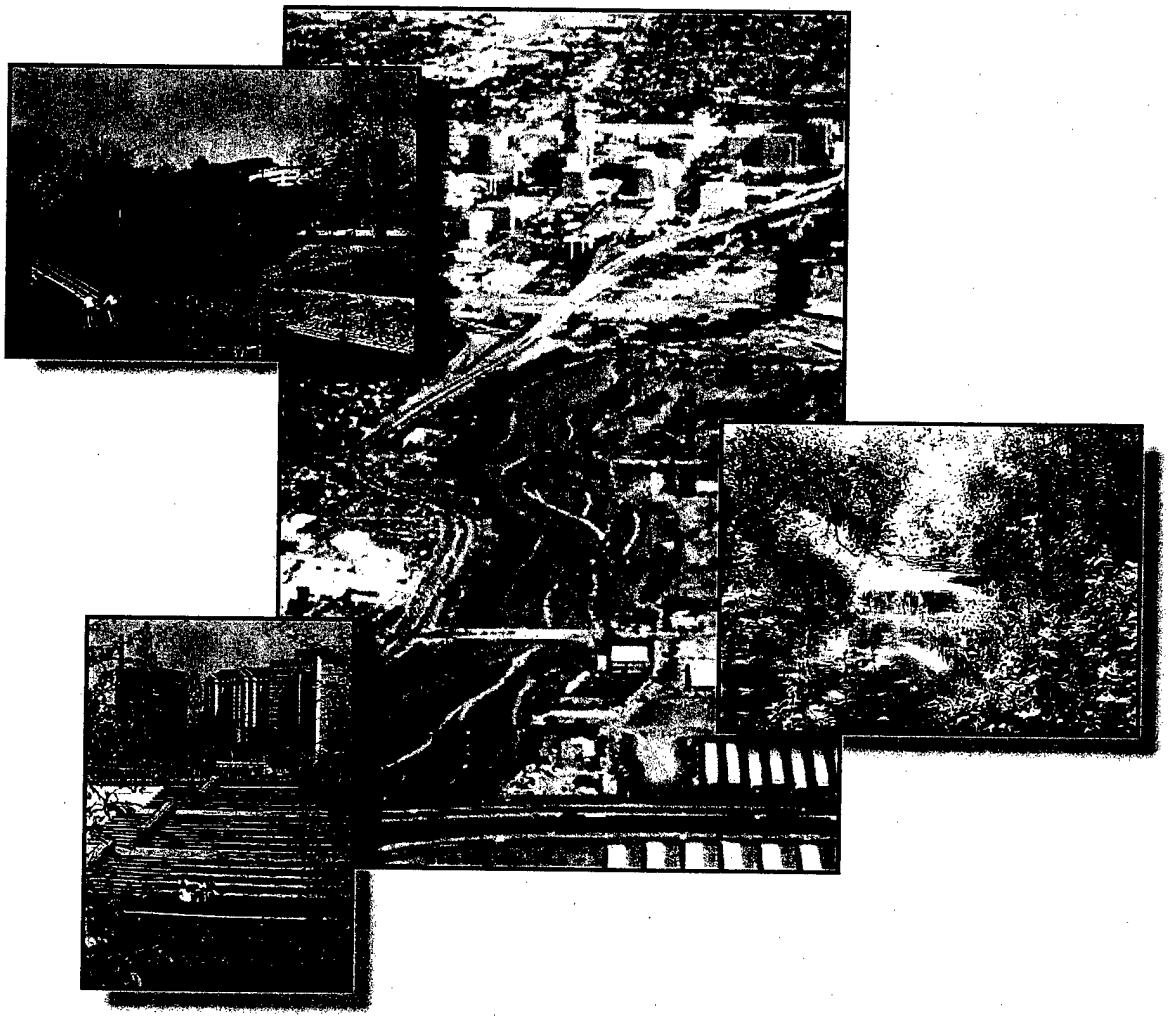
Final General Re-Evaluation & Environmental Report for Proposed Project Modifications

Guadalupe River Project
Downtown San Jose, California



Volume 3
February 2001
SCH#199902056
Filed with U.S. EPA April 2001

U.S. Army Corps of Engineers
Sacramento District

20010516 085

Santa Clara Valley Water District

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	Feb 2001	Final Report

4. TITLE AND SUBTITLE
Final General Re-Evaluation & Environmental Report for Proposed Project Modifications Guadalupe River Project, Downtown San Jose, California

5. FUNDING NUMBERS

6. AUTHOR(S)
U.S. Army Corps of Engineers, Sacramento District, Santa Clara Valley Water District Montgomery Watson/CH2M Hill, Jones and Stokes, Northwest Hydraulics Consultants, Inc.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Corps
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Santa Clara Valley Water District
5750 Alameda Expressway
San Jose, CA 95118

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
SCH# 1999025056

11. SUPPLEMENTARY NOTES
Available from the U.S. Army Corps of Engineers
1325 J Street
Sacramento, CA 95814-2922

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This report addresses proposed modifications to the federally authorized Guadalupe River Project in downtown San Jose, California. These modifications include flood protection, recreation and related mitigation measure primarily along 2.6 miles of the Guadalupe River and two related offsite mitigation areas. This report support decision making by the U.S. Army Corps of Engineers (Corps), Santa Clara Valley Water District (SCVWD), and other responsible agencies to implement proposed project modifications and ensure compliance with the National Environmental Policy Act (NEPA), California Environmental Quality Act (CEQA), and other pertinent laws and regulations.

14. SUBJECT TERMS
General Re-Evaluation Report, Environmental Impact Statement, Environmental Impact Report, Modification of G.R.P., and Downtown San Jose, California.

15. NUMBER OF PAGES
1,833.00

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

Final

Integrated General Re-Evaluation Report/ Environmental Impact Report/ Supplemental Environmental Impact Statement for

Proposed Modifications to the Guadalupe River Project, Downtown San Jose, California

(Supplemental to the 1985 Final Environmental Impact Statement for the Guadalupe River Flood Control and Adjacent Streams Investigation, Santa Clara County, California)

Volume 3

Prepared by

U.S. Army Corps of Engineers, Sacramento District

1325 J Street
Sacramento, California 95814

Santa Clara Valley Water District

5750 Almaden Expressway
San Jose, California 95118

February 2001

State Clearinghouse # 199902056

Contents – Volume 3

Appendix 5: Engineering

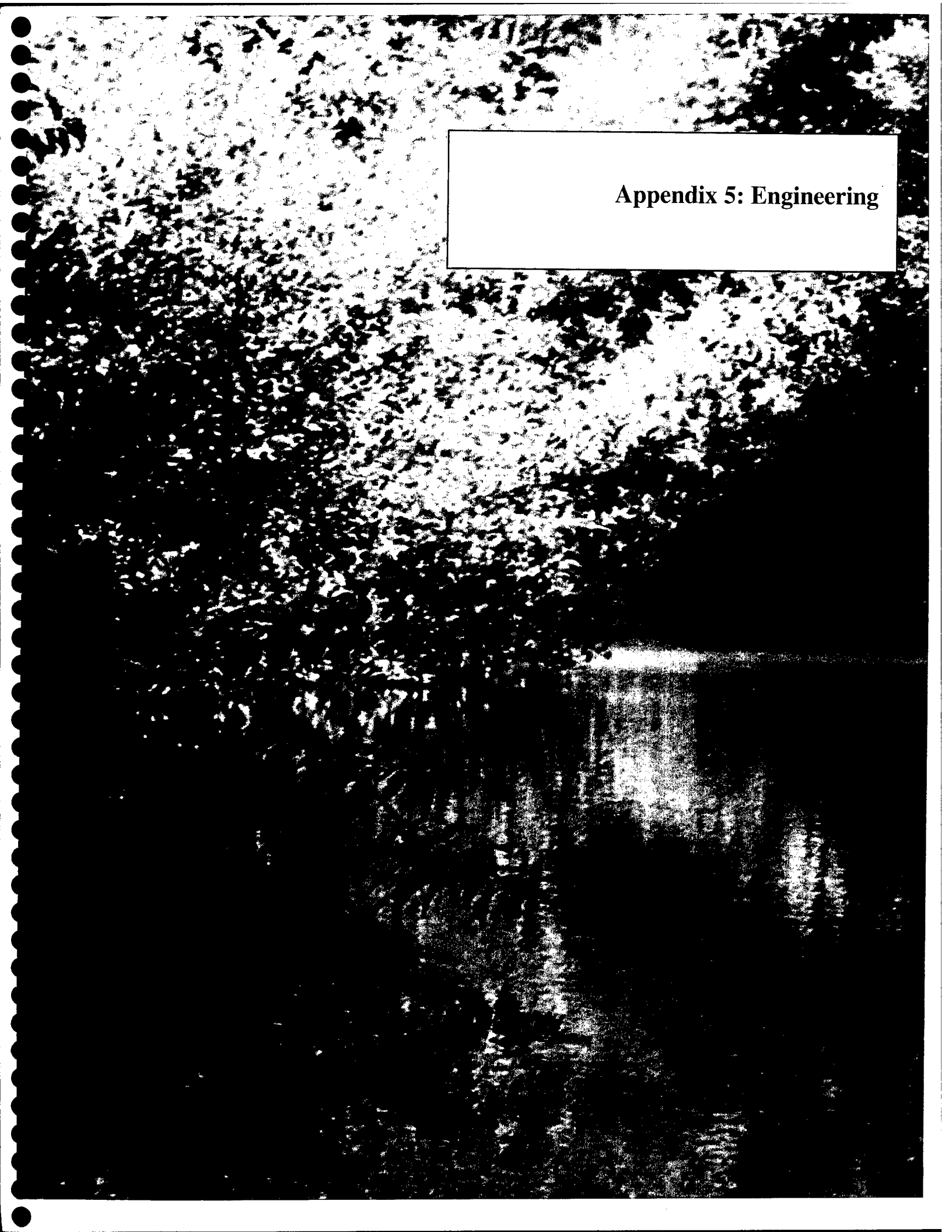
Appendix 6: Real Estate Plan

Appendix 7: Economic Analysis

Appendix 8: Recreation

Appendix 9: Cost Effectiveness and Incremental Cost Analysis

Appendix 10: Habitat Evaluation Procedures Analysis



Appendix 5: Engineering

APPENDIX 5 - ENGINEERING

Contents

Appendix

5A Introduction
5B Plan Alternatives
5C Hydrology and Hydraulic Design
5D Structural Design
5E Surveying and Mapping
5F Geology
5G Geotechnical Design
5H Relocations
5I Special Construction Issues
5J Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R)
5K Covered Bypass Engineering Considerations
5L Design and Construction Schedule
5M Cost Estimates

Plates

5A-1 Vicinity Map
5C-1 Box Culvert Bypass Alternative - Plan
5C-2 Box Culvert Bypass Alternative - Partial Plans
5C-3 Box Culvert Alternative – Plans and Sections
5C-4 Box Culvert Alternative – Typical Cross Sections
5C-5 Peak Flow Frequency
5C-6 1% Chance Flood Hydrographs
5C-7 Standard Project Flood Hydrographs
5F-1 Coast Range Geomorphic Province
5F-2 Seismic Zone Map of California
5F-3 San Francisco Bay Region Earthquake Probability
5F-4 Estimated Intensity Map, 1989 Loma Prieta Earthquake on San Andreas Fault
5F-5 Estimated Intensity Map, 1868 Earthquake on Hayward Fault
5F-6 Estimate Intensity Map, 1906 Earthquake on San Andreas Fault
5G-1 Location of Explorations, Legend and Notes
5G-2 Location of Explorations
5G-3 Log of Exploration
5G-4 Log of Explorations
5G-5 Log of Explorations
5G-6 Log of Explorations
5G-7 Log of Explorations
5G-8 Log of Explorations
5G-9 Log of Explorations

5G-10 Right Bank Profile sta. 19+35 to sta. 137+50
5G-11 Right Bank Profile sta. 137+50 to 156+00
5G-12 Atterberg Limits
5G-13 Atterberg Limits
5G-14 Shear Strength Data
5G-15 Shear Strength Data
5G-16 Consolidation Graph
5G-17 Consolidation Graph
5G-18 Consolidation Graph
5L-1 Guadalupe River Project Schedule
5M-1 Cost Estimate Summary
5M-2 Recommended Plan – Remaining Costs/Remaining Benefits

Appendix 5A - Introduction

5A.1 Purpose and Scope

This Engineering Appendix presents the analytical results of studies conducted to re-evaluate the most complete, effective, efficient, and acceptable solution to flood damage reduction in Segment 3 (between Park Avenue and Coleman Avenue) of the Guadalupe River. Included is supplemental information to the General Design Memorandum. This report outlines the basis of design, recommends a logical sequence of construction, and summarizes costs data. It will also serve as the basis for the preparation of the final plans and specifications for construction of the Proposed Action.

5A.2 Background

5A.2.1 Authorization

Construction of local flood protection measures along the Guadalupe River, in the vicinity of downtown San Jose, California, was authorized by Section 401(b) of the Water Resources Development Act (WRDA) of 1986, (Public Law 99-662) dated 17 November 1986, as amended by the Energy and Water Development Appropriations Act (EWDAA) for Fiscal Year 1990 (Public Law 101-101). The EWDAA for Fiscal Year 1990 included language directing the Secretary of the Army to construct the project using funds provided in the Act notwithstanding the WRDA of 1986 Section 902 limit. The Office of the Assistant Secretary of the Army for Civil Works (ASA(CW)) concluded that this language was sufficient to authorize the project. Therefore, the authorizing document is the General Design Memorandum (GDM) dated December 1991 and approved March 26, 1992. The currently approved flood control and recreation plans are described in the GDM.

5A.2.2 Project Location

The Guadalupe River drainage basin lies immediately south of San Francisco Bay between the Santa Cruz Mountains on the west and the Diablo Range on the east. The project reach is located between I-280 and I-880 adjacent to downtown San Jose, California. The Guadalupe River joins with Los Gatos Creek within the project reach and flows northwest into San Francisco Bay. See Plate 5A-1 for a vicinity map.

5A.2.3 Constructed Project Features

Subsequent to the approval of the GDM and Conditional State Water Quality Certification, construction commenced in August 1992. Segment 1 (I-880 to Hedding Street) flood control and recreation improvements were completed in August 1994. Segment 2 (Hedding Street to Coleman Avenue) flood control and recreation improvements were completed in September 1996. The flood control and recreation improvements within these reaches have been transferred to the non-Federal sponsor. Riparian mitigation has also been planted within these reaches and is currently being maintained and monitored for three years prior to being

transferred to the non-Federal sponsor. In Segment 3 (Coleman Avenue to I-280), completed work includes the demolition of two railroad bridges, the removal and mitigation of the River Street Historic District, and construction of approximately 325 lf of flood control recreation improvements upstream from Woz Way on the east bank. The non-Federal sponsor has completed the relocation of the Hedding Street Bridge in Segment 1, the Central Pipeline (water) in Segment 2, and the Hetch Hetchy Aqueduct downstream from the project. Construction of the Taylor Street Bridge relocation in Segment 2 will begin in March 2000 as part of the Route 87 Freeway Project. These project relocations are described in the GDM.

5A.2.4 Project Reevaluation

The requirement for a General Reevaluation Report was identified in June 1998, when the Corps determined that the Authorized Project required significant modifications to the design to fulfill the environmental commitments contained in the project State Water Quality Certification prior to resuming construction of Segment 3 of the project. The environmental commitments include mitigation for project impacts to endangered species (steelhead trout, chinook salmon, and red-legged frog) (water temperature and fish passage issues) and the loss of shaded riverine aquatic and riparian habitat.

APPENDIX 5A - INTRODUCTION

Plates

5A-1 Vicinity Map

VICINITY MAP

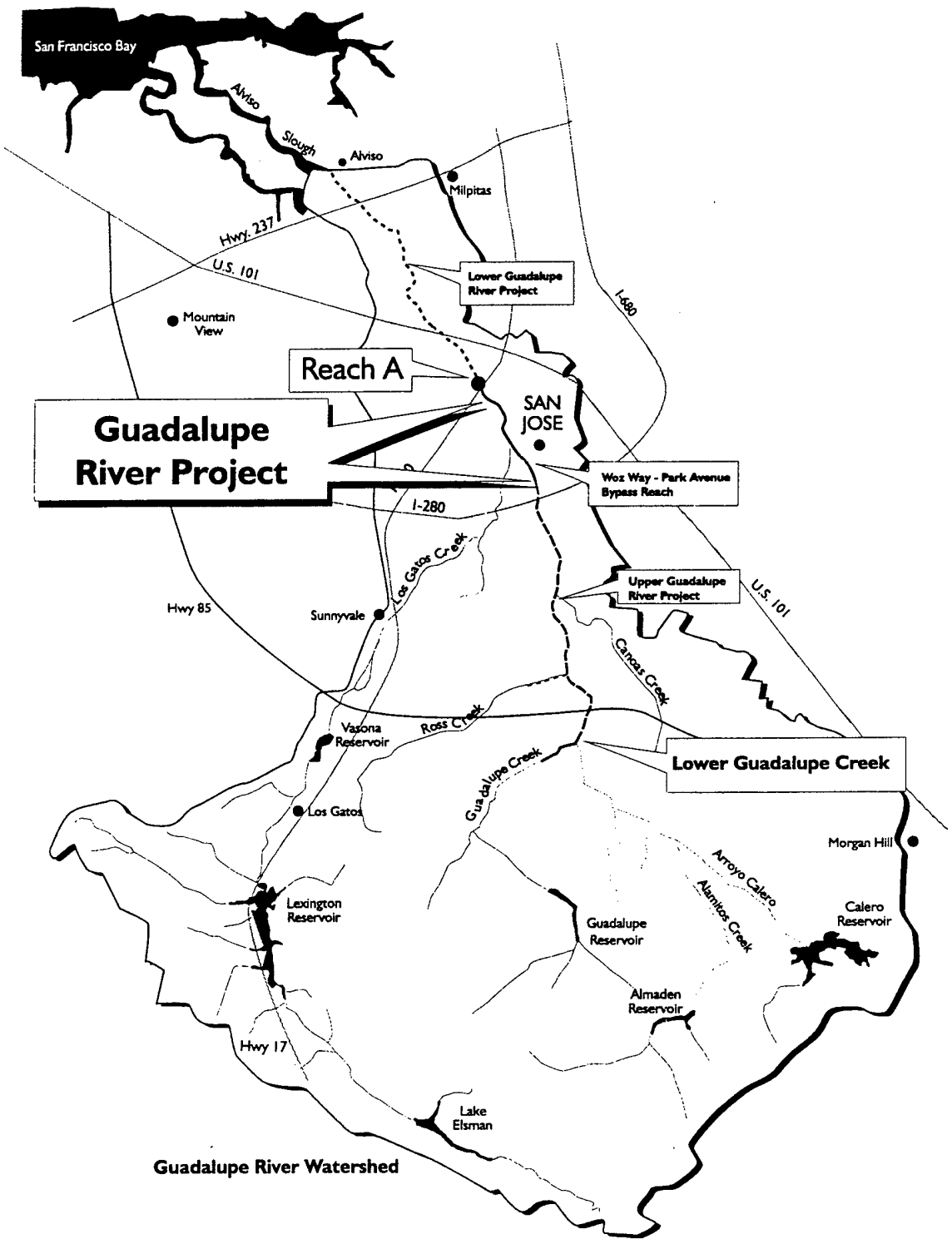


Plate 5A-1

Appendix 5B – Plan Alternatives

5B.1 General

The development of plans to achieve the planning objectives for the Modified Project (modifications to the Authorized Plan, also known as the Proposed Action (Chapter 3) was initiated with the consideration of all feasible measures to prevent flood damage in the floodplain area of the Guadalupe River in downtown San Jose. Concurrently, equal consideration was given to the goal of achieving objectives not specifically associated with the flooding problem. These included those that would preserve and mitigate for loss of or damage to fish and wildlife habitats and enhance recreation in and adjacent to the Guadalupe River in downtown San Jose. These measures were analyzed to determine their applicability and overall feasibility in the study area. Subsequently, the management measures that were considered appropriate to address the flooding, environmental, and redevelopment issues were assembled into an array of alternative plans for project modifications. These alternatives were progressively screened and refined through the planning process until a set of final candidate plans was obtained for selection of the recommended plan.

5B.2 Alternative Comparison

Numerous alternatives have been considered to meet the objective of providing 100-year flood protection for downtown San Jose since the Authorized Project was evaluated in the Feasibility Report/Environmental Impact Statement (U.S. Army Corps of Engineers 1985). As part of the Collaborative process (Section 7.2), a Technical Fact-Finding Subcommittee (TFFS) screened and evaluated alternatives in an iterative process. Detailed information pertaining to the screening and evaluation of alternatives is provided in *Alternative Development Documentation, Guadalupe River Project, Downtown San Jose, California.* The alternatives evaluated during this process include:

- a revised channel-widening alternative
- an upstream detention alternative
- the Authorized Project with additional mitigation alternative
- six bypass alternatives (east and west bank alternatives)
- eight bypass variations of east bank alternatives

5B.2.1 Revised Channel-Widening Alternative

This alternative considered widening the Guadalupe River channel downstream from the SR 87 viaduct at San Fernando Street, including the installation of a box culvert at the Santa Clara Street Bridge. Downstream from Santa Clara Street, the river would continue to be widened on the eastside until the confluence with Los Gatos Creek.

This alternative was not considered for further evaluation due to right-of-way limitations upstream from Santa Clara Street and the relatively short distance between Santa Clara

Street and the Los Gatos Creek confluence. Expected velocities would also require some armoring downstream from Santa Clara Street.

5B.2.2 Upstream Detention Alternative

An upstream detention alternative was considered that would include construction of two new dams and improvements to and changes in the operation of Lexington Dam. These new dams would reduce the extent of the flood control improvements defined under the Authorized Project. This alternative was dropped from further consideration because the components either would be economically infeasible or would not meet the objective of providing 100-year flood protection. The following dams were considered under this alternative.

5B.2.2.1 New Guadalupe Dam

Construction of a new dam approximately two miles downstream from the existing Guadalupe Dam was considered. The new dam would be 65 feet high and have the capacity to capture the entire hydrograph at that location during a 100-year flood. This plan was removed from further studies, since further analysis showed that the dam would not provide 100-year flood protection along the Guadalupe River in downtown San Jose and the plan was deemed infeasible from an economic point of view with a low Benefit/Cost (B/C) ratio of 0.33:1.

5B.2.2.2 Raising Lenihan Dam

Under this plan, Lenihan Dam would be raised about 25 feet to provide 15,000 acre-feet of flood storage capacity. This would reduce the 100-year flood in Guadalupe River from 17,000 cubic feet per second to 11,000 cubic feet per second. Since the capacity of the river in San Jose through downtown San Jose is only 8,000 cubic feet per second, flooding would still occur. The continued flooding, coupled with a B/C ratio of 0.67:1, removed this plan from further consideration.

5B.2.2.3 Hooker Dam

A dam upstream from Lenihan Dam would be constructed to provide flood control storage and thus flood protection for the Guadalupe River. The dam would be located midway between Lenihan and Austrian Dams. This plan was eliminated from further study since the drainage area would be only 17 square miles, not enough to provide the flood protection needed.

5B.2.2.4 Alter Operation of Lenihan Dam

Operations of Lenihan Dam and Lexington Reservoir would be altered for purposes of using part of the storage for flood control instead of for water supply. This would require lowering the water level and necessitate purchasing water from sources outside the watershed to make up for the estimated 7,000 acre-foot per year loss. The projected water costs were about three times the average annual benefits, making this plan infeasible.

5B.2.3 Authorized Project with Additional Mitigation

The Authorized Project with additional mitigation alternative was proposed to meet the conditions of the State Water Quality Certification and for compliance with the Endangered

Species Act. Five principal mitigation concerns were: redesign of the project to avoid impacts and maximize on-site mitigation, maximize on-site revegetation to replace lost shaded riverine aquatic (SRA) habitat cover, maximize off-site revegetation to replace lost SRA cover, fisheries mitigation, and thermal mitigation. The intent was to add additional mitigation to compensate for all environmental effects of the Authorized Project.

Analyses have determined that 10,721 feet of SRA habitat planting would be needed to compensate for the project impacts to SRA habitat. This alternative is not implementable because there is not adequate area to provide mitigation for reduction of water temperature impacts to anadromous fish and SRA cover impacts to less than significant levels.

5B.2.4 Bypass Alternatives

5B.2.4.1 Six Bypass Alternatives

In March 1998, the Collaborative evaluated six bypass alternatives. Bypass alternatives were considered because this concept would provide as much flood protection as the Authorized Project and would include adequate mitigation. The alternatives were evaluated based on technical, environmental, and economic factors. The alternatives, summarized below, were referred to as "Alternative 2-1" through "Alternative 2-6."

Alternative 2-1. A covered, double box culvert bypass extending from upstream from Santa Clara Street to upstream from Coleman Avenue on the east bank of the Guadalupe River. This alternative had fewer adverse effects on existing habitat than Alternatives 2-2 and 2-3, but did not address hydraulic factors as well as Alternatives 2-5 and 2-6. Therefore, this alternative was eliminated from further evaluation.

Alternative 2-2. A covered, double box culvert bypass from Santa Clara Street to New Julian Street on the east bank and a covered single box culvert from New Julian Street to the UP railroad tracks on the west bank. This alternative minimized risks from potential hazardous waste sites and the amount of land acquisition, but had greater adverse effects on existing habitat than Alternatives 2-1 and 2-4 through 2-6. Therefore, this alternative was eliminated from further evaluation.

Alternative 2-3. A covered, double box culvert bypass from upstream from Santa Clara Street to New Julian Street on the east bank. This alternative minimized risks from potential hazardous waste sites and the amount of land acquisition, but had greater adverse effects on existing habitat than Alternatives 2-1 and 2-4 through 2-6. Therefore, this alternative was eliminated from further evaluation.

Alternative 2-4. An open earthen channel bypass extending from upstream from Santa Clara Street to upstream from Coleman Avenue on the east bank of the Guadalupe River. This alternative had fewer adverse effects on existing habitat than Alternatives 2-2 and 2-3, but did not address hydraulic factors as well as Alternatives 2-5 and 2-6 and had a higher incremental cost than other alternatives. Therefore, this alternative was eliminated from further evaluation.

Alternative 2-5. A covered, double box culvert bypass extending from upstream from Santa Clara Street to upstream from Coleman Avenue on the east bank of the Guadalupe River. The alternative includes a double entrance to the box culvert near the confluence of Los

Gatos Creek and Guadalupe River to address hydraulic conditions at this location. This alternative had fewer adverse effects on existing habitat than Alternatives 2-2 and 2-3.

Alternative 2-6. A double, covered box culvert bypass from the confluence of Los Gatos Creek and the Guadalupe River near St. John Street to upstream from Coleman Avenue on the east bank of the Guadalupe River. This alternative had fewer adverse effects on existing habitat than Alternatives 2-2 and 2-3.

The results of evaluation of these bypass alternatives indicated that Alternatives 2-5 and 2-6 provided the most flood control benefits with the fewest adverse environmental and economic effects. From these two bypass alternatives, eight bypass variations were developed and ranked according to specific criteria. The development and ranking of the eight bypass variations are discussed below.

5B.2.4.2 Eight Bypass Variations

In early 1999, eight bypass variations of two previously considered alternatives described above were developed in more detail by NHC (Guadalupe River Bypass – Hydraulic Analyses, 1999). The eight alternatives were ranked using criteria that included a mix of environmental, engineering, and hydraulic considerations. The alternatives included variations of double or triple box culverts on the east bank of the river to bypass the flow, as summarized below.

Alternative 1. Covered, double box culverts beginning at the San Fernando Street Bridge, with one outlet upstream from Coleman Avenue and one outlet downstream from Coleman Avenue.

Alternative 2. Covered, triple box culverts with two culverts from the San Fernando Street Bridge with one outlet upstream from Coleman Avenue and one outlet downstream from Coleman Avenue. One culvert from the confluence with Los Gatos Creek to upstream from Coleman Avenue.

Alternative 3. Covered, double box culverts with one culvert running from the San Fernando Street Bridge to downstream from Coleman Avenue and one culvert running from the San Fernando Street Bridge to upstream from Coleman Avenue, with an additional entrance at the confluence with Los Gatos Creek (same as Alternative 2, except two culverts were combined into one).

Alternative 4. Covered, triple box culverts with two box culverts from Santa Clara Street to upstream from Coleman Avenue and one box culvert from St. John Street to upstream from Coleman Avenue.

Alternative 5. Covered, double box culverts with one box culvert from upstream from San Fernando Street to downstream from Julian Street and one box culvert from downstream from San Fernando Street to downstream from Julian Street.

Alternative 6. Covered, double box culverts with one box culvert from upstream from St. John Street to upstream from Coleman Avenue.

Alternative 7. Covered, double box culverts with one box culvert from upstream from Santa Clara Street to downstream from Coleman Avenue and one box culvert from upstream from Santa Clara Street to upstream from Coleman Avenue.

Alternative 8. Covered, triple box culverts with one box culvert from upstream from Santa Clara Avenue to downstream from Coleman Avenue, one box culvert from upstream from Santa Clara Street to downstream from Coleman Avenue, and one box culvert from the confluence with Los Gatos Creek to upstream from Coleman Avenue.

5B.3 Preliminary Alternative Selection and Rationale

The preliminary analysis results indicated that the box culvert bypass alternatives without an inlet at Los Gatos Creek could not adequately convey the peak flows from Los Gatos Creek during significant flood events. Subsequent analysis using HEC-RAS and UNET computer models have indicated that a double box culvert may still be feasible. Therefore, the Bypass System Alternative discussed in this document is a box culvert bypass structure based on Alternative 8, with either two or three box culverts used to carry the diverted floodflows. Physical model testing will be used to determine how many culvert structures are required in order to convey the required flows.

After development of a wide array of alternatives and rigorous evaluation of related environmental effects, the proposed action was the alternative that fulfills the stated objectives and criteria. These criteria included the avoidance of adverse effects to of the environment and full mitigation of unavoidable environmental effects resulting from the proposed project.

Appendix 5C - Hydrology and Hydraulic Design

4C.1 General

This chapter presents new information and analyses performed after March 1992 in support of the plans and specifications for construction and for the re-evaluation study. It presents the basis for the hydraulic design of the Proposed Action. The information in this chapter will serve as the basis for subsequent hydraulic modeling in support of the construction contract plans and specifications to complete the project. The basic flood control objectives of the project are to prevent flooding from a 1 percent or 100-year flood event and to preserve, as much as possible, the existing riparian and shaded riverine aquatic vegetation along the Guadalupe River.

5C.1.1 References

1. Hydrologic Engineering Office Report dated July 1977
2. Upper Guadalupe River Draft Feasibility Report dated August 1997
3. General Design Memorandum dated December 1991 (approved March 1992)
4. WES Physical Model Report dated February 1998
5. NHC Guadalupe River Bypass – Hydraulic Analyses, August 1999

4C.2 Hydrology

5C.2.1 Drainage Area Description

The Guadalupe River basin is located at the south end of the San Francisco Bay. The drainage area covers approximately 160 square miles above its confluence with San Francisco Bay and 144 square miles at the U.S. Geological Survey (USGS) gage and the project site. The basin is bounded on the west by the Santa Cruz Mountains and on the east by Coyote Creek and further east by the Diablo Mountain Range. Elevations within the basin vary from sea level to 3,791 feet above sea level atop Loma Prieta. The basin is characterized by a perimeter of high, steep, natural slopes with a large wide valley below. Valley land use has changed from agriculture to urban community over the last 50 years. The runoff from the mountainous areas is impeded by a number of reservoirs. At the downstream limits of the project, approximately 40 percent of the basin is below 400-foot elevation and within the urban area. The reservoirs intercept 63 square miles of area, while approximately 25 square miles of mountains and foothills are without reservoir control. The reservoirs are primarily used for water supply and therefore, not designed with flood control storage capability. A major tributary, Los Gatos Creek, merges with the Guadalupe River between Santa Clara Street and St. John Street within the project reach. The above-mentioned USGS gage is located immediately downstream from the confluence with Los Gatos Creek.

5C.2.2 Basis of Hydrology

As stated in the 1991 GDM, the basis of the hydrology is the Hydrologic Engineering Office Report dated June 1977. It includes a statistical evaluation of annual maximum discharges (spills during the winter season caused by flood runoff) for each reservoir in the basin. The design 1 percent peak floodflows were reviewed for the 1991 GDM, considering flood events and conditions that exist since the 1977 report. The analysis considered future urban development that is nearly in place. The hydrology properly reflects future upstream channel improvements and urbanization. Based on the review, the routings and rainfall loss rates were still valid and properly reflect the future prevailing conditions. Another review of the 1977 hydrology was conducted in 1999 for the GRR and it was determined at that time that the 1977 hydrology would be used for the Proposed Action.

5C.2.3 Floods Since March 1992

In January 1995, the Guadalupe River overtopped its banks immediately upstream from I-280. Flooding also occurred near the confluence with Los Gatos Creek within the project reach. The discharge was estimated at 9,000 cfs. Later, in March 1995, the river again overtopped its banks immediately upstream from I-280. These flood events caused extensive erosion damage, sediment deposition, debris accumulation, and interior street flooding. The discharge was estimated at 10,400 cfs. In 1997, the river once again overtopped its banks. The discharge flows were slightly lower in magnitude than the 1995 event.

5C.2.4 Project Design (1 percent/100-year) Flow Considerations

The 1 percent design discharges are 14,600 cubic feet per second (cfs) upstream from Los Gatos Creek and 17,000 cfs downstream from Los Gatos Creek.

5C.2.5 Standard Project Flood

The SPF discharges are 19,800 cfs upstream from Los Gatos Creek and 34,900 cfs downstream from Los Gatos Creek. These flows are based on the assumption that there is no inter-basin transfer of floodwaters. Additional topographic surveys and analysis would be required to determine the percentage of the standard project floodflows generated in the Guadalupe River watershed that would have the potential to leave the watershed through overland release to adjacent watersheds

5C.3 Hydraulic Design

5C.3.1 General

This section is a compilation of hydraulic design analyses performed since issuance of the 1991 GDM and indicates changes to the hydraulic design parameters. Segments 1 and 2, covering the reach of the Guadalupe River from Coleman Avenue downstream to I-880, have been completed. There has also been a reanalysis of channel and overbank flows upstream from the project boundary at I-280. This study indicated no induced flooding will be caused by proposed overbank training walls designed to capture overbank flood flows at I-280 and direct the flows into the project channel. Capture of overbank flows is an interim condition until the SCVWD completes the Upper Guadalupe River Project.

A physical model study was completed for the project reach from I-280 to Santa Clara Street in 1997. This includes a bypass culvert that diverts 8,100 cfs of the 100-year flood flow from upstream from Woz Way to downstream from Park Avenue. A feasibility-level analysis of a second bypass from the vicinity of Santa Clara Street to Coleman Avenue by was performed NHC in 1999 (NHC, August 1999).

This section also presents descriptions of those analyses still required to complete design of the project. These include:

- Physical model study of the proposed bypass system from near Santa Clara Street to Coleman Avenue.
- Design of a low flow channel through all armored areas
- Sediment analysis of the Santa Clara Street to Coleman Avenue reach.
- Reevaluation of channel stabilization needs.
- Provision of mitigation within the reach of the Guadalupe River from I-101 to I-880, referred to as Reach A.

The Reach A mitigation constraint is no increase in water surface elevation above that used for the Segment 1 and 2 design, which is elevation of 17.86 m NAVD (55.95 ft NGVD) at the downstream face of I-880 (baseline Sta. 63+78).

5C.3.2 Project Design Flows

The project features for the Guadalupe River are designed to safely pass the 1 percent or 100-year flood peak discharge. The current Authorized Project has a west bank (left bank looking downstream) bypass from Woz Way to immediately downstream from Park Avenue. At the bypass, the design flow split requires the initial 1,500 cfs flow to remain in to the natural channel. Between 1,500 cfs and 14,600 cfs, flows will be divided between the natural channel and the box culvert bypass. At the 100-year flood peak, 8,100 cfs will be bypassed through the box culvert and 6,500 cfs will remain in the natural channel.

The Proposed Action would provide a second bypass on the east bank (right bank looking downstream), from near Santa Clara Street to Coleman Avenue. This bypass will divert floodflows in a similar manner to the current approved project's bypass, but at two locations, one upstream from the Los Gatos Creek confluence and one downstream from the confluence. The two intake locations are necessary to preserve as much of the natural channel as possible while accounting for the inflow hydrographs which occur on both the Guadalupe River as well as Los Gatos Creek. The objective is to maintain flows within the capacity of the natural channel from Santa Clara Street to Coleman Avenue. Flows of 1,500 cfs or less would not be diverted. Between 1,500 cfs and 17,000 cfs, flows will be divided between the natural channel and the box culverts, without exceeding the natural channel capacity.

5C.3.3 Design Considerations and Criteria

5C.3.3.1 General

In addition to the technical criteria cited in the GDM, the following Corps references indicate additional computational tools that were used to evaluate the hydraulic conditions of the project channel after 1992.

- HEC-RAS, River Analysis System – User's Manual, September 1998.
- UNET, One-Dimensional Unsteady Flow through a Full Network of Open Channels, User's Manual, July 1995.

5C.3.3.2 Water Surface Profiles

The HEC-2 computer program was used to determine design water surface profiles for the GDM and is still valid. For the subsequent work that this chapter indicates, HEC-RAS and UNET were used. HEC-RAS is the "next generation" of the HEC-2 computer program. While HEC-2 and HEC-RAS compute profiles for a steady gradually varied flow, UNET computes profiles for unsteady flows using the hydrograph for a chosen design event, in this case the 1 percent design flood hydrograph.

5C.3.3.3 Minimum Freeboard Requirements

Freeboard constitutes the vertical distance from the design water surface to the top of channel or low chord (low point) of a bridge or culvert. Freeboard requirements are the same as those presented in the GDM.

5C.3.3.4 Riprap, Gabion and Cellular Concrete Mattress Criteria

The designs of these items are unchanged from those presented in the GDM.

5C.3.4 Roughness Factors

Manning's equation is used to evaluate friction loss throughout the project reach, as presented in the GDM. For the additional bypass box culverts designed as part of the project re-evaluation (presented in par. 5C.3.5.a. below), a Manning's "n" value of 0.014 was selected for capacity determination.

5C.3.5 Hydraulic Design

5C.3.5.1 Proposed Bypass System

A feasibility-level analysis of a second bypass from the vicinity of Santa Clara Street to Coleman Avenue has been completed by NHC (August 1999). The investigation was performed to determine if a bypass could be used in conjunction with the natural channel to pass the 1 percent peak floodflows. The results indicate that a bypass is a workable hydraulic solution. The following is a summary of the hydraulic design information.

General. A number of bypass alternatives were developed. The selected alternative by the Corps and by the Santa Clara Valley Water District (SCVWD) for advanced design is the subcritical flow box culvert bypass.

A feasibility-level hydraulic analysis was conducted for the subcritical bypass to determine the approximate configuration, dimensions, and alignment of the bypass components necessary to fulfill the project design objectives.

Description of Bypass. The design consists of open channel flow through enclosed box culverts extending beneath the right overbank of the Guadalupe River. Excluding the weir flow at the inlets, the flow regime for the entire bypass is subcritical flow. Inlet weirs are of the side-channel type, due to restricted space at the entrance structure locations. Inlet weirs are located near the Santa Clara Street Bridge and near the St. John Street Bridge. Inlet weir crest elevations are designed to keep flows less than 1,500 cfs in the Guadalupe River channel. Flows exceeding 1,500 cfs will be partially diverted through the bypass culverts paralleling the main channel. The culverts exit near Coleman Avenue. The natural channel remains in its existing condition, with the possible exception of invert stabilization measures at selected locations along the channel alignment.

Summary of Hydraulic Analyses. The bypass design was evaluated using the HEC-RAS computer program. The HEC-RAS model of the study reach is based on earlier HEC-2 models developed by the Corps' Sacramento District for design of the flood control project, as described in the GDM. The HEC-RAS model was updated to reflect present-day channel conditions and proposed bridge modifications. The UNET computer program was also used to evaluate the performance of the two bypass alternatives for the design flood event hydrograph.

HEC-RAS Modeling – The HEC-RAS model was developed and run for two design discharge conditions, both of which represent different points in time on the design flood event hydrograph. The first design discharge scenario represents peak flow conditions during the design event, and includes 14,600 cfs peak Guadalupe River flow plus 2,400 cfs from Los Gatos Creek for a total discharge of 17,000 cfs downstream from the Los Gatos Creek confluence. The second design discharge scenario represents flow conditions when Los Gatos Creek flows are at their peak. For this scenario, 7,800 cfs from Los Gatos Creek is combined with 8,000 cfs from the Guadalupe to provide a total of 15,800 cfs downstream from the Los Gatos Creek confluence.

The primary design event for the culverts was the peak Guadalupe River flow and coincident Los Gatos Creek flow, since that particular point on the hydrograph requires the greatest culvert discharge capacity. Water surface profiles remain below project freeboard requirements throughout the design event for both alternatives.

UNET Modeling – The second design discharge scenario was evaluated primarily with UNET using the design developed from HEC-RAS. The entire design flood event hydrograph was run through the UNET model to observe the water surface profiles generated, and to determine flow portioning and the maximum discharge passed during the entire design event.

UNET results showed that during the peak flow on Los Gatos Creek, a portion of the flow actually turns and flows upstream from the confluence to the inlets near Santa Clara Street.

These results were used to refine the HEC-RAS hydraulics for use in the inlet weir designs. The results also confirmed that two inlets are required because of the timing of the hydrographs and the large peak occurring on Los Gatos Creek.

Conclusions. The proposed bypass system provides significant reductions in water surface profiles in the bypassed reach by drawing a large portion of the river flow out of the channel. The diverted flow, approximately 10,000 cfs (combined), is then returned back to the channel at Coleman Avenue, where there is sufficient capacity to carry the peak flow of the design event in the river and floodway. Undiverted flows for the design flood event are contained within the existing Guadalupe River channel between Santa Clara Street and Coleman Avenue with at least one-foot of freeboard.

The proposed bypass system allows the preservation of existing SRA, aquatic habitat and channel bank vegetation. The bypass will require some disruption of the existing bank vegetation in order to install inlet and outlet features. A section of the Guadalupe River channel in the vicinity of the proposed bypass inlets will require bed and bank revetment (armoring) to ensure channel stability. The existing river channel downstream from and adjacent to the bypass outlet structures may require stabilization measures. A physical model study of the bypass will determine if the design will perform as expected, or if modifications to the design are necessary. The physical model will also evaluate sediment characteristics of the reach and if stabilization measures are needed in the natural channel.

The proposed bypass system is ungated and would not require operation during flood events. Trashracks may be designed for the inlets to the bypass system if it is determined that they are necessary to prevent clogging of the bypass. The trashracks would be designed to be effective with 50 percent clogging, although a cleaning mechanism may also be required.

5C.3.5.2 Invert and Bank Stabilization Design

With the construction of a bypass there will be reduced discharges down the natural channel during flood events, however, until detailed with-project sediment transport analyses and the physical model study are completed, the long-term condition of the channel cannot be estimated with accuracy. Channel grade stabilization structures may be required throughout the bypass reach to arrest additional thalweg degradation and bank erosion.

5C.3.5.3 Low Flow Channel Design

Low-flow channels have been incorporated into the reach above Santa Clara Street. The low-flow channel in the armored area of the second bypass must still be designed. Chapter 3 of the Report contains figures illustrating various proposed low-flow channel designs. Approved designs will address USFWS, NMFS, CDFG and RWQCB issues, along with operations and maintenance and fish passage.

5C.3.6 Streambank Protection Requirements

5C.3.6.1 General

In some reaches of the river, high velocities are expected to occur during flood events. Streambank protection will be required at critical locations where project velocities are

greater than permissible, at locations where flow transitions occur, and at interfaces between different channel materials (e.g., from concrete to natural channel). Generally, streambank protection is recommended wherever velocities exceed 6 fps. Grade control structures are also proposed in order to stabilize the invert slope of the river. Streambank protection methods proposed consist of grade controls and terminations, cellular concrete mattresses (CCM), concrete, and gabions.

5C.3.6.2 Project Velocities

Project velocities for streambank protection design are computed assuming a reduction in Manning's "n" value of 20 percent from the overbank "n" values and main channel "n" values. During the completed physical model study, velocities in the modeled reach between Grant Street and Santa Clara Street were measured along selected cross-sections. The velocities indicated below represent an average across the channel at the channel invert.

Location	Project Velocity (fps)	Permissible Velocity (fps)
Santa Clara St. Bridge	4.8	6.8
San Fernando St. Bridge	5.6	6.8
Bypass Outlet	5.1	6.8
Park Ave. Bridge	3.7	5.1
San Carlos St. Bridge	6.7	5.1
Woz Way Bridge	2.7	5.1
Bypass Weir	10.0	7.7

The project velocities at the riverbed indicate additional streambank protection will be required near San Carlos Street. Updated project velocities within the reach from Santa Clara to Coleman will be obtained with the new physical model and additional streambank protection needs determined there also. The bypass weir areas are armored as part of the current project so streambank protection is already addressed.

5C.3.6.3 Permissible Velocities

Permissible channel velocities for project conditions were based upon hydraulic simulation of the 1986 (approximately 20-year) event. The computed velocities for this event were considered to represent the upper limit of permissible velocities for project conditions.

5C.3.6.4 Local Scour Protection

Where vegetation removal and excavation is required adjacent to new or existing bridge piers as part of the project improvements, and general channel invert protection is not required, pier scour protection will be provided.

5C.3.6.5 Grade Control and Invert Stabilization

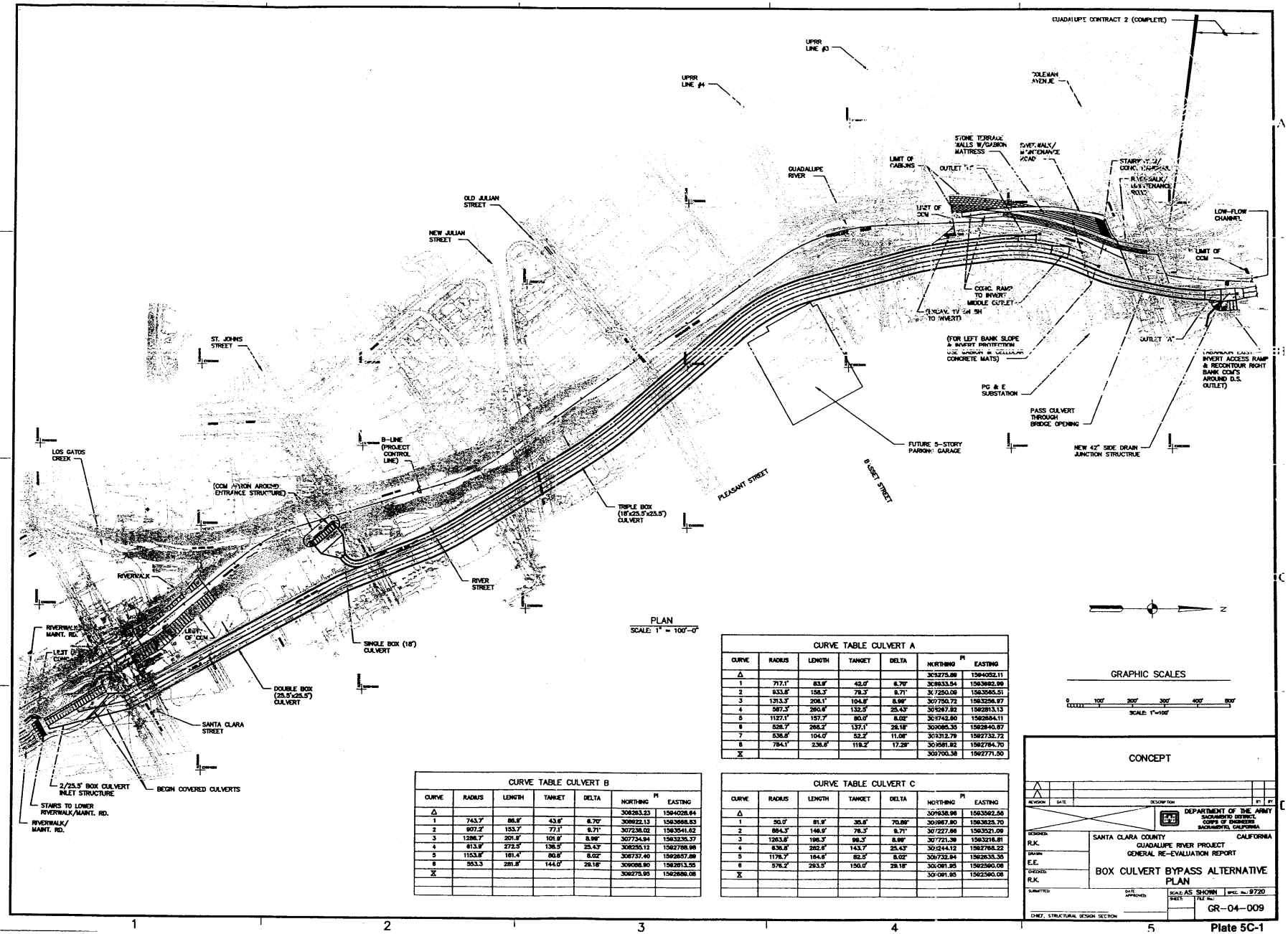
Channel grade stabilization structures may be required throughout the bypass reach between Santa Clara and Coleman to arrest thalweg degradation and bank erosion. Proposed grade stabilization concepts are presented in Chapter 3 of the report.

5C.3.6.6 Interior Drainage

In the 1991 GDM there were three areas where potential drainage problems were investigated. These areas lacked the required 1-foot of freeboard between the adjacent ground and the design water surface elevation. Engineered fill was proposed to provide the required freeboard with drop inlets used where the fill will cause an interior drainage problem by impeding overland drainage back to the river. This re-evaluation study provides for a bypass from near Santa Clara Street to Coleman Ave, resulting in less flow in the natural channel near two of the previously identified areas. These areas will be checked during detailed design, with data from the physical model, to ensure there will be proper freeboard as well as no interior drainage problems.

Plates

5C-1 Box Culvert Bypass Alternative - Plan
5C-2 Box Culvert Bypass Alternative - Partial Plans
5C-3 Box Culvert Alternative – Plans and Sections
5C-4 Box Culvert Alternative – Typical Cross Sections
5C-5 Peak Flow Frequency
5C-6 1% Chance Flood Hydrographs
5C-7 Standard Project Flood Hydrographs



PLAN
SCALE: 1" = 100'-0"

CURVE TABLE CULVERT A						
CURVE	RADIUS	LENGTH	TANGET	DELTA	PI NORTHING	PI EASTING
Δ					309275.88	1564052.11
1	717.1'	83.9'	42.0'	6.70°	309333.54	1563992.99
2	833.8'	158.3'	79.3'	9.71°	307250.09	1563565.51
3	1313.3'	208.1'	104.8'	8.99°	307750.72	1563256.97
4	587.3'	260.8'	132.5'	25.43°	309267.92	1562813.13
5	1127.1'	157.7'	80.0'	8.02°	309742.80	1562684.11
6	526.7'	268.2'	137.1'	29.18°	309085.35	1562840.87
7	536.6'	104.0'	52.2'	11.06°	309312.79	1562732.72
8	784.1'	236.6'	119.2'	17.29°	309581.82	1562784.70
X					309700.38	1562771.50

CURVE TABLE CULVERT B						
CURVE	RADIUS	LENGTH	TANGET	DELTA	PI NORTHING	PI EASTING
Δ					308283.23	1564028.84
1	743.7'	86.8'	43.6'	6.70°	308922.13	1563988.83
2	907.2'	153.7'	77.1'	9.71°	307238.02	1563541.62
3	1286.7'	201.8'	101.9'	8.99°	307734.94	1563235.37
4	613.9'	272.5'	138.9'	25.43°	308255.12	1562788.98
5	1153.8'	161.4'	80.8'	8.02°	308737.40	1562657.89
6	553.3	281.8'	144.0'	29.18°	309088.90	1562813.55
X					309275.95	1562880.08

CURVE TABLE CULVERT C						
CURVE	RADIUS	LENGTH	TANGET	DELTA	PI NORTHING	PI EASTING
Δ					309938.98	1563592.56
1	50.0'	81.9'	35.8'	70.89°	309987.90	1563625.70
2	884.3'	146.9'	76.3'	9.71°	307227.88	1563521.09
3	1263.8'	198.3'	99.3'	8.99°	307721.39	1563216.81
4	636.8'	282.6'	143.7'	25.43°	309244.12	1562768.22
5	1176.7'	164.6'	82.5'	8.02°	309732.94	1562635.35
6	576.2'	293.5'	150.0'	29.18°	309091.95	1562580.08
X					309091.95	1562580.08

GRAPHIC SCALES

0 100' 200' 300' 400' 800'
SCALE 1"=100'

CONCEPT

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: R.K.
DRAWN: E.E.
CHECKED: R.K.
SUBMITTED: CHIEF, STRUCTURAL DESIGN SECTION
DATE APPROVED:

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT

BOX CULVERT BYPASS ALTERNATIVE PLAN

SCALE: AS SHOWN SPEC. No. 9720
SHEET: FILE No.: GR-04-009

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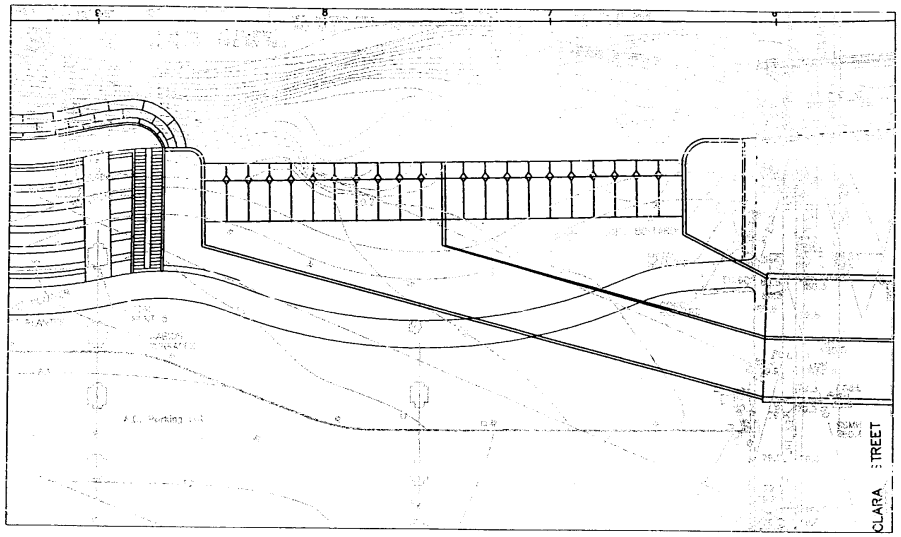
Plate 5C-1



PLAN–2/25.5' INLET STRUCTURE 'A' AND 'B'
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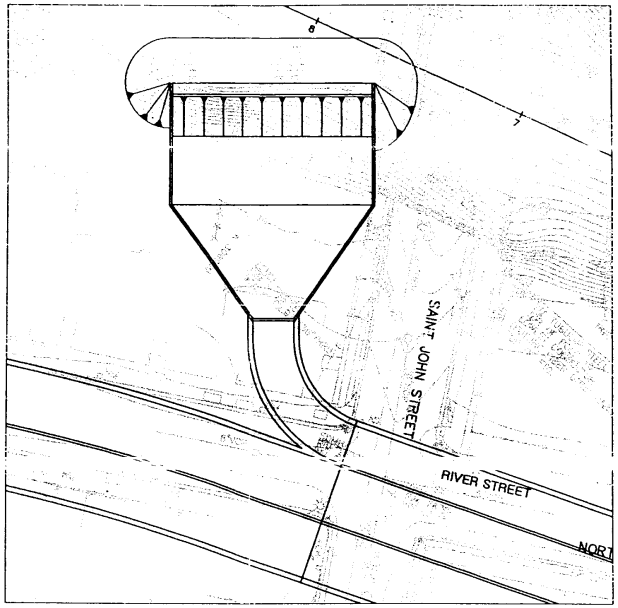

PLAN–1/18' INLET STRUCTURE 'C'
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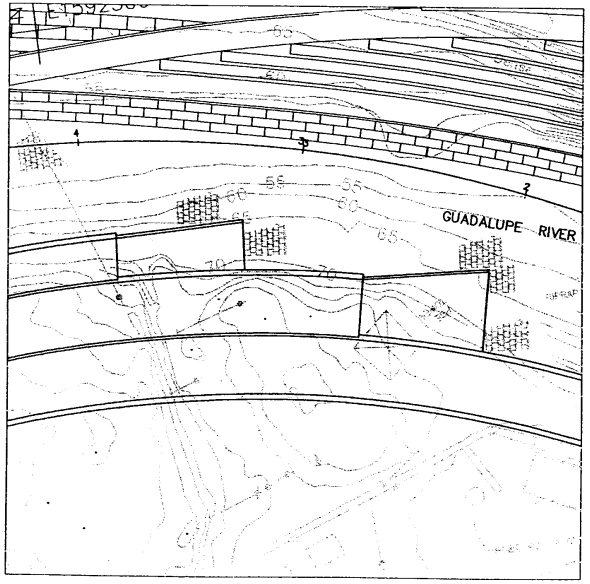

PLAN–EXIT STRUCTURES 'C' AND 'B'
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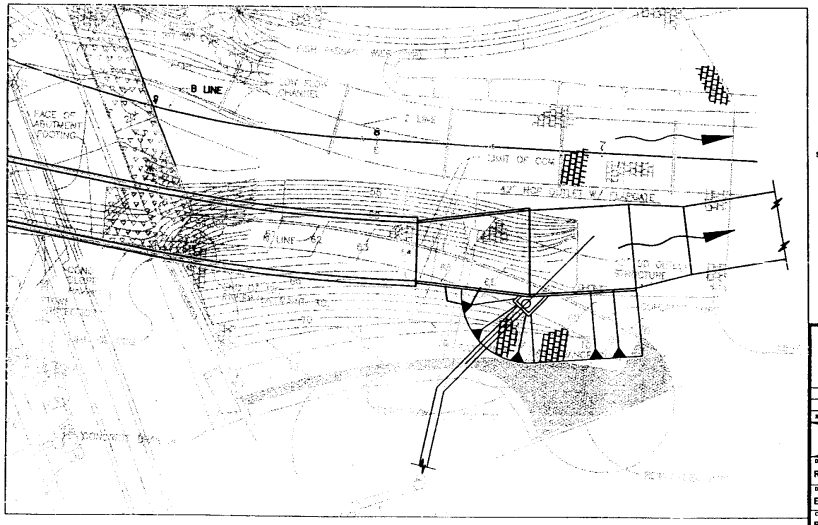

PLAN–EXIT STRUCTURE 'A'
SCALE: 1" = 20'–0"

GRAPHIC SCALES

SCALE: 1"=20'

0 20' 40' 60' 80' 100'

CONCEPT

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: R.K.	SANTA CLARA COUNTY CALIFORNIA
DRAWN: E.E.	GUADALUPE RIVER PROJECT
CHECKED: R.K.	GENERAL RE-EVALUATION REPORT
SUBMITTED:	BOX CULVERT BYPASS ALTERNATIVE PARTIAL PLANS
CHIEF, STRUCTURAL DESIGN SECTION	DATE APPROVED: SCALE: AS SHOWN SPEC. No. 9720 SHEET: FILE No.: GR-04-009

Plate 5C-2

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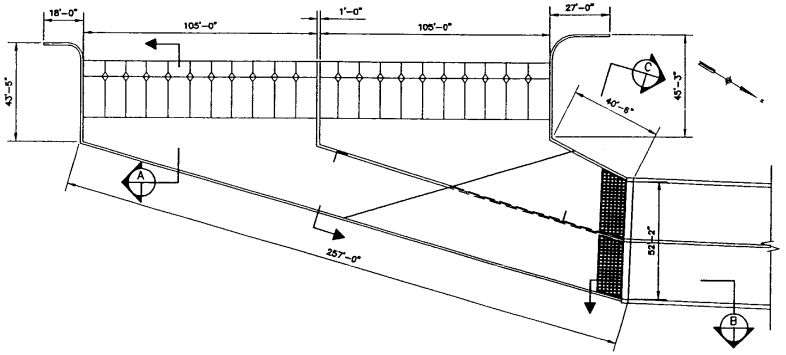

PLAN–2/25.5' BOX CULVERT
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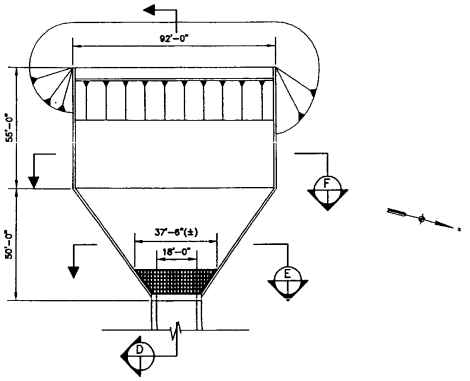

PLAN–1/18' BOX CULVERT
INLET STRUCTURE 'C'
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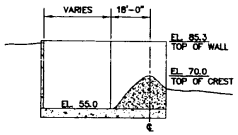

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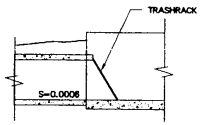

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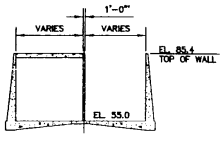

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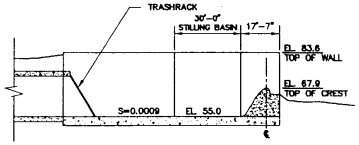

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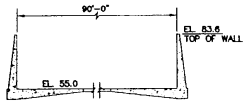

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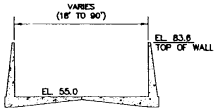

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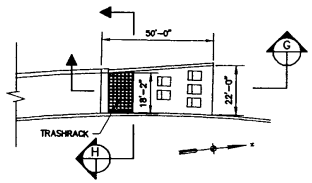

PLAN–1/18' BOX CULVERT
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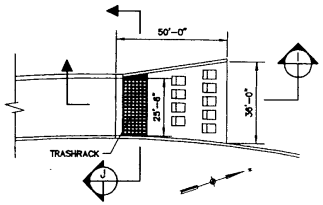

PLAN–1/25.5' BOX CULVERT "B"
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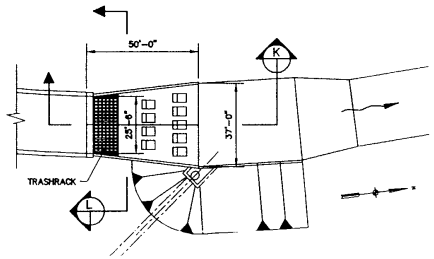

PLAN–1/25.5' BOX CULVERT
OUTLET STRUCTURE 'A'
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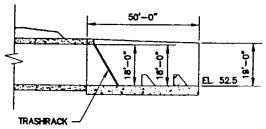

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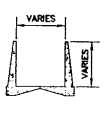

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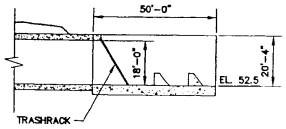

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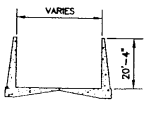

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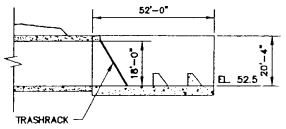

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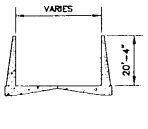

SECTION L
SCALE: 1"=20'-0"

GRAPHIC SCALES

SCALE: 1"=10'-0" 0 10' 20' 30' 40' 80'

SCALE: 1"=20'-0" 0 20' 40' 80' 80' 100'

CONCEPT

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED	X.X.
DRAWN	E.E.
CHECKED	

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT

BOX CULVERT ALTERNATIVE

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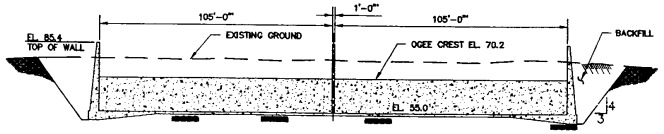
Plate 5C-3



2/25.5' BOX CULVERT INLET 'A & B'
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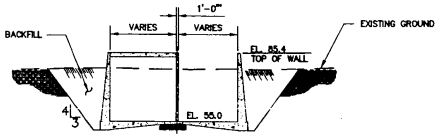
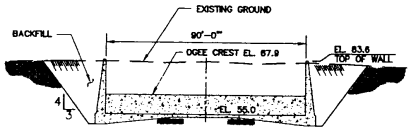


2/25.5' BOX CULVERT
INLET 'A & B' SECTION (TYP.)
SCALE: 1" = 20'-0"



1/18' BOX CULVERT INLET 'C'
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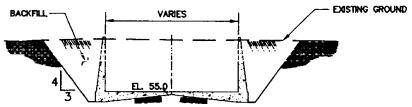
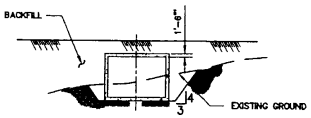
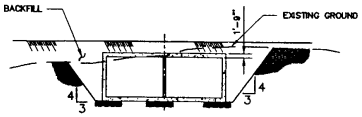


1/18' BOX CULVERT
INLET'C' SECTION (TYP.)
SCALE: 1" = 20'-0"



25.5'x18' BOX CULVERT SECTION (TYP.)
SCALE: 1" = 20'-0"



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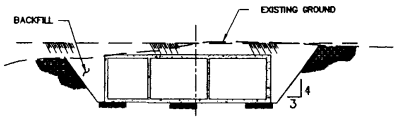
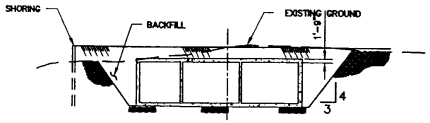
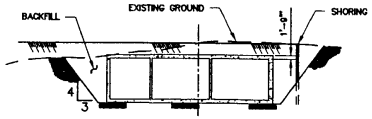


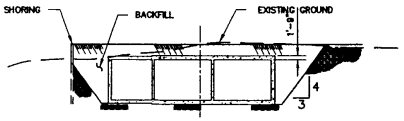
2/25.5' & 1/18' BOX CULVERT SECTION (TYP.)
SCALE: 1" = 20'-0"



2/25.5'x18' & 1/18'x18' BOX CULVERT SECTION
AT NEW JULIAN STREET
SCALE: 1" = 20'-0"



2/25.5'x18' & 1/18'x18' BOX CULVERT SECTION
AT FUTURE PARKING GARGAGE
SCALE: 1" = 20'-0"



2/25.5'x18' & 1/18'x18' BOX CULVERT SECTION
AT RAILROAD CROSSING
SCALE: 1" = 20'-0"

TYPICAL CROSS SECTION FOR BOX CULVERT ALT.

