1	0.0	0	0.0	1	7.3	0.003	1607.5	17000	0.0	2.0	2.4	10.0
12615	10.0	9.0	12.4	10.9	2.0	2.9	0	0.0	1	0.0	0	0.0	1	8.7	0.002	1471.0	17000	0.0	2.0	2.1	10.0
12395	10.0	8.9	12.3	11.5	2.0	2.9	0	0.0	1	0.0	0	0.0	1	9.0	0.002	1438.4	17000	0.0	2.0	2.0	10.0
12195	10.0	7.8	10.6	12.5	2.0	2.3	0	0.0	1	0.0	0	0.0	1	10.3	0.001	1389.3	17000	0.0	2.0	1.5	10.0
11995	10.0	9.2	12.7	13.7	2.0	3.0	0	0.0	1	0.0	0	0.0	1	9.8	0.002	1281.1	17000	0.0	2.0	2.2	10.0
11780	10.0	9.0	12.5	14.4	2.0	2.9	0	0.0	1	0.0	0	0.0	1	9.4	0.001	1400.9	17000	0.0	2.0	2.1	10.0
11605	10.2	10.2	14.1	13.7	2.0	3.5	0	0.0	1	0.0	0	0.0	1	8.7	0.002	1282.9	17000	0.0	2.0	2.7	10.0
11405	10.0	9.5	13.2	15.1	2.0	3.2	0	0.0	1	0.0	0	0.0	1	10.1	0.002	1130.2	17000	0.0	2.0	2.3	10.0
11180	12.5	12.3	16.6	13.9	2.0	4.6	0	0.0	1	0.0	0	0.0	1	10.6	0.003	835.7	17000	0.0	2.0	3.7	12.5
11015	14.7	14.7	19.1	13.3	2.0	5.7	0	0.0	1	0.0	0	0.0	1	11.0	0.004	679.4	17000	0.0	2.0	4.9	14.0
10835	16.7	16.7	21.9	10.9	2.0	7.2	0	0.0	1	0.0	0	0.0	1	8.2	0.007	790.4	17000	0.0	2.0	5.4	14.0
10575	16.2	16.2	24.1	7.5	2.0	8.5	0	0.0	1	0.0	0	0.0	1	5.3	0.016	1108.8	17000	0.0	2.0	3.7	14.0
10390	16.1	16.1	22.7	8.8	2.0	7.7	0	0.0	1	0.0	0	0.0	1	5.8	0.008	1247.1	17000	0.0	2.0	4.4	14.0
10225	13.4	13.4	17.8	9.5	2.0	5.1	0	0.0	1	0.0	0	0.0	1	5.9	0.007	1373.8	17000	0.0	2.0	4.3	12.5
10000	10.9	10.9	14.9	11.1	2.0	3.9	0	0.0	1	0.0	0	0.0	1	6.6	0.004	1488.0	17000	0.0	2.0	3.0	10.0
9820	14.2	14.2	18.6	10.0	2.0	5.5	0	0.0	1	0.0	0	0.0	1	5.7	0.008	1336.6	17000	0.0	2.0	4.7	14.0
9595	10.6	10.6	14.6	10.3	2.0	3.7	0	0.0	1	0.0	0	0.0	1	6.6	0.005	1619.7	17000	0.0	2.0	2.9	10.0
9385	18.0	11.7	15.8	9.5	2.0	4.2	0	0.0	1	0.0	0	0.0	1	5.3	0.006	1770.4	17000	0.2	2.0	3.4	18.0
9220	18.0	12.3	16.4	8.9	2.0	4.5	0	0.0	1	0.0	0	0.0	1	4.9	0.008	1771.4	17000	0.1	2.0	3.6	18.0
9025	18.0	11.8	15.9	8.9	2.0	4.3	0	0.0	1	0.0	0	0.0	1	5.5	0.005	1736.9	17000	0.1	2.0	3.4	18.0
MAX=	27.2	27.2			8.1	12.1						0.0					17000.0	11.3	2.0	8.3	21.0
MIN=	8.0	6.3			2.0	1.0						0.0					3000.0	0.0	2.0	0.5	8.0

CALCULATIONS FOR TOTAL TOE-DOWN BY INDIVIDUAL ADJUSTMENT COMPONENT BASED ON LACH&SM -- SANTA CLARA RIVER EXISTING CONDITIONS STRAIGHT-INSIDE CURVED REACH Q_{CAP} n=0.025

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_I+	H/2	Z_{DM}=
46195	18.2	18.2	21.7	18.1	2.8	7.1	0	0.0	1	0.0	0	0.0	0	11.7	0.005	453.0	9000	0.0	2.0	6.3	14.0
46020	21.2	21.2	24.1	18.1	2.8	8.5	0	0.0	1	0.0	0	0.0	0	9.2	0.009	520.9	9000	0.0	2.0	7.9	14.0
45545	16.8	16.8	20.3	19.2	2.8	6.4	0	0.0	1	0.0	0	0.0	0	12.7	0.004	446.7	9000	0.0	2.0	5.6	14.0
45030	22.8	22.8	26.1	16.5	2.8	9.7	0	0.0	1	0.0	0	0.0	0	9.0	0.011	492.5	9000	0.0	2.0	8.3	14.0
44585	15.5	15.5	19.2	21.1	2.8	5.8	0	0.0	1	0.0	0	0.0	0	11.3	0.004	531.9	9000	0.0	2.0	5.0	14.0
44210	22.2	22.2	26.2	15.4	2.8	9.7	0	0.0	1	0.0	0	0.0	0	9.7	0.009	452.6	9000	0.0	2.0	7.7	14.0
43820	21.6	21.6	19.9	19.5	8.1	6.2	0	0.0	1	0.0	0	0.0	0	12.1	0.004	476.5	9000	0.0	2.0	5.3	14.0
43610	27.1	27.1	26.7	13.8	8.1	10.1	0	0.0	1	0.0	0	0.0	0	9.6	0.010	450.6	9000	0.0	2.0	6.9	14.0
43410	27.2	27.2	28.8	11.3	8.1	11.5	0	0.0	1	0.0	0	0.0	0	7.4	0.011	583.4	9000	0.0	2.0	5.7	14.0
43200	26.0	26.0	26.1	12.4	8.1	9.7	0	0.0	1	0.0	0	0.0	0	6.7	0.011	689.2	9000	0.0	2.0	6.2	14.0
42975	25.6	25.6	26.6	10.8	8.1	10.0	0	0.0	1	0.0	0	0.0	0	5.9	0.016	735.1	9000	0.0	2.0	5.4	14.0
42815	23.9	23.9	24.1	10.6	8.1	8.5	0	0.0	1	0.0	0	0.0	0	5.5	0.016	878.5	9000	0.0	2.0	5.3	14.0
42590	22.2	22.2	22.6	8.9	8.1	7.6	0	0.0	1	0.0	0	0.0	0	5.1	0.014	1023.2	9000	0.0	2.0	4.5	14.0
42430	21.6	21.6	20.8	9.6	8.1	6.6	0	0.0	1	0.0	0	0.0	0	5.9	0.012	940.5	9000	0.0	2.0	4.8	14.0
42215	13.8	13.8	10.4	14.3	8.1	2.2	0	0.0	1	0.0	0	0.0	0	8.5	0.002	1310.4	9000	0.0	2.0	1.5	10.0
41940	14.5	14.5	11.6	14.3	8.1	2.6	0	0.0	1	0.0	0	0.0	0	7.6	0.002	1321.5	9000	0.0	2.0	1.8	10.0
41730	14.6	14.6	11.8	14.7	8.1	2.7	0	0.0	1	0.0	0	0.0	0	8.0	0.002	1229.5	9000	0.0	2.0	1.9	10.0
41460	14.5	14.5	11.5	16.2	8.1	2.6	0	0.0	1	0.0	0	0.0	0	7.6	0.002	1329.0	9000	0.0	2.0	1.8	10.0
41280	15.4	15.4	16.5	14.3	5.2	4.5	0	0.0	1	0.0	0	0.0	0	8.2	0.004	852.1	9000	0.0	2.0	3.7	12.5
41080	18.7	18.7	19.9	12.1	5.2	6.2	0	0.0	1	0.0	0	0.0	0	6.7	0.007	874.2	9000	0.0	2.0	5.3	14.0
40825	16.8	16.8	18.0	11.5	5.2	5.2	0	0.0	1	0.0	0	0.0	0	6.2	0.007	1039.9	9000	0.0	2.0	4.4	14.0
40585	15.8	15.8	17.0	11.7	5.2	4.7	0	0.0	1	0.0	0	0.0	0	6.8	0.006	1005.9	9000	0.0	2.0	3.9	12.5
40335	11.3	11.3	11.1	14.5	5.2	2.4	0	0.0	1	0.0	0	0.0	0	7.1	0.002	1504.8	9000	0.0	2.0	1.7	10.0
40130	11.3	11.3	11.2	15.1	5.2	2.5	0	0.0	1	0.0	0	0.0	0	6.9	0.002	1636.5	9000	0.0	2.0	1.7	10.0
39945	10.8	10.8	10.3	16.1	5.2	2.2	0	0.0	1	0.0	0	0.0	0	7.6	0.001	1648.1	9000	0.0	2.0	1.4	10.0
39755	14.4	14.4	15.4	13.5	5.2	4.0	0	0.0	1	0.0	0	0.0	0	6.6	0.003	1251.4	9000	0.0	2.0	3.2	12.5
39605	18.1	18.1	19.4	11.4	5.2	5.9	0	0.0	1	0.0	0	0.0	0	5.8	0.007	1100.6	9000	0.0	2.0	5.1	14.0
39310	15.0	15.0	16.0	12.4	5.2	4.3	0	0.0	1	0.0	0	0.0	0	6.8	0.004	1204.5	9000	0.0	2.0	3.5	12.5
39100	12.1	12.1	12.4	14.1	5.2	2.9	0	0.0	1	0.0	0	0.0	0	7.8	0.002	1294.8	9000	0.0	2.0	2.1	10.0
38925	11.5	11.5	11.4	14.5	5.2	2.5	0	0.0	1	0.0	0	0.0	0	9.0	0.002	1181.3	9000	0.0	2.0	1.8	10.0
38710	10.0	8.5	10.6	15.9	2.7	2.3	0	0.0	1	0.0	0	0.0	0	10.8	0.001	1043.1	9000	0.0	2.0	1.5	10.0
38475	14.1	14.1	17.8	14.0	2.7	5.1	0	0.0	1	0.0	0	0.0	0	8.8	0.004	755.4	9000	0.0	2.0	4.3	12.5
38300	17.3	17.3	22.7	9.8	2.7	7.7	0	0.0	1	0.0	0	0.0	0	7.4	0.010	688.1	9000	0.0	2.0	4.9	14.0
38065	10.9	10.9	14.1	14.2	2.7	3.5	0	0.0	1	0.0	0	0.0	0	12.0	0.002	678.3	9000	0.0	2.0	2.7	10.0
37810	14.5	14.5	18.2	12.2	2.7	5.3	0	0.0	1	0.0	0	0.0	0	10.2	0.004	622.3	9000	0.0	2.0	4.5	14.0
37655	16.7	16.7	21.2	10.3	2.7	6.8	0	0.0	1	0.0	0	0.0	0	7.4	0.009	735.9	9000	0.0	2.0	5.1	14.0
37390	16.1	16.1	23.9	6.1	2.7	8.4	0	0.0	1	0.0	0	0.0	0	5.4	0.017	892.2	9000	0.0	2.0	3.1	14.0
37135	13.4	13.4	17.0	8.0	2.7	4.8	0	0.0	1	0.0	0	0.0	0	6.4	0.006	1088.9	9000	0.0	2.0	3.9	12.5
36930	14.0	14.0	18.3	7.9	2.7	5.4	0	0.0	1	0.0	0	0.0	0	6.0	0.007	1112.0	9000	0.0	2.0	3.9	14.0
36735	12.5	11.6	15.0	9.6	2.7	3.9	0	0.0	1	0.0	0	0.0	0	6.8	0.004	1195.7	9000	0.0	2.0	3.0	12.5
36515	13.1	13.1	16.7	9.6	2.7	4.6	0	0.0	1	0.0	0	0.0	0	5.5	0.006	1306.1	9000	0.0	2.0	3.8	12.5
36265	10.1	10.1	13.0	11.2	2.7	3.1	0	0.0	1	0.0	0	0.0	0	6.4	0.003	1373.1	9000	0.0	2.0	2.3	10.0
36080	10.2	10.2	12.5	11.7	3.2	2.9	0	0.0	1	0.0	0	0.0	0	6.4	0.004	1455.4	9000	0.0	2.0	2.1	10.0
35845	10.0	9.1	10.9	13.5	3.2	2.4	0	0.0	1	0.0	0	0.0	0	7.4	0.002	1496.2	9000	0.0	2.0	1.6	10.0
35725	11.8	11.8	14.7	13.0	3.2	3.8	0	0.0	1	0.0	0	0.0	0	6.3	0.003	1431.2	9000	0.0	2.0	2.9	10.0
35515	13.9	13.9	17.1	11.9	3.2	4.8	0	0.0	1	0.0	0	0.0	0	5.7	0.005	1353.4	9000	0.0	2.0	3.9	12.5
35245	11.7	11.7	14.5	12.5	3.2	3.7	0	0.0	1	0.0	0	0.0	0	5.8	0.003	1555.5	9000	0.0	2.0	2.8	10.0
35040	16.2	16.2	19.5	10.7	3.2	5.9	0	0.0	1	0.0	0	0.0	0	5.5	0.005	1355.9	9000	0.0	2.0	5.1	14.0
34860	14.8	14.8	18.1	10.1	3.2	5.3	0	0.0	1	0.0	0	0.0	0	4.8	0.008	1338.9	9000	0.0	2.0	4.4	14.0
34720	14.9	14.9	18.2	9.3	3.2	5.3	0	0.0	1	0.0	0	0.0	0	4.5	0.009	1411.5	9000	0.0	2.0	4.4	14.0
34495	14.8	14.8	18.1	8.9	3.2	5.3	0	0.0	1	0.0	0	0.0	0	5.0	0.009	1277.2	9000	0.0	2.0	4.4	14.0
34310	14.4	14.4	17.6	9.0	3.2	5.0	0	0.0	1	0.0	0	0.0	0	5.7	0.005	1280.8	9000	0.0	2.0	4.2	12.5
34090	14.0	14.0	17.2	8.6	3.2	4.8	0	0.0	1	0.0	0	0.0	0	5.4	0.007	1267.8	9000	0.0	2.0	4.0	12.5
33880	12.9	12.9	15.8	9.8	3.4	4.2	0	0.0	1	0.0	0	0.0	0	5.6	0.005	1310.6	9000	0.0	2.0	3.3	12.5
33710	13.6	13.6	16.5	9.4	3.4	4.6	0	0.0	1	0.0	0	0.0	0	5.2	0.007	1355.1	9000	0.0	2.0	3.7	12.5
33500	13.0	13.0	15.8	9.5	3.4	4.2	0	0.0	1	0.0	0	0.0	0	5.4	0.006	1474.3	9000	0.0	2.0	3.4	12.5
33310	13.0	13.0	15.9	9.1	3.4	4.3	0	0.0	1	0.0	0	0.0	0	4.2	0.006	1744.5	9000	0.0	2.0	3.4	12.5
33115	12.7	12.7	15.5	8.7	3.4	4.1	0	0.0	1	0.0	0	0.0	0	4.8	0.009	1573.2	9000	0.0	2.0	3.3	12.5
32795	10.2	10.2	12.2	11.0	3.4	2.8	0	0.0	1	0.0	0	0.0	0	5.5	0.003	1732.9	9000	0.0	2.0	2.0	10.0
32605	11.6	11.6	14.1	11.5	3.4	3.5	0	0.0	1	0.0	0	0.0	0	6.2	0.004	1344.6	9000	0.0	2.0	2.7	10.0
32265	12.5	12.4	16.7	10.2	2.0	4.6	0	0.0	1	0.0	0	0.0	0	4.6	0.007	1829.9	9000	0.0	2.0	3.8	12.5
31875	10.0	8.0	10.9	11.0	2.0	2.4	0	0.0	1	0.0	0	0.0	0	5.2	0.004	2482.2	9000	0.0	2.0	1.6	10.0
31585	12.5	12.3	16.6	9.8	2.0	4.6	0	0.0	1	0.0	0	0.0	0	4.0	0.009	2120.3	9000	0.0	2.0	3.7	12.5
31360	8.0	7.3	9.8	13.9	2.0	2.0	0	0.0	1	0.0	0	0.0	0	7.8	0.001	1884.4	9000	0.0	2.0	1.3	8.0
31060	8.0	6.3	7.9	15.9	2.0	1.5	0	0.0	1	0.0	0	0.0	0	10.5	0.001	1711.5	9000	0.0	2.0	0.8	8.0
30720	8.0	5.6	6.4	18.0	2.0	1.1	0	0.0	1	0.0	0	0.0	0	11.6	0.000	1891.7	9000	0.0	2.0	0.6	8.0
30445	8.0	5.5	6.0	19.9	2.0	1.0	0	0.0	1	0.0	0	0.0	0	13.1	0.000	1783.7	9000	0.0	2.0	0.5	8.0
30095	8.0	5.7	6.6	21.7	2.0	1.1	0	0.0	1	0.0	0	0.0	0	12.7	0.000	1730.3	9000	0.0	2.0	0.6	8.0
29815	8.0	6.2	7.7	22.4	2.0	1.4	0	0.0	1	0.0	0	0.0	0	11.7	0.000	1675.2	9000	0.0	2.0	0.8	8.0
29565	8.0	6.1	7.4	23.3	2.0	1.3	0	0.0	1	0.0	0	0.0	0	11.8	0.000	1717.4	9000	0.0	2.0	0.7	8.0
29385	8.0	6.6	8.5	24.0	2.0	1.6	0	0.0	1	0.0	0	0.0	0	10.8	0.000	1675.1	9000	0.0	2.0	1.0	8.0
29140	10.0	9.8	10.1	24.3	4.4	2.1	0	0.0	1	0.0	0	0.0	0	9.3	0.001	1557.6	9000	0.0	2.0	1.4	10.0
28895	17.6	17.6	19.7	22.4	4.4	6.0	0	0.0	1	0.0	0	0.0	0	8.6	0.002	1062.3	9000	0.0	2.0	5.2	14.0
28695	25.0	25.0	27.5	16.0	4.4	10.6	0	0.0	1	0.0	0	0.0	0	9.4	0.009	544.9	9000	0.0	2.0	8.0	14.0
28500	24.5	24.5	28.6	13.6	4.4	11.4	0	0.0	1	0.0	0	0.0	0	9.8	0.010	503.7	9000	0.0	2.0	6.8	14.0
28280	24.4	24.4	29.7	11.8	4.4	12.1	0	0.0	1	0.0	0	0.0	0	8.8	0.011	549.3	9000	0.0	2.0	5.9	14.0
28080	23.1	23.1	28.1	11.4	4.4	11.0	0	0.0	1	0.0	0	0.0	0	9.2	0.011	547.6	9000	0.0	2.0	5.7	14.0
27925	15.9	15.9	18.0	17.5	4.4	5.2	0	0.0	1	0.0	0	0.0	0	13.0	0.002	612.7	9000	0.0	2.0	4.3	12.5
27725	18.6	18.6	20.5	16.3	4.4	6.5	0	0.0	1	0.0	0	0.0	0	12.1	0.003	587.1	9000	0.0	2.0	5.7	14.0
27545	21.8	21.8	24.7	13.2	4.4	8.8	0	0.0	1	0.0	0	0.0	0	9.5	0.007	613.0	9000	0.0	2.0	6.6	14.0
27335	21.7	21.7	25.5	12.0	4.4	9.3	0	0.0	1	0.0	0	0.0	0	8.1	0.008	691.0	9000	0.0	2.0	6.0	14.0
27155	20.4	20.4	22.3	13.2	4.4	7.4	0	0.0	1	0.0	0	0.0	0	8.0	0.005	856.6	9000	0.0	2.0	6.6	14.0
26990	17.7	17.7	23.5	11.2	2.0	8.1	0	0.0	1	0.0	0	0.0	0	6.0	0.010	1008.2	9000	0.0	2.0	5.6	14.0
26780	17.9	17.9	23.9	11.0	2.0	8.4	0	0.0	1	0.0	0	0.0	0	5.6	0.010	1131.7	9000	0.0	2.0	5.5	14.0
26575	16.2	16.2	21.0	11.0	2.0	6.7	0	0.0	1	0.0	0	0.0	0	5.5	0.013	1216.4	3000	0.0	2.0	5.5	14.0
26355	12.5	11.6	15.8	13.4	2.0	4.2	0	0.0	1	0.0	0	0.0	0	7.5	0.003	1282.4	3000	0.0	2.0	3.4	12.5
26170	13.6	13.6	18.0	13.0	2.0	5.2	0	0.0	1	0.0	0	0.0	0	6.8	0.004	1347.9	3000	0.0	2.0	4.4	12.5
25965	13.5	13.5	17.9	13.0	2.0	5.2	0	0.0	1	0.0	0	0.0	0	7.0	0.004	1288.3	3000	0.0	2.0	4.3	12.5

DEFINITIONS

V(FPS) =VELOCITY IN FEET PER SECOND
Z_{TOT}=TOTAL POTENTIAL VERTICAL ADJUSTMENT IN FEET
Z_{DEG}=LONG TERM DEGRADATION IN FEET
Z_{GS}=GENERAL SCOUR IN FEET
Z_{LS}=LOCAL SCOUR IN FEET
PIER TYPE=PIER SHAPE FACTOR; IF NO PIERS=**0**
1.0=SQUARE NOSE; **0.9** ROUND NOSE; **0.9** CYLINDER;
0.8 SHARP NOSE; **0.9** GROUP OF CYLINDERS
FLOW DEPTH=WATER DEPTH IN CHANNEL IN FEET
B=WIDTH OF PIERS IN FEET; NO PIER=0
ABUT TYPE=VERT WALL FACTOR; IF VERT=**2**; NON VERT=**1**
A=ABUTMENT PROTRUSION INTO FLOW PATH IN FEET
SOFT = SOFT BOTTOM AT A BRIDGE OR AN ABUTMENT
0 = HARD BOTTOM; **1** = SOFT BOTTOM
Z_{BS}=BEND SCOUR IN FEET
BEND COEFF=BEND COEFFICIENT; IF NO BEND=0, BEND=1
HYD DEPTH=HYDRAULIC DEPTH IN FEET
E SLOPE=ENERGY SLOPE, UNITLESS
TOP WIDTH=CHANNEL TOP WIDTH IN FEET
RADIUS=RADIUS OF CURVATURE TO CENTERLINE IN FEET
Z_I=LOW-FLOW INCISEMENT IN FEET, MEASURED OR 2'; VALUE **NOT LESS THAN 2'**
H=BEDFORM HEIGHT IN FEET, LIMITED TO FLOW DEPTH AFTER KENNEDY (1963)
Z_{DM}=CUT OFF DEPTH REQUIRED BY LACFCDDM

GENERAL

THIS SPREADSHEET IS DESIGNED TO CALCULATE SCOUR PROTECTION (TOE DOWN) BASED ON LADPW COUNTY HYDROLOGY MANUAL (1991) PAGES 5.2-5.8 AND ASSOCIATED APPENDICES (SEDIMENTATION MANUAL). ALL VELOCITIES ARE IN FPS, WITH A MAXIMUM VALUE LIMITED BY THE EQUATION. THE PRESENT VERSION (10/04) WILL CALCULATE UP TO 50 VELOCITIES AT ONE TIME. LONG TERM DEGRADATION IS USER SUPPLIED. GENERAL SCOUR IS TAKEN FROM APPENDIX Q3, INTERPOLATED. LOCAL SCOUR AT BENDS AND ABUTMENTS ARE BASED ON LADWP EQUATIONS FOUND IN APP Q12. BEND SCOUR IS BASED ON EQUATIONS IN APPENDIX Q12. A LONGITUDINAL EXTENT BASED ON SECONDARY CURRENTS IS NOT INCLUDED. BEDFORM HEIGHT IS BASED ON EQUATIONS IN APPENDIX Q13. JULY 2005 REVISION INCLUDES CALCULATION FOR CUT OFF DEPTH BASED ON LOS ANGELES COUNTY FLOOD CONTROL DISTRICT DESIGN MANUAL. THE CALCULATION DOES NOT CONSIDER ADJUSTMENTS TO CUT OFF DEPTH BASED ON TABLE F-06
THE OCTOBER 2005 REVISION INCLUDES ADDITIONAL TOEDOWN AT BRIDGES/ABUTMENTS WITH SOFT BOTTOMS.

COLOR CODES

OUTPUT
DATA FROM HEC-RAS
USER SUPPLIED DATA
INTERMEDIATE CALCULATIONS (INDIVIDUAL SHEETS ONLY)

DESIGNED BY DAVID A JAFFE, PHD, PE
PACIFIC ADVANCED CIVIL ENGINEERING, INC
OCTOBER, 2004
OCTOBER 2005, REVISED

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_t+	H/2	Z_{DM}=
25785	15.1	15.1	19.5	11.7	2.0	6.0	0	0.0	1	0.0	0	0.0	0	6.2	0.005	1336.9	3000	0.0	2.0	5.2	14.0
25600	16.1	16.1	20.6	11.3	2.0	6.5	0	0.0	1	0.0	0	0.0	0	5.2	0.006	1596.5	3000	0.0	2.0	5.6	14.0
25425	15.6	15.6	20.0	11.3	2.0	6.2	0	0.0	1	0.0	0	0.0	0	4.4	0.008	1773.8	3000	0.0	2.0	5.4	14.0
25215	10.5	10.5	14.5	13.6	2.0	3.7	0	0.0	1	0.0	0	0.0	0	6.1	0.003	1748.6	3000	0.0	2.0	2.8	10.0
25000	13.0	13.0	17.4	12.2	2.0	5.0	0	0.0	1	0.0	0	0.0	0	4.4	0.006	2103.2	3000	0.0	2.0	4.1	12.5
24795	14.5	14.5	19.0	11.4	2.0	5.7	0	0.0	1	0.0	0	0.0	0	3.9	0.007	2311.7	3000	0.0	2.0	4.9	14.0
24550	16.3	16.3	21.3	10.8	2.0	6.9	0	0.0	1	0.0	0	0.0	0	3.8	0.009	2227.0	3000	0.0	2.0	5.4	14.0
24335	10.5	10.5	14.5	13.1	2.0	3.7	0	0.0	1	0.0	0	0.0	0	5.7	0.003	2089.5	3000	0.0	2.0	2.8	10.0
24115	14.4	14.4	18.8	11.1	2.0	5.6	0	0.0	1	0.0	0	0.0	0	4.5	0.008	2015.8	3000	0.0	2.0	4.8	14.0
23975	14.6	14.6	19.0	10.2	2.0	5.7	0	0.0	1	0.0	0	0.0	0	4.6	0.008	1913.7	3000	0.0	2.0	4.9	14.0
23755	12.5	12.4	16.7	10.9	2.0	4.6	0	0.0	1	0.0	0	0.0	0	5.1	0.006	1935.4	3000	0.0	2.0	3.8	12.5
23565	10.5	10.5	14.5	12.7	2.0	3.7	0	0.0	1	0.0	0	0.0	0	5.6	0.004	2039.5	3000	0.0	2.0	2.8	10.0
23365	12.7	12.7	17.0	10.8	2.0	4.8	0	0.0	1	0.0	0	0.0	0	5.4	0.006	1781.4	3000	0.0	2.0	3.9	12.5
23180	10.0	9.5	13.2	11.8	2.0	3.2	0	0.0	1	0.0	0	0.0	0	6.6	0.002	2084.2	3000	0.0	2.0	2.3	10.0
23000	8.0	6.8	8.9	13.0	2.0	1.7	0	0.0	1	0.0	0	0.0	0	7.7	0.001	2069.1	3000	0.0	2.0	1.1	8.0
22790	8.0	7.1	9.4	13.1	2.0	1.9	0	0.0	1	0.0	0	0.0	0	7.8	0.001	1949.0	3000	0.0	2.0	1.2	8.0
22600	10.0	8.3	11.4	14.1	2.0	2.5	0	0.0	1	0.0	0	0.0	0	7.9	0.001	1865.2	3000	0.0	2.0	1.7	10.0
22415	10.0	8.5	11.8	14.1	2.0	2.7	0	0.0	1	0.0	0	0.0	0	8.1	0.002	1705.6	3000	0.0	2.0	1.9	10.0
22195	10.2	10.2	14.1	13.7	2.0	3.5	0	0.0	1	0.0	0	0.0	0	7.8	0.003	1322.2	3000	0.0	2.0	2.7	10.0
22010	12.5	11.8	16.0	14.4	2.0	4.3	0	0.0	1	0.0	0	0.0	0	7.3	0.003	1328.0	3000	0.0	2.0	3.5	12.5
21790	15.3	15.3	19.7	11.6	2.0	6.0	0	0.0	1	0.0	0	0.0	0	6.5	0.006	1145.7	3000	0.0	2.0	5.2	14.0
21615	15.2	15.2	21.4	8.5	2.0	6.9	0	0.0	1	0.0	0	0.0	0	5.8	0.010	1161.3	3000	0.0	2.0	4.3	14.0
21440	15.1	15.1	20.1	9.7	2.0	6.3	0	0.0	1	0.0	0	0.0	0	5.0	0.008	1574.6	3000	0.0	2.0	4.8	14.0
21225	15.0	15.0	19.5	10.6	2.0	5.9	0	0.0	1	0.0	0	0.0	0	3.9	0.008	2217.7	3000	0.0	2.0	5.1	14.0
21020	15.1	15.1	20.8	8.9	2.0	6.6	0	0.0	1	0.0	0	0.0	0	4.6	0.009	1676.4	3000	0.0	2.0	4.4	14.0
20845	12.7	12.7	17.1	10.4	2.0	4.8	0	0.0	1	0.0	0	0.0	0	4.2	0.006	2369.3	3000	0.0	2.0	3.9	12.5
20595	12.5	11.1	15.2	10.9	2.0	4.0	0	0.0	1	0.0	0	0.0	0	4.7	0.003	2463.7	3000	0.0	2.0	3.1	12.5
20435	10.0	9.3	12.9	12.2	2.0	3.1	0	0.0	1	0.0	0	0.0	0	5.4	0.002	2582.7	3000	0.0	2.0	2.3	10.0
20280	10.1	10.1	14.0	11.8	2.0	3.5	0	0.0	1	0.0	0	0.0	0	5.0	0.003	2589.6	3000	0.0	2.0	2.6	10.0
20070	14.9	14.9	20.2	9.2	2.0	6.3	0	0.0	1	0.0	0	0.0	0	4.7	0.009	1767.5	3000	0.0	2.0	4.6	14.0
19855	13.4	13.4	17.8	9.9	2.0	5.1	0	0.0	1	0.0	0	0.0	0	4.8	0.006	1975.1	3000	0.0	2.0	4.3	12.5
19630	13.5	13.5	17.9	8.9	2.0	5.2	0	0.0	1	0.0	0	0.0	0	4.9	0.006	1836.2	3000	0.0	2.0	4.3	12.5
19440	10.0	8.7	11.9	12.1	2.0	2.7	0	0.0	1	0.0	0	0.0	0	6.5	0.002	2095.3	3000	0.0	2.0	1.9	10.0
19240	10.1	10.1	13.9	11.4	2.0	3.5	0	0.0	1	0.0	0	0.0	0	5.6	0.003	2091.7	3000	0.0	2.0	2.6	10.0
19050	10.0	8.0	11.0	12.9	2.0	2.4	0	0.0	1	0.0	0	0.0	0	6.7	0.002	2160.8	3000	0.0	2.0	1.6	10.0
18830	10.0	7.8	10.7	14.6	2.0	2.3	0	0.0	1	0.0	0	0.0	0	7.1	0.002	2094.4	3000	0.0	2.0	1.5	10.0
18650	8.0	7.4	9.9	15.0	2.0	2.1	0	0.0	1	0.0	0	0.0	0	8.0	0.001	2022.7	3000	0.0	2.0	1.3	8.0
18475	8.0	6.4	8.1	16.6	2.0	1.5	0	0.0	1	0.0	0	0.0	0	9.4	0.001	1944.4	3000	0.0	2.0	0.9	8.0
18290	8.0	6.7	8.7	16.8	2.0	1.7	0	0.0	1	0.0	0	0.0	0	9.3	0.001	1843.7	3000	0.0	2.0	1.0	8.0
18025	8.0	6.3	7.8	18.2	2.0	1.5	0	0.0	1	0.0	0	0.0	0	11.5	0.001	1610.9	17000	0.0	2.0	0.8	8.0
17785	8.0	6.7	8.7	19.8	2.0	1.7	0	0.0	1	0.0	0	0.0	0	11.6	0.001	1417.5	17000	0.0	2.0	1.0	8.0
17510	10.1	10.1	14.0	18.0	2.0	3.5	0	0.0	1	0.0	0	0.0	0	8.5	0.002	1243.6	17000	0.0	2.0	2.6	10.0
17360	12.7	12.7	17.0	16.9	2.0	4.8	0	0.0	1	0.0	0	0.0	0	8.9	0.004	936.6	17000	0.0	2.0	3.9	12.5
17110	17.5	17.5	21.7	15.4	2.0	7.1	0	0.0	1	0.0	0	0.0	0	5.6	0.006	1274.3	17000	0.0	2.0	6.4	14.0
16970	18.6	18.6	22.9	13.6	2.0	7.8	0	0.0	1	0.0	0	0.0	0	5.7	0.008	1125.6	17000	0.0	2.0	6.8	14.0
16720	17.6	17.6	25.2	9.0	2.0	9.1	0	0.0	1	0.0	0	0.0	0	4.1	0.018	1404.6	17000	0.0	2.0	4.5	14.0
16515	15.7	15.7	21.5	9.5	2.0	7.0	0	0.0	1	0.0	0	0.0	0	4.3	0.012	1622.6	17000	0.0	2.0	4.8	14.0
16305	15.8	15.8	21.5	9.6	2.0	7.0	0	0.0	1	0.0	0	0.0	0	4.2	0.011	1812.8	17000	0.0	2.0	4.8	14.0
16130	12.5	11.8	16.1	10.2	2.0	4.3	0	0.0	1	0.0	0	0.0	0	5.2	0.005	1945.1	17000	0.0	2.0	3.5	12.5
15960	12.5	11.6	15.8	9.3	2.0	4.2	0	0.0	1	0.0	0	0.0	0	4.1	0.011	2180.9	17000	0.0	2.0	3.4	12.5
15745	10.0	8.0	10.9	10.6	2.0	2.4	0	0.0	1	0.0	0	0.0	0	5.7	0.003	2279.0	17000	0.0	2.0	1.6	10.0
15540	10.0	8.1	11.0	10.6	2.0	2.4	0	0.0	1	0.0	0	0.0	0	5.8	0.003	2324.2	17000	0.0	2.0	1.6	10.0
15335	10.0	9.2	12.7	10.5	2.0	3.0	0	0.0	1	0.0	0	0.0	0	4.9	0.005	2302.1	17000	0.0	2.0	2.2	10.0
15125	12.5	11.9	16.2	9.6	2.0	4.4	0	0.0	1	0.0	0	0.0	0	5.5	0.007	1618.5	17000	0.0	2.0	3.5	12.5
14900	10.6	10.6	14.5	10.4	2.0	3.7	0	0.0	1	0.0	0	0.0	0	6.1	0.004	1704.5	17000	0.0	2.0	2.9	10.0
14720	12.5	12.5	16.8	9.3	2.0	4.7	0	0.0	1	0.0	0	0.0	0	5.1	0.008	1763.5	17000	0.0	2.0	3.8	12.5
14480	10.3	10.3	14.3	10.2	2.0	3.6	0	0.0	1	0.0	0	0.0	0	6.0	0.004	1801.7	17000	0.0	2.0	2.7	10.0
14315	10.8	10.8	14.8	9.4	2.0	3.8	0	0.0	1	0.0	0	0.0	0	5.2	0.006	1868.1	17000	0.0	2.0	3.0	10.0
14090	10.0	9.9	13.8	9.0	2.0	3.4	0	0.0	1	0.0	0	0.0	0	5.9	0.005	1766.8	17000	0.0	2.0	2.6	10.0
13850	12.5	11.4	15.6	8.4	2.0	4.2	0	0.0	1	0.0	0	0.0	0	5.3	0.007	1727.3	17000	0.0	2.0	3.3	12.5
13635	12.5	11.3	15.4	10.3	2.0	4.1	0	0.0	1	0.0	0	0.0	0	6.4	0.004	1691.9	17000	0.0	2.0	3.2	12.5
13425	12.9	12.9	17.3	8.3	2.0	4.9	0	0.0	1	0.0	0	0.0	0	4.5	0.009	1854.4	17000	0.0	2.0	4.0	12.5
13190	10.0	8.8	12.2	9.5	2.0	2.8	0	0.0	1	0.0	0	0.0	0	6.4	0.003	1847.3	17000	0.0	2.0	2.0	10.0
13030	10.3	10.3	14.2	9.6	2.0	3.6	0	0.0	1	0.0	0	0.0	0	6.5	0.003	1763.0	17000	0.0	2.0	2.7	10.0
12835	10.0	9.6	13.3	10.1	2.0	3.2	0	0.0	1	0.0	0	0.0	0	7.3	0.003	1607.5	17000	0.0	2.0	2.4	10.0
12615	10.0	9.0	12.4	10.9	2.0	2.9	0	0.0	1	0.0	0	0.0	0	8.7	0.002	1471.0	17000	0.0	2.0	2.1	10.0
12395	10.0	8.9	12.3	11.5	2.0	2.9	0	0.0	1	0.0	0	0.0	0	9.0	0.002	1438.4	17000	0.0	2.0	2.0	10.0
12195	10.0	7.8	10.6	12.5	2.0	2.3	0	0.0	1	0.0	0	0.0	0	10.3	0.001	1389.3	17000	0.0	2.0	1.5	10.0
11995	10.0	9.2	12.7	13.7	2.0	3.0	0	0.0	1	0.0	0	0.0	0	9.8	0.002	1281.1	17000	0.0	2.0	2.2	10.0
11780	10.0	9.0	12.5	14.4	2.0	2.9	0	0.0	1	0.0	0	0.0	0	9.4	0.001	1400.9	17000	0.0	2.0	2.1	10.0
11605	10.2	10.2	14.1	13.7	2.0	3.5	0	0.0	1	0.0	0	0.0	0	8.7	0.002	1282.9	17000	0.0	2.0	2.7	10.0
11405	10.0	9.5	13.2	15.1	2.0	3.2	0	0.0	1	0.0	0	0.0	0	10.1	0.002	1130.2	17000	0.0	2.0	2.3	10.0
11180	12.5	12.3	16.6	13.9	2.0	4.6	0	0.0	1	0.0	0	0.0	0	10.6	0.003	835.7	17000	0.0	2.0	3.7	12.5
11015	14.7	14.7	19.1	13.3	2.0	5.7	0	0.0	1	0.0	0	0.0	0	11.0	0.004	679.4	17000	0.0	2.0	4.9	14.0
10835	16.7	16.7	21.9	10.9	2.0	7.2	0	0.0	1	0.0	0	0.0	0	8.2	0.007	790.4	17000	0.0	2.0	5.4	14.0
10575	16.2	16.2	24.1	7.5	2.0	8.5	0	0.0	1	0.0	0	0.0	0	5.3	0.016	1108.8	17000	0.0	2.0	3.7	14.0
10390	16.1	16.1	22.7	8.8	2.0	7.7	0	0.0	1	0.0	0	0.0	0	5.8	0.008	1247.1	17000	0.0	2.0	4.4	14.0
10225	13.4	13.4	17.8	9.5	2.0	5.1	0	0.0	1	0.0	0	0.0	0	5.9	0.007	1373.8	17000	0.0	2.0	4.3	12.5
10000	10.9	10.9	14.9	11.1	2.0	3.9	0	0.0	1	0.0	0	0.0	0	6.6	0.004	1488.0	17000	0.0	2.0	3.0	10.0
9820	14.2	14.2	18.6	10.0	2.0	5.5	0	0.0	1	0.0	0	0.0	0	5.7	0.008	1336.6	17000	0.0	2.0	4.7	14.0
9595	10.6	10.6	14.6	10.3	2.0	3.7	0	0.0	1	0.0	0	0.0	0	6.6	0.005	1619.7	17000	0.0	2.0	2.9	10.0
9385	12.5	11.6	15.8	9.5	2.0	4.2	0	0.0	1	0.0	0	0.0	0	5.3	0.006	1770.4	17000	0.0	2.0	3.4	12.5
9220	12.5	12.1	16.4	8.9	2.0	4.5	0	0.0	1	0.0	0	0.0	0	4.9	0.008	1771.4	17000	0.0	2.0	3.6	12.5
9025	12.5	11.7	15.9	8.9	2.0	4.3	0	0.0	1	0.0	0	0.0	0	5.5	0.005	1736.9	17000	0.0	2.0	3.4	12.5
MAX=	27.2	27.2			8.1	12.1						0.0					17000.0	0.0	2.0	8.3	14.0
MIN=	8.0	5.5			2.0	1.0						0.0					3000.0	0.0	2.0	0.5	8.0

CALCULATIONS FOR TOTAL TOE-DOWN BY INDIVIDUAL ADJUSTMENT COMPONENT BASED ON LACH&SM -- SANTA CLARA RIVER PROPOSED CONDITIONS OUTSIDE CURVED REACH C_{CAP} n=0.025

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_I+	H/2	Z_{DM}=
46195	18.2	18.2	21.7	18.1	2.8	7.1	0	0.0	1	0.0	0	0.0	1	11.7	0.005	453.0	9000	0.0	2.0	6.3	14.0
46020	21.2	21.2	24.1	18.1	2.8	8.5	0	0.0	1	0.0	0	0.0	1	9.2	0.009	520.9	9000	0.0	2.0	7.9	14.0
45545	16.8	16.8	20.3	19.2	2.8	6.4	0	0.0	1	0.0	0	0.0	1	12.7	0.004	446.7	9000	0.0	2.0	5.6	14.0
45030	22.8	22.8	26.1	16.5	2.8	9.7	0	0.0	1	0.0	0	0.0	1	9.0	0.011	492.5	9000	0.0	2.0	8.3	14.0
44585	15.5	15.5	19.2	21.1	2.8	5.8	0	0.0	1	0.0	0	0.0	1	11.3	0.004	531.9	9000	0.0	2.0	5.0	14.0
44210	22.2	22.2	26.2	15.4	2.8	9.7	0	0.0	1	0.0	0	0.0	1	9.7	0.009	452.6	9000	0.0	2.0	7.7	14.0
43820	21.6	21.6	19.9	19.5	8.1	6.2	0	0.0	1	0.0	0	0.0	1	12.1	0.004	476.5	9000	0.0	2.0	5.3	14.0
43610	27.1	27.1	26.7	13.8	8.1	10.1	0	0.0	1	0.0	0	0.0	1	9.6	0.010	450.6	9000	0.0	2.0	6.9	14.0
43410	27.2	27.2	28.8	11.3	8.1	11.5	0	0.0	1	0.0	0	0.0	1	7.4	0.011	583.4	9000	0.0	2.0	5.7	14.0
43200	26.0	26.0	26.1	12.4	8.1	9.7	0	0.0	1	0.0	0	0.0	1	6.7	0.011	689.2	9000	0.0	2.0	6.2	14.0
42975	25.6	25.6	26.6	10.8	8.1	10.0	0	0.0	1	0.0	0	0.0	1	5.9	0.016	735.1	9000	0.0	2.0	5.4	14.0
42815	23.8	23.8	23.9	10.7	8.1	8.4	0	0.0	1	0.0	0	0.0	1	5.6	0.016	864.3	9000	0.0	2.0	5.4	14.0
42590	22.6	22.6	22.4	9.2	8.1	7.5	0	0.0	1	0.0	0	0.0	1	5.2	0.014	1013.1	9000	0.4	2.0	4.6	21.0
42430	21.4	21.4	19.6	10.7	8.1	6.0	0	0.0	1	0.0	0	0.0	1	6.4	0.009	915.8	9000	0.1	2.0	5.2	21.0
42215	21.0	20.6	18.5	11.2	8.1	5.5	0	0.0	1	0.0	0	0.0	1	6.1	0.009	1019.0	9000	0.5	2.0	4.6	21.0
41940	16.0	16.0	11.6	14.3	8.1	2.6	0	0.0	1	0.0	0	0.0	1	7.7	0.002	1284.2	9000	1.4	2.0	1.8	15.0
41730	15.8	15.8	11.8	14.7	8.1	2.7	0	0.0	1	0.0	0	0.0	1	8.2	0.002	1190.9	9000	1.2	2.0	1.9	15.0
41460	15.4	15.4	11.6	16.2	8.1	2.6	0	0.0	1	0.0	0	0.0	1	9.1	0.002	1093.5	9000	0.9	2.0	1.8	15.0
41280	15.3	15.3	16.4	14.4	5.2	4.5	0	0.0	1	0.0	0	0.0	1	8.3	0.004	852.3	9000	0.0	2.0	3.6	12.5
41080	18.7	18.7	19.9	12.1	5.2	6.2	0	0.0	1	0.0	0	0.0	1	6.7	0.008	874.1	9000	0.0	2.0	5.4	14.0
40825	21.0	17.4	18.0	11.5	5.2	5.2	0	0.0	1	0.0	0	0.0	1	6.2	0.007	1040.4	9000	0.5	2.0	4.4	21.0
40585	18.0	16.3	17.0	11.7	5.2	4.8	0	0.0	1	0.0	0	0.0	1	6.8	0.006	1005.8	9000	0.4	2.0	3.9	18.0
40335	15.0	12.3	10.5	15.1	5.2	2.3	0	0.0	1	0.0	0	0.0	1	8.8	0.002	1249.6	9000	1.4	2.0	1.5	15.0
40130	15.0	12.7	11.3	15.5	5.2	2.5	0	0.0	1	0.0	0	0.0	1	8.8	0.002	1195.6	9000	1.3	2.0	1.7	15.0
39945	15.0	12.5	11.0	16.3	5.2	2.4	0	0.0	1	0.0	0	0.0	1	9.3	0.002	1173.3	9000	1.3	2.0	1.6	15.0
39755	15.4	15.4	16.5	13.3	5.2	4.5	0	0.0	1	0.0	0	0.0	1	8.1	0.004	894.5	9000	0.0	2.0	3.7	12.5
39605	18.5	18.5	19.7	11.5	5.2	6.1	0	0.0	1	0.0	0	0.0	1	7.1	0.007	849.7	9000	0.0	2.0	5.2	14.0
39310	18.0	15.6	16.5	12.7	5.2	4.6	0	0.0	1	0.0	0	0.0	1	8.1	0.004	931.1	9000	0.2	2.0	3.7	18.0
39100	19.1	19.1	20.9	10.4	5.2	6.7	0	0.0	1	0.0	0	0.0	1	7.2	0.009	761.1	9000	0.0	2.0	5.2	14.0
38925	12.5	12.5	12.8	14.3	5.2	3.0	0	0.0	1	0.0	0	0.0	1	10.3	0.002	873.5	9000	0.0	2.0	2.2	10.0
38710	10.0	9.4	12.0	15.6	2.7	2.8	0	0.0	1	0.0	0	0.0	1	11.7	0.002	820.3	9000	0.0	2.0	2.0	10.0
38475	14.2	14.2	17.9	14.0	2.7	5.2	0	0.0	1	0.0	0	0.0	1	9.8	0.004	659.7	9000	0.0	2.0	4.3	12.5
38300	17.4	17.4	22.5	10.3	2.7	7.6	0	0.0	1	0.0	0	0.0	1	7.7	0.010	666.3	9000	0.0	2.0	5.1	14.0
38065	11.3	11.3	14.5	14.0	2.7	3.7	0	0.0	1	0.0	0	0.0	1	12.0	0.002	658.4	9000	0.0	2.0	2.9	10.0
37810	14.5	14.5	18.2	12.2	2.7	5.3	0	0.0	1	0.0	0	0.0	1	10.2	0.004	618.2	9000	0.0	2.0	4.5	14.0
37655	16.6	16.6	20.9	10.5	2.7	6.7	0	0.0	1	0.0	0	0.0	1	7.8	0.008	706.7	9000	0.0	2.0	5.3	14.0
37390	16.2	16.2	23.7	6.5	2.7	8.3	0	0.0	1	0.0	0	0.0	1	5.9	0.015	823.8	9000	0.0	2.0	3.3	14.0
37135	13.0	13.0	16.6	9.3	2.7	4.6	0	0.0	1	0.0	0	0.0	1	8.5	0.005	821.4	9000	0.0	2.0	3.7	12.5
36930	14.8	14.8	19.8	8.1	2.7	6.1	0	0.0	1	0.0	0	0.0	1	7.2	0.008	812.4	9000	0.0	2.0	4.1	14.0
36735	12.6	12.6	16.1	9.8	2.7	4.4	0	0.0	1	0.0	0	0.0	1	8.0	0.005	896.9	9000	0.0	2.0	3.5	12.5
36515	15.0	10.4	12.9	12.0	2.7	3.1	0	0.0	1	0.0	0	0.0	1	9.0	0.002	994.7	9000	0.4	2.0	2.2	15.0
36265	15.0	10.5	12.3	12.5	2.7	2.9	0	0.0	1	0.0	0	0.0	1	7.9	0.003	1176.0	9000	0.9	2.0	2.1	15.0
36080	26.0	26.0	14.7	11.6	3.2	3.8	0.9	2.0	1	0.0	0	13.3	1	6.7	0.006	1176.0	9000	0.9	2.0	2.9	15.0
35845	15.0	10.9	11.0	13.6	3.2	2.4	0	0.0	1	0.0	0	0.0	1	7.9	0.002	1401.7	9000	1.7	2.0	1.6	15.0
35725	15.0	13.9	15.0	13.0	3.2	3.9	0	0.0	1	0.0	0	0.0	1	6.5	0.004	1377.9	9000	1.8	2.0	3.0	15.0
35515	18.0	15.6	17.1	12.0	3.2	4.8	0	0.0	1	0.0	0	0.0	1	6.0	0.005	1354.8	9000	1.7	2.0	3.9	18.0
35245	18.0	15.6	17.3	11.3	3.2	4.9	0	0.0	1	0.0	0	0.0	1	5.5	0.006	1328.3	9000	1.5	2.0	4.0	18.0
35040	21.0	18.0	19.6	10.7	3.2	6.0	0	0.0	1	0.0	0	0.0	1	5.5	0.006	1354.8	9000	1.7	2.0	5.2	21.0
34860	21.0	16.3	18.4	10.0	3.2	5.4	0	0.0	1	0.0	0	0.0	1	4.9	0.009	1285.7	9000	1.2	2.0	4.6	21.0
34720	21.0	16.5	18.4	9.2	3.2	5.4	0	0.0	1	0.0	0	0.0	1	4.5	0.009	1411.2	9000	1.4	2.0	4.6	21.0
34495	18.0	15.2	17.4	9.0	3.2	5.0	0	0.0	1	0.0	0	0.0	1	5.2	0.009	1283.9	9000	1.0	2.0	4.1	18.0
34310	18.0	14.8	16.8	9.3	3.2	4.7	0	0.0	1	0.0	0	0.0	1	5.9	0.005	1308.5	9000	1.2	2.0	3.8	18.0
34090	18.0	14.8	17.0	8.6	3.2	4.8	0	0.0	1	0.0	0	0.0	1	5.3	0.007	1295.5	9000	1.0	2.0	3.9	18.0
33880	18.0	14.8	16.6	9.3	3.4	4.6	0	0.0	1	0.0	0	0.0	1	5.3	0.007	1318.4	9000	1.2	2.0	3.7	18.0
33710	18.0	13.9	15.4	9.7	3.4	4.1	0	0.0	1	0.0	0	0.0	1	5.5	0.005	1372.1	9000	1.3	2.0	3.2	18.0
33500	18.0	14.8	16.2	9.3	3.4	4.4	0	0.0	1	0.0	0	0.0	1	5.1	0.007	1496.0	9000	1.5	2.0	3.5	18.0
33310	18.0	15.1	15.8	9.0	3.4	4.2	0	0.0	1	0.0	0	0.0	1	4.2	0.006	1770.4	9000	2.1	2.0	3.4	18.0
33115	15.0	11.2	10.4	10.6	3.4	2.2	0	0.0	1	0.0	0	0.0	1	6.1	0.003	1847.3	9000	2.1	2.0	1.4	15.0
32795	15.0	13.0	13.0	10.6	3.4	3.1	0	0.0	1	0.0	0	0.0	1	5.2	0.004	1735.6	9000	2.3	2.0	2.3	15.0
32605	15.0	14.2	14.4	11.1	3.4	3.6	0	0.0	1	0.0	0	0.0	1	5.0	0.005	1699.9	9000	2.3	2.0	2.8	15.0
32265	18.0	14.2	15.9	10.5	2.0	4.3	0	0.0	1	0.0	0	0.0	1	4.8	0.006	1853.2	9000	2.5	2.0	3.4	18.0
31875	15.0	12.0	12.4	10.4	2.0	2.9	0	0.0	1	0.0	0	0.0	1	4.7	0.006	2409.2	9000	3.0	2.0	2.1	15.0
31585	15.0	11.0	10.9	11.9	2.0	2.4	0	0.0	1	0.0	0	0.0	1	5.9	0.003	2182.2	9000	3.0	2.0	1.6	15.0
31360	15.0	10.4	10.3	13.5	2.0	2.2	0	0.0	1	0.0	0	0.0	1	7.4	0.002	1878.7	9000	2.8	2.0	1.4	15.0
31060	12.0	9.1	8.2	15.5	2.0	1.6	0	0.0	1	0.0	0	0.0	1	10.1	0.001	1708.2	9000	2.6	2.0	0.9	12.0
30720	12.0	9.1	6.7	17.5	2.0	1.2	0	0.0	1	0.0	0	0.0	1	11.2	0.001	1888.6	9000	3.3	2.0	0.6	12.0
30445	12.0	8.9	6.3	19.5	2.0	1.1	0	0.0	1	0.0	0	0.0	1	12.7	0.000	1779.7	9000	3.3	2.0	0.5	12.0
30095	12.0	9.2	6.7	21.3	2.0	1.2	0	0.0	1	0.0	0	0.0	1	13.4	0.000	1622.7	9000	3.5	2.0	0.6	12.0
29815	12.0	9.1	7.7	21.9	2.0	1.4	0	0.0	1	0.0	0	0.0	1	13.5	0.000	1433.2	9000	2.9	2.0	0.8	12.0
29565	12.0	8.4	7.4	22.9	2.0	1.3	0	0.0	1	0.0	0	0.0	1	14.8	0.000	1323.8	9000	2.4	2.0	0.7	12.0
29385	12.0	8.6	8.3	23.6	2.0	1.6	0	0.0	1	0.0	0	0.0	1	14.4	0.000	1237.4	9000	2.1	2.0	0.9	12.0
29140	12.0	10.6	9.2	24.1	4.4	1.8	0	0.0	1	0.0	0	0.0	1	14.1	0.001	1087.2	9000	1.2	2.0	1.1	12.0
28895	21.0	17.5	18.8	22.5	4.4	5.6	0	0.0	1	0.0	0	0.0	1	9.9	0.002	972.1	9000	0.8	2.0	4.8	21.0
28695	24.9	24.9	28.9	14.0	4.4	11.5	0	0.0	1	0.0	0	0.0	1	5.4	0.025	899.4	9000	0.0	2.0	7.0	14.0
28500	20.6	20.6	22.4	16.1	4.4	7.5	0	0.0	1	0.0	0	0.0	1	11.4	0.006	552.2	9000	0.0	2.0	6.8	14.0
28280	24.1	24.1	29.6	10.8	4.4	12.0	0	0.0	1	0.0	0	0.0	1	5.8	0.013	944.5	9000	0.3	2.0	5.4	21.0
28080	15.0	10.8	11.3	19.1	4.4	2.5	0	0.0	1	0.0	0	0.0	1	14.7	0.001	926.4	9000	0.2	2.0	1.7	15.0
27925	11.8	11.8	13.1	19.3	4.4	3.1	0	0.0	1	0.0	0	0.0	1	13.8	0.001	866.6	9000	0.0	2.0	2.3	10.0
27725	17.0	17.0	19.0	16.7	4.4	5.7	0	0.0	1	0.0	0	0.0	1	10.4	0.003	786.6	9000	0.0	2.0	4.9	14.0
27545	21.2	21.2	22.9	14.1	4.4	7.8	0	0.0	1	0.0	0	0.0	1	9.9	0.005	643.2	9000	0.0	2.0	7.0	14.0
27335	21.3	21.3	24.6	12.3	4.4	8.7	0	0.0	1	0.0	0	0.0	1	8.3	0.008	703.5	9000	0.0	2.0	6.2	14.0
27155	17.0	17.0	19.1	14.8	4.4	5.7	0	0.0	1	0.0	0	0.0	1	9.2	0.003	888.4	9000	0.0	2.0	4.9	14.0
26990	21.0	17.5	22.6	11.5	2.0	7.6	0	0.0	1	0.0	0	0.0	1	6.8	0.011	922.3	9000	0.1	2.0	5.7	21.0
26780	21.0	18.2	23.1	11.3	2.0	7.9	0	0.0	1	0.0	0	0.0	1	6.2	0.009	1043.3	9000	0.6	2.0	5.6	21.0
26575	21.3	21.3	20.7	11.1	2.0	6.6	0	0.0	1	0.0	0	0.0	1	5.7	0.012	1187.3	3000	5.2	2.0	5.6	21.0
26355	18.3	18.3	15.9	13.4	2.0	4.3	0	0.0	1	0.0	0	0.0	1	7.5	0.004	1260.4	3000	6.7	2.0	3.4	18.0
26170	20.1	20.1	17.0	13.5	2.0	4.8	0	0.0	1	0.0	0	0.0	1	7.6	0.003	1269.0	3000	7.4	2.0	3.9	18.0
25965	21.1	21.1	18.2	12.9	2.0	5.3	0	0.0	1	0.0	0	0.0	1	6.9	0.004	1281.3	3000	7.3	2.0	4.5	21.0
25785	21.0	21.0	18.9	12.1	2.0	5.7	0	0.0	1	0.0	0	0.0	1	6.9	0.005	1219.7	3000	6.5	2.0	4.8	21.0
25600	21.0	20.1	18.5	12.4	2.0	5.5	0	0.0	1	0.0	0	0.0	1	7.6	0.005	1109.4	3000	6.0	2.0	4.6	21.0

DEFINITIONS

V(FPS) =VELOCITY IN FEET PER SECOND
Z_{TOT}=TOTAL POTENTIAL VERTICAL ADJUSTMENT IN FEET
Z_{DEG}=LONG TERM DEGRADATION IN FEET
Z_{GS}=GENERAL SCOUR IN FEET
Z_{LS}=LOCAL SCOUR IN FEET
PIER TYPE=PIER SHAPE FACTOR; IF NO PIERS=**0**
1.0=SQUARE NOSE; **0.9** ROUND NOSE; **0.9** CYLINDER;
0.8 SHARP NOSE; **0.9** GROUP OF CYLINDERS
FLOW DEPTH=WATER DEPTH IN CHANNEL IN FEET
B=WIDTH OF PIERS IN FEET; NO PIER=0
ABUT TYPE=VERT WALL FACTOR; IF VERT=**2**; NON VERT=**1**
A=ABUTMENT PROTRUSION INTO FLOW PATH IN FEET
SOFT = SOFT BOTTOM AT A BRIDGE OR AN ABUTMENT
0 = HARD BOTTOM; **1** = SOFT BOTTOM
Z_{BS}=BEND SCOUR IN FEET
BEND COEFF=BEND COEFFICIENT; IF NO BEND=0, BEND=1
HYD DEPTH=HYDRAULIC DEPTH IN FEET
E SLOPE=ENERGY SLOPE, UNITLESS
TOP WIDTH=CHANNEL TOP WIDTH IN FEET
RADIUS=RADIUS OF CURVATURE TO CENTERLINE IN FEET
Z_I=LOW-FLOW INCISEMENT IN FEET, MEASURED OR 2'; VALUE **NOT LESS THAN 2'**
H=BEDFORM HEIGHT IN FEET, LIMITED TO FLOW DEPTH AFTER KENNEDY (1963)
Z_{DM}=CUT OFF DEPTH REQUIRED BY LACFCDDM

GENERAL

THIS SPREADSHEET IS DESIGNED TO CALCULATE SCOUR PROTECTION (TOE DOWN) BASED ON LADPW COUNTY HYDROLOGY MANUAL (1991) PAGES 5.2-5.8 AND ASSOCIATED APPENDICES (SEDIMENTATION MANUAL). ALL VELOCITIES ARE IN FPS, WITH A MAXIMUM VALUE LIMITED BY THE EQUATION. THE PRESENT VERSION (10/04) WILL CALCULATE UP TO 50 VELOCITIES AT ONE TIME. LONG TERM DEGRADATION IS USER SUPPLIED. GENERAL SCOUR IS TAKEN FROM APPENDIX Q3, INTERPOLATED. LOCAL SCOUR AT BENDS AND ABUTMENTS ARE BASED ON LADWP EQUATIONS FOUND IN APP Q12. BEND SCOUR IS BASED ON EQUATIONS IN APPENDIX Q12. A LONGITUDINAL EXTENT BASED ON SECONDARY CURRENTS IS NOT INCLUDED. BEDFORM HEIGHT IS BASED ON EQUATIONS IN APPENDIX Q13. JULY 2005 REVISION INCLUDES CALCULATION FOR CUT OFF DEPTH BASED ON LOS ANGELES COUNTY FLOOD CONTROL DISTRICT DESIGN MANUAL. THE CALCULATION DOES NOT CONSIDER ADJUSTMENTS TO CUT OFF DEPTH BASED ON TABLE F-06
THE OCTOBER 2005 REVISION INCLUDES ADDITIONAL TOEDOWN AT BRIDGES/ABUTMENTS WITH SOFT BOTTOMS.

COLOR CODES

OUTPUT
DATA FROM HEC-RAS
USER SUPPLIED DATA
INTERMEDIATE CALCULATIONS (INDIVIDUAL SHEETS ONLY)

DESIGNED BY DAVID A JAFFE, PHD, PE
PACIFIC ADVANCED CIVIL ENGINEERING, INC
OCTOBER, 2004
OCTOBER 2005, REVISED

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_{I}+	H/2	Z_{DM}=
25425	21.0	19.2	18.3	12.5	2.0	5.4	0	0.0	1	0.0	0	0.0	1	7.1	0.007	1082.2	3000	5.3	2.0	4.5	21.0
25215	16.3	16.3	14.3	14.7	2.0	3.6	0	0.0	1	0.0	0	0.0	1	9.0	0.003	1097.3	3000	6.0	2.0	2.7	15.0
25000	15.5	15.5	13.2	15.5	2.0	3.2	0	0.0	1	0.0	0	0.0	1	10.1	0.002	1062.4	3000	6.0	2.0	2.3	15.0
24795	15.8	15.8	14.1	15.6	2.0	3.5	0	0.0	1	0.0	0	0.0	1	10.5	0.002	957.4	3000	5.6	2.0	2.7	15.0
24550	18.0	16.4	15.1	16.5	2.0	3.9	0	0.0	1	0.0	0	0.0	1	11.0	0.003	856.1	3000	5.4	2.0	3.1	18.0
24335	21.0	18.3	18.2	15.0	2.0	5.3	0	0.0	1	0.0	0	0.0	1	10.1	0.004	764.8	3000	4.5	2.0	4.5	21.0
24115	21.0	19.7	20.0	13.8	2.0	6.2	0	0.0	1	0.0	0	0.0	1	9.4	0.006	754.2	3000	4.1	2.0	5.4	21.0
23975	21.0	20.5	20.8	12.9	2.0	6.6	0	0.0	1	0.0	0	0.0	1	8.7	0.007	783.2	3000	4.1	2.0	5.8	21.0
23755	21.0	18.5	18.1	14.7	2.0	5.3	0	0.0	1	0.0	0	0.0	1	9.7	0.004	815.7	3000	4.8	2.0	4.4	21.0
23565	21.0	20.8	20.2	14.3	2.0	6.3	0	0.0	1	0.0	0	0.0	1	8.2	0.007	850.9	3000	4.9	2.0	5.5	21.0
23365	21.0	19.7	18.4	14.3	2.0	5.4	0	0.0	1	0.0	0	0.0	1	8.7	0.004	939.0	3000	5.7	2.0	4.6	21.0
23180	23.0	23.0	21.9	12.6	2.0	7.2	0	0.0	1	0.0	0	0.0	1	8.0	0.005	916.6	3000	5.5	2.0	6.3	21.0
23000	21.0	20.3	22.0	11.3	2.0	7.3	0	0.0	1	0.0	0	0.0	1	8.2	0.010	784.0	3000	3.4	2.0	5.6	21.0
22790	31.9	31.9	17.9	13.0	2.0	5.2	0.9	2.0	1	0.0	0	14.7	1	10.0	0.005	784.0	3000	3.7	2.0	4.3	18.0
22600	21.0	20.9	19.8	12.8	2.0	6.1	0	0.0	1	0.0	0	0.0	1	7.6	0.006	999.0	3000	5.5	2.0	5.3	21.0
22415	21.0	20.9	21.3	10.8	2.0	6.9	0	0.0	1	0.0	0	0.0	1	6.6	0.010	1039.1	3000	4.6	2.0	5.4	21.0
22195	16.5	16.5	13.6	14.0	2.0	3.4	0	0.0	1	0.0	0	0.0	1	8.7	0.003	1309.6	3000	6.6	2.0	2.5	15.0
22010	19.5	19.5	16.1	14.3	2.0	4.4	0	0.0	1	0.0	0	0.0	1	7.6	0.003	1254.1	3000	7.6	2.0	3.5	18.0
21790	21.2	21.2	19.7	11.6	2.0	6.1	0	0.0	1	0.0	0	0.0	1	6.5	0.006	1144.5	3000	5.9	2.0	5.2	21.0
21615	21.0	19.2	21.3	8.5	2.0	6.9	0	0.0	1	0.0	0	0.0	1	5.8	0.011	1163.0	3000	4.1	2.0	4.3	21.0
21440	18.9	18.9	17.5	11.0	2.0	5.0	0	0.0	1	0.0	0	0.0	1	6.9	0.005	1286.1	3000	5.8	2.0	4.1	18.0
21225	21.4	21.4	18.1	11.7	2.0	5.2	0	0.0	1	0.0	0	0.0	1	5.6	0.005	1559.0	3000	7.7	2.0	4.4	21.0
21020	21.0	18.8	20.3	9.7	2.0	6.3	0	0.0	1	0.0	0	0.0	1	7.8	0.007	903.0	3000	3.6	2.0	4.9	21.0
20845	18.9	18.9	15.1	12.7	2.0	3.9	0	0.0	1	0.0	0	0.0	1	6.7	0.003	1563.7	3000	7.9	2.0	3.1	18.0
20595	16.8	16.8	12.4	13.4	2.0	2.9	0	0.0	1	0.0	0	0.0	1	8.3	0.002	1548.8	3000	7.8	2.0	2.1	15.0
20435	17.0	17.0	12.1	14.3	2.0	2.8	0	0.0	1	0.0	0	0.0	1	8.8	0.001	1528.3	3000	8.3	2.0	2.0	15.0
20280	19.4	19.4	15.6	12.8	2.0	4.1	0	0.0	1	0.0	0	0.0	1	6.8	0.003	1531.3	3000	8.0	2.0	3.3	18.0
20070	22.5	22.5	19.3	11.1	2.0	5.9	0	0.0	1	0.0	0	0.0	1	5.2	0.006	1526.6	3000	7.5	2.0	5.0	21.0
19855	21.0	21.0	20.6	10.2	2.0	6.5	0	0.0	1	0.0	0	0.0	1	6.0	0.008	1205.4	3000	5.4	2.0	5.1	21.0
19630	21.0	18.8	20.6	8.9	2.0	6.5	0	0.0	1	0.0	0	0.0	1	6.6	0.009	1060.3	3000	3.8	2.0	4.4	21.0
19440	15.4	15.4	13.1	13.4	2.0	3.2	0	0.0	1	0.0	0	0.0	1	9.2	0.002	1194.5	3000	5.9	2.0	2.3	15.0
19240	18.0	17.3	15.9	11.9	2.0	4.3	0	0.0	1	0.0	0	0.0	1	7.4	0.004	1216.9	3000	5.6	2.0	3.4	18.0
19050	21.0	19.8	18.8	10.5	2.0	5.6	0	0.0	1	0.0	0	0.0	1	5.8	0.009	1321.4	3000	5.4	2.0	4.8	21.0
18830	17.7	17.7	13.3	14.6	2.0	3.2	0	0.0	1	0.0	0	0.0	1	7.4	0.003	1531.5	3000	8.1	2.0	2.4	15.0
18650	17.5	17.5	12.1	15.0	2.0	2.8	0	0.0	1	0.0	0	0.0	1	8.0	0.002	1604.5	3000	8.8	2.0	2.0	15.0
18475	15.4	15.4	8.9	16.9	2.0	1.8	0	0.0	1	0.0	0	0.0	1	9.9	0.001	1621.5	3000	8.5	2.0	1.1	12.0
18290	16.2	16.2	9.8	16.9	2.0	2.0	0	0.0	1	0.0	0	0.0	1	9.4	0.001	1594.2	3000	8.9	2.0	1.3	12.0
18025	8.0	6.3	7.9	18.5	2.0	1.5	0	0.0	1	0.0	0	0.0	1	11.9	0.001	1520.2	17000	0.0	2.0	0.8	8.0
17785	8.0	6.6	8.5	20.2	2.0	1.6	0	0.0	1	0.0	0	0.0	1	12.0	0.001	1398.1	17000	0.0	2.0	1.0	8.0
17510	10.0	8.0	11.0	19.2	2.0	2.4	0	0.0	1	0.0	0	0.0	1	10.2	0.001	1350.7	17000	0.0	2.0	1.6	10.0
17360	12.8	12.8	17.1	15.9	2.0	4.8	0	0.0	1	0.0	0	0.0	1	8.8	0.004	943.2	17000	0.0	2.0	3.9	12.5
17110	18.1	18.1	22.3	15.2	2.0	7.4	0	0.0	1	0.0	0	0.0	1	5.8	0.007	1175.4	17000	0.0	2.0	6.7	14.0
16970	18.6	18.6	23.1	13.6	2.0	7.9	0	0.0	1	0.0	0	0.0	1	5.9	0.010	1067.0	17000	0.0	2.0	6.8	14.0
16720	17.2	17.2	24.4	9.2	2.0	8.6	0	0.0	1	0.0	0	0.0	1	5.2	0.019	1122.9	17000	0.0	2.0	4.6	14.0
16515	15.0	15.0	19.4	10.4	2.0	5.9	0	0.0	1	0.0	0	0.0	1	5.8	0.010	1249.9	17000	0.0	2.0	5.1	14.0
16305	10.0	8.4	11.6	14.6	2.0	2.6	0	0.0	1	0.0	0	0.0	1	9.4	0.002	1360.5	17000	0.0	2.0	1.8	10.0
16130	12.5	11.5	15.7	12.3	2.0	4.2	0	0.0	1	0.0	0	0.0	1	7.1	0.005	1326.5	17000	0.0	2.0	3.3	12.5
15960	13.3	13.3	17.7	11.0	2.0	5.1	0	0.0	1	0.0	0	0.0	1	5.9	0.008	1386.0	17000	0.0	2.0	4.2	12.5
15745	10.0	8.9	12.3	13.3	2.0	2.9	0	0.0	1	0.0	0	0.0	1	8.4	0.003	1363.9	17000	0.0	2.0	2.0	10.0
15540	10.0	7.8	10.6	13.7	2.0	2.3	0	0.0	1	0.0	0	0.0	1	9.4	0.002	1426.6	17000	0.0	2.0	1.5	10.0
15335	12.5	12.0	16.2	12.1	2.0	4.4	0	0.0	1	0.0	0	0.0	1	8.2	0.006	1064.1	17000	0.0	2.0	3.5	12.5
15125	30.9	30.9	17.9	11.6	2.0	5.2	0.9	4.0	1	0.0	0	17.4	1	8.0	0.007	1000.5	17000	0.0	2.0	4.3	12.5
14900	14.7	14.7	19.3	9.8	2.0	5.8	0	0.0	1	0.0	0	0.0	1	6.3	0.009	1626.5	17000	0.0	2.0	4.9	14.0
14720	21.0	13.7	18.1	9.8	2.0	5.3	0	0.0	1	0.0	0	0.0	1	6.0	0.008	1722.3	17000	0.1	2.0	4.4	21.0
14480	21.0	14.2	19.0	8.9	2.0	5.7	0	0.0	1	0.0	0	0.0	1	5.2	0.010	1726.7	17000	0.1	2.0	4.4	21.0
14315	15.0	10.4	14.0	9.9	2.0	3.5	0	0.0	1	0.0	0	0.0	1	5.8	0.005	1881.0	17000	0.3	2.0	2.6	15.0
14090	15.0	10.5	14.3	8.5	2.0	3.6	0	0.0	1	0.0	0	0.0	1	5.6	0.006	1772.8	17000	0.1	2.0	2.8	15.0
13850	15.0	9.2	12.6	9.7	2.0	3.0	0	0.0	1	0.0	0	0.0	1	6.5	0.004	1741.6	17000	0.1	2.0	2.2	15.0
13635	18.0	11.4	15.5	10.3	2.0	4.1	0	0.0	1	0.0	0	0.0	1	6.3	0.004	1705.8	17000	0.1	2.0	3.2	18.0
13425	21.0	13.4	18.0	7.8	2.0	5.2	0	0.0	1	0.0	0	0.0	1	4.3	0.011	1850.7	17000	0.2	2.0	3.9	21.0
13190	15.0	9.1	12.2	9.5	2.0	2.8	0	0.0	1	0.0	0	0.0	1	6.5	0.003	1847.4	17000	0.3	2.0	2.0	15.0
13030	15.0	10.4	14.2	9.6	2.0	3.6	0	0.0	1	0.0	0	0.0	1	6.5	0.003	1763.0	17000	0.2	2.0	2.7	15.0
12835	10.0	9.6	13.3	10.1	2.0	3.2	0	0.0	1	0.0	0	0.0	1	7.3	0.003	1607.5	17000	0.0	2.0	2.4	10.0
12615	10.0	9.0	12.5	10.9	2.0	2.9	0	0.0	1	0.0	0	0.0	1	8.6	0.002	1470.8	17000	0.0	2.0	2.1	10.0
12395	10.0	8.9	12.3	11.5	2.0	2.9	0	0.0	1	0.0	0	0.0	1	9.0	0.002	1438.1	17000	0.0	2.0	2.0	10.0
12195	10.0	7.8	10.6	12.5	2.0	2.3	0	0.0	1	0.0	0	0.0	1	10.3	0.001	1383.7	17000	0.0	2.0	1.5	10.0
11995	10.0	9.3	12.8	13.6	2.0	3.0	0	0.0	1	0.0	0	0.0	1	9.7	0.002	1280.5	17000	0.0	2.0	2.2	10.0
11780	10.0	9.1	12.6	14.4	2.0	3.0	0	0.0	1	0.0	0	0.0	1	9.3	0.001	1422.2	17000	0.0	2.0	2.1	10.0
11605	10.1	10.1	13.9	13.8	2.0	3.5	0	0.0	1	0.0	0	0.0	1	8.6	0.002	1325.5	17000	0.0	2.0	2.6	10.0
11405	10.0	9.5	13.2	15.1	2.0	3.2	0	0.0	1	0.0	0	0.0	1	10.3	0.002	1114.6	17000	0.0	2.0	2.3	10.0
11180	12.5	12.3	16.6	13.9	2.0	4.6	0	0.0	1	0.0	0	0.0	1	10.6	0.003	835.7	17000	0.0	2.0	3.7	12.5
11015	14.7	14.7	19.1	13.3	2.0	5.7	0	0.0	1	0.0	0	0.0	1	11.0	0.004	679.4	17000	0.0	2.0	4.9	14.0
10835	16.7	16.7	21.9	10.9	2.0	7.2	0	0.0	1	0.0	0	0.0	1	8.2	0.007	790.4	17000	0.0	2.0	5.4	14.0
10575	16.2	16.2	24.1	7.5	2.0	8.5	0	0.0	1	0.0	0	0.0	1	5.3	0.016	1108.8	17000	0.0	2.0	3.7	14.0
10390	16.1	16.1	22.7	8.8	2.0	7.7	0	0.0	1	0.0	0	0.0	1	5.8	0.008	1247.0	17000	0.0	2.0	4.4	14.0
10225	13.4	13.4	17.8	9.5	2.0	5.1	0	0.0	1	0.0	0	0.0	1	5.9	0.007	1374.1	17000	0.0	2.0	4.3	12.5
10000	10.9	10.9	14.9	11.1	2.0	3.9	0	0.0	1	0.0	0	0.0	1	6.6	0.004	1488.0	17000	0.0	2.0	3.0	10.0
9820	14.2	14.2	18.6	10.0	2.0	5.5	0	0.0	1	0.0	0	0.0	1	5.7	0.008	1402.3	17000	0.0	2.0	4.7	14.0
9595	10.6	10.6	14.6	10.3	2.0	3.7	0	0.0	1	0.0	0	0.0	1	6.6	0.005	1619.5	17000	0.0	2.0	2.9	10.0
9385	18.0	11.7	15.8	9.5	2.0	4.2	0	0.0	1	0.0	0	0.0	1	5.3	0.006	1770.4	17000	0.2	2.0	3.4	18.0
9220	18.0	12.3	16.4	8.9	2.0	4.5	0	0.0	1	0.0	0	0.0	1	4.9	0.008	1771.4	17000	0.1	2.0	3.6	18.0
9025	18.0	11.8	15.9	8.9	2.0	4.3	0	0.0	1	0.0	0	0.0	1	5.5	0.005	1736.9	17000	0.1	2.0	3.4	18.0
MAX=	31.9	31.9			8.1	12.0						17.4					17000.0	8.9	2.0	8.3	21.0
MIN=	8.0	6.3			2.0	1.1						0.0					3000.0	0.0	2.0	0.5	8.0

CALCULATIONS FOR TOTAL TOE-DOWN BY INDIVIDUAL ADJUSTMENT COMPONENT BASED ON LACH&SM -- SANTA CLARA RIVER PROPOSED CONDITIONS STRAIGHT-INSIDE CURVED REACH,Q_P n=0.025

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_I+	H/2	Z_{DM}=
46195	18.2	18.2	21.7	18.1	2.8	7.1	0	0.0	1	0.0	0	0.0	0	11.7	0.005	453.0	9000	0.0	2.0	6.3	14.0
46020	21.2	21.2	24.1	18.1	2.8	8.5	0	0.0	1	0.0	0	0.0	0	9.2	0.009	520.9	9000	0.0	2.0	7.9	14.0
45545	16.8	16.8	20.3	19.2	2.8	6.4	0	0.0	1	0.0	0	0.0	0	12.7	0.004	446.7	9000	0.0	2.0	5.6	14.0
45030	22.8	22.8	26.1	16.5	2.8	9.7	0	0.0	1	0.0	0	0.0	0	9.0	0.011	492.5	9000	0.0	2.0	8.3	14.0
44585	15.5	15.5	19.2	21.1	2.8	5.8	0	0.0	1	0.0	0	0.0	0	11.3	0.004	531.9	9000	0.0	2.0	5.0	14.0
44210	22.2	22.2	26.2	15.4	2.8	9.7	0	0.0	1	0.0	0	0.0	0	9.7	0.009	452.6	9000	0.0	2.0	7.7	14.0
43820	21.6	21.6	19.9	19.5	8.1	6.2	0	0.0	1	0.0	0	0.0	0	12.1	0.004	476.5	9000	0.0	2.0	5.3	14.0
43610	27.1	27.1	26.7	13.8	8.1	10.1	0	0.0	1	0.0	0	0.0	0	9.6	0.010	450.6	9000	0.0	2.0	6.9	14.0
43410	27.2	27.2	28.8	11.3	8.1	11.5	0	0.0	1	0.0	0	0.0	0	7.4	0.011	583.4	9000	0.0	2.0	5.7	14.0
43200	26.0	26.0	26.1	12.4	8.1	9.7	0	0.0	1	0.0	0	0.0	0	6.7	0.011	689.2	9000	0.0	2.0	6.2	14.0
42975	25.6	25.6	26.6	10.8	8.1	10.0	0	0.0	1	0.0	0	0.0	0	5.9	0.016	735.1	9000	0.0	2.0	5.4	14.0
42815	23.8	23.8	23.9	10.7	8.1	8.4	0	0.0	1	0.0	0	0.0	0	5.6	0.016	864.3	9000	0.0	2.0	5.4	14.0
42590	22.2	22.2	22.4	9.2	8.1	7.5	0	0.0	1	0.0	0	0.0	0	5.2	0.014	1013.1	9000	0.0	2.0	4.6	14.0
42430	21.3	21.3	19.6	10.7	8.1	6.0	0	0.0	1	0.0	0	0.0	0	6.4	0.009	915.8	9000	0.0	2.0	5.2	14.0
42215	20.2	20.2	18.5	11.2	8.1	5.5	0	0.0	1	0.0	0	0.0	0	6.1	0.009	1019.0	9000	0.0	2.0	4.6	14.0
41940	14.5	14.5	11.6	14.3	8.1	2.6	0	0.0	1	0.0	0	0.0	0	7.7	0.002	1284.2	9000	0.0	2.0	1.8	10.0
41730	14.7	14.7	11.8	14.7	8.1	2.7	0	0.0	1	0.0	0	0.0	0	8.2	0.002	1190.9	9000	0.0	2.0	1.9	10.0
41460	14.5	14.5	11.6	16.2	8.1	2.6	0	0.0	1	0.0	0	0.0	0	9.1	0.002	1093.5	9000	0.0	2.0	1.8	10.0
41280	15.3	15.3	16.4	14.4	5.2	4.5	0	0.0	1	0.0	0	0.0	0	8.3	0.004	852.3	9000	0.0	2.0	3.6	12.5
41080	18.7	18.7	19.9	12.1	5.2	6.2	0	0.0	1	0.0	0	0.0	0	6.7	0.008	874.1	9000	0.0	2.0	5.4	14.0
40825	16.8	16.8	18.0	11.5	5.2	5.2	0	0.0	1	0.0	0	0.0	0	6.2	0.007	1040.4	9000	0.0	2.0	4.4	14.0
40585	15.8	15.8	17.0	11.7	5.2	4.8	0	0.0	1	0.0	0	0.0	0	6.8	0.006	1005.8	9000	0.0	2.0	3.9	12.5
40335	11.0	11.0	10.5	15.1	5.2	2.3	0	0.0	1	0.0	0	0.0	0	8.8	0.002	1249.6	9000	0.0	2.0	1.5	10.0
40130	11.4	11.4	11.3	15.5	5.2	2.5	0	0.0	1	0.0	0	0.0	0	8.8	0.002	1195.6	9000	0.0	2.0	1.7	10.0
39945	11.2	11.2	11.0	16.3	5.2	2.4	0	0.0	1	0.0	0	0.0	0	9.3	0.002	1173.3	9000	0.0	2.0	1.6	10.0
39755	15.4	15.4	16.5	13.3	5.2	4.5	0	0.0	1	0.0	0	0.0	0	8.1	0.004	894.5	9000	0.0	2.0	3.7	12.5
39605	18.5	18.5	19.7	11.5	5.2	6.1	0	0.0	1	0.0	0	0.0	0	7.1	0.007	849.7	9000	0.0	2.0	5.2	14.0
39310	15.4	15.4	16.5	12.7	5.2	4.6	0	0.0	1	0.0	0	0.0	0	8.1	0.004	931.1	9000	0.0	2.0	3.7	12.5
39100	19.1	19.1	20.9	10.4	5.2	6.7	0	0.0	1	0.0	0	0.0	0	7.2	0.009	761.1	9000	0.0	2.0	5.2	14.0
38925	12.5	12.5	12.8	14.3	5.2	3.0	0	0.0	1	0.0	0	0.0	0	10.3	0.002	873.5	9000	0.0	2.0	2.2	10.0
38710	10.0	9.4	12.0	15.6	2.7	2.8	0	0.0	1	0.0	0	0.0	0	11.7	0.002	820.3	9000	0.0	2.0	2.0	10.0
38475	14.2	14.2	17.9	14.0	2.7	5.2	0	0.0	1	0.0	0	0.0	0	9.8	0.004	659.7	9000	0.0	2.0	4.3	12.5
38300	17.4	17.4	22.5	10.3	2.7	7.6	0	0.0	1	0.0	0	0.0	0	7.7	0.010	666.3	9000	0.0	2.0	5.1	14.0
38065	11.3	11.3	14.5	14.0	2.7	3.7	0	0.0	1	0.0	0	0.0	0	12.0	0.002	658.4	9000	0.0	2.0	2.9	10.0
37810	14.5	14.5	18.2	12.2	2.7	5.3	0	0.0	1	0.0	0	0.0	0	10.2	0.004	618.2	9000	0.0	2.0	4.5	14.0
37655	16.6	16.6	20.9	10.5	2.7	6.7	0	0.0	1	0.0	0	0.0	0	7.8	0.008	706.7	9000	0.0	2.0	5.3	14.0
37390	16.2	16.2	23.7	6.5	2.7	8.3	0	0.0	1	0.0	0	0.0	0	5.9	0.015	823.8	9000	0.0	2.0	3.3	14.0
37135	13.0	13.0	16.6	9.3	2.7	4.6	0	0.0	1	0.0	0	0.0	0	8.5	0.005	821.4	9000	0.0	2.0	3.7	12.5
36930	14.8	14.8	19.8	8.1	2.7	6.1	0	0.0	1	0.0	0	0.0	0	7.2	0.008	812.4	9000	0.0	2.0	4.1	14.0
36735	12.6	12.6	16.1	9.8	2.7	4.4	0	0.0	1	0.0	0	0.0	0	8.0	0.005	896.9	9000	0.0	2.0	3.5	12.5
36515	10.0	10.0	12.9	12.0	2.7	3.1	0	0.0	1	0.0	0	0.0	0	9.0	0.002	994.7	9000	0.0	2.0	2.2	10.0
36265	10.0	9.6	12.3	12.5	2.7	2.9	0	0.0	1	0.0	0	0.0	0	7.9	0.003	1176.0	9000	0.0	2.0	2.1	10.0
36080	25.1	25.1	14.7	11.6	3.2	3.8	0.9	2.0	1	0.0	0	13.3	0	6.7	0.006	1176.0	9000	0.0	2.0	2.9	10.0
35845	10.0	9.2	11.0	13.6	3.2	2.4	0	0.0	1	0.0	0	0.0	0	7.9	0.002	1401.7	9000	0.0	2.0	1.6	10.0
35725	12.1	12.1	15.0	13.0	3.2	3.9	0	0.0	1	0.0	0	0.0	0	6.5	0.004	1377.9	9000	0.0	2.0	3.0	10.0
35515	13.9	13.9	17.1	12.0	3.2	4.8	0	0.0	1	0.0	0	0.0	0	6.0	0.005	1354.8	9000	0.0	2.0	3.9	12.5
35245	14.1	14.1	17.3	11.3	3.2	4.9	0	0.0	1	0.0	0	0.0	0	5.5	0.006	1328.3	9000	0.0	2.0	4.0	12.5
35040	16.3	16.3	19.6	10.7	3.2	6.0	0	0.0	1	0.0	0	0.0	0	5.5	0.006	1354.8	9000	0.0	2.0	5.2	14.0
34860	15.1	15.1	18.4	10.0	3.2	5.4	0	0.0	1	0.0	0	0.0	0	4.9	0.009	1285.7	9000	0.0	2.0	4.6	14.0
34720	15.1	15.1	18.4	9.2	3.2	5.4	0	0.0	1	0.0	0	0.0	0	4.5	0.009	1411.2	9000	0.0	2.0	4.6	14.0
34495	14.2	14.2	17.4	9.0	3.2	5.0	0	0.0	1	0.0	0	0.0	0	5.2	0.009	1283.9	9000	0.0	2.0	4.1	12.5
34310	13.6	13.6	16.8	9.3	3.2	4.7	0	0.0	1	0.0	0	0.0	0	5.9	0.005	1308.5	9000	0.0	2.0	3.8	12.5
34090	13.8	13.8	17.0	8.6	3.2	4.8	0	0.0	1	0.0	0	0.0	0	5.3	0.007	1295.5	9000	0.0	2.0	3.9	12.5
33880	13.7	13.7	16.6	9.3	3.4	4.6	0	0.0	1	0.0	0	0.0	0	5.3	0.007	1318.4	9000	0.0	2.0	3.7	12.5
33710	12.6	12.6	15.4	9.7	3.4	4.1	0	0.0	1	0.0	0	0.0	0	5.5	0.005	1372.1	9000	0.0	2.0	3.2	12.5
33500	13.3	13.3	16.2	9.3	3.4	4.4	0	0.0	1	0.0	0	0.0	0	5.1	0.007	1496.0	9000	0.0	2.0	3.5	12.5
33310	13.0	13.0	15.8	9.0	3.4	4.2	0	0.0	1	0.0	0	0.0	0	4.2	0.006	1770.4	9000	0.0	2.0	3.4	12.5
33115	10.0	9.0	10.4	10.6	3.4	2.2	0	0.0	1	0.0	0	0.0	0	6.1	0.003	1847.3	9000	0.0	2.0	1.4	10.0
32795	10.8	10.8	13.0	10.6	3.4	3.1	0	0.0	1	0.0	0	0.0	0	5.2	0.004	1735.6	9000	0.0	2.0	2.3	10.0
32605	11.8	11.8	14.4	11.1	3.4	3.6	0	0.0	1	0.0	0	0.0	0	5.0	0.005	1699.9	9000	0.0	2.0	2.8	10.0
32265	12.5	11.7	15.9	10.5	2.0	4.3	0	0.0	1	0.0	0	0.0	0	4.8	0.006	1853.2	9000	0.0	2.0	3.4	12.5
31875	10.0	9.0	12.4	10.4	2.0	2.9	0	0.0	1	0.0	0	0.0	0	4.7	0.006	2409.2	9000	0.0	2.0	2.1	10.0
31585	10.0	8.0	10.9	11.9	2.0	2.4	0	0.0	1	0.0	0	0.0	0	5.9	0.003	2182.2	9000	0.0	2.0	1.6	10.0
31360	10.0	7.6	10.3	13.5	2.0	2.2	0	0.0	1	0.0	0	0.0	0	7.4	0.002	1878.7	9000	0.0	2.0	1.4	10.0
31060	8.0	6.5	8.2	15.5	2.0	1.6	0	0.0	1	0.0	0	0.0	0	10.1	0.001	1708.2	9000	0.0	2.0	0.9	8.0
30720	8.0	5.7	6.7	17.5	2.0	1.2	0	0.0	1	0.0	0	0.0	0	11.2	0.001	1888.6	9000	0.0	2.0	0.6	8.0
30445	8.0	5.6	6.3	19.5	2.0	1.1	0	0.0	1	0.0	0	0.0	0	12.7	0.000	1779.7	9000	0.0	2.0	0.5	8.0
30095	8.0	5.8	6.7	21.3	2.0	1.2	0	0.0	1	0.0	0	0.0	0	13.4	0.000	1622.7	9000	0.0	2.0	0.6	8.0
29815	8.0	6.2	7.7	21.9	2.0	1.4	0	0.0	1	0.0	0	0.0	0	13.5	0.000	1433.2	9000	0.0	2.0	0.8	8.0
29565	8.0	6.1	7.4	22.9	2.0	1.3	0	0.0	1	0.0	0	0.0	0	14.8	0.000	1323.8	9000	0.0	2.0	0.7	8.0
29385	8.0	6.5	8.3	23.6	2.0	1.6	0	0.0	1	0.0	0	0.0	0	14.4	0.000	1237.4	9000	0.0	2.0	0.9	8.0
29140	9.4	9.4	9.2	24.1	4.4	1.8	0	0.0	1	0.0	0	0.0	0	14.1	0.001	1087.2	9000	0.0	2.0	1.1	8.0
28895	16.8	16.8	18.8	22.5	4.4	5.6	0	0.0	1	0.0	0	0.0	0	9.9	0.002	972.1	9000	0.0	2.0	4.8	14.0
28695	24.9	24.9	28.9	14.0	4.4	11.5	0	0.0	1	0.0	0	0.0	0	5.4	0.025	899.4	9000	0.0	2.0	7.0	14.0
28500	20.6	20.6	22.4	16.1	4.4	7.5	0	0.0	1	0.0	0	0.0	0	11.4	0.006	552.2	9000	0.0	2.0	6.8	14.0
28280	23.8	23.8	29.6	10.8	4.4	12.0	0	0.0	1	0.0	0	0.0	0	5.8	0.013	944.5	9000	0.0	2.0	5.4	14.0
28080	10.6	10.6	11.3	19.1	4.4	2.5	0	0.0	1	0.0	0	0.0	0	14.7	0.001	926.4	9000	0.0	2.0	1.7	10.0
27925	11.8	11.8	13.1	19.3	4.4	3.1	0	0.0	1	0.0	0	0.0	0	13.8	0.001	866.6	9000	0.0	2.0	2.3	10.0
27725	17.0	17.0	19.0	16.7	4.4	5.7	0	0.0	1	0.0	0	0.0	0	10.4	0.003	786.6	9000	0.0	2.0	4.9	14.0
27545	21.2	21.2	22.9	14.1	4.4	7.8	0	0.0	1	0.0	0	0.0	0	9.9	0.005	643.2	9000	0.0	2.0	7.0	14.0
27335	21.3	21.3	24.6	12.3	4.4	8.7	0	0.0	1	0.0	0	0.0	0	8.3	0.008	703.5	9000	0.0	2.0	6.2	14.0
27155	17.0	17.0	19.1	14.8	4.4	5.7	0	0.0	1	0.0	0	0.0	0	9.2	0.003	888.4	9000	0.0	2.0	4.9	14.0
26990	17.3	17.3	22.6	11.5	2.0	7.6	0	0.0	1	0.0	0	0.0	0	6.8	0.011	922.3	9000	0.0	2.0	5.7	14.0
26780	17.5	17.5	23.1	11.3	2.0	7.9	0	0.0	1	0.0	0	0.0	0	6.2	0.009	1043.3	9000	0.0	2.0	5.6	14.0
26575	16.1	16.1	20.7	11.1	2.0	6.6	0	0.0	1	0.0	0	0.0	0	5.7	0.012	1187.3	3000	0.0	2.0	5.6	14.0
26355	12.5	11.7	15.9	13.4	2.0	4.3	0	0.0	1	0.0	0	0.0	0	7.5	0.004	1260.4	3000	0.0	2.0	3.4	12.5
26170	12.7	12.7	17.0	13.5	2.0	4.8	0	0.0	1	0.0	0	0.0	0	7.6	0.003	1269.0	3000	0.0	2.0	3.9	12.5
25965	14.0	13.8	18.2	12.9	2.0	5.3	0	0.0	1	0.0	0	0.0	0	6.9	0.004	1281.3	3000	0.0	2.0	4.5	14.0

DEFINITIONS

V(FPS) =VELOCITY IN FEET PER SECOND
Z_{TOT}=TOTAL POTENTIAL VERTICAL ADJUSTMENT IN FEET
Z_{DEG}=LONG TERM DEGRADATION IN FEET
Z_{GS}=GENERAL SCOUR IN FEET
Z_{LS}=LOCAL SCOUR IN FEET
PIER TYPE=PIER SHAPE FACTOR; IF NO PIERS=**0**
1.0=SQUARE NOSE; **0.9** ROUND NOSE; **0.9** CYLINDER;
0.8 SHARP NOSE; **0.9** GROUP OF CYLINDERS
FLOW DEPTH=WATER DEPTH IN CHANNEL IN FEET
B=WIDTH OF PIERS IN FEET; NO PIER=0
ABUT TYPE=VERT WALL FACTOR; IF VERT=**2**; NON VERT=**1**
A=ABUTMENT PROTRUSION INTO FLOW PATH IN FEET
SOFT = SOFT BOTTOM AT A BRIDGE OR AN ABUTMENT
0 = HARD BOTTOM; **1** = SOFT BOTTOM
Z_{BS}=BEND SCOUR IN FEET
BEND COEFF=BEND COEFFICIENT; IF NO BEND=0, BEND=1
HYD DEPTH=HYDRAULIC DEPTH IN FEET
E SLOPE=ENERGY SLOPE, UNITLESS
TOP WIDTH=CHANNEL TOP WIDTH IN FEET
RADIUS=RADIUS OF CURVATURE TO CENTERLINE IN FEET
Z_I=LOW-FLOW INCISEMENT IN FEET, MEASURED OR 2'; VALUE **NOT LESS THAN 2'**
H=BEDFORM HEIGHT IN FEET, LIMITED TO FLOW DEPTH AFTER KENNEDY (1963)
Z_{DM}=CUT OFF DEPTH REQUIRED BY LACFCDDM

GENERAL

THIS SPREADSHEET IS DESIGNED TO CALCULATE SCOUR PROTECTION (TOE DOWN) BASED ON LADPW COUNTY HYDROLOGY MANUAL (1991) PAGES 5.2-5.8 AND ASSOCIATED APPENDICES (SEDIMENTATION MANUAL). ALL VELOCITIES ARE IN FPS, WITH A MAXIMUM VALUE LIMITED BY THE EQUATION. THE PRESENT VERSION (10/04) WILL CALCULATE UP TO 50 VELOCITIES AT ONE TIME. LONG TERM DEGRADATION IS USER SUPPLIED. GENERAL SCOUR IS TAKEN FROM APPENDIX Q3, INTERPOLATED. LOCAL SCOUR AT BENDS AND ABUTMENTS ARE BASED ON LADWP EQUATIONS FOUND IN APP Q12. BEND SCOUR IS BASED ON EQUATIONS IN APPENDIX Q12. A LONGITUDINAL EXTENT BASED ON SECONDARY CURRENTS IS NOT INCLUDED. BEDFORM HEIGHT IS BASED ON EQUATIONS IN APPENDIX Q13. JULY 2005 REVISION INCLUDES CALCULATION FOR CUT OFF DEPTH BASED ON LOS ANGELES COUNTY FLOOD CONTROL DISTRICT DESIGN MANUAL. THE CALCULATION DOES NOT CONSIDER ADJUSTMENTS TO CUT OFF DEPTH BASED ON TABLE F-06
THE OCTOBER 2005 REVISION INCLUDES ADDITIONAL TOEDOWN AT BRIDGES/ABUTMENTS WITH SOFT BOTTOMS.