GRAPHIC SCALES

SCALE: 1"=20'-0" 0 20' 40' 60' 80' 100'

CONCEPT

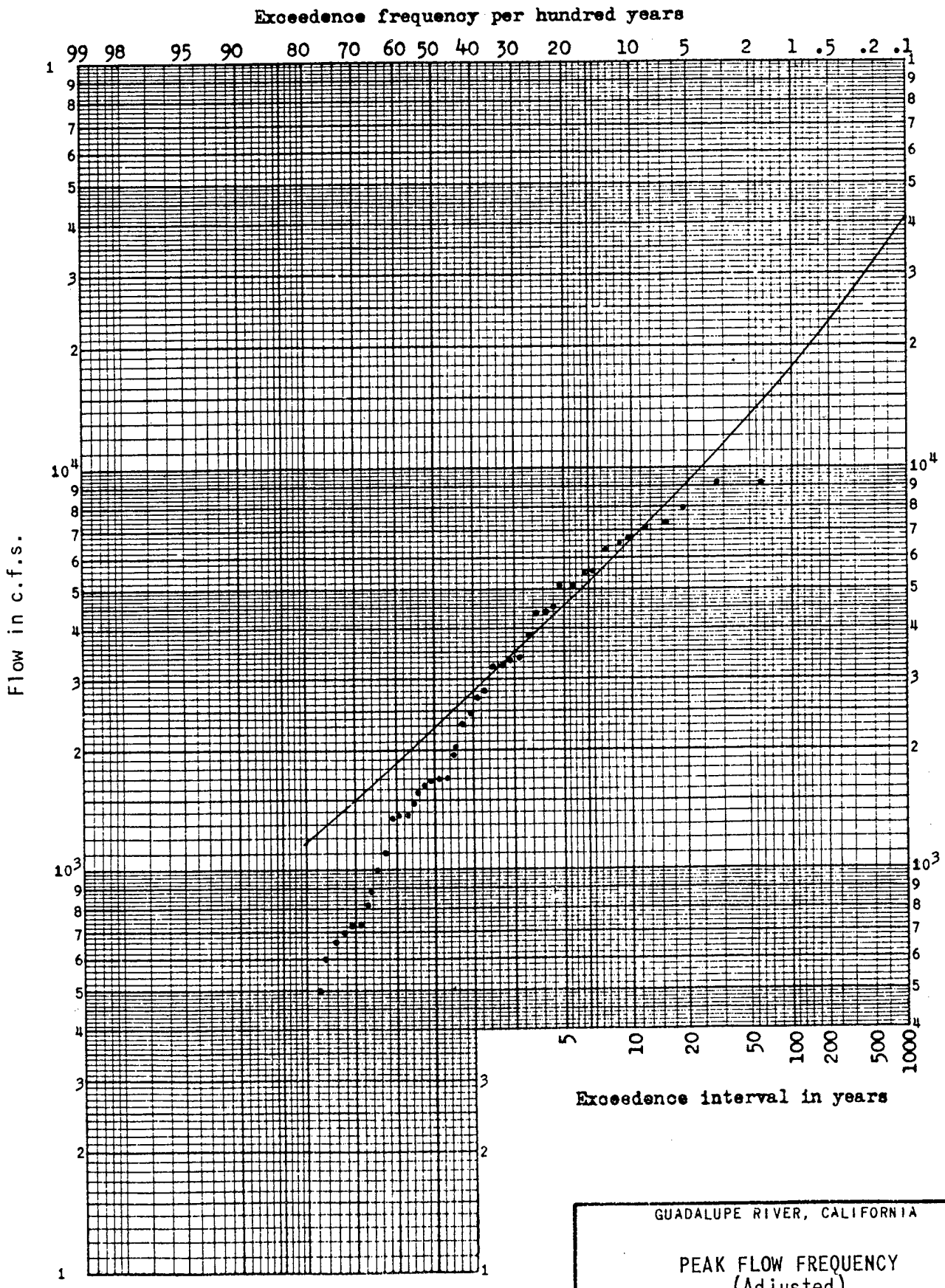
REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT,
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: XX	SANTA CLARA COUNTY CALIFORNIA
DRAWN: E.E.	GUADALUPE RIVER PROJECT
CHECKED: R.N.	GENERAL RE-EVALUATION REPORT
SUBMITTED:	BOX CULVERT ALTERNATIVE TYPICAL CROSS SECTIONS
DATE APPROVED:	SCALE: AS SHOWN SPEC. No. 9720
CHIEF, STRUCTURAL DESIGN SECTION	SHEET: FILE No.: GR-04-009

Plate 5C-4

C:\PROJECTS\GUADALUP\CONT-5\GR-TB 09/09/97 10:37
D:\GUADALUPE\CONT-3AA381999\GRS-PLATE4.DWG 5 JAN 2000



Period of Record: 1930-1987
Drainage Area: 144 Sq. Mi.

GUADALUPE RIVER, CALIFORNIA

PEAK FLOW FREQUENCY
(Adjusted)

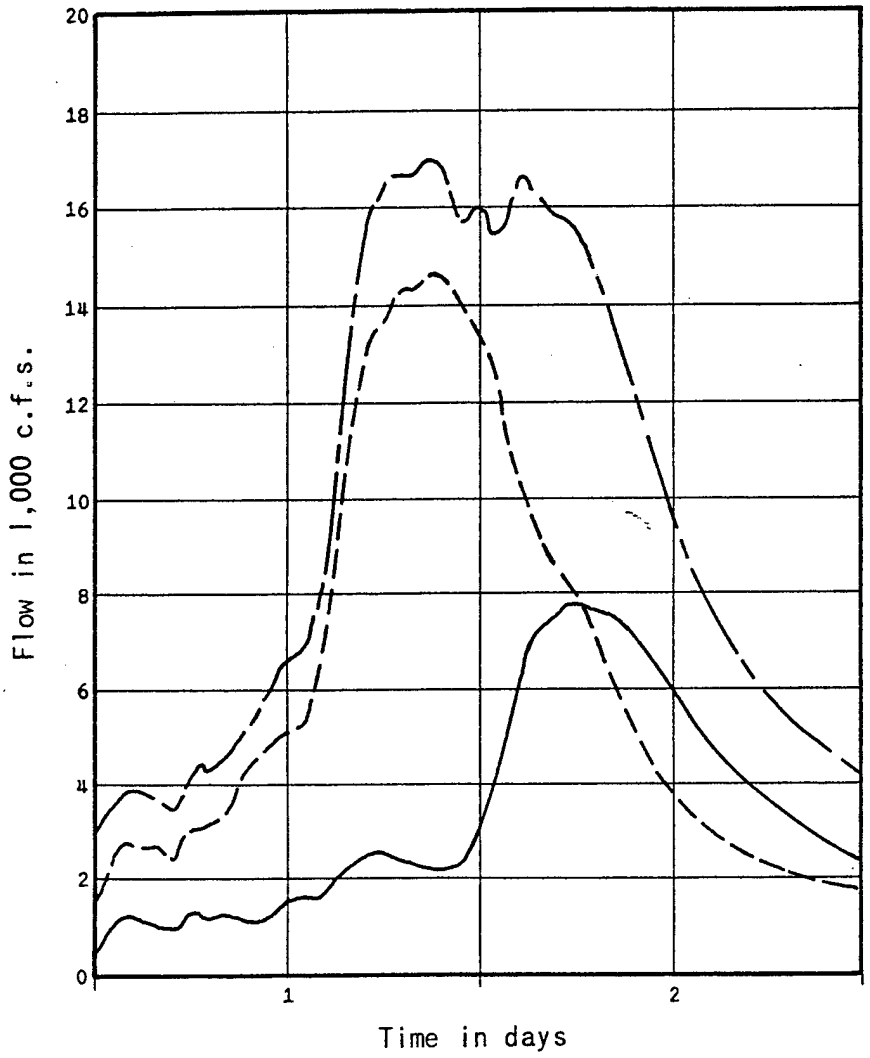
GUADALUPE R. @ SAN JOSE
(Below Los Gatos Cr.)

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: K.F.
Drawn: C.A.P.

Date: JAN. 1991

Plate 5C-5



LEGEND:

——— Guadalupe R. at San Jose
D.A. 144 Sq. Mi.

——— Guadalupe R. Above Los Gatos Cr.
D.A. 92 Sq. Mi.

——— Los Gatos Cr. at Guadalupe R.
D.A. 52 Sq. Mi.

GUADALUPE RIVER, CALIFORNIA

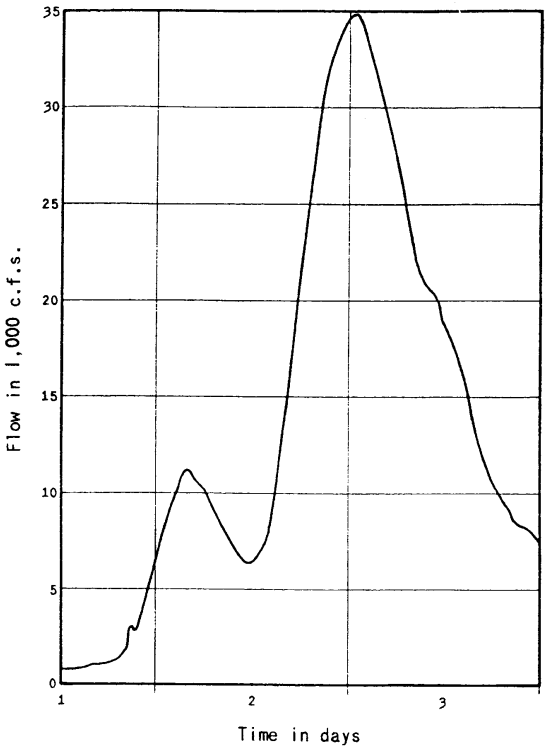
ONE PERCENT CHANCE
FLOOD HYDROGRAPHS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

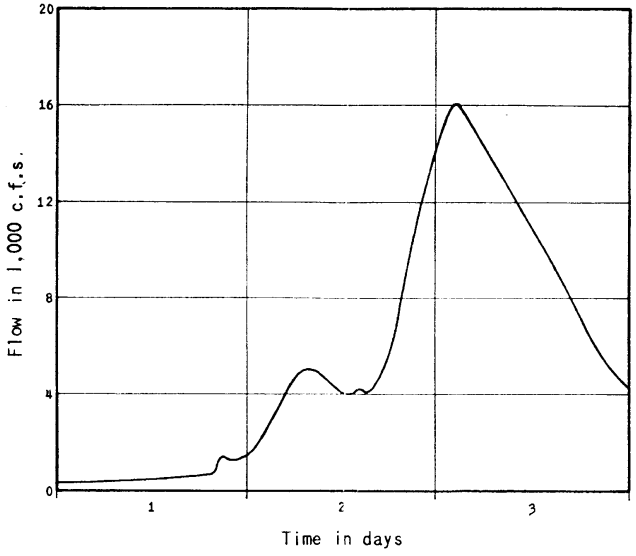
Prepared: K.F.
Drawn: C.A.P.

Date: JAN. 1991

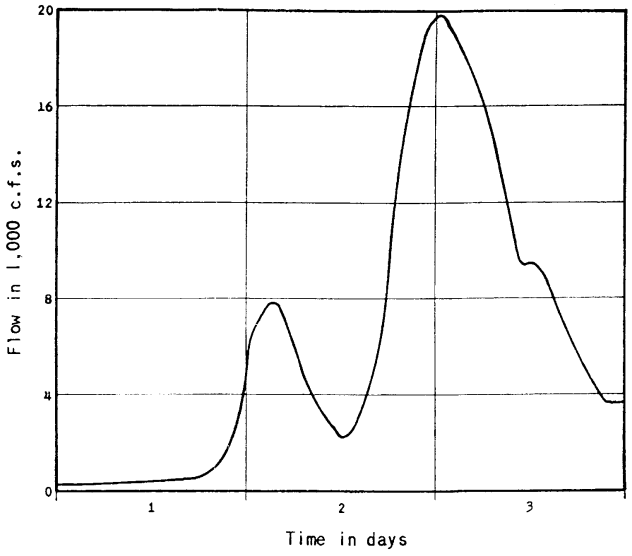
GPO 585-067/40010



GUADALUPE R. AT SAN JOSE
Drainage Area: 144 Sq. Mi.



LOS GATOS CR. AT GUADALUPE R.
Drainage Area: 52 Sq. Mi.



GUADALUPE R. ABOVE LOS GATOS CR.
Drainage Area: 92 Sq. Mi.

GUADALUPE RIVER, CALIFORNIA

STANDARD PROJECT
FLOOD HYDROGRAPHS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared:
Drawn:
Date: JAN. 1991

Plate 5C-7

Appendix 5D - Structural Design

5D.1 General

This chapter presents the basis for structural design of the proposed bypass channel located in the Segment 3A/3B reach of the Guadalupe River Project between Santa Clara St. and Coleman Ave. Structural design includes the following reinforced concrete and gabion hydraulic structures: (1) box culvert, (2) rectangular open channel (2) invert access ramps, (3) ogee weirs, (4) retaining walls, (5) gabion terraces and concrete steps for slope protection, (6) protective measures for existing bridge abutments, and (7) miscellaneous structures such as side drain structures. Design criteria, design assumptions, and loading conditions are presented. Brief descriptions of the structures are also included to supplement the data shown on the plates. The information in this chapter serves as the basis of design for subsequent contract plans and specifications for the channel project.

5D.2 Design Criteria

Structural design of the channel structures shall be in accordance with applicable Corps of Engineers' Engineering Regulations (ER), Engineering Manuals (EM), and Engineering Technical Letters (ETL). The criteria and procedures presented in the documents are supplemented by applicable building codes and recognized design procedures where necessary and appropriate.

5D.2.1 References

The principal references used for structural analyses and design are as follows:

"Retaining and Flood Walls," EM 1110-2-2502 and ETL 1110-2-322, 29 September 1989 and 15 October 1990, respectively.

"Details & Reinforcement - Hydraulic Structures," EM 1110-2-2103, 21 May 1971.

"Strength Design for Reinforced Concrete Hydraulic Structures," EM 1110-2-2104, 30 June 1992.

"Earthquake Design and Evaluation for Civil Works Projects," ER 1110-2-1806, 31 July 1995.

"Earthquake Design Guidance for Structures (EDGS)@, CECW-ED Memorandum, 30 October 1996.

"Conduits, Culverts and Pipes," EM 1110-2-2902, (Changes 1 to 3), 3 March 1969.

"Flotation Stability Criteria for Concrete Hydraulic Structures," ETL 1110-2-307, 20 August 1987.

"Working Stresses for Structural Design," EM 1110-2-2101, 1 November 1963.

"Design Criteria - Paved Concrete Flood Control Channels," ETL 1110-3-236, 30 June 1978.

"Building Code Requirements for Reinforced Concrete," ACI 318, 1983 (Revised 1986).

"Standard Specifications for Highway Bridges," AASHTO, 13th Edition, 1983.

"Bridge Design Practice: Section 6 - Structures Under Roadway Embankments", California Department of Transportation, October 1982.

"Bridge Design Aids: Section 14 – Seismic", California Department of Transportation, October 1989.

"Rigid Pavements for Roads, Streets, Walks, and Open Storage Areas," TM 5-822-6.

5D.2.2 Material Strength

Material strength for various elements of the structures shall be as follows:

Concrete (Ultimate compressive strength):

Box culvert structures	f'c = 4,000 psi
All other cast-in-place structures	f'c = 3,000 psi

Reinforcing Steel:

ASTM Grade A615 Grade 60	fy = 60,000 psi

5D.3 Design Method

Design of the reinforced concrete structures will be by the strength design method in accordance with EM 1110-2-2104 and EM 1110-2-2502. The factored loads and forces shall be applied as defined in these references. The stability analyses are based on unfactored loads.

5D.4 Design Load Conditions

The load conditions to be considered for the design of channel retaining wall and rectangular concrete channel wall structures shall include: (a) *construction case,* (b) *normal case,* (c) *seismic case,* and (d) *flood case.* Wind loading is not considered significant and was not used in the design. EM 1110-2502 presents the criteria for sliding stability factors of safety, overturning resultant locations and bearing capacity factors of safety. EM 1110-2-2502 requires that at-rest earth pressures be used for driving side lateral force computations. Resisting side earth pressures shall not exceed one-half the passive earth pressures calculated using unfactored shear strengths. The seismic load case shall be analyzed for active earth pressures on the driving side and full passive earth pressures on the resisting side. The effects of surcharge loads, ground water table and sloping backfill will be considered, as applicable, for all load cases. The Boussinesq method of analysis can be used to approximate the lateral earth pressures due to surcharge loads. The design construction surcharge load will be equivalent to either a D-6 Caterpillar bulldozer located four feet from the structure or a D-4 Caterpillar bulldozer located two feet from the structure. The service load for the normal load condition will be an H-15 truck loading.

For channel structures which are able to yield laterally during an earthquake (i.e., retaining wall structures), the calculation of lateral active earth pressures during seismic loading can

be approximated by the pseudo-static Mononobe-Okabe method of analysis as outlined in EM 1110-2-2502. In addition, the inertia forces of the wall due to earthquake accelerations, plus that portion of the adjacent earth and/or water which is assumed to act with the wall will be included. The seismic coefficient to be used for this project, which is located in Seismic Zone 4, is 0.20. For all wall types use of the seismic coefficient method is dependent upon the foundation materials being non-susceptible to liquefaction. A liquefaction assessment should be conducted before final design of the wall systems.

5D.5 Project Structures

5D.5.1 Reinforced Concrete Box Culvert

The bypass channel is a multi-cell rectangular box culvert structure that will run between Santa Clara Street and Coleman Avenue. The box culvert will be designed as a rigid frame structure in accordance with the design procedure and loading conditions obtained from the CALTRANS Bridge Design Practice manual and EM 1110-2-2902. The design loading conditions are similar to those shown on Plate 33 of the GDM. The box culvert will be constructed using the conventional open-cut, cast-in-place method. Pre-fabricated culvert sections with different shapes were investigated as feasible alternatives to the cast-in-place culvert and will be given further consideration in the final design.

Safety considerations led to the selection of a covered box culvert rather than an open channel for the bypass system. The urban nature of downtown San Jose, along with the fact that the bypass system will be constructed in a park that attracts thousands of adults and children each week, were significant factors in the decision to cover the bypass.

5D.5.2 Rectangular Channel

The inlet and outlet structures for the bypass channel will be reinforced concrete rectangular channel structures with vertical side walls and attached concrete invert slabs. A subdrain system will be provided beneath the channel invert slab and along the channel walls. The vertical wall will be backfilled with a sandy free-draining material that will be imported, as described in the geotechnical basis of design. The invert will be placed over compacted native material and drainage material. The design loading conditions are similar to those shown on Plate 31 of the GDM. In addition to these loading conditions, the invert slab will be designed for H20-44 vehicular loading (maintenance vehicles and construction equipment) acting both during and after construction.

5D.5.3 Cantilever Retaining Walls

The channel retaining walls will be inverted tee cantilever walls backfilled as described for the rectangular channel wall in the paragraph above. A stability analysis shall be performed for all retaining wall structures in accordance with EM 1110-2-2502. The loading conditions are shown on Plate 31 of the GDM. In areas where construction and right-of-way is restricted so that shoring of soil slopes is necessary, the native material properties will be considered in the design of the channel walls.

5D.5.4 Temporary Shoring

At Santa Clara Street, St. John Street, New Julian Street, and UPRR Bridge No. 4 portions of the bridge abutments will have to be shored by a system of cantilever soldier piles and lagging or other acceptable forms of temporary shoring (i.e. sheet pile walls). Temporary shoring will also be required near the center of the street crossings to maintain through-traffic on one half of the street while constructing the box culvert on the other half of the street. The use of tiebacks is not feasible at these locations. At the Sobrato Development Co. property where a 5-story parking garage structure is planned, there is very limited space to construct the right wall (looking downstream) of the box culvert structure. At this location, a cantilever wall shoring system will be required which may be left in place after construction.

5D.5.5 Bypass Weir

Weirs located at the 2 inlet structures control the division of flow from the main channel to the box culvert bypass channel. The loading conditions are similar to those shown on Plate 34 of the GDM. Stability analysis flotation loads will be applied in accordance with ETL 1110-2-307.

5D.5.6 Gabion Walls

Gabion walls will be designed as mass gravity retaining walls in accordance with EM 1110-2-2502. The design loading conditions are shown on Plate 32 of the GDM. Flotation stability criteria shall be evaluated in accordance with ETL 1110-2-307.

5D.5.7 Concrete Steps and Terraces

Concrete steps and terraces will be designed as mass gravity retaining walls in accordance with EM 1110-2-2502.

5D.5.8 Confluences

All confluences will be designed for their respective differential heads of water pressure against the common walls between the two channels or a minimum of five feet of hydrostatic head.

5D.5.9 Side Drainage Structures

Various sizes of RCP (reinforced concrete) drainage pipes will be provided to connect existing facilities and new drainage facilities into the new proposed bypass channel. Flap gates will be provided where necessary. Circular pipes entering the channel through a concrete wall will be reinforced concrete laid on an ordinary bedding of drainage and filter material in a standard trench as shown in the plans for the Authorized Project. The design loads shall be determined in accordance with EM 1110-2-2902, and a load factor of 1.5 will be used. Circular pipes entering the main channel through an earth bank or gabion slope protection will be reinforced concrete as shown in the plans for the Authorized Project.

5D.5.10 Pier Extensions

Pier extensions associated with the construction of the bypass channel alignment currently proposed are not anticipated.

5D.5.11 Railroad Bridges

The Proposed Action may require replacement of railroad bridges. A shoo-fly to temporarily re-route traffic from UPRR Bridge No. 4 to UPRR Bridge No. 3 will be designed at existing grade in accordance with applicable standards of the AREA manual for Railway Engineering. A Cooper E-80 train loading will be used to design the temporary shoo-fly.

5D.6 Joints

The paving for the invert of the channels shall be designed as continuously reinforced without transverse and longitudinal joints, except for construction joints placed at the end of a concrete placement operation. This type of construction has been successfully used on the Corps of Engineers' Walnut Creek project. Control joints in the wall shall be spaced at intervals of 25 feet or less. Vertical expansion joints shall be provided where the channel abuts another structure such as a box culvert or bridge abutment. Other design criteria will be in accordance with ETL 1110-3-236.

5D.7 Reinforcement Details

5D.7.1 Minimum Reinforcement

The minimum amount of shrinkage and temperature reinforcement required shall be in accordance with ETL 1110-3-236, EM 1110-2-2103, and ACI 318. The longitudinal and transverse reinforcement for the continuously reinforced concrete slab shall be 0.40 percent of the gross cross-sectional area of the concrete in each direction, up to a maximum of #7 reinforcement bars spaced at 12 inches on center. The amount of horizontal and vertical reinforcement for shrinkage and temperature changes for the wall between contraction joints shall be 0.25 percent of the gross cross-sectional area of the concrete in each direction, up to a maximum of #6 reinforcement bars spaced at 12 inches on center. The exposed face shall have a minimum of one-half and a maximum of two-thirds the total steel required for each direction.

5D.7.2 Minimum Cover Of Reinforcement

The minimum concrete cover for reinforcement shall be 3" where concrete is placed against earth, 3" for invert slabs, and 2" where concrete is exposed to earth or weather but placed in forms.

Appendix 5E - Surveying and Mapping

5E.1 General

Engineering surveys were originally conducted in 1987 to support the GDM design efforts. Since 1987, several large flood events have eroded the river, portions of the project have been constructed, and urban redevelopment has occurred adjacent to the river. Several permanent monuments have been destroyed because of the urban redevelopment. New permanent monuments will have to be established. During the preparation of the construction plans and specifications for Segments 1,2, and 3, the 1987 topography was supplemented by field surveys performed in 1990, 1994, 1995, and 1996 and by aerial photographic topography maps dated performed in 1991 and 1994. The survey is based on the California State Plane Coordinates Zone III (NAD 27) horizontal datum and NGVD 1929 vertical datum. Most recently, cross-sectional surveys of the river have been performed to supplement the hydraulic modeling efforts. In addition, topographic mapping produced by the Sobrato Development Company for the east bank area between New Julian Street and the Union Pacific Railroad (UPRR) property has been obtained. It is being reviewed for conformance with the project survey standards. Further topographic mapping will be required for the east bank between the Sobrato Development Company property and Coleman Avenue (i.e., the UPRR property).

Appendix 5F - Geology

5F.1 General

This chapter presents information from the 1991 GDM along with new information and analyses performed after completion of the GDM in support of the plans and specifications for construction and for the re-evaluation study.

The Guadalupe River flows generally in a northwesterly direction beginning in the Santa Cruz Mountains, part of the Coast Ranges of Central California, through downtown San Jose and empties into the southern end of San Francisco Bay along the northern boundary of U.S. Naval Station Moffett Field. This river flows through a large alluvial basin known as the Santa Clara Valley. The topography of the region varies in elevation from sea level, 6 miles northwest of the project, to 4,200 feet National Geodetic Vertical Datum (NGVD) on Mt. Hamilton, 15 miles east of the project.

5F.2 Geologic History and Regional Geology

The Geologic History of the region is characterized by a series of depositional sequences, numerous folding and faulting episodes, and uplift and erosion. Widespread folding in the Coast Ranges occurred repeatedly since early Cretaceous time.

The Coast Ranges are defined as a Geomorphic Province in California and consist of many separate ranges, coalescing mountains, and a few major structural valleys. A map of California is included showing the Coast Range Geomorphic Province highlighted (Plate 5F-1). These mountains were formed by tectonic, sedimentary, and igneous process related to the Circum-Pacific orogenic belt. There are two core complexes within the Coast Ranges Geomorphic Province.

(1) A complex that is comprised primarily of regionally metamorphosed rocks and granitic plutons which is typical of the southern portion of the Coast Ranges.

(2) The more widespread northern portion of the Coast Ranges has a diverse core complex without the regional metamorphism and granitic plutons so typically found in the southern part of the complex. The core complex of the northern Coast Ranges was named the Franciscan Series by Lawson in 1895 after a typical rock assemblage studied near San Francisco. The prevalent rock type is a graywacke sandstone with shale interbeds. Other rock types found within the northern Coast Ranges include shale, conglomerate, volcanic rocks, chert, limestone, and some metamorphic rocks that attribute their presence to load metamorphism. As orogenic and tectonic activity occurred in the area of the present day Coast Ranges, the older existing faulted and folded structures were refaulted and refolded. There is believed to have been at least four orogenic events that helped shape the Coast Ranges. These are (1) Early Cretaceous orogeny that is recorded in the Salinian Block of the southern Coast Ranges; (2) Early Tertiary thrusting in the northern Coast Ranges area; (3) Prolonged Cenozoic strike-slip

faulting along the San Andreas fault system; and (4) Late Pliocene and Pleistocene folding and faulting.

During the early Cenozoic abundant deposition of sediments, in the area of the present day Coast Ranges occurred. These sediments are now indurated into sandstone, shale, and mudstone. Orogenic activity in the region during the Pliocene-Pleistocene time uplifted the Santa Cruz Mountains and the Diablo Range. Concurrent downwarping produced a structural trough between northwest-trending faults. Moreover, by mid-to-late Pleistocene time, the surrounding highlands were undergoing erosion of the Mesozoic (Jurassic to Cretaceous) formations, and vast quantities of sediment were deposited in the trough that is the present Santa Clara Valley. Although each epoch of Cenozoic time is represented in the stratigraphy, correlation of bedding is laterally discontinuous. Widespread late Cenozoic deposits occur and are mainly stream-deposited sand and gravel, thick sequences of fine-grained alluvium, and marine sediments.

5F.3 Geologic Units of the Central and Northern Coast Ranges

The basement rock for much of the Coast Ranges in central and northern California consists of the Jurassic-Cretaceous age Franciscan Complex and the Cretaceous age Great Valley Sequence. Overlying these two units are materials consisting of early Cenozoic (Tertiary-to-Quaternary) sedimentary formations and late Cenozoic continental shelf marine and alluvial deposits, some of which are unconsolidated.

The Franciscan Complex has been extensively folded, faulted, and sheared into structures that reflect its history. Approximately 90 percent of Franciscan material consist of grayish green graywacke sandstone. The remaining 10 percent consist of chert, shale, volcanics, ultramafic intrusives, and minor amounts of limestone interbedded with the graywackes. The chert and limestone are believed to have formed organically in a marine environment.

Rock of the Great Valley Sequence geographically flanks the Franciscan Complex and is generally in fault contact. The Great Valley Sequence is represented by the Knoxville Formation, the Oakland Conglomerate, and the Berryessa Formation. Rock types consist primarily of dark gray, thin-bedded shale with sandstone and conglomerate interbeds as well as small amounts of graywacke sandstone, pillow lava, and basal-derived sandstone.

5F.4 Geologic Structure

The dominant structure of the Central Coast Ranges is the parallel pattern of elongated topographical features and lithological units. This pattern consists of major northwest-trending structural blocks of basement complex terrane. From the Santa Clara Valley, the Franciscan basement has been postulated to extend underneath the Great Valley Sequence to the Sierra Nevada granitic-metamorphic basement located under the Great Valley Sequence. This is based solely on a few deep borings and the fact that some of the older rocks of the western Sierra Nevada foothills resemble those found within the Franciscan Complex boundaries. The San Andreas Fault separates the Franciscan basement from another granitic-metamorphic basement known as the Salinian Block. Fold axes generally parallel faults that commonly strike from N. 40 degrees to 60 degrees W. Concurrent uplift and erosion caused the formation of many localized unconformities. Faulting was an

integral part of the structural framework of the region. The area contains numerous faults, many of which are active.

5F.5 Project Geology

The project is located along approximately 2.5 miles of the Guadalupe River within the City of San Jose. The river follows a gently meandering northwesterly course with a relatively low gradient. Riverbank elevations vary from about 95 feet NGVD at the south (upstream) end to about 60 feet NGVD at the north (downstream) end.

The project area is underlain by several hundred feet of late-Quaternary age surficial deposits or valley fill that overlie early Quaternary sedimentary or volcanic rock. These materials are all underlain by Jurassic to Cretaceous age bedrock. The surficial deposits are shown on Plates 35 and 36 in the GDM (January 1991, Volume I of II).

Deposition of the valley fill, which consists of at least 900 feet of interbedded fine grained marine and continental sediments, probably occurred continuously throughout Quaternary time. These sediments are composed primarily of clay and silt with layers of sand and gravel. Sand and gravel deposits predominate near the mountains. These alluvial fan deposits thin toward the northern end of the valley. Periodic major fluctuations in sea level changed the mode of sediment deposition from subaqueous to subaerial (marine to fluvial). This explains the alternating sequence of near-surface marine and alluvial deposits. The marine sediments are divided into deposits of younger bay mud, sand, and older bay mud in order of increasing depth (Treasher, Ray C., Geology of Sedimentary Deposits in San Francisco Bay, California: California Division of Mines and Geology, Special Report 82, 1963).

In the project area most of the surface is covered by relatively thin fluvial deposits (not exceeding 10 feet where sub-surface explorations were conducted) with a few exposures of the underlying marine deposits (younger bay mud). Subsurface materials become progressively finer-grained toward the north (downstream). The younger and older bay mud layers (clay) become increasingly thicker toward San Francisco Bay where they constitute nearly the entire thickness of the sedimentary materials (Norris, Robert M. and Webb, Robert W., Geology of California, John Wiley, 1976). In the northern portion of the project, the bay mud layers are separated by relatively thin fluvial deposits of fine-grained sand, silt, and silty clay. In the southern portion, the bay mud layers are separated by alluvium consisting of fine to coarse-grained sand with gravel beds.

The Quaternary valley fill deposits are underlain by the Pleistocene age Santa Clara Formation at a depth of approximately 900 feet below the ground surface. The Santa Clara Formation consists of approximately 1,800 feet of poorly consolidated conglomerate, sandstone, siltstone, and claystone with minor lignite beds. Exposures of the Santa Clara Formation consisting of unconsolidated gravel and clay crop out along the eastern edge of the Santa Clara Valley.

No information was found to indicate that any Tertiary formations or Cretaceous Great Valley Sequence rocks overlie the Jurassic-Cretaceous Franciscan bedrock beneath the project area.

Franciscan bedrock is reported to occur at various depths to more than 1,500 feet beneath the Quaternary valley fill in the Santa Clara Valley. However, based on water level data, a conservative interpretation for depth to bedrock beneath the project is approximately 900 feet below ground surface. The bedrock surface is reported to be highly irregular with extreme elevation changes. About two miles southeast of the project, near Oak Hill, the depth to Franciscan bedrock varies from 270 to 780 feet below ground surface. Two wells located at the south end of the project area did not encounter bedrock at depths of 715 and 865 feet as shown on Plate 36 in the GDM (January 1991, Volume I of II). A city of San Jose water well, located about 1.5 miles east of the project area, did not encounter bedrock at a depth of 1,535 feet (California Department of Water Resources, Evaluation of Ground Water Resources-South Bay, Bulletin 118-1, San Francisco Bay District, 1967). This well is located near the intersection of Santa Clara and 17th Streets. The closest bedrock outcrop is located 2.5 miles southeast of the project area at Oak Hill Cemetery. This outcrop consists of Franciscan Complex and associated ultramafic intrusive rocks. The ultramafics have been altered to serpentinized peridotite or serpentinite.

No faults are known to exist beneath the project area. Two northwest-trending faults are shown on the Project Geology Map on Plate 36 in the GDM (January 1991, Volume I of II). These are the Silver Creek fault, 1 to 1.5 miles northeast of the project area and the San Jose fault, 2.5 to 3.0 miles southwest of the project area. The Silver Creek fault is the only fault considered to be active for the purposes of this report.

The geologic structure at the project area consists of alternating layers of nearly horizontally deposited sediments. Contacts between layers are generally clear and distinct. These layers all exhibit a slight regional dip (4 degrees) northward toward San Francisco Bay. Lateral material changes occur due to gradational fascies changes and cut-and-fill structure.

5F.6 Groundwater

The thick accumulation of Quaternary alluvial deposits constitute the bulk of the Santa Clara Valley groundwater basin. In general, the materials within the basin grade from coarse gravel near the foothill margins to sand, silt, and clay near the bay. Except for surficial bay mud deposits, individual bedding is primarily lenticular and discontinuous and rarely extends over any large area. The bedrock surface underlying the Quaternary materials is highly irregular with extreme changes in elevation across the valley.

The groundwater regime beneath the project area is best described as a three-layer system with an upper unconfined aquifer, an aquitard, and a confined aquifer at the base. The unconfined aquifer generally extends from the ground surface to a depth of approximately 150 feet where the clay and silt beds form an aquitard that is approximately 150 feet thick. The unconfined aquifer consists of sand and gravel lenses interbedded with locally confining clay layers. Near-surface perched water is common throughout the upper portion of the unconfined aquifer, especially within the project vicinity (Cooper-Clark & Associates, City of San Jose's Sphere of Influence, Geotechnical Investigation, 1974). Perched water was often encountered in isolated thin sand lenses during exploratory drilling. Beneath the aquitard is a confined aquifer, which is at least 500 to perhaps 600 feet thick and is bounded on the bottom by impermeable bedrock. The confined aquifer contains an upper and a lower layer with varied grain sizes. Within the upper layer, between approximately 300 and 500

feet below the ground surface, sand and gravel deposits predominate. The bulk of the groundwater pumped is from this zone of the confined aquifer. Below 500 feet the sediments reportedly become finer grained, are semiconsolidated, and are interbedded with blue clay layers.

Water level (perched water) information along the project alignment was obtained from several sources: subsurface exploratory drill hole logs; water level readings from three Corps of Engineers observation wells; and drill logs from various geotechnical firms under contract to the City of San Jose. Exploration holes 2F-10 and 2F-11, drilled for the box culvert portion of the project in June and August of 1987, were left open for 2 to 3 days to allow the static water level to equilibrate before water level readings were taken. These subsurface explorations were conducted before construction of the box culvert and before dewatering was initiated in that area.

During explorations in the summer of 1987, water was encountered in various drill holes between 16.5 and 35.0 feet below ground surface. Perforated casings (2-inch-diameter ID) were installed in holes 2F-3, 2F-10, and 2F-11 for monitoring (Plate 39 in the GDM (January 1991, Volume I of II)). Water level monitoring in August and September 1987 indicated depths to water in these holes of approximately 33.0 feet, 16.5 feet, and 23.0 feet below top of casing, respectively. Water level readings on 4 January 1988 indicated depths to water of 33.9 feet, 16.1 feet, and 21.1 feet below top of casing, respectively. Although December 1987 was a wet month, these readings indicate that the water levels along the project reach were below the river channel elevation of 67.5 feet, except in 2F-10, where the water level was slightly higher. The existence of a 9-foot-thick sand and gravel layer encountered between depths of 9 and 18 feet in hole 2F-10 most likely accounts for the localized rise in water-level readings. The higher water levels in holes 2F-10 and 2F-11, as compared to the level in 2F-3, are probably controlled by impermeable and discontinuous clay lenses that create a layered perched-water network.

In December of 1995 five borings were completed for the purpose of bridge foundation design near the UPRR tracks where they cross the Guadalupe River. Water was encountered in these drill holes as listed; 2F-95-1 at 12.5 feet deep; 2F-95-2 at 14.0 feet deep; 2F-95-3 at 1.5 feet deep (this drill site was in the river bottom); 2F-95-4 at 19.0 feet deep; and 2 F-95-5 at 15 feet deep. The following year, in December, three additional deeper borings were completed to supplement the information obtained from the December 1995 subsurface explorations. Water was encountered at varying depths in these three borings but usually the first encounter was between 30 and 40 feet deep which was about 15 feet deeper than the previous year's borings.

During field explorations in November and December of 1998, six borings were completed, for the Guadalupe River Segment 3C, in the Woz Way near Route 87 parking lot and under the freeway interchange near there. These explorations, 2F-99-1 through 2F-99-6, encountered water at the following depths: 2F-99-1 at 17.0 feet deep; 2F-99-2 at 21.0 feet deep; 2F-99-3 at 37.0 feet deep; 2F-99-4 at 22.2 feet deep; 2F-99-5 at 22.0 feet deep; and 2F-99-6 at 22.0 feet and then again at 26.0 feet deep. None of these borings had any shallow, thick sandy zones as reported in the 1987 explorations.

During explorations in October 1999 along North River Street between West Santa Clara Street and West Saint James Street water was encountered in the two drill holes (2F-00-1 and

2F-00-2) at 16.0 feet and 15.0 feet respectively. Both of these drill holes encountered a 9-foot-thick sandy zone from about 16 feet to 25 feet deep. A third boring was conducted near the Guadalupe River where the Union Pacific railroad tracks cross the river. Water was encountered in this drill hole at 24.5 feet deep and a sandy zone was encountered between about 23.0 feet to 29.0 feet deep.

The Guadalupe River channel was inspected for seepage areas in September 1986 and again in June 1987. The first inspection was during a normally dry period, and no seepage was noted. The winter of 1986 produced record amounts of rainfall but evidently did not have a long-term effect on the shallow unconfined aquifer. The winter season of 1987 was unusually dry and, consequently, no seepage was observed during the second inspection of the riverbank slopes.

5F.7 Foundation Conditions

5F.7.1 Original Project (I-280 ramp south of the Auzerais Street Bridge north to I-880)

In 1987, the Corps of Engineers, Sacramento District drilled 13 exploratory holes for the project along the reach from the I-280 ramp south of the Auzerais Street Bridge north to I-880. Drilling was accomplished using an 8-inch-diameter hollow stem flight auger to depths ranging from 30 to 70 feet below ground surface. During drilling, ASTM Standard Penetration Testing (SPT) was performed, and disturbed and undisturbed samples of foundation material were obtained. Laboratory testing of material samples was performed at the Corps of Engineers, South Pacific Division Laboratory in Sausalito, California.

A general description of the geologic materials underlying the project area was given in Section 5F.5, Project Geology. Descriptions of materials in this reach are limited to the upper 45 to 70 feet of the approximately 900-foot-thick valley fill beneath the project. Construction activities involve only the upper 20 to 25 feet of these surficial materials.

The geologic cross section A-A' on Plate 38 in the GDM (January 1991, Volume I of II), shows that the project area is underlain by a sequence of nearly horizontal, continuous sedimentary layers that generally dip slightly northward. From the ground surface downward, these materials are described as fluvial (stream) deposits, younger bay mud, alluvium, and older bay mud. The younger bay mud contains some alluvium (sediments deposited by running water) and some sand that may be of eolian origin (wind blown). These materials are described below:

5F.7.1.1 Geologic Layers

Fluvial Deposits. Along most of this reach, the ground surface is covered by fluvial deposits up to a maximum of about 4.0 feet thick. These deposits are absent along three portions of the project where the underlying upper clay unit is exposed. The fluvial deposits consist primarily of yellowish brown to light brown sand, sand and gravel, and clayey or silty sand with gravel. The sand varies from fine to coarse grained, and the angular to subrounded gravel is up to 3-inches in diameter. Scattered cobbles to 10-inches in diameter were encountered near the surface of drill hole 2F-9, see Plate 36 in the GDM (January 1991, Volume I of II). The consistency of these materials ranges from loose to dense with an

average standard penetrometer value (N) of 16 blow counts per foot (firm). The fines generally have low to medium plasticity.

Upper Clay Unit. Except for an approximately 2000-foot long reach, from about the Park Avenue Bridge to north of the Santa Clara Street Bridge, the entire design channel invert is expected to be founded on the upper clay unit. The 2000-foot reach noted above is expected to be founded on the upper alluvium described below. The clay unit is described as light gray and yellowish gray to black clay and sandy clay with a small percentage of fine-grained sand and shell lenses. The clay has a soft to stiff consistency with an average N value of 9 blow counts per foot. The clay is highly compressible, and is moderately sensitive when disturbed.

Sand. A discontinuous zone of moderate to dark yellowish brown loose sand was encountered in drill holes 2F-1, 2F-2, and 2F-3 above the design invert elevation of the channel and is located within the upper clay unit. The zone varies from about 1-foot-thick in drill hole 2F-3 to about 5 feet thick in drill hole 2F-1 at the northern end of the project area, where it is approximately 2 feet above the design channel invert. The N values averaged about 8 blows per foot.

Upper and Lower Alluvium. The upper alluvium was encountered in drill hole 2F-9 and 2F-10 at depths of 7.5 and 9.0 feet respectively. This deposit is at least 15 feet thick and extends laterally an undetermined distance south of the Park Avenue Bridge and north of the Santa Clara Street Bridge. The lower alluvium is a continuous layer encountered in all the deeper drill holes from the south end of the project to just north of drill hole 2F-5 where it pitches out. To that point, it separates the upper and lower clay units. The lower alluvium has a fairly uniform thickness of over 15 feet in drill hole 2F-11 to about 12 feet in drill hole 2F-12, then thins to 1.2 feet in drill hole 2F-5. The alluvium (upper and lower) consists of pale yellowish brown to moderate olive brown, to olive gray sand and gravel with clay. It varies from firm to very dense. The N values were higher in the alluvium than in the bay mud layers with an average blow count of 25 per foot.

Lower Clay Unit. The lower clay unit underlies the entire project area at depths ranging from about 52 feet below ground surface at the south end of the project to about 21 feet at the north end. Typically, it consists of greenish to bluish gray clay with lenses of sandy clay. Generally, the material is preconsolidated and varies from soft to stiff. The N values averaged 18 blows per foot in this layer.

4.F.7.1.2 Seepage Conditions.

Factors to be considered in predicting the probability of seepage problems occurring along the project area during construction include the existing perched-water levels, characteristics of the foundation materials, depth of the channel excavation, and precipitation. Since June 1987, the measured perched-water levels have remained consistently below the design channel invert elevation, except in one localized area. This is between Park Avenue and West San Fernando Street where water is contained in the upper alluvium as shown on Plate 38 in the GDM (January 1991, Volume I of II). The water level in drill hole 2F-10 was one-foot above the design channel invert elevation on 4 January 1988, and has not fluctuated more than one foot since 7 August 1987. The presence of water above

the design invert elevation is a source for seepage and possibly some hydrostatic uplift pressure on the lined channel walls and floor.

The foundation materials for most of this reach generally consist of relatively impermeable clay and sandy clay of the upper clay unit. However, during drilling of holes 2F-6, 2F-7 and 2F-12 water levels were encountered very near the design channel invert elevation. Permeable sand and gravel of the upper alluvium exist along the 2,000-foot reach between Park Avenue and Santa Clara Street. Also, a loose sand layer exists at the north end of the project between drill holes 2F-1 and 2F-3. Localized seepage may enter the excavation area through these and probably other pervious layers during construction. Local fluctuations in the perched-water levels should be expected. To provide for dry and stable conditions during construction, project design shall incorporate remedial measures for drainage and protection against uplift pressures along the lined channel reach.

5F.7.1.3 Materials Alteration Processes

Several natural processes are known to physically and/or chemically alter the character of the foundation materials. These may or may not be measurable or have any pronounced effect on material properties or behavior under normal conditions. The alteration of materials at the project are primarily due to over-consolidation and weathering.

Consolidation. Consolidation tests were performed on undisturbed samples from drill holes 2F-10, 2F-11, and 2F-12. The values indicate that sediments taken from a depth of 25 feet in drill hole 2F-10 and from a depth of 64 feet in drill hole 2F-12 are overconsolidated. The tests on samples 2F-11 resulted in values that indicate the materials are normal to slightly overconsolidated

The over-consolidation of sediments at different depths may be attributed to conditions caused by separate Pleistocene age glacial advances and retreats (Treasher, Ray C., Geology of the Sedimentary Deposits in San Francisco Bay, California: California Division of Mines and Geology, Special Report 82, 1963). This may explain the overconsolidation of these sediments, however the exact age correlation between glacial ages and bay sediments is not known. The events are briefly described below:

The Illinoian glaciation lowered sea level causing valley erosion and desiccation of sediments. This was followed by glacial melting which was the source for sediments deposited as the lower clay unit.

The first Wisconsin glaciation again lowered the sea level and exposed the lower clay unit to desiccation and preconsolidation. Upon retreat of the glaciers, the bay flooded again, and the lower portion of the younger bay mud was deposited. These deposits are now semiconsolidated.

The second Wisconsin glaciation lowered sea level for a brief time which allowed less desiccation and preconsolidation than before. Upon glacial retreat, the bay flooded again, and the soft upper clay was deposited. It is normally consolidated and has not been exposed to desiccation.

Weathering. Iron-oxide staining is evidence of weathering within the foundation materials. Inert particles of carbon are also present throughout some materials, and they result from decay of organic matter. The carbon should have no effect on material properties.

Slickensides were encountered in the laboratory samples from drill hole 2F-1 between depths of 5 and 8 feet and 20 to 23 feet. Although slickensides normally result from faulting, these are internal structures within the clay and would only affect the strength of unconfined foundation materials.

5F.7.2 Channel Re-alignment (West Santa Clara Street north to Union Pacific Railroad Tracks)

In October 1999 the Corps of Engineers, Sacramento District drilled 3 exploratory holes along this reach and completed six Cone Penetrometer (CPT) explorations. This reach is the channel relocation attributed to environmental concerns. Drilling was accomplished using an 8-inch-diameter hollow stem flight auger to a depth of 50 feet below ground surface. During drilling, SPT's were performed, and disturbed and undisturbed samples of foundation material were obtained. Laboratory testing of material samples was provided by Diversified Environmental Services in Culver City, California.

A general description of the geologic materials underlying the project area was given in Section 5F.5, Project Geology. Descriptions of materials in this section are limited to the upper 50 feet of the approximately 900-foot-thick valley fill beneath the project. Construction activities involve only the upper 20 to 25 feet of these surficial materials.

A geologic cross section is being developed in the Sacramento District Soil Design Section and will be included in their portion of the report.

5F.7.2.1 Geologic Layers

Fluvial Deposits. Along this reach, the upper most sedimentary materials, from ground surface to a maximum of 9.4 feet deep, are fluvial deposits. These deposits were delineated using the CPT subsurface explorations and verified with drill hole and soil sampling using SPT's. The fluvial deposits sampled along North River Street thickened from south to north with the least thick at the CPT-1A site where it was only about 2 feet thick and to the north at the CPT-4A site this deposit was about 6.6 feet thick. Continuing north this deposit generally thickens to about 9.4 feet at the CPT-6A exploration site. SPT sampling confirmed the depth of the fluvial deposits delineated by the CPT. The fluvial deposit consists primarily of brown to dark yellowish brown to dark grayish brown sand, sand and gravel, and clayey or silty gravel with sand. The sand varies from fine to coarse grained, and the angular to subrounded gravel is up to 3-inches in diameter. The density of these materials range from loose to firm with an average N value of 13 blow counts per foot (firm). The fines generally have low to medium plasticity.

Upper Clay Unit. Except for an area near drill hole 2F-00-2 and an area near the CPT-1A site, it appears that the entire design channel invert is expected to be founded on the upper clay unit. The clay unit is described as brown to dark grayish brown clay with a small percentage of fine-grained sand. The clay is generally firm to very stiff in consistency with an average N value of about 15 blows per foot. The clay is highly compressible, and is moderately sensitive when disturbed.

Sand. A discontinuous zone of dark gray to brown, very loose to dense sand was encountered in drill holes 2F-00-1 (from 22 to 25 feet), 2F-00-2 (from 22 to 26feet), and 2F-00-3 (from 26 to 30 feet) below ground surface. Drill hole 2F-00-1 and 2F-00-2 were on

North River Street about 1,000 feet from each other. The depths listed to the sand zone show the variability during deposition of these sediments. The CPT data indicates that the sand layer is continuous throughout this reach and variable in thickness and depth. It varies from about 2-feet thick in CPT-1A and is about 4 feet thick in drill hole 2F-00-3A at the northern end of this reach. The sand zone appears to be at or near the channel design invert. The N values averaged about 14 blows per foot (firm).

Upper and Lower Alluvium. The upper alluvium was encountered in drill hole 2F-2 only at about depths of 14.0 feet deep. This deposit is at least 12 feet thick when present and is discontinuous throughout the reach. The lower alluvium is a continuous layer encountered in the deeper part of the drill holes. Both the upper and lower alluvium in this reach are primarily fine-grained. The lower alluvium appears to be stratigraphically below the lower clay unit here instead of separating the upper and lower clay units as was reported in the GDM (January 1991, Volume I of II). The lower alluvium, as defined for this reach, is variable in thickness, and then dips to the north at the far north end of this reach. The alluvium (upper and lower) consists of pale yellowish brown to moderate olive brown, to olive gray sand and clay. No significant percentage of gravel was encountered. It varies from firm to very dense. The N values were higher in the alluvium than in the bay mud layers with an average blow count of 25 per foot.

Lower Clay Unit. The lower clay, as discussed in the GDM (January 1991, Volume I of II) appears to have only been encountered in drill hole 2F-00-3 at the far north end of this reach. What has been discussed in the previous paragraph, as having the lower alluvium stratigraphically below the lower clay unit may not be the case. Typically, the clay encountered at depth in drill hole 2F-00-3 is dark gray to olive gray with lenses of sandy clay. Generally, the material is preconsolidated and varies from firm to stiff. The N values averaged about 12 blows per foot in this layer (stiff).

5F.7.3 Channel Widening (Woz Way near Route 87 parking lot reach)

This portion of the Guadalupe River project, the Woz Way near Route 87 parking lot reach, was for proposed channel widening and to determine the effect, if any of the proposed channel widening, on the Caltrans freeway interchange bridge foundations.

The Corps of Engineers, Sacramento District drilled six exploratory holes at the project in November and December 1998. Drilling was accomplished using an 8-inch-diameter hollow stem flight auger to a depth of 70 feet below ground surface. During drilling, SPT's were performed, and both disturbed and undisturbed samples of foundation material were obtained. Laboratory testing of material samples was provided by Northwest Geotech, Inc. of Wilsonville, Oregon.

A general description of the geologic materials underlying the project area was given in Section 5F.5, Project Geology. Descriptions of materials in this section are limited to the upper 70 feet of the approximately 900-foot-thick valley fill beneath the project. Construction activities involve only the upper 20 to 25 feet of these surficial materials.

5F.7.3.1 Geologic Layers

Fluvial Deposits. Along this reach of the project alignment, the ground surface is covered by fluvial deposits up to a maximum of about 4 feet thick. These deposits were delineated using SPT soil sampling techniques. The fluvial deposits generally varied from less than

6 inches thick to a maximum of 4 feet thick. The fluvial deposit consists primarily of brown to dark grayish brown clay, sand, and gravel. The sand varies from fine to coarse grained, and the angular to subrounded gravel is up to 3-inches in diameter. The density of these materials range from loose to firm with an average N value of 13 blow counts per foot (firm). The fines generally have low to medium plasticity.

Upper Clay Unit. This unit is continuous and varies from about 70 feet thick at drill hole 2F-99-1 to about 44 feet thick near drill hole 2F-99-3. A distinct color change is evident in all drill holes and varies from about 30 to 40 feet deep. This color change is from the grayish browns to a turquoise color that is more indicative of the color of bay mud. It appears that the entire design channel invert is founded on the upper clay unit. The clay unit contains some sand, but gravel is not present. The clay is generally firm to very stiff in consistency with an average N value of about 12 blows per foot. The clay is highly compressible, and is moderately sensitive when disturbed.

Sand. No distinct sand layers were encountered.

Upper and Lower Alluvium. It appears that the upper alluvium as described in the Guadalupe River, California, General Design Memorandum, US Army Corps of Engineers, Sacramento District, January 1991, Volume I of II was not encountered in this reach. An alluvium zone was encountered at depth . The depth varied, but ranged from as shallow as 44 feet at drill hole 2F-99-3 to as deep as 64 feet in drill hole 2F-99-4. Alluvium was not encountered in drill hole 2F-99-1. The thickness of these alluvial deposits is also variable and ranges from a minimum of 6 feet in drill hole 2F-99-6 to greater than 16 feet in drill hole 2F-99-3. This alluvium can be considered the lower alluvium. The N values were higher in the alluvium than in the bay mud layers with an average blow count of greater than 50 per foot.

Lower Clay Unit. This unit was only encountered in drill holes 2F-99-2, 2F-99-5, and 2F-99-6. Typically, the clay encountered at depth in these drill holes is dark gray to olive gray with a few lenses of sandy clay. Generally, the material is preconsolidated and varies from firm to stiff. The N values averaged about 12 blows per foot in this layer (stiff).

5F.7.4 Union Pacific Railroad Bridge Replacement

It is possible that the UPRR Bridge #4 may need to be removed and replaced as part of the project. In December 1995 the Corps of Engineers, Sacramento District conducted 5 cone penetrometer tests and drilled 5 exploratory holes at this reach. Drilling was accomplished using an 8-inch-diameter hollow stem flight auger to a maximum depth of 100 feet below ground surface. During drilling, SPT's were performed, and disturbed and undisturbed samples of foundation material were obtained. In December 1996 three more exploratory holes were drilled using mud-rotary drilling techniques to a depth of 120 feet. These three additional holes were drilled to augment information obtained from the 1995 drill holes. They were drilled within 10 feet of the following 1995 drill holes: 2F-96-2, 2F-96-4, and 2F-96-5 and had the same drill hole numbers except with the letter "A" at the end to distinguish them. Both the 1995 and the 1996 explorations were for determining the subsurface conditions to design a railroad bridge foundation to replace the existing Union Pacific railroad bridge.

A general description of the geologic materials underlying the project area was given in Section 5F.5, Project Geology. Descriptions of materials in this section are limited to the

upper 100 to 120 feet of the approximately 900-foot-thick valley fill beneath the project. Construction activities will depend on the design depth and type of crossing to be constructed.

5F.7.4.1 Geologic Layers

Fluvial Deposits. Along this reach, the ground surface is covered by fluvial deposits up to a maximum of about 11 feet thick. These deposits were delineated using SPT soil sampling techniques. The fluvial deposits generally varied from non-existent to a maximum of 11 feet thick at drill site 2F-96-3. The fluvial deposit consists primarily of brown to dark grayish brown clay, sand, and gravel. The sand varies from fine to coarse grained, and the angular to subrounded gravel is up to 3-inches in diameter. The density of these materials range from loose to firm with an average N value of 13 blow counts per foot (firm). The fines generally have low to medium plasticity.

Upper Clay Unit. This unit is continuous and varies from greater than 100 feet thick at drill hole 2F-96-3 and 2F-96-4 to about 65 feet thick near drill hole 2F-96-1. The clay unit contains some sand, but gravel is not present. The clay is generally firm to very stiff in consistency with an average N value of about 12 blows per foot. The clay is highly compressible, and is moderately sensitive when disturbed.

Sand. The sand layers in the Upper Clay Unit are thin and discontinuous. It is 7 feet thick at drill hole 2F-96-1, 3 feet thick at drill hole 2F-96-2, absent at drill holes 2F-96-3 and 2F-96-4, and about 2 feet thick at drill hole 2F-96-5. The sand is primarily fine to medium grained, very loose to loose, and not consolidated.

Upper and Lower Alluvium. It appears that the upper alluvium as described in the GDM (January 1991, Volume I of II)was not encountered in this reach. An alluvium zone was encountered at depth . The depth varied, but ranged from as shallow as 65 feet at drill holes 2F-96-1, 2F-96-2, and 2F-96-2A, at 60 feet deep in drill hole 2F-96-4A, and at 72 feet below ground surface in drill hole 2F-96-5. It was absent or not encountered at the other drill sites, 2F-96-3, 2F-96-4, and 2F-96-5A. The thickness of these alluvial deposits is also variable and ranges from a minimum of 9 feet in drill hole 2F-96-1 to about 21 feet thick at drill hole 2F-96-2, and of an undetermined thickness at drill hole 2F-96-5. This alluvium can be considered the lower alluvium. The N values were higher in the alluvium than in the bay mud layers with an average blow count of greater than 50 per foot.

Lower Clay Unit. This unit was only encountered in drill holes 2F-96-1, 2F-96-2, 2F-96-2A, 2F-96-4A,and 2F-96-5. Typically, the clay encountered at depth in these drill holes is dark gray to olive gray with a few lenses of sandy clay. This clay, considered the Lower Clay Unit, was underlain by another alluvium that was encountered at about 105 feet deep in drill hole 2F-96-2A and at about 110 feet deep in drill hole 2F-96-5A. This alluvium was not encountered in drill hole 2F-96-4A. Generally, the material is preconsolidated and varies from firm to stiff. The N values averaged about 12 blows per foot in this layer (stiff).

5F.8 Land Subsidence

Historically, the initial use of ground water in the northern Santa Clara Valley was from the unconfined aquifer, between ground surface and approximately 100 feet deep in the valley alluvium. Continued use and an increase in ground water extraction from the 1920's until

1967 produced undesirable effects. Water levels in the unconfined aquifer system declined, and a reduction in the pressure head occurred in the confined aquifer system. The result was twofold (California Department of Water Resources, Reconnaissance Investigation of Ground Water Storage in Santa Clara Valley to Increase Yield of State Water Project, Central District, 1985):

(1) Water levels dropped below sea level allowing salt-water intrusion into the aquifer system

(2) The decrease in artesian head in the confined aquifer caused subsidence of the land surface.

Based on information from the monitoring of U. S. Geological Survey bench marks near the project area, subsidence in the City of San Jose is reported to have been as much as 12 feet between the years of 1933 and 1965 (California Department of Water Resources, Evaluation of Ground Water Resources-South Bay, Bulletin 118-1, San Francisco Bay District, 1967). However, a controlled recharge program implemented during the 1960's apparently halted subsidence by raising the piezometric level (Cooper-Clark and Associates, City of San Jose's Sphere of Influence, Geotechnical Investigation, 1974).

Land surface elevations in the San Jose area stabilized by 1970, as the piezometric level and a balanced recharge supply were maintained. The Santa Clara Valley Water District operates numerous artificial recharge ponds, that increases the percolation rate of collected runoff water. This has successfully balanced the supply and demand over the past 20 years. Maintenance of current ground water levels and surface elevations is possible if ground water resource management is continued in the future.

5F.9 Faults and Seismicity

The Guadalupe River Project is located within Seismic Zone 4 (see Plate 5F-2) where potential for earthquake damage is considered to be great. This is an area that contains numerous faults that can be classified as either as active, capable, or inactive by Corps of Engineers criteria depending on their ability to generate earthquakes (Slemmons, David B and McKinney, Roy, Definition of Active Fault, U.S. Army Waterways Experiment Station, Miscellaneous Paper S-77-B, 1977).

Three major historically active faults (zones) are located within 12 miles of the project area. These are the San Andreas Fault Zone, the Hayward Fault, and the Calaveras Fault Zone. All of these faults have produced damaging earthquakes in the past and are expected to do so in the future. The sense of movement on these faults is considered right-lateral strike/slip, which is primarily horizontal motion. Some components of vertical movement may occur at some locations. Also, ground displacement in the form of seismic creep (slight apparently continuous slippage) occurs along portions of these faults although not specifically adjacent to the project area except on the Calaveras Fault Zone as referenced in Cooper-Clark & Associates, City of San Jose's Sphere of Influence, Geotechnical Investigation, 1974. All faults shown on Plate 35, included in the GDM (January 1991, Volume I of II), essentially parallel the alignment of the project area, and no faults are know to cross it. Eastward of the Shannon Fault, which is about 10 miles south of the project area and trends northwest to southeast, all faults converge on the Calaveras Fault Zone

approximately 20 miles southeast of the project area in the vicinity of Anderson Reservoir. The San Jose Fault, also shown on Plate 35, is about 10 miles long as trends in a northwesterly direction about 20 miles west of the project area. This fault is classified by the State of California Division of Mines and Geology (CDMG) as a Quaternary fault with age undifferentiated that shows evidence of some activity sometime within the last 1.6 million years and is shown on the DMG Fault Activity Map of California and Adjacent Areas, 1994

5F.9.1 San Andreas Fault

The San Andreas Fault Zone that traverses about 675 miles of California and strikes about North 45° West as it passes through this part of the Coast Ranges. It is located about 11 miles southwest of the project area and is considered capable of generating an earthquake of Richter magnitude (M) 7.9 or greater (CDMG Open File Report 96-08, 1996). Estimates of total displacement along this fault since Jurassic time (135 million years before present) are as much as 350 miles (Dibblee, T.W., Jr., *Evidence for Cumulative Offset on the San Andreas Fault in Central and Northern California: Geology of Northern California,* CDMG Bulletin 190).

5F.9.2 Hayward Fault

The Hayward Fault is about 6.5 miles northeast of the project area. This fault is notable because of its continual movement know as fault creep to the north of the project area in Alameda County from Berkeley south to near Fremont. This fault is classified by CDMG as capable of producing a M6.9-7.1 earthquake (CDMG Open File Report 96-08, 1996). It has evidence of displacement on the northern part of this fault zone during historic time, notably the 1836 and 1868 events. The southern portion of this fault zone near the project area has evidence of movement in the Holocene or at least sometime within the last 10,000 years.

5F.9.3 Calaveras Fault

The Calaveras Fault is also considered to be capable of producing a M6.2-6.8 earthquake along its extent (CDMG Open File Report 96-08, 1996). The epicenter for the M 6.2 Morgan Hill earthquake of April 1984 was located near Mt. Hamilton, about 12 miles east of the project. The shaking force of the earthquake was measured at 1.3 times the force of gravity (1.3g) on a strong-motion recorder located 17 miles south of Mt. Hamilton at Coyote Dam (Shakal, Anthony, Gay, Thomas E. Jr., and Sherburne, Roger, Morgan Hill Earthquake Caused Record Shaking Force: California Geology, August 1984). Damage in Morgan Hill consisted of houses falling off unbraced foundations and streambanks caving in (Treasher, Ray C., Geology of the Sedimentary Deposits in San Francisco Bay, California: California Division of Mines and Geology, Special Report 82, 1963).

5F.9.4 Other Active Faults

5F.9.4.1 Sargent Fault

The Sargent fault is located about 14 miles south of the project area where it branches southeastward from the San Andreas Fault near Lexington Reservoir. According to the CDMG 1994 publication of the Fault Activity Map of California and Adjacent Areas Explanatory Text, this fault has shown evidence of movement in the Holocene and evidence of fault creep in historic times. This is a complex zone with geomorphic evidence of the

Holocene movement, a well-defined seismic zone, and verified fault creep of about 3 millimeters per year at the northwest end (California Division of Mines and Geology, Proceedings Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, Special Publication 62, 1982). CDMG has also classified the Sargent fault capable of producing a M 7.0 earthquake (Greensfelder, Roger W., Maximum Credible Rock Acceleration from Earthquakes in California, California Division of Mines and Geology, Map Sheet 23, 1974).

5F.9.4.2 Quimby Fault

The Quimby fault is located about 9 miles southeast of the project at the south end of the Hayward fault. This is a small, poorly defined fault with no evidence of late Quaternary offset, except where it coincides with the Hayward fault (California Division of Mines and Geology, Proceedings Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, Special Publication 62, 1982). For that reason, it is considered active by CDMG (Bryant, William A. oral communication 10 March 1988, California Division of Mines and Geology). The 1994 publication of the Fault Activity Map of California and Adjacent Areas Explanatory Text does not reference this fault, therefore it is not known what capability has been assigned to it, if any.

5F.9.5 Capable Faults

The faults listed below are variously listed in the literature as "potentially active" or "possibly active," but generally lack evidence of Recent or Holocene activity. However, since some sources suggest that these are capable of generating earthquakes and have specified magnitudes, they are included as capable until more information can be obtained.

5F.9.5.1 Silver Creek Fault

The Silver Creek fault, shown on Plate 35, splays from the Calaveras fault near Anderson Reservoir and trends northwesterly somewhat parallel to the eastern shore of San Francisco Bay. The northern portion is concealed by valley fill but has been located in the subsurface by gravity and magnetic methods (Cooper-Clark and Associates, City of San Jose's Sphere of Influence, Geotechnical Investigation, 1974) where it passes about 1.5 miles east of the project area. The youngest geologic units known to be offset by this fault belong to the Plio-Pleistocene age Santa Clara Formation (California Division of Mines and Geology, Geologic and Engineering Aspects of San Francisco Bay Fill, Special Report 97, 1969). However, southeast of San Jose the fault is well defined and is accompanied by topographical features, such as sag-ponds, that suggest there has been recent activity. On that basis, the fault should be considered active south of Evergreen and at least potentially active in the northern area (Cooper-Clark and Associates, City of San Jose's Sphere of Influence, Geotechnical Investigation, 1974). This fault is considered to be capable of generating a M 6.2 to 6.5 earthquake (Akers, Robert J., oral communication, Chief Geology Branch, California Division of Safety of Dams). The M 6.2 reference was obtained from Map MF-709 (Borcherdt, R. D., Gibbs, J. F., and Lajoie, K.R., Earthquake Intensity – Southern San Francisco Bay Region, California, United States Geological Survey Map MF-709, 1:250,000, Sheet 2, 1975).

5F.9.5.2 Coyote Creek Fault

The Coyote Creek fault, shown on Plate 35, is about 11 miles southeast of the project area. It is parallel to the Silver Creek fault and was at one time classified as the same fault (Cooper-Clark and Associates, City of San Jose's Sphere of Influence, Geotechnical Investigation, 1974). It also offsets the Santa Clara Formation but is classified by the State of California as having movement in the Quaternary Period (1994 Fault Activity Map of California and Adjacent Areas Explanatory Text). The 1994 Fault Activity Map of California and Adjacent Areas show that the Coyote Creek fault and the 10-mile long San Jose fault may be considered as one long fault, however the literature search has not indicated that these faults are one and the same.

5F.9.5.3 Shannon Fault

The Shannon fault, shown on Plate 35, is listed in the 1994 Fault Activity Map of California and Adjacent Areas Explanatory Text as not having any activity since the Quaternary Period. This fault trends northwest along the southern edge of the Santa Clara Valley and is approximately 7 miles south of the project area. The Pleistocene age Santa Clara formation has been offset by this fault, but no evidence has been documented of Recent or Holocene movement (California Division of Mines and Geology, Proceedings Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, Special Publication 62, 1982). It may be associated with small earthquake clusters south of San Jose. The Shannon fault is to be considered active and capable of producing a M 6.0 earthquake (Akers, Robert J., oral communication, Chief Geology Branch, California Division of Safety of Dams).

5F.9.6 Inactive Faults

The San Jose fault, shown on Plate 35, passes through the subsurface about 2.5 miles west of the project area. This fault is also on the 1994 Fault Activity Map of California and Adjacent Areas and is characterized by having some activity during the Quaternary Period. No Recent or Holocene activity has been reported for this fault. This fault is considered inactive for the purpose of this report as suggested in oral communication with Mr. Robert J. Akers, Chief of the State of California Division of Safety of Dams.

Several other faults plotted on Plate 35 are considered inactive by the State of California Division of Mines and Geology. These include the Ben Trovato, Berrocal, the Soda Springs, and Sierra Azul faults. These faults are south of the Shannon fault.

5F.10 Historical Earthquakes

Since 1849, twenty-four earthquakes of M 5.8 or greater have occurred within 100 kilometers of San Francisco Bay (Toppozada, Tousson R., Morgan Hill Earthquake of April, Santa Clara County: California Geology, July 1984 and The Loma Prieta (Santa Cruz Mountains), California Earthquake of 17 October 1989, California Division of Mines and Geology Special Publication 104, 1990). The largest of these were the October 1868 M 6.8 earthquake on the central portion of the Hayward fault, the M 8.3 San Francisco Earthquake of 18 April 1906, the April 1994 M 6.2 Morgan Hill Earthquake along the Calaveras fault; and the 17 October 1989 M 7.1 Loma Prieta (Santa Cruz Mountains) Earthquake. As a result of these earthquakes, surface rupture was reported along 30 miles of the Hayward fault for the

1868 event; along 250 miles of the San Andreas fault for the 1906 event; 8-inches of right-lateral strike-slip surface displacement (observed in a landslide area) on the Calaveras fault in the 1994 event; and no significant surface rupture was reported along the San Andreas fault for the Loma Prieta Earthquake. However this earthquake triggered slip along the Calaveras fault and initiated numerous ridgetop fissures especially in the epicentral area.

The 17 October 1989 Loma Prieta Earthquake occurred at 5:04 PM and was calculated as a M 7.1 event. It was the largest earthquake in Northern California since the 1984 Morgan Hill earthquake. The epicenter was about 34 kilometers (21 miles) south of San Jose. As a result of this quake the United States Geological Survey, the Association of Bay Area Geologist, the University of California at Berkeley, along with other scientists developed an earthquake probability map for the San Francisco Bay Region and some estimated earthquake intensity maps for a replication of the Loma Prieta Earthquake, the 1868 earthquake on the Hayward fault, and the 1906 San Francisco Earthquake (Plates 5F-3 to 5F-6). These maps have been reproduced from the Internet and are self-explanatory and are included for information purposes only.

5F.11 Ground Rupture Analysis

Cooper-Clark and Associates performed a ground response analysis for the City of San Jose in 1984. The report of their investigation included maximum ground accelerations that could be expected to occur in an area of varying alluvial thickness. The report indicates that ground surface accelerations of 0.2 g to .75 g can be expected in the San Jose area from the maximum credible earthquakes originating on portions of the San Andreas, Hayward, and Calaveras faults.

A separate study, conducted by the California Division of Mines and Geology and reported by Roger W. Greensfelder in Maximum Credible Rock Acceleration in California, CDMG Map Sheet 23, 1974, suggested that maximum bedrock accelerations of 0.5 g could be expected for the City of San Jose. For the purpose of this study, the term "rock" denotes any material with shear wave velocity faster than 2,000 feet per second. Except for the deeper gravel beds, the alluvium beneath the project area generally has shear wave velocities of less than 1,300 feet per second. Therefore, the use of a 0.5 g value as an upper limit for acceleration would be inappropriate for this project.

General horizontal ground accelerations were calculated using Krinitzsky-Chang (1987) strong motion charts (Krinitzsky, E. L. and Chang, Frank K., State of the Art for Assessing Earthquake Hazard in the United States, U.S. Army Waterways Experiment Station, Miscellaneous Paper S-73-1, Report 25, 1987). Individual charts present horizontal peak motions of 987 accelerograms and relate intensity units to peak horizontal accelerations. Each chart was categorized by the following:

(1) Modified Mercalli Intensity (MM)
(2) Near-field or Far-field event
(3) Site conditions (hard or soft)
(4) Far-field magnitudes: M<6.9, M=7.0, M>7.6

By using the mean-plus-one standard deviation (S.D.) curve, the expected ground acceleration is calculated as 0.7 g. Use of the-mean-plus one S.D. was chosen as a conservative position for major structures where failure is not tolerable.

Considering site-specific conditions and the high felt intensity related with a maximum credible earthquake of M 8.3 from the San Andreas fault, charts 2 and 3 were selected and used in order to make a realistic determination for expected accelerations. Chart 2 distinguishes the following parameters:

(1) MM intensity
(2) Near-field conditions
(3) Soft site
(4) All magnitudes for maximum credible earthquakes

f. In order to obtain a near-field acceleration with MM XI, some far-field motions were added to accommodate the shaking from the near-field into the far-field (Krinitzsky, E. L. and Chang, Frank K., State of the Art for Assessing Earthquake Hazard in the United States, U.S. Army Waterways Experiment Station, Miscellaneous Paper S-73-1, Report 25, 1987). Chart 3 was selected with the following parameters:

(1) MM intensity
(2) Far-field conditions
(3) Hard and soft sites
(4) All magnitudes for maximum credible earthquakes

The mean-plus-one standard deviation curve was used again to calculate a ground acceleration of 0.3 g.

The analysis incorporating Krinitzsky-Chang charts indicates that the project can expect maximum ground accelerations in the range of 0.3 g to 0.7 g. The values from these charts represent ground response data from historic earthquakes as recorded on strong motion instruments. These values are subject to modifications as more earthquakes occur. The 1987 Krinitzsky-Chang analysis compares favorably with the 1974 Cooper –Clark report (Cooper-Clark and Associates, City of San Jose's Sphere of Influence, Geotechnical Investigation, 1974). In addition, Krinitzsky 1995 (State of the Art for Assessing Earthquake Hazards in the United States, Report 29, Selection of Earthquake Ground Motions for Engineering) continues to agree with these values. Although these analyses were calculated for a maximum credible earthquake, near-field conditions exist for the project area from all earthquake sources, in which case any great event could over ride values calculated for a maximum design earthquake.

5F.12 References

(a) Akers, Robert J., oral communication, 11 March 1988, Chief, Geology Branch, California Division of Safety of Dams.

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(c) Borcherdt, R. D., Gibbs, J. F., and Lajoie, K. R., *Earthquake Intensity-Southern San Francisco Bay Region, California*: U.S.G.S., Map MF-709, 1:250,000, Sheet 3, 1975.

(d) Bryant, William A., oral communication, 10 March 1988, California Division of Mines and Geology.

(e) California Department of Water Resources, *Evaluation of Ground Water Resources-South Bay,* Bulletin 118-1, San Francisco Bay District, 1967.

(f) California Division of Mines and Geology, *Geologic and Engineering Aspects of San Francisco Bay Fill*, Special Report 97, 1969.

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(h) California Division of Mines and Geology, Proceedings Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, Special Publication 62, 1982.

(i) California Division of Mines and Geology, The Loma Prieta (Santa Cruz Mountains), California, Earthquake of 17 October 1989, Special Publication 104, 1990.

(j) California Department of Water Resources, Reconnaissance Investigation of Ground Water Storage in Santa Clara Valley to Increase Yield of State Water Project, Central District, 1985.

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(m) Diblee, T. W. Jr., *Evidence for Cumulative Offset on the San Andreas Fault in Central and Northern California:* Geology of Northern California, California Division of Mines and Geology, Bulletin 190, 1966.

(n) Goldham, Harold B., *Geology of San Francisco Bay*, California Division of Mines and Geology, Special Report 97, 1969.

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(p) Hart, Earl W., Surface Faulting Associated with the Morgan Hill Earthquake of 24 April 1984: California Geology, August, 1984.

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(r) Jennings, Charles W., Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions, California Division of Mines and Geology, 1994.

(s) Krinitzsky, E. L., and Chang, Frank K., State of the Art for Assessing Earthquake Hazards in the United States, U. S. Army Waterways Experiment Station, Miscellaneous Paper S-73-1, Report 25, 1987.

(t) Krinitzsky, E. L., State of the Art for Assessing Earthquake Hazards in the United States, Report 29, Selection of Earthquake Ground Motions for Engineering, 1995.

(u) Mitchell, James K. Engineering Properties and Problems of the San Francisco Bay Fill, Special Report 97, 1963.

(v) Norris, Robert M., and Webb, Robert W., *Geology of California*, John Wiley, 1976.

(w) Saul, Richard B., The Calaveras Fault Zone in Contra Costa County: California Geology, March, 1967.

(x) Shakal, Anthony, Gay, Thomas E. Jr., and Sherburne, Roger, *Morgan Hill Earthquake Caused Record Shaking Force: California Geology*, August 1984.

(y) Slemmons, David B., and McKinney, Roy, *Definition of Active Fault*, U.S. Army Waterways Experiment Station, Miscellaneous Paper S-77-B, 1977.

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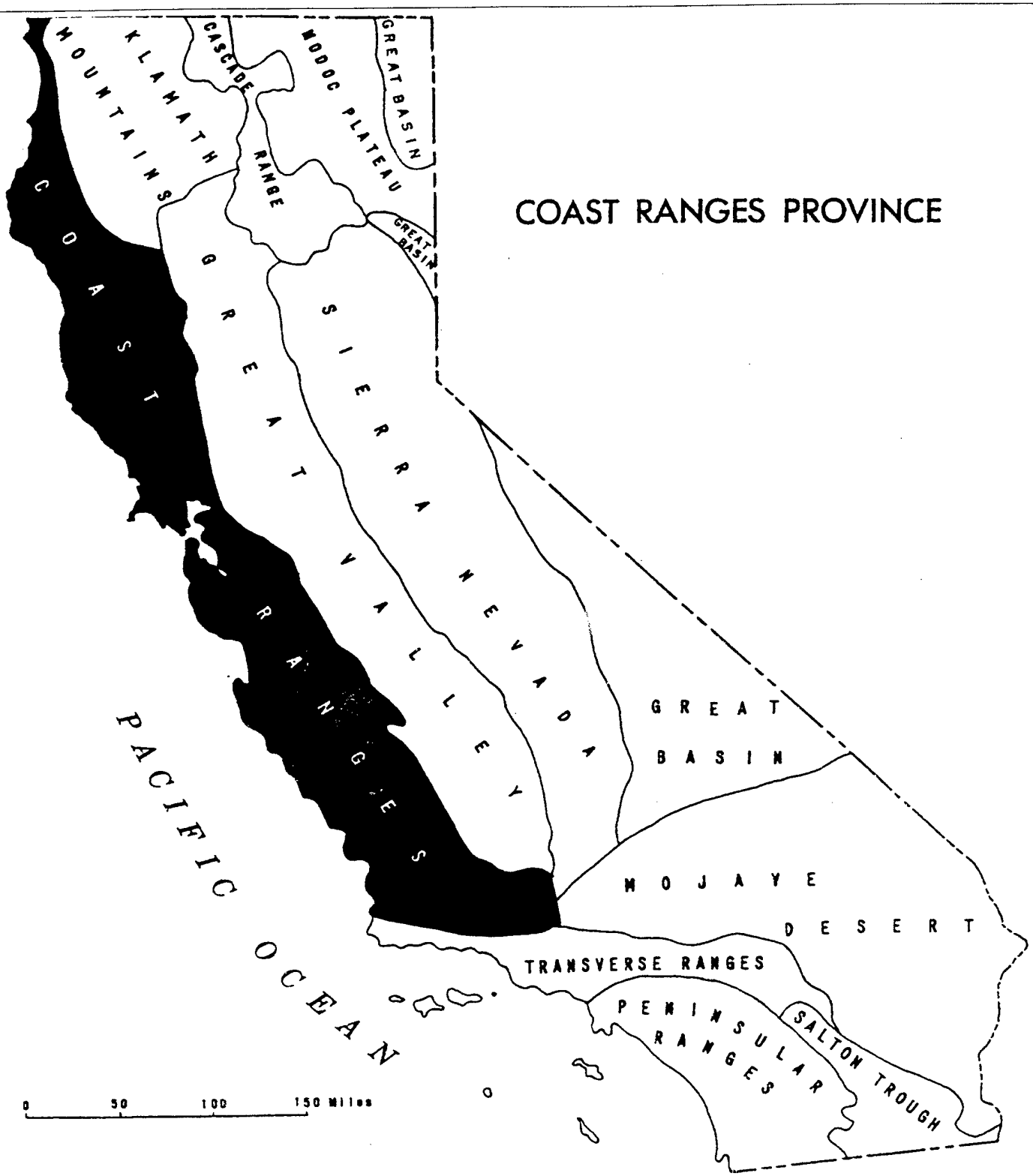
(aa) Treasher, Ray C., Geology of the Sedimentary Deposits in San Francisco Bay, California: California Division of Mines and Geology, Special Report 82, 1963.

APPENDIX 5F - GEOLOGY

Plates

5F-1 Coast Range Geomorphic Province
5F-2 Seismic Zone Map of California
5F-3 San Francisco Bay Region Earthquake Probability
5F-4 Estimated Intensity Map, 1989 Loma Prieta Earthquake on San Andreas Fault
5F-5 Estimated Intensity Map, 1868 Earthquake on Hayward Fault
5F-6 Estimate Intensity Map, 1906 Earthquake on San Andreas Fault



Coast Range Geomorphic Province

Plate 5F-1

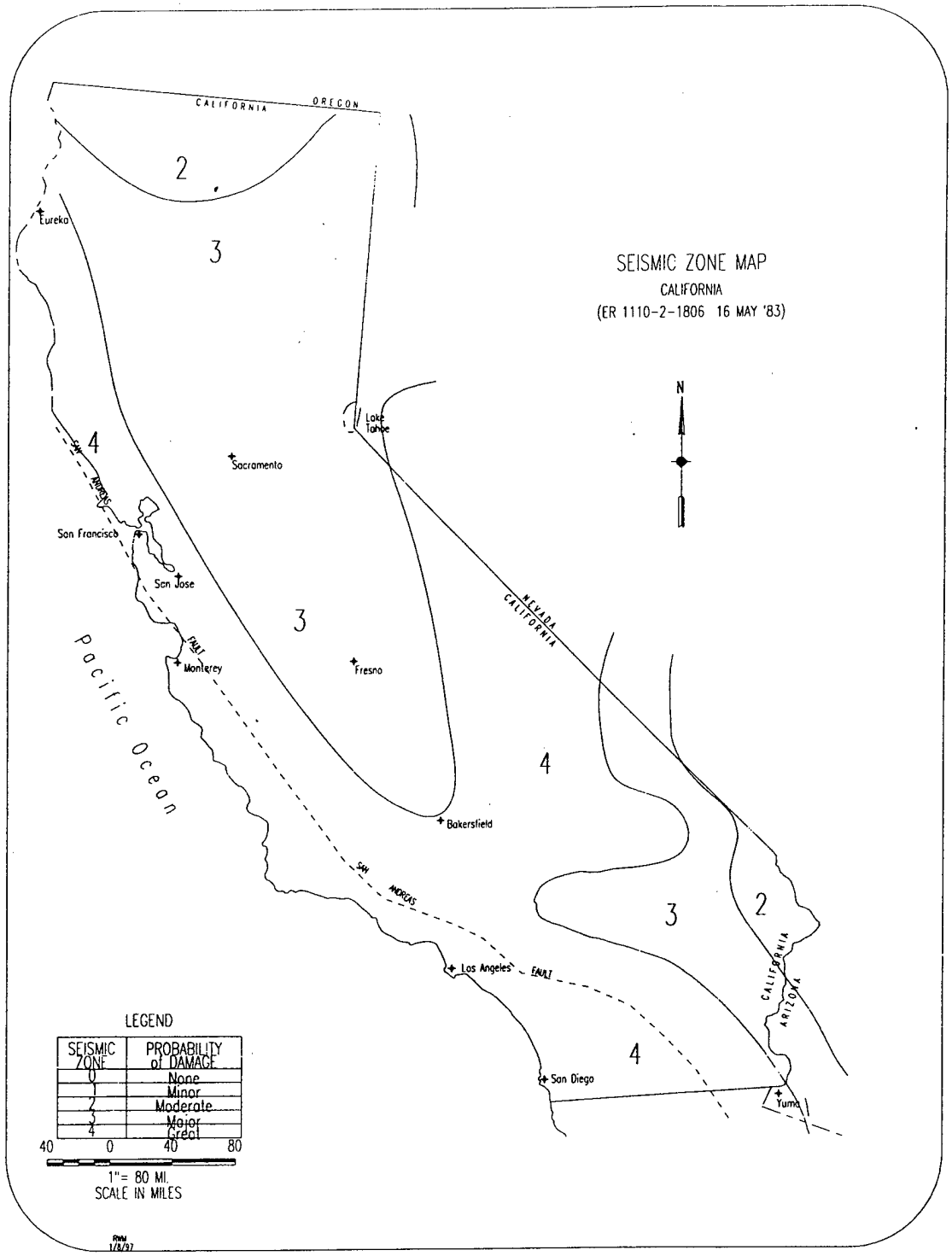

SEISMIC ZONE MAP
CALIFORNIA
(ER 1110-2-1806 16 MAY '83)
CALIFORNIA
OREGON
Eureka
Lake Tahoe
Sacramento
San Francisco
San Jose
Monterey
Fresno
Bakersfield
Los Angeles
San Diego
Yuma
SAN ANDREAS FAULT
NEVADA
CALIFORNIA
CALIFORNIA
ARIZONA
Pacific Ocean
N
LEGEND
SEISMIC ZONE
PROBABILITY of DAMAGE
0 None
1 Minor
2 Moderate
3 Major
4 Great
40 0 40 80
1"= 80 MI.
SCALE IN MILES
RMM 1/8/97

Plate 5F-2

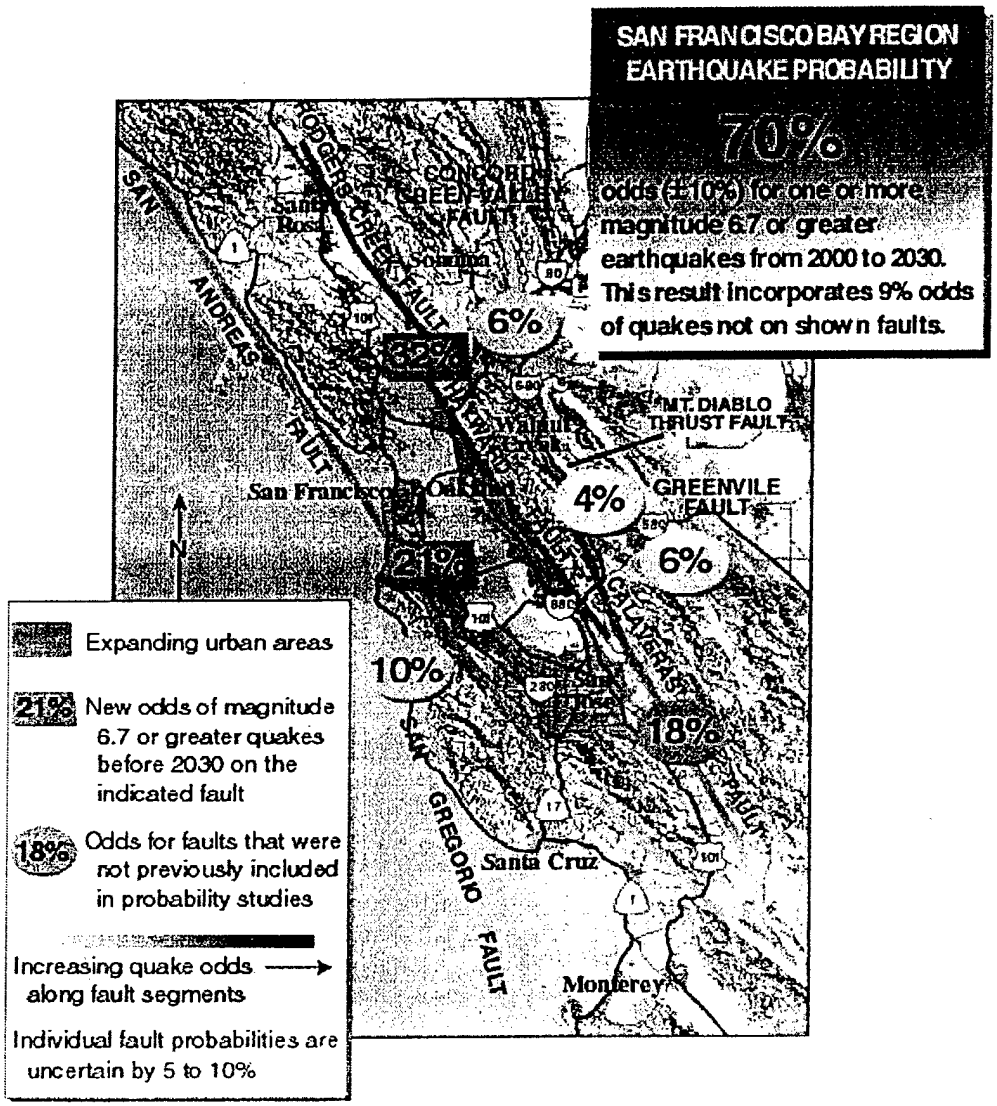

SAN FRANCISCO BAY REGION
EARTHQUAKE PROBABILITY
70%
odds (±10%) for one or more magnitude 6.7 or greater earthquakes from 2000 to 2030.
This result incorporates 9% odds of quakes not on shown faults.
SAN ANDREAS FAULT
RODGERS CREEK FAULT
CONCORD-GREEN VALLEY FAULT
HAYWARD FAULT
MT. DIABLO THRUST FAULT
GREENVILE FAULT
CALAVERAS FAULT
SAN GREGORIO FAULT
San Francisco
Oakland
Santa Cruz
Monterey
6%
82%
4%
6%
21%
10%
18%
N
Expanding urban areas
21% New odds of magnitude 6.7 or greater quakes before 2030 on the indicated fault
18% Odds for faults that were not previously included in probability studies
Increasing quake odds along fault segments
Individual fault probabilities are uncertain by 5 to 10%

Plate 5F-3

U.S.G.S. Estimated Intensity Map

1989 Loma Prieta Earthquake on San Andreas Fault

GMT Dec 17 10:39

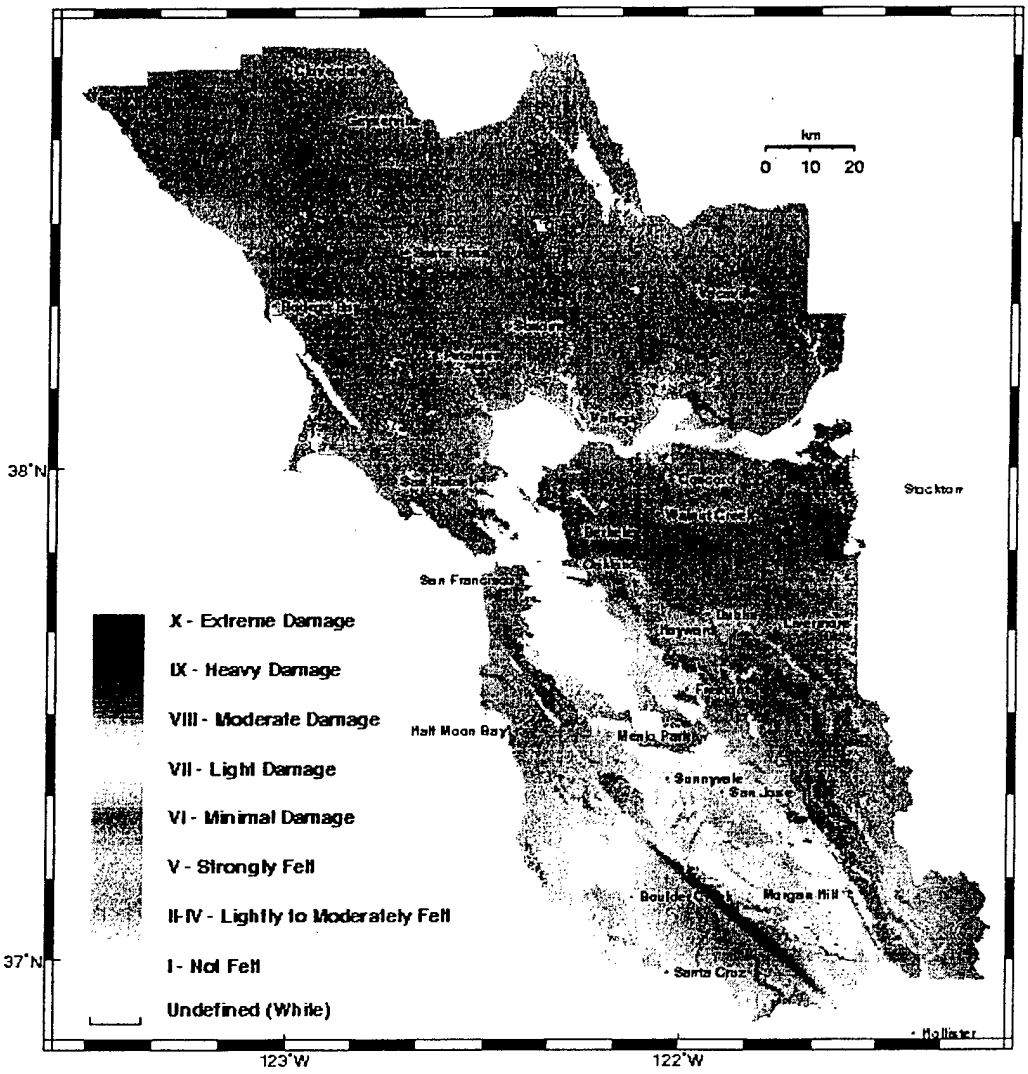


Plate 5F-4

U.S.G.S. Estimated Intensity Map

1989 Earthquake on Hayward Fault

GMT Dec 17 09:39

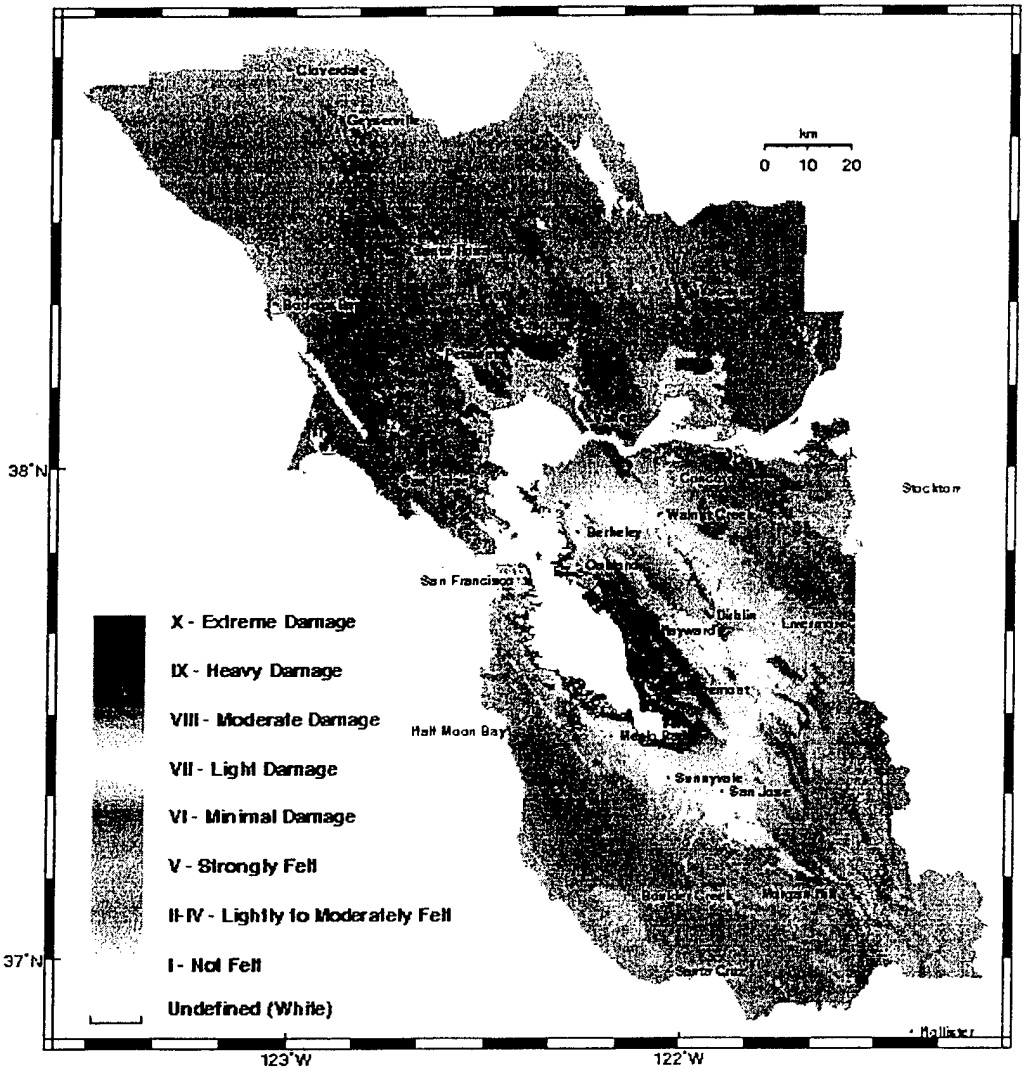


Plate 5F-5

U.S.G.S. Estimated Intensity Map

1906 Earthquake on San Andreas Fault

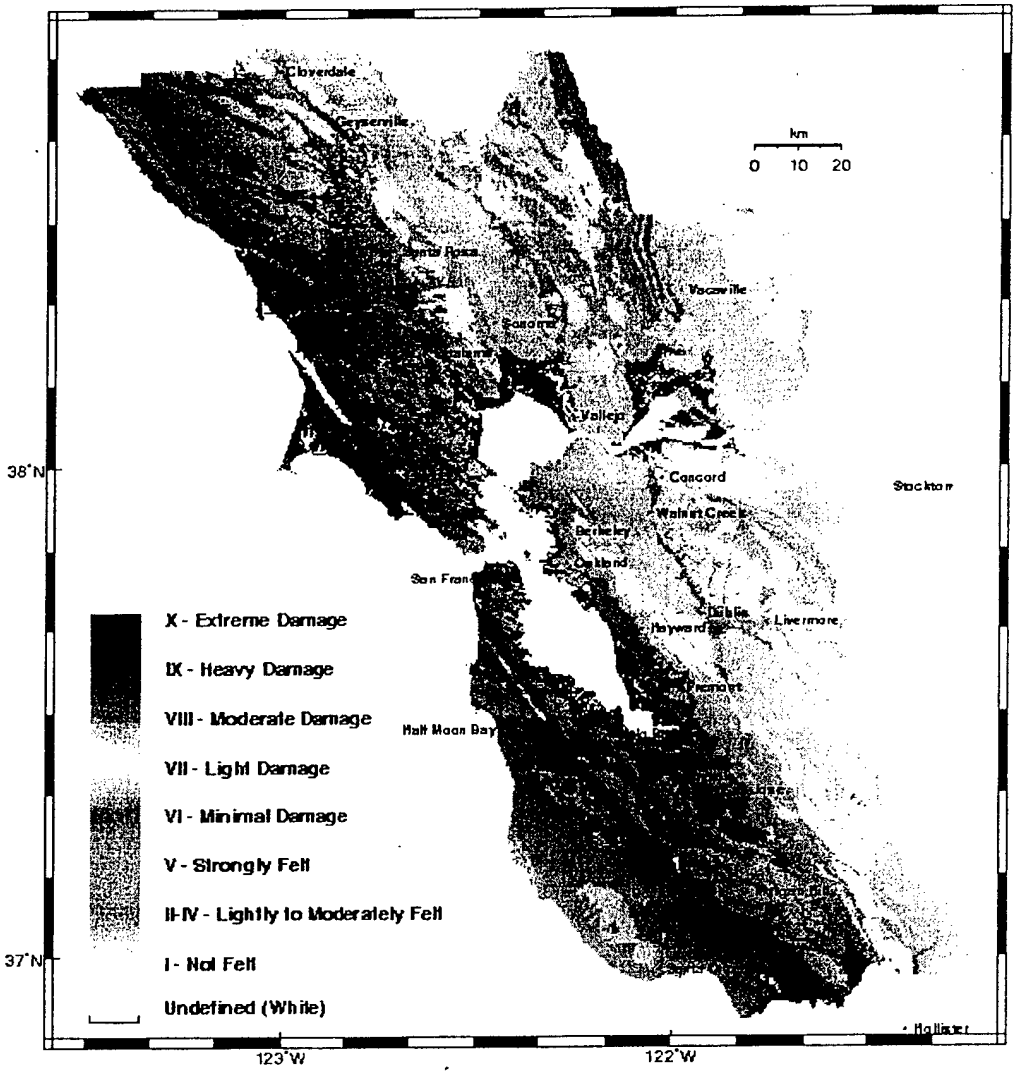


Plate 5F-6

Appendix 5G - Geotechnical Design

5G.1 General

Geotechnical exploration and testing work has been completed along the proposed route of the underground river overflow bypass system. From the subsurface information available at this time, we think that the following will be necessary: potential groundwater inflow; soil strengths and lateral loading information for design, shoring, and bracing, tie-back design information. Geotechnical analyses for the General Reevaluation Report (GRR) for the Guadalupe River Project were performed with data obtained from several sources including: the Guadalupe River Flood Control Project (Segments 3A and 3B), the UPRR Bridge Reconstruction Project, the West Julian Street Development (Sobrato Property), and the West Julian Street Improvements Project. For final design, route-specific geotechnical explorations and laboratory work were performed. Route specific work was performed on the Sobrato Property in the summer of 1999 and work was performed on River Street and the UPRR right-of-way in the fall of 1999.

5G.2 Subsurface Conditions

5G.2.1 Explorations and Laboratory Testing by the Corps of Engineers

Plates 5G-1 and 5G-2 show exploration locations.

5G.2.1.1 Guadalupe River Project, Segments 3A and 3B

Field explorations 2F-87-6, 8, 9, and 12 were performed to investigate soil types and to determine soil parameters for river project features such as embankment cuts, concrete and gabion terraces, and retaining walls. Exploration logs are shown on Plates 5G-4 and 5G-5. The borings were drilled with a CME 55 drill rig utilizing an 8-inch O.D. hollow stem flight auger. Boring 2F-87-6 and 8 were drilled to 30 feet. Boring 2F-87-9 was drilled to 50 feet and Boring 2F-87-12 was drilled to 70 feet. Drilling was performed in June and July of 1987.

Representative samples were obtained for visual and laboratory classification and engineering properties testing. The laboratory testing consisted of sieve analyses, Atterberg limits, moisture contents, dry unit weights, specific gravity of solids, and unconsolidated-undrained triaxial compression tests. In-situ testing consisted of performing standard penetration tests, in accordance with ASTM D 1586, with a 1.38-inch I.D. and 2-inch O.D. split-tube sampler. Undisturbed samples were taken with a 3-inch thin-wall Shelby tube sampler.

5G.2.1.2 Union Pacific Railroad Bridge Reconstruction Project.

Field explorations 2F-95-4 and 5 were performed for the Union Pacific (formerly Southern Pacific) Railroad Bridge reconstruction pile and abutment design. Exploration logs are shown on Plates 5G-6 and 5G-7. Borings 2F-95-4 and 5 were drilled to 81.5 feet with a CME 45 rotary wash drill rig utilizing a 6-inch O.D. hollow stem flight auger. Drilling was

performed in December of 1995. Cone penetrometer soundings were performed for continuous and preliminary information near these same locations in December 1995; sounding readouts are available upon request.

Representative samples were obtained for visual and laboratory classification and engineering properties testing. The laboratory testing consisted of sieve analyses, Atterberg limits, moisture contents, dry unit weights, specific gravity of solids, consolidation tests, and unconsolidated-undrained triaxial compression tests. Consolidation tests were performed on clay materials at the depths of 66 feet and 84 feet. In-situ testing consisted of performing standard penetration tests, in accordance with ASTM D 1586, with a 1.38-inch I.D. and 2-inch O.D. split-tube sampler. Undisturbed samples were taken with 3-inch thin-wall Shelby tube samplers.

5G.2.1.3 Guadalupe River Project, GRR Explorations, West Julian Street Development

Route specific field explorations 2F-99-1 and 2 were performed on the Sobrato Property, West Julian Street Development. The Sobrato property consists of the former FMC Plant site bounded on the north by the Union Pacific Railroad easement and the south by West (New) Julian Street. Cone penetrometer soundings CPT-99-1 through 4 were performed on 14 April 1999 to depths of 50 feet as part of the subsurface reconnaissance program; sounding readouts are available on request. On 19 April 1999, drilled explorations 2F-99-1 and 2 were performed to a depth of 51.5 feet with a Failing 1500 rotary wash drill rig and a 4-7/8 inch O.D. hollow-stem drill rod using a drag bit and tricone bit. Exploration logs are shown on Plate 5G-8.

Laboratory testing for classification, strength, and volume change properties was performed by Diversified Environmental services, Inc. In-situ testing consisted of performing standard penetration tests, in accordance with ASTM D 1586, with a 1.38-inch I.D. and 2-inch O.D. split-tube sampler. Undisturbed samples were taken with a 2-1/2 inch I.D. California modified sampler and 3-inch thin-wall Shelby tube samplers. SPT blow counts were taken with a cat head wench and rope.

5G.2.1.4 Guadalupe River Project, GRR Explorations, River Street and Union Pacific Right-of-Way

Route specific explorations were performed in the River Street and Union Pacific Railroad rights-of-way. Cone penetrometer soundings CPT-00-1 through 6 were performed on 12 October 1999 to depths of 50 feet; sounding readouts are available upon request. Drilled explorations 2F-00-1 through 3 were performed on 18 to 21 October 1999, to a depth of 51.5 feet. Drilling was performed with a Mobile B-61 drill rig with a 6-inch diameter hollow stem flight auger. Exploration Logs are shown on Plate 5G-9.

Laboratory testing for classification, strength, and volume change properties was performed by diversified environmental services, inc. In-situ testing consisted of performing standard penetration tests, in accordance with ASTM d 1586, with a 1.38-inch i.d. and 2-inch o.d. Split-tube sampler. Undisturbed samples were taken with 3-inch thin-wall shelby tube samplers. Spt blow counts were taken with a mobile automatic hammer.

5G.2.2 Explorations and Laboratory Testing by Others

5G.2.2.1 Caltrans

Two cone penetrometer soundings, CPT-94-2 and 4, were performed south of Coleman Avenue, for the California Department of Transportation, in February 1995, by AGS, Inc. Consulting Engineers. The soundings were performed to a depth of 60 feet. The cone profiles are located in Appendix B of the Guadalupe River Project Construction Segment 3A; readouts are available on request.

5G.2.2.2 Lowney and Associates

Exploratory borings, EB-2 and 5, were performed by Lowney and Associates, in the vicinity of the proposed channel, for the Sobrato Property's West Julian Street Development. Exploration logs are shown on Plate 5G-3. EB-2 was drilled to a depth of 44.5 feet and EB-5 was drilled to a depth of 16.5 feet. Explorations were drilled with a Failing 1500 rotary wash drill rig with a 6-inch hollow stem flight auger in December of 1997. Additionally, two cone penetrometer soundings, CPT-1 and 2 were performed to depths of 92 and 71.5 feet, respectively. Cone penetrometer soundings were performed in June and July of 1998.

Representative samples were obtained from the borings at selected depths and tested at the Lowney and Associate's laboratory for evaluation and appropriate testing. Testing was performed to verify field and cone classifications, determine shear strengths, dry densities, and water contents. In-situ testing consisted of performing standard penetration tests, in accordance with ASTM D 1586, with a 1.38-inch I.D. and 2-inch O.D. split-tube sampler. Undisturbed samples were taken with a 2.5-inch I.D. Modified California Sampler.

5G.2.2.3 Woodward-Lundgren & Associates

Woodward-Lundgren & Associates performed the exploration work for the Julian Street Improvements, specifically the West (New) Julian Street Bridge. Explorations 21 and 22 were performed on 17 November 1973, on the north and south sides of New Julian Street, on the west side of the Guadalupe River. Explorations were performed to depths of 92 feet and penetration tests were performed at 5-foot intervals with a slip-jar hammer. Laboratory testing consisted of moisture contents, dry densities, and unconfined compressive strengths. The penetration testing was done with a "slip-jar hammer" whose weight and drop height was not recorded; but some of this data may be useful when correlated with other information.

5G.2.3 Summary of Soil Conditions

The soils in the bypass area are mostly located within soil reach 2 of the Guadalupe River Flood Control Project. The bypass inlet is located near exploration, 2F-87-9 at the north edge of soil reach 3 and the bypass outlet is located at the south edge of soil reach 1, north of Coleman Avenue. The soils show large variations from exploration to exploration with few areas of congruence or defined patterns. The material stratification is typical for a meandering stream channel where heavy sands and gravels are laid down as the stream meanders and cuts, and lighter clays and silts are deposited as the stream spreads out and the velocities decrease. Most explorations encountered cohesive sand-lean clay mixtures, lean and silty clays, and silty and clayey sands. An exception was Exploration 2F-87-9 near the south entrance of the proposed channel where relatively significant quantities of course

grained sandy clays, clayey sands, as well as graded sands and gravels were encountered. In general, the exploration materials consisted of fine sands intermixed with various quantities of clays and silts combined with isolated lenses of "clean" sands and gravels, lean and fat clays, and one lens of elastic silt. A soil layer profile is shown on Plates 5G-10 and 5G-11.

Within anticipated construction depths, consistencies for the cohesive clays, silts, and clay-silt-sand mixtures range from very soft to very stiff with the majority in the firm to stiff range. Densities for the cohesionless sand, gravel, and sand-gravel-silt-clay mixtures range from very loose to dense. The majority of the cohesionless material densities ranged from firm to very firm. Standard penetration blow counts typically ranged from 2 to 20 with isolated zones in the 30's, 40's, and 50's.

Natural water contents ranged from 10 to 38 percent with one exceptionally high water content of 138 percent for an isolated sample of elastic silt. Dry unit weights ranged from to 130 pcf and total unit weight range from 87 to 104 pcf. The average total unit weight was about 120 pcf.

See Plate 5G-12 for Atterberg limit plots. Clay materials were predominantly medium plastic with isolated zones of low and high plasticity clays and elastic silts. Liquid limits ranged from a high of 88 to a low of 23 and plasticity indices ranged from a high of 60 to a low of 7. Liquidity indices ranged from 0.10 to 1.18; a pretty wide range.

5G.2.3.1 Groundwater Conditions.

Groundwater was encountered in all explorations on the channel route. Groundwater depths range from 15 feet near New Julian Street to 24.5 feet near the PG&E Company Substation near Coleman Avenue. These readings are shown on the exploration logs and profile logs (Plates 5G 3 to 5G-11) and reflect water levels encountered only during the course of drilling. Many of the exploration holes were not left open long enough for the free water level to stabilize in the predominantly clayey soils.

5G.2.3.2 Volatile Organic Compounds and Heavy Metal Contamination

Soil contamination was suspected at the site of the West Julian Street Development. The site of the former FMC tractor plant was suspected of fuel contamination as well as lead and copper contamination from painting processes. However, during our cone penetrometer soundings and our sample retrieval drilling operations, the cone and cuttings were checked with a volatile chemical analyzer; there was no evidence of volatile compounds. Representatives of the Santa Clara Valley Water District performed twelve hazardous waste explorations at this site.

We were informed that most, if not all, of the heavy metal contamination was located at the paint site on the other side of the existing retaining wall adjacent to the Guadalupe River. However, no unusual smells or coloration of the drill cuttings was observed during our drilling operations.

5G.3 Soil and Foundation Design

5G.3.1 Soil Volume Change

The following paragraphs are provided for the evaluation of various items of soil volume change.

5G.3.1.1 Shrink-Swell

During consolidation testing, partially saturated lean clay and fat clay was inundated. The percent swells varied from 0.18 to 0.35 percent, which is not very much. As the materials along the sides and bottom of the proposed channel are unlikely to undergo any radical long term moisture changes to any appreciable depth, shrink and swell is unlikely to be a problem for consideration in design.

5G.3.1.2 Consolidation-Rebound

The following is a summary of the ASTM D 2435 consolidation testing for this project, see Plates 5G-15, 5G-16, and 5G-17 for plots and calculations.

Exploration	Depth (feet)	Material	Compression Index	Recompression Index
2F-99-1	30.0-32.5	Fat Clay	0.255	0.045
2F-00-3	29.0-31.5	Lean Clay	0.224	0.038
2F-00-3	40.0-42.5	Lean Clay	0.176	0.022

Laboratory tests of the deep lean clay materials at depths of 66 and 84 feet from our railroad bridge explorations have compression indexes that range from 0.20 to 0.25. Shallow gray sandy clay and gray silt materials at 26 and 30 feet deep from off-route location in the West Julian Street Development have lower compression indexes of about 0.14. These lower compression index values are more in-line with Schmertmann's values where the compression index estimations are based on the S_U/σ_V' ratios from the cone penetrometer tests. Some of the laboratory consolidation and triaxial test data suggests that some of the clay materials are overconsolidated by a factors of 1.3 to 1.9. Consolidation probably will not be a factor in the design of the bypass as the channel area will be unloaded during excavation.

Rebound uplift is difficult to accurately determine due to the uncertainty of the depth of mobilization under the bypass channel. From our laboratory recompression data, we estimate that the worse case rebound uplift will be quite small, on the order of about 0.25 inches.

5G.3.2 Shear Strength

5G.3.2.1 Laboratory R-Bar Test Sets

See Plates 5G-14 and 5G-15 for shear strength diagrams and a compilation of laboratory shear strength test results. The following table is a summary of six sets of ASTM D 4767

consolidated undrained compression shear strength tests taken with pore water pressure readings (CU or R-Bar tests):

Location	Depth (feet)	Material	Cu (TSF)	Ø degrees	Cd (TSF)	Ø' Degrees
2F-95-5	18.0-19.5	Sandy CL	0.60	7.0	0	33.0
2F-99-1	30.8-32.3	Fat Clay, CH	0.31	13.0	0.26	21.6
2F-99-2	25.5-26.5	Lean Clay	0.24	15.0	0.13	24.6
2F-00-1	14.5-15.5	Lean Clay	0.45	9.3	0	30.8
2F-00-2	26.5-27.5	Lean Clay	0.33	14.5	0	31.8
2F-00-3	22.0-23.5	Sandy CL	0.52	4.9	0	32.0

5G.3.2.2 Laboratory R-Bar Tests

The following table is a summary of two ASTM D 4767 consolidated undrained compression shear strength tests taken with pore water pressure readings (CU or R-Bar tests): sets were not performed due to dissimilar material types:

Location	Depth (feet)	Material	σ3 (TSF)	M (TSF)	σ1 (TSF)	σd (TSF)
2F-99-2	25.5'-26.0'	CL	1.00	0.48	2.25	1.25
2F-99-2	26.0'-26.5'	SM	0.50	-1.52	6.02	5.52

5G.3.2.3 Laboratory UU Tests

The following table is a compilation of ten ASTM D 2850 unconsolidated-undrained triaxial shear tests (UU or Q tests):

Location	Depth (feet)	Material	Cu (TSF)
2F-89-9	6.5'-9.0'	Sandy-Silty CL[a]	0.73
"	"	Sandy-Silty CL	0.67
"	25.0'-27.5'	Sandy CL	0.95
"		Sandy CL	0.76
2F-87-12	17.0'-20.0'	CL	1.14
"	"	Sandy CL-CH	0.86
"	22.5'-25.5'	CL	0.54
"	28.0'-31.0'	Silty CL	0.44
"	22.5'-25.5'	SC-SM	1.55
"	28.0'-31.0'	Silty CL & SM[b]	0.75

[a] Sample only 40-42 percent saturated.
[b] Composite sample; 1/3 silty-clay and 2/3 silty sand

5G.3.2.4 Laboratory Unconfined Compression Tests

The following table is a compilation of unconfined compression tests performed by Woodward-Lungren on explorations 21 and 22 for the Julian Street Bridge and one test from 2F-00-1.

Exploration	Depth (feet)	Material	Compressive Strength (TSF)
21	6	Silty CL	0.92
"	16	Sandy CL	0.97
"	31	Silty CL-CH	0.87
"	36	Silty CL-CH	0.98
"	51	Sandy CL	1.11
22	15	Silty CL	1.06
"	20	Silty CL	0.70
"	25	Silty CL-CH	1.60
"	31	Silty CL-CH	1.34
"	36	Silty CL-CH	0.99
"	41	Silty CL	1.16
"	46	Sandy CL	1.57
"	56	Sandy CL	0.53
2F-00-1	27.0 – 27.5	CL	0.55

5G.3.2.5 Adopted Design Strength:

Based on laboratory shear strength test results and the variability of the subsurface materials use a unconsolidated-undrained shear strength of 0.60 tons/square foot (TSF) for overall design.

5G.3.3 Design Considerations.

5G.3.3.1 Groundwater

Groundwater depths vary from 15 feet near West Santa Clara Street to 24.5 feet near Coleman Avenue. Difference in groundwater depth is likely due to the presence of clay zones which act as aquatards, causing a perched water table. In some areas, the groundwater table may be locally connected to the Guadalupe River by local lenses of "clean" sands and gravels. In other areas, groundwater fluctuations are primarily due to variations in rainfall and seasonal changes.

Drainage layers to relieve pour water and hydrostatic pressures may not be practical due to perched water conditions, low seepage rates, and the absence of places to drain the water to. Also, consider that drainage layers may create undesirable conditions by creating a flow path for when the Guadalupe River is in a high-water condition.

5G.3.3.2 Seepage and Uplift

As the water table is within the zone of channel construction, control of ground water and dewatering will be required for construction in order to limit seepage, instability, boils, and uplift during construction. Seepage flows, for the most part, should be low due to the large quantities of clay and "dirty" silty sands and gravels in the subsurface soils. High flows into the cut are possible in areas where "clean" sand and gravel lenses are prevalent, e.g. in the vicinity of 2F-87-9 (near the channel inlet). High groundwater may create some buoyant-uplift forces, especially if seismic events reduce side friction hold-down forces; as a precaution, the channel and cover weigh should be checked to ensure that they are greater that potential uplift forces.

5G.3.3.3 Liquefaction

Due to the anticipated unloading of the channel construction area and the minimal occurrence of saturated loose clean fine sands within the stressed areas under and around the proposed channel location, the possibility of liquefaction during a seismic event is very low.

5G.3.3.4 Slope Stability

Slope stability of the Guadalupe River banks is not considered as the main purpose of the bypass channel is to prevent disturbance of the riverbank area.

5G.3.4 Structural Design Parameters

5G.3.4.1 Precautions

Much of the subsurface material shows evidence of overconsolidation which means that these materials are likely to lose strength when they are loaded and the negative pore water pressures dissipate. Also, as the subsurface soils are predominantly cohesive and drain very slowly, shoring and lateral design should be based only on total stress parameters.

5G.3.4.2 Lateral Earth Pressures

Bypass channel walls will be designed for at-rest earth pressures plus temporary and construction surcharge loads. Use an undrained condition with a Ø angle of 0, a undrained cohesion of 0.70 tons per square foot (TSF), and a total soil unit weight of 120 pounds per square foot for lateral design. Neglect the negative pressures in the tension crack zone. Due to overconsolidation, do not depend on the development of additional strength with the release of pore water pressures.

5G.3.4.3 Coefficient of Subgrade Reaction

At the estimated depth of excavation utilizing the SPT blow count information, a value of 50 pounds per square inch per inch of deflection was calculated.

5G.3.4.4 Bearing Capacity

The bypass channel area is being unloaded by 2 to 3 KSF, which will likely be more than any surcharge additions. Rebound is covered in the paragraph Soil Volume Change. Bearing capacity may need to be addressed at the bridge and railroad crossing areas and the inlet-outlet areas where circular and sliding failures need to be considered.

5G.4 References

1. U.S. Army Corps of Engineers, General Design Memorandum, Guadalupe River, California, December 1991.

2. Lowney Associates, Final Geotechnical Investigation, 333 West Julian Street Development, San Jose, California, September 1998.

3. Das, Braja M., Principles of Geotechnical Engineering, Third Edition, PWS Publishing Company, Boston, MA, 1994.

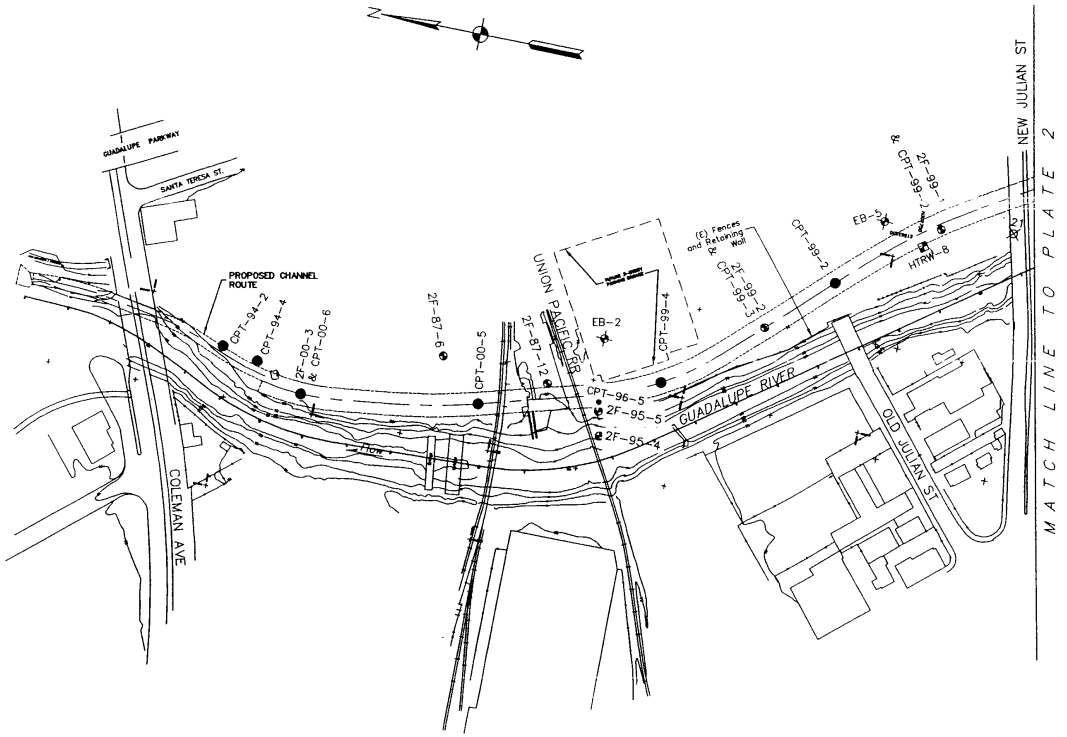
4. Das, Braja M., Principles of Foundation Engineering, Third Edition, PWS Publishing Company, Boston MA, 1995.

5. State of California, Department of Transportation, Bridge Design Practice-Section 6, Underground Structures Design Practice, December 1990.

6. AGS, Inc., Second Revised Draft Report, Geotechnical Study, Guadalupe River Contract 3, San Jose, CA, December 1996.

Plates

5G-1 Location of Explorations, Legend and Notes
5G-2 Location of Explorations
5G-3 Log of Exploration
5G-4 Log of Explorations
5G-5 Log of Explorations
5G-6 Log of Explorations
5G-7 Log of Explorations
5G-8 Log of Explorations
5G-9 Log of Explorations
5G-10 Right Bank Profile sta. 19+35 to sta. 137+50
5G-11 Right Bank Profile sta. 137+50 to 156+00
5G-12 Atterberg Limits
5G-13 Atterberg Limits
5G-14 Shear Strength Data
5G-15 Shear Strength Data
5G-16 Consolidation Graph
5G-17 Consolidation Graph
5G-18 Consolidation Graph



LOCATION OF EXPLORATIONS

Scale: 1" = 100'

STANDARD PENETROMETER DESCRIPTIVE DATA

COHESIONLESS		COHESIVE	
BLOWS*	RELATIVE DENSITY	BLOWS*	CONSISTENCY
0–4	Very Loose	0–1	Very Soft
5–10	Loose	2–4	Soft
11–20	Firm	5–8	Firm
21–30	Very Firm	9–15	Stiff
31–50	Dense	16–30	Very Stiff
51+	Very Dense	31+	Hard

*Blows per 1.0 foot of penetration of a 2-inch O.D. and 1 3/8-inch I.D. sampler driven by a 140-lb. hammer, 30-inch freefall.

LEGEND:

● 2F-87-6	Location of Explorations for Corps of Engineers borings.
● CPT-94-4	Location of Cone Penetrometer soundings.
+21	Location of Explorations for Woodward-Lundgren Associates.
+EB-1	Location of Explorations for West Julian Street Development by Lowney Associates.
⊠ HTRW-B	Location of Explorations for Hazardous and Toxic Waste.
GR	Gravel, Percent by Weight Passing the 3-inch Sieve and Retained on the No. 4 Sieve.
SA	Sand, Percent by Weight Passing the No. 4 Sieve and Retained on the No. 200 Sieve.
FI	Fines, Percent by Weight Passing the No. 200 Sieve.
LL	Liquid Limit.
PI	Plasticity Index (Liquid Limit Minus Plastic Limit).
MC	Laboratory Determined Moisture Content in Percent of Dry Weight.
γ_d	Dry Density in Pounds per Cubic Foot.
SM	Combined Field Visual Identification and/or Laboratory Classification.
N	Number of Blows with the Standard Penetrometer.
*	Attempt with the Standard Penetrometer (See Note 8)
B.O.H.	Bottom of Hole.
PS	Pavement Section.
NP	Nonplastic.
(E)	Existing.

NOTES:

1. These drawings are to be used only for approximate location of explorations and description of subsurface conditions.
2. Soil Classifications and Descriptions are based on field log descriptions in accordance with ASTM D2488 (Description and Identification of Soils, Visual-Manual Procedure) and/or laboratory test results in accordance with ASTM D2487 (Classification of Soils for Engineering Purposes).
3. All sieve sizes shown are U.S. Standard.
4. Borings 2F-73-21 (WLA) and -22 (WLA) were drilled with a 4-inch rotary drill using a slip-jar hammer on 12 and 13 July 1973. Borings 2F-87-6, -8, -9 and -12 were drilled with a CME 75 drill rig using an 8-inch O.D. hollow stem flight auger during 4 June through 24 July 1987. Borings 2F-95-4 and -5 were drilled with a CME 45 drill rig during 8 through 13 December 1995. Borings EB-2 and -5 were drilled with a Failing 1500 drill rig on 24 December 1997. Borings 2F-99-1 and -2 were drilled with a Failing 1500 "Holemaster" direct circulation drill rig using a 4-7/8" hollow stem flight auger on 19 April 1999. Borings 2F-00-1, -2 and -3 were drilled with Mobile B-61 drill rig using a 6-inch diameter hollow stem flight auger during 18 to 21 October 1999. Cone Penetrometer CPT-99-1 through -4 and CPT-00-1 through -6 were accomplished by VSI.
5. Standard Penetrometer data were obtained in accordance with ASTM D 1586 utilizing an 18-inch I.D. long split-barrel sampler. Utilizing both a Rope and Cathead and Automatic Hammer.
6. Groundwater was encountered in several of the borings at the time of explorations. Groundwater levels can be expected to fluctuate.
7. Depending on the soil moisture at the time of construction, the soil encountered may be unstable or potentially unstable. The probability of unstable conditions is highest when the soil moisture is greatest.
8. Attempt with the Standard Penetrometer is defined as refusal within the first 6 inches (seating penetration).
9. Thickness of pavement section shown is that at location of explorations; thickness may vary at other locations.
10. Additional Locations of Explorations are shown on Plate 2.
11. Logs of Explorations are shown on Plates 3 through 9.

GRAPHIC SCALE

1" = 100' 0 50' 100' 200' 300' 400' 500'

REVISION	DATE	DESCRIPTION	BY	BY

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION

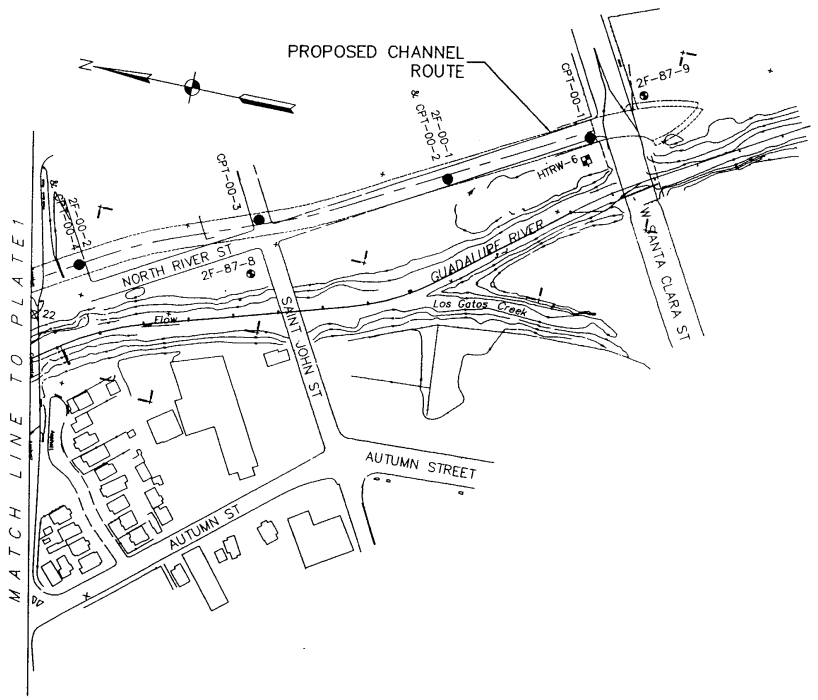
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. CHAMBERS
DRAWN: R. TELLEFSON
CHECKED:

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT. #7 AND #8
LOCATION OF EXPLORATIONS
LEGEND AND NOTES

DAVID A. HELLEN
CHIEF, SOIL DESIGN SECTION

Plate 5G-1



LOCATION OF EXPLORATIONS

Scale: 1" = 100'

NOTES:

1. Legend, Notes, and additional Locations of Explorations are shown on Plate 1.
2. Logs of Explorations are shown on Plates 3 through 9.

GRAPHIC SCALE

1" = 100' 0 50' 100' 200' 300' 400' 500'

REVISION	DATE	DESCRIPTION	BY	BY

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION

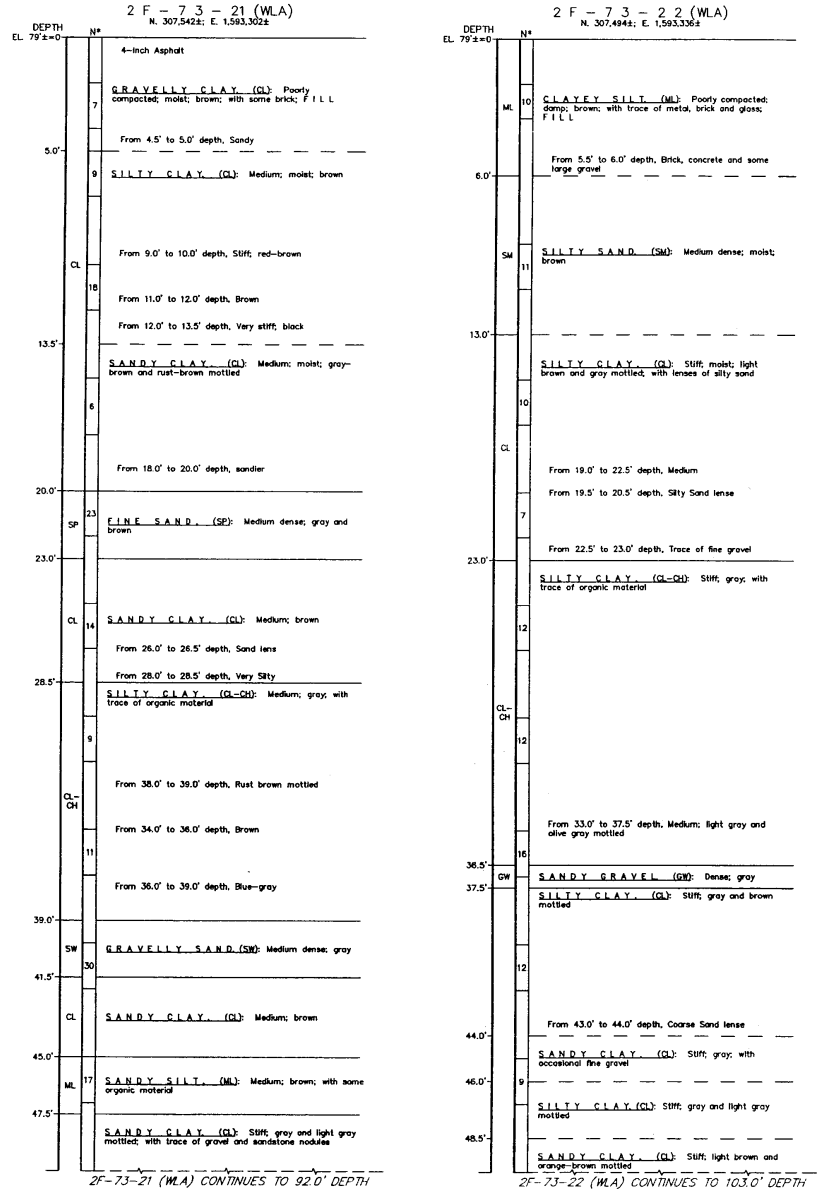
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. CHAMBERS
DRAWN: R. TELLEFSON
CHECKED: J. SCIANDRONE
SUBMITTED: DAVID A. FICKETTS, CHIEF, SOIL DESIGN SECTION
DATE APPROVED:

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT. #7 AND #8
LOCATION OF EXPLORATIONS

SCALE: AS SHOWN
SHEET:
SPEC. No.
FILE No.:

Plate EG-2



NOTES:

1. Legend and Notes are shown on Plate 1.
2. Locations of Explorations are shown on Plates 1 and 2.
3. Additional Logs of Explorations are shown on Plates 3 through 9.

GRAPHIC SCALE

1" = 2' 0 1' 2' 4' 6' 8' 10'

REVISION	DATE	DESCRIPTION	BY	BY

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. CHAMBERS
DRAWN: N. BOLAND
CHECKED: J. SCIANDRONE
SUBMITTED: DAVID A. RICKETTS, CHIEF, SOIL DESIGN SECTION
DATE APPROVED:

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT. #7 AND #8

LOG OF EXPLORATION
2F-73-21 (WLA) & 2F-73-22 (WLA)

SCALE: AS SHOWN
SHEET
FILE NO.