COLOR CODES

OUTPUT
DATA FROM HEC-RAS
USER SUPPLIED DATA
INTERMEDIATE CALCULATIONS (INDIVIDUAL SHEETS ONLY)

DESIGNED BY DAVID A JAFFE, PHD, PE
PACIFIC ADVANCED CIVIL ENGINEERING, INC
OCTOBER, 2004
OCTOBER 2005, REVISED

P:\8197E\5-Administrative\Reports\Fluvial Report\Fluvial Spreadsheets\Toedown-PROP-Straight 02-21-06

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_t+	H/2	Z_{DM}=
25785	14.5	14.5	18.9	12.1	2.0	5.7	0	0.0	1	0.0	0	0.0	0	6.9	0.005	1219.7	3000	0.0	2.0	4.8	14.0
25600	14.1	14.1	18.5	12.4	2.0	5.5	0	0.0	1	0.0	0	0.0	0	7.6	0.005	1109.4	3000	0.0	2.0	4.6	14.0
25425	14.0	13.9	18.3	12.5	2.0	5.4	0	0.0	1	0.0	0	0.0	0	7.1	0.007	1082.2	3000	0.0	2.0	4.5	14.0
25215	10.4	10.4	14.3	14.7	2.0	3.6	0	0.0	1	0.0	0	0.0	0	9.0	0.003	1097.3	3000	0.0	2.0	2.7	10.0
25000	10.0	9.5	13.2	15.5	2.0	3.2	0	0.0	1	0.0	0	0.0	0	10.1	0.002	1062.4	3000	0.0	2.0	2.3	10.0
24795	10.2	10.2	14.1	15.6	2.0	3.5	0	0.0	1	0.0	0	0.0	0	10.5	0.002	957.4	3000	0.0	2.0	2.7	10.0
24550	12.5	11.0	15.1	16.5	2.0	3.9	0	0.0	1	0.0	0	0.0	0	11.0	0.003	856.1	3000	0.0	2.0	3.1	12.5
24335	14.0	13.8	18.2	15.0	2.0	5.3	0	0.0	1	0.0	0	0.0	0	10.1	0.004	764.8	3000	0.0	2.0	4.5	14.0
24115	15.6	15.6	20.0	13.8	2.0	6.2	0	0.0	1	0.0	0	0.0	0	9.4	0.006	754.2	3000	0.0	2.0	5.4	14.0
23975	16.5	16.5	20.8	12.9	2.0	6.6	0	0.0	1	0.0	0	0.0	0	8.7	0.007	783.2	3000	0.0	2.0	5.8	14.0
23755	14.0	13.7	18.1	14.7	2.0	5.3	0	0.0	1	0.0	0	0.0	0	9.7	0.004	815.7	3000	0.0	2.0	4.4	14.0
23565	15.8	15.8	20.2	14.3	2.0	6.3	0	0.0	1	0.0	0	0.0	0	8.2	0.007	850.9	3000	0.0	2.0	5.5	14.0
23365	14.0	14.0	18.4	14.3	2.0	5.4	0	0.0	1	0.0	0	0.0	0	8.7	0.004	939.0	3000	0.0	2.0	4.6	14.0
23180	17.5	17.5	21.9	12.6	2.0	7.2	0	0.0	1	0.0	0	0.0	0	8.0	0.005	916.6	3000	0.0	2.0	6.3	14.0
23000	16.9	16.9	22.0	11.3	2.0	7.3	0	0.0	1	0.0	0	0.0	0	8.2	0.010	784.0	3000	0.0	2.0	5.6	14.0
22790	28.2	28.2	17.9	13.0	2.0	5.2	0.9	2.0	1	0.0	0	14.7	0	10.0	0.005	784.0	3000	0.0	2.0	4.3	12.5
22600	15.4	15.4	19.8	12.8	2.0	6.1	0	0.0	1	0.0	0	0.0	0	7.6	0.006	999.0	3000	0.0	2.0	5.3	14.0
22415	16.3	16.3	21.3	10.8	2.0	6.9	0	0.0	1	0.0	0	0.0	0	6.6	0.010	1039.1	3000	0.0	2.0	5.4	14.0
22195	10.0	9.9	13.6	14.0	2.0	3.4	0	0.0	1	0.0	0	0.0	0	8.7	0.003	1309.6	3000	0.0	2.0	2.5	10.0
22010	12.5	11.9	16.1	14.3	2.0	4.4	0	0.0	1	0.0	0	0.0	0	7.6	0.003	1254.1	3000	0.0	2.0	3.5	12.5
21790	15.3	15.3	19.7	11.6	2.0	6.1	0	0.0	1	0.0	0	0.0	0	6.5	0.006	1144.5	3000	0.0	2.0	5.2	14.0
21615	15.1	15.1	21.3	8.5	2.0	6.9	0	0.0	1	0.0	0	0.0	0	5.8	0.011	1163.0	3000	0.0	2.0	4.3	14.0
21440	13.1	13.1	17.5	11.0	2.0	5.0	0	0.0	1	0.0	0	0.0	0	6.9	0.005	1286.1	3000	0.0	2.0	4.1	12.5
21225	14.0	13.6	18.1	11.7	2.0	5.2	0	0.0	1	0.0	0	0.0	0	5.6	0.005	1559.0	3000	0.0	2.0	4.4	14.0
21020	15.2	15.2	20.3	9.7	2.0	6.3	0	0.0	1	0.0	0	0.0	0	7.8	0.007	903.0	3000	0.0	2.0	4.9	14.0
20845	12.5	11.0	15.1	12.7	2.0	3.9	0	0.0	1	0.0	0	0.0	0	6.7	0.003	1563.7	3000	0.0	2.0	3.1	12.5
20595	10.0	9.0	12.4	13.4	2.0	2.9	0	0.0	1	0.0	0	0.0	0	8.3	0.002	1548.8	3000	0.0	2.0	2.1	10.0
20435	10.0	8.7	12.1	14.3	2.0	2.8	0	0.0	1	0.0	0	0.0	0	8.8	0.001	1528.3	3000	0.0	2.0	2.0	10.0
20280	12.5	11.4	15.6	12.8	2.0	4.1	0	0.0	1	0.0	0	0.0	0	6.8	0.003	1531.3	3000	0.0	2.0	3.3	12.5
20070	14.9	14.9	19.3	11.1	2.0	5.9	0	0.0	1	0.0	0	0.0	0	5.2	0.006	1526.6	3000	0.0	2.0	5.0	14.0
19855	15.6	15.6	20.6	10.2	2.0	6.5	0	0.0	1	0.0	0	0.0	0	6.0	0.008	1205.4	3000	0.0	2.0	5.1	14.0
19630	14.9	14.9	20.6	8.9	2.0	6.5	0	0.0	1	0.0	0	0.0	0	6.6	0.009	1060.3	3000	0.0	2.0	4.4	14.0
19440	10.0	9.5	13.1	13.4	2.0	3.2	0	0.0	1	0.0	0	0.0	0	9.2	0.002	1194.5	3000	0.0	2.0	2.3	10.0
19240	12.5	11.7	15.9	11.9	2.0	4.3	0	0.0	1	0.0	0	0.0	0	7.4	0.004	1216.9	3000	0.0	2.0	3.4	12.5
19050	14.4	14.4	18.8	10.5	2.0	5.6	0	0.0	1	0.0	0	0.0	0	5.8	0.009	1321.4	3000	0.0	2.0	4.8	14.0
18830	10.0	9.6	13.3	14.6	2.0	3.2	0	0.0	1	0.0	0	0.0	0	7.4	0.003	1531.5	3000	0.0	2.0	2.4	10.0
18650	10.0	8.7	12.1	15.0	2.0	2.8	0	0.0	1	0.0	0	0.0	0	8.0	0.002	1604.5	3000	0.0	2.0	2.0	10.0
18475	8.0	6.8	8.9	16.9	2.0	1.8	0	0.0	1	0.0	0	0.0	0	9.9	0.001	1621.5	3000	0.0	2.0	1.1	8.0
18290	8.0	7.3	9.8	16.9	2.0	2.0	0	0.0	1	0.0	0	0.0	0	9.4	0.001	1594.2	3000	0.0	2.0	1.3	8.0
18025	8.0	6.3	7.9	18.5	2.0	1.5	0	0.0	1	0.0	0	0.0	0	11.9	0.001	1520.2	17000	0.0	2.0	0.8	8.0
17785	8.0	6.6	8.5	20.2	2.0	1.6	0	0.0	1	0.0	0	0.0	0	12.0	0.001	1398.1	17000	0.0	2.0	1.0	8.0
17510	10.0	8.0	11.0	19.2	2.0	2.4	0	0.0	1	0.0	0	0.0	0	10.2	0.001	1350.7	17000	0.0	2.0	1.6	10.0
17360	12.8	12.8	17.1	15.9	2.0	4.8	0	0.0	1	0.0	0	0.0	0	8.8	0.004	943.2	17000	0.0	2.0	3.9	12.5
17110	18.1	18.1	22.3	15.2	2.0	7.4	0	0.0	1	0.0	0	0.0	0	5.8	0.007	1175.4	17000	0.0	2.0	6.7	14.0
16970	18.6	18.6	23.1	13.6	2.0	7.9	0	0.0	1	0.0	0	0.0	0	5.9	0.010	1067.0	17000	0.0	2.0	6.8	14.0
16720	17.2	17.2	24.4	9.2	2.0	8.6	0	0.0	1	0.0	0	0.0	0	5.2	0.019	1122.9	17000	0.0	2.0	4.6	14.0
16515	15.0	15.0	19.4	10.4	2.0	5.9	0	0.0	1	0.0	0	0.0	0	5.8	0.010	1249.9	17000	0.0	2.0	5.1	14.0
16305	10.0	8.4	11.6	14.6	2.0	2.6	0	0.0	1	0.0	0	0.0	0	9.4	0.002	1360.5	17000	0.0	2.0	1.8	10.0
16130	12.5	11.5	15.7	12.3	2.0	4.2	0	0.0	1	0.0	0	0.0	0	7.1	0.005	1326.5	17000	0.0	2.0	3.3	12.5
15960	13.3	13.3	17.7	11.0	2.0	5.1	0	0.0	1	0.0	0	0.0	0	5.9	0.008	1386.0	17000	0.0	2.0	4.2	12.5
15745	10.0	8.9	12.3	13.3	2.0	2.9	0	0.0	1	0.0	0	0.0	0	8.4	0.003	1363.9	17000	0.0	2.0	2.0	10.0
15540	10.0	7.8	10.6	13.7	2.0	2.3	0	0.0	1	0.0	0	0.0	0	9.4	0.002	1426.6	17000	0.0	2.0	1.5	10.0
15335	12.5	12.0	16.2	12.1	2.0	4.4	0	0.0	1	0.0	0	0.0	0	8.2	0.006	1064.1	17000	0.0	2.0	3.5	12.5
15125	30.9	30.9	17.9	11.6	2.0	5.2	0.9	4.0	1	0.0	0	17.4	0	8.0	0.007	1000.5	17000	0.0	2.0	4.3	12.5
14900	14.7	14.7	19.3	9.8	2.0	5.8	0	0.0	1	0.0	0	0.0	0	6.3	0.009	1626.5	17000	0.0	2.0	4.9	14.0
14720	14.0	13.7	18.1	9.8	2.0	5.3	0	0.0	1	0.0	0	0.0	0	6.0	0.008	1722.3	17000	0.0	2.0	4.4	14.0
14480	14.1	14.1	19.0	8.9	2.0	5.7	0	0.0	1	0.0	0	0.0	0	5.2	0.010	1726.7	17000	0.0	2.0	4.4	14.0
14315	10.1	10.1	14.0	9.9	2.0	3.5	0	0.0	1	0.0	0	0.0	0	5.8	0.005	1881.0	17000	0.0	2.0	2.6	10.0
14090	10.4	10.4	14.3	8.5	2.0	3.6	0	0.0	1	0.0	0	0.0	0	5.6	0.006	1772.8	17000	0.0	2.0	2.8	10.0
13850	10.0	9.1	12.6	9.7	2.0	3.0	0	0.0	1	0.0	0	0.0	0	6.5	0.004	1741.6	17000	0.0	2.0	2.2	10.0
13635	12.5	11.3	15.5	10.3	2.0	4.1	0	0.0	1	0.0	0	0.0	0	6.3	0.004	1705.8	17000	0.0	2.0	3.2	12.5
13425	14.0	13.1	18.0	7.8	2.0	5.2	0	0.0	1	0.0	0	0.0	0	4.3	0.011	1850.7	17000	0.0	2.0	3.9	14.0
13190	10.0	8.8	12.2	9.5	2.0	2.8	0	0.0	1	0.0	0	0.0	0	6.5	0.003	1847.4	17000	0.0	2.0	2.0	10.0
13030	10.3	10.3	14.2	9.6	2.0	3.6	0	0.0	1	0.0	0	0.0	0	6.5	0.003	1763.0	17000	0.0	2.0	2.7	10.0
12835	10.0	9.6	13.3	10.1	2.0	3.2	0	0.0	1	0.0	0	0.0	0	7.3	0.003	1607.5	17000	0.0	2.0	2.4	10.0
12615	10.0	9.0	12.5	10.9	2.0	2.9	0	0.0	1	0.0	0	0.0	0	8.6	0.002	1470.8	17000	0.0	2.0	2.1	10.0
12395	10.0	8.9	12.3	11.5	2.0	2.9	0	0.0	1	0.0	0	0.0	0	9.0	0.002	1438.1	17000	0.0	2.0	2.0	10.0
12195	10.0	7.8	10.6	12.5	2.0	2.3	0	0.0	1	0.0	0	0.0	0	10.3	0.001	1383.7	17000	0.0	2.0	1.5	10.0
11995	10.0	9.3	12.8	13.6	2.0	3.0	0	0.0	1	0.0	0	0.0	0	9.7	0.002	1280.5	17000	0.0	2.0	2.2	10.0
11780	10.0	9.1	12.6	14.4	2.0	3.0	0	0.0	1	0.0	0	0.0	0	9.3	0.001	1422.2	17000	0.0	2.0	2.1	10.0
11605	10.1	10.1	13.9	13.8	2.0	3.5	0	0.0	1	0.0	0	0.0	0	8.6	0.002	1325.5	17000	0.0	2.0	2.6	10.0
11405	10.0	9.5	13.2	15.1	2.0	3.2	0	0.0	1	0.0	0	0.0	0	10.3	0.002	1114.6	17000	0.0	2.0	2.3	10.0
11180	12.5	12.3	16.6	13.9	2.0	4.6	0	0.0	1	0.0	0	0.0	0	10.6	0.003	835.7	17000	0.0	2.0	3.7	12.5
11015	14.7	14.7	19.1	13.3	2.0	5.7	0	0.0	1	0.0	0	0.0	0	11.0	0.004	679.4	17000	0.0	2.0	4.9	14.0
10835	16.7	16.7	21.9	10.9	2.0	7.2	0	0.0	1	0.0	0	0.0	0	8.2	0.007	790.4	17000	0.0	2.0	5.4	14.0
10575	16.2	16.2	24.1	7.5	2.0	8.5	0	0.0	1	0.0	0	0.0	0	5.3	0.016	1108.8	17000	0.0	2.0	3.7	14.0
10390	16.1	16.1	22.7	8.8	2.0	7.7	0	0.0	1	0.0	0	0.0	0	5.8	0.008	1247.0	17000	0.0	2.0	4.4	14.0
10225	13.4	13.4	17.8	9.5	2.0	5.1	0	0.0	1	0.0	0	0.0	0	5.9	0.007	1374.1	17000	0.0	2.0	4.3	12.5
10000	10.9	10.9	14.9	11.1	2.0	3.9	0	0.0	1	0.0	0	0.0	0	6.6	0.004	1488.0	17000	0.0	2.0	3.0	10.0
9820	14.2	14.2	18.6	10.0	2.0	5.5	0	0.0	1	0.0	0	0.0	0	5.7	0.008	1402.3	17000	0.0	2.0	4.7	14.0
9595	10.6	10.6	14.6	10.3	2.0	3.7	0	0.0	1	0.0	0	0.0	0	6.6	0.005	1619.5	17000	0.0	2.0	2.9	10.0
9385	12.5	11.6	15.8	9.5	2.0	4.2	0	0.0	1	0.0	0	0.0	0	5.3	0.006	1770.4	17000	0.0	2.0	3.4	12.5
9220	12.5	12.1	16.4	8.9	2.0	4.5	0	0.0	1	0.0	0	0.0	0	4.9	0.008	1771.4	17000	0.0	2.0	3.6	12.5
9025	12.5	11.7	15.9	8.9	2.0	4.3	0	0.0	1	0.0	0	0.0	0	5.5	0.005	1736.9	17000	0.0	2.0	3.4	12.5
MAX=	30.9	30.9			8.1	12.0						17.4					17000.0	0.0	2.0	8.3	14.0
MIN=	8.0	5.6			2.0	1.1						0.0					3000.0	0.0	2.0	0.5	8.0

Santa Clara River Fluvial Study

APPENDIX CHAPTER 6.1B

LACH&SM with SAM Toe
Existing & Proposed Conditions
Curved & Straight Reaches

PACIFIC ADVANCED CIVIL ENGINEERING, INC.

CALCULATIONS FOR TOTAL TOE-DOWN BY INDIVIDUAL ADJUSTMENT COMPONENT BASED ON LACH&SM W/ SAM -- SANTA CLARA RIVER EXISTING CONDITIONS OUTSIDE CURVED REACH C_{CAP} n=0.025

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_{I}+	H/2	Z_{DM}=
46195	14.0	11.1	21.7	18.1	2.8	0.0	0	0.0	1	0.0	0	0.0	1	11.7	0.005	453.0	9000	0.0	2.0	6.3	14.0
46020	14.0	12.7	24.1	18.1	2.8	0.0	0	0.0	1	0.0	0	0.0	1	9.2	0.009	520.9	9000	0.0	2.0	7.9	14.0
45545	14.0	10.4	20.3	19.2	2.8	0.0	0	0.0	1	0.0	0	0.0	1	12.7	0.004	446.7	9000	0.0	2.0	5.6	14.0
45030	14.0	13.1	26.1	16.5	2.8	0.0	0	0.0	1	0.0	0	0.0	1	9.0	0.011	492.5	9000	0.0	2.0	8.3	14.0
44585	14.0	9.8	19.2	21.1	2.8	0.0	0	0.0	1	0.0	0	0.0	1	11.3	0.004	531.9	9000	0.0	2.0	5.0	14.0
44210	14.0	12.5	26.2	15.4	2.8	0.0	0	0.0	1	0.0	0	0.0	1	9.7	0.009	452.6	9000	0.0	2.0	7.7	14.0
43820	15.4	15.4	19.9	19.5	8.1	0.0	0	0.0	1	0.0	0	0.0	1	12.1	0.004	476.5	9000	0.0	2.0	5.3	14.0
43610	17.0	17.0	26.7	13.8	8.1	0.0	0	0.0	1	0.0	0	0.0	1	9.6	0.010	450.6	9000	0.0	2.0	6.9	14.0
43410	15.8	15.8	28.8	11.3	8.1	0.0	0	0.0	1	0.0	0	0.0	1	7.4	0.011	583.4	9000	0.0	2.0	5.7	14.0
43200	16.3	16.3	26.1	12.4	8.1	0.0	0	0.0	1	0.0	0	0.0	1	6.7	0.011	689.2	9000	0.0	2.0	6.2	14.0
42975	15.5	15.5	26.6	10.8	8.1	0.0	0	0.0	1	0.0	0	0.0	1	5.9	0.016	735.1	9000	0.0	2.0	5.4	14.0
42815	15.4	15.4	24.1	10.6	8.1	0.0	0	0.0	1	0.0	0	0.0	1	5.5	0.016	878.5	9000	0.0	2.0	5.3	14.0
42590	21.0	15.0	22.6	8.9	8.1	0.0	0	0.0	1	0.0	0	0.0	1	5.1	0.014	1023.2	9000	0.4	2.0	4.5	21.0
42430	21.0	15.1	20.8	9.6	8.1	0.0	0	0.0	1	0.0	0	0.0	1	5.9	0.012	940.5	9000	0.2	2.0	4.8	21.0
42215	15.0	13.1	10.4	14.3	8.1	0.0	0	0.0	1	0.0	0	0.0	1	8.5	0.002	1310.4	9000	1.5	2.0	1.5	15.0
41940	15.0	13.5	11.6	14.3	8.1	0.0	0	0.0	1	0.0	0	0.0	1	7.6	0.002	1321.5	9000	1.6	2.0	1.8	15.0
41730	15.0	13.3	11.8	14.7	8.1	0.0	0	0.0	1	0.0	0	0.0	1	8.0	0.002	1229.5	9000	1.3	2.0	1.9	15.0
41460	15.0	13.8	11.5	16.2	8.1	0.0	0	0.0	1	0.0	0	0.0	1	7.6	0.002	1329.0	9000	1.9	2.0	1.8	15.0
41280	12.5	11.2	16.5	14.3	5.2	0.3	0	0.0	1	0.0	0	0.0	1	8.2	0.004	852.1	9000	0.0	2.0	3.7	12.5
41080	14.0	12.8	19.9	12.1	5.2	0.3	0	0.0	1	0.0	0	0.0	1	6.7	0.007	874.2	9000	0.0	2.0	5.3	14.0
40825	21.0	12.4	18.0	11.5	5.2	0.3	0	0.0	1	0.0	0	0.0	1	6.2	0.007	1039.9	9000	0.5	2.0	4.4	21.0
40585	18.0	11.8	17.0	11.7	5.2	0.3	0	0.0	1	0.0	0	0.0	1	6.8	0.006	1005.9	9000	0.4	2.0	3.9	18.0
40335	15.0	11.4	11.1	14.5	5.2	0.3	0	0.0	1	0.0	0	0.0	1	7.1	0.002	1504.8	9000	2.2	2.0	1.7	15.0
40130	15.0	12.0	11.2	15.1	5.2	0.3	0	0.0	1	0.0	0	0.0	1	6.9	0.002	1636.5	9000	2.8	2.0	1.7	15.0
39945	15.0	11.9	10.3	16.1	5.2	0.3	0	0.0	1	0.0	0	0.0	1	7.6	0.001	1648.1	9000	3.0	2.0	1.4	15.0
39755	18.0	12.2	15.4	13.5	5.2	0.3	0	0.0	1	0.0	0	0.0	1	6.6	0.003	1251.4	9000	1.5	2.0	3.2	18.0
39605	21.0	13.4	19.4	11.4	5.2	0.3	0	0.0	1	0.0	0	0.0	1	5.8	0.007	1100.6	9000	0.8	2.0	5.1	21.0
39310	18.0	12.2	16.0	12.4	5.2	0.3	0	0.0	1	0.0	0	0.0	1	6.8	0.004	1204.5	9000	1.3	2.0	3.5	18.0
39100	15.0	11.2	12.4	14.1	5.2	0.3	0	0.0	1	0.0	0	0.0	1	7.8	0.002	1294.8	9000	1.6	2.0	2.1	15.0
38925	15.0	10.4	11.4	14.5	5.2	0.3	0	0.0	1	0.0	0	0.0	1	9.0	0.002	1181.3	9000	1.2	2.0	1.8	15.0
38710	15.0	6.9	10.6	15.9	2.7	0.0	0	0.0	1	0.0	0	0.0	1	10.8	0.001	1043.1	9000	0.7	2.0	1.5	15.0
38475	12.5	9.0	17.8	14.0	2.7	0.0	0	0.0	1	0.0	0	0.0	1	8.8	0.004	755.4	9000	0.0	2.0	4.3	12.5
38300	14.0	9.6	22.7	9.8	2.7	0.0	0	0.0	1	0.0	0	0.0	1	7.4	0.010	688.1	9000	0.0	2.0	4.9	14.0
38065	10.0	7.4	14.1	14.2	2.7	0.0	0	0.0	1	0.0	0	0.0	1	12.0	0.002	678.3	9000	0.0	2.0	2.7	10.0
37810	14.0	9.2	18.2	12.2	2.7	0.0	0	0.0	1	0.0	0	0.0	1	10.2	0.004	622.3	9000	0.0	2.0	4.5	14.0
37655	14.0	9.8	21.2	10.3	2.7	0.0	0	0.0	1	0.0	0	0.0	1	7.4	0.009	735.9	9000	0.0	2.0	5.1	14.0
37390	14.0	7.8	23.9	6.1	2.7	0.0	0	0.0	1	0.0	0	0.0	1	5.4	0.017	892.2	9000	0.0	2.0	3.1	14.0
37135	18.0	9.1	17.0	8.0	2.7	0.0	0	0.0	1	0.0	0	0.0	1	6.4	0.006	1088.9	9000	0.5	2.0	3.9	18.0
36930	21.0	9.2	18.3	7.9	2.7	0.0	0	0.0	1	0.0	0	0.0	1	6.0	0.007	1112.0	9000	0.6	2.0	3.9	21.0
36735	18.0	8.6	15.0	9.6	2.7	0.0	0	0.0	1	0.0	0	0.0	1	6.8	0.004	1195.7	9000	0.9	2.0	3.0	18.0
36515	18.0	9.7	16.7	9.6	2.7	0.0	0	0.0	1	0.0	0	0.0	1	5.5	0.006	1306.1	9000	1.2	2.0	3.8	18.0
36265	15.0	8.4	13.0	11.2	2.7	0.0	0	0.0	1	0.0	0	0.0	1	6.4	0.003	1373.1	9000	1.4	2.0	2.3	15.0
36080	15.0	9.5	12.5	11.7	3.2	0.6	0	0.0	1	0.0	0	0.0	1	6.4	0.004	1455.4	9000	1.6	2.0	2.1	15.0
35845	15.0	9.4	10.9	13.5	3.2	0.6	0	0.0	1	0.0	0	0.0	1	7.4	0.002	1496.2	9000	2.1	2.0	1.6	15.0
35725	15.0	10.7	14.7	13.0	3.2	0.6	0	0.0	1	0.0	0	0.0	1	6.3	0.003	1431.2	9000	2.1	2.0	2.9	15.0
35515	18.0	11.4	17.1	11.9	3.2	0.6	0	0.0	1	0.0	0	0.0	1	5.7	0.005	1353.4	9000	1.8	2.0	3.9	18.0
35245	15.0	11.0	14.5	12.5	3.2	0.6	0	0.0	1	0.0	0	0.0	1	5.8	0.003	1555.5	9000	2.4	2.0	2.8	15.0
35040	21.0	12.6	19.5	10.7	3.2	0.6	0	0.0	1	0.0	0	0.0	1	5.5	0.005	1355.9	9000	1.7	2.0	5.1	21.0
34860	21.0	11.5	18.1	10.1	3.2	0.6	0	0.0	1	0.0	0	0.0	1	4.8	0.008	1338.9	9000	1.3	2.0	4.4	21.0
34720	21.0	11.6	18.2	9.3	3.2	0.6	0	0.0	1	0.0	0	0.0	1	4.5	0.009	1411.5	9000	1.4	2.0	4.4	21.0
34495	21.0	11.2	18.1	8.9	3.2	0.6	0	0.0	1	0.0	0	0.0	1	5.0	0.009	1277.2	9000	1.0	2.0	4.4	21.0
34310	18.0	11.1	17.6	9.0	3.2	0.6	0	0.0	1	0.0	0	0.0	1	5.7	0.005	1280.8	9000	1.1	2.0	4.2	18.0
34090	18.0	10.7	17.2	8.6	3.2	0.6	0	0.0	1	0.0	0	0.0	1	5.4	0.007	1267.8	9000	1.0	2.0	4.0	18.0
33880	18.0	9.9	15.8	9.8	3.4	0.0	0	0.0	1	0.0	0	0.0	1	5.6	0.005	1310.6	9000	1.2	2.0	3.3	18.0
33710	18.0	10.3	16.5	9.4	3.4	0.0	0	0.0	1	0.0	0	0.0	1	5.2	0.007	1355.1	9000	1.3	2.0	3.7	18.0
33500	18.0	10.3	15.8	9.5	3.4	0.0	0	0.0	1	0.0	0	0.0	1	5.4	0.006	1474.3	9000	1.5	2.0	3.4	18.0
33310	18.0	10.9	15.9	9.1	3.4	0.0	0	0.0	1	0.0	0	0.0	1	4.2	0.006	1744.5	9000	2.1	2.0	3.4	18.0
33115	18.0	10.1	15.5	8.7	3.4	0.0	0	0.0	1	0.0	0	0.0	1	4.8	0.009	1573.2	9000	1.5	2.0	3.3	18.0
32795	15.0	9.7	12.2	11.0	3.4	0.0	0	0.0	1	0.0	0	0.0	1	5.5	0.003	1732.9	9000	2.3	2.0	2.0	15.0
32605	15.0	9.5	14.1	11.5	3.4	0.0	0	0.0	1	0.0	0	0.0	1	6.2	0.004	1344.6	9000	1.4	2.0	2.7	15.0
32265	18.0	10.2	16.7	10.2	2.0	0.0	0	0.0	1	0.0	0	0.0	1	4.6	0.007	1829.9	9000	2.5	2.0	3.8	18.0
31875	15.0	8.9	10.9	11.0	2.0	0.0	0	0.0	1	0.0	0	0.0	1	5.2	0.004	2482.2	9000	3.3	2.0	1.6	15.0
31585	18.0	10.6	16.6	9.8	2.0	0.0	0	0.0	1	0.0	0	0.0	1	4.0	0.009	2120.3	9000	2.9	2.0	3.7	18.0
31360	12.0	8.3	9.8	13.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.8	0.001	1884.4	9000	3.0	2.0	1.3	12.0
31060	12.0	7.6	7.9	15.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.5	0.001	1711.5	9000	2.7	2.0	0.8	12.0
30720	12.0	8.1	6.4	18.0	2.0	0.0	0	0.0	1	0.0	0	0.0	1	11.6	0.000	1891.7	9000	3.5	2.0	0.6	12.0
30445	12.0	8.0	6.0	19.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	13.1	0.000	1783.7	9000	3.5	2.0	0.5	12.0
30095	12.0	8.7	6.6	21.7	2.0	0.0	0	0.0	1	0.0	0	0.0	1	12.7	0.000	1730.3	9000	4.1	2.0	0.6	12.0
29815	12.0	9.1	7.7	22.4	2.0	0.0	0	0.0	1	0.0	0	0.0	1	11.7	0.000	1675.2	9000	4.3	2.0	0.8	12.0
29565	12.0	9.4	7.4	23.3	2.0	0.0	0	0.0	1	0.0	0	0.0	1	11.8	0.000	1717.4	9000	4.6	2.0	0.7	12.0
29385	12.0	9.8	8.5	24.0	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.8	0.000	1675.1	9000	4.8	2.0	1.0	12.0
29140	15.1	15.1	10.1	24.3	4.4	2.9	0	0.0	1	0.0	0	0.0	1	9.3	0.001	1557.6	9000	4.4	2.0	1.4	15.0
28895	21.0	16.1	19.7	22.4	4.4	2.9	0	0.0	1	0.0	0	0.0	1	8.6	0.002	1062.3	9000	1.6	2.0	5.2	21.0
28695	17.3	17.3	27.5	16.0	4.4	2.9	0	0.0	1	0.0	0	0.0	1	9.4	0.009	544.9	9000	0.0	2.0	8.0	14.0
28500	16.1	16.1	28.6	13.6	4.4	2.9	0	0.0	1	0.0	0	0.0	1	9.8	0.010	503.7	9000	0.0	2.0	6.8	14.0
28280	15.2	15.2	29.7	11.8	4.4	2.9	0	0.0	1	0.0	0	0.0	1	8.8	0.011	549.3	9000	0.0	2.0	5.9	14.0
28080	15.0	15.0	28.1	11.4	4.4	2.9	0	0.0	1	0.0	0	0.0	1	9.2	0.011	547.6	9000	0.0	2.0	5.7	14.0
27925	13.6	13.6	18.0	17.5	4.4	2.9	0	0.0	1	0.0	0	0.0	1	13.0	0.002	612.7	9000	0.0	2.0	4.3	12.5
27725	15.0	15.0	20.5	16.3	4.4	2.9	0	0.0	1	0.0	0	0.0	1	12.1	0.003	587.1	9000	0.0	2.0	5.7	14.0
27545	15.9	15.9	24.7	13.2	4.4	2.9	0	0.0	1	0.0	0	0.0	1	9.5	0.007	613.0	9000	0.0	2.0	6.6	14.0
27335	15.3	15.3	25.5	12.0	4.4	2.9	0	0.0	1	0.0	0	0.0	1	8.1	0.008	691.0	9000	0.0	2.0	6.0	14.0
27155	15.9	15.9	22.3	13.2	4.4	2.9	0	0.0	1	0.0	0	0.0	1	8.0	0.005	856.6	9000	0.0	2.0	6.6	14.0
26990	21.0	10.5	23.5	11.2	2.0	0.4	0	0.0	1	0.0	0	0.0	1	6.0	0.010	1008.2	9000	0.5	2.0	5.6	21.0
26780	21.0	10.9	23.9	11.0	2.0	0.4	0	0.0	1	0.0	0	0.0	1	5.6	0.010	1131.7	9000	1.0	2.0	5.5	21.0
26575	21.0	15.2	21.0	11.0	2.0	0.4	0	0.0	1	0.0	0	0.0	1	5.5	0.013	1216.4	3000	5.3	2.0	5.5	21.0
26355	18.0	14.8	15.8	13.4	2.0	0.4	0	0.0	1	0.0	0	0.0	1	7.5	0.003	1282.4	3000	7.0	2.0	3.4	18.0
26170	18.0	16.5	18.0	13.0	2.0	0.4	0	0.0	1	0.0	0	0.0	1	6.8	0.004	1347.9	3000	7.7	2.0	4.4	18.0

DEFINITIONS
V(FPS) =VELOCITY IN FEET PER SECOND
Z_{TOT}=TOTAL POTENTIAL VERTICAL ADJUSTMENT IN FEET
Z_{DEG}=LONG TERM DEGRADATION IN FEET
Z_{GS}=GENERAL SCOUR IN FEET FROM SAM
Z_{LS}=LOCAL SCOUR IN FEET
PIER TYPE=PIER SHAPE FACTOR; IF NO PIERS=**0**
1.0=SQUARE NOSE; **0.9** ROUND NOSE; **0.9** CYLINDER;
0.8 SHARP NOSE; **0.9** GROUP OF CYLINDERS
FLOW DEPTH=WATER DEPTH IN CHANNEL IN FEET
B=WIDTH OF PIERS IN FEET; NO PIER=0
ABUT TYPE=VERT WALL FACTOR; IF VERT=**2**; NON VERT=**1**
A=ABUTMENT PROTRUSION INTO FLOW PATH IN FEET
SOFT = SOFT BOTTOM AT A BRIDGE OR AN ABUTMENT
0 = HARD BOTTOM; **1** = SOFT BOTTOM
Z_{BS}=BEND SCOUR IN FEET
BEND COEFF=BEND COEFFICIENT; IF NO BEND=0, BEND=1
HYD DEPTH=HYDRAULIC DEPTH IN FEET
E SLOPE=ENERGY SLOPE, UNITLESS
TOP WIDTH=CHANNEL TOP WIDTH IN FEET
RADIUS=RADIUS OF CURVATURE TO CENTERLINE IN FEET
Z_{I}=LOW-FLOW INCISEMENT IN FEET, MEASURED OR 2'; VALUE **NOT LESS THAN 2'**
H=BEDFORM HEIGHT IN FEET, LIMITED TO FLOW DEPTH AFTER KENNEDY (1963)
Z_{DM}=CUT OFF DEPTH REQUIRED BY LACFCDDM

GENERAL
THIS SPREADSHEET IS DESIGNED TO CALCULATE SCOUR PROTECTION (TOE DOWN) BASED ON LADPW COUNTY HYDROLOGY MANUAL (1991) PAGES 5.2-5.8 AND ASSOCIATED APPENDICES (SEDIMENTATION MANUAL). ALL VELOCITIES ARE IN FPS, WITH A MAXIMUM VALUE LIMITED BY THE EQUATION. THE PRESENT VERSION (10/04) WILL CALCULATE UP TO 50 VELOCITIES AT ONE TIME. LONG TERM DEGRADATION IS USER SUPPLIED. GENERAL SCOUR IS TAKEN FROM APPENDIX Q3, INTERPOLATED. LOCAL SCOUR AT BENDS AND ABUTMENTS ARE BASED ON LADWP EQUATIONS FOUND IN APP Q12. BEND SCOUR IS BASED ON EQUATIONS IN APPENDIX Q12. A LONGITUDINAL EXTENT BASED ON SECONDARY CURRENTS IS NOT INCLUDED. BEDFORM HEIGHT IS BASED ON EQUATIONS IN APPENDIX Q13. JULY 2005 REVISION INCLUDES CALCULATION FOR CUT OFF DEPTH BASED ON LOS ANGELES COUNTY FLOOD CONTROL DISTRICT DESIGN MANUAL. THE CALCULATION DOES NOT CONSIDER ADJUSTMENTS TO CUT OFF DEPTH BASED ON TABLE F-06
THE OCTOBER 2005 REVISION INCLUDES ADDITIONAL TOEDOWN AT BRIDGES/ABUTMENTS WITH SOFT BOTTOMS.

COLOR CODES
OUTPUT
DATA FROM HEC-RAS
USER SUPPLIED DATA
INTERMEDIATE CALCULATIONS (INDIVIDUAL SHEETS ONLY)

DESIGNED BY DAVID A JAFFE, PHD, PE
PACIFIC ADVANCED CIVIL ENGINEERING, INC
OCTOBER, 2004
OCTOBER 2005, REVISED

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_t+	H/2	Z_{DM}=
25965	18.0	16.1	17.9	13.0	2.0	0.4	0	0.0	1	0.0	0	0.0	1	7.0	0.004	1288.3	3000	7.4	2.0	4.3	18.0
25785	21.0	16.6	19.5	11.7	2.0	0.4	0	0.0	1	0.0	0	0.0	1	6.2	0.005	1336.9	3000	7.0	2.0	5.2	21.0
25600	21.0	18.4	20.6	11.3	2.0	0.4	0	0.0	1	0.0	0	0.0	1	5.2	0.006	1596.5	3000	8.3	2.0	5.6	21.0
25425	21.0	18.5	20.0	11.3	2.0	0.4	0	0.0	1	0.0	0	0.0	1	4.4	0.008	1773.8	3000	8.7	2.0	5.4	21.0
25215	16.3	16.3	14.5	13.6	2.0	0.4	0	0.0	1	0.0	0	0.0	1	6.1	0.003	1748.6	3000	9.0	2.0	2.8	15.0
25000	19.0	19.0	17.4	12.2	2.0	0.4	0	0.0	1	0.0	0	0.0	1	4.4	0.006	2103.2	3000	10.5	2.0	4.1	18.0
24795	21.0	19.7	19.0	11.4	2.0	0.0	0	0.0	1	0.0	0	0.0	1	3.9	0.007	2311.7	3000	10.8	2.0	4.9	21.0
24550	21.0	19.6	21.3	10.8	2.0	0.0	0	0.0	1	0.0	0	0.0	1	3.8	0.009	2227.0	3000	10.2	2.0	5.4	21.0
24335	17.0	17.0	14.5	13.1	2.0	0.0	0	0.0	1	0.0	0	0.0	1	5.7	0.003	2089.5	3000	10.2	2.0	2.8	15.0
24115	21.0	17.5	18.8	11.1	2.0	0.0	0	0.0	1	0.0	0	0.0	1	4.5	0.008	2015.8	3000	8.7	2.0	4.8	21.0
23975	21.0	16.6	19.0	10.2	2.0	0.0	0	0.0	1	0.0	0	0.0	1	4.6	0.008	1913.7	3000	7.7	2.0	4.9	21.0
23755	18.0	15.8	16.7	10.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	5.1	0.006	1935.4	3000	8.0	2.0	3.8	18.0
23565	16.1	16.1	14.5	12.7	2.0	0.0	0	0.0	1	0.0	0	0.0	1	5.6	0.004	2039.5	3000	9.3	2.0	2.8	15.0
23365	18.0	15.3	17.0	10.8	2.0	0.0	0	0.0	1	0.0	0	0.0	1	5.4	0.006	1781.4	3000	7.4	2.0	3.9	18.0
23180	15.5	15.5	13.2	11.8	2.0	0.0	0	0.0	1	0.0	0	0.0	1	6.6	0.002	2084.2	3000	9.2	2.0	2.3	15.0
23000	13.0	13.0	8.9	13.0	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.7	0.001	2069.1	3000	7.9	2.0	1.1	12.0
22790	13.0	13.0	9.4	13.1	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.8	0.001	1949.0	3000	7.8	2.0	1.2	12.0
22600	15.0	15.0	11.4	14.1	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.9	0.001	1865.2	3000	9.3	2.0	1.7	15.0
22415	15.0	14.6	11.8	14.1	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.1	0.002	1705.6	3000	8.7	2.0	1.9	15.0
22195	15.0	14.4	14.1	13.7	2.0	0.6	0	0.0	1	0.0	0	0.0	1	7.8	0.003	1322.2	3000	7.1	2.0	2.7	15.0
22010	18.0	16.2	16.0	14.4	2.0	0.6	0	0.0	1	0.0	0	0.0	1	7.3	0.003	1328.0	3000	8.2	2.0	3.5	18.0
21790	21.0	15.7	19.7	11.6	2.0	0.6	0	0.0	1	0.0	0	0.0	1	6.5	0.006	1145.7	3000	5.9	2.0	5.2	21.0
21615	21.0	13.0	21.4	8.5	2.0	0.6	0	0.0	1	0.0	0	0.0	1	5.8	0.010	1161.3	3000	4.2	2.0	4.3	21.0
21440	21.0	16.0	20.1	9.7	2.0	0.6	0	0.0	1	0.0	0	0.0	1	5.0	0.008	1574.6	3000	6.6	2.0	4.8	21.0
21225	21.0	19.5	19.5	10.6	2.0	0.6	0	0.0	1	0.0	0	0.0	1	3.9	0.008	2217.7	3000	9.7	2.0	5.1	21.0
21020	21.0	15.5	20.8	8.9	2.0	0.6	0	0.0	1	0.0	0	0.0	1	4.6	0.009	1676.4	3000	6.5	2.0	4.4	21.0
20845	18.1	18.1	17.1	10.4	2.0	0.6	0	0.0	1	0.0	0	0.0	1	4.2	0.006	2369.3	3000	9.6	2.0	3.9	18.0
20595	18.0	18.0	15.2	10.9	2.0	0.6	0	0.0	1	0.0	0	0.0	1	4.7	0.003	2463.7	3000	10.3	2.0	3.1	18.0
20435	18.2	18.2	12.9	12.2	2.0	0.6	0	0.0	1	0.0	0	0.0	1	5.4	0.002	2582.7	3000	11.3	2.0	2.3	15.0
20280	18.2	18.2	14.0	11.8	2.0	0.6	0	0.0	1	0.0	0	0.0	1	5.0	0.003	2589.6	3000	11.0	2.0	2.6	15.0
20070	21.0	15.9	20.2	9.2	2.0	0.6	0	0.0	1	0.0	0	0.0	1	4.7	0.009	1767.5	3000	6.7	2.0	4.6	21.0
19855	18.0	16.2	17.8	9.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	4.8	0.006	1975.1	3000	7.9	2.0	4.3	18.0
19630	18.0	14.9	17.9	8.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	4.9	0.006	1836.2	3000	6.6	2.0	4.3	18.0
19440	15.0	14.8	11.9	12.1	2.0	0.0	0	0.0	1	0.0	0	0.0	1	6.5	0.002	2095.3	3000	8.9	2.0	1.9	15.0
19240	15.3	15.3	13.9	11.4	2.0	0.0	0	0.0	1	0.0	0	0.0	1	5.6	0.003	2091.7	3000	8.7	2.0	2.6	15.0
19050	15.0	14.7	11.0	12.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	6.7	0.002	2160.8	3000	9.1	2.0	1.6	15.0
18830	15.6	15.6	10.7	14.6	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.1	0.002	2094.4	3000	10.1	2.0	1.5	15.0
18650	15.5	15.5	9.9	15.0	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.0	0.001	2022.7	3000	10.1	2.0	1.3	12.0
18475	14.6	14.6	8.1	16.6	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.4	0.001	1944.4	3000	9.7	2.0	0.9	12.0
18290	14.9	14.9	8.7	16.8	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.3	0.001	1843.7	3000	9.9	2.0	1.0	12.0
18025	8.0	4.8	7.8	18.2	2.0	0.0	0	0.0	1	0.0	0	0.0	1	11.5	0.001	1610.9	17000	0.0	2.0	0.8	8.0
17785	8.0	5.0	8.7	19.8	2.0	0.0	0	0.0	1	0.0	0	0.0	1	11.6	0.001	1417.5	17000	0.0	2.0	1.0	8.0
17510	10.0	7.8	14.0	18.0	2.0	1.2	0	0.0	1	0.0	0	0.0	1	8.5	0.002	1243.6	17000	0.0	2.0	2.6	10.0
17360	12.5	9.1	17.0	16.9	2.0	1.2	0	0.0	1	0.0	0	0.0	1	8.9	0.004	936.6	17000	0.0	2.0	3.9	12.5
17110	14.0	11.6	21.7	15.4	2.0	1.2	0	0.0	1	0.0	0	0.0	1	5.6	0.006	1274.3	17000	0.0	2.0	6.4	14.0
16970	14.0	12.0	22.9	13.6	2.0	1.2	0	0.0	1	0.0	0	0.0	1	5.7	0.008	1125.6	17000	0.0	2.0	6.8	14.0
16720	14.0	9.7	25.2	9.0	2.0	1.2	0	0.0	1	0.0	0	0.0	1	4.1	0.018	1404.6	17000	0.0	2.0	4.5	14.0
16515	14.0	10.0	21.5	9.5	2.0	1.2	0	0.0	1	0.0	0	0.0	1	4.3	0.012	1622.6	17000	0.0	2.0	4.8	14.0
16305	21.0	10.3	21.5	9.6	2.0	1.2	0	0.0	1	0.0	0	0.0	1	4.2	0.011	1812.8	17000	0.3	2.0	4.8	21.0
16130	18.0	9.2	16.1	10.2	2.0	1.2	0	0.0	1	0.0	0	0.0	1	5.2	0.005	1945.1	17000	0.5	2.0	3.5	18.0
15960	18.0	9.3	15.8	9.3	2.0	1.2	0	0.0	1	0.0	0	0.0	1	4.1	0.011	2180.9	17000	0.7	2.0	3.4	18.0
15745	15.0	7.7	10.9	10.6	2.0	1.2	0	0.0	1	0.0	0	0.0	1	5.7	0.003	2279.0	17000	0.9	2.0	1.6	15.0
15540	15.0	7.8	11.0	10.6	2.0	1.2	0	0.0	1	0.0	0	0.0	1	5.8	0.003	2324.2	17000	1.0	2.0	1.6	15.0
15335	15.0	8.3	12.7	10.5	2.0	1.2	0	0.0	1	0.0	0	0.0	1	4.9	0.005	2302.1	17000	1.0	2.0	2.2	15.0
15125	12.5	8.1	16.2	9.6	2.0	0.6	0	0.0	1	0.0	0	0.0	1	5.5	0.007	1618.5	17000	0.0	2.0	3.5	12.5
14900	15.0	7.5	14.5	10.4	2.0	0.6	0	0.0	1	0.0	0	0.0	1	6.1	0.004	1704.5	17000	0.1	2.0	2.9	15.0
14720	18.0	8.6	16.8	9.3	2.0	0.6	0	0.0	1	0.0	0	0.0	1	5.1	0.008	1763.5	17000	0.1	2.0	3.8	18.0
14480	15.0	7.6	14.3	10.2	2.0	0.6	0	0.0	1	0.0	0	0.0	1	6.0	0.004	1801.7	17000	0.2	2.0	2.7	15.0
14315	15.0	7.8	14.8	9.4	2.0	0.6	0	0.0	1	0.0	0	0.0	1	5.2	0.006	1868.1	17000	0.3	2.0	3.0	15.0
14090	15.0	7.3	13.8	9.0	2.0	0.6	0	0.0	1	0.0	0	0.0	1	5.9	0.005	1766.8	17000	0.1	2.0	2.6	15.0
13850	18.0	8.0	15.6	8.4	2.0	0.6	0	0.0	1	0.0	0	0.0	1	5.3	0.007	1727.3	17000	0.1	2.0	3.3	18.0
13635	12.5	7.8	15.4	10.3	2.0	0.6	0	0.0	1	0.0	0	0.0	1	6.4	0.004	1691.9	17000	0.0	2.0	3.2	12.5
13425	18.0	8.9	17.3	8.3	2.0	0.6	0	0.0	1	0.0	0	0.0	1	4.5	0.009	1854.4	17000	0.3	2.0	4.0	18.0
13190	15.0	6.9	12.2	9.5	2.0	0.6	0	0.0	1	0.0	0	0.0	1	6.4	0.003	1847.3	17000	0.3	2.0	2.0	15.0
13030	15.0	6.9	14.2	9.6	2.0	0.0	0	0.0	1	0.0	0	0.0	1	6.5	0.003	1763.0	17000	0.2	2.0	2.7	15.0
12835	10.0	6.4	13.3	10.1	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.3	0.003	1607.5	17000	0.0	2.0	2.4	10.0
12615	10.0	6.1	12.4	10.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.7	0.002	1471.0	17000	0.0	2.0	2.1	10.0
12395	10.0	6.0	12.3	11.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.0	0.002	1438.4	17000	0.0	2.0	2.0	10.0
12195	10.0	5.5	10.6	12.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.3	0.001	1389.3	17000	0.0	2.0	1.5	10.0
11995	10.0	6.2	12.7	13.7	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.8	0.002	1281.1	17000	0.0	2.0	2.2	10.0
11780	10.0	6.1	12.5	14.4	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.4	0.001	1400.9	17000	0.0	2.0	2.1	10.0
11605	10.0	6.7	14.1	13.7	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.7	0.002	1282.9	17000	0.0	2.0	2.7	10.0
11405	10.0	6.3	13.2	15.1	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.1	0.002	1130.2	17000	0.0	2.0	2.3	10.0
11180	12.5	7.7	16.6	13.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.6	0.003	835.7	17000	0.0	2.0	3.7	12.5
11015	14.0	10.3	19.1	13.3	2.0	1.4	0	0.0	1	0.0	0	0.0	1	11.0	0.004	679.4	17000	0.0	2.0	4.9	14.0
10835	14.0	10.8	21.9	10.9	2.0	1.4	0	0.0	1	0.0	0	0.0	1	8.2	0.007	790.4	17000	0.0	2.0	5.4	14.0
10575	14.0	9.1	24.1	7.5	2.0	1.4	0	0.0	1	0.0	0	0.0	1	5.3	0.016	1108.8	17000	0.0	2.0	3.7	14.0
10390	14.0	9.8	22.7	8.8	2.0	1.4	0	0.0	1	0.0	0	0.0	1	5.8	0.008	1247.1	17000	0.0	2.0	4.4	14.0
10225	12.5	9.7	17.8	9.5	2.0	1.4	0	0.0	1	0.0	0	0.0	1	5.9	0.007	1373.8	17000	0.0	2.0	4.3	12.5
10000	10.0	8.4	14.9	11.1	2.0	1.4	0	0.0	1	0.0	0	0.0	1	6.6	0.004	1488.0	17000	0.0	2.0	3.0	10.0
9820	14.0	10.1	18.6	10.0	2.0	1.4	0	0.0	1	0.0	0	0.0	1	5.7	0.008	1336.6	17000	0.0	2.0	4.7	14.0
9595	10.0	8.3	14.6	10.3	2.0	1.4	0	0.0	1	0.0	0	0.0	1	6.6	0.005	1619.7	17000	0.0	2.0	2.9	10.0
9385	18.0	8.9	15.8	9.5	2.0	1.4	0	0.0	1	0.0	0	0.0	1	5.3	0.006	1770.4	17000	0.2	2.0	3.4	18.0
9220	18.0	9.2	16.4	8.9	2.0	1.4	0	0.0	1	0.0	0	0.0	1	4.9	0.008	1771.4	17000	0.1	2.0	3.6	18.0
9025	18.0	8.9	15.9	8.9	2.0	1.4	0	0.0	1	0.0	0	0.0	1	5.5	0.005	1736.9	17000	0.1	2.0	3.4	18.0
MAX=	21.0	19.7			8.1	2.9						0.0					17000.0	11.3	2.0	8.3	21.0
MIN=	8.0	4.8			2.0	0.0						0.0					3000.0	0.0	2.0	0.5	8.0

CALCULATIONS FOR TOTAL TOE-DOWN BY INDIVIDUAL ADJUSTMENT COMPONENT BASED ON LACH&SM W/ SAM -- SANTA CLARA RIVER EXISTING CONDITIONS STRAIGHT-INSIDE CURVED REACH Q_{cap} n=0.025

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_I+	H/2	Z_{DM}=
46195	14.0	11.1	21.7	18.1	2.8	0.0	0	0.0	1	0.0	0	0.0	0	11.7	0.005	453.0	9000	0.0	2.0	6.3	14.0
46020	14.0	12.7	24.1	18.1	2.8	0.0	0	0.0	1	0.0	0	0.0	0	9.2	0.009	520.9	9000	0.0	2.0	7.9	14.0
45545	14.0	10.4	20.3	19.2	2.8	0.0	0	0.0	1	0.0	0	0.0	0	12.7	0.004	446.7	9000	0.0	2.0	5.6	14.0
45030	14.0	13.1	26.1	16.5	2.8	0.0	0	0.0	1	0.0	0	0.0	0	9.0	0.011	492.5	9000	0.0	2.0	8.3	14.0
44585	14.0	9.8	19.2	21.1	2.8	0.0	0	0.0	1	0.0	0	0.0	0	11.3	0.004	531.9	9000	0.0	2.0	5.0	14.0
44210	14.0	12.5	26.2	15.4	2.8	0.0	0	0.0	1	0.0	0	0.0	0	9.7	0.009	452.6	9000	0.0	2.0	7.7	14.0
43820	15.4	15.4	19.9	19.5	8.1	0.0	0	0.0	1	0.0	0	0.0	0	12.1	0.004	476.5	9000	0.0	2.0	5.3	14.0
43610	17.0	17.0	26.7	13.8	8.1	0.0	0	0.0	1	0.0	0	0.0	0	9.6	0.010	450.6	9000	0.0	2.0	6.9	14.0
43410	15.8	15.8	28.8	11.3	8.1	0.0	0	0.0	1	0.0	0	0.0	0	7.4	0.011	583.4	9000	0.0	2.0	5.7	14.0
43200	16.3	16.3	26.1	12.4	8.1	0.0	0	0.0	1	0.0	0	0.0	0	6.7	0.011	689.2	9000	0.0	2.0	6.2	14.0
42975	15.5	15.5	26.6	10.8	8.1	0.0	0	0.0	1	0.0	0	0.0	0	5.9	0.016	735.1	9000	0.0	2.0	5.4	14.0
42815	15.4	15.4	24.1	10.6	8.1	0.0	0	0.0	1	0.0	0	0.0	0	5.5	0.016	878.5	9000	0.0	2.0	5.3	14.0
42590	14.6	14.6	22.6	8.9	8.1	0.0	0	0.0	1	0.0	0	0.0	0	5.1	0.014	1023.2	9000	0.0	2.0	4.5	14.0
42430	14.9	14.9	20.8	9.6	8.1	0.0	0	0.0	1	0.0	0	0.0	0	5.9	0.012	940.5	9000	0.0	2.0	4.8	14.0
42215	11.6	11.6	10.4	14.3	8.1	0.0	0	0.0	1	0.0	0	0.0	0	8.5	0.002	1310.4	9000	0.0	2.0	1.5	10.0
41940	11.9	11.9	11.6	14.3	8.1	0.0	0	0.0	1	0.0	0	0.0	0	7.6	0.002	1321.5	9000	0.0	2.0	1.8	10.0
41730	12.0	12.0	11.8	14.7	8.1	0.0	0	0.0	1	0.0	0	0.0	0	8.0	0.002	1229.5	9000	0.0	2.0	1.9	10.0
41460	11.9	11.9	11.5	16.2	8.1	0.0	0	0.0	1	0.0	0	0.0	0	7.6	0.002	1329.0	9000	0.0	2.0	1.8	10.0
41280	12.5	11.2	16.5	14.3	5.2	0.3	0	0.0	1	0.0	0	0.0	0	8.2	0.004	852.1	9000	0.0	2.0	3.7	12.5
41080	14.0	12.8	19.9	12.1	5.2	0.3	0	0.0	1	0.0	0	0.0	0	6.7	0.007	874.2	9000	0.0	2.0	5.3	14.0
40825	14.0	11.9	18.0	11.5	5.2	0.3	0	0.0	1	0.0	0	0.0	0	6.2	0.007	1039.9	9000	0.0	2.0	4.4	14.0
40585	12.5	11.4	17.0	11.7	5.2	0.3	0	0.0	1	0.0	0	0.0	0	6.8	0.006	1005.9	9000	0.0	2.0	3.9	12.5
40335	10.0	9.2	11.1	14.5	5.2	0.3	0	0.0	1	0.0	0	0.0	0	7.1	0.002	1504.8	9000	0.0	2.0	1.7	10.0
40130	10.0	9.2	11.2	15.1	5.2	0.3	0	0.0	1	0.0	0	0.0	0	6.9	0.002	1636.5	9000	0.0	2.0	1.7	10.0
39945	10.0	8.9	10.3	16.1	5.2	0.3	0	0.0	1	0.0	0	0.0	0	7.6	0.001	1648.1	9000	0.0	2.0	1.4	10.0
39755	12.5	10.7	15.4	13.5	5.2	0.3	0	0.0	1	0.0	0	0.0	0	6.6	0.003	1251.4	9000	0.0	2.0	3.2	12.5
39605	14.0	12.6	19.4	11.4	5.2	0.3	0	0.0	1	0.0	0	0.0	0	5.8	0.007	1100.6	9000	0.0	2.0	5.1	14.0
39310	12.5	11.0	16.0	12.4	5.2	0.3	0	0.0	1	0.0	0	0.0	0	6.8	0.004	1204.5	9000	0.0	2.0	3.5	12.5
39100	10.0	9.6	12.4	14.1	5.2	0.3	0	0.0	1	0.0	0	0.0	0	7.8	0.002	1294.8	9000	0.0	2.0	2.1	10.0
38925	10.0	9.3	11.4	14.5	5.2	0.3	0	0.0	1	0.0	0	0.0	0	9.0	0.002	1181.3	9000	0.0	2.0	1.8	10.0
38710	10.0	6.2	10.6	15.9	2.7	0.0	0	0.0	1	0.0	0	0.0	0	10.8	0.001	1043.1	9000	0.0	2.0	1.5	10.0
38475	12.5	9.0	17.8	14.0	2.7	0.0	0	0.0	1	0.0	0	0.0	0	8.8	0.004	755.4	9000	0.0	2.0	4.3	12.5
38300	14.0	9.6	22.7	9.8	2.7	0.0	0	0.0	1	0.0	0	0.0	0	7.4	0.010	688.1	9000	0.0	2.0	4.9	14.0
38065	10.0	7.4	14.1	14.2	2.7	0.0	0	0.0	1	0.0	0	0.0	0	12.0	0.002	678.3	9000	0.0	2.0	2.7	10.0
37810	14.0	9.2	18.2	12.2	2.7	0.0	0	0.0	1	0.0	0	0.0	0	10.2	0.004	622.3	9000	0.0	2.0	4.5	14.0
37655	14.0	9.8	21.2	10.3	2.7	0.0	0	0.0	1	0.0	0	0.0	0	7.4	0.009	735.9	9000	0.0	2.0	5.1	14.0
37390	14.0	7.8	23.9	6.1	2.7	0.0	0	0.0	1	0.0	0	0.0	0	5.4	0.017	892.2	9000	0.0	2.0	3.1	14.0
37135	12.5	8.6	17.0	8.0	2.7	0.0	0	0.0	1	0.0	0	0.0	0	6.4	0.006	1088.9	9000	0.0	2.0	3.9	12.5
36930	14.0	8.6	18.3	7.9	2.7	0.0	0	0.0	1	0.0	0	0.0	0	6.0	0.007	1112.0	9000	0.0	2.0	3.9	14.0
36735	12.5	7.7	15.0	9.6	2.7	0.0	0	0.0	1	0.0	0	0.0	0	6.8	0.004	1195.7	9000	0.0	2.0	3.0	12.5
36515	12.5	8.5	16.7	9.6	2.7	0.0	0	0.0	1	0.0	0	0.0	0	5.5	0.006	1306.1	9000	0.0	2.0	3.8	12.5
36265	10.0	7.0	13.0	11.2	2.7	0.0	0	0.0	1	0.0	0	0.0	0	6.4	0.003	1373.1	9000	0.0	2.0	2.3	10.0
36080	10.0	7.9	12.5	11.7	3.2	0.6	0	0.0	1	0.0	0	0.0	0	6.4	0.004	1455.4	9000	0.0	2.0	2.1	10.0
35845	10.0	7.4	10.9	13.5	3.2	0.6	0	0.0	1	0.0	0	0.0	0	7.4	0.002	1496.2	9000	0.0	2.0	1.6	10.0
35725	10.0	8.7	14.7	13.0	3.2	0.6	0	0.0	1	0.0	0	0.0	0	6.3	0.003	1431.2	9000	0.0	2.0	2.9	10.0
35515	12.5	9.7	17.1	11.9	3.2	0.6	0	0.0	1	0.0	0	0.0	0	5.7	0.005	1353.4	9000	0.0	2.0	3.9	12.5
35245	10.0	8.6	14.5	12.5	3.2	0.6	0	0.0	1	0.0	0	0.0	0	5.8	0.003	1555.5	9000	0.0	2.0	2.8	10.0
35040	14.0	10.9	19.5	10.7	3.2	0.6	0	0.0	1	0.0	0	0.0	0	5.5	0.005	1355.9	9000	0.0	2.0	5.1	14.0
34860	14.0	10.2	18.1	10.1	3.2	0.6	0	0.0	1	0.0	0	0.0	0	4.8	0.008	1338.9	9000	0.0	2.0	4.4	14.0
34720	14.0	10.2	18.2	9.3	3.2	0.6	0	0.0	1	0.0	0	0.0	0	4.5	0.009	1411.5	9000	0.0	2.0	4.4	14.0
34495	14.0	10.2	18.1	8.9	3.2	0.6	0	0.0	1	0.0	0	0.0	0	5.0	0.009	1277.2	9000	0.0	2.0	4.4	14.0
34310	12.5	9.9	17.6	9.0	3.2	0.6	0	0.0	1	0.0	0	0.0	0	5.7	0.005	1280.8	9000	0.0	2.0	4.2	12.5
34090	12.5	9.7	17.2	8.6	3.2	0.6	0	0.0	1	0.0	0	0.0	0	5.4	0.007	1267.8	9000	0.0	2.0	4.0	12.5
33880	12.5	8.7	15.8	9.8	3.4	0.0	0	0.0	1	0.0	0	0.0	0	5.6	0.005	1310.6	9000	0.0	2.0	3.3	12.5
33710	12.5	9.1	16.5	9.4	3.4	0.0	0	0.0	1	0.0	0	0.0	0	5.2	0.007	1355.1	9000	0.0	2.0	3.7	12.5
33500	12.5	8.7	15.8	9.5	3.4	0.0	0	0.0	1	0.0	0	0.0	0	5.4	0.006	1474.3	9000	0.0	2.0	3.4	12.5
33310	12.5	8.8	15.9	9.1	3.4	0.0	0	0.0	1	0.0	0	0.0	0	4.2	0.006	1744.5	9000	0.0	2.0	3.4	12.5
33115	12.5	8.6	15.5	8.7	3.4	0.0	0	0.0	1	0.0	0	0.0	0	4.8	0.009	1573.2	9000	0.0	2.0	3.3	12.5
32795	10.0	7.4	12.2	11.0	3.4	0.0	0	0.0	1	0.0	0	0.0	0	5.5	0.003	1732.9	9000	0.0	2.0	2.0	10.0
32605	10.0	8.0	14.1	11.5	3.4	0.0	0	0.0	1	0.0	0	0.0	0	6.2	0.004	1344.6	9000	0.0	2.0	2.7	10.0
32265	12.5	7.8	16.7	10.2	2.0	0.0	0	0.0	1	0.0	0	0.0	0	4.6	0.007	1829.9	9000	0.0	2.0	3.8	12.5
31875	10.0	5.6	10.9	11.0	2.0	0.0	0	0.0	1	0.0	0	0.0	0	5.2	0.004	2482.2	9000	0.0	2.0	1.6	10.0
31585	12.5	7.7	16.6	9.8	2.0	0.0	0	0.0	1	0.0	0	0.0	0	4.0	0.009	2120.3	9000	0.0	2.0	3.7	12.5
31360	8.0	5.3	9.8	13.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.8	0.001	1884.4	9000	0.0	2.0	1.3	8.0
31060	8.0	4.8	7.9	15.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.5	0.001	1711.5	9000	0.0	2.0	0.8	8.0
30720	8.0	4.6	6.4	18.0	2.0	0.0	0	0.0	1	0.0	0	0.0	0	11.6	0.000	1891.7	9000	0.0	2.0	0.6	8.0
30445	8.0	4.5	6.0	19.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	13.1	0.000	1783.7	9000	0.0	2.0	0.5	8.0
30095	8.0	4.6	6.6	21.7	2.0	0.0	0	0.0	1	0.0	0	0.0	0	12.7	0.000	1730.3	9000	0.0	2.0	0.6	8.0
29815	8.0	4.8	7.7	22.4	2.0	0.0	0	0.0	1	0.0	0	0.0	0	11.7	0.000	1675.2	9000	0.0	2.0	0.8	8.0
29565	8.0	4.7	7.4	23.3	2.0	0.0	0	0.0	1	0.0	0	0.0	0	11.8	0.000	1717.4	9000	0.0	2.0	0.7	8.0
29385	8.0	5.0	8.5	24.0	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.8	0.000	1675.1	9000	0.0	2.0	1.0	8.0
29140	10.6	10.6	10.1	24.3	4.4	2.9	0	0.0	1	0.0	0	0.0	0	9.3	0.001	1557.6	9000	0.0	2.0	1.4	10.0
28895	14.5	14.5	19.7	22.4	4.4	2.9	0	0.0	1	0.0	0	0.0	0	8.6	0.002	1062.3	9000	0.0	2.0	5.2	14.0
28695	17.3	17.3	27.5	16.0	4.4	2.9	0	0.0	1	0.0	0	0.0	0	9.4	0.009	544.9	9000	0.0	2.0	8.0	14.0
28500	16.1	16.1	28.6	13.6	4.4	2.9	0	0.0	1	0.0	0	0.0	0	9.8	0.010	503.7	9000	0.0	2.0	6.8	14.0
28280	15.2	15.2	29.7	11.8	4.4	2.9	0	0.0	1	0.0	0	0.0	0	8.8	0.011	549.3	9000	0.0	2.0	5.9	14.0
28080	15.0	15.0	28.1	11.4	4.4	2.9	0	0.0	1	0.0	0	0.0	0	9.2	0.011	547.6	9000	0.0	2.0	5.7	14.0
27925	13.6	13.6	18.0	17.5	4.4	2.9	0	0.0	1	0.0	0	0.0	0	13.0	0.002	612.7	9000	0.0	2.0	4.3	12.5
27725	15.0	15.0	20.5	16.3	4.4	2.9	0	0.0	1	0.0	0	0.0	0	12.1	0.003	587.1	9000	0.0	2.0	5.7	14.0
27545	15.9	15.9	24.7	13.2	4.4	2.9	0	0.0	1	0.0	0	0.0	0	9.5	0.007	613.0	9000	0.0	2.0	6.6	14.0
27335	15.3	15.3	25.5	12.0	4.4	2.9	0	0.0	1	0.0	0	0.0	0	8.1	0.008	691.0	9000	0.0	2.0	6.0	14.0
27155	15.9	15.9	22.3	13.2	4.4	2.9	0	0.0	1	0.0	0	0.0	0	8.0	0.005	856.6	9000	0.0	2.0	6.6	14.0
26990	14.0	10.0	23.5	11.2	2.0	0.4	0	0.0	1	0.0	0	0.0	0	6.0	0.010	1008.2	9000	0.0	2.0	5.6	14.0
26780	14.0	9.9	23.9	11.0	2.0	0.4	0	0.0	1	0.0	0	0.0	0	5.6	0.010	1131.7	9000	0.0	2.0	5.5	14.0
26575	14.0	9.9	21.0	11.0	2.0	0.4	0	0.0	1	0.0	0	0.0	0	5.5	0.013	1216.4	3000	0.0	2.0	5.5	14.0
26355	12.5	7.8	15.8	13.4	2.0	0.4	0	0.0	1	0.0	0	0.0	0	7.5	0.003	1282.4	3000	0.0	2.0	3.4	12.5
26170	12.5	8.8	18.0	13.0	2.0	0.4	0	0.0	1	0.0	0	0.0	0	6.8	0.004	1347.9	3000	0.0	2.0	4.4	12.5
25965	12.5	8.7	17.9	13.0	2.0	0.4	0	0.0	1	0.0	0	0.0	0	7.0	0.004	1288.3	3000	0.0	2.0	4.3	12.5

DEFINITIONS

V(FPS) =VELOCITY IN FEET PER SECOND
Z_{TOT}=TOTAL POTENTIAL VERTICAL ADJUSTMENT IN FEET
Z_{DEG}=LONG TERM DEGRADATION IN FEET
Z_{GS}=GENERAL SCOUR IN FEET FROM SAM
Z_{LS}=LOCAL SCOUR IN FEET
PIER TYPE=PIER SHAPE FACTOR; IF NO PIERS=**0**
1.0=SQUARE NOSE; **0.9** ROUND NOSE; **0.9** CYLINDER;
0.8 SHARP NOSE; **0.9** GROUP OF CYLINDERS
FLOW DEPTH=WATER DEPTH IN CHANNEL IN FEET
B=WIDTH OF PIERS IN FEET; NO PIER=0
ABUT TYPE=VERT WALL FACTOR; IF VERT=**2**; NON VERT=**1**
A=ABUTMENT PROTRUSION INTO FLOW PATH IN FEET
SOFT = SOFT BOTTOM AT A BRIDGE OR AN ABUTMENT
0 = HARD BOTTOM; **1** = SOFT BOTTOM
Z_{BS}=BEND SCOUR IN FEET
BEND COEFF=BEND COEFFICIENT; IF NO BEND=0, BEND=1
HYD DEPTH=HYDRAULIC DEPTH IN FEET
E SLOPE=ENERGY SLOPE, UNITLESS
TOP WIDTH=CHANNEL TOP WIDTH IN FEET
RADIUS=RADIUS OF CURVATURE TO CENTERLINE IN FEET
Z_I=LOW-FLOW INCISEMENT IN FEET, MEASURED OR 2'; VALUE **NOT LESS THAN 2'**
H=BEDFORM HEIGHT IN FEET, LIMITED TO FLOW DEPTH AFTER KENNEDY (1963)
Z_{DM}=CUT OFF DEPTH REQUIRED BY LACFCDDM

GENERAL

THIS SPREADSHEET IS DESIGNED TO CALCULATE SCOUR PROTECTION (TOE DOWN) BASED ON LADPW COUNTY HYDROLOGY MANUAL (1991) PAGES 5.2-5.8 AND ASSOCIATED APPENDICES (SEDIMENTATION MANUAL). ALL VELOCITIES ARE IN FPS, WITH A MAXIMUM VALUE LIMITED BY THE EQUATION. THE PRESENT VERSION (10/04) WILL CALCULATE UP TO 50 VELOCITIES AT ONE TIME. LONG TERM DEGRADATION IS USER SUPPLIED. GENERAL SCOUR IS TAKEN FROM APPENDIX Q3, INTERPOLATED. LOCAL SCOUR AT BENDS AND ABUTMENTS ARE BASED ON LADWP EQUATIONS FOUND IN APP Q12. BEND SCOUR IS BASED ON EQUATIONS IN APPENDIX Q12. A LONGITUDINAL EXTENT BASED ON SECONDARY CURRENTS IS NOT INCLUDED. BEDFORM HEIGHT IS BASED ON EQUATIONS IN APPENDIX Q13. JULY 2005 REVISION INCLUDES CALCULATION FOR CUT OFF DEPTH BASED ON LOS ANGELES COUNTY FLOOD CONTROL DISTRICT DESIGN MANUAL. THE CALCULATION DOES NOT CONSIDER ADJUSTMENTS TO CUT OFF DEPTH BASED ON TABLE F-06
THE OCTOBER 2005 REVISION INCLUDES ADDITIONAL TOEDOWN AT BRIDGES/ABUTMENTS WITH SOFT BOTTOMS.

COLOR CODES

OUTPUT
DATA FROM HEC-RAS
USER SUPPLIED DATA
INTERMEDIATE CALCULATIONS (INDIVIDUAL SHEETS ONLY)

DESIGNED BY DAVID A JAFFE, PHD, PE
PACIFIC ADVANCED CIVIL ENGINEERING, INC
OCTOBER, 2004
OCTOBER 2005, REVISED

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_t+	H/2	Z_{DM}=
25785	14.0	9.6	19.5	11.7	2.0	0.4	0	0.0	1	0.0	0	0.0	0	6.2	0.005	1336.9	3000	0.0	2.0	5.2	14.0
25600	14.0	10.0	20.6	11.3	2.0	0.4	0	0.0	1	0.0	0	0.0	0	5.2	0.006	1596.5	3000	0.0	2.0	5.6	14.0
25425	14.0	9.8	20.0	11.3	2.0	0.4	0	0.0	1	0.0	0	0.0	0	4.4	0.008	1773.8	3000	0.0	2.0	5.4	14.0
25215	10.0	7.2	14.5	13.6	2.0	0.4	0	0.0	1	0.0	0	0.0	0	6.1	0.003	1748.6	3000	0.0	2.0	2.8	10.0
25000	12.5	8.5	17.4	12.2	2.0	0.4	0	0.0	1	0.0	0	0.0	0	4.4	0.006	2103.2	3000	0.0	2.0	4.1	12.5
24795	14.0	8.9	19.0	11.4	2.0	0.0	0	0.0	1	0.0	0	0.0	0	3.9	0.007	2311.7	3000	0.0	2.0	4.9	14.0
24550	14.0	9.4	21.3	10.8	2.0	0.0	0	0.0	1	0.0	0	0.0	0	3.8	0.009	2227.0	3000	0.0	2.0	5.4	14.0
24335	10.0	6.8	14.5	13.1	2.0	0.0	0	0.0	1	0.0	0	0.0	0	5.7	0.003	2089.5	3000	0.0	2.0	2.8	10.0
24115	14.0	8.8	18.8	11.1	2.0	0.0	0	0.0	1	0.0	0	0.0	0	4.5	0.008	2015.8	3000	0.0	2.0	4.8	14.0
23975	14.0	8.9	19.0	10.2	2.0	0.0	0	0.0	1	0.0	0	0.0	0	4.6	0.008	1913.7	3000	0.0	2.0	4.9	14.0
23755	12.5	7.8	16.7	10.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	5.1	0.006	1935.4	3000	0.0	2.0	3.8	12.5
23565	10.0	6.8	14.5	12.7	2.0	0.0	0	0.0	1	0.0	0	0.0	0	5.6	0.004	2039.5	3000	0.0	2.0	2.8	10.0
23365	12.5	7.9	17.0	10.8	2.0	0.0	0	0.0	1	0.0	0	0.0	0	5.4	0.006	1781.4	3000	0.0	2.0	3.9	12.5
23180	10.0	6.3	13.2	11.8	2.0	0.0	0	0.0	1	0.0	0	0.0	0	6.6	0.002	2084.2	3000	0.0	2.0	2.3	10.0
23000	8.0	5.1	8.9	13.0	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.7	0.001	2069.1	3000	0.0	2.0	1.1	8.0
22790	8.0	5.2	9.4	13.1	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.8	0.001	1949.0	3000	0.0	2.0	1.2	8.0
22600	10.0	5.7	11.4	14.1	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.9	0.001	1865.2	3000	0.0	2.0	1.7	10.0
22415	10.0	5.9	11.8	14.1	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.1	0.002	1705.6	3000	0.0	2.0	1.9	10.0
22195	10.0	7.3	14.1	13.7	2.0	0.6	0	0.0	1	0.0	0	0.0	0	7.8	0.003	1322.2	3000	0.0	2.0	2.7	10.0
22010	12.5	8.1	16.0	14.4	2.0	0.6	0	0.0	1	0.0	0	0.0	0	7.3	0.003	1328.0	3000	0.0	2.0	3.5	12.5
21790	14.0	9.8	19.7	11.6	2.0	0.6	0	0.0	1	0.0	0	0.0	0	6.5	0.006	1145.7	3000	0.0	2.0	5.2	14.0
21615	14.0	8.9	21.4	8.5	2.0	0.6	0	0.0	1	0.0	0	0.0	0	5.8	0.010	1161.3	3000	0.0	2.0	4.3	14.0
21440	14.0	9.4	20.1	9.7	2.0	0.6	0	0.0	1	0.0	0	0.0	0	5.0	0.008	1574.6	3000	0.0	2.0	4.8	14.0
21225	14.0	9.7	19.5	10.6	2.0	0.6	0	0.0	1	0.0	0	0.0	0	3.9	0.008	2217.7	3000	0.0	2.0	5.1	14.0
21020	14.0	9.0	20.8	8.9	2.0	0.6	0	0.0	1	0.0	0	0.0	0	4.6	0.009	1676.4	3000	0.0	2.0	4.4	14.0
20845	12.5	8.5	17.1	10.4	2.0	0.6	0	0.0	1	0.0	0	0.0	0	4.2	0.006	2369.3	3000	0.0	2.0	3.9	12.5
20595	12.5	7.7	15.2	10.9	2.0	0.6	0	0.0	1	0.0	0	0.0	0	4.7	0.003	2463.7	3000	0.0	2.0	3.1	12.5
20435	10.0	6.9	12.9	12.2	2.0	0.6	0	0.0	1	0.0	0	0.0	0	5.4	0.002	2582.7	3000	0.0	2.0	2.3	10.0
20280	10.0	7.2	14.0	11.8	2.0	0.6	0	0.0	1	0.0	0	0.0	0	5.0	0.003	2589.6	3000	0.0	2.0	2.6	10.0
20070	14.0	9.2	20.2	9.2	2.0	0.6	0	0.0	1	0.0	0	0.0	0	4.7	0.009	1767.5	3000	0.0	2.0	4.6	14.0
19855	12.5	8.3	17.8	9.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	4.8	0.006	1975.1	3000	0.0	2.0	4.3	12.5
19630	12.5	8.3	17.9	8.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	4.9	0.006	1836.2	3000	0.0	2.0	4.3	12.5
19440	10.0	5.9	11.9	12.1	2.0	0.0	0	0.0	1	0.0	0	0.0	0	6.5	0.002	2095.3	3000	0.0	2.0	1.9	10.0
19240	10.0	6.6	13.9	11.4	2.0	0.0	0	0.0	1	0.0	0	0.0	0	5.6	0.003	2091.7	3000	0.0	2.0	2.6	10.0
19050	10.0	5.6	11.0	12.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	6.7	0.002	2160.8	3000	0.0	2.0	1.6	10.0
18830	10.0	5.5	10.7	14.6	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.1	0.002	2094.4	3000	0.0	2.0	1.5	10.0
18650	8.0	5.3	9.9	15.0	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.0	0.001	2022.7	3000	0.0	2.0	1.3	8.0
18475	8.0	4.9	8.1	16.6	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.4	0.001	1944.4	3000	0.0	2.0	0.9	8.0
18290	8.0	5.0	8.7	16.8	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.3	0.001	1843.7	3000	0.0	2.0	1.0	8.0
18025	8.0	4.8	7.8	18.2	2.0	0.0	0	0.0	1	0.0	0	0.0	0	11.5	0.001	1610.9	17000	0.0	2.0	0.8	8.0
17785	8.0	5.0	8.7	19.8	2.0	0.0	0	0.0	1	0.0	0	0.0	0	11.6	0.001	1417.5	17000	0.0	2.0	1.0	8.0
17510	10.0	7.8	14.0	18.0	2.0	1.2	0	0.0	1	0.0	0	0.0	0	8.5	0.002	1243.6	17000	0.0	2.0	2.6	10.0
17360	12.5	9.1	17.0	16.9	2.0	1.2	0	0.0	1	0.0	0	0.0	0	8.9	0.004	936.6	17000	0.0	2.0	3.9	12.5
17110	14.0	11.6	21.7	15.4	2.0	1.2	0	0.0	1	0.0	0	0.0	0	5.6	0.006	1274.3	17000	0.0	2.0	6.4	14.0
16970	14.0	12.0	22.9	13.6	2.0	1.2	0	0.0	1	0.0	0	0.0	0	5.7	0.008	1125.6	17000	0.0	2.0	6.8	14.0
16720	14.0	9.7	25.2	9.0	2.0	1.2	0	0.0	1	0.0	0	0.0	0	4.1	0.018	1404.6	17000	0.0	2.0	4.5	14.0
16515	14.0	10.0	21.5	9.5	2.0	1.2	0	0.0	1	0.0	0	0.0	0	4.3	0.012	1622.6	17000	0.0	2.0	4.8	14.0
16305	14.0	10.0	21.5	9.6	2.0	1.2	0	0.0	1	0.0	0	0.0	0	4.2	0.011	1812.8	17000	0.0	2.0	4.8	14.0
16130	12.5	8.7	16.1	10.2	2.0	1.2	0	0.0	1	0.0	0	0.0	0	5.2	0.005	1945.1	17000	0.0	2.0	3.5	12.5
15960	12.5	8.6	15.8	9.3	2.0	1.2	0	0.0	1	0.0	0	0.0	0	4.1	0.011	2180.9	17000	0.0	2.0	3.4	12.5
15745	10.0	6.8	10.9	10.6	2.0	1.2	0	0.0	1	0.0	0	0.0	0	5.7	0.003	2279.0	17000	0.0	2.0	1.6	10.0
15540	10.0	6.8	11.0	10.6	2.0	1.2	0	0.0	1	0.0	0	0.0	0	5.8	0.003	2324.2	17000	0.0	2.0	1.6	10.0
15335	10.0	7.4	12.7	10.5	2.0	1.2	0	0.0	1	0.0	0	0.0	0	4.9	0.005	2302.1	17000	0.0	2.0	2.2	10.0
15125	12.5	8.1	16.2	9.6	2.0	0.6	0	0.0	1	0.0	0	0.0	0	5.5	0.007	1618.5	17000	0.0	2.0	3.5	12.5
14900	10.0	7.5	14.5	10.4	2.0	0.6	0	0.0	1	0.0	0	0.0	0	6.1	0.004	1704.5	17000	0.0	2.0	2.9	10.0
14720	12.5	8.4	16.8	9.3	2.0	0.6	0	0.0	1	0.0	0	0.0	0	5.1	0.008	1763.5	17000	0.0	2.0	3.8	12.5
14480	10.0	7.3	14.3	10.2	2.0	0.6	0	0.0	1	0.0	0	0.0	0	6.0	0.004	1801.7	17000	0.0	2.0	2.7	10.0
14315	10.0	7.6	14.8	9.4	2.0	0.6	0	0.0	1	0.0	0	0.0	0	5.2	0.006	1868.1	17000	0.0	2.0	3.0	10.0
14090	10.0	7.2	13.8	9.0	2.0	0.6	0	0.0	1	0.0	0	0.0	0	5.9	0.005	1766.8	17000	0.0	2.0	2.6	10.0
13850	12.5	7.9	15.6	8.4	2.0	0.6	0	0.0	1	0.0	0	0.0	0	5.3	0.007	1727.3	17000	0.0	2.0	3.3	12.5
13635	12.5	7.8	15.4	10.3	2.0	0.6	0	0.0	1	0.0	0	0.0	0	6.4	0.004	1691.9	17000	0.0	2.0	3.2	12.5
13425	12.5	8.6	17.3	8.3	2.0	0.6	0	0.0	1	0.0	0	0.0	0	4.5	0.009	1854.4	17000	0.0	2.0	4.0	12.5
13190	10.0	6.6	12.2	9.5	2.0	0.6	0	0.0	1	0.0	0	0.0	0	6.4	0.003	1847.3	17000	0.0	2.0	2.0	10.0
13030	10.0	6.7	14.2	9.6	2.0	0.0	0	0.0	1	0.0	0	0.0	0	6.5	0.003	1763.0	17000	0.0	2.0	2.7	10.0
12835	10.0	6.4	13.3	10.1	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.3	0.003	1607.5	17000	0.0	2.0	2.4	10.0
12615	10.0	6.1	12.4	10.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.7	0.002	1471.0	17000	0.0	2.0	2.1	10.0
12395	10.0	6.0	12.3	11.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.0	0.002	1438.4	17000	0.0	2.0	2.0	10.0
12195	10.0	5.5	10.6	12.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.3	0.001	1389.3	17000	0.0	2.0	1.5	10.0
11995	10.0	6.2	12.7	13.7	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.8	0.002	1281.1	17000	0.0	2.0	2.2	10.0
11780	10.0	6.1	12.5	14.4	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.4	0.001	1400.9	17000	0.0	2.0	2.1	10.0
11605	10.0	6.7	14.1	13.7	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.7	0.002	1282.9	17000	0.0	2.0	2.7	10.0
11405	10.0	6.3	13.2	15.1	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.1	0.002	1130.2	17000	0.0	2.0	2.3	10.0
11180	12.5	7.7	16.6	13.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.6	0.003	835.7	17000	0.0	2.0	3.7	12.5
11015	14.0	10.3	19.1	13.3	2.0	1.4	0	0.0	1	0.0	0	0.0	0	11.0	0.004	679.4	17000	0.0	2.0	4.9	14.0
10835	14.0	10.8	21.9	10.9	2.0	1.4	0	0.0	1	0.0	0	0.0	0	8.2	0.007	790.4	17000	0.0	2.0	5.4	14.0
10575	14.0	9.1	24.1	7.5	2.0	1.4	0	0.0	1	0.0	0	0.0	0	5.3	0.016	1108.8	17000	0.0	2.0	3.7	14.0
10390	14.0	9.8	22.7	8.8	2.0	1.4	0	0.0	1	0.0	0	0.0	0	5.8	0.008	1247.1	17000	0.0	2.0	4.4	14.0
10225	12.5	9.7	17.8	9.5	2.0	1.4	0	0.0	1	0.0	0	0.0	0	5.9	0.007	1373.8	17000	0.0	2.0	4.3	12.5
10000	10.0	8.4	14.9	11.1	2.0	1.4	0	0.0	1	0.0	0	0.0	0	6.6	0.004	1488.0	17000	0.0	2.0	3.0	10.0
9820	14.0	10.1	18.6	10.0	2.0	1.4	0	0.0	1	0.0	0	0.0	0	5.7	0.008	1336.6	17000	0.0	2.0	4.7	14.0
9595	10.0	8.3	14.6	10.3	2.0	1.4	0	0.0	1	0.0	0	0.0	0	6.6	0.005	1619.7	17000	0.0	2.0	2.9	10.0
9385	12.5	8.8	15.8	9.5	2.0	1.4	0	0.0	1	0.0	0	0.0	0	5.3	0.006	1770.4	17000	0.0	2.0	3.4	12.5
9220	12.5	9.0	16.4	8.9	2.0	1.4	0	0.0	1	0.0	0	0.0	0	4.9	0.008	1771.4	17000	0.0	2.0	3.6	12.5
9025	12.5	8.8	15.9	8.9	2.0	1.4	0	0.0	1	0.0	0	0.0	0	5.5	0.005	1736.9	17000	0.0	2.0	3.4	12.5
MAX=	17.3	17.3			8.1	2.9						0.0					17000.0	0.0	2.0	8.3	14.0
MIN=	8.0	4.5			2.0	0.0						0.0					3000.0	0.0	2.0	0.5	8.0

CALCULATIONS FOR TOTAL TOE-DOWN BY INDIVIDUAL ADJUSTMENT COMPONENT BASED ON LACH&SM W/ SAM -- SANTA CLARA RIVER PROPOSED CONDITIONS OUTSIDE CURVED REACH Q_{CAP} n=0.025

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_I+	H/2	Z_{DM}=
46195	14.0	11.1	21.7	18.1	2.8	0.0	0	0.0	1	0.0	0	0.0	1	11.7	0.005	453.0	9000	0.0	2.0	6.3	14.0
46020	14.0	12.7	24.1	18.1	2.8	0.0	0	0.0	1	0.0	0	0.0	1	9.2	0.009	520.9	9000	0.0	2.0	7.9	14.0
45545	14.0	10.4	20.3	19.2	2.8	0.0	0	0.0	1	0.0	0	0.0	1	12.7	0.004	446.7	9000	0.0	2.0	5.6	14.0
45030	14.0	13.1	26.1	16.5	2.8	0.0	0	0.0	1	0.0	0	0.0	1	9.0	0.011	492.5	9000	0.0	2.0	8.3	14.0
44585	14.0	9.8	19.2	21.1	2.8	0.0	0	0.0	1	0.0	0	0.0	1	11.3	0.004	531.9	9000	0.0	2.0	5.0	14.0
44210	14.0	12.5	26.2	15.4	2.8	0.0	0	0.0	1	0.0	0	0.0	1	9.7	0.009	452.6	9000	0.0	2.0	7.7	14.0
43820	15.4	15.4	19.9	19.5	8.1	0.0	0	0.0	1	0.0	0	0.0	1	12.1	0.004	476.5	9000	0.0	2.0	5.3	14.0
43610	17.0	17.0	26.7	13.8	8.1	0.0	0	0.0	1	0.0	0	0.0	1	9.6	0.010	450.6	9000	0.0	2.0	6.9	14.0
43410	15.8	15.8	28.8	11.3	8.1	0.0	0	0.0	1	0.0	0	0.0	1	7.4	0.011	583.4	9000	0.0	2.0	5.7	14.0
43200	16.3	16.3	26.1	12.4	8.1	0.0	0	0.0	1	0.0	0	0.0	1	6.7	0.011	689.2	9000	0.0	2.0	6.2	14.0
42975	15.5	15.5	26.6	10.8	8.1	0.0	0	0.0	1	0.0	0	0.0	1	5.9	0.016	735.1	9000	0.0	2.0	5.4	14.0
42815	15.5	15.5	23.9	10.7	8.1	0.0	0	0.0	1	0.0	0	0.0	1	5.6	0.016	864.3	9000	0.0	2.0	5.4	14.0
42590	21.0	15.1	22.4	9.2	8.1	0.0	0	0.0	1	0.0	0	0.0	1	5.2	0.014	1013.1	9000	0.4	2.0	4.6	21.0
42430	21.0	15.4	19.6	10.7	8.1	0.0	0	0.0	1	0.0	0	0.0	1	6.4	0.009	915.8	9000	0.1	2.0	5.2	21.0
42215	21.0	15.2	18.5	11.2	8.1	0.0	0	0.0	1	0.0	0	0.0	1	6.1	0.009	1019.0	9000	0.5	2.0	4.6	21.0
41940	15.0	13.4	11.6	14.3	8.1	0.0	0	0.0	1	0.0	0	0.0	1	7.7	0.002	1284.2	9000	1.4	2.0	1.8	15.0
41730	15.0	13.2	11.8	14.7	8.1	0.0	0	0.0	1	0.0	0	0.0	1	8.2	0.002	1190.9	9000	1.2	2.0	1.9	15.0
41460	15.0	12.8	11.6	16.2	8.1	0.0	0	0.0	1	0.0	0	0.0	1	9.1	0.002	1093.5	9000	0.9	2.0	1.8	15.0
41280	12.5	10.9	16.4	14.4	5.2	0.1	0	0.0	1	0.0	0	0.0	1	8.3	0.004	852.3	9000	0.0	2.0	3.6	12.5
41080	14.0	12.7	19.9	12.1	5.2	0.1	0	0.0	1	0.0	0	0.0	1	6.7	0.008	874.1	9000	0.0	2.0	5.4	14.0
40825	21.0	12.2	18.0	11.5	5.2	0.1	0	0.0	1	0.0	0	0.0	1	6.2	0.007	1040.4	9000	0.5	2.0	4.4	21.0
40585	18.0	11.6	17.0	11.7	5.2	0.1	0	0.0	1	0.0	0	0.0	1	6.8	0.006	1005.8	9000	0.4	2.0	3.9	18.0
40335	15.0	10.2	10.5	15.1	5.2	0.1	0	0.0	1	0.0	0	0.0	1	8.8	0.002	1249.6	9000	1.4	2.0	1.5	15.0
40130	15.0	10.3	11.3	15.5	5.2	0.1	0	0.0	1	0.0	0	0.0	1	8.8	0.002	1195.6	9000	1.3	2.0	1.7	15.0
39945	15.0	10.2	11.0	16.3	5.2	0.1	0	0.0	1	0.0	0	0.0	1	9.3	0.002	1173.3	9000	1.3	2.0	1.6	15.0
39755	12.5	11.0	16.5	13.3	5.2	0.1	0	0.0	1	0.0	0	0.0	1	8.1	0.004	894.5	9000	0.0	2.0	3.7	12.5
39605	14.0	12.5	19.7	11.5	5.2	0.1	0	0.0	1	0.0	0	0.0	1	7.1	0.007	849.7	9000	0.0	2.0	5.2	14.0
39310	18.0	11.2	16.5	12.7	5.2	0.1	0	0.0	1	0.0	0	0.0	1	8.1	0.004	931.1	9000	0.2	2.0	3.7	18.0
39100	14.0	12.5	20.9	10.4	5.2	0.1	0	0.0	1	0.0	0	0.0	1	7.2	0.009	761.1	9000	0.0	2.0	5.2	14.0
38925	10.0	9.5	12.8	14.3	5.2	0.1	0	0.0	1	0.0	0	0.0	1	10.3	0.002	873.5	9000	0.0	2.0	2.2	10.0
38710	10.0	6.7	12.0	15.6	2.7	0.0	0	0.0	1	0.0	0	0.0	1	11.7	0.002	820.3	9000	0.0	2.0	2.0	10.0
38475	12.5	9.0	17.9	14.0	2.7	0.0	0	0.0	1	0.0	0	0.0	1	9.8	0.004	659.7	9000	0.0	2.0	4.3	12.5
38300	14.0	9.8	22.5	10.3	2.7	0.0	0	0.0	1	0.0	0	0.0	1	7.7	0.010	666.3	9000	0.0	2.0	5.1	14.0
38065	10.0	7.6	14.5	14.0	2.7	0.0	0	0.0	1	0.0	0	0.0	1	12.0	0.002	658.4	9000	0.0	2.0	2.9	10.0
37810	14.0	9.2	18.2	12.2	2.7	0.0	0	0.0	1	0.0	0	0.0	1	10.2	0.004	618.2	9000	0.0	2.0	4.5	14.0
37655	14.0	10.0	20.9	10.5	2.7	0.0	0	0.0	1	0.0	0	0.0	1	7.8	0.008	706.7	9000	0.0	2.0	5.3	14.0
37390	14.0	8.0	23.7	6.5	2.7	0.0	0	0.0	1	0.0	0	0.0	1	5.9	0.015	823.8	9000	0.0	2.0	3.3	14.0
37135	12.5	8.4	16.6	9.3	2.7	0.0	0	0.0	1	0.0	0	0.0	1	8.5	0.005	821.4	9000	0.0	2.0	3.7	12.5
36930	14.0	8.8	19.8	8.1	2.7	0.0	0	0.0	1	0.0	0	0.0	1	7.2	0.008	812.4	9000	0.0	2.0	4.1	14.0
36735	12.5	8.2	16.1	9.8	2.7	0.0	0	0.0	1	0.0	0	0.0	1	8.0	0.005	896.9	9000	0.0	2.0	3.5	12.5
36515	15.0	7.3	12.9	12.0	2.7	0.0	0	0.0	1	0.0	0	0.0	1	9.0	0.002	994.7	9000	0.4	2.0	2.2	15.0
36265	15.0	7.7	12.3	12.5	2.7	0.0	0	0.0	1	0.0	0	0.0	1	7.9	0.003	1176.0	9000	0.9	2.0	2.1	15.0
36080	22.9	22.9	14.7	11.6	3.2	0.7	0.9	2.0	1	0.0	0	13.3	1	6.7	0.006	1176.0	9000	0.9	2.0	2.9	15.0
35845	15.0	9.2	11.0	13.6	3.2	0.7	0	0.0	1	0.0	0	0.0	1	7.9	0.002	1401.7	9000	1.7	2.0	1.6	15.0
35725	15.0	10.7	15.0	13.0	3.2	0.7	0	0.0	1	0.0	0	0.0	1	6.5	0.004	1377.9	9000	1.8	2.0	3.0	15.0
35515	18.0	11.5	17.1	12.0	3.2	0.7	0	0.0	1	0.0	0	0.0	1	6.0	0.005	1354.8	9000	1.7	2.0	3.9	18.0
35245	18.0	11.4	17.3	11.3	3.2	0.7	0	0.0	1	0.0	0	0.0	1	5.5	0.006	1328.3	9000	1.5	2.0	4.0	18.0
35040	21.0	12.7	19.6	10.7	3.2	0.7	0	0.0	1	0.0	0	0.0	1	5.5	0.006	1354.8	9000	1.7	2.0	5.2	21.0
34860	21.0	11.6	18.4	10.0	3.2	0.7	0	0.0	1	0.0	0	0.0	1	4.9	0.009	1285.7	9000	1.2	2.0	4.6	21.0
34720	21.0	11.8	18.4	9.2	3.2	0.7	0	0.0	1	0.0	0	0.0	1	4.5	0.009	1411.2	9000	1.4	2.0	4.6	21.0
34495	18.0	10.9	17.4	9.0	3.2	0.7	0	0.0	1	0.0	0	0.0	1	5.2	0.009	1283.9	9000	1.0	2.0	4.1	18.0
34310	18.0	10.8	16.8	9.3	3.2	0.7	0	0.0	1	0.0	0	0.0	1	5.9	0.005	1308.5	9000	1.2	2.0	3.8	18.0
34090	18.0	10.8	17.0	8.6	3.2	0.7	0	0.0	1	0.0	0	0.0	1	5.3	0.007	1295.5	9000	1.0	2.0	3.9	18.0
33880	18.0	10.2	16.6	9.3	3.4	0.0	0	0.0	1	0.0	0	0.0	1	5.3	0.007	1318.4	9000	1.2	2.0	3.7	18.0
33710	18.0	9.9	15.4	9.7	3.4	0.0	0	0.0	1	0.0	0	0.0	1	5.5	0.005	1372.1	9000	1.3	2.0	3.2	18.0
33500	18.0	10.4	16.2	9.3	3.4	0.0	0	0.0	1	0.0	0	0.0	1	5.1	0.007	1496.0	9000	1.5	2.0	3.5	18.0
33310	18.0	10.9	15.8	9.0	3.4	0.0	0	0.0	1	0.0	0	0.0	1	4.2	0.006	1770.4	9000	2.1	2.0	3.4	18.0
33115	15.0	9.0	10.4	10.6	3.4	0.0	0	0.0	1	0.0	0	0.0	1	6.1	0.003	1847.3	9000	2.1	2.0	1.4	15.0
32795	15.0	9.9	13.0	10.6	3.4	0.0	0	0.0	1	0.0	0	0.0	1	5.2	0.004	1735.6	9000	2.3	2.0	2.3	15.0
32605	15.0	10.5	14.4	11.1	3.4	0.0	0	0.0	1	0.0	0	0.0	1	5.0	0.005	1699.9	9000	2.3	2.0	2.8	15.0
32265	18.0	9.9	15.9	10.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	4.8	0.006	1853.2	9000	2.5	2.0	3.4	18.0
31875	15.0	9.1	12.4	10.4	2.0	0.0	0	0.0	1	0.0	0	0.0	1	4.7	0.006	2409.2	9000	3.0	2.0	2.1	15.0
31585	15.0	8.6	10.9	11.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	5.9	0.003	2182.2	9000	3.0	2.0	1.6	15.0
31360	15.0	8.3	10.3	13.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.4	0.002	1878.7	9000	2.8	2.0	1.4	15.0
31060	12.0	7.5	8.2	15.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.1	0.001	1708.2	9000	2.6	2.0	0.9	12.0
30720	12.0	7.9	6.7	17.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	11.2	0.001	1888.6	9000	3.3	2.0	0.6	12.0
30445	12.0	7.9	6.3	19.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	12.7	0.000	1779.7	9000	3.3	2.0	0.5	12.0
30095	12.0	8.1	6.7	21.3	2.0	0.0	0	0.0	1	0.0	0	0.0	1	13.4	0.000	1622.7	9000	3.5	2.0	0.6	12.0
29815	12.0	7.7	7.7	21.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	13.5	0.000	1433.2	9000	2.9	2.0	0.8	12.0
29565	12.0	7.1	7.4	22.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	14.8	0.000	1323.8	9000	2.4	2.0	0.7	12.0
29385	12.0	7.0	8.3	23.6	2.0	0.0	0	0.0	1	0.0	0	0.0	1	14.4	0.000	1237.4	9000	2.1	2.0	0.9	12.0
29140	12.0	10.4	9.2	24.1	4.4	1.6	0	0.0	1	0.0	0	0.0	1	14.1	0.001	1087.2	9000	1.2	2.0	1.1	12.0
28895	21.0	13.5	18.8	22.5	4.4	1.6	0	0.0	1	0.0	0	0.0	1	9.9	0.002	972.1	9000	0.8	2.0	4.8	21.0
28695	15.0	15.0	28.9	14.0	4.4	1.6	0	0.0	1	0.0	0	0.0	1	5.4	0.025	899.4	9000	0.0	2.0	7.0	14.0
28500	14.7	14.7	22.4	16.1	4.4	1.6	0	0.0	1	0.0	0	0.0	1	11.4	0.006	552.2	9000	0.0	2.0	6.8	14.0
28280	21.0	13.6	29.6	10.8	4.4	1.6	0	0.0	1	0.0	0	0.0	1	5.8	0.013	944.5	9000	0.3	2.0	5.4	21.0
28080	15.0	9.9	11.3	19.1	4.4	1.6	0	0.0	1	0.0	0	0.0	1	14.7	0.001	926.4	9000	0.2	2.0	1.7	15.0
27925	10.3	10.3	13.1	19.3	4.4	1.6	0	0.0	1	0.0	0	0.0	1	13.8	0.001	866.6	9000	0.0	2.0	2.3	10.0
27725	14.0	12.9	19.0	16.7	4.4	1.6	0	0.0	1	0.0	0	0.0	1	10.4	0.003	786.6	9000	0.0	2.0	4.9	14.0
27545	15.0	15.0	22.9	14.1	4.4	1.6	0	0.0	1	0.0	0	0.0	1	9.9	0.005	643.2	9000	0.0	2.0	7.0	14.0
27335	14.1	14.1	24.6	12.3	4.4	1.6	0	0.0	1	0.0	0	0.0	1	8.3	0.008	703.5	9000	0.0	2.0	6.2	14.0
27155	14.0	12.9	19.1	14.8	4.4	1.6	0	0.0	1	0.0	0	0.0	1	9.2	0.003	888.4	9000	0.0	2.0	4.9	14.0
26990	21.0	11.2	22.6	11.5	2.0	1.3	0	0.0	1	0.0	0	0.0	1	6.8	0.011	922.3	9000	0.1	2.0	5.7	21.0
26780	21.0	11.6	23.1	11.3	2.0	1.3	0	0.0	1	0.0	0	0.0	1	6.2	0.009	1043.3	9000	0.6	2.0	5.6	21.0
26575	21.0	16.0	20.7	11.1	2.0	1.3	0	0.0	1	0.0	0	0.0	1	5.7	0.012	1187.3	3000	5.2	2.0	5.6	21.0
26355	18.0	15.4	15.9	13.4	2.0	1.3	0	0.0	1	0.0	0	0.0	1	7.5	0.004	1260.4	3000	6.7	2.0	3.4	18.0
26170	18.0	16.6	17.0	13.5	2.0	1.3	0	0.0	1	0.0	0	0.0	1	7.6	0.003	1269.0	3000	7.4	2.0	3.9	18.0
25965	21.0	17.1	18.2	12.9	2.0	1.3	0	0.0	1	0.0	0	0.0	1	6.9	0.004	1281.3	3000	7.3	2.0	4.5	21.0
25785	21.0	16.7	18.9	12.1	2.0	1.3	0	0.0	1	0.0	0	0.0	1	6.9	0.005	1219.7	3000	6.5	2.0	4.8	21.0
25600	21.0	15.9	18.5	12.4	2.0	1.3	0	0.0	1	0.0	0	0.0	1	7.6	0.005	1109.4	3000	6.0	2.0	4.6	21.0

DEFINITIONS

V(FPS) =VELOCITY IN FEET PER SECOND
Z_{TOT}=TOTAL POTENTIAL VERTICAL ADJUSTMENT IN FEET
Z_{DEG}=LONG TERM DEGRADATION IN FEET
Z_{GS}=GENERAL SCOUR IN FEET FROM SAM
Z_{LS}=LOCAL SCOUR IN FEET
PIER TYPE=PIER SHAPE FACTOR; IF NO PIERS=**0**
1.0=SQUARE NOSE; **0.9** ROUND NOSE; **0.9** CYLINDER;
0.8 SHARP NOSE; **0.9** GROUP OF CYLINDERS
FLOW DEPTH=WATER DEPTH IN CHANNEL IN FEET
B=WIDTH OF PIERS IN FEET; NO PIER=0
ABUT TYPE=VERT WALL FACTOR; IF VERT=**2**; NON VERT=**1**
A=ABUTMENT PROTRUSION INTO FLOW PATH IN FEET
SOFT = SOFT BOTTOM AT A BRIDGE OR AN ABUTMENT
0 = HARD BOTTOM; **1** = SOFT BOTTOM
Z_{BS}=BEND SCOUR IN FEET
BEND COEFF=BEND COEFFICIENT; IF NO BEND=0, BEND=1
HYD DEPTH=HYDRAULIC DEPTH IN FEET
E SLOPE=ENERGY SLOPE, UNITLESS
TOP WIDTH=CHANNEL TOP WIDTH IN FEET
RADIUS=RADIUS OF CURVATURE TO CENTERLINE IN FEET
Z_I=LOW-FLOW INCISEMENT IN FEET, MEASURED OR 2'; VALUE **NOT LESS THAN 2'**
H=BEDFORM HEIGHT IN FEET, LIMITED TO FLOW DEPTH AFTER KENNEDY (1963)
Z_{DM}=CUT OFF DEPTH REQUIRED BY LACFCDDM

GENERAL

THIS SPREADSHEET IS DESIGNED TO CALCULATE SCOUR PROTECTION (TOE DOWN) BASED ON LADPW COUNTY HYDROLOGY MANUAL (1991) PAGES 5.2-5.8 AND ASSOCIATED APPENDICES (SEDIMENTATION MANUAL). ALL VELOCITIES ARE IN FPS, WITH A MAXIMUM VALUE LIMITED BY THE EQUATION. THE PRESENT VERSION (10/04) WILL CALCULATE UP TO AT ONE TIME. LONG TERM DEGRADATION IS USER SUPPLIED. GENERAL SCOUR IS TAKEN FROM APPENDIX Q3, INTERPOLATED. LOCAL SCOUR AT BENDS AND ABUTMENTS ARE BASED ON LADWP EQUATIONS FOUND IN APP Q12. BEND SCOUR IS BASED ON EQUATIONS IN APPENDIX Q12. A LONGITUDINAL EXTENT BASED ON SECONDARY CURRENTS IS NOT INCLUDED. BEDFORM HEIGHT IS BASED ON EQUATIONS IN APPENDIX Q13. JULY 2005 REVISION INCLUDES CALCULATION FOR CUT OFF DEPTH BASED ON LOS ANGELES COUNTY FLOOD CONTROL DISTRICT DESIGN MANUAL. THE CALCULATION DOES NOT CONSIDER ADJUSTMENTS TO CUT OFF DEPTH BASED ON TABLE F-06
THE OCTOBER 2005 REVISION INCLUDES ADDITIONAL TOEDOWN AT BRIDGES/ABUTMENTS WITH SOFT BOTTOMS.