Plate 5G-3

2F-87-6

N 308,739.0±; E 1,592,787.0±

EL. ±78.4' = 0

DEPTH		N	GR	SA	FI	LL	PI	MC	
0.8'	SM								At surface sand and gravel
	ML	22							SILTY SAND WITH GRAVEL, SM: Very firm; dry; brown; fine sand; fill material (concrete debris)
	ML	11							SANDY SILT, ML: Stiff to very stiff; moist; brownish-black; nonplastic to low plasticity fines; fine sand At 2.0 feet olive-gray; scattered gravel to 3/4 inch; fill material
4.0'	SC	3	11	43	46	30	10	21	CLAYEY SAND, SC: Very loose; moist; yellowish-gray with scattered reddish-brown material and black particles; medium plasticity fines; fine to medium (with scattered coarse) sand; gravel to 3/4 inch
6.0'	GP	A							POORLY GRADED GRAVEL, GP: Granitic gravel; possible fill (concrete debris)
8.0'	CL	6	15	30	55	34	14	24	SANDY LEAN CLAY WITH GRAVEL, CL: Firm; moist; olive-gray to brown; medium plasticity fines; fine to medium (with scattered coarse), angular sand; angular gravel to 1 inch At 9.0 feet fill material (concrete debris)
10.0'	CL/ML	14							SILTY CLAY, CL/ML: Stiff; moist; dusky brown with a few moderate brown particles (possibly iron oxide staining); low plasticity fines
	CL/ML	13							At 14.0 feet light olive-gray with scattered dark grayish-brown particles
16.0'	CL/ML	13							
18.0'	CL	11	0	30	70	39	19	28	SANDY LEAN CLAY, CL: Stiff; moist; grayish-black; medium plasticity fines; fine to medium (with scattered coarse) sand
19.4'	CL	15							SANDY LEAN CLAY, CL: Stiff; moist; light olive-gray and light brown (possibly iron oxide staining); low plasticity fines; fine; subrounded sand
20.0'	SM								SILTY SAND, SM: Moist; olive-gray with some light gray material; fine, rounded sand
22.0'	CL	8	0	31	69	29	13	25	SANDY LEAN CLAY, CL: Firm; moist; olive-gray with some light gray material; low plasticity fines; fine to medium sand
23.5'	CL	7	0	40	60	31	15	24	SANDY LEAN CLAY, CL: Firm; moist; olive-black with some light brown particles (iron oxide staining); medium plasticity fines; fine to medium, rounded sand
24.0' ▽									NO SAMPLE TAKEN: Drilled to 28.5 feet At 24.0 feet water lever after 24 hours At 25.0 feet initial water level during drilling
28.5'	CL	7	0	2	98	38	15	35	LEAN CLAY, CL: Firm; moist to wet; olive-gray with some light reddish-brown particles; medium plasticity fines; fine sand
29.6'	SM								SILTY SAND, SM: Loose; wet; light olive-brown; scattered subangular gravel to 1/4 inch
30.0'	B.O.H.								23 JUL 87

2F-87-8

N 307,040.0±; E 1,593,525.0±

EL. ±79.0' = 0

DEPTH		N	GR	SA	FI	LL	PI	MC	
2.0'	SC	14							CLAYEY SAND/CLAYEY SAND WITH GRAVEL, SC: Firm; dry; dark yellowish-brown; 50% to 60% fine to coarse, subrounded sand; 20% medium plasticity fines; 10% to 20% angular to subrounded gravel to 1 inch
	CL	4							LEAN CLAY WITH SAND, CL: Soft; moist; dark yellowish-brown; 20% fine to coarse, angular to subrounded sand; trace of gravel to 1/2 inch; carbonaceous material; organic material (roots)
4.0'	CL	3	10	38	52	42	19	11	SANDY LEAN CLAY, CL: Soft; moist; dark yellowish-brown; medium plasticity fines; fine to coarse, angular to subrounded sand; gravel to 1/2 inch; petroleum odor; carbonaceous material
6.0'	CL	2	20	30	50	44	21	11	SANDY LEAN CLAY WITH GRAVEL, CL: Soft; moist; dark yellowish-brown; medium plasticity fines; fine to coarse, subrounded sand; gravel to 1 inch; petroleum odor; organic material (roots)
8.0'	CL	11							LEAN CLAY WITH SAND, CL: Stiff; moist; dark yellowish-brown with some moderate reddish-brown material; 80% low plasticity fines; 20% fine sand; petroleum odor; carbonaceous; organic material (roots)
10.0'	CL/ML	19							SILTY CLAY, CL/ML: Very stiff; moist; dark yellowish-brown with some moderate reddish-brown material; medium plasticity fines; petroleum odor; organic material (roots)
11.2'	CH								FAT CLAY, CH: Very stiff; moist; black; 95% high plasticity fines; 5% fine to coarse sand; organic material (roots)
12.0'	CH	15							FAT CLAY, CH: Stiff; moist; white to light gray; 90% high plasticity fines; 10% fine sand
14.0'	SP-SC	12							POORLY GRADED SAND WITH CLAY, SP-SC: Firm; moist; greenish-gray to moderate reddish-orange; 90% to 95% fine sand; 5% to 10% medium plasticity fines; trace of carbonaceous material
16.0'	CL	7	0	50	50	27	9	14	SANDY LEAN CLAY, CL: Firm; moist; grayish-orange; low plasticity fines; fine to medium (mostly fine) sand
18.0'	CL/CH	8							LEAN TO FAT CLAY, CL/CH: Firm; moist; medium gray with moderate reddish-orange material; medium to high plasticity fines
20.0'	CL	7	0	15	85	35	14	26	LEAN CLAY WITH SAND, CL: Firm; moist; dark yellowish-brown; medium plasticity fines; fine (with scattered medium) sand
21.5'									NO SAMPLE TAKEN: Material as above; drilled to 25.0 feet
25.0'	CL	14							LEAN CLAY/LEAN CLAY WITH SAND, CL: Stiff; moist; dark yellowish-brown; 85% to 90% medium plasticity fines; 10% to 15% fine sand; carbonaceous
26.5'									NO SAMPLE TAKEN: Material as above; drilled to 28.5 feet
28.5'	CH	7							FAT CLAY, CH: Firm; moist; dark yellowish-brown with some black material; high plasticity fines
30.0'	B.O.H.								4 Jun 87

2F-87-9

N 306,265.0±; E 1,594,090.0±

EL. ±80.2' = 0

DEPTH		N	GR	SA	FI	LL	PI	MC	γd	
2.5'	SP									NO SAMPLE TAKEN: Drilled to 2.5 feet From 0 to 2-1/2 inches fill material Cuttings showed POORLY GRADED SAND WITH GRAVEL, SP: Dry; pale yellowish-brown; gravel to 3 inches; cobbles to 10 inches; boulders to 18 inches; fill material
4.0'	CL	3	14	34	52	28	12	11		SANDY LEAN CLAY, CL: Soft; moist; dark yellowish-brown; low plasticity fines; fine to coarse sand; gravel to 1 inch; carbonaceous material; fill material (with pieces of brick)
6.5'										NO SAMPLE TAKEN: Cobbles; hard augering; drilled to 6.5 feet
7.8'	CL	SHELBY TUBE	1	27	72	37	15	18 21	76.0 72.8	LEAN CLAY WITH SAND, CL: Moist; dark brown; medium plasticity fines; fine to medium sand; gravel to 3/8 inch; organic material (root hair) LEAN CLAY WITH SAND, CL: Firm; dark brown; medium plasticity fines; fine to medium sand; gravel to 3/8 inch; trace of organic material (root hair)
9.0'										NO SAMPLE TAKEN: Drilled to 10.0 feet
10.7'	SP									POORLY GRADED SAND, SP: Moist; moderate brown; 95% fine sand; 5% low plasticity fines
12.5'	GP									POORLY GRADED GRAVEL WITH SAND, GP: Moist; pale yellowish-brown; gravel to 3/4 inch; fine to coarse, subrounded sand
	SP-SM	26	38	54	8	–	–	4	–	POORLY GRADED SAND WITH CLAY AND GRAVEL, SP-SC or POORLY GRADED SAND WITH SILT AND GRAVEL, SP-SM: Very firm; moist; pale yellowish-brown to dark yellowish-brown; fine to coarse, angular to subrounded sand; angular to subrounded gravel to 3/4 inch; no data for fines fraction
15.0'	SP-SC	22	32	61	7	–	–	4	–	POORLY GRADED SAND WITH CLAY AND GRAVEL, SP-SC or POORLY GRADED SAND WITH SILT AND GRAVEL, SP-SM: Very firm; moist; pale yellowish-brown to dark yellowish-brown; fine to coarse, angular to subrounded gravel to 1 inch; no data for fines fraction
17.0'	GW-GM	29	47	46	7	–	–	5	–	WELL-GRADED GRAVEL WITH CLAY AND SAND, GW-GC, or WELL-GRADED GRAVEL WITH SILT AND SAND, GW-GM: Very firm; moist; pale yellowish-brown to dark yellowish-brown; angular to subrounded gravel to 1-1/2 inches; fine to coarse sand; no data for fines fraction
VARIES 19.0' ▽	GW-GM	27	59	36	5	–	–	9	–	
20.2' ▽										At 20.2 feet water level
21.0'	SP-SC	12	50	38	12	–	–	14	–	POORLY GRADED GRAVEL WITH CLAY AND SAND, GP-GC, or POORLY GRADED GRAVEL WITH SILT AND SAND, GP-GM: Very firm; moist to wet; pale yellowish-brown to dark yellowish-brown; angular to subrounded gravel to 1 inch; fine to coarse, angular to subrounded sand; no data for fines fraction
22.2'	SC	6								POORLY GRADED GRAVEL WITH CLAY AND SAND, GP-GC, or POORLY GRADED GRAVEL WITH SILT AND SAND, GP-GM: Firm; wet; pale yellowish-brown to dark yellowish-brown; angular gravel to 1 inch; fine to coarse, angular to subrounded sand; no data for fines fraction
25.0'	CL	SHELBY TUBE	0	9	91	38	16	24 28	100.4 95.7	CLAYEY SAND, SC: Loose; moist; dark yellowish-brown; 80% sand; 20% medium plasticity fines At 23.0 feet some medium gray material
27.5'										LEAN CLAY, CL: Firm; moist; gray; medium plasticity fines; fine sand; blocky
30.0'										NO SAMPLE TAKEN: Drilled to 30.0 feet
	CH									FAT CLAY, CH: Moist; dark yellowish-orange to pale yellowish-brown; high plasticity fines
32.0'										NO SAMPLE TAKEN: Drilled to 33.0 feet
33.0'	SP	60								POORLY GRADED SAND WITH GRAVEL, SP: Dense to very dense; moist; pale yellowish-brown to dark yellowish-brown; 60% to 70% fine to coarse, angular to subrounded sand; 30% to 40% angular to subrounded gravel to 3/4 inch
35.0'	SP	42								
36.5'										NO SAMPLE TAKEN: Drilled to 40.0 feet
40.0'	SP	46								POORLY GRADED SAND WITH GRAVEL, SP: Dense; moist; pale yellowish-orange to dark yellowish-brown; 60% to 70% fine to coarse, angular to subrounded sand; 30% to 40% angular to subrounded gravel to 3/4 inch
41.5'										NO SAMPLE TAKEN: Drilled to 45.0 feet
45.0'	SC	13								CLAYEY SAND, SC: Firm; moist; dark yellowish-brown; 80% to 90% fine sand; 10% to 20% medium plasticity fines
46.5'										NO SAMPLE TAKEN: Drilled to 48.5 feet
48.5'	CL/CH	6								LEAN TO FAT CLAY WITH SAND, CH: Firm; moist; medium dark gray; 80% to 85% medium to high plasticity fines; 15% to 20% fine to coarse sand
50.0'	B.O.H.									6 AUG 87

EB-5

N 307,832.0±; E 1,593,272.0±

EL. ±76.0' = 0

DEPTH		N	MC	γd	
0.83'	PS				PAVEMENT SECTION, PS: Asphaltic concrete (4 inches) over aggregate base (6 inches)
2.0'	CL	16	13	111	SANDY CLAY, CL (FILL): Very stiff; moist; brown; low plasticity; fine sand; fragments of brick
4.3'	CL	12	20	–	SANDY CLAY, CL: Stiff; moist; brown; low plasticity; fine sand; increasing sand
	SP				SAND, SP: Loose to medium dense; moist; brown; fine sand; trace of silt
5.5'	CL	9	24	–	
8.5'	CL	23	17	111	SILTY CLAY, CL: Very stiff; moist; brown; low to moderate plasticity; trace to some very fine sand SANDY CLAY, CL: Very stiff; moist; black; high plasticity; sand to 1/4 inch; color grading to black
12.5'	SP	13	14	–	SAND, SP: Loose; moist; light brown; medium to coarse sand
15.5'	SW	14	10	–	GRAVELLY SAND, SW: Dense; moist; light brown; medium to coarse sand; medium gravel
16.5'	B.O.H.				24 DEC 97

NOTES:

1. Legend and Notes are shown on Plate 1.
2. Locations of Explorations are shown on Plates 1 and 2.
3. Logs of Explorations are shown on Plates 3 through 9.

GRAPHIC SCALE

1" = 2' (0, 1', 2', 4', 6', 8', 10')

VERTICAL SCALE: 1" = 2'

REVISION	DATE	DESCRIPTION	BY	BY

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. CHAMBERS
DRAWN: N. BOLAND
CHECKED: J. SCIANDRONE
SUBMITTED: DAVID A. RICKETTS, CHIEF, SOIL DESIGN SECTION
DATE APPROVED:

SANTA CLARA COUNTY, CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT. #7 AND #8

LOG OF EXPLORATIONS
2F-87-6, -8 AND -9 AND EB-5

SCALE: AS SHOWN
SHEET:
FILE NO.:

Plate 5G-4

2F-87-12

N 308,499.0±; E 1,592,769.0±

EL. ±78.0' = 0

DEPTH		N	GR	SA	FI	LL	PI	MC	γ_d	G_s	
	SM	20	–	–	–	–	–	–	–	–	At surface gravel and silty sand (railroad ballast)
2.0'	SM	7	–	–	–	–	–	–	–	–	SILTY SAND WITH GRAVEL: SC: Firm; dry; dark yellowish-brown; 60% fine sand; 20% low plasticity fines; 20% subrounded gravel; hard drilling
	SM	7	–	–	–	–	–	–	–	–	SILTY SAND: SC: Loose; dry; grayish-brown; 50% fine sand; 40% low plasticity fines; 10% subrounded gravel
4.0'	CL	0	30	70	34	16	21	102.8	–		SANDY LEAN CLAY: CL: Moist; dusky brown; medium plasticity fines; fine sand; scattered subrounded gravel
7.5'	CL	8	–	–	–	–	–	–	–	–	LEAN CLAY: CL: Firm; moist; dusky brown; low to medium plasticity fines; scattered pieces of black carbonaceous material
9.5'	CL	14	0	24	78	44	22	25	–	–	LEAN CLAY WITH SAND: CL: Stiff; moist; grayish-brown; medium plasticity fines; fine sand
11.5'	CH		0	1	99	53	28	30	92.9	–	FAT CLAY: CH: Moist; olive-gray; high plasticity fines; rounded sand
15.0'	CL	10	0	13	87	47	28	23	–	–	LEAN CLAY WITH SAND: CL: Stiff; moist; dusky yellowish-brown with scattered light gray particles; medium plasticity fines; fine sand
17.0'	CL		0	11	89	35	15	23	101.2	2.7	LEAN CLAY: CL: Dense; moist; gray and mottled dark brown; blocky
18.5'	CH							26	95.4		SANDY LEAN CLAY: CL: Gray and mottled dark brown
19.75'											FAT CLAY: CH: Firm; moist; gray
20.5'	CL	9	2	40	58	29	12	22	–	–	SANDY LEAN CLAY: CL: Stiff; olive-gray with thin layers of light brown particles (possibly iron oxide); low plasticity fines; fine to medium (with scattered coarse); subangular to rounded (with some flat) sand; gravel to 3/8 inch
22.5' ▽	SP-SM										From 22.5 feet to 26.0 feet water level varies
23.25'	SM		0	61	39	27	8	20	108.9	–	POORLY GRADED SAND WITH SILT: SP-SM: SILTY SAND: SM: Wet; dark brown; fine to coarse sand; considerable nonplastic fines
24.0'	CL							28	95.4		LEAN CLAY: CL: Firm; moist; grayish-brown; medium plasticity fines; blocky
26.0'	SM										SILTY SAND: SM: Wet; dark yellowish-brown; 80% fine to coarse, subrounded sand; 20% nonplastic fines; scattered gravel to 1/4 inch
26.5'	SC-SM	5	0	54	46	24	6	25	–	–	SILTY, CLAYEY SAND: SC-SM: Loose; wet; gray; fine to medium sand; low plasticity fines
28.0'	CL		0	1	99	41	17	38	82.9	–	LEAN CLAY: CL: Firm; moist; gray; medium plasticity fines; fine sand
30.0'	SM							31	91.6		SILTY SAND: SM: Wet; gray; fine sand; moderate amount of nonplastic fines
31.5'	CL	6	–	–	–	–	–	–	–	–	LEAN CLAY: CL: Firm; moist; dark gray; medium plasticity fines; flat particles of black material (possibly carbonaceous)
33.5'	CH	7	0	14	86	88	60	44	–	–	FAT CLAY: CH: Firm; moist; dark gray; high plasticity fines; fine sand
35.5'											

(CONTINUED NEXT COLUMN)

2F-87-12

(CONTINUED FROM PREVIOUS COLUMN)

DEPTH

DEPTH		N	GR	SA	FI	LL	PI	MC	γ_d	G_s	
35.5'	CL	7	–	–	–	–	–	–	–	–	LEAN CLAY: CL: Firm; moist; dark gray; medium plasticity fines; thin layers of fibrous organic material
37.8'	CH										At 37.5 feet as above with fine, rounded sand
38.2'	SP										POORLY GRADED SAND WITH GRAVEL: SP: Moderate brown; 80% to 85% fine to coarse sand; 15% to 20% rounded gravel to 1 inch
											NO SAMPLE RECOVERED: Shelby tube was damaged; gravelly material was encountered
41.0'	GP-GM	75	60	35	5	–	–	6	–	–	POORLY GRADED GRAVEL WITH CLAY AND SAND, GP-GC or POORLY GRADED GRAVEL WITH SILT AND SAND, GP-GM: Very dense; moist; olive-gray; subrounded gravel to 1 inch; fine to coarse, rounded sand; no data for fines fraction
42.5'											
45.0'											NO SAMPLE TAKEN: Drilled to 45.0 feet
	SC or SM	34	36	50	14	–	–	14	–	–	CLAYEY SAND WITH GRAVEL, SC or SILTY SAND WITH GRAVEL, SM: Dense; wet; olive-gray; fine to coarse, subrounded sand; subrounded gravel to 1 inch; no data for fines fraction
46.5'											
50.0'											NO SAMPLE TAKEN: Drilled to 50.0 feet
	CL	4	0	28	72	28	10	24	–	–	LEAN CLAY WITH SAND: CL: Soft; moist; greenish-black; low plasticity fines; fine to medium sand
52.0'	CL-ML										
		1	24	75	26	7	24	102.0	–		SILTY CLAY WITH SAND: CL-ML: Firm; moist; gray; low plasticity fines; fine to medium sand; gravel to 3/8 inch; blocky
55.0'								23	103.7		
											NO SAMPLE TAKEN: Drilled to 60..0 feet
60.0'	CL-ML	11	–	–	–	–	–	–	–	–	SILTY CLAY: CL/ML: Firm; moist; greenish-black; low plasticity fines; fine, rounded sand
62.0'	CL		0	11	89	31	12	25	100.0	–	LEAN CLAY: CL: Dense; moist; light gray; blocky; scattered cemented particles to 1 inch
65.0'								24	102.3		
											NO SAMPLE TAKEN: Drilled to 68.5 feet
68.5'	CL	13	0	28	72	30	14	25	–	–	LEAN CLAY WITH SAND: CL: Firm; moist; greenish-black; medium plasticity fines; fine (with scattered medium) sand
70.0'	B.O.H.										24 JUL 87

EB-2

N 308,394.0±; E 1,592,895.0±

EL. ±76.0' = 0

DEPTH		N	MC	γ_d	
0.5'	PS				PAVEMENT SECTION: PS: Asphaltic concrete (2 inches) over concrete (4 inches)
2.0'	CL	8	15	102	SILTY CLAY: CL: Stiff; moist; yellowish-brown; moderate plasticity; trace of fine sand
	SP	3	24	–	SAND: SP: Loose; moist; brown; fine to medium sand; trace of clay
4.8'					At 4.0 feet increasing clayey fines
		11	29	–	
					SILTY CLAY: CL: Stiff; moist; brown; trace of very fine sand; moderate plasticity
					At 8.5 feet becomes hard
		35	29	91	
12.5'	CL				
		37	23	106	SANDY CLAY: CL: Hard; moist; gray with brown streaks; low to moderate plasticity; very fine sand
18.5' ▽	SM	7	19	–	SILTY SAND: SM: Loose; wet; mottled brown and gray; fine to medium sand; trace of clayey fines; percent passing #200 sieve = 34%
20.0'	SP				SAND: SP: Dense; wet; mottled brown and dark gray; fine to medium sand
		31	18	–	From 24.0 feet to 24.3 feet lens of SILTY CLAY: CL
					At 28.0 feet loose; color grading to gray
		7	27	–	
31.0'					At 30.0 feet percent passing #200 sieve = 16%
	CL	11	23	–	SILTY CLAY: CL: Stiff; moist; dark bluish-gray; moderate plasticity; trace of very fine sand
					At 37.0 feet trace of red staining; increasing fine sand
38.0'					

(CONTINUED NEXT COLUMN)

EB-2

(CONTINUED)

DEPTH		N	MC	γ_d	
38.0'					
39.6'	SP	8	22	–	SAND: SP: Medium dense; wet; fine sand; trace of clay
41.0'	CL	14	23	–	CLAYEY SILT: CL: Stiff; moist; gray with white specks; low plasticity; trace of very fine sand
44.5'	B.O.H.				24 DEC 97

NOTES:

1. Legend and Notes are shown on Plate 1.
2. Locations of Explorations are shown on Plates 1 and 2.
3. Logs of Explorations are shown on Plates 3 through 9.

VERTICAL SCALE: 1" = 2'

GRAPHIC SCALE

1" = 2' 0 1' 2' 4' 6' 8' 10'

REVISION	DATE	DESCRIPTION	BY	BY

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. CHAMBERS
DRAWN: N. BOLAND
CHECKED:
SUBMITTED:
DAVID A. RICKETTS
CHIEF, SOIL DESIGN SECTION
DATE APPROVED:

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT #7 AND #8
LOG OF EXPLORATIONS
21 [illegible] 12 AND 13

SHEET NO. | FILE No.:

Plate 5G-5

2F-95-4

N 308,362.0±; E 1,592,681.0±

EL. ±66.5' = 0

DEPTH		N	GR	SA	FI	LL	PI	MC	γ_d	G_s	
											NO SAMPLE TAKEN: Overburden from leveling pad for CPT and drill rig
3.0'	ML	8									SANDY SILT, ML: Firm; dry; dark brown; 60% nonplastic fines; 40% fine to coarse, subangular to subrounded sand; weak reaction to HCl; trace of organic material (roots, wood particles)
5.0'	MH	0	0	8	92	88	26	–	–		ELASTIC SILT, MH: Very soft; moist; white; high plasticity fines; fine to medium sand; no odor; strong reaction to HCl; plaster-like material
7.0'	SM	4		31	43	26	40	13	25	–	SILTY SAND WITH GRAVEL, SM: Very loose; moist; dark brown; fine to coarse, subangular to subrounded sand; gravel to 1-1/2 inches; medium plasticity fines; weak reaction to HCl
9.0'	SP-SM										POORLY GRADED SAND WITH SILT, SP-SM: Loose; moist; very dark gray; 90% fine to medium (mostly fine), subangular to subrounded sand; 10% nonplastic fines; no reaction to HCl
9.7'	CL	6									
11.0'	SM	17									LEAN CLAY WITH SAND, CL: Firm; moist; mottled dark gray and dark brown; 85% low plasticity fines; 15% fine to medium (mostly fine), subangular to subrounded sand; weak reaction to HCl
12.5' ▽ 13.0'	CL	10	0	15	85	36	15	28	–	–	SILTY SAND, SM: Firm; moist; dark brown; 60% fine to medium (mostly fine), subangular to subrounded sand; 40% nonplastic fines; no reaction to HCl
											At 12.5 feet water level
	CL	9									LEAN CLAY WITH SAND, CL: Stiff; moist; dark gray; medium plasticity fines; fine (with scattered medium to coarse), subangular to subrounded sand; no reaction to HCl
17.0'											At 15.0 feet wet
	CL	3	0	13	87	33	14	40	–	–	LEAN CLAY WITH SAND, CL: Soft; moist; dark gray; medium plasticity fines; fine to medium (mostly fine), subangular to subrounded sand; no reaction to HCl
18.5'	ML	SHELBY TUBE (ATTEMPT)									NO RECOVERY: Cuttings showed SANDY SILT, ML: Wet; dark gray; 60% nonplastic fines; 40% fine to coarse (mostly fine), subangular to subrounded sand
21.0'	CL	6	2	43	55	36	19	31	–	–	SANDY LEAN CLAY, CL: Firm; wet; dark gray; medium plasticity fines; fine to coarse (mostly fine to medium), subangular to subrounded sand; gravel to 3/8 inch; no reaction to HCl
22.0' 22.5'			0	16	84	47	29	33	–	–	
24.0'	CL	SHELBY TUBE (ATTEMPT)									LEAN CLAY WITH SAND, CL: Firm; moist; very dark gray to black; medium plasticity fines; fine to medium (mostly fine, with scattered coarse), subangular to subrounded sand; no reaction to HCl
											NO SAMPLE TAKEN: Drilled to 24.0 feet
27.0'											NO RECOVERY: Drilled to 27.0 feet
28.5'	CL	2	0	15	85	27	10	29	–	–	LEAN CLAY WITH SAND, CL: Soft; moist; very dark gray; low plasticity fines; fine, subangular to subrounded sand
31.0'	ML	SHELBY TUBE (ATTEMPT)									NO RECOVERY: Drilled to 31.0 feet
33.0'	CL	11	0	18	82	32	14	–	–	–	LEAN CLAY WITH SAND, CL: Stiff; wet; dark gray, medium plasticity fines; fine (with scattered medium to coarse), subangular to subrounded sand
35.5'		SHELBY TUBE									NO DESCRIPTION: Drilled to 31.0 feet

(CONTINUED NEXT COLUMN)

2F-95-4

(CONTINUED FROM PREVIOUS COLUMN)

DEPTH		N	GR	SA	FI	LL	PI	MC	γ_d	G_s	
35.5'	CL	3									SANDY LEAN CLAY, CL: Soft; moist; dark gray; 60% medium plasticity fines; 40% fine to medium (mostly fine), subangular to subrounded sand; weak reaction to HCl
37.0'											NO SAMPLE TAKEN: Drilled to 38.5 feet
38.5'	CL	9	0	13	87	42	23	–	–	–	LEAN CLAY WITH SAND, CL: Stiff; moist; gray; medium plasticity fines; fine (with scattered medium to coarse) sand; strong reaction to HCl
40.0'											NO SAMPLE TAKEN: Drilled to 41.5 feet
41.5'	CL	11	0	26	74	27	12	–	–	–	LEAN CLAY WITH SAND, CL: Stiff; moist; dark gray; low plasticity fines; fine (with scattered medium to coarse), subangular to subrounded sand; weak reaction to HCl
43.0'											At 45.0 feet no reaction to HCl
46.5'	CL	14									NO SAMPLE TAKEN: Drilled to 48.5 feet
48.5'	CL	13	0	32	68	28	13	–	–	–	SANDY LEAN CLAY, CL: Stiff; moist; dark gray; low plasticity fines; fine (with scattered medium to coarse), subangular to subrounded sand; no reaction to HCl
50.0'											NO SAMPLE TAKEN: Drilled to 52.0 feet
52.0'	CL	16									LEAN CLAY, CL: Very stiff; moist; gray to grayish-brown; 90% medium plasticity fines; 10% fine to medium (mostly fine), subangular to subrounded sand; strong reaction to HCl
53.5'											NO SAMPLE TAKEN: Drilled to 55.0 feet
55.0'	SC-SM	13	0	57	43	25	7	22	–	–	SILTY, CLAYEY SAND, SC-SM: Firm; moist to wet; fine (with scattered medium to coarse), subangular to subrounded sand; low plasticity fines; no reaction to HCl
56.5'											NO SAMPLE TAKEN: Drilled to 57.5 feet
57.5'	CL	SHELBY TUBE	0	22	78	35	19	26 24 23	98.7 102.3 104.1	2.7	LEAN CLAY WITH SAND, CL: Stiff; moist to wet; grayish-brown; medium plasticity fines; fine, subangular to subrounded sand; no reaction to HCl
60.0'	CL	9	1	31	68	32	17	25	–	–	SANDY LEAN CLAY, CL: Stiff; moist; gray; medium plasticity fines; fine to medium (mostly fine, with scattered coarse), subangular to subrounded sand; gravel to 3/8 inch; strong reaction to HCl
62.0'	CL	41									LEAN CLAY WITH SAND, CL: Hard; moist; gray; 80% medium plasticity fines; 20% fine to coarse (mostly fine), subangular to subrounded sand; trace of gravel to 3/8 inch; no reaction to HCl; trace of iron oxide staining
63.5'											NO SAMPLE TAKEN: Drilled to 68.5 feet
68.5'	CL	12	0	30	70	28	10	24	–	–	SANDY LEAN CLAY, CL: Stiff; moist; gray; low plasticity fines; fine (with scattered medium to coarse), subangular to subrounded sand; strong reaction to HCl
70.0'											NO SAMPLE TAKEN: Drilled to 71.0 feet
71.0'											

(CONTINUED NEXT COLUMN)

2F-95-4

(CONTINUED FROM PREVIOUS COLUMN)

DEPTH		N	GR	SA	FI	LL	PI	MC	γ_d	G_s	
71.0'	CL	22									LEAN CLAY WITH SAND, CL: Very stiff; moist; grayish-brown; 80% medium plasticity fines; 20% fine to medium (mostly fine), subangular to subrounded sand; no reaction to HCl
72.5'											NO SAMPLE TAKEN: Drilled to 75.0 feet
75.0'	CL	14	0	22	78	34	18	29	–	–	LEAN CLAY WITH SAND, CL: Stiff; moist; light gray; medium plasticity fines; fine (with scattered medium), subangular sand; weak reaction to HCl
76.5'											NO SAMPLE TAKEN: Drilled to 77.5 feet
77.5'	CL	SHELBY TUBE	3	17	80	38	23	30	90.2	2.7	LEAN CLAY WITH SAND, CL: Soft; wet; light gray; medium plasticity fines; fine to medium (mostly fine), subangular to subrounded sand; gravel to 3/4 inch; weak reaction to HCl
80.0'		26									SANDY LEAN CLAY, CL: Very stiff; moist; gray to yellowish-brown; 60% medium plasticity fines; 40% fine to coarse, subangular to subrounded sand; weak reaction to HCl
81.5'	B.O.H.										8 DEC 95

NOTES:

1. Legend and Notes are shown on Plate 1.
2. Locations of Explorations are shown on Plates 1 and 2.
3. Logs of Explorations are shown on Plates 3 through 9.

VERTICAL SCALE: 1" = 2'

GRAPHIC SCALE

1" = 2' 0 1' 2' 4' 6' 8' 10'

REVISION	DATE	DESCRIPTION	BY	BY

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. CHAMBERS
DRAWN: N. BOLAND
CHECKED: J. SCIANDRONE
SUBMITTED: DAVID A. RICKETTS, CHIEF, SOIL DESIGN SECTION
DATE APPROVED:

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT #7 AND #8
LOG OF EXPLORATIONS
2F-95-4
SCALE AS SHOWN
SHEET
FILE No.

Plate 5G-6

2F-95-5

N 308,378.0±; E 1,592,742.0±

EL. ±75.0' = 0

DEPTH			N	GR	SA	FI	LL	PI	MC	γ_d	G_s	
0												SANDY LEAN CLAY, (CL): Soft; moist; dark brown; 70% medium plasticity fines; 30% fine to coarse, subangular to subrounded sand; trace of gravel to 3/8 inch; no reaction to HCl
1.5'	CL		4	–	–	–	–	–	–	–	–	
			11	0	19	81	38	19	21	–	–	LEAN CLAY WITH SAND, CL: Stiff; moist; dark grayish-brown; medium plasticity fines; fine to coarse (mostly fine), subangular to subrounded sand; no reaction to HCl
3.0'	CL/CH		7	–	–	–	–	–	–	–	–	
4.5'												LEAN TO FAT CLAY, CL/CH: Firm; moist; dark brown; medium to high plasticity fines; trace of fine sand; no reaction to HCl
			1	–	–	–	–	–	–	–	–	
6.0'	CL											LEAN CLAY, CL: Very soft; moist; dark brown; 90% medium plasticity fines; 10% fine to medium (mostly fine), subangular to subrounded sand; no reaction to HCl
			21	–	–	–	–	–	–	–	–	
7.5'												LEAN CLAY, CL: Very stiff; moist; dark brown; medium plasticity fines; trace of fine sand; no reaction to HCl
	CH		22	0	2	98	60	32	32	–	–	FAT CLAY, CH: Very stiff; moist; dark brown; high plasticity fines; fine sand; no reaction to HCl
9.0'	CL											LEAN CLAY, CL: Very stiff; moist; grayish-brown; medium plasticity fines; trace of fine sand; no reaction to HCl
10.5'			18	–	–	–	–	–	–	–	–	
												NO SAMPLE TAKEN: Drilled to 12.0 feet
12.0'	CL											SANDY LEAN CLAY, CL: Very stiff; moist; brownish-gray; 60% low to medium plasticity fines; 40% fine to coarse, subangular to subrounded sand; trace of subangular gravel to 1/2 inch; strong reaction to HCl
13.5'			25	–	–	–	–	–	–	–	–	
												NO SAMPLE TAKEN: Drilled to 15.0 feet
15.0' ▽												At 15.0 feet water level
	CL		8	–	–	–	–	–	–	–	–	LEAN CLAY WITH SAND, CL: Firm; moist; dark grayish-brown; 75% medium plasticity fines; 25% fine to coarse (mostly fine), subangular to subrounded sand; no reaction to HCl
17.0'												
	CL	SHELBY TUBE		0	30	70	40	23	21	106.0	2.7	SANDY LEAN CLAY, CL: Firm; wet; dark grayish-brown; medium plasticity fines; fine to medium (mostly fine, with scattered coarse), subangular to subrounded sand; no reaction to HCl
									22	105.0		
19.5'									23	102.4		
	SC		7	0	59	41	27	10	23	–	–	CLAYEY SAND, SC: Loose; moist; mottled yellowish-brown to gray; fine (with scattered medium), subangular to subrounded sand; low plasticity fines; weak reaction to HCl
21.0'												
												NO SAMPLE TAKEN: Drilled to 22.5 feet
22.5'	CL OR ML		23	–	–	–	–	–	–	–	–	SANDY LEAN CLAY, CL or SANDY SILT, ML: Very stiff; moist to wet; grayish-brown; 70% low plasticity fines; 30% fine to medium (mostly fine), subangular to subrounded sand; no reaction to HCl
24.0'												
												NO SAMPLE TAKEN: Drilled to 25.5 feet
25.5'	CL											
26.0'	OR ML OR SM		10	–	–	–	–	–	–	–	–	SANDY LEAN CLAY, CL or SANDY SILT, ML: Moist to wet; grayish-brown; 70% low plasticity fines; 30% fine to medium fine), subangular to subrounded sand; no reaction to HCl
27.0'												SILTY SAND, SM: Loose; moist; dark gray; 60% fine to coarse (mostly fine), subangular to subrounded sand; 40% nonplastic fines; no reaction to HCl
28.5'	CL		10	7	38	55	31	12	22	–	–	NO SAMPLE TAKEN: Drilled to 28.5 feet
30.0'												SANDY LEAN CLAY, CL: Stiff; moist; very dark gray to black; medium plasticity fines; fine to coarse (mostly fine) sand; gravel to 3/4 inch; no odor; no reaction to HCl
31.5'	CL/CH		12	–	–	–	–	–	–	–	–	
												NO SAMPLE TAKEN: Drilled to 31.5 feet
33.0'												LEAN TO FAT CLAY, CL/CH: Stiff; moist; very dark gray to black; medium to high plasticity fines; trace of fine sand; no odor; no reaction to HCl
												NO SAMPLE TAKEN: Drilled to 35.0 feet
35.0'												

(CONTINUED NEXT COLUMN)

2F-95-5

(CONTINUED FROM PREVIOUS COLUMN)

DEPTH			N	GR	SA	FI	LL	PI	MC	γ_d	G_s	
35.0'	CH		9	0	3	97	63	38	38	–	–	FAT CLAY, CH: Stiff; moist; dark gray; high plasticity fines; fine, subangular to subrounded sand; no reaction to HCl
36.5'												
												NO SAMPLE TAKEN: Drilled to 38.0 feet
38.0'		SHELBY TUBE										
												SAMPLE NOT TESTED: No description given
40.5'	CL		11	–	–	–	–	–	–	–	–	
42.0'												LEAN CLAY, CL: Stiff; moist; mottled gray to yellowish-brown; 95% medium plasticity fines; 5% fine sand; trace of gravel to 3/8 inch; no reaction to HCl; iron oxide staining
43.5'												
												NO SAMPLE TAKEN: Drilled to 43.5 feet
45.0'	CL		17	0	30	70	31	13	26	–	–	SANDY LEAN CLAY, CL: Very stiff; moist; dark gray; medium plasticity fines; fine, subangular to subrounded sand; no reaction to HCl
46.5'												
												NO SAMPLE TAKEN: Drilled to 46.5 feet
48.0'	CL		12	–	–	–	–	–	–	–	–	LEAN CLAY WITH SAND, CL: Stiff; moist; gray; 85% low to medium plasticity fines; 15% fine to medium (mostly fine), subangular to subrounded sand; weak reaction to HCl
49.5'												
												NO SAMPLE TAKEN: Drilled to 49.5 feet
51.5'	CL		21	0	19	81	29	9	27	–	–	LEAN CLAY WITH SAND, CL: Very stiff; moist; gray; low plasticity fines; fine, subangular to subrounded sand; trace of gravel to 1 inch; strong reaction to HCl
		SHELBY TUBE		0	23	77	36	18	25	99.4	2.7	LEAN CLAY WITH SAND, CL: Medium plasticity fines; fine to coarse (mostly fine) sand
54.0'									22	105.4		At 53.9 feet mottled gray to yellowish-brown; no reaction to HCl
	CL OR ML		23	–	–	–	–	–	–	–	–	SANDY LEAN CLAY, CL or SANDY SILT, ML: Very stiff; moist; mottled gray to yellowish-brown to gray; 60% low plasticity fines; 40% fine to medium (mostly fine), subangular sand; no reaction to HCl
55.5'												
57.0'												NO SAMPLE TAKEN: Drilled to 57.0 feet
	SC OR CL		18	0	61	39	32	14	20	–	–	CLAYEY SAND, SC: Firm; moist; dark gray; fine, subangular to subrounded sand; medium plasticity fines; no reaction to HCl
58.5'				0	41	59	23	8	–	–	–	or
												SANDY LEAN CLAY, CL: Very stiff; moist; dark gray; low plasticity fines; fine, subangular to subrounded sand; no reaction to HCl
60.0'												NO SAMPLE TAKEN: Drilled to 60.0 feet
	CL		18	0	19	81	35	17	27	–	–	LEAN CLAY WITH SAND, CL: Very stiff; moist; gray; medium plasticity fines; fine to coarse (mostly fine), subangular to subrounded sand; trace of gravel to 1/2 inch; weak reaction to HCl
61.5'												
63.0'												NO SAMPLE TAKEN: Drilled to 63.0 feet
	CL		18	–	–	–	–	–	–	–	–	LEAN CLAY, CL: Very stiff; moist; grayish-brown; 90% medium plasticity fines; 5% fine sand; 5% gravel to 3/8 inch; weak reaction to HCl
64.5'												
66.0'												NO SAMPLE TAKEN: Drilled to 66.0 feet
	CL-ML		31	0	48	52	25	5	24	–	–	SANDY SILTY CLAY, CL-ML: Hard; moist; gray; low plasticity fines; fine (with scattered medium to coarse), subangular to subrounded sand; no reaction to HCl
67.5'												
												NO SAMPLE TAKEN: Drilled to 69.0 feet
69.0'												

(CONTINUED NEXT COLUMN)

2F-95-5

(CONTINUED FROM PREVIOUS COLUMN)

DEPTH			N	GR	SA	FI	LL	PI	MC	γ_d	G_s	
69.0'	CL		23	–	–	–	–	–	–	–	–	LEAN CLAY WITH SAND, CL: Very stiff; moist; gray; 70% medium plasticity fines; 25% fine to medium (mostly fine), subangular to subrounded sand; 5% gravel to 3/8 inch; weak reaction to HCl
70.5'												
												NO SAMPLE TAKEN: Drilled to 72.0 feet
72.0'	SM/ML		41	–	–	–	–	–	–	–	–	SILTY SAND WITH GRAVEL/SILT WITH SAND AND GRAVEL, SM/ML: Dense/hard; moist; 50% low plasticity fines; 25% fine to coarse, subangular to subrounded sand; 25% subangular to subrounded gravel to 1 inch
73.5'												
												NO SAMPLE TAKEN: Drilled to 75.0 feet
75.0'	CL		16	3	21	76	29	10	22	–	–	LEAN CLAY WITH SAND, CL: Very stiff; moist; dark gray; low plasticity fines; fine (with scattered medium to coarse) sand; gravel to 3/4 inch; no reaction to HCl
76.5'												
												NO SAMPLE TAKEN: Drilled to 78.0 feet
78.0'	CL	SHELBY TUBE		0	23	77	29	12	–	–	–	LEAN CLAY WITH SAND, CL: Firm; low plasticity fines; fine (with scattered medium to coarse) sand
80.5'									22	100.3	2.7	
			31	–	–	–	–	–	–	–	–	LEAN CLAY, CL: Hard; moist; dark gray; 95% medium plasticity fines; 5% fine sand; no reaction to HCl
82.0'	B.O.H.											

13 DEC 95

VERTICAL SCALE: 1" = 2'

NOTES:

1. Legend and Notes are shown on Plate 1.
2. Locations of Explorations are shown on Plates 1 and 2.
3. Logs of Explorations are shown on Plates 3 through 9.

GRAPHIC SCALE

1" = 2' 0 1' 2' 4' 6' 8' 10'

REVISION	DATE	DESCRIPTION	BY

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION

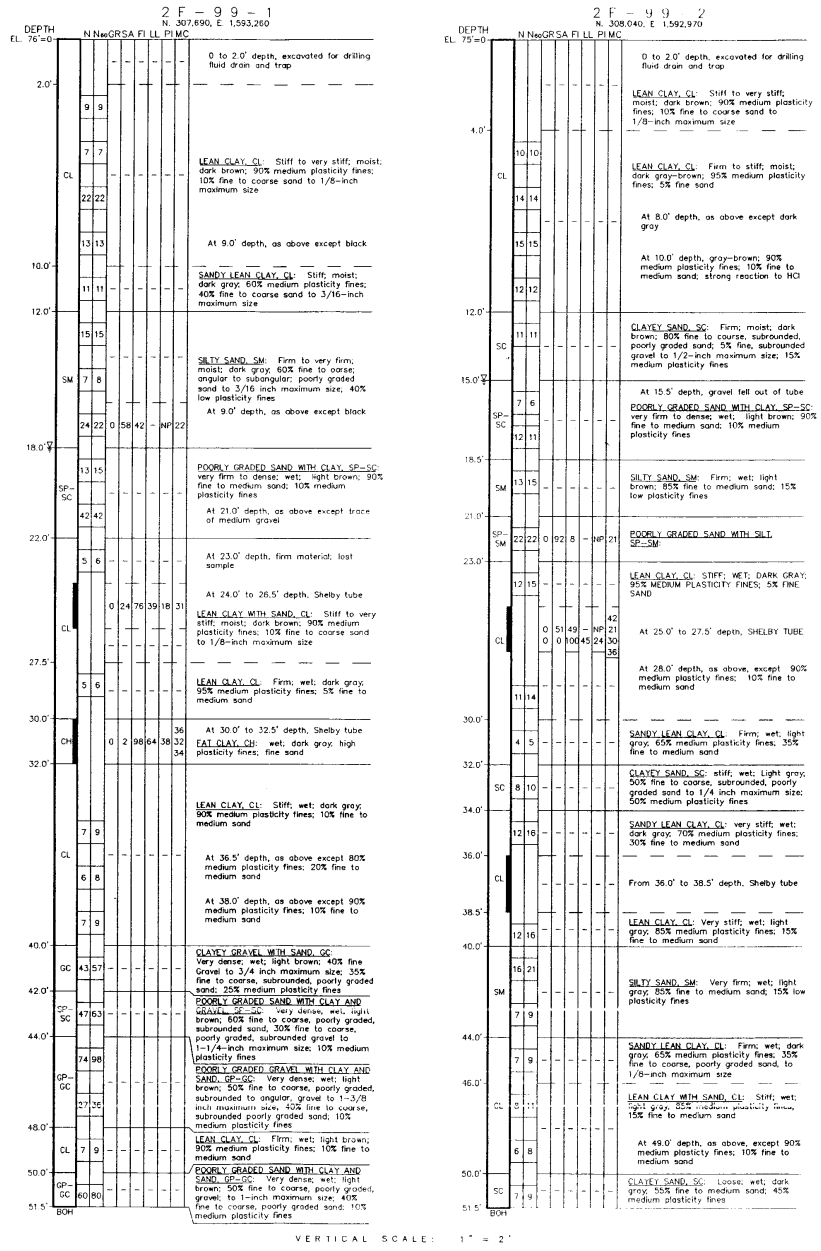
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. CHAMBERS
DRAWN: N. BOLAND
CHECKED: J. SCIANDRONE
SUBMITTED: DAVID A. RICKETTS
CHIEF, SOIL DESIGN SECTION
DATE APPROVED:

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT. #7 AND #8
LOG OF EXPLORATIONS
2F-95-5

SCALE: AS SHOWN | SPEC. No.:
SHEET: | FILE No.:

Plate 5G-7



NOTES:

1. Legend and Notes are shown on Plate 1.
2. Locations of Explorations are shown on Plates 1 and 2.
3. Logs of Explorations are shown on Plates 3 through 9.

GRAPHIC SCALE

1" = 2' 0 1' 2' 4' 6' 8' 10'

REVISION	DATE	DESCRIPTION	BY	BY

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION

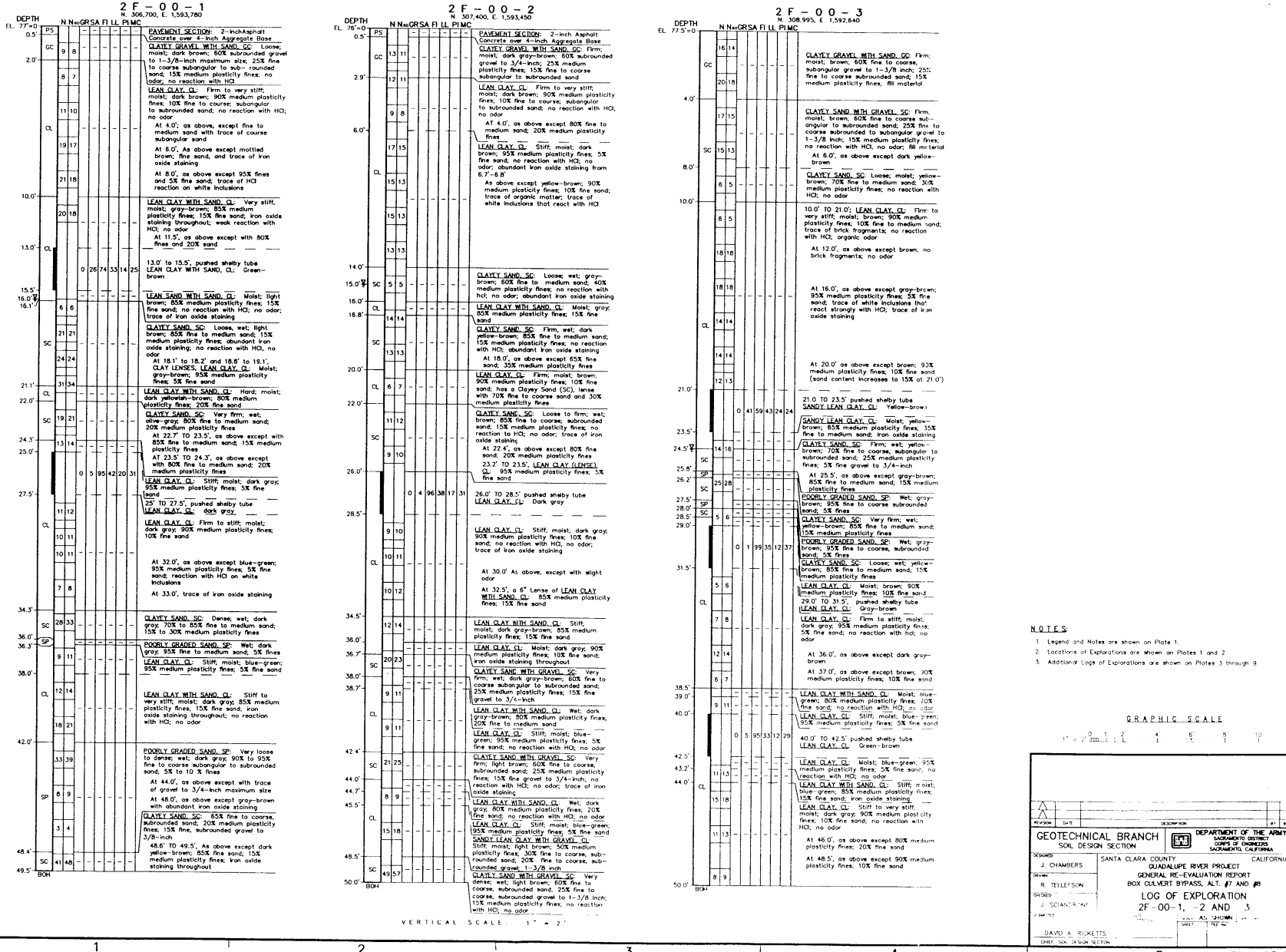
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

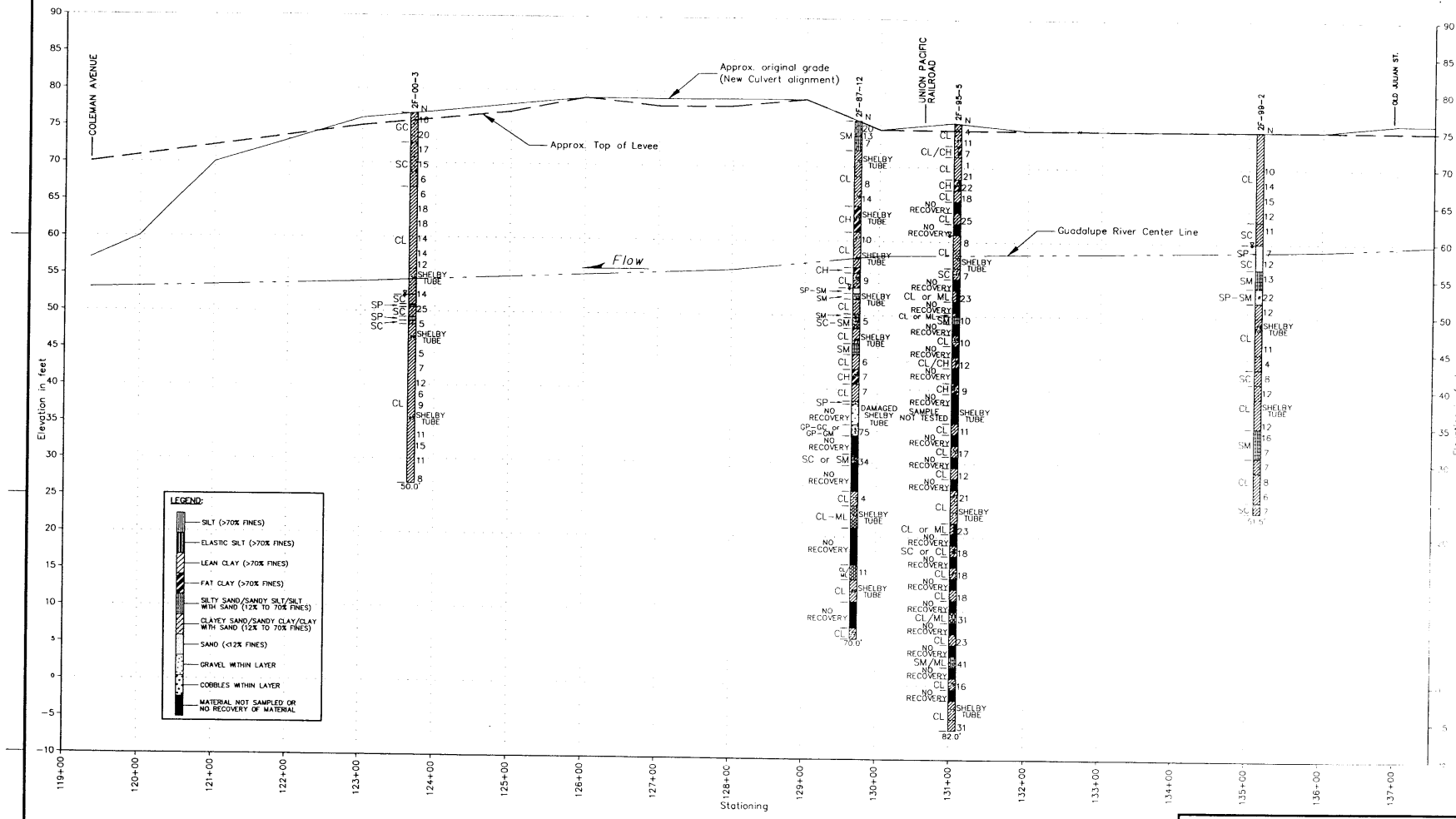
DESIGNED: J. CHAMBERS
DRAWN: N. BOLAND
CHECKED: J. SCIANDRONE
SUBMITTED: DAVID A. RICKETTS, CHIEF, SOIL DESIGN SECTION
DATE APPROVED:

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
HWY 101/ALT BYPASS, ALT #2 AND #3
LOG OF EXPLORATIONS
2F-99-1 AND 2F-99-2

SCALE: AS SHOWN
SHEET: FILE No.

Plate 5G-8


2F-00-1
N. 306,700, E. 1,593,780
2F-00-2
N. 307,400, E. 1,593,450
2F-00-3
N. 308,995, E. 1,592,640
DEPTH
N N60 GR SA FI LL PI MC
PAVEMENT SECTION: 2-inch Asphalt Concrete over 4-inch Aggregate Base
CLAYEY GRAVEL WITH SAND, GC: Loose; moist; dark brown; 60% subrounded gravel to 1-3/8-inch maximum size; 25% fine to coarse subangular to sub- rounded sand; 15% medium plasticity fines; no odor, no reaction with HCl
LEAN CLAY, CL: Firm to very stiff; moist; dark brown; 90% medium plasticity fines; 10% fine to course; subangular to subrounded sand; no reaction with HCl; no odor
At 4.0', as above, except fine to medium sand with trace of coarse subangular sand
At 8.0', As above except mottled brown; fine sand, and trace of iron oxide staining
At 8.0', as above except 95% fines and 5% fine sand; trace of HCl reaction on white inclusions
LEAN CLAY WITH SAND, CL: Very stiff, moist; gray-brown; 85% medium plasticity fines; 15% fine sand; iron oxide staining throughout; weak reaction with HCl; no odor
At 11.5', as above except with 80% fines and 20% sand
13.0' to 15.5', pushed shelby tube LEAN CLAY WITH SAND, CL: Green-brown
LEAN SAND WITH SAND, CL: Moist; light brown; 85% medium plasticity fines; 15% fine sand; no reaction with HCl; no odor; trace of iron oxide staining
CLAYEY SAND, SC: Loose, wet; light brown; 85% fine to medium sand; 15% medium plasticity fines; abundant iron oxide staining; no reaction with HCl, no odor
At 18.1' to 18.2' and 18.8' to 19.1', CLAY LENSES, LEAN CLAY, CL: Moist; gray-brown; 95% medium plasticity fines; 5% fine sand
LEAN CLAY WITH SAND, CL: Hard; moist; dark yellowish-brown; 80% medium plasticity fines; 20% fine sand
CLAYEY SAND, SC: Very firm; wet; olive-gray; 80% fine to medium sand; 20% medium plasticity fines
At 22.7' TO 23.5', as above except with 85% fine to medium sand; 15% medium plasticity fines
At 23.5' TO 24.3', as above except with 80% fine to medium sand; 20% medium plasticity fines
LEAN CLAY, CL: Stiff; moist; dark gray; 95% medium plasticity fines; 5% fine sand
25' TO 27.5', pushed shelby tube LEAN CLAY, CL: dark gray
LEAN CLAY, CL: Firm to stiff; moist; dark gray; 90% medium plasticity fines; 10% fine sand
At 32.0', as above except blue-green; 95% medium plasticity fines; 5% fine sand; reaction with HCl on white inclusions
At 33.0', trace of iron oxide staining
CLAYEY SAND, SC: Dense; wet; dark gray; 70% to 85% fine to medium sand; 15% to 30% medium plasticity fines
POORLY GRADED SAND, SP: Wet; dark gray; 95% fine to medium sand; 5% fines
LEAN CLAY, CL: Stiff; moist; blue-green; 95% medium plasticity fines; 5% fine sand
LEAN CLAY WITH SAND, CL: Stiff to very stiff; moist; dark gray; 85% medium plasticity fines; 15% fine sand; iron oxide staining throughout; no reaction with HCl; no odor
POORLY GRADED SAND, SP: Very loose to dense; wet; dark gray; 90% to 95% fine to coarse subangular to subrounded sand; 5% to 10 % fines
At 44.0', as above except with trace of gravel to 3/4-inch maximum size
At 48.0', as above except gray-brown with abundant iron oxide staining
CLAYEY SAND, SC: 65% fine to coarse, subrounded sand; 20% medium plasticity fines; 15% fine, subrounded gravel to 3/8-inch
48.6' TO 49.5', As above except dark yellow-brown; 85% fine sand; 15% medium plasticity fines; iron oxide staining throughout
BOH
CLAYEY GRAVEL WITH SAND, GC: Firm; moist; dark gray-brown; 60% subrounded gravel to 1-3/4-inch; 25% medium plasticity fines; 15% fine to coarse subangular to subrounded sand
LEAN CLAY, CL: Firm to very stiff; moist; dark brown; 90% medium plasticity fines; 10% fine to course; subangular to subrounded sand; no reaction with HCl; no odor
At 4.0', as above except 80% fine to medium sand; 20% medium plasticity fines
LEAN CLAY, CL: Stiff; moist; dark brown; 95% medium plasticity fines; 5% fine sand; no reaction with HCl; no odor; abundant iron oxide staining from 6.7'-8.8'
As above except yellow-brown; 90% medium plasticity fines; 10% fine sand; trace of organic matter; trace of white inclusions that react with HCl
CLAYEY SAND, SC: Loose; wet; gray-brown; 60% fine to medium sand; 40% medium plasticity fines; no reaction with hcl; no odor; abundant iron oxide staining
LEAN CLAY WITH SAND, CL: Moist; gray; 80% medium plasticity fines; 15% fine sand
CLAYEY SAND, SC: Firm, wet; dark yellow-brown; 85% fine to medium sand; 15% medium plasticity fines; no reaction with HCl; abundant iron oxide staining
At 18.0', as above except 65% fine sand; 35% medium plasticity fines
LEAN CLAY, CL: Firm; moist; brown; 90% medium plasticity fines; 10% fine sand; has a Clayey Sand (SC), lense with 70% fine to coarse sand and 30% medium plasticity fines
CLAYEY SAND, SC: Loose to firm; wet; brown; 85% fine to coarse; subrounded sand; 15% medium plasticity fines; no reaction to HCl; no odor; trace of iron oxide staining
At 22.4', as above except 80% fine sand; 20% medium plasticity fines
23.2' TO 23.5', LEAN CLAY (LENSE), CL: 95% medium plasticity fines; 5% fine sand
26.0' TO 28.5', pushed shelby tube LEAN CLAY, CL: Dark gray
LEAN CLAY, CL: Stiff; moist; dark gray; 90% medium plasticity fines; 10% fine sand; no reaction with HCl, no odor; trace of iron oxide staining
At 30.0' As above, except with slight odor
At 32.5', a 6" Lense of LEAN CLAY WITH SAND, CL: 85% medium plasticity fines; 15% fine sand
LEAN CLAY WITH SAND, CL: Stiff; moist; dark gray-brown; 85% medium plasticity fines; 15% fine sand
LEAN CLAY, CL: Moist; dark gray; 90% medium plasticity fines; 10% fine sand; iron oxide staining throughout
CLAYEY SAND WITH GRAVEL, SC: Very firm; wet; dark gray-brown; 60% fine to coarse subangular to subrounded sand; 25% medium plasticity fines; 15% fine
LEAN CLAY WITH SAND, CL: Wet; dark gray-brown; 80% medium plasticity fines; 20% fine to medium sand
LEAN CLAY, CL: Stiff; moist; blue-green; 95% medium plasticity fines; 5% fine sand; no reaction with HCl; no odor
CLAYEY SAND WITH GRAVEL, SC: Very firm; light brown; 60% fine to coarse, subrounded sand; 25% medium plasticity fines; 15% fine gravel to 3/4-inch; no reaction with HCl; no odor; trace of iron oxide staining
LEAN CLAY WITH SAND, CL: Wet; dark gray; 80% medium plasticity fines; 20% fine sand; no reaction with HCl; no odor
LEAN CLAY, CL: Stiff; moist; blue-green; 95% medium plasticity fines; 5% fine sand
SANDY LEAN CLAY WITH GRAVEL, CL: Stiff; moist; light brown; 50% medium plasticity fines; 30% fine to coarse, sub-rounded sand; 20% fine to coarse, sub-rounded gravel; 1-3/8 inch
CLAYEY SAND WITH GRAVEL, SC: Very dense; wet; light brown; 60% fine to coarse, subrounded sand; 25% fine to coarse, subrounded gravel to 1-3/8 inch; 15% medium plasticity fines; no reaction with HCl; no odor
VERTICAL SCALE: 1" = 2'
CLAYEY GRAVEL WITH SAND, GC: Firm; moist; brown; 60% fine to coarse, subangular gravel to 1-3/8 inch; 25% fine to coarse subrounded sand; 15% medium plasticity fines; fill material
CLAYEY SAND WITH GRAVEL, SC: Firm, moist; brown; 60% fine to coarse sub-angular to subrounded sand; 25% fine to coarse subrounded to subangular gravel to 1-3/8 inch; 15% medium plasticity fines; no reaction with HCl, no odor; fill material
At 6.0', as above except dark yellow-brown
CLAYEY SAND, SC: Loose; moist; yellow-brown; 70% fine to medium sand; 30% medium plasticity fines; no reaction with HCl; no odor
10.0' TO 21.0', LEAN CLAY, CL: Firm to very stiff; moist; brown; 90% medium plasticity fines; 10% fine to medium sand; trace of brick fragments; no reaction with HCl, organic odor
At 12.0', as above except brown; no brick fragments; no odor
At 16.0', as above except gray-brown; 95% medium plasticity fines; 5% fine sand; trace of white inclusions that react strongly with HCl; trace of iron oxide staining
At 20.0' as above except brown; 93% medium plasticity fines; 10% fine sand (sand content increases to 15% at 21.0')
21.0 TO 23.5' pushed shelby tube SANDY LEAN CLAY, CL: Yellow-brown
SANDY LEAN CLAY, CL: Moist; yellow-brown; 65% medium plasticity fines; 35% fine to medium sand; iron oxide staining
CLAYEY SAND, SC: Firm; wet; yellow-brown; 70% fine to coarse, subangular to subrounded sand; 25% medium plasticity fines; 5% fine gravel to 3/4-inch
At 25.5', as above except gray-brown; 85% fine to medium sand; 15% medium plasticity fines
POORLY GRADED SAND, SP: Wet; gray-brown; 95% fine to coarse subrounded sand; 5% fines
CLAYEY SAND, SC: Very firm; wet; yellow-brown; 85% fine to medium sand; 15% medium plasticity fines
POORLY GRADED SAND, SP: Wet; gray-brown; 95% fine to coarse, subrounded sand; 5% fines
CLAYEY SAND, SC: Loose; wet; yellow-brown; 85% fine to medium sand; 15% medium plasticity fines
LEAN CLAY, CL: Moist; brown; 90% medium plasticity fines; 10% fine sand
29.0' TO 31.5', pushed shelby tube LEAN CLAY, CL: Gray-brown
LEAN CLAY, CL: Firm to stiff; moist; dark gray; 95% medium plasticity fines; 5% fine sand; no reaction with hcl; no odor
At 36.0', as above except dark gray-brown
At 37.0', as above except brown; 90% medium plasticity fines; 10% fine sand
LEAN CLAY WITH SAND, CL: Moist; blue-green; 80% medium plasticity fines; 20% fine sand; no reaction with HCl; no odor
LEAN CLAY, CL: Stiff; moist; blue-green; 95% medium plasticity fines; 5% fine sand
40.0' TO 42.5' pushed shelby tube LEAN CLAY, CL: Green-brown
LEAN CLAY, CL: Moist; blue-green; 95% medium plasticity fines; 5% fine sand; no reaction with HCl; no odor
LEAN CLAY WITH SAND, CL: Stiff; moist; blue-green; 85% medium plasticity fines; 15% fine sand; iron oxide staining
LEAN CLAY, CL: Stiff to very stiff; moist; dark gray; 90% medium plasticity fines; 10% fine sand; no reaction with HCl; no odor
At 46.0', as above except 80% medium plasticity fines; 20% fine sand
At 48.5', as above except 90% medium plasticity fines; 10% fine sand
NOTES
1. Legend and Notes are shown on Plate 1.
2. Locations of Explorations are shown on Plates 1 and 2.
3. Additional Logs of Explorations are shown on Plates 3 through 9.
GRAPHIC SCALE
1" = 2'
GEOTECHNICAL BRANCH
SOIL DESIGN SECTION
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
DESIGNED J. CHAMBERS
DRAWN R. TELLEFSON
TRACED J. SCIANCALEPORE
CHECKED DAVID A. RICKETTS
CHIEF, SOIL DESIGN SECTION
SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT. #7 AND #8
LOG OF EXPLORATION
2F-00-1, -2 AND -3
SCALE AS SHOWN
SHEET NO.
Plate 5G-9



LEGEND:

1F-87-6	EXPLORATION DESIGNATION
CL	SOIL CLASSIFICATION
41	FINES CONTENT (PERCENT PASSING THE NO. 200 SIEVE)
N	NUMBER OF BLOWS WITH THE STANDARD PENETROMETER
▽	WATER LEVEL AT TIME OF EXPLORATION

NOTES:

1. Legend and Notes are shown on Plate 1.
2. Locations of Explorations are shown on Plates 1 and 2.
3. Additional Logs of Explorations are shown on Plates 3 through .

GRAPHIC SCALES

5' 4' 3' 2' 1' 0 5' 10'
1" = 5' (Vert.)

100' 50' 0 100' 200'
1" = 100' (Horiz.) (Approx.)

REVISION	DATE	DESCRIPTION	BY

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION

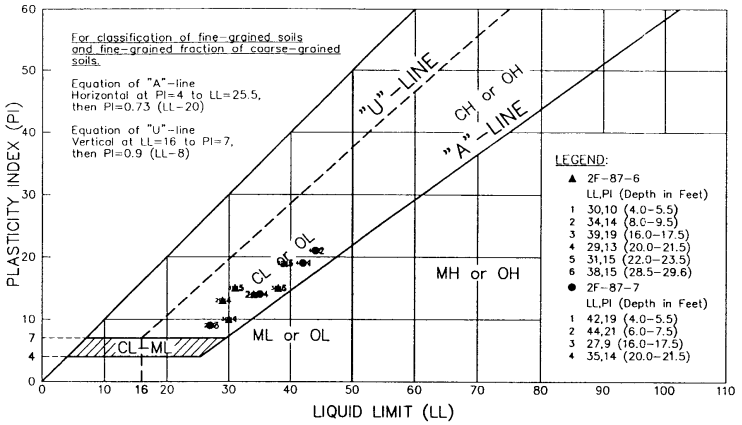
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. CHAMBERS
DRAWN: R. TELLEFSON
CHECKED: J. SCIANDRONE
SUBMITTED: DAVID A. RICKETTS, CHIEF, SOIL DESIGN SECTION

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT. #7 AND #8
RIGHT BANK PROFILE
STA. 19+35 TO STA. 137+50

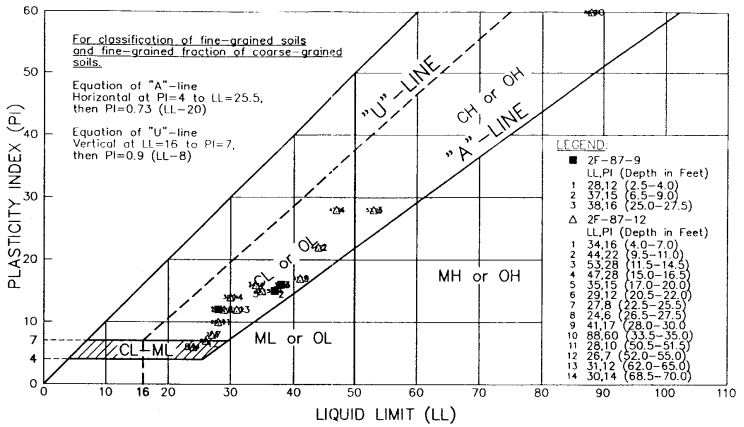
SCALE: AS SHOWN | DATE APPROVED | SHEET | FILE NO.

Plate 5G-10



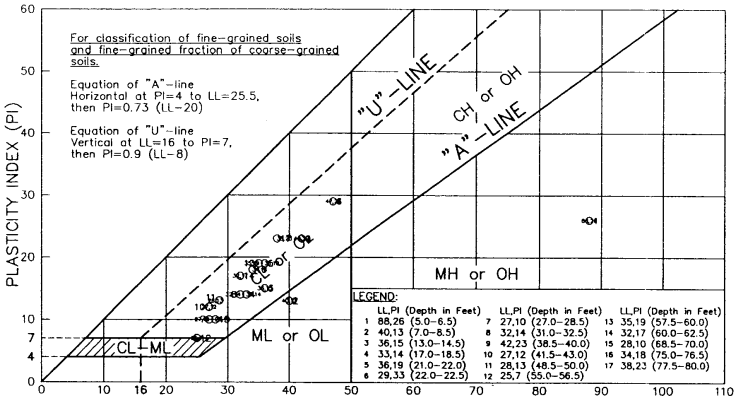
ATTERBERG LIMITS

BORING NOS. 2F-87-6 AND 2F-87-8



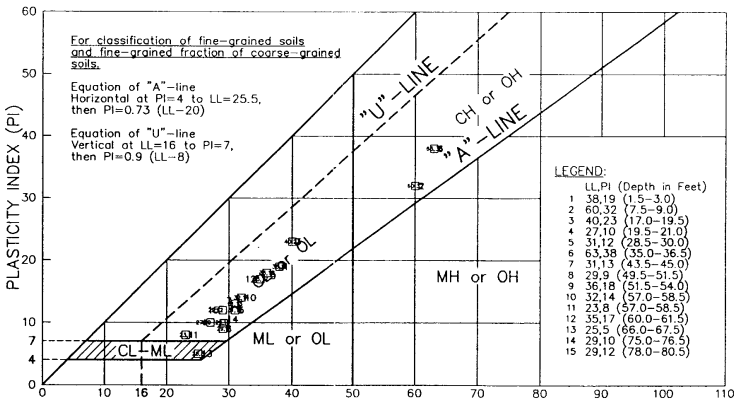
ATTERBERG LIMITS

BORING NOS. 2F-87-9 AND 2F-87-12



ATTERBERG LIMITS

BORING NO. 2F-95-4



ATTERBERG LIMITS

BORING NO. 2F-95-5

REVISION	DATE	DESCRIPTION	BY	BY

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J. CHAMBERS
DRAWN: M. BOLAND
CHECKED: J. SCIANDRONE
SUBMITTED: DAVID A. RICKETTS, CHIEF, SOIL DESIGN SECTION
DATE APPROVED:

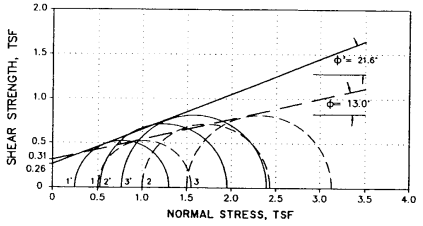
SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT. #7 AND #8

ATTERBERG LIMITS
2F-87-6, -8, -9, -12 AND 2F-95-4 AND -5

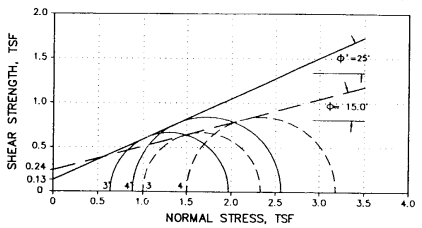
SCALE: AS SHOWN
SHEET:
FILE NO.

Plate 5G-12

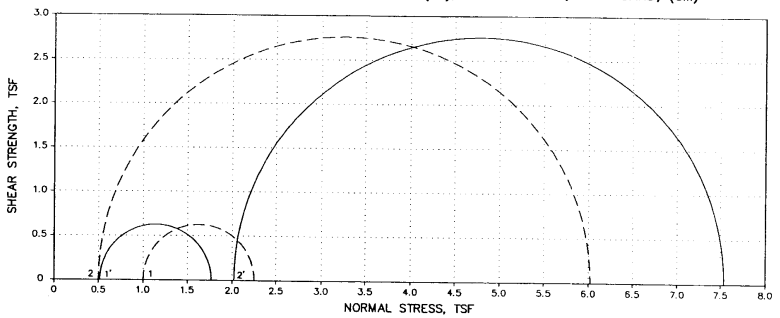
2F-99-1 (30.8' – 32.3')
TRIAXIAL COMPRESSION TEST
CONSOLIDATED – DRAINED
R-bar TEST: FAT CLAY (CH), GRAY-BROWN



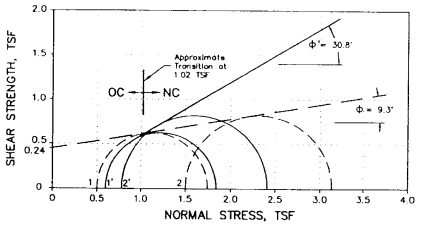
2F-99-2 (25.5' – 26.5')
TRIAXIAL COMPRESSION TEST
CONSOLIDATED – DRAINED
R-bar TEST: SAMPLE NO. 3 AND 4, LEAN CLAY (CL)



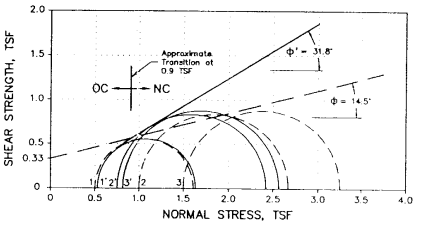
2F-99-2 (25.5' – 26.5')
TRIAXIAL COMPRESSION TEST
CONSOLIDATED – DRAINED
R-bar TEST: SAMPLE NO. 1, LEAN CLAY (CL); SAMPLE NO. 2, SILTY SAND, (SM)



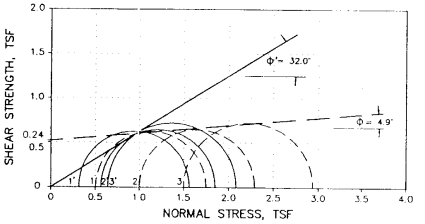
2F--00-1, 2-CU (14.5' – 15.5')
TRIAXIAL COMPRESSION TEST
CONSOLIDATED – DRAINED
R-bar TEST: SAMPLE NO. 1 AND 2, LEAN CLAY (CL)



2F-00-2, 3-CU (27.0' – 28.5')
TRIAXIAL COMPRESSION TEST
CONSOLIDATED – DRAINED
R-bar TEST: SAMPLE NO. 1, 2 AND 3, LEAN CLAY (CL)



2F--00-3, 3-CU (22.0' – 23.5')
TRIAXIAL COMPRESSION TEST
CONSOLIDATED – DRAINED
R-bar TEST: SAMPLE NO. 1, 2 AND 3, SANDY LEAN CLAY (CL)



NO.	BORING NO.	DEPTH (FEET)	MATERIAL CLASSIFICATION	GRADATION (%)			LIQUID LIMIT	PLASTICITY INDEX	INITIAL CONDITION				AFTER SHEAR CONDITION				MINOR PRINCIPAL STRESS (TSF) TOTAL	MAJOR PRINCIPAL STRESS (TSF) TOTAL	MINOR PRINCIPAL STRESS (TSF) EFFECTIVE	MAJOR PRINCIPAL STRESS (TSF) EFFECTIVE
				GR	SA	FI			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	e	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	e				
	2F-99-1	24.6 - 25.1	LEAN CLAY	0	24	76	39	18	31.4	91.1	100	0.849	UNCONFINED COMPRESSION TEST				0	0.86	-	-
1	2F-99-1	30.8 - 31.3	FAT CLAY	0	2	98	64	38	36.43	82.1	93.5	1.052	39.45	83.0	100.0	1.030	0.50	1.55	0.25	1.30
2	2F-99-1	31.3 - 31.8	FAT CLAY	0	2	98	64	38	31.67	85.5	88.2	0.970	38.52	87.8	100.0	0.919	1.00	2.45	0.53	1.96
3	2F-99-1	31.8 - 32.3	FAT CLAY	0	2	98	64	38	33.62	85.4	93.4	0.972	36.73	88.6	100.0	0.902	1.50	3.13	0.76	2.39
1	2F-99-2	25.5 - 26.0	LEAN CLAY	-	-	-	-	-	42.06	84.9	100.0	0.986	27.23	96.7	99.0	0.743	1.00	2.25	0.52	1.76
2	2F-99-2	26.0 - 26.5	SILTY SAND	0	51	49	NP	NP	21.34	106.0	97.9	0.539	20.88	106.7	97.3	0.579	0.50	6.02	2.02	7.54
3	2F-99-2	26.5 - 27.0	LEAN CLAY	0	0	100	45	24	30.19	89.3	92.0	0.886	33.86	92.5	100.0	0.821	1.00	2.33	0.64	1.97
4	2F-99-2	27.0 - 27.5	LEAN CLAY	0	0	100	45	24	36.10	84.6	98.2	0.992	35.64	88.6	100.0	0.901	1.50	3.18	0.89	2.57
1	2F-00-1	14.5 - 15.0	LEAN CLAY w/ SAND	0	26	74	33	14	24.86	97.7	92.6	0.725	26.08	97.9	97.6	0.722	0.497	1.743	0.593	1.839
2	2F-00-1	15.0 - 15.5	LEAN CLAY w/ SAND	0	26	74	33	14	25.85	98.8	99.1	0.705	26.02	100.2	100.0	0.682	1.498	3.132	0.776	2.410
1	2F-00-2	27.0 - 27.5	LEAN CLAY	0	4	96	38	17	29.65	91.6	95.4	0.839	30.69	92.2	100.0	0.828	0.497	1.606	0.523	1.632
2	2F-00-2	27.5 - 28.0	LEAN CLAY	0	4	96	38	17	30.73	91.8	99.2	0.836	29.61	95.3	100.0	0.768	1.001	2.671	0.714	2.384
3	2F-00-2	28.0 - 28.5	LEAN CLAY	0	4	96	38	17	32.13	88.9	97.0	0.895	30.02	92.8	99.5	0.815	1.498	3.248	0.812	2.562
1	2F-00-3	22.0 - 22.5	SANDY LEAN CLAY	0	41	59	43	24	26.75	91.8	86.4	0.836	31.63	90.2	98.5	0.867	0.497	1.750	0.506	1.559
2	2F-00-3	22.5 - 23.0	SANDY LEAN CLAY	0	41	59	43	24	22.00	100.1	87.1	0.682	25.23	101.5	100.0	0.659	1.001	2.29	0.563	1.852
3	2F-00-3	23.0 - 23.5	SANDY LEAN CLAY	0	41	59	43	24	24.22	99.6	94.5	0.692	23.10	104.9	100.0	0.606	1.498	2.938	0.639	2.079

LEGEND
EFFECTIVE STRESSES
TOTAL STRESSES

GEOTECHNICAL BRANCH
SOIL DESIGN SECTION
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED J. CHAMBERS
DRAWN R. TELLEFSON
CHECKED

SANTA CLARA COUNTY CALIFORNIA
GUADALUPE RIVER PROJECT
GENERAL RE-EVALUATION REPORT
BOX CULVERT BYPASS, ALT. #7 AND #8

SHEAR STRENGTH DATA

DAVID A. ROBERTS
CHIEF, SOIL DESIGN SECTION

Plate 5G-15

$$Cr = \frac{0.814 - 0.760}{\log \frac{8.0}{0.5}} = 0.045$$

CONSOLIDATION CURVES
2F-99-1; 30.0' TO 32.5'

$$Cc = \frac{0.898 - 0.377}{\log \frac{310}{2.8}} = 0.255$$

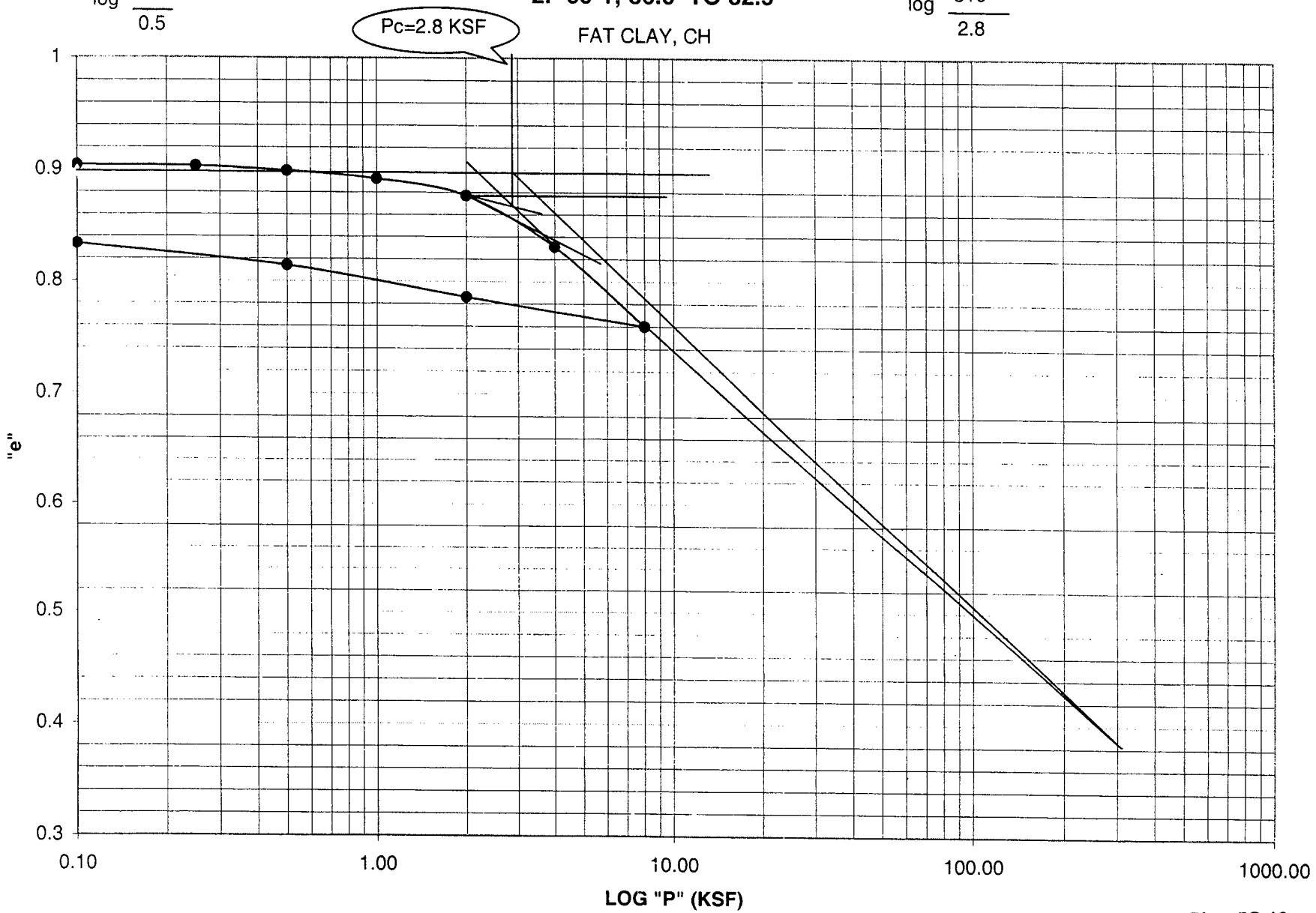


Plate 5G-16

$$Cr = \frac{0.895 - 0.849}{\log \frac{8.0}{0.5}} = 0.038$$

CONSOLIDATION CURVES
2F-00-3; 29.0' TO 31.5'

$$Cc = \frac{0.986 - 0.414}{\log \frac{1000}{2.8}} = 0.224$$

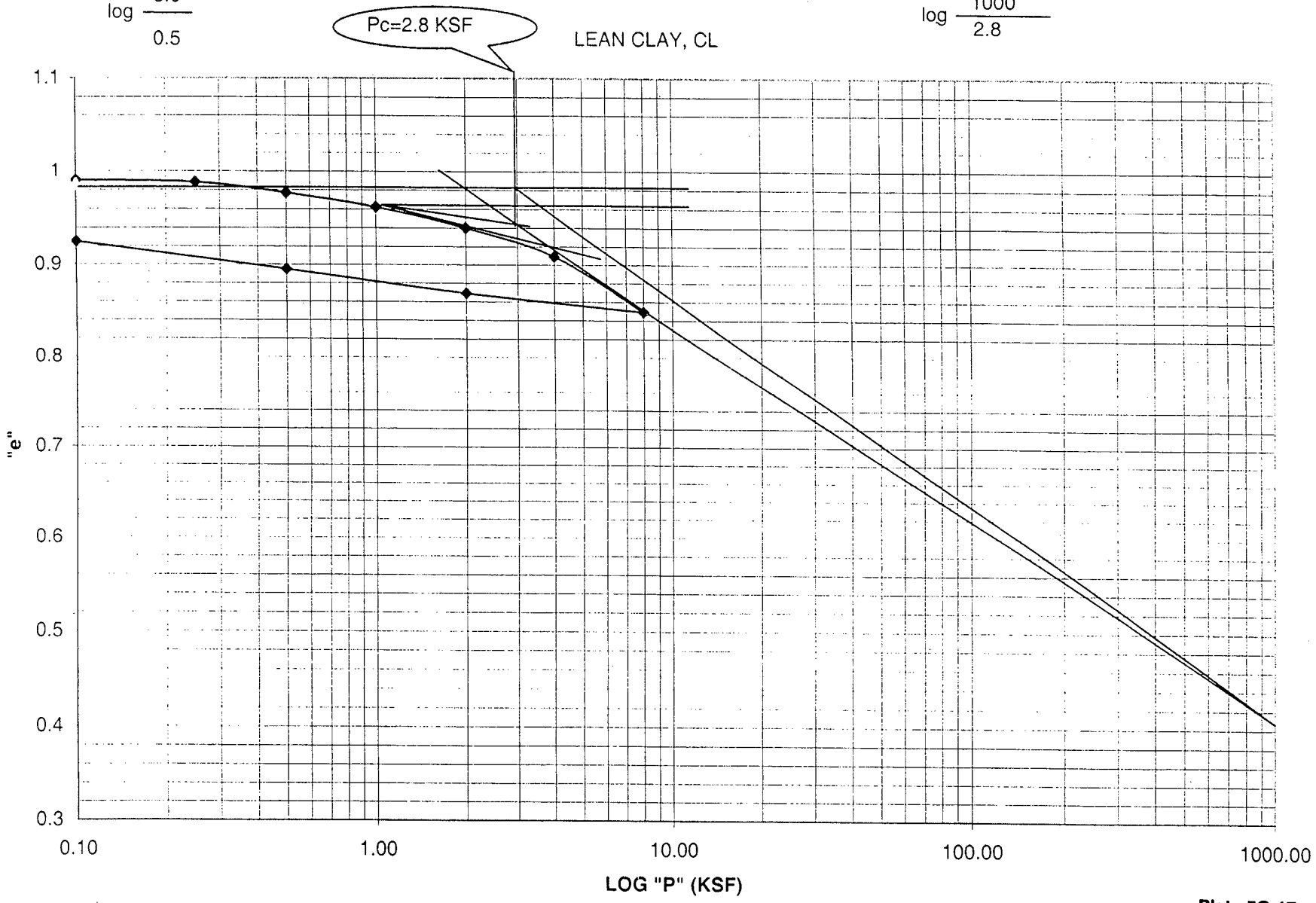


Plate 5G-17

CONSOLIDATION CURVE
2F-00-3; 40.0' TO 42.5'

$$Cr = \frac{0.694 - 0.667}{\log \frac{8.0}{0.5}} = 0.022$$

$$Cc = \frac{0.782 - 0.328}{\log \frac{1200}{3.2}} = 0.176$$

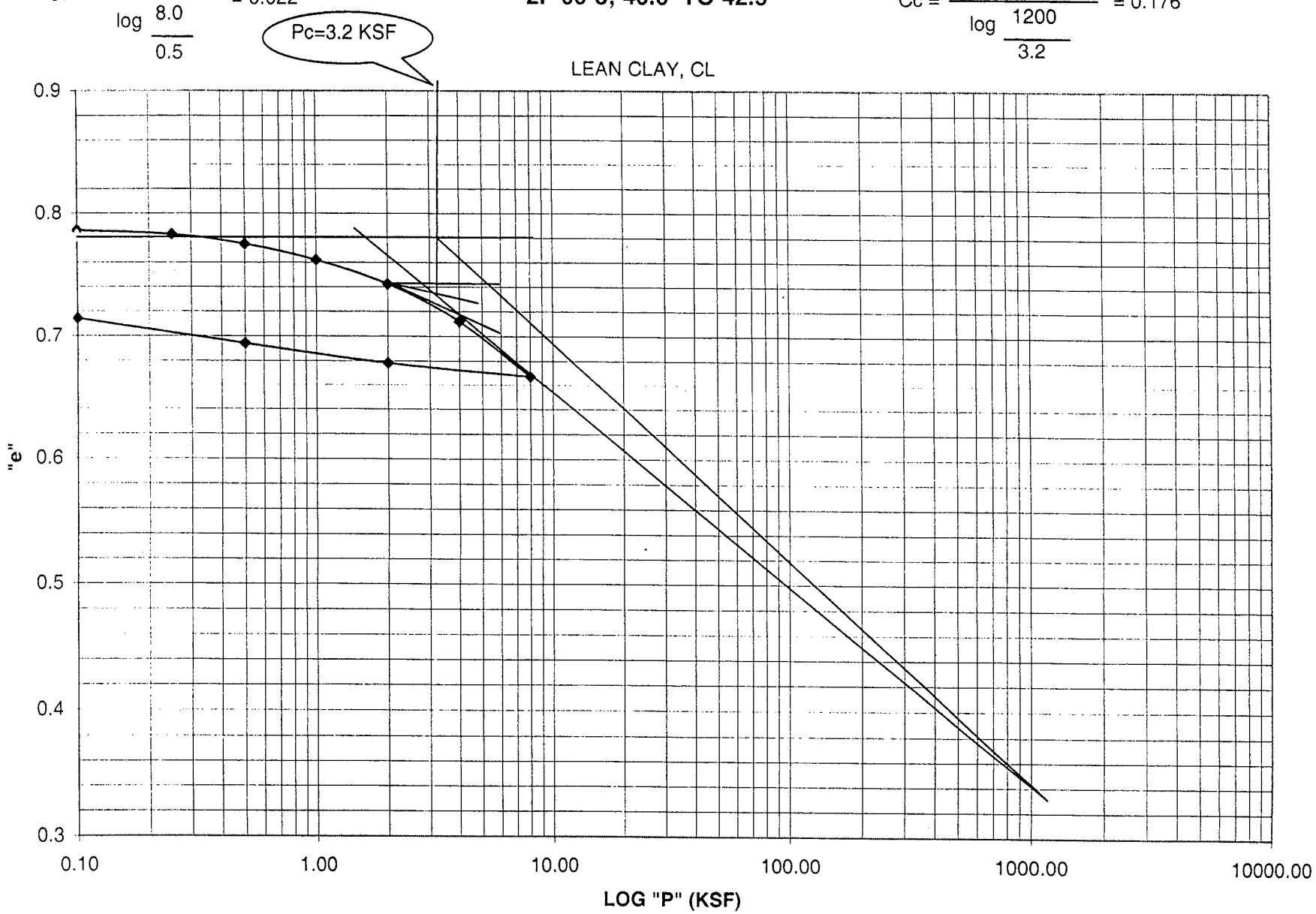


Plate 5G-18

Appendix 5H - Relocations

5H.1 General

The Santa Clara Valley Water District, the local project sponsor, is responsible for the relocation and modification of highways, roads, bridges, utilities, streets, and drainage facilities required for the flood control and recreation features of this project. The Federal Government is responsible for the relocation of railroad bridges.

5H.2 Road Crossings

The proposed Bypass channel box conduits will be constructed in the Guadalupe River's right bank (looking downstream) to maximize environmental benefits. The multiple flood control structures run about .75 miles in length and affect 5 highway crossings and one railroad crossing, as shown in Table 5H.2-1. Four bridges will be protected in place with the channel passing outside their abutments (Santa Clara, St. John, and New Julian) or through the existing bridge opening (Coleman). Two other existing bridges (old Julian and St. John) are being evaluated for hydraulic capacity and will be demolished and removed as required, with no new bridges replacing them.

The last crossing of the conduits is the Union Pacific Railroad Bridge No. 4. This construction will use the existing bridge No. 3, just downstream from No. 4, as a shoo-fly for No. 4's construction.

TABLE 5H.2-1. Road Crossings

Item No	Location Baseline Sta.	Utility	Agency (Owner)	Proposed Action
1.	Sta. 119+23 to 120+32	Exist. Coleman Avenue Bridge	City of San Jose	Bridge to Remain
2.	Sta. 130+60 To 130+95	UPRR Bridge No. 3 and 4	Union Pacific Railroad	Possible Demo and New RR Bridge
3.	Sta. 136+58 to 137+21	Old Julian Street Bridge	City of San Jose	Remove & Dispose of Bridge
4.	Sta. 140+70 to 141+64	New Julian Street Bridge	City of San Jose	Bridge to Remain
5.	Sta. 146+95 to 147+59	St. John Street Bridge	City of San Jose	Remove & Dispose of Bridge
6.	Sta. 155+08 to 156+08	Santa Clara Street Bridge	City of San Jose	Bridge to Remain

5H.3 Utility Relocations

Utility relocations will consist of protecting, relocating, modifying, or abandoning existing storm drain, electric, well, sewer, cable television, water, electrolier, fiber optic cable, gas, hydrant, telephone lines and installations that the bypass channel structures directly conflict with. Where possible, required relocations will be accomplished prior to project construction. Relocation work that can be phased with the channel construction, (for better cost-effectiveness), will be carefully scheduled to preclude construction delays. Pertinent information on existing facilities to be relocated is given in Table 5H.3-1.

TABLE 5H.3-1. Utility & Drainage Relocations

Item No.	Location (B-Line Sta.)	Utility	Agency (Owner)	Proposed Action
1.	Sta. 117+69 (117 R)	42" Storm Drain	City of San Jose	Relocate
2.	Sta. 119+88 (80' R)	6" Storm Drain	City of San Jose	Relocate
3.	Sta. 121+05-121+18 (50'R. to 100'R)	12" Storm Drain	City of San Jose	Relocate
4.	Sta. 121+24 (54'L)	Power Pole	Pacific Gas & Electric	Relocate
5.	Sta. 121+45 (57' L)	Power Pole	Pacific Gas & Electric	Relocate
8.	Sta. 122+46 (80' R)	High Voltage Tower	Pacific Gas & Electric	Relocate
9.	Sta. 123 + 24 (70' R)	Power Pole	Pacific Gas & Electric	Relocate
10.	Sta. 123+45 (104' R)	Power Pole	Pacific Gas & Electric	Relocate
11.	Sta. 123+83 (69' R)	Power Pole	Pacific Gas & Electric	Relocate
12.	Sta. 125+61 (79' R)	Power Pole	Pacific Gas & Electric	Relocate
13.	Sta. 126+53 (84' R)	Power Pole	Pacific Gas & Electric	Relocate
14.	Sta. 126+98 (82' R)	Power Pole	Pacific Gas & Electric	Relocate
17.	Sta 128+62 (104' R)	Power Pole	Pacific Gas & Electric	Relocate
18.	Sta. 128+74 (106' R)	Power Pole	Pacific Gas & Electric	Relocate
19.	Sta. 129+11 (103' R)	Power Pole	Pacific Gas & Electric	Relocate
21.	Sta. 130+32 (104' R)	Power Pole	Pacific Gas & Electric	Relocate
22.	Sta. 130+98 (75' R)	Power Pole	Pacific Gas & Electric	Relocate
30.	Sta. 142+26	Electrolier	City of San Jose	Relocate
32.	Sta. 142+48 (63' R)	Electrolier	City of San Jose	Relocate
49.	Sta. 146+77 (65' R)	High Voltage Tower	Pacific Gas & Electric	Relocate
50.	Sta. 148+08 (55' R)	Power Pole	Pacific Gas & Electric	Relocate
51.	Sta. 148+73 (on centerline)	Stream Gaging Station	U. S. Geological Survey	Relocate
52.	Sta. 147+13 (202' R)	Electrolier	City of San Jose	Relocate
53.	Sta. 148+62 (235' R)	Power Pole	Pacific Gas & Electric	Relocate
54.	Sta. 150+59 (248' R)	Power Pole	Pacific Gas & Electric	Relocate

Appendix 5I - Special Construction Issues

5I.1 General

This chapter presents new information and analyses performed subsequent of March 1992 in support of the plans and specifications for construction and for the re-evaluation study.

5I.2 Protection of Existing Bridge Foundations

The following existing foundations will require protection during construction:

Construction Segment 3A/3B

Coleman Avenue Bridge
UPRR Bridge #4
New Julian Street Bridge
St. John Street Bridge
Santa Clara Street Bridge
San Fernando Street Bridge
Park Avenue Bridge
State Highway 87 Guadalupe Viaduct Bents 2, 3, 4, 5, 6, and 7

5I.3 Protection of Existing Buildings

The Sobrato Development Company is currently constructing the first phase of a three phase office development project. The Sobrato (formally known as FMC) property is located between New Julian Street and the Union Pacific Railroad (UPRR) (formally known as the Southern Pacific Transportation Company) property on the east bank. The proposed bypass alignment impacts this development. Existing driveways, parking spaces, utilities, landscaping, and irrigation system will be impacted. In addition, a five-story parking garage, proposed to be constructed during Phase 3, may be impacted. The timing of the construction of Phase 3 is currently under design with a Summer/Fall 2000 proposed start of construction. Special construction provisions will be used when constructing the proposed bypass alternative adjacent to the proposed parking garage because of the lack of area between the building and the shaded riverine aquatic corridor. If the bypass is to be constructed prior to the parking garage, provisions will be included in the bypass design to accommodate the structure. If the parking garage is to be constructed prior to the bypass, provisions will be included in the parking garage design to accommodate the bypass structure. In either scenario, it is anticipated that close coordination with the Sobrato designers is imperative.

5I.4 Protection Of Existing Shaded Riverine Aquatic Vegetation

The construction of the proposed project modification will protect existing shaded riverine aquatic (SRA) habitat to the maximum extent possible. The construction contracts will contain provisions restricting excavation or fill within the dripline of trees designated to be saved and protected.

5I.5 Environmental Protection

The project must be compliant with the Clean Water Act Section 402 storm water quality regulations program. The construction contracts will require the preparation of and compliance with an Environmental Protection Plan. As a minimum, the plan will include a list of State and local laws and regulations, a Spill Control Plan, a Recycling and Waste Minimization Plan, a Toxic Material Control Plan, environmental monitoring provisions, a Vegetation Protection Plan, and an Erosion and Sediment Control Plan.

5I.6 Protection of Endangered Species

The proposed project impacts the red-legged frog, the steelhead trout and the Chinook salmon. Formal Endangered Species Act (ESA) Section 7 consultation will be conducted with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The designs will minimize the impacts to the greatest extent possible. Frog and fish surveys will be required immediately before construction starts. They will be conducted by qualified biologists furnished by the Corps or the local sponsor. The construction contracts will include provisions for inspection and review of the Environmental Protection Plan and the Care and Diversion of Water Plan by the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game. In addition, instream construction activities will be restricted between October 15 and April 15.

5I.7 Known Hazardous, Toxic and Radiological Waste Sites

There are two existing hazardous, toxic, and radiological waste (HTRW) sites remaining to be cleaned up by the non-Federal sponsor in accordance with the project Local Cooperation Agreement. They are the Sobrato (formally known as FMC) and UPRR (formally known as the Southern Pacific Transportation Company) sites located on the east bank in the Construction Segment 3A/B reach. Each site will require special construction considerations for the excavation and disposal of earth quantities and worker protection. A contingency plan has been developed outlining a course of action in the event that unforeseen HTRW sites are uncovered during construction. The contingency plan was included in the construction contracts already completed. The non-Federal sponsor, the Santa Clara Valley Water District will be the lead agency in implementing the contingency plan. All costs associated with the engineering and design of response measures and cleanup, including any necessary studies and investigations, are the responsibility of the non-Federal sponsor. Further descriptions of the two HTRW sites mentioned above can be found in the *Final Preconstruction Soil and Groundwater Investigation and Management Report* dated June 1995, the *Southern Pacific Transportation Company Hazardous Substance Site*

Assessment Report dated May 1995, and the *Hazardous Material Investigation for FMC Corporation Property at 333 West Julian Street, San Jose* dated January 1997. In 1995, the project was removed from the State of California Regional Water Quality Control Board's Spills, Leaks, Investigation, and Cleanup Oversight Cost-Recovery program.

5I.8 Proposed Disposal Sites

All excavation and demolition material will be considered excess and will be disposed of at sites provided by the non-Federal sponsor. All HTRW material will be legally disposed of at an appropriate landfill. The current recommended disposal sites are:

(1) A disposal site, located approximately 10 miles from the project site, located near the intersection of Zanker Road and Los Estros Road (north of State Highway 237 between Alviso and I-880) can be utilized for the disposal of excavated earth materials.

(2) The Newby Island landfill, located approximately 7 miles from the project site, can be utilized for the disposal of stripping and demolition materials.

(3) Clean surplus fill may be used by Caltrans during their construction of the adjacent Highway 87 improvements, but this will depend on the timing and whether the surplus material is in compliance with the Caltrans Specifications for Import Material.

5I.9 Utility and Drainage Relocations and Modifications

Pertinent information on existing facilities to be relocated, protected in place, or abandoned, is given in Table 5I.9-1.

TABLE 5I.9-1 Utility & Drainage Relocations & Modifications

Item No.	Location (B-Line Sta.)	Utility	Agency (Owner)	Proposed Action
1.	Sta. 117+69 (117 R)	42" Storm Drain	City of San Jose	Remove & Disp. Relocate
2.	Sta. 119+88 (80' R)	6" Storm Drain	City of San Jose	R & D Exist Exit Relocate
3.	Sta. 121+05-121+18 (50'R. to 100'R)	12" Storm Drain	City of San Jose	R & D Relocate
4.	Sta. 121+24 (54'L)	Power Pole	Pacific Gas & Electric	Relocate
5.	Sta. 121+45 (57' L)	Power Pole	Pacific Gas & Electric	Relocate
6.	Sta. 121+80 (133' R)	Power Tower	Pacific Gas & Electric	Protect in Place
7.	Sta. 121 + 89 (79' L)	MW-8 (Monitoring Well)	Santa Clara Valley Water District	Seal/Destroy
8.	Sta. 122+46 (80' R)	High Voltage Tower	Pacific Gas & Electric	Relocate
9.	Sta. 123 + 24 (70' R)	Power Pole	Pacific Gas & Electric	Relocate

TABLE 5I.9-1 (continued)

Item No.	Location (B-Line Sta.)	Utility	Agency (Owner)	Proposed Action
10.	Sta. 123+45 (104′ R)	Power Pole	Pacific Gas & Electric	Relocate
11.	Sta. 123+83 (69′ R)	Power Pole	Pacific Gas & Electric	Relocate
12.	Sta. 125+61 (79′ R)	Power Pole	Pacific Gas & Electric	Relocate
13.	Sta. 126+53 (84′ R)	Power Pole	Pacific Gas & Electric	Relocate
14.	Sta. 126+98 (82′ R)	Power Pole	Pacific Gas & Electric	Relocate
15.	Sta. 127+02 (95′ R)	MW-9-1 Monitoring Well	Santa Clara Valley Water District	Seal/Destroy
16.	Sta. 127+90 (116′ R)	MW-12 Monitoring Well	Santa Clara Valley Water District	Seal/Destroy
17.	Sta 128+62 (104′ R)	Power Pole	Pacific Gas & Electric	Relocate
18.	Sta. 128+74 (106′ R)	Power Pole	Pacific Gas & Electric	Relocate
19.	Sta. 129+11 (103′ R)	Power Pole	Pacific Gas & Electric	Relocate
20.	Sta. 130+14 (93′ R)	MW-9-2 Monitoring Well	Santa Clara Valley Water District	Seal/Destroy
21.	Sta. 130+32 (104′ R)	Power Pole	Pacific Gas & Electric	Relocate
22.	Sta. 130+98 (75′ R)	Power Pole	Pacific Gas & Electric	Relocate
23.	Sta. 132+53 to 132+78 (167′R to 151′ L)	12″ Sanitary Sewer Plug ends	City of San Jose	R & D Relocate
24.	Sta. 140+94 to 141+48 (65′ R to 198′ R)	4″ CATV	Heritage Cable	Protect in Place
25.	Sta. 141+16 to 141+61 (62′ R to 198′ R)	4″ Gas	Pacific Gas & Electric	Protect in Place
26.	Sta. 141+34 to 142+56 (55′ R to 186′ R)	Power Line Overhead	Pacific Gas & Electric	Protect in Place
27.	Sta. 142+65 (128′ R. to 215′ R)	4″ CATV	Heritage Cable	R & D
28.	Sta. 142+90 (82′ R to 252′ R)	4″ Water	San Jose Water Company	R & D & Cap
29.	Sta. 142+93 (89′ R to 230′ R)	8″ Sanitary Sewer	City of San Jose	R & D Pipe & Manholes
30.	Sta. 142+26	Electrolier	City of San Jose	Salvage & Relocate

TABLE 5I.9-1 (continued)

Item No.	Location (B-Line Sta.)	Utility	Agency (Owner)	Proposed Action
31.	Sta. 141+94 to 142+57 (56′ R to 223′ R)	Fiber Optic Cable – Underground	T. C. I.	Protect in Place
32.	Sta. 142+48 (63′ R)	Electrolier	City of San Jose	Salvage & Relocate
33.	Sta. 142+88 (48′ R to 238′ R)	33″ Storm Drain	City of San Jose	R & D Pipe & Salvage Flap Gate.
34.	Sta. 142+99 (101′ R to 230′ R)	4″ Gas	Pacific Gas & Electric	R & D, Cap
35.	Sta. 142+74 (60′ R to 223′ R)	30″ Storm Drain	City of San Jose	R & D
36.	Sta. 142+56 to 151+50 (186′ R to 60′ L)	High Voltage Power Line – Overhead	Pacific Gas & Electric	Protect in Place
37.	Sta. 143+00 to 146+95 (81′ R to 173′ R) in River Street	2″ Water	San Jose Water Company	R & D
38.	Sta. 142+93 to 146+94 (89′ R to 174′ R) in River Street	8″ Sanitary Sewer	City of San Jose	R & D
39.	Sta. 142+99 to 146+69 (101′ R to 173′ R) in River Street	4″ Gas	Pacific Gas & Electric	R & D
40.	Sta. 142+65 to 153+05 (128′ R to 204′ R) in River Street	4″ CATV	Heritage Cable	R & D
41.	Sta. 145+10 (171′ R)	MW-16-2 Monitoring Well	Santa Clara Valley Water District	Seal/Destroy
42.	Sta. 144+98 (216′ R)	MW-16-3 Monitoring well	Santa Clara Valley Water District	Seal/Destroy
43.	Sta. 145+30 (195′ R)	MW-16-1 Monitoring Well	Santa Clara Valley Water District	Seal/Destroy
44.	Sta. 147+00 to 154+00 (200′ R to 173′ R) in River Street	2″ Water	San Jose Water Company	R & D
45.	Sta. 146+94 to 154+00 (174′ R to 160′ R) in River Street	8″ Sanitary Sewer	City of San Jose	R & D
46.	Sta. 146+69 to	4″ Gas	Pacific Gas & Electric	R &D

TABLE 5I.9-1 (continued)

Item No.	Location (B-Line Sta.)	Utility	Agency (Owner)	Proposed Action
	154+00 (173′ R to 144′ R) in River Street			
47.	Sta. 147+22 to 146+69 (58′ R to 270′ R)	27″ Storm Drain	City of San Jose	R & D pipe & Salvage Gate
48.	Sta. 147+02 to 146+71 (110′ R to 268′ R)	33″ Sanitary Sewer	City of San Jose	R & D pipe & Manhole
49.	Sta. 146+77 (65′ R)	High Voltage Tower	Pacific Gas & Electric	Relocate
50.	Sta. 148+08 (55′ R)	Power Pole	Pacific Gas & Electric	Relocate
51.	Sta. 148+73 (on centerline)	Stream Gaging Station	U. S. Geological Survey	Relocate
52.	Sta. 147+13 (202′ R)	Electrolier	City of San Jose	Salvage, Relocate
53.	Sta. 148+62 (235′ R)	Power Pole	Pacific Gas & Electric	Relocate
54.	Sta. 150+59 (248′ R)	Power Pole	Pacific Gas & Electric	Relocate
55.	Sta. 153+16 (201′ R)	Fire Hydrant	San Jose Water Company	Salvage
56.	Sta. 153+60 (164′ R)	Storm Drain Manhole	City of San Jose	R & D
57.	Sta. 153+58 (192′ R)	Catch Basin	City of San Jose	R & D
58.	Sta. 153+31 (145′ R)	MW-1 Monitoring Well	Santa Clara Valley Water District	Seal/Destroy
59.	Sta. 153+86 (149′ R)	MW-9 Monitoring Well	Santa Clara Valley Water District	Seal/Destroy
60.	Sta. 154+13 (73′ R)	MW- Monitoring Well	Santa Clara Valley Water District	Seal/Destroy
61.	Sta. 154+38 (113′ R)	MW- Monitoring Well	Santa Clara Valley Water District	Seal/Destroy
62.	Sta. 154+00 to 155+45 (143′ R to 124′ R) in River Street	4″ Gas	Pacific Gas & Electric	R & D & Cap
63.	Sta. 154+00 to 155+18 (162′ R to 148′ R) in River Street	8″ Sanitary Sewer	City of San Jose	R & D & Cap
64.	Sta. 154+00 to 155+82 (174′ R to 143′ R)	12″ Water	San Jose Water Company	R &D & Cap

TABLE 5I.9-1 (continued)

Item No.	Location (B-Line Sta.)	Utility	Agency (Owner)	Proposed Action
	in River Street			
65.	Sta. 155+82 (74′ R to 210′ R) in Santa Clara Street	20″ Water	San Jose Water Company	R & D & Cap
66.	Sta. 155+72 (58′ R to 180′ R) in Santa Clara Street	12″ Sanitary Sewer	City of San Jose	To Remain & Plug in Manhole
67.	Sta. 155+48 (97′ R to 203′R) in Santa Clara Street	36″ Storm Drain	City of San Jose	To Remain; Salvage Flap Gate & Plug End
68.	Sta. 155+34 to 155+40 (80′ R to 193′ R) in Santa Clara Street	Telephone (Underground)	Pacific Bell	To Remain
69.	Sta. 155+35 to 155+40 (96′ R to 192′ R) in Santa Clara Street	15″ Storm Drain	City of San Jose	Pipe to Remain, plug end & Salvage Flap Gate
70.	Sta. 155+90 (51′ R to 227′ R) in Santa Clara Street	15″ Storm Drain	City of San Jose	Pipe to Remain, plug end & Salvage Flap Gate
71.	Sta. 156+54 to 160+30 (76′ R to 109′ R)	ELECTROLIERS (11 ea. @ 40′ on center)	City of San Jose	Remove & Salvage
72.	Sta. 159+50 to 159+69 (28′ R to 152′ R)	24″ Storm Drain	City of San Jose	R & D

Appendix 5J - Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R)

5J.1 General

This report's recommended plan is the result of input from several sources. The Collaborative has been the main driving force behind adoption of the design GRR bypass reach (Santa Clara St. to Coleman Ave.) for this portion of the Guadalupe River. This group's members include upper level management representing; local constituents, interested organizations, Federal and State of California agencies, the SCVWD (local sponsor), and the Army Corps of Engineers. Additionally, Northwest Hydraulic Consultants, Inc. (NHC) has performed hydraulic and geomorphic assessments of this river reach which have substantially aided the collaborative in its decision making.

The Corps has taken the ideas and suggestions of the above groups and individuals and laid out this latest design between Santa Clara St. and Coleman Ave. It is known as the Bypass System Plan. Major features of this plan include: preservation of 2600+ lineal feet of natural river channel; removal and disposal of one existing bridge (UPRR Bridge No. 3) and potentially three others (St. John Street Bridge, Old Julian Street Bridge, and UPRR Bridge No. 4; cellular concrete mattress invert and slope armoring at Santa Clara St., Coleman Ave., and at the Saint John St. inlet structure; gabion baskets at Coleman Ave.; double changing to triple, box conduits from Santa Clara St. through the Coleman Ave. bridge (all buried in the east riverbank); inlet structures at Santa Clara and St. John Streets; three outlet structures with baffle blocks upstream and downstream from the Coleman Ave. bridge; and invert access ramps for invert debris clean-out and for repair of any damaged structural element in this reach.

The bypass channel box conduits will be constructed in the right riverbank to maximize the propagation of Shaded Riverine Aquatic (SRA) cover mitigation plantings along the river's natural banks. Where cellular concrete mattresses (CCM) are installed at Santa Clara St. and Coleman Ave., native vegetative growth will be encouraged through the mattress openings.

The low-flow channel currently terminates at the downstream face of the Coleman Ave. Bridge. It has a trapezoidal cross-section in the CCMs. The GRR plan has it continuing upstream from the bridge for approximately 700 feet where it terminates at the natural river invert. The earth invert then continues upstream for about 2,600 feet where cellular concrete mattresses begin again and the low flow channel runs, in a trapezoidal cross-section, about 270 feet more to the downstream face of the Santa Clara St. bridge.

The concrete box conduit structures in the east riverbank will serve the dual purpose of safely passing flood flows and also of supporting recreation features on their roofs. Elements that will be constructed on top of the concrete boxes will be those that lend themselves to a linear park concept. A continuous pathway/river walk/maintenance road from Coleman Ave. to Santa Clara St. will be the main feature anchoring the recreation plan for this reach. Additionally, recreational landscaping will be provided atop the conduits, all

along the riverwalk. Appropriate lighting will be installed as well. Trash receptacles, picnic tables and benches will be provided at nodal points where they would best be utilized by visitors to the project.

The above paragraphs briefly describe the features of the recommended plan. In accordance with the Local Cooperation Agreement and upon completion of construction of this bypass reach, it will be the responsibility of the SCVWD to maintain and operate the project in accordance with Federal regulations and guidelines. The SCVWD will assign Operation, Maintenance, Repair, Replacement & Rehabilitation (OMRR&R) responsibilities of the recreational elements of the GRR reach to the City of San Jose as a provision of the Memorandum of Agreement between the SCVWD, the City of San Jose, and the San Jose Redevelopment Agency (SJRA). The OMRR&R responsibilities of this bypass channel reach will be assigned upon completion of construction and will be documented in operation and maintenance manuals for flood control, mitigation management, and recreation development by the Army Corps of Engineers. Any changes in operation, maintenance, or replacement practices for either the flood control, mitigation plantings or recreational features within this GRR reach will require written approval from the Army Corps of Engineers.

5J.2 Flood Control

5J.2.1 Concrete Channels

At the upstream limit of the GRR reach, the three box conduits join together to capture 13,000 cubic-feet per second of flood waters passing down the Guadalupe River. Although Santa Clara Street is an area where erosion will likely occur, the area downstream from Santa Clara Street has been identified as a nodal point where sediment begins to drop out while traveling downstream. A large portion of produced sediment will enter the 3 entrance structures, travel through the conduits, and pass out of the outlet structures. The more abrasive material, will over time, have a deleterious effect on the walls and invert of the structures. Some concrete erosion may occur exposing reinforcing steel. Deterioration from cracking, chipping, or breaking may also result. Remove and replace any badly worn locations identified. Repair any spalled concrete and any evidence of settlement or uplift failure of these concrete structures shall be given special attention and replaced as needed.

5J.2.2 Armored channel.

The GRR reach contains approximately 970 lineal feet of invert and bank armoring.

Immediately downstream from the Santa Clara St. bridge, 270 lineal feet of cellular concrete mattresses (CCM) will be installed across the natural invert and up the right and left banks. Then, slightly further downstream, at the St. John St. inlet structure, a protective CCM apron will wrap around the entrance of the structure. The downstream face of the Coleman Ave. Bridge is the upstream end of the CCMs installed in Segment 2. For this GRR construction reach, these mattresses will be extended upstream, through the Coleman Avenue Bridge for 700 lineal feet of invert protection. The left bank (looking downstream) will have 500 lineal feet of gabion baskets and mattresses with stone terraces protecting the Riverwalk/Maintenance Road and invert access ramp. Maintenance concerns in this reach

are for the flexible armoring of the CCMs and gabions. Gabion baskets will require replacement of broken wires and lost rock over time, and out-right basket replacement in some cases. Cellular concrete mattresses are articulated for sub-grade movement, but their cable connections will break here and there over time, exposing sections to undermining and loss of the concrete blocks. Regular inspections are therefore required for the CCM and gabion structures.

5J.2.3 Earth-Lined Channel

From downstream from Santa Clara St. to upstream from Coleman Ave., 7,500 cubic-feet per second will flow through the natural Guadalupe River during the 100-year flood. The only improvements that may be installed in this 2,600-foot reach would be grade control structures if they are determined to be necessary.

5J.2.4 Erosion/Sedimentation/Debris Control

The upstream half of the study reach, between New Julian St. and Santa Clara St., will experience erosion of the natural riverbanks in the future. This assessment has been substantiated by Northwest Hydraulic Consultants, Inc., in their July 1998 report. Operation and maintenance costs will likely be incurred by the SCVWD (local sponsor), because scour abatement and erosion control will be required even when regular, small magnitude floods pass through annually.

Sedimentation analysis indicates that the reverse is true of the lower half of this study reach, between Coleman Ave. and New Julian St. Deposits of sediments will occur first within the natural river channel (for about 1500 lineal feet downstream from the New Julian St. crossing), and then secondly, on the remaining 700 lineal feet of armored bank and invert, through Coleman Ave. The low-flow channel in this reach could become completely filled in thereby rendering fish passage impossible. As much as 4,000 tons of sands and gravels per year could require removal. In addition, the two conduit inlet structures and their corresponding box conduits will collect a portion of the suspended sediments that do not pass down the river. Some clean-out of these concrete channels and inlet structures will be required as well. Every five years, a sediment survey should be conducted of this entire GRR study reach to determine if sediment removal is necessary. The minimum removal criteria is when any location or reach of channel has its design freeboard reduced 50 percent by accumulated sediment, then clean-out is required.

Debris control is necessary at the Santa Clara, St. John, UPRR #4, New Julian, and Coleman bridges. Debris build-up on the two inlet structures is also of concern. In a major flood event the bridges and inlets have the potential for becoming partially obstructed by large, floatable debris. This debris could accumulate on baffles, piers, divider walls, and behind the numerous grade control structures in the river. Also, there will be some mitigation plantings along the riverbanks which will catch flood water debris that floats down the river. After the flood waters recede, the bridge and inlet structures, the grade control structures, and the bank mitigation areas should all be checked for debris deposited on them. Following the survey, sediment and debris removal should be undertaken to return the GRR reach to its pre-flood condition.

5J.2.5 Mitigation

Plantings along the riverbanks, between Santa Clara St. and Coleman Ave., will be afforded a three-year or five-year establishment period as part of the construction contract. After that, the operation, maintenance, and replacement of riparian mitigation areas will follow the procedures of this project's mitigation management plan. This plan has been coordinated with the California Department of Fish and Game, the U. S. Fish and Wildlife Service, and the SCVWD.

Animal life will frequent the Guadalupe River corridor and utilize the adjacent mitigation areas. As mentioned in the opening paragraphs, migrating salmon will swim upstream to spawn in the armored, CCM low-flow channel (700-feet upstream from Coleman), then through the 2600-foot natural reach (resting at the grade control structures), then through 260 feet of CCM low-flow channel (downstream from Santa Clara) and then upstream from this Bypass Reach. This route for passage of fish will require continuous maintenance to insure no blockages from floated debris or sands, gravels, or silts.

5J.2.6 Recreation

A linear park concept will be developed atop the concrete flood control structures, between Coleman Ave. and Santa Clara St. The roof of the structures will support a continuous pathway/riverwalk/maintenance road, with recreational nodal points adjacent to it from one end to the other (approximately 3400 lineal feet). Recreational landscaping will be supported by earth mounding necessary to support the turf and plant growth. An irrigation system will be installed to service the full length of the park. Turf will be mowed on a regular basis to keep the area neat and trim. A weed control program will be instituted. Trees and shrubs will be pruned annually to ensure that they are not a public hazard. Individual trees or large shrubs that become diseased or die, will be replaced. The park will accumulate trash, debris, leaves, etc. that will be cleaned-up and disposed of as required.

The linear park will be set at an elevation that is above the design flood's water surface. This will eliminate the problem of floating debris and sediment depositing on the recreational features. Trash receptacles, picnic tables, lighting fixtures, and any type of fencing will be subject to vandalism and graffiti, however, and will be replaced, repaired, or repainted, as needed.

Major replacements will be incurred for most of the recreation features over the 100-year economic life of the project.

5J.2.7 Annual Operation, Maintenance, Repair, Replacement and Rehabilitation Costs (OMRR&R)

The annual OMRR&R costs for flood control and recreation are summarized in Table 5J.2-1. Estimated annual costs are based on costs incurred at existing Corps of Engineers flood control and recreation projects in the San Francisco Bay Area and data provided by the SCVWD and the San Jose Redevelopment Agency.

TABLE 5J.2-1. Annual Operation, Maintenance, Repair, Replacement, and Rehabilitation Costs

	Item	Annual Cost
Flood Control		
A. I-280 to I-880		
1. O&M		
Segment 1 –	Earth Channels (Low Flow)	$ 3,516
	ACM Invert	3,396
	Sediment Removal	3,000
	Mitigation Management	5,339
Segment 2 –	Earth Channels (Low Flow)	11,435
	ACM	8,970
	Sediment Removal	5,000
	Mitigation Management	17,204
Segment 3 –	Scour Repair	10,000
	Natural Channel	5,940
	Concrete Channel	36,648
	ACM Invert	6,891
	Sediment Removal	77,066
	Subtotal O&M	$194,405
2. Replacement		
Segment 1 -	Gabion Baskets and Mattresses	$ 15,000
	Maintenance Roads/Riverwalk	10,000
	Articulated Concrete Mattresses	44,145
Segment 2 -	Gabion Baskets and Mattresses	186,589
	Maintenance Roads/Riverwalk	53,307
	Articulated Concrete Mattresses	116,609
Segment 3 -	Gabion Baskets and Mattresses	167,945
	Maintenance Roads/Riverwalk	146,172
	Articulated Concrete Mattresses	89,539
	Subtotal Replacement	$829,306

TABLE 5J.2-1. Annual Operation, Maintenance, Repair, Replacement, and Rehabilitation Costs

Item		Annual Cost
Total I-280 to I-880		$1,023,711
B. I-880 to SPTC Bridge (Alviso)		
1. O&M		
	Sediment & Debris Removal	$ 111,175
	Erosion Control	24,679
	Vegetation/Weed Abatement	166,703
	Property Maintenance	37,019
	Subtotal O&M	$ 339,576
2. Replacement		$ 0
	Total I-880 to SPTC Bridge (Alviso)	$ 339,576
C. Long-Term Surveillance Program		
Crest-Stage Gages		$ 3,560
	Total Flood Control O&M	$533,981
	Total Flood Control Replacement	$829,306
	Total Flood Control	**$1,363,287**
Recreation		
I-280 to I-880		
Segment 1 – O&M		$ 70,527
Replacement -	Riverwalk	$ 30,336
	Landscaping	12,425
	Picnic Tables	5,648
	Lighting	4,620
	Trash Receptacles	1,445
	Subtotal Replacement	$ 54,474
Segment 2–O&M		$ 195,907

TABLE 5J.2-1. Annual Operation, Maintenance, Repair, Replacement, and Rehabilitation Costs

	Item	Annual Cost
Replacement -	Riverwalk	$ 49,966
	Riverwalk/Maintenance Road	31,263
	Landscaping	36,146
	Picnic Tables	4,659
	Lighting	6,160
	Trash Receptacles	1,803
	Subtotal Replacement	$ 129,997
Segment 3–O&M	$ 205,309	
Replacement	Riverwalk	$ 68,702
	Riverwalk/Maintenance Road	85,922
	Landscaping	33,480
	Picnic Tables	1,982
	Lighting	34,436
	Trash Receptacles	3,001
	Subtotal Replacement	$ 227,523
	Total Recreation O&M	**$ 471,743**
	Total Recreation Replacement	**$ 411,994**
Total Recreation		**$ 883,737**
Total Flood Control and Recreation		**$2,247,024**

Appendix 5K – Covered Bypass Engineering Considerations

5K.1 Introduction

This chapter presents a discussion of the engineering considerations that must be evaluated for covered bypass channels, as specified in ER 1165-2-118.

5K.2 Impacts of Entrance Submergence

Submergence of the covered channel entrance may result in lower than design capacity flows in the bypass system. The covered channel is part of a bypass system, thus the expected effect of the reduced capacity in the covered channel will be to pass the additional flows down the Guadalupe River natural channel.

The Standard Project Flood (SPF) of 34,900 cfs would exceed the diversion capacity of the covered bypass system, pass the inlet structures, and continue down the natural channel of the Guadalupe River. It is estimated that with the bypass system in operation, the SPF floodplain flows would be approximately 8,500 cfs, which is half of the preproject SPF floodplain flows.

5K.3 Dangers of Rupture

The bypass channel will be about 3,500 ft long, the invert of the channel at both the upstream and downstream ends will at or near the invert of the natural channel, and the invert profile will approximate the invert profile of the natural channel. Pressurization of the channel, even at flowrates exceeding the design capacity would not pose a serious problem because the pressure head would not be significantly higher than the water surface in the River or the ground over the bypass.

5K.4 Human Ingress

Several options for preventing human ingress into the covered bypass channel have been considered. Each of these options has been declined by the local partner, SCVWD, as described below. SCVWD has other covered bypass systems in operation and finds that human ingress is not a serious problem. In addition, their legal staff has stated that attempting to prevent ingress actually increases liability rather than reducing it.

5K.4.1 Trash/Man Racks

Trash racks that could be designed to also prevent human ingress to the bypass system have been considered. The SCVWD is concerned that the structures may become obstructed during floods and thereby cause the system to bypass less than design flows. Automated

mechanical trash rack cleaning devices could be installed to prevent obstruction of the trash racks, but would require additional maintenance, operator intervention, and related costs.

5K.4.2 Roll-Up Doors

Large roll-up garage-type doors have also been considered as a means to prevent ingress to the bypass system. These doors would require additional maintenance and may not operate when needed before a flood caused flows to be diverted to the bypass. As a failsafe mechanism, the doors could be designed to "breakaway" when water on the outside reached a specified depth. The SCVWD has the same liability concerns (see 5K.4.1) for roll-up doors as it does for trash racks.

5K.5 Inspection and Maintenance

The SCVWD has stated that, in cooperation with the City of San Jose, it will provide all required inspection and maintenance of the covered bypass system. The large cross sectional area of the proposed box culverts will even allow ingress by large trucks or other construction equipment if required for maintenance.

5K.6 Pressure Release and Venting

The covered bypass system will be constructed such that design flows leave an airspace of at least a couple of feet at the top of each culvert. In addition, pressure release and venting systems will be installed at appropriate distances and locations to prevent pressure buildup in the bypass during operations that may exceed design flows.

5K.7 Storm Warning System

The SCVWD currently has an ALERT warning system consisting of flow and precipitation monitors that communicate with headquarters via radio. An ALERT station flow monitor would be installed on the Guadalupe River upstream from the project reach to provide warning to the SCVWD and the San Jose Police Department when stages in the river approach levels above which the bypass will begin operation. At that time, personnel from the San Jose Police Department will patrol the bypass to remove any persons who may be inside and prevent further ingress.

5K.8 Diversion Facilities

The proposed covered bypass system is a bypass for peak floodflows in the Guadalupe River. As such, there is no requirement for additional diversion facilities. If floodflows in the Guadalupe River exceed the design flows of 17,000 cfs, the bypass will continue to take additional flow until maximum capacity is reached. At that time, all floodflows that can no longer be diverted will continue down the natural Guadalupe River channel.

Appendix 5L - Design and Construction Schedule

5L.1 General

Construction of the remaining portions of the project is anticipated to consist two general construction contracts and four design/construct mitigation contracts. The design and construction schedule is shown on Plate 5L-1.

Construction Segments 3A and 3B include the construction of flood protection and recreation improvements between Park Avenue (station 171+ 40) and Coleman Avenue (station 119+23). It is also estimated to be completed in two construction seasons. The design between Park Avenue and Santa Clara Street remains unchanged from the GDM. Plans and Specifications for this work are 95 percent complete.

The design between Santa Clara Street and Coleman Avenue will be finalized in February 2001 after completion of the physical model study. Plans and Specifications for this portion of the project will be completed by Fall 2001. A final decision has not been made whether to construct this work using 1 or 2 construction contracts. The schedule reflects construction using 1 contract.

The first mitigation contract will implement plant material within Segments 1, 2, and 3 along the river's edge. The second mitigation contract will implement plant material with Reach A located immediately downstream from I-880. Two additional mitigation contracts will plant mitigation on lower Guadalupe Creek located upstream from I-280 and within the river between Woz Way and San Carlos Street. The collection and propagation of plant material will be accomplished in the fall approximately 6-12 months before contract initiation. The contracts will consist of a 3-year or 5-year establishment period prior to being transferred to the non-Federal sponsor for operation and maintenance.

5L.2 Work by Federal Government

The Federal contracts will include construction of all flood control and recreation improvements and mitigation plantings except as noted below. The contracts will include some utility relocations in accordance with the project Local Cooperation Agreement.

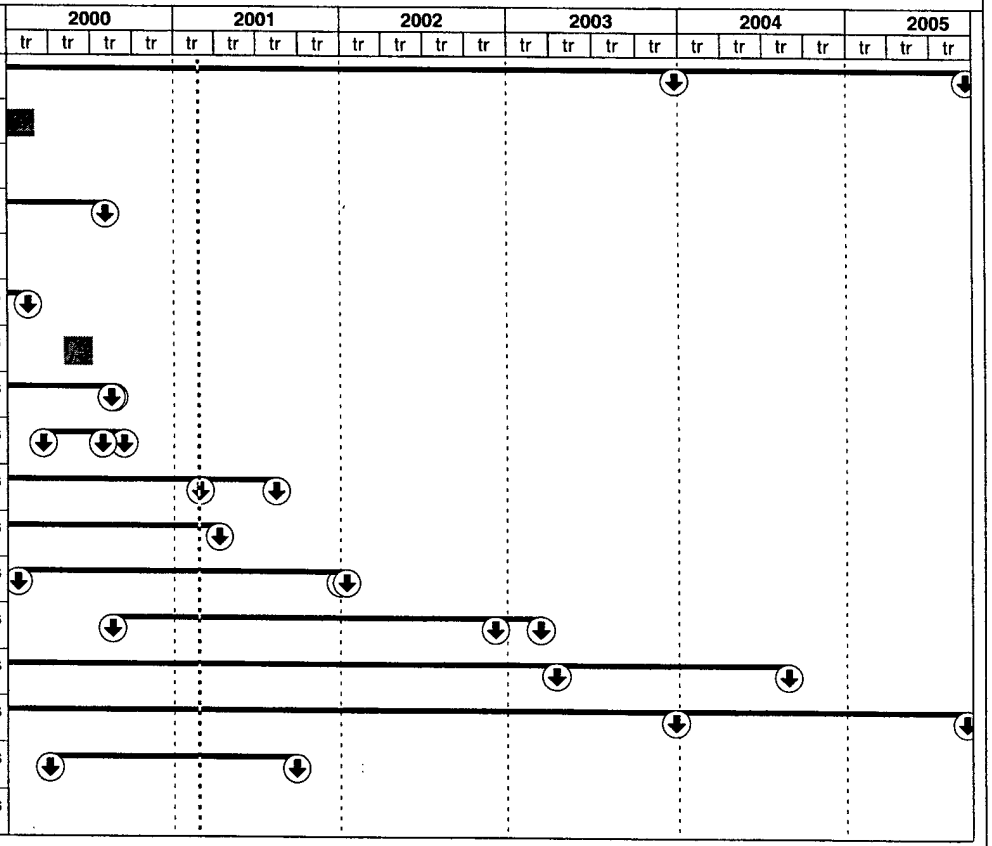
5L.3 Work by Non-Federal Sponsor

The non-Federal sponsor, the Santa Clara Valley Water District will be responsible for acquiring all project lands (except for RR bridges), altering or relocating all roads, bridges, and utilities affected by project construction, and subsequent operation and maintenance in accordance with the project Local Cooperation Agreement. In addition, SCVWD will be responsible for a two mitigation contracts that will implement plant material on lower Guadalupe Creek located upstream from I-280 and within the river between Woz Way and San Carlos Street. A Section 215 Agreement will be executed prior to start of construction on the Guadalupe Creek site.

Guadalupe River Project Shedule

Revision 36

ID	Task Name	Dur
1	**Guadalupe River Project**	**2012 days**
2	Gen. Reeval. Study Management Plan	44 days
3	**General Reevaluation Report (GRR) Original Plan**	**236 days**
48	**HEP Report (Jones & Stokes)**	**478 days**
56	**Mitigation & Monitoring Plan (Development)**	**178 days**
63	**Mitigation and Monitoring Plan (Incorp into Joint Document)**	**86 days**
71	HTRW Analysis/Report	44 days
72	**ESA Coordination**	**233 days**
88	**401 State Water Certification CN 3C Phase II**	**127 days**
97	**Joint GRR/EIR/SEIS**	**483 days**
224	**Early Implementation of CN 3C PH I**	**521 days**
266	**Contract 3C PH II**	**506 days**
312	**Contract 3 B**	**670 days**
334	**Contract 3 A**	**1365 days**
380	**Mitigation Commitments**	**2012 days**
585	**Contract 3C PH III**	**388 days**
611	**Contract 2 as-builts**	**50 days**



Task
Task Progress
Critical Task
Critical Task Progress
Baseline
Milestone
Baseline Milestone
Summary
Rolled Up Task
Rolled Up Critical Task
Baseline Summary
Rolled Up Baseline
Rolled Up Baseline Milestone
Rolled Up Progress
External Tasks
Project Summary
Split
Rolled Up Split

Appendix 5M – Cost Estimates

4M.1 General

The attached tables contain the summary cost estimates for the Guadalupe River Project. Complete MCACES cost estimates for the Proposed Action will be included in the Final GRR/EIR/SEIS.