COLOR CODES

OUTPUT
DATA FROM HEC-RAS
USER SUPPLIED DATA
INTERMEDIATE CALCULATIONS (INDIVIDUAL SHEETS ONLY)

DESIGNED BY DAVID A JAFFE, PHD, PE
PACIFIC ADVANCED CIVIL ENGINEERING, INC
OCTOBER, 2004
OCTOBER 2005, REVISED

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_t+	H/2	Z_{DM}=
25425	21.0	15.1	18.3	12.5	2.0	1.3	0	0.0	1	0.0	0	0.0	1	7.1	0.007	1082.2	3000	5.3	2.0	4.5	21.0
25215	15.0	14.0	14.3	14.7	2.0	1.3	0	0.0	1	0.0	0	0.0	1	9.0	0.003	1097.3	3000	6.0	2.0	2.7	15.0
25000	15.0	13.7	13.2	15.5	2.0	1.3	0	0.0	1	0.0	0	0.0	1	10.1	0.002	1062.4	3000	6.0	2.0	2.3	15.0
24795	15.0	12.3	14.1	15.6	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.5	0.002	957.4	3000	5.6	2.0	2.7	15.0
24550	18.0	12.4	15.1	16.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	11.0	0.003	856.1	3000	5.4	2.0	3.1	18.0
24335	21.0	13.0	18.2	15.0	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.1	0.004	764.8	3000	4.5	2.0	4.5	21.0
24115	21.0	13.5	20.0	13.8	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.4	0.006	754.2	3000	4.1	2.0	5.4	21.0
23975	21.0	13.9	20.8	12.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.7	0.007	783.2	3000	4.1	2.0	5.8	21.0
23755	21.0	13.2	18.1	14.7	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.7	0.004	815.7	3000	4.8	2.0	4.4	21.0
23565	21.0	14.5	20.2	14.3	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.2	0.007	850.9	3000	4.9	2.0	5.5	21.0
23365	21.0	14.3	18.4	14.3	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.7	0.004	939.0	3000	5.7	2.0	4.6	21.0
23180	21.0	15.8	21.9	12.6	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.0	0.005	916.6	3000	5.5	2.0	6.3	21.0
23000	21.0	13.0	22.0	11.3	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.2	0.010	784.0	3000	3.4	2.0	5.6	21.0
22790	26.8	26.8	17.9	13.0	2.0	0.0	0.9	2.0	1	0.0	0	14.7	1	10.0	0.005	784.0	3000	3.7	2.0	4.3	18.0
22600	21.0	14.8	19.8	12.8	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.6	0.006	999.0	3000	5.5	2.0	5.3	21.0
22415	21.0	14.0	21.3	10.8	2.0	0.0	0	0.0	1	0.0	0	0.0	1	6.6	0.010	1039.1	3000	4.6	2.0	5.4	21.0
22195	15.0	13.3	13.6	14.0	2.0	0.2	0	0.0	1	0.0	0	0.0	1	8.7	0.003	1309.6	3000	6.6	2.0	2.5	15.0
22010	18.0	15.3	16.1	14.3	2.0	0.2	0	0.0	1	0.0	0	0.0	1	7.6	0.003	1254.1	3000	7.6	2.0	3.5	18.0
21790	21.0	15.3	19.7	11.6	2.0	0.2	0	0.0	1	0.0	0	0.0	1	6.5	0.006	1144.5	3000	5.9	2.0	5.2	21.0
21615	21.0	12.5	21.3	8.5	2.0	0.2	0	0.0	1	0.0	0	0.0	1	5.8	0.011	1163.0	3000	4.1	2.0	4.3	21.0
21440	18.0	14.1	17.5	11.0	2.0	0.2	0	0.0	1	0.0	0	0.0	1	6.9	0.005	1286.1	3000	5.8	2.0	4.1	18.0
21225	21.0	16.3	18.1	11.7	2.0	0.2	0	0.0	1	0.0	0	0.0	1	5.6	0.005	1559.0	3000	7.7	2.0	4.4	21.0
21020	21.0	12.6	20.3	9.7	2.0	0.2	0	0.0	1	0.0	0	0.0	1	7.8	0.007	903.0	3000	3.6	2.0	4.9	21.0
20845	18.0	15.2	15.1	12.7	2.0	0.2	0	0.0	1	0.0	0	0.0	1	6.7	0.003	1563.7	3000	7.9	2.0	3.1	18.0
20595	15.0	14.1	12.4	13.4	2.0	0.2	0	0.0	1	0.0	0	0.0	1	8.3	0.002	1548.8	3000	7.8	2.0	2.1	15.0
20435	15.0	14.4	12.1	14.3	2.0	0.2	0	0.0	1	0.0	0	0.0	1	8.8	0.001	1528.3	3000	8.3	2.0	2.0	15.0
20280	18.0	15.4	15.6	12.8	2.0	0.2	0	0.0	1	0.0	0	0.0	1	6.8	0.003	1531.3	3000	8.0	2.0	3.3	18.0
20070	21.0	16.8	19.3	11.1	2.0	0.2	0	0.0	1	0.0	0	0.0	1	5.2	0.006	1526.6	3000	7.5	2.0	5.0	21.0
19855	21.0	14.5	20.6	10.2	2.0	0.0	0	0.0	1	0.0	0	0.0	1	6.0	0.008	1205.4	3000	5.4	2.0	5.1	21.0
19630	21.0	12.3	20.6	8.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	6.6	0.009	1060.3	3000	3.8	2.0	4.4	21.0
19440	15.0	12.2	13.1	13.4	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.2	0.002	1194.5	3000	5.9	2.0	2.3	15.0
19240	18.0	13.0	15.9	11.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.4	0.004	1216.9	3000	5.6	2.0	3.4	18.0
19050	21.0	14.1	18.8	10.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	5.8	0.009	1321.4	3000	5.4	2.0	4.8	21.0
18830	15.0	14.5	13.3	14.6	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.4	0.003	1531.5	3000	8.1	2.0	2.4	15.0
18650	15.0	14.7	12.1	15.0	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.0	0.002	1604.5	3000	8.8	2.0	2.0	15.0
18475	13.6	13.6	8.9	16.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.9	0.001	1621.5	3000	8.5	2.0	1.1	12.0
18290	14.1	14.1	9.8	16.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.4	0.001	1594.2	3000	8.9	2.0	1.3	12.0
18025	8.0	4.8	7.9	18.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	11.9	0.001	1520.2	17000	0.0	2.0	0.8	8.0
17785	8.0	5.0	8.5	20.2	2.0	0.0	0	0.0	1	0.0	0	0.0	1	12.0	0.001	1398.1	17000	0.0	2.0	1.0	8.0
17510	10.0	6.9	11.0	19.2	2.0	1.3	0	0.0	1	0.0	0	0.0	1	10.2	0.001	1350.7	17000	0.0	2.0	1.6	10.0
17360	12.5	9.2	17.1	15.9	2.0	1.3	0	0.0	1	0.0	0	0.0	1	8.8	0.004	943.2	17000	0.0	2.0	3.9	12.5
17110	14.0	12.0	22.3	15.2	2.0	1.3	0	0.0	1	0.0	0	0.0	1	5.8	0.007	1175.4	17000	0.0	2.0	6.7	14.0
16970	14.0	12.1	23.1	13.6	2.0	1.3	0	0.0	1	0.0	0	0.0	1	5.9	0.010	1067.0	17000	0.0	2.0	6.8	14.0
16720	14.0	9.9	24.4	9.2	2.0	1.3	0	0.0	1	0.0	0	0.0	1	5.2	0.019	1122.9	17000	0.0	2.0	4.6	14.0
16515	14.0	10.4	19.4	10.4	2.0	1.3	0	0.0	1	0.0	0	0.0	1	5.8	0.010	1249.9	17000	0.0	2.0	5.1	14.0
16305	10.0	7.1	11.6	14.6	2.0	1.3	0	0.0	1	0.0	0	0.0	1	9.4	0.002	1360.5	17000	0.0	2.0	1.8	10.0
16130	12.5	8.6	15.7	12.3	2.0	1.3	0	0.0	1	0.0	0	0.0	1	7.1	0.005	1326.5	17000	0.0	2.0	3.3	12.5
15960	12.5	9.5	17.7	11.0	2.0	1.3	0	0.0	1	0.0	0	0.0	1	5.9	0.008	1386.0	17000	0.0	2.0	4.2	12.5
15745	10.0	7.3	12.3	13.3	2.0	1.3	0	0.0	1	0.0	0	0.0	1	8.4	0.003	1363.9	17000	0.0	2.0	2.0	10.0
15540	10.0	6.8	10.6	13.7	2.0	1.3	0	0.0	1	0.0	0	0.0	1	9.4	0.002	1426.6	17000	0.0	2.0	1.5	10.0
15335	12.5	8.8	16.2	12.1	2.0	1.3	0	0.0	1	0.0	0	0.0	1	8.2	0.006	1064.1	17000	0.0	2.0	3.5	12.5
15125	26.1	26.1	17.9	11.6	2.0	0.4	0.9	4.0	1	0.0	0	17.4	1	8.0	0.007	1000.5	17000	0.0	2.0	4.3	12.5
14900	14.0	9.3	19.3	9.8	2.0	0.4	0	0.0	1	0.0	0	0.0	1	6.3	0.009	1626.5	17000	0.0	2.0	4.9	14.0
14720	21.0	8.9	18.1	9.8	2.0	0.4	0	0.0	1	0.0	0	0.0	1	6.0	0.008	1722.3	17000	0.1	2.0	4.4	21.0
14480	21.0	8.9	19.0	8.9	2.0	0.4	0	0.0	1	0.0	0	0.0	1	5.2	0.010	1726.7	17000	0.1	2.0	4.4	21.0
14315	15.0	7.4	14.0	9.9	2.0	0.4	0	0.0	1	0.0	0	0.0	1	5.8	0.005	1881.0	17000	0.3	2.0	2.6	15.0
14090	15.0	7.3	14.3	8.5	2.0	0.4	0	0.0	1	0.0	0	0.0	1	5.6	0.006	1772.8	17000	0.1	2.0	2.8	15.0
13850	15.0	6.7	12.6	9.7	2.0	0.4	0	0.0	1	0.0	0	0.0	1	6.5	0.004	1741.6	17000	0.1	2.0	2.2	15.0
13635	18.0	7.7	15.5	10.3	2.0	0.4	0	0.0	1	0.0	0	0.0	1	6.3	0.004	1705.8	17000	0.1	2.0	3.2	18.0
13425	21.0	8.6	18.0	7.8	2.0	0.4	0	0.0	1	0.0	0	0.0	1	4.3	0.011	1850.7	17000	0.2	2.0	3.9	21.0
13190	15.0	6.7	12.2	9.5	2.0	0.4	0	0.0	1	0.0	0	0.0	1	6.5	0.003	1847.4	17000	0.3	2.0	2.0	15.0
13030	15.0	6.9	14.2	9.6	2.0	0.0	0	0.0	1	0.0	0	0.0	1	6.5	0.003	1763.0	17000	0.2	2.0	2.7	15.0
12835	10.0	6.4	13.3	10.1	2.0	0.0	0	0.0	1	0.0	0	0.0	1	7.3	0.003	1607.5	17000	0.0	2.0	2.4	10.0
12615	10.0	6.1	12.5	10.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.6	0.002	1470.8	17000	0.0	2.0	2.1	10.0
12395	10.0	6.0	12.3	11.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.0	0.002	1438.1	17000	0.0	2.0	2.0	10.0
12195	10.0	5.5	10.6	12.5	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.3	0.001	1383.7	17000	0.0	2.0	1.5	10.0
11995	10.0	6.2	12.8	13.6	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.7	0.002	1280.5	17000	0.0	2.0	2.2	10.0
11780	10.0	6.1	12.6	14.4	2.0	0.0	0	0.0	1	0.0	0	0.0	1	9.3	0.001	1422.2	17000	0.0	2.0	2.1	10.0
11605	10.0	6.6	13.9	13.8	2.0	0.0	0	0.0	1	0.0	0	0.0	1	8.6	0.002	1325.5	17000	0.0	2.0	2.6	10.0
11405	10.0	6.3	13.2	15.1	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.3	0.002	1114.6	17000	0.0	2.0	2.3	10.0
11180	12.5	7.7	16.6	13.9	2.0	0.0	0	0.0	1	0.0	0	0.0	1	10.6	0.003	835.7	17000	0.0	2.0	3.7	12.5
11015	14.0	10.4	19.1	13.3	2.0	1.5	0	0.0	1	0.0	0	0.0	1	11.0	0.004	679.4	17000	0.0	2.0	4.9	14.0
10835	14.0	10.9	21.9	10.9	2.0	1.5	0	0.0	1	0.0	0	0.0	1	8.2	0.007	790.4	17000	0.0	2.0	5.4	14.0
10575	14.0	9.2	24.1	7.5	2.0	1.5	0	0.0	1	0.0	0	0.0	1	5.3	0.016	1108.8	17000	0.0	2.0	3.7	14.0
10390	14.0	9.9	22.7	8.8	2.0	1.5	0	0.0	1	0.0	0	0.0	1	5.8	0.008	1247.0	17000	0.0	2.0	4.4	14.0
10225	12.5	9.8	17.8	9.5	2.0	1.5	0	0.0	1	0.0	0	0.0	1	5.9	0.007	1374.1	17000	0.0	2.0	4.3	12.5
10000	10.0	8.5	14.9	11.1	2.0	1.5	0	0.0	1	0.0	0	0.0	1	6.6	0.004	1488.0	17000	0.0	2.0	3.0	10.0
9820	14.0	10.2	18.6	10.0	2.0	1.5	0	0.0	1	0.0	0	0.0	1	5.7	0.008	1402.3	17000	0.0	2.0	4.7	14.0
9595	10.0	8.4	14.6	10.3	2.0	1.5	0	0.0	1	0.0	0	0.0	1	6.6	0.005	1619.5	17000	0.0	2.0	2.9	10.0
9385	18.0	9.0	15.8	9.5	2.0	1.5	0	0.0	1	0.0	0	0.0	1	5.3	0.006	1770.4	17000	0.2	2.0	3.4	18.0
9220	18.0	9.3	16.4	8.9	2.0	1.5	0	0.0	1	0.0	0	0.0	1	4.9	0.008	1771.4	17000	0.1	2.0	3.6	18.0
9025	18.0	9.0	15.9	8.9	2.0	1.5	0	0.0	1	0.0	0	0.0	1	5.5	0.005	1736.9	17000	0.1	2.0	3.4	18.0
MAX=	26.8	26.8			8.1	1.6					0.0	17.4					17000.0	8.9	2.0	8.3	21.0
MIN=	8.0	4.8			2.0	0.0					0.0	0.0					3000.0	0.0	2.0	0.5	8.0

CALCULATIONS FOR TOTAL TOE-DOWN BY INDIVIDUAL ADJUSTMENT COMPONENT BASED ON LACH&SM W/ SAM -- SANTA CLARA RIVER PROPOSED CONDITIONS STRAIGHT-INSIDE CURVED REACH Q_{cap} n=0.025

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_I+	H/2	Z_{DM}=
46195	14.0	11.1	21.7	18.1	2.8	0.0	0	0.0	1	0.0	0	0.0	0	11.7	0.005	453.0	9000	0.0	2.0	6.3	14.0
46020	14.0	12.7	24.1	18.1	2.8	0.0	0	0.0	1	0.0	0	0.0	0	9.2	0.009	520.9	9000	0.0	2.0	7.9	14.0
45545	14.0	10.4	20.3	19.2	2.8	0.0	0	0.0	1	0.0	0	0.0	0	12.7	0.004	446.7	9000	0.0	2.0	5.6	14.0
45030	14.0	13.1	26.1	16.5	2.8	0.0	0	0.0	1	0.0	0	0.0	0	9.0	0.011	492.5	9000	0.0	2.0	8.3	14.0
44585	14.0	9.8	19.2	21.1	2.8	0.0	0	0.0	1	0.0	0	0.0	0	11.3	0.004	531.9	9000	0.0	2.0	5.0	14.0
44210	14.0	12.5	26.2	15.4	2.8	0.0	0	0.0	1	0.0	0	0.0	0	9.7	0.009	452.6	9000	0.0	2.0	7.7	14.0
43820	15.4	15.4	19.9	19.5	8.1	0.0	0	0.0	1	0.0	0	0.0	0	12.1	0.004	476.5	9000	0.0	2.0	5.3	14.0
43610	17.0	17.0	26.7	13.8	8.1	0.0	0	0.0	1	0.0	0	0.0	0	9.6	0.010	450.6	9000	0.0	2.0	6.9	14.0
43410	15.8	15.8	28.8	11.3	8.1	0.0	0	0.0	1	0.0	0	0.0	0	7.4	0.011	583.4	9000	0.0	2.0	5.7	14.0
43200	16.3	16.3	26.1	12.4	8.1	0.0	0	0.0	1	0.0	0	0.0	0	6.7	0.011	689.2	9000	0.0	2.0	6.2	14.0
42975	15.5	15.5	26.6	10.8	8.1	0.0	0	0.0	1	0.0	0	0.0	0	5.9	0.016	735.1	9000	0.0	2.0	5.4	14.0
42815	15.5	15.5	23.9	10.7	8.1	0.0	0	0.0	1	0.0	0	0.0	0	5.6	0.016	864.3	9000	0.0	2.0	5.4	14.0
42590	14.7	14.7	22.4	9.2	8.1	0.0	0	0.0	1	0.0	0	0.0	0	5.2	0.014	1013.1	9000	0.0	2.0	4.6	14.0
42430	15.3	15.3	19.6	10.7	8.1	0.0	0	0.0	1	0.0	0	0.0	0	6.4	0.009	915.8	9000	0.0	2.0	5.2	14.0
42215	14.7	14.7	18.5	11.2	8.1	0.0	0	0.0	1	0.0	0	0.0	0	6.1	0.009	1019.0	9000	0.0	2.0	4.6	14.0
41940	11.9	11.9	11.6	14.3	8.1	0.0	0	0.0	1	0.0	0	0.0	0	7.7	0.002	1284.2	9000	0.0	2.0	1.8	10.0
41730	12.0	12.0	11.8	14.7	8.1	0.0	0	0.0	1	0.0	0	0.0	0	8.2	0.002	1190.9	9000	0.0	2.0	1.9	10.0
41460	11.9	11.9	11.6	16.2	8.1	0.0	0	0.0	1	0.0	0	0.0	0	9.1	0.002	1093.5	9000	0.0	2.0	1.8	10.0
41280	12.5	10.9	16.4	14.4	5.2	0.1	0	0.0	1	0.0	0	0.0	0	8.3	0.004	852.3	9000	0.0	2.0	3.6	12.5
41080	14.0	12.7	19.9	12.1	5.2	0.1	0	0.0	1	0.0	0	0.0	0	6.7	0.008	874.1	9000	0.0	2.0	5.4	14.0
40825	14.0	11.7	18.0	11.5	5.2	0.1	0	0.0	1	0.0	0	0.0	0	6.2	0.007	1040.4	9000	0.0	2.0	4.4	14.0
40585	12.5	11.2	17.0	11.7	5.2	0.1	0	0.0	1	0.0	0	0.0	0	6.8	0.006	1005.8	9000	0.0	2.0	3.9	12.5
40335	10.0	8.8	10.5	15.1	5.2	0.1	0	0.0	1	0.0	0	0.0	0	8.8	0.002	1249.6	9000	0.0	2.0	1.5	10.0
40130	10.0	9.0	11.3	15.5	5.2	0.1	0	0.0	1	0.0	0	0.0	0	8.8	0.002	1195.6	9000	0.0	2.0	1.7	10.0
39945	10.0	8.9	11.0	16.3	5.2	0.1	0	0.0	1	0.0	0	0.0	0	9.3	0.002	1173.3	9000	0.0	2.0	1.6	10.0
39755	12.5	11.0	16.5	13.3	5.2	0.1	0	0.0	1	0.0	0	0.0	0	8.1	0.004	894.5	9000	0.0	2.0	3.7	12.5
39605	14.0	12.5	19.7	11.5	5.2	0.1	0	0.0	1	0.0	0	0.0	0	7.1	0.007	849.7	9000	0.0	2.0	5.2	14.0
39310	12.5	11.0	16.5	12.7	5.2	0.1	0	0.0	1	0.0	0	0.0	0	8.1	0.004	931.1	9000	0.0	2.0	3.7	12.5
39100	14.0	12.5	20.9	10.4	5.2	0.1	0	0.0	1	0.0	0	0.0	0	7.2	0.009	761.1	9000	0.0	2.0	5.2	14.0
38925	10.0	9.5	12.8	14.3	5.2	0.1	0	0.0	1	0.0	0	0.0	0	10.3	0.002	873.5	9000	0.0	2.0	2.2	10.0
38710	10.0	6.7	12.0	15.6	2.7	0.0	0	0.0	1	0.0	0	0.0	0	11.7	0.002	820.3	9000	0.0	2.0	2.0	10.0
38475	12.5	9.0	17.9	14.0	2.7	0.0	0	0.0	1	0.0	0	0.0	0	9.8	0.004	659.7	9000	0.0	2.0	4.3	12.5
38300	14.0	9.8	22.5	10.3	2.7	0.0	0	0.0	1	0.0	0	0.0	0	7.7	0.010	666.3	9000	0.0	2.0	5.1	14.0
38065	10.0	7.6	14.5	14.0	2.7	0.0	0	0.0	1	0.0	0	0.0	0	12.0	0.002	658.4	9000	0.0	2.0	2.9	10.0
37810	14.0	9.2	18.2	12.2	2.7	0.0	0	0.0	1	0.0	0	0.0	0	10.2	0.004	618.2	9000	0.0	2.0	4.5	14.0
37655	14.0	10.0	20.9	10.5	2.7	0.0	0	0.0	1	0.0	0	0.0	0	7.8	0.008	706.7	9000	0.0	2.0	5.3	14.0
37390	14.0	8.0	23.7	6.5	2.7	0.0	0	0.0	1	0.0	0	0.0	0	5.9	0.015	823.8	9000	0.0	2.0	3.3	14.0
37135	12.5	8.4	16.6	9.3	2.7	0.0	0	0.0	1	0.0	0	0.0	0	8.5	0.005	821.4	9000	0.0	2.0	3.7	12.5
36930	14.0	8.8	19.8	8.1	2.7	0.0	0	0.0	1	0.0	0	0.0	0	7.2	0.008	812.4	9000	0.0	2.0	4.1	14.0
36735	12.5	8.2	16.1	9.8	2.7	0.0	0	0.0	1	0.0	0	0.0	0	8.0	0.005	896.9	9000	0.0	2.0	3.5	12.5
36515	10.0	6.9	12.9	12.0	2.7	0.0	0	0.0	1	0.0	0	0.0	0	9.0	0.002	994.7	9000	0.0	2.0	2.2	10.0
36265	10.0	6.8	12.3	12.5	2.7	0.0	0	0.0	1	0.0	0	0.0	0	7.9	0.003	1176.0	9000	0.0	2.0	2.1	10.0
36080	22.0	22.0	14.7	11.6	3.2	0.7	0.9	2.0	1	0.0	0	13.3	0	6.7	0.006	1176.0	9000	0.0	2.0	2.9	10.0
35845	10.0	7.5	11.0	13.6	3.2	0.7	0	0.0	1	0.0	0	0.0	0	7.9	0.002	1401.7	9000	0.0	2.0	1.6	10.0
35725	10.0	8.9	15.0	13.0	3.2	0.7	0	0.0	1	0.0	0	0.0	0	6.5	0.004	1377.9	9000	0.0	2.0	3.0	10.0
35515	12.5	9.8	17.1	12.0	3.2	0.7	0	0.0	1	0.0	0	0.0	0	6.0	0.005	1354.8	9000	0.0	2.0	3.9	12.5
35245	12.5	9.9	17.3	11.3	3.2	0.7	0	0.0	1	0.0	0	0.0	0	5.5	0.006	1328.3	9000	0.0	2.0	4.0	12.5
35040	14.0	11.0	19.6	10.7	3.2	0.7	0	0.0	1	0.0	0	0.0	0	5.5	0.006	1354.8	9000	0.0	2.0	5.2	14.0
34860	14.0	10.4	18.4	10.0	3.2	0.7	0	0.0	1	0.0	0	0.0	0	4.9	0.009	1285.7	9000	0.0	2.0	4.6	14.0
34720	14.0	10.4	18.4	9.2	3.2	0.7	0	0.0	1	0.0	0	0.0	0	4.5	0.009	1411.2	9000	0.0	2.0	4.6	14.0
34495	12.5	10.0	17.4	9.0	3.2	0.7	0	0.0	1	0.0	0	0.0	0	5.2	0.009	1283.9	9000	0.0	2.0	4.1	12.5
34310	12.5	9.6	16.8	9.3	3.2	0.7	0	0.0	1	0.0	0	0.0	0	5.9	0.005	1308.5	9000	0.0	2.0	3.8	12.5
34090	12.5	9.7	17.0	8.6	3.2	0.7	0	0.0	1	0.0	0	0.0	0	5.3	0.007	1295.5	9000	0.0	2.0	3.9	12.5
33880	12.5	9.1	16.6	9.3	3.4	0.0	0	0.0	1	0.0	0	0.0	0	5.3	0.007	1318.4	9000	0.0	2.0	3.7	12.5
33710	12.5	8.6	15.4	9.7	3.4	0.0	0	0.0	1	0.0	0	0.0	0	5.5	0.005	1372.1	9000	0.0	2.0	3.2	12.5
33500	12.5	8.9	16.2	9.3	3.4	0.0	0	0.0	1	0.0	0	0.0	0	5.1	0.007	1496.0	9000	0.0	2.0	3.5	12.5
33310	12.5	8.7	15.8	9.0	3.4	0.0	0	0.0	1	0.0	0	0.0	0	4.2	0.006	1770.4	9000	0.0	2.0	3.4	12.5
33115	10.0	6.8	10.4	10.6	3.4	0.0	0	0.0	1	0.0	0	0.0	0	6.1	0.003	1847.3	9000	0.0	2.0	1.4	10.0
32795	10.0	7.7	13.0	10.6	3.4	0.0	0	0.0	1	0.0	0	0.0	0	5.2	0.004	1735.6	9000	0.0	2.0	2.3	10.0
32605	10.0	8.2	14.4	11.1	3.4	0.0	0	0.0	1	0.0	0	0.0	0	5.0	0.005	1699.9	9000	0.0	2.0	2.8	10.0
32265	12.5	7.4	15.9	10.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	4.8	0.006	1853.2	9000	0.0	2.0	3.4	12.5
31875	10.0	6.1	12.4	10.4	2.0	0.0	0	0.0	1	0.0	0	0.0	0	4.7	0.006	2409.2	9000	0.0	2.0	2.1	10.0
31585	10.0	5.6	10.9	11.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	5.9	0.003	2182.2	9000	0.0	2.0	1.6	10.0
31360	10.0	5.4	10.3	13.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.4	0.002	1878.7	9000	0.0	2.0	1.4	10.0
31060	8.0	4.9	8.2	15.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.1	0.001	1708.2	9000	0.0	2.0	0.9	8.0
30720	8.0	4.6	6.7	17.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	11.2	0.001	1888.6	9000	0.0	2.0	0.6	8.0
30445	8.0	4.5	6.3	19.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	12.7	0.000	1779.7	9000	0.0	2.0	0.5	8.0
30095	8.0	4.6	6.7	21.3	2.0	0.0	0	0.0	1	0.0	0	0.0	0	13.4	0.000	1622.7	9000	0.0	2.0	0.6	8.0
29815	8.0	4.8	7.7	21.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	13.5	0.000	1433.2	9000	0.0	2.0	0.8	8.0
29565	8.0	4.7	7.4	22.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	14.8	0.000	1323.8	9000	0.0	2.0	0.7	8.0
29385	8.0	4.9	8.3	23.6	2.0	0.0	0	0.0	1	0.0	0	0.0	0	14.4	0.000	1237.4	9000	0.0	2.0	0.9	8.0
29140	9.1	9.1	9.2	24.1	4.4	1.6	0	0.0	1	0.0	0	0.0	0	14.1	0.001	1087.2	9000	0.0	2.0	1.1	8.0
28895	14.0	12.7	18.8	22.5	4.4	1.6	0	0.0	1	0.0	0	0.0	0	9.9	0.002	972.1	9000	0.0	2.0	4.8	14.0
28695	15.0	15.0	28.9	14.0	4.4	1.6	0	0.0	1	0.0	0	0.0	0	5.4	0.025	899.4	9000	0.0	2.0	7.0	14.0
28500	14.7	14.7	22.4	16.1	4.4	1.6	0	0.0	1	0.0	0	0.0	0	11.4	0.006	552.2	9000	0.0	2.0	6.8	14.0
28280	14.0	13.4	29.6	10.8	4.4	1.6	0	0.0	1	0.0	0	0.0	0	5.8	0.013	944.5	9000	0.0	2.0	5.4	14.0
28080	10.0	9.7	11.3	19.1	4.4	1.6	0	0.0	1	0.0	0	0.0	0	14.7	0.001	926.4	9000	0.0	2.0	1.7	10.0
27925	10.3	10.3	13.1	19.3	4.4	1.6	0	0.0	1	0.0	0	0.0	0	13.8	0.001	866.6	9000	0.0	2.0	2.3	10.0
27725	14.0	12.9	19.0	16.7	4.4	1.6	0	0.0	1	0.0	0	0.0	0	10.4	0.003	786.6	9000	0.0	2.0	4.9	14.0
27545	15.0	15.0	22.9	14.1	4.4	1.6	0	0.0	1	0.0	0	0.0	0	9.9	0.005	643.2	9000	0.0	2.0	7.0	14.0
27335	14.1	14.1	24.6	12.3	4.4	1.6	0	0.0	1	0.0	0	0.0	0	8.3	0.008	703.5	9000	0.0	2.0	6.2	14.0
27155	14.0	12.9	19.1	14.8	4.4	1.6	0	0.0	1	0.0	0	0.0	0	9.2	0.003	888.4	9000	0.0	2.0	4.9	14.0
26990	14.0	11.0	22.6	11.5	2.0	1.3	0	0.0	1	0.0	0	0.0	0	6.8	0.011	922.3	9000	0.0	2.0	5.7	14.0
26780	14.0	10.9	23.1	11.3	2.0	1.3	0	0.0	1	0.0	0	0.0	0	6.2	0.009	1043.3	9000	0.0	2.0	5.6	14.0
26575	14.0	10.9	20.7	11.1	2.0	1.3	0	0.0	1	0.0	0	0.0	0	5.7	0.012	1187.3	3000	0.0	2.0	5.6	14.0
26355	12.5	8.7	15.9	13.4	2.0	1.3	0	0.0	1	0.0	0	0.0	0	7.5	0.004	1260.4	3000	0.0	2.0	3.4	12.5
26170	12.5	9.2	17.0	13.5	2.0	1.3	0	0.0	1	0.0	0	0.0	0	7.6	0.003	1269.0	3000	0.0	2.0	3.9	12.5
25965	14.0	9.8	18.2	12.9	2.0	1.3	0	0.0	1	0.0	0	0.0	0	6.9	0.004	1281.3	3000	0.0	2.0	4.5	14.0

DEFINITIONS

V(FPS) =VELOCITY IN FEET PER SECOND
Z_{TOT}=TOTAL POTENTIAL VERTICAL ADJUSTMENT IN FEET
Z_{DEG}=LONG TERM DEGRADATION IN FEET
Z_{GS}=GENERAL SCOUR IN FEET FROM SAM
Z_{LS}=LOCAL SCOUR IN FEET
PIER TYPE=PIER SHAPE FACTOR; IF NO PIERS=**0**
1.0=SQUARE NOSE; **0.9** ROUND NOSE; **0.9** CYLINDER;
0.8 SHARP NOSE; **0.9** GROUP OF CYLINDERS
FLOW DEPTH=WATER DEPTH IN CHANNEL IN FEET
B=WIDTH OF PIERS IN FEET; NO PIER=0
ABUT TYPE=VERT WALL FACTOR; IF VERT=**2**; NON VERT=**1**
A=ABUTMENT PROTRUSION INTO FLOW PATH IN FEET
SOFT = SOFT BOTTOM AT A BRIDGE OR AN ABUTMENT
0 = HARD BOTTOM; **1** = SOFT BOTTOM
Z_{BS}=BEND SCOUR IN FEET
BEND COEFF=BEND COEFFICIENT; IF NO BEND=0, BEND=1
HYD DEPTH=HYDRAULIC DEPTH IN FEET
E SLOPE=ENERGY SLOPE, UNITLESS
TOP WIDTH=CHANNEL TOP WIDTH IN FEET
RADIUS=RADIUS OF CURVATURE TO CENTERLINE IN FEET
Z_I=LOW-FLOW INCISEMENT IN FEET, MEASURED OR 2'; VALUE **NOT LESS THAN 2'**
H=BEDFORM HEIGHT IN FEET, LIMITED TO FLOW DEPTH AFTER KENNEDY (1963)
Z_{DM}=CUT OFF DEPTH REQUIRED BY LACFCDDM

GENERAL

THIS SPREADSHEET IS DESIGNED TO CALCULATE SCOUR PROTECTION (TOE DOWN) BASED ON LADPW COUNTY HYDROLOGY MANUAL (1991) PAGES 5.2-5.8 AND ASSOCIATED APPENDICES (SEDIMENTATION MANUAL). ALL VELOCITIES ARE IN FPS, WITH A MAXIMUM VALUE LIMITED BY THE EQUATION. THE PRESENT VERSION (10/04) WILL CALCULATE UP TO 50 VELOCITIES AT ONE TIME. LONG TERM DEGRADATION IS USER SUPPLIED. GENERAL SCOUR IS TAKEN FROM APPENDIX Q3, INTERPOLATED. LOCAL SCOUR AT BENDS AND ABUTMENTS ARE BASED ON LADWP EQUATIONS FOUND IN APP Q12. BEND SCOUR IS BASED ON EQUATIONS IN APPENDIX Q12. A LONGITUDINAL EXTENT BASED ON SECONDARY CURRENTS IS NOT INCLUDED. BEDFORM HEIGHT IS BASED ON EQUATIONS IN APPENDIX Q13. JULY 2005 REVISION INCLUDES CALCULATION FOR CUT OFF DEPTH BASED ON LOS ANGELES COUNTY FLOOD CONTROL DISTRICT DESIGN MANUAL. THE CALCULATION DOES NOT CONSIDER ADJUSTMENTS TO CUT OFF DEPTH BASED ON TABLE F-06
THE OCTOBER 2005 REVISION INCLUDES ADDITIONAL TOEDOWN AT BRIDGES/ABUTMENTS WITH SOFT BOTTOMS.

COLOR CODES

OUTPUT
DATA FROM HEC-RAS
USER SUPPLIED DATA
INTERMEDIATE CALCULATIONS (INDIVIDUAL SHEETS ONLY)

DESIGNED BY DAVID A JAFFE, PHD, PE
PACIFIC ADVANCED CIVIL ENGINEERING, INC
OCTOBER, 2004
OCTOBER 2005, REVISED

SECTION	Z_{MAX}=	Z_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Z_{DEG}+	Z_{GS}+	PIER TYPE	B	ABUT TYPE	A	SOFT	Z_{LS}+	BEND COEFF	HYD DEPTH	E SLOPE	TOP WIDTH	RADIUS	Z_{BS}+	Z_{I}+	H/2	Z_{DM}=
25785	14.0	10.1	18.9	12.1	2.0	1.3	0	0.0	1	0.0	0	0.0	0	6.9	0.005	1219.7	3000	0.0	2.0	4.8	14.0
25600	14.0	9.9	18.5	12.4	2.0	1.3	0	0.0	1	0.0	0	0.0	0	7.6	0.005	1109.4	3000	0.0	2.0	4.6	14.0
25425	14.0	9.8	18.3	12.5	2.0	1.3	0	0.0	1	0.0	0	0.0	0	7.1	0.007	1082.2	3000	0.0	2.0	4.5	14.0
25215	10.0	8.0	14.3	14.7	2.0	1.3	0	0.0	1	0.0	0	0.0	0	9.0	0.003	1097.3	3000	0.0	2.0	2.7	10.0
25000	10.0	7.6	13.2	15.5	2.0	1.3	0	0.0	1	0.0	0	0.0	0	10.1	0.002	1062.4	3000	0.0	2.0	2.3	10.0
24795	10.0	6.7	14.1	15.6	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.5	0.002	957.4	3000	0.0	2.0	2.7	10.0
24550	12.5	7.1	15.1	16.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	11.0	0.003	856.1	3000	0.0	2.0	3.1	12.5
24335	14.0	8.5	18.2	15.0	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.1	0.004	764.8	3000	0.0	2.0	4.5	14.0
24115	14.0	9.4	20.0	13.8	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.4	0.006	754.2	3000	0.0	2.0	5.4	14.0
23975	14.0	9.8	20.8	12.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.7	0.007	783.2	3000	0.0	2.0	5.8	14.0
23755	14.0	8.4	18.1	14.7	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.7	0.004	815.7	3000	0.0	2.0	4.4	14.0
23565	14.0	9.5	20.2	14.3	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.2	0.007	850.9	3000	0.0	2.0	5.5	14.0
23365	14.0	8.6	18.4	14.3	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.7	0.004	939.0	3000	0.0	2.0	4.6	14.0
23180	14.0	10.3	21.9	12.6	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.0	0.005	916.6	3000	0.0	2.0	6.3	14.0
23000	14.0	9.6	22.0	11.3	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.2	0.010	784.0	3000	0.0	2.0	5.6	14.0
22790	23.0	23.0	17.9	13.0	2.0	0.0	0.9	2.0	1	0.0	0	14.7	0	10.0	0.005	784.0	3000	0.0	2.0	4.3	12.5
22600	14.0	9.3	19.8	12.8	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.6	0.006	999.0	3000	0.0	2.0	5.3	14.0
22415	14.0	9.4	21.3	10.8	2.0	0.0	0	0.0	1	0.0	0	0.0	0	6.6	0.010	1039.1	3000	0.0	2.0	5.4	14.0
22195	10.0	6.7	13.6	14.0	2.0	0.2	0	0.0	1	0.0	0	0.0	0	8.7	0.003	1309.6	3000	0.0	2.0	2.5	10.0
22010	12.5	7.7	16.1	14.3	2.0	0.2	0	0.0	1	0.0	0	0.0	0	7.6	0.003	1254.1	3000	0.0	2.0	3.5	12.5
21790	14.0	9.4	19.7	11.6	2.0	0.2	0	0.0	1	0.0	0	0.0	0	6.5	0.006	1144.5	3000	0.0	2.0	5.2	14.0
21615	14.0	8.5	21.3	8.5	2.0	0.2	0	0.0	1	0.0	0	0.0	0	5.8	0.011	1163.0	3000	0.0	2.0	4.3	14.0
21440	12.5	8.3	17.5	11.0	2.0	0.2	0	0.0	1	0.0	0	0.0	0	6.9	0.005	1286.1	3000	0.0	2.0	4.1	12.5
21225	14.0	8.6	18.1	11.7	2.0	0.2	0	0.0	1	0.0	0	0.0	0	5.6	0.005	1559.0	3000	0.0	2.0	4.4	14.0
21020	14.0	9.1	20.3	9.7	2.0	0.2	0	0.0	1	0.0	0	0.0	0	7.8	0.007	903.0	3000	0.0	2.0	4.9	14.0
20845	12.5	7.3	15.1	12.7	2.0	0.2	0	0.0	1	0.0	0	0.0	0	6.7	0.003	1563.7	3000	0.0	2.0	3.1	12.5
20595	10.0	6.3	12.4	13.4	2.0	0.2	0	0.0	1	0.0	0	0.0	0	8.3	0.002	1548.8	3000	0.0	2.0	2.1	10.0
20435	10.0	6.2	12.1	14.3	2.0	0.2	0	0.0	1	0.0	0	0.0	0	8.8	0.001	1528.3	3000	0.0	2.0	2.0	10.0
20280	12.5	7.5	15.6	12.8	2.0	0.2	0	0.0	1	0.0	0	0.0	0	6.8	0.003	1531.3	3000	0.0	2.0	3.3	12.5
20070	14.0	9.2	19.3	11.1	2.0	0.2	0	0.0	1	0.0	0	0.0	0	5.2	0.006	1526.6	3000	0.0	2.0	5.0	14.0
19855	14.0	9.1	20.6	10.2	2.0	0.0	0	0.0	1	0.0	0	0.0	0	6.0	0.008	1205.4	3000	0.0	2.0	5.1	14.0
19630	14.0	8.4	20.6	8.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	6.6	0.009	1060.3	3000	0.0	2.0	4.4	14.0
19440	10.0	6.3	13.1	13.4	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.2	0.002	1194.5	3000	0.0	2.0	2.3	10.0
19240	12.5	7.4	15.9	11.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.4	0.004	1216.9	3000	0.0	2.0	3.4	12.5
19050	14.0	8.8	18.8	10.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	5.8	0.009	1321.4	3000	0.0	2.0	4.8	14.0
18830	10.0	6.4	13.3	14.6	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.4	0.003	1531.5	3000	0.0	2.0	2.4	10.0
18650	10.0	6.0	12.1	15.0	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.0	0.002	1604.5	3000	0.0	2.0	2.0	10.0
18475	8.0	5.1	8.9	16.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.9	0.001	1621.5	3000	0.0	2.0	1.1	8.0
18290	8.0	5.3	9.8	16.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.4	0.001	1594.2	3000	0.0	2.0	1.3	8.0
18025	8.0	4.8	7.9	18.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	11.9	0.001	1520.2	17000	0.0	2.0	0.8	8.0
17785	8.0	5.0	8.5	20.2	2.0	0.0	0	0.0	1	0.0	0	0.0	0	12.0	0.001	1398.1	17000	0.0	2.0	1.0	8.0
17510	10.0	6.9	11.0	19.2	2.0	1.3	0	0.0	1	0.0	0	0.0	0	10.2	0.001	1350.7	17000	0.0	2.0	1.6	10.0
17360	12.5	9.2	17.1	15.9	2.0	1.3	0	0.0	1	0.0	0	0.0	0	8.8	0.004	943.2	17000	0.0	2.0	3.9	12.5
17110	14.0	12.0	22.3	15.2	2.0	1.3	0	0.0	1	0.0	0	0.0	0	5.8	0.007	1175.4	17000	0.0	2.0	6.7	14.0
16970	14.0	12.1	23.1	13.6	2.0	1.3	0	0.0	1	0.0	0	0.0	0	5.9	0.010	1067.0	17000	0.0	2.0	6.8	14.0
16720	14.0	9.9	24.4	9.2	2.0	1.3	0	0.0	1	0.0	0	0.0	0	5.2	0.019	1122.9	17000	0.0	2.0	4.6	14.0
16515	14.0	10.4	19.4	10.4	2.0	1.3	0	0.0	1	0.0	0	0.0	0	5.8	0.010	1249.9	17000	0.0	2.0	5.1	14.0
16305	10.0	7.1	11.6	14.6	2.0	1.3	0	0.0	1	0.0	0	0.0	0	9.4	0.002	1360.5	17000	0.0	2.0	1.8	10.0
16130	12.5	8.6	15.7	12.3	2.0	1.3	0	0.0	1	0.0	0	0.0	0	7.1	0.005	1326.5	17000	0.0	2.0	3.3	12.5
15960	12.5	9.5	17.7	11.0	2.0	1.3	0	0.0	1	0.0	0	0.0	0	5.9	0.008	1386.0	17000	0.0	2.0	4.2	12.5
15745	10.0	7.3	12.3	13.3	2.0	1.3	0	0.0	1	0.0	0	0.0	0	8.4	0.003	1363.9	17000	0.0	2.0	2.0	10.0
15540	10.0	6.8	10.6	13.7	2.0	1.3	0	0.0	1	0.0	0	0.0	0	9.4	0.002	1426.6	17000	0.0	2.0	1.5	10.0
15335	12.5	8.8	16.2	12.1	2.0	1.3	0	0.0	1	0.0	0	0.0	0	8.2	0.006	1064.1	17000	0.0	2.0	3.5	12.5
15125	26.1	26.1	17.9	11.6	2.0	0.4	0.9	4.0	1	0.0	0	17.4	0	8.0	0.007	1000.5	17000	0.0	2.0	4.3	12.5
14900	14.0	9.3	19.3	9.8	2.0	0.4	0	0.0	1	0.0	0	0.0	0	6.3	0.009	1626.5	17000	0.0	2.0	4.9	14.0
14720	14.0	8.8	18.1	9.8	2.0	0.4	0	0.0	1	0.0	0	0.0	0	6.0	0.008	1722.3	17000	0.0	2.0	4.4	14.0
14480	14.0	8.8	19.0	8.9	2.0	0.4	0	0.0	1	0.0	0	0.0	0	5.2	0.010	1726.7	17000	0.0	2.0	4.4	14.0
14315	10.0	7.0	14.0	9.9	2.0	0.4	0	0.0	1	0.0	0	0.0	0	5.8	0.005	1881.0	17000	0.0	2.0	2.6	10.0
14090	10.0	7.2	14.3	8.5	2.0	0.4	0	0.0	1	0.0	0	0.0	0	5.6	0.006	1772.8	17000	0.0	2.0	2.8	10.0
13850	10.0	6.6	12.6	9.7	2.0	0.4	0	0.0	1	0.0	0	0.0	0	6.5	0.004	1741.6	17000	0.0	2.0	2.2	10.0
13635	12.5	7.6	15.5	10.3	2.0	0.4	0	0.0	1	0.0	0	0.0	0	6.3	0.004	1705.8	17000	0.0	2.0	3.2	12.5
13425	14.0	8.3	18.0	7.8	2.0	0.4	0	0.0	1	0.0	0	0.0	0	4.3	0.011	1850.7	17000	0.0	2.0	3.9	14.0
13190	10.0	6.4	12.2	9.5	2.0	0.4	0	0.0	1	0.0	0	0.0	0	6.5	0.003	1847.4	17000	0.0	2.0	2.0	10.0
13030	10.0	6.7	14.2	9.6	2.0	0.0	0	0.0	1	0.0	0	0.0	0	6.5	0.003	1763.0	17000	0.0	2.0	2.7	10.0
12835	10.0	6.4	13.3	10.1	2.0	0.0	0	0.0	1	0.0	0	0.0	0	7.3	0.003	1607.5	17000	0.0	2.0	2.4	10.0
12615	10.0	6.1	12.5	10.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.6	0.002	1470.8	17000	0.0	2.0	2.1	10.0
12395	10.0	6.0	12.3	11.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.0	0.002	1438.1	17000	0.0	2.0	2.0	10.0
12195	10.0	5.5	10.6	12.5	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.3	0.001	1383.7	17000	0.0	2.0	1.5	10.0
11995	10.0	6.2	12.8	13.6	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.7	0.002	1280.5	17000	0.0	2.0	2.2	10.0
11780	10.0	6.1	12.6	14.4	2.0	0.0	0	0.0	1	0.0	0	0.0	0	9.3	0.001	1422.2	17000	0.0	2.0	2.1	10.0
11605	10.0	6.6	13.9	13.8	2.0	0.0	0	0.0	1	0.0	0	0.0	0	8.6	0.002	1325.5	17000	0.0	2.0	2.6	10.0
11405	10.0	6.3	13.2	15.1	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.3	0.002	1114.6	17000	0.0	2.0	2.3	10.0
11180	12.5	7.7	16.6	13.9	2.0	0.0	0	0.0	1	0.0	0	0.0	0	10.6	0.003	835.7	17000	0.0	2.0	3.7	12.5
11015	14.0	10.4	19.1	13.3	2.0	1.5	0	0.0	1	0.0	0	0.0	0	11.0	0.004	679.4	17000	0.0	2.0	4.9	14.0
10835	14.0	10.9	21.9	10.9	2.0	1.5	0	0.0	1	0.0	0	0.0	0	8.2	0.007	790.4	17000	0.0	2.0	5.4	14.0
10575	14.0	9.2	24.1	7.5	2.0	1.5	0	0.0	1	0.0	0	0.0	0	5.3	0.016	1108.8	17000	0.0	2.0	3.7	14.0
10390	14.0	9.9	22.7	8.8	2.0	1.5	0	0.0	1	0.0	0	0.0	0	5.8	0.008	1247.0	17000	0.0	2.0	4.4	14.0
10225	12.5	9.8	17.8	9.5	2.0	1.5	0	0.0	1	0.0	0	0.0	0	5.9	0.007	1374.1	17000	0.0	2.0	4.3	12.5
10000	10.0	8.5	14.9	11.1	2.0	1.5	0	0.0	1	0.0	0	0.0	0	6.6	0.004	1488.0	17000	0.0	2.0	3.0	10.0
9820	14.0	10.2	18.6	10.0	2.0	1.5	0	0.0	1	0.0	0	0.0	0	5.7	0.008	1402.3	17000	0.0	2.0	4.7	14.0
9595	10.0	8.4	14.6	10.3	2.0	1.5	0	0.0	1	0.0	0	0.0	0	6.6	0.005	1619.5	17000	0.0	2.0	2.9	10.0
9385	12.5	8.9	15.8	9.5	2.0	1.5	0	0.0	1	0.0	0	0.0	0	5.3	0.006	1770.4	17000	0.0	2.0	3.4	12.5
9220	12.5	9.1	16.4	8.9	2.0	1.5	0	0.0	1	0.0	0	0.0	0	4.9	0.008	1771.4	17000	0.0	2.0	3.6	12.5
9025	12.5	8.9	15.9	8.9	2.0	1.5	0	0.0	1	0.0	0	0.0	0	5.5	0.005	1736.9	17000	0.0	2.0	3.4	12.5
MAX=	26.1	26.1			8.1	1.6					0.0						17000.0		2.0	8.3	14.0
MIN=	8.0	4.5			2.0	0.0					0.0						3000.0		2.0	0.5	8.0

Santa Clara River Fluvial Study

APPENDIX CHAPTER 6.2

LACH&SM Freeboard Proposed Condition Curved & Straight Reaches

PACIFIC ADVANCED CIVIL ENGINEERING, INC.

CALCULATIONS FOR TOTAL FREEBOARD BY INDIVIDUAL ADJUSTMENT COMPONENT BASED ON LACH&SM - SANTA CLARA RIVER PROPOSED CONDITIONS OUTSIDE CURVED REACH Q_{CAP} n=0.085

SECTION	Y_{MAX}	Y_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Y_{AGG}+	Y_{GA}+	CHANNEL TYPE	BOTTOM WIDTH (FT)	TOP WIDTH (FT)	Y_{SE}+	BEND COEFF	SIDE SLOPE	RADIUS	H/2	Y_{DM}
46195	**3.1**	3.1	10.7	28.1	1.0	0.6	2	215.7	750.8	0.0	1	1.5	9000	1.5	2.5
46020	**3.0**	3.0	10.2	30.0	1.0	0.6	2	162.7	570.2	0.0	1	1.5	9000	1.4	2.5
45545	**3.4**	3.4	11.6	27.8	1.0	0.6	2	151.3	524.2	0.0	1	1.5	9000	1.8	2.5
45030	**3.0**	3.0	10.3	29.2	1.0	0.6	2	222.6	558.0	0.0	1	1.5	9000	1.4	2.5
44585	**3.2**	3.2	10.7	28.6	1.0	0.6	2	163.7	654.4	0.0	1	1.5	9000	1.6	2.5
44210	**2.9**	2.9	10.0	27.8	1.0	0.6	2	204.3	620.0	0.0	1	1.5	9000	1.3	2.5
43820	**3.9**	3.9	14.2	24.1	1.0	0.2	2	207.8	528.7	0.0	1	1.5	9000	2.7	2.5
43610	**4.0**	4.0	14.4	21.3	1.0	0.2	2	242.1	536.9	0.0	1	1.5	9000	2.8	2.5
43410	**3.6**	3.6	13.3	19.8	1.0	0.2	2	312.8	729.1	0.0	1	1.5	9000	2.4	2.5
43200	**3.5**	3.5	13.0	19.2	1.0	0.2	2	308.4	779.5	0.0	1	1.5	9000	2.3	2.5
42975	**2.9**	2.9	10.7	19.0	1.0	0.2	2	410.5	955.8	0.1	1	1.5	9000	1.5	2.5
42815	**2.5**	2.4	9.1	18.7	1.0	0.2	2	380.4	1120.8	0.1	1	1.5	9000	1.1	2.5
42590	**2.5**	2.0	7.7	18.4	1.0	0.2	2	451.9	1230.7	0.1	1	1.5	9000	0.8	2.5
42430	**2.5**	2.0	7.6	19.5	1.0	0.2	2	445.9	1334.9	0.1	1	1.5	9000	0.8	2.5
42215	**2.5**	1.8	6.6	20.7	1.0	0.2	2	493.2	1374.6	0.0	1	1.5	9000	0.6	2.5
41940	**2.5**	1.8	6.4	20.6	1.0	0.2	2	454.2	1327.0	0.0	1	1.5	9000	0.5	2.5
41730	**2.5**	1.9	6.9	20.6	1.0	0.2	2	404.1	1221.5	0.0	1	1.5	9000	0.6	2.5
41460	**2.5**	2.0	7.4	21.2	1.0	0.2	2	365.7	1121.0	0.0	1	1.5	9000	0.7	2.5
41280	**2.5**	2.1	8.7	20.8	1.0	0.0	2	342.4	1193.2	0.1	1	1.5	9000	1.0	2.5
41080	**2.5**	2.1	8.6	20.5	1.0	0.0	2	429.5	1136.8	0.1	1	1.5	9000	1.0	2.5
40825	**2.5**	1.8	7.3	19.8	1.0	0.0	2	426.6	1213.0	0.1	1	1.5	9000	0.7	2.5
40585	**2.5**	1.7	7.1	20.3	1.0	0.0	2	404.3	1247.2	0.0	1	1.5	9000	0.7	2.5
40335	**2.5**	1.5	6.1	21.4	1.0	0.0	2	397.2	1288.6	0.0	1	1.5	9000	0.5	2.5
40130	**2.5**	1.6	6.6	21.6	1.0	0.0	2	311.3	1264.5	0.0	1	1.5	9000	0.6	2.5
39945	**2.5**	1.7	6.8	21.9	1.0	0.0	2	293.8	1212.3	0.0	1	1.5	9000	0.6	2.5
39755	**2.5**	2.0	8.6	20.6	1.0	0.0	2	296.7	1088.1	0.1	1	1.5	9000	1.0	2.5
39605	**2.5**	2.0	8.5	20.7	1.0	0.0	2	348.8	1074.7	0.1	1	1.5	9000	1.0	2.5
39310	**2.5**	2.0	8.4	20.2	1.0	0.0	2	323.4	977.3	0.1	1	1.5	9000	1.0	2.5
39100	**2.5**	1.9	8.2	21.1	1.0	0.0	2	436.5	831.5	0.0	1	1.5	9000	0.9	2.5
38925	**2.5**	1.9	7.8	20.8	1.0	0.0	2	422.3	906.7	0.1	1	1.5	9000	0.8	2.5
38710	**2.5**	2.0	8.1	21.2	1.0	0.1	2	394.9	844.1	0.0	1	1.5	9000	0.9	2.5
38475	**2.6**	2.6	10.4	21.0	1.0	0.1	2	375.1	695.3	0.0	1	1.5	9000	1.5	2.5
38300	**2.5**	2.3	9.6	20.3	1.0	0.1	2	407.6	716.8	0.0	1	1.5	9000	1.2	2.5
38065	**2.5**	2.3	9.6	20.1	1.0	0.1	2	569.0	691.3	0.0	1	1.5	9000	1.2	2.5
37810	**2.8**	2.8	11.3	18.4	1.0	0.1	2	546.8	648.4	0.0	1	1.5	9000	1.7	2.5
37655	**2.6**	2.6	10.6	17.9	1.0	0.1	2	348.9	738.9	0.0	1	1.5	9000	1.5	2.5
37390	**2.5**	2.0	8.2	17.5	1.0	0.1	2	803.3	869.1	0.0	1	1.5	9000	0.9	2.5
37135	**2.5**	2.1	8.7	16.8	1.0	0.1	2	564.0	863.7	0.0	1	1.5	9000	1.0	2.5
36930	**2.5**	2.1	8.3	17.7	1.0	0.1	2	708.3	923.7	0.1	1	1.5	9000	0.9	2.5
36735	**2.5**	2.1	8.1	17.6	1.0	0.1	2	633.8	963.2	0.1	1	1.5	9000	0.9	2.5
36515	**2.5**	1.9	7.4	18.6	1.0	0.1	2	532.1	1032.7	0.1	1	1.5	9000	0.7	2.5
36265	**2.5**	1.8	7.1	18.3	1.0	0.1	2	359.0	1176.0	0.0	1	1.5	9000	0.7	2.5
36080	**2.5**	1.9	7.8	17.6	1.0	0.0	2	326.3	1176.0	0.0	1	1.5	9000	0.8	2.5
35845	**2.5**	1.7	7.0	18.1	1.0	0.0	2	376.2	1512.8	0.0	1	1.5	9000	0.7	2.5
35725	**2.5**	1.9	8.0	18.3	1.0	0.0	2	378.2	1488.9	0.1	1	1.5	9000	0.9	2.5
35515	**2.5**	2.0	8.5	17.9	1.0	0.0	2	379.3	1501.0	0.1	1	1.5	9000	1.0	2.5
35245	**2.5**	2.0	8.3	17.0	1.0	0.0	2	414.3	1580.3	0.1	1	1.5	9000	0.9	2.5
35040	**2.5**	2.1	8.8	16.6	1.0	0.0	2	440.9	1491.6	0.1	1	1.5	9000	1.0	2.5
34860	**2.5**	1.9	7.7	16.3	1.0	0.0	2	432.9	1431.5	0.1	1	1.5	9000	0.8	2.5
34720	**2.5**	1.8	7.4	15.8	1.0	0.0	2	545.6	1449.9	0.1	1	1.5	9000	0.7	2.5
34495	**2.5**	1.8	7.2	15.7	1.0	0.0	2	504.6	1461.5	0.1	1	1.5	9000	0.7	2.5
34310	**2.5**	2.0	8.1	15.4	1.0	0.0	2	684.5	1384.9	0.1	1	1.5	9000	0.9	2.5
34090	**2.5**	1.9	7.5	15.0	1.0	0.0	2	787.5	1371.0	0.1	1	1.5	9000	0.8	2.5
33880	**2.5**	2.0	7.3	15.7	1.0	0.2	2	761.0	1482.9	0.1	1	1.5	9000	0.7	2.5
33710	**2.5**	1.9	7.0	15.6	1.0	0.2	2	719.2	1637.9	0.1	1	1.5	9000	0.7	2.5
33500	**2.5**	1.9	7.0	15.3	1.0	0.2	2	666.4	1755.5	0.1	1	1.5	9000	0.7	2.5
33310	**2.5**	1.8	6.2	15.3	1.0	0.2	2	609.9	1828.2	0.1	1	1.5	9000	0.5	2.5
33115	**2.5**	1.7	5.8	15.4	1.0	0.2	2	667.8	1927.1	0.0	1	1.5	9000	0.4	2.5
32795	**2.5**	1.8	6.3	15.7	1.0	0.2	2	697.6	1920.8	0.1	1	1.5	9000	0.5	2.5

DEFINITIONS

Y_{MAX} = GREATER OF THE DM AND S&H HEIGHTS

Y_{TOT}=TOTAL EMBANKMENT PROTECTION IN FEET BASED ON THE H&S

V(FPS) =VELOCITY IN FEET PER SECOND

FLOW DEPTH=WATER DEPTH IN CHANNEL IN FEET

Y_{AGG}=LONG TERM AGGRADATION IN FEET

Y_{GA}=GENERAL AGGRADATION IN FEET FROM SAM

CHANNEL TYPE=CHANNEL SHAPE/FLOW FACTOR:
IF Fr<1, RECTANGULAR = 0; IF Fr>1, RECTANGULAR = 1;
IF Fr<1, TRAPEZOIDAL = 2; IF Fr>1, TRAPEZOIDAL = 3.

Y_{SE}=SUPER ELEVATION IN FEET

BEND COEFF=BEND COEFFICIENT; IF NO BEND=0, BEND=1

SIDE SLOPE=CHANNEL SIDE SLOPE (H:V), UNITLESS

BOTTOM WIDTH=CHANNEL BOTTOM WIDTH IN FEET, $Q_{2\text{-}YEAR}$ TOP WIDTH

RADIUS=RADIUS OF CURVATURE TO CENTERLINE IN FEET

H/2=HALF BEDFORM HEIGHT IN FEET, LIMITED TO FLOW DEPTH,
AFTER KENNEDY (1963)

Y_{DM} = EMBANKMENT PROTECTION REQUIRED BY THE LACFCDDM IN FEET

GENERAL

THIS SPREADSHEET IS DESIGNED TO CALCULATE TOP PROTECTION (FREE BOARD) BASED ON LACDWP COUNTY HYDROLOGY MANUAL (1991) PAGES 5.8-5.9 AND ASSOCIATED APPENDICES (SEDIMENTATION MANUAL). ALL VELOCITIES ARE IN FPS, WITH NO MAXIMUM VALUE. THE USER SHOULD CONSIDER A PRACTICAL MAXIMUM OF APPROXIMATELY 20-30 FPS. THE PRESENT VERSION (8/05) WILL CALCULATE UP TO 100 VELOCITIES AT ONE TIME. LONG TERM AGGRADATION IS USER SUPPLIED. GENERAL AGGRADATION IS ALSO USER SUPPLIED. SUPER ELEVATION AT BENDS IS BASED ON LACFCDDM EQUATIONS FOUND IN C-3.1. BEDFORM HEIGHT, LIMITED TO FLOW DEPTH AFTER KENNEDY (1963), IS BASED ON EQUATIONS IN APPENDIX Q13. IF FLOW IS SUPERCRITICAL SPREADSHEET REPORTS LACFCDDM TOTAL WALL HEIGHT INSTEAD OF FREEBOARD. LOS ANGELES COUNTY FLOOD CONTROL DISTRICT DESIGN MANUAL (LACFCDDM) VALUES ARE PRESENTED AS A PART OF LACH&SM CALCULATIONS. THE SPREADSHEET CALCULATES THE GREATER OF THE TWO METHODOLOGIES. BOTTOM WIDTH IS BASED ON THE 2-YEAR WATER SURFACE AFTER ACOE PROCEDURES.

COLOR CODES

OUTPUT
DATA FROM HEC-RAS
USER SUPPLIED DATA
INTERMEDIATE CALCULATIONS (INDIVIDUAL SHEETS ONLY)

DESIGNED BY DAVID A JAFFE, PHD, PE
PACIFIC ADVANCED CIVIL ENGINEERING, INC
AUGUST, 2005

SECTION	Y_{MAX}	Y_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Y_{AGG}+	Y_{GA}+	CHANNEL TYPE	BOTTOM WIDTH (FT)	TOP WIDTH (FT)	Y_{SE}+	BEND COEFF	SIDE SLOPE	RADIUS	H/2	Y_{DM}
32605	2.5	1.7	6.1	16.7	1.0	0.2	2	652.8	2407.4	0.1	1	1.5	9000	0.5	2.5
32265	2.5	2.2	5.5	17.2	1.0	0.8	2	651.0	2840.2	0.0	1	1.5	9000	0.4	2.5
31875	2.5	2.2	5.3	16.6	1.0	0.8	2	562.0	2593.1	0.0	1	1.5	9000	0.4	2.5
31585	2.5	2.2	5.0	18.7	1.0	0.8	2	619.5	2377.5	0.0	1	1.5	9000	0.3	2.5
31360	2.5	2.2	5.5	19.9	1.0	0.8	2	672.2	1959.5	0.0	1	1.5	9000	0.4	2.5
31060	2.5	2.2	5.1	21.2	1.0	0.8	2	955.0	1975.9	0.1	1	1.5	9000	0.3	2.5
30720	2.5	2.1	4.6	22.5	1.0	0.8	2	772.7	1911.5	0.0	1	1.5	9000	0.3	2.5
30445	2.5	2.1	4.6	24.1	1.0	0.8	2	700.9	1841.8	0.0	1	1.5	9000	0.3	2.5
30095	2.5	2.2	5.2	25.5	1.0	0.8	2	617.1	1637.3	0.0	1	1.5	9000	0.4	2.5
29815	2.5	2.3	6.1	25.8	1.0	0.8	2	551.1	1445.2	0.0	1	1.5	9000	0.5	2.5
29565	2.5	2.3	6.0	26.3	1.0	0.8	2	461.8	1334.9	0.0	1	1.5	9000	0.5	2.5
29385	2.5	2.5	6.8	26.6	1.0	0.8	2	381.5	1249.1	0.0	1	1.5	9000	0.6	2.5
29140	2.5	1.9	7.9	26.4	1.0	0.0	2	217.2	1095.0	0.0	1	1.5	9000	0.8	2.5
28895	4.8	4.8	16.5	23.8	1.0	0.0	2	201.9	978.0	0.1	1	1.5	9000	3.7	2.5
28695	2.5	2.3	9.4	24.9	1.0	0.0	2	269.6	951.6	0.1	1	1.5	9000	1.2	2.5
28500	3.1	3.1	12.0	23.0	1.0	0.0	2	326.0	1039.5	0.1	1	1.5	9000	1.9	2.5
28280	2.5	2.1	8.7	23.8	1.0	0.0	2	379.1	1003.9	0.1	1	1.5	9000	1.0	2.5
28080	2.5	2.0	8.3	24.1	1.0	0.0	2	416.6	945.4	0.1	1	1.5	9000	0.9	2.5
27925	2.5	2.2	9.6	24.1	1.0	0.0	2	402.0	884.9	0.0	1	1.5	9000	1.2	2.5
27725	2.9	2.9	11.9	23.1	1.0	0.0	2	386.2	811.8	0.0	1	1.5	9000	1.9	2.5
27545	3.1	3.1	12.4	22.3	1.0	0.0	2	409.6	852.5	0.0	1	1.5	9000	2.1	2.5
27335	2.7	2.7	10.9	22.0	1.0	0.0	2	422.5	937.2	0.1	1	1.5	9000	1.6	2.5
27155	2.9	2.9	11.4	21.0	1.0	0.0	2	452.4	978.1	0.1	1	1.5	9000	1.8	2.5
26990	2.5	2.3	9.4	20.4	1.0	0.0	2	440.9	1020.9	0.1	1	1.5	9000	1.2	2.5
26780	2.5	2.1	8.8	21.3	1.0	0.0	2	527.5	1106.5	0.1	1	1.5	9000	1.0	2.5
26575	2.5	1.9	7.3	21.5	1.0	0.0	2	513.5	1243.6	0.2	1	1.5	3000	0.7	2.5
26355	2.5	2.0	7.4	21.6	1.0	0.0	2	601.4	1294.5	0.2	1	1.5	3000	0.9	2.5
26170	2.5	2.3	7.7	21.9	1.0	0.0	2	457.8	1301.2	0.2	1	1.5	3000	1.1	2.5
25965	2.6	2.6	7.5	22.2	1.0	0.0	2	568.4	1313.2	0.2	1	1.5	3000	1.3	2.5
25785	2.7	2.7	7.5	22.0	1.0	0.0	2	550.9	1256.9	0.3	1	1.5	3000	1.4	2.5
25600	2.5	2.5	7.8	22.3	1.0	0.0	2	478.1	1149.9	0.2	1	1.5	3000	1.3	2.5
25425	2.5	2.5	7.3	23.1	1.0	0.0	2	399.8	1138.3	0.2	1	1.5	3000	1.3	2.5
25215	2.5	2.4	7.3	23.3	1.0	0.0	2	444.6	1133.6	0.2	1	1.5	3000	1.2	2.5
25000	2.5	2.5	7.3	23.5	1.0	0.0	2	453.1	1093.8	0.2	1	1.5	3000	1.3	2.5
24795	3.7	3.7	8.0	23.5	1.9	0.2	2	391.4	986.5	0.3	1	1.5	3000	1.3	2.5
24550	3.6	3.6	8.9	24.1	1.9	0.2	2	334.0	887.1	0.3	1	1.5	3000	1.2	2.5
24335	3.9	3.9	9.9	23.5	1.9	0.2	2	337.2	800.3	0.3	1	1.5	3000	1.5	2.5
24115	3.8	3.8	10.0	23.0	1.9	0.2	2	422.7	793.2	0.3	1	1.5	3000	1.4	2.5
23975	3.5	3.5	9.7	22.6	1.9	0.2	2	354.1	828.2	0.2	1	1.5	3000	1.2	2.5
23755	3.2	3.2	9.9	22.7	1.9	0.2	2	333.9	939.2	0.2	1	1.5	3000	1.0	2.5
23565	3.7	3.7	9.4	23.6	1.9	0.2	2	322.2	941.5	0.3	1	1.5	3000	1.3	2.5
23365	3.5	3.5	9.4	22.4	1.9	0.2	2	329.4	987.4	0.3	1	1.5	3000	1.1	2.5
23180	3.2	3.2	9.6	22.5	1.9	0.2	2	400.7	975.5	0.2	1	1.5	3000	0.9	2.5
23000	3.3	3.3	9.5	22.0	1.9	0.2	2	407.6	784.0	0.3	1	1.5	3000	0.9	2.5
22790	3.1	3.1	10.6	20.0	1.9	0.2	2	425.5	784.0	0.2	1	1.5	3000	0.9	2.5
22600	3.2	3.2	10.2	19.8	1.9	0.2	2	386.7	1050.2	0.3	1	1.5	3000	0.8	2.5
22415	3.2	3.2	9.3	18.9	1.9	0.2	2	422.3	1091.6	0.2	1	1.5	3000	0.8	2.5
22195	2.5	2.4	8.4	19.1	1.4	0.0	2	371.3	1464.0	0.3	1	1.5	3000	0.8	2.5
22010	2.5	2.5	9.8	19.4	1.4	0.0	2	471.8	1735.1	0.3	1	1.5	3000	0.8	2.5
21790	2.6	2.6	9.0	18.4	1.4	0.0	2	549.9	1778.4	0.2	1	1.5	3000	1.0	2.5
21615	2.6	2.6	8.0	16.9	1.4	0.0	2	563.1	1687.7	0.3	1	1.5	3000	0.9	2.5
21440	2.5	2.4	8.2	17.8	1.4	0.0	2	638.9	1653.0	0.2	1	1.5	3000	0.8	2.5
21225	2.5	2.4	8.0	18.7	1.4	0.0	2	352.4	1600.8	0.2	1	1.5	3000	0.7	2.5
21020	2.5	2.3	7.8	18.6	1.4	0.0	2	675.0	1607.4	0.2	1	1.5	3000	0.7	2.5
20845	2.5	2.3	7.9	18.7	1.4	0.0	2	613.7	1605.1	0.2	1	1.5	3000	0.8	2.5
20595	2.5	2.1	7.5	18.6	1.4	0.0	2	744.5	1600.4	0.1	1	1.5	3000	0.6	2.5
20435	2.5	2.1	7.9	18.8	1.4	0.0	2	765.2	1613.5	0.1	1	1.5	3000	0.6	2.5
20280	2.5	2.1	8.7	18.1	1.4	0.0	2	439.6	1636.3	0.1	1	1.5	3000	0.6	2.5
20070	2.5	1.9	8.3	18.6	1.4	0.0	2	602.4	1797.8	0.1	1	1.5	3000	0.5	2.5
19855	3.0	3.0	7.7	19.1	1.0	1.4	2	585.9	1809.6	0.1	1	1.5	3000	0.5	2.5
19630	2.9	2.9	7.4	18.6	1.0	1.4	2	634.2	1833.7	0.0	1	1.5	3000	0.5	2.5
19440	3.0	3.0	7.2	19.9	1.0	1.4	2	536.3	1986.1	0.0	1	1.5	3000	0.6	2.5

SECTION	Y_{MAX}	Y_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Y_{AGG}+	Y_{GA}+	CHANNEL TYPE	BOTTOM WIDTH (FT)	TOP WIDTH (FT)	Y_{SF}+	BEND COEFF	SIDE SLOPE	RADIUS	H/2	Y_{DM}
19240	3.4	3.4	7.6	19.4	1.0	1.4	2	445.4	1738.0	0.0	1	1.5	3000	1.0	2.5
19050	4.1	4.1	6.7	20.2	1.0	1.4	2	418.1	1753.4	0.0	1	1.5	3000	1.7	2.5
18830	4.1	4.1	6.8	21.4	1.0	1.4	2	338.9	1684.0	0.0	1	1.5	3000	1.6	2.5
18650	4.0	4.0	6.7	21.2	1.0	1.4	2	339.7	1686.2	0.0	1	1.5	3000	1.6	2.5
18475	3.4	3.4	5.8	22.3	1.0	1.4	2	336.6	1665.9	0.0	1	1.5	3000	1.0	2.5
18290	3.2	3.2	6.3	22.1	1.0	1.4	2	365.1	1631.9	0.0	1	1.5	3000	0.8	2.5
18025	3.1	3.1	5.8	22.9	1.0	1.4	2	380.4	1557.4	0.0	1	1.5	17000	0.7	2.5
17785	3.2	3.2	6.4	24.0	1.0	1.4	2	389.3	1444.1	0.0	1	1.5	17000	0.8	2.5
17510	2.5	1.7	8.4	22.4	1.0	0.0	2	326.3	1398.9	0.0	1	1.5	17000	0.7	2.5
17360	2.5	1.7	11.1	20.3	1.0	0.0	2	223.6	1303.3	0.0	1	1.5	17000	0.7	2.5
17110	2.5	1.6	11.0	21.5	1.0	0.0	2	228.7	1229.6	0.0	1	1.5	17000	0.6	2.5
16970	2.5	2.1	10.7	20.3	1.0	0.0	2	235.7	1196.0	0.0	1	1.5	17000	1.1	2.5
16720	2.5	2.3	8.5	18.8	1.0	0.0	2	260.0	1182.0	0.0	1	1.5	17000	1.3	2.5
16515	2.5	2.1	7.7	19.2	1.0	0.0	2	296.5	1303.8	0.0	1	1.5	17000	1.1	2.5
16305	2.5	2.0	7.1	20.4	1.0	0.0	2	304.6	1395.5	0.0	1	1.5	17000	1.0	2.5
16130	2.5	1.7	7.7	19.4	1.0	0.0	2	323.4	1368.9	0.0	1	1.5	17000	0.7	2.5
15960	2.5	1.6	7.1	19.6	1.0	0.0	2	294.6	1437.6	0.0	1	1.5	17000	0.6	2.5
15745	2.5	1.6	7.0	19.6	1.0	0.0	2	295.8	1401.3	0.0	1	1.5	17000	0.6	2.5
15540	2.5	1.6	6.6	19.2	1.0	0.0	2	344.9	2361.2	0.0	1	1.5	17000	0.6	2.5
15335	2.5	1.7	8.9	18.8	1.0	0.0	2	348.6	1064.1	0.0	1	1.5	17000	0.7	2.5
15125	2.5	1.4	9.8	18.0	1.0	0.0	2	437.3	1053.5	0.0	1	1.5	17000	0.4	2.5
14900	2.5	1.4	8.8	16.7	1.0	0.0	2	584.1	2233.1	0.0	1	1.5	17000	0.4	2.5
14720	2.5	1.5	8.5	16.4	1.0	0.0	2	532.9	2020.9	0.0	1	1.5	17000	0.5	2.5
14480	2.5	1.5	7.4	16.4	1.0	0.0	2	819.8	1851.8	0.0	1	1.5	17000	0.5	2.5
14315	2.5	1.6	6.8	16.0	1.0	0.0	2	1014.4	1944.1	0.0	1	1.5	17000	0.6	2.5
14090	2.5	1.6	6.7	14.8	1.0	0.0	2	787.4	1816.2	0.0	1	1.5	17000	0.6	2.5
13850	2.5	1.6	6.6	15.6	1.0	0.0	2	582.7	1774.9	0.0	1	1.5	17000	0.6	2.5
13635	2.5	1.8	7.3	16.5	1.0	0.0	2	631.2	1818.0	0.0	1	1.5	17000	0.7	2.5
13425	2.5	1.8	5.7	16.8	1.0	0.0	2	576.3	1936.1	0.0	1	1.5	17000	0.7	2.5
13190	2.5	1.9	5.6	17.1	1.0	0.0	2	713.9	1911.1	0.0	1	1.5	17000	0.8	2.5
13030	4.2	4.2	6.0	17.6	1.0	2.1	2	712.9	1863.7	0.1	1	1.5	17000	1.0	2.5
12835	4.7	4.7	6.2	18.0	1.0	2.1	2	799.4	1775.1	0.1	1	1.5	17000	1.5	2.5
12615	5.2	5.2	6.5	18.3	1.0	2.1	2	741.8	1566.5	0.0	1	1.5	17000	2.1	2.5
12395	5.1	5.1	6.7	18.7	1.0	2.1	2	738.1	1543.0	0.0	1	1.5	17000	2.0	2.5
12195	4.2	4.2	6.5	19.1	1.0	2.1	2	990.8	1463.7	0.0	1	1.5	17000	1.1	2.5
11995	4.1	4.1	7.4	20.3	1.0	2.1	2	589.4	1448.5	0.0	1	1.5	17000	1.0	2.5
11780	4.0	4.0	7.3	20.6	1.0	2.1	2	590.4	1460.8	0.0	1	1.5	17000	0.9	2.5
11605	4.0	4.0	7.9	20.3	1.0	2.1	2	587.6	1417.5	0.0	1	1.5	17000	0.9	2.5
11405	3.9	3.9	8.7	20.6	1.0	2.1	2	579.7	1144.9	0.0	1	1.5	17000	0.8	2.5
11180	3.9	3.9	10.7	19.7	1.0	2.1	2	580.2	1009.2	0.0	1	1.5	17000	0.8	2.5
11015	3.8	3.8	12.6	18.7	3.1	0.0	2	519.8	851.0	0.0	1	1.5	17000	0.7	2.5
10835	3.7	3.7	12.2	17.1	3.1	0.0	2	510.4	1073.0	0.0	1	1.5	17000	0.6	2.5
10575	3.8	3.8	9.1	16.1	3.1	0.0	2	534.5	1322.2	0.0	1	1.5	17000	0.7	2.5
10390	3.1	3.1	8.6	17.1	3.1	0.0	2	598.1	1517.0	0.0	1	1.5	17000	0.0	2.5
10225	3.1	3.1	8.0	16.6	3.1	0.0	2	606.9	1543.4	0.0	1	1.5	17000	0.0	2.5
10000	3.1	3.1	8.1	16.6	3.1	0.0	2	685.3	1626.0	0.0	1	1.5	17000	0.0	2.5
9820	3.1	3.1	7.9	17.4	3.1	0.0	2	773.4	1648.8	0.0	1	1.5	17000	0.0	2.5
9595	3.1	3.1	7.8	16.1	3.1	0.0	2	698.1	1719.6	0.0	1	1.5	17000	0.0	2.5
9385	3.1	3.1	7.2	15.6	3.1	0.0	2	694.0	1799.3	0.0	1	1.5	17000	0.0	2.5
9220	3.1	3.1	6.8	15.6	3.1	0.0	2	645.1	1853.4	0.0	1	1.5	17000	0.0	2.5
9025	3.1	3.1	7.0	15.6	3.1	0.0	2	537.6	1822.9	0.0	1	1.5	17000	0.0	2.5
MAX=	5.2	5.2			3.1					0.3				3.7	2.5
MIN=	2.5	1.4			1.0					0.0				0.0	2.5

CALCULATIONS FOR TOTAL FREEBOARD BY INDIVIDUAL ADJUSTMENT COMPONENT BASED ON LACH&SM - SANTA CLARA RIVER PROPOSED CONDITIONS STRAIGHT-INSIDE CURVED REACH Q_{CAP} n=0.085

SECTION	Y_{MAX}	Y_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Y_{AGG}+	Y_{GA}+	CHANNEL TYPE	BOTTOM WIDTH (FT)	TOP WIDTH (FT)	Y_{SE}+	BEND COEFF	SIDE SLOPE	RADIUS	H/2	Y_{DM}
46195	3.1	3.1	10.7	28.1	1.0	0.6	2	215.7	750.8	0.0	0	1.5	9000	1.5	2.5
46020	3.0	3.0	10.2	30.0	1.0	0.6	2	162.7	570.2	0.0	0	1.5	9000	1.4	2.5
45545	3.4	3.4	11.6	27.8	1.0	0.6	2	151.3	524.2	0.0	0	1.5	9000	1.8	2.5
45030	3.0	3.0	10.3	29.2	1.0	0.6	2	222.6	558.0	0.0	0	1.5	9000	1.4	2.5
44585	3.2	3.2	10.7	28.6	1.0	0.6	2	163.7	654.4	0.0	0	1.5	9000	1.6	2.5
44210	2.9	2.9	10.0	27.8	1.0	0.6	2	204.3	620.0	0.0	0	1.5	9000	1.3	2.5
43820	3.9	3.9	14.2	24.1	1.0	0.2	2	207.8	528.7	0.0	0	1.5	9000	2.7	2.5
43610	4.0	4.0	14.4	21.3	1.0	0.2	2	242.1	536.9	0.0	0	1.5	9000	2.8	2.5
43410	3.6	3.6	13.3	19.8	1.0	0.2	2	312.8	729.1	0.0	0	1.5	9000	2.4	2.5
43200	3.5	3.5	13.0	19.2	1.0	0.2	2	308.4	779.5	0.0	0	1.5	9000	2.3	2.5
42975	2.7	2.7	10.7	19.0	1.0	0.2	2	410.5	955.8	0.0	0	1.5	9000	1.5	2.5
42815	2.5	2.3	9.1	18.7	1.0	0.2	2	380.4	1120.8	0.0	0	1.5	9000	1.1	2.5
42590	2.5	2.0	7.7	18.4	1.0	0.2	2	451.9	1230.7	0.0	0	1.5	9000	0.8	2.5
42430	2.5	2.0	7.6	19.5	1.0	0.2	2	445.9	1334.9	0.0	0	1.5	9000	0.8	2.5
42215	2.5	1.8	6.6	20.7	1.0	0.2	2	493.2	1374.6	0.0	0	1.5	9000	0.6	2.5
41940	2.5	1.7	6.4	20.6	1.0	0.2	2	454.2	1327.0	0.0	0	1.5	9000	0.5	2.5
41730	2.5	1.8	6.9	20.6	1.0	0.2	2	404.1	1221.5	0.0	0	1.5	9000	0.6	2.5
41460	2.5	1.9	7.4	21.2	1.0	0.2	2	365.7	1121.0	0.0	0	1.5	9000	0.7	2.5
41280	2.5	2.0	8.7	20.8	1.0	0.0	2	342.4	1193.2	0.0	0	1.5	9000	1.0	2.5
41080	2.5	2.0	8.6	20.5	1.0	0.0	2	429.5	1136.8	0.0	0	1.5	9000	1.0	2.5
40825	2.5	1.7	7.3	19.8	1.0	0.0	2	426.6	1213.0	0.0	0	1.5	9000	0.7	2.5
40585	2.5	1.7	7.1	20.3	1.0	0.0	2	404.3	1247.2	0.0	0	1.5	9000	0.7	2.5
40335	2.5	1.5	6.1	21.4	1.0	0.0	2	397.2	1288.6	0.0	0	1.5	9000	0.5	2.5
40130	2.5	1.6	6.6	21.6	1.0	0.0	2	311.3	1264.5	0.0	0	1.5	9000	0.6	2.5
39945	2.5	1.6	6.8	21.9	1.0	0.0	2	293.8	1212.3	0.0	0	1.5	9000	0.6	2.5
39755	2.5	2.0	8.6	20.6	1.0	0.0	2	296.7	1088.1	0.0	0	1.5	9000	1.0	2.5
39605	2.5	2.0	8.5	20.7	1.0	0.0	2	348.8	1074.7	0.0	0	1.5	9000	1.0	2.5
39310	2.5	2.0	8.4	20.2	1.0	0.0	2	323.4	977.3	0.0	0	1.5	9000	1.0	2.5
39100	2.5	1.9	8.2	21.1	1.0	0.0	2	436.5	831.5	0.0	0	1.5	9000	0.9	2.5
38925	2.5	1.8	7.8	20.8	1.0	0.0	2	422.3	906.7	0.0	0	1.5	9000	0.8	2.5
38710	2.5	2.0	8.1	21.2	1.0	0.1	2	394.9	844.1	0.0	0	1.5	9000	0.9	2.5
38475	2.6	2.6	10.4	21.0	1.0	0.1	2	375.1	695.3	0.0	0	1.5	9000	1.5	2.5
38300	2.5	2.3	9.6	20.3	1.0	0.1	2	407.6	716.8	0.0	0	1.5	9000	1.2	2.5
38065	2.5	2.3	9.6	20.1	1.0	0.1	2	569.0	691.3	0.0	0	1.5	9000	1.2	2.5
37810	2.8	2.8	11.3	18.4	1.0	0.1	2	546.8	648.4	0.0	0	1.5	9000	1.7	2.5
37655	2.6	2.6	10.6	17.9	1.0	0.1	2	348.9	738.9	0.0	0	1.5	9000	1.5	2.5
37390	2.5	2.0	8.2	17.5	1.0	0.1	2	803.3	869.1	0.0	0	1.5	9000	0.9	2.5
37135	2.5	2.1	8.7	16.8	1.0	0.1	2	564.0	863.7	0.0	0	1.5	9000	1.0	2.5
36930	2.5	2.0	8.3	17.7	1.0	0.1	2	708.3	923.7	0.0	0	1.5	9000	0.9	2.5
36735	2.5	2.0	8.1	17.6	1.0	0.1	2	633.8	963.2	0.0	0	1.5	9000	0.9	2.5
36515	2.5	1.8	7.4	18.6	1.0	0.1	2	532.1	1032.7	0.0	0	1.5	9000	0.7	2.5
36265	2.5	1.8	7.1	18.3	1.0	0.1	2	359.0	1176.0	0.0	0	1.5	9000	0.7	2.5
36080	2.5	1.8	7.8	17.6	1.0	0.0	2	326.3	1176.0	0.0	0	1.5	9000	0.8	2.5
35845	2.5	1.7	7.0	18.1	1.0	0.0	2	376.2	1512.8	0.0	0	1.5	9000	0.7	2.5
35725	2.5	1.9	8.0	18.3	1.0	0.0	2	378.2	1488.9	0.0	0	1.5	9000	0.9	2.5
35515	2.5	2.0	8.5	17.9	1.0	0.0	2	379.3	1501.0	0.0	0	1.5	9000	1.0	2.5
35245	2.5	1.9	8.3	17.0	1.0	0.0	2	414.3	1580.3	0.0	0	1.5	9000	0.9	2.5
35040	2.5	2.0	8.8	16.6	1.0	0.0	2	440.9	1491.6	0.0	0	1.5	9000	1.0	2.5
34860	2.5	1.8	7.7	16.3	1.0	0.0	2	432.9	1431.5	0.0	0	1.5	9000	0.8	2.5
34720	2.5	1.7	7.4	15.8	1.0	0.0	2	545.6	1449.9	0.0	0	1.5	9000	0.7	2.5
34495	2.5	1.7	7.2	15.7	1.0	0.0	2	504.6	1461.5	0.0	0	1.5	9000	0.7	2.5
34310	2.5	1.9	8.1	15.4	1.0	0.0	2	684.5	1384.9	0.0	0	1.5	9000	0.9	2.5
34090	2.5	1.8	7.5	15.0	1.0	0.0	2	787.5	1371.0	0.0	0	1.5	9000	0.8	2.5
33880	2.5	1.9	7.3	15.7	1.0	0.2	2	761.0	1482.9	0.0	0	1.5	9000	0.7	2.5
33710	2.5	1.9	7.0	15.6	1.0	0.2	2	719.2	1637.9	0.0	0	1.5	9000	0.7	2.5
33500	2.5	1.9	7.0	15.3	1.0	0.2	2	666.4	1755.5	0.0	0	1.5	9000	0.7	2.5
33310	2.5	1.7	6.2	15.3	1.0	0.2	2	609.9	1828.2	0.0	0	1.5	9000	0.5	2.5
33115	2.5	1.6	5.8	15.4	1.0	0.2	2	667.8	1927.1	0.0	0	1.5	9000	0.4	2.5
32795	2.5	1.7	6.3	15.7	1.0	0.2	2	697.6	1920.8	0.0	0	1.5	9000	0.5	2.5

DEFINITIONS

Y_{MAX} = GREATER OF THE DM AND S&H HEIGHTS

Y_{TOT}=TOTAL EMBANKMENT PROTECTION IN FEET BASED ON THE H&S

V(FPS) =VELOCITY IN FEET PER SECOND

FLOW DEPTH=WATER DEPTH IN CHANNEL IN FEET

Y_{AGG}=LONG TERM AGGRADATION IN FEET

Y_{GA}=GENERAL AGGRADATION IN FEET FROM SAM

CHANNEL TYPE=CHANNEL SHAPE/FLOW FACTOR:
IF Fr<1, RECTANGULAR = 0; IF Fr>1, RECTANGULAR = 1;
IF Fr<1, TRAPEZOIDAL = 2; IF Fr>1, TRAPEZOIDAL = 3.

Y_{SE}=SUPER ELEVATION IN FEET

BEND COEFF=BEND COEFFICIENT; IF NO BEND=0, BEND=1

SIDE SLOPE=CHANNEL SIDE SLOPE (H:V), UNITLESS

BOTTOM WIDTH=CHANNEL BOTTOM WIDTH IN FEET, $Q_{2\text{-}YEAR}$ TOP WIDTH

RADIUS=RADIUS OF CURVATURE TO CENTERLINE IN FEET

H/2=HALF BEDFORM HEIGHT IN FEET, LIMITED TO FLOW DEPTH,
AFTER KENNEDY (1963)

Y_{DM} = EMBANKMENT PROTECTION REQUIRED BY THE LACFCDDM IN FEET

GENERAL

THIS SPREADSHEET IS DESIGNED TO CALCULATE TOP PROTECTION (FREE BOARD) BASED ON LACDWP COUNTY HYDROLOGY MANUAL (1991) PAGES 5.8-5.9 AND ASSOCIATED APPENDICES (SEDIMENTATION MANUAL). ALL VELOCITIES ARE IN FPS, WITH NO MAXIMUM VALUE. THE USER SHOULD CONSIDER A PRACTICAL MAXIMUM OF APPROXIMATELY 20-30 FPS. THE PRESENT VERSION (8/05) WILL CALCULATE UP TO 100 VELOCITIES AT ONE TIME. LONG TERM AGGRADATION IS USER SUPPLIED. GENERAL AGGRADATION IS ALSO USER SUPPLIED. SUPER ELEVATION AT BENDS IS BASED ON LACFCDDM EQUATIONS FOUND IN C-3.1. BEDFORM HEIGHT, LIMITED TO FLOW DEPTH AFTER KENNEDY (1963), IS BASED ON EQUATIONS IN APPENDIX Q13. IF FLOW IS SUPERCRITICAL SPREADSHEET REPORTS LACFCDDM TOTAL WALL HEIGHT INSTEAD OF FREEBOARD. LOS ANGELES COUNTY FLOOD CONTROL DISTRICT DESIGN MANUAL (LACFCDDM) VALUES ARE PRESENTED AS A PART OF LACH&SM CALCULATIONS. THE SPREADSHEET CALCULATES THE GREATER OF THE TWO METHODOLOGIES. BOTTOM WIDTH IS BASED ON THE 2-YEAR WATER SURFACE AFTER ACOE PROCEDURES.

COLOR CODES

OUTPUT
DATA FROM HEC-RAS
USER SUPPLIED DATA
INTERMEDIATE CALCULATIONS (INDIVIDUAL SHEETS ONLY)

DESIGNED BY DAVID A JAFFE, PHD, PE
PACIFIC ADVANCED CIVIL ENGINEERING, INC
AUGUST, 2005

SECTION	Y_{MAX}	Y_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Y_{AGG}+	Y_{GA}+	CHANNEL TYPE	BOTTOM WIDTH (FT)	TOP WIDTH (FT)	Y_{SF}+	BEND COEFF	SIDE SLOPE	RADIUS	H/2	Y_{DM}
32605	2.5	1.7	6.1	16.7	1.0	0.2	2	652.8	2407.4	0.0	0	1.5	9000	0.5	2.5
32265	2.5	2.2	5.5	17.2	1.0	0.8	2	651.0	2840.2	0.0	0	1.5	9000	0.4	2.5
31875	2.5	2.2	5.3	16.6	1.0	0.8	2	562.0	2593.1	0.0	0	1.5	9000	0.4	2.5
31585	2.5	2.1	5.0	18.7	1.0	0.8	2	619.5	2377.5	0.0	0	1.5	9000	0.3	2.5
31360	2.5	2.2	5.5	19.9	1.0	0.8	2	672.2	1959.5	0.0	0	1.5	9000	0.4	2.5
31060	2.5	2.1	5.1	21.2	1.0	0.8	2	955.0	1975.9	0.0	0	1.5	9000	0.3	2.5
30720	2.5	2.1	4.6	22.5	1.0	0.8	2	772.7	1911.5	0.0	0	1.5	9000	0.3	2.5
30445	2.5	2.1	4.6	24.1	1.0	0.8	2	700.9	1841.8	0.0	0	1.5	9000	0.3	2.5
30095	2.5	2.2	5.2	25.5	1.0	0.8	2	617.1	1637.3	0.0	0	1.5	9000	0.4	2.5
29815	2.5	2.3	6.1	25.8	1.0	0.8	2	551.1	1445.2	0.0	0	1.5	9000	0.5	2.5
29565	2.5	2.3	6.0	26.3	1.0	0.8	2	461.8	1334.9	0.0	0	1.5	9000	0.5	2.5
29385	2.5	2.4	6.8	26.6	1.0	0.8	2	381.5	1249.1	0.0	0	1.5	9000	0.6	2.5
29140	2.5	1.8	7.9	26.4	1.0	0.0	2	217.2	1095.0	0.0	0	1.5	9000	0.8	2.5
28895	4.7	4.7	16.5	23.8	1.0	0.0	2	201.9	978.0	0.0	0	1.5	9000	3.7	2.5
28695	2.5	2.2	9.4	24.9	1.0	0.0	2	269.6	951.6	0.0	0	1.5	9000	1.2	2.5
28500	2.9	2.9	12.0	23.0	1.0	0.0	2	326.0	1039.5	0.0	0	1.5	9000	1.9	2.5
28280	2.5	2.0	8.7	23.8	1.0	0.0	2	379.1	1003.9	0.0	0	1.5	9000	1.0	2.5
28080	2.5	1.9	8.3	24.1	1.0	0.0	2	416.6	945.4	0.0	0	1.5	9000	0.9	2.5
27925	2.5	2.2	9.6	24.1	1.0	0.0	2	402.0	884.9	0.0	0	1.5	9000	1.2	2.5
27725	2.9	2.9	11.9	23.1	1.0	0.0	2	386.2	811.8	0.0	0	1.5	9000	1.9	2.5
27545	3.1	3.1	12.4	22.3	1.0	0.0	2	409.6	852.5	0.0	0	1.5	9000	2.1	2.5
27335	2.6	2.6	10.9	22.0	1.0	0.0	2	422.5	937.2	0.0	0	1.5	9000	1.6	2.5
27155	2.8	2.8	11.4	21.0	1.0	0.0	2	452.4	978.1	0.0	0	1.5	9000	1.8	2.5
26990	2.5	2.2	9.4	20.4	1.0	0.0	2	440.9	1020.9	0.0	0	1.5	9000	1.2	2.5
26780	2.5	2.0	8.8	21.3	1.0	0.0	2	527.5	1106.5	0.0	0	1.5	9000	1.0	2.5
26575	2.5	1.7	7.3	21.5	1.0	0.0	2	513.5	1243.6	0.0	0	1.5	3000	0.7	2.5
26355	2.5	1.9	7.4	21.6	1.0	0.0	2	601.4	1294.5	0.0	0	1.5	3000	0.9	2.5
26170	2.5	2.1	7.7	21.9	1.0	0.0	2	457.8	1301.2	0.0	0	1.5	3000	1.1	2.5
25965	2.5	2.3	7.5	22.2	1.0	0.0	2	568.4	1313.2	0.0	0	1.5	3000	1.3	2.5
25785	2.5	2.4	7.5	22.0	1.0	0.0	2	550.9	1256.9	0.0	0	1.5	3000	1.4	2.5
25600	2.5	2.3	7.8	22.3	1.0	0.0	2	478.1	1149.9	0.0	0	1.5	3000	1.3	2.5
25425	2.5	2.3	7.3	23.1	1.0	0.0	2	399.8	1138.3	0.0	0	1.5	3000	1.3	2.5
25215	2.5	2.2	7.3	23.3	1.0	0.0	2	444.6	1133.6	0.0	0	1.5	3000	1.2	2.5
25000	2.5	2.3	7.3	23.5	1.0	0.0	2	453.1	1093.8	0.0	0	1.5	3000	1.3	2.5
24795	3.4	3.4	8.0	23.5	1.9	0.2	2	391.4	986.5	0.0	0	1.5	3000	1.3	2.5
24550	3.3	3.3	8.9	24.1	1.9	0.2	2	334.0	887.1	0.0	0	1.5	3000	1.2	2.5
24335	3.6	3.6	9.9	23.5	1.9	0.2	2	337.2	800.3	0.0	0	1.5	3000	1.5	2.5
24115	3.5	3.5	10.0	23.0	1.9	0.2	2	422.7	793.2	0.0	0	1.5	3000	1.4	2.5
23975	3.3	3.3	9.7	22.6	1.9	0.2	2	354.1	828.2	0.0	0	1.5	3000	1.2	2.5
23755	3.1	3.1	9.9	22.7	1.9	0.2	2	333.9	939.2	0.0	0	1.5	3000	1.0	2.5
23565	3.4	3.4	9.4	23.6	1.9	0.2	2	322.2	941.5	0.0	0	1.5	3000	1.3	2.5
23365	3.2	3.2	9.4	22.4	1.9	0.2	2	329.4	987.4	0.0	0	1.5	3000	1.1	2.5
23180	3.0	3.0	9.6	22.5	1.9	0.2	2	400.7	975.5	0.0	0	1.5	3000	0.9	2.5
23000	3.0	3.0	9.5	22.0	1.9	0.2	2	407.6	784.0	0.0	0	1.5	3000	0.9	2.5
22790	3.0	3.0	10.6	20.0	1.9	0.2	2	425.5	784.0	0.0	0	1.5	3000	0.9	2.5
22600	2.9	2.9	10.2	19.8	1.9	0.2	2	386.7	1050.2	0.0	0	1.5	3000	0.8	2.5
22415	2.9	2.9	9.3	18.9	1.9	0.2	2	422.3	1091.6	0.0	0	1.5	3000	0.8	2.5
22195	2.5	2.2	8.4	19.1	1.4	0.0	2	371.3	1464.0	0.0	0	1.5	3000	0.8	2.5
22010	2.5	2.2	9.8	19.4	1.4	0.0	2	471.8	1735.1	0.0	0	1.5	3000	0.8	2.5
21790	2.5	2.4	9.0	18.4	1.4	0.0	2	549.9	1778.4	0.0	0	1.5	3000	1.0	2.5
21615	2.5	2.3	8.0	16.9	1.4	0.0	2	563.1	1687.7	0.0	0	1.5	3000	0.9	2.5
21440	2.5	2.2	8.2	17.8	1.4	0.0	2	638.9	1653.0	0.0	0	1.5	3000	0.8	2.5
21225	2.5	2.1	8.0	18.7	1.4	0.0	2	352.4	1600.8	0.0	0	1.5	3000	0.7	2.5
21020	2.5	2.1	7.8	18.6	1.4	0.0	2	675.0	1607.4	0.0	0	1.5	3000	0.7	2.5
20845	2.5	2.2	7.9	18.7	1.4	0.0	2	613.7	1605.1	0.0	0	1.5	3000	0.8	2.5
20595	2.5	2.0	7.5	18.6	1.4	0.0	2	744.5	1600.4	0.0	0	1.5	3000	0.6	2.5
20435	2.5	2.0	7.9	18.8	1.4	0.0	2	765.2	1613.5	0.0	0	1.5	3000	0.6	2.5
20280	2.5	2.0	8.7	18.1	1.4	0.0	2	439.6	1636.3	0.0	0	1.5	3000	0.6	2.5
20070	2.5	1.9	8.3	18.6	1.4	0.0	2	602.4	1797.8	0.0	0	1.5	3000	0.5	2.5
19855	2.9	2.9	7.7	19.1	1.0	1.4	2	585.9	1809.6	0.0	0	1.5	3000	0.5	2.5
19630	2.9	2.9	7.4	18.6	1.0	1.4	2	634.2	1833.7	0.0	0	1.5	3000	0.5	2.5
19440	3.0	3.0	7.2	19.9	1.0	1.4	2	536.3	1986.1	0.0	0	1.5	3000	0.6	2.5

SECTION	Y_{MAX}	Y_{TOT}=	V (FPS)	FLOW DEPTH (FT)	Y_{AGG}+	Y_{GA}+	CHANNEL TYPE	BOTTOM WIDTH (FT)	TOP WIDTH (FT)	Y_{SE}+	BEND COEFF	SIDE SLOPE	RADIUS	H/2	Y_{DM}
19240	**3.4**	3.4	7.6	19.4	1.0	1.4	2	445.4	1738.0	0.0	0	1.5	3000	1.0	2.5
19050	**4.1**	4.1	6.7	20.2	1.0	1.4	2	418.1	1753.4	0.0	0	1.5	3000	1.7	2.5
18830	**4.0**	4.0	6.8	21.4	1.0	1.4	2	338.9	1684.0	0.0	0	1.5	3000	1.6	2.5
18650	**4.0**	4.0	6.7	21.2	1.0	1.4	2	339.7	1686.2	0.0	0	1.5	3000	1.6	2.5
18475	**3.4**	3.4	5.8	22.3	1.0	1.4	2	336.6	1665.9	0.0	0	1.5	3000	1.0	2.5
18290	**3.2**	3.2	6.3	22.1	1.0	1.4	2	365.1	1631.9	0.0	0	1.5	3000	0.8	2.5
18025	**3.1**	3.1	5.8	22.9	1.0	1.4	2	380.4	1557.4	0.0	0	1.5	17000	0.7	2.5
17785	**3.2**	3.2	6.4	24.0	1.0	1.4	2	389.3	1444.1	0.0	0	1.5	17000	0.8	2.5
17510	**2.5**	1.7	8.4	22.4	1.0	0.0	2	326.3	1398.9	0.0	0	1.5	17000	0.7	2.5
17360	**2.5**	1.7	11.1	20.3	1.0	0.0	2	223.6	1303.3	0.0	0	1.5	17000	0.7	2.5
17110	**2.5**	1.6	11.0	21.5	1.0	0.0	2	228.7	1229.6	0.0	0	1.5	17000	0.6	2.5
16970	**2.5**	2.1	10.7	20.3	1.0	0.0	2	235.7	1196.0	0.0	0	1.5	17000	1.1	2.5
16720	**2.5**	2.3	8.5	18.8	1.0	0.0	2	260.0	1182.0	0.0	0	1.5	17000	1.3	2.5
16515	**2.5**	2.1	7.7	19.2	1.0	0.0	2	296.5	1303.8	0.0	0	1.5	17000	1.1	2.5
16305	**2.5**	2.0	7.1	20.4	1.0	0.0	2	304.6	1395.5	0.0	0	1.5	17000	1.0	2.5
16130	**2.5**	1.7	7.7	19.4	1.0	0.0	2	323.4	1368.9	0.0	0	1.5	17000	0.7	2.5
15960	**2.5**	1.6	7.1	19.6	1.0	0.0	2	294.6	1437.6	0.0	0	1.5	17000	0.6	2.5
15745	**2.5**	1.6	7.0	19.6	1.0	0.0	2	295.8	1401.3	0.0	0	1.5	17000	0.6	2.5
15540	**2.5**	1.6	6.6	19.2	1.0	0.0	2	344.9	2361.2	0.0	0	1.5	17000	0.6	2.5
15335	**2.5**	1.7	8.9	18.8	1.0	0.0	2	348.6	1064.1	0.0	0	1.5	17000	0.7	2.5
15125	**2.5**	1.4	9.8	18.0	1.0	0.0	2	437.3	1053.5	0.0	0	1.5	17000	0.4	2.5
14900	**2.5**	1.4	8.8	16.7	1.0	0.0	2	584.1	2233.1	0.0	0	1.5	17000	0.4	2.5
14720	**2.5**	1.5	8.5	16.4	1.0	0.0	2	532.9	2020.9	0.0	0	1.5	17000	0.5	2.5
14480	**2.5**	1.5	7.4	16.4	1.0	0.0	2	819.8	1851.8	0.0	0	1.5	17000	0.5	2.5
14315	**2.5**	1.6	6.8	16.0	1.0	0.0	2	1014.4	1944.1	0.0	0	1.5	17000	0.6	2.5
14090	**2.5**	1.6	6.7	14.8	1.0	0.0	2	787.4	1816.2	0.0	0	1.5	17000	0.6	2.5
13850	**2.5**	1.6	6.6	15.6	1.0	0.0	2	582.7	1774.9	0.0	0	1.5	17000	0.6	2.5
13635	**2.5**	1.7	7.3	16.5	1.0	0.0	2	631.2	1818.0	0.0	0	1.5	17000	0.7	2.5
13425	**2.5**	1.7	5.7	16.8	1.0	0.0	2	576.3	1936.1	0.0	0	1.5	17000	0.7	2.5
13190	**2.5**	1.8	5.6	17.1	1.0	0.0	2	713.9	1911.1	0.0	0	1.5	17000	0.8	2.5
13030	**4.1**	4.1	6.0	17.6	1.0	2.1	2	712.9	1863.7	0.0	0	1.5	17000	1.0	2.5
12835	**4.6**	4.6	6.2	18.0	1.0	2.1	2	799.4	1775.1	0.0	0	1.5	17000	1.5	2.5
12615	**5.2**	5.2	6.5	18.3	1.0	2.1	2	741.8	1566.5	0.0	0	1.5	17000	2.1	2.5
12395	**5.1**	5.1	6.7	18.7	1.0	2.1	2	738.1	1543.0	0.0	0	1.5	17000	2.0	2.5
12195	**4.2**	4.2	6.5	19.1	1.0	2.1	2	990.8	1463.7	0.0	0	1.5	17000	1.1	2.5
11995	**4.1**	4.1	7.4	20.3	1.0	2.1	2	589.4	1448.5	0.0	0	1.5	17000	1.0	2.5
11780	**4.0**	4.0	7.3	20.6	1.0	2.1	2	590.4	1460.8	0.0	0	1.5	17000	0.9	2.5
11605	**4.0**	4.0	7.9	20.3	1.0	2.1	2	587.6	1417.5	0.0	0	1.5	17000	0.9	2.5
11405	**3.9**	3.9	8.7	20.6	1.0	2.1	2	579.7	1144.9	0.0	0	1.5	17000	0.8	2.5
11180	**3.9**	3.9	10.7	19.7	1.0	2.1	2	580.2	1009.2	0.0	0	1.5	17000	0.8	2.5
11015	**3.8**	3.8	12.6	18.7	3.1	0.0	2	519.8	851.0	0.0	0	1.5	17000	0.7	2.5
10835	**3.7**	3.7	12.2	17.1	3.1	0.0	2	510.4	1073.0	0.0	0	1.5	17000	0.6	2.5
10575	**3.8**	3.8	9.1	16.1	3.1	0.0	2	534.5	1322.2	0.0	0	1.5	17000	0.7	2.5
10390	**3.1**	3.1	8.6	17.1	3.1	0.0	2	598.1	1517.0	0.0	0	1.5	17000	0.0	2.5
10225	**3.1**	3.1	8.0	16.6	3.1	0.0	2	606.9	1543.4	0.0	0	1.5	17000	0.0	2.5
10000	**3.1**	3.1	8.1	16.6	3.1	0.0	2	685.3	1626.0	0.0	0	1.5	17000	0.0	2.5
9820	**3.1**	3.1	7.9	17.4	3.1	0.0	2	773.4	1648.8	0.0	0	1.5	17000	0.0	2.5
9595	**3.1**	3.1	7.8	16.1	3.1	0.0	2	698.1	1719.6	0.0	0	1.5	17000	0.0	2.5
9385	**3.1**	3.1	7.2	15.6	3.1	0.0	2	694.0	1799.3	0.0	0	1.5	17000	0.0	2.5
9220	**3.1**	3.1	6.8	15.6	3.1	0.0	2	645.1	1853.4	0.0	0	1.5	17000	0.0	2.5
9025	**3.1**	3.1	7.0	15.6	3.1	0.0	2	537.6	1822.9	0.0	0	1.5	17000	0.0	2.5
MAX=	**5.2**	5.2			3.1					0.0				3.7	2.5
MIN=	**2.5**	1.4			1.0					0.0				0.0	2.5

Santa Clara River Fluvial Study

APPENDIX CHAPTER 6.3

Summary of Appendix 6
Toedown & Freeboard
Proposed Condition
Curved & Straight Reaches

PACE
PACIFIC ADVANCED CIVIL ENGINEERING, INC.

Table A6.3: Santa Clara River Appendix 6 Summary of Proposed Toe-down & Freeboard (ft)

Subreach	HEC-RAS Station	Z_{99} [2]	Outside Curved Reach: Total Degradation (H&S w/ SAM) [3]	Outside Curved Reach: Proposed Toe-down Elevation [1,4]	Straight-Inside Curved Reach: Total Degradation (H&S w/ SAM) [3]	Straight-Inside Curved Reach: Proposed Toe-down Elevation [1,4]	WSE	Outside Curved Reach: Total Freeboard (H&S w/ SAM) [3]	Outside Curved Reach: Proposed Top of Levee Elevation [2]	Straight-Inside Curved Reach: Total Freeboard (H&S w/ SAM) [4]	Straight-Inside Curved Reach: Proposed Top of Levee Elevation [1]
SRA1	46195	1035.0	11.1	1023.9	11.1	1023.9	1063.1	3.1	1066.3	3.1	1066.3
	46020	1032.0	12.7	1019.3	12.7	1019.3	1062.0	3.0	1065.0	3.0	1065.0
	45545	1030.0	10.4	1019.6	10.4	1019.6	1057.9	3.4	1061.3	3.4	1061.3
	45030	1025.0	13.1	1011.9	13.1	1011.9	1054.2	3.0	1057.3	3.0	1057.3
	44585	1022.0	9.8	1012.2	9.8	1012.2	1050.6	3.2	1053.8	3.2	1053.8
	44210	1020.0	12.5	1007.5	12.5	1007.5	1047.8	2.9	1050.8	2.9	1050.8
SRA2	43820	1018.0	15.4	1002.6	15.4	1002.6	1042.1	3.9	1046.0	3.9	1046.0
	43610	1017.0	17.0	1000.0	17.0	1000.0	1038.3	4.0	1042.2	4.0	1042.2
	43410	1016.0	15.8	1000.2	15.8	1000.2	1035.8	3.6	1039.4	3.6	1039.4
	43200	1014.0	16.3	997.7	16.3	997.7	1033.2	3.5	1036.7	3.5	1036.7
	42975	1012.0	15.5	996.5	15.5	996.5	1031.0	2.9	1033.8	2.7	1033.7
	42815	1011.0	15.5	995.5	15.5	995.5	1029.7	2.5	1032.2	2.5	1032.2
	42590	1010.0	15.1	994.9	14.7	995.3	1028.4	2.5	1030.9	2.5	1030.9
	42430	1008.0	15.4	992.6	15.3	992.7	1027.5	2.5	1030.0	2.5	1030.0
	42215	1006.0	15.2	990.8	14.7	991.3	1026.7	2.5	1029.2	2.5	1029.2
	41940	1005.0	13.4	991.6	11.9	993.1	1025.6	2.5	1028.1	2.5	1028.1
	41730	1004.0	13.2	990.8	12.0	992.0	1024.6	2.5	1027.1	2.5	1027.1
	41460	1002.0	12.8	989.2	11.9	990.1	1023.2	2.5	1025.7	2.5	1025.7
SRA3	41280	1001.0	10.9	990.1	10.9	990.1	1021.8	2.5	1024.3	2.5	1024.3
	41080	1000.0	12.7	987.3	12.7	987.3	1020.5	2.5	1023.0	2.5	1023.0
	40825	999.5	12.2	987.3	11.7	987.8	1019.3	2.5	1021.8	2.5	1021.8
	40585	998.0	11.6	986.4	11.2	986.8	1018.3	2.5	1020.8	2.5	1020.8
	40335	996.0	10.2	985.8	8.8	987.2	1017.4	2.5	1019.9	2.5	1019.9
	40130	995.0	10.3	984.7	9.0	986.0	1016.6	2.5	1019.1	2.5	1019.1
	39945	994.0	10.2	983.8	8.9	985.1	1015.9	2.5	1018.4	2.5	1018.4
	39755	994.0	11.0	983.0	11.0	983.0	1014.6	2.5	1017.1	2.5	1017.1
	39605	993.0	12.5	980.5	12.5	980.5	1013.7	2.5	1016.2	2.5	1016.2
	39310	992.0	11.2	980.8	11.0	981.0	1012.2	2.5	1014.7	2.5	1014.7
	39100	990.0	12.5	977.5	12.5	977.5	1011.1	2.5	1013.6	2.5	1013.6
	38925	989.5	9.5	980.0	9.5	980.0	1010.3	2.5	1012.8	2.5	1012.8
SRA4	38710	988.0	6.7	981.3	6.7	981.3	1009.2	2.5	1011.7	2.5	1011.7
	38475	986.0	9.0	977.0	9.0	977.0	1007.0	2.6	1009.5	2.6	1009.5
	38300	985.5	9.8	975.7	9.8	975.7	1005.8	2.5	1008.3	2.5	1008.3
	38065	984.0	7.6	976.4	7.6	976.4	1004.1	2.5	1006.6	2.5	1006.6
	37810	983.0	9.2	973.8	9.2	973.8	1001.4	2.8	1004.2	2.8	1004.2
	37655	982.0	10.0	972.0	10.0	972.0	999.9	2.6	1002.5	2.6	1002.5
	37390	981.0	8.0	973.0	8.0	973.0	998.5	2.5	1001.0	2.5	1001.0
	37135	980.0	8.4	971.6	8.4	971.6	996.8	2.5	999.3	2.5	999.3
	36930	978.0	8.8	969.3	8.8	969.3	995.7	2.5	998.2	2.5	998.2
	36735	977.0	8.2	968.8	8.2	968.8	994.6	2.5	997.1	2.5	997.1
	36515	975.0	7.3	967.7	6.9	968.1	993.6	2.5	996.1	2.5	996.1
	36265	974.0	7.7	966.3	6.8	967.2	992.3	2.5	994.8	2.5	994.8
SRB1	36080	973.0	22.9	950.1	22.0	951.0	990.6	2.5	993.1	2.5	993.1
	35845	971.0	9.2	961.8	7.5	963.5	989.1	2.5	991.6	2.5	991.6
	35725	970.0	10.7	959.3	8.9	961.1	988.3	2.5	990.8	2.5	990.8
	35515	969.0	11.5	957.5	9.8	959.2	986.9	2.5	989.4	2.5	989.4
	35245	968.0	11.4	956.6	9.9	958.1	985.0	2.5	987.5	2.5	987.5
	35040	967.0	12.7	954.3	11.0	956.0	983.6	2.5	986.1	2.5	986.1
	34860	966.0	11.6	954.4	10.4	955.6	982.3	2.5	984.8	2.5	984.8
	34720	965.5	11.8	953.7	10.4	955.1	981.3	2.5	983.8	2.5	983.8
	34495	964.0	10.9	953.1	10.0	954.0	979.7	2.5	982.2	2.5	982.2
	34310	963.0	10.8	952.2	9.6	953.4	978.4	2.5	980.9	2.5	980.9
	34090	962.0	10.8	951.2	9.7	952.3	977.0	2.5	979.5	2.5	979.5
SRB2	33880	960.0	10.2	949.8	9.1	950.9	975.7	2.5	978.2	2.5	978.2
	33710	959.0	9.9	949.1	8.6	950.4	974.6	2.5	977.1	2.5	977.1
	33500	958.0	10.4	947.6	8.9	949.1	973.3	2.5	975.8	2.5	975.8
	33310	957.0	10.9	946.1	8.7	948.3	972.3	2.5	974.8	2.5	974.8
	33115	956.0	9.0	947.0	6.8	949.2	971.4	2.5	973.9	2.5	973.9
	32795	954.0	9.9	944.1	7.7	946.3	969.7	2.5	972.2	2.5	972.2
	32605	952.0	10.5	941.5	8.2	943.8	968.7	2.5	971.2	2.5	971.2
SRC1	32265	950.0	9.9	940.1	7.4	942.6	967.2	2.5	969.7	2.5	969.7
	31875	949.0	9.1	939.9	6.1	942.9	965.6	2.5	968.1	2.5	968.1
	31585	946.0	8.6	937.4	5.6	940.4	964.7	2.5	967.2	2.5	967.2
	31360	944.0	8.3	935.7	5.4	938.6	963.9	2.5	966.4	2.5	966.4
	31060	942.0	7.5	934.5	4.9	937.1	963.2	2.5	965.7	2.5	965.7
	30720	940.0	7.9	932.1	4.6	935.4	962.5	2.5	965.0	2.5	965.0
	30445	938.0	7.9	930.1	4.5	933.5	962.1	2.5	964.6	2.5	964.6
	30095	936.0	8.1	927.9	4.6	931.4	961.5	2.5	964.0	2.5	964.0
	29815	935.0	7.7	927.3	4.8	930.2	960.8	2.5	963.3	2.5	963.3
	29565	934.0	7.1	926.9	4.7	929.3	960.3	2.5	962.8	2.5	962.8
	29385	933.0	7.0	926.0	4.9	928.1	959.6	2.5	962.1	2.5	962.1
SRC2	29140	932.0	10.4	921.6	9.1	922.9	958.4	2.5	960.9	2.5	960.9
	28895	930.0	13.5	916.5	12.7	917.3	953.8	4.8	958.6	4.7	958.5
	28695	928.0	15.0	913.0	15.0	913.0	952.9	2.5	955.4	2.5	955.4
	28500	927.5	14.7	912.8	14.7	912.8	950.5	3.1	953.5	2.9	953.4
	28280	926.0	13.6	912.4	13.4	912.6	949.8	2.5	952.3	2.5	952.3
	28080	925.0	9.9	915.1	9.7	915.3	949.1	2.5	951.6	2.5	951.6
	27925	924.0	10.3	913.7	10.3	913.7	948.1	2.5	950.6	2.5	950.6
	27725	923.0	12.9	910.1	12.9	910.1	946.1	2.9	949.0	2.9	949.0
	27545	922.0	15.0	907.0	15.0	907.0	944.3	3.1	947.4	3.1	947.4
	27335	921.0	14.1	906.9	14.1	906.9	943.0	2.7	945.7	2.6	945.6
	27155	920.5	12.9	907.6	12.9	907.6	941.5	2.9	944.4	2.8	944.2
SRC3	26990	920.0	11.2	908.8	11.0	909.0	940.4	2.5	942.9	2.5	942.9
	26780	918.0	11.6	906.4	10.9	907.1	939.3	2.5	941.8	2.5	941.8
	26575	917.0	16.0	901.0	10.9	906.1	938.5	2.5	941.0	2.5	941.0
	26355	916.0	15.4	900.6	8.7	907.3	937.6	2.5	940.1	2.5	940.1
	26170	915.0	16.6	898.4	9.2	905.8	936.9	2.5	939.4	2.5	939.4
	25965	914.0	17.1	896.9	9.8	904.2	936.2	2.6	938.8	2.5	938.7
	25785	913.5	16.7	896.8	10.1	903.4	935.5	2.7	938.2	2.5	938.0
	25600	912.5	15.9	896.6	9.9	902.6	934.8	2.5	937.3	2.5	937.3
	25425	911.0	15.1	895.9	9.8	901.2	934.1	2.5	936.7	2.5	936.6
	25215	910.0	14.0	896.0	8.0	902.0	933.3	2.5	935.8	2.5	935.8
	25000	909.0	13.7	895.3	7.6	901.4	932.5	2.5	935.0	2.5	935.0
SRC4	24795	908.0	12.3	895.7	6.7	901.3	931.5	3.7	935.2	3.4	934.9
	24550	906.0	12.4	893.6	7.1	898.9	930.1	3.6	933.6	3.3	933.4
	24335	905.0	13.0	892.0	8.5	896.5	928.5	3.9	932.4	3.6	932.1
	24115	904.0	13.5	890.5	9.4	894.6	927.0	3.8	930.8	3.5	930.5
	23975	903.5	13.9	889.6	9.8	893.7	926.1	3.5	929.7	3.3	929.4
	23755	902.0	13.2	888.8	8.4	893.6	924.7	3.2	927.9	3.1	927.8
	23565	900.0	14.5	885.5	9.5	890.5	923.6	3.7	927.3	3.4	927.0
	23365	900.0	14.3	885.7	8.6	891.4	922.4	3.5	925.9	3.2	925.6
	23180	899.0	15.8	883.2	10.3	888.7	921.5	3.2	924.6	3.0	924.4
	23000	898.0	13.0	885.0	9.6	888.4	920.0	3.3	923.3	3.0	923.0
	22790	897.5	26.8	870.7	23.0	874.5	917.5	3.1	920.6	3.0	920.5
	22600	896.0	14.8	881.2	9.3	886.7	915.8	3.2	919.0	2.9	918.7
	22415	895.5	14.0	881.5	9.4	886.1	914.4	3.2	917.6	2.9	917.4

1 - Phase 1 Analysis

2 - Minimum 1999 Bed Elevation

3 - Toe-down based on LA County Hydrology & Sedimentation Manual; Freeboard based on max of LA County Hydrology & Sedimentation Manual and LA County Design Manual, as per Hydrology & Sedimentation Manual

4 - Final design of levee will include detailed bridge analysis

Table A6.3: Santa Clara River Summary of Proposed Toe-down & Freeboard (ft) continued

Subreach	HEC-RAS Station	Z_{99} [2]	Outside Curved Reach: Total Degradation (H&S w/ SAM) [3]	Outside Curved Reach: Proposed Toe-down Elevation [1,4]	Straight-Inside Curved Reach: Total Degradation (H&S w/ SAM) [3]	Straight-Inside Curved Reach: Proposed Toe-down Elevation [1,4]	WSE	Outside Curved Reach: Total Freeboard (H&S w/ SAM) [3]	Outside Curved Reach: Proposed Top of Levee Elevation [2]	Straight-Inside Curved Reach: Total Freeboard (H&S w/ SAM) [4]	Straight-Inside Curved Reach: Proposed Top of Levee Elevation [1]
SRD1	22195	894.0	13.3	880.7	6.7	887.3	913.1	2.5	915.6	2.5	915.6
	22010	892.0	15.3	876.7	7.7	884.3	911.4	2.5	913.9	2.5	913.9
	21790	891.5	15.3	876.2	9.4	882.1	909.9	2.6	912.6	2.5	912.4
	21615	892.0	12.5	879.5	8.5	883.5	908.9	2.6	911.5	2.5	911.4
	21440	890.0	14.1	875.9	8.3	881.7	907.8	2.5	910.3	2.5	910.3
	21225	888.0	16.3	871.7	8.6	879.4	906.7	2.5	909.2	2.5	909.2
	21020	887.0	12.6	874.4	9.1	877.9	905.6	2.5	908.1	2.5	908.1
	20845	886.0	15.2	870.8	7.3	878.7	904.7	2.5	907.2	2.5	907.2
	20595	885.0	14.1	870.9	6.3	878.7	903.6	2.5	906.1	2.5	906.1
	20435	884.0	14.4	869.6	6.2	877.8	902.8	2.5	905.3	2.5	905.3
	20280	883.7	15.4	868.3	7.5	876.2	901.8	2.5	904.3	2.5	904.3
	20070	882.0	16.8	865.2	9.2	872.8	900.6	2.5	903.1	2.5	903.1
SRD2	19855	880.5	14.5	866.0	9.1	871.4	899.6	3.0	902.6	2.9	902.5
	19630	880.0	12.3	867.7	8.4	871.6	898.6	2.9	901.5	2.9	901.5
	19440	878.0	12.2	865.8	6.3	871.7	897.9	3.0	900.8	3.0	900.8
	19240	877.5	13.0	864.5	7.4	870.1	896.9	3.4	900.3	3.4	900.2
	19050	876.0	14.1	861.9	8.8	867.2	896.2	4.1	900.3	4.1	900.3
	18830	874.0	14.5	859.5	6.4	867.6	895.4	4.1	899.4	4.0	899.4
	18650	873.5	14.7	858.8	6.0	867.5	894.7	4.0	898.7	4.0	898.7
	18475	872.0	13.6	858.4	5.1	866.9	894.3	3.4	897.6	3.4	897.6
	18290	871.5	14.1	857.4	5.3	866.2	893.6	3.2	896.8	3.2	896.8
	18025	870.0	4.8	865.2	4.8	865.2	892.9	3.1	895.9	3.1	895.9
	17785	868.0	5.0	863.0	5.0	863.0	892.0	3.2	895.2	3.2	895.2
SRD3	17510	868.0	6.9	861.1	6.9	861.1	890.4	2.5	892.9	2.5	892.9
	17360	868.0	9.2	858.8	9.2	858.8	888.3	2.5	890.8	2.5	890.8
	17110	864.0	12.0	852.0	12.0	852.0	885.5	2.5	888.0	2.5	888.0
	16970	863.7	12.1	851.6	12.1	851.6	884.0	2.5	886.5	2.5	886.5
	16720	863.5	9.9	853.6	9.9	853.6	882.3	2.5	884.8	2.5	884.8
	16515	862.0	10.4	851.6	10.4	851.6	881.2	2.5	883.7	2.5	883.7
	16305	860.0	7.1	852.9	7.1	852.9	880.4	2.5	882.9	2.5	882.9
	16130	860.0	8.6	851.4	8.6	851.4	879.4	2.5	881.9	2.5	881.9
	15960	859.0	9.5	849.5	9.5	849.5	878.6	2.5	881.1	2.5	881.1
	15745	858.0	7.3	850.7	7.3	850.7	877.6	2.5	880.1	2.5	880.1
	15540	857.5	6.8	850.7	6.8	850.7	876.7	2.5	879.2	2.5	879.2
	15335	856.0	8.8	847.2	8.8	847.2	874.8	2.5	877.3	2.5	877.3
SRE1	15125	854.0	26.1	827.9	26.1	827.9	872.0	2.5	874.5	2.5	874.5
	14900	853.0	9.3	843.7	9.3	843.7	869.7	2.5	872.2	2.5	872.2
	14720	852.0	8.9	843.1	8.8	843.2	868.4	2.5	870.9	2.5	870.9
	14480	850.5	8.9	841.6	8.8	841.7	866.9	2.5	869.4	2.5	869.4
	14315	850.0	7.4	842.6	7.0	843.0	866.0	2.5	868.5	2.5	868.5
	14090	850.0	7.3	842.7	7.2	842.8	864.8	2.5	867.3	2.5	867.3
	13850	848.0	6.7	841.3	6.6	841.4	863.6	2.5	866.1	2.5	866.1
	13635	846.0	7.7	838.3	7.6	838.4	862.5	2.5	865.0	2.5	865.0
	13425	845.0	8.6	836.4	8.3	836.7	861.8	2.5	864.3	2.5	864.3
	13190	844.0	6.7	837.3	6.4	837.6	861.1	2.5	863.6	2.5	863.6
SRE2	13030	843.0	6.9	836.1	6.7	836.3	860.6	4.2	864.8	4.1	864.8
	12835	842.0	6.4	835.6	6.4	835.6	860.0	4.7	864.7	4.6	864.7
	12615	841.0	6.1	834.9	6.1	834.9	859.3	5.2	864.6	5.2	864.6
	12395	840.0	6.0	834.0	6.0	834.0	858.7	5.1	863.8	5.1	863.8
	12195	839.0	5.5	833.5	5.5	833.5	858.1	4.2	862.3	4.2	862.3
	11995	837.0	6.2	830.8	6.2	830.8	857.3	4.1	861.4	4.1	861.4
	11780	836.0	6.1	829.9	6.1	829.9	856.6	4.0	860.5	4.0	860.5
	11605	835.5	6.6	828.9	6.6	828.9	855.8	4.0	859.8	4.0	859.8
	11405	834.0	6.3	827.7	6.3	827.7	854.6	3.9	858.6	3.9	858.6
	11180	833.0	7.7	825.3	7.7	825.3	852.7	3.9	856.6	3.9	856.6
SRE3	11015	831.5	10.4	821.1	10.4	821.1	850.2	3.8	854.0	3.8	854.0
	10835	831.0	10.9	820.1	10.9	820.1	848.1	3.7	851.8	3.7	851.8
	10575	830.0	9.2	820.8	9.2	820.8	846.1	3.8	849.9	3.8	849.9
	10390	828.0	9.9	818.1	9.9	818.1	845.1	3.1	848.2	3.1	848.2
	10225	827.5	9.8	817.7	9.8	817.7	844.1	3.1	847.2	3.1	847.2
	10000	826.0	8.5	817.5	8.5	817.5	842.6	3.1	845.7	3.1	845.7
	9820	824.0	10.2	813.8	10.2	813.8	841.4	3.1	844.5	3.1	844.5
	9595	823.8	8.4	815.4	8.4	815.4	839.9	3.1	843.0	3.1	843.0
	9385	823.0	9.0	814.0	8.9	814.1	838.6	3.1	841.7	3.1	841.7
	9220	822.0	9.3	812.7	9.1	812.9	837.6	3.1	840.7	3.1	840.7
	9025	821.0	9.0	812.0	8.9	812.1	836.6	3.1	839.7	3.1	839.7

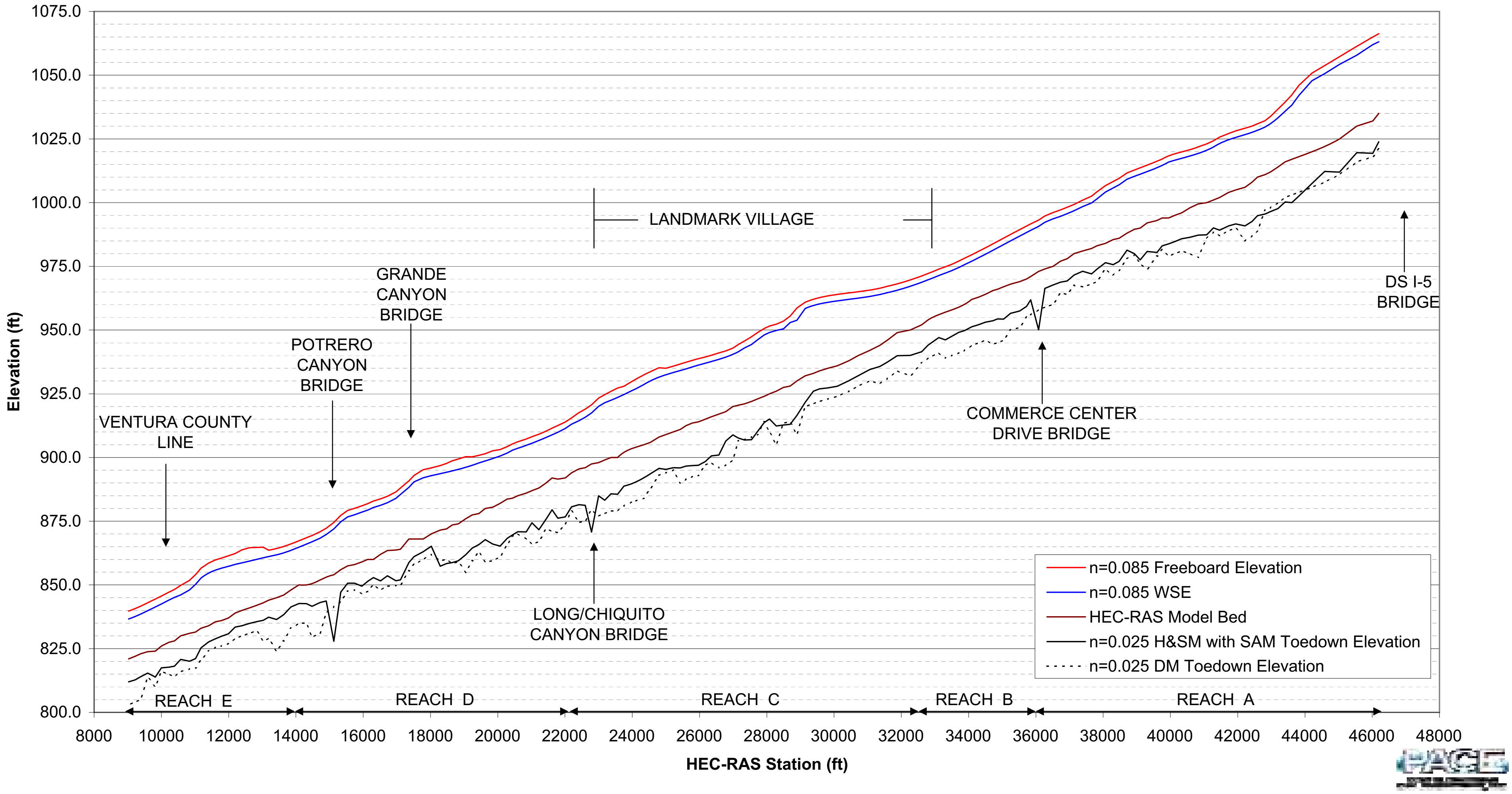
1 - Phase 1 Analysis

2 - Minimum 1999 Bed Elevation

3 - Toe-down based on LA County Hydrology & Sedimentation Manual; Freeboard based on max of LA County Hydrology & Sedimentation Manual and LA County Design Manual, as per Hydrology & Sedimentation Manual

4 - Final design of levee will include detailed bridge analysis

Figure A6.3: Santa Clara River Appendix 6 Summary of Proposed Conditions Outside Curved Reach Toedown & Freeboard



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Landmark Village Tentative Tract Map 53108
Drainage Concept
Dated September 21, 2005

PSOMAS

FILE COPY

LANDMARK VILLAGE
TENTATIVE TRACT MAP 53108
DRAINAGE CONCEPT

September 21, 2005

LANDMARK VILLAGE
TENTATIVE TRACT MAP 53108
DRAINAGE CONCEPT

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APPENDICES

1. **LACDPW Hydrology Data**
2. **Existing Condition TC Calculations**
3. **Proposed Condition TC Calculations**
4. **Existing Condition LACDPW MORA Calculations**
5. **Proposed Condition LACDPW MORA Calculations**
6. **SUSMP Calculations**
7. **Drainage Concept Exhibits**

1.0 Introduction

Project Background

Psomas has been retained by the Newhall Land Co. to prepare a drainage concept report in conjunction with the preparation of Tentative Tract Map No. 53108 for Landmark Village. The project site, located in an unincorporated portion of Los Angeles County, is bounded by the Santa Clara River on the south, the SR 126 on the north and CA Interstate 5 on the east, consists of single- and multi-family residential, commercial, and recreational uses. Landmark Village is a part of Newhall Land's Newhall Ranch, an approximately 12,000-acre proposed master planned community. Two borrow site areas are associated with Landmark Village but are under a Conditional Use Permit (CUP), not part of the tentative tract map itself, and are addressed in a separate drainage concept report.

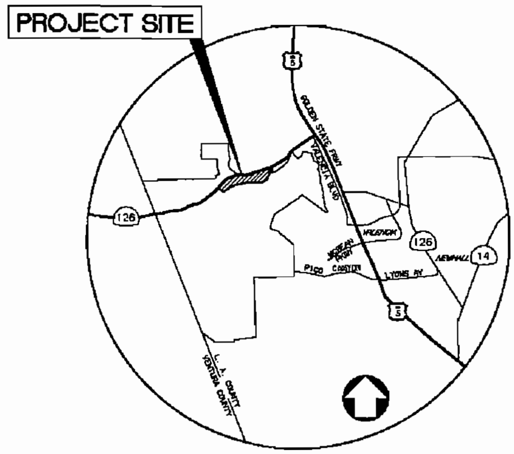
Purpose and Scope

The project falls under the jurisdiction of the Los Angeles County Department of Public Works (LACDPW). The purpose of this drainage concept report is:

- To meet Los Angeles County Land Development requirements in support of the tentative tract map submittal, allowing final design and construction to proceed in a timely manner;
- To determine the proposed development's impact (increase peak flow rates) to existing hydrologic conditions;
- To provide sufficient detailed information to support detailed hydraulic design of storm drainage facilities; and
- To document that the Los Angeles County Standard Urban Stormwater Mitigation Plan (SUSMP) requirements will be met.

It should be noted that detailed catch basin, storm drain and detention basin analyses sizing is beyond the scope of this drainage concept.

The following figure is a vicinity map of the Landmark Village site.



VICINITY MAP
NOT TO SCALE

Figure 1. Vicinity Map

2.0 Hydrology

General Approach

The watershed of the project was divided into several sub-basins that were identified and characterized for both existing and proposed conditions. Computer modeling was used to estimate the runoff for the 50-year storm events; the analysis considered burned hydrology but no additional bulking factors were used in the proposed conditions, as sediment trapping devices will be installed upstream of the project. In addition, the need for water quality mitigation was evaluated and is addressed in section 4.

Data Sources

The primary sources of data were the *LACDPW Hydrology/ Sedimentation Manual and Appendices* (LACDPW 1991, 1992, 1993, 2002) and the LA County *Standard Urban Stormwater Mitigation Plan* (March 2000). Other key sources included the *TC (v1.0),* and *MORA (v7.2)* manuals and the Newhall Ranch Specific Plan Master Hydrology and Drainage Concept, Sikand December, 1999 (appended for reference).

Watershed Characteristics

The project site is bounded by the Santa Clara River on the south, SR 126 on the north, and CA Interstate 5 on the east. The off-site contributing drainage area for the site encompasses approximately 236 acres and extends predominantly in the northerly direction from the site. The majority of the area is undeveloped land with moderate slopes. The Chiquito Canyon Landfill drainage area is addressed in a separate study and excluded from this analysis.

The soil of the watershed is classified by Los Angeles County to be Type 020, as shown on the figure (LACDPW 1-H1.43) included in Appendix 1. The figure also shows that the drainage area is associated Debris Potential Area (DPA) number 9. As previously discussed, the proposed use of sediment trapping devices preclude the necessity of bulking factors in the proposed conditions. The peak bulking factor curves and peak debris production rates used in the analysis are included in Appendix 1 (LACDPW P2 & P5).

Landmark Village is located in Los Angeles County's Rainfall Isohyet 5.8, as shown on the aforementioned figure in Appendix 1.

The drainage area for the site consists of six sub-basins that independently drain toward the Santa Clara River; refer to the Existing Condition Hydrology Map included with this report. The sub-basins drain southwesterly on site, ultimately tributary to the Santa Clara River.

The *LACDPW TC (TC_calc_depth.xls, June2002)* program was used to calculate the time of concentration for each sub area. The *LACDPW MORA (v7.2)* computer program was used for the *Modified Rational Method* calculations and calculation of peak runoff rates and hydrographs. The TC calculations and MORA program output are provided in Appendix 2-3 and 4-5, respectively. In accordance with LACDPW requirements, the 50-year burned, bulked storm event was used as the main design storm in the analysis.

Existing Condition Results

Existing condition hydrology results for the Capital Flood storm event is summarized in Table 1 below.

Table 1: Existing Condition Hydrology Summary

Sub basins	Area (Ac)	50-Year Storm Event[A]			
		Time of Conc. (min)	Q_u (cfs)	Q_b (cfs) (MORA)	Q_{bb} (cfs) $1.27*Q_b$
100A	32.7	22	27	41	52
110A	49.6	20	44	58	74
Cumulative	**82.3**			**87**	**111**
200A	17.3	17	17	24	30
210A	35.8	24	28	39	50
Cumulative	**53.1**			**60**	**76**
400B	18.4	24	14	20	25
405B	38.9	28	27	39	50
408C	15.3	8	25	32	41
410C	44.3	19	41	57	72
415B	35.3	11	46	62	79
420A	34.4	24	27	37	47
425A	39.9	20	35	48	61

Sub basins	Area (Ac)	50-Year Storm Event[A]			
		Time of Conc. (min)	Q_u (cfs)	Q_b (cfs) (MORA)	Q_{bb} (cfs) $1.27*Q_b$
Cumulative	**226.5**			**205**	**260**
500A	26.5	20	23	33	42
510A	40.0	24	31	44	53
Cumulative	**66.5**			**65**	**83**
CQT-1A	6.1	8	10	13	16
CQT-2A	3.6	6	7	9	11
CQT-3A	1.8	5	4	5	6
CQT-4A	12.3	10	17	22	28
CQT-5A	4.4	5	10	12	15
CQT-6A	24.9	15	27	36	46
CQT-7A	2.1	5	5	6	8
CQT-8A	2.8	5	6	7	10
CQT-9A	31.8	14	36	48	61
CQT-10A	15.6	11	21	27	35
CQT-11A	10.2	17	18	18	19
CQT-12A	11.7	10	26	26	28
620A	12.4	22	10	14	18
Cumulative	**140**			**243**	**301**
Total	**568.1**			**660**	**831**

Notes

A. *Burned and bulked flow. The Cumulative flow is the result shown in the MORA tabulations that are in the Appendix. The Total Flow is the sum of the Cumulative Flows shown.*

Post-Project Condition Results

The post-project condition hydrologic analysis was based on the preliminary concept drainage plan prepared by Psomas, included with this report. The post-project (developed) Condition Drainage Concept Map is also included with this report. Post-development drainage patterns do not significantly differ from the aforementioned existing characteristics.

As with the existing condition analysis, the *LACDPW TC* program was used to calculate the time of concentration, and the *LACDPW MORA* computer program was used to calculate the peak runoff rates and hydrographs. The calculations and program output are provided in Appendix 3 and 5 respectively. In accordance with *the LACDPW Hydrology/Sedimentation Appendix*, imperviousness coefficients are as follows:

Table 2: Land Use Impervious Values

Land Use	Percent Imperviousness
Single Family Residential	42%

Multi Family Residential	68%
School	82%
Commercial	92%
Park	15%
Roadway	100%
Open Space	0%

Post-project condition hydrology results for the 50-year storm event is summarized in Table 3.

Table 3: Post-Project Condition Hydrology Summary

Sub basins	Area (Ac)	Time of Conc. (min)	50-Year Storm Event[A]			
			Q_u (cfs)	Q_b (cfs)	Q_{bb} (cfs)	Q_{design} (cfs) (MORA)
RVE-1A	18	24	14	20	25	20
RVE-2A	39	28	28	39	50	39
RVE-3B	15	8	24	32	41	32
RVE-4B	44	19	41	57	72	57
RVE-6A	35	11	47	62	79	62
Off-Site	**151**					**147**
RVE-7A	14	29	21			21
RVE-8A	23	30	26			26
RVE-9A	6	11	11			11
Cumulative (Including Off-Site)						**198**
RVE-11B	16	14	27			27
RVE-12C	1	15	1			1
RVE-13C	17	19	25			25
RVE-16D	2	20	2			2
RVE-17D	18	15	30			30
RVE-20E	18	16	28			28
RVE-21F	1	7	1			1
RVE-24F	2	14	2			2
RVE-25F	14	16	22			22
RVE-27B	7	12	15			15
RVE-28B	5	10	11			11
RVE-29B	1	14	1			1
Subtotal (RVE)						**363**
RVC-2A	11	9	18			18
RVC-3A	12	15	20			20
RVC-7A	10	27	13			13
RVC-8A	5	14	8			8

Sub basins	Area (Ac)	Time of Conc. (min)	50-Year Storm Event[A]			
			Q_u (cfs)	Q_b (cfs)	Q_{bb} (cfs)	Q_{design} (cfs) (MORA)
Cumulative (A)						**60**
RVC-11B	16	11	30			30
RVC-12C	3	18	3			3
RVC-13C	2	12	3			3
RVC-17C	2	19	2			2
RVC-18C	17	14	29			29
RVC-21D	3	16	3			3
RVC-22D	3	12	7			7
RVC-23E	39	24	53			53
RVC-24E	7	22	12			12
Subtotal(RVC)						**202**
CQT-1/4A	23.9	9	37	41	46	41
CQT-5A	4.4	5	10	12	15	12
CQT-6A	22.6	15	25	31	39	31
CQT 7/8A	6.2	5	14	14	14	14
CQT-9A	31.8	14	37	44	52	52
CQT-10A	14.5	11	20	23	27	27
CQT-11A	7.4	21	11	11	11	11
CQT-12A	4.4	12	9	9	9	9
Subtotal (CQT)						**197**
RVW-1A	11	14	17			17
RVW-2A	15	14	28			28
Subtotal (RVW)						**33**
Total	**568**					**795**[A]

Notes

A. *The Cumulative flow is the result shown in the MORA tabulations that are in the Appendix. The Total Flow is the sum of the Cumulative Flows shown. Burned flow for Subareas RVE 1A thru 6A, Develop flow for the remaining Subareas RVE, Subareas RVC and RVW, Burned flow for Subareas CQT-1/4A, CQT-5/6A, Burned and bulked flow for Subareas CQT-9/10A, Develop flow for Subareas CQT-7/8A and CQT-11/12A.*

Baseline Hydrology Comparison

A comparison of existing and proposed peak flow rates is provided as Table 4. In accordance with Los Angeles County hydrology method, existing condition burned and bulked flow is assessed with proposed condition flow burned, unbulked due to the proposed addition of debris facilities where needed.

Table 4: Existing vs. Proposed Condition Hydrology Comparison Summary

50-Year Storm Event						
Sub area	Area (Ac)			Q_{50} (cfs)		
	Exist.[A]	Prop.[B]	Diff.	Exist[C].	Prop.[D]	Diff.
Total Study Area	568	568	0	831	795	-36

Notes

A. *Existing Tributary Drainage Area*
B. *Proposed Tributary Drainage Area.*
C. *Burned and bulked flow*
D. *Burned flow for Subareas RVE 1A thru 6A, Develop flow for the remaining Subareas RVE, Subareas RVC and RVW, Burned flow for Subareas CQT-1/4A, CQT-5/6A, Burned and bulked flow for Subareas CQT-9/10A, Develop flow for Subareas CQT-7/8A and CQT-11/12A.*

3.0 Standard Urban Stormwater Mitigation Plan (SUSMP)

Structural or Treatment Control Best Management Practices (BMPs) are required for this project under the LA County Standard Urban Stormwater Mitigation Plan (SUSMP). Volume-based or flow-based design standards may be used separately or in combination. Volume-based criteria are used in sizing of detention or infiltration structures while flow-based criteria are used on swales, hydrodynamic separator systems (e.g. CDS units), catch basin devices or wetlands. The SUSMP requirements, approved by the Regional Water Quality Control Board, call for the treatment of the volume of runoff produced by a 0.75 inch 24-hour rainfall event.

For the Landmark Village project, the proposed BMPs have been designed to capture and treat 80 percent of the annual runoff volume. This performance criteria requires that flow-based BMPs (vegetative swales) be sized using a rainfall intensity of 0.3 inches per hour.

The calculation methodology described in the *Landmark Village Water Quality Technical Report* prepared by Geosyntec Consultants, dated April 10, 2005 ("Geosyntec Report"), was used to calculate the required treatment flows and volumes for each of the discharge points from the site. The LACDPW intensity-duration data and the runoff coefficient curve for soil type 20 are included in Appendix 1. The calculations are included in Appendix 6. The results are summarized in the table below.

Table 5: Water Quality Facility Sizing
Proposed BMPs

Subarea	Area (ac)	Design Flow (Qpm) cfs	Mitigated Volume (Vm) Acre-Ft	BMP Type	Prop. BMP Site
RVE-1A	18.4	Off-site - Undeveloped			
RVE-2A	38.9				
RVE-3B	15.3				
RVE-4B	44.3				
RVE-6A	35.3				
RVE-7A	14.1	SR-126 Per Separate Plan			
RVE-8A	22.8	N/A	1.82	Bioretention	RVE-8A
RVE-9A	5.7	N/A	0.46	Bioretention	RVE-9A
RVE-11B	16.2	2.9	N/A	Vegetative Swale	RVE-12C
RVE-12C	1.2	0.0	N/A	BMP site	
RVE-13C	16.5	3.3	N/A	Vegetative Swale	RVE-16D
RVE-16D	2.1	0.0	N/A	BMP site	
RVE-17D	18.0	3.1	N/A	Vegetative Swale	RVE-21F & RVE-24F
RVE-20E	18.3	3.6	N/A	Vegetative Swale	RVE-24F
RVE-21F	0.7	0.0	N/A	BMP site	
RVE-24F	1.5	0.0	N/A	BMP site	
RVE-25F	14.4	2.5	N/A	Vegetative Swale	RVE-29B
RVE-27B	7.3	N/A	0.66	Bioretention	RVC-12C

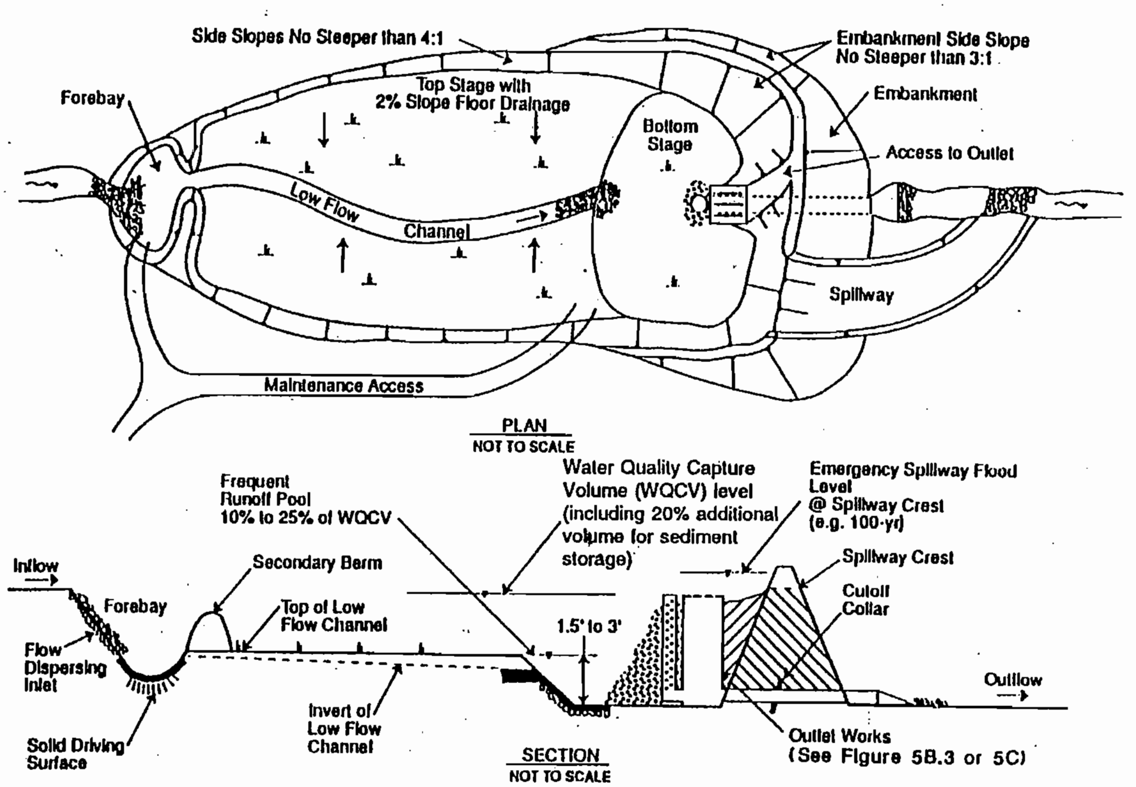
Subarea	Area (ac)	Design Flow (Qpm) cfs	Mitigated Volume (Vm) Acre-Ft	BMP Type	Prop. BMP Site
RVE-28B	5.0	N/A	0.45	Bioretention	RVC-12C
RVE-29B	1.1	0.0	N/A	BMP Site	
RVC-2A	10.9	N/A	0.55	Bioretention	RVC-12C
RVC-3A	11.9	N/A	0.95	Bioretention	RVC-12C
RVC-7A	10.2	N/A	0.92	Bioretention	RVC-12C
RVC-8A	5.1	N/A	0.46	Bioretention	RVC-12C
RVC-11B	16.4	3.2	N/A	Vegetative Swale	RVC-17C
RVC-17C	2.1	0.0	N/A	BMP Site	
RVC-18C	17.4	3.3	N/A	Vegetative Swale	RVC-21D
RVC-21D	2.6	0.0	N/A	BMP Site	
RVC-22D	2.5	N/A	0.2	Extended Detention Basin	RVC-21D
RVC-23E	39.3	N/A	3.1	Extended Detention Basin[A]	RVC-21D
RVC-24E	7.4	N/A	0.81	Extended Detention Basin	RVC-21D
RVW-1A	10.8	2.1	N/A	Vegetative Swale	RVW-2A
RVW-2A	14.7	3.1	N/A	Vegetative Swale	RVW-2A

Notes
A. – Interim condition only. Additional BMPs will be added during final design according to 80% capture requirement.

Treatment goals can be achieved through a variety of BMPs including detention basins, biofilter swales, catch basin inserts and media filtration. Biofilter swales, bioretention, and an extended detention basins (EDB) have been selected for this project given the proposed land use, pollutants of concern, local site restrictions and available technologies. The proposed EDB shall be designed to have a drawdown time or 48 hours, as described in the Geosyntec Report. A comparison of the required treatment volumes and the volume available within the detention basin clearly indicates that this approach is feasible. The detailed design of the extended detention basin, bioretention areas, and biofilter swales for the project is beyond the scope of this report. However, this report does show that the 80% capture requirements can be met within the areas allocated for the proposed BMPs.

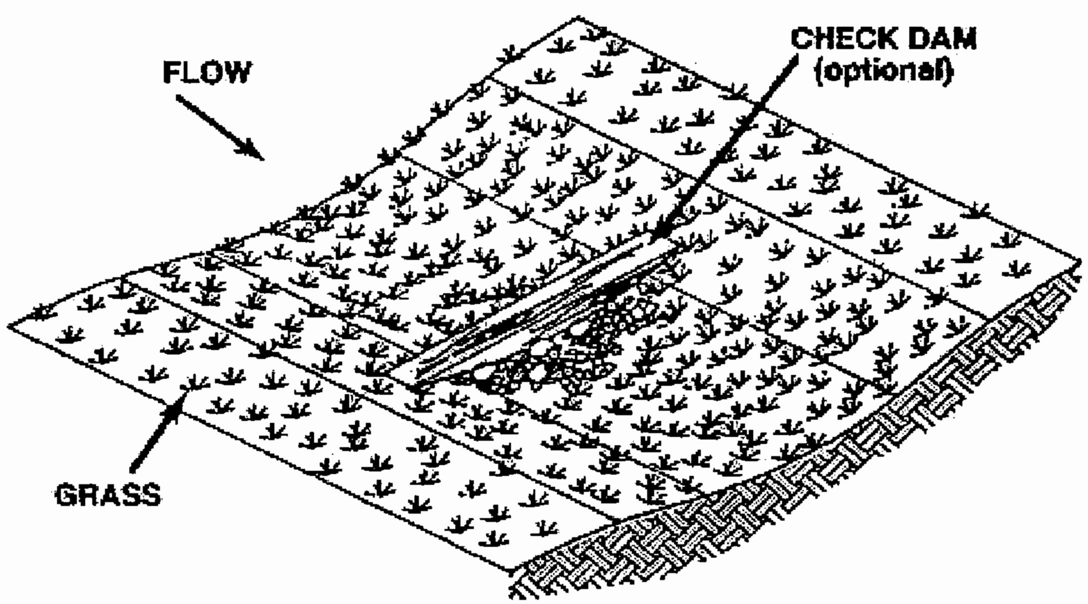
Alternative department approved BMPs may be substituted for extended detention basins during the final design process. Localized treatment facilities could also be used to meet the stormwater quality requirements. Analysis of this approach is beyond the scope of this preliminary analysis. It should be noted that the SUSMP requirements were calculated for all areas of the project site.

Both bioretention areas and vegetative swales will require flow spreaders so that stormwater flows from the inlet pipes will extend across the width of the swale or bioretention area and reduce the chance of channeling caused by concentrated flows. Typical layouts of the proposed BMPs are shown below.

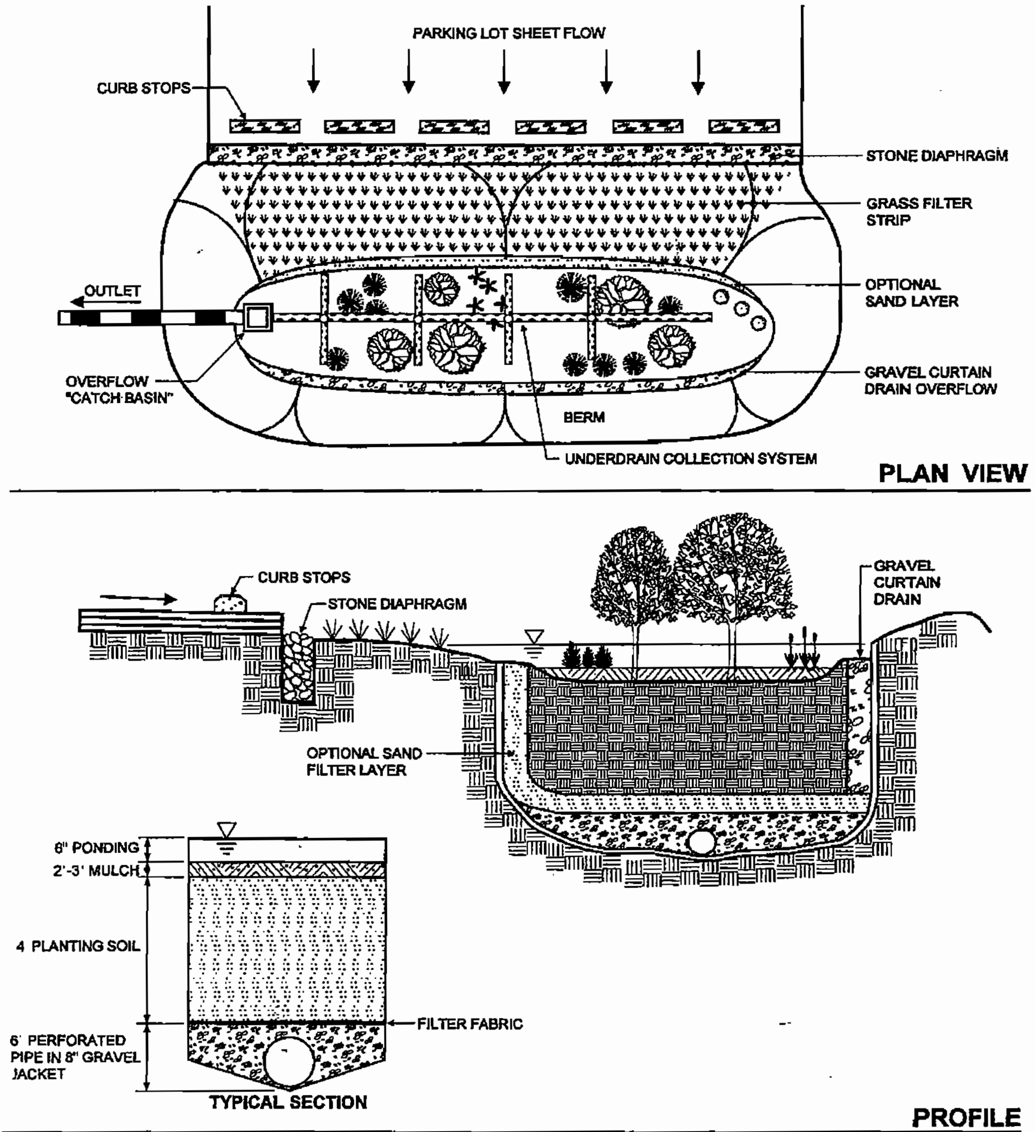


(Used By Permission, UDFCD, 1992)

PLAN AND SECTION OF AN EXTENDED DETENTION BASIN



VEGETATED SWALE



Schematic of a Bioretention Facility (MDE, 2000)

5.0 Limitations

This report was prepared to comply with the guidelines established by the County of Los Angeles and their representatives. Evaluation of the appropriateness of these guidelines and the accuracy of the County data were beyond the scope of this work.

Usage of the report is limited to address the purpose and scope previously defined by the project owner, Newhall Land. Psomas shall not be held responsible for any unauthorized application of this report and the contents herein.

The opinions represented in this report have been derived in accordance with current standards of civil engineering practice. No other warranty is expressed or implied.

6.0 References

California Stormwater Quality Association, *Stormwater Best Management Practice Handbook, New Development and Redevelopment*, January 2003

Los Angeles County Department of Public Works, *LACDPW Hydrology/ Sedimentation Manual and Appendices* (1991, 1992, 1993, 2002)

Los Angeles County Department of Public Works, *LACDPW TC v1.0 Manual, TC_calc_depth.xls* (December 1991, June 2002)

Los Angeles County Department of Public Works, *LACDPW Modified Rational Method, MORA (MORA) v7.2 Manual* (September 2002)

Los Angeles Regional Water Quality Control Board, *Standard Urban Stormwater Mitigation Plan for Los Angeles County and Cities in Los Angeles County* (March 2000)

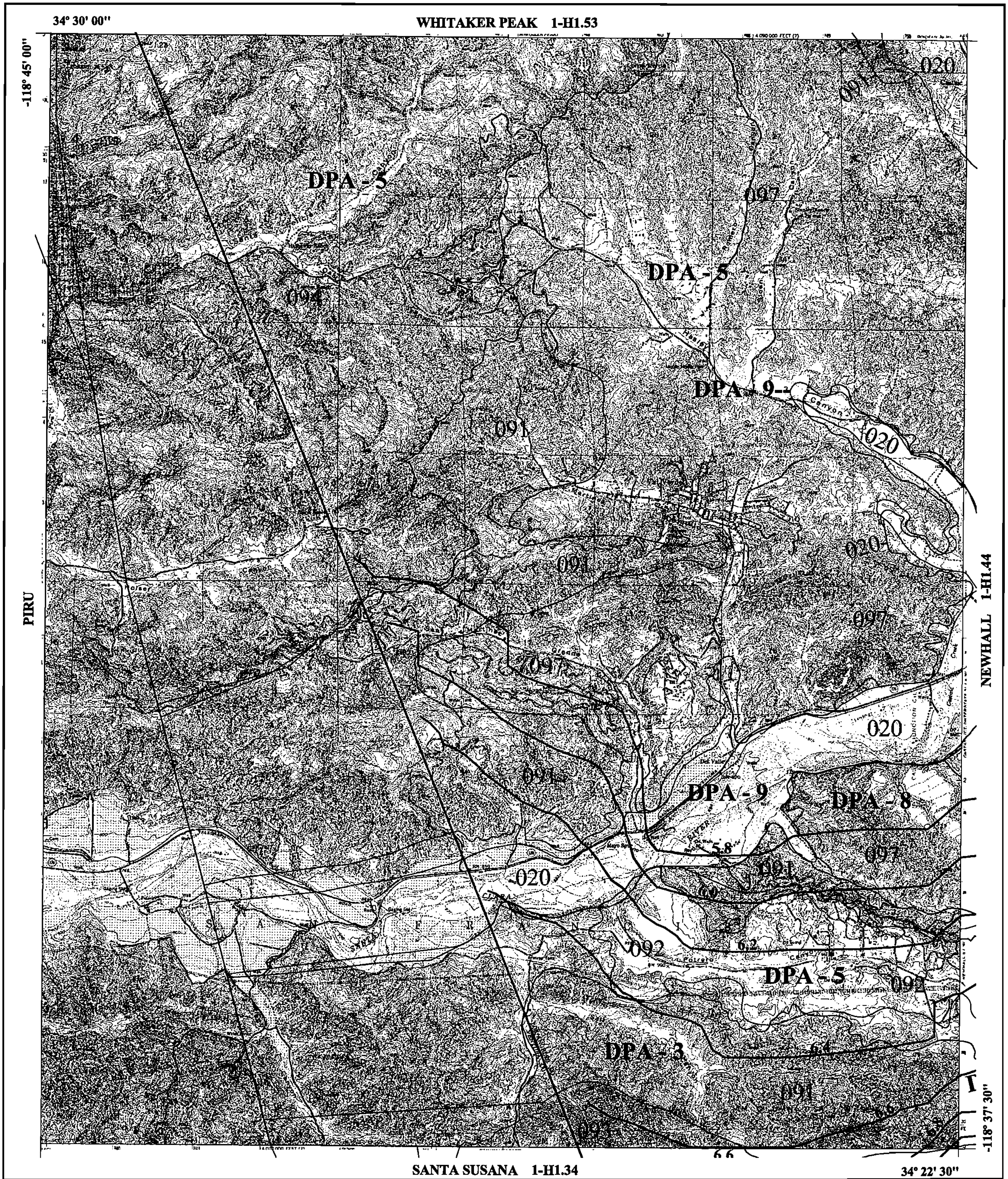
Newhall Land and Farming Company, Landmark Village Water Quality Technical Report (GeoSyntec Consultants, April 10, 2005)

Newhall Ranch, Newhall Ranch Specific Plan Master Hydrology and Drainage Concept (Sikand, December, 1999)

APPENDICES

APPENDIX 1

LACDPW HYDROLOGY DATA



016	SOIL CLASSIFICATION AREA
7.2	INCHES OF RAINFALL
DPA - 6	DEBRIS POTENTIAL AREA

1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

VAL VERDE 50-YEAR 24-HOUR ISOHYET

1-H1.43

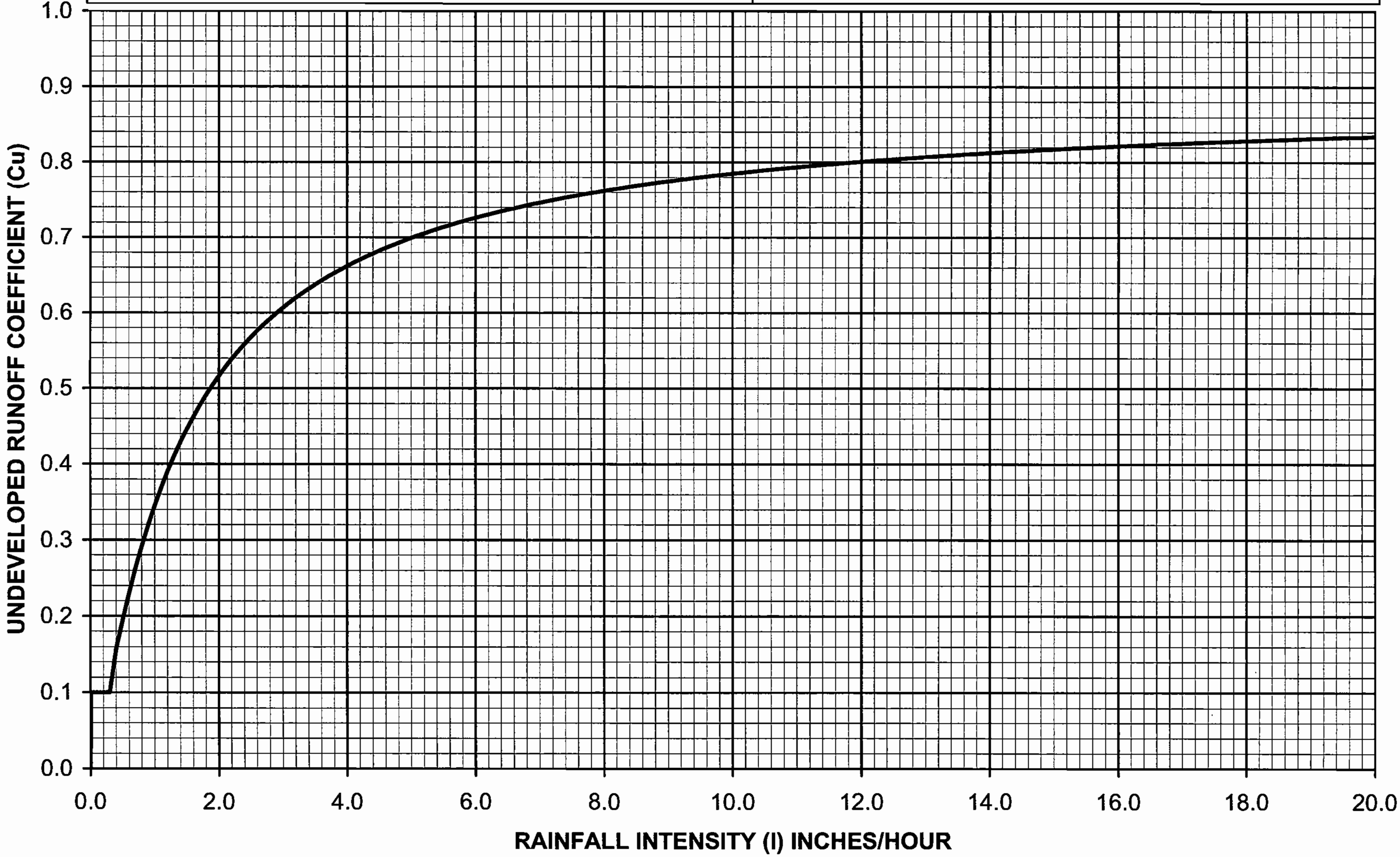
LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

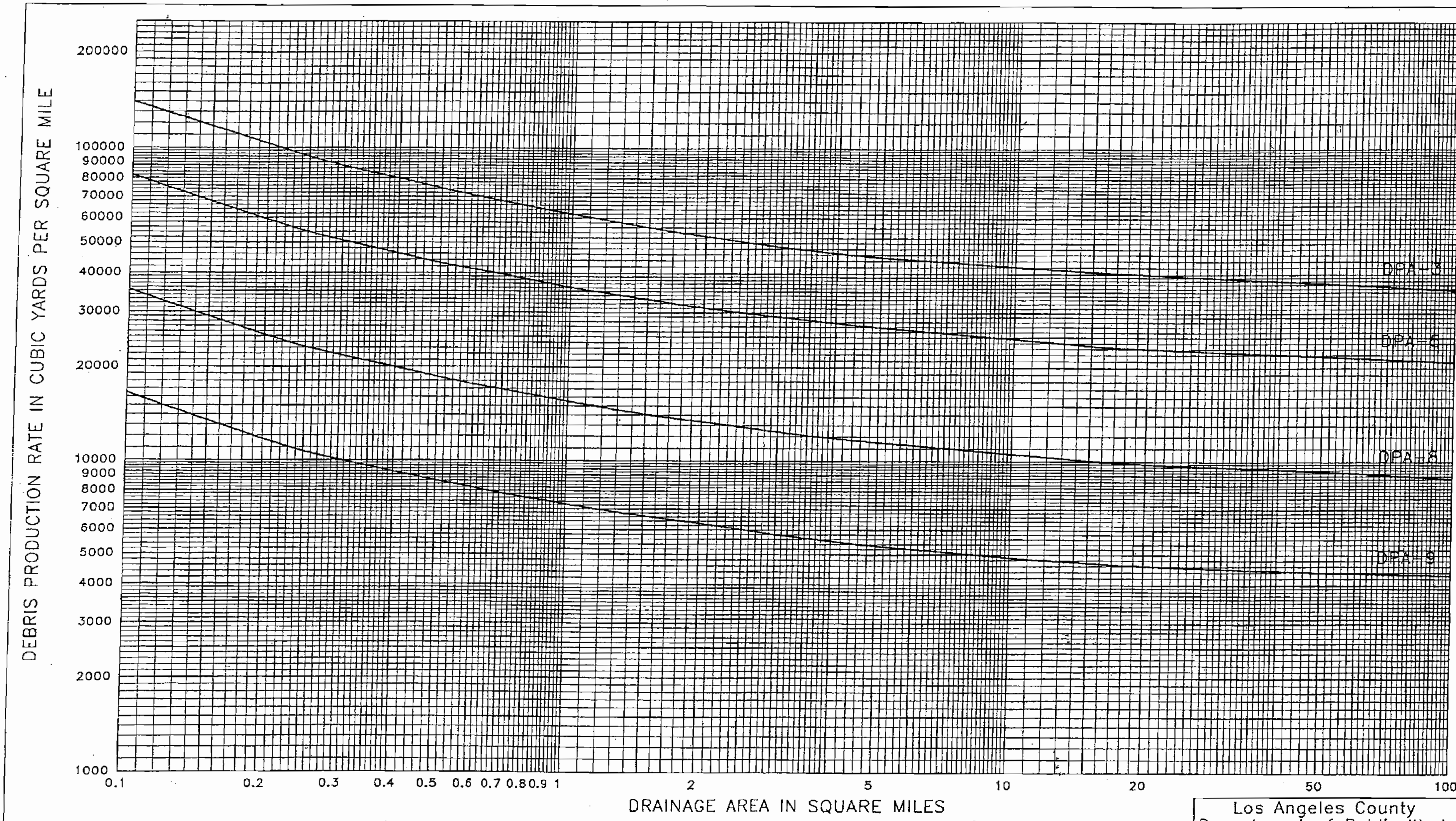
$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

Where: C_D = Developed Runoff Coefficient
IMP = Proportion Impervious
C_U = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 020





Los Angeles County
Department of Public Works

DEBRIS PRODUCTION RATES
for Santa Clara Basin

APPENDIX 2

TC CALCULATIONS: EXISTING CONDITION

Landmark Village TR53108
Existing Condition
TC Data File

Project	Subarea	Area	%imp	Frequency	Soil Type	Length	Slope	Isohyet
Area (E)	100A	32.7	0	50	20	1350	0.007	5.8
Area (E)	110A	49.6	0	50	20	1250	0.008	5.8
Area (E)	200A	17.3	0	50	20	1250	0.016	5.8
Area (E)	210A	35.8	0	50	20	1990	0.015	5.8
Area (E)	400A	18.4	0	50	20	2410	0.034	5.8
Area (E)	405A	38.9	0	50	20	3600	0.068	5.8
Area (E)	408C	15.3	0	50	20	1050	0.410	5.8
Area (E)	410C	44.3	0	50	20	1990	0.048	5.8
Area (E)	415B	35.3	0	50	20	1360	0.200	5.8
Area (E)	420A	34.4	0	50	20	1950	0.015	5.8
Area (E)	425A	39.9	0	50	20	1900	0.030	5.8
Area (E)	500A	26.5	0	50	20	1560	0.016	5.8
Area (E)	510A	40	0	50	20	1540	0.006	5.8
Area (E)	CQT-1A	6.1	0	50	20	890	0.265	5.8
Area (E)	CQT-2A	3.6	0	50	20	720	0.317	5.8
Area (E)	CQT-3A	1.8	0	50	20	530	0.336	5.8
Area (E)	CQT-4A	12.3	0	50	20	1160	0.229	5.8
Area (E)	CQT-5A	4.4	0	50	20	530	0.321	5.8
Area (E)	CQT-6A	24.9	0	50	20	1620	0.069	5.8
Area (E)	CQT-7A	2.1	0	50	20	490	0.269	5.8
Area (E)	CQT-8A	2.8	0	50	20	480	0.208	5.8
Area (E)	CQT-9A	31.8	0	50	20	1750	0.150	5.8
Area (E)	CQT-10A	15.6	0	50	20	1300	0.155	5.8
Area (E)	CQT-11A	10.2	65	50	20	2370	0.018	5.8
Area (E)	CQT-12A	11.7	65	50	20	1250	0.032	5.8
Area (E)	620A	12.4	0	50	20	2120	0.030	5.8

Landmark Village TR53108
Existing Condition
TC Calculation Results

Project	Subarea	Area (acre	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.	Tc-calculat	Intensity (ir	Cu	Cd	Flowrate (cfs	Tc Equation		
Area (E)	100A	32.7	0	50	20	1350	0.007	5.8	22	1.72	0.48	0.48	27	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	110A	49.6	0	50	20	1250	0.008	5.8	20	1.8	0.49	0.49	43.75	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	200A	17.3	0	50	20	1250	0.016	5.8	17	1.95	0.51	0.51	17.2	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	210A	35.8	0	50	20	1990	0.015	5.8	24	1.66	0.47	0.47	27.93	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	400A	18.4	0	50	20	2410	0.034	5.8	24	1.66	0.47	0.47	14.36	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	405A	38.9	0	50	20	3600	0.068	5.8	28	1.54	0.45	0.45	26.96	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	408C	15.3	0	50	20	1050	0.41	5.8	8	2.77	0.59	0.59	25	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	410C	44.3	0	50	20	1990	0.048	5.8	19	1.85	0.5	0.5	40.98	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	415B	35.3	0	50	20	1360	0.2	5.8	11	2.39	0.55	0.55	46.4	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	420A	34.4	0	50	20	1950	0.015	5.8	24	1.66	0.47	0.47	26.84	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	425A	39.9	0	50	20	1900	0.03	5.8	20	1.8	0.49	0.49	35.19	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	500A	26.5	0	50	20	1560	0.016	5.8	20	1.8	0.49	0.49	23.37	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	510A	40	0	50	20	1540	0.006	5.8	24	1.66	0.47	0.47	31.21	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-1A	6.1	0	50	20	890	0.265	5.8	8	2.77	0.59	0.59	9.97	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-2A	3.6	0	50	20	720	0.317	5.8	6	3.18	0.62	0.62	7.1	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-3A	1.8	0	50	20	530	0.336	5.8	5	3.46	0.63	0.63	3.92	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-4A	12.3	0	50	20	1160	0.229	5.8	10	2.5	0.56	0.56	17.22	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-5A	4.4	0	50	20	530	0.321	5.8	5	3.46	0.63	0.63	9.59	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-6A	24.9	0	50	20	1620	0.069	5.8	15	2.06	0.52	0.52	26.67	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-7A	2.1	0	50	20	490	0.269	5.8	5	3.46	0.63	0.63	4.58	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-8A	2.8	0	50	20	480	0.208	5.8	5	3.46	0.63	0.63	6.1	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-9A	31.8	0	50	20	1750	0.15	5.8	14	2.13	0.53	0.53	35.9	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-10A	15.6	0	50	20	1300	0.155	5.8	11	2.39	0.55	0.55	20.51	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-11A	10.2	65	50	20	2370	0.018	5.8	17	1.95	0.51	0.9	17.9	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	CQT-12A	11.7	65	50	20	1250	0.032	5.8	10	2.5	0.56	0.9	26.33	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
Area (E)	620A	12.4	0	50	20	2120	0.03	5.8	22	1.72	0.48	0.48	10.24	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		

APPENDIX 3

TC CALCULATIONS: PROPOSED CONDITION

Landmark Village TR53108
Proposed Condition
TC Data File

Project	Subarea	Area	%imp	Frequency	Soil Type	Length	Slope	Isohyet
RVE	1A	18.4	0	50	20	2430	0.034	5.8
RVE	2A	38.9	0	50	20	3550	0.069	5.8
RVE	3B	15.3	0	50	20	1050	0.410	5.8
RVE	4B	44.3	0	50	20	1990	0.050	5.8
RVE	6A	35.3	0	50	20	1360	0.200	5.8
RVE	7A	14.1	1	50	20	4200	0.007	5.8
RVE	8A	22.8	0.58	50	20	2900	0.002	5.8
RVE	9A	5.7	0.58	50	20	500	0.002	5.8
RVE	11B	16.2	0.54	50	20	1165	0.004	5.8
RVE	12C	1.2	0	50	20	670	0.003	5.8
RVE	13C	16.5	0.63	50	20	1874	0.005	5.8
RVE	16D	2.1	0	50	20	1115	0.005	5.8
RVE	17D	18	0.53	50	20	1440	0.007	5.8
RVE	20E	18.3	0.5	50	20	1805	0.008	5.8
RVE	21F	0.7	0	50	20	370	0.016	5.8
RVE	24F	1.5	0	50	20	840	0.008	5.8
RVE	25F	14.4	0.52	50	20	1040	0.001	5.8
RVE	27B	7.3	0.76	50	20	1100	0.010	5.8
RVE	28B	5	0.76	50	20	800	0.010	5.8
RVE	29B	1.1	0	50	20	625	0.003	5.8
RVC	2A	10.9	0.13	50	20	760	0.009	5.8
RVC	3A	11.9	0.6	50	20	1465	0.007	5.8
RVC	7A	10.2	0.71	50	20	2530	0.004	5.8
RVC	8A	5.1	0.55	50	20	955	0.002	5.8
RVC	11B	16.4	0.53	50	20	750	0.003	5.8
RVC	12C	3.4	0.15	50	20	1560	0.003	5.8
RVC	13C	1.5	0	50	20	895	0.003	5.8
RVC	17C	2.1	0	50	20	875	0.003	5.8
RVC	18C	17.4	0.6	50	20	1230	0.005	5.8
RVC	21D	2.6	0	50	20	747	0.003	5.8
RVC	22D	2.5	1	50	20	1180	0.008	5.8
RVC	23E	39.3	0.67	50	20	3400	0.010	5.8
RVC	24E	7.4	0.92	50	20	2800	0.009	5.8
RVW	1A	10.8	0.44	50	20	1365	0.008	5.8
RVW	2A	14.7	0.73	50	20	1790	0.019	5.8
CQT	1/4A	23.9	0.06	50	20	1160	0.229	5.8
CQT	5A	4.4	0	50	20	530	0.321	5.8
CQT	6A	22.6	0.02	50	20	1620	0.069	5.8
CQT	7/8A	6.2	0.1	50	20	550	0.267	5.8
CQT	9A	31.8	0.04	50	20	1750	0.150	5.8
CQT	10A	14.5	0.05	50	20	1300	0.155	5.8
CQT	11A	7.4	0.9	50	20	2350	0.006	5.8
CQT	12A	4.4	0.9	50	20	1300	0.019	5.8

Landmark Village TR53108
Proposed Condition
TC Calculation Results

Project	Subarea	Area (acre	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.	Tc-calculat	Intensity (ir	Cu	Cd	Flowrate (c	Tc Equation
RVE	1A	18.4	0	50	20	2430	0.034	5.8	24	1.66	0.47	0.47	14.36	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	2A	38.9	0	50	20	3550	0.069	5.8	28	1.54	0.45	0.45	26.96	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	3B	15.3	0	50	20	1050	0.41	5.8	8	2.77	0.59	0.59	25	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	4B	44.3	0	50	20	1990	0.05	5.8	19	1.85	0.5	0.5	40.98	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	6A	35.3	0	50	20	1360	0.2	5.8	11	2.39	0.55	0.55	46.4	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	7A	14.1	1	50	20	4200	0.007	5.8	29	1.51	0.45	0.9	19.16	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	8A	22.8	0.58	50	20	2900	0.002	5.8	30	1.49	0.44	0.71	24.12	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	9A	5.7	0.58	50	20	500	0.002	5.8	11	2.39	0.55	0.75	10.22	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	11B	16.2	0.54	50	20	1165	0.004	5.8	16	2	0.52	0.73	23.65	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	12C	1.2	0	50	20	670	0.0029	5.8	15	2.06	0.52	0.52	1.29	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	13C	16.5	0.63	50	20	1874	0.0047	5.8	21	1.76	0.48	0.74	21.49	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	16D	2.1	0	50	20	1115	0.0054	5.8	20	1.8	0.49	0.49	1.85	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	17D	18	0.53	50	20	1440	0.0069	5.8	17	1.95	0.51	0.72	25.27	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	20E	18.3	0.5	50	20	1805	0.0083	5.8	20	1.8	0.49	0.7	23.06	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	21F	0.7	0	50	20	370	0.016	5.8	7	2.95	0.6	0.6	1.24	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	24F	1.5	0	50	20	840	0.0083	5.8	14	2.13	0.53	0.53	1.69	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	25F	14.4	0.52	50	20	1040	0.0012	5.8	19	1.85	0.5	0.71	18.91	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	27B	7.3	0.76	50	20	1100	0.01	5.8	12	2.29	0.54	0.81	13.54	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	28B	5	0.76	50	20	800	0.01	5.8	10	2.5	0.56	0.82	10.25	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVE	29B	1.1	0	50	20	625	0.0032	5.8	14	2.13	0.53	0.53	1.24	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	2A	10.9	0.13	50	20	760	0.0092	5.8	12	2.29	0.54	0.59	14.73	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	3A	11.9	0.6	50	20	1465	0.0069	5.8	17	1.95	0.51	0.74	17.17	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	7A	10.2	0.71	50	20	2530	0.0035	5.8	27	1.57	0.46	0.77	12.33	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	8A	5.1	0.55	50	20	955	0.00209	5.8	16	2	0.52	0.73	7.45	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	11B	16.4	0.53	50	20	750	0.0033	5.8	13	2.21	0.54	0.73	26.46	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	12C	3.4	0.15	50	20	1560	0.0032	5.8	25	1.62	0.46	0.53	2.92	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	13C	1.5	0	50	20	895	0.003	5.8	19	1.85	0.5	0.5	1.39	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	17C	2.1	0	50	20	875	0.003	5.8	19	1.85	0.5	0.5	1.94	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	18C	17.4	0.6	50	20	1230	0.0048	5.8	16	2	0.52	0.75	26.1	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	21D	2.6	0	50	20	747	0.003	5.8	16	2	0.52	0.52	2.7	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	22D	2.5	1	50	20	1180	0.008	5.8	12	2.29	0.54	0.9	5.15	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	23E	39.3	0.67	50	20	3400	0.01	5.8	27	1.57	0.46	0.75	46.28	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVC	24E	7.4	0.92	50	20	2800	0.0086	5.8	22	1.72	0.48	0.87	11.07	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVW	1A	10.8	0.44	50	20	1365	0.008	5.8	17	1.95	0.51	0.68	14.32	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
RVW	2A	14.7	0.73	50	20	1790	0.0189	5.8	15	2.06	0.52	0.8	24.23	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	1/4A	23.9	0.06	50	20	1160	0.229	5.8	9	2.63	0.57	0.59	37.09	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	5A	4.4	0	50	20	530	0.321	5.8	5	3.46	0.63	0.63	9.59	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	6A	22.6	0.02	50	20	1620	0.069	5.8	15	2.06	0.52	0.53	24.67	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	7/8A	6.2	0.1	50	20	550	0.267	5.8	5	3.46	0.63	0.66	14.16	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	9A	31.8	0.04	50	20	1750	0.15	5.8	14	2.13	0.53	0.54	36.58	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	10A	14.5	0.05	50	20	1300	0.155	5.8	11	2.39	0.55	0.57	19.75	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	11A	7.4	0.9	50	20	2350	0.006	5.8	21	1.76	0.48	0.86	11.2	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	12A	4.4	0.9	50	20	1300	0.019	5.8	12	2.29	0.54	0.86	8.67	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^

APPENDIX 4

LACDPW MORA CALCULATIONS: EXISTING CONDITION

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

RIVER VILLAGE EXISTING HYDROLOGY STUDY 7-29-03 STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	100A	32.7	41.	32.7	41.	2	1400.	.00710	.00	.00	0.	220	20	A29	.00
300	101A	.0	0.	32.7	36.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	102A	.0	0.	32.7	36.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	103A	.0	0.	32.7	36.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	104A	.0	0.	32.7	36.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	105A	.0	0.	32.7	36.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	106A	.0	0.	32.7	36.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	107A	.0	0.	32.7	36.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	108A	.0	0.	32.7	36.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	109A	.0	0.	32.7	36.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	110A	49.6	58.	82.3	87.	0	0.	.00000	.00	.00	0.	220	22	A29	.00
300	111A	.0	0.	82.3	87.	0	0.	.00000	.00	.00	0.	220	99	A29	.00

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

LINE A AT FIRST OUTLET POINT

HYDROGRAPH AT 300 111A STORM DAY 4 REDUCTION FACTOR = 1.000

TIME	Q	TIME	Q	TIME	Q	TIME	Q	TIME	Q
0	0.	100	5.	200	6.	300	6.	400	6.
500	7.	600	7.	700	8.	800	9.	900	10.
1000	12.	1050	15.	1100	19.	1110	20.	1120	23.
1130	27.	1131	27.	1132	27.	1133	28.	1134	28.
1135	29.	1136	29.	1137	30.	1138	30.	1139	31.
1140	32.	1141	33.	1142	34.	1143	35.	1144	36.
1145	38.	1146	39.	1147	41.	1148	43.	1149	48.
1150	54.	1151	59.	1152	65.	1153	71.	1154	73.
1155	74.	1156	76.	1157	78.	1158	80.	1159	82.
1160	84.	1161	86.	1162	86.	1163	87.	1164	87.
1165	87.	1166	86.	1167	85.	1168	83.	1169	81.
1170	79.	1171	73.	1172	67.	1173	61.	1174	55.
1175	50.	1176	47.	1177	45.	1178	42.	1179	39.
1180	37.	1181	35.	1182	33.	1183	31.	1184	29.
1185	28.	1186	26.	1187	25.	1188	24.	1189	23.
1190	22.	1191	22.	1192	21.	1193	20.	1194	20.
1195	19.	1196	19.	1197	18.	1198	18.	1199	17.
1200	17.	1201	17.	1202	16.	1203	16.	1204	16.
1205	15.	1206	15.	1207	15.	1208	15.	1209	14.
1210	14.	1211	14.	1212	14.	1213	14.	1214	13.
1215	13.	1216	13.	1217	13.	1218	13.	1219	13.
1220	13.	1221	12.	1222	12.	1223	12.	1224	12.
1225	12.	1226	12.	1227	12.	1228	12.	1229	12.
1230	11.	1231	11.	1232	11.	1233	11.	1234	11.
1235	11.	1236	11.	1237	11.	1238	11.	1239	11.
1240	11.	1241	10.	1242	10.	1243	10.	1244	10.
1245	10.	1246	10.	1247	10.	1248	10.	1249	10.
1250	10.	1251	10.	1252	10.	1253	10.	1254	10.
1255	10.	1256	10.	1257	9.	1258	9.	1259	9.
1260	9.	1261	9.	1262	9.	1263	9.	1264	9.
1265	9.	1266	9.	1267	9.	1268	9.	1269	9.
1270	9.	1271	9.	1272	9.	1273	9.	1274	9.
1275	9.	1276	9.	1277	9.	1278	9.	1279	8.
1280	8.	1281	8.	1282	8.	1283	8.	1284	8.
1285	8.	1286	8.	1287	8.	1288	8.	1289	8.
1290	8.	1291	8.	1292	8.	1293	8.	1294	8.
1295	8.	1296	8.	1297	8.	1298	8.	1299	8.
1300	8.	1310	8.	1320	7.	1330	7.	1340	7.
1350	7.	1360	7.	1370	6.	1380	6.	1390	6.
1400	6.	1420	6.	1440	5.	1460	2.	1500	2.

TOTAL VOLUME THIS HYDROGRAPH = 20.02(Ac.Ft)

Program Package Serial Number: 2033

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

RIVER VILLAGE EXISTING HYDROLOGY STUDY 7-29-03 STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	200A	17.3	24.	17.3	24.	2	800.	.01130	.00	.00	0.	220	17	A29	.00
300	201A	.0	0.	17.3	22.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	202A	.0	0.	17.3	22.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	203A	.0	0.	17.3	22.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	204A	.0	0.	17.3	22.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	205A	.0	0.	17.3	22.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	206A	.0	0.	17.3	22.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	207A	.0	0.	17.3	22.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	208A	.0	0.	17.3	22.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	209A	.0	0.	17.3	22.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	210A	35.8	39.	53.1	60.	0	0.	.00000	.00	.00	0.	220	25	A29	.00
300	211A	.0	0.	53.1	60.	0	0.	.00000	.00	.00	0.	220	99	A29	.00

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

LINE AT SECOND OUTLET POINT

HYDROGRAPH AT 300 211A STORM DAY 4 REDUCTION FACTOR = 1.000

TIME	Q	TIME	Q	TIME	Q	TIME	Q	TIME	Q
0	0.	100	4.	200	4.	300	4.	400	4.
500	4.	600	5.	700	5.	800	6.	900	6.
1000	8.	1050	10.	1100	12.	1110	13.	1120	15.
1130	18.	1131	18.	1132	18.	1133	19.	1134	19.
1135	19.	1136	20.	1137	20.	1138	20.	1139	21.
1140	21.	1141	22.	1142	23.	1143	24.	1144	24.
1145	26.	1146	27.	1147	28.	1148	29.	1149	33.
1150	36.	1151	40.	1152	44.	1153	49.	1154	51.
1155	54.	1156	56.	1157	58.	1158	59.	1159	60.
1160	60.	1161	60.	1162	60.	1163	60.	1164	59.
1165	58.	1166	57.	1167	55.	1168	54.	1169	52.
1170	50.	1171	47.	1172	44.	1173	41.	1174	36.
1175	31.	1176	26.	1177	22.	1178	19.	1179	18.
1180	17.	1181	16.	1182	15.	1183	14.	1184	14.
1185	13.	1186	13.	1187	13.	1188	12.	1189	12.
1190	12.	1191	11.	1192	11.	1193	11.	1194	11.
1195	10.	1196	10.	1197	10.	1198	10.	1199	10.
1200	10.	1201	9.	1202	9.	1203	9.	1204	9.
1205	9.	1206	9.	1207	9.	1208	9.	1209	9.
1210	8.	1211	8.	1212	8.	1213	8.	1214	8.
1215	8.	1216	8.	1217	8.	1218	8.	1219	8.
1220	8.	1221	8.	1222	7.	1223	7.	1224	7.
1225	7.	1226	7.	1227	7.	1228	7.	1229	7.
1230	7.	1231	7.	1232	7.	1233	7.	1234	7.
1235	7.	1236	7.	1237	7.	1238	7.	1239	7.
1240	7.	1241	7.	1242	6.	1243	6.	1244	6.
1245	6.	1246	6.	1247	6.	1248	6.	1249	6.
1250	6.	1251	6.	1252	6.	1253	6.	1254	6.
1255	6.	1256	6.	1257	6.	1258	6.	1259	6.
1260	6.	1261	6.	1262	6.	1263	6.	1264	6.
1265	6.	1266	6.	1267	6.	1268	6.	1269	6.
1270	6.	1271	6.	1272	6.	1273	6.	1274	5.
1275	5.	1276	5.	1277	5.	1278	5.	1279	5.
1280	5.	1281	5.	1282	5.	1283	5.	1284	5.
1285	5.	1286	5.	1287	5.	1288	5.	1289	5.
1290	5.	1291	5.	1292	5.	1293	5.	1294	5.
1295	5.	1296	5.	1297	5.	1298	5.	1299	5.
1300	5.	1310	5.	1320	5.	1330	5.	1340	4.
1350	4.	1360	4.	1370	4.	1380	4.	1390	4.
1400	4.	1420	4.	1440	4.	1460	2.	1500	1.

TOTAL VOLUME THIS HYDROGRAPH = 12.91(Ac.Ft)

Program Package Serial Number: 2033

12/02/03 FILE: 400.IN INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

RIVER VILLAGEEXISTING HYDROLOGY STUDY 7-29-03 STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	400B	18.4	20.	18.4	20.	4	155.	.01300	2.00	.00	0.	220	24	A29	.00
300	401B	.0	0.	18.4	20.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	402B	.0	0.	18.4	20.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	403B	.0	0.	18.4	20.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	404B	.0	0.	18.4	20.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	405B	38.9	39.	57.3	59.	2	920.	.00500	.00	.00	0.	220	29	A29	.00
300	406B	.0	0.	57.3	57.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	407B	.0	0.	57.3	57.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	408C	15.3	32.	15.3	32.	2	1990.	.04800	.00	.00	0.	220	8	A29	.00
300	409C	.0	0.	15.3	27.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	410C	44.3	57.	59.6	82.	0	0.	.00000	.00	.00	0.	220	19	A29	.00

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*                                        CONFLUENCE Q'S                                               *
*  300  411B  TB 1167 QB      57. QBC     114. QC      57.    300  411C  TC 1159 QC     82. QCB    129. QB     47.  *
*                          300  411BC TBC 1161 QBC    131. QB      51. QC      80.                    *
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LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	411BC	59.6	82.	116.9	131.	2	560.	.00180	.00	.00	0.	220	0	A29	.00
300	412B	.0	0.	116.9	125.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	413B	.0	0.	116.9	125.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	414B	.0	0.	116.9	125.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	415B	35.3	62.	152.2	145.	2	2430.	.01400	.00	.00	0.	220	11	A29	.00
300	416B	.0	0.	152.2	135.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	417B	.0	0.	152.2	135.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	418B	.0	0.	152.2	135.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	419B	.0	0.	152.2	135.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	420A	34.4	37.	34.4	37.	3	600.	.01000	.00	.00	0.	220	25	A29	.00

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*                                        CONFLUENCE Q'S                                               *
*  300  421A  TA 1161 QA      37. QAB     140. QB     103.    300  421B  TB 1173 QB    135. QBA    165. QA     30.  *
*                          300  421AB TAB 1169 QAB    167. QA      34. QB     133.                    *
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LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	421AB	152.2	135.	186.6	167.	0	0.	.00000	.00	.00	0.	220	0	A29	.00
300	422A	.0	0.	186.6	167.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	423A	.0	0.	186.6	167.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	424A	.0	0.	186.6	167.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	425A	39.9	48.	226.5	205.	0	0.	.00000	.00	.00	0.	220	21	A29	.00
300	426A	.0	0.	226.5	205.	0	0.	.00000	.00	.00	0.	220	99	A29	.00

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

LINE AT FOURTH OUTLET POINT

HYDROGRAPH AT 300 426A STORM DAY 4 REDUCTION FACTOR = 1.000

TIME	Q	TIME	Q	TIME	Q	TIME	Q	TIME	Q
0	0.	100	15.	200	15.	300	16.	400	17.
500	18.	600	20.	700	21.	800	24.	900	27.
1000	32.	1050	38.	1100	49.	1110	52.	1120	58.
1130	65.	1131	66.	1132	67.	1133	68.	1134	69.
1135	70.	1136	71.	1137	72.	1138	73.	1139	74.
1140	76.	1141	77.	1142	79.	1143	81.	1144	83.
1145	85.	1146	88.	1147	91.	1148	94.	1149	101.
1150	107.	1151	115.	1152	123.	1153	132.	1154	139.
1155	146.	1156	153.	1157	160.	1158	168.	1159	174.
1160	181.	1161	187.	1162	192.	1163	197.	1164	201.
1165	204.	1166	205.	1167	205.	1168	204.	1169	203.
1170	198.	1171	193.	1172	188.	1173	182.	1174	178.
1175	175.	1176	171.	1177	166.	1178	160.	1179	154.
1180	148.	1181	142.	1182	137.	1183	131.	1184	127.
1185	122.	1186	118.	1187	114.	1188	111.	1189	107.
1190	104.	1191	101.	1192	98.	1193	95.	1194	92.
1195	89.	1196	86.	1197	84.	1198	81.	1199	79.
1200	76.	1201	74.	1202	71.	1203	69.	1204	67.
1205	65.	1206	63.	1207	61.	1208	59.	1209	57.
1210	56.	1211	54.	1212	53.	1213	52.	1214	50.
1215	49.	1216	48.	1217	47.	1218	46.	1219	45.
1220	44.	1221	43.	1222	42.	1223	42.	1224	41.
1225	40.	1226	40.	1227	39.	1228	39.	1229	38.
1230	37.	1231	37.	1232	36.	1233	36.	1234	35.
1235	35.	1236	35.	1237	34.	1238	34.	1239	34.
1240	33.	1241	33.	1242	33.	1243	32.	1244	32.
1245	32.	1246	31.	1247	31.	1248	31.	1249	31.
1250	30.	1251	30.	1252	30.	1253	30.	1254	29.
1255	29.	1256	29.	1257	29.	1258	29.	1259	28.
1260	28.	1261	28.	1262	28.	1263	28.	1264	27.
1265	27.	1266	27.	1267	27.	1268	27.	1269	27.
1270	26.	1271	26.	1272	26.	1273	26.	1274	26.
1275	26.	1276	26.	1277	25.	1278	25.	1279	25.
1280	25.	1281	25.	1282	25.	1283	25.	1284	25.
1285	24.	1286	24.	1287	24.	1288	24.	1289	24.
1290	24.	1291	24.	1292	24.	1293	24.	1294	23.
1295	23.	1296	23.	1297	23.	1298	23.	1299	23.
1300	23.	1310	22.	1320	21.	1330	21.	1340	20.
1350	19.	1360	19.	1370	18.	1380	18.	1390	17.
1400	17.	1420	16.	1440	16.	1460	12.	1500	12.