Plates

5M-1 LPP Project Cost Estimate Summary
5M-2 NED Project Cost Estimate Summary
5M-3 LPP Project Cost Estimate

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE) SUMMARY

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	SUNK COST THRU 01-Oct-00	FIRST COST: PREVIOUS 1-Oct-99	FIRST COST: COST CHANGES		FIRST COST: CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	FULLY FUNDED: CHANGE IN INFLATION	FULLY FUNDED: CURRENT		
					PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7			DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)	(3)	AMOUNT (4)($K)	COST EST (5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	EST (12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
SUMMARY OF ESTIMATED COSTS															
	FEDERAL COST (CORPS OF ENGINEERS)		36067	88888	948	32434	115867		6403	122270	85639	9679	121881	6819	128700
	REQUIRED NON-FEDERAL COST		39067	95712	743	-915	95130		410	95540	99861	-1589	97674	426	98100
	CASH CONTRIBUTION		9406	12308	93	598	12589		410	12999	14817	-2002	13080	426	13506
	OTHER COSTS		29661	83404	650	-1513	82541		0	82541	85044	413	84594	0	84594
	TOTAL FEDERAL AND REQUIRED NON-FEDERAL COSTS		75154	184600	1691	31519	210997		6813	217810	185500	8090	219555	7245	226800
PROJECT EXECUTIVE SUMMARY															
1	LANDS AND DAMAGES		7122	43389	0	-13720	29669		0	29669	43396	1490	31166	0	31166
2	RELOCATIONS		18928	44849	540	3586	46452		2523	48975	45009	1615	48045	2705	50750
6	FISH AND WILDLIFE FACILITIES		1718	8550	2	4492	13044		0	13044	8654	771	13919	0	13919
9	CHANNELS AND CANALS		13867	33859	537	32647	63755		3288	67043	34080	3287	67060	3491	70551
14	RECREATIONS		407	632	0	287	872		47	919	633	25	900	45	945
15	FLOODWAY CONTROL-DIVERSION STRCT.		0	10998	297	-5929	4997		369	5366	11300	-66	5216	386	5602
18	CULTURAL RESOURCES PRESERV.		324	775	4	-135	608		36	644	775	7	633	18	651
30	PLANNING, ENGINEERING AND DESIGN		30380	33843	110	9805	43753		5	43758	33926	976	44814	3	44817
31	CONSTRUCTION MANAGEMENT		2408	7705	201	486	7847		545	8392	7727	-15	7802	597	8399
	TOTAL PROJECT COST		75154	184600	1691	31519	210997		6813	217810	185500	8090	219555	7245	226800
	FEDERAL COST		36067	88888	948	32434	115867		6403	122270	85639	9679	121881	6819	128700
	NON-FEDERAL COST		39067	95712	743	-915	95130		410	95540	99861	-1589	97674	426	98100

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	CODE	SUNK COST THRU 01-Oct-00	FIRST COST: PREVIOUS 1-Oct-99	FIRST COST: COST CHANGES		FIRST COST: CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	FULLY FUNDED: CHANGE IN	FULLY FUNDED: CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST	INFLA-TION	DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)		(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
	FEDERAL															
1	LANDS AND DAMAGES, (2			5979	5912	0	218	6130	0	0	6130	5919	9	6146	0	6146
	Misc. Federal cost		3	5979	5912	0	218	6130	0	0	6130	5919	9	6146	0	6146
	Federal Cost, Pre-FY2000		3	298	211	0	87	298	0	0	298	218	-7	298	0	298
	Federal Cost, FY2000 and Beyond		3	-20	0	0	131	131	0	0	131	0	16	147	0	147
	Section 104 Credit,		3	5701	5701	0	0	5701	0	0	5701	5701	0	5701	0	5701
2	RELOCATIONS(RAILROAD, CONTRACT 3)		2	26	8875	0	186	6538	0	2523	9061	9035	516	7032	2705	9737
	Federal Cost		2	26	8875	0	186	6538	38.6	2523	9061	9035	516	7032	2705	9737
6	FISH AND WILDLIFE FACILITIES		2	1718	8550	2	4492	13044	0	0	13044	8654	771	13919	0	13919
	CONTRACT 1 MITIGATION		2	291	330	0	-39	291	0	0	291	330	0	291	0	291
	PROPAGATION CONTRACT		2	4	4	0	0	4	0	0	4	4	0	4	0	4
	PLANTING AND		2	287	326	0	-39	287	0	0	287	326	0	287	0	287
	ESTABLISHMENT		2	282	226	0	56	282	0	0	282	226	0	282	0	282
	REPAIR FLOOD DAMAGES		2	5	100	0	-95	5	0	0	5	100	0	5	0	5
	CONTRACT 2 MITIGATION		2	743	1349	0	-391	958	0	0	958	1376	-21	964	0	964
	CONTRACT 1&2 SRA Mitigation(infill)		2	583	0	0	583	583	0	0	583	0	0	583	0	583
	SRA CONTRACT 3 MITIGATION		2	0	6735	0	-6004	731	0	0	731	6812	-39	769	0	769
	3A		2	0	3474	0	-3097	377	0	0	377	3513	-18	398	0	398
	3B		2	0	3189	0	-2825	344	0	0	344	3206	-20	361	0	361
	3C		2	0	92	0	-82	10	0	0	10	93	-1	10	0	10
	SRA CONTRACT 4 MITIGATION		2	0	0	0	3008	3008	0	0	3008	0	329	3337	0	3337
	SRA CONTRACT 5 MITIGATION		2	0	0	0	1610	1610	0	0	1610	0	89	1699	0	1699
	SRA CONTRACT 6 MITIGATION		2	0	0	0	1159	1159	0	0	1159	0	70	1229	0	1229
	Reach A SRA Mitigation (offsite/pilot sites)		2	0	0	0	77	77	0	0	77	0	1	78	0	78
	USFWS EFFORT		2	101	136	2	398	536	0	0	536	136	7	543	0	543
	CURRENT OBLIGATION		2	101	59	0	42	101	0	0	101	80	-21	101	0	101
	FUTURE		2	0	77	2	356	435	0	0	435	56	28	442	0	442
	Section 215 Credit,		2	0	0	0	4091	4091	0	0	4091	0	335	4426	0	4426
9	CHANNELS AND CANALS		2	8568	28560	537	32647	58456	0	3288	61744	28781	3287	61761	3491	65252
	CONTRACT 1		2	1478	2245	21	-768	1478	0	0	1478	2245	0	1478	0	1478
	CONTRACT 2		2	4773	6197	0	-1424	4591	0	182	4773	6197	0	4591	182	4773
	CONTRACT 3		2	1775	19105	516	35330	51845	6.2	3108	54951	19309	3304	55150	3309	58459
	DEMO AND SALVAGE CONTRACT		2	542	1013	0	-471	542	0	0	542	1030	-17	542	0	542
14	RECREATIONS		2	407	632	0	287	872	0	47	919	633	25	900	45	945
	CONTRACT 1		2	90	181	0	-91	90	0	0	90	181	0	90	0	90
	CONTRACT 2		2	163	451	0	-288	159	2.7	4	163	452	-1	163	0	163
	CONTRACT 3		2	154	0	0	666	623	0	43	666	0	26	647	45	692
	A		2	0	0	0	225	206	9.2	19	225	0	12	217	20	237
	B		2	0	0	0	206	189	9.2	17	206	0	11	199	18	217
	C Phase 1		2	154	0	0	154	154	0	0	154	0	0	154	0	154
	C Phase 2		2	0	0	0	81	74	9.2	7	81	0	3	77	7	84
15	FLOOD CONTROL AND DIVERSION		2	0	10998	297	-5929	4997		369	5366	11300	-66	5216	386	5602
	Contract 3B		2	0	0	0	195	182	7.4	13	195	0	10	191	14	205
	Contract 3 A/B Bypass		2	0	0	0	2489	2318	7.4	171	2489	0	140	2448	181	2629
	STRUCTURES (CONTRACT 3C)		2	0	10998	297	-8613	2497	7.4	185	2682	11300	-216	2577	191	2768
18	CULTURAL RESOURCES PRESERV.			324	775	4	-135	608	0	36	644	775	7	633	18	651
	CONTRACT 2		2	0	50	0	-20	30	0	0	30	50	0	30	0	30

1

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	CODE	SUNK COST THRU 01-Oct-00	FIRST COST: PREVIOUS 1-Oct-99	FIRST COST: COST CHANGES		FIRST COST: CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	FULLY FUNDED: CHANGE IN INFLATION	FULLY FUNDED: CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST		DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)		(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
	CONTRACT 3		2	324	725	4	-115	578	0	36	614	725	7	603	18	621
	RIVER STREET MITIGATION		2	200	267	2	131	364	10	36	400	263	7	385	18	403
	HISTORIC & PREHIST. ARCH. MIT.		2	42	319	0	-277	42	0	0	42	323	-4	42	0	42
	PHOTO DOCUMENTATION		2	68	69	0	-1	68	0	0	68	69	0	68	0	68
	OTHER		2	14	70	2	32	104	0	0	104	70	4	108	0	108
30	PLANNING/ENGINEERING/DESIGN			24251	23646	0	8319	31960		5	31965	23729	845	32890	3	32893
	CONSTRUCTION, Pre-FY2000		3	18062	17801	0	261	18062	9.1	0	18062	17863	-62	18062	0	18062
	CONSTRUCTION, FY2000 and Beyond		3	5594	5594	0	7495	13089	0	0	13089	5614	883	13992	0	13992
	RECREATION		3	27	251	0	-193	53	9.4	5	58	252	0	56	3	59
	FISH & WILDLIFE MITIGATION		3	568	0	0	756	756	9.4	0	756	0	24	780	0	780
	Pre-FY2000		3	518	0	0	518	518	0	0	518	0	0	518	0	518
	FY2000 and Beyond		3	50	0	0	238	238	0	0	238	0	24	262	0	262
31	CONSTRUCTION MANAGEMENT			1070	6352	201	-157	5851		545	6396	6374	643	6464	597	7061
	CONSTRUCTION, Pre-FY2000		3	925	925	0	0	925	0	0	925	925	0	925	0	925
	CONSTRUCTION, FY2000 and Beyond		3	117	5183	193	0	4839	11.1	537	5376	5204	637	5443	591	6034
	RECREATION		3	28	244	8	-157	87	9.5	8	95	245	6	96	6	102
	TOTAL COST (FEDERAL FUNDS & NON-FEDERAL CASH CONTRIBUTION)			42343	94300	1041	39928	128456		6813	135269	95200	6037	134961	7245	142206
	NON-FEDERAL CASH CONTRIBUTION	3		9406	12308	93	598	12589		410	12999	14817	-2002	13080	426	13506
	SUBTOTAL			32937	81992	948	39330	115867		6403	122270	85659	8039	121881	6819	128700
	FEDERAL REIMBURSEMENT			3150	6896	0	-6896	0		0	0	5256	1640	0	0	0
	TOTAL FEDERAL COST			36087	88888	948	32434	115867		6403	122270	90915	9679	121881	6819	128700
NON-FEDERAL COST																
1	LANDS AND DAMAGES			1143	37477	0	-13938	23539	0	0	23539	37477	1481	25020	0	25020
	CONSTRUCTION		1	1143	37477	0	-13938	23539	0	0	23539	37477	1481	25020	0	25020
	CONTRACT 1		1	1588	2880	0	-1292	1588	0	0	1588	2880	0	1588	0	1588
	CONTRACT 2		1	1498	16680	0	-15182	1498	0	0	1498	16680	0	1498	0	1498
	CONTRACT 3		1	3336	23203	0	-2861	20342	9.9	0	20342	23203	1395	21737	0	21737
	Pre-FY2000		1	3336	3336	0	0	3336	0	0	3336	3336	0	3336	0	3336
	FY2000 and Beyond		1	0	19867	0	-2861	17006	0	0	17006	19867	1395	18401	0	18401
	SRA, MITIGATION		1	20	13	0	5397	5410	0	0	5410	13	86	5496	0	5496
	SECTION 104 CREDIT, TRAN TO FED		1	-5701	-5701	0	0	-5701	0	0	-5701	-5701	0	-5701	0	-5701
	LANDS, EASEMENTS, RIGHTS OF-WAY, RELOCATIONS, AND DREDGED MAT'AL DISPOSAL AREAS(SECTION 104 EXTERNAL WORK CREDIT)		1	402	402	0	0	402	0	0	402	402	0	402	0	402
2	RELOCATIONS		2	18902	35974	540	3400	39914	0	0	39914	35974	1099	41013	0	41013
	ROADS, CONTRACT 1		2	3940	0	0	3940	3940	0	0	3940	0	0	3940	0	3940
	ROADS, CONTRACT 2		2	2594	3650	0	-1056	2594	0	0	2594	3650	0	2594	0	2594
	CEMETERIES, UTILS AND STRUCTS		2	12368	32324	540	516	33380	0	0	33380	32324	1099	34479	0	34479
	RELOCATIONS WORK BY SPONSORS		2	11131	28788	477	468	29733	0	0	29733	28788	902	30635	0	30635
	RELOCATIONS WORK INCLUDED IN CORPS		2	1237	3536	63	48	3647	0	0	3647	3536	197	3844	0	3844

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO. (1)	FEATURE/SUBFEATURE (2)	NOTES (3)	COD E	SUNK COST THRU 01-Oct-00 AMOUNT (4)($K)	FIRST COST: PREVIOUS 1-Oct-99 COST EST (5)($K)	COST CHANGES: PRICE LEVEL (6)($K)	COST CHANGES: OTHER (SEE NOTE) (7)($K)	CURRENT: DIRECT COST (8)($K)	CURRENT: CNTG RATE (9)(%)	CURRENT: CONTIN-GENCY (10)($K)	CURRENT: CST EST 5+6+7 (11)($K)	FULLY FUNDED: PREVIOUS 1-Oct-99 EST (12)($K)	FULLY FUNDED: CHANGE IN INFLA-TION (13)($K)	FULLY FUNDED: CURRENT DIRECT COST (14)($K)	FULLY FUNDED: CURRENT CONTIN-GENCY (15)($K)	FULLY FUNDED: CURRENT COST EST 12+6+7+13 (16)($K)
	CONSTRUCTION CONTRACTS															
	CONTRACT 1	2		857	809	0	48	857	0	0	857	809	0	857	0	857
	CONTRACT 2	2		380	468	2	0	470	0	0	470	468	7	477	0	477
	CONTRACT 3	2		0	2259	61	0	2320	0	0	2320	2259	190	2510	0	2510
6	FISH AND WILDLIFE FACILITIES	2		0	0	0	0	0	0	0	0	0	0	0	0	0
	Section 215	2		0	0	0	4091	4091	0	0	4091	0	335	4426	0	4426
	Section 215, Credit, Transfer to Federal Cost	2		0	0	0	-4091	-4091	0	0	-4091	0	-335	-4426	0	-4426
9	CHANNELS	2		5299	5299	0	0	5299	0	0	5299	5299	0	5299	0	5299
	SECTIONS 104 INTEGRAL WORK CREDIT	2		485	485	0	0	485	0	0	485	485	0	485	0	485
	SECTIONS 104 INTEGRAL WORK CREDIT	2		4814	4814	0	0	4814	0	0	4814	4814	0	4814	0	4814
30	PLANNING/ENGINEERING/DESIGN	2		6129	10197	110	1486	11793	0	0	11793	10197	131	11924	0	11924
31	CONSTRUCTION MANAGEMENT	2		1338	1353	0	643	1996	0	0	1996	1353	-658	1338	0	1338
	SPONSOR'S CM COST FOR RELOCATIONS WORK BY SPONSOR	2		1238	1253	0	643	1896	0	0	1896	1253	-658	1238	0	1238
	SPONSOR'S SHARE OF S&I FOR SPONSOR RELOCATIONS WORK INCLUDED IN CORPS CONSTRUCTION CONTRACTS	2		100	100	0	0	100	0	0	100	100	0	100	0	100
	CONTRACT 1	2		70	70	0	0	70	0	0	70	70	0	70	0	70
	CONTRACT 2	2		30	30	0	0	30	0	0	30	30	0	30	0	30
	TOTAL NON-FEDERAL LERRD			32811	90300	650	-8409	82541		0	82541	90300	2053	84594	0	84594
	NON-FEDERAL CONTRIBUTION			9406	12308	93	598	12589		410	12999	14817	-2002	13080	426	13506
	NED Non-Federal Contribution			5905	7760	84	2821	10328		337	10665	8611	-391	10769	356	11125
	RECREATION			595	564	4	-32	506		30	536	930	-349	526	27	553
	Additional Cost Above NED			2906	3984	5	-2191	1755		43	1798	5276	-1262	1785	43	1828
	SUBTOTAL			42217	102808	743	-7811	95130		410	95540	105117	51	97674	426	98100
	NED, FEDERAL REIMBURSEMENT			3150	6896	0	-6896	0		0	0	5256	1640	0	0	0
	TOTAL NON-FEDERAL COST			39067	95712	743	-915	95130		410	95540	99861	-1589	97674	426	98100
	TOTAL			75154	184600	1691	31519	210997		6813	217810	185500	8090	219555	7245	226800

BASIS OF ESTIMATE:

(1 Cultural Resources Preservation costs associated with mitigation and/or data recovery up to one percent of the total Federal cost are not subject to cost sharing.
(2 Federal administrative costs for non-Federal land acquisition.
(3 Percentages used to Calculate Non-federal cash contribution are min. 25% of Combine Cost and 50% of Recreation Cost.
(4 The Fully Funded cost estimate was prepared in compliance with EC-11-2-177, published in March 1999
(5 Escalation Rate From 10/01/99 to 10/01/2000: Lands 2.70%; Constructions 2.70%; and FedLandAdmin, PED & CM 3.80%.

PROJECT: Guadalupe River, NED PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE) SUMMARY

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	SUNK COST THRU 01-Oct-00	FIRST COST							FULLY FUNDED				
				PREVIOUS 1-Oct-99	COST CHANGES		CURRENT				PREVIOUS 1-Oct-99	CHANGE IN INFLA-TION	CURRENT		
			AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST		DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)	(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
	SUMMARY OF ESTIMATED COSTS														
	FEDERAL COST (CORPS OF ENGINEERS)		37193	88822	948	32500	115867		6403	122270	87619	7633	121881	6819	128700
	REQUIRED NON-FEDERAL COST		35089	84595	738	7337	92303		367	92670	86513	612	94817	383	95200
	CASH CONTRIBUTION		6500	8324	88	2789	10834		367	11201	8611	190	11295	383	11678
	OTHER COSTS		28589	76271	650	4548	81469		0	81469	77902	422	83522	0	83522
	TOTAL FEDERAL AND REQUIRED NON-FEDERAL COSTS		72282	173417	1686	39837	208170		6770	214940	174132	8245	216698	7202	223900
	PROJECT EXECUTIVE SUMMARY														
1	LANDS AND DAMAGES		5928	36165	0	-7690	28475		0	28475	36165	1497	29972	0	29972
2	RELOCATIONS		18928	44853	540	3582	46452		2523	48975	45009	1619	48045	2705	50750
6	FISH AND WILDLIFE FACILITIES		1718	8550	2	4492	13044		0	13044	8654	771	13919	0	13919
9	CHANNELS AND CANALS		12392	30804	532	34232	62323		3245	65568	31025	3287	65628	3448	69076
14	RECREATIONS		407	632	0	287	872		47	919	633	25	900	45	945
15	FLOODWAY CONTROL-DIVERSION STRCT.		0	10998	297	-5929	4997		369	5368	11300	-66	5216	386	5602
18	CULTURAL RESOURCES PRESERV.		324	775	4	-135	608		36	644	775	7	633	18	651
30	PLANNING, ENGINEERING AND DESIGN		30187	33838	110	9619	43562		5	43567	33740	1127	44593	3	44596
31	CONSTRUCTION MANAGEMENT		2396	6802	201	1379	7837		545	8382	6831	-22	7792	597	8389
	TOTAL PROJECT COST		72282	173417	1686	39837	208170		6770	214940	174132	8245	216698	7202	223900
	FEDERAL COST		37193	88822	948	32500	115867		6403	122270	87619	7633	121881	6819	128700
	NON-FEDERAL COST		35089	84595	738	7337	92303		367	92670	86513	612	94817	383	95200

PROJECT: Guadalupe River, NED PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO. (1)	FEATURE/SUBFEATURE (2)	NOTES	CODE (3)	SUNK COST THRU 01-Oct-00 AMOUNT (4)($K)	FIRST COST PREVIOUS 1-Oct-99 COST EST (5)($K)	COST CHANGES PRICE LEVEL (6)($K)	COST CHANGES OTHER (SEE NOTE) (7)($K)	CURRENT DIRECT COST (8)($K)	CURRENT CNTG RATE (9)(%)	CURRENT CONTIN-GENCY (10)($K)	CURRENT CST EST 5+6+7 (11)($K)	FULLY FUNDED PREVIOUS 1-Oct-99 EST (12)($K)	CHANGE IN INFLA-TION (13)($K)	FULLY FUNDED CURRENT DIRECT COST (14)($K)	FULLY FUNDED CURRENT CONTIN-GENCY (15)($K)	FULLY FUNDED CURRENT COST EST 12+6+7+13 (16)($K)
	FEDERAL															
1	LANDS AND DAMAGES, (2			5857	5825	0	183	6008	0	0	6008	5830	11	6024	0	6024
	Federal Cost, Pre-FY2000		3	176	124	0	52	176	0	0	176	129	-5	176	0	176
	Federal Cost, FY2000 and Beyond		3	-20	0	0	131	131	0	0	131	0	16	147	0	147
	Section 104 Credit,		3	5701	5701	0	0	5701	0	0	5701	5701	0	5701	0	5701
2	RELOCATIONS(RAILROAD, CONTRACT 3)		2	26	8875	0	186	6538	38.6	2523	9061	9035	516	7032	2705	9737
6	FISH AND WILDLIFE FACILITIES		2	1718	8550	2	4492	13044	0	0	13044	8654	771	13919	0	13919
	CONTRACT 1 MITIGATION		2	291	330	0	-39	291	0	0	291	330	0	291	0	291
	PROPAGATION CONTRACT		2	4	4	0	0	4	0	0	4	4	0	4	0	4
	PLANTING AND		2	287	326	0	-39	287	0	0	287	326	0	287	0	287
	ESTABLISHMENT		2	282	226	0	56	282	0	0	282	226	0	282	0	282
	REPAIR FLOOD DAMAGES		2	5	100	0	-95	5	0	0	5	100	0	5	0	5
	CONTRACT 2 MITIGATION		2	743	1349	0	-391	958	0	0	958	1376	-21	964	0	964
	CONTRACT 1&2 SRA Mitigation(infill)		2	583	0	0	583	583	0	0	583	0	0	583	0	583
	SRA CONTRACT 3 MITIGATION		2	0	6735	0	-6004	731	0	0	731	6812	-39	769	0	769
	3A		2	0	3474	0	-3097	377	0	0	377	3513	-18	396	0	396
	3B		2	0	3169	0	-2825	344	0	0	344	3206	-20	361	0	361
	3C		2	0	92	0	-82	10	0	0	10	93	-1	10	0	10
	SRA CONTRACT 4 MITIGATION		2	0	0	0	3008	3008	0	0	3008	0	329	3337	0	3337
	SRA CONTRACT 5 MITIGATION		2	0	0	0	1610	1610	0	0	1610	0	89	1699	0	1699
	SRA CONTRACT 6 MITIGATION		2	0	0	0	1159	1159	0	0	1159	0	70	1229	0	1229
	Reach A SRA Mitigation (offsite/pilot sites)		2	0	0	0	77	77	0	0	77	0	1	78	0	78
	USFWS EFFORT		2	101	136	2	398	536	0	0	536	136	7	543	0	543
	CURRENT OBLIGATION		2	101	59	0	42	101	0	0	101	80	-21	101	0	101
	FUTURE		2	0	77	2	356	435	0	0	435	56	28	442	0	442
	Section 215 Credit,		2	0	0	0	4091	4091	0	0	4091	0	335	4426	0	4426
9	CHANNELS AND CANALS		2	7093	25505	532	34232	57024	0	3245	60269	25726	3287	60329	3448	63777
	CONTRACT 1		2	1129	1715	16	-602	1129	0	0	1129	1715	0	1129	0	1129
	CONTRACT 2		2	3647	4735	0	-1088	3508	0	139	3647	4735	0	3508	139	3647
	CONTRACT 3 \1/		2	1775	18042	516	36393	51845	6.2	3106	54951	18246	3304	55150	3309	58459
	DEMO AND SALVAGE CONTRACT		2	542	1013	0	-471	542	0	0	542	1030	-17	542	0	542
14	RECREATIONS		2	407	632	0	287	872	0	47	919	633	25	900	45	945
	CONTRACT 1		2	90	181	0	-91	90	0	0	90	181	0	90	0	90
	CONTRACT 2		2	163	451	0	-288	159	2.7	4	163	452	-1	163	0	163
	CONTRACT 3		2	154	0	0	666	623	0	43	666	0	26	647	45	692
15	FLOODWAY CONTROL AND DIVERSION STRUCTURES (CONTRACT 3C)		2	0	10998	297	-5929	4997	0	369	5366	11300	-66	5216	386	5602
18	CULTURAL RESOURCES PRESERV.			324	775	4	-135	608		36	644	775	7	633	18	651
	CONTRACT 2		2	0	50	0	-20	30	0	0	30	50	0	30	0	30
	CONTRACT 3		2	324	725	4	-115	578	0	36	614	725	7	603	18	621
	RIVER STREET MITIGATION		2	200	267	2	131	364	10	36	400	263	7	385	18	403
	HISTORIC & PREHIST. ARCH. MIT.		2	42	319	0	-277	42	0	0	42	323	-4	42	0	42
	PHOTO DOCUMENTATION		2	68	69	0	-1	68	0	0	68	69	0	68	0	68
	OTHER		2	14	70	2	32	104	0	0	104	70	4	108	0	108
30	PLANNING/ENGINEERING/DESIGN			24058	23641	0	8133	31769		5 \2/	31774	23543	996	32669	3	32672
	CONSTRUCTION		3	23468	23390	0	7575	30965	0	0	30965	23291	972	31838	0	31838

PROJECT: Guadalupe River, NED PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	COD E	SUNK COST THRU 01-Oct-00	FIRST COST: PREVIOUS 1-Oct-99	FIRST COST: COST CHANGES		FIRST COST: CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	FULLY FUNDED: CHANGE IN	FULLY FUNDED: CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST	INFLA-TION	DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)		(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
	CONSTRUCTION, Pre-FY2000		3	17874	17796	0	78	17874	0	0	17874	17877	119	17874	0	17874
	CONSTRUCTION, FY2000 and Beyond		2	5594	5594	0	7497	13091	0	0	13091	5614	853	13964	0	13964
	RECREATION		3	27	251	0	-193	53	0	5	58	252	0	56	3	59
	FISH & WILDLIFE MITIGATION		3	563	0	0	751	751	0	0	751	0	24	775	0	775
	Pre-FY2000		3	513	0	0	513	513	0	0	513	0	0	513	0	513
	FY2000 and Beyond		3	50	0	0	238	238	0	0	238	0	24	262	0	262
31	CONSTRUCTION MANAGEMENT			1060	5449	201	736	5841		545	6386	5478	636	6454	597	7051
	CONSTRUCTION		3	1032	5205	193	893	5754		537	6291	5233	630	6358	591	6949
	CONSTRUCTION, Pre-FY2000		3	915	915	0	0	915	0	0	915	915	0	915	0	915
	CONSTRUCTION, FY2000 and Beyond		3	117	4290	193	893	4839	11.1	537	5376	4318	630	5443	591	6034
	RECREATION		3	28	244	8	-157	87	0	8	95	245	6	96	6	102
	TOTAL COST (FEDERAL FUNDS & NON-FEDERAL CASH CONTRIBUTION)			40543	90250	1036	42185	126701		6770	133471	90974	6183	133176	7202	140378
	NON-FEDERAL CASH CONTRIBUTION	\3/		6500	8324	88	2789	10834		367	11201	8611	190	11295	383	11678
	SUBTOTAL			34043	81926	948	39396	115867		6403	122270	82363	5993	121881	6819	128700
	FEDERAL REIMBURSEMENT	\4/		3150	6896	0	-6896	0		0	0	5256	1640	0	0	0
	TOTAL FEDERAL COST			37193	88822	948	32500	115867		6403	122270	87619	7633	121881	6819	128700

\2/ COSTS ALREADY EXPENDED ARE EXCLUDED BEFORE APPLYING CONTINGENCY RATE.

\3/ CALCULATION FOR NON-FEDERAL CASH CONTRIBUTION FOR FLOOD CONTROL IS PAY A MINIMUM 25% OF PROJECT COST ALLOCATED TO FLOOD CONTROL (FOR THE NED PLAN) THRU A COMBINATION OF ALL LERRD AND A CASH CONTRIBUTION, WITH THE CASH CONTRIBUTION A MINIMUM OF 5%. CULTURAL RESOURCES PRESERVATION COSTS ASSOCIATED WITH MITIGATION AND/OR DATA RECOVERY UP TO ONE PERCENT OF THE TOTAL FEDERAL COST ARE NOT SUBJECT TO COST SHARING (FEATURE 18 COSTS).

\4/ FEDERAL REIMBURSEMENT IS REQUIRED TO PROVIDE THAT THE NON-FEDERAL COST SHARING FOR FLOOD CONTROL (NED PLAN) SHALL NOT EXCEED 50% OF COST ASSIGNED TO FLOOD CONTROL (SECTION 103(a)(3), WRDA 86). FEDERAL REIMBURSEMENT, WHEN SECTION 104 CREDITS ARE INCLUDED IN THE ANALYSIS, WILL NOT EXCEED A FEDERAL REIMBURSEMENT CALCULATED BASED ON THE BASIC PROJECT WITHOUT SECTION 104 CREDITS.

NON-FEDERAL COST		\5/		\6/												
1	LANDS AND DAMAGES			71	30340	0	-7873	22467	0	0	22467	30335	1486	23948	0	23948
	CONTRACT 1		1	1323	2399	0	-1076	1323	0	0	1323	2399	0	1323	0	1323
	CONTRACT 2		1	1248	13894	0	-12646	1248	0	0	1248	13894	0	1248	0	1248
	CONTRACT 3		1	2779	19333	0	452	19785	9.9	0	19785	19328	1400	21180	0	21180
	Pre-FY2000		1	2779	2779	0	0	2779	0	0	2779	2779	0	2779	0	2779
	FY2000 and Beyond		1	0	16554	0	452	17006	0	0	17006	16549	1400	18401	0	18401
	SRA, MITIGATION		1	20	13	0	5397	5410	0	0	5410	13	86	5496	0	5496
	SECTION 104 CREDIT, TRAN TO FED		1	-5701	-5701	0	0	-5701	0	0	-5701	-5701	0	-5701	0	-5701
	LANDS, EASEMENTS, RIGHTS OF-WAY, RELOCATIONS, AND DREDGED MAT'AL DISPOSAL AREAS(SECTION 104 EXTERNAL WORK CREDIT)		1	402	402	0	0	402	0	0	402	402	0	402	0	402
2	RELOCATIONS		2	18902	35978	540	3396	39914	0	0	39914	35974	1103	41013	0	41013
	ROADS, CONTRACT 1		2	3940	0	0	3940	3940	0	0	3940	0	0	3940	0	3940
	ROADS, CONTRACT 2		2	2594	3650	0	-1056	2594	0	0	2594	3650	0	2594	0	2594
	CEMETERIES, UTILS AND STRUCTS		2	12368	32328	540	512	33380	0	0	33380	32324	1103	34479	0	34479
	RELOCATIONS WORK BY SPONSORS		2	11131	28792	477	464	29733	0	0	29733	28788	906	30635	0	30635
	RELOCATIONS WORK		2	1237	3536	63	48	3647	0	0	3647	3536	197	3844	0	3844

PROJECT: Guadalupe River, NED PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO. (1)	FEATURE/SUBFEATURE (2)	NOTES	COIDE (3)	SUNK COST THRU 01-Oct-00 AMOUNT (4)($K)	FIRST COST: PREVIOUS 1-Oct-99 COST EST (5)($K)	COST CHANGES: PRICE LEVEL (6)($K)	COST CHANGES: OTHER (SEE NOTE) (7)($K)	CURRENT: DIRECT COST (8)($K)	CURRENT: CNTG RATE (9)(%)	CURRENT: CONTIN-GENCY (10)($K)	CURRENT: CST EST 5+6+7 (11)($K)	FULLY FUNDED: PREVIOUS 1-Oct-99 EST (12)($K)	FULLY FUNDED: CHANGE IN INFLA-TION (13)($K)	FULLY FUNDED: CURRENT DIRECT COST (14)($K)	FULLY FUNDED: CURRENT CONTIN-GENCY (15)($K)	FULLY FUNDED: CURRENT COST EST 12+6+7+13 (16)($K)
	INCLUDED IN CORPS CONSTRUCTION CONTRACTS															
	CONTRACT 1		2	857	809	0	48	857	0	0	857	809	0	857	0	857
	CONTRACT 2		2	380	468	2	0	470	0	0	470	468	7	477	0	477
	CONTRACT 3		2	0	2259	61	0	2320	0	0	2320	2259	190	2510	0	2510
6	FISH AND WILDLIFE FACILITIES		2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Section 215		2	0	0	0	4091	4091	0	0	4091	0	335	4426	0	4426
	Section 215, Credit, Transfer to Federal Cost		2	0	0	0	-4091	-4091	0	0	-4091	0	-335	-4426	0	-4426
9	CHANNELS		2	5299	5299	0	0	5299	0	0	5299	5299	0	5299	0	5299
	SECTIONS 104 INTEGRAL WORK CREDIT		2	485	485	0	0	485	0	0	485	485	0	485	0	485
	SECTIONS 104 INTEGRAL WORK CREDIT		2	4814	4814	0	0	4814	0	0	4814	4814	0	4814	0	4814
30	PLANNING/ENGINEERING/DESIGN		2	6129	10197	110	1486	11793	0	0	11793	10197	131	11924	0	11924
31	CONSTRUCTION MANAGEMENT		2	1338	1353	0	643	1996	0	0	1996	1353	-658	1338	0	1338
	SPONSOR'S CM COST FOR RELOCATIONS WORK BY SPONSOR		2	1238	1253	0	643	1896	0	0	1896	1253	-658	1238	0	1238
	SPONSOR'S SHARE OF S&I FOR SPONSOR RELOCATIONS WORK INCLUDED IN CORPS CONSTRUCTION CONTRACTS		2	100	100	0	0	100	0	0	100	100	0	100	0	100
	CONTRACT 1		2	70	70	0	0	70	0	0	70	70	0	70	0	70
	CONTRACT 2		2	30	30	0	0	30	0	0	30	30	0	30	0	30
	TOTAL NON-FEDERAL LERRD			31739	83167	650	-2348	81469		0	81469	83158	2082	83522	0	83522
	NON-FEDERAL CASH CONTRIBUTION (3			6500	8324	88	2789	10834		367	11201	8611	190	11295	383	11678
	50% OF RECREATION COST			595	564	4	-32	506		30	536	0	581	526	27	553
	REMAINING COST			5905	7760	84	2821	10328		337	10665	8611	-391	10769	356	11125
	SUBTOTAL			38239	91491	738	441	92303		367	92670	91769	2252	94817	383	95200
	FEDERAL REIMBURSEMENT			3150	6896	0	-6896	0		0	0	5256	1640	0	0	0
	TOTAL NON-FEDERAL COST			35089	84595	738	7337	92303		367	92670	86513	612	94817	383	95200
	TOTAL			72282	173417	1686	39837	208170		6770	214940	174132	8245	216698	7202	223900

\5/ THE SACRAMENTO DISTRICT REQUESTED THE NON-FEDERAL SPONSOR (SANTA CLARA VALLEY WATER DISTRICT) TO FURNISH THE FIRST OF AN ANNUAL CURRENT UPDATE OF THE SPONSOR LERRD COST ESTIMATE. THE SPONSOR WAS UNABLE TO FURNISH, WITH THE EXCEPTION OF A ROUNDED ESTIMATE OF $12,800,000 FOR UTILITIES. THEREFORE, IN MOST INSTANCES, THE NON-FEDERAL LERRD COST ESTIMATE IS STILL BASED ON THE GENERAL DESIGN MEMORANDUM COST ESTIMATE AT 1 OCTOBER 1991 PRICE LEVEL.

\6/ THE NON-FEDERAL EXPENDITURES LISTED HERE FOR (1) LANDS AND DAMAGES, CONTRACT 1, (2) RELOCATIONS, RELOCATIONS WORK BY SPONSOR, AND (3) PLANNING, ENGINEERING AND DESIGN ARE BASED ON A DRAFT INTERIM AUDIT REPORT BY SPD AUDIT OFFICE FOR COSTS THRU 30 JUNE 1993. THE NON-FEDERAL SPONSOR WAS REQUESTED TO FURNISH A CURRENT UPDATE, BUT IT WAS NOT FURNISHED.

BASIS OF ESTIMATE:

BASED ON FEASIBILITY REPORT "GUADALUPE RIVER AND ADJACENT STREAMS INVESTIGATION" DATED JULY 1985, PASSED BY BERH 29 JUNE 1986, TRANSMITTED TO ASA(CW) FROM THE CHIEF OF ENGINEERS ON 10 JUNE 1987,

3

PROJECT: Guadalupe River, NED PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	CIDE	SUNK COST THRU 01-Oct-00	FIRST COST							FULLY FUNDED				
					PREVIOUS 1-Oct-99	COST CHANGES		CURRENT				PREVIOUS 1-Oct-99	CHANGE IN INFLATION	CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTINGENCY	CST EST 5+6+7	EST		DIRECT COST	CONTINGENCY	COST EST 12+6+7+13
(1)	(2)		(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)

AND AUTHORIZED BY WRDA 1986 AT A TOTAL COST OF $32,600,000, ESCALATED BY APPLICABLE PRICE LEVEL INDICES TO 1 OCTOBER 1986 PRICE LEVELS, MODIFIED BY:

(1) ASA(CW) APPROVAL IN CONCEPT OF THE NON-FEDERAL APPLICATION FOR CREDIT UNDER SECTION 104 OF THE WRDA OF 1986;
(2) M-CACES COST ESTIMATE AT 1 OCTOBER 1991 PRICE LEVEL INCLUDED IN THE GENERAL DESIGN MEMORANDUM FOR GUADALUPE RIVER, CALIFORNIA, DATED DECEMBER 1991, APPROVED BY THE ASA(CW) 26 MARCH 1992, REVISED IN JUNE 1993;
(3) REVISED SECTION 104 REPORT DATED FEBRUARY 1992, APPROVED 24 MARCH 1992 BY CECW-PW WITH REVISED PAGES TRANSMITTED JANUARY 1993 AND SUBMITTED TO SPD FEBRUARY 1993;
(4) AWARD AND COMPLETION OF CONTRACTS TO DATE;
(5) CHANGE IN PRICE LEVEL, AND INFLATED FOR A FULLY FUNDED COST ESTIMATE:

(1 Cultural Resources Preservation costs associated with mitigation and/or data recovery up to one percent of the total Federal cost are not subject to cost sharing.
(2 Federal administrative costs for non-Federal land acquisition.
(3 Percentages used to Calculate Non-federal cash contribution are min. 25% of Combine Cost and 50% of Recreation Cost.
(4 The Fully Funded cost estimate was prepared in compliance with EC-11-2-177, published in March 1999
(5 Escalation Rate From 10/01/99 to 10/01/2000: Lands 2.70%; Constructions 2.70%; and FedLandAdmin, PED & CM 3.80%.

\7/ BASED ON STUDIES BY DISTRICT REAL ESTATE DIVISION.
\8/ USING ESCALATION FACTOR DEVELOPED BY OMB.
\9/ USING ESCALATION FACTOR DEVELOPED BY THE SACRAMENTO DISTRICT.

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	COD E	SUNK COST THRU 01-Oct-00	FIRST COST: PREVIOUS 1-Oct-99	FIRST COST: COST CHANGES		FIRST COST: CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	FULLY FUNDED: CHANGE IN INFLATION	FULLY FUNDED: CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST		DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)		(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
	FEDERAL															
1	LANDS AND DAMAGES, (2			5979	5912	0	218	6130	0	0	6130	5919	9	6146	0	6146
	Misc. Federal cost		3	5979	5912	0	218	6130	0	0	6130	5919	9	6146	0	6146
	Federal Cost, Pre-FY2000		3	298	211	0	87	298	0	0	298	218	-7	298	0	298
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			3	FY 1991		01-Oct-90	01-Oct-91	01-Apr-91	0.00	3				0	3	
			3	FY 1992		01-Oct-91	01-Oct-92	01-Apr-92	0.00	4				0	4	
			3	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	5				0	5	
			3	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	2				0	2	
			3	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	-2				0	-2	
			3	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	6				0	6	
			3	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	1				0	1	
			3	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	4				0	4	
			3	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	275				0	275	
	Federal Cost, FY2000 and Beyond		3	-20	0	0	131	131	0	0	131	0	16	147	0	147
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	-20				0	-20	
			3	FY 2003		01-Oct-2000	01-Oct-2005	02-Apr-2003	2.50	151				16	167	
	Section 104 Credit,		3	5701	5701	0	0	5701	0	0	5701	5701	0	5701	0	5701
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			3	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	2000				0	2000	
			3	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	3701				0	3701	
2	RELOCATIONS(RAILROAD, CONTRACT 3)		2	26	8875	0	186	6538	0	2523	9061	9035	516	7032	2705	9737
	Federal Cost		2	26	8875	0	186	6538	38.6	2523	9061	9035	516	7032	2705	9737
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	2				0	2	
			2	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	6				0	6	
			2	FY 1998		01-Oct-96	01-Oct-98	01-Apr-98	0.00	18				0	18	
			2	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	18				0	18	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	139				2	141	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	1667				81	1748	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	7229				593	7822	
6	FISH AND WILDLIFE FACILITIES		2	1718	8550	2	4492	13044	0	0	13044	8654	771	13919	0	13919
	CONTRACT 1 MITIGATION		2	291	330	0	-39	291	0	0	291	330	0	291	0	291
	PROPAGATION CONTRACT		2	4	4	0	0	4	0	0	4	4	0	4	0	4
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	2				0	2	
			2	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	2				0	2	
	PLANTING AND		2	287	326	0	-39	287	0	0	287	326	0	287	0	287
	ESTABLISHMENT		2	282	226	0	56	282	0	0	282	226	0	282	0	282
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	CODE	SUNK COST THRU 01-Oct-00 AMOUNT (4)($K)	PREVIOUS 1-Oct-99 COST EST (5)($K)	FIRST COST: COST CHANGES PRICE LEVEL (6)($K)	COST CHANGES OTHER (SEE NOTE) (7)($K)	CURRENT DIRECT COST (8)($K)	CURRENT CNTG RATE (9)(%)	CURRENT CONTIN-GENCY (10)($K)	CURRENT CST EST 5+6+7 (11)($K)	FULLY FUNDED PREVIOUS 1-Oct-99 EST (12)($K)	CHANGE IN INFLA-TION (13)($K)	FULLY FUNDED CURRENT DIRECT COST (14)($K)	FULLY FUNDED CURRENT CONTIN-GENCY (15)($K)	FULLY FUNDED CURRENT COST EST 12+6+7+13 (16)($K)
(1)	(2)		(3)													
			2	FY 1992		01-Oct-91	01-Oct-92	01-Apr-92	0.00	9				0	9	
			2	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	3				0	3	
			2	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	-9				0	-9	
			2	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	141				0	141	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	4				0	4	
			2	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	20				0	20	
			2	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	114				0	114	
	REPAIR FLOOD DAMAGES		2	5	100	0	-95	5	0	0	5	100	0	5	0	5
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	(45)				0	-45	
			2	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	50				0	50	
	CONTRACT 2 MITIGATION		2	743	1349	0	-391	958	0	0	958	1376	-21	964	0	964
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	47				0	47	
			2	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	31				0	31	
			2	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	371				0	371	
			2	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	294				0	294	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	123				2	125	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	92				4	96	
	CONTRACT 1&2 SRA Mitigation(infill)		2	583	0	0	583	583	0	0	583	0	0	583	0	583
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	9				0	9	
			2	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	414				0	414	
			2	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	160				0	160	
	SRA CONTRACT 3 MITIGATION		2	0	6735	0	-6004	731	0	0	731	6812	-39	769	0	769
	3A		2	0	3474	0	-3097	377	0	0	377	3513	-18	398	0	398
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	21				0	21	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	251				12	263	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	105				9	114	
	3B		2	0	3169	0	-2825	344	0	0	344	3206	-20	361	0	361
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	57				1	58	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	229				11	240	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	58				5	63	
	3C		2	0	92	0	-82	10	0	0	10	93	-1	10	0	10
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	5				0	5	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	5				0	5	
	SRA CONTRACT 4 MITIGATION		2	0	0	0	3008	3008	0	0	3008	0	329	3337	0	3337

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	CODE	SUNK COST THRU 01-Oct-00	FIRST COST: PREVIOUS 1-Oct-99	FIRST COST: COST CHANGES		FIRST COST: CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	FULLY FUNDED: CHANGE IN	FULLY FUNDED: CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST	INFLA-TION	DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)		(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	1840				151	1991	
			2	FY 2004		01-Oct-2003	01-Oct-2004	01-Apr-2004	3.50	389				45	434	
			2	FY 2005		01-Oct-2004	01-Oct-2005	01-Apr-2005	4.50	389				59	448	
			2	FY 2006		01-Oct-2005	01-Oct-2006	01-Apr-2006	5.50	390				74	464	
	SRA CONTRACT 5 MITIGATION		2	0	0	0	1610	1610	0	0	1610	0	89	1699	0	1699
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	661				11	672	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	316				15	331	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	316				26	342	
			2	FY 2004		01-Oct-2003	01-Oct-2004	01-Apr-2004	3.50	317				37	354	
	SRA CONTRACT 6 MITIGATION		2	0	0	0	1159	1159	0	0	1159	0	70	1229	0	1229
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	384				6	390	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	258				13	271	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	258				21	279	
			2	FY 2004		01-Oct-2003	01-Oct-2004	01-Apr-2004	3.50	259				30	289	
	Reach A SRA Mitigation (offsite/pilot sites)		2	0	0	0	77	77	0	0	77	0	1	78	0	78
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	77				1	78	
	USFWS EFFORT		2	101	136	2	398	536	0	0	536	136	7	543	0	543
	CURRENT OBLIGATION		2	101	59	0	42	101	0	0	101	80	-21	101	0	101
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	18				0	18	
			2	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	42				0	42	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	-3				0	-3	
			2	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	3				0	3	
			2	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	9				0	9	
			2	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	7				0	7	
			2	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	76				0	76	
			2	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	-51				0	-51	
	FUTURE		2	0	77	2	356	435	0	0	435	56	28	442	0	442
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	435				7	442	
	Section 215 Credit,		2	0	0	0	4091	4091	0	0	4091	0	335	4426	0	4426
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	4091				335	4426	
9	CHANNELS AND CANALS		2	8568	28560	537	32647	58456	0	3288	61744	28781	3287	61781	3491	65252
	CONTRACT 1		2	1478	2245	21	-788	1478	0	0	1478	2245	0	1478	0	1478

PROJECT: Guadalupe River, LPP PLAN
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PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
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CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	CODE	SUNK COST THRU 01-Oct-00	FIRST COST: PREVIOUS 1-Oct-99	FIRST COST: COST CHANGES		FIRST COST: CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	FULLY FUNDED: CHANGE IN	FULLY FUNDED: CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST	INFLA-TION	DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)		(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
			2	Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1992		01-Oct-91	01-Oct-92	01-Apr-92	0.00	40				0	40	
			2	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	2460				0	2460	
			2	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	898				0	898	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	-1783				0	-1783	
			2	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	-115				0	-115	
			2	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	-22				0	-22	
	CONTRACT 2		2	4773	6197	0	-1424	4591	0	182	4773	6197	0	4591	182	4773
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	1541				0	1541	
			2	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	2198				0	2198	
			2	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	261				0	261	
			2	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	180				0	180	
			2	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	493				0	493	
			2	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	100				0	100	
	CONTRACT 3		2	1775	19105	516	35330	51845	6.2	3106	54951	19309	3304	55150	3309	58459
	CONTRACT 3A (31.54%)		2	0	6025	163	27933	32129	6.2	1992	34121	6090	2355	34408	2133	36541
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	1896				30	1926	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	15247				739	15986	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	9478				777	10255	
			2	FY 2004		01-Oct-2003	01-Oct-2004	01-Apr-2004	3.50	7500				874	8374	
	CONTRACT 3B (47.91%)		2	0	9154	247	1200	9962	6.2	619	10601	9264	483	10540	654	11194
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	589				9	598	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	7067				343	7410	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	2945				241	3186	
	CONTRACT 3C (20.55%)		2	1775	3926	106	6197	9734		495	10229	3955	466	10202	522	10724
	Phase 1		2	1775	3926	106	-2277	1755	0	0	1755	3955	-9	1775	0	1775
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	1775				0	1775	
	Phase 2		2	0	0	0	8474	7979	6.2	495	8474	0	475	8427	522	8949
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	471				8	479	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	5649				274	5923	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	2354				193	2547	
	DEMO AND SALVAGE CONTRACT		2	542	1013	0	-471	542	0	0	542	1030	-17	542	0	542
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	542				0	542	
14	RECREATIONS		2	407	632	0	287	872	0	47	919	633	25	900	45	945

4

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	CODE	SUNK COST THRU 01-Oct-00	PREVIOUS 1-Oct-99	FIRST COST: COST CHANGES		FIRST COST: CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	FULLY FUNDED: CHANGE IN INFLATION	FULLY FUNDED: CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST		DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)		(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
	CONTRACT 1		2	90	181	0	-91	90	0	0	90	181	0	90	0	90
	Expenditure Allocations					Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
	FY 1993		2			01-Oct-92	01-Oct-93	01-Apr-93	0.00	250				0	250	
	FY 1994		2			01-Oct-93	01-Oct-94	01-Apr-94	0.00	50				0	50	
	FY 1995		2			01-Oct-94	01-Oct-95	01-Apr-95	0.00	-217				0	-217	
	FY 1997		2			01-Oct-96	01-Oct-97	01-Apr-97	0.00	7				0	7	
	CONTRACT 2		2	163	451	0	-288	159	2.7	4	163	452	-1	163	0	163
	Expenditure Allocations					Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
	FY 1995		2			01-Oct-94	01-Oct-95	01-Apr-95	0.00	38				0	38	
	FY 1996		2			01-Oct-95	01-Oct-96	01-Apr-96	0.00	58				0	58	
	FY 1997		2			01-Oct-96	01-Oct-97	01-Apr-97	0.00	72				0	72	
	FY 1998		2			01-Oct-97	01-Oct-98	01-Apr-98	0.00	7				0	7	
	FY 2000		2			01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	-12				0	-12	
	CONTRACT 3		2	154	0	0	666	623	0	43	666	0	26	647	45	692
	A		2	0	0	0	225	206	9.2	19	225	0	12	217	20	237
	Expenditure Allocations					Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
	FY 2001		2			01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	13				0	13	
	FY 2002		2			01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	150				7	157	
	FY 2003		2			01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	62				5	67	
	B		2	0	0	0	206	189	9.2	17	206	0	11	199	18	217
	Expenditure Allocations					Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
	FY 2001		2			01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	34				1	35	
	FY 2002		2			01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	137				7	144	
	FY 2003		2			01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	35				3	38	
	C Phase 1		2	154	0	0	154	154	0	0	154	0	0	154	0	154
	Expenditure Allocations					Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
	FY 2000		2			01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	154				0	154	
	C Phase 2		2	0	0	0	81	74	9.2	7	81	0	3	77	7	84
	Expenditure Allocations					Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
	FY 2001		2			01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	40				1	41	
	FY 2002		2			01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	41				2	43	
15	FLOOD CONTROL AND DIVERSION		2	0	10998	297	-5929	4997		369	5366	11300	-66	5216	386	5602
	Contract 3B		2	0	0	0	195	182	7.4	13	195	0	10	191	14	205
	Expenditure Allocations					Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
	FY 2001		2			01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	32				1	33	
	FY 2002		2			01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	130				6	136	
	FY 2003		2			01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	33				3	36	
	Contract 3 A/B Bypass		2	0	0	0	2489	2318	7.4	171	2489	0	140	2448	181	2629

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO. (1)	FEATURE/SUBFEATURE (2)	NOTES (3)	C O D E	SUNK COST THRU 01-Oct-00 AMOUNT (4)($K)	FIRST COST: PREVIOUS 1-Oct-99 COST EST (5)($K)	COST CHANGES: PRICE LEVEL (6)($K)	COST CHANGES: OTHER (SEE NOTE) (7)($K)	CURRENT: DIRECT COST (8)($K)	CURRENT: CNTG RATE (9)(%)	CURRENT: CONTIN-GENCY (10)($K)	CURRENT: CST EST 5+6+7 (11)($K)	FULLY FUNDED: PREVIOUS 1-Oct-99 EST (12)($K)	FULLY FUNDED: CHANGE IN INFLA-TION (13)($K)	FULLY FUNDED: CURRENT DIRECT COST (14)($K)	FULLY FUNDED: CURRENT CONTIN-GENCY (15)($K)	FULLY FUNDED: CURRENT COST EST 12+8+7+13 (16)($K)
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	138				2	140	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	1660				81	1741	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	691				57	748	
	STRUCTURES (CONTRACT 3C)		2	0	10998	297	-8613	2497	7.4	185	2682	11300	-216	2577	191	2768
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	1341				21	1362	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	1341				65	1406	
18	CULTURAL RESOURCES PRESERV. CONTRACT 2			324	775	4	-135	608	0	36	644	775	7	633	18	651
			2	0	50	0	-20	30	0	0	30	50	0	30	0	30
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	30				0	30	
	CONTRACT 3 RIVER STREET MITIGATION		2	324	725	4	-115	578	0	36	614	725	7	603	18	621
			2	200	267	2	131	364	10	36	400	263	7	385	18	403
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	100				0	100	
			2	FY 1998		31-Jan-98	01-Oct-98	01-Jun-98	0.00	100				0	100	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	200				3	203	
	HISTORIC & PREHIST. ARCH. MIT.		2	42	319	0	-277	42	0	0	42	323	-4	42	0	42
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	42				0	42	
	PHOTO DOCUMENTATION		2	68	69	0	-1	68	0	0	68	69	0	68	0	68
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	53				0	53	
			2	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	15				0	15	
	OTHER		2	14	70	2	32	104	0	0	104	70	4	108	0	108
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	5				0	5	
			2	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	9				0	9	
			2	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	43				1	44	
			2	FY 2002		01-Oct-2001	01-Oct-2002	01-Apr-2002	1.50	35				2	37	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	12				1	13	
30	PLANNING/ENGINEERING/DESIGN CONSTRUCTION, Pre-FY2000			24251	23646	0	8319	31960		5	31965	23729	845	32890	3	32893
			3	18062	17801	0	261	18062	9.1	0	18062	17863	-62	18062	0	18062
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			3	FY 1986		01-Oct-85	01-Oct-86	01-Apr-86	0.00	17				0	17	
			3	FY 1987		01-Oct-86	01-Oct-87	01-Apr-87	0.00	435				0	435	
			3	FY 1988		01-Oct-87	01-Oct-88	01-Apr-88	0.00	822				0	822	

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO. (1)	FEATURE/SUBFEATURE (2)	NOTES	CODE (3)	SUNK COST THRU 01-Oct-00 AMOUNT (4)($K)	PREVIOUS 1-Oct-99 COST EST (5)($K)	FIRST COST: COST CHANGES PRICE LEVEL (6)($K)	COST CHANGES OTHER (SEE NOTE) (7)($K)	CURRENT DIRECT COST (8)($K)	CURRENT CNTG RATE (9)(%)	CURRENT CONTIN-GENCY (10)($K)	CURRENT CST EST 5+6+7 (11)($K)	FULLY FUNDED PREVIOUS 1-Oct-99 EST (12)($K)	CHANGE IN INFLA-TION (13)($K)	CURRENT DIRECT COST (14)($K)	CURRENT CONTIN-GENCY (15)($K)	CURRENT COST EST 12+6+7+13 (16)($K)
			3	FY 1989		01-Oct-88	01-Oct-89	01-Apr-89	0.00	717				0	717	
			3	FY 1990		01-Oct-89	01-Oct-90	01-Apr-90	0.00	877				0	877	
			3	FY 1991		01-Oct-90	01-Oct-91	01-Apr-91	0.00	1134				0	1134	
			3	FY 1992		01-Oct-91	01-Oct-92	01-Apr-92	0.00	1825				0	1825	
			3	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	1051				0	1051	
			3	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	2556				0	2556	
			3	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	662				0	662	
			3	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	1309				0	1309	
			3	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	2033				0	2033	
			3	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	1967				0	1967	
			3	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	2472				0	2472	
	CN2		3	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	13				0	13	
	CN3C		3	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	144				0	144	
	GRR		3	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	28				0	28	
	CONSTRUCTION, FY2000 and Beyond		3	5594	5594	0	7495	13089	0	0	13089	5614	883	13992	0	13992
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	1597				0	1597	
	CN2		3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	50				0	50	
	CN3		3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	455				0	455	
	CN3AB		3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	770				0	770	
	CN3C		3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	24				0	24	
	GRR		3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	2698				0	2698	
			3	FY 2003		01-Oct-2000	01-Oct-2006	01-Oct-2003	3.00	7495				903	8398	
	RECREATION		3	27	251	0	-193	53	9.4	5	58	252	0	56	3	59
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
	Contract 1		3	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	7				0	7	
	Contract 2		3	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	2				0	2	
			3	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	12				0	12	
	Contract 3ABC		3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	6				0	6	
			3	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	31				1	32	
	FISH & WILDLIFE MITIGATION		3	568	0	0	756	756	9.4	0	756	0	24	780	0	780
	Pre-FY2000		3	518	0	0	518	518	0	0	518	0	0	518	0	518
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			3	FY 1992		01-Oct-91	01-Oct-92	01-Apr-92	0.00	30				0	30	
			3	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	104				0	104	
			3	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	67				0	67	
			3	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	224				0	224	
			3	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	33				0	33	
			3	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	60				0	60	
	FY2000 and Beyond		3	50	0	0	238	238	0	0	238	0	24	262	0	262
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	50				0	50	
			3	FY 2003		01-Oct-2000	01-Oct-2006	01-Oct-2003	3.00	188				24	212	
31	CONSTRUCTION MANAGEMENT			1070	6352	201	-157	5851		545	6396	6374	643	6464	597	7061

PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

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PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO. (1)	FEATURE/SUBFEATURE (2)	NOTES	COD E (3)	SUNK COST THRU 01-Oct-00 AMOUNT (4)($K)	FIRST COST PREVIOUS 1-Oct-99 COST EST (5)($K)	COST CHANGES PRICE LEVEL (6)($K)	COST CHANGES OTHER (SEE NOTE) (7)($K)	CURRENT DIRECT COST (8)($K)	CURRENT CNTG RATE (9)(%)	CURRENT CONTIN-GENCY (10)($K)	CURRENT CST EST 5+6+7 (11)($K)	FULLY FUNDED PREVIOUS 1-Oct-99 EST (12)($K)	FULLY FUNDED CHANGE IN INFLA-TION (13)($K)	FULLY FUNDED CURRENT DIRECT COST (14)($K)	FULLY FUNDED CURRENT CONTIN-GENCY (15)($K)	FULLY FUNDED CURRENT COST EST 12+6+7+13 (16)($K)
	CONSTRUCTION, Pre-FY2000		3	925	925	0	0	925	0	0	925	925	0	925	0	925
	Contract 1			Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			3	FY 1992		01-Oct-91	01-Oct-92	01-Apr-92	0.00	-2				0	-2	
			3	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	266				0	266	
			3	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	295				0	295	
			3	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	-252				0	-252	
	Contract 2		3	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	0				0	0	
			3	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	173				0	173	
			3	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	92				0	92	
			3	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	73				0	73	
			3	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	54				0	54	
			3	FY 1999		01-Oct-98	01-Oct-99	01-Apr-99	0.00	226				0	226	
	CONSTRUCTION, FY2000 and Beyond		3	117	5183	193	0	4839	11.1	537	5376	5204	637	5443	591	6034
	GRR			Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
	Mitigation		3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	12				0	12	
			3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	28				0	28	
	Contract 3		3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	-33				0	-33	
			3	FY 2000		01-Oct-99	01-Oct-2000	01-Apr-2000	0.00	110				0	110	
			3	FY 2003		01-Oct-2000	01-Oct-2006	01-Oct-2003	3.00	5259				658	5917	
	RECREATION		3	28	244	8	-157	87	9.5	8	95	245	6	96	6	102
	Contract 1			Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			3	FY 1993		01-Oct-92	01-Oct-93	01-Apr-93	0.00	7				0	7	
			3	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	6				0	6	
			3	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	-2				0	-2	
			3	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	-2				0	-2	
	Contract 2		3	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	2				0	2	
			3	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	2				0	2	
			3	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	15				0	15	
			2	FY 2003		01-Oct-2000	01-Oct-2006	01-Oct-2003	3.00	67				7	74	
	TOTAL COST (FEDERAL FUNDS & NON-FEDERAL CASH CONTRIBUTION)			42343	94300	1041	39928	128456		6813	135269	95200	6037	134961	7245	142206
	NON-FEDERAL CASH CONTRIBUTION	3		9406	12308	93	598	12589		410	12999	14817	-2002	13080	426	13506
	SUBTOTAL			32937	81992	948	39330	115867		6403	122270	85659	8039	121881	6819	128700
	FEDERAL REIMBURSEMENT			3150	6896	0	-6896	0		0	0	5256	1640	0	0	0
	TOTAL FEDERAL COST			36087	88888	948	32434	115867		6403	122270	90915	9679	121881	6819	128700
	NON-FEDERAL COST															
1	LANDS AND DAMAGES			1143	37477	0	-13938	23539	0	0	23539	37477	1481	25020	0	25020
	CONSTRUCTION		1	1143	37477	0	-13938	23539	0	0	23539	37477	1481	25020	0	25020
	CONTRACT 1		1	1588	2880	0	-1292	1588	0	0	1588	2880	0	1588	0	1588
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	

PROJECT: Guadalupe River, LPP PLAN
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PROJECT COST ESTIMATE(PCE)

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CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	C O D E	SUNK COST THRU 01-Oct-00	PREVIOUS 1-Oct-99	FIRST COST: COST CHANGES		FIRST COST: CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	FULLY FUNDED: CHANGE IN INFLATION	FULLY FUNDED: CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST		DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)		(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
			1	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	1588				0	1588	
	CONTRACT 2		1	1498	16680	0	-15182	1498	0	0	1498	16680	0	1498	0	1498
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			1	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	818				0	818	
			1	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	680				0	680	
	CONTRACT 3		1	3336	23203	0	-2861	20342	9.9	0	20342	23203	1395	21737	0	21737
	Pre-FY2000		1	3336	3336	0	0	3336	0	0	3336	3336	0	3336	0	3336
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			1	FY 1996		01-Oct-93	01-Oct-99	30-Sep-96	0.00	3336				0	3336	
	FY2000 and Beyond		1	0	19867	0	-2861	17006	0	0	17006	19867	1395	18401	0	18401
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			1	FY 2003		01-Oct-2000	01-Oct-2005	02-Apr-2003	2.50	17006				1395	18401	
	SRA, MITIGATION		1	20	13	0	5397	5410	0	0	5410	13	86	5496	0	5496
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			1	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	20				0	20	
			1	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	5390				86	5476	
	SECTION 104 CREDIT, TRAN TO FED		1	-5701	-5701	0	0	-5701	0	0	-5701	-5701	0	-5701	0	-5701
									Sum/Exp.---->	(5,701)						
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			1	FY 2001		01-Oct-2000	01-Oct-2001	01-Apr-2001	0.50	(5,701)				(91)	-5792	
	LANDS, EASEMENTS, RIGHTS OF-WAY, RELOCATIONS, AND DREDGED MAT'AL DISPOSAL AREAS(SECTION 104 EXTERNAL WORK CREDIT)		1	402	402	0	0	402	0	0	402	402	0	402	0	402
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			1	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	402				0	402	
2	RELOCATIONS		2	18902	35974	540	3400	39914	0	0	39914	35974	1099	41013	0	41013
	ROADS, CONTRACT 1		2	3940	0	0	3940	3940	0	0	3940	0	0	3940	0	3940
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1994		01-Oct-93	01-Oct-94	01-Apr-94	0.00	3650				0	3650	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	290				0	290	
	ROADS, CONTRACT 2		2	2594	3650	0	-1056	2594	0	0	2594	3650	0	2594	0	2594
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1998		01-Oct-95	01-Oct-2000	01-Apr-98	0.00	2594				0	2594	
	CEMETERIES, UTILS AND STRUCTS RELOCATIONS WORK BY SPONSORS		2	12368	32324	540	516	33380	0	0	33380	32324	1099	34479	0	34479
			2	11131	28788	477	468	29733	0	0	29733	28788	902	30635	0	30635

PROJECT: Guadalupe River, LPP PLAN
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CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	COD E	SUNK COST THRU 01-Oct-00	FIRST COST: PREVIOUS 1-Oct-99	COST CHANGES		CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	CHANGE IN	CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST	INFLA-TION	DIRECT COST	CONTIN-GENCY	COST EST 12+8+7+13
(1)	(2)		(3)	(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
			2	Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	2258				0	2258	
			2	FY 1998		01-Oct-95	01-Oct-2000	01-Apr-98	0.00	8873				0	8873	
			2	FY 2002		01-Oct-2000	01-Oct-2003	01-Apr-2002	1.50	18602				902	19504	
	RELOCATIONS WORK INCLUDED IN CORPS CONSTRUCTION CONTRACTS		2	1237	3536	63	48	3647	0	0	3647	3536	197	3844	0	3844
	CONTRACT 1		2	857	809	0	48	857	0	0	857	809	0	857	0	857
			2	Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	857				0	857	
	CONTRACT 2		2	380	468	2	0	470	0	0	470	468	7	477	0	477
			2	Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	380				0	380	
			2	FY 2003		01-Oct-2000	01-Oct-2005	02-Apr-2003	2.50	90				7	97	
	CONTRACT 3		2	0	2259	61	0	2320	0	0	2320	2259	190	2510	0	2510
			2	Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2003		01-Oct-2000	01-Oct-2005	02-Apr-2003	2.50	2320				190	2510	
6	FISH AND WILDLIFE FACILITIES		2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Section 215		2	0	0	0	4091	4091	0	0	4091	0	335	4426	0	4426
			2	Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	4091				335	4426	
	Section 215, Credit, Transfer to Federal Cost		2	0	0	0	-4091	-4091	0	0	-4091	0	-335	-4426	0	-4426
			2	Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 2003		01-Oct-2002	01-Oct-2003	01-Apr-2003	2.50	-4091				-335	-4426	
9	CHANNELS		2	5299	5299	0	0	5299	0	0	5299	5299	0	5299	0	5299
	SECTIONS 104 INTEGRAL WORK CREDIT		2	485	485	0	0	485	0	0	485	485	0	485	0	485
			2	Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	485				0	485	
	SECTIONS 104 INTEGRAL WORK CREDIT		2	4814	4814	0	0	4814	0	0	4814	4814	0	4814	0	4814
			2	Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	4814				0	4814	
30	PLANNING/ENGINEERING/DESIGN		2	6129	10197	110	1486	11793	0	0	11793	10197	131	11924	0	11924
			2	Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	6129				0	6129	

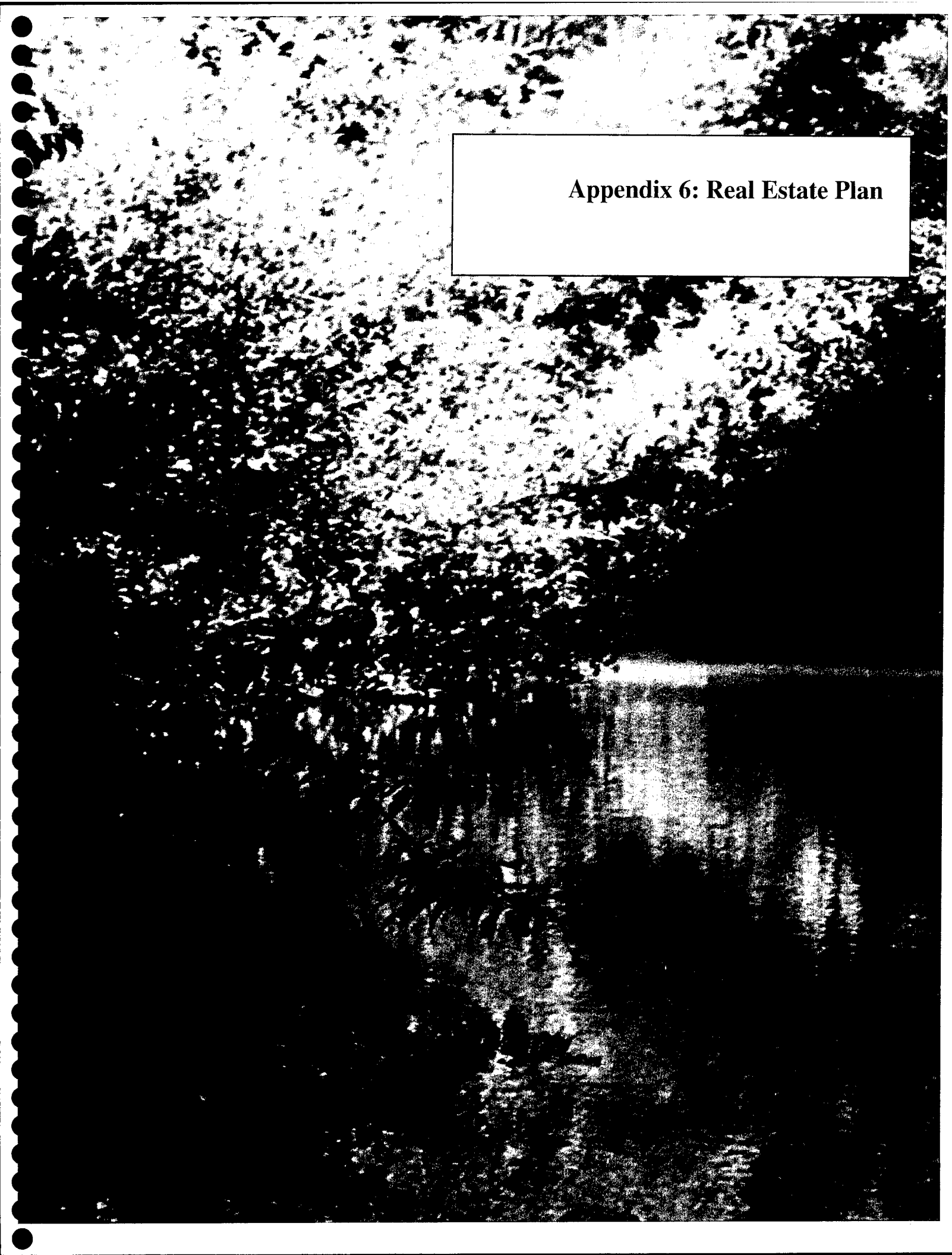
PROJECT: Guadalupe River, LPP PLAN
LOCATION: California
PROJECT COST ESTIMATE(PCE)

DATE PREPARED: 2-Feb-2001
PRICE LEVEL: 1-Oct-2000

CODE OF ACCT. NO.	FEATURE/SUBFEATURE	NOTES	COD E	SUNK COST THRU 01-Oct-00	PREVIOUS 1-Oct-99	FIRST COST: COST CHANGES		FIRST COST: CURRENT				FULLY FUNDED: PREVIOUS 1-Oct-99	FULLY FUNDED: CHANGE IN INFLATION	FULLY FUNDED: CURRENT		
				AMOUNT	COST EST	PRICE LEVEL	OTHER (SEE NOTE)	DIRECT COST	CNTG RATE	CONTIN-GENCY	CST EST 5+6+7	EST		DIRECT COST	CONTIN-GENCY	COST EST 12+6+7+13
(1)	(2)	(3)		(4)($K)	(5)($K)	(6)($K)	(7)($K)	(8)($K)	(9)(%)	(10)($K)	(11)($K)	(12)($K)	(13)($K)	(14)($K)	(15)($K)	(16)($K)
			2	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	4068				0	4068	
			2	FY 2003		01-Oct-2000	01-Oct-2005	02-Apr-2003	2.50	1596				131	1727	
31	CONSTRUCTION MANAGEMENT		2	1336	1353	0	643	1996	0	0	1996	1353	-658	1338	0	1338
	SPONSOR'S CM COST FOR RELOCATIONS WORK BY SPONSOR		2	1238	1253	0	643	1896	0	0	1896	1253	-658	1238	0	1238
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	409				0	409	
			2	FY 1996		01-Oct-95	01-Oct-96	01-Apr-96	0.00	200				0	200	
			2	FY 1997		01-Oct-96	01-Oct-97	01-Apr-97	0.00	8				0	8	
			2	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	301				0	301	
			2	FY 1998		01-Oct-97	01-Oct-98	01-Apr-98	0.00	320				0	320	
			2	FY 2003		01-Oct-2000	01-Oct-2005	02-Apr-2003	2.50	658				54	712	
	SPONSOR'S SHARE OF S&I FOR SPONSOR RELOCATIONS WORK INCLUDED IN CORPS CONSTRUCTION CONTRACTS		2	100	100	0	0	100	0	0	100	100	0	100	0	100
	CONTRACT 1		2	70	70	0	0	70	0	0	70	70	0	70	0	70
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	70				0	70	
	CONTRACT 2		2	30	30	0	0	30	0	0	30	30	0	30	0	30
				Expenditure Allocations		Start	End	Midpoint	Period(YRS)	Expend.				Inflat. Amt.	FullyFund	
			2	FY 1995		01-Oct-94	01-Oct-95	01-Apr-95	0.00	30				0	30	
	TOTAL NON-FEDERAL LERRD			32811	90300	650	-8409	82541			0	82541	90300	2053	84594	0	84594
	NON-FEDERAL CONTRIBUTION			9406	12308	93	598	12589			410	12999	14817	-2002	13080	426	13506
	NED Non-Federal Contribution			5905	7760	84	2821	10328			337	10665	8611	-391	10769	356	11125
	RECREATION			595	584	4	-32	506			30	536	930	-349	526	27	553
	Additional Cost Above NED			2906	3984	5	-2191	1755			43	1798	5276	-1262	1785	43	1828
	SUBTOTAL			42217	102608	743	-7811	95130			410	95540	105117	51	97674	426	98100
	NED, FEDERAL REIMBURSEMENT			3150	6896	0	-6896	0			0	0	5256	1640	0	0	0
	TOTAL NON-FEDERAL COST			39067	95712	743	-915	95130			410	95540	99861	-1589	97674	426	98100
	TOTAL			75154	184600	1691	31519	210997			6813	217810	185500	8090	219555	7245	226800

BASIS OF ESTIMATE:

(1 Cultural Resources Preservation costs associated with mitigation and/or data recovery up to one percent of the total Federal cost are not subject to cost sharing.
(2 Federal administrative costs for non-Federal land acquisition.
(3 Percentages used to Calculate Non-federal cash contribution are min. 25% of Combine Cost and 50% of Recreation Cost.
(4 The Fully Funded cost estimate was prepared in compliance with EC-11-2-177, published in March 1999
(5 Escalation Rate From 10/01/99 to 10/01/2000: Lands 2.70%; Constructions 2.70%; and FedLandAdmin, PED & CM 3.80%.



Appendix 6: Real Estate Plan

APPENDIX 6 – REAL ESTATE PLAN

Contents

6.1 Introduction
6.2 General Description of the Real Estate Requirements
6.3 Federal Lands
6.4 Partner Owned Lands
6.5 Public Law 91-646 Relocations
6.6 Facility/Utility Relocations and Removals
6.7 Partners Ability to Acquire
6.8 Maps
6.9 Minerals
6.10 Hazardous, Toxic, and Radioactive Waste (HTRW)
6.11 Attitude of Lands' Owners and Community
6.12 Baseline Cost Estimate
6.13 Acquisition Schedule
6.14 Assessment of Non-Federal Partner's Real Estate Capacity

Plates

6-1 Real Estate Mapping

Appendix 6 – Real Estate Plan

6.1 Introduction

This Real Estate Plan is prepared in accordance with ER 405-1-12, 12-16, Real Estate Plan and presents the Real Estate requirements for the Guadalupe River General Reevaluation Report (GRR). This GRR addresses the modifications to the Guadalupe River Flood Control Project (Authorized Project) in the downtown area of San Jose, California which was authorized by Section 401(b) of the Water Resources Development Act (WRDA) of 1986, (Public Law 99-662) dated November 17, 1986, as amended by the Energy and Water Development Appropriations Act for Fiscal Year 1990 (Public Law 101-101). The modifications to the authorized project are necessary because of concerns raised about the adequacy of the environmental mitigation for the entire authorized project during its initial phases. The revised project as described in the REP is, in essence, an incremental increase in these original LER requirements as described in GDM. As such, the LER requirements set forth in the REP address the new, or increased LER requirements that would be authorized per the approval of GRR. Assuming approval of GRR and execution of amended LCA, this incremental increase in LER values will be added to the previously approved LERRDs as put forth in the original GDM and codified with official RE requirements notification. Thus, for crediting purposes, approved LERRDs for GDM requirements will be added to these additional, approved LER requirements (described herein) that are required for this GRR modification. No additional facility/utility relocations are required.

6.2 General Description of the Real Estate Requirements

The Guadalupe River drainage basin lies immediately south of San Francisco Bay. The authorized project which was broken down into Contracts 1, 2 and 3, includes approximately 2.6 miles of channel improvements, mitigation sites and recreation trails for the portion of the Guadalupe River between Grant Street (just upstream of Interstate 280) and Interstate 880 adjacent to downtown San Jose. The GRR which effects Contract 3 of the authorized project, addresses the construction and operation of an underground bypass system, plus inlet and outlet structures, bank and invert armoring and stream channel-invert gradient control structures, low flow channel and mitigation measures. To reduce flooding, the bypass system will route flood water from the natural river channel into the underground conduits and discharge further downstream where there is greater channel capacity to pass flood waters. The system will have two different inlet and outlet locations. Inlets will be located on the Guadalupe River in the vicinity of the West Santa Clara Street Bridge and downstream of the confluence with Los Gatos Creek. The outlets will be located in the vicinity of the Coleman Street Bridge. This system will avoid or minimize impacts on riparian resources and Federally protected fish and wildlife species that would occur within said Contract 3 of the authorized project.

Real estate requirements for this GRR which have been broken down into Contracts 1, 2, 3A, 3B, Reach "A" and Guadalupe Creek consists of 41.79 acres needed for a channel

improvement easements, 0.89 acres needed for road easements, 67.83 acres needed for 3 year temporary construction easements and 11.38 acres for mitigation sites. The non-federal partner will be required to acquire from 8 private owners and 6 public ownership's, the aforementioned lands prior to construction. All of these lands are suitable for the project. The non-federal partner will acquire the minimal Corps of Engineers estate required. A non-standard estate, as described and approved in the GDM, will be utilized for all mitigation sites and recreation. The recreation easement area is delineated by those areas described and encumbered in GDM by road easement. A combined easement road and recreation easement will be utilized for these recreation trail elements.

6.3 Federal Lands

There are no lands subject to the application of navigational servitude.

6.4 Partner Owned Lands

The non-Federal partner holds fee title to 67.74 acres of the lands required for this GRR. All of these lands are suitable and available for this project. None of these lands have been previously provided as an item of local cooperation in a Federal project.

6.5 Public Law 91-646 Relocations

There are no Public Law 91-646 relocations associated with the additional effort described in this GRR.

6.6 Facility/Utility Relocations and Removals

The LER requirements set forth in the GRR address the new, or increased real estate requirements that would be authorized per the approval of GRR. Assuming approval of GRR and execution of amended LCA, this incremental increase will be added to the previously approved LERRDs as put forth in the GDM and codified with official RE requirements notification. No additional facility/utility relocations are required for new work as described in GRR.

Relocations as put forth in table 4H2 and 4H3 of GRR are the same as described in the original GDM. Utility relocations as described in 4H3 were active utility systems and were in the proposed project area as defined by both the GDM and GRR. Per standard preliminary attorney's opinion of compensability, those portions of the existing gas, storm drains, and electrical power utilities where the purveyor has fee title to the underlying land or has obtained title to any interest in real property may have a compensable right. The amount of compensation is the actual, reasonable cost of the relocation of the utilities or the in-place engineering fix. The existing gas, storm drains and electrical utilities where the purveyor did not obtain title to any interest in real property would not be considered to have a compensable interest. As such, the utility purveyor, at its own cost and expense, must remove, relocate, or reconstruct all or any part of the utility system affected by the flood control plans for the area in which they do not have any real property interest.

Crediting of any utility relocations will occur only on those found compensable upon final compensability analysis.

6.7 Partners Ability to Acquire

No change from Authorized Project.

6.8 Maps

See Plate 5-1 for real estate mapping.

6.9 Minerals

There are no mineral interests associated with this GRR.

6.10 Hazardous, Toxic and Radioactive Waste (HTRW)

The value estimate of property is predicated on the assumption that there is no HTRW material on or in the property that would cause a loss in value. Reference Appendix 5I.7 Known Waste Sites for additional information.

6.11 Attitude of Lands Owners and Community

No change from Authorized Project.

6.12 Baseline Cost Estimate

The following table (Table 6.12-1) shows the components of the baseline cost estimate, which is done at October 1999 price levels. The difference between State and Federal appraisal rules have been considered and are not expected to have any appreciable impact on the estimated real estate cost. All lands needed for this GRR regardless of ownership have been appraised at fair market value. Contingenciesthat have been added to the fair market value take into account unknown property splits, undetected improvements, minor project design changes and any additional costs involved in the application of PL 91-646. Two gross appraisals were done by a Sacramento District staff appraiser. The first appraisal, which covered Contracts 3A and 3B, was reviewed and approved by District, Division and Headquarters on January 13, 2000. Authority to approve the second appraisal which covered Contracts 1, 2,additional areas of contracts 3A and 3B, Reach A and Guadalupe Creek was delegated from Division to District. These values, would be added to the Original GDM, Recommended Plan, LERD values (Table 6.12-2). Here, "Permanent" equates to "Mitigation Easement", and "Roads & Channel" equate to Road Easement and Channel Improvement Easement.

TABLE 6.12-1
Baseline Cost Estimate

Contract Number	Estate	Area (acres)	Total LERRDS Cost	Admin. Costs Per Segment
1	Mitigation	0.26	$8	$15,492
2	Mitigation	0.38		
	Road Easement	0.48	$209	$22,391
3A	Temporary Construction	8.06		
	Channel Improvement	17.47		
	Road Easement	0.41	$6,564,896	$157,404
3B	Temporary Construction	3.33		
	Channel Improvement	24.31	$11,547,004	$177,696
Reach "A"	Mitigation	2.73		
	Temporary Construction	16.43	$1,491	$14,809
Guadalupe Creek	Mitigation	8.00		
	Temporary Construction	40.00	$3,659	$22,441
				Summary Costs
			Land Costs	**$18,117,267**
			Non-Federal Admin. Costs	**$259,233**
			Federal Admin. & Review Costs	**$151,000**
			Total	**$18,527,500**

Thus, in summary, per the approval of GRR and execution of amended LCA, this incremental increase in LER values (Table 6.12-1) will be added to the previously approved LERRDs as put forth in the original GDM (Table 6.12-2) and codified with official Real Estate requirements notification.

6.13 Acquisition Schedule

A detailed acquisition schedule is shown on Table 6.13-1. The non- Federal partner has reviewed and co-developed this schedule. The non-Federal partner will be directed to begin real property acquisitions for the project only after the PCA is fully executed. The non-Federal partner is aware of the risks of initiating the acquisition process in advance of the PCA being signed.

6.14 Assessment of Non-Federal Partner's Real Estate Capacity

6.14.1 Legal Authority:

a. Does the Partner have legal authority to acquire and hold title to real property for project purposes? **YES**

b. Does the partner have the power of eminent domain for this project? **YES**

c. Does the partner have "quick-take" authority for this project? **YES**

TABLE 6.12-2
Recommended Plan, Approved GDM LERRD Values

Contract Number	Estate	Area (acres)	Total LERRDS Cost
1	Permanent ROW	4.30	$1,873,080
	Temporary Construction Easement	0.46	20,038
	Roads & Channel Ease.	6.65	1,000
	Total		$1,894,118
2	Permanent ROW	28.00	$ 12,989,285
	Temporary Construction Easement	2.14	270,594
	Roads & Channel Ease.	28.00	2,800
	Total		$ 13,262,679
3	Permanent ROW	12.85	$ 22,762,496
	Temporary Construction Easement	1.21	459,993
	Roads & Channel Ease.	30.70	3,200
	Total		$ 23,225,689
CONTINGENCY (10%)			$ 3,837,000
PL 91-646 Relocations Contracts 1-3			$ 1,215,600
Total LERRDS			**$ 43,435,000**

d. Are any of the lands/interests inland required for the project located outside the partner's political boundary? **NO**

e. Are any of the lands/interests in land required for the project owned by an entity whose property the partner cannot condemn? **NO**

6.14.2 Human Resource Requirements:

a. Will the partner's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? **NO**

b. If the answer to 6.14.2.a. is "yes," has a reasonable plan been developed to provide such training?

c. Does the partner's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? **YES**

d. Is the partner's in-house staffing level sufficient considering its other workload, if any, and the project schedule? **YES**

e. Can the partner obtain contractor support, if required, in timely fashion? **YES**

f. Will the partner likely request USACE assistance in acquiring real estate? **NO**

TABLE 6.13-1
Acquisition Schedule

Task	Corps Start	Corps Finish	SCVWD Start	SCVWD Finish
Receipt of final drawings from Engineering				
Execution of PCA		7-6-00		
Formal transmittal of final ROW drawings and instruction to acquire LERRDS	1-17-01	1-17-01		
Conduct landowner meetings			9-2-99	1-31-00
Prepare/review mapping and legal descriptions			2-1-00	4-14-00
Obtain/review title evidence			2-1-00	4-14-00
Obtain/review tract appraisals			4-14-00	8-1-00
Conduct negotiations			8-2-00	12-1-00
Perform closing			12-1-00	1-31-01
Prepare/review condemnations			N/A	
Obtain possession			N/A	
Complete/review PL 91-646 benefit assistance			N/A	
Conduct/review facility and utility relocations			N/A	
Certify all necessary LERRDS are available for construction	5-01-01	5-01-01	4-27-01	4-30-01
Prepare and submit credit requests			7-2-01	9-3-01
Review/approve or deny credit requests	9-4-01	11-5-01		
Establish value for creditable LERRDS in F&A cost accounting system	11-6-01	12-6-01		

6.14.3 Other Project Variables:

a. Will the partner's staff office be located within reasonable proximity to the project site? **YES**

b. Has the partner approved the project real estate schedule/milestones? **YES**

6.14.4 Overall Assessment:

a. Has the partner performed satisfactorily on other USACE projects? **YES**

b. With regard to this project, the partner is anticipated to be: **Santa Clara Valley Water District**

6.14.5 Coordination:

a. Has this assessment been coordinated with the partner? **YES**

b. Does the Partner concur with this assessment? **YES**

Prepared by:

Dan Fodrini
Realty Specialist
Acquisition Branch
Date: March 30, 2000

Reviewed and Approved by:

Marvin D. Fisher
Chief, Real Estate Division
Date: March 30, 2000

APPENDIX 6 – REAL ESTATE PLAN

Plates

6-1 Real Estate Mapping

Guadalupe GRR
Contract 3A & 3B

TEMPORARY WORK AREA EASEMENT

CHANNEL IMPROVEMENT EASEMENT

MITIGATION EASEMENT

ROAD EASEMENT

500 0 500 Ft..

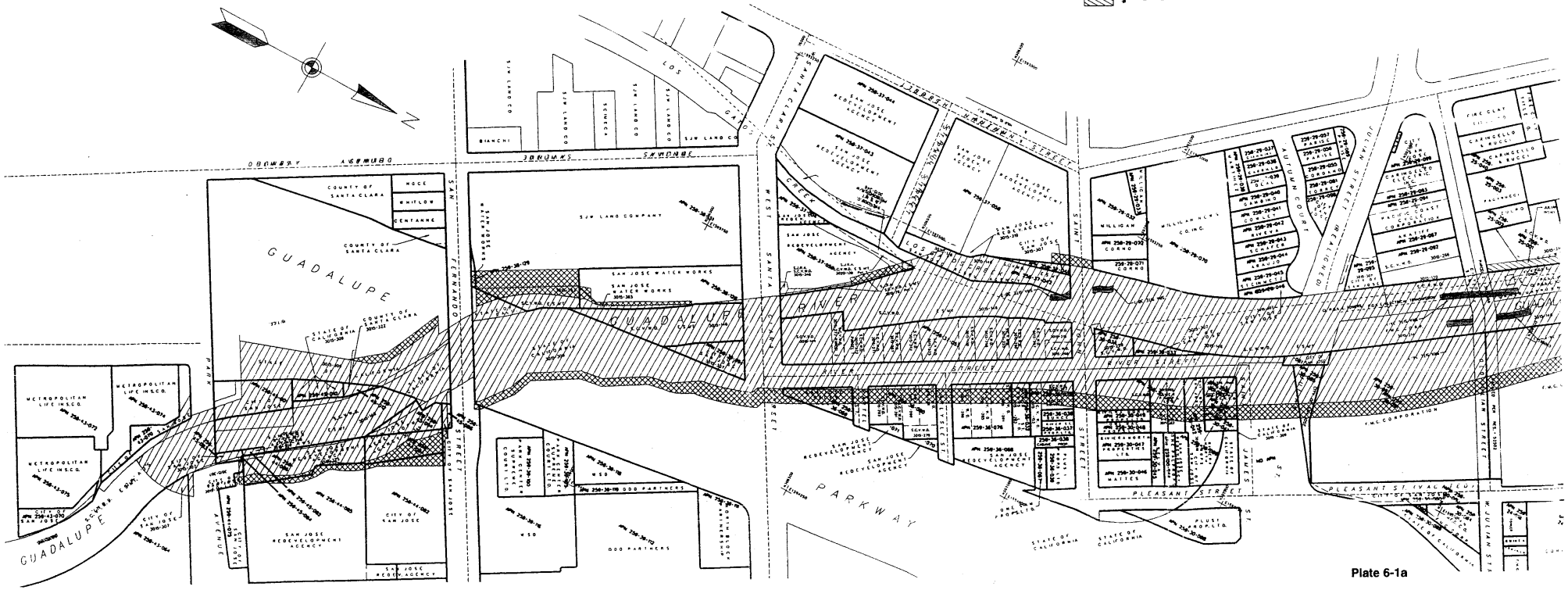


Plate 6-1a

Guadalupe GRR
Contract 3A & 3B

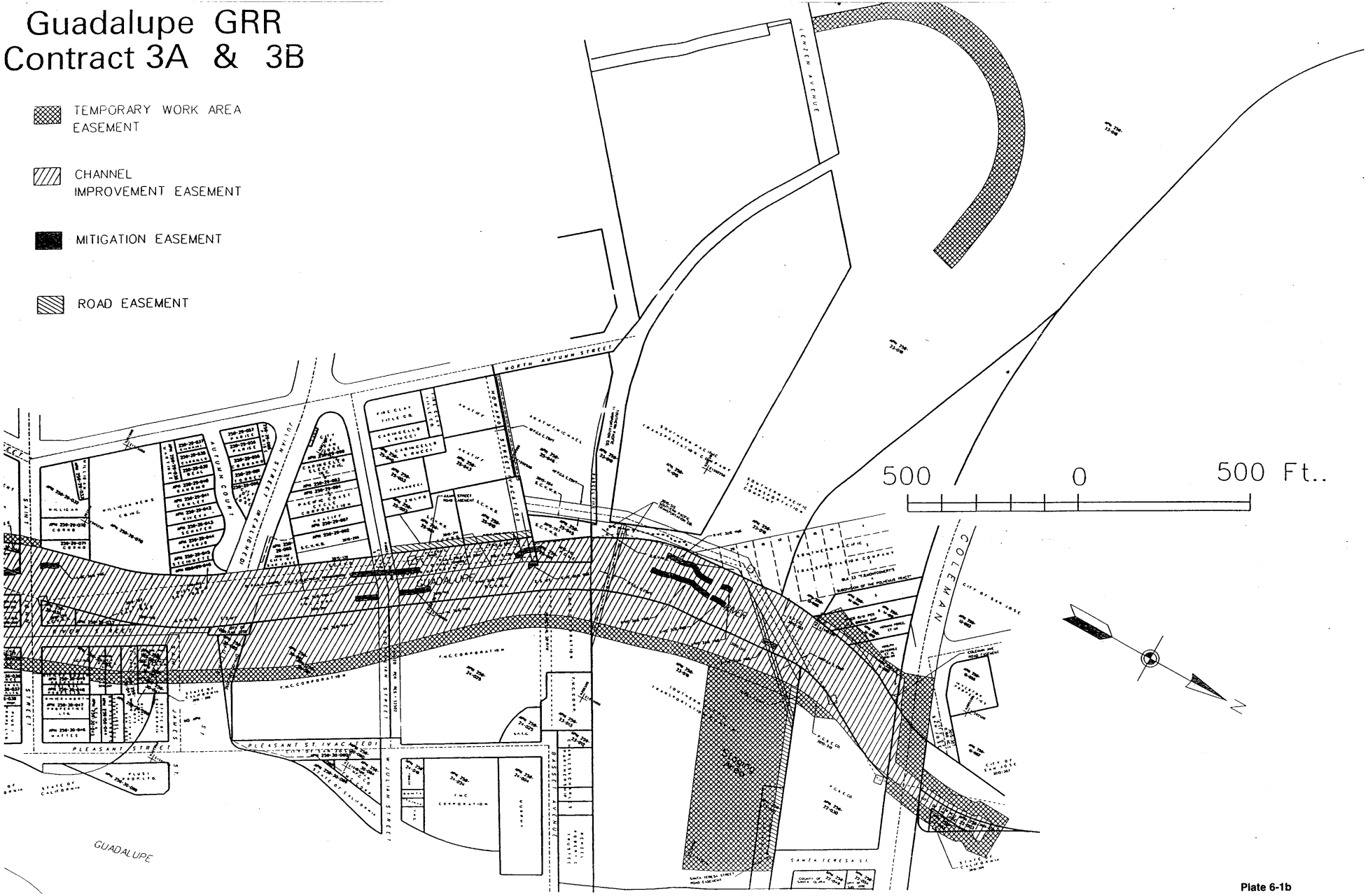


Plate 6-1b

Guadalupe River GRR – Mitigation
Downtown – Contract 1

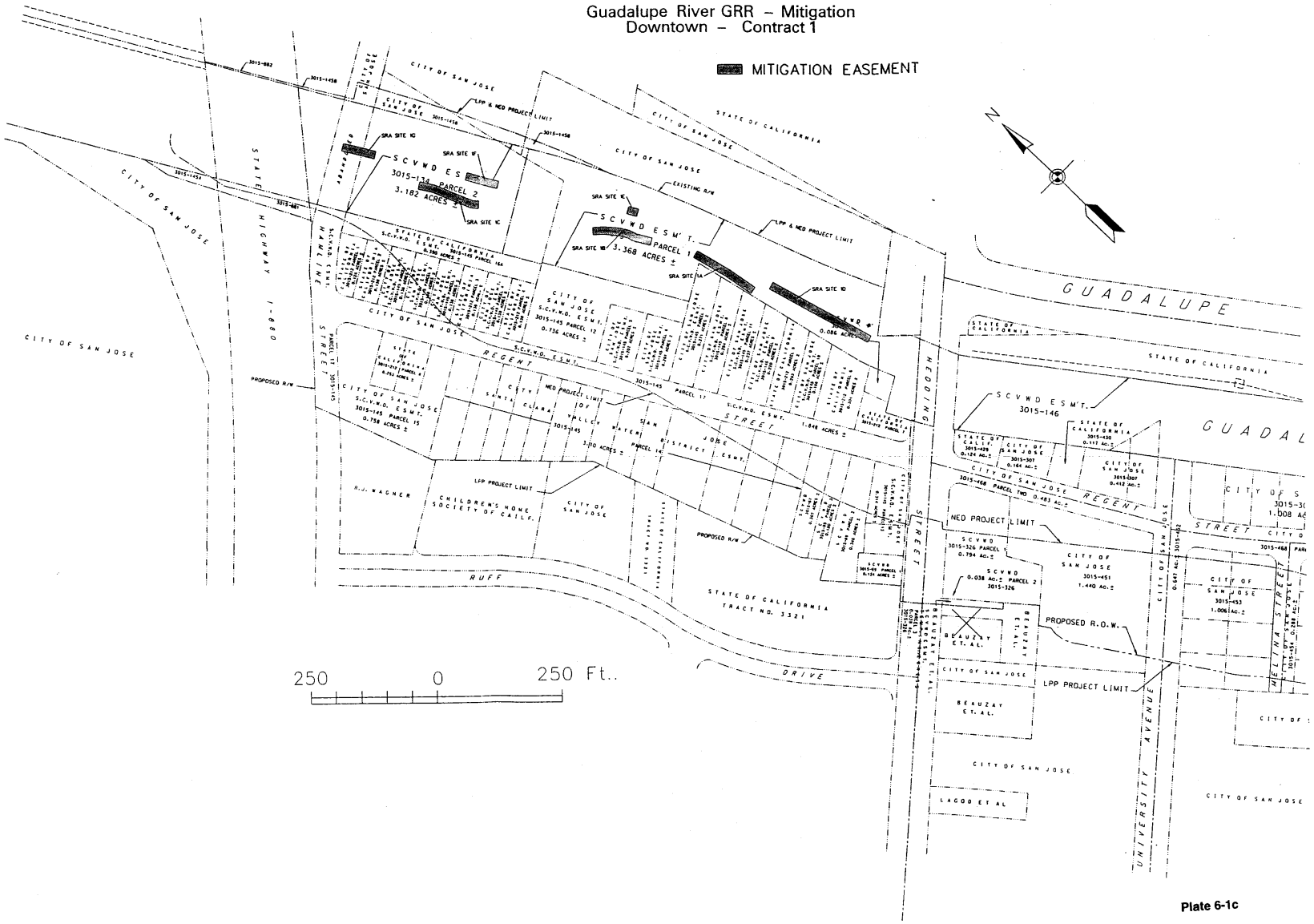


Plate 6-1c

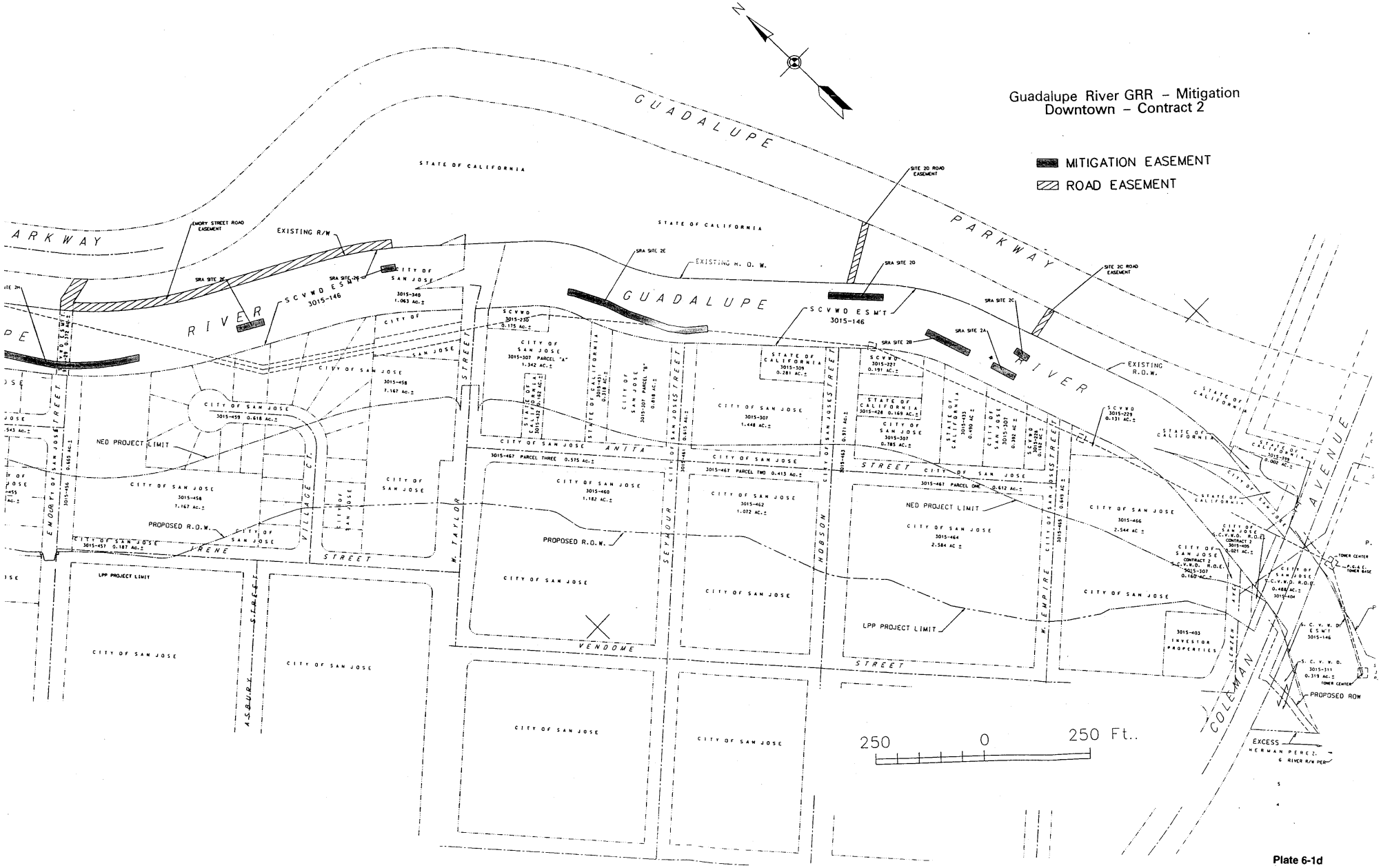
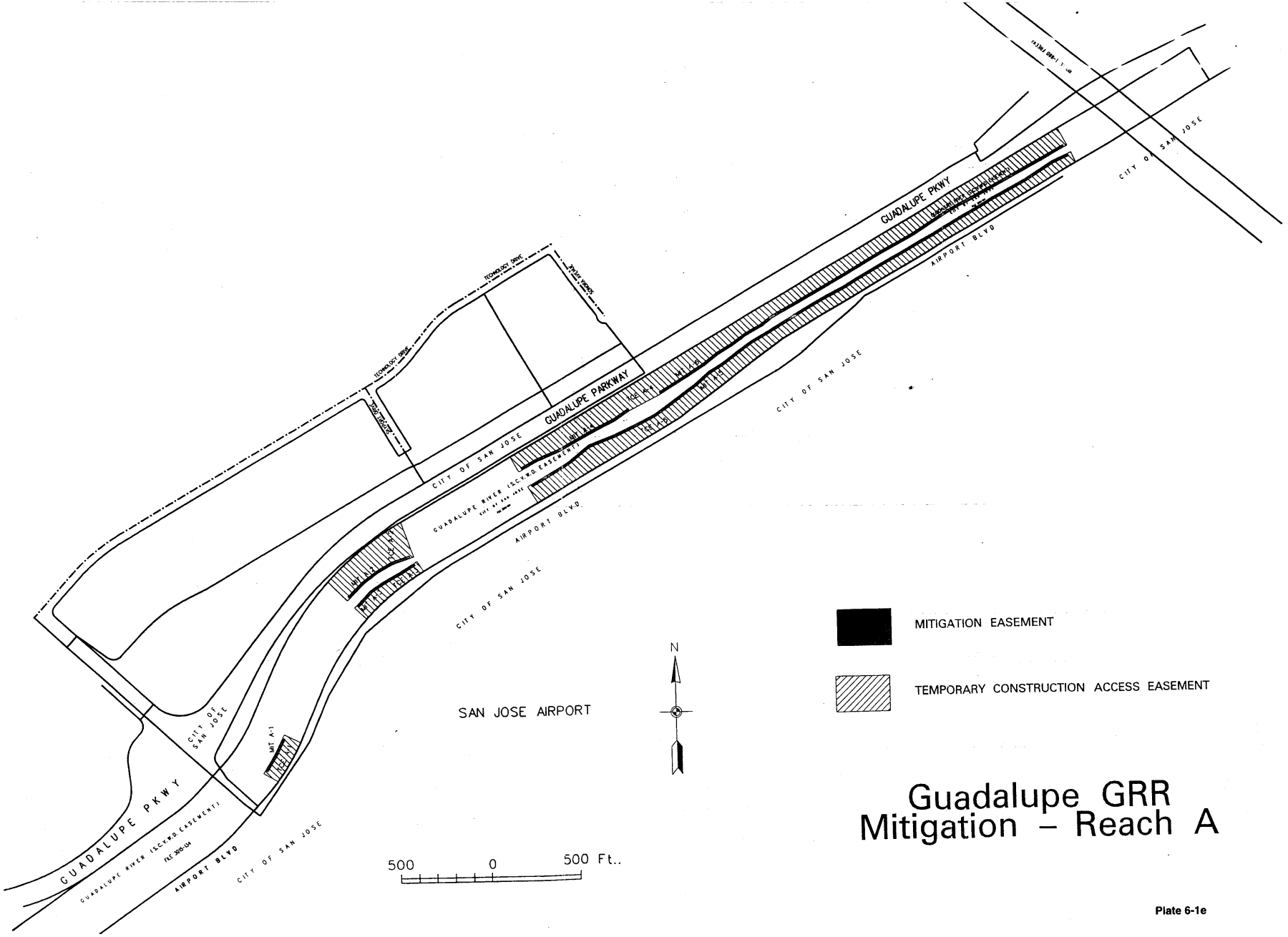
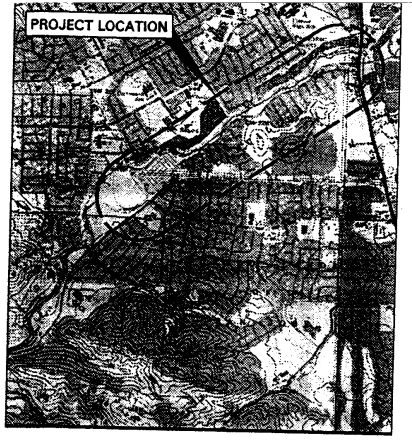

Guadalupe River GRR – Mitigation
Downtown – Contract 2
MITIGATION EASEMENT
ROAD EASEMENT
N
GUADALUPE PARKWAY
GUADALUPE RIVER
STATE OF CALIFORNIA
EXISTING R/W
EXISTING R. O. W.
EXISTING R.O.W.
SITE 2D ROAD EASEMENT
SITE 2C ROAD EASEMENT
EMORY STREET ROAD EASEMENT
SRA SITE 2C
SRA SITE 2D
SRA SITE 2B
SRA SITE 2A
SCVWD E S M'T 3015-146
NED PROJECT LIMIT
LPP PROJECT LIMIT
PROPOSED R.O.W.
PROPOSED ROW
CITY OF SAN JOSE
STATE OF CALIFORNIA
SCVWD
INVESTOR PROPERTIES
EXCESS
HERMAN PEREZ
& RIVER R/W PER
IRENE STREET
VILLAGE CT.
W. TAYLOR STREET
ASBURY STREET
ANITA STREET
SEYMOUR STREET
HOBSON STREET
EMPIRE AVE.
VENDOME STREET
COLEMAN AVENUE
250 0 250 Ft..

Plate 6-1d



Guadalupe GRR Mitigation – Reach A

Plate 6-1e



GUADALUPE CREEK

ALMADEN EXPRESSWAY TO MASSON DAM
SAN JOSE, SANTA CLARA COUNTY, CALIFORNIA

N
W
E

TRACT NO. 4108

LEGEND

TEMPORARY CONSTRUCTION EASEMENT (40.0 ACRES ±)

40.0'

MITIGATION EASEMENT (8.0 ACRES ±)

1" = 300' 300' 150' 0 300' 600' 900'
SCALE IN FEET

Plate 6-1f

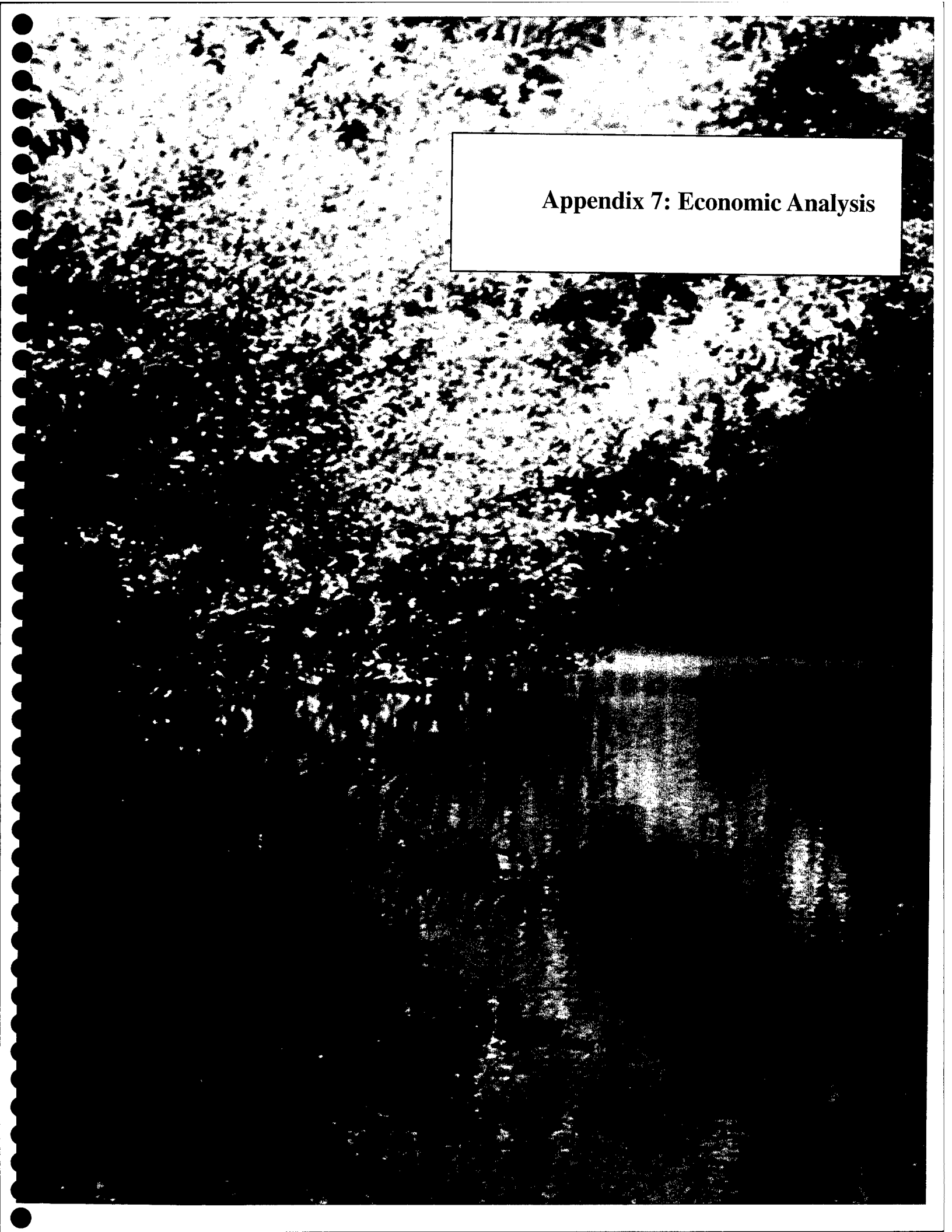
US Army Corps of Engineers Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

PREPARED BY:
REAL ESTATE DIVISION
CADASTRAL SECTION

CALIFORNIA
SAN JOSE, SANTA CLARA COUNTY
REAL ESTATE MAP
GUADALUPE CREEK

Sheet reference number:
EX. A
1 OF 1



Appendix 7: Economic Analysis

APPENDIX 7 – ECONOMIC ANALYSIS

Contents

7A Introduction
7B Description of Floodplain
7C Flood Damage Evaluation

Tables

7B.2-1 Existing (1990) Number of Structures in Floodplain
7B.2-2 Total Value of Existing (1990) Damageable Property ($1,000)
7B.2-3 Average Value of Existing (1990) Structures, October 2000 Prices
7C.8-1 Damages to Structure and Content, Existing Conditions (1990), October 2000 Prices ($1,000)
7C.9-1 Total Average Annual Equivalent Damages and Benefits, Existing Conditions (1990), October 2000 Prices, 2002-2052 @ 6-3/8% Interest Rate

Plates

7A-1 Study Area
7A-2 Guadalupe River Floodplain Map

Appendix 7A – Introduction

7A.1 Purpose

The purpose of this chapter is to present the economic analysis used to measure beneficial contributions to National Economic Development (NED) associated with the flood damage reduction project for Guadalupe River in San Jose, California. The NED plan provides 100-year protection and consists of channel improvements along the Guadalupe River between Interstate Highways 280 and 880. Economic benefits have been developed in accordance with ER 1105-2-100.

7A.2 Methodology

This chapter presents a description of the methodology used to develop damages and benefit-cost ratios. Benefits and costs are expressed as average annual values at a current federal discount rate of 6-5/8 percent and a project economic life of 50 years. The project base year (the year in which significant benefits will accrue from project construction) is 2002. All damages and benefits are in October 2000 price levels.

7A.3 Definition

The study area is located in central California immediately south of San Francisco Bay and includes areas in Santa Clara and Alameda County. Almost all of the study area is located in Santa Clara County with only a very small portion extending into Alameda County. The boundary of the study area is very irregular but the area is basically elongate with the long axis oriented northwest- southeast. The study area is bounded on the east by the Diablo Range, on the south by a line that extends from a divide in the Diablo Range through the former Coyote Creek alluvial fan on the floor of Santa Clara Valley to a drainage divide in the Santa Cruz Mountains, on the west by a very poorly defined drainage divide which passes through San Jose, and on the north by San Francisco Bay. See Plate 7A-1 for the location and extent of the study area.

The 1991 analysis was broken down into three sections in order to document support for economic justification of two areas proposed for Section 104 credit. The first section proposed for Section 104 credit extends from the intersection of the Guadalupe River and Highway 101 downstream to Hwy. 237 (Reach 1). The second section (Reach 2), also proposed for Section 104 credit, extends from Interstate 280 to San Carlos Street. The third section (Reach 3) extends from San Carlos Street downstream to the intersection of the Guadalupe River and Highway 101. Reach 1 and Reach 2 were evaluated separately for Section 104 credit purposes and along with Reach 3, the remaining floodplain area, were used to comprise the total average annual benefit of this project. See Plate 7A-2 for the location of each reach. The current reevaluation and updating for prices combines all three reaches into one.

Appendix 7B – Description of Floodplain

7B.1 500-Year Overflow Area

There are approximately 6,500 acres of land in the Guadalupe River 500-year floodplain. Plate 7A-2 shows both the 100-year and 500-year floodplains.

7B.2 Floodplain Inventory

The floodplain was inventoried through site visits and aerial photography. This work was largely completed by September 1990. Ground surveys encompassed a large majority of total land area and structures with the exception of the San Jose State University and a few multi-family structures. More than 95 percent of land area and structures were visually inspected and inventoried. The floodplain was delineated into flood hazard zones (50-year, 100-year, 500-year) on one inch equal 500 feet aerial photographs. The aerial photography was completed in June 1986 by the County Surveyor's Office in Santa Clara County.

Structure enumeration was accomplished through site visits that identified the location of each structure by flood hazard zone. A list of structures by flood hazard zone was made and the square footage, foundation height, type, and value of each structure (residential, commercial, industrial and public) were clearly identified. In addition, consultation was made with professionals from the Redevelopment Agency in San Jose, the City of San Jose Planning Department, and the Santa Clara County Assessor's office in compiling information.

Square footage of commercial, industrial, and public structures was determined by the measurement of its unit dimensions from aerial photographs. Square footage for residential structures was based on information obtained from real estate professionals and the Santa Clara County Assessor's office.

The number of structures in the 50-year, 100-year, and 500-year floodplains are shown in Table 7B.2-1.

TABLE 7B.2-1 Existing (1990) Number of Structures in Floodplain

Land Use Category	50-Year	100-Year	500-Year
Single Family Residential	547	3,130	3,980
Multi-Family Residential	33	143	224
Commercial	187	945	1,535
Industrial	2	6	30
Public	9	66	92
Total	**778**	**4,290**	**5,861**

Under existing conditions, there are 4,290 structures in the 100-year floodplain, of which 3,130 are single family residences. There are 5,861 structures in the 500-year floodplain of which 3,980 are single family residences.

Structure values were determined by estimating the replacement costs less depreciation. The replacement cost less depreciation was estimated from unit cost data contained in Marshall and Swift Valuation Cost handbooks. The information obtained from Marshall & Swift, in combination with discussions with assessors from the Santa Clara County Assessor's office, was used to arrive at square-foot replacement values. Structures were categorized according to particular construction classification. Condition and age were estimated from field surveys and from local real estate professionals. Square-foot replacement values were modified to reflect current cost and local area multiplier adjustments. The square-foot replacement values were depreciated as necessary to account for the true effective age. The effective age reflects the actual "worth" of a structure and is a combination of variables (expected building life, current age, and condition). The above information reflects the steps taken in the original economic analysis. The Marshall and Swift Valuation Cost handbook was once again used in the updating process. The floodplain was visited in March of 2000 to verify the inventory and the structure values. Local appraisers and real estate developers were contacted to verify October 1999 and historic (1990) values. They all stated that Marshall and Swift is generally an excellent tool for estimating construction costs and depreciation. However, for San Jose this method is very low. San Jose is more costly than San Francisco. They also felt that the San Jose area demand for commercial and light industrial has been and is still extremely high. These values and demand have not decreased since 1990. The Marshall and Swift publication was used to bring properties up to October 2000 price levels.

For residential structures, content values are fifty percent of the structure value. Residential content value was not projected to grow beyond fifty percent of structure value. For many of the commercial, industrial, and public structures the value of contents percentages were based on information in the Lake Pontchartrain Study prepared by the Lower Mississippi Valley Division. In addition to these percentages and because of their uniqueness many computer hardware and software companies were interviewed. It was also realized during these interviews that this type of business was also very vulnerable to water damage.

Total depreciated replacement value of all floodplain structures and contents in the 500-year overflow area is approximately $8.6 billion (October 2000 price levels) and is shown in Table 7B.2-2.

In the estimation of the depreciated value for multistory structures (those structures taller than two stories), the square footage of a typical floor was measured from the aerial photographs and multiplied by the number of floors in the structure. Therefore, the value as shown is representative of the total structure. However, for damage estimation purposes only the value of the first two floors was used. Table 7B.2-3 shows the average value of structure and contents by type. It should be noted that commercial structures have an average size of approximately 32,000 square feet and consist primarily of business parks, offices, and office/warehouse facilities.

TABLE 7B.2-2. Total Value of Existing (1990) Damageable Property ($1,000)

Land Use Category	Structure Value	Content Value
Single Family Residential	$339,085	$169,542
Multi-Family Residential	$101,112	$50,556
Commercial	$3,601,009	$3,913,897
Industrial	$49,876	$60,135
Public	$175,855	$122,239
Total	**$4,266,937**	**$4,316,369**

TABLE 7B.2-3. Average Value of Existing (1990) Structures, October 2000 Price Levels

Land Use Category	Structure Value	Content Value
Single Family Residential	$85,200	$42,600
Multi-Family Residential	$451,400	$225,700
Commercial	$2,345,900	$2,549,700
Industrial	$1,662,600	$2,004,500
Public	$1,911,500	$1,328,700

7B.3 Future Growth and Development

Estimates of future growth and development were obtained from the General Plans for San Jose and Santa Clara. These land use plans provided information on the location of the developable land by zoning classification and year of development. In 1991 build out of the floodplain was projected to be completed by the year 2014; therefore, no development was projected beyond that period. For the current damage and benefit analysis future growth was not reevaluated. No plan formulation was redone and also, if the B/C ratio is greater than one, ER 1105-2-100 (6-40.b) allows only the existing benefits to be compared to costs to determine project feasibility. Comparing results from the previous economic analysis can show the sensitivity of the inundation reduction benefits with the inclusion of future growth. Future growth for the 1991 analysis showed that benefits would increase by 13 percent.

Appendix 7C – Flood Damage Evaluation

7C.1 Introduction

This section describes the methodology used to compute the inundation damages expected to be sustained by floods occurring in the Guadalupe River system. The inundation damages are desegregated by flood event and damage category. The damages include inundation damages to floodplain structures and contents, flood clean-up and emergency costs, vehicle damages, and damages to roads.

7C.2 Structure and Content Damages

7C.2.1 Damage Categories

Inventoried floodplain structures include single family residential, multi-family residential, commercial, industrial, and public. The structure count was determined through aerial photographs and field surveys. The number of units given in the inventory tables refers to the actual number of discrete structures and not necessarily the number of commercial establishments in those structures. In some cases, primarily commercial malls, more than one commercial enterprise may be within the physical structure of a building. The categories are characterized below:

- *Single Family Residential* - detached one family homes
- *Multi-Family Residential* - apartments, attached condominiums and townhouses
- *Commercial* - offices, business parks, office/warehouses, retail outlets, motels
- *Industrial* - manufacturing plants, industrial business parks, construction yards, warehouses
- *Public* - schools, hospitals, public organizations and offices, police and fire stations, utilities and churches

7C.3 Depth Over First Floor

Depths over first floor of the structures is based on cross-sectional water surface elevations. Depths over first floor for a given structure or group of structures was determined based on their location in reference to the cross-section. Depth of flooding over the first floor is determined by subtracting first floor elevation from the water surface elevation.

7C.4 Depth Damage Curves

Once the inventory was completed, damage susceptibility relationships were established as a function of structure and content values. Depth-damage relationships describe the damages that occur under different depths of flooding. The 1988 Federal Emergency

Management Agency depth-damage relationships were used for residential structures. The depth-damage relationships developed by the Tennessee Valley Authority for the Department of Housing and Urban Development in December 1969, Small Business Research for Flood Insurance rate-setting, were used in estimating damages to many commercial and industrial structures. For the South Sacramento County Streams study (formally the Morrison Creek Investigation), interviews with owners and managers of commercial and industrial buildings established depth-percent damage relationships that are very similar to those in the aforementioned TVA study. Although the South Sacramento County Streams Study Creek flood plains are in the Sacramento Metropolitan area, structures in the San Jose Metropolitan area are comparable in type of construction and use to those in the Sacramento Metropolitan area. Therefore, it is felt that the TVA depth-percent damage relationships are acceptable and reflect actual damage information. Again, because of the their uniqueness the computer industry contents had their own damage relationships used for this analysis. Depths of flooding ranged from 0 to 6.9 feet. The depth of flooding was evaluated for each structure by adjusting for individual foundation heights. This information on depths was obtained from the Guadalupe River Feasibility Report, July 1985.

7C.5 Emergency Costs

Emergency costs include losses over and above physical flood damages, which result from the disruption of normal activities. Emergency costs include the costs of evacuation and reoccupation of the floodplain, flood fighting, and disaster relief; increased costs of normal operations during the flood; and increased cost of police, fire, and medical activity, and military patrol.

Within the provisions of flood protection, current costs for emergency aid would be saved. While many agencies and individuals are involved, the benefits have been developed based on the recent experience of the Federal Emergency Management Agency (FEMA).

Data for flood events indicated direct payments of $2,400,000 (1991 prices) were made to approximately 1,500 families and individuals within an area FEMA has designated as Region IX. The study area is within this region. These payments consisted of the cost of temporary housing, emergency repairs, furniture and "living kits." In addition, there were administrative costs associated with the Disaster Assistance Program of approximately 25 percent, or $600,000 (1991 prices). The median per payment cost was $2,500 (1991 prices) or $3,230 (2000 prices).

7C.6 Damages to Automobiles

Damages to automobiles were based on an estimate of the total number of automobiles in each floodplain hazard zone. Based on discussions with insurance companies it was determined that the typical household had 1.7 automobiles. The total number of automobiles in the floodplain was estimated by multiplying 1.7 by the number of residential households. It was assumed that 50 percent of the automobiles would be damaged during a flood event. The estimated number of cars was multiplied by the average value of an automobile $6,000 (1991 prices), $8,060 (2000 prices), to determine the value of automobiles in the floodplain. The depth-damage relationship derived by the Soil Conservation Service

in 1983 for the Lower Silver Creek Watershed was used to estimate damages to automobiles. Average annual benefits for automobiles were found to be $244,000 (2000 prices).

7C.7 Road Damages

Road damages were estimated by measuring the total miles of roads in each floodplain at various depths of flooding and then applying a dollar-damage per mile for each depth.

7C.8 Damages by Flood Event

Based on the foregoing parameters of value, depth, and percent-damage factors, the LA Damages computer program was used to estimate flood damages. This program was also used for the 1999 updating. The resultant product was the flow-damage relationship for the Guadalupe River floodplain. Damages by flood event for structures and contents under existing conditions are shown in Table 7C.8-1. The damages from the 1999 update have been raised to reflect October 2000 price levels.

TABLE 6C.8-1 Damages to Structure and Existing Conditions (1990), October 2000 Prices

Damage Category		500-Year	100-Year	50-Year
Single Family Residential				
	Structure	$53,201	$21,803	$10,213
	Content	$29,851	$7,053	$1,991
Multi Family Residential				
	Structure	$11,624	$3,627	$991
	Content	$7,800	$2,383	$838
Commercial				
	Structure	$248,694	$112,113	$36,656
	Content	$1,097,504	$406,850	$208,325
Industrial				
	Structure	$5,628	$1,411	$217
	Content	$40,617	$9,483	$1,512
Public				
	Structure	$29,082	$7,998	$4,438
	Content	$23,185	$5,773	$2,722
Emergency Costs		$20,772	$15,160	$2,933
Auto Damages		$8,284	$5,419	$2,995
Road Damages		$7,754	$5,030	$917
Total Damages		**$1,583,996**	**$604,103**	**$274,748**

7C.9 Annual Damage Calculations and Inundation Reduction Benefits

The damages expected to result from each of the various sized floods used in the analysis were weighted by the probability of occurrence of each flood by combining the depth-discharge and discharge-frequency curves. Annual damages were then calculated by using standard damage-frequency integration techniques. For the economic evaluation, no freeboard benefits were taken. Equivalent annual damages were calculated by using a discount rate of 6-3/8%. The damages and benefits derived with the integration of the discharge-frequency and discharge-damage curves for all three reaches combined are shown in Table 7C.9-1.

TABLE 7C.9-1 Total Average Annual Equivalent Damages and Benefits
Existing Conditions (1990), October 2000 Prices, 2002-2052 @ 6-3/8% Interest Rate

Benefit Category	Without Project Damages ($1,000)	With Project Damages ($1,000)	Benefits ($1,000)
Single Family Residential	$1,419	$247	$1,172
Multi Family Residential	$246	$53	$193
Commercial	$23,612	$4,139	$19,473
Industrial	$432	$114	$318
Public	$737	$142	$595
Emergency Costs	$395	$75	$320
Auto Damages	$279	$35	$244
Road Damages	$134	$27	$107
TOTAL	**$27,254**	**$4,832**	**$22,422**
Saving in Maintenance			
Savings of Flood Insurance Administrative Costs			$192
Total Annual Benefits			**$22,614**

7C.10 Other Benefit Categories

7C.10.1 Savings in Flood Insurance Administration Costs

The Federal Flood Insurance Program is administered by the Federal Emergency Management Agency (FEMA), which provides insurance against flood damages for residents of a recognized flood prone area. There is a national cost associated with the administration of the flood insurance program. The cost of servicing flood insurance policies in effect at the time of the study is the average cost per policy, including agent commission, and the cost of servicing and claims adjusting. This National Flood Insurance Program operating cost is currently $135 per policy. Two assumptions were used to determine the amount of structures affected by these costs: (1) structures above the 100-year flood plain would no longer purchase flood insurance, and (2) one third of the structures would have flood insurance. The latter assumption was based upon a discussion with FEMA officials. In the Guadalupe River study area there are 4,290 structures in the 100-year floodplain. FEMA

estimates that about one third of theses structures have flood insurance. This would result in 1,428 structures buying flood insurance, thus yielding a savings of $192,000 (2000 prices).

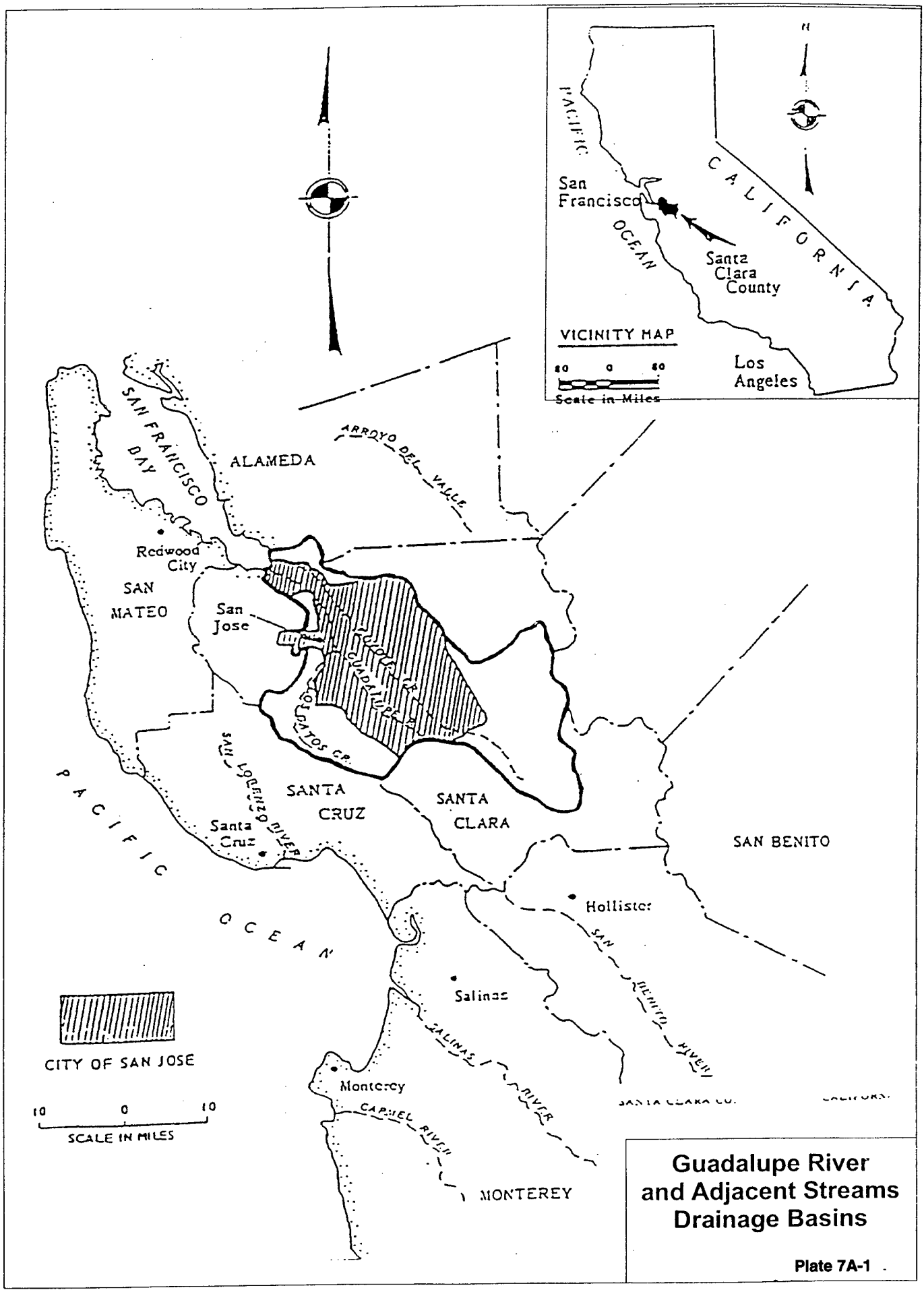
7C.11 Summary of Benefits

The summary of average annual benefits by category for the NED plan is presented in Table 7C.9-1.

APPENDIX 7 – ECONOMIC ANALYSIS

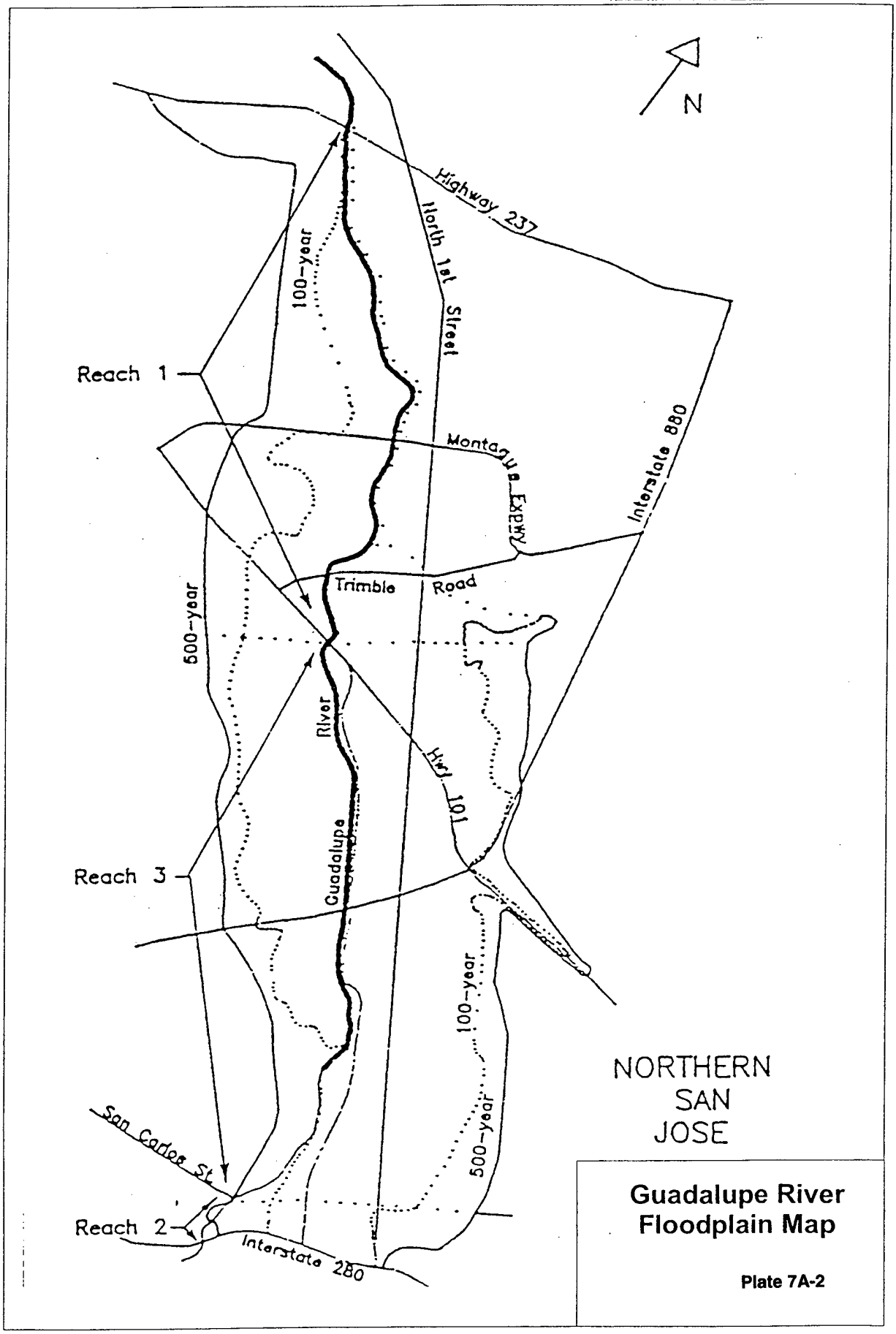
Plates

7A-1 Study Area
7A-2 Guadalupe River Floodplain Map



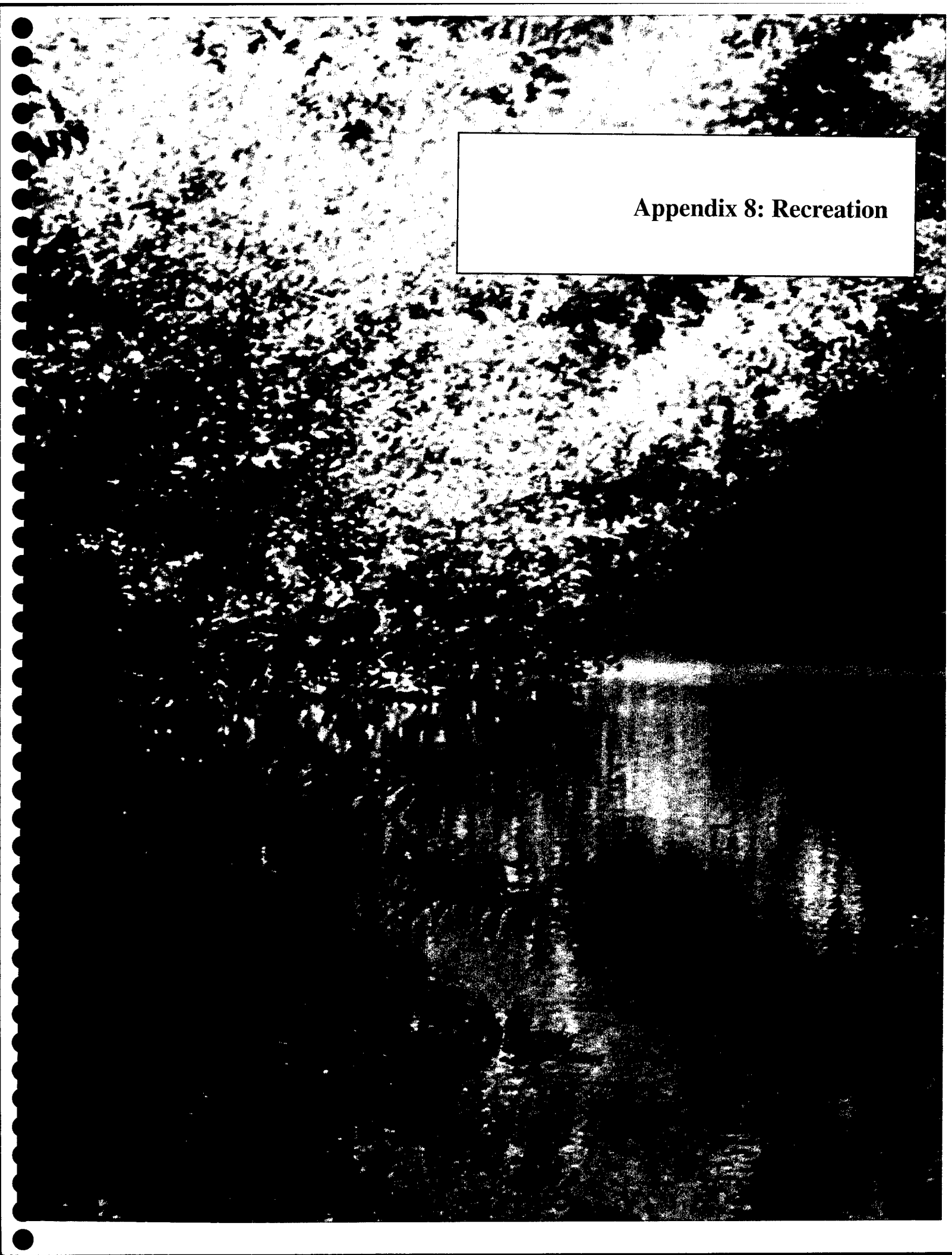
Guadalupe River and Adjacent Streams Drainage Basins

Plate 7A-1



Guadalupe River Floodplain Map

Plate 7A-2



Appendix 8: Recreation

APPENDIX 8 - RECREATION

Contents

Appendix

8A Introduction
8B Project Recreation Plan
8C Recreation Use and Benefits
8D Comparison of Benefits and Costs

ATTACHMENT 1 Local Cooperation Agreement
ATTACHMENT 2 Additional Betterments/Recreation Facilities

Appendix 8A - Introduction

8A.1 Updating the Recreation Plan

The project recreation plan was presented in the 1992 GDM and approved, with modifications, by the Assistant Secretary of the Army for Civil Works (ASA (CW)). A local cooperation agreement (LCA) was executed 30 March 1992 between the Corps and the Santa Clara Valley Water District (SCVWD) which specifies principal features of the plan. Basic facilities for public access, public health, and safety will be cost shared 50-50 between the Corps and SCVWD. SCVWD will also assume all operation and maintenance (O&M) of the recreation facilities. Additional facilities—betterments beyond basic facilities—desired by local interests will be provided at their cost.