TOTAL VOLUME THIS HYDROGRAPH = 55.57(Ac.Ft)

Program Package Serial Number: 2033

12/02/03 FILE: 500.IN INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

RIVER VILLAGE EXISTING HYDROLOGY STUDY 7-29-03 STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	500A	26.5	33.	26.5	33.	2	1530.	.00590	.00	.00	0.	220	20	A29	.00
300	501A	.0	0.	26.5	28.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	502A	.0	0.	26.5	28.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	503A	.0	0.	26.5	28.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	504A	.0	0.	26.5	28.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	505A	.0	0.	26.5	28.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	506A	.0	0.	26.5	28.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	507A	.0	0.	26.5	28.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	508A	.0	0.	26.5	28.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	509A	.0	0.	26.5	28.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	510A	40.0	44.	66.5	65.	0	0.	.00000	.00	.00	0.	220	25	A29	.00

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

LINE AT FIFTH OUTLET POINT

HYDROGRAPH AT 300 510A STORM DAY 4 REDUCTION FACTOR = 1.000

TIME	Q	TIME	Q	TIME	Q	TIME	Q	TIME	Q
0	0.	100	4.	200	5.	300	5.	400	5.
500	5.	600	6.	700	6.	800	7.	900	8.
1000	10.	1050	12.	1100	15.	1110	16.	1120	18.
1130	21.	1131	21.	1132	21.	1133	22.	1134	22.
1135	23.	1136	23.	1137	23.	1138	24.	1139	24.
1140	25.	1141	25.	1142	26.	1143	27.	1144	28.
1145	29.	1146	30.	1147	32.	1148	33.	1149	36.
1150	40.	1151	44.	1152	48.	1153	52.	1154	54.
1155	55.	1156	56.	1157	57.	1158	58.	1159	59.
1160	60.	1161	62.	1162	63.	1163	64.	1164	64.
1165	65.	1166	65.	1167	65.	1168	65.	1169	64.
1170	63.	1171	62.	1172	60.	1173	59.	1174	54.
1175	50.	1176	46.	1177	42.	1178	38.	1179	36.
1180	34.	1181	32.	1182	31.	1183	29.	1184	27.
1185	26.	1186	25.	1187	24.	1188	23.	1189	22.
1190	21.	1191	20.	1192	19.	1193	19.	1194	18.
1195	17.	1196	17.	1197	17.	1198	16.	1199	16.
1200	15.	1201	15.	1202	15.	1203	14.	1204	14.
1205	14.	1206	13.	1207	13.	1208	13.	1209	13.
1210	12.	1211	12.	1212	12.	1213	12.	1214	12.
1215	11.	1216	11.	1217	11.	1218	11.	1219	11.
1220	11.	1221	11.	1222	10.	1223	10.	1224	10.
1225	10.	1226	10.	1227	10.	1228	10.	1229	10.
1230	10.	1231	9.	1232	9.	1233	9.	1234	9.
1235	9.	1236	9.	1237	9.	1238	9.	1239	9.
1240	9.	1241	9.	1242	9.	1243	9.	1244	9.
1245	8.	1246	8.	1247	8.	1248	8.	1249	8.
1250	8.	1251	8.	1252	8.	1253	8.	1254	8.
1255	8.	1256	8.	1257	8.	1258	8.	1259	8.
1260	8.	1261	8.	1262	8.	1263	8.	1264	8.
1265	7.	1266	7.	1267	7.	1268	7.	1269	7.
1270	7.	1271	7.	1272	7.	1273	7.	1274	7.
1275	7.	1276	7.	1277	7.	1278	7.	1279	7.
1280	7.	1281	7.	1282	7.	1283	7.	1284	7.
1285	7.	1286	7.	1287	7.	1288	7.	1289	7.
1290	7.	1291	7.	1292	7.	1293	7.	1294	7.
1295	6.	1296	6.	1297	6.	1298	6.	1299	6.
1300	6.	1310	6.	1320	6.	1330	6.	1340	6.
1350	5.	1360	5.	1370	5.	1380	5.	1390	5.
1400	5.	1420	5.	1440	4.	1460	2.	1500	2.

TOTAL VOLUME THIS HYDROGRAPH = 16.19(Ac.Ft)

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4LADEPTH.RDT
5 50300    1A   50 YR River Village - Newhall Ranch - Chiquito Existing
5 50300   17A   HYDROGRAPH AT OUTLET BASIN 600 and Chiquito site
6 50300    1A  020   0    6 8A292   890 26500                   G1
6 50300    2A  020   0    4 6A292   200 01000
6 50300    3A   20   0    2 5A294   275 01000
6 50300    4A   20   0  1210A294   385 02000
6 50300    5B   20   0    4 5A292   530 32100
6 50300    6B   20   0  2515A294   835 02200
6 50300    7AB  20   0       A29
6 50300    8A   20   0    2 5A294   320 02000
6 50300    9A   20   0    3 5A294   900 01000
6 50300   10C   20   0  3214A292  1750 01500
6 50300   11C   20   0  1611A292  2800 01000
6 50300   12AC020            A29
6 50300   13D   20  65  1017A292  2370 01800
6 50300   14D   20  65  1210A292  1250 03200
6 50300   15AD  20           A29
6 50300   16A   20   0  1223A29
6 50300   17A  020   0    99A29                              1  2
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3-15-2005 SITE LICENSEE: Psomas

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY

50 YR River Village - Newhall Ranch - Chiquito Existing

STORM DAY 4

LOCATION		SUBAREA AREA	SUBAREA Q	TOTAL AREA	TOTAL Q	CONV TYPE	CONV LNGTH	CONV SLOPE	CONV SIZE	CONV Z	CONTROL Q	SOIL NAME	TC	RAIN ZONE	PCT IMPV
50300	1A	6.	10.	6.	10.	2	890.	0.26500	0.00	0.00	0.	20	8	A29	0.00
50300	2A	4.	8.	10.	17.	2	200.	0.01000	0.00	0.00	0.	20	6	A29	0.00
50300	3A	2.	4.	12.	18.	4	275.	0.01000	2.00	0.00	0.	20	5	A29	0.00
50300	4A	12.	17.	24.	34.	4	385.	0.02000	2.00	0.00	0.	20	10	A29	0.00
50300	5B	4.	9.	4.	9.	2	530.	0.32100	0.00	0.00	0.	20	5	A29	0.00
50300	6B	25.	27.	29.	35.	4	835.	0.02200	2.00	0.00	0.	20	15	A29	0.00
50300	7AB	29.	34.	53.	68.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	8A	2.	4.	55.	69.	4	320.	0.02000	2.75	0.00	0.	20	5	A29	0.00
50300	9A	3.	7.	58.	72.	4	900.	0.01000	3.00	0.00	0.	20	5	A29	0.00
50300	10C	32.	36.	32.	36.	2	1750.	0.01500	0.00	0.00	0.	20	14	A29	0.00
50300	11C	16.	21.	48.	40.	2	2800.	0.01000	0.00	0.00	0.	20	11	A29	0.00
50300	12AC	48.	29.	106.	78.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	13D	10.	16.	10.	16.	2	2370.	0.01800	0.00	0.00	0.	20	17	A29	0.65
50300	14D	12.	25.	22.	32.	2	1250.	0.03200	0.00	0.00	0.	20	10	A29	0.65
50300	15AD	22.	30.	128.	107.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	16A	12.	10.	140.	117.	0	0.	0.00000	0.00	0.00	0.	20	23	A29	0.00
50300	17A	0.	0.	140.	117.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY
HYDROGRAPH AT OUTLET BASIN 600 and Chiquito site
HYDROGRAPH AT 50300 17A STORM DAY 4 REDUCTION FACTOR = 1.000

TIME	Q	TIME	Q	TIME	Q	TIME	Q	TIME	Q
0	0.	100	4.	200	4.	300	4.	400	5.
500	5.	600	5.	700	6.	800	6.	900	7.
1000	8.	1050	10.	1100	13.	1110	15.	1120	18.
1130	23.	1131	23.	1132	24.	1133	25.	1134	25.
1135	26.	1136	27.	1137	27.	1138	28.	1139	29.
1140	30.	1141	32.	1142	33.	1143	34.	1144	36.
1145	37.	1146	39.	1147	41.	1148	44.	1149	47.
1150	51.	1151	56.	1152	63.	1153	72.	1154	82.
1155	93.	1156	102.	1157	109.	1158	114.	1159	116.
1160	117.	1161	116.	1162	113.	1163	107.	1164	101.
1165	94.	1166	89.	1167	84.	1168	80.	1169	76.
1170	73.	1171	70.	1172	67.	1173	63.	1174	61.
1175	58.	1176	57.	1177	55.	1178	54.	1179	53.
1180	52.	1181	51.	1182	50.	1183	48.	1184	47.
1185	46.	1186	44.	1187	43.	1188	41.	1189	40.
1190	38.	1191	37.	1192	35.	1193	34.	1194	33.
1195	32.	1196	30.	1197	29.	1198	28.	1199	27.
1200	26.	1201	25.	1202	24.	1203	23.	1204	23.
1205	22.	1206	21.	1207	21.	1208	20.	1209	19.
1210	19.	1211	18.	1212	18.	1213	17.	1214	17.
1215	16.	1216	16.	1217	15.	1218	15.	1219	15.
1220	14.	1221	14.	1222	14.	1223	13.	1224	13.
1225	13.	1226	13.	1227	12.	1228	12.	1229	12.
1230	12.	1231	11.	1232	11.	1233	11.	1234	11.
1235	11.	1236	11.	1237	10.	1238	10.	1239	10.
1240	10.	1241	10.	1242	10.	1243	9.	1244	9.
1245	9.	1246	9.	1247	9.	1248	9.	1249	9.
1250	9.	1251	9.	1252	9.	1253	8.	1254	8.
1255	8.	1256	8.	1257	8.	1258	8.	1259	8.
1260	8.	1261	8.	1262	8.	1263	8.	1264	8.
1265	8.	1266	7.	1267	7.	1268	7.	1269	7.
1270	7.	1271	7.	1272	7.	1273	7.	1274	7.
1275	7.	1276	7.	1277	7.	1278	7.	1279	7.
1280	7.	1281	7.	1282	7.	1283	7.	1284	7.
1285	7.	1286	7.	1287	7.	1288	6.	1289	6.
1290	6.	1291	6.	1292	6.	1293	6.	1294	6.
1295	6.	1296	6.	1297	6.	1298	6.	1299	6.
1300	6.	1310	6.	1320	6.	1330	5.	1340	5.
1350	5.	1360	5.	1370	5.	1380	5.	1390	5.
1400	5.	1420	5.	1440	4.	1460	4.	1500	4.

Total Runoff = 17.108 Acre-Ft.
Peak Q = 117 CFS
Time to Peak Q = 1160 Minutes

APPENDIX 5

LACDPW MORA CALCULATIONS
PROPOSED CONDITION

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY

RIVER VILLAGE WEST HYDROLOGY - Proposed Condition STORM DAY 4

LOCATION		SUBAREA AREA	SUBAREA Q	TOTAL AREA	TOTAL Q	CONV TYPE	CONV LNGTH	CONV SLOPE	CONV SIZE	CONV Z	CONTROL Q	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	1A	11.	17.	11.	17.	5	820.	0.00013	8.00	4.00	0.	20	14	A29	0.44
300	2A	15.	28.	26.	33.	0	0.	0.00000	0.00	0.00	0.	20	14	A29	0.73

5-24-2005 SITE LICENSEE: GMV ENGINEERING

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

PROG F0601A

MODIFIED RATIONAL METHOD HYDROLOGY

RIVER VILLAGE CENTRAL, PROPOSED CONDITION, FREQ=50, LADEPTH

STORM DAY 4

LOCATION		SUBAREA AREA	SUBAREA Q	TOTAL AREA	TOTAL Q	CONV TYPE	CONV LNGTH	CONV SLOPE	CONV SIZE	CONV Z	CONTROL Q	SOIL NAME	TC	RAIN ZONE	PCT IMPV
1	1A	0.	0.	0.	0.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	2A	11.	18.	11.	18.	0	0.	0.00000	0.00	0.00	0.	20	9	A29	0.13
1	3A	12.	20.	23.	38.	4	112.	0.00800	2.50	0.00	0.	20	15	A29	0.60
1	4A	0.	0.	23.	38.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	5A	0.	0.	23.	38.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	6A	0.	0.	23.	38.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	7A	10.	13.	33.	51.	0	0.	0.00000	0.00	0.00	0.	20	27	A29	0.71
1	8A	5.	8.	38.	60.	0	0.	0.00000	0.00	0.00	0.	20	14	A29	0.55
1	9A	0.	0.	38.	60.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	10A	0.	0.	38.	60.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	11B	16.	30.	16.	30.	0	0.	0.00000	0.00	0.00	0.	20	11	A29	0.53
1	12C	3.	3.	3.	3.	5	802.	0.00300	1.00	0.00	0.	20	18	A29	0.15
1	13C	2.	3.	5.	5.	5	860.	0.00300	2.00	0.00	0.	20	12	A29	0.00
1	14C	0.	0.	5.	4.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	15C	0.	0.	5.	4.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	16C	0.	0.	5.	4.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	17C	2.	2.	7.	6.	0	0.	0.00000	0.00	0.00	0.	20	19	A29	0.00
1	18C	17.	29.	24.	34.	0	0.	0.00000	0.00	0.00	0.	20	14	A29	0.60
1	19D	0.	0.	0.	0.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	20D	0.	0.	0.	0.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00
1	21D	3.	3.	3.	3.	0	0.	0.00000	0.00	0.00	0.	20	16	A29	0.00
1	22D	3.	7.	6.	10.	0	0.	0.00000	0.00	0.00	0.	20	12	A29	1.00
1	23E	39.	53.	39.	53.	4	100.	0.00900	2.75	0.00	0.	20	24	A29	0.67
1	24E	7.	12.	46.	65.	4	260.	0.00900	3.00	0.00	0.	20	22	A29	0.92

Program Package Serial Number: 2033

05/23/05 FILE: rvebur INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units PAGE 1

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

RIVER VILLAGE EAST HYDROLOGY - Proposed Condition STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	1A	18.4	20.	18.4	20.	4	110.	.01000	2.00	.00	0.	220	24	A29	.00
300	2A	38.9	39.	57.3	60.	2	915.	.00500	.00	.00	0.	220	28	A29	.00
300	3B	15.3	32.	15.3	32.	3	1930.	.04800	.00	.00	0.	220	8	A29	.00
300	4B	44.3	57.	59.6	83.	0	0.	.00000	.00	.00	0.	220	19	A29	.00

****

* CONFLUENCE Q'S *

* 300 5A TA 1167 QA 57. QAB 114. QB 56. 300 5B TB 1159 QB 83. QBA 130. QA 47. *

* 300 5AB TAB 1161 QAB 132. QA 52. QB 80. *

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LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	5AB	59.6	83.	116.9	132.	2	550.	.00180	.00	.00	0.	20	0	A29	.00
300	6A	35.3	62.	152.2	147.	4	243.	.01300	3.75	.00	0.	220	11	A29	.00
300	7A	14.1	21.	166.3	167.	4	50.	.00700	4.50	.00	0.	20	29	A29	1.00
300	8A	22.8	26.	189.1	193.	4	600.	.00360	5.50	.00	0.	20	30	A29	.58
300	9A	5.7	11.	194.8	198.	4	830.	.00360	5.50	.00	0.	20	11	A29	.58
300	10A	.0	0.	194.8	196.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	11B	16.2	27.	16.2	27.	0	0.	.00000	.00	.00	0.	20	14	A29	.54
300	12C	1.2	1.	1.2	1.	0	0.	.00000	.00	.00	0.	20	15	A29	.00
300	13C	16.5	25.	17.7	26.	0	0.	.00000	.00	.00	0.	20	19	A29	.63
300	14C	.0	0.	17.7	26.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	15C	.0	0.	17.7	26.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	16D	2.1	2.	2.1	2.	0	0.	.00000	.00	.00	0.	20	20	A29	.00
300	17D	18.0	30.	20.1	32.	0	0.	.00000	.00	.00	0.	20	15	A29	.58
300	18D	.0	0.	20.1	32.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	19D	.0	0.	20.1	32.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	20E	18.3	28.	18.3	28.	0	0.	.00000	.00	.00	0.	20	16	A29	.50
300	21F	.7	1.	.7	1.	5	861.	.00300	8.00	4.00	0.	20	7	A29	.00
300	22F	.0	0.	.7	1.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	23F	.0	0.	.7	1.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	24F	1.5	2.	2.2	3.	0	0.	.00000	.00	.00	0.	20	14	A29	.00
300	25F	14.4	22.	16.6	25.	0	0.	.00000	.00	.00	0.	20	16	A29	.52
300	26F	.0	0.	16.6	25.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	27B	7.3	15.	7.3	15.	4	700.	.02000	2.00	.00	0.	20	12	A29	.76
300	28B	5.0	11.	12.3	26.	4	300.	.05290	2.00	.00	0.	20	10	A29	.76
300	29B	1.1	1.	13.4	27.	4	550.	.01000	2.25	.00	0.	20	14	A29	.00
300	30B	.0	0.	13.4	27.	0	0.	.00000	.00	.00	0.	20	99	A29	.00

```
4LADEPTH.RDT
5 50300    1A  50 YR River Village - Newhall Ranch - Chiquito Proposed
5 50300   12A  HYDROGRAPH AT OUTLET BASIN AREAs A
6 50300    1A 020   623.9 9A292 1160 22900                     G1
6 50300    2B 020   0 4.4 5A292  530 32100
6 50300    3B  20   222.615A294  835 02200
6 50300    4AB 20   0       A29
6 50300    5A  20 10 6.2 5A294  320 02200
6 50300    6C  20   431.814A292 1750 01500
6 50300    7C  20   514.511A292 2800 01000
6 50300    8AC020           A29
6 50300    9D  20 90 7.321A292 2350 00600
6 50300   10D  20 90 4.412A292 1300 01900
6 50300   11AD 20           A29
6 50300   12A 020  0     99A29                              1  2
```

3-15-2005 SITE LICENSEE: Psomas

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY

50 YR River Village - Newhall Ranch - Chiquito Proposed

LOCATION		SUBAREA AREA	SUBAREA Q	TOTAL AREA	TOTAL Q	CONV TYPE	CONV LNGTH	CONV SLOPE	CONV SIZE	CONV Z	CONTROL Q	SOIL NAME	TC	STORM DAY 4 RAIN ZONE	PCT IMPV
50300	1A	24.	38.	24.	38.	2	1160.	0.22900	0.00	0.00	0.	20	9	A29	0.06
50300	2B	4.	9.	4.	9.	2	530.	0.32100	0.00	0.00	0.	20	5	A29	0.00
50300	3B	23.	25.	27.	33.	4	835.	0.02200	2.00	0.00	0.	20	15	A29	0.02
50300	4AB	27.	32.	51.	70.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	5A	6.	14.	57.	78.	4	320.	0.02200	2.75	0.00	0.	20	5	A29	0.10
50300	6C	32.	38.	32.	38.	2	1750.	0.01500	0.00	0.00	0.	20	14	A29	0.04
50300	7C	14.	19.	46.	40.	2	2800.	0.01000	0.00	0.00	0.	20	11	A29	0.05
50300	8AC	46.	30.	103.	85.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	9D	7.	12.	7.	12.	2	2350.	0.00600	0.00	0.00	0.	20	21	A29	0.90
50300	10D	4.	9.	11.	13.	2	1300.	0.01900	0.00	0.00	0.	20	12	A29	0.90
50300	11AD	11.	12.	114.	93.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	12A	0.	0.	114.	93.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00

1 3-15-2005 SITE LICENSEE: Psomas

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY
HYDROGRAPH AT OUTLET BASIN AREAs A

HYDROGRAPH AT 50300 12A STORM DAY 4 REDUCTION FACTOR = 1.000

TIME	Q	TIME	Q	TIME	Q	TIME	Q	TIME	Q
0	0.	100	4.	200	4.	300	4.	400	4.
500	4.	600	4.	700	5.	800	5.	900	6.
1000	7.	1050	9.	1100	11.	1110	13.	1120	16.
1130	20.	1131	20.	1132	21.	1133	21.	1134	22.
1135	22.	1136	23.	1137	24.	1138	24.	1139	25.
1140	26.	1141	27.	1142	29.	1143	30.	1144	31.
1145	33.	1146	35.	1147	37.	1148	39.	1149	43.
1150	48.	1151	55.	1152	65.	1153	76.	1154	85.
1155	91.	1156	93.	1157	93.	1158	90.	1159	86.
1160	81.	1161	75.	1162	70.	1163	66.	1164	62.
1165	59.	1166	56.	1167	53.	1168	51.	1169	49.
1170	47.	1171	46.	1172	45.	1173	44.	1174	44.
1175	44.	1176	44.	1177	44.	1178	44.	1179	44.
1180	44.	1181	44.	1182	43.	1183	43.	1184	42.
1185	41.	1186	41.	1187	40.	1188	39.	1189	38.
1190	37.	1191	36.	1192	35.	1193	34.	1194	33.
1195	32.	1196	31.	1197	30.	1198	29.	1199	28.
1200	27.	1201	26.	1202	26.	1203	25.	1204	24.
1205	23.	1206	22.	1207	22.	1208	21.	1209	20.
1210	20.	1211	19.	1212	19.	1213	18.	1214	18.
1215	17.	1216	17.	1217	16.	1218	16.	1219	15.
1220	15.	1221	15.	1222	14.	1223	14.	1224	14.
1225	13.	1226	13.	1227	13.	1228	13.	1229	12.
1230	12.	1231	12.	1232	12.	1233	11.	1234	11.
1235	11.	1236	11.	1237	11.	1238	10.	1239	10.
1240	10.	1241	10.	1242	10.	1243	10.	1244	9.
1245	9.	1246	9.	1247	9.	1248	9.	1249	9.
1250	9.	1251	9.	1252	8.	1253	8.	1254	8.
1255	8.	1256	8.	1257	8.	1258	8.	1259	8.
1260	8.	1261	8.	1262	8.	1263	7.	1264	7.
1265	7.	1266	7.	1267	7.	1268	7.	1269	7.
1270	7.	1271	7.	1272	7.	1273	7.	1274	7.
1275	7.	1276	7.	1277	7.	1278	7.	1279	6.
1280	6.	1281	6.	1282	6.	1283	6.	1284	6.
1285	6.	1286	6.	1287	6.	1288	6.	1289	6.
1290	6.	1291	6.	1292	6.	1293	6.	1294	6.
1295	6.	1296	6.	1297	6.	1298	6.	1299	6.
1300	6.	1310	5.	1320	5.	1330	5.	1340	5.
1350	5.	1360	4.	1370	4.	1380	4.	1390	4.
1400	4.	1420	4.	1440	4.	1460	4.	1500	4.

Total Runoff = 14.857 Acre-Ft.
Peak Q = 93 CFS
Time to Peak Q = 1156 Minutes

APPENDIX 6

SUSMP CALCULATIONS

Landmark Village TR53108
Water Quality BMP Calculations
Based on Geosyntec Report Criteria

TREATMENT BMP CALCULATIONS FOR 80% CAPTURE BY DRAINAGE AREA

Calculations based on criteria from Geosyntec Report

LANDMARK VILLAGE EAST

Subarea	Area (ac)	Intensity (in/hr)	% Impervious	C	Qpm (cfs)	BMP Type	BMP Site	n	Side Slope (Z)	Longitudinal Slope (ft/ft)	Bottom Width (b)	Depth (Dwq)	Cross-Sectional Area (A)	Velocity	Required Length for 10 min contact	Bioretention Factor	Bioretention Area (acres)	Mitigated Volume (Vm (acre-ft))
RVE-8A	22.8	0.3	0.58	0.572	n/a	Bioretention	RVE-8A									0.04	0.91	1.82
RVE-9A	5.7	0.3	0.58	0.572	n/a	Bioretention	RVE-9A									0.04	0.23	0.46
RVE-11B	16.2	0.3	0.607	0.5963	2.9	Vegetative Swale	RVE-12C	0.25	3	0.01	15.5253	0.5	8.512637	0.34067	210	0.042	n/a	n/a
RVE-13C	16.5	0.3	0.68	0.662	3.3	Vegetative Swale	RVE-16D	0.25	3	0.01	17.6667	0.5	9.583346	0.344347	210	0.048	n/a	n/a
RVE-17D	18	0.3	0.576	0.5684	3.1	Vegetative Swale	RVE-21F	0.25	3	0.01	16.596	0.5	9.047992	0.342617	210	0.042	n/a	n/a
RVE-20E	18.3	0.3	0.673	0.6557	3.6	Vegetative Swale	RVE-24F	0.25	3	0.01	19.2728	0.5	10.38638	0.346608	210	0.048	n/a	n/a
RVE-25F	14.4	0.3	0.589	0.5801	2.5	Vegetative Swale	RVE-29B	0.25	3	0.01	13.3839	0.5	7.441929	0.335934	210	0.042	n/a	n/a
RVE-27B	7.3	0.3	0.76	0.734	n/a	Bioretention	RVC-12C	0.25	3	0.01	n/a	0.33	n/a	n/a	n/a	0.052	0.38	0.66
RVE-28B	5	0.3	0.76	0.734	n/a	Bioretention	RVC-12C	0.25	3	0.01	n/a	0.33	n/a	n/a	n/a	0.052	0.26	0.45

LANDMARK VILLAGE CENTRAL

Subarea	Area (ac)	Intensity (in/hr)	% Impervious	C	Qpm (cfs)	BMP Type	BMP Site	n	Side Slope (Z)	Longitudinal Slope (ft/ft)	Bottom Width (b)	Depth (Dwq)	Cross-Sectional Area (A)	Velocity	Required Length for 10 min contact	Bioretention Factor	Bioretention Area (acres)	Mitigated Volume (Vm (acre-ft))
RVC-2A	10.9	0.3	0.131	0.1679	n/a	Bioretention	RVC-12C	0.25	3	0.01	n/a	0.33	n/a	n/a	n/a	0.02	0.22	0.55
RVC-3A	11.9	0.3	0.597	0.5873	n/a	Bioretention	RVC-12C	0.25	3	0.013	n/a	0.33	n/a	n/a	n/a	0.042	0.50	0.95
RVC-7A	10.2	0.3	0.738	0.7142	n/a	Bioretention	RVC-12C	0.25	3	0.014	n/a	0.33	n/a	n/a	n/a	0.05	0.51	0.92
RVC-8A	5.1	0.3	0.761	0.7349	n/a	Bioretention	RVC-12C	0.25	3	0.014	n/a	0.33	n/a	n/a	n/a	0.052	0.27	0.46
RVC-11B	16.4	0.3	0.664	0.6476	3.2	Vegetative Swale	RVC-17C	0.25	3	0.01	17.1313	0.5	9.315669	0.343507	210	0.048	n/a	n/a
RVC-18C	17.4	0.3	0.646	0.6314	3.3	Vegetative Swale	RVC-21D	0.25	3	0.01	17.6667	0.5	9.583346	0.344347	210	0.046	n/a	n/a
RVC-22D	2.5					WQ Extended Detention Basin	RVC-21D											0.30
RVC-23E	39.3					WQ Extended Detention Basin	RVC-21D											3.14
RVC-24E	7.4	0.3	0.909	0.8681	1.9	WQ Extended Detention Basin	RVC-21D	0.25	3	0.01	10.1717	0.5	5.835866	0.325573	200			0.81

LANDMARK VILLAGE WEST

Subarea	Area (ac)	Intensity (in/hr)	% Impervious	C	Qpm (cfs)	BMP Type	BMP Site	n	Side Slope (Z)	Longitudinal Slope (ft/ft)	Bottom Width (b)	Depth (Dwq)	Cross-Sectional Area (A)	Velocity	Required Length for 10 min contact	Bioretention Factor	Bioretention Area (acres)	Mitigated Volume (Vm (acre-ft))
RVW-1A	10.8	0.3	0.65	0.635	2.1	Vegetative Swale	RVW-2A	0.25	3	0.01	11.2424	0.5	6.37122	0.329607	200		n/a	n/a
RVW-2A	14.7	0.3	0.729	0.7061	3.1	Vegetative Swale	RVW-2A	0.25	3	0.01	16.596	0.5	9.047992	0.342617	210		n/a	n/a

SUSMP CALCULATIONS USING LA COUNTY METHODOLOGY
Landmark - VTTM 53108

SUMMARY

LANDMARK VILLAGE EAST

Sub-area	Area (ac)	Qpm	Vm
RVE-8A	22.8	2.5	0.80
RVE-9A	5.7	0.6	0.20
RVE-11B	16.2	1.8	0.59
RVE-13C	16.5	2.1	0.66
RVE-17D	18	2.0	0.63
RVE-20E	18.3	2.3	0.73
RVE-25F	14.4	1.6	0.51
RVE-27B	7.3	1.0	0.32
RVE-28B	5	0.7	0.22

LANDMARK VILLAGE CENTRAL

Sub-area	Area (ac)	Qpm	Vm
RVC-2A	10.9	0.4	0.14
RVC-3A	11.9	1.3	0.43
RVC-7A	10.2	1.4	0.44
RVC-8A	5.1	0.7	0.23
RVC-11B	16.4	2.0	0.65
RVC-18C	16.4	2.0	0.65
RVC-22D	2.5	0.4	0.14
RVC-23E	39.3	6.3	2.01
RVC-24E	7.4	1.2	0.38

LANDMARK VILLAGE WEST.

Sub-area	Area (ac)	Qpm (cfs)	Vm (ac/ft)
RVW-1A	14.7	2.0	0.63
RVW-2A	10.8	1.3	0.42

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVW - 2A**

PROJECT CHARACTERISTICS

A_{Total}	14.7
Type of Development	Mullti Family - Commercial - Road
Predominate Soil Type	20
% of Project Impervious	0.729
% of Project Pervious	0.271
% of project contributing undeveloped area	0
A_I (Impervious Area)	10.7
A_p (Pervious Area)	4.0
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.6832	0.131858	56.4	26.4	0.729	1800	0.02	958	922
2	56.4			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X*A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **2.0 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **27342.18** Cubic Ft.

0.63 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVW - 1A**

PROJECT CHARACTERISTICS

A_{Total}	10.8
Type of Development	Mullti Family & Commercial
Predominate Soil Type	20
% of Project Impervious	0.65
% of Project Pervious	0.35
% of project contributing undeveloped area	0
A_I (Impervious Area)	7.0
A_p (Pervious Area)	3.8
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.62	0.11966	56.9	26.9	0.65	1300	0.008462	934	923
2	56.9			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X \cdot A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} 1.3 cfs.

Mitigation Volume Calculations - V_m

$V_m = 2722.5(Cu\ Ft/Ac)*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} 18229.86 Cubic Ft.

0.42 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVE - 28B**

PROJECT CHARACTERISTICS

A_{Total}	5
Type of Development	Multi-Family & commercial
Predominate Soil Type	20
% of Project Impervious	0.76
% of Project Pervious	0.24
% of project contributing undeveloped area	0
A_I (Impervious Area)	3.8
A_p (Pervious Area)	1.2
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.708	0.136644	39.7	9.7	0.76	650	0.006154	946	942
2	39.7			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D * I_X \cdot A_{Total}$*(1.008333ft^3-hour/acre-inches-second)

Q_{PM} **0.7 cfs.**

Mitigation Volume Calculations - V_m

V_m = 2722.5(Cu Ft/Ac)*[(A_I)(0.9) + (A_p+A_u)(C_u)}

V_{m+} **9637.65** Cubic Ft.

0.22 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVE - 27B**

PROJECT CHARACTERISTICS

A_{Total}	7.3
Type of Development	Multi-Family & commercial
Predominate Soil Type	20
% of Project Impervious	0.76
% of Project Pervious	0.24
% of project contributing undeveloped area	0
A_I (Impervious Area)	5.5
A_p (Pervious Area)	1.8
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.708	0.136644	49.0	19.0	0.76	1200	0.011667	961	947
2	49.0			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D * I_X \cdot A_{Total} * (1.008333 ft^3\text{-hour/acre-inches-second})$

Q_{PM} **1.0 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac}) * [(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **14070.97** Cubic Ft.
0.32 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVE - 25F**

PROJECT CHARACTERISTICS

A_{Total}	14.4
Type of Development	Multi-Family detatched units
Predominate Soil Type	20
% of Project Impervious	0.589
% of Project Pervious	0.411
% of project contributing undeveloped area	0
A_I (Impervious Area)	8.5
A_p (Pervious Area)	5.9
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.5712	0.110242	59.6	29.6	0.589	1100	0.004545	954	949
2	59.6			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X \cdot A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **1.6 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **22393.32** Cubic Ft.
0.51 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVE - 20E**

PROJECT CHARACTERISTICS

A_{Total}	18.3
Type of Development	Multi-Family & Commercial
Predominate Soil Type	20
% of Project Impervious	0.673
% of Project Pervious	0.327
% of project contributing undeveloped area	0
A_I (Impervious Area)	12.3
A_p (Pervious Area)	6.0
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.6384	0.123211	65.2	35.2	0.673	1800	0.008889	971	955
2	65.2			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D * I_X * A_{Total} * (1.008333 ft^3\text{-hour/acre-inches-second})$

Q_{PM} **2.3 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **31806.21** Cubic Ft.

0.73 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVE - 17D**

PROJECT CHARACTERISTICS

A_{Total}	18
Type of Development	Multi-Family detatched units
Predominate Soil Type	20
% of Project Impervious	0.576
% of Project Pervious	0.424
% of project contributing undeveloped area	0
A_I (Impervious Area)	10.4
A_p (Pervious Area)	7.6
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.5608	0.108234	65.0	35.0	0.576	1500	0.0078	969.7	958
2	65.0			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D * I_X * A_{Total} * (1.008333 ft^3\text{-hour/acre-inches-second})$

Q_{PM} **2.0 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **27482** Cubic Ft.

0.63 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVE - 13C**

PROJECT CHARACTERISTICS

A_{Total}	16.5
Type of Development	Multi-Family detatched units
Predominate Soil Type	20
% of Project Impervious	0.68
% of Project Pervious	0.32
% of project contributing undeveloped area	0
A_I (Impervious Area)	11.2
A_p (Pervious Area)	5.3
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.644	0.124292	73.1	43.1	0.68	1900	0.004474	974.5	966
2	73.1			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X \cdot A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **2.1 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **28929.29** Cubic Ft.
0.66 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVE - 11B**

PROJECT CHARACTERISTICS

A_{Total}	16.2
Type of Development	Multi-Family detatched units
Predominate Soil Type	20
% of Project Impervious	0.607
% of Project Pervious	0.393
% of project contributing undeveloped area	0
A_I (Impervious Area)	9.8
A_p (Pervious Area)	6.4
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.5856	0.113021	55.2	25.2	0.607	1050	0.00619	974.5	968
2	55.2			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X*A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **1.8 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **25827.6** Cubic Ft.

0.59 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVE - 9A**

PROJECT CHARACTERISTICS

A_{Total}	5.7
Type of Development	Multi-Family / Open Space
Predominate Soil Type	20
% of Project Impervious	0.58
% of Project Pervious	0.42
% of project contributing undeveloped area	0
A_I (Impervious Area)	3.3
A_p (Pervious Area)	2.4
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.564	0.108852	38.1	8.1	0.58	550	0.010909	949	943
2	38.1			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X \cdot A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **0.6 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **8752.293** Cubic Ft.
0.20 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVE - 8A**

PROJECT CHARACTERISTICS

A_{Total}	22.8
Type of Development	Multi-Family / Open Space
Predominate Soil Type	20
% of Project Impervious	0.58
% of Project Pervious	0.42
% of project contributing undeveloped area	0
A_I (Impervious Area)	13.2
A_p (Pervious Area)	9.6
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.564	0.108852	84.5	54.5	0.58	2500	0.0068	965	948
2	84.5			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X \cdot A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **2.5 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **35009.17** Cubic Ft.

0.80 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVC - 24E**

PROJECT CHARACTERISTICS

A_{Total}	7.4
Type of Development	Commercial / Road
Predominate Soil Type	20
% of Project Impervious	0.9
% of Project Pervious	0.1
% of project contributing undeveloped area	0
A_I (Impervious Area)	6.7
A_p (Pervious Area)	0.7
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.82	0.15826	71.2	41.2	0.9	2800	0.008571	950	926
2	71.2			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X*A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **1.2 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **16520.13** Cubic Ft.
0.38 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVC - 23E**

PROJECT CHARACTERISTICS

A_{Total}	39.3
Type of Development	Commercial
Predominate Soil Type	20
% of Project Impervious	0.9
% of Project Pervious	0.1
% of project contributing undeveloped area	0
A_I (Impervious Area)	35.4
A_p (Pervious Area)	3.9
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.82	0.15826	71.2	41.2	0.9	2800	0.008571	950	926
2	71.2			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X \cdot A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **6.3 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(Cu Ft/Ac)*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **87735.29** Cubic Ft.
2.01 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVC - 22D**

PROJECT CHARACTERISTICS

A_{Total}	2.5
Type of Development	Road - Bridge
Predominate Soil Type	20
% of Project Impervious	1
% of Project Pervious	0
% of project contributing undeveloped area	0
A_I (Impervious Area)	2.5
A_p (Pervious Area)	0.0
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS   Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.9	0.1737	40.4	10.4	1	1000	0.01	939	929
2	40.4			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X*A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **0.4 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(Cu\ Ft/Ac)*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **6125.625** Cubic Ft.

0.14 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVC - 18C**

PROJECT CHARACTERISTICS

A_{Total}	16.4
Type of Development	Multi Family - Detatched & Road
Predominate Soil Type	20
% of Project Impervious	0.664
% of Project Pervious	0.336
% of project contributing undeveloped area	0
A_I (Impervious Area)	10.9
A_p (Pervious Area)	5.5
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.6312	0.121822	57.1	27.1	0.664	1200	0.005833	940	933
2	57.1			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D * I_X * A_{Total} * (1.008333 ft^3\text{-hour/acre-inches-second})$

Q_{PM} **2.0 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac}) * [(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **28182.45** Cubic Ft.
0.65 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVC - 11B**

PROJECT CHARACTERISTICS

A_{Total}	16.4
Type of Development	Multi Family - Detatched & Road
Predominate Soil Type	20
% of Project Impervious	0.664
% of Project Pervious	0.336
% of project contributing undeveloped area	0
A_I (Impervious Area)	10.9
A_p (Pervious Area)	5.5
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS | Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.6312	0.121822	55.6	25.6	0.664	1150	0.006087	944	937
2	55.6			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D * I_X \cdot A_{Total} * (1.008333 ft^3\text{-hour/acre-inches-second})$

Q_{PM} **2.0 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(Cu\ Ft/Ac)*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **28182.45** Cubic Ft.
0.65 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVC - 8A**

PROJECT CHARACTERISTICS

A_{Total}	5.1
Type of Development	Multi Family - Detatched & Road
Predominate Soil Type	20
% of Project Impervious	0.761
% of Project Pervious	0.239
% of project contributing undeveloped area	0
A_I (Impervious Area)	3.9
A_p (Pervious Area)	1.2
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.7088	0.136798	48.7	18.7	0.761	950	0.005263	944	939
2	48.7			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X \cdot A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **0.7 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **9841.511** Cubic Ft.
0.23 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVC - 7A**

PROJECT CHARACTERISTICS

A_{Total}	10.2
Type of Development	Multi Family - Detatched & Road
Predominate Soil Type	20
% of Project Impervious	0.738
% of Project Pervious	0.262
% of project contributing undeveloped area	0
A_I (Impervious Area)	7.5
A_p (Pervious Area)	2.7
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.6904	0.133247	70.7	40.7	0.738	2300	0.008696	960	940
2	70.7			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X*A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **1.4 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(Cu\ Ft/Ac)*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **19172.06** Cubic Ft.
0.44 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVC - 3A**

PROJECT CHARACTERISTICS

A_{Total}	11.9
Type of Development	Park
Predominate Soil Type	20
% of Project Impervious	0.597
% of Project Pervious	0.403
% of project contributing undeveloped area	0
A_I (Impervious Area)	7.1
A_p (Pervious Area)	4.8
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS

Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.5776	0.111477	56.4	26.4	0.597	1250	0.0104	953	940
2	56.4			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D{*}I_X{\cdot}A_{Total}{*}(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **1.3 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **18712.94** Cubic Ft.

0.43 Acre ft

SUSMP CALCULATIONS

PROJECT: **LANDMARK VILLAGE**
SUB-BASIN NUMBER **RVC - 2A**

PROJECT CHARACTERISTICS

A_{Total}	10.9
Type of Development	Park
Predominate Soil Type	20
% of Project Impervious	0.131
% of Project Pervious	0.869
% of project contributing undeveloped area	0
A_I (Impervious Area)	1.4
A_p (Pervious Area)	9.5
A_u (Contrib Undeveloped upstream area)	0

TABLE FOR T_c ITERATIONS Area P3

Iteration No.	Initial Tc (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr	Calculated Tc (min)	Difference (min)	Imp.	Length	Slope	Top Elev	Low Elev
1	30	0.193	0.1	0.2048	0.039526	75.2	45.2	0.131	750	0.010667	948	940
2	75.2			0	0	#DIV/0!	#DIV/0!			#DIV/0!		
3												

Acceptable Tc Value 30.0 Minutes. Use 30 min max for Tc.

Peak Mitigation Flow Rate Q_{pm}

$Q_{pm} = C_D*I_X*A_{Total}*(1.008333ft^3\text{-hour/acre-inches-second})$

Q_{PM} **0.4 cfs.**

Mitigation Volume Calculations - V_m

$V_m = 2722.5(\text{Cu Ft/Ac})*[(A_I)(0.9) + (A_p+A_u)(C_u)\}$

V_{m+} **6077.491** Cubic Ft.

0.14 Acre ft

APPENDIX 7

DRAINAGE CONCEPT EXHIBITS

Please refer to map No. 4.2-E in the accompanying map box.

Please refer to map No. 4.2-F in the accompanying map box.

Please refer to map No. 4.2-G in the accompanying map box.

Please refer to map No. 4.2-H in the accompanying map box.

Please refer to map No. 4.2-I in the accompanying map box.

Please refer to map No. 4.2-J in the accompanying map box.

Off-Site Borrow Areas
Dated September 21, 2005

PSOMAS

FILE COPY

OFF-SITE BORROW AREAS
(UNDER CONDITIONAL USE PERMIT)
DRAINAGE CONCEPT

September 21, 2005

OFF-SITE BORROW AREAS
(UNDER CONDITIONAL USE PERMIT)
DRAINAGE CONCEPT

Psomas Project No: 1NRC010706
Prepared: 09-21-2005

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REGISTERED PROFESSIONAL ENGINEER
ROSS WILLIAM BARKER
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STATE OF CALIFORNIA

9-22-2005

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1.0 Introduction

Project Background

Psomas has been retained by the Newhall Land Co. to prepare a drainage concept report for the two off-site borrow areas associated with the Tentative Tract Map No. 53108 for the proposed Landmark Village development. The borrow areas are under a Conditional Use Permit (CUP), not part of the tentative tract map itself. The Chiquito Canyon borrow site is located north of Landmark Village, just north of SR 126. The Adobe Canyon borrow site is located south of Landmark Village, just south of the Santa Clara River.

Purpose and Scope

The project falls under the jurisdiction of the Los Angeles County Department of Public Works (LACDPW). The purpose of this drainage concept report is:

- To meet Los Angeles County Land Development requirements in support of the tentative tract map submittal, allowing final design and construction to proceed in a timely manner;
- To determine the proposed development's impact to existing hydrologic conditions;
- To provide sufficient detailed information to support detailed hydraulic design of storm drainage facilities; and
- To document that the Los Angeles County Standard Urban Stormwater Mitigation Plan (SUSMP) requirements will be met.

It should be noted that detailed storm drain and debris basin analyses is beyond the scope of this drainage concept.

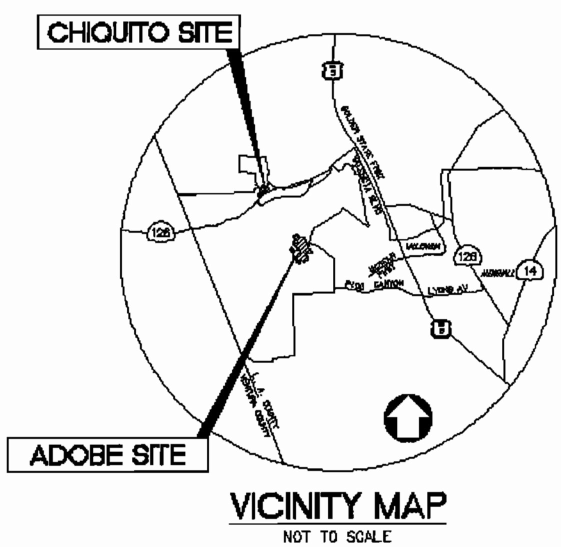


Figure 1. Location Map

2.0 Hydrology

General Approach

The watershed for each borrow site area was divided into several sub-basins that were identified and characterized for both existing and proposed conditions. Computer modeling was used to estimate the runoff for the 50-year storm events. The analysis considered with the additional bulking factors where appropriate to size sediment/debris facilities.

For the proposed condition for the Chiquito Canyon site, a combination of burned hydrology, and burned and bulked hydrology, was considered for the discharges from the site, since sediment-trapping devices will be installed at the downstream end of the project for certain areas only. Debris basins are not planned for sub-basins CQT-9A and CQT-10A for the following reasons: the existing condition generates more debris than the proposed condition, the sub-basins drain directly to Chiquito Canyon, the improvements are temporary in nature, i.e., a borrow site for constructing the proposed development, and no dwelling units are downstream of the sub-basins.

Data Sources

The primary sources of data were the *LACDPW Hydrology/ Sedimentation Manual and Appendices* (LACDPW 1991, 1992, 1993, 2002) and the LA County *Standard Urban Stormwater Mitigation Plan* (March 2000). Other key sources included the *TC (v1.0),* and *MORA (v7.2)* manuals and the Newhall Ranch Specific Plan Master Hydrology and Drainage Concept, Sikand December 1999 (appended for reference).

Watershed Characteristics

The Chiquito borrow site is bounded by SR 126 on the south, Chiquito Canyon on the west, and the Chiquito Landfill on the east. The total drainage area for the site encompasses approximately 73 acres and flows predominantly south to existing culverts under SR 126; a small portion drains west to Chiquito Canyon. The majority of the area is undeveloped land with steep to moderate slopes.

The Adobe borrow site is located south of the Santa Clara River and is bounded by Long Canyon to the west and the proposed Mesas East development to the east. The total drainage area for the site is about 214 acres and flows generally northwest and westerly. The majority of the land is undeveloped with steep to moderate slopes.

The soil of the two watersheds is classified by Los Angeles County to be Type 020, as shown on the figure (LACDPW 1-H1.43) included in Appendix 1. The figure also shows that the drainage areas of the two sites are associated with Debris Potential Area (DPA) number 05 and 09. As previously discussed, the proposed use of sediment trapping devices preclude the necessity of bulking factors in the proposed condition for the storm drain system leaving Chiquito borrow site. The peak bulking factor curves and peak debris production rates used in the analysis are included in Appendix 1 (LACDPW P2 & P5).

The Chiquito and Adobe borrow sites are located in Los Angeles County's Rainfall Isohyets 5.8, as shown on the aforementioned figure in Appendix 1.

The drainage area for the Chiquito site consists of twelve (12) sub-basins that independently drain toward the Santa Clara River, as shown on the Existing Condition Hydrology Map included with this report. The sub-basins drain southwesterly on site, ultimately tributary to the Santa Clara River.

The drainage area for the Adobe site consists of eight (8) sub-basins that independently drain toward the Santa Clara River, as shown on the Existing Condition Hydrology Map included with this report. The sub-basins drain northwesterly on site, ultimately tributary to the Santa Clara River.

The *LACDPW TC (TC_calc_depth.xls, June2002)* program was used to calculate the time of concentration for each sub area. The *LACDPW MORA (v7.2)* computer program was used for the *Modified Rational Method* calculations and calculation of peak runoff rates and hydrographs. The TC calculations and MORA program output are provided in Appendix 2-3 and 4-5, respectively. In accordance with LACDPW requirements, the 50-year burned-and-bulked storm event was used as the main design storm in the analysis.

In the tables that follow, the following abbreviations apply:

Q_u	=	Runoff, Unburned and Unbulked
Q_b	=	Burned Runoff
Q_{bb}	=	Burned and Bulked Runoff
Q_{b+d}	=	Burned and Developed Runoff
Q_{bb+d}	=	Burned and Bulked and Developed Runoff
Q_{design}	=	Runoff Value Used for Design

Existing Condition Results

Existing condition hydrology results for the Capital Flood storm event are summarized in Tables 1a and 1b below.

Table 1a: Existing Condition Hydrology Summary – Chiquito Site

Sub basins	Area (Ac)	50-Year Storm Event			
		Time of Conc. (min)	Q_u (cfs)	Q_{b+d} (cfs)	Q_{bb+d} (cfs)
CQT-1A	6.1	8	10	13	16
CQT-2A	3.6	6	7	9	11
CQT-3A	1.8	5	4	5	6
CQT-4A	12.3	10	17	22	28

Sub basins	Area (Ac)	50-Year Storm Event			
		Time of Conc. (min)	Q_u (cfs)	Q_{b+d} (cfs)	Q_{bb+d} (cfs)
CQT-5A	4.4	5	10	12	15
CQT-6A	24.9	15	27	36	46
CQT-7A	2.1	5	5	6	8
CQT-8A	2.8	5	6	7	10
CQT-9A	31.8	14	36	48	61
CQT-10A	15.6	11	21	27	35
CQT-11A	10.2	17	18	18	19
CQT-12A	11.7	10	26	26	28
Total	**127.3**		187	229	**283**

Table 1b: Existing Condition Hydrology Summary – Adobe Site

Sub basins	Area (Ac)	50-Year Storm Event			
		Time of Conc. (min)	Q_u (cfs)	Q_{b+d} (cfs)	Q_{bb+d} (cfs)
ADB-1A	35.8	11	47	62	90
ADB-2A	40.0	12	49	65	95
ADB-3A	24.0	12	30	39	50
ADB-4B	16.7	13	20	26	33
ADB-5B	39.9	20	34	48	61
ADB-7C	27.4	14	31	41	52
ADB-8C	12.9	11	17	22	28
ADB-9C	16.6	9	25	32	41
Total	**213.3**		253	335	**450**

Post-Project Condition Results

The post-project condition hydrologic analysis was based on the preliminary concept drainage plan prepared by Psomas, included with this report. The post-project (developed) Condition Drainage Concept Map is also included with this report. Post-development drainage patterns do not significantly differ from the aforementioned existing characteristics.

As with the existing condition analysis, the *LACDPW TC* program was used to calculate the time of concentration, and the *LACDPW MORA* computer program was used to calculate the peak runoff rates and hydrographs. The calculations and program output are provided in Appendix 3 and 5 respectively. In accordance with the *LACDPW Hydrology/Sedimentation Appendix*, imperviousness coefficients are as follows:

Table 2: Land Use Impervious Values

Land Use	Percent Imperviousness
Open Space/Natural	0%
Borrow Site Grading	0%

Post-project condition hydrology results for the 50-year storm event are summarized in Table 3a and 3b.

Table 3a: Post-Project Condition Hydrology Summary – Chiquito Site

Sub basins	Area (Ac)	50-Year Storm Event				
		Time of Conc. (min)	Q_u (cfs)	Q_{b+d} (cfs)	Q_{bb+d} (cfs)	$Q_{design}{}^{A}$(cfs)
CQT-1/4A	23.9	9	37	41	46	41
CQT-5A	4.4	5	10	12	15	12
CQT-6A	22.6	15	25	31	39	31
CQT-7/8A	6.2	5	14	14	14	14
CQT-9A	31.8	14	37	44	52	52
CQT-10A	14.5	11	20	23	27	27
CQT-11A	7.4	21	11	11	11	11
CQT-12A	4.4	12	9	9	9	9
Total	**115.2**		163	185	213	**197**

<u>Notes</u>
A. *Burned and Developed flow for Sub-basins 1/4A,5A,6A, plus Burned and Bulked and Developed flow for Sub-basins 9A,10A, plus Developed flow for Sub-basins 7/8A,11A,12A*

Table 3b: Post-Project Condition Hydrology Summary – Adobe Site

Sub basins	Area (Ac)	50-Year Storm Event				
		Time of Conc. (min	Q_u (cfs)	Q_{b+d} (cfs)	Q_{bb+d} (cfs)	$Q_{design}{}^{A}$(cfs)
ADB-1A	28.0	12	35	46	67	46
ADB-2A	12.7	7	23	27	36	27
ADB-3A	29.5	12	39	39	39	39
ADB-4A	22.2	13	28	28	28	28
ADB-5A	25.2	11	36	36	36	36
ADB-6B	13.6	13	16	21	27	27
ADB-7B	28.7	26	21	30	38	38
ADB-9C	30.6	14	36	42	48	48
ADB-10C	8.8	6	17	21	27	27
ADB-11C	13.9	8	22	28	36	36
Total	**213.2**		273	318	382	**352**

<u>Notes</u>
A. *Burned and Developed flow for Sub-basins 1A thru 5A, plus Burned and Bulked and Developed flow for the remaining Sub-basins.*

Baseline Hydrology Comparison

A comparison of existing and proposed peak flow rates are provided as Table 4a and 4b. In accordance with Los Angeles County hydrology method, existing condition burned and bulked flow is assessed with proposed condition flow burned, unbulked due to the proposed addition of debris facilities where needed.

Table 4a: Existing vs. Proposed Condition Hydrology Comparison Summary – Chiquito Site

50-Year Storm Event						
Sub area	Area (Ac)			Q_{50} (cfs)		
	Exist.[A]	Prop.[B]	Diff.	Exist[C].	Prop.[D]	Diff.
Total Study Area	127	115	-12	283	197	-86

Notes
A. *Drainage tributary area includes portion of Newhall Ranch – Landmark Village Tract 53108.*
B. *Drainage tributary area reduced because a portion of the area is accounted for in the on-site hydrology study for Newhall Ranch - Landmark Village Tract 53108.*
C. *Burned and bulked flow*
D. *Burned and Developed flow for Sub-basins 1/4A,5A,6A, plus Burned and Bulked and Developed flow for Sub-basins 9A,10A, plus Developed flow for Sub-basins 7/8A,11A,12A*

Table 4b: Existing vs. Proposed Condition Hydrology Comparison Summary – Adobe Site

50-Year Storm Event						
Sub area	Area (Ac)			Q_{50} (cfs)		
	Exist.	Prop.	Diff.	Exist[A].	Prop.[B]	Diff.
Total Study Area	213	213	0	450	352	-98

Notes
A. *Burned and bulked flow*
B. *Burned and Developed flow for Sub-basins 1A thru 5A, plus Burned and Bulked and Developed flow for the remaining Sub-basins.*

3.0 Standard Urban Stormwater Mitigation Plan (SUSMP)

Instead of volume- or flow-based Treatment Control BMPs, the Los Angeles County Standard Urban Stormwater Mitigation Plan (SUSMP) requirements will be met by Erosion and Sediment Control BMPs, which decrease the potential of slopes and channels to erode and impact stormwater runoff. LA County SUSMP guidelines specify BMPs such as the following:

- Conveying runoff safely from the tops of slopes and stabilizing disturbed slopes
- Utilizing natural drainage systems to the maximum extent practicable (MEP)
- Stabilizing permanent channel crossings
- Vegetating slopes with native or drought tolerant vegetation
- Installing energy dissipators, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion

As shown on the Drainage Concept Exhibits, both temporary and permanent Erosion and Sediment Control BMPs have been incorporated into the two sites. Temporary BMPs will be implemented during the 'construction phase' of the site, while permanent BMPs will be implemented upon completion of construction. Potential erosion and sediment control BMP options are summarized in the following table; however, BMPs will be finalized during the completion of the Construction Stormwater Pollution Prevention Plan (SWPPP).

Table 5: Potential Temporary and Permanent Erosion/Sediment Control BMP Options

BMP	Fact Sheet # [A]	Temporary	Permanent
Scheduling	EC-1	X	
Hydraulic Mulch [B]	EC-3	X	X
Hydroseeding [B]	EC-4	X	X
Soil Binders	EC-5	X	
Geotextiles and Mats	EC-7	X	
Earth Dikes and Drainage Swales	EC-9	X	X
Velocity Dissipation Devices	EC-10	X	X
Slope Drains	EC-11	X	X
Silt Fence	SE-1	X	
Desilting (Sediment) Basin	SE-2	X	X
Sediment Trap	SE-3	X	
Check Dams	SE-4	X	X
Gravel Bag Berm	SE-6	X	
Street Sweeping and Vacuuming	SE-7	X	
Sandbag Barrier	SE-8	X	
Straw Bale Barrier	SE-9	X	
Storm Drain Inlet Protection	SE-10	X	
Wind Erosion Control	WE-1	X	

Stabilized Construction Entrance/Exit	TC-1	X	
Stabilized Construction Roadway	TC-2	X	
Entrance/Outlet Tire Wash	TC-3	X	

A. CASQA, 2003.
B. Requires BMP monitoring plan until vegetation is permanently established.

BMP fact sheets for the above Sediment and Erosion Control BMPs are included in Appendix 6. Final selection and detailed design of these BMPs is beyond the scope of this report. However, the report and exhibits show that erosion and sediment control SUSMP requirements can be met.

4.0 Limitations

This report was prepared to comply with the guidelines established by the County of Los Angeles and their representatives. Evaluation of the appropriateness of these guidelines and the accuracy of the County data were beyond the scope of this work.

Usage of the report is limited to address the purpose and scope previously defined by the project owner, Newhall Land. Psomas shall not be held responsible for any unauthorized application of this report and the contents herein.

The opinions represented in this report have been derived in accordance with current standards of civil engineering practice. No other warranty is expressed or implied.

5.0 References

California Stormwater Quality Association, *Stormwater Best Management Practice Handbook – Construction* (January 2003)

Los Angeles County Department of Public Works, *LACDPW Hydrology/ Sedimentation Manual and Appendices* (1991, 1992, 1993, 2002)

Los Angeles County Department of Public Works, *LACDPW TC v1.0 Manual, TC_calc_depth.xls* (December 1991, June 2002)

Los Angeles County Department of Public Works, *LACDPW Modified Rational Method, MORA (MORA) v7.2 Manual* (September 2002)

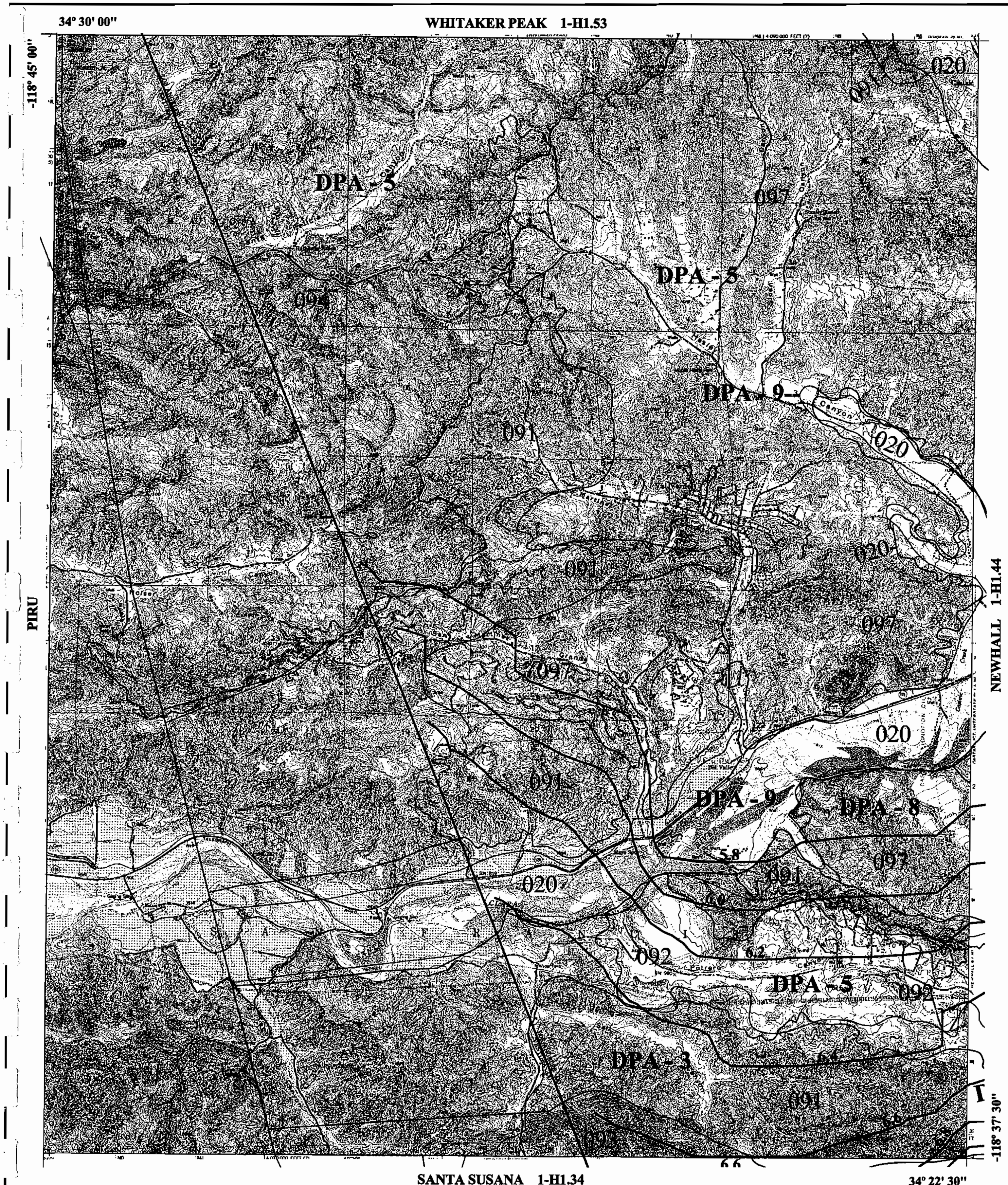
Los Angeles Regional Water Quality Control Board, *Standard Urban Stormwater Mitigation Plan for Los Angeles County and Cities in Los Angeles County* (March 2000)

Newhall Ranch, Newhall Ranch Specific Plan Master Hydrology and Drainage Concept (Sikand, December, 1999)

APPENDICES

APPENDIX 1

LACDPW HYDROLOGY DATA



016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

VAL VERDE
50-YEAR 24-HOUR ISOHYET

1-H1.43

$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

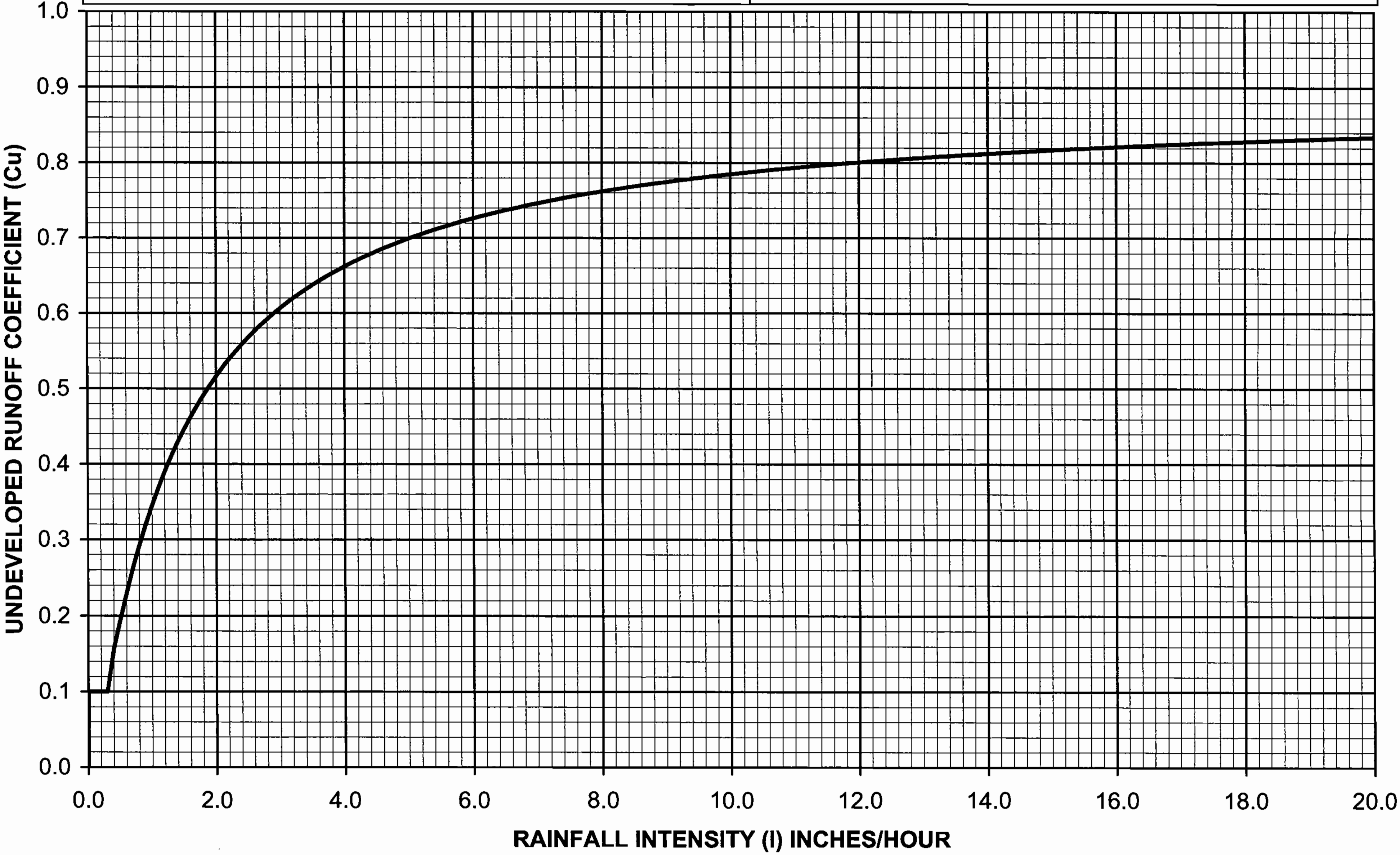
Where: C_D = Developed Runoff Coefficient

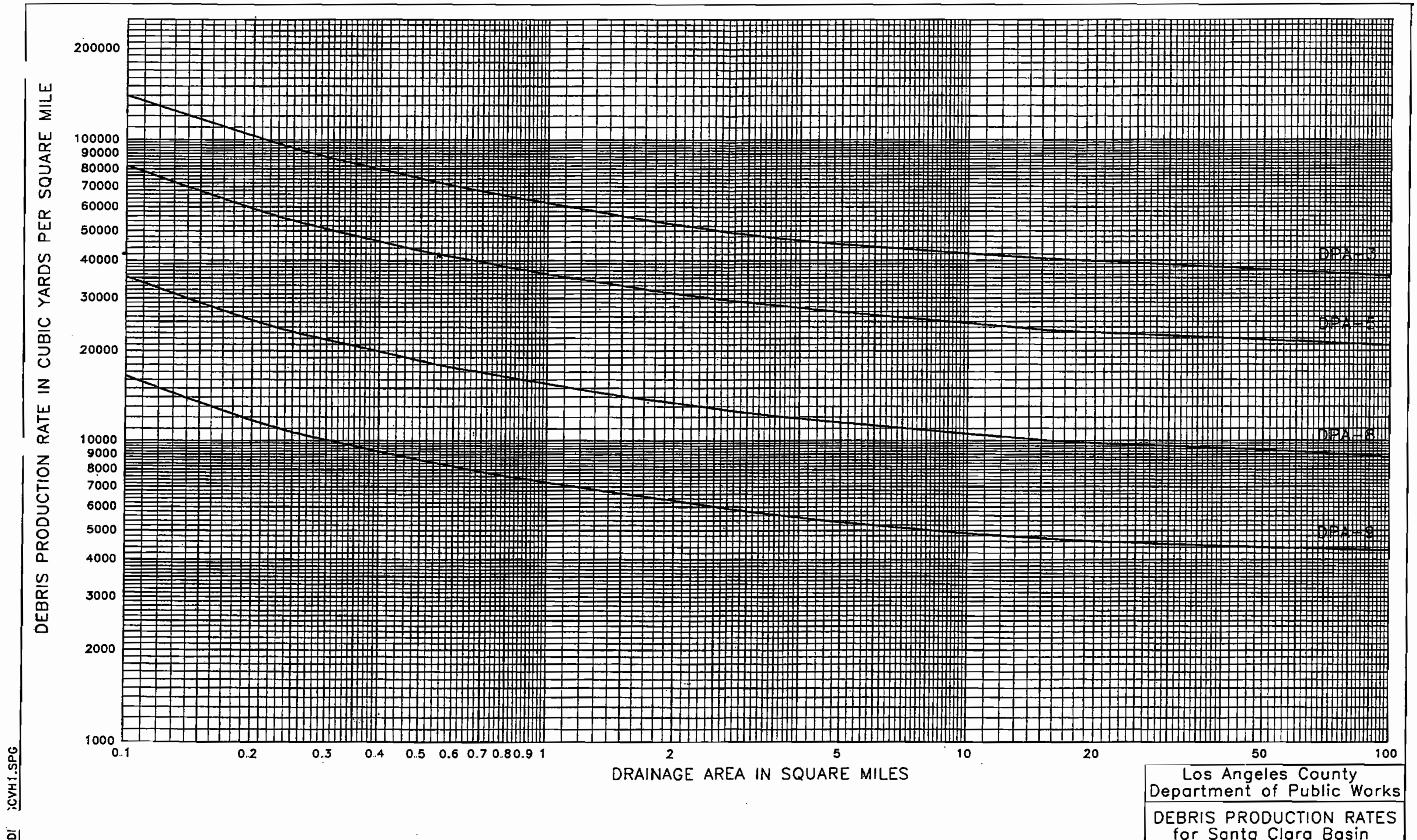
IMP = Proportion Impervious

C_U = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

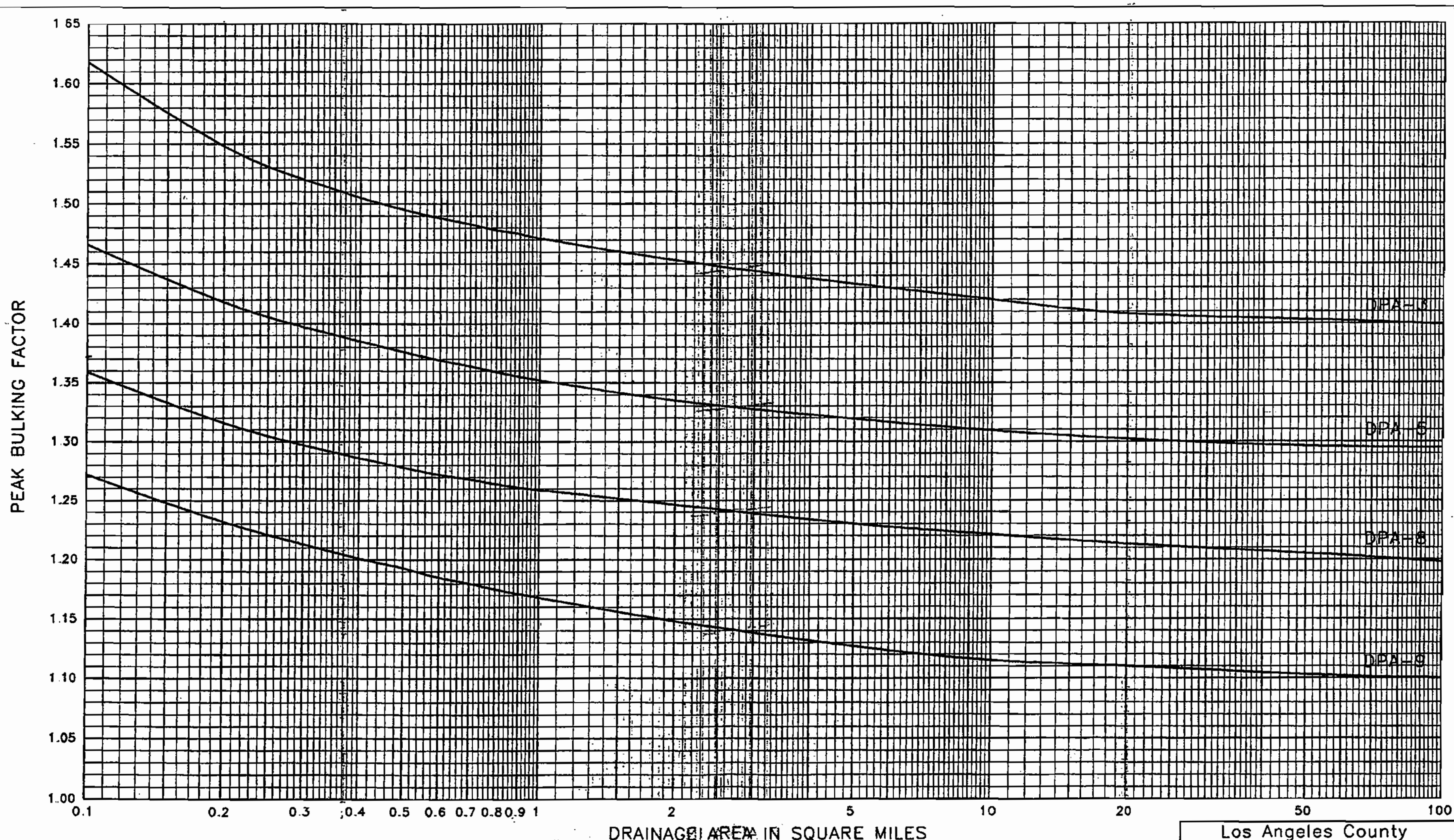
RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 020





Los Angeles County
Department of Public Works

DEBRIS PRODUCTION RATES
for Santa Clara Basin



Los Angeles County
Department of Public Works

PEAK BULKING FACTORS
for Santa Clara Basin

PI :CVH2.SPG

APPENDIX 2

TC CALCULATIONS: EXISTING CONDITION

Chiquito Borrow Site
Existing Condition
TC Data File

Project	Subarea	Area	%imp	Frequency	Soil Type	Length	Slope	Isohyet
Area (E)	1A	35.8	0	2	20	1755	0.614	2.2
Area (E)	2A	40	0	2	20	1035	0.059	2.2
Area (E)	3A	24	0	2	20	1095	0.046	2.2
Area (E)	1B	16.7	0	2	20	1560	0.138	2.2
Area (E)	2B	39.9	0	2	20	2490	0.092	2.2
Area (E)	1C	27.4	0	2	20	1985	0.217	2.2
Area (E)	1D	12.9	0	2	20	1450	0.221	2.2
Area (E)	1E	16.6	0	2	20	1110	0.270	2.2
Area (E)	1A	35.8	0	5	20	1755	0.614	3.4
Area (E)	2A	40	0	5	20	1035	0.059	3.4
Area (E)	3A	24	0	5	20	1095	0.046	3.4
Area (E)	1B	16.7	0	5	20	1560	0.138	3.4
Area (E)	2B	39.9	0	5	20	2490	0.092	3.4
Area (E)	1C	27.4	0	5	20	1985	0.217	3.4
Area (E)	1D	12.9	0	5	20	1450	0.221	3.4
Area (E)	1E	16.6	0	5	20	1110	0.270	3.4
Area (E)	1A	35.8	0	10	20	1755	0.614	4.1
Area (E)	2A	40	0	10	20	1035	0.059	4.1
Area (E)	3A	24	0	10	20	1095	0.046	4.1
Area (E)	1B	16.7	0	10	20	1560	0.138	4.1
Area (E)	2B	39.9	0	10	20	2490	0.092	4.1
Area (E)	1C	27.4	0	10	20	1985	0.217	4.1
Area (E)	1D	12.9	0	10	20	1450	0.221	4.1
Area (E)	1E	16.6	0	10	20	1110	0.270	4.1
Area (E)	1A	35.8	0	25	20	1755	0.614	5.1
Area (E)	2A	40	0	25	20	1035	0.059	5.1
Area (E)	3A	24	0	25	20	1095	0.046	5.1
Area (E)	1B	16.7	0	25	20	1560	0.138	5.1
Area (E)	2B	39.9	0	25	20	2490	0.092	5.1
Area (E)	1C	27.4	0	25	20	1985	0.217	5.1
Area (E)	1D	12.9	0	25	20	1450	0.221	5.1
Area (E)	1E	16.6	0	25	20	1110	0.270	5.1
Area (E)	1A	35.8	0	50	20	1755	0.614	5.8
Area (E)	2A	40	0	50	20	1035	0.059	5.8
Area (E)	3A	24	0	50	20	1095	0.046	5.8
Area (E)	1B	16.7	0	50	20	1560	0.138	5.8
Area (E)	2B	39.9	0	50	20	2490	0.092	5.8
Area (E)	1C	27.4	0	50	20	1985	0.217	5.8
Area (E)	1D	12.9	0	50	20	1450	0.221	5.8
Area (E)	1E	16.6	0	50	20	1110	0.270	5.8
Area (E)	1A	35.8	0	100	20	1755	0.614	6.5
Area (E)	2A	40	0	100	20	1035	0.059	6.5
Area (E)	3A	24	0	100	20	1095	0.046	6.5
Area (E)	1B	16.7	0	100	20	1560	0.138	6.5
Area (E)	2B	39.9	0	100	20	2490	0.092	6.5
Area (E)	1C	27.4	0	100	20	1985	0.217	6.5
Area (E)	1D	12.9	0	100	20	1450	0.221	6.5
Area (E)	1E	16.6	0	100	20	1110	0.270	6.5
Area (E)	1A	35.8	0	500	20	1755	0.614	8.2
Area (E)	2A	40	0	500	20	1035	0.059	8.2
Area (E)	3A	24	0	500	20	1095	0.046	8.2
Area (E)	1B	16.7	0	500	20	1560	0.138	8.2
Area (E)	2B	39.9	0	500	20	2490	0.092	8.2
Area (E)	1C	27.4	0	500	20	1985	0.217	8.2
Area (E)	1D	12.9	0	500	20	1450	0.221	8.2
Area (E)	1E	16.6	0	500	20	1110	0.270	8.2

Chiquito Borrow Site
Existing Condition
TC Calculation Results

Project	Subarea	Area (acre	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in	Tc-calculat	Intensity (i	Cu	Cd	Flowrate (c	Tc Equation
Area (E)	1A	35.8	0	2	20	1755	0.614	2.2	30	0.57	0.22	0.22	4.49	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	2	20	1035	0.059	2.2	30	0.57	0.22	0.22	5.02	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	2	20	1095	0.046	2.2	30	0.57	0.22	0.22	3.01	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	2	20	1560	0.138	2.2	30	0.57	0.22	0.22	2.09	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	2	20	2490	0.092	2.2	30	0.57	0.22	0.22	5	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	2	20	1985	0.217	2.2	30	0.57	0.22	0.22	3.44	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	2	20	1450	0.221	2.2	30	0.57	0.22	0.22	1.62	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	2	20	1110	0.27	2.2	30	0.57	0.22	0.22	2.08	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	5	20	1755	0.614	3.4	20	1.06	0.36	0.36	13.66	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	5	20	1035	0.059	3.4	22	1.01	0.35	0.35	14.14	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	5	20	1095	0.046	3.4	25	0.95	0.33	0.33	7.52	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	5	20	1560	0.138	3.4	26	0.93	0.32	0.32	4.97	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	5	20	2490	0.092	3.4	30	0.87	0.31	0.31	10.76	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	5	20	1985	0.217	3.4	29	0.89	0.31	0.31	7.56	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	5	20	1450	0.221	3.4	22	1.01	0.35	0.35	4.56	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	5	20	1110	0.27	3.4	17	1.14	0.37	0.37	7	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	10	20	1755	0.614	4.1	15	1.46	0.44	0.44	23	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	10	20	1035	0.059	4.1	17	1.38	0.42	0.42	23.18	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	10	20	1095	0.046	4.1	19	1.31	0.41	0.41	12.89	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	10	20	1560	0.138	4.1	20	1.28	0.4	0.4	8.55	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	10	20	2490	0.092	4.1	30	1.05	0.36	0.36	15.08	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	10	20	1985	0.217	4.1	22	1.22	0.39	0.39	13.04	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	10	20	1450	0.221	4.1	17	1.38	0.42	0.42	7.48	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	10	20	1110	0.27	4.1	13	1.56	0.45	0.45	11.65	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	25	20	1755	0.614	5.1	12	2.02	0.52	0.52	37.6	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	25	20	1035	0.059	5.1	13	1.94	0.51	0.51	39.58	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	25	20	1095	0.046	5.1	14	1.88	0.5	0.5	22.56	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	25	20	1560	0.138	5.1	15	1.82	0.49	0.49	14.89	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	25	20	2490	0.092	5.1	23	1.49	0.44	0.44	26.16	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	25	20	1985	0.217	5.1	16	1.76	0.48	0.48	23.15	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	25	20	1450	0.221	5.1	13	1.94	0.51	0.51	12.76	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	25	20	1110	0.27	5.1	10	2.2	0.53	0.53	19.36	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	50	20	1755	0.614	5.8	11	2.39	0.55	0.55	47.06	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	50	20	1035	0.059	5.8	12	2.29	0.54	0.54	49.46	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	50	20	1095	0.046	5.8	12	2.29	0.54	0.54	29.68	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	50	20	1560	0.138	5.8	13	2.21	0.54	0.54	19.93	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	50	20	2490	0.092	5.8	20	1.8	0.49	0.49	35.19	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	50	20	1985	0.217	5.8	14	2.13	0.53	0.53	30.93	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	50	20	1450	0.221	5.8	11	2.39	0.55	0.55	16.96	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	50	20	1110	0.27	5.8	9	2.63	0.57	0.57	24.89	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	100	20	1755	0.614	6.5	9	2.94	0.6	0.6	63.15	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	100	20	1035	0.059	6.5	10	2.8	0.59	0.59	66.08	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	100	20	1095	0.046	6.5	11	2.68	0.58	0.58	37.31	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	100	20	1560	0.138	6.5	12	2.57	0.57	0.57	24.46	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	100	20	2490	0.092	6.5	18	2.12	0.53	0.53	44.83	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	100	20	1985	0.217	6.5	12	2.57	0.57	0.57	40.14	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	100	20	1450	0.221	6.5	10	2.8	0.59	0.59	21.31	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	100	20	1110	0.27	6.5	8	3.11	0.61	0.61	31.49	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	500	20	1755	0.614	8.2	7	4.18	0.67	0.67	100.26	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	500	20	1035	0.059	8.2	8	3.92	0.66	0.66	103.49	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	500	20	1095	0.046	8.2	9	3.71	0.65	0.65	57.88	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	500	20	1560	0.138	8.2	9	3.71	0.65	0.65	40.27	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	500	20	2490	0.092	8.2	13	3.12	0.61	0.61	75.94	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	500	20	1985	0.217	8.2	10	3.53	0.64	0.64	61.9	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	500	20	1450	0.221	8.2	8	3.92	0.66	0.66	33.37	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	500	20	1110	0.27	8.2	6	4.49	0.68	0.68	50.68	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

Landmark Village - Newhall Ranch
Chiquito Area

Drainage Existing Area Chiquito

Subarea	Area (Ac)	Calcs Tc (min)	I_{50} (in/hr)	Cu	Cd	Q_{50} (cfs)	Area Undeveloped (Ac)	K (1)	Q_{50b} (cfs) (2)	Q_{50bb} (cfs) (3)	$Q_{50b}+Q_d$ (cfs)	$Q_{50bb}+Q_d$ (cfs)	DP (cy) (4)
CQT-1A	6.1	8	2.77	0.58	0.58	10	6.1	0.61	12.69	16.11	13	16	165
CQT-2A	3.6	6	3.18	0.61	0.61	7	3.6	0.60	8.77	11.14	9	11	97
CQT-3A	1.8	5	3.46	0.63	0.63	4	1.8	0.60	4.90	6.22	5	6	49
CQT-4A	12.3	10	2.5	0.56	0.56	17	12.3	0.62	22.27	28.29	22	28	332
CQT-5A	4.4	5	3.46	0.63	0.63	10	4.4	0.60	12.11	15.38	12	15	119
CQT-6A	24.9	15	2.06	0.52	0.52	27	24.9	0.63	36.02	45.74	36	46	672
CQT-7A	2.1	5	3.46	0.63	0.63	5	2.1	0.60	5.91	7.51	6	8	57
CQT-8A	2.8	5	3.46	0.63	0.63	6	2.8	0.60	7.49	9.51	7	10	76
CQT-9A	31.8	14	2.13	0.53	0.53	36	31.8	0.63	47.84	60.76	48	61	859
CQT-10A	15.6	11	2.39	0.55	0.55	21	15.6	0.62	27.20	34.54	27	35	421
CQT-11A	10.2	17	1.95	0.51	0.9	18	2.0	0.63	3.67	4.66	18	19	54
CQT-12A	11.7	10	2.5	0.56	0.9	26	3.0	0.62	6.99	8.87	26	28	81
Total	127.3					187.0			195.9	248.7	229	283	2981

(1) - K = Burn Factor from Appendix G-2, K = 0.677*(I ^-0.102)
(2) - Qb = A*I*(1-K)+K*Qu
(3) - Qbb = 1.27*Qb
(4) - DP = A*27 cy (Zone 9)

V:\Newhall\PRODDATA\53108-MP\ENGR\DOCS\[CQT_HYDRO_EXIST.xls]Qbb

Adobe Borrow Site
Existing Condition
TC Data File

Project	Subarea	Area	%imp	Frequency	Soil Type	Length	Slope	Isohyet
Area (E)	1A	35.8	0	2	20	1755	0.614	2.2
Area (E)	2A	40	0	2	20	1035	0.059	2.2
Area (E)	3A	24	0	2	20	1095	0.046	2.2
Area (E)	1B	16.7	0	2	20	1560	0.138	2.2
Area (E)	2B	39.9	0	2	20	2490	0.092	2.2
Area (E)	1C	27.4	0	2	20	1985	0.217	2.2
Area (E)	1D	12.9	0	2	20	1450	0.221	2.2
Area (E)	1E	16.6	0	2	20	1110	0.270	2.2
Area (E)	1A	35.8	0	5	20	1755	0.614	3.4
Area (E)	2A	40	0	5	20	1035	0.059	3.4
Area (E)	3A	24	0	5	20	1095	0.046	3.4
Area (E)	1B	16.7	0	5	20	1560	0.138	3.4
Area (E)	2B	39.9	0	5	20	2490	0.092	3.4
Area (E)	1C	27.4	0	5	20	1985	0.217	3.4
Area (E)	1D	12.9	0	5	20	1450	0.221	3.4
Area (E)	1E	16.6	0	5	20	1110	0.270	3.4
Area (E)	1A	35.8	0	10	20	1755	0.614	4.1
Area (E)	2A	40	0	10	20	1035	0.059	4.1
Area (E)	3A	24	0	10	20	1095	0.046	4.1
Area (E)	1B	16.7	0	10	20	1560	0.138	4.1
Area (E)	2B	39.9	0	10	20	2490	0.092	4.1
Area (E)	1C	27.4	0	10	20	1985	0.217	4.1
Area (E)	1D	12.9	0	10	20	1450	0.221	4.1
Area (E)	1E	16.6	0	10	20	1110	0.270	4.1
Area (E)	1A	35.8	0	25	20	1755	0.614	5.1
Area (E)	2A	40	0	25	20	1035	0.059	5.1
Area (E)	3A	24	0	25	20	1095	0.046	5.1
Area (E)	1B	16.7	0	25	20	1560	0.138	5.1
Area (E)	2B	39.9	0	25	20	2490	0.092	5.1
Area (E)	1C	27.4	0	25	20	1985	0.217	5.1
Area (E)	1D	12.9	0	25	20	1450	0.221	5.1
Area (E)	1E	16.6	0	25	20	1110	0.270	5.1
Area (E)	1A	35.8	0	50	20	1755	0.614	5.8
Area (E)	2A	40	0	50	20	1035	0.059	5.8
Area (E)	3A	24	0	50	20	1095	0.046	5.8
Area (E)	1B	16.7	0	50	20	1560	0.138	5.8
Area (E)	2B	39.9	0	50	20	2490	0.092	5.8
Area (E)	1C	27.4	0	50	20	1985	0.217	5.8
Area (E)	1D	12.9	0	50	20	1450	0.221	5.8
Area (E)	1E	16.6	0	50	20	1110	0.270	5.8
Area (E)	1A	35.8	0	100	20	1755	0.614	6.5
Area (E)	2A	40	0	100	20	1035	0.059	6.5
Area (E)	3A	24	0	100	20	1095	0.046	6.5
Area (E)	1B	16.7	0	100	20	1560	0.138	6.5
Area (E)	2B	39.9	0	100	20	2490	0.092	6.5
Area (E)	1C	27.4	0	100	20	1985	0.217	6.5
Area (E)	1D	12.9	0	100	20	1450	0.221	6.5
Area (E)	1E	16.6	0	100	20	1110	0.270	6.5
Area (E)	1A	35.8	0	500	20	1755	0.614	8.2
Area (E)	2A	40	0	500	20	1035	0.059	8.2
Area (E)	3A	24	0	500	20	1095	0.046	8.2
Area (E)	1B	16.7	0	500	20	1560	0.138	8.2
Area (E)	2B	39.9	0	500	20	2490	0.092	8.2
Area (E)	1C	27.4	0	500	20	1985	0.217	8.2
Area (E)	1D	12.9	0	500	20	1450	0.221	8.2
Area (E)	1E	16.6	0	500	20	1110	0.270	8.2

Adobe Borrow Site
Existing Condition
TC Calculation Results

Project	Subarea	Area (acre	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in	Tc-calculat	Intensity (i	Cu	Cd	Flowrate (c	Tc Equation
Area (E)	1A	35.8	0	2	20	1755	0.614	2.2	30	0.57	0.22	0.22	4.49	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	2	20	1035	0.059	2.2	30	0.57	0.22	0.22	5.02	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	2	20	1095	0.046	2.2	30	0.57	0.22	0.22	3.01	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	2	20	1560	0.138	2.2	30	0.57	0.22	0.22	2.09	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	2	20	2490	0.092	2.2	30	0.57	0.22	0.22	5	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	2	20	1985	0.217	2.2	30	0.57	0.22	0.22	3.44	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	2	20	1450	0.221	2.2	30	0.57	0.22	0.22	1.62	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	2	20	1110	0.27	2.2	30	0.57	0.22	0.22	2.08	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	5	20	1755	0.614	3.4	20	1.06	0.36	0.36	13.66	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	5	20	1035	0.059	3.4	22	1.01	0.35	0.35	14.14	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	5	20	1095	0.046	3.4	25	0.95	0.33	0.33	7.52	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	5	20	1560	0.138	3.4	26	0.93	0.32	0.32	4.97	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	5	20	2490	0.092	3.4	30	0.87	0.31	0.31	10.76	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	5	20	1985	0.217	3.4	29	0.89	0.31	0.31	7.56	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	5	20	1450	0.221	3.4	22	1.01	0.35	0.35	4.56	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	5	20	1110	0.27	3.4	17	1.14	0.37	0.37	7	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	10	20	1755	0.614	4.1	15	1.46	0.44	0.44	23	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	10	20	1035	0.059	4.1	17	1.38	0.42	0.42	23.18	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	10	20	1095	0.046	4.1	19	1.31	0.41	0.41	12.89	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	10	20	1560	0.138	4.1	20	1.28	0.4	0.4	8.55	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	10	20	2490	0.092	4.1	30	1.05	0.36	0.36	15.08	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	10	20	1985	0.217	4.1	22	1.22	0.39	0.39	13.04	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	10	20	1450	0.221	4.1	17	1.38	0.42	0.42	7.48	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	10	20	1110	0.27	4.1	13	1.56	0.45	0.45	11.65	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	25	20	1755	0.614	5.1	12	2.02	0.52	0.52	37.6	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	25	20	1035	0.059	5.1	13	1.94	0.51	0.51	39.58	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	25	20	1095	0.046	5.1	14	1.88	0.5	0.5	22.56	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	25	20	1560	0.138	5.1	15	1.82	0.49	0.49	14.89	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	25	20	2490	0.092	5.1	23	1.49	0.44	0.44	26.16	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	25	20	1985	0.217	5.1	16	1.76	0.48	0.48	23.15	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	25	20	1450	0.221	5.1	13	1.94	0.51	0.51	12.76	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	25	20	1110	0.27	5.1	10	2.2	0.53	0.53	19.36	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	50	20	1755	0.614	5.8	11	2.39	0.55	0.55	47.06	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	50	20	1035	0.059	5.8	12	2.29	0.54	0.54	49.46	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	50	20	1095	0.046	5.8	12	2.29	0.54	0.54	29.68	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	50	20	1560	0.138	5.8	13	2.21	0.54	0.54	19.93	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	50	20	2490	0.092	5.8	20	1.8	0.49	0.49	35.19	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	50	20	1985	0.217	5.8	14	2.13	0.53	0.53	30.93	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	50	20	1450	0.221	5.8	11	2.39	0.55	0.55	16.96	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	50	20	1110	0.27	5.8	9	2.63	0.57	0.57	24.89	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	100	20	1755	0.614	6.5	9	2.94	0.6	0.6	63.15	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	100	20	1035	0.059	6.5	10	2.8	0.59	0.59	66.08	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	100	20	1095	0.046	6.5	11	2.68	0.58	0.58	37.31	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	100	20	1560	0.138	6.5	12	2.57	0.57	0.57	24.46	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	100	20	2490	0.092	6.5	18	2.12	0.53	0.53	44.83	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	100	20	1985	0.217	6.5	12	2.57	0.57	0.57	40.14	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	100	20	1450	0.221	6.5	10	2.8	0.59	0.59	21.31	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	100	20	1110	0.27	6.5	8	3.11	0.61	0.61	31.49	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1A	35.8	0	500	20	1755	0.614	8.2	7	4.18	0.67	0.67	100.26	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2A	40	0	500	20	1035	0.059	8.2	8	3.92	0.66	0.66	103.49	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	3A	24	0	500	20	1095	0.046	8.2	9	3.71	0.65	0.65	57.88	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1B	16.7	0	500	20	1560	0.138	8.2	9	3.71	0.65	0.65	40.27	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	2B	39.9	0	500	20	2490	0.092	8.2	13	3.12	0.61	0.61	75.94	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1C	27.4	0	500	20	1985	0.217	8.2	10	3.53	0.64	0.64	61.9	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1D	12.9	0	500	20	1450	0.221	8.2	8	3.92	0.66	0.66	33.37	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Area (E)	1E	16.6	0	500	20	1110	0.27	8.2	6	4.49	0.68	0.68	50.68	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

Landmark Village - Newhall Ranch

Adobe Area

Drainage Existing Area ADOBE

Subarea	Area (Ac)	Calcs Tc (min)	I_{50} (in/hr)	Cu	Cd	Q_{50} (cfs)	Area Undeveloped (Ac)	K (1)	Q_{50b} (cfs) (2)	Q_{50bb} (cfs) (3)	$Q_{50b}+Q_d$ (cfs)	$Q_{50bb}+Q_d$ (cfs)	DP (cy) (4)
1A	35.8	11	2.39	0.55	0.55	47.00	35.8	0.62	62	90	62	90	4582
2A	40.0	12	2.29	0.54	0.54	49.00	40.0	0.62	65	95	65	95	5120
3A	24.0	12	2.29	0.54	0.54	30.00	24.0	0.62	39	50	39	50	648
4B	16.7	13	2.21	0.53	0.53	20.00	16.7	0.62	26	33	26	33	451
5B	39.9	20	1.80	0.48	0.48	34.00	39.9	0.64	48	61	48	61	1077
7C	27.4	14	2.13	0.53	0.53	31.00	27.4	0.63	41	52	41	52	740
8C	12.9	11	2.39	0.55	0.55	17.00	12.9	0.62	22	28	22	28	348
9C	16.6	9	2.63	0.57	0.57	25.00	16.6	0.61	32	41	32	41	448
Total	213.3					253			336	451	335	450	13415

(1) - K = Burn Factor from Appendix G-2, K = 0.677*(I ^-0.102)

(2) - Qb = A*I*(1-K)+K*Qu

Subareas 1A and 2A:
(3) - Qbb = 1.465*Qb
(4) - DP = A*128 cy (Zone 5)

Subareas 3A, 4A, 5A, 6B, 7B, 9C, 10C and 11C:
(3) - Qbb = 1.27*Qb
(4) - DP = A*27 cy (Zone 9)

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APPENDIX 3

TC CALCULATIONS:
PROPOSED CONDITION

Chiquito Borrow Site
Proposed Condition
TC Data File

Project	Subarea	Area	%imp	Frequency	Soil Type	Length	Slope	Isohyet
CQT	1/4A	23.9	0.06	50	20	1160	0.229	5.8
CQT	5A	4.4	0	50	20	530	0.321	5.8
CQT	6A	22.6	0.02	50	20	1620	0.069	5.8
CQT	7/8A	6.2	0.1	50	20	550	0.267	5.8
CQT	9A	31.8	0.04	50	20	1750	0.150	5.8
CQT	10A	14.5	0.05	50	20	1300	0.155	5.8
CQT	11A	7.4	0.9	50	20	2350	0.006	5.8
CQT	12A	4.4	0.9	50	20	1300	0.019	5.8

Chiquito Burrow Site
Proposed Condition
TC Calculation Results

Project	Subarea	Area (acre	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.	Tc-calculat	Intensity (i	Cu	Cd	Flowrate (c	Tc Equation
CQT	1/4A	23.9	0.06	50	20	1160	0.229	5.8	9	2.63	0.57	0.59	37.09	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	5A	4.4	0	50	20	530	0.321	5.8	5	3.46	0.63	0.63	9.59	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	6A	22.6	0.02	50	20	1620	0.069	5.8	15	2.06	0.52	0.53	24.67	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	7/8A	6.2	0.1	50	20	550	0.267	5.8	5	3.46	0.63	0.66	14.16	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	9A	31.8	0.04	50	20	1750	0.15	5.8	14	2.13	0.53	0.54	36.58	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	10A	14.5	0.05	50	20	1300	0.155	5.8	11	2.39	0.55	0.57	19.75	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	11A	7.4	0.9	50	20	2350	0.006	5.8	21	1.76	0.48	0.86	11.2	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^
CQT	12A	4.4	0.9	50	20	1300	0.019	5.8	12	2.29	0.54	0.86	8.67	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^

Landmark Village - Newhall Ranch

Chiquito Area

Drainage Proposed Area Chiquito

Subarea	Area (Ac)	Calcs Tc (min)	I_{50} (in/hr)	Cu	Cd	Q_{50} (cfs)	Area Undeveloped (Ac)	K (1)	Q_{50b} (cfs) (2)	Q_{50bb} (cfs) (3)	$Q_{50b}+Q_d$ (cfs)	$Q_{50bb}+Q_d$ (cfs)	DP (cy) (4)	DP BASIN (cy)	$Q_{50design}$ (cfs)
1/4A	23.9	9	2.63	0.57	0.59	37	10.0	0.61	19.66	24.97	41	46	270	270	41
5A	4.4	5	3.46	0.63	0.63	10	4.4	0.60	12.11	15.38	12	15	119		12
6A	22.6	15	2.06	0.52	0.53	25	18.2	0.63	26.57	33.75	31	39	491	610.2	31
7/8A	6.2	5	3.46	0.63	0.66	14	0	0.60	0.00	0.00	14	14	0		14
9A	31.8	14	2.13	0.53	0.54	37	19.3	0.63	29.42	37.36	44	52	521		52
10A	14.5	11	2.39	0.55	0.57	20	7.6	0.62	13.41	17.03	23	27	205		27
11A	7.4	21	1.76	0.48	0.86	11	0	0.64	0.00	0.00	11	11	0		11
12A	4.4	12	2.29	0.54	0.86	9	0	0.62	0.00	0.00	9	9	0		9
Total	115.2					163.00			101.17	128.49	185	213	1607		197

(1) - K = Burn Factor from Appendix G-2, K = 0.677*(I ^-0.102)
(2) - Qb = A*I*(1-K)+K*Qu
(3) - Qbb = 1.27*Qb
(4) - DP = A*27 cy (Zone 9)

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Adobe Borrow Site
Proposed Condition
TC Data File