The City of San Jose and its Redevelopment Agency (CSJ/RA) are lead agencies for the project recreation plan and have an agreement with SCVWD to provide the local share of development costs and assume O&M of the completed recreation development. CSJ/RA developed a local recreation plan--the urban river parkway described in their Guadalupe River Park Master Plan (GRPMP) to be incorporated with flood protection plans--in 1985 and in subsequent updates. The 1992 project recreation plan was developed in close cooperation with the local interests and assists in implementing their plans.

Construction of some features of the project recreation plan has been completed along with flood protection features in Segment 1, 1994; and Segment 2, 1996. Work on Segment 3C is underway and will be completed in 2000. The principal remaining flood protection work includes the proposed bypass system (Segments 3A and 3B) that would be completed following approval of the GRR as well as associated recreation development and fish and wildlife mitigation.

Recently, beginning in late 1996 and continuing, the Corps and SCVWD are cooperating with the multiple-party Guadalupe River Project Collaborative. The Collaborative was established to execute a facilitated dispute resolution process to develop project modifications to ensure compliance with the Clean Water Act and the Endangered Species Act. This collaborative effort includes a brief overview of related recreation requirements or recreation assumptions and this is summarized herein.

An update of the 1992 project recreation plan is presented to reflect current conditions and updated local recreation plans. A breakdown of completed recreation work and remaining recreation facilities proposed to be completed is presented. Benefits and costs of the project recreation plan are presented along with the benefits and costs of the remaining recreation facilities proposed to be completed. The recreation use and benefits analyses have been revised and updated resulting in additional benefits. There are no changes proposed to the basic recreation facilities described in the GDM and LCA, but there are increased betterments or added recreation facilities desired by CSJ/RA to be paid entirely by them. This updated recreation plan reflects general policies and guidance in the PGN and clarification provided specifically for the project recreation plan by ASA(CW) in approving the GDM.

8A.2. References

1. GDM: General Design Memorandum, Guadalupe River, CA approved 1992 and revised June 1993. See especially the more detailed recreation plan presented therein.

2. LCA: Local Cooperation Agreement between the Department of the Army and the SCVWD, executed 30 March 1992. See copy provided as Attachment 1 of this appendix.

3. GRPMP: Guadalupe River Park Master Plan prepared by CSJ/RA in 1985 and updated 1989, 1991, 1995.

4. PGN: Planning Guidance Notebook, Engineer Regulation 1105-2-100. (Section VI-Recreation)

5. PCD: Pre-Conference Documentation, Guadalupe River Project, Downtown San Jose, California, July 1999. The Corps and SCVWD prepared documentation to assist in dispute resolution with Guadalupe River Project Collaborative, including certain recreation assumptions.

8A.3. Guadalupe River and City of San Jose Environs

The Guadalupe River is located in Santa Clara Valley and flows generally northwest to San Francisco Bay. Average annual precipitation for the Guadalupe River watershed is 26 inches and occurs mostly during December to April. Average annual natural runoff from 1931 to 1960 was 35,500 acre-feet and the highest was 123,000 acre-feet in 1938. Year around temperatures range from the 40's to over 100 degrees in the hottest periods of summer. The 1999 population of San Jose is about 909,000 and of Santa Clara County is about 1.7 million.

The City is in the midst of redeveloping its downtown area. The GRPMP urban river parkway plan with assistance afforded by the project recreation plan is located along 2.6 miles of the Guadalupe River in downtown San Jose. Flood protection and recreation improvements afforded by the project complement the redevelopment. The City's plans incorporate the Guadalupe River's natural resources and man-made improvements to complement and enhance its downtown redevelopment. Plans for redevelopment adjacent to the river are oriented to the river so that business development and the river's resources and its improvements complement and support each other.

Completed portions of the overall redevelopment in close proximity to the Guadalupe River include the Convention Center, Children's Discovery Museum, Technology Museum, and the Center of Performing Arts. Due to its location in the center of the downtown San Jose business area served by adjacent freeways, 15 bridge crossings of the Guadalupe River in the project reach, and public transportation including an adjacent light rail station, the parkway will be highly accessible for public use. The project recreation trails total some 5.8 miles and will connect with other citywide and regional hiking and bicycling trails for users that enjoy a more extensive outing.

8A.4 Influence of Flood Protection Features

The project flood protection features are described in detail elsewhere in the GRR. It is important to note that a number of features included for flood protection are important contributions to the GRPMP and the project recreation plan. The adopted flood protection features have evolved over time during detailed coordination with flood protection sponsors, recreation sponsors, fish and wildlife agencies and the general public. Examples of such features include the bypass channel with its weir inlet and outlet works that preserve existing vegetation from impacts of other alternative designs, the variety of channel improvements including vertical side walls, cantilever retaining walls, stepped gabion walls, flood overbank areas, low flow channel, and fish and wildlife mitigation features that replace or mitigate vegetation and river habitats.

These features provide a visual relief and changing panorama of river environs important to public perception of a desirable area for public outdoor recreation activities. And of course, the primary function of the flood protection features in preventing frequent recurrence of damaging floods changes the perception of the local populace in how they regard the Guadalupe River over time. Following project completion, local people will come to regard the river and its adjacent downtown environs as safer and less subject to expensive and unattractive periodic damage from floods. This will contribute to their perception of the urban river parkway as a valued recreation resource they are attracted to at selected times for outdoor recreation activities.

8A.5 Dispute Resolution Recreation Assumptions

The PCD includes the following recreation assumptions:

(1) The recreation plan must be consistent with the plan presented in the GDM and Recreation LCA.

(2) The recreation plan must be compatible with the GRPMP, the Regional Parks, Trails, and Scenic Highways Plan for Santa Clara County, and the City of San Jose Horizon 2000 General Plan within the project reach by providing a trail system and river access points. The Project is compatible with the GRPMP by ensuring that natural attributes of the project area are maintained or replaced (shaded riverine aquatic cover and riparian vegetation mitigation) and by maintaining public access through the project site. The project may also complement the GRPMP and recreation use in the project area by providing additional river access and viewing opportunities.

(3) Recreation elements must be constructed on project lands required for flood protection improvements.

This updated recreation plan complies with and implements these assumptions.

Appendix 8B – Project Recreation Plan

8B.1 Overall Recreation Plan

The project recreation plan provides basic recreation facilities to take advantage of opportunities created by flood protection features in close proximity to the Guadalupe River's natural resources. The key features of the basic recreation facilities are 5.8 miles of trails and 49 acres of land for picnicking. The basic recreation facilities will be located on lands acquired for flood protection and include a riverwalk and trails superimposed on maintenance roads for the flood protection project, landscaping, picnic area, access ramps and stairways connecting with city streets primarily at bridge crossings, and lighting. CSJ/RA desires certain facilities in addition to basic facilities and these betterments will be provided at their cost. The overall layout of the project recreation plan is shown on Figure 3.4-6, Existing and Proposed Recreation Components. A summary breakdown of recreation facilities is provided in Attachments 1 and 2, including separate breakdowns of basic facilities (LCA-Exhibit A) and of betterments (LCA-Exhibit B and Attachment 2).

8B.2 Completed and Proposed Remaining Facilities

Portions of the flood protection project and accompanying recreation facilities have been completed. Segment 1 was completed in 1994 and Segment 2 in 1996. Segment 3C is under construction to be completed in 2000. Segments 3A and 3B which contain proposed changes from the approved GDM—principally a bypass flood protection system—are proposed for approval in this GRR together with remaining fish and wildlife mitigation features and remaining recreation facilities.

8B.3 Recreation Costs

Costs of construction and operation and maintenance (O & M) of recreation facilities are summarized in Table 8B.3-1.

The total first cost of recreation construction will be shared 50 percent Federal and 50 percent non-Federal. The 50 percent Federal cost is termed the separable recreation cost. A further breakdown of facilities and costs is provided elsewhere in the GRR.

8B.4 Recreation Facilities

The project recreation facilities that have been completed or are remaining to be completed are given in Table 8B.4-1.

TABLE 8B.3-1. Recreation Facilities Construction and O&M Costs

Item	Completed Segments ($1,000)	Remaining Segments ($1,000)	Total ($1,000)
1. First Cost of Construction	$407	$610	$1,017
2. Annual Cost of Construction	$34	$49	$83
3. Annual O&M Cost	$279	$419	$698
4. Major Replacements (Annual Cost)	$310	$465	$776
Total Annual Cost (2, 3, & 4)	**$623**	**$933**	**$1,556**

[a] Existing Conditions 1990; October 2000 Price Levels; Base Year 2004; Project Life 50 Years; 6-3/8 percent Interest Rate

TABLE 8B.4-1
Recreation Facilities Completed and Remaining to be Completed

Facility	Completed	Remaining	Total
Riverwalk/Trails	7,266 lf	5,609 lf	12,875 lf
Trails/Maintenance Road	12,131 lf	5806 lf	17,937 lf
Trees, 24" box	252	158	410
Trees, 15 gallon	175	138	313
Shrubs	122	158	280
Irrigation Installation	549	454	1,003
Signs	2	7	9
Facing Wall, Type 1	0	0	0
Picnic Tables	12	3	15
Trash Receptacles	12	13	25
Grills & Fireplaces	3	2	5
Picnic Shelter	1	0	1
Stairway, New Julian, S.	0	1	1
Stairway, Santa Clara, NE	0	1	1
Stairway, Park Way, N.	0	1	1
Stairway, Woz Way, N.	1	0	1
Electrical Lighting, Det 1	4	17	21
Electrical Lighting, Det 3	7	8	15

Appendix 8C – Recreation Use and Benefits

8C.1 Recreation Use

Recreation use currently estimated for the project recreation plan has been refined and updated from that previously estimated and approved in the GDM. The total estimated project recreation use is now 1,320,800 recreation days. Existing recreation use without the project is estimated at 58,000 recreation days. Therefore, the use creditable for estimating project benefits is 1,262,800 recreation days. Recreation facilities are sized to accommodate 1,320,800 recreation days.

Both the previous and current recreation use estimate were developed by analyzing the design capacity of the key recreation facilities and the lands within the project limits. The facilities included the flood protection channel with its low flow channel, all of which will accommodate a modest amount picnicking and other day use activities including fishing and boating. Optimization of public use consistent with the carrying capacity of the natural and modified resources of the Guadalupe River in the project area is a factor considered in determining the carrying capacity allowances. Maintaining environmental quality is a another factor that was included by CSJ/RA in developing the GRPMP and was used by the Corps in determining carrying capacity allowances.

The current estimate differs from the previous estimate in only one respect: analysis and application of the turnover rate. A turnover rate is applied to recognize that recreation users ordinarily stay only a few hours or less for the types of day use activities estimated. A turnover rate of 3 was utilized for all activities described in the GDM. The refined and updated analysis has employed a variable turnover rate for various activities. A turnover rate of 3 is appropriate for leisurely activities, including picnicking, play areas, nature study, fishing, and outside sitting. However, walking and boating are somewhat more intense activities and accomplished within the project area and its facilities in a shorter amount of time. A turnover rate of 5 is more appropriate for these two activities. Similarly, jogging and bicycling are substantially more intense and accomplished within the project area and its facilities in an even shorter amount of time. A turnover rate of 10 was used for these two activities. Accordingly, the design capacity presented in the GDM has been modified to include these variable turnover rates as tabulated in Table 8C.1-1.

TABLE 8C.1-1. Recreation Facilities Completed and Remaining to be Completed

Activity	Carrying Capacity	Units	Initial Design Load	Variable Turnover	Updated Design Load
Walking	50 per mile	5.8	290	5	1,450
Jogging	25 per mile	5.8	145	10	1,450
Biking	2 per mile	5.8	12	10	120
Picnicking	10 per acre	49	490	3	1,470
Play Areas	N/A		30	3	90
Nature Study	N/A	549	30	3	90
Fishing	8 per mile	0.5	20	3	60
Boating	10 per mile	1	10	5	50
Outside Sitting	N/A	12	100	3	300
			Total Design Capacity		**5,080**

To derive annual use, the design capacity was related to the seasons of the year. The summer months (June through August) are considered the prime use season during which the urban river parkway will receive the optimum use estimated to account for about 35 percent of the total annual visitation. It is expected that the design capacity will occur during this peak recreation season. It is anticipated that spring months of March through May and fall months of September through November will attract somewhat fewer people due to work schedules, less than optimal weather conditions, and other factors. The percent of use during each of these periods is estimated at 25 percent—and when combined, at 50 percent—of the total. Use during December though February would be less and is estimated at 15 percent. Accordingly, total annual use was estimated as shown in Table 8C.1-2.

TABLE 8C.1-2. Estimated Annual Use

Daily Design Load	Season	Percentage of Annual Use	Total Annual Use
5,080 x 91 days	Mar thru May	25	330,200
	Jun thru Aug	35	462,280
	Sep thru Nov	25	330,200
	Dec thru Feb	15	198,120
Totals		**100**	**1,320,800**

Existing recreation use of the Guadalupe River without flood protection and recreation improvements is estimated at 58,000 recreation days annually. Accordingly, the use creditable to the project is 1,262,800. Due to its highly accessible location near a large urban population, the modest size of the overall recreation development, and considerable

progress by CSJ/RA in implementing its redevelopment efforts, it is anticipated that the urban river parkway recreation facilities will be used to capacity immediately following completion of construction.

8C.2 Recreation Benefits

As described in the approved GDM, benefits of recreation use were determined using the Unit Day Value Method. This method is one of the methods prescribed by the Principles, Standards and Procedures of 1979 and by the Principles and Guidelines of 1983 for estimating recreation benefits produced by Federal water projects (see PGN for more information). The method employs a standard rating system for assigning points to a recreation day of use at Federal water projects. Five criteria with variable attributes that affect recreation users of water projects are appraised (see Recreation Plan Appendix of GDM for more details). The appraisal of the Guadalupe River Project and its recreation features as previously described in the GDM is illustrated in Table 8C.2-1.

TABLE 8C.2-1. Estimated Recreation Benefits

Criteria	Possible Points	Selected Range	Assigned Point Value
Recreation experience	30	5-10	10
Availability of opportunity	18	4-6	5
Carrying capacity	14	9-11	11
Accessibility	18	15-18	18
Environmental quality	20	7-10	10
Total Points			**54**

The total points are translated to dollar values for estimating the benefits of the project recreation use. The originally established dollar values are updated annually based on the National Consumer Price Index. The appraised point value of 54 for the Guadalupe River Project translates to $5.98 (October 2000 Price Level) per recreation day of use. Accordingly, the total annual project recreation benefits for the Guadalupe River Project are $7,551,544 ($5.98 x 1,262,800 recreation days, paragraph 8C.1).

Appendix 8D – Comparison of Benefits and Costs

8D.1 Total Benefits and Costs

Total annual recreation benefits of $7,551,544 compare favorably to total annual recreation costs of $1,556,000 (paragraph 8B.3), with a benefit: cost ratio of 4.9: 1.

8D.2 Remaining Benefits

Remaining benefits were estimated by examining the recreation facilities remaining to be provided as described in paragraph 8B.5. Recreation use and benefits of the remaining facilities were estimated in a manner similar to that described in Chapter 8C, as shown in the modified tabulations of Design Capacity Analysis and Estimated Annual Use in table 8D.2-1.

TABLE 8D.2-1. Design Capacity Analysis and Estimated Annual Use

Activity	Carrying Capacity	Total Design Load	Variable Turnover	Updated Design Load	Remaining Percentage	Remaining Design Load
Walking	50 per mile	290	5	1,450	37%	1,450
Jogging	25 per mile	145	10	1,450	37%	1,450
Biking	2 per mile	12	10	120	37%	120
Picnicking	10 per acre	490	3	1,470	45%	1,470
Play Areas	N/A	30	3	90	45%	90
Nature Study	N/A	30	3	90	45%	90
Fishing	8 per mile	20	3	60	37%	60
Boating	10 per mile	10	3	50	37%	50
Outside Sitting	N/A	100	3	300	45%	300
		Total Design Capacity		**5,080**		**2,035***

* 40 percent of Total Updated Design Load of 5,080

Percentages utilized in this tabulation were derived as follows. The percentage for remaining walking, jogging and biking is a simple computation from the figures shown in paragraph 8B.5. These three activities depend upon the amount of trails; accordingly the remaining length of Riverwalk/Trails and Trails/Maintenance Roads compared to the total length results in 37 percent (11,415 lf / 30,812 lf). However, four activities—picnicking, play

areas, nature study and outside sitting—depend upon or are associated with several facilities shown in paragraph 8B.5: picnic tables, trash receptacles, grills & fireplaces, picnic shelter, trees, shrubs, landscape irrigation, signs, and electrical lighting. Accordingly, all these facilities were totaled and remaining numbers were compared to total numbers to derive the percentage of 45 percent (958 / 2,097) applied to these four activities. Fishing and boating activities are oriented to the river and riverbanks with access provided by the trails. Accordingly, the percentage of remaining trails of 37 percent was utilized for these activities.

TABLE 8D.2-2. Estimated Annual Use for Remaining Recreation Facilities

Daily Design Load	Season	Percentage of Annual Use	Total Annual Use
2,035 x 91 days	Mar thru May	25	132,275
	Jun thru Aug	35	185,185
	Sep thru Nov	25	132,275
	Dec thru Feb	15	79,365
Totals		**100**	**529,100**

Existing use of the Guadalupe River without flood protection and recreation improvements is estimated at 58,000 recreation days annually. The amount of existing use associated with the reach of river on which the remaining recreation facilities would be constructed is 23,200, or 40 percent of 58,000. Recreation use creditable to the remaining recreation facilities to be constructed is 505,900 (529,100 – 23,200).

8D.3 Comparison of Remaining Benefits and Costs

Remaining annual recreation benefits are estimated to be $3,025,282 ($5.98 x 505,900 recreation days). This compares favorably with remaining annual recreation costs of $933,000 (paragraph 8B.3), with a benefit to cost ratio of 3.2:1.

8D.4 Recreation Cost Compared to Project Cost

Federal policy (PGN) requires that the Federal cost of the flood protection project may not be increased more than 10 percent by the separable 50 percent Federal share of recreation cost without prior approval of ASA(CW). A comparison of total and remaining project costs, recreation costs and the Federal share of each is presented in Table 8D.4-1.

TABLE 8D.4-1. Federal Share of Total and Remaining Project and Recreation Costs [a]

Item	Project Costs ($1,000)	Recreation Costs ($1,000)
Total first cost	$226,800	$1,017
Federal Share	$128,700	$508
Remaining first cost	$151,646	$610
Federal Share	$92,613	$305

[a] Existing Conditions 1990; October 2000 Price Levels; Base Year 2004; Project Life 50 Years; 6-3/8 percent Interest Rate

Accordingly, recreation adds only 0.4 percent to the Federal share of the total project cost ($508/$128,700) and only 0.3 percent to the Federal share of the remaining project cost ($305/$92,613).

ATTACHMENT 1

LOCAL COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE SANTA CLARA VALLEY WATER DISTRICT
FOR RECREATION DEVELOPMENT AT
GUADALUPE RIVER, CALIFORNIA

THIS AGREEMENT is entered into this 30th day of March, 1992, by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government"), acting by and through the Assistant Secretary of the Army (Civil Works), and THE SANTA CLARA VALLEY WATER DISTRICT (hereinafter referred to as the "District"), represented by and through the Chairman of its Board of Directors;

WITNESSETH, THAT:

WHEREAS, construction of the Guadalupe River, California project (hereinafter referred to as the "Project", defined in Article I), was authorized by Section 401 (b) of the Water Resources Development Act of 1986, Public Law 99-662;

WHEREAS, the Water Resources Development Act of 1986, Public Law 99-662, as amended, specifies the cost-sharing requirements applicable to the Project;

WHEREAS, Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended, provides that the construction of any water resources project by the Secretary of the Army shall not be commenced until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project;

WHEREAS, the District desires that the Government construct certain recreation facilities on its behalf in addition to those included in the Project, and is willing to pay for the entire cost of such facilities;

WHEREAS, the Secretary of the Army is authorized to accept the funds provided by the District for construction of the additional recreation facilities under section 5 of the Flood Control Act of June 22, 1936, (33 USC 701 h), and has included the recreation facilities desired by the District in its Guadalupe River, California, General Design Memorandum(GDM), December 1991;

WHEREAS, the District has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in cost-sharing and financing in accordance with the terms of this Agreement.

NOW, THEREFORE, the parties agree as follows:

ARTICLE I - DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

a. The term "Project" shall mean the construction of certain trails and related supporting facilities along the Guadalupe River in downtown San Jose, California. The specific features of the Project as well as their estimated costs are identified in Exhibit A of this agreement.

b. The term "total Project costs" shall mean all costs incurred by the District and the Government directly related to construction of the recreation features identified in Exhibit A. Such costs shall include, but not necessarily be limited to: the value of separable recreation lands necessary for the project, all Advanced Engineering and Design (AE&D) costs; Continuing Planning and Engineering (CP&E) costs incurred after October 1, 1985; all Preconstruction Engineering and Design (PED) costs; engineering and design during construction; actual construction costs of the recreation features; supervision and administration costs; and costs of contract dispute settlements or awards; but shall not include any costs for betterments, operation, maintenance, repair, replacement, or rehabilitation.

c. The term "period of construction" shall mean the time from the advertisement of the first construction contract to the time the Contracting Officer certifies the Project is complete.

d. The term "Contracting Officer" shall mean the U.S. Army Engineer for the Sacramento District, or his designee.

e. The term "fiscal year" shall mean one fiscal year of the United States Government, unless otherwise specifically indicated. The Government fiscal year begins on October 1 and ends on September 30.

f. The term "functional portion of the Project" shall mean a completed portion of the Project as determined by the Contracting Officer to be suitable for tender to the District to operate and maintain in advance of completion of construction of the entire Project.

ARTICLE II - OBLIGATIONS OF THE PARTIES

a. The Government, subject to and using funds provided by the District and appropriated by the Congress of the United States, shall expeditiously construct the Project, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The District shall be afforded the opportunity to review and comment on all contracts, including relevant plans and specifications, prior to the issuance of invitations for bid. To the extent possible, the District shall be afforded the opportunity to review and comment on modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. The

Government will consider the comments of the District, but award of contracts, modifications or change orders, and performance of all work on the Project (whether the work is performed under contract or by Government personnel), shall be exclusively within the control of the Government.

b. When the Government determines that the Project or a functional portion of the Project is complete, the Government shall turn the completed Project or functional portion over to the District, which shall accept the Project or functional portion and be solely responsible for operating, repairing, maintaining, replacing, and rehabilitating the Project or functional portion in accordance with ARTICLE XI of this agreement.

c. As further specified in ARTICLE VII of this Agreement, the District shall provide, during the period of construction, a cash contribution of 50 percent of total Project costs. This cash contribution may be reduced by an amount equal to the value of any separable lands, easements, and right-of-way provided for the Project.

d. No Federal funds may be used to meet the District share of total Project costs under this Agreement unless the expenditure of such funds is expressly authorized by statute as verified in writing by the Federal granting agency.

ARTICLE III - LANDS AND FACILITIES, AND PUBLIC LAW 91-646 RELOCATION ASSISTANCE

a. The District shall furnish to the Government all lands, easements, and rights-of-way, including suitable borrow and dredged material disposal areas, as may be determined by the Government to be necessary for the construction, operation, and maintenance of the Project, and shall furnish to the Government evidence supporting the District's legal authority to grant rights-of-entry to such lands. The necessary lands, easements, and rights-of-way may be provided incrementally, but all lands, easements, and rights-of-way determined by the Government to be necessary for work to be performed under a construction contract must be furnished prior to the advertisement of the construction contract.

b. The District shall provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged material disposal areas necessary for construction of the Project.

c. Upon notification from the Government, the District shall accomplish or arrange for accomplishment at no cost to the Government all relocations (excluding railroad bridges and approaches thereto) determined by the Government to be necessary for construction of the Project.

d. The District shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of

1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way for construction and subsequent operation and maintenance of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

e. Title to all lands, easements and rights-of-way on which recreation facilities have been developed or constructed by or with Government assistance shall at all times be and remain in the name of a legally constituted public body with full authority and capability to perform the terms of this Agreement. Changes in the title and/or cessation of specific recreation uses shall not be made without consent of the Commander, U.S. Army Engineer District, Sacramento, or his successor in authority.

ARTICLE IV - VALUE OF LANDS AND FACILITIES

a. The District shall not receive any credit for lands, easements, and rights-of-way provided for the Guadalupe River Flood Control improvements or provided as an item of local cooperation for another Federal project., nor shall the value thereof be included in total Project cost. The value of the lands, easements, and rights-of-way to be included in total Project cost and credited toward the District's share of total Project costs will be determined in accordance with the following procedures:

1. If the lands, easements, or rights-of-way are owned by the District as of the date the first construction contract for the Project is awarded, the credit shall be the fair market value of the interest at the time of such award. The fair market value shall be determined by an appraisal, to be obtained by the District, which has been prepared by a qualified appraiser who is acceptable to both the District and the Government. The appraisal shall be reviewed and approved by the Government.

2. If the lands, easements, or rights-of-way are to be acquired by the District after the date of award of the first construction contract for the Project, the credit shall be the fair market value of the interest at the time such interest is acquired. The fair market value shall be determined as specified in ARTICLE IV.a.1. of this Agreement. If the District pays an amount in excess of the appraised fair market value, it may be entitled to a credit for the excess if the District has secured prior written approval from the Government of its offer to purchase such interest.

3. If the District acquires more lands, easements, or rights-of-way than are necessary for the Project , as determined by the Government, then only the value of such portions of those acquisitions as are necessary for the Project shall be included in total Project costs and credited toward the District's share.

4. Credit for lands, easements, and rights-of-way in the case of involuntary acquisitions which occur within a one-year period preceding the date this Agreement is signed or which occur after the date this Agreement is signed will be based on court awards, or on stipulated settlements that have received prior written approval of the Government.

5. Credit for lands, easements, or rights-of-way acquired by the District within a five-year period preceding the date this Agreement is signed, or at any time after this Agreement is signed, will also include reasonable incidental costs of acquiring the interest, e.g., closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with the obligations under this Agreement.

b. The costs of relocations which will be included in total Project costs and credited toward the District's share of total Project costs shall be that portion of the actual costs as set forth below, and approved by the Government:

1. Highways and Highway Bridges: Only that portion of the cost as would be necessary to construct substitute bridges and highways to the design standard that the State of California would use in constructing a new bridge or highway under similar conditions of geography and traffic loads.

2. Utilities and Facilities (including railroads): Actual relocation costs, less depreciation, less salvage value, plus the cost of removal, less the cost of betterments. With respect to betterments, new materials shall not be used in any alteration or relocation if materials of value and usability equal to those in the existing facility are available or can be obtained as salvage from the existing facility or otherwise, unless the provision of new material is more economical. If, despite the availability of used material, new material is used, where the use of such new material represents an additional cost, such cost will not be included in separable recreation costs, nor credited toward the District's share.

ARTICLE V - CONSTRUCTION PHASING AND MANAGEMENT

a. To provide for consistent and effective communication between the District and the Government during the period of construction, the District and the Government have appointed representatives to a Project Executive Committee and a Project Management Team to coordinate on scheduling, plans, specifications, modifications, contract costs, and other matters relating to construction of the Project. The District will be informed of any changes in cost estimates.

b. The representatives appointed above shall meet as necessary during the period of construction and shall make such recommendations as they deem warranted to the Contracting Officer.

c. The Contracting Officer shall consider the recommendations of the representatives in all matters relating to construction of the Project, but the Contracting Officer, having ultimate responsibility for construction of the Project, has complete discretion to accept, reject, or modify the recommendations.

ARTICLE VI - WORK DESIRED BY THE DISTRICT AND NOT A PART OF THE PROJECT

a. During the period of construction, the District may ask the Government to design and construct certain recreation facilities on its behalf. Upon the request of the District, the Government shall design or construct such additional recreation facilities as are desired by the District. Any such additional recreation facilities are not to be considered a part of the Project. The District shall be solely responsible for the cost of such additional recreation facilities and shall pay all in house and contract costs incurred by the Government relating to such requests as determined by the Government, including all costs of real estate, engineering, design, construction, and any contract settlement or dispute awards. The additional recreation facilities presently desired by the District are shown on Exhibit B of this agreement.

b. Prior to the award of any contract for the design or construction of these or other recreation facilities, the District shall provide to the government 100% of the cost of such work. Thereafter, the District shall provide such additional amounts as are necessary to cover contract obligations as they are incurred by the Government as provided in Article VII. The District shall be solely responsible for Operation, Maintenance, Repair, Replacement, and Rehabilitation of any recreation facilities constructed on its behalf.

ARTICLE VII - METHOD OF PAYMENT

a. The District shall provide pursuant to ARTICLE II c of this Agreement during the period of construction, such cash payments as are necessary to meet its obligation to pay 50% of total Project costs. Total Project costs are presently estimated to be $1,985,000. In order to meet its share of total Project costs, the District shall provide a cash contribution presently estimated to be $992,500. The District also shall pay 100% of the costs of constructing any additional recreation facilities constructed on its behalf. The costs of such additional recreation facilities are presently estimated to be $1,615,000. The dollar amounts set forth in this ARTICLE are based upon the Government's best estimates which will reflect projections of costs, price level changes, and anticipated inflation. Such cost estimates are subject to adjustments based upon costs actually incurred and are not to be construed as the total financial responsibilities of the Government and the District.

b. The District shall provide its required cash contribution in accordance with the following provisions:

1. For purposes of budget planning, the Government shall notify the District by April 1 of each year of the estimated funds that will be

required from the District during the upcoming fiscal year to meet the District's obligation to pay for 50% of the total Project cost and all costs of non-project recreation facilities.

2. No later than 60 calendar days prior to the award of the first construction contract, the Government shall notify the District of the amount due from the District to meet its share of total Project costs and to pay all costs of non-project recreation facilities, including its share of costs attributable to the Project and non-project recreation facilities incurred prior to the initiation of construction, for the first fiscal year of construction. No later than 30 calendar days thereafter, the District shall verify to the satisfaction of the Government that it has deposited the requisite amount in an escrow account acceptable to the Government, with interest accruing to the District.

3. For the second and subsequent fiscal years of Project construction, the Government shall, no later than 60 calendar days prior to the beginning of the fiscal year, notify the District of the amount due from the District to meet its share of total Project costs and to pay all costs of non-project recreation facilities for that fiscal year. No later than 30 calendar days prior to the beginning of the fiscal year, the District shall make the necessary funds available to the Government through the funding mechanism specified in ARTICLE VII.b.2. of this Agreement. As construction of the Project proceeds, the Government shall adjust the amounts required to be provided under this paragraph to reflect actual costs.

4. If at any time during the period of construction the Government determines that additional funds will be needed from the District, the Government shall so notify the District, and the District, no later than 45 calendar days from receipt of such notice, shall make the necessary funds available through the funding mechanism specified in ARTICLE VII.b.2. of this Agreement.

c. The Government will draw on the escrow account such sums as the Government deems necessary to cover contractual and in-house fiscal obligations attributable to the Project and non-project recreation facilities as they are incurred, as well as costs incurred by the Government prior to the initiation of construction.

d. Upon completion of the Project and resolution of all relevant contract claims and appeals, the Government shall compute the Project and non-project recreation facilities costs and tender to the District a final accounting of the District's share of Project and non project recreation facilities costs. In the event the total contribution by the District is less than its minimum required share of Project and non-project recreation facilities costs, the District shall, no later than 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet its minimum required share of Project and non-project recreation facilities costs.

e. If the District's total contributions under this Agreement exceed the sum of 50 percent of total Project costs, or the amount required to satisfy its

requirement to pay for all non-project recreation facilities, the Government shall, subject to the availability of funds for that purpose, refund the excess to the District no later than 90 calendar days after the final accounting is complete.

ARTICLE VIII - CONSTRUCTION AND OPERATION OF ADDITIONAL FACILITIES

Certain types of facilities, including but not necessarily limited to restaurants, lodges, golf courses, cabins, clubhouses, overnight or vacation type structures, stables, swimming pools, commissaries, and such similar revenue-producing facilities, may be constructed and operated by the District. Any such construction and operation of these types of facilities shall be compatible with all project purposes and shall be subject to the prior approval of the Contracting Officer. However, the District shall not receive credit for costs of such facilities against amounts due and payable under ARTICLE VII and such facilities shall not be deemed to be developed or constructed with Government assistance.

ARTICLE IX - FEES AND CHARGES

The District may assess and collect fees for entrance to and use of developed recreation facilities and areas, in accordance with a fee schedule mutually agreed to by the parties. Not less often than every five years, the parties will review such schedule and, upon the request of either, renegotiate the schedule. The renegotiated fee schedule shall, upon written agreement thereto by the parties, supersede the previous fee schedule without the necessity of modifying this contractual document.

ARTICLE X - DISPUTES

Before any party to this Agreement may bring suit in any court concerning an issue relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or other forms of nonbinding alternative dispute resolution mutually acceptable to the parties.

ARTICLE XI - OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION

a. After the Government has turned the completed Project, or functional portion of the Project, over to the District, the District shall operate, maintain, repair, replace, and rehabilitate the completed Project, or functional portion of the Project, in accordance with regulations or directions prescribed by the Government.

b. The District hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon land which it owns or controls, for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. If an inspection shows that the District for

any reason is failing to fulfill its obligations under this Agreement without receiving prior written approval from the Government, the Government will send a written notice to the District. If the District persists in such failure for 30 calendar days after receipt of the notice, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon lands the District owns or controls, for access to the Project for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Government shall operate to relieve the District of responsibility to meet its obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to this Agreement.

ARTICLE XII - RELEASE OF CLAIMS

The District shall hold and save the Government free from all damages arising from the construction, operation, and maintenance of the Project and non-project recreation facilities, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE XIII - MAINTENANCE OF RECORDS

The Government and the District shall keep books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect Project and non-project recreation facilities costs. The Government and the District shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the Project and non-project recreation facilities and resolution of all relevant claims arising therefrom, and shall make available at their offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the parties to this Agreement.

ARTICLE XIV - GOVERNMENT AUDIT

The Government shall conduct an audit when appropriate of the District's records for the Project to ascertain the allowability, reasonableness, and allocability of its costs for inclusion as credit against the non-Federal share of total Project costs.

ARTICLE XV - OBLIGATIONS OF FUTURE APPROPRIATIONS

Nothing in this Agreement shall constitute, nor be deemed to constitute, an obligation of future appropriations by the legislature of the State of California when such obligation would be inconsistent with the State's constitutional or statutory limitations.

ARTICLE XVI - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the District agrees to comply with all applicable Federal and State laws and regulations, including section 601 of Title VI of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.II issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army".

ARTICLE XVII - RELATIONSHIP OF PARTIES

The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

ARTICLE XVIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XIX - COVENANT AGAINST CONTINGENT FEES

The District warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the District for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Agreement without liability, or, in its discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XX - TERMINATION OR SUSPENSION

a. If at any time the District fails to make the payments required under this Agreement, the Assistant Secretary of the Army (Civil Works) shall terminate or suspend work on the Project until the District is no longer in arrears, unless the Assistant Secretary of the Army (Civil Works) determines that continuation of work on the Project is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project. Any delinquent payment shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

b. If the Government fails to receive annual appropriations for the Project in amounts sufficient to meet Project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the District. After 60 calendar days either party may elect without penalty to terminate this Agreement pursuant to this ARTICLE or to defer future performance hereunder; however, deferral of future performance under this Agreement shall not affect existing obligations or relieve the parties of liability for any obligation previously incurred. In the event that either party elects to terminate this Agreement pursuant to this ARTICLE, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with ARTICLE VII.d. of this Agreement. In the event that either party elects to defer future performance under this Agreement pursuant to this ARTICLE, such deferral shall remain in effect until such time as the Government receives sufficient appropriations or until either party elects to terminate this Agreement.

ARTICLE XXI - HAZARDOUS SUBSTANCES

a. After execution of this Agreement and upon direction by the Contracting Officer, the District shall perform, or cause to be performed, such environmental investigations as are determined necessary by the Government or the District to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, on lands necessary for Project construction, operation, and maintenance. All actual costs incurred by the District which are properly allowable and allocable to performance of any such environmental investigations shall be included in total project costs and cost shared as a construction cost in accordance with Section 103 of Public Law 99-662.

b. In the event it is discovered through an environmental investigation or other means that any lands, easements, rights-of-way, or disposal areas to be acquired or provided for the Project contain any hazardous substances regulated under CERCLA, the District and the Government shall provide prompt notice to each other, and the District shall not proceed with the acquisition of lands, easements, rights-of-way, or disposal areas until mutually agreed.

c. The Government and the District shall determine whether to initiate construction, or if already in construction, to continue with construction of the Project, or to terminate construction of the Project for the convenience of the Government in any case where hazardous substances regulated under CERCLA are found to exist on any lands necessary for the Project. Should the Government and the District determine to proceed or continue with construction after considering any liability that may arise under CERCLA, the District shall be responsible, as between the Government and the District for any and all necessary clean up and response costs, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination. Such costs shall not be considered a part of total Project costs as defined in this Agreement. In the event the District fails to provide any funds

necessary to pay for clean up and response costs or to otherwise discharge its responsibilities under this paragraph upon direction by the Government, the Government may either terminate or suspend work on the Project or proceed with further work as provided in ARTICLE XX of this Agreement, TERMINATION OR SUSPENSION.

d. The District and the Government shall consult with each other under the CONSTRUCTION PHASING AND MANAGEMENT ARTICLE of this Agreement to assure that responsible parties bear any necessary clean up and response costs as defined in CERCLA. Any decision made pursuant to paragraph c of this ARTICLE shall not relieve any party from any liability that may arise under CERCLA.

e. The District shall operate, maintain, repair, replace and rehabilitate the Project in a manner so that liability will not arise under CERCLA.

ARTICLE XXII - NOTICES

a. All notices, requests, demands, and other communications required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and delivered personally, given by prepaid telegram, or mailed by first-class (postage pre-paid), registered, or certified mail, as follows:

If to the District:

General Manager
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, California 95118

If to the Government:

Commander
U.S. Army Engineer District, Sacramento
1325 J Street
Sacramento, California 95814-2922

b. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this ARTICLE.

c. Any notice, request, demand, or other communication made pursuant to this ARTICLE shall be deemed to have been received by the addressee at such time as it is personally delivered or seven calendar days after it is mailed, as the case may be.

ARTICLE XXIII - CONFIDENTIALITY

To the extent permitted by the laws governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the Assistant Secretary of the Army (Civil Works).

THE DEPARTMENT OF THE ARMY

By _____
ROGER F. YANKOUPE
Brigadier General, U. S. Army
Commander, South Pacific Division

Date March 30, 1992

THE SANTA CLARA VALLEY WATER DISTRICT

By _____
PATRICK T. FERARRO
Chairman, Board of Directors
Santa Clara Valley
Water District

Date March 30, 1992

GUADALUPE RIVER, CALIFORNIA
Recreation Cost Sharing Agreement

Exhibit A -- The Project

Item of Work	Quantity	Unit	Costs
Riverwalk/Trails	12,875	lf	$514,850
Trails/Maintenance Rd	17,937	lf	$397,450
Trees, 24" box	410	ea	$112,650
Trees, 15 gal	313	ea	$64,850
Shrubs	280	ea	$5,900
Irrigation Installation	1,003	ea	$44,910
Signs	9	ea	$3,770
Facing Wall, Type I	0	lf	$0
Picnic Tables	15	ea	$23,800
Trash Receptacles	25	ea	$17,080
Grills & Fireplaces	5	ea	$1,300
Picnic Shelter	1	ea	$23,880
Stairway, New Julian, N	0	job	$0
Stairway, New Julian, S	1	job	$70,900
Stairway, W Santa Clara NW	0	job	$0
Stairway, W Santa Clara NS	1	job	$58,900
Stairway, N Side Park Way	1	job	$45,800
Stairway, S Side Park Way	0	job	$0
Stairway, N WOZ Way	1	job	$39,200
Stairway, S WOZ Way	0	job	$0
Electrical Lighting, Det 1	21	ea	$53,900
Electrical Lighting, Det 3	15	ea	$23,500
Habitat & Feeding Facs, etc	0	ac	$0
Plannig Engrg & Design	1	job	$158,000
Construction Management	1	job	$113,760
TOTALS			$1,774,400
Inflation During Construction			$210,600
FULLY FUNDED TOTALS			$1,985,000
FEDERAL COST SHARE			$992,500
LOCAL COST SHARE			$992,500

GUADALUPE RIVER, CALIFORNIA
Recreation Cost Sharing Agreement

Exhibit B -- Additional Desired Recreation Features

Item of Work	Quantity	Unit	Costs
Riverwalk/Trails	0	lf	$0
Trails/Maintenance Rd	0	lf	$0
Trees, 24" box	410	ea	$112,250
Trees, 15 gal	312	ea	$64,050
Shrubs	280	ea	$5,900
Irrigation Installation	1,002	ea	$44,310
Signs	0	ea	$0
Facing Wall, Type I	5,010	lf	$629,960
Picnic Tables	0	ea	$0
Trash Receptacles	0	ea	$0
Grills & Fireplaces	0	ea	$0
Picnic Shelter	0	ea	$0
Stairway, New Julian, N	1	job	$50,100
Stairway, New Julian, S	0	job	$0
Stairway, W Santa Clara NW	1	job	$22,900
Stairway, W Santa Clara NS	0	job	$0
Stairway, N Side Park Way	0	job	$0
Stairway, S Side Park Way	1	job	$45,800
Stairway, N WOZ Way	0	job	$0
Stairway, S WOZ Way	1	job	$81,800
Electrical Lighting, Det 1	21	ea	$53,300
Electrical Lighting, Det 3	15	ea	$23,590
Habitat & Feeding Facs, etc	1.20	ac	$26,500
Plannig Engrg & Design	1	job	$162,140
Construction Management	1	job	$113,000
TOTALS			$1,435,600
Inflation During Construction			$179,400
FULLY FUNDED TOTALS			$1,615,000
FEDERAL COST SHARE			$0
LOCAL COST SHARE			$1,615,000

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

PATRICK T. FERARRO
Chairman, Board of Directors
Santa Clara Valley Water District

Date: March 30, 1992

CERTIFICATE OF AUTHORITY

I, Anthony Bennetti do hereby certify that I am the principal legal officer of the Santa Clara Valley Water District, that the Santa Clara Valley Water District is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the Santa Clara Valley Water District in connection with the Project, and to pay damages, if necessary, in the event of the failure to perform, in accordance with Section 221 of Public Law 91-611, and that the persons who have executed this Agreement on behalf of the Santa Clara Valley Water District have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 30th day of March 1992.

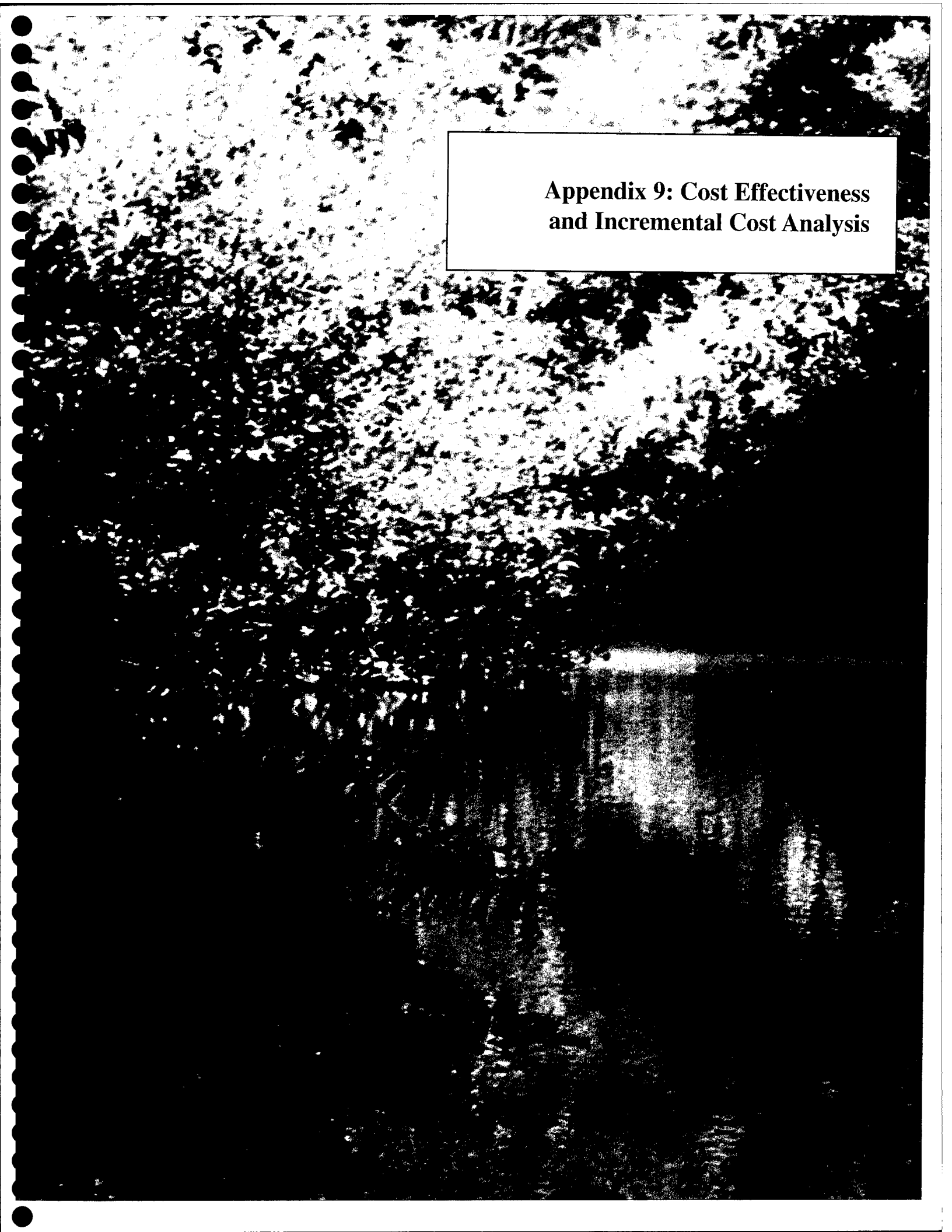
Anthony C. Bennetti

ANTHONY C. BENNETTI
General Counsel
Santa Clara Valley Water District

ATTACHMENT 2

Additional Betterments/Recreation Facilities: Segment 3C-Phase 2

Item	Quantity/Unit	Estimated Cost
Stone Veneer:		
Stone Veneer Wall Cap	1,991 lf	$ 128,530
Stone Veneer Wall Facing	1,761 lf	154,519
Stone Veneer at Stairs	618 sf	242,470
	Subtotal	**$ 525,518**
Landscaping and Irrigation:		
Stripping	5,710 cy	$ 31,493
Irrigation System	1 job	297,367
Soil Preparation	2.91 ac	5,107
Topsoil Replacement	1,910 cy	6,345
Hydroseeding on Earth	0.91 ac	5,133
CCM Hydroseeding	2 ac	7,270
Gabion Hydroseeding	0.89 ac	3,458
Maintenance	2.8 ac	91,255
Soils Report	1 job	1,880
Trees, 5 gal	48 ea	2,708
Trees, 5 gal in Gabions	41 ea	1,696
Trees, 36" Box	55 ea	59,635
Trees, 24" Box in Gabions	47 ea	18,558
Trees, 36" Box in Gabions	15 ea	16,076
Trees, 1 gal in CCM	15 ea	508
Trees, 1 gal	21 ea	500
Stubby Tubelings	90,927 sf	148,170
Metal Edging	72 lf	677
Electrical Work	1 job	56,408
Adjustments to Contour Grading	144 hours	27,866
	Subtotal	**$ 782,109**
Riverwalk:		
Concrete Band	541 lf	$ 11,189
Treated Douglas Fir Header	1,050 lf	6,581
	Subtotal	**$ 17,770**
Site Amenities:		
Concrete, Seat Wall	8 cy	$ 3,510
Concrete, Bench Wall	105 cy	40,801
Concrete, Stairs	138 cy	83,032
Concrete, Handrail	48 cy	55,355
Steel Tubular Handrail @ Stairs	146 lf	6,405
Custom Pedestrian Barrier	285 lf	51,801
Anti-Graffiti Coating	1,168 sf	4,246
	Subtotal	**$ 245,150**
Overlook Plaza:		
Box Culvert Roof (edge beam)	1 job	$ 160,000
Landscaping	1 job	84,798
Irrigation System	1 job	23,646
Pavements	1 job	333,751
Metal Fabrications	1 job	49,952
Electrical Work	1 job	83,985
	Subtotal	**$ 736,131**
	Total	**$2,306,678**



Appendix 9: Cost Effectiveness and Incremental Cost Analysis

Cost Effectiveness and Incremental Cost Analysis for

Proposed Modifications to the Guadalupe River Project, Downtown San Jose, California

Prepared by

U.S. Army Corps of Engineers, Sacramento District

1325 J Street
Sacramento, California 95814

February 2001

Cost Effectiveness and Incremental Cost Analysis

Table of Contents

1 Introduction

2 Project Background
- 2.1 Current Conditions
- 2.2 Need for Project Modifications, Including Mitigation Features

3 MMP Components
- 3.1 Resource Losses from Project Implementation that Require Mitigation
- 3.2 Mitigation Objectives
- 3.3 Primary Mitigation Measures of the Bypass System Alternative

4 MMP Selection Rationale

5 Estimated Costs of the MMP

6 Results of the Incremental Analysis
- 6.1 SRA Cover Mitigation
- 6.2 Significance Criteria
- 6.3 Step 9. Is It Worth It?

7 Conclusions
- 7.1 Bypass System Alternative, with Incorporated Mitigation Commitments
- 7.2 Mitigation Justification

8 References

Tables

1. Summary of SRA Cover AAHUs Required to Mitigate for Project Alternative Effects on Salmonids and Non-Salmonids
2. Location of Compensatory Mitigation Components
3. Description of MMP Components and Associated Monitoring Indicators
4. Management Measure Outputs and Estimated Costs
5. Estimated SRA Cover Mitigation Cost Breakdown by Mitigation Site

Figures

1. Incremental Cost of SRA Cover AAHUs for the Two Final Solutions from the CEICA
2. Average Cost per SRA Cover AAHU for the Three Individual Management Measures

Appendix—Outputs from Nine Easy Steps Process

Cost Effectiveness and Incremental Cost Analysis

1 Introduction

This report summarizes the results of a cost effectiveness and incremental cost analysis (CEICA) of new mitigation components included in the Proposed Modifications to the Guadalupe River Project in downtown San Jose, California. This analysis builds on work associated with environmental planning efforts for the proposed modifications, including a Habitat Evaluation Procedures (HEP) analysis (U.S. Army Corps of Engineers, 2000a); a mitigation and monitoring plan (MMP) (U.S. Army Corps of Engineers, 2000b); and a general re-evaluation report/environmental impact report/supplemental environmental impact statement (GRR/EIR-SEIS) (U.S. Army Corps of Engineers 2000c). This CEICA was conducted following the guidelines outlined in IWR Report 94-PS-2 "Cost Effectiveness Analysis for Environmental Planning: Nine Easy Steps" (U.S. Army Institute for Water Resources, 1994).

This CEICA has been prepared to assess costs associated with alternatives for mitigation of damages to fish and wildlife resources. The cost effectiveness portion provides information and rationale for the recommended plan and recommended mitigation. The incremental analysis portion provides information to help determine whether or not recommended mitigation elements are worth their cost if Federal finding is justified. ER 1105-2-100 requires that a CEICA be performed for all recommended mitigation plans. The purpose of the CEICA is to discover and display variation in cost of outputs for mitigation component management measures and identify the "best buy" approach to mitigate for environmental effects from a project alternative.

"Justification of mitigation features recommended for inclusion in projects shall be based upon analyses that demonstrate the combined monetary and non-monetary values of the last increment of losses prevented, reduced, or replaced is at least equal to the combined monetary and non-monetary costs of the last added increment so as to reasonably maximize overall project benefits. An incremental analysis, to the level of detail appropriate, will be used to demonstrate that the most cost effective mitigation measure(s) has been selected." (Engineer Regulation 1105-2-100, December 1990)

2 Project Background

2.1 Current Conditions

The Guadalupe River Project is being implemented in segments along 2.6 miles of the Guadalupe River in downtown San Jose, between Grant Street (just upstream from Interstate 280) and Interstate 880. The project area is discussed in five major segments:

- Segment 1 - located between I-880 and Hedding Street;
- Segment 2 - located between Hedding Street and Coleman Avenue;
- Segment 3A - located between Coleman Avenue and New Julian Street;
- Segment 3B - located between New Julian Street and Park Avenue; and

- Segment 3C - located downstream from Woz Way to Grant Street. Segment 3C is further broken down into three construction phases, Segment 3C Phases 1, 2, and 3.

2.2 Need for Project Modifications, Including Mitigation Features

Project modifications are now being considered to refine flood protection, recreation, and environmental mitigation features in Segments 3A and 3B. Two offsite mitigation areas are also being added to adequately compensate for potential adverse effects to the habitat of species of concern and to satisfy conditions for water quality certification.

Following authorization in 1986 and approval of the General Design Memorandum (GDM) in 1991, construction of Segments 1 and 2 was completed in 1994 and 1996 respectively. Construction of Segments 3C, 3A, and 3B was suspended in May 1996 in response to threatened litigation alleging that the authorized project violated conditions of the state water quality certification requirements related to water temperature. State and Federal resource agencies also were not satisfied with planned mitigation because of growing uncertainty over the adequacy of compensation for stream-side riparian vegetation known as Shaded Riverine Aquatic (SRA) cover and associated impacts on anadromous-fish habitat and wildlife habitat. In addition, fish species that occur in the project area had recently become listed (steelhead), or were proposed for listing (Central California Coast fall-run chinook salmon) under the Federal Endangered Species Act (ESA). Jeopardy determinations were expected in pending Biological Opinions from the USFWS and NMFS. The resource agencies and conservation groups were concerned about increases in water temperatures, loss of fish-spawning gravels, loss of fish rearing habitat, interference with fish passage, and loss of SRA cover, including its associated overhead shade and instream-structure features that together provide habitat for resident and anadromous fish.

These considerations prompted the reexamination of the remaining construction components of the Authorized Project and required the modification of the project's mitigation and monitoring plan. The Corps and Santa Clara Valley Water District (SCVWD) began a Dispute Resolution Process in December 1997, joining with the City of San Jose, the San Jose Redevelopment Agency, three Federal agencies, three county/city agencies, and three citizen's organizations to form a collaborative and facilitated program to resolve the mitigation disputes. The Guadalupe River Flood Control Project Collaborative includes the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), California Department of Fish and Game (DFG), California State Water Resources Control Board (SWRCB), California Regional Water Quality Control Board (RWQCB), Guadalupe-Coyote Resource Conservation District, Pacific Coast Federation of Fishermen's Associations, and Trout Unlimited (latter 3 are represented by the Natural Heritage Institute [NHI]).

As the basis for formal dispute resolution, the proponent agencies (Corps and SCVWD) agreed unanimously with all other Collaborative entities to conditions and commitments incorporated in the revised Mitigation and Monitoring Plan for the Proposed Action (U.S. Army Corps of Engineers, 2000b and 2000c). The MMP reflects the multiple-party, iterative planning process and specifies the minimally acceptable objectives and the actions required to meet them.

The Collaborative determined the need for additional fish and wildlife investigations, including an additional HEP to assess impacts to SRA cover. Potential modifications to the unconstructed portions of the Guadalupe River Project were rigorously evaluated. The Collaborative subsequently recommended an underground Bypass System in Segments 3A and 3B plus two offsite mitigation areas as the preferred alternative for modification of the Authorized Project. A HEP analysis was performed on two variations of the Bypass System alternative (double and triple bypass systems) to determine effects of the preferred alternative on fish and wildlife

habitat. In addition, a second alternative, the Authorized Project With Additional Mitigation was also analyzed included in the HEP analysis to provide context for the two bypass systems variations being evaluated. The HEP analysis results for the "triple" bypass variation was then used to develop a compensatory mitigation package for the Bypass System Alternative and to write a new MMP.

The Bypass System Alternative and accompanying MMP are the Proposed Action. It is anticipated that the Guadalupe River Project with Proposed Action will be favorably received by the public, acceptable to concerned resource agencies, and approved by decision-makers to implement the modified project.

3 MMP Components

3.1 Resource Losses from Project Implementation that Require Mitigation

Several fish and wildlife resources are being adversely affected as a result of project construction: riparian vegetation, including SRA cover; instream geomorphic features such as low-flow pools and riffles; and fish-spawning gravels. These losses result in water temperature increases during summer low-flow periods. The bank and channel bottom armoring feature of the project, needed to combat the erosive forces of high flood flows, is the primary cause behind the adverse effects to fish and wildlife resources.

As described in the MMP, riparian vegetation loss for the Bypass System Alternative is estimated to be 14.12 acres. Riparian vegetation mitigation of 21 acres has been planted in the bench-cut areas on the west side of Segments 1 and 2. As described below, 22,892 lf of SRA cover plantings in 15-feet-wide strips adjacent to the river (7.9 acres) are planned in addition to the 21 acres of riparian vegetation, giving a total riparian vegetation acreage of 28.9 acres. The approved mitigation plan described in the GDM totaled 26.9 acres. Thus, the number of acres of riparian mitigation proposed now is very similar to that previously approved and the 7 percent increase is due to the emphasis now on fully mitigating SRA cover and maintaining water temperatures below 77 °F.

The MMP notes there are 25,400 square feet of fish-spawning gravels in the project area that may be eroded by increased with-project flood flows. Mitigation of up to 25,190 square feet of spawning gravels will be placed in both the natural and armored river bottom reaches of Segments 1, 2, 3A, and 3B following construction of flood protection features.

SRA cover loss is estimated to be 8,821 lf (Bypass System Alternative). SRA cover mitigation was determined through a HEP analysis and includes instream geomorphic features. Several geomorphic features such as boulders, root wads, deflector logs, biotechnical bank stabilization measures, and invert stabilization structures, will be placed in Segments 3A, 3B, 3C, and Guadalupe Creek to provide instream cover, improve spawning and rearing habitat, and create additional riffles. The shade provided by SRA cover works in conjunction with instream geomorphic features to cool water temperature and provide habitat components for fish resources.

To respond to resource agency concerns regarding the adequacy of SRA cover mitigation, both from a quality and quantity perspective, the Corps agreed to use a HEP analysis approach to guide development of acceptable mitigation for the 8,821 lf of SRA cover losses caused by the Guadalupe River project with the Bypass System Alternative. Three Habitat Suitability Index (HSI) models were selected by the USFWS and the HEP team to represent all fish and wildlife species that use instream and overhead SRA cover along the Guadalupe River. The HSI models

used were the rainbow trout (salmonid fish) evaluation species, belted kingfisher evaluation species, and a non-salmonid fish pool-habitat cover type model. A summary of the SRA cover Average Annual Habitat Units (AAHUs) required to fully mitigate effects of the Guadalupe River with Bypass System Alternative are presented in Table 1.

TABLE 1. Summary of SRA Cover AAHUs Required to Mitigate for Project Alternative Effects on Salmonids and Non-Salmonids.

Project Alternative	SRA-Cover AAHUs Necessary to Mitigate for Rainbow trout	Additional SRA-Cover AAHUs Necessary to Mitigate for Non-Salmonid pool- habitat cover	Total SRA-Cover AAHUs Needed
Bypass System	2.21	0.21	2.42

Note:
The belted kingfisher evaluation species habitat suitability index (HSI) model was also used in the HEP analysis. Mitigation AAHU requirements for belted kingfisher evaluation species were included in the mitigation AAHU requirements for salmonids and non-salmonids

3.2 Mitigation Objectives

There are six main mitigation objectives:

A. Maintain summer water temperatures at levels that do not harm anadromous fish

B. Replace the amount, quality and value of lost SRA cover (8,821 lf lost = 2.42 AAHUs)

C. Replace lost riparian vegetation

D. Replace lost fish- spawning gravels

E. Replace lost fish passage capability

F. Replace lost fish rearing habitat

3.3 Primary Mitigation Measures of the Bypass System Alternative

Measures to avoid impacts to environmental resources were included in the design of the Bypass System Alternative:

- Bypass system - meets objectives A, B, E, and F
- Low-flow channel - meets objectives A and E

There are four primary compensatory mitigation components associated with the Guadalupe River Project with Bypass System Alternative: fish passage, fish-spawning gravels, riparian vegetation, and shaded riverine aquatic (SRA) cover. These mitigation components will be located onsite (Segments 1-3 and Woz Way to Park Avenue Bypass Reach) and offsite (Reach A and Guadalupe Creek) (see Table 1).

- Riparian Vegetation, 21 acres - meets objective C
- SRA cover, 22,892 lf = 2.56 AAHUs - meets objectives A, B, and F

TABLE 2. Location of Compensatory Mitigation Components

Mitigation Component	Location of Mitigation Component		Guadalupe Creek
	Onsite	Reach A	
Fish Passage [a]	Yes	No	No
Fish-Spawning Gravels	Yes	No	No
Riparian Vegetation [b]	Yes	No	No
SRA cover	Yes	Yes	Yes

[a] Installation of the fish passage mitigation component in Segments 1 and 2 was completed in 1996. Because this portion of the fish passage mitigation component was analyzed in the original incremental cost analysis prepared for the Guadalupe River Project (U.S. Army Corps of Engineers 1991), it is not included in this incremental cost analysis. Only the portion of the fish passage mitigation component in Segment 3 is considered in this incremental cost analysis.

[b] Installation of the riparian vegetation mitigation component was completed in 2000. Because this mitigation component was analyzed in the original incremental cost analysis prepared for the Guadalupe River Project (U.S. Army Corps of Engineers, 1991), it is not considered in this incremental cost analysis.

- SRA also includes artificial shade (box trees) temporarily placed along the armored low-flow channels – meets objectives A and B.
- Fish-spawning gravels, up to 25,190 SF – meets objective D
- Stream geomorphic features, Reach A and Guadalupe Cr. – meets objectives A, B, E, and F

The mitigation and monitoring plan includes adaptive management as a decision-making process to optimize the long-term implementation of flood protection measures on the Guadalupe River. The objective of adaptive management is to ensure that ecological functions and habitats values affected by the Bypass System Alternative are reestablished. Key parts of adaptive management are identifying indicators for ecological functions and habitat values, monitoring the indicators, setting measurable objectives (numerical and descriptive goals) for each indicator, and implementing remedial actions. Table 3 lists the indicators that will be monitored for each of the MMP mitigation components.

The results of the SRA cover HEP analysis showed that implementing the Bypass System Alternative will reduce habitat values for the two evaluation species and the pool-habitat cover type with relative to without-project conditions. Rainbow trout evaluation species had the greatest habitat value loss, followed by non-salmonid fish-pool habitat cover type and belted kingfisher evaluation species. The habitat value loss for these evaluation species and cover type occur despite maximizing onsite SRA mitigation. Although on site mitigation plays a significant role in minimizing effects in the construction area and in minimizing overall mitigation requirements, offsite mitigation sites are needed to fully compensate for SRA losses. The overall results of the SRA-cover HEP analysis show that with the proposed onsite mitigation and proposed offsite mitigation in Reach A and Guadalupe Creek, the MMP adequately compensates for effects of the Bypass System Alternative on SRA cover. A total of 22,892 lf of SRA cover mitigation will be installed in Segments 1, 2, 3A, 3B, and the Reach A and Guadalupe Creek mitigation sites. The HEP analysis determined that 18,026 lf of SRA cover mitigation would be required to mitigate for the loss of SRA cover. The USFWS has determined that all of Guadalupe Creek between Masson Dam and Almaden Expressway would need to be restored for any mitigation credits to be applied from the Guadalupe Creek site. Therefore, 12,044 lf of

SRA cover will be planted on Guadalupe Creek, but 4,866 lf of SRA cover mitigation credits would be used by SCVWD to mitigate for other projects. NMFS considers the SRA cover mitigation on Guadalupe Creek to be required mitigation as a term and condition of its Biological Opinion

4 MMP Selection Rationale

During the past two years, the Collaborative has reached a number of agreements on how the Guadalupe River Project may proceed with Collaborative support. Redesign of the project to avoid SRA cover loss and the adoption of the Bypass System Alternative was essential, as well as the inclusion of mitigation measures to replace lost quality as well as quantity of SRA cover and fish habitat. The on-site SRA cover mitigation areas in Segments 1, 2, 3A, 3B, and the Woz Way-Park bypass reach are believed to be of benefit to both chinook salmon and steelhead. SRA cover mitigation at the off-site Reach A mitigation area is believed to be of principal benefit to chinook salmon.

A key mitigation measure is the offsite Guadalupe Creek mitigation site at which 12,044 lf of overhead and in-stream SRA cover would be installed to provide 0.33 AAHUs at a cost of about $4.96 million. The Corps portion of this cost is approximately $4.09 million. This SRA cover mitigation will lower summer average water temperature on Guadalupe Creek by as much 7.6 °F and provide improved habitat conditions for fish and wildlife dependent on SRA cover. The greatest benefit of the Guadalupe Creek

TABLE 3 Description of MMP Components and Associated Monitoring Indicators

ONSITE MITIGATION COMPONENTS			
Location	**Mitigation Component** [a]	**Quantity of Mitigation to be Constructed**	**Monitoring Indicator** [a]
Segments 1-3 and Woz Way to Park Avenue Bypass Reach	Fish-spawning gravels	Install 25,190 square feet of fish-spawning gravels	Gravel abundance Gravel quality
	Fish passage	Install 2,800 linear feet of constructed low-flow channel, using a check structure design, on portions of armored channel bed (Segments 3A and 3B) Install 1,045 linear feet of constructed low-flow, using a trapezoid/boulder design, in armored channel bed sections (Segment 3C)	Visual observation Depth and velocity Vertical barriers Rearing habitat diversity Adult migration and fish-spawning Juvenile rearing
	SRA cover	Install 3,000 linear feet of SRA cover plantings	Survival Health and vigor Natural recruitment Non-native species Shaded stream surface Bank stability Instream cover Channel invert stability Measured water temperature Heat transfer Stream channel geometry Simulated water temperature Monthly thermal suitability Short-term thermal suitability

TABLE 3 (continued)

Location