Project	Subarea	Area	%imp	Frequency	Soil Type	Length	Slope	Isohyet
ADB	1A	28	0	50	20	1530	0.216	5.8
ADB	2A	12.7	0.05	50	20	850	0.265	5.8
ADB	3A	29.5	0.1	50	20	1300	0.085	5.8
ADB	4A	22.2	0.1	50	20	1320	0.046	5.8
ADB	5A	25.2	0.1	50	20	1260	0.103	5.8
ADB	6B	13.6	0	50	20	1560	0.138	5.8
ADB	7B	28.7	0	50	20	2540	0.029	5.8
ADB	9C	30.6	0.05	50	20	1985	0.217	5.8
ADB	10C	8.8	0	50	20	675	0.281	5.8
ADB	11C	13.9	0	50	20	750	0.167	5.8

Adobe Borrow Site
Proposed Condition
TC Calculation Results

Project	Subarea	Area (acre	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in	Tc-calculat	Intensity (i	Cu	Cd	Flowrate (c	Tc Equation		
ADB	1A	28	0	50	20	1530	0.216	5.8	12	2.29	0.54	0.54	34.62	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
ADB	2A	12.7	0.05	50	20	850	0.265	5.8	7	2.95	0.6	0.62	23.23	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
ADB	3A	29.5	0.1	50	20	1300	0.085	5.8	12	2.29	0.54	0.58	39.18	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
ADB	4A	22.2	0.1	50	20	1320	0.046	5.8	13	2.21	0.54	0.58	28.46	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
ADB	5A	25.2	0.1	50	20	1260	0.103	5.8	11	2.39	0.55	0.59	35.53	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
ADB	6B	13.6	0	50	20	1560	0.138	5.8	13	2.21	0.54	0.54	16.23	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
ADB	7B	28.7	0	50	20	2540	0.029	5.8	26	1.59	0.46	0.46	20.99	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
ADB	9C	30.6	0.05	50	20	1985	0.217	5.8	14	2.13	0.53	0.55	35.85	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
ADB	10C	8.8	0	50	20	675	0.281	5.8	6	3.18	0.62	0.62	17.35	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		
ADB	11C	13.9	0	50	20	750	0.167	5.8	7	2.95	0.6	0.6	24.6	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^		

Landmark Village - Newhall Ranch

Adobe Area

Drainage Proposed Area ADOBE

Subarea	Area (Ac)	Calcs Tc (min)	I_{50} (in/hr)	Cu	Cd	Q_{50} (cfs)	Area Undeveloped (Ac)	K (1)	Q_{50b} (cfs) (2)	Q_{50bb} (cfs) (3)	$Q_{50b}+Q_d$ (cfs)	$Q_{50bb}+Q_d$ (cfs)	DP (cy) (4)	DP BASIN (cy)	$Q_{50design}$ (cfs)
ADB-1A	**28.0**	12	2.29	0.54	0.54	35	**28.0**	0.62	46	67	**46**	**67**	3584		46
ADB-2A	**12.7**	7	2.95	0.59	0.61	23	**8.6**	0.61	19	28	**27**	**36**	1101		27
ADB-3A	**29.5**	12	2.29	0.54	0.58	39					**39**	**39**			39
ADB-4A	**22.2**	13	2.21	0.53	0.57	28					**28**	**28**			28
ADB-5A	**25.2**	11	2.39	0.55	0.59	36					**36**	**36**		4684.8	36
ADB-6B	**13.6**	13	2.21	0.53	0.53	16	**13.6**	0.62	21	27	**21**	**27**	367		27
ADB-7B	**28.7**	26	1.59	0.45	0.45	21	**28.7**	0.65	30	38	**30**	**38**	775		38
ADB-9C	**30.6**	14	2.13	0.53	0.55	36	**15.5**	0.63	24	30	**42**	**48**	419		48
ADB-10C	**8.8**	6	3.18	0.61	0.61	17	**8.8**	0.60	21	27	**21**	**27**	238		27
ADB-11C	**13.9**	8	2.77	0.58	0.58	22	**13.9**	0.61	28	36	**28**	**36**	375		36
Total	**213.2**					**273.00**			190	254	**318**	**382**	**6858**		352

(1) - K = Burn Factor from Appendix G-2, K = 0.677*(I ^-0.102)

(2) - Qb = A*I*(1-K)+K*Qu

Subareas 1A and 2A:
(3) - Qbb = 1.465*Qb
(4) - DP = A*128 cy (Zone 5)

Subareas 3A, 4A, 5A, 6B, 7B, 9C, 10C and 11C:
(3) - Qbb = 1.27*Qb
(4) - DP = A*27 cy (Zone 9)

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APPENDIX 4

LACDPW MORA CALCULATIONS: EXISTING CONDITION

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4LADEPTH.RDT
5 50300    1A   50 YR River Village - Newhall Ranch - Chiquito Existing
5 50300   16A   HYDROGRAPH AT OUTLET BASIN AREAs A
6 50300    1A 020   0    6 8A292   890 26500                      G1
6 50300    2A 020   0    4 6A292   200 01000
6 50300    3A  20   0    2 5A294   275 01000
6 50300    4A  20   0   1210A294   385 02000
6 50300    5B  20   0    4 5A292   530 32100
6 50300    6B  20   0   2515A294   835 02200
6 50300    7AB 20   0       A29
6 50300    8A  20   0    2 5A294   320 02000
6 50300    9A  20   0    3 5A294   900 01000
6 50300   10C  20   0   3214A292 1750 01500
6 50300   11C  20   0   1611A292 2800 01000
6 50300   12AC020           A29
6 50300   13D  20 65   1017A292 2370 01800
6 50300   14D  20 65   1210A292 1250 03200
6 50300   15AD 20           A29
6 50300   16A 020   0     99A29                                1  2
```

2-26-2005 SITE LICENSEE: PSOMAS

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY

50 YR River Village - Newhall Ranch - Chiquito Existing

STORM DAY 4

LOCATION		SUBAREA AREA	SUBAREA Q	TOTAL AREA	TOTAL Q	CONV TYPE	CONV LNGTH	CONV SLOPE	CONV SIZE	CONV Z	CONTROL Q	SOIL NAME	TC	RAIN ZONE	PCT IMPV
50300	1A	6.	10.	6.	10.	2	890.	0.26500	0.00	0.00	0.	20	8	A29	0.00
50300	2A	4.	8.	10.	17.	2	200.	0.01000	0.00	0.00	0.	20	6	A29	0.00
50300	3A	2.	4.	12.	18.	4	275.	0.01000	2.00	0.00	0.	20	5	A29	0.00
50300	4A	12.	17.	24.	34.	4	385.	0.02000	2.00	0.00	0.	20	10	A29	0.00
50300	5B	4.	9.	4.	9.	2	530.	0.32100	0.00	0.00	0.	20	5	A29	0.00
50300	6B	25.	27.	29.	35.	4	835.	0.02200	2.00	0.00	0.	20	15	A29	0.00
50300	7AB	29.	34.	53.	68.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	8A	2.	4.	55.	69.	4	320.	0.02000	2.75	0.00	0.	20	5	A29	0.00
50300	9A	3.	7.	58.	72.	4	900.	0.01000	3.00	0.00	0.	20	5	A29	0.00
50300	10C	32.	36.	32.	36.	2	1750.	0.01500	0.00	0.00	0.	20	14	A29	0.00
50300	11C	16.	21.	48.	40.	2	2800.	0.01000	0.00	0.00	0.	20	11	A29	0.00
50300	12AC	48.	29.	106.	78.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	13D	10.	16.	10.	16.	2	2370.	0.01800	0.00	0.00	0.	20	17	A29	0.65
50300	14D	12.	25.	22.	32.	2	1250.	0.03200	0.00	0.00	0.	20	10	A29	0.65
50300	15AD	22.	30.	128.	107.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	16A	0.	0.	128.	107.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY
HYDROGRAPH AT OUTLET BASIN AREAs A
HYDROGRAPH AT 50300 16A STORM DAY 4 REDUCTION FACTOR = 1.000

TIME	Q	TIME	Q	TIME	Q	TIME	Q	TIME	Q
0	0.	100	4.	200	4.	300	4.	400	4.
500	5.	600	5.	700	5.	800	6.	900	7.
1000	8.	1050	9.	1100	12.	1110	14.	1120	17.
1130	21.	1131	21.	1132	22.	1133	23.	1134	23.
1135	24.	1136	24.	1137	25.	1138	26.	1139	27.
1140	28.	1141	29.	1142	30.	1143	31.	1144	32.
1145	34.	1146	35.	1147	37.	1148	39.	1149	42.
1150	45.	1151	49.	1152	55.	1153	63.	1154	73.
1155	83.	1156	92.	1157	99.	1158	104.	1159	106.
1160	107.	1161	107.	1162	103.	1163	98.	1164	92.
1165	86.	1166	80.	1167	76.	1168	72.	1169	69.
1170	66.	1171	63.	1172	61.	1173	59.	1174	57.
1175	56.	1176	55.	1177	54.	1178	53.	1179	52.
1180	51.	1181	50.	1182	49.	1183	48.	1184	46.
1185	45.	1186	43.	1187	42.	1188	40.	1189	39.
1190	38.	1191	36.	1192	35.	1193	33.	1194	32.
1195	31.	1196	30.	1197	29.	1198	28.	1199	27.
1200	26.	1201	25.	1202	24.	1203	23.	1204	22.
1205	22.	1206	21.	1207	20.	1208	20.	1209	19.
1210	18.	1211	18.	1212	17.	1213	17.	1214	16.
1215	16.	1216	15.	1217	15.	1218	15.	1219	14.
1220	14.	1221	14.	1222	13.	1223	13.	1224	13.
1225	13.	1226	12.	1227	12.	1228	12.	1229	12.
1230	11.	1231	11.	1232	11.	1233	11.	1234	11.
1235	10.	1236	10.	1237	10.	1238	10.	1239	10.
1240	10.	1241	9.	1242	9.	1243	9.	1244	9.
1245	9.	1246	9.	1247	9.	1248	9.	1249	9.
1250	8.	1251	8.	1252	8.	1253	8.	1254	8.
1255	8.	1256	8.	1257	8.	1258	8.	1259	8.
1260	8.	1261	8.	1262	7.	1263	7.	1264	7.
1265	7.	1266	7.	1267	7.	1268	7.	1269	7.
1270	7.	1271	7.	1272	7.	1273	7.	1274	7.
1275	7.	1276	7.	1277	7.	1278	7.	1279	7.
1280	7.	1281	7.	1282	6.	1283	6.	1284	6.
1285	6.	1286	6.	1287	6.	1288	6.	1289	6.
1290	6.	1291	6.	1292	6.	1293	6.	1294	6.
1295	6.	1296	6.	1297	6.	1298	6.	1299	6.
1300	6.	1310	6.	1320	5.	1330	5.	1340	5.
1350	5.	1360	5.	1370	5.	1380	5.	1390	5.
1400	4.	1420	4.	1440	4.	1460	4.	1500	4.

Total Runoff = 16.196 Acre-Ft.
Peak Q = 107 CFS
Time to Peak Q = 1160 Minutes

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4LADEPTH.RDT
5 50300    1A  50 YR River Village - Newhall Ranch - ADOBE Existing
5 50300   11A  HYDROGRAPH AT OUTLET BASIN AREAs A, B, And c
6 50300    1A 020  035.811A292 1755 61400                     G1
6 50300    2A 020  0  4012A292 1035 05900
6 50300    3A  20  0  2412A292  890 34000
6 50300    4B  20  016.713A292 1560 13800
6 50300    5B  20  039.920A292 2490 09200
6 50300    6AB020        A29
6 50300    7C 020  027.414A292  720 01300
6 50300    8C 020  012.711A292 1250 01200
6 50300    9C 020  016.6 9A292 1150 01000
6 50300   10AC020        A29
6 50300   11A 020  0    99A29                               1  2
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2-25-2005 SITE LICENSEE: Psomas

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY

50 YR River Village - Newhall Ranch - ADOBE Existing

STORM DAY 4

LOCATION		SUBAREA AREA	SUBAREA Q	TOTAL AREA	TOTAL Q	CONV TYPE	CONV LNGTH	CONV SLOPE	CONV SIZE	CONV Z	CONTROL Q	SOIL NAME	TC	RAIN ZONE	PCT IMPV
50300	1A	36.	48.	36.	48.	2	1755.	0.61400	0.00	0.00	0.	20	11	A29	0.00
50300	2A	40.	50.	76.	97.	2	1035.	0.05900	0.00	0.00	0.	20	12	A29	0.00
50300	3A	24.	30.	100.	124.	2	890.	0.34000	0.00	0.00	0.	20	12	A29	0.00
50300	4B	17.	20.	17.	20.	2	1560.	0.13800	0.00	0.00	0.	20	13	A29	0.00
50300	5B	40.	36.	57.	55.	2	2490.	0.09200	0.00	0.00	0.	20	20	A29	0.00
50300	6AB	57.	53.	157.	169.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	7C	27.	31.	27.	31.	2	720.	0.01300	0.00	0.00	0.	20	14	A29	0.00
50300	8C	13.	17.	40.	43.	2	1250.	0.01200	0.00	0.00	0.	20	11	A29	0.00
50300	9C	17.	26.	57.	43.	2	1150.	0.01000	0.00	0.00	0.	20	9	A29	0.00
50300	10AC	57.	40.	214.	201.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	11A	0.	0.	214.	201.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY
HYDROGRAPH AT OUTLET BASIN AREAs A, B, and c
HYDROGRAPH AT 50300 11A STORM DAY 4 REDUCTION FACTOR = 1.000

TIME	Q	TIME	Q	TIME	Q	TIME	Q	TIME	Q
0	0.	100	3.	200	3.	300	3.	400	3.
500	4.	600	4.	700	4.	800	4.	900	5.
1000	6.	1050	8.	1100	13.	1110	15.	1120	20.
1130	28.	1131	29.	1132	30.	1133	31.	1134	32.
1135	33.	1136	35.	1137	36.	1138	37.	1139	39.
1140	41.	1141	42.	1142	45.	1143	47.	1144	50.
1145	53.	1146	56.	1147	60.	1148	64.	1149	70.
1150	77.	1151	87.	1152	100.	1153	116.	1154	135.
1155	154.	1156	172.	1157	185.	1158	194.	1159	199.
1160	201.	1161	200.	1162	195.	1163	186.	1164	174.
1165	161.	1166	147.	1167	136.	1168	125.	1169	116.
1170	108.	1171	101.	1172	94.	1173	88.	1174	81.
1175	75.	1176	69.	1177	63.	1178	58.	1179	54.
1180	50.	1181	46.	1182	43.	1183	40.	1184	37.
1185	35.	1186	32.	1187	30.	1188	29.	1189	27.
1190	25.	1191	24.	1192	23.	1193	21.	1194	20.
1195	19.	1196	18.	1197	17.	1198	17.	1199	16.
1200	15.	1201	15.	1202	14.	1203	13.	1204	13.
1205	12.	1206	12.	1207	12.	1208	11.	1209	11.
1210	10.	1211	10.	1212	10.	1213	9.	1214	9.
1215	9.	1216	9.	1217	9.	1218	8.	1219	8.
1220	8.	1221	8.	1222	8.	1223	8.	1224	7.
1225	7.	1226	7.	1227	7.	1228	7.	1229	7.
1230	7.	1231	7.	1232	7.	1233	6.	1234	6.
1235	6.	1236	6.	1237	6.	1238	6.	1239	6.
1240	6.	1241	6.	1242	6.	1243	6.	1244	6.
1245	6.	1246	6.	1247	6.	1248	6.	1249	5.
1250	5.	1251	5.	1252	5.	1253	5.	1254	5.
1255	5.	1256	5.	1257	5.	1258	5.	1259	5.
1260	5.	1261	5.	1262	5.	1263	5.	1264	5.
1265	5.	1266	5.	1267	5.	1268	5.	1269	5.
1270	5.	1271	5.	1272	5.	1273	5.	1274	5.
1275	5.	1276	5.	1277	5.	1278	5.	1279	5.
1280	5.	1281	5.	1282	4.	1283	4.	1284	4.
1285	4.	1286	4.	1287	4.	1288	4.	1289	4.
1290	4.	1291	4.	1292	4.	1293	4.	1294	4.
1295	4.	1296	4.	1297	4.	1298	4.	1299	4.
1300	4.	1310	4.	1320	4.	1330	4.	1340	4.
1350	4.	1360	4.	1370	3.	1380	3.	1390	3.
1400	3.	1420	3.	1440	3.	1460	3.	1500	3.

Total Runoff = 15.989 Acre-Ft.
Peak Q = 201 CFS
Time to Peak Q = 1160 Minutes

APPENDIX 5

LACDPW MORA CALCULATIONS
PROPOSED CONDITION

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4LADEPTH.RDT
5 50300    1A  50 YR River Village - Newhall Ranch - Chiquito Proposed
5 50300   12A  HYDROGRAPH AT OUTLET BASIN AREAs A
6 50300    1A 020  623.9 9A292 1160 22900                        G1
6 50300    2B 020  0 4.4 5A292  530 32100
6 50300    3B  20  222.615A294  835 02200
6 50300    4AB 20  0        A29
6 50300    5A  20 10 6.2 5A294  320 02200
6 50300    6C  20  431.814A292 1750 01500
6 50300    7C  20  514.511A292 2800 01000
6 50300    8AC020           A29
6 50300    9D  20 90 7.321A292 2350 00600
6 50300   10D  20 90 4.412A292 1300 01900
6 50300   11AD 20           A29
6 50300   12A 020  0    99A29                                  1  2
```

3-15-2005 SITE LICENSEE: Psomas

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY
50 YR River Village - Newhall Ranch - Chiquito Proposed

STORM DAY 4

LOCATION		SUBAREA AREA	SUBAREA Q	TOTAL AREA	TOTAL Q	CONV TYPE	CONV LNGTH	CONV SLOPE	CONV SIZE	CONV Z	CONTROL Q	SOIL NAME	TC	RAIN ZONE	PCT IMPV
50300	1A	24.	38.	24.	38.	2	1160.	0.22900	0.00	0.00	0.	20	9	A29	0.06
50300	2B	4.	9.	4.	9.	2	530.	0.32100	0.00	0.00	0.	20	5	A29	0.00
50300	3B	23.	25.	27.	33.	4	835.	0.02200	2.00	0.00	0.	20	15	A29	0.02
50300	4AB	27.	32.	51.	70.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	5A	6.	14.	57.	78.	4	320.	0.02200	2.75	0.00	0.	20	5	A29	0.10
50300	6C	32.	38.	32.	38.	2	1750.	0.01500	0.00	0.00	0.	20	14	A29	0.04
50300	7C	14.	19.	46.	40.	2	2800.	0.01000	0.00	0.00	0.	20	11	A29	0.05
50300	8AC	46.	30.	103.	85.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	9D	7.	12.	7.	12.	2	2350.	0.00600	0.00	0.00	0.	20	21	A29	0.90
50300	10D	4.	9.	11.	13.	2	1300.	0.01900	0.00	0.00	0.	20	12	A29	0.90
50300	11AD	11.	12.	114.	93.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	12A	0.	0.	114.	93.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY
HYDROGRAPH AT OUTLET BASIN AREAs A
HYDROGRAPH AT 50300 12A STORM DAY 4 REDUCTION FACTOR = 1.000

TIME	Q	TIME	Q	TIME	Q	TIME	Q	TIME	Q
0	0.	100	4.	200	4.	300	4.	400	4.
500	4.	600	4.	700	5.	800	5.	900	6.
1000	7.	1050	9.	1100	11.	1110	13.	1120	16.
1130	20.	1131	20.	1132	21.	1133	21.	1134	22.
1135	22.	1136	23.	1137	24.	1138	24.	1139	25.
1140	26.	1141	27.	1142	29.	1143	30.	1144	31.
1145	33.	1146	35.	1147	37.	1148	39.	1149	43.
1150	48.	1151	55.	1152	65.	1153	76.	1154	85.
1155	91.	1156	93.	1157	93.	1158	90.	1159	86.
1160	81.	1161	75.	1162	70.	1163	66.	1164	62.
1165	59.	1166	56.	1167	53.	1168	51.	1169	49.
1170	47.	1171	46.	1172	45.	1173	44.	1174	44.
1175	44.	1176	44.	1177	44.	1178	44.	1179	44.
1180	44.	1181	44.	1182	43.	1183	43.	1184	42.
1185	41.	1186	41.	1187	40.	1188	39.	1189	38.
1190	37.	1191	36.	1192	35.	1193	34.	1194	33.
1195	32.	1196	31.	1197	30.	1198	29.	1199	28.
1200	27.	1201	26.	1202	26.	1203	25.	1204	24.
1205	23.	1206	22.	1207	22.	1208	21.	1209	20.
1210	20.	1211	19.	1212	19.	1213	18.	1214	18.
1215	17.	1216	17.	1217	16.	1218	16.	1219	15.
1220	15.	1221	15.	1222	14.	1223	14.	1224	14.
1225	13.	1226	13.	1227	13.	1228	13.	1229	12.
1230	12.	1231	12.	1232	12.	1233	11.	1234	11.
1235	11.	1236	11.	1237	11.	1238	10.	1239	10.
1240	10.	1241	10.	1242	10.	1243	10.	1244	9.
1245	9.	1246	9.	1247	9.	1248	9.	1249	9.
1250	9.	1251	9.	1252	8.	1253	8.	1254	8.
1255	8.	1256	8.	1257	8.	1258	8.	1259	8.
1260	8.	1261	8.	1262	8.	1263	7.	1264	7.
1265	7.	1266	7.	1267	7.	1268	7.	1269	7.
1270	7.	1271	7.	1272	7.	1273	7.	1274	7.
1275	7.	1276	7.	1277	7.	1278	7.	1279	6.
1280	6.	1281	6.	1282	6.	1283	6.	1284	6.
1285	6.	1286	6.	1287	6.	1288	6.	1289	6.
1290	6.	1291	6.	1292	6.	1293	6.	1294	6.
1295	6.	1296	6.	1297	6.	1298	6.	1299	6.
1300	6.	1310	5.	1320	5.	1330	5.	1340	5.
1350	5.	1360	4.	1370	4.	1380	4.	1390	4.
1400	4.	1420	4.	1440	4.	1460	4.	1500	4.

Total Runoff = 14.857 Acre-Ft.
Peak Q = 93 CFS
Time to Peak Q = 1156 Minutes

```
4LADEPTH.RDT
5 50300    1A  50 YR River Village - Newhall Ranch - ADOBE Proposed
5 50300   13A  HYDROGRAPH AT OUTLET BASIN AREAs A, B, and c
6 50300    1A 020  028.012A292 1530 21600                   G1
6 50300    2A 020  512.7 7A292  220 05000
6 50300    3A  20 1029.512A292  590 05000
6 50300    4A  20 1022.213A292  450 05000
6 50300    5A  20 1025.211A292  920 05000
6 50300    6B  20  013.613A292 1560 13800
6 50300    7B  20  028.726A292 2490 09200
6 50300    8AB020         A29
6 50300    9C 020  530.614A292  720 01300
6 50300   10C 020  0 8.8 6A292 1250 01200
6 50300   11C 020  013.9 8A292 1150 01000
6 50300   12AC020         A29
6 50300   13A 020  0    99A29                            1  2
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3-15-2005 SITE LICENSEE: Psomas

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY

50 YR River Village - Newhall Ranch - ADOBE Proposed

STORM DAY 4

LOCATION		SUBAREA AREA	SUBAREA Q	TOTAL AREA	TOTAL Q	CONV TYPE	CONV LNGTH	CONV SLOPE	CONV SIZE	CONV Z	CONTROL Q	SOIL NAME	TC	RAIN ZONE	PCT IMPV
50300	1A	28.	35.	28.	35.	2	1530.	0.21600	0.00	0.00	0.	20	12	A29	0.00
50300	2A	13.	24.	41.	56.	2	220.	0.05000	0.00	0.00	0.	20	7	A29	0.05
50300	3A	29.	39.	70.	94.	2	590.	0.05000	0.00	0.00	0.	20	12	A29	0.10
50300	4A	22.	28.	92.	120.	2	450.	0.05000	0.00	0.00	0.	20	13	A29	0.10
50300	5A	25.	36.	117.	153.	2	920.	0.05000	0.00	0.00	0.	20	11	A29	0.10
50300	6B	14.	17.	14.	17.	2	1560.	0.13800	0.00	0.00	0.	20	13	A29	0.00
50300	7B	29.	22.	43.	38.	2	2490.	0.09200	0.00	0.00	0.	20	26	A29	0.00
50300	8AB	43.	36.	160.	181.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	9C	31.	37.	31.	37.	2	720.	0.01300	0.00	0.00	0.	20	14	A29	0.05
50300	10C	9.	17.	40.	42.	2	1250.	0.01200	0.00	0.00	0.	20	6	A29	0.00
50300	11C	14.	23.	54.	41.	2	1150.	0.01000	0.00	0.00	0.	20	8	A29	0.00
50300	12AC	54.	38.	214.	212.	0	0.	0.00000	0.00	0.00	0.	20	0	A29	0.00
50300	13A	0.	0.	214.	212.	0	0.	0.00000	0.00	0.00	0.	20	99	A29	0.00

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
MODIFIED RATIONAL METHOD HYDROLOGY
HYDROGRAPH AT OUTLET BASIN AREAs A, B, and c
HYDROGRAPH AT 50300 13A STORM DAY 4 REDUCTION FACTOR = 1.000

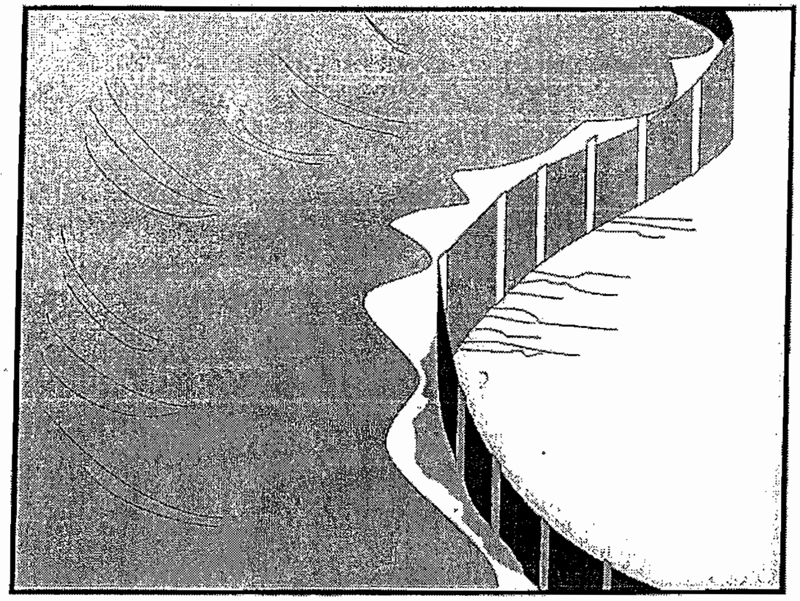
TIME	Q	TIME	Q	TIME	Q	TIME	Q	TIME	Q
0	0.	100	4.	200	4.	300	5.	400	5.
500	5.	600	5.	700	6.	800	6.	900	7.
1000	9.	1050	11.	1100	16.	1110	19.	1120	24.
1130	32.	1131	33.	1132	34.	1133	35.	1134	36.
1135	37.	1136	39.	1137	40.	1138	41.	1139	43.
1140	44.	1141	46.	1142	48.	1143	51.	1144	53.
1145	56.	1146	59.	1147	63.	1148	67.	1149	72.
1150	78.	1151	86.	1152	98.	1153	113.	1154	131.
1155	152.	1156	172.	1157	189.	1158	201.	1159	209.
1160	212.	1161	210.	1162	204.	1163	196.	1164	185.
1165	172.	1166	160.	1167	148.	1168	137.	1169	127.
1170	118.	1171	110.	1172	103.	1173	96.	1174	90.
1175	85.	1176	80.	1177	75.	1178	71.	1179	66.
1180	62.	1181	58.	1182	54.	1183	50.	1184	46.
1185	43.	1186	40.	1187	37.	1188	35.	1189	33.
1190	31.	1191	29.	1192	27.	1193	26.	1194	25.
1195	23.	1196	22.	1197	21.	1198	20.	1199	20.
1200	19.	1201	18.	1202	17.	1203	17.	1204	16.
1205	16.	1206	15.	1207	15.	1208	14.	1209	14.
1210	13.	1211	13.	1212	13.	1213	12.	1214	12.
1215	12.	1216	12.	1217	11.	1218	11.	1219	11.
1220	11.	1221	10.	1222	10.	1223	10.	1224	10.
1225	10.	1226	10.	1227	10.	1228	9.	1229	9.
1230	9.	1231	9.	1232	9.	1233	9.	1234	9.
1235	9.	1236	9.	1237	8.	1238	8.	1239	8.
1240	8.	1241	8.	1242	8.	1243	8.	1244	8.
1245	8.	1246	8.	1247	8.	1248	8.	1249	8.
1250	8.	1251	8.	1252	7.	1253	7.	1254	7.
1255	7.	1256	7.	1257	7.	1258	7.	1259	7.
1260	7.	1261	7.	1262	7.	1263	7.	1264	7.
1265	7.	1266	7.	1267	7.	1268	7.	1269	7.
1270	7.	1271	7.	1272	7.	1273	7.	1274	7.
1275	7.	1276	7.	1277	6.	1278	6.	1279	6.
1280	6.	1281	6.	1282	6.	1283	6.	1284	6.
1285	6.	1286	6.	1287	6.	1288	6.	1289	6.
1290	6.	1291	6.	1292	6.	1293	6.	1294	6.
1295	6.	1296	6.	1297	6.	1298	6.	1299	6.
1300	6.	1310	6.	1320	6.	1330	5.	1340	5.
1350	5.	1360	5.	1370	5.	1380	5.	1390	5.
1400	5.	1420	4.	1440	4.	1460	4.	1500	4.

Total Runoff = 19.970 Acre-Ft.
Peak Q = 212 CFS
Time to Peak Q = 1160 Minutes

APPENDIX 6

EROSION AND SEDIMENT CONTROL
BMP FACT SHEETS

Silt Fence



Objectives

EC	Erosion Control	✓
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-9 Straw Bale Barrier

Description and Purpose

A silt fence is made of a filter fabric that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains sediment-laden water, promoting sedimentation behind the fence.

Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They should also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion. Silt fences are generally ineffective in locations where the flow is concentrated and are only applicable for sheet or overland flows. Silt fences are most effective when used in combination with erosion controls. Suitable applications include:

- Along the perimeter of a project.
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Below other small cleared areas.

Limitations

- Do not use in streams, channels, drain inlets, or anywhere flow is concentrated.

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- Do not use in locations where ponded water may cause flooding.
- Do not place fence on a slope, or across any contour line. If not installed at the same elevation throughout, silt fences will create erosion.
- Filter fences will create a temporary sedimentation pond on the upstream side of the fence and may cause temporary flooding. Fences not constructed on a level contour will be overtopped by concentrated flow resulting in failure of the filter fence.
- Improperly installed fences are subject to failure from undercutting, overlapping, or collapsing.
  - Not effective unless trenched and keyed in.
  - Not intended for use as mid-slope protection on slopes greater than 4:1 (H:V).
  - Do not allow water depth to exceed 1.5 ft at any point.

Implementation

General

A silt fence is a temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts, entrenched, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap sediment by intercepting and detaining small amounts of sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

Silt fences are preferable to straw bale barriers in many cases. Laboratory work at the Virginia Highway and Transportation Research Council has shown that silt fences can trap a much higher percentage of suspended sediments than can straw bales. While the failure rate of silt fences is lower than that of straw bale barriers, there are many instances where silt fences have been improperly installed. The following layout and installation guidance can improve performance and should be followed:

- Use principally in areas where sheet flow occurs.
- Don't use in streams, channels, or anywhere flow is concentrated. Don't use silt fences to divert flow.
- Don't use below slopes subject to creep, slumping, or landslides.
- Select filter fabric that retains 85% of soil by weight, based on sieve analysis, but that is not finer than an equivalent opening size of 70.
- Install along a level contour, so water does not pond more than 1.5 ft at any point along the silt fence.
- The maximum length of slope draining to any point along the silt fence should be 200 ft or less.
- The maximum slope perpendicular to the fence line should be 1:1.

- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 ft^2 of ponding area should be provided for every acre draining to the fence.
- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence.
- Leave an undisturbed or stabilized area immediately down slope from the fence where feasible.
- Silt fences should remain in place until the disturbed area is permanently stabilized.

Design and Layout

Selection of a filter fabric is based on soil conditions at the construction site (which affect the equivalent opening size (EOS) fabric specification) and characteristics of the support fence (which affect the choice of tensile strength). The designer should specify a filter fabric that retains the soil found on the construction site yet that it has openings large enough to permit drainage and prevent clogging. The following criteria is recommended for selection of the equivalent opening size:

1. If 50 percent or less of the soil, by weight, will pass the U.S. Standard Sieve No. 200, select the EOS to retain 85 % of the soil. The EOS should not be finer than EOS 70.
2. For all other soil types, the EOS should be no larger than the openings in the U.S. Standard Sieve No. 70 except where direct discharge to a stream, lake, or wetland will occur, then the EOS should be no larger than Standard Sieve No. 100.

To reduce the chance of clogging, it is preferable to specify a fabric with openings as large as allowed by the criteria. No fabric should be specified with an EOS smaller than U.S. Standard Sieve No. 100. If 85% or more of a soil, by weight, passes through the openings in a No. 200 sieve, filter fabric should not be used. Most of the particles in such a soil would not be retained if the EOS was too large and they would clog the fabric quickly if the EOS were small enough to capture the soil.

The fence should be supported by a plastic or wire mesh if the fabric selected does not have sufficient strength and bursting strength characteristics for the planned application (as recommended by the fabric manufacturer). Filter fabric material should contain ultraviolet inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 °F to 120 °F.

- Layout in accordance with attached figures.
- For slopes steeper than 2:1 (H:V) and that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to install additional protection immediately adjacent to the bottom of the slope, prior to installing silt fence. Additional protection may be a chain link fence or a cable fence.
- For slopes adjacent to sensitive receiving waters or Environmentally Sensitive Areas (ESAs), silt fence should be used in conjunction with erosion control BMPs.

Materials

- Silt fence fabric should be woven polypropylene with a minimum width of 36 in. and a minimum tensile strength of 100 lb force. The fabric should conform to the requirements in ASTM designation D4632 and should have an integral reinforcement layer. The reinforcement layer should be a polypropylene, or equivalent, net provided by the manufacturer. The permittivity of the fabric should be between 0.1 sec^{-1} and 0.15 sec^{-1} in conformance with the requirements in ASTM designation D4491.

- Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.

- Staples used to fasten the fence fabric to the stakes should be not less than 1.75 in. long and should be fabricated from 15 gauge or heavier wire. The wire used to fasten the tops of the stakes together when joining two sections of fence should be 9 gauge or heavier wire. Galvanizing of the fastening wire will not be required.

- There are new products that may use prefabricated plastic holders for the silt fence and use bar reinforcement instead of wood stakes. If bar reinforcement is used in lieu of wood stakes, use number four or greater bar. Provide end protection for any exposed bar reinforcement.

Installation Guidelines

Silt fences are to be constructed on a level contour. Sufficient area should exist behind the fence for ponding to occur without flooding or overtopping the fence.

- A trench should be excavated approximately 6 in. wide and 6 in. deep along the line the proposed silt fence.

- Bottom of the silt fence should be keyed-in a minimum of 12 in.

- Posts should be spaced a maximum of 6 ft apart and driven securely into the ground a minimum of 18 in. or 12 in. below the bottom of the trench.

- When standard strength filter fabric is used, a plastic or wire mesh support fence should be fastened securely to the upslope side of posts using heavy-duty wire staples at least 1 in. long. The mesh should extend into the trench. When extra-strength filter fabric and closer post spacing are used, the mesh support fence may be eliminated. Filter fabric should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, filter cloth should be spliced together only at a support post, with a minimum 6 in. overlap and both ends securely fastened to the post.

- The trench should be backfilled with compacted native material.

- Construct silt fences with a setback of at least 3 ft from the toe of a slope. Where a silt fence is determined to be not practicable due to specific site conditions, the silt fence may be constructed at the toe of the slope, but should be constructed as far from the toe of the slope as practicable. Silt fences close to the toe of the slope will be less effective and difficult to maintain.

- Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the barrier; in no case should the reach exceed 500 ft.

Costs

- Average annual cost for installation and maintenance (assumes 6 month useful life): $7 per lineal foot ($850 per drainage acre). Range of cost is $3.50 - $9.10 per lineal foot.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric. The lifespan of silt fence fabric is generally 5 to 8 months.
- Silt fences that are damaged and become unsuitable for the intended purpose should be removed from the site of work, disposed of, and replaced with new silt fence barriers.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Silt fences should be left in place until the upstream area is permanently stabilized. Until then, the silt fence must be inspected and maintained.
- Holes, depressions, or other ground disturbance caused by the removal of the silt fences should be backfilled and repaired.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group-Working Paper, USEPA, April 1992.

Sedimentation and Erosion Control Practices, and Inventory of Current Practices (Draft), UESPA, 1990.

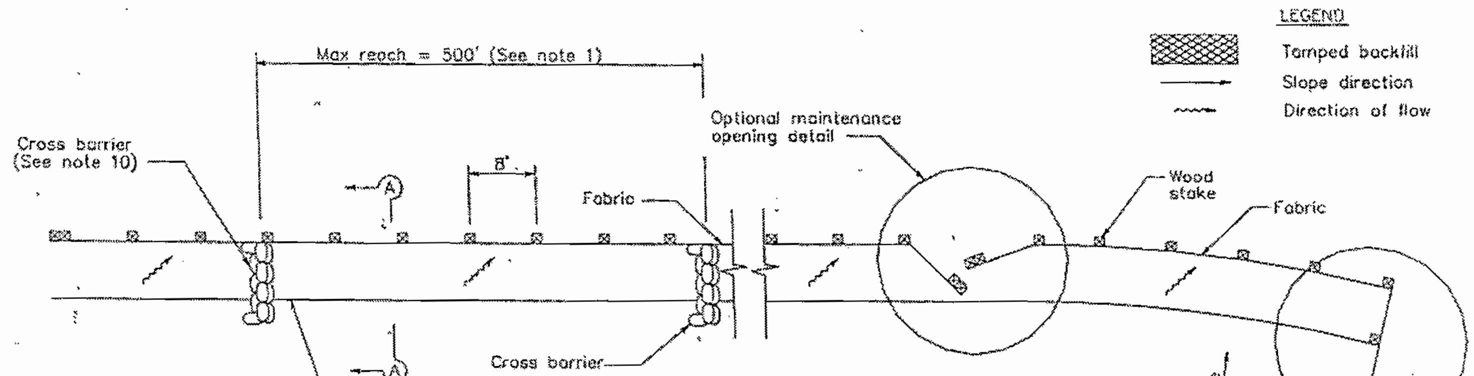
Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

U.S. Environmental Protection Agency (USEPA). Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

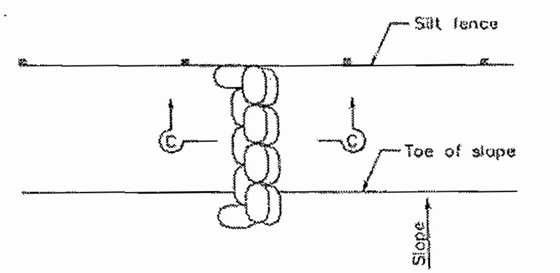


PLAN

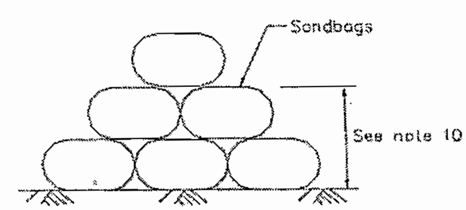
SILT FENCE

NOTES

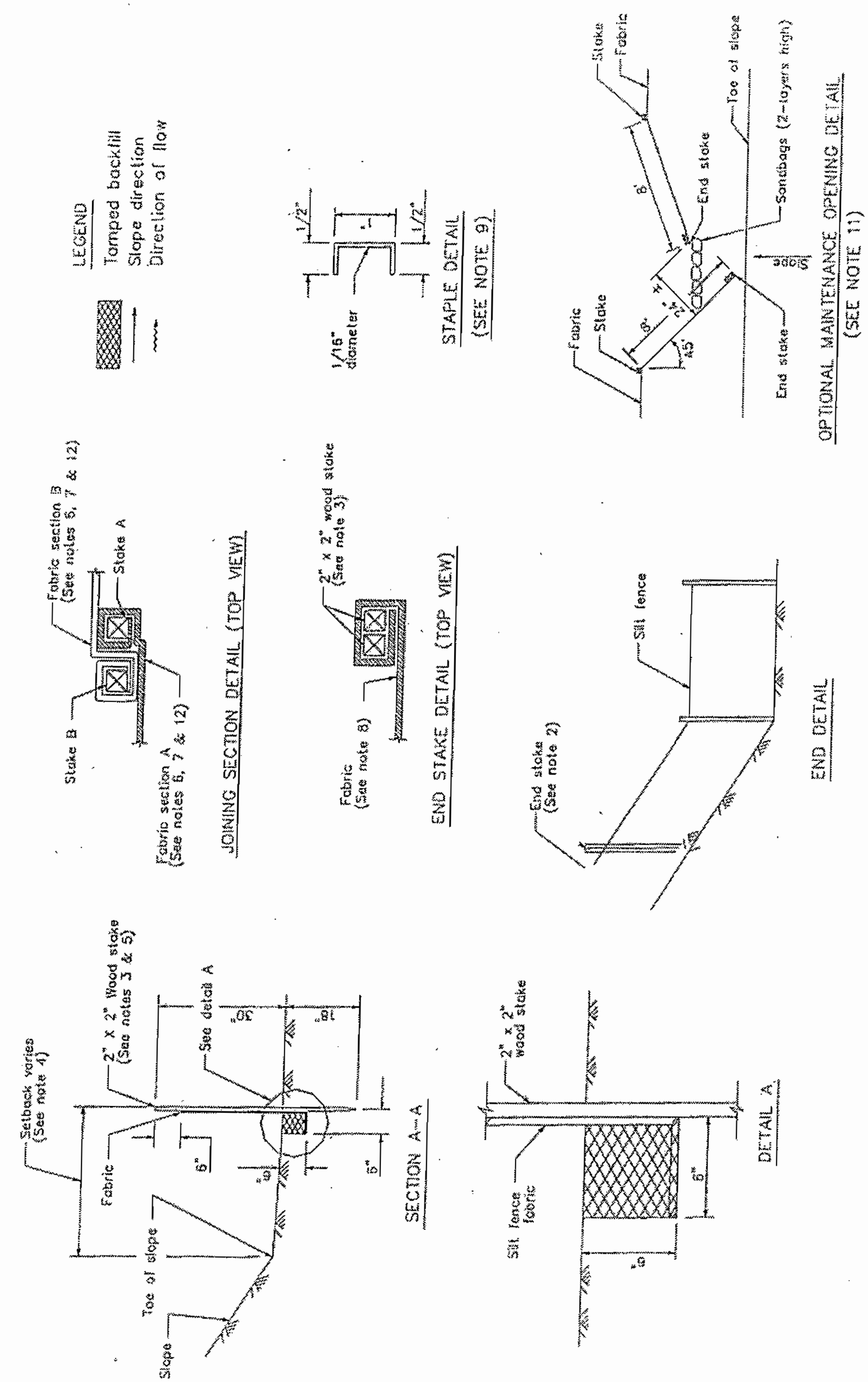
1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the linear barrier, in no case shall the reach length exceed 500'.
2. The last 8'-0" of fence shall be turned up slope.
3. Stake dimensions are nominal.
4. Dimension may vary to fit field condition.
5. Stakes shall be spaced at 8'-0" maximum and shall be positioned on downstream side of fence.
6. Stakes to overlap and fence fabric to fold around each stake one full turn. Secure fabric to stake with 4 staples.
7. Stakes shall be driven tightly together to prevent potential flow-through of sediment at joint. The tops of the stakes shall be secured with wire.
8. For end stake, fence fabric shall be folded around two stakes one full turn and secured with 4 staples.
9. Minimum 4 staples per stake. Dimensions shown are typical.
10. Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
11. Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
12. Joining sections shall not be placed at sump locations.
13. Sandbag rows and layers shall be offset to eliminate gaps.



CROSS BARRIER DETAIL

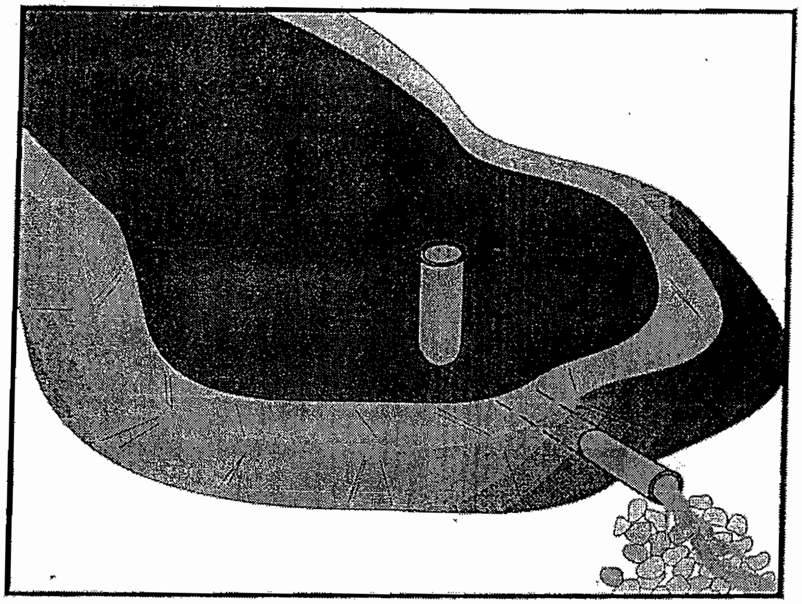


SECTION C-C


LEGEND
Tamped backfill
Slope direction
Direction of flow
1/2"
1"
1/2"
1/16" diameter
STAPLE DETAIL
(SEE NOTE 9)
Stake
Fabric
Toe of slope
End stake
Sandbags (2-layers high)
8'
8'
45°
Slope
OPTIONAL MAINTENANCE OPENING DETAIL
(SEE NOTE 11)
Fabric section B
(See notes 6, 7 & 12)
Stake A
Stake B
Fabric section A
(See notes 6, 7 & 12)
JOINING SECTION DETAIL (TOP VIEW)
2" x 2" wood stake
(See note 3)
Fabric
(See note 8)
END STAKE DETAIL (TOP VIEW)
Silt fence
End stake
(See note 2)
END DETAIL
Setback varies
(See note 4)
2" X 2" Wood stake
(See notes 3 & 5)
See detail A
Fabric
Toe of slope
Slope
30"
18"
6"
6"
6"
SECTION A-A
2" x 2" wood stake
Silt fence fabric
6"
6"
DETAIL A

Sediment Basin

SE-2



Objectives

EC	Erosion Control	
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-3 Sediment Trap (for smaller areas)

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Description and Purpose

A sediment basin is a temporary basin formed by excavation or by constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is discharged.

Suitable Applications

Sediment basins may be suitable for use on larger projects with sufficient space for constructing the basin. Sediment basins should be considered for use:

- Where sediment-laden water may enter the drainage system or watercourses
- On construction projects with disturbed areas during the rainy season
- At the outlet of disturbed watersheds between 5 acres and 75 acres
- At the outlet of large disturbed watersheds, as necessary
- Where post construction detention basins are required
- In association with dikes, temporary channels, and pipes used to convey runoff from disturbed areas

Limitations

Sediment basins must be installed only within the property limits and where failure of the structure will not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities. In addition, sediment basins are attractive to children and can be very dangerous. Local ordinances regarding health and safety must be adhered to. If fencing of the basin is required, the type of fence and its location should be shown in the SWPPP and in the construction specifications.

- Generally, sediment basins are limited to drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres.
- Sediment basins may become an "attractive nuisance" and care must be taken to adhere to all safety practices. If safety is a concern, basin may require protective fencing.
- Sediment basins designed according to this handbook are only practically effective in removing sediment down to about the medium silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated unless chemical treatment is used in addition to the sediment basin.
- Sites with very fine sediments (fine silt and clay) may require longer detention times for effective sediment removal.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft or more must obtain approval from Division of Safety of Dams.
- Standing water may cause mosquitoes or other pests to breed.
- Basins require large surface areas to permit settling of sediment. Size may be limited by the available area.

Implementation

General

A sediment basin is a controlled stormwater release structure formed by excavation or by construction of an embankment of compacted soil across a drainage way, or other suitable location. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure with a design life of 12 to 28 months in most cases and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed.

Sediment basins are suitable for nearly all types of construction projects. Whenever possible, construct the sediment basins before clearing and grading work begins. Basins should be located at the stormwater outlet from the site but not in any natural or undisturbed stream. A typical application would include temporary dikes, pipes, and/or channels to divert runoff to the basin inlet.

Many development projects in California will be required by local ordinances to provide a stormwater detention basin for post-construction flood control, desilting, or stormwater pollution control. A temporary sediment basin may be constructed by rough grading the post-construction control basins early in the project.

Sediment basins trap 70-80 % of the sediment that flows into them if designed according to this handbook. Therefore, they should be used in conjunction with erosion control practices such as temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

Planning

To improve the effectiveness of the basin, it should be located to intercept runoff from the largest possible amount of disturbed area. The best locations are generally low areas. Drainage into the basin can be improved by the use of earth dikes and drainage swales (see BMP EC-9). The basin must not be located in a stream but it should be located to trap sediment-laden runoff before it enters the stream. The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

- Construct before clearing and grading work begins when feasible.
- Do not locate in a stream.
- Basin sites should be located where failure of the structure will not cause loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities.
- Large basins are subject to state and local dam safety requirements.
- Limit the contributing area to the sediment basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the sediment basin.
- The basin should be located: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where post-construction (permanent) detention basins will be constructed, and (3) where the basins can be maintained on a year-round basis to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area, and to maintain the basin to provide the required capacity.

Design

Sediment basins must be designed in accordance with Section A of the State of California NPDES General Permit for Stormwater Discharges Associated with Construction Activities (General Permit) where sediment basins are the only control measure proposed for the site. If there is insufficient area to construct a sediment basin in accordance with the General Permit requirements, then the alternate design standards specified herein may be used.

Sediment basins designed per the General Permit shall be designed as follows:

Option 1:

Pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 3.

OR

Option 2:

Sediment basin(s), as measured from the bottom of the basin to the principal outlet, shall have at least a capacity equivalent to 3,600 cubic feet (133 yd^3) of storage per acre draining into the sediment basin. The length of the basin shall be more than twice the width of the basin. The length is determined by measuring the distance between the inlet and the outlet; and the depth must not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency.

OR

Option 3:
Sediment basin(s) shall be designed using the standard equation:

$$As=1.2Q/Vs \qquad \text{(Eq. 1)}$$

Where:

As = Minimum surface area for trapping soil particles of a certain size

Vs = Settling velocity of the design particle size chosen

Q = C I A

Where

Q = Discharge rate measured in cubic feet per second

C = Runoff coefficient

I = Precipitation intensity for the 10-year, 6-hour rain event

A = Area draining into the sediment basin in acres

The design particle size shall be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01 mm [or 0.0004 in.]) particle, and the *Vs* used shall be 100 percent of the calculated settling velocity.

The length is determined by measuring the distance between the inlet and the outlet; the length shall be more than twice the dimension as the width; the depth shall not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity). The basin(s) shall be located on the site where it can be maintained on a year-round basis and shall be maintained on a schedule to retain the 2 ft of capacity.

OR

Option 4:
The use of an equivalent surface area design or equation, provided that the design efficiency is as protective or more protective of water quality than Option 3.

Other design considerations are:

- The volume of the settling zone should be sized to capture runoff from a 2-year storm or other appropriate design storms specified by the local agency. A detention time of 24 to 40 hours should allow 70 to 80 % of sediment to settle.
- The basin volume consists of two zones:
  - A sediment storage zone at least 1 ft deep.
  - A settling zone at least 2 ft deep.
- The length to settling depth ratio (L/SD) should be less than 200.
- Sediment basins are best used in conjunction with erosion controls. Sediment basins that will be used as the only means of treatment, without upstream erosion and sediment controls, must be designed according to the four options required by the General Permit (see Options 1-4 above). Sediment basins that are used in conjunction with upstream erosion and sediment controls should be designed to have a capacity equivalent to 67 yd^3 of sediment storage per acre of contributory area.
- The length of the basin should be more than twice the width of the basin; the length should be determined by measuring the distance between the inlet and the outlet.
- The depth must be no less than 3 ft.
- Basins with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and basins capable of impounding more than 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.
- Basins should be designed to drain within 72 hours following storm events. If a basin fails to drain within 72 hours, it must be pumped dry.
- Sediment basins, regardless of size and storage volume, should include features to accommodate overflow or bypass flows that exceed the design storm event.
  - Include an emergency spillway to accommodate flows not carried by the principal spillway. The spillway should consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap.
  - The spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, should be a minimum of 20 ft in length.
- Rock or vegetation should be used to protect the basin inlet and slopes against erosion.
- A forebay, constructed upstream of the basin may be provided to remove debris and larger particles.

- The outflow from the sediment basin should be provided with velocity dissipation devices (see BMP EC-10) to prevent erosion and scouring of the embankment and channel.
- Basin inlets should be located to maximize travel distance to the basin outlet.
- The principal outlet should consist of a corrugated metal, high density polyethylene (HDPE), or reinforced concrete riser pipe with dewatering holes and an anti-vortex device and trash rack attached to the top of the riser, to prevent floating debris from flowing out of the basin or obstructing the system. This principal structure should be designed to accommodate the inflow design storm.
- A rock pile or rock-filled gabions can serve as alternatives to the debris screen, although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.
- The outlet structure should be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel). Provide anti-seep collars on the barrel.
- Cleanout level should be clearly marked on the riser pipe.
- Proper hydraulic design of the outlet is critical to achieving the desired performance of the basin. The outlet should be designed to drain the basin within 24 to 72 hours (also referred to as "drawdown time"). The 24-hour limit is specified to provide adequate settling time; the 72-hour limit is specified to mitigate vector control concerns.
- The two most common outlet problems that occur are: (1) the capacity of the outlet is too great resulting in only partial filling of the basin and drawdown time less than designed for; and (2) the outlet clogs because it is not adequately protected against trash and debris. To avoid these problems, the following outlet types are recommended for use: (1) a single orifice outlet with or without the protection of a riser pipe, and (2) perforated riser. Design guidance for single orifice and perforated riser outlets follow:
  - *Flow Control Using a Single Orifice At The Bottom Of The Basin (Figure 1)*: The outlet control orifice should be sized using the following equation:

$$a = \frac{2A(H-Ho)^{0.5}}{3600CT(2g)^{0.5}} = \frac{(7x10^{-5})A(H-Ho)^{0.5}}{CT} \qquad \text{(Eq. 2)}$$

where:

a = area of orifice (ft²)

A = surface area of the basin at mid elevation (ft²)

C = orifice coefficient

T = drawdown time of full basin (hrs)

g = gravity (32.2 ft/s²)

H = elevation when the basin is full (ft)

Ho = final elevation when basin is empty (ft)

With a drawdown time of 40 hours, the equation becomes:

$$a = \frac{(1.75x10^{-6})A(H - Ho)^{0.5}}{C} \quad \text{(Eq. 3)}$$

- *Flow Control Using Multiple Orifices (see Figure2):*

$$a_t = \frac{2A(h_{max})}{CT(2g[h_{max} - h_{centroid\ of\ orifices}])^{0.5}} \quad \text{(Eq. 4)}$$

With terms as described above except:

a_t = total area of orifices

h_{max} = maximum height from lowest orifice to the maximum water surface (ft)

$h_{centroid\ of\ orifices}$ = height from the lowest orifice to the centroid of the orifice configuration (ft)

Allocate the orifices evenly on two rows; separate the holes by 3x hole diameter vertically, and by 120 degrees horizontally (refer to Figure 2).

Because basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

Care must be taken in the selection of "C"; 0.60 is most often recommended and used. However, based on actual tests, GKY (1989), "Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission", recommends the following:

C = 0.66 for thin materials; where the thickness is equal to or less than the orifice diameter, or

C = 0.80 when the material is thicker than the orifice diameter

Installation

- Securely anchor and install an anti-seep collar on the outlet pipe/riser and provide an emergency spillway for passing major floods (see local flood control agency).
- Areas under embankments must be cleared and stripped of vegetation.
- Chain link fencing should be provided around each sediment basin to prevent unauthorized entry to the basin or if safety is a concern.

Costs

Average annual costs for installation and maintenance (2 year useful life) are:

- Basin less than 50,000 ft^3: Range, \$0.24 - \$1.58/ft^3. Average, \$0.73 per ft^3. \$400 - \$2,400, \$1,200 average per drainage acre.
- Basin size greater than 50,000 ft^3: Range, \$0.12 – \$0.48/ft^3. Average, \$0.36 per ft^3. \$200 - \$800, \$600 average per drainage acre.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Examine basin banks for seepage and structural soundness.
- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Check inlet and outlet area for erosion and stabilize if required.
- Check fencing for damage and repair as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage volume. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at appropriate locations.
- Remove standing water from basin within 72 hours after accumulation.
- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs shall be implemented at all times during dewatering activities.
- To minimize vector production:
  - Remove accumulation of live and dead floating vegetation in basins during every inspection.
  - Remove excessive emergent and perimeter vegetation as needed or as advised by local or state vector control agencies.

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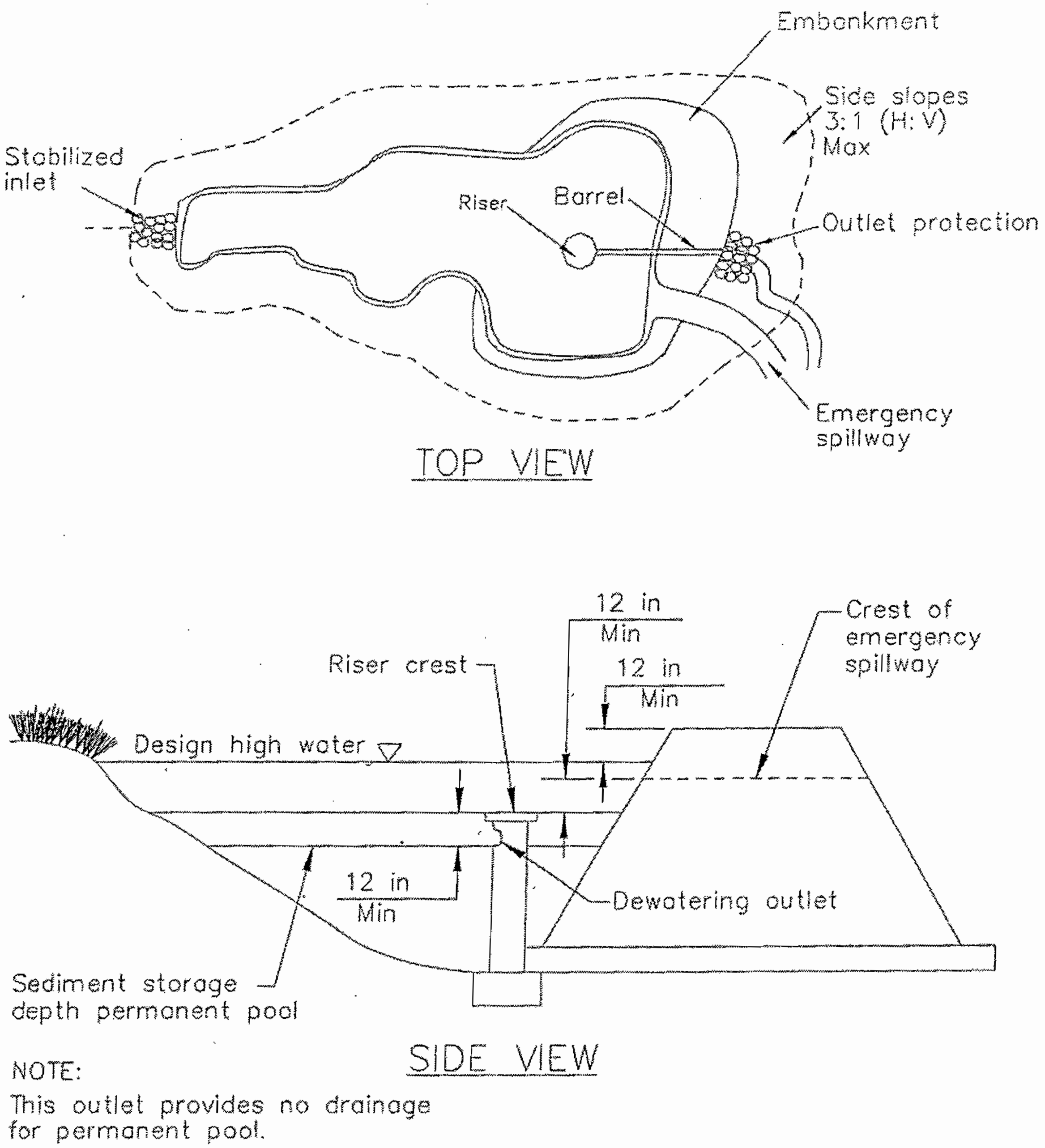


FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN

SINGLE ORIFICE DESIGN

NOT TO SCALE

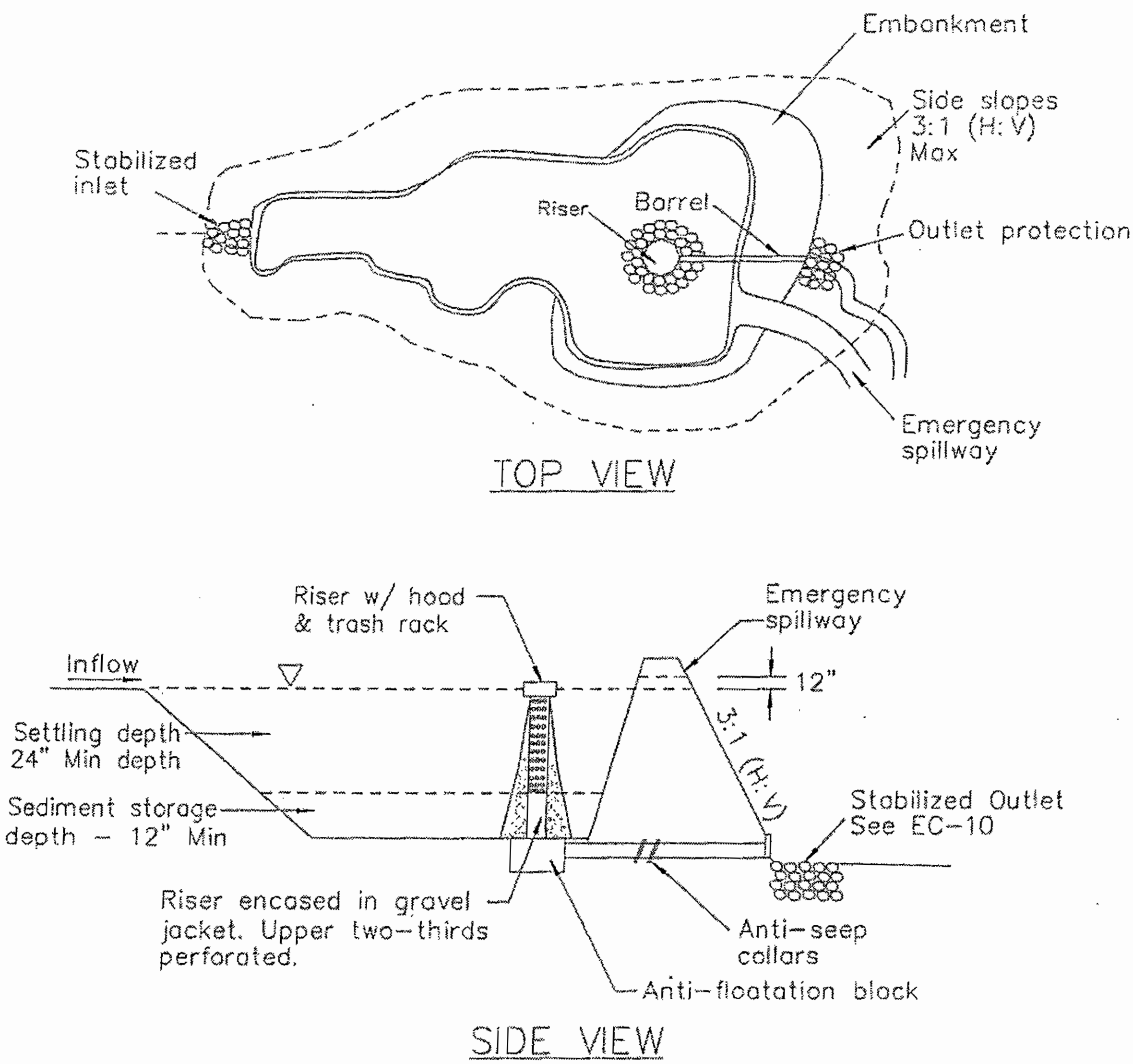


FIGURE 2: TYPICAL TEMPORARY SEDIMENT BASIN

MULTIPLE ORIFICE DESIGN

NOT TO SCALE

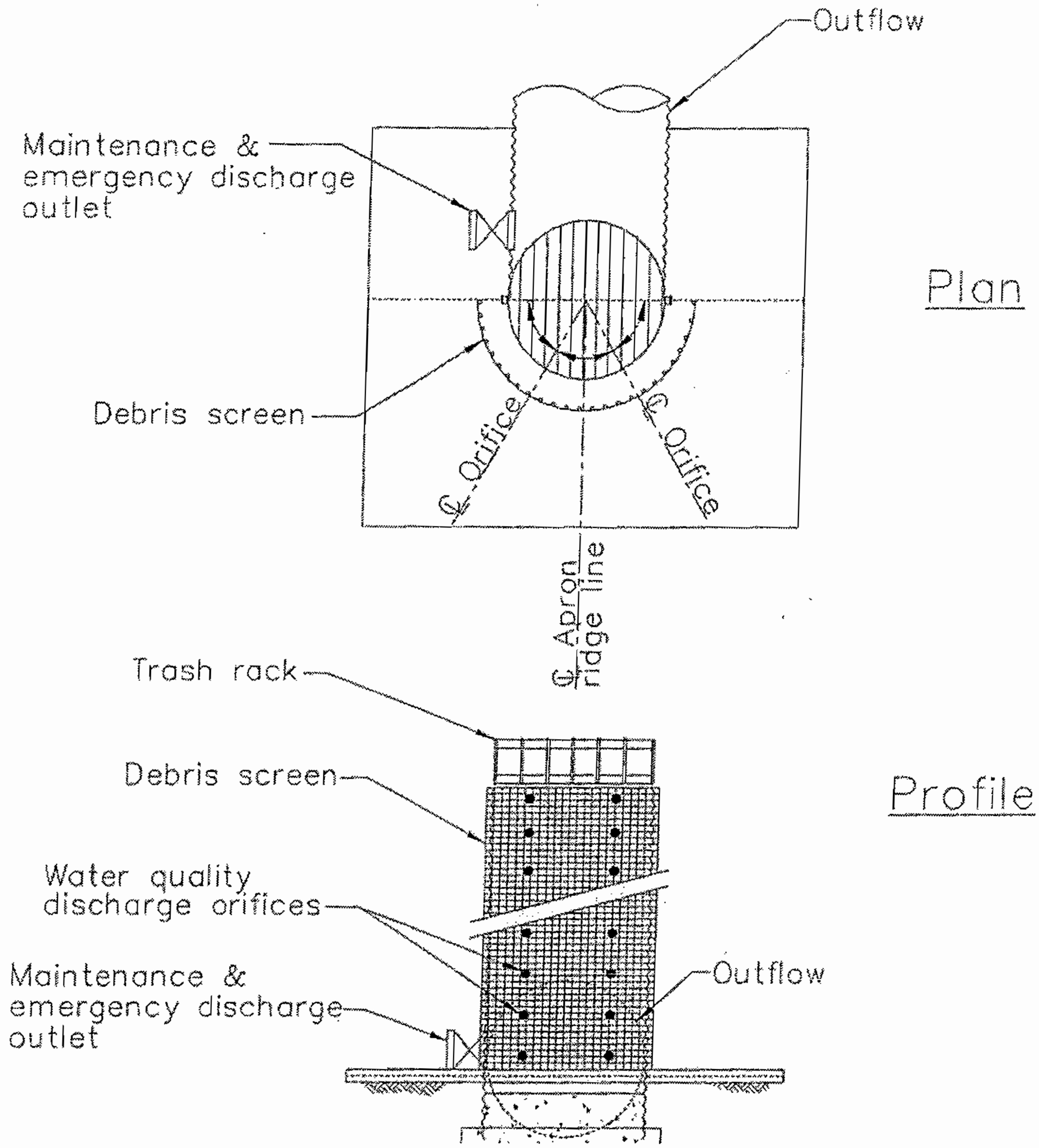
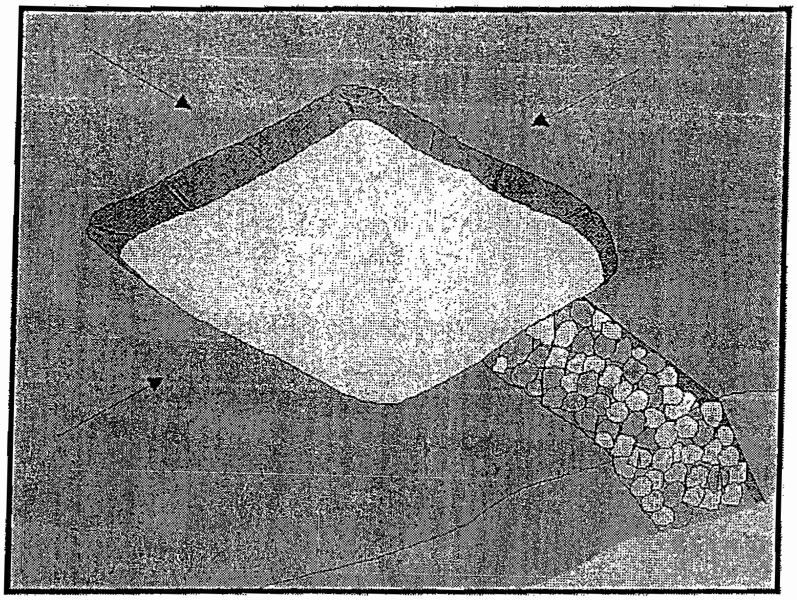


FIGURE 3: MULTIPLE ORIFICE OUTLET RISER

NOT TO SCALE

Sediment Trap



Objectives

EC	Erosion Control	
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-2 Sediment Basin (for larger areas)

Description and Purpose

A sediment trap is a containment area where sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out or before the runoff is discharged. Sediment traps are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Suitable Applications

Sediment traps should be considered for use:

- At the perimeter of the site at locations where sediment-laden runoff is discharged offsite.
- At multiple locations within the project site where sediment control is needed.
- Around or upslope from storm drain inlet protection measures.
- Sediment traps may be used on construction projects where the drainage area is less than 5 acres. Traps would be placed where sediment-laden stormwater may enter a storm drain or watercourse. SE-2, Sediment Basins, must be used for drainage areas greater than 5 acres.
- As a supplemental control, sediment traps provide additional protection for a water body or for reducing sediment before it enters a drainage system.

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Limitations

- Requires large surface areas to permit infiltration and settling of sediment.
- Not appropriate for drainage areas greater than 5 acres.
- Only removes large and medium sized particles and requires upstream erosion control.
- Attractive and dangerous to children, requiring protective fencing.
- Conducive to vector production.
- Should not be located in live streams.

Implementation

Design

A sediment trap is a small temporary ponding area, usually with a gravel outlet, formed by excavation or by construction of an earthen embankment. Its purpose is to collect and store sediment from sites cleared or graded during construction. It is intended for use on small drainage areas with no unusual drainage features and projected for a quick build-out time. It should help in removing coarse sediment from runoff. The trap is a temporary measure with a design life of approximately six months to one year and is to be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Sediment traps should be used only for small drainage areas. If the contributing drainage area is greater than 5 acres, refer to SE-2, Sediment Basins, or subdivide the catchment area into smaller drainage basins.

Sediment usually must be removed from the trap after each rainfall event. The SWPPP should detail how this sediment is to be disposed of, such as in fill areas onsite, or removal to an approved offsite dump. Sediment traps used as perimeter controls should be installed before any land disturbance takes place in the drainage area.

Sediment traps are usually small enough that a failure of the structure would not result in a loss of life, damage to home or buildings, or interruption in the use of public roads or utilities. However, sediment traps are attractive to children and can be dangerous. The following recommendations should be implemented to reduce risks:

- Install continuous fencing around the sediment trap or pond. Consult local ordinances regarding requirements for maintaining health and safety.
- Restrict basin side slopes to 3:1 or flatter.

Sediment trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency (see SE-2, Sediment Basin). As a rule of thumb, the larger the basin volume the greater the sediment removal efficiency. Sizing criteria are typically established under the local grading ordinance or equivalent. The runoff volume from a 2-year storm is a common design criteria for a sediment trap. The sizing criteria below assume that this runoff volume is 0.042 acre-ft/acre (0.5 in. of runoff). While the climatic, topographic, and soil type extremes make it difficult to establish a statewide standard, the following criteria should trap moderate to high amounts of sediment in most areas of California:

- Locate sediment traps as near as practical to areas producing the sediment.
- Trap should be situated according to the following criteria: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where failure would not cause loss of life or property damage, and (3) to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area.
- Trap should be sized to accommodate a settling zone and sediment storage zone with recommended minimum volumes of 67 yd^3/acre and 33 yd^3/acre of contributing drainage area, respectively, based on 0.5 in. of runoff volume over a 24-hour period. In many cases, the size of an individual trap is limited by available space. Multiple traps or additional volume may be required to accommodate specific rainfall, soil, and site conditions.
- Traps with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and traps capable of impounding more than 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the trap outlet and bypass structures.
- The outlet pipe or open spillway must be designed to convey anticipated peak flows.
- Use rock or vegetation to protect the trap outlets against erosion.
- Fencing should be provided to prevent unauthorized entry.

Installation

Sediment traps can be constructed by excavating a depression in the ground or creating an impoundment with a small embankment. Sediment traps should be installed outside the area being graded and should be built prior to the start of the grading activities or removal of vegetation. To minimize the area disturbed by them, sediment traps should be installed in natural depressions or in small swales or drainage ways. The following steps must be followed during installation:

- The area under the embankment must be cleared, grubbed, and stripped of any vegetation and root mat. The pool area should be cleared.
- The fill material for the embankment must be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. The embankment may be compacted by traversing with equipment while it is being constructed.
- All cut-and-fill slopes should be 3:1 or flatter.
- When a riser is used, all pipe joints must be watertight.
- When a riser is used, at least the top two-thirds of the riser should be perforated with 0.5 in. diameter holes spaced 8 in. vertically and 10 to 12 in. horizontally. See SE-2, Sediment Basin.
- When an earth or stone outlet is used, the outlet crest elevation should be at least 1 ft below the top of the embankment.

- When crushed stone outlet is used, the crushed stone used in the outlet should meet AASHTO M43, size No. 2 or 24, or its equivalent such as MSHA No. 2. Gravel meeting the above gradation may be used if crushed stone is not available.

Costs

Average annual cost per installation and maintenance (18 month useful life) is $0.73 per ft³ ($1,300 per drainage acre). Maintenance costs are approximately 20% of installation costs.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- Inspect outlet area for erosion and stabilize if required.

- Inspect trap banks for seepage and structural soundness, repair as needed.

- Inspect outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.

- Inspect fencing for damage and repair as needed.

- Inspect the sediment trap for area of standing water during every visit. Corrective measures should be taken if the BMP does not dewater completely in 72 hours or less to prevent vector production.

- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the trap capacity. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at an appropriate location.

- Remove vegetation from the sediment trap when first detected to prevent pools of standing water and subsequent vector production.

- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs shall be implemented at all times during dewatering activities.

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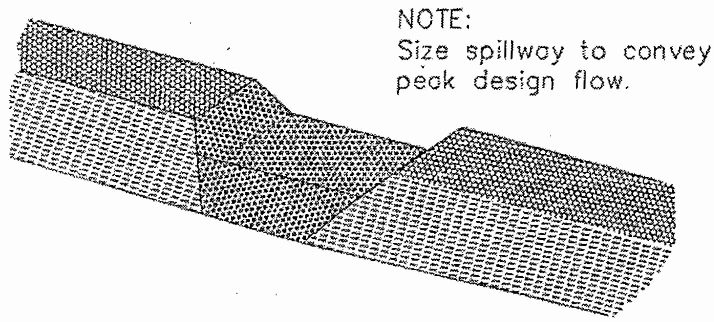
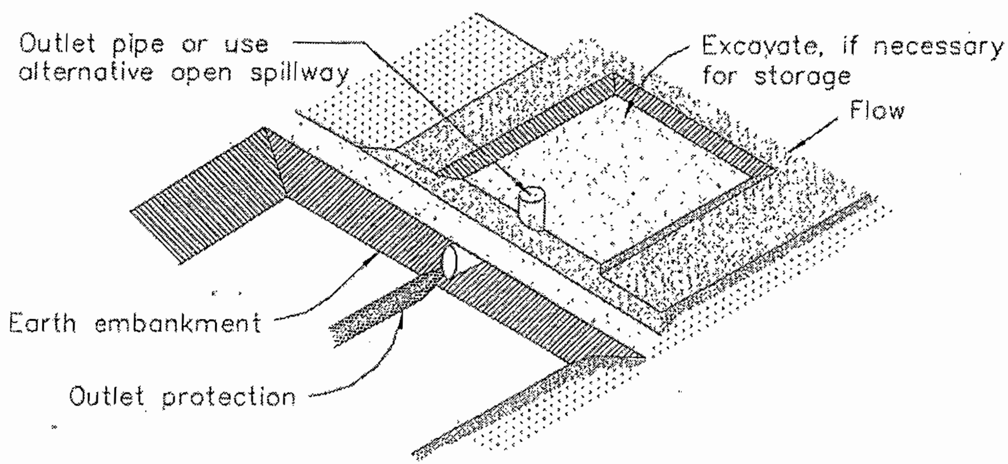
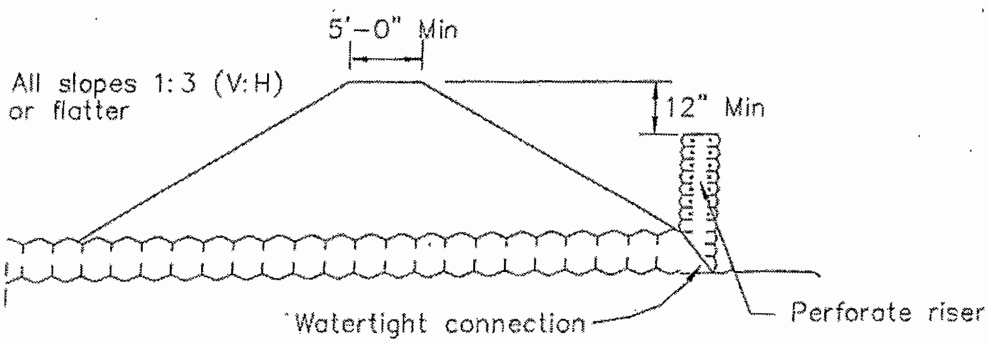


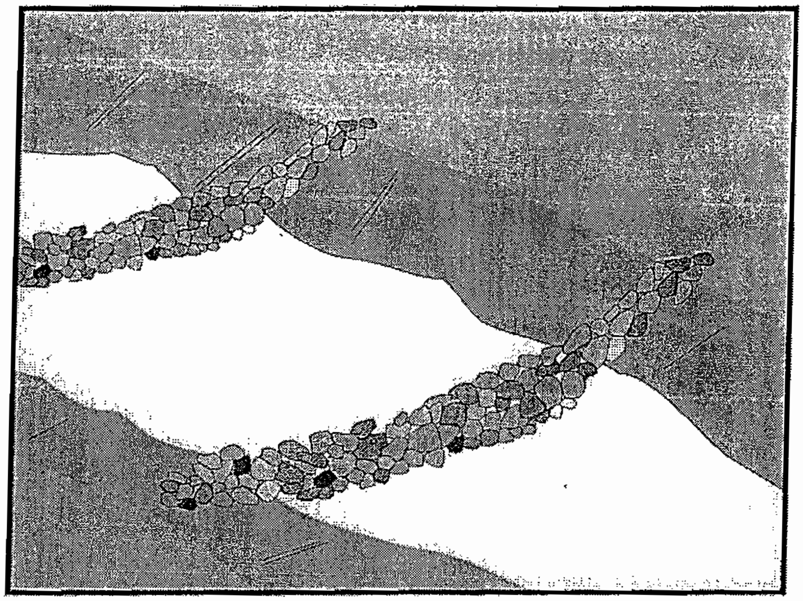
TYPICAL OPEN SPILLWAY





EMBANKMENT SECTION THRU RISER

TYPICAL SEDIMENT TRAP
NOT TO SCALE



Objectives

EC	Erosion Control	✓
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls
SE-6 Gravel Bag Berm
SE-8 Sandbag Barrier

Description and Purpose

A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or reusable products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing the velocity of flowing water, allowing sediment to settle and reducing erosion.

Suitable Applications

Check dams may be appropriate in the following situations:

- To promote sedimentation behind the dam.
- To prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.
- In small open channels that drain 10 acres or less.
- In steep channels where stormwater runoff velocities exceed 5 ft/s.
- During the establishment of grass linings in drainage ditches or channels.
- In temporary ditches where the short length of service does not warrant establishment of erosion-resistant linings.

Limitations

- Not to be used in live streams or in channels with extended base flows.

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- Not appropriate in channels that drain areas greater than 10 acres.

- Not appropriate in channels that are already grass-lined unless erosion is expected, as installation may damage vegetation.

- Require extensive maintenance following high velocity flows.

- Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam.

Implementation

General

Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Reduced slopes reduce the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Use of check dams for sedimentation will likely result in little net removal of sediment because of the small detention time and probable scour during longer storms. Using a series of check dams will generally increase their effectiveness. A sediment trap (SE-3) may be placed immediately upstream of the check dam to increase sediment removal efficiency.

Design and Layout

Check dams work by decreasing the effective slope in ditches and swales. An important consequence of the reduced slope is a reduction in capacity of the ditch or swale. This reduction in capacity must be considered when using this BMP, as reduced capacity can result in overtopping of the ditch or swale and resultant consequences. In some cases, such as a "permanent" ditch or swale being constructed early and used as a "temporary" conveyance for construction flows, the ditch or swale may have sufficient capacity such that the temporary reduction in capacity due to check dams is acceptable. When check dams reduce capacities beyond acceptable limits, there are several options:

- Don't use check dams. Consider alternative BMPs.

- Increase the size of the ditch or swale to restore capacity.

Maximum slope and velocity reduction is achieved when the toe of the upstream dam is at the same elevation as the top of the downstream dam. The center section of the dam should be lower than the edge sections so that the check dam will direct flows to the center of the ditch or swale.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products manufactured specifically for use as check dams are also being used, and some of these products can be removed and reused. Check dams can also be constructed of logs or lumber, and have the advantage of a longer lifespan when compared to gravel bags, sandbags, and fiber rolls. Straw bales can also be used for check dams and can work if correctly installed; but in practice, straw bale check dams have a high failure rate. Check dams should not be constructed from straw bales or silt fences, since concentrated flows quickly wash out these materials.

Rock check dams are usually constructed of 8 to 12 in. rock. The rock is placed either by hand or mechanically, but never just dumped into the channel. The dam must completely span the ditch or swale to prevent washout. The rock used must be large enough to stay in place given the expected design flow through the channel.

Log check dams are usually constructed of 4 to 6 in. diameter logs. The logs should be embedded into the soil at least 18 in. Logs can be bolted or wired to vertical support logs that have been driven or buried into the soil.

Gravel bag and sandbag check dams are constructed by stacking bags across the ditch or swale, shaped as shown in the drawings at the end of this fact sheet.

Manufactured products should be installed in accordance with the manufacturer's instructions.

If grass is planted to stabilize the ditch or swale, the check dam should be removed when the grass has matured (unless the slope of the swales is greater than 4%).

The following guidance should be followed for the design and layout of check dams:

- Install the first check dam approximately 16 ft from the outfall device and at regular intervals based on slope gradient and soil type.
- Check dams should be placed at a distance and height to allow small pools to form between each check dam.
- Backwater from a downstream check dam should reach the toes of the upstream check dam.
- A sediment trap provided immediately upstream of the check dam will help capture sediment. Due to the potential for this sediment to be resuspended in subsequent storms, the sediment trap must be cleaned following each storm event.
- High flows (typically a 2-year storm or larger) should safely flow over the check dam without an increase in upstream flooding or damage to the check dam.
- Where grass is used to line ditches, check dams should be removed when grass has matured sufficiently to protect the ditch or swale.
- Gravel bags may be used as check dams with the following specifications:

Materials

Gravel bags used for check dams should conform to the requirements of SE-6, Gravel Bag Berms. Sandbags used for check dams should conform to SE-8, Sandbag Barrier. Fiber rolls used for check dams should conform to SE-5, Fiber Rolls. Straw bales used for check dams should conform to SE-9, Straw Bale Barrier.

Installation

- Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.
- Tightly abut bags and stack according to detail shown in the figure at the end of this section. Gravel bags and sandbags should not be stacked any higher than 3 ft.
- Fiber rolls and straw bales must be trenched in and firmly staked in place.

Costs

Cost consists of only installation costs if materials are readily available. If material must be imported, costs may increase. For material costs, see SE-5, SE-6, SE-8 and SE-9.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Replace missing rock, bags, bales, etc. Replace bags or bales that have degraded or have become damaged.
- If the check dam is used as a sediment capture device, sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- If the check dam is used as a grade control structure, sediment removal is not required as long as the system continues to control the grade.
- Remove accumulated sediment prior to permanent seeding or soil stabilization.
- Remove check dam and accumulated sediment when check dams are no longer needed.

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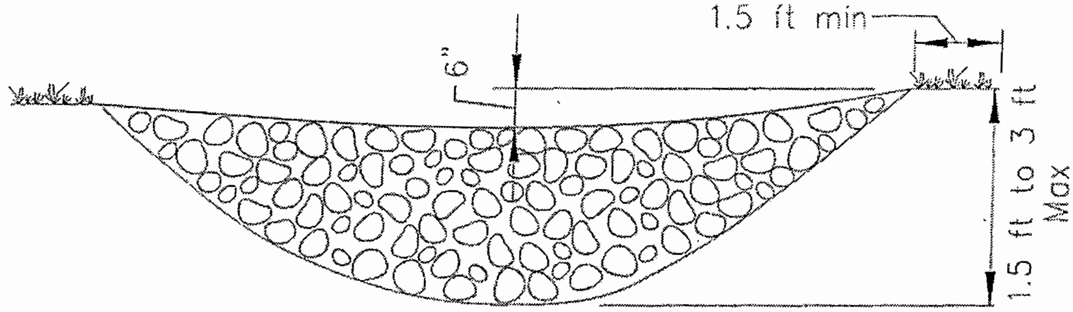
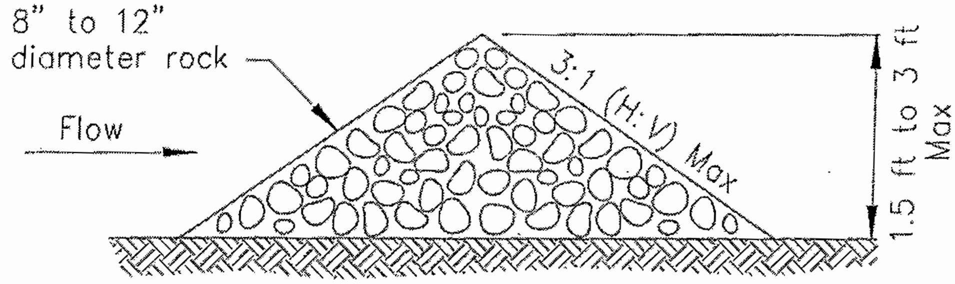
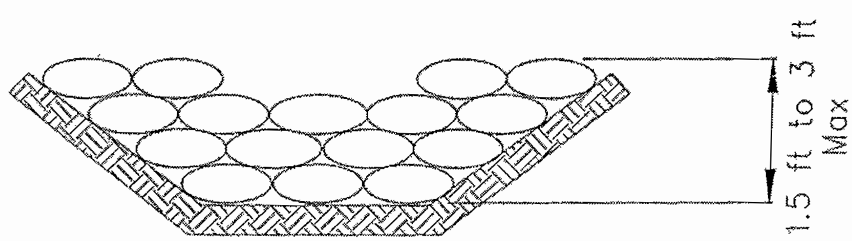


ELEVATION



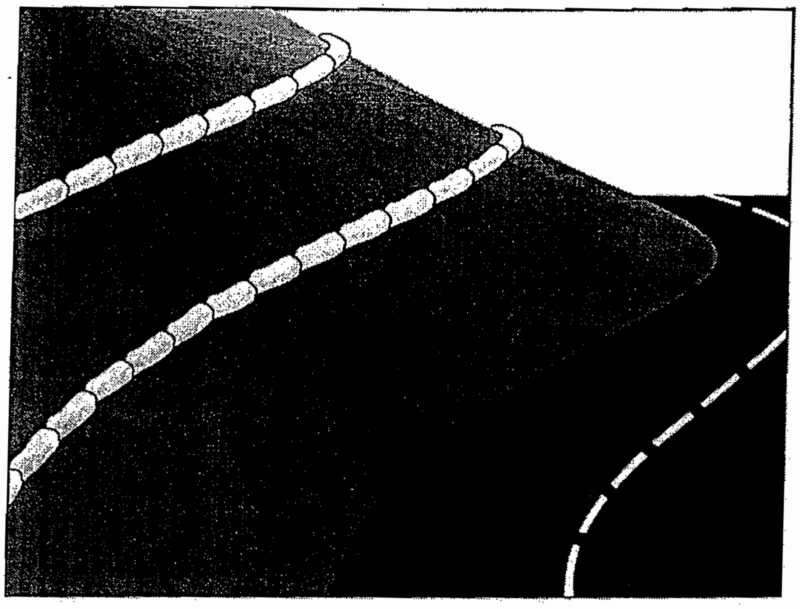
TYPICAL ROCK CHECK DAM SECTION

ROCK CHECK DAM
NOT TO SCALE



GRAVEL BAG CHECK DAM ELEVATION
NOT TO SCALE

Gravel Bag Berm



Objectives

EC	Erosion Control	✓
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-8 Sandbag Barrier

SE-9 Straw Bale Barrier

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Description and Purpose

A gravel bag berm is a series of gravel-filled bags placed on a level contour to intercept sheet flows. Gravel bags pond sheet flow runoff, allowing sediment to settle out, and release runoff slowly as sheet flows, preventing erosion.

Suitable Applications

Gravel bag berms may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:

- Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

- At the top of slopes to divert runoff away from disturbed slopes

- As check dams across mildly sloped construction roads

Limitations

- Gravel berms may be difficult to remove.
- Removal problems limit their usefulness in landscaped areas.
- Gravel bag berm may not be appropriate for drainage areas greater than 5 acres.
- Runoff will pond upstream of the filter, possibly causing flooding if sufficient space does not exist.
- Degraded gravel bags may rupture when removed, spilling contents.
- Installation can be labor intensive.
- Berms may have limited durability for long-term projects.
- When used to detain concentrated flows, maintenance requirements increase.

Implementation

General

A gravel bag berm consists of a row of open graded gravel–filled bags placed on a level contour. When appropriately placed, a gravel bag berm intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. The open graded gravel in the bags is porous, which allows the ponded runoff to flow slowly through the bags, releasing the runoff as sheet flows. Gravel bag berms also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. Gravel bag berms are similar to sand bag barriers, but are more porous.

Design and Layout

- Locate gravel bag berms on level contours.

  - Slopes between 20:1 and 2:1 (H:V): Gravel bags should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the slope toe.

  - Slopes 2:1 (H:V) or steeper: Gravel bags should be placed at a maximum interval of 25 ft (a closer spacing is more effective), with the first row placed the slope toe.

- Turn the ends of the gravel bag barriers up slope to prevent runoff from going around the berm.

- Allow sufficient space up slope from the gravel bag berm to allow ponding, and to provide room for sediment storage.

- For installation near the toe of the slope, consider moving the gravel bag barriers away from the slope toe to facilitate cleaning. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- In Non-Traffic Areas:
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Top width = 12 in. minimum for one or two layer construction
  - Side slopes = 2:1 or flatter
- In Construction Traffic Areas:
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Top width = 12 in. minimum for one or two layer construction.
  - Side slopes = 2:1 or flatter.
- Butt ends of bags tightly
- On multiple row, or multiple layer construction, overlapp butt joints of adjacent row and row beneath.
- Use a pyramid approach when stacking bags.

Materials

- ***Bag Material:*** Bags should be woven polypropylene, polyethylene or polyamide fabric or burlap, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355.
- ***Bag Size:*** Each gravel-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.
- ***Fill Material:*** Fill material should be 0.5 to 1 in. Class 2 aggregate base, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.

Costs

Gravel filter: Expensive, since off-site materials, hand construction, and demolition/removal are usually required. Material costs for gravel bags are average of $2.50 per empty gravel bag. Gravel costs range from $20-$35 per yd^3.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.
- Reshape or replace gravel bags as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove gravel bag berms when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

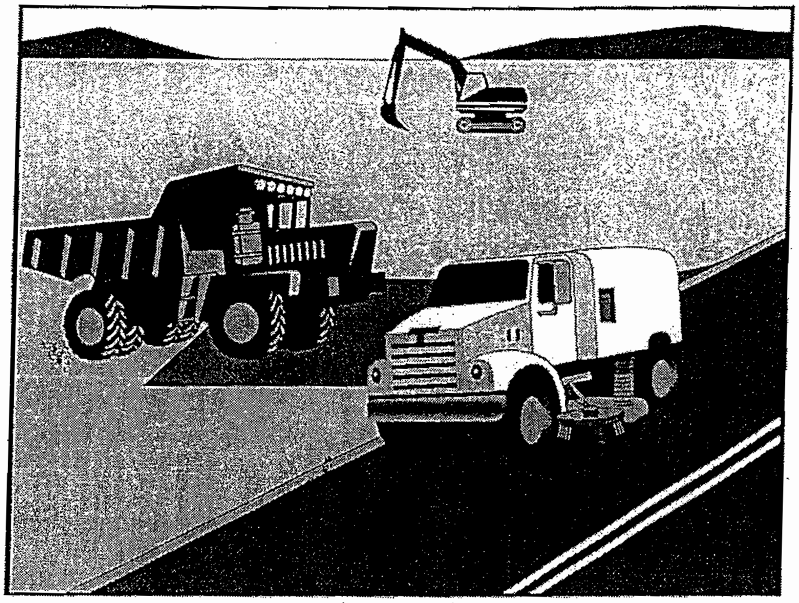
References

Handbook of Steel Drainage and Highway Construction, American Iron and Steel Institute, 1983.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Pollution Plan Handbook, First Edition, State of California, Department of Transportation Division of New Technology, Materials and Research, October 1992.

Street Sweeping and Vacuuming SE-7



Objectives		
EC	Erosion Control	
SE	Sediment Control	✓
TC	Tracking Control	✓
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	
Oil and Grease	✓
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

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- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- When actively in use, points of ingress and egress must be inspected daily.

- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.

- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.

- Adjust brooms frequently; maximize efficiency of sweeping operations.

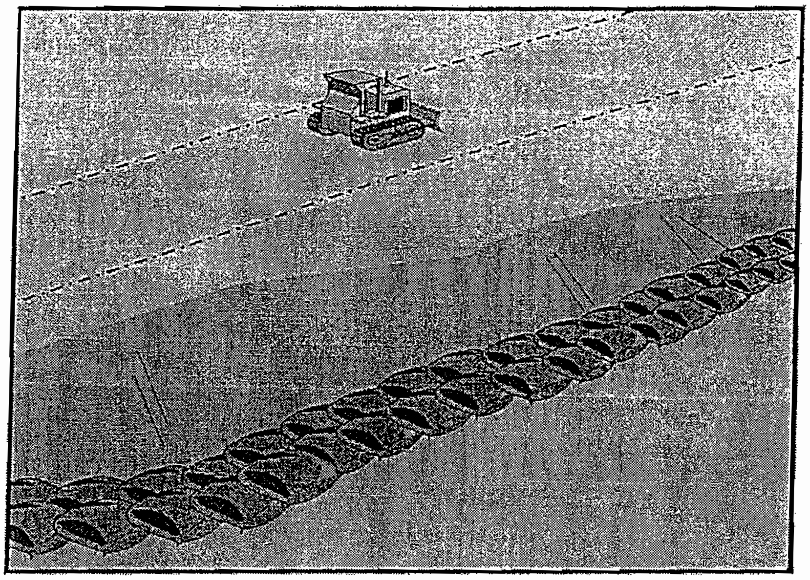
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Sandbag Barrier SE-8



Objectives

EC	Erosion Control	✓
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence
SE-5 Fiber Rolls
SE-6 Gravel Bag Berm
SE-9 Straw Bale Barrier

Description and Purpose

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept sheet flows. Sandbag barriers pond sheet flow runoff, allowing sediment to settle out.

Suitable Applications

Sandbag barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

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- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

- It is necessary to limit the drainage area upstream of the barrier to 5 acres.
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Barriers may have limited durability for long-term projects.
- When used to detain concentrated flows, maintenance requirements increase.
- Burlap should not be used for sandbags.

Implementation

General

A sandbag barrier consists of a row of sand-filled bags placed on a level contour. When appropriately placed, a sandbag barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. While the sand-filled bags are porous, the fine sand tends to quickly plug with sediment, limiting the rate of flow through the barrier. If a porous barrier is desired, consider SE-1, Silt Fence, SE-5, Fiber Rolls, SE-6, Gravel Bag Berms, or SE-9, Straw Bale Barriers. Sandbag barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets which erode rills, and ultimately gullies, into disturbed, sloped soils. Sandbag barriers are similar to ground bag berms, but less porous.

Design and Layout

- Locate sandbag barriers on a level contour.
  - Slopes between 20:1 and 2:1 (H:V): Sandbags should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the slope toe.
  - Slopes 2:1 (H:V) or steeper: Sandbags should be placed at a maximum interval of 25 ft (a closer spacing is more effective), with the first row placed near the slope toe.
- Turn the ends of the sandbag barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sandbags can be placed perpendicular to the barrier to serve as cross barriers.
- Drainage area should not exceed 5 acres.

- Stack sandbags at least three bags high.
- Butt ends of bags tightly.
- Overlapp butt joints of row beneath with each successive row.
- Use a pyramid approach when stacking bags.
- In non-traffic areas
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Side slope = 2:1 or flatter
- In construction traffic areas
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Side slopes = 2:1 or flatter.

Materials

- ***Sandbag Material:*** Sandbag should be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355. Use of burlap may not acceptable in some jurisdictions.
- ***Sandbag Size:*** Each sand-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.
- ***Fill Material:*** All sandbag fill material should be non-cohesive, Class 1 or Class 2 permeable material free from clay and deleterious material.

Costs

Sandbag barriers are more costly, but typically have a longer useful life than other barriers. Empty sandbags cost $0.25 - $0.75. Average cost of fill material is $8 per yd^3. Pre-filled sandbags are more expensive at $1.50 - $2.00 per bag.

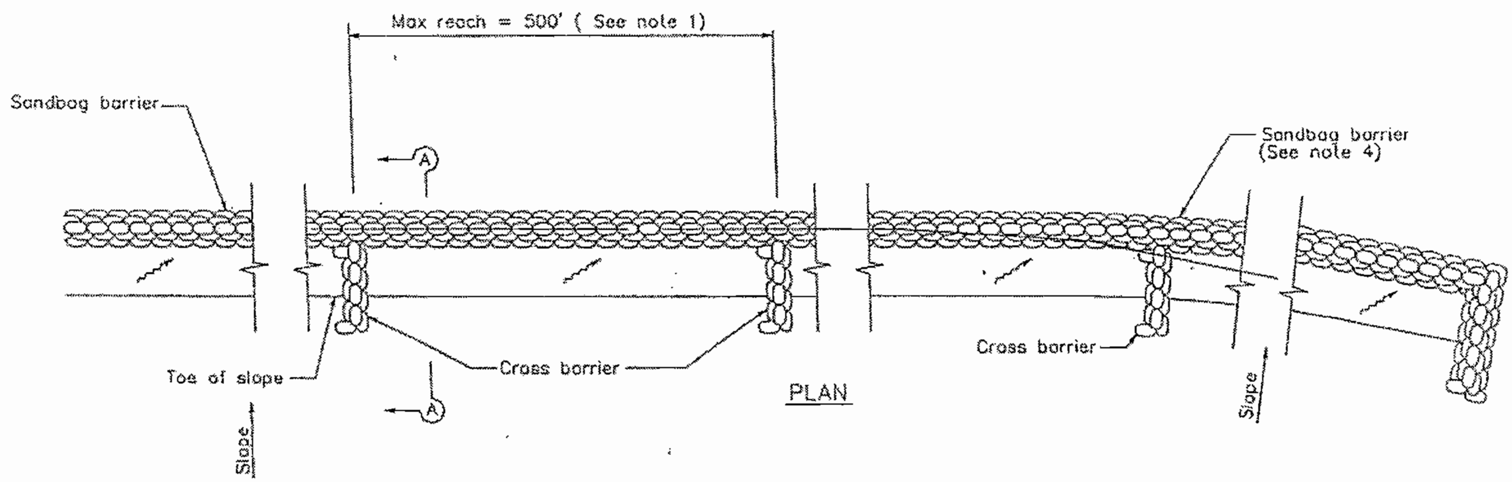
Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Sandbags exposed to sunlight will need to be replaced every two to three months due to degradation of the bags.
- Reshape or replace sandbags as needed.

- Repair washouts or other damage as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove sandbags when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

References

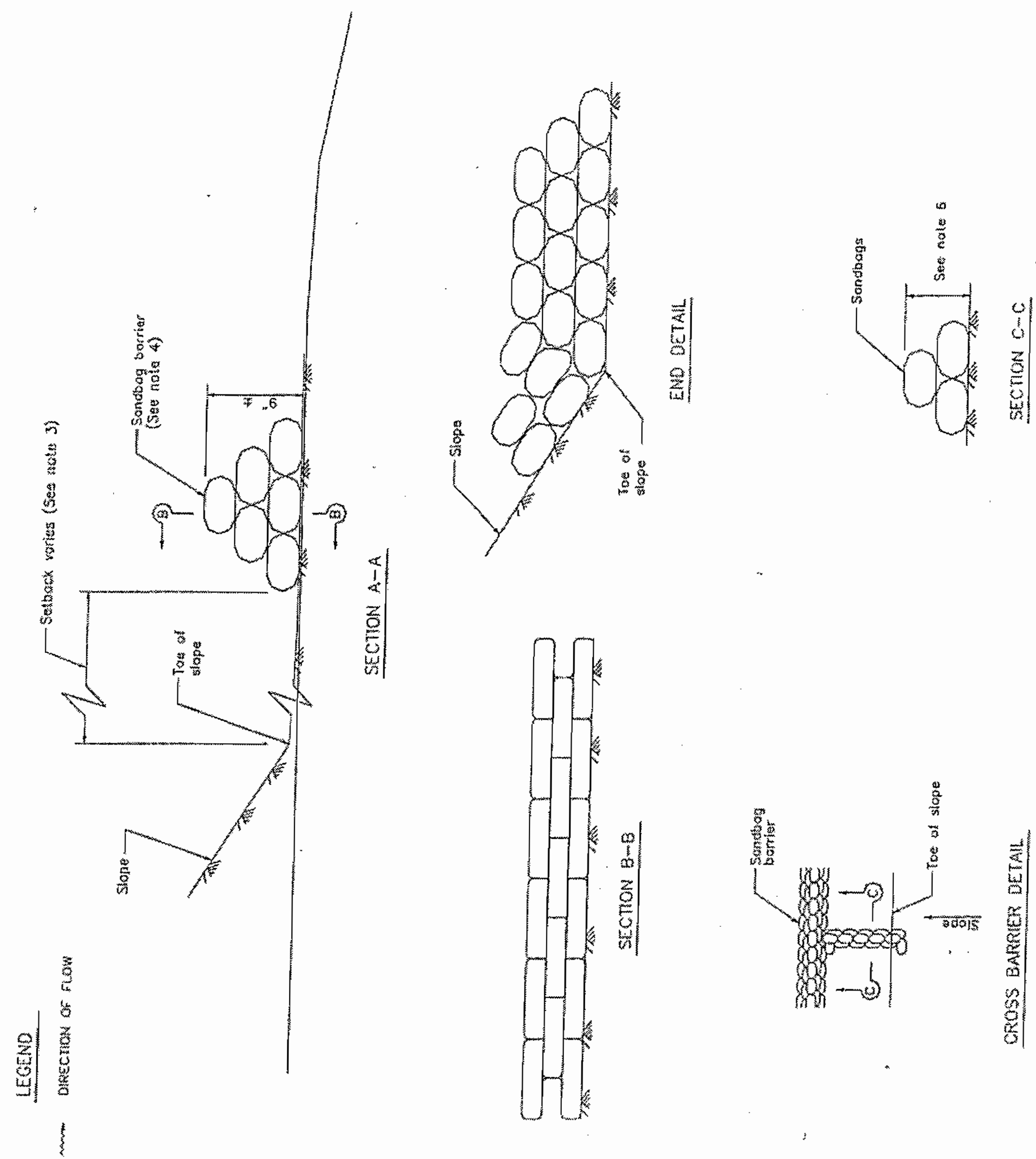
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



SANDBAG BARRIER

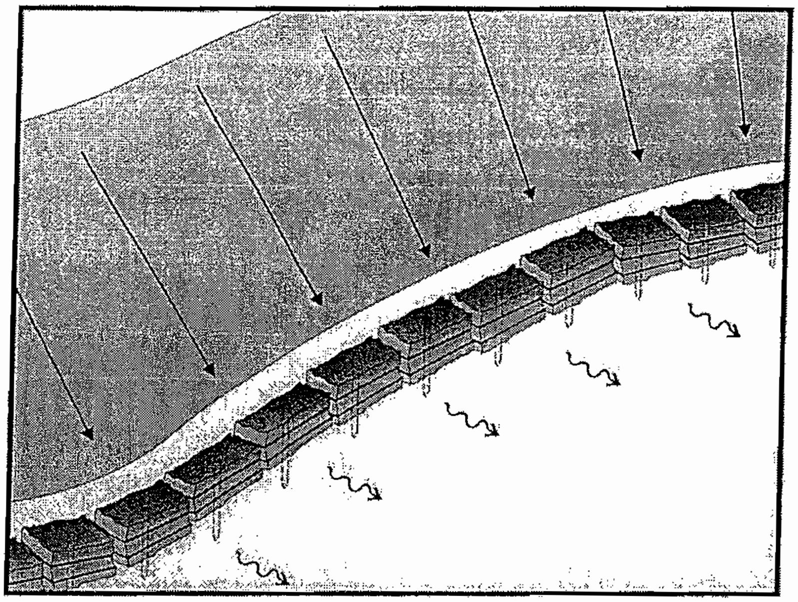
NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 500'.
2. Place sandbags tightly.
3. Dimension may vary to fit field condition.
4. Sandbag barrier shall be a minimum of 3 bags high.
5. The end of the barrier shall be turned up slope.
6. Cross barriers shall be a min of 1/2 and a max of 2/3 the height of the linear barrier.
7. Sandbag rows and layers shall be staggered to eliminate gaps.


LEGEND
DIRECTION OF FLOW
Slope
Toe of slope
Setback varies (See note 3)
Sandbag barrier (See note 4)
9" ±
B
B
SECTION A–A
Slope
Toe of slope
END DETAIL
SECTION B–B
Sandbags
See note 6
SECTION C–C
Sandbag barrier
Toe of slope
C
C
Slope
CROSS BARRIER DETAIL

Straw Bale Barrier

SE-9



Objectives

EC	Erosion Control	✓
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

Description and Purpose

A straw bale barrier is a series of straw bales placed on a level contour to intercept sheet flows. Straw bale barriers pond sheet- flow runoff, allowing sediment to settle out.

Suitable Applications

Straw bale barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

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- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

Straw bale barriers:

- Are not to be used for extended periods of time because they tend to rot and fall apart
- Are suitable only for sheet flow on slopes of 10 % or flatter
- Are not appropriate for large drainage areas, limit to one acre or less
- May require constant maintenance due to rotting
- Are not recommended for concentrated flow, inlet protection, channel flow, and live streams
- Cannot be made of bale bindings of jute or cotton
- Require labor-intensive installation and maintenance
- Cannot be used on paved surfaces
- Should not to be used for drain inlet protection
- Should not be used on lined ditches
- May introduce undesirable non-native plants to the area

Implementation

General

A straw bale barrier consists of a row of straw bales placed on a level contour. When appropriately placed, a straw bale barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. Straw bale barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils.

Straw bale barriers have not been as effective as expected due to improper use. These barriers have been placed in streams and drainage ways where runoff volumes and velocities have caused the barriers to wash out. In addition, failure to stake and entrench the straw bale has allowed undercutting and end flow. Use of straw bale barriers in accordance with this BMP should produce acceptable results.

Design and Layout

- Locate straw bale barriers on a level contour.
  - Slopes up to 10:1 (H:V): Straw bales should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the toe of slope.
  - Slopes greater than 10:1 (H:V): Not recommended.

- Turn the ends of the straw bale barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sand bags can be placed perpendicular to the barrier to serve as cross barriers.
- Drainage area should not exceed 1 acre, or 0.25 acre per 100 ft of barrier.
- Maximum flow path to the barrier should be limited to 100 ft.
- Straw bale barriers should consist of two parallel rows.
  - Butt ends of bales tightly
  - Stagger butt joints between front and back row
  - Each row of bales must be trenched in and firmly staked
- Straw bale barriers are limited in height to one bale laid on its side.
- Anchor bales with either two wood stakes or four bars driven through the bale and into the soil. Drive the first stake towards the butt joint with the adjacent bale to force the bales together.
- See attached figure for installation details.

Materials

- ***Straw Bale Size:*** Each straw bale should be a minimum of 14 in. wide, 18 in. in height, 36 in. in length and should have a minimum mass of 50 lbs. The straw bale should be composed entirely of vegetative matter, except for the binding material.
- ***Bale Bindings:*** Bales should be bound by steel wire, nylon or polypropylene string placed horizontally. Jute and cotton binding should not be used. Baling wire should be a minimum diameter of 14 gauge. Nylon or polypropylene string should be approximately 12 gauge in diameter with a breaking strength of 80 lbs force.
- ***Stakes:*** Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake, or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable. Steel bar reinforcement should be equal to a #4 designation or greater. End protection should be provided for any exposed bar reinforcement.

Costs

Straw bales cost $5 - $7 each. Adequate labor should be budgeted for installation and maintenance.

Inspection and Maintenance

Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- Straw bales degrade, especially when exposed to moisture. Rotting bales will need to be replaced on a regular basis.

- Replace or repair damaged bales as needed.

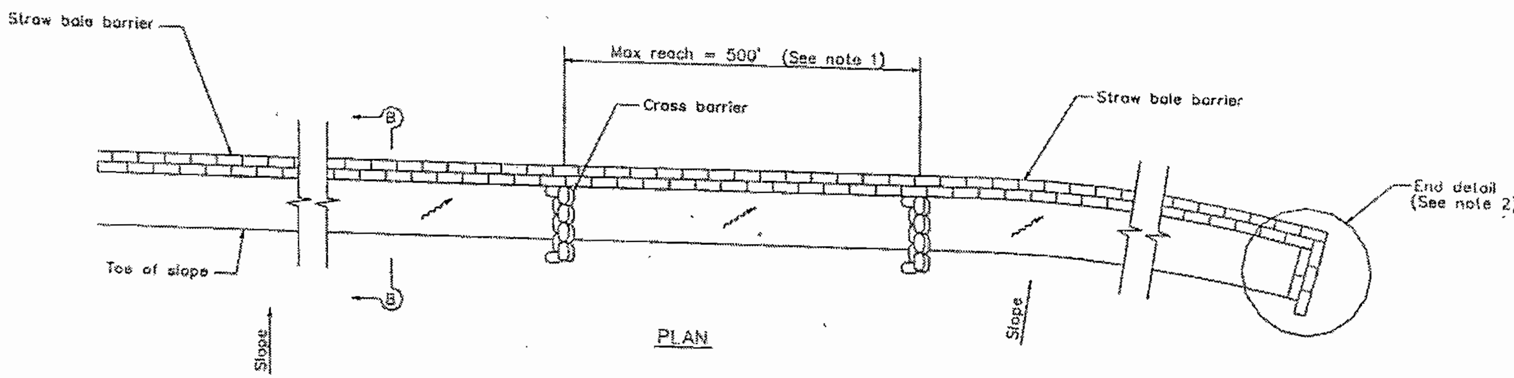
- Repair washouts or other damages as needed.

- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

- Remove straw bales when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



PLAN

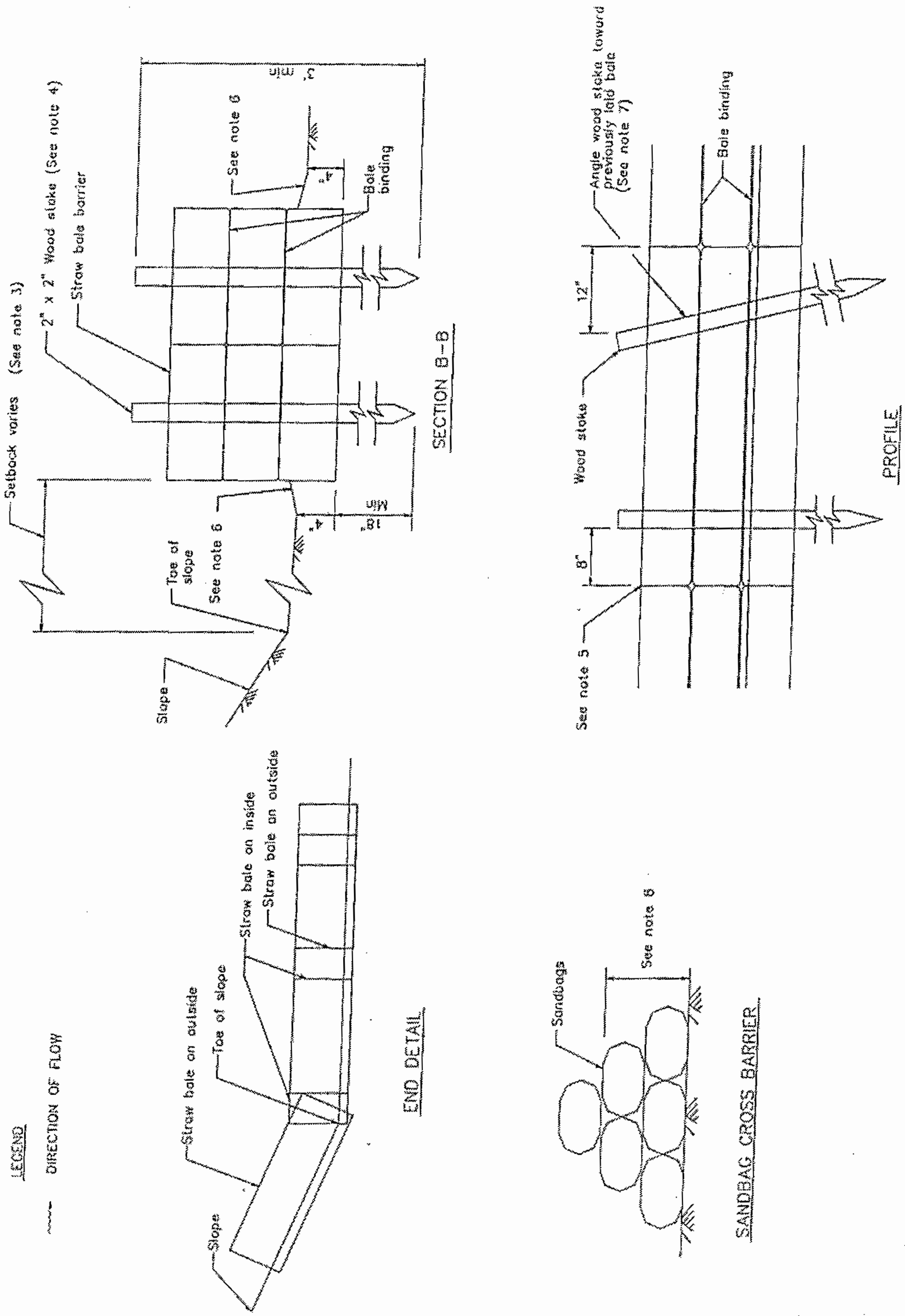
STRAW BALE BARRIER

NOTES

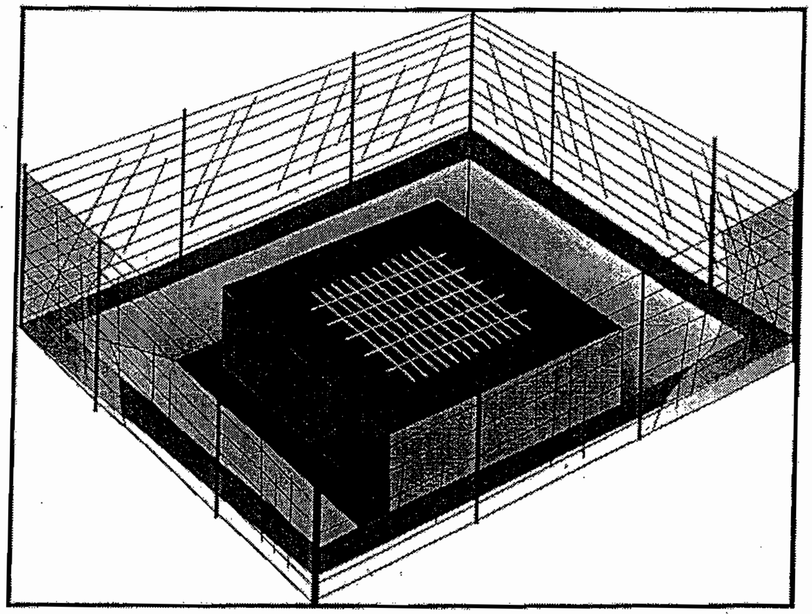
1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 500'.
2. The end of barrier shall be turned up slope.
3. Dimension may vary to fit field condition.
4. Stake dimensions are nominal.
5. Place straw bales tightly together.
6. Tamp embedment spoils against sides of installed bales.
7. Drive angled wood stake before vertical stake to ensure tight abutment to adjacent bale.
8. Sandbag cross barriers should be a min of 1/2 and a max of 2/3 the height of the linear barrier.
9. Sandbag rows and layers should be offset to eliminate gaps.

LEGEND

~ DIRECTION OF FLOW


Setback varies (See note 3)
2" x 2" Wood stake (See note 4)
Straw bale barrier
See note 6
3' min
4"
Bale binding
Toe of slope
See note 6
18" Min
Slope
SECTION B-B
Angle wood stake toward previously laid bale (See note 7)
Bale binding
12"
8"
Wood stake
See note 5
PROFILE
Straw bale on inside
Straw bale on outside
Straw bale on outside
Toe of slope
Slope
END DETAIL
LEGEND
DIRECTION OF FLOW
Sandbags
See note 6
SANDBAG CROSS BARRIER

Storm Drain Inlet Protection SE-10



Objectives		
EC	Erosion Control	
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-9 Straw Bale Barrier

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Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction.

Suitable Applications

Every storm drain inlet receiving sediment-laden runoff should be protected.

Limitations

- Drainage area should not exceed 1 acre.
- Straw bales, while potentially effective, have not produced in practice satisfactory results, primarily due to improper installation.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.
- Inlet protection usually requires other methods of temporary protection to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.
- Sediment removal may be difficult in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are

expected, use other onsite sediment trapping techniques in conjunction with inlet protection.

- Frequent maintenance is required.
- For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Large amounts of sediment may enter the storm drain system when storm drains are installed before the upslope drainage area is stabilized, or where construction is adjacent to an existing storm drain. In cases of extreme sediment loading, the storm drain itself may clog and lose a major portion of its capacity. To avoid these problems, it is necessary to prevent sediment from entering the system at the inlets.

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Inlet protection methods not presented in this handbook should be approved by the local stormwater management agency.

Design and Layout

Identify existing and planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed and which method to use.

- Limit upstream drainage area to 1 acre maximum. For larger drainage areas, use SE-2, Sediment Basin, or SE-3, Sediment Trap, upstream of the inlet protection device.
- The key to successful and safe use of storm drain inlet protection devices is to know where runoff will pond or be diverted.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the

inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.

- Four types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.
  - Filter Fabric Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
  - Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
  - Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
  - Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Provide area around the inlet for water to pond without flooding structures and property.
- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- ***DI Protection Type 1 - Filter Fabric Fence*** - The filter fabric fence (Type 1) protection is shown in the attached figure. Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place filter fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced.
  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes must be at least 48 in.
  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.
  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.
  5. Backfill the trench with gravel or compacted earth all the way around.
- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap*** - The excavated drop inlet sediment trap (Type 2) is shown in the attached figures. Install filter fabric fence in

accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area.

- *DI Protection Type 3 - Gravel bag* - The gravel bag barrier (Type 3) is shown in the figures. Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability.

  1. Use sand bag made of geotextile fabric (not burlap) and fill with 0.75 in. rock or 0.25 in. pea gravel.
  2. Construct on gently sloping street.
  3. Leave room upstream of barrier for water to pond and sediment to settle.
  4. Place several layers of sand bags – overlapping the bags and packing them tightly together.
  5. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- *DI Protection Type 4 – Block and Gravel Filter* - The block and gravel filter (Type 4) is shown in the figures. Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place filter fabric over the wire mesh.
  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.
  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.
  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

Costs

- Average annual cost for installation and maintenance (one year useful life) is $200 per inlet.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- Filter Fabric Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes.

- Gravel Filters. If the gravel becomes clogged with sediment, it must be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.

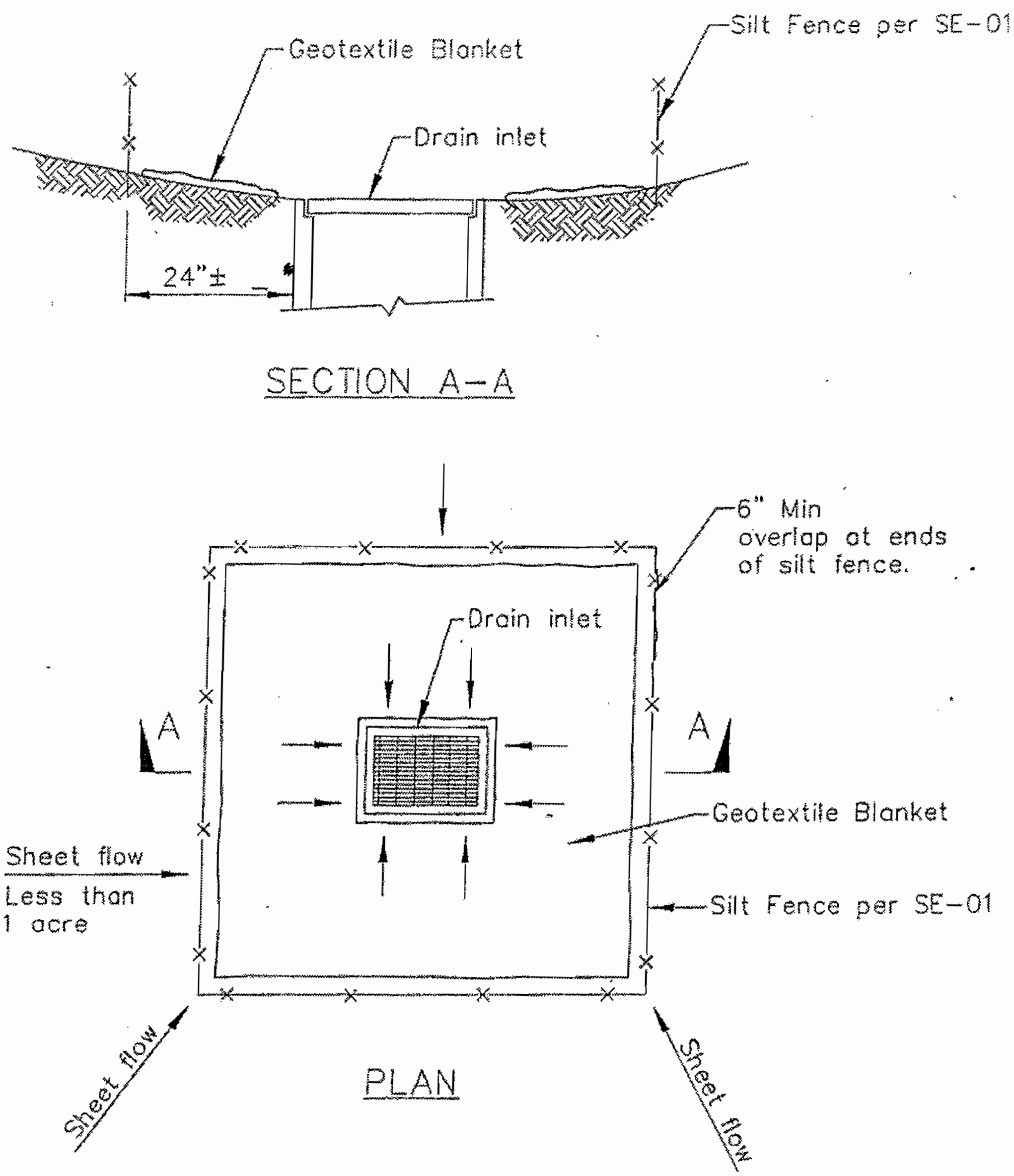
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site ore disposed at an appropriate location.

- Remove storm drain inlet protection once the drainage area is stabilized.
  - Clean and regrade area around the inlet and clean the inside of the storm drain inlet as it must be free of sediment and debris at the time of final inspection.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

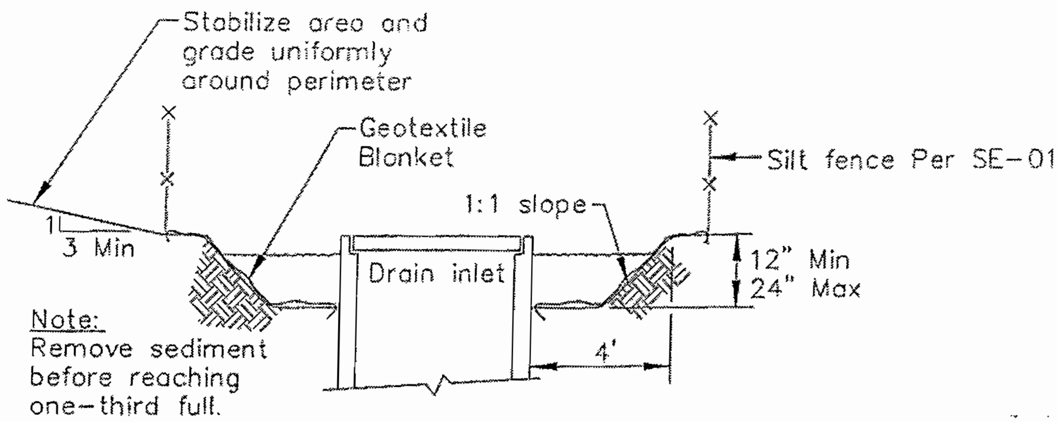
Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.



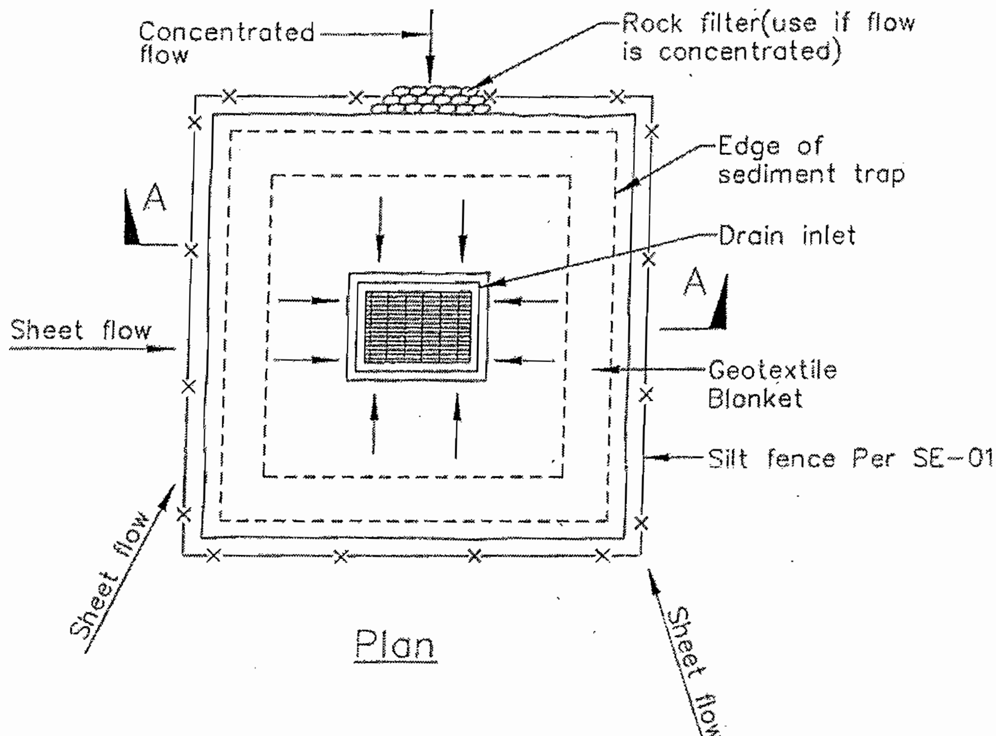
DI PROTECTION TYPE 1
NOT TO SCALE

NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.



Section A–A



Plan

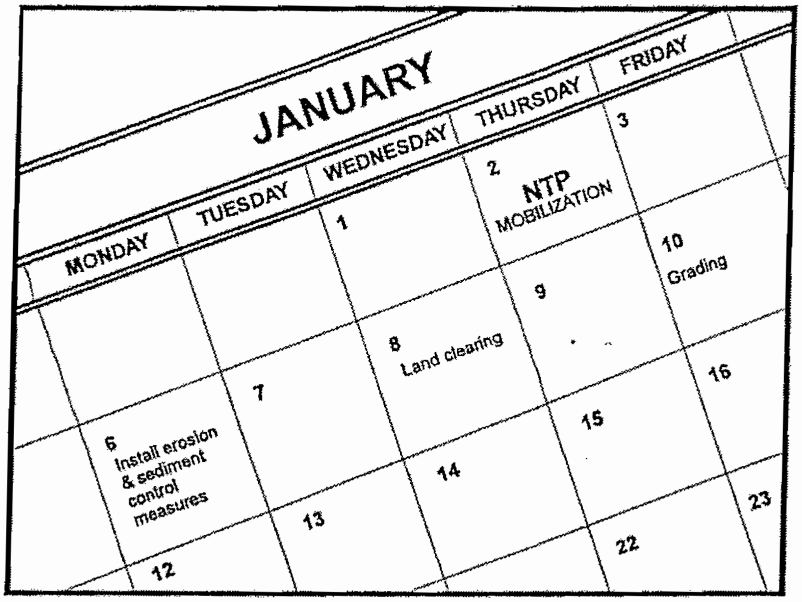
DI PROTECTION TYPE 2

NOT TO SCALE

Notes

1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.

Scheduling EC-1



Objectives

EC	Erosion Control	✓ (primary)
SE	Sediment Control	✓
TC	Tracking Control	✓
WE	Wind Erosion Control	✓
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
- ✓ **Primary Objective**
- ✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control while taking local climate (rainfall, wind, etc.) into consideration. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.

Suitable Applications

Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

Limitations

- Environmental constraints such as nesting season prohibitions reduce the full capabilities of this BMP.

Implementation

- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.

- Plan the project and develop a schedule showing each phase of construction. Clearly show how the rainy season relates to soil

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disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPPP.

- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control BMPs
  - Sediment control BMPs
  - Tracking control BMPs
  - Wind erosion control BMPs
  - Non-stormwater BMPs
  - Waste management and materials pollution control BMPs
- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.
- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - Sequence trenching activities so that most open portions are closed before new trenching begins.
  - Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.
- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition.
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.

Costs

Construction scheduling to reduce erosion may increase other construction costs due to reduced economies of scale in performing site grading. The cost effectiveness of scheduling techniques should be compared with the other less effective erosion and sedimentation controls to achieve a cost effective balance.

Inspection and Maintenance

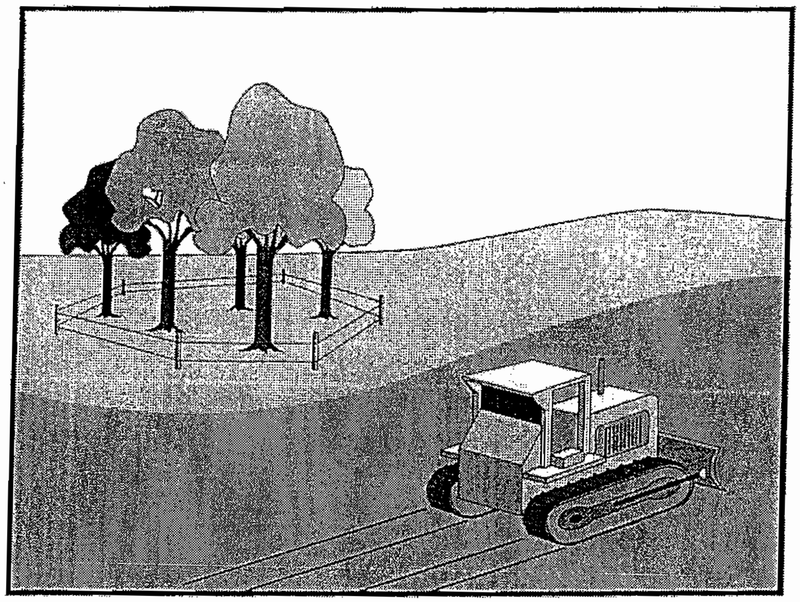
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005), U.S. Environmental Protection Agency, Office of Water, September 1992.

Preservation Of Existing Vegetation EC-2



Objectives

EC	Erosion Control	✓
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

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EC-2 Preservation Of Existing Vegetation

Limitations

- Requires forward planning by the owner/developer, contractor, and design staff.
- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.
- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  - Orange colored plastic mesh fencing works well.
  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of $10,000 per tree.

Inspection and Maintenance

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  - Fertilize stressed or damaged broadleaf trees to aid recovery.
  - Fertilize trees in the late fall or early spring.

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.

- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

References

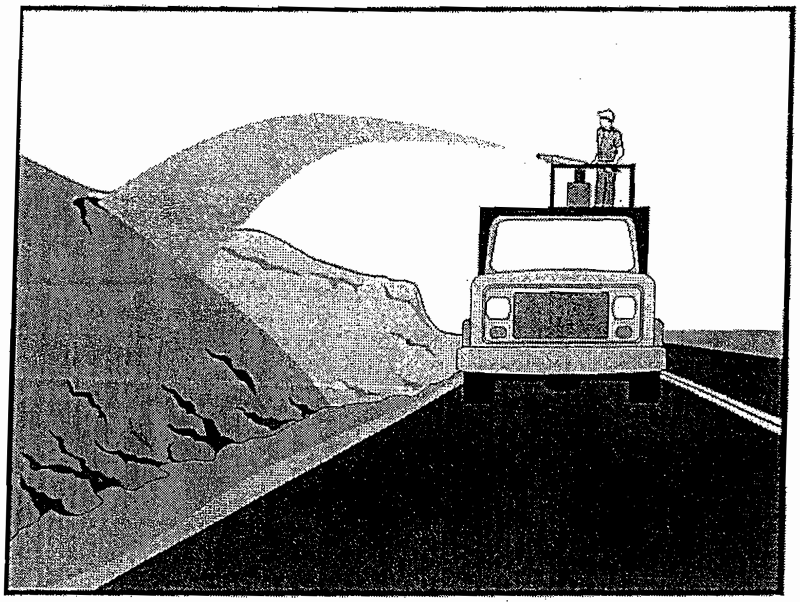
County of Sacramento Tree Preservation Ordinance, September 1981.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydraulic Mulch



Objectives

EC	Erosion Control	✓
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	✓
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-4 Hydroseeding

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

Description and Purpose

Hydraulic mulch consists of applying a mixture of shredded wood fiber or a hydraulic matrix, and a stabilizing emulsion or tackifier with hydro-mulching equipment, which temporarily protects exposed soil from erosion by raindrop impact or wind.

Suitable Applications

Hydraulic mulch is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

Limitations

Wood fiber hydraulic mulches are generally short lived and need 24 hours to dry before rainfall occurs to be effective. May require a second application in order to remain effective for an entire rainy season.

Implementation

- Prior to application, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking. Track walking shall only be used where other methods are impractical.
- To be effective, hydraulic matrices require 24 hours to dry before rainfall occurs.
- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

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- Paper based hydraulic mulches alone shall not be used for erosion control.

Hydraulic Mulches
Wood fiber mulch can be applied alone or as a component of hydraulic matrices. Wood fiber applied alone is typically applied at the rate of 2,000 to 4,000 lb/acre. Wood fiber mulch is manufactured from wood or wood waste from lumber mills or from urban sources.

Hydraulic Matrices
Hydraulic matrices include a mixture of wood fiber and acrylic polymer or other tackifier as binder. Apply as a liquid slurry using a hydraulic application machine (i.e., hydro seeder) at the following minimum rates, or as specified by the manufacturer to achieve complete coverage of the target area: 2,000 to 4,000 lb/acre wood fiber mulch, and 5 to 10% (by weight) of tackifier (acrylic copolymer, guar, psyllium, etc.)

Bonded Fiber Matrix
Bonded fiber matrix (BFM) is a hydraulically applied system of fibers and adhesives that upon drying forms an erosion resistant blanket that promotes vegetation, and prevents soil erosion. BFMs are typically applied at rates from 3,000 lb/acre to 4,000 lb/acre based on the manufacturer's recommendation. A biodegradable BFM is composed of materials that are 100% biodegradable. The binder in the BFM should also be biodegradable and should not dissolve or disperse upon re-wetting. Typically, biodegradable BFMs should not be applied immediately before, during or immediately after rainfall if the soil is saturated. Depending on the product, BFMs typically require 12 to 24 hours to dry and become effective.

Costs
Average cost for installation of wood fiber mulch is $900/acre. Average cost for installation of BFM is $5,500/acre.

Inspection and Maintenance
- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked.

References
Controlling Erosion of Construction Sites Agricultural Information #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Soil Erosion by Water, Agriculture Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

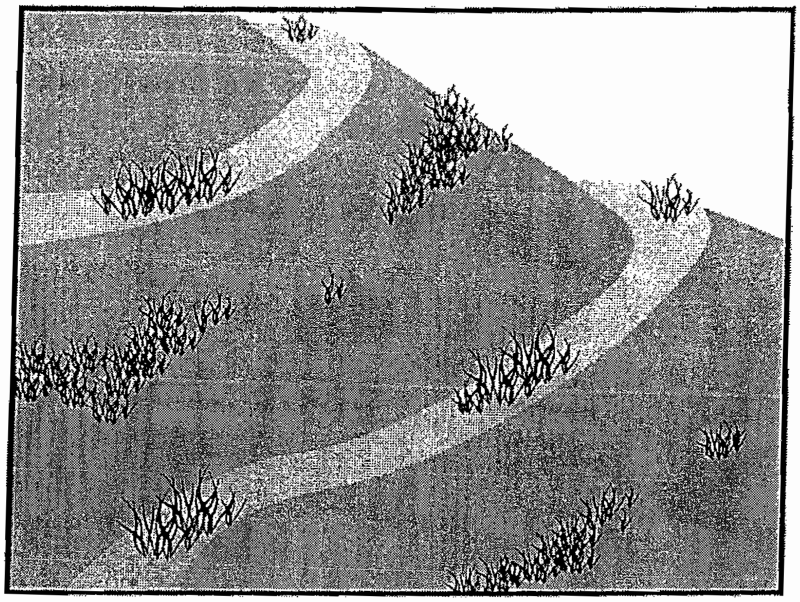
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydroseeding



Objectives

EC	Erosion Control	✓
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	✓
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-5 Soil Binders
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching

Description and Purpose

Hydroseeding typically consists of applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion with hydro-mulch equipment, to temporarily protect exposed soils from erosion by water and wind.

Suitable Applications

Hydroseeding is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

Limitations

- Hydroseeding may be used alone only when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control. Otherwise, hydroseeding must be used in conjunction with mulching (i.e., straw mulch).
- Steep slopes are difficult to protect with temporary seeding.
- Temporary seeding may not be appropriate in dry periods without supplemental irrigation.
- Temporary vegetation may have to be removed before permanent vegetation is applied.
- Temporary vegetation is not appropriate for short term inactivity.

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Implementation

In order to select appropriate hydroseeding mixtures, an evaluation of site conditions shall be performed with respect to:

- Soil conditions
- Site topography
- Season and climate
- Vegetation types
- Maintenance requirements
- Sensitive adjacent areas
- Water availability
- Plans for permanent vegetation

The local office of the U.S.D.A. Natural Resources Conservation Service (NRCS) is an excellent source of information on appropriate seed mixes.

The following steps shall be followed for implementation:

- Avoid use of hydroseeding in areas where the BMP would be incompatible with future earthwork activities and would have to be removed.
- Hydroseeding can be accomplished using a multiple step or one step process. The multiple step process ensures maximum direct contact of the seeds to soil. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate shall be increased to compensate for all seeds not having direct contact with the soil.
- Prior to application, roughen the area to be seeded with the furrows trending along the contours.
- Apply a straw mulch to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed shall be pellet inoculated. Inoculant sources shall be species specific and shall be applied at a rate of 2 lb of inoculant per 100 lb seed.
- Commercial fertilizer shall conform to the requirements of the California Food and Agricultural Code. Fertilizer shall be pelleted or granular form.
- Follow up applications shall be made as needed to cover weak spots and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Costs

Average cost for installation and maintenance may vary from as low as $300 per acre for flat slopes and stable soils, to $1600 per acre for moderate to steep slopes and/or erosive soils.

Hydroseeding		Installed Cost per Acre
High Density	Ornamentals	$400 - $1600
	Turf Species	$350
	Bunch Grasses	$300 - $1300
Fast Growing	Annual	$350 - $650
	Perennial	$300 - $800
Non-Competing	Native	$300 - $1600
	Non-Native	$400 - $500
Sterile	Cereal Grain	$500

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Where seeds fail to germinate, or they germinate and die, the area must be re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates.
- Irrigation systems, if applicable, should be inspected daily while in use to identify system malfunctions and line breaks. When line breaks are detected, the system must be shut down immediately and breaks repaired before the system is put back into operation.
- Irrigation systems shall be inspected for complete coverage and adjusted as needed to maintain complete coverage.

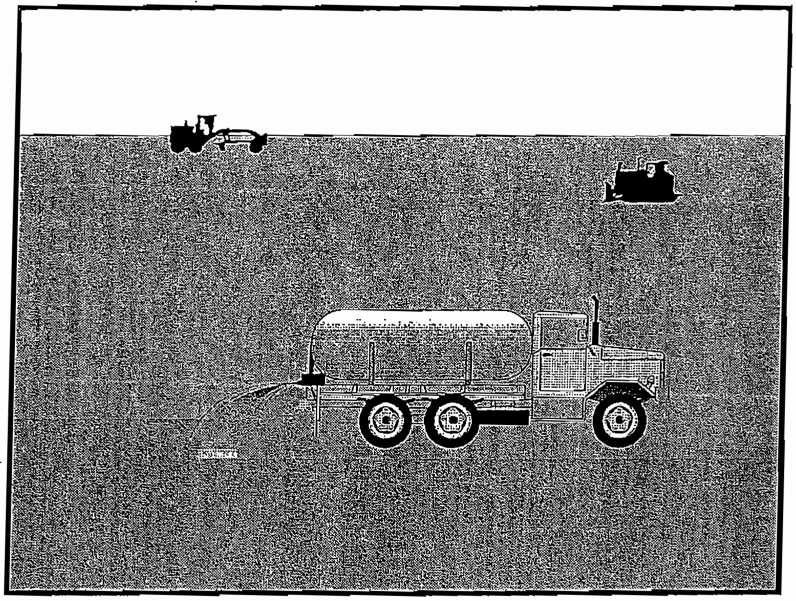
References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Soil Binders

EC-5



Objectives

EC	Erosion Control	✔
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	✓
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✔ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✔
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

Description and Purpose

Soil binders consist of applying and maintaining a soil stabilizer to exposed soil surfaces. Soil binders are materials applied to the soil surface to temporarily prevent water induced erosion of exposed soils on construction sites. Soil binders also prevent wind erosion.

Suitable Applications

Soil binders are typically applied to disturbed areas requiring short term temporary protection. Because soil binders can often be incorporated into the work, they are a good alternative to mulches in areas where grading activities will soon resume. Soil binders are also suitable for use on stockpiles.

Limitations

- Soil binders are temporary in nature and may need reapplication.
- Soil binders require a minimum curing time until fully effective, as prescribed by the manufacturer. Curing time may be 24 hours or longer. Soil binders may need reapplication after a storm event.
- Soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.

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- Soil binders do not hold up to pedestrian or vehicular traffic across treated areas.
- Soil binders may not penetrate soil surfaces made up primarily of silt and clay, particularly when compacted.
- Some soil binders may not perform well with low relative humidity. Under rainy conditions, some agents may become slippery or leach out of the soil.
- Soil binders may not cure if low temperatures occur within 24 hours of application.
- The water quality impacts of soil binders are relatively unknown and some may have water quality impacts due to their chemical makeup.
- A sampling and analysis plan must be incorporated into the SWPPP as soil binders could be a source of non-visible pollutants.

Implementation

General Considerations

- Regional soil types will dictate appropriate soil binders to be used.
- A soil binder must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical, and should not stain paved or painted surfaces. Soil binders should not pollute stormwater.
- Some soil binders may not be compatible with existing vegetation.
- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Selecting a Soil Binder

Properties of common soil binders used for erosion control are provided on Table 1 at the end of this BMP. Use Table 1 to select an appropriate soil binder. Refer to WE-1, Wind Erosion Control, for dust control soil binders.

Factors to consider when selecting a soil binder include the following:

- Suitability to situation - Consider where the soil binder will be applied, if it needs a high resistance to leaching or abrasion, and whether it needs to be compatible with any existing vegetation. Determine the length of time soil stabilization will be needed, and if the soil binder will be placed in an area where it will degrade rapidly. In general, slope steepness is not a discriminating factor for the listed soil binders.
- Soil types and surface materials - Fines and moisture content are key properties of surface materials. Consider a soil binder's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials.
- Frequency of application - The frequency of application can be affected by subgrade conditions, surface type, climate, and maintenance schedule. Frequent applications could

lead to high costs. Application frequency may be minimized if the soil binder has good penetration, low evaporation, and good longevity. Consider also that frequent application will require frequent equipment clean up.

Plant-Material Based (Short Lived) Binders

Guar: Guar is a non-toxic, biodegradable, natural galactomannan based hydrocolloid treated with dispersant agents for easy field mixing. It should be mixed with water at the rate of 11 to 15 lb per 1,000 gallons. Recommended minimum application rates are as follows:

Application Rates for Guar Soil Stabilizer

Slope (H:V):	Flat	4:1	3:1	2:1	1:1
lb/acre:	40	45	50	60	70

Psyllium: Psyllium is composed of the finely ground muciloid coating of plantago seeds that is applied as a dry powder or in a wet slurry to the surface of the soil. It dries to form a firm but rewettable membrane that binds soil particles together but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Application rates should be from 80 to 200 lb/acre, with enough water in solution to allow for a uniform slurry flow.

Starch: Starch is non-ionic, cold water soluble (pre-gelatinized) granular cornstarch. The material is mixed with water and applied at the rate of 150 lb/acre. Approximate drying time is 9 to 12 hours.

Plant-Material Based (Long Lived) Binders

Pitch and Rosin Emulsion: Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48%. The rosin should be a minimum of 26% of the total solids content. The soil stabilizer should be non-corrosive, water dilutable emulsion that upon application cures to a water insoluble binding and cementing agent. For soil erosion control applications, the emulsion is diluted and should be applied as follows:

- For clayey soil: 5 parts water to 1 part emulsion
- For sandy soil: 10 parts water to 1 part emulsion

Application can be by water truck or hydraulic seeder with the emulsion and product mixture applied at the rate specified by the manufacturer.

Polymeric Emulsion Blend Binders

Acrylic Copolymers and Polymers: Polymeric soil stabilizers should consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55% solids. The polymeric compound should be handled and mixed in a manner that will not cause foaming or should contain an anti-foaming agent. The polymeric emulsion should not exceed its shelf life or expiration date; manufacturers should provide the expiration date. Polymeric soil stabilizer should be readily miscible in water, non-injurious to seed or animal life, non-flammable, should provide surface soil stabilization for various soil types without totally inhibiting water infiltration, and should not re-emulsify when cured. The applied compound should air cure within a maximum of 36 to 48 hours. Liquid copolymer should be diluted at a rate of 10 parts water to 1 part polymer and the mixture applied to soil at a rate of 1,175 gallons/acre.

Liquid Polymers of Methacrylates and Acrylates: This material consists of a tackifier/sealer that is a liquid polymer of methacrylates and acrylates. It is an aqueous 100% acrylic emulsion blend of 40% solids by volume that is free from styrene, acetate, vinyl, ethoxylated surfactants or silicates. For soil stabilization applications, it is diluted with water in accordance with manufacturer's recommendations, and applied with a hydraulic seeder at the rate of 20 gallons/acre. Drying time is 12 to 18 hours after application.

Copolymers of Sodium Acrylates and Acrylamides: These materials are non-toxic, dry powders that are copolymers of sodium acrylate and acrylamide. They are mixed with water and applied to the soil surface for erosion control at rates that are determined by slope gradient:

Slope Gradient (H:V)	lb/acre
Flat to 5:1	3.0 – 5.0
5:1 to 3:1	5.0 – 10.0
2:2 to 1:1	10.0 – 20.0

Poly-Acrylamide and Copolymer of Acrylamide: Linear copolymer polyacrylamide is packaged as a dry flowable solid. When used as a stand alone stabilizer, it is diluted at a rate of 11lb/1,000 gal of water and applied at the rate of 5.0 lb/acre.

Hydro-Colloid Polymers: Hydro-Colloid Polymers are various combinations of dry flowable poly-acrylamides, copolymers and hydro-colloid polymers that are mixed with water and applied to the soil surface at rates of 55 to 60 lb/acre. Drying times are 0 to 4 hours.

Cementitious-Based Binders

Gypsum: This is a formulated gypsum based product that readily mixes with water and mulch to form a thin protective crust on the soil surface. It is composed of high purity gypsum that is ground, calcined and processed into calcium sulfate hemihydrate with a minimum purity of 86%. It is mixed in a hydraulic seeder and applied at rates 4,000 to 12,000 lb/acre. Drying time is 4 to 8 hours.

Applying Soil Binders

After selecting an appropriate soil binder, the untreated soil surface must be prepared before applying the soil binder. The untreated soil surface must contain sufficient moisture to assist the agent in achieving uniform distribution. In general, the following steps should be followed:

- Follow manufacturer's written recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders should not be applied during or immediately before rainfall.
- Avoid over spray onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.

- Soil binders should not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below 40°F during the curing period.
- More than one treatment is often necessary, although the second treatment may be diluted or have a lower application rate.
- Generally, soil binders require a minimum curing time of 24 hours before they are fully effective. Refer to manufacturer's instructions for specific cure time.
- For liquid agents:
  - Crown or slope ground to avoid ponding.
  - Uniformly pre-wet ground at 0.03 to 0.3 gal/yd² or according to manufacturer's recommendations.
  - Apply solution under pressure. Overlap solution 6 to 12 in.
  - Allow treated area to cure for the time recommended by the manufacturer; typically at least 24 hours.
  - Apply second treatment before first treatment becomes ineffective, using 50% application rate.
  - In low humidities, reactivate chemicals by re-wetting with water at 0.1 to 0.2 gal/yd².

Costs

Costs vary according to the soil stabilizer selected for implementation. The following are approximate costs:

Soil Binder	Cost per Acre
Plant-Material Based (Short Lived) Binders	$400
Plant-Material Based (Long Lived) Binders	$1,200
Polymeric Emulsion Blend Binders	$400 (1)
Cementitious-Based Binders	$800

(1) $1,200 for Acrylic polymers and copolymers

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Reapply the selected soil binder as needed to maintain effectiveness.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

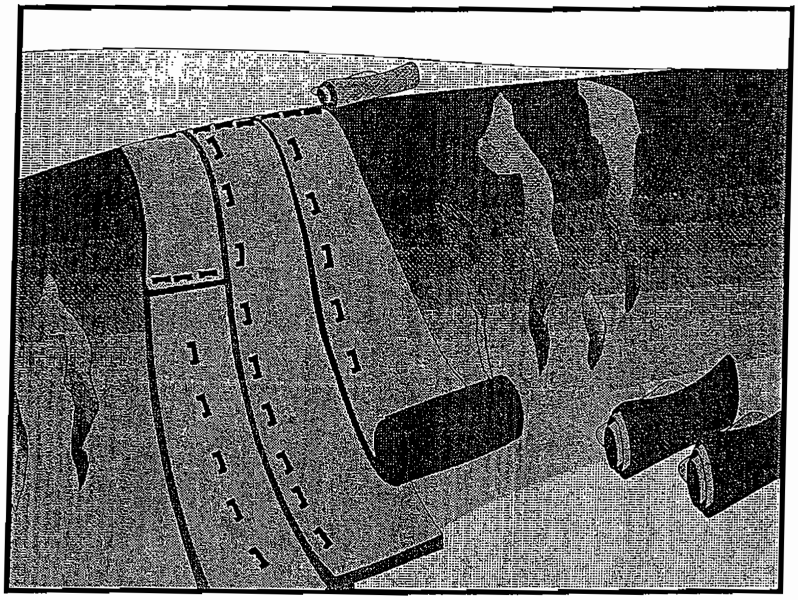
Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Table 1 Properties of Soil Binders for Erosion Control

Evaluation Criteria	Binder Type			
	Plant Material Based (Short Lived)	Plant Material Based (Long Lived)	Polymeric Emulsion Blends	Cementitious-Based Binders
Relative Cost	Low	Low	Low	Low
Resistance to Leaching	High	High	Low to Moderate	Moderate
Resistance to Abrasion	Moderate	Low	Moderate to High	Moderate to High
Longevity	Short to Medium	Medium	Medium to Long	Medium
Minimum Curing Time before Rain	9 to 18 hours	19 to 24 hours	0 to 24 hours	4 to 8 hours
Compatibility with Existing Vegetation	Good	Poor	Poor	Poor
Mode of Degradation	Biodegradable	Biodegradable	Photodegradable/ Chemically Degradable	Photodegradable/ Chemically Degradable
Labor Intensive	No	No	No	No
Specialized Application Equipment	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher
Liquid/Powder	Powder	Liquid	Liquid/Powder	Powder
Surface Crusting	Yes, but dissolves on rewetting	Yes	Yes, but dissolves on rewetting	Yes
Clean Up	Water	Water	Water	Water
Erosion Control Application Rate	Varies (1)	Varies (1)	Varies (1)	4,000 to 12,000 lbs/acre

(1) See Implementation for specific rates.



Objectives

EC	Erosion Control	✓
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	✓
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-5 Soil Binders
EC-6 Straw Mulch
EC-8 Wood Mulching

Description and Purpose

Mattings of natural materials are used to cover the soil surface to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface. Additionally, matting may be used to stabilize soils until vegetation is established.

Suitable Applications

Mattings are commonly applied on short, steep slopes where erosion hazard is high and vegetation will be slow to establish. Mattings are also used on stream banks where moving water at velocities between 3 ft/s and 6 ft/s are likely to wash out new vegetation, and in areas where the soil surface is disturbed and where existing vegetation has been removed. Matting may also be used when seeding cannot occur (e.g., late season construction and/or the arrival of an early rain season). Erosion control matting should be considered when the soils are fine grained and potentially erosive. These measures should be considered in the following situations.

- Steep slopes, generally steeper than 3:1 (H:V)
- Slopes where the erosion potential is high
- Slopes and disturbed soils where mulch must be anchored
- Disturbed areas where plants are slow to develop
- Channels with flows exceeding 3.3 ft/s

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- Channels to be vegetated
- Stockpiles
- Slopes adjacent to water bodies of Environmentally Sensitive Areas (ESAs)

Limitations

- Properly installed mattings provide excellent erosion control but do so at relatively high cost. This high cost typically limits the use of mattings to areas of concentrated channel flow and steep slopes.
- Mattings are more costly than other BMP practices, limiting their use to areas where other BMPs are ineffective (e.g. channels, steep slopes).
- Installation is critical and requires experienced contractors. The contractor should install the matting material in such a manner that continuous contact between the material and the soil occurs.
- Geotextiles and Mats may delay seed germination, due to reduction in soil temperature.
- Blankets and mats are generally not suitable for excessively rocky sites or areas where the final vegetation will be mowed (since staples and netting can catch in mowers).
- Blankets and mats must be removed and disposed of prior to application of permanent soil stabilization measures.
- Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
- Plastic results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.
- The use of plastic should be limited to covering stockpiles or very small graded areas for short periods of time (such as through one imminent storm event) until alternative measures, such as seeding and mulching, may be installed.
- Geotextiles, mats, plastic covers, and erosion control covers have maximum flow rate limitations; consult the manufacturer for proper selection.
- Not suitable for areas that have heavy foot traffic (tripping hazard) – e.g., pad areas around buildings under construction.

Implementation

Material Selection

Organic matting materials have been found to be effective where re-vegetation will be provided by re-seeding. The choice of matting should be based on the size of area, side slopes, surface conditions such as hardness, moisture, weed growth, and availability of materials.

The following natural and synthetic mattings are commonly used:

Geotextiles

- Material should be a woven polypropylene fabric with minimum thickness of 0.06 in., minimum width of 12 ft and should have minimum tensile strength of 150 lbs (warp), 80 lbs (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric should be approximately 0.07 sec^{-1} in conformance with the requirements in ASTM Designation: D4491. The fabric should have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355. Geotextile blankets must be secured in place with wire staples or sandbags and by keying into tops of slopes to prevent infiltration of surface waters under geotextile. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- Geotextiles may be reused if they are suitable for the use intended.

Plastic Covers

- Plastic sheeting should have a minimum thickness of 6 mils, and must be keyed in at the top of slope and firmly held in place with sandbags or other weights placed no more than 10 ft apart. Seams are typically taped or weighted down their entire length, and there should be at least a 12 in. to 24 in. overlap of all seams. Edges should be embedded a minimum of 6 in. in soil.

- All sheeting must be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures must be repaired immediately. If washout or breakages occur, the material should be re-installed after repairing the damage to the slope.

Erosion Control Blankets/Mats

- Biodegradable rolled erosion control products (RECPs) are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. In order for an RECP to be considered 100% biodegradable, the netting, sewing or adhesive system that holds the biodegradable mulch fibers together must also be biodegradable.

  - **Jute** is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. It is designed to be used in conjunction with vegetation and has longevity of approximately one year. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

  - **Excelsior** (curled wood fiber) blanket material should consist of machine produced mats of curled wood excelsior with 80 percent of the fiber 6 in. or longer. The excelsior blanket should be of consistent thickness. The wood fiber must be evenly distributed over the entire area of the blanket. The top surface of the blanket should be covered with a photodegradable extruded plastic mesh. The blanket should be smolder resistant without the use of chemical additives and should be non-toxic and non-injurious to plant and animal life. Excelsior blankets should be furnished in rolled strips, a minimum of 48 in. wide, and should have an average weight of 0.8 lb/yd^2, ±10 percent, at the time of manufacture. Excelsior blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Straw blanket** should be machine produced mats of straw with a lightweight biodegradable netting top layer. The straw should be attached to the netting with biodegradable thread or glue strips. The straw blanket should be of consistent thickness. The straw should be evenly distributed over the entire area of the blanket. Straw blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd². Straw blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Wood fiber blanket** is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Coconut fiber blanket** should be a machine produced mat of 100 percent coconut fiber with biodegradable netting on the top and bottom. The coconut fiber should be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket should be of consistent thickness. The coconut fiber should be evenly distributed over the entire area of the blanket. Coconut fiber blanket should be furnished in rolled strips with a minimum of 6.5 ft wide, a minimum of 80 ft. long and a minimum of 0.5 lb/yd². Coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Coconut fiber mesh** is a thin permeable membrane made from coconut or corn fiber that is spun into a yarn and woven into a biodegradable mat. It is designed to be used in conjunction with vegetation and typically has longevity of several years. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Straw coconut fiber blanket** should be machine produced mats of 70 percent straw and 30 percent coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber should be attached to the netting with biodegradable thread or glue strips. The straw coconut fiber blanket should be of consistent thickness. The straw and coconut fiber should be evenly distributed over the entire area of the blanket. Straw coconut fiber blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd². Straw coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

■ Non-biodegradable RECPs are typically composed of polypropylene, polyethylene, nylon or other synthetic fibers. In some cases, a combination of biodegradable and synthetic fibers is used to construct the RECP. Netting used to hold these fibers together is typically non-biodegradable as well.

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other synthetic fibers. In some cases, a combination of
used to construct the RECP. Netting used to hold these
biodegradable as well.

- **Plastic netting** is a lightweight biaxially oriented netting designed for securing loose mulches like straw or paper to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Plastic mesh** is an open weave geotextile that is composed of an extruded synthetic fiber woven into a mesh with an opening size of less than ¼ in. It is used with re-vegetation or may be used to secure loose fiber such as straw to the ground. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Synthetic fiber with netting** is a mat that is composed of durable synthetic fibers treated to resist chemicals and ultraviolet light. The mat is a dense, three dimensional mesh of synthetic (typically polyolefin) fibers stitched between two polypropylene nets. The mats are designed to be re-vegetated and provide a permanent composite system of soil, roots, and geomatrix. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Bonded synthetic fibers** consist of a three dimensional geomatrix nylon (or other synthetic) matting. Typically it has more than 90 percent open area, which facilitates root growth. It's tough root reinforcing system anchors vegetation and protects against hydraulic lift and shear forces created by high volume discharges. It can be installed over prepared soil, followed by seeding into the mat. Once vegetated, it becomes an invisible composite system of soil, roots, and geomatrix. The material is furnished in rolled strips that must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Combination synthetic and biodegradable RECPs** consist of biodegradable fibers, such as wood fiber or coconut fiber, with a heavy polypropylene net stitched to the top and a high strength continuous filament geomatrix or net stitched to the bottom. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Site Preparation

- Proper site preparation is essential to ensure complete contact of the blanket or matting with the soil.

- Grade and shape the area of installation.

- Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.

- Prepare seedbed by loosening 2 to 3 in. of topsoil.

Seeding

Seed the area before blanket installation for erosion control and revegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket installation, all check slots and other areas disturbed during installation must be re-seeded. Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Fertilize and seed in accordance with seeding specifications or other types of landscaping plans. When using jute matting on a seeded area, apply approximately half the seed before laying the mat and the remainder after laying the mat. The protective matting can be laid over areas where grass has been planted and the seedlings have emerged. Where vines or other ground covers are to be planted, lay the protective matting first and then plant through matting according to design of planting.

Check Slots

Check slots are made of glass fiber strips, excelsior matting strips or tight folded jute matting blanket or strips for use on steep, highly erodible watercourses. The check slots are placed in narrow trenches 6 to 12 in. deep across the channel and left flush with the soil surface. They are to cover the full cross section of designed flow.

Laying and Securing Matting

- Before laying the matting, all check slots should be installed and the friable seedbed made free from clods, rocks, and roots. The surface should be compacted and finished according to the requirements of the manufacturer's recommendations.
- Mechanical or manual lay down equipment should be capable of handling full rolls of fabric and laying the fabric smoothly without wrinkles or folds. The equipment should meet the fabric manufacturer's recommendations or equivalent standards.

Anchoring

- U-shaped wire staples, metal geotextile stake pins, or triangular wooden stakes can be used to anchor mats and blankets to the ground surface.
- Wire staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Metal stake pins should be 0.188 in. diameter steel with a 1.5 in. steel washer at the head of the pin, and 8 in. in length.
- Wire staples and metal stakes should be driven flush to the soil surface.

Installation on Slopes

Installation should be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Begin at the top of the slope and anchor the blanket in a 6 in. deep by 6 in. wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket down slope in the direction of water flow.
- Overlap the edges of adjacent parallel rolls 2 to 3 in. and staple every 3 ft.

- When blankets must be spliced, place blankets end over end (shingle style) with 6 in. overlap. Staple through overlapped area, approximately 12 in. apart.
- Lay blankets loosely and maintain direct contact with the soil. Do not stretch.
- Staple blankets sufficiently to anchor blanket and maintain contact with the soil. Staples should be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 (H:V) to 2:1 (H:V), require a minimum of 2 staples/yd^2. Moderate slopes, 2:1 (H:V) to 3:1 (H:V), require a minimum of 1 ½ staples/yd^2.

Installation in Channels

Installation should be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Dig initial anchor trench 12 in. deep and 6 in. wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 6 in. deep and 6 in. wide across the channel at 25 to 30 ft intervals along the channels.
- Cut longitudinal channel anchor trenches 4 in. deep and 4 in. wide along each side of the installation to bury edges of matting, whenever possible extend matting 2 to 3 in. above the crest of the channel side slopes.
- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 12 in. intervals. Note: matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of 3 in.
- Secure these initial ends of mats with anchors at 12 in. intervals, backfill and compact soil.
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining a 3 in. overlap.
- Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 12 in. intervals, then backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench.
- Alternate method for non-critical installations: Place two rows of anchors on 6 in. centers at 25 to 30 ft. intervals in lieu of excavated check slots.
- Staple shingled lap spliced ends a minimum of 12 in. apart on 12 in. intervals.
- Place edges of outside mats in previously excavated longitudinal slots; anchor using prescribed staple pattern, backfill, and compact soil.
- Anchor, fill, and compact upstream end of mat in a 12 in. by 6 in. terminal trench.

- Secure mat to ground surface using U-shaped wire staples, geotextile pins, or wooden stakes.
- Seed and fill turf reinforcement matting with soil, if specified.

Soil Filling (if specified for turf reinforcement)

- Always consult the manufacturer's recommendations for installation.
- Do not drive tracked or heavy equipment over mat.
- Avoid any traffic over matting if loose or wet soil conditions exist.
- Use shovels, rakes, or brooms for fine grading and touch up.
- Smooth out soil filling just exposing top netting of mat.

Temporary Soil Stabilization Removal

- Temporary soil stabilization removed from the site of the work must be disposed of if necessary.

Costs

Relatively high compared to other BMPs. Biodegradable materials: \$0.50 - \$0.57/yd². Permanent materials: \$3.00 - \$4.50/yd². Staples: \$0.04 - \$0.05/staple. Approximate costs for installed materials are shown below:

Rolled Erosion Control Products		Installed Cost per Acre
Biodegradable	Jute Mesh	\$6,500
	Curled Wood Fiber	\$10,500
	Straw	\$8,900
	Wood Fiber	\$8,900
	Coconut Fiber	\$13,000
	Coconut Fiber Mesh	\$31,200
	Straw Coconut Fiber	\$10,900
Non-Biodegradable	Plastic Netting	\$2,000
	Plastic Mesh	\$3,200
	Synthetic Fiber with Netting	\$34,800
	Bonded Synthetic Fibers	\$50,000
	Combination with Biodegradable	\$32,000

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.

- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.

- Make sure matting is uniformly in contact with the soil.

- Check that all the lap joints are secure.

- Check that staples are flush with the ground.

- Check that disturbed areas are seeded.

References

Guides for Erosion and Sediment Controls in California, USDA Soils Conservation Service, January 1991.

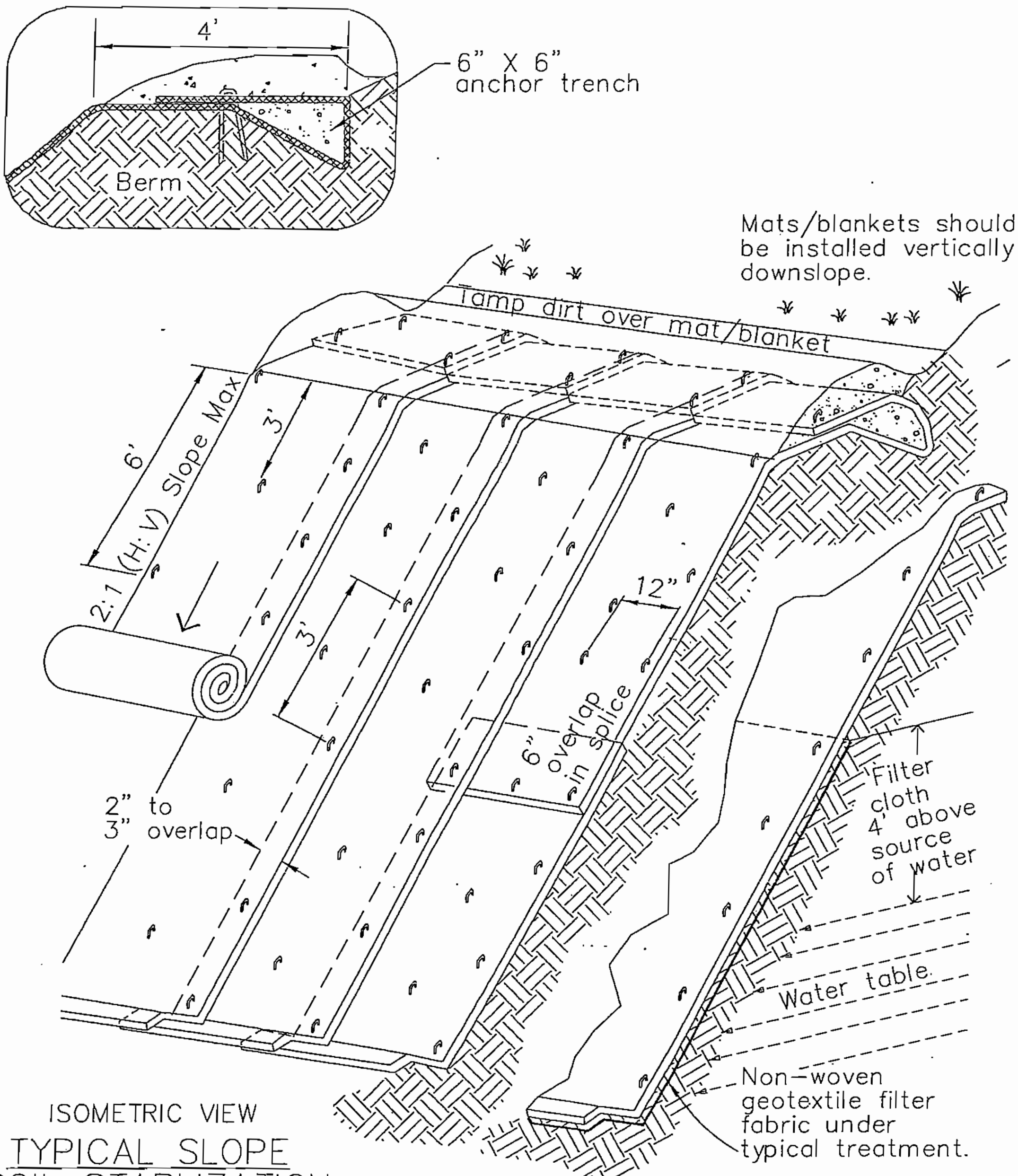
National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



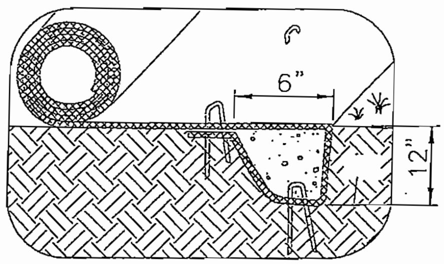
ISOMETRIC VIEW
TYPICAL SLOPE SOIL STABLIZATION
NTS

WET SLOPE LINING
NTS

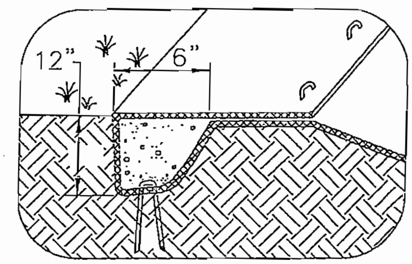
NOTES:

1. Slope surface shall be free of rocks, clods, sticks and grass. Mats/blankets shall have good soil contact.
2. Lay blankets loosely and stake or staple to maintain direct contact with the soil. Do not stretch.
3. Install per manufacturer's recommendations

TYPICAL INSTALLATION DETAIL



INITIAL CHANNEL ANCHOR TRENCH
NTS



TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH
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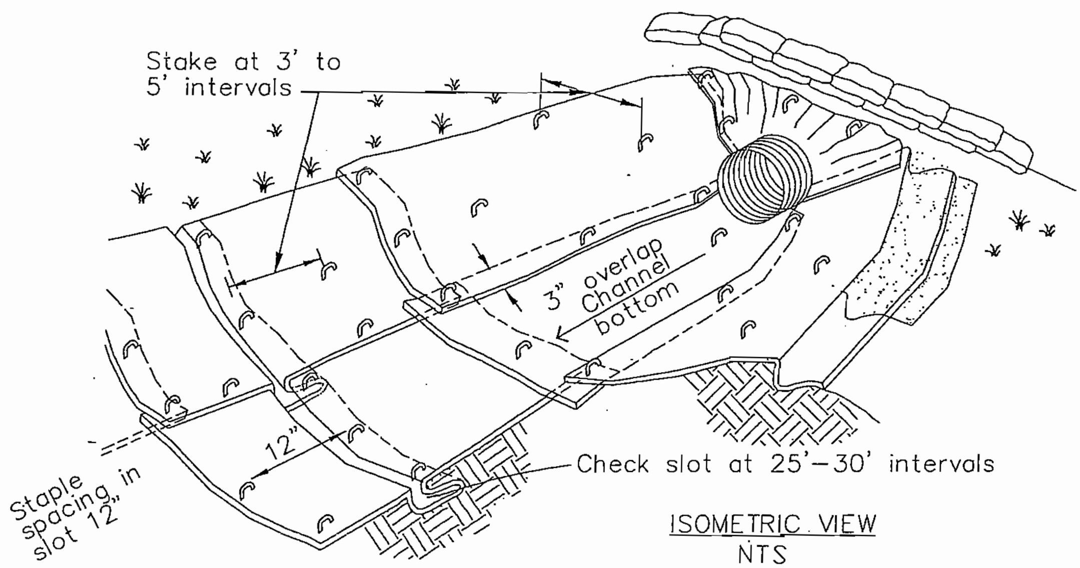
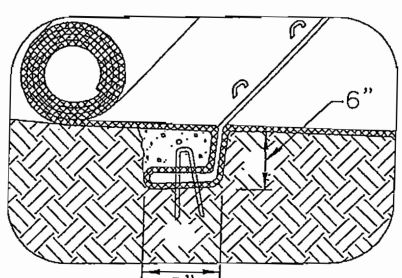
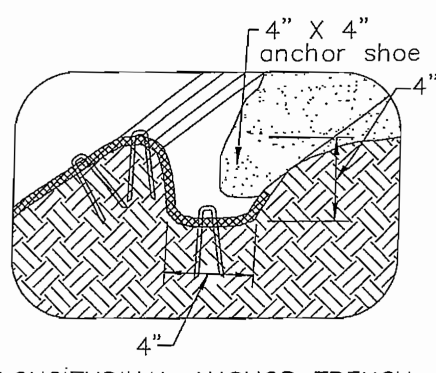


ISOMETRIC VIEW
NTS



INTERMITTENT CHECK SLOT
NTS

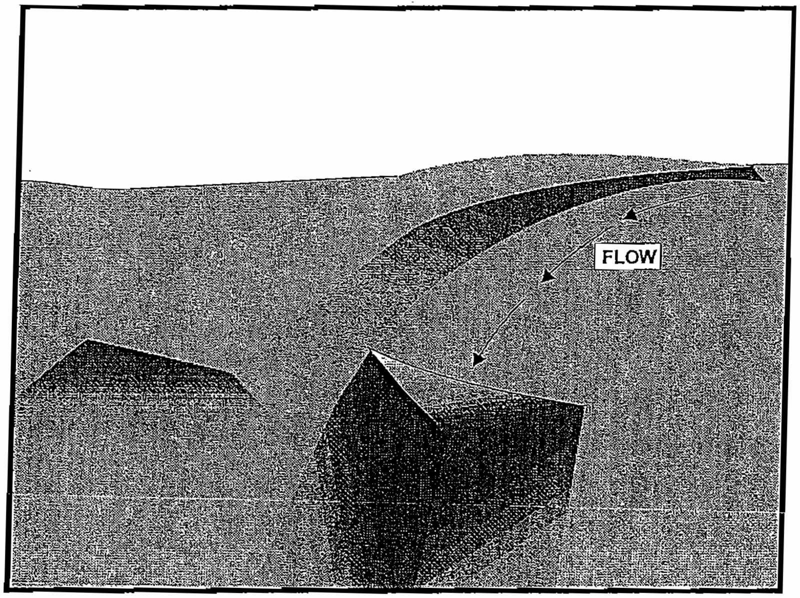


LONGITUDINAL ANCHOR TRENCH
NTS

NOTES:
1. Check slots to be constructed per manufacturers specifications.
2. Staking or stapling layout per manufacturers specifications.
3. Install per manufacturer's recommendations

TYPICAL INSTALLATION DETAIL

Earth Dikes and Drainage Swales EC-9



Objectives

EC	Erosion Control	✓
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Suitable Applications

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another.

- Earth dikes and drainage swales may be used:
  - To convey surface runoff down sloping land
  - To intercept and divert runoff to avoid sheet flow over sloped surfaces
  - To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel
  - To intercept runoff from paved surfaces
  - Below steep grades where runoff begins to concentrate
  - Along roadways and facility improvements subject to flood drainage

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- At the top of slopes to divert runon from adjacent or undisturbed slopes
- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows
- Divert sediment laden runoff into sediment basins or traps

Limitations

Dikes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.
- Dikes should not be constructed of soils that may be easily eroded.
- Regrading the site to remove the dike may add additional cost.
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.
- Earth dikes/drainage swales are not suitable as sediment trapping devices.
- It may be necessary to use other soil stabilization and sediment controls such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dikes, swales, and ditches.

Implementation

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off site and from undisturbed areas away from disturbed areas and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff. A dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike at the top of a slope can divert runoff to a location where it can be brought to the bottom of the slope (see EC-11, Slope Drains). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

General

- Care must be applied to correctly size and locate earth dikes, drainage swales. Excessively steep, unlined dikes, and swales are subject to erosion and gully formation.
- Conveyances should be stabilized.
- Use a lined ditch for high flow velocities.
- Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, overtopping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

Earth Dikes

Temporary earth dikes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin (SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.

- Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.

- If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. -12 in. Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.

- Filter cloth may be used to cover dikes in use for long periods.

- Construction activity on the earth dike should be kept to a minimum.

Drainage Swales

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

- No more than 5 acres may drain to a temporary drainage swale.

- Place drainage swales above or below, not on, a cut or fill slope.

- Swale bottom width should be at least 2 ft

- Depth of the swale should be at least 18 in.

- Side slopes should be 2:1 or flatter.

- Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.

- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.

- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.

- Compact any fill material along the path of the swale.

- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.
- Irrigation may be required to establish sufficient vegetation to prevent erosion.
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.
- Construct the drainage swale with a positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

Costs

- Cost ranges from $15 to $55 per ft for both earthwork and stabilization and depends on availability of material, site location, and access.
- Small dikes: $2.50 - $6.50/linear ft; Large dikes: $2.50/yd^3.
- The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive, as they are quickly formed during routine earthwork.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.
- Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment and repair linings and embankments as needed.
- Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction

References

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursetynsky, P.E., McGraw Hill Book Company, 1986.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

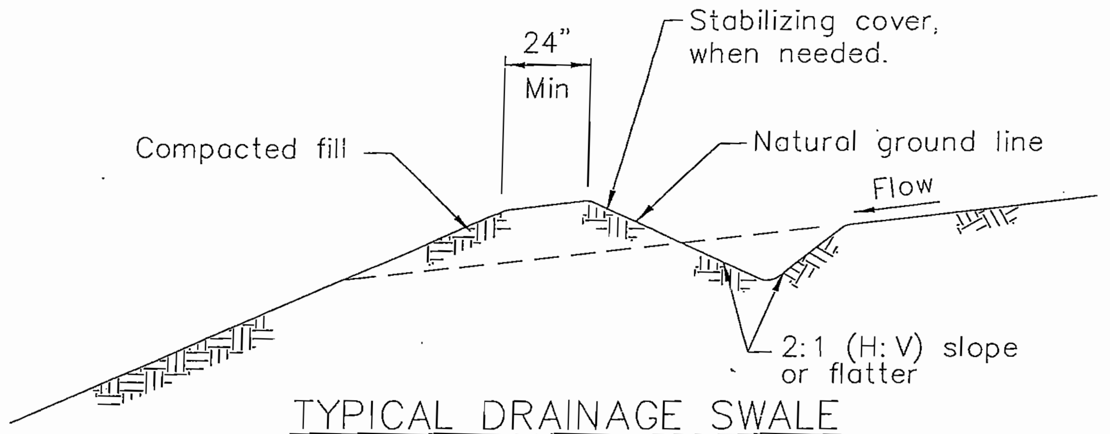
National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

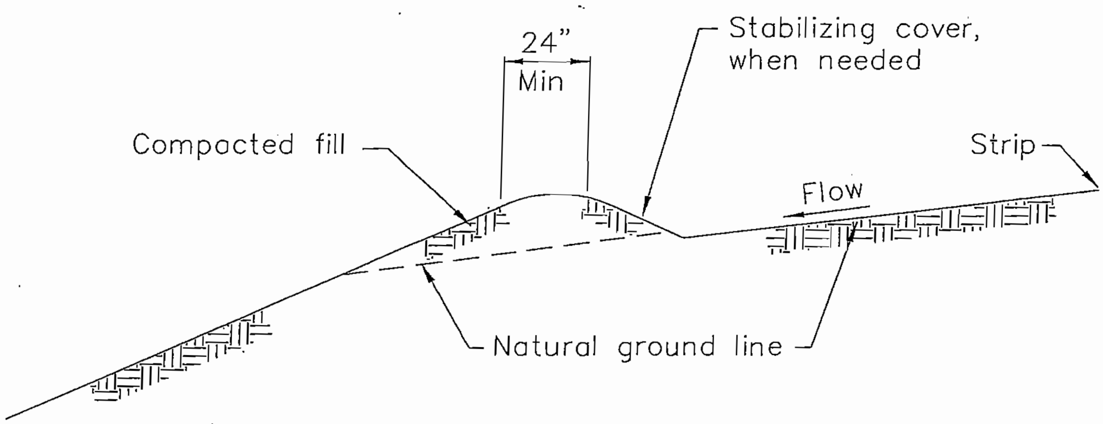
Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL DRAINAGE SWALE
NOT TO SCALE

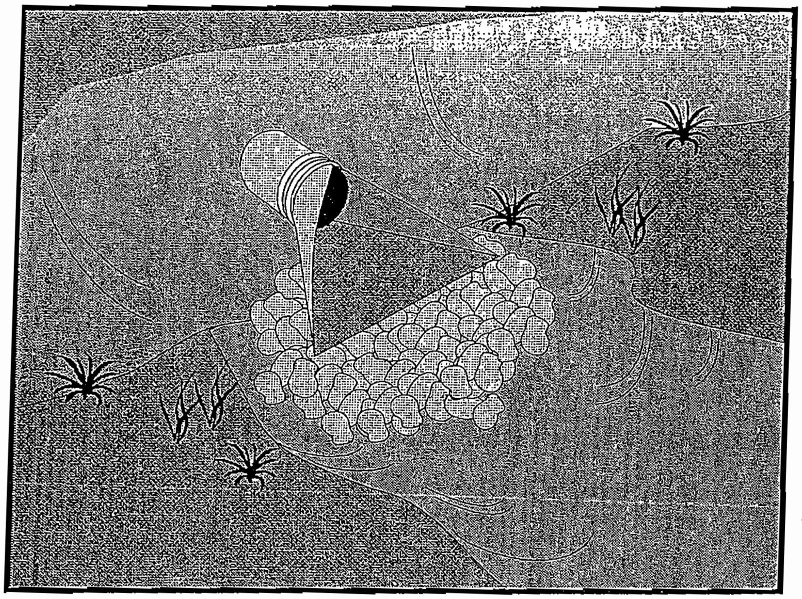
NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.



TYPICAL EARTH DIKE
NOT TO SCALE

Velocity Dissipation Devices EC-10



Objectives

EC	Erosion Control	✓
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Outlet protection is a physical device composed of rock, grouted riprap, or concrete rubble, which is placed at the outlet of a pipe or channel to prevent scour of the soil caused by concentrated, high velocity flows.

Suitable Applications

Whenever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This includes temporary diversion structures to divert runon during construction.

- These devices may be used at the following locations:
  - Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits, or channels.
  - Outlets located at the bottom of mild to steep slopes.
  - Discharge outlets that carry continuous flows of water.
  - Outlets subject to short, intense flows of water, such as flash floods.
  - Points where lined conveyances discharge to unlined conveyances

Limitations

- Large storms or high flows can wash away the rock outlet protection and leave the area susceptible to erosion.

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- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- Outlet protection may negatively impact the channel habitat.
- Grouted riprap may break up in areas of freeze and thaw.
- If there is not adequate drainage, and water builds up behind grouted riprap, it may cause the grouted riprap to break up due to the resulting hydrostatic pressure.

Implementation

General

Outlet protection is needed where discharge velocities and energies at the outlets of culverts, conduits or channels are sufficient to erode the immediate downstream reach. This practice protects the outlet from developing small eroded pools (plange pools), and protects against gully erosion resulting from scouring at a culvert mouth.

Design and Layout

As with most channel design projects, depth of flow, roughness, gradient, side slopes, discharge rate, and velocity should be considered in the outlet design. Compliance to local and state regulations should also be considered while working in environmentally sensitive streambeds. General recommendations for rock size and length of outlet protection mat are shown in the rock outlet protection figure in this BMP and should be considered minimums. The apron length and rock size gradation are determined using a combination of the discharge pipe diameter and estimate discharge rate: Select the longest apron length and largest rock size suggested by the pipe size and discharge rate. Where flows are conveyed in open channels such as ditches and swales, use the estimated discharge rate for selecting the apron length and rock size. Flows should be same as the culvert or channel design flow but never the less than the peak 5 year flow for temporary structures planned for one rainy season, or the 10 year peak flow for temporary structures planned for two or three rainy seasons.

- There are many types of energy dissipaters, with rock being the one that is represented in the attached figure.
- Best results are obtained when sound, durable, and angular rock is used.
- Install riprap, grouted riprap, or concrete apron at selected outlet. Riprap aprons are best suited for temporary use during construction. Grouted or wired tied rock riprap can minimize maintenance requirements.
- Rock outlet protection is usually less expensive and easier to install than concrete aprons or energy dissipaters. It also serves to trap sediment and reduce flow velocities.
- Carefully place riprap to avoid damaging the filter fabric.
  - Stone 4 in. to 6 in. may be carefully dumped onto filter fabric from a height not to exceed 12 in.
  - Stone 8 in. to 12 in. must be hand placed onto filter fabric, or the filter fabric may be covered with 4 in. of gravel and the 8 in. to 12 in. rock may be dumped from a height not to exceed 16 in.

  - Stone greater than 12 in. shall only be dumped onto filter fabric protected with a layer of gravel with a thickness equal to one half the D_{50} rock size, and the dump height limited to twice the depth of the gravel protection layer thickness.

- For proper operation of apron: Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in upper section of apron.

- Outlets on slopes steeper than 10 percent should have additional protection.

Costs

Costs are low if material is readily available. If material is imported, costs will be higher. Average installed cost is $150 per device.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur.

- Inspect apron for displacement of the riprap and damage to the underlying fabric. Repair fabric and replace riprap that has washed away. If riprap continues to wash away, consider using larger material.

- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.

- Temporary devices should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.

References

County of Sacramento Improvement Standards, Sacramento County, May 1989.

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursztynsky, P.E., McGraw Hill Book Company, 1986.

Handbook of Steel Drainage & Highway Construction, American Iron and Steel Institute, 1983.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

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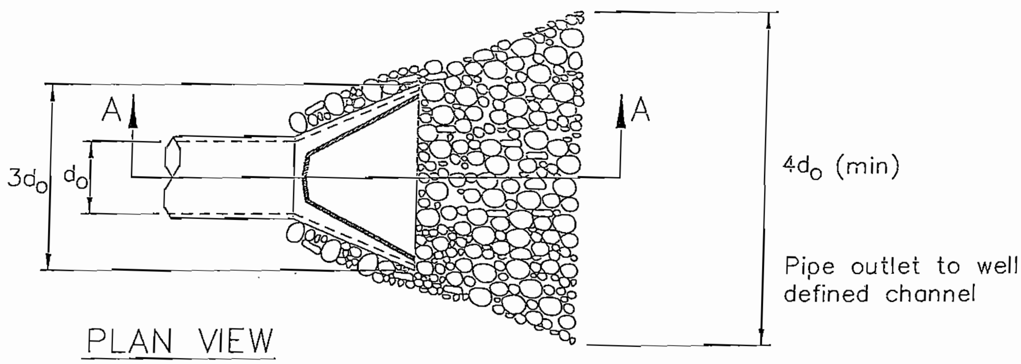
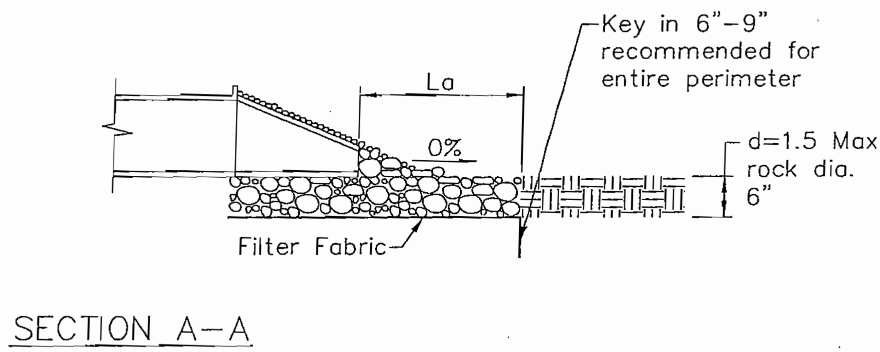
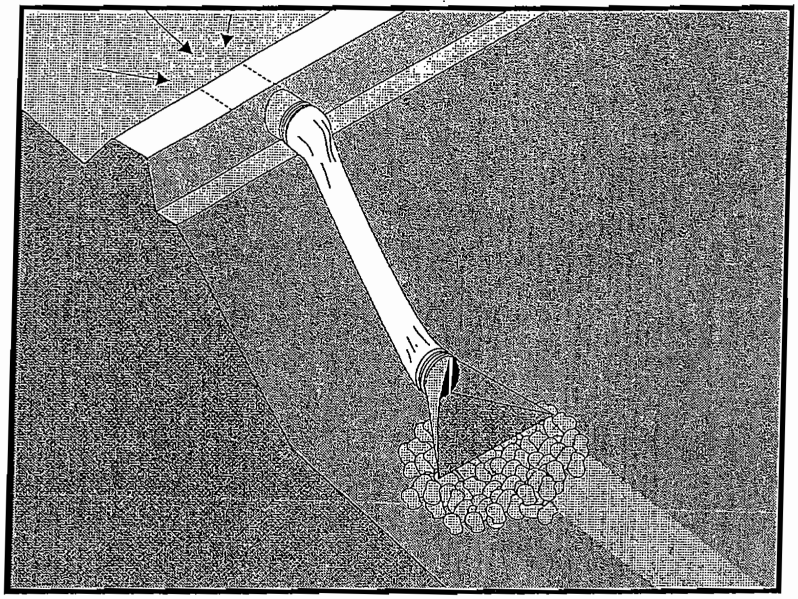




Pipe Diameter inches	Discharge ft³/s	Apron Length, La ft	Rip Rap D_{50} Diameter Min inches
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

For larger or higher flows consult a Registered Civil Engineer
Source: USDA - SCS



Objectives

EC	Erosion Control	✓
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-9 Earth Dike, Drainage Swales

Description and Purpose

A slope drain is a pipe used to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device, or stabilized area. Slope drains are used with earth dikes and drainage ditches to intercept and direct surface flow away from slope areas to protect cut or fill slopes.

Suitable Applications

- Where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion.
- Drainage for top of slope diversion dikes or swales.
- Drainage for top of cut and fill slopes where water can accumulate.
- Emergency spillway for a sediment basin.

Limitations

Installation is critical for effective use of the pipe slope drain to minimize potential gully erosion.

- Maximum drainage area per slope drain is 10 acres. (For large areas use a paved chute, rock lined channel, or additional pipes.)
- Severe erosion may result when slope drains fail by overtopping, piping, or pipe separation.

- During large storms, pipe slope drains may become clogged or over charged, forcing water around the pipe and causing extreme slope erosion.
- If the sectional downdrain is not sized correctly, the runoff can spill over the drain sides causing gully erosion and potential failure of the structure.

- Dissipation of high flow velocities at the pipe outlet is required to avoid downstream erosion.

Implementation

General

The slope drain is applicable for any construction site where concentrated surface runoff can accumulate and must be conveyed down the slope in order to prevent erosion. The slope drain is effective because it prevents the stormwater from flowing directly down the slope by confining all the runoff into an enclosed pipe or channel. Due to the time lag between grading slopes and installation of permanent stormwater collection systems and slope stabilization measures, temporary provisions to intercept runoff are sometimes necessary. Particularly in steep terrain, slope drains can protect unstabilized areas from erosion.

Installation

The slope drain may be a rigid pipe, such as corrugated metal, a flexible conduit, or a lined terrace drain with the inlet placed on the top of a slope and the outlet at the bottom of the slope. This BMP typically is used in combination with a diversion control, such as an earth dike or drainage swale at the top of the slope.

The following criteria must be considered when siting slope drains.

- Permanent structures included in the project plans can often serve as construction BMPs if implemented early. However, the permanent structure must meet or exceed the criteria for the temporary structure.
- Inlet structures must be securely entrenched and compacted to avoid severe gully erosion.
- Slope drains must be securely anchored to the slope and must be adequately sized to carry the capacity of the design storm and associated forces.
- Outlets must be stabilized with riprap, concrete or other type of energy dissipator, or directed into a stable sediment trap or basin. See EC-10, Velocity Dissipation Devices.
- Debris racks are recommended at the inlet. Debris racks located several feet upstream of the inlet can usually be larger than racks at the inlet, and thus provide enhanced debris protection and less plugging.
- Safety racks are also recommended at the inlet and outlet of pipes where children or animals could become entrapped.
- Secure inlet and surround with dikes to prevent gully erosion and anchor pipe to slope.
- When using slope drains, limit drainage area to 10 acres per pipe. For larger areas, use a rock lined channel or a series of pipes.

- Size to convey at least the peak flow of a 10-year storm. The design storm is conservative due to the potential impact of system failures.
- Maximum slope generally limited to 2:1 (H:V) as energy dissipation below steeper slopes is difficult.
- Direct surface runoff to slope drains with interceptor dikes. See BMP EC-9, Earth Dikes and Drainage Swales. Top of interceptor dikes should be 12 in. higher than the top of the slope drain.
- Slope drains can be placed on or buried underneath the slope surface.
- Recommended materials include both metal and plastic pipe, either corrugated or smooth wall. Concrete pipe can also be used.
- When installing slope drains:
  - Install slope drains perpendicular to slope contours.
  - Compact soil around and under entrance, outlet, and along length of pipe.
  - Securely anchor and stabilize pipe and appurtenances into soil.
  - Check to ensure that pipe connections are watertight.
  - Protect area around inlet with filter cloth. Protect outlet with riprap or other energy dissipation device. For high energy discharges, reinforce riprap with concrete or use reinforced concrete device.
  - Protect outlet of slope drains using a flared end section when outlet discharges to a flexible energy dissipation device.
  - A flared end section installed at the inlet will improve flow into the slope drain and prevent erosion at the pipe entrance. Use a flared end section with a 6 in. minimum toe plate to help prevent undercutting. The flared section should slope towards the pipe inlet.

Design and Layout

The capacity for temporary drains should be sufficient to convey at least the peak runoff from a 10-year rainfall event. The pipe size may be computed using the Rational Method or a method established by the local municipality. Higher flows must be safely stored or routed to prevent any offsite concentration of flow and any erosion of the slope. The design storm is purposely conservative due to the potential impacts associated with system failures.

As a guide, temporary pipe slope drains should not be sized smaller than shown in the following table:

Minimum Pipe Diameter (Inches)	Maximum Drainage Area (Acres)
12	1.0
18	3.0
21	5.0
24	7.0
30	10.0

Larger drainage areas can be treated if the area can be subdivided into areas of 10 acres or less and each area is treated as a separate drainage. Drainage areas exceeding 10 acres must be designed by a Registered Civil Engineer and approved by the agency that issued the grading permit.

Materials:

Soil type, rainfall patterns, construction schedule, local requirements, and available supply are some of the factors to be considered when selecting materials. The following types of slope drains are commonly used:

- **Rigid Pipe:** This type of slope drain is also known as a pipe drop. The pipe usually consists of corrugated metal pipe or rigid plastic pipe. The pipe is placed on undisturbed or compacted soil and secured onto the slope surface or buried in a trench. Concrete thrust blocks must be used when warranted by the calculated thrust forces. Collars should be properly installed and secured with metal strappings or watertight collars.

- **Flexible Pipe**: The flexible pipe slope drain consists of a flexible tube of heavy duty plastic, rubber, or composite material. The tube material is securely anchored onto the slope surface. The tube should be securely fastened to the metal inlet and outlet conduit sections with metal strappings or watertight collars.

- **Section Downdrains**: The section downdrain consists of pre-fabricated, section conduit of half round or third round material. The sectional downdrain performs similar to a flume or chute. The pipe must be placed on undisturbed or compacted soil and secured into the slope.

- **Concrete-lined Terrace Drain:** This is a concrete channel for draining water from a terrace on a slope to the next level. These drains are typically specified as permanent structures and if installed early, can serve as slope drains during construction, which should be designed according to local drainage design criteria.

Costs

- Cost varies based on pipe selection and selected outlet protection.

Corrugated Steel Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12"	$19.60 per LF
15"	$22.00
18"	$26.00
24"	$32.00
30"	$50.00
PVC Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12"	$24.50
14"	$49.00
16"	$51.00
18"	$54.00
20"	$66.00
24"	$93.00
30"	$130.00

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect outlet for erosion and downstream scour. If eroded, repair damage and install additional energy dissipation measures. If downstream scour is occurring, it may be necessary to reduce flows being discharged into the channel unless other preventative measures are implemented.
- Insert inlet for clogging or undercutting. Remove debris from inlet to maintain flows. Repair undercutting at inlet and if needed, install flared section or rip rap around the inlet to prevent further undercutting.
- Inspect pipes for leakage. Repair leaks and restore damaged slopes.
- Inspect slope drainage for accumulations of debris and sediment.
- Remove built up sediment from entrances and outlets as required. Flush drains if necessary; capture and settle out sediment from discharge.

- Make sure water is not ponding onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.).
- Pipe anchors must be checked to ensure that the pipe remains anchored to the slope. Install additional anchors if pipe movement is detected.

References

Draft – Sedimentation and Erosion Control, An Inventory of Current Practices, U.S.E.P.A., April 1990.

National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

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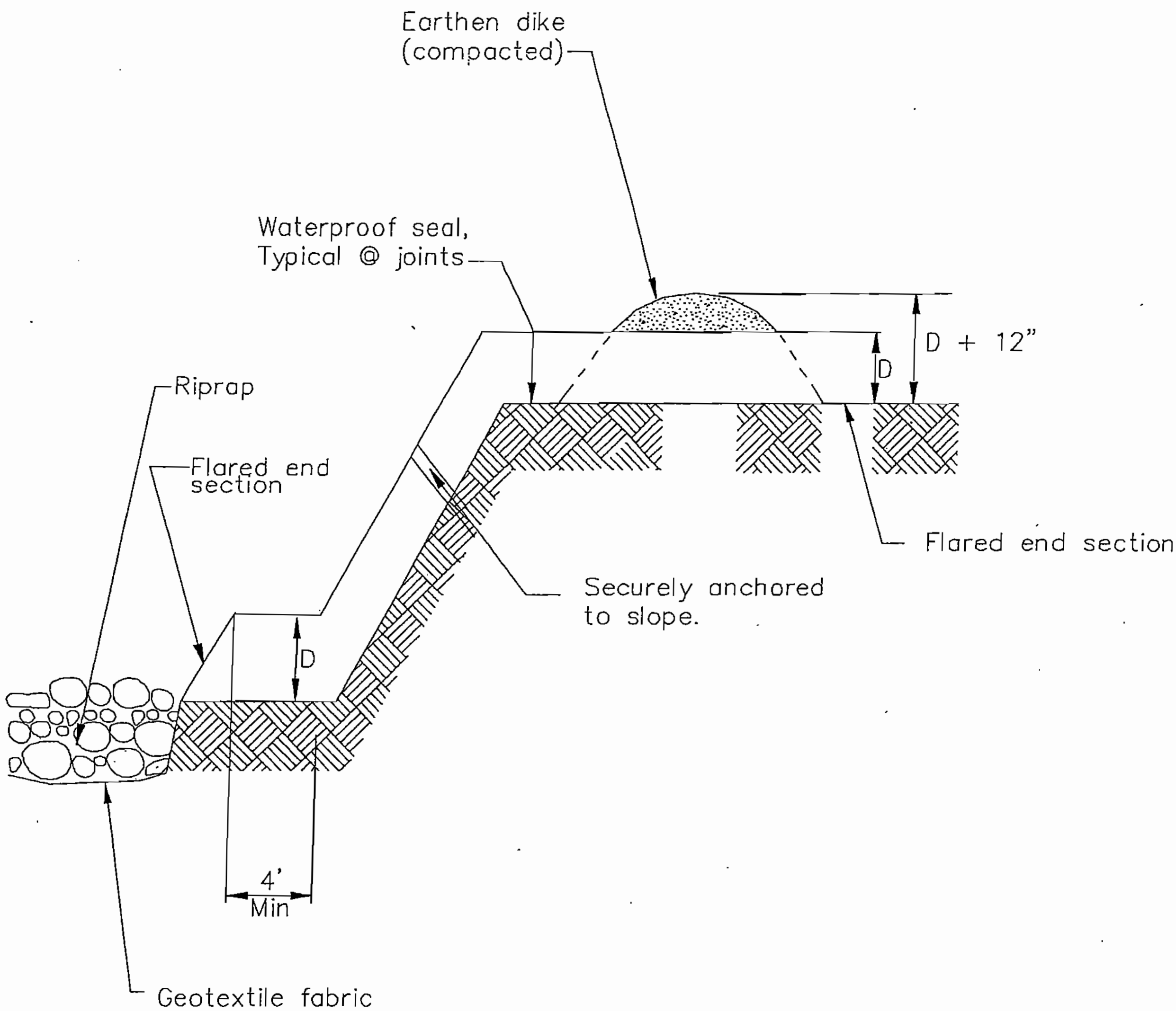
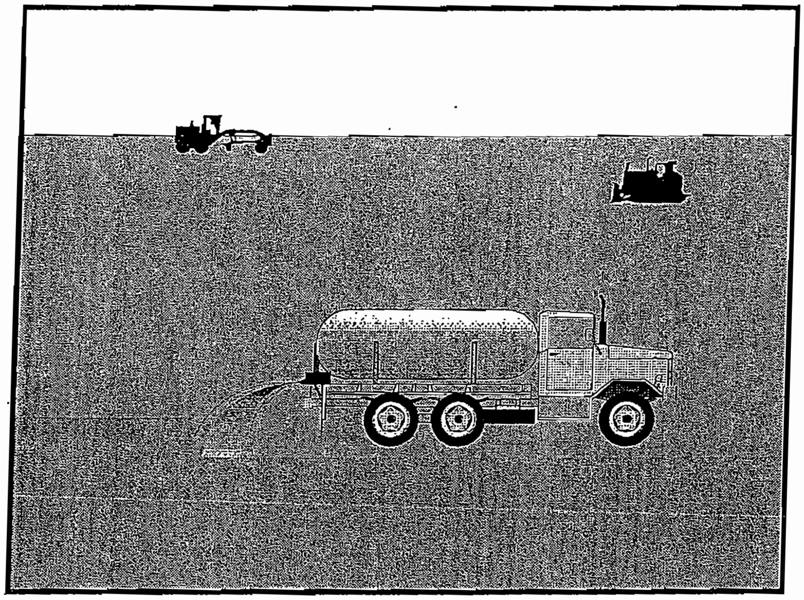


TYPICAL SLOPE DRAIN
NOT TO SCALE

Wind Erosion Control — WE-1



Objectives		
EC	Erosion Control	
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	✓
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
- ✓ **Primary Objective**
- ✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Wind erosion or dust control consists of applying water or other dust palliatives as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

Suitable Applications

Wind erosion control BMPs are suitable during the following construction activities:

- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Sediment tracking onto paved roads
- Soils and debris storage piles
- Batch drop from front-end loaders
- Areas with unstabilized soil
- Final grading/site stabilization

Limitations

- Watering prevents dust only for a short period and should be applied daily (or more often) to be effective.
- Over watering may cause erosion.

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- Oil or oil-treated subgrade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil.
- Effectiveness depends on soil, temperature, humidity, and wind velocity.
- Chemically treated sub grades may make the soil water repellant, interfering with long-term infiltration and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- Asphalt, as a mulch tack or chemical mulch, requires a 24-hour curing time to avoid adherence to equipment, worker shoes, etc. Application should be limited because asphalt surfacing may eventually migrate into the drainage system.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.

Implementation

General

California's Mediterranean climate, with short wet seasons and long hot dry seasons, allows the soils to thoroughly dry out. During these dry seasons, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment.

Dust control, as a BMP, is a practice that is already in place for many construction activities. Los Angeles, the North Coast, and Sacramento, among others, have enacted dust control ordinances for construction activities that cause dust to be transported beyond the construction project property line.

Recently, the State Air Resources Control Board has, under the authority of the Clean Air Act, started to address air quality in relation to inhalable particulate matter less than 10 microns (PM-10). Approximately 90 percent of these small particles are considered to be dust. Existing dust control regulations by local agencies, municipal departments, public works department, and public health departments are in place in some regions within California.

Many local agencies require dust control in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. The following are measures that local agencies may have already implemented as requirements for dust control from contractors:

- Construction and Grading Permits: Require provisions for dust control plans.
- Opacity Emission Limits: Enforce compliance with California air pollution control laws.
- Increase Overall Enforcement Activities: Priority given to cases involving citizen complaints.
- Maintain Field Application Records: Require records of dust control measures from contractor;
- Stormwater Pollution Prevention Plan: (SWPPP): Integrate dust control measures into SWPPP.

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table shows dust control practices that can be applied to site conditions that cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching can be employed for areas of occasional or no construction traffic. Preventive measures would include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph, and controlling the number and activity of vehicles on a site at any given time.

SITE CONDITION	DUST CONTROL PRACTICES								
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Silt Fences	Temporary Gravel Construction Entrances/Equipment Wash Down	Haul Truck Covers	Minimize Extent of Disturbed Area
Disturbed Areas not Subject to Traffic	X	X	X	X	X				X
Disturbed Areas Subject to Traffic			X	X	X		X		X
Material Stock Pile Stabilization			X	X		X			X
Demolition			X				X	X	
Clearing/ Excavation			X	X		X			X
Truck Traffic on Unpaved Roads			X	X	X		X	X	
Mud/Dirt Carry Out					X		X		

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (EC-1, Scheduling).
- Quickly stabilize exposed soils using vegetation, mulching, spray-on adhesives, calcium chloride, sprinkling, and stone/gravel layering.
- Identify and stabilize key access points prior to commencement of construction.
- Minimize the impact of dust by anticipating the direction of prevailing winds.
- Direct most construction traffic to stabilized roadways within the project site.
- Water should be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution.
- All distribution equipment should be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit should be available at all times to apply water or dust palliative to the project.

- If reclaimed waste water is used, the sources and discharge must meet California Department of Health Services water reclamation criteria and the Regional Water Quality Control Board requirements. Non-potable water should not be conveyed in tanks or drain pipes that will be used to convey potable water and there should be no connection between potable and non-potable supplies. Non-potable tanks, pipes, and other conveyances should be marked, "NON-POTABLE WATER - DO NOT DRINK."
- Materials applied as temporary soil stabilizers and soil binders also generally provide wind erosion control benefits.
- Pave or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for wet suppression or chemical stabilization of exposed soils.
- Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and vehicle wash down areas.
- Stabilize inactive construction sites using vegetation or chemical stabilization methods.
- Limit the amount of areas disturbed by clearing and earth moving operations by scheduling these activities in phases.

For chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. If chemical stabilization is used, the chemicals should not create any adverse effects on stormwater, plant life, or groundwater.

Costs

Installation costs for water and chemical dust suppression are low, but annual costs may be quite high since these measures are effective for only a few hours to a few days.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Check areas protected to ensure coverage.
- Most dust control measures require frequent, often daily, or multiple times per day attention.

References

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

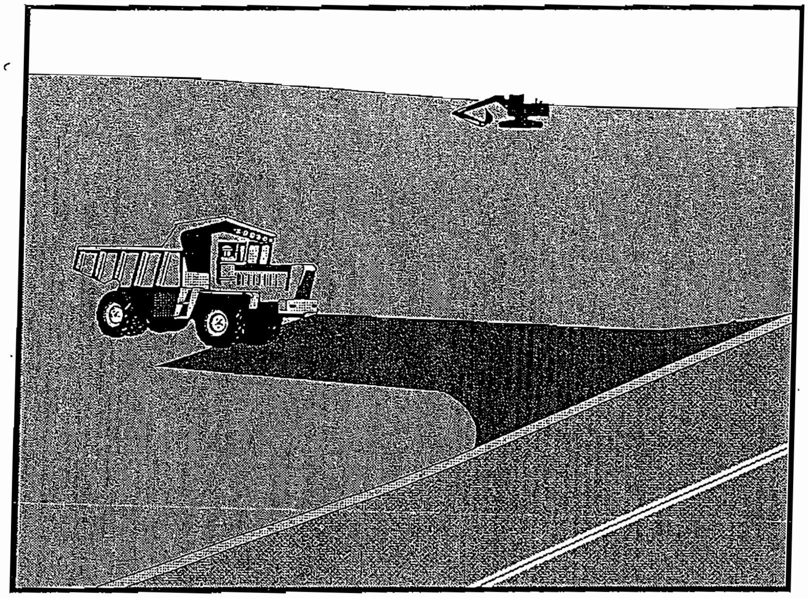
California Air Pollution Control Laws, California Air Resources Board, 1992.

Caltrans, Standard Specifications, Sections 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative".

Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stabilized Construction Entrance/Exit TC-1



Objectives

EC	Erosion Control	✓
SE	Sediment Control	✓
TC	Tracking Control	✓
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Suitable Applications

Use at construction sites:

- Where dirt or mud can be tracked onto public roads.
- Adjacent to water bodies.
- Where poor soils are encountered.
- Where dust is a problem during dry weather conditions.

Limitations

- Entrances and exits require periodic top dressing with additional stones.
- This BMP should be used in conjunction with street sweeping on adjacent public right of way.
- Entrances and exits should be constructed on level ground only.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water runoff.

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Stabilized Construction Entrance/Exit TC-1

Implementation

General

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. NPDES permits require that appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

Design and Layout

- Construct on level ground where possible.
- Select 3 to 6 in. diameter stones.
- Use minimum depth of stones of 12 in. or as recommended by soils engineer.
- Construct length of 50 ft minimum, and 30 ft minimum width.
- Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
- Provide ample turning radii as part of the entrance.
- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.
- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment trapping device before discharge.
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.
- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.

- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.
- Designate combination or single purpose entrances and exits to the construction site.
- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.
- Implement SE-7, Street Sweeping and Vacuuming, as needed.
- All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.
- Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.
- Keep all temporary roadway ditches clear.
- Check for damage and repair as needed.
- Replace gravel material when surface voids are visible.
- Remove all sediment deposited on paved roadways within 24 hours.
- Remove gravel and filter fabric at completion of construction

Costs

Average annual cost for installation and maintenance may vary from $1,200 to $4,800 each, averaging $2,400 per entrance. Costs will increase with addition of washing rack, and sediment trap. With wash rack, costs range from $1,200 - $6,000 each, averaging $3,600 per entrance.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, USEPA Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

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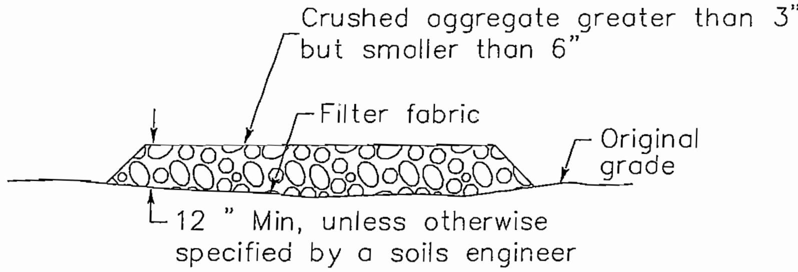
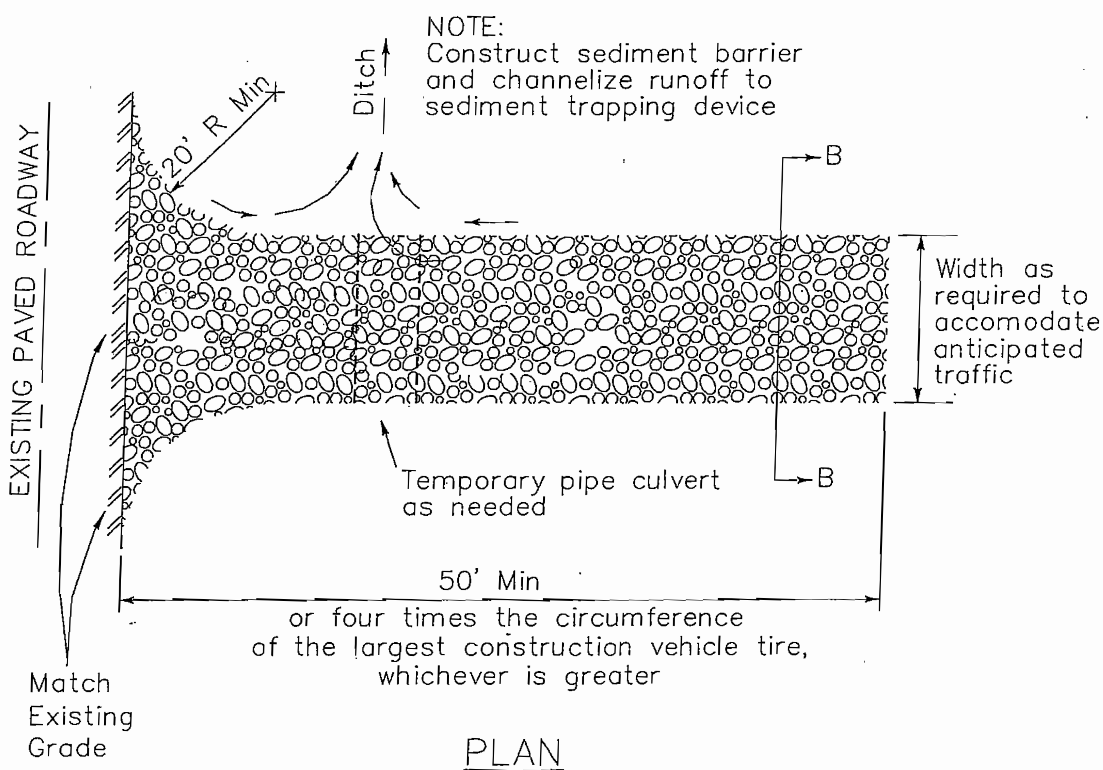
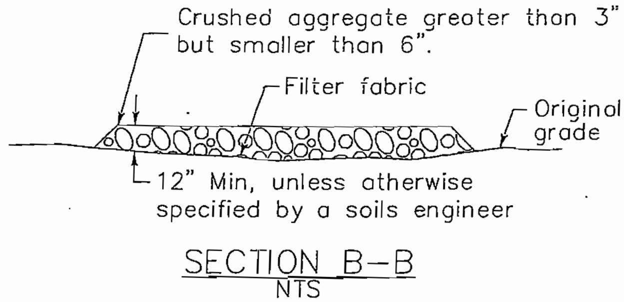


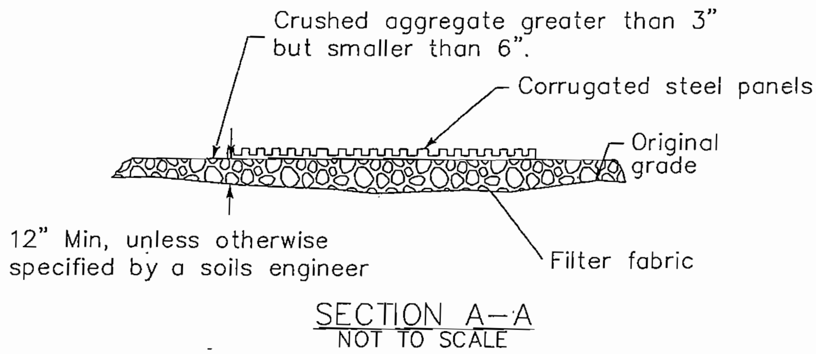
SECTION B–B
NTS



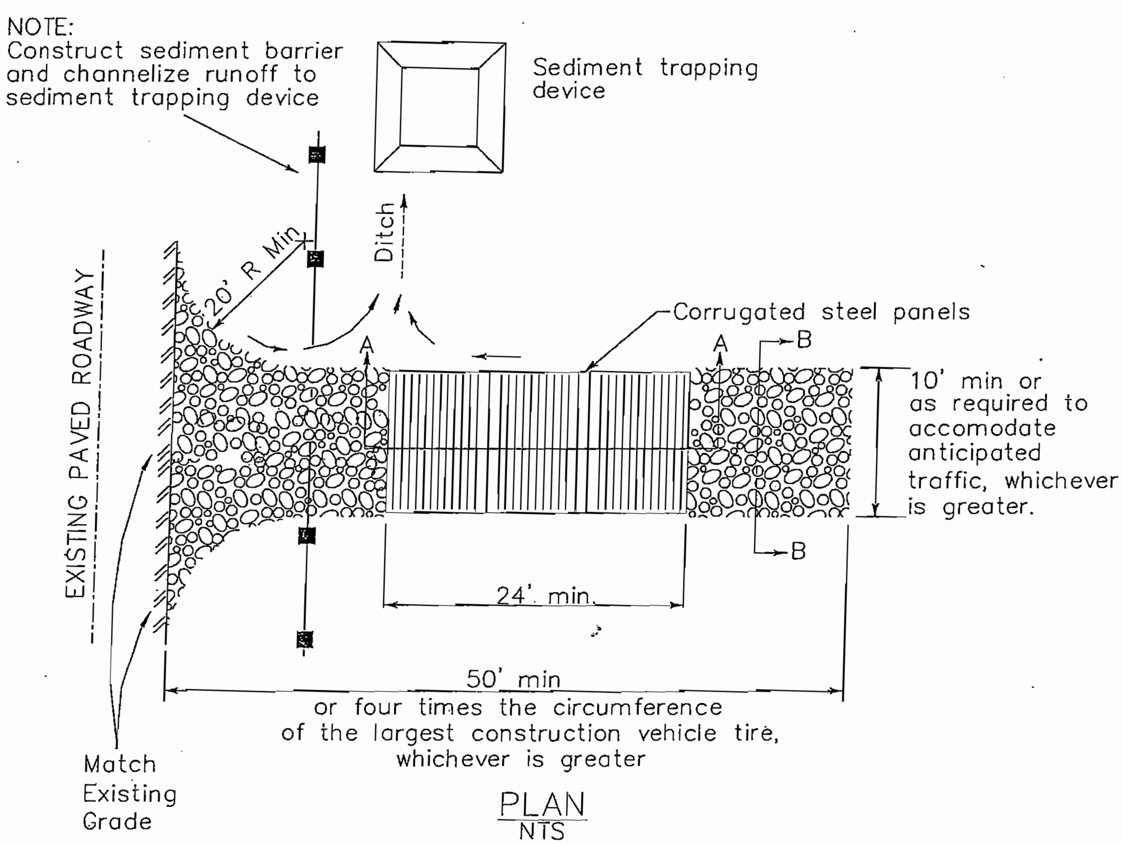
PLAN
NTS



Crushed aggregate greater than 3" but smaller than 6".
Filter fabric
Original grade
12" Min, unless otherwise specified by a soils engineer
SECTION B–B
NTS

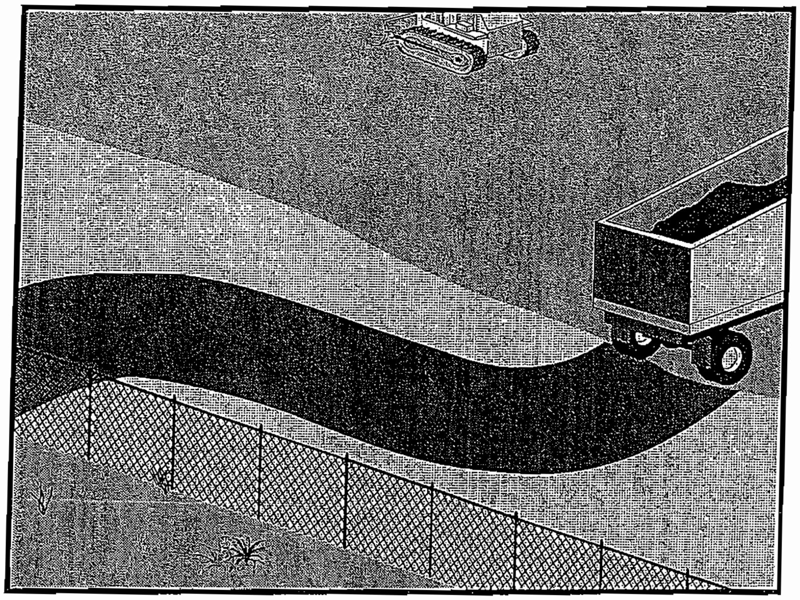


Crushed aggregate greater than 3" but smaller than 6".
Corrugated steel panels
Original grade
12" Min, unless otherwise specified by a soils engineer
Filter fabric
SECTION A–A
NOT TO SCALE



NOTE:
Construct sediment barrier and channelize runoff to sediment trapping device
Sediment trapping device
Ditch
20' R Min
EXISTING PAVED ROADWAY
Corrugated steel panels
A
A
B
B
10' min or as required to accomodate anticipated traffic, whichever is greater.
24' min.
50' min
or four times the circumference of the largest construction vehicle tire, whichever is greater
Match Existing Grade
PLAN
NTS

Stabilized Construction Roadway TC-2



Objectives

EC	Erosion Control	✓
SE	Sediment Control	✓
TC	Tracking Control	✓
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Access roads, subdivision roads, parking areas, and other onsite vehicle transportation routes should be stabilized immediately after grading, and frequently maintained to prevent erosion and control dust.

Suitable Applications

This BMP should be applied for the following conditions:

- Temporary Construction Traffic:
  - Phased construction projects and offsite road access
  - Construction during wet weather
- Construction roadways and detour roads:
  - Where mud tracking is a problem during wet weather
  - Where dust is a problem during dry weather
  - Adjacent to water bodies
  - Where poor soils are encountered

Limitations

- The roadway must be removed or paved when construction is complete.

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- Certain chemical stabilization methods may cause stormwater or soil pollution and should not be used. See WE-1, Wind Erosion Control.
- Management of construction traffic is subject to air quality control measures. Contact the local air quality management agency.
- Materials will likely need to be removed prior to final project grading and stabilization.
- Use of this BMP may not be applicable to very short duration projects.

Implementation

General

Areas that are graded for construction vehicle transport and parking purposes are especially susceptible to erosion and dust. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy quagmires that generate significant quantities of sediment that may pollute nearby streams or be transported offsite on the wheels of construction vehicles. Dirt roads can become so unstable during wet weather that they are virtually unusable.

Efficient construction road stabilization not only reduces onsite erosion but also can significantly speed onsite work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather

Installation/Application Criteria

Permanent roads and parking areas should be paved as soon as possible after grading. As an alternative where construction will be phased, the early application of gravel or chemical stabilization may solve potential erosion and stability problems. Temporary gravel roadway should be considered during the rainy season and on slopes greater than 5%.

Temporary roads should follow the contour of the natural terrain to the maximum extent possible. Slope should not exceed 15%. Roadways should be carefully graded to drain transversely. Provide drainage swales on each side of the roadway in the case of a crowned section or one side in the case of a super elevated section. Simple gravel berms without a trench can also be used.

Installed inlets should be protected to prevent sediment laden water from entering the storm sewer system (SE-10, Storm Drain Inlet Protection). In addition, the following criteria should be considered.

- Road should follow topographic contours to reduce erosion of the roadway.
- The roadway slope should not exceed 15%.
- Chemical stabilizers or water are usually required on gravel or dirt roads to prevent dust (WE-1, Wind Erosion Control).
- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support heaviest vehicles and equipment that will use it.

- Stabilize roadway using aggregate, asphalt concrete, or concrete based on longevity, required performance, and site conditions. The use of cold mix asphalt or asphalt concrete (AC) grindings for stabilized construction roadway is not allowed.
- Coordinate materials with those used for stabilized construction entrance/exit points.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, impact weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Keep all temporary roadway ditches clear.
- When no longer required, remove stabilized construction roadway and re-grade and repair slopes.
- Periodically apply additional aggregate on gravel roads.
- Active dirt construction roads are commonly watered three or more times per day during the dry season.

Costs

Gravel construction roads are moderately expensive, but cost is often balanced by reductions in construction delay. No additional costs for dust control on construction roads should be required above that needed to meet local air quality requirements.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

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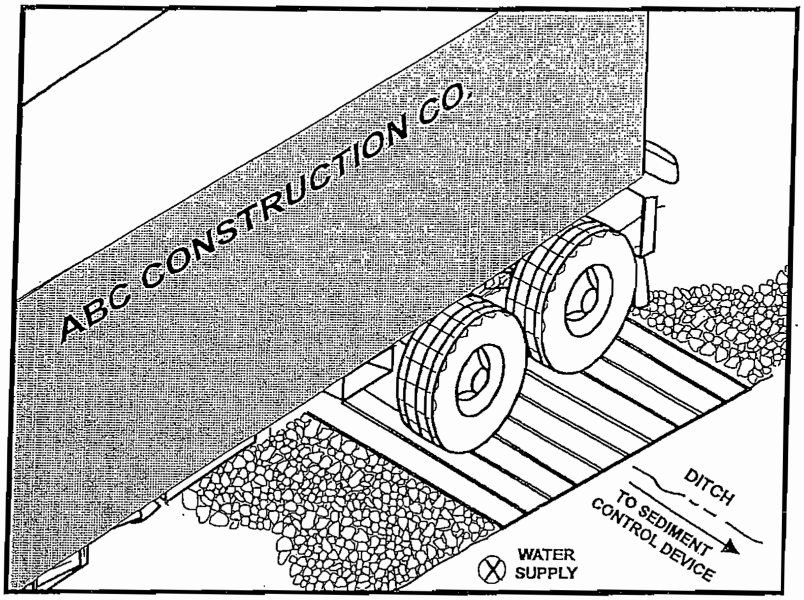

Objectives

EC	Erosion Control	
SE	Sediment Control	✓
TC	Tracking Control	✓
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

TC-1 Stabilized Construction Entrance/Exit

Description and Purpose

A tire wash is an area located at stabilized construction access points to remove sediment from tires and under carriages and to prevent sediment from being transported onto public roadways.

Suitable Applications

Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

Limitations

- The tire wash requires a supply of wash water.
- A turnout or doublewide exit is required to avoid having entering vehicles drive through the wash area.
- Do not use where wet tire trucks leaving the site leave the road dangerously slick.

Implementation

- Incorporate with a stabilized construction entrance/exit. See TC-1, Stabilized Construction Entrance/Exit.
- Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. but smaller than 6 in. A geotextile fabric should be placed below the aggregate.
- Wash rack should be designed and constructed/manufactured for anticipated traffic loads.

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- Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.
- Use hoses with automatic shutoff nozzles to prevent hoses from being left on.
- Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.
- Implement SC-7, Street Sweeping and Vacuuming, as needed.

Costs

Costs are low for installation of wash rack.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.
- Inspect routinely for damage and repair as needed.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

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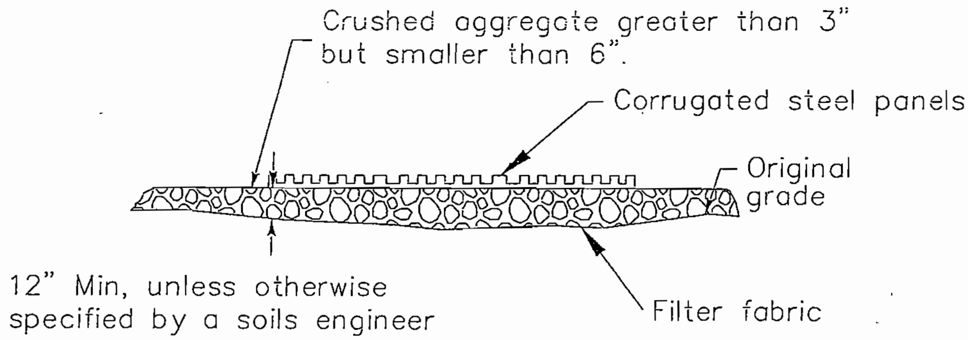
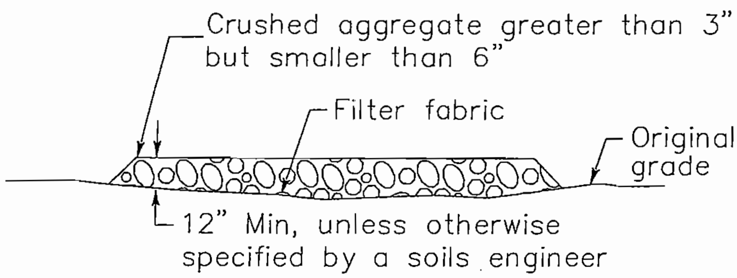
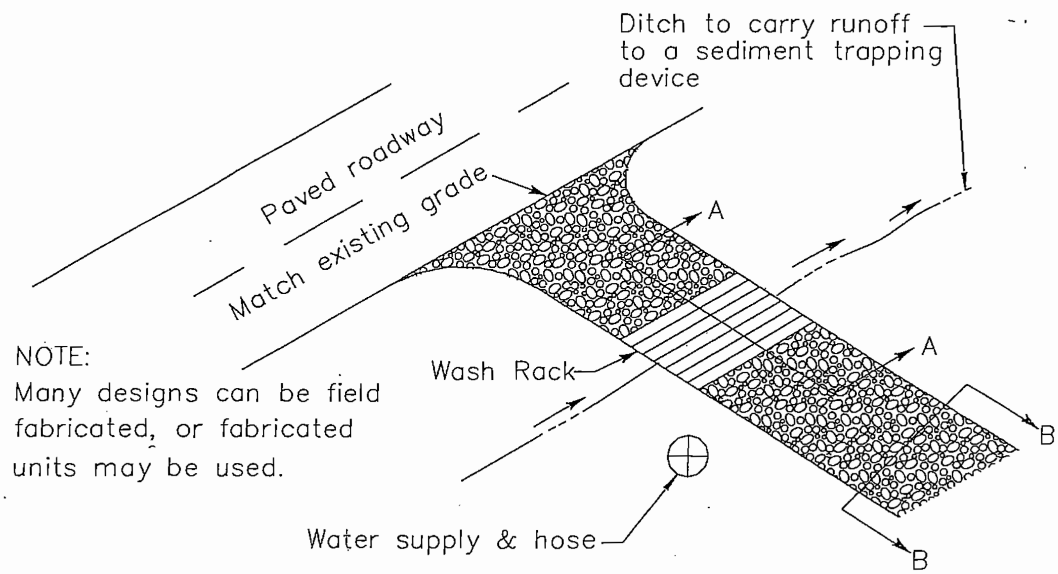


SECTION A–A
NOT TO SCALE



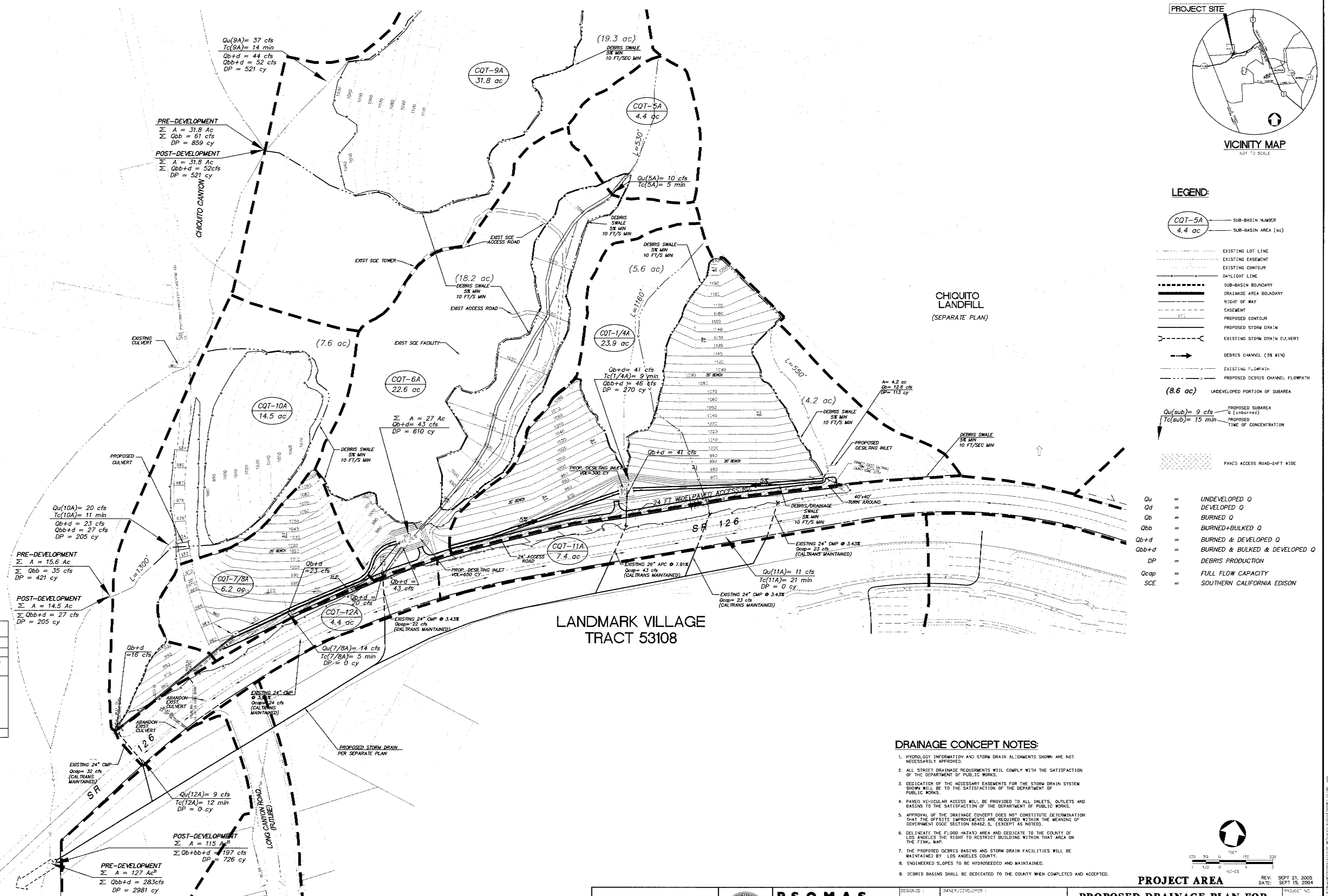
SECTION B–B
NTS



TYPICAL TIRE WASH
NOT TO SCALE

APPENDIX 7

HYDROLOGY EXHIBITS
CHIQUITO CANYON BORROW SITE



PROPOSED CHIQUITO PROJECT DRAINAGE

SUB-BASIN NUMBER	TIME OF CONCENTRATION (minutes)	INCREMENTAL SUB-BASINS / 50-YEAR STORM EVENT: SUB-BASIN AREA (acres)	Qu (cfs)	Qb+d (cfs)	Qbb+d (cfs)	DEBRIS PRODUCTION (cy)	PROP. DEBRIS BASIN CAP. (cy)	Qd[A] (cfs)
CQT-1/4A	9	23.9	37	41	46	270	300	41
CQT-5A	5	4.4	10	12	15	119		12
CQT-6A	15	22.6	25	31	39	491	650	31
CQT-7/8A	5	6.2	14	14	14	0		14
CQT-9A	14	31.8	37	44	52	521[C]		52
CQT-10A	11	14.5	20	23	27	205[C]		27
CQT-11A	21	7.4	11	11	11	0		11
CQT-12A	12	4.4	9	9	9	0		9
	Σ	115.2[B]	163	185	213	1607		197

K = Burn Factor from Appendix G-2, K=0.677*(1^-0.102)

Qb = A*I*(1-K)+K*Qu

Qbb = 1.27*Qb

DP = A*27 cy (DPA Zone 9)

NOTES:

A BURNED AND DEVELOPED FLOW FOR SUB-BASINS 1/4A, 5/6A, PLUS BURNED AND BULKED AND DEVELOPED FLOW FOR SUB-BASINS 9A, 10A, PLUS DEVELOPED FLOW FOR SUB-BASINS 7/8A, 11A, AND 12A

B DRAINAGE TRIBUTARY AREA IS LESS THAN IN EXISTING CONDITION BECAUSE THE AREA SOUTH OF SR-126 IS PART OF LANDMARK VILLAGE DEVELOPMENT TRACT 53108 IN THE PROPOSED CONDITION.

C AREAS CQT-9A AND CQT-10A DRAIN DIRECTLY TO CHIQUITO CANYON. EXISTING CONDITION IS MAINTAINED.

DRAINAGE CONCEPT NOTES:

1. HYDROLOGY INFORMATION AND STORM DRAIN ALIGNMENTS SHOWN ARE NOT NECESSARILY APPROVED.
2. ALL STREET DRAINAGE REQUIRMENTS WILL COMPLY WITH THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS.
3. DEDICATION OF THE NECESSARY EASEMENTS FOR THE STORM DRAIN SYSTEM SHOWN WILL BE TO THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS.
4. PAVED VEHICULAR ACCESS WILL BE PROVIDED TO ALL INLETS, OUTLETS AND BASINS TO THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS.
5. APPROVAL OF THE DRAINAGE CONCEPT DOES NOT CONSTITUTE DETERMINATION THAT THE OFFSITE IMPROVEMENTS ARE REQUIRED WITHIN THE MEANING OF GOVERNMENT CODE SECTION 66462.5, (EXCEPT AS NOTED).
6. DELINEATE THE FLOOD HAZARD AREA AND DEDICATE TO THE COUNTY OF LOS ANGELES THE RIGHT TO RESTRICT BUILDING WITHIN THAT AREA ON THE FINAL MAP.
7. THE PROPOSED DEBRIS BASINS AND STORM DRAIN FACILITIES WILL BE MAINTAINED BY LOS ANGELES COUNTY.
8. ENGINEERED SLOPES TO BE HYDROSEEDED AND MAINTAINED.
9. DEBRIS BASINS SHALL BE DEDICATED TO THE COUNTY WHEN COMPLETED AND ACCEPTED.

PROJECT AREA

REV: SEPT 21, 2005
DATE: SEPT 15, 2004

LEGAL DESCRIPTION:
PARCELS 14, 15, 16, 17 OF PARCEL MAP NO. 24500-01 PMB 293-34 / 67, RECORDS OF LOS ANGELES COUNTY.

REGISTERED PROFESSIONAL ENGINEER ROSS W. BARKER No. C-32799 Exp. 06/30/06 CIVIL STATE OF CALIFORNIA

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ROSS W. BARKER R.C.E. NO. C32799 DATE 9-22-2005

DESIGNED: JY/SW/EW
DRAFTED: AC/ML
CHECKED: MG/RB

OWNER/DEVELOPER:
NEWHALL RANCH
23823 WEST VALENCIA BOULEVARD
VALENCIA, CALIFORNIA 91355
TELEPHONE: (661) 255-4000
REPRESENTATIVE: MR. FRED MACMURDO

PROPOSED DRAINAGE PLAN FOR CONDITIONAL USE PERMIT (CUP) CHIQUITO CANYON BORROW SITE

IN THE UNINCORPORATED AREA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

PROJECT NO. 1NRC0107.08

SHEET 1 OF 2

RV067-01

EXISTING CHIQUITO PROJECT DRAINAGE						
		INCREMENTAL SUB-BASINS				
		50-YEAR STORM EVENT				
SUB-BASIN NUMBER	TIME OF CONCENTRATION (minutes)	SUB-BASIN AREA (acres)	Qu (cfs)	Qb (cfs)	Qbb (cfs)	DEBRIS PRODUCTION (cy)
CQT-1A	8	6.1	10	13	16	165
CQT-2A	6	3.6	7	9	11	97
CQT-3A	5	1.8	4	5	6	49
CQT-4A	10	12.3	17	22	28	332
CQT-5A	5	4.4	10	12	15	119
CQT-6A	15	24.9	27	36	46	672
CQT-7A	5	2.1	5	6	8	57
CQT-8A	5	2.8	6	7	10	76
CQT-9A	14	31.8	36	48	61	859
CQT-10A	11	15.6	21	27	35	421
CQT-11A	17	10.2	18	18	19	54
CQT-12A	10	11.7	26	26	28	81
TOTAL		127.3^A	187	223	283	2981

K = Burn Factor from Appendix G-2, K=0.677*(1^-0.102)

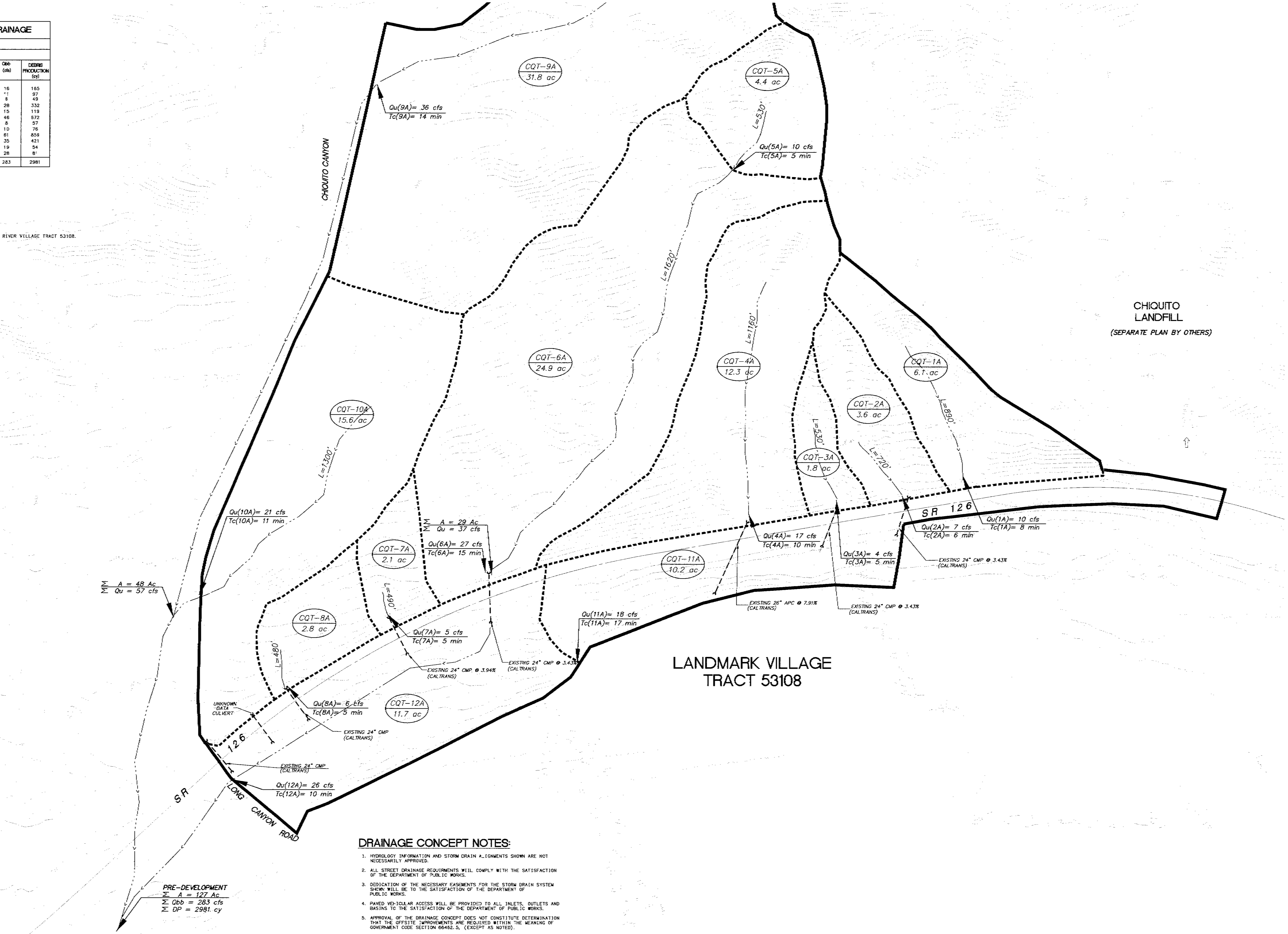
Qb = A*I*(1-K)+K*Qu

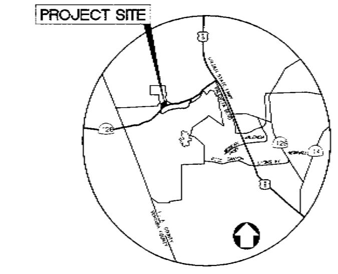
Qbb = 1.27*Qb

DP = A*27 cy (DPA Zone 9)

NOTES:

A DRAINAGE TRIBUTARY INCLUDES PORTION OF NEWHALL RANCH - RIVER VILLAGE TRACT 53108.





VICINITY MAP
NOT TO SCALE

LEGEND:

- CQT-5A — SUB-BASIN NUMBER
- 4.4 ac — SUB-BASIN AREA (ac)
- EXISTING LOT LINE
- EXISTING EASEMENT
- EXISTING CONTOUR
- DAYLIGHT LINE
- SUB-BASIN BOUNDARY
- DRAINAGE AREA BOUNDARY
- RIGHT OF WAY
- EASEMENT
- EXISTING STORM DRAIN CULVERT
- EXISTING FLOWPATH
- Qu(sub)= 9 cfs — EXISTING SUB-BASIN Q (unburned)
- Tc(sub)= 15 min — EXISTING TIME OF CONCENTRATION

QU = UNDEVELOPED Q
Qb = BURNED Q
Qbb = BURNED+BULKED Q
DP = DEBRIS PRODUCTION

DRAINAGE DESIGN CRITERIA:

1. 50-YEAR 24-HOUR ISOHYET: 5.8
2. SOIL TYPE: 020
3. DESIGN STORM: 50 YEAR RETURN PERIOD
4. PERCENT IMPERVIOUS VALUES: SINGLE FAMILY - 42%, MULTI-FAMILY - 68%, COMMERCIAL - 92%, SCHOOL - 82%, OPEN SPACE - 0%, PARK - 15%, ROADWAY - 100%
5. DPA= 09
6. BULK FACTOR= 1.27

DRAINAGE CONCEPT NOTES:

1. HYDROLOGY INFORMATION AND STORM DRAIN ALIGNMENTS SHOWN ARE NOT NECESSARILY APPROVED.
2. ALL STREET DRAINAGE REQUIRMENTS WILL COMPLY WITH THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS.
3. DEDICATION OF THE NECESSARY EASEMENTS FOR THE STORM DRAIN SYSTEM SHOWN WILL BE TO THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS.
4. PAVED VEHICULAR ACCESS WILL BE PROVIDED TO ALL INLETS, OUTLETS AND BASINS TO THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS.
5. APPROVAL OF THE DRAINAGE CONCEPT DOES NOT CONSTITUTE DETERMINATION THAT THE OFFSITE IMPROVEMENTS ARE REQUIRED WITHIN THE MEANING OF GOVERNMENT CODE SECTION 66462.5, (EXCEPT AS NOTED).
6. DELINEATE THE FLOOD HAZARD AREA AND DEDICATE TO THE COUNTY OF LOS ANGELES THE RIGHT TO RESTRICT BUILDING WITHIN THAT AREA ON THE FINAL MAP.
7. THE PROPOSED DEBRIS BASINS AND STORM DRAIN FACILITIES WILL BE MAINTAINED BY LOS ANGELES COUNTY.

FEET: 100 50 0 100 200
INCHES: 1/2 0 1 2

REV: SEPT 21, 2005
DATE: SEPT 15, 2004

LEGAL DESCRIPTION:
PARCELS 14, 15, 16, 17 OF PARCEL MAP NO. 24500-01
PMB 293-34 / 67, RECORDS OF LOS ANGELES COUNTY.

REGISTERED PROFESSIONAL ENGINEER — ROSS W. BARKER — No. C-32799 — Exp. 06/30/06 — CIVIL — STATE OF CALIFORNIA

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9-22-2005
ROSS W. BARKER R.C.E. NO. C32799 DATE

DESIGNED: JY/SW/EW
DRAFTED: AC/ML
CHECKED: MG/RB

OWNER/DEVELOPER:
NEWHALL RANCH
23823 WEST VALENCIA BOULEVARD
VALENCIA, CALIFORNIA 91355
TELEPHONE: (661) 255-4000
REPRESENTATIVE: MR. FRED MACMURDO

EXISTING DRAINAGE PLAN FOR CONDITIONAL USE PERMIT (CUP) CHIQUITO CANYON BORROW SITE

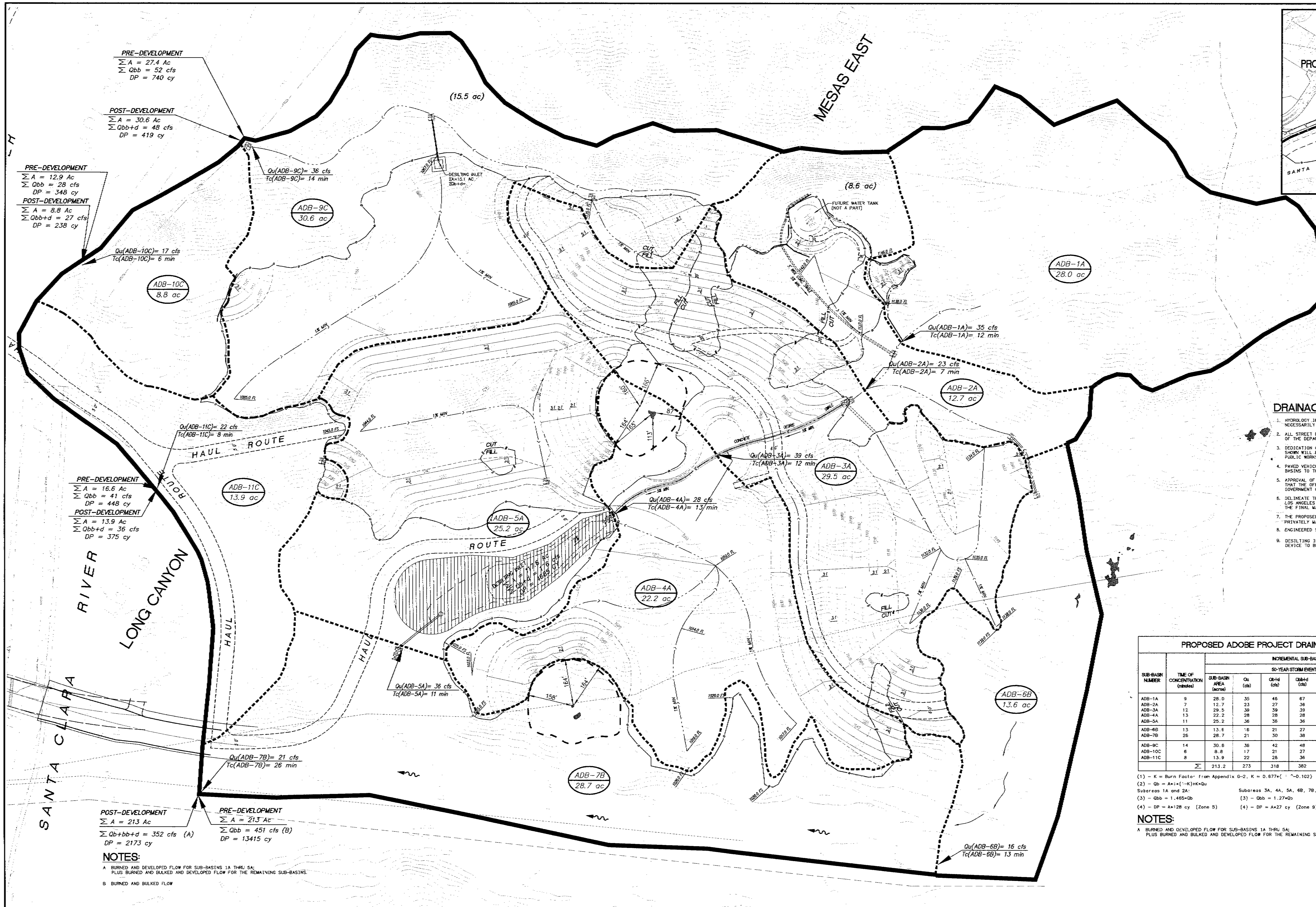
IN THE UNINCORPORATED AREA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

PROJECT NO. 1NRC0107.08
SHEET 2 OF 2

RV067-02

APPENDIX 8

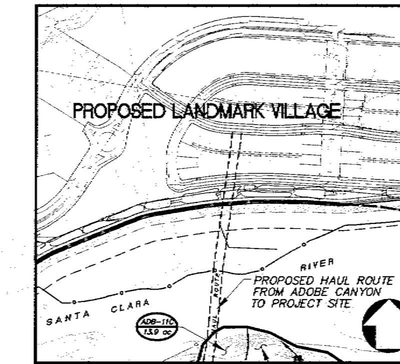
HYDROLOGY EXHIBITS
ADOBE CANYON BORROW SITE



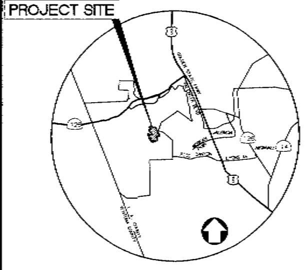
NOTES:

A BURNED AND DEVELOPED FLOW FOR SUB-BASINS 1A THRU 5A; PLUS BURNED AND BULKED AND DEVELOPED FLOW FOR THE REMAINING SUB-BASINS.

B BURNED AND BULKED FLOW



KEY MAP
SCALE: 1"=300'



VICINITY MAP
NOT TO SCALE

LEGEND:

- ADB-1A 28.0 ac — SUB-BASIN NUMBER / SUB-BASIN AREA (ac)
- EXISTING PROPERTY LINE
- EXISTING EASEMENT
- EXISTING CONTOUR
- DAYLIGHT LINE
- CUT & FILL
- FLOW LINE
- BENCH
- CONCRETE DEBRIS SWALE
- HAUL ROUTE ACCESS ROAD
- RIVER CORRIDOR-2003 (FORMERLY SEA 23)
- FEMA
- Q-CAP
- DEBRIS TRIBUTARY LIMIT
- SUB-BASIN BOUNDARY
- DRAINAGE AREA BOUNDARY
- RIGHT OF WAY
- EASEMENT
- PROPOSED CONTOUR
- DAYLIGHT LINE
- STORM DRAIN
- EXISTING CMP INLET
- FLOWPATH
- DEBRIS FLOWPATH
- DEBRIS BASIN
- SPINE FLOWER
- SPINE FLOWER PROTECTION BOUNDARY
- COAST LIVE OAK (Quercus agrifolia)
- VALLEY OAK (Quercus lobata)
- SCRUB OAK (Quercus berberidifolia)
- SOUTHERN CALIFORNIA BLACK WALNUT (Juglans californica)
- HOLLYLEAF CHERRY (Prunus ilicifolia)
- EXISTING TREE CANOPY
- (8.6 ac) UNDEVELOPED PORTION OF SUBAREA
- Qu(sub)= 9 cfs — PROPOSED SUBAREA Q(unburned)
- Tc(sub)= 15 min — PROPOSED TIME OF CONCENTRATION

Qu	=	UNDEVELOPED Q
Qd	=	DEVELOPED Q
Qb	=	BURNED Q
Qbb	=	BURNED+BULKED Q
Qb+d	=	BURNED & DEVELOPED Q
Qbb+d	=	BURNED & BULKED & DEVELOPED Q
DP	=	DEBRIS PRODUCTION

DRAINAGE CONCEPT NOTES:

1. HYDROLOGY INFORMATION AND STORM DRAIN ALIGNMENTS SHOWN ARE NOT NECESSARILY APPROVED.
2. ALL STREET DRAINAGE REQUIRMENTS WILL COMPLY WITH THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS.
3. DEDICATION OF THE NECESSARY EASEMENTS FOR THE STORM DRAIN SYSTEM SHOWN WILL BE TO THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS.
4. PAVED VEHICULAR ACCESS WILL BE PROVIDED TO ALL INLETS, OUTLETS, AND BASINS TO THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS.
5. APPROVAL OF THE DRAINAGE CONCEPT DOES NOT CONSTITUTE DETERMINATION THAT THE OFFSITE IMPROVEMENTS ARE REQUIRED WITHIN THE MEANING OF GOVERNMENT CODE SECTION 66462.5, (EXCEPT AS NOTED).
6. DELINEATE THE FLOOD HAZARD AREA AND DEDICATE TO THE COUNTY OF LOS ANGELES THE RIGHT TO RESTRICT BUILDING WITHIN THAT AREA ON THE FINAL MAP.
7. THE PROPOSED DEBRIS BASINS AND STORM DRAIN FACILITIES WILL BE PRIVATELY MAINTAINED.
8. ENGINEERED SLOPES TO BE HYDROSEEDED AND MAINTAINED.
9. DESILTING INLETS, CONC. SWALES AND OTHER DRAINAGE DEVICE TO BE PRIVATELY MAINTAINED

PROPOSED ADOBE PROJECT DRAINAGE

SUB-BASIN NUMBER	TIME OF CONCENTRATION (minutes)	INCREMENTAL SUB-BASINS — 50-YEAR STORM EVENT: SUB-BASIN AREA (acres)	Qu (cfs)	Qb+d (cfs)	Qbb+d (cfs)	DEBRIS PRODUCTION (cy)	PROP. DEBRIS BASIN CAP. (cy)	Qd[A] (cfs)
ADB-1A	9	28.0	35	46	67	3584		46
ADB-2A	7	12.7	23	27	36	1101		27
ADB-3A	12	29.5	39	39	39			39
ADB-4A	13	22.2	28	28	28			28
ADB-5A	11	25.2	36	36	36		4685	36
ADB-6B	13	13.6	16	21	27	367		27
ADB-7B	26	28.7	21	30	38	775		38
ADB-9C	14	30.6	36	42	48	419		48
ADB-10C	6	8.8	17	21	27	238		27
ADB-11C	8	13.9	22	28	36	375		36
	Σ	213.2	273	318	382	6858		352

(1) – K = Burn Factor from Appendix G-2, K = 0.677*(^-0.102)

(2) – Qb = A*I*(1-K)+K*Qu

Subareas 1A and 2A:
(3) – Qbb = 1.465*Qb
(4) – DP = A*128 cy (Zone 5)

Subareas 3A, 4A, 5A, 6B, 7B, 9C, 10C and 11C:
(3) – Qbb = 1.27*Qb
(4) – DP = A*27 cy (Zone 9)

NOTES:

A BURNED AND DEVELOPED FLOW FOR SUB-BASINS 1A THRU 5A; PLUS BURNED AND BULKED AND DEVELOPED FLOW FOR THE REMAINING SUB-BASINS.

FEET 100 50 0 100 200
INCHES 1 1/2 0 1 2

REV: SEPT 21, 2005
DATE: SEPT 15, 2004

NEWHALL RANCH

LEGAL DESCRIPTION:
PARCELS 14, 15, 16, 17 OF PARCEL MAP NO. 24500-01 PMB 293-34 / 67, RECORDS OF LOS ANGELES COUNTY.

REGISTERED PROFESSIONAL ENGINEER — ROSS W. BARKER — No. C-32799 — Exp. 06/30/06 — CIVIL — STATE OF CALIFORNIA

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9-22-2005
ROSS W. BARKER R.C.E. NO. C32799 DATE

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DRAFTED: AC/ML
CHECKED: MG/RB

OWNER/DEVELOPER:
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23823 WEST VALENCIA BOULEVARD
VALENCIA, CALIFORNIA 91355
TELEPHONE: (661) 255-4000
REPRESENTATIVE: MR. FRED MACMURDO

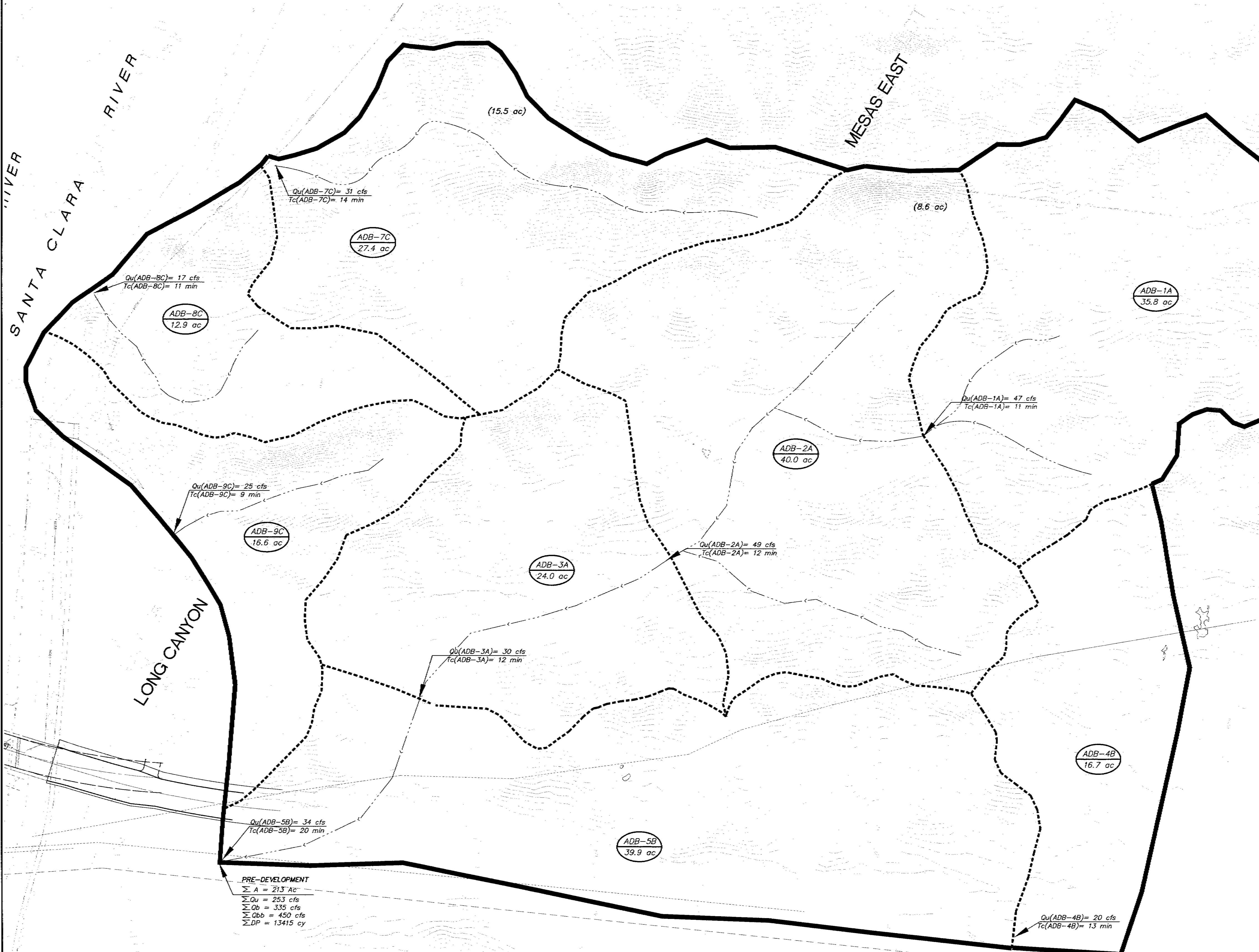
DRAINAGE CONCEPT PLAN FOR CONDITIONAL USE PERMIT (CUP) ADOBE CANYON BORROW SITE

IN THE UNINCORPORATED AREA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

PROJECT NO. 1NRO0107.05

SHEET 1 OF 2

RV068-01



DRAINAGE CONCEPT NOTES:

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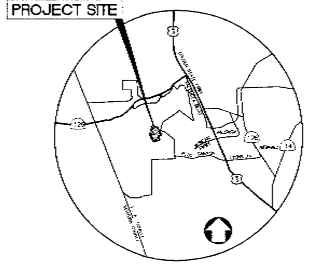
PROJECT SITE



VICINITY MAP

NOT TO SCALE

LEGEND:

- ADB-1A — SUB-BASIN NUMBER
- 35.8 ac — SUB-BASIN AREA (ac)
- SUB-BASIN BOUNDARY
- DRAINAGE AREA BOUNDARY
- RIGHT OF WAY
- EASEMENT
- PROPOSED CONTOUR
- DAYLIGHT LINE
- STORM DRAIN
- EXISTING CMP INLET
- FLOWPATH
- DEBRIS FLOWPATH
- RIVER CORRIDOR-2003 (FORMERLY SEA 23)
- FEMA
- Q-CAP
- DEBRIS TRIBUTARY LIMIT
- SPINE FLOWER
- COAST LIVE OAK (Quercus agrifolia)
- VALLEY OAK (Quercus lobata)
- SCRUB OAK (Quercus berberidifolia)
- SOUTHERN CALIFORNIA BLACK WALNUT (Juglans californic)
- HOLLYLEAF CHERRY (Prunus ilicifolia)
- EXISTING TREE CANOPY
- Qu(sub)= 9 cfs — EXISTING SUB-BASIN Q(unburned)
- Tc(sub)= 15 min — EXISTING TIME OF CONCENTRATION

QU = UNDEVELOPED Q
Qb = BURNED Q
Qbb = BURNED+BULKED Q
DP = DEBRIS PRODUCTION

EXISTING ADOBE PROJECT DRAINAGE

SUB-BASIN NUMBER	TIME OF CONCENTRATION (minutes)	50-YEAR STORM EVENT INCREMENTAL SUB-BASINS: SUB-BASIN AREA (acres)	Qu (cfs)	Qb (cfs)	Qbb (cfs)	DP (cy)	DEBRIS BASIN (cy)
ADB-1A	11	35.8	47	62	90	4582	
ADB-2A	12	40.0	49	65	95	5120	
ADB-3A	12	24.0	30	39	50	648	
ADB-4B	13	16.7	20	26	33	451	
ADB-5B	20	39.9	34	48	61	1077	
ADB-7C	14	27.4	31	41	52	740	
ADB-8C	11	12.9	17	22	28	348	
ADB-9C	9	16.6	25	32	41	448	
TOTAL		213.3	253	335	450^A	13415	

K = Burn Factor from Appendix G-2, K=0.677*(1^-0.102)
Qb = A*I*(1-K)+K*Qu

Subareas 1A and 2A:
Qbb = 1.465*Qb
DP = A*128 cy (DPA Zone 5)

Subareas 3A, 4B, 5B, 7C, 8C, 9C:
Qbb = 1.27*Qb
DP = A*27 cy (DPA Zone 9)

NOTES:

A BURNED AND BULKED FLOW

FEET 100 50 0 100 200
INCHES 1 1/2 0 1 2

NEWHALL RANCH.

PROJECT AREA

REV: SEPT 21, 2005
DATE: SEPT 15, 2004

LEGAL DESCRIPTION:
PARCELS 14, 15, 16, 17 OF PARCEL MAP NO. 24500-01 PMB 293-34 / 67, RECORDS OF LOS ANGELES COUNTY.

REGISTERED PROFESSIONAL ENGINEER ROSS W. BARKER No. C-32799 Exp. 06/30/06 CIVIL STATE OF CALIFORNIA

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9-22-2005
ROSS W. BARKER R.C.E. NO. C32799 DATE

DESIGNED : JY/SW/EW
DRAFTED : AC/ML
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OWNER/DEVELOPER :
NEWHALL RANCH.
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VALENCIA, CALIFORNIA 91355
TELEPHONE: (661) 255-4000
REPRESENTATIVE : MR. FRED MACMURDO

EXISTING DRAINAGE PLAN FOR CONDITIONAL USE PERMIT (CUP) ADOBE CANYON BORROW SITE

IN THE UNINCORPORATED AREA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA

PROJECT NO. NRC0107.06
SHEET 2 OF 2

RV068-02

Off-Site Chiquito Landfill Drainage Concept
Dated September 21, 2005

PSOMAS

FILE COPY

OFF-SITE CHIQUITO LANDFILL DRAINAGE CONCEPT

Psomas Project No: 1NRC010708

September 21, 2005

Prepared for:

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Valencia, CA 91355-2194
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Prepared by:

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No. C 32799
Exp. 6-30-2006
CIVIL
STATE OF CALIFORNIA

9-22-2005

Ross W. Barker, P.E.	R.C.E. No. C32799	Exp. Date 06-30-06

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Purpose and Scope

Hydrology **2**

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Data Sources
Watershed Characteristics
Existing Condition Results

Standard Urban Stormwater Mitigation Plan (SUSMP) **3**

Limitations **5**

References **6**

APPENDICES

A. **Existing Condition TC Calculations**

B. **Existing Condition LACDPW MORA Calculations (Clear)**

C. **Existing Condition LACDPW MORA Calculations (burned)**

D. **Hydrology/Sedimentation (LAC) Manual P-2 and P-5**

E. **Hydrologic/drainage map**

1.0 Introduction

Project Background

Psomas has been retained by the Newhall Land Co. to prepare a drainage concept report for the landfill area associated with the Tentative Tract Map No. 53108 for the proposed Landmark Village development. The landfill area is under a Conditional Use Permit (CUP), not part of the tentative tract map itself. The Chiquito landfill site is located north of Landmark Village, just north of SR 126.

Purpose and Scope

The project falls under the jurisdiction of the Los Angeles County Department of Public Works (LACDPW). The purpose of this drainage concept report is:

- To meet Los Angeles County Land Development requirements in support of the tentative tract map submittal, allowing final design and construction to proceed in a timely manner;
- To determine the runoff for existing hydrologic conditions;
- To provide sufficient detailed information to support debris basin facilities,

It should be noted that detailed storm drain and debris basin analyses is beyond the scope of this drainage concept.

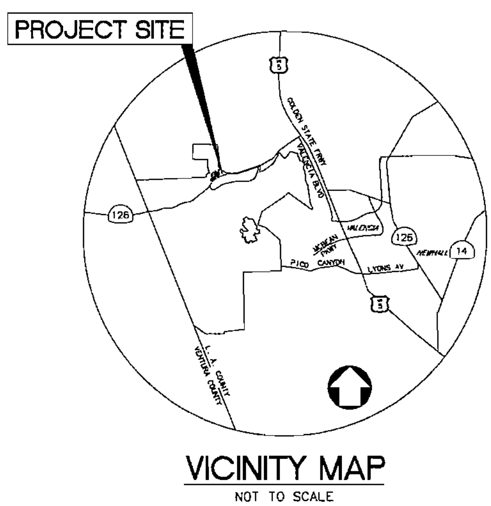

Figure 1. Location Map

2.0 Hydrology

General Approach

The watershed for the landfill area was divided into several sub-basins that were identified and characterized for existing conditions. Computer modeling was used to estimate the runoff for the 50-year storm events. The sub-basins drain southwesterly on site, ultimately tributary to the Santa Clara River. The analysis considered with the additional bulking factors where appropriate to size sediment/debris facilities.

Data Sources

The primary sources of data were the *LACDPW Hydrology/ Sedimentation Manual and Appendices* (LACDPW 1991, 1992, 1993, 2002) and the Los Angeles County *Standard Urban Stormwater Mitigation Plan* (March 2000). Other key sources included the *TC (v1.0),* and *MORA (v7.2)* manuals and the Newhall Ranch Specific Plan Master Hydrology and Drainage Concept, Sikand, December 1999 (appended for reference).

Watershed Characteristics

The Chiquito landfill site is bounded by SR 126 on the south, Chiquito borrow site on the west, and the existing Post Office site and Parcel Map 18108 on the east. The total drainage area for the site encompasses approximately 349 acres and flows predominantly south toward SR 126. The majority of the area is undeveloped land with steep to moderate slopes.

The soil of the landfill site is classified by Los Angeles County to be Type 020. The drainage area of the site is associated with Debris Potential Area (DPA) number 05. The peak bulking factor curves and peak debris production rates used in the analysis are included in Appendix D (LACDPW P2 & P5).

The Chiquito Landfill site is located in Los Angeles County's Rainfall Isohyets 5.8.

The *LACDPW TC (TC_calc_depth.xls, June2002)* program was used to calculate the time of concentration for each sub area. The *LACDPW MORA (v7.2)* computer program was used for the *Modified Rational Method* calculations and calculation of peak runoff rates and hydrographs. The TC calculations and MORA program output for clear and burned flow condition are provided in Appendix 1, 2 and 3, respectively. In accordance with LACDPW requirements, the 50-year burned; bulked storm event was used as the main design storm in the analysis.

Existing Condition Results

Existing condition hydrology results for the Capital Flood storm event are summarized in Tables 1 and 2 below.

Table 1
Existing Condition Hydrology Summary – Chiquito Landfill Site

EXISTING CONDITION						
INCREMENTAL SUB-BASINS						
Sub-Basin Number	**Time of Concentration (Tc)**	**Sub-Basin Area (acres)**	**Q50 Unburned (cfs)**	**Q50 Burned (cfs)**	**Q50 Burned Bulked (cfs)**	**Debris Volume (Yd^3)**
1A	11	18.5	25	33	-	-
2A	9	21.6	35	42	-	-
3A	16	37.7	38	54	-	-
4A	16	33.2	34	47	-	-
5A	10	30.9	38	53	-	-
10A	13	13.1	18	21	-	-
12A	16	32.7	34	47	-	-
6B	10	14.8	21	28	-	-
7B	10	9.5	14	18	-	-
13B	12	18.7	23	31	-	-
14B	14	20.9	24	32	-	-
15B	17	28.0	28	40	-	-
18C	14	23.1	28	35	-	-
19C	16	30.4	31	43	-	-
25C	9	10.3	20	40	-	-
TOTAL	---	349.4	328	470	645*	23,100**

** Bulking factor is taken form Hydrology/Sedimentation Appendix P-5*
*** Debris production rate is taken from P-2*

Table 2
Land Use Impervious Values

Land Use	**Percent Imperviousness**
Open Space/Natural Landfill	0%

3.0 Standard Urban Stormwater Mitigation Plan (SUSMP)

Instead of volume- or flow-based Treatment Control BMPs, the Los Angeles County Standard Urban Stormwater Mitigation Plan (SUSMP) requirements will be met by Erosion and Sediment Control BMPs, which decrease the potential of slopes and channels to erode and impact stormwater runoff. Los Angeles County SUSMP guidelines specify BMPs such as the following:

- Conveying runoff safely from the tops of slopes and stabilizing disturbed slopes
- Utilizing natural drainage systems to the maximum extent practicable (MEP)
- Stabilizing permanent channel crossings
- Vegetating slopes with native or drought tolerant vegetation
- Installing energy dissipators, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion

Final selection and detailed design of these BMPs is beyond the scope of this report. However, the report and exhibits show that erosion and sediment control SUSMP requirements can be met.

4.0 Limitations

This report was prepared to comply with the guidelines established by the County of Los Angeles and their representatives. Evaluation of the appropriateness of these guidelines and the accuracy of the County data were beyond the scope of this work.

Usage of the report is limited to address the purpose and scope previously defined by the project owner, Newhall Land. Psomas shall not be held responsible for any unauthorized application of this report and the contents herein.

The opinions represented in this report have been derived in accordance with current standards of civil engineering practice. No other warranty is expressed or implied.

5.0 References

Los Angeles County Department of Public Works, *LACDPW Hydrology/ Sedimentation Manual and Appendices* (1991, 1992, 1993, 2002)

Los Angeles County Department of Public Works, *LACDPW TC v1.0 Manual, TC_calc_depth.xls* (December 1991, June 2002)

Los Angeles County Department of Public Works, *LACDPW Modified Rational Method, MORA (MORA) v7.2 Manual* (September 2002)

Newhall Ranch, Newhall Ranch Specific Plan Master Hydrology and Drainage Concept (Sikand, December 1999)

APPENDICES

APPENDIX A

TC CALCULATIONS: EXISTING CONDITION

Project	Subarea	Area (acres	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.	Tc-calculat	Intensity (in	Cu	Cd	Flowrate (cfs)	Tc Equation
Landfill	1A	18.5	0	50	20	1340	0.231	5.8	11	2.39	0.55	0.55	24	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	2A	21.6	0	50	20	1060	0.193	5.8	9	2.63	0.57	0.57	32	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	3A	37.7	0	50	20	2000	0.11	5.8	16	2	0.52	0.52	39	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	4A	33.2	0	50	20	2000	0.115	5.8	16	2	0.52	0.52	35	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	5A	35.9	0	50	20	1900	0.15	5.8	15	2.06	0.52	0.52	38	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	10A	13.1	0	50	20	1560	0.141	5.8	13	2.21	0.53	0.53	15	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	12A	32.7	0	50	20	1920	0.095	5.8	16	2	0.52	0.52	34	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	6B	14.8	0	50	20	1770	0.093	5.8	15	2.06	0.52	0.52	16	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	7B	9.5	0	50	20	940	0.112	5.8	10	2.5	0.56	0.56	13	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	13B	18.7	0	50	20	1190	0.077	5.8	12	2.29	0.54	0.54	23	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	14B	20.9	0	50	20	1130	0.027	5.8	14	2.13	0.53	0.53	24	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	15B	29	0	50	20	1940	0.075	5.8	17	1.95	0.51	0.51	29	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	18C	23.1	0	50	20	2000	0.255	5.8	14	2.13	0.53	0.53	26	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	19C	30.4	0	50	20	1990	0.131	5.8	16	2	0.52	0.52	32	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
Landfill	26C	10.3	0	50	20	1100	0.223	5.8	9	2.63	0.57	0.57	15	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

APPENDIX B

LACDPW MORA CALCULATIONS: EXISTING CONDITION CLEAR

Program Package Serial Number: 2033

07/18/05 FILE: lndfil INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units PAGE 1

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

CHIQUITO LANDFILL HYDROLOGY - EXISTING Condition STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	1A	18.5	25.	18.5	25.	2	1060.	.19300	.00	.00	0.	20	11	A29	.00
300	2A	21.6	33.	40.1	56.	2	900.	.05000	.00	.00	0.	20	9	A29	.00
300	3A	37.7	39.	77.8	92.	2	440.	.06800	.00	.00	0.	20	16	A29	.00
300	4A	33.2	34.	111.0	125.	0	0.	.00000	.00	.00	0.	20	16	A29	.00
300	5A	35.9	39.	146.9	162.	0	0.	.00000	.00	.00	0.	20	15	A29	.00
300	6B	14.8	21.	14.8	21.	2	940.	.11200	.00	.00	0.	20	10	A29	.00
300	7B	9.5	14.	24.3	33.	0	0.	.00000	.00	.00	0.	20	10	A29	.00

CONFLUENCE Q'S

300 8A TA 1158 QA 162. QAB 194. QB 32. 300 8B TB 1156 QB 33. QBA 192. QA 159.

300 8AB TAB 1157 QAB 195. QA 162. QB 33.

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	8AB	24.3	33.	171.2	195.	0	0.	.00000	.00	.00	0.	20	0	A29	.00
300	9A	.0	0.	171.2	195.	2	1240.	.03600	.00	.00	0.	20	99	A29	.00
300	10A	13.1	16.	184.3	205.	2	1470.	.00800	.00	.00	0.	20	13	A29	.00
300	11A	.0	0.	184.3	184.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	12A	32.7	34.	217.0	205.	0	0.	.00000	.00	.00	0.	20	16	A29	.00
300	13B	18.7	23.	18.7	23.	2	1130.	.02700	.00	.00	0.	20	12	A29	.00
300	14B	20.9	24.	39.6	43.	2	1940.	.07500	.00	.00	0.	20	14	A29	.00
300	15B	29.0	29.	68.6	66.	2	860.	.07200	.00	.00	0.	20	17	A29	.00
300	16B	.0	0.	68.6	65.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	17B	.0	0.	68.6	65.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	18C	23.1	26.	23.1	26.	2	1480.	.12200	.00	.00	0.	20	14	A29	.00
300	19C	30.4	31.	53.5	56.	0	0.	.00000	.00	.00	0.	20	16	A29	.00

CONFLUENCE Q'S

300 20B TB 1164 QB 65. QBC 112. QC 46. 300 20C TC 1158 QC 56. QCB 110. QB 55.

300 20BC TBC 1161 QBC 116. QB 63. QC 53.

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	20BC	53.5	56.	122.1	116.	0	0.	.00000	.00	.00	0.	20	0	A29	.00
300	21B	.0	0.	122.1	116.	2	570.	.00400	.00	.00	0.	20	99	A29	.00
300	22B	.0	0.	122.1	113.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	23B	.0	0.	122.1	113.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	24B	.0	0.	122.1	113.	0	0.	.00000	.00	.00	0.	20	99	A29	.00

CONFLUENCE Q'S

300 25A TA 1165 QA 205. QAB 318. QB 113. 300 25B TB 1165 QB 113. QBA 318. QA 205.

300 25AB TAB 1165 QAB 318. QA 205. QB 113.

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	25AB	122.1	113.	339.1	318.	0	0.	.00000	.00	.00	0.	20	0	A29	.00

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

CHIQUITO LANDFILL HYDROLOGY - EXISTING Condition STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	26C	10.3	16.	10.3	16.	2	1080.	.01600	.00	.00	0.	20	9	A29	.00
300	27A	.0	0.	339.1	318.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	28A	.0	0.	339.1	318.	0	0.	.00000	.00	.00	0.	20	99	A29	.00
300	29A	.0	0.	339.1	318.	0	0.	.00000	.00	.00	0.	20	99	A29	.00

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*********************************************************************************************************************************
*                                                 CONFLUENCE Q'S                                                                *
*   300    30A  TA 1165 QA      318. QAC      328. QC       10.      300    30C  TC 1161 QC       13. QCA      285. QA     272.   *
*                             300    30AC TAC 1165 QAC      328. QA      318. QC      10.                                       *
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LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	30AC	10.3	13.	349.4	328.	0	0.	.00000	.00	.00	0.	20	0	A29	.00
300	31A	.0	0.	349.4	328.	0	0.	.00000	.00	.00	0.	20	99	A29	.00

APPENDIX C

LACDPW MORA CALCULATIONS: BURNED CONDITION

Program Package Serial Number: 2033

07/18/05 FILE: lndflB INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units PAGE 1

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

CHIQUITO LANDFILL HYDROLOGY - EXISTING Condition STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	1A	18.5	33.	18.5	33.	2	1060.	.19300	.00	.00	0.	220	11	A29	.00
300	2A	21.6	42.	40.1	73.	2	900.	.05000	.00	.00	0.	220	9	A29	.00
300	3A	37.7	54.	77.8	125.	2	440.	.06800	.00	.00	0.	220	16	A29	.00
300	4A	33.2	47.	111.0	170.	0	0.	.00000	.00	.00	0.	220	16	A29	.00
300	5A	35.9	53.	146.9	222.	0	0.	.00000	.00	.00	0.	220	15	A29	.00
300	6B	14.8	28.	14.8	28.	2	940.	.11200	.00	.00	0.	220	10	A29	.00
300	7B	9.5	18.	24.3	44.	0	0.	.00000	.00	.00	0.	220	10	A29	.00

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*****************************************************************************************************
*                                          CONFLUENCE Q'S                                           *
*  300   8A  TA 1157 QA    222. QAB    265. QB     43.    300   8B  TB 1156 QB    44. QBA    263. QA    219.  *
*                    300   8AB TAB 1157 QAB    265. QA    222. QB    43.                            *
*****************************************************************************************************
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LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	8AB	24.3	44.	171.2	265.	0	0.	.00000	.00	.00	0.	220	0	A29	.00
300	9A	.0	0.	171.2	265.	2	1240.	.03600	.00	.00	0.	220	99	A29	.00
300	10A	13.1	21.	184.3	281.	2	1470.	.00800	.00	.00	0.	220	13	A29	.00
300	11A	.0	0.	184.3	260.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	12A	32.7	47.	217.0	294.	0	0.	.00000	.00	.00	0.	220	16	A29	.00
300	13B	18.7	31.	18.7	31.	2	1130.	.02700	.00	.00	0.	220	12	A29	.00
300	14B	20.9	32.	39.6	59.	2	1940.	.07500	.00	.00	0.	220	14	A29	.00
300	15B	29.0	40.	68.6	93.	2	860.	.07200	.00	.00	0.	220	17	A29	.00
300	16B	.0	0.	68.6	92.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	17B	.0	0.	68.6	92.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	18C	23.1	35.	23.1	35.	2	1480.	.12200	.00	.00	0.	220	14	A29	.00
300	19C	30.4	43.	53.5	77.	0	0.	.00000	.00	.00	0.	220	16	A29	.00

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*****************************************************************************************************
*                                          CONFLUENCE Q'S                                           *
*  300   20B TB 1163 QB     92. QBC    160. QC     68.    300   20C TC 1157 QC    77. QCB    154. QB     77.  *
*                    300   20BC TBC 1161 QBC    163. QB     90. QC    73.                           *
*****************************************************************************************************
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LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	20BC	53.5	77.	122.1	163.	0	0.	.00000	.00	.00	0.	220	0	A29	.00
300	21B	.0	0.	122.1	163.	2	570.	.00400	.00	.00	0.	220	99	A29	.00
300	22B	.0	0.	122.1	160.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	23B	.0	0.	122.1	160.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	24B	.0	0.	122.1	160.	0	0.	.00000	.00	.00	0.	220	99	A29	.00

```
*****************************************************************************************************
*                                          CONFLUENCE Q'S                                           *
*  300   25A TA 1164 QA    294. QAB    455. QB    160.    300   25B TB 1165 QB   160. QBA    452. QA    292.  *
*                    300   25AB TAB 1164 QAB    455. QA    294. QB    160.                          *
*****************************************************************************************************
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LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	25AB	122.1	160.	339.1	455.	0	0.	.00000	.00	.00	0.	220	0	A29	.00

Program Package Serial Number: 2033

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50

CHIQUITO LANDFILL HYDROLOGY - EXISTING Condition STORM DAY 4

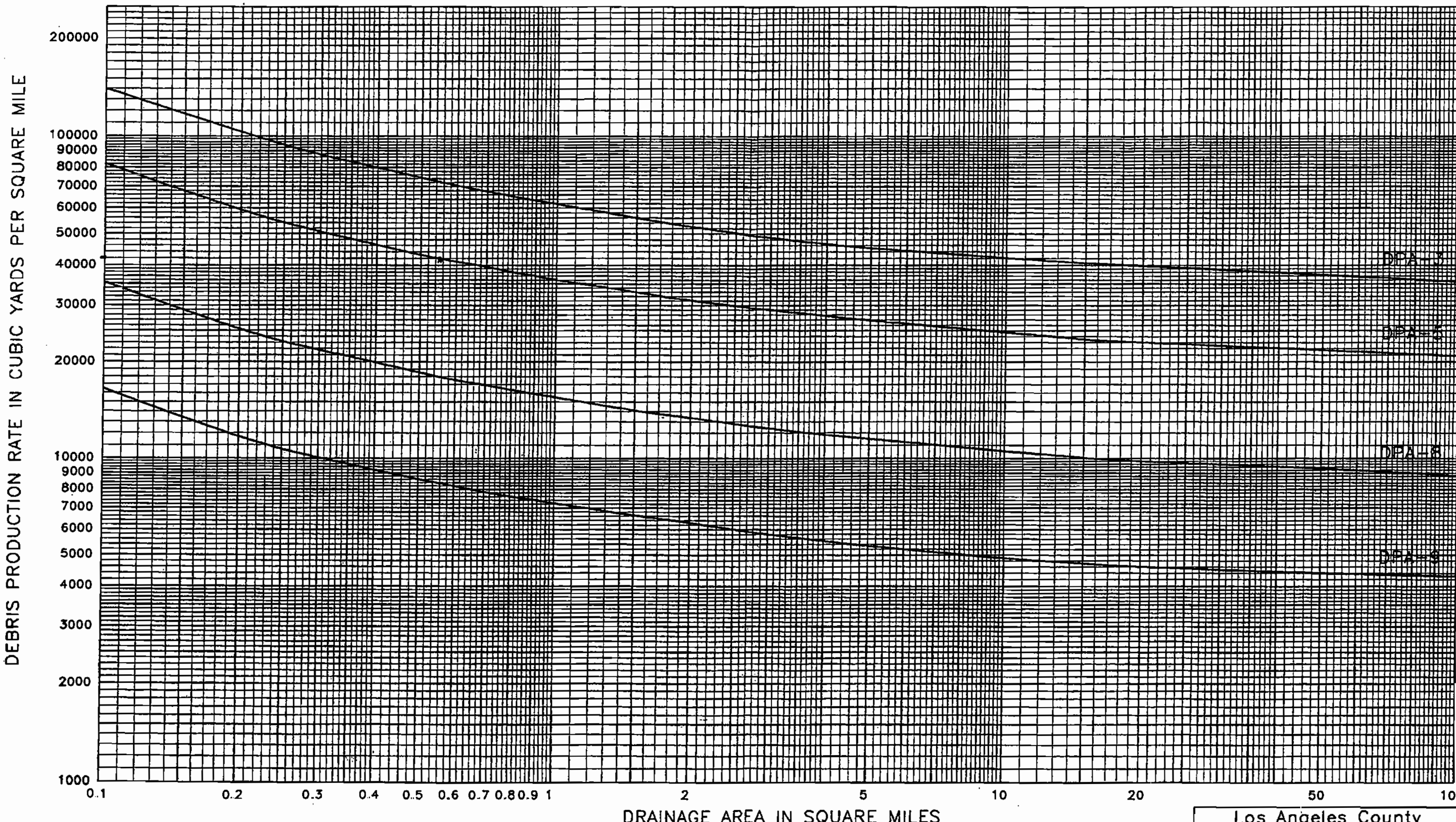
LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	26C	10.3	20.	10.3	20.	2	1080.	.01600	.00	.00	0.	220	9	A29	.00
300	27A	.0	0.	339.1	455.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	28A	.0	0.	339.1	455.	0	0.	.00000	.00	.00	0.	220	99	A29	.00
300	29A	.0	0.	339.1	455.	0	0.	.00000	.00	.00	0.	220	99	A29	.00

```
*********************************************************************************************************************
*                                            CONFLUENCE Q'S                                                         *
*   300   30A  TA 1164 QA     455. QAC    470. QC     15.    300   30C  TC 1161 QC     17. QCA    433. QA    416.   *
*                          300   30AC TAC 1164 QAC     470. QA     455. QC     15.                                  *
*********************************************************************************************************************
```

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
300	30AC	10.3	17.	349.4	470.	0	0.	.00000	.00	.00	0.	220	0	A29	.00
300	31A	.0	0.	349.4	470.	0	0.	.00000	.00	.00	0.	220	99	A29	.00

APPENDIX D

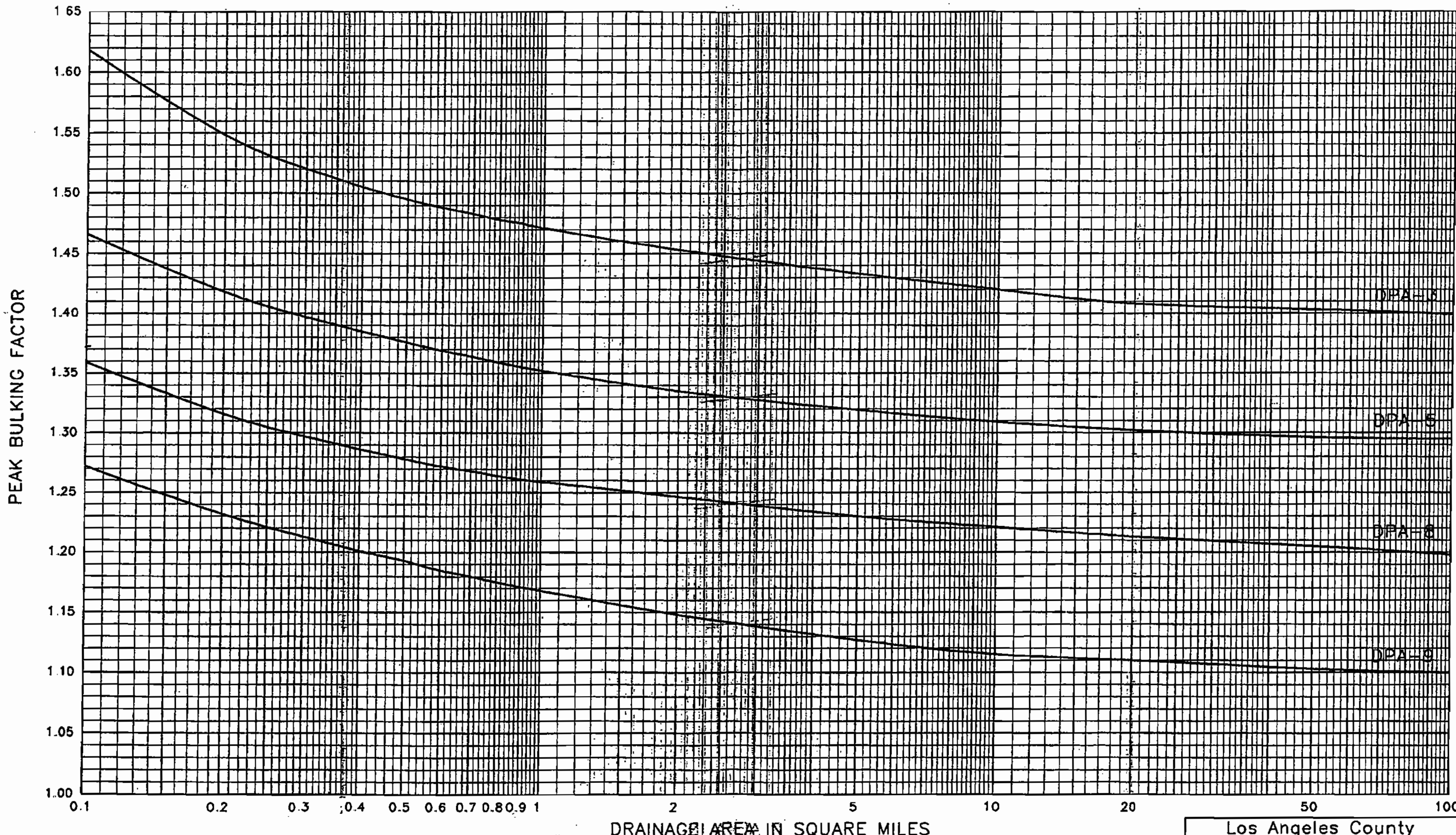
HYDROLOGY/SEDIMENTATION
LA COUNTY MANUAL P-2, P-5



Los Angeles County
Department of Public Works

DEBRIS PRODUCTION RATES
for Santa Clara Basin

DI :CVH1.SPG



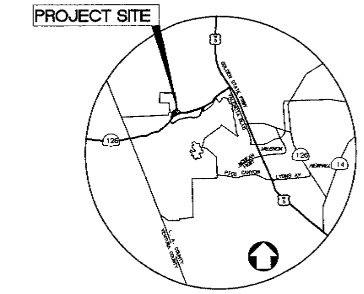
Los Angeles County
Department of Public Works

PEAK BULKING FACTORS
for Santa Clara Basin

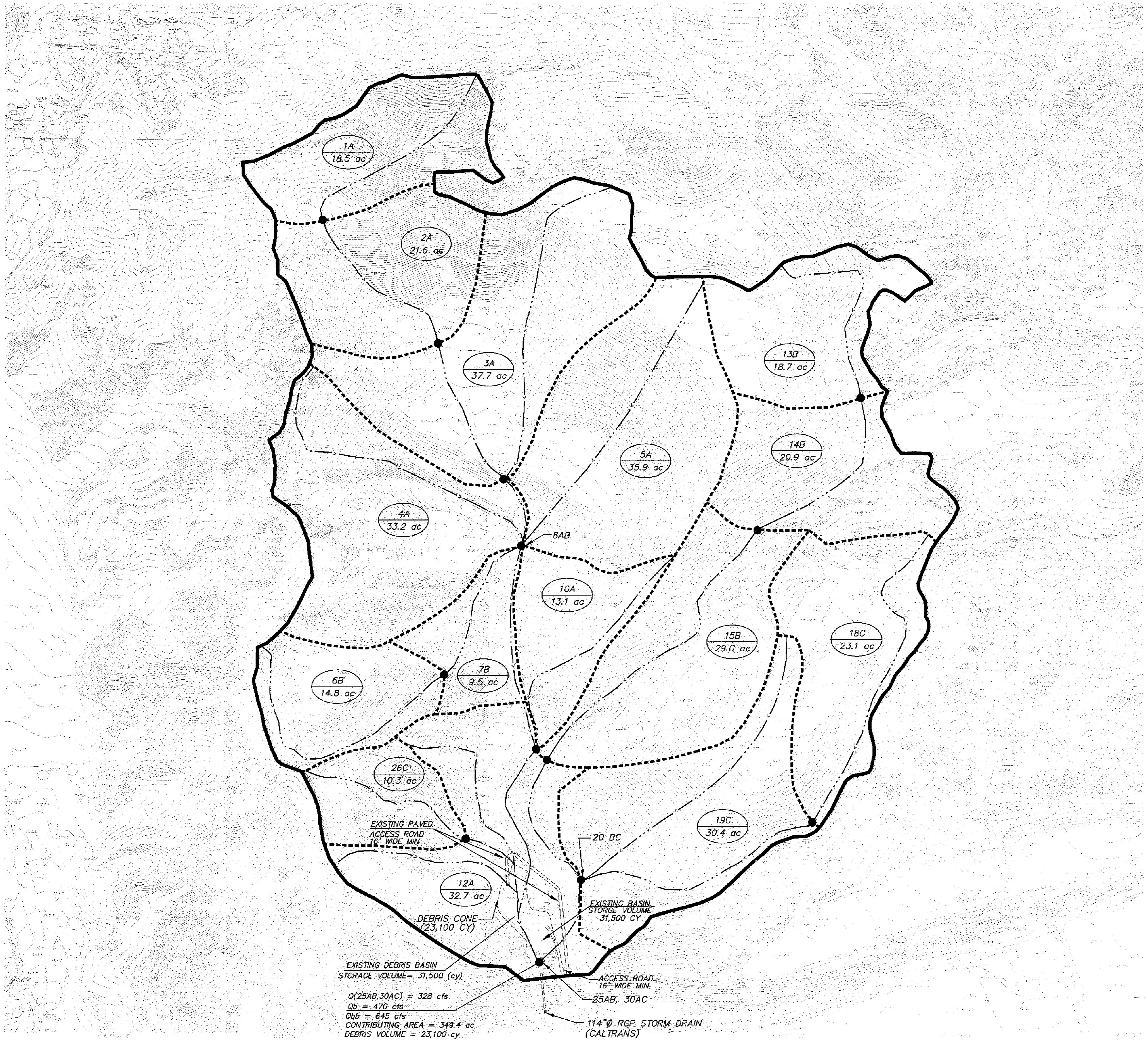
PI :CVH2.SPG

PSOMAS

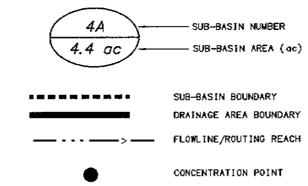
APPENDIX E
HYDROLOGIC MAP



DEBRIS POTENTIAL AREA (DPA=5)



LEGEND:

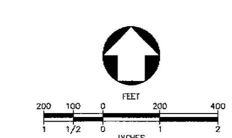


EXISTING CONDITION

INCREMENTAL SUB-BASINS						CUMULATIVE SUB-BASINS		
SUB-BASIN NUMBER	TIME OF CONCENTRATION (minutes)	SUB-BASIN AREA (acres)	Q50 UNBURNED (cfs)	Q50 BURNED (cfs)	Q50 BURNED + BULKED (cfs)	A CUMULATIVE (cy)	DEBRIS PROD RATE (cy/sq mi)	DPV CUMULATIVE (cy)
1A	11	18.5	24	32	47	18.5	82,000	2,370
2A	9	21.6	32	42	61	40.1	82,000	5,138
3A	16	37.7	39	53	77	77.8	75,000	9,117
4A	16	33.2	35	46	68	111.0	64,000	11,100
5A	15	35.9	38	52	76	146.9	56,000	12,854
10A	13	13.1	15	20	30	160.0	54,000	13,500
12A	16	32.7	34	46	67	192.7	50,000	15,055
6B	10	14.8	16	21	31	207.5	49,000	15,887
7B	10	9.5	13	17	25	217.0	48,000	16,275
13B	12	18.7	23	31	45	235.7	47,000	17,309
14B	14	20.9	24	31	46	256.6	46,000	18,443
15B	17	29.0	29	39	57	285.6	45,000	20,081
18C	14	23.1	26	35	51	308.7	44,000	21,223
19C	16	30.4	32	42	62	339.1	43,000	22,783
26C	9	10.3	15	20	29	349.4	42,300	23,093
TOTAL:	---	349.4	328	470	645*	349.4	---	23,100**

* BULKING FACTOR IS TAKEN FROM HYDROLOGY/SEDIMENTATION APPENDIX, P-5

** DEBRIS PRODUCTION RATE IS TAKEN FROM P-2, DPA-5



PROJECT AREA

REGISTERED PROFESSIONAL ENGINEER ROSS W. BARKER No. C-32799 Exp. 06/30/06 CIVIL STATE OF CALIFORNIA	PSOMAS 28470 Avenue Stanford, Suite 300 Santa Clarita, CA 91355 (661) 219-6000 (661) 775-2718 (FAX) ROSS W. BARKER R.C.E. NO. C32799 DATE 9-22-2005	DESIGNED : AC/EW DRAFTED : AC/ML CHECKED : SW/MG/RB	OWNER/DEVELOPER : NEWHALL RANCH. 23823 WEST VALENCIA BOULEVARD VALENCIA, CALIFORNIA 91335 TELEPHONE: (661) 255-4000 REPRESENTATIVE : MR. FRED MACMURDO	EXISTING DRAINAGE PLAN FOR CHIQUITO LANDFILL IN THE UNINCORPORATED AREA OF THE COUNTY OF LOS ANGELES STATE OF CALIFORNIA	PROJECT NO. 1NRC010708 SHEET 1 OF 1

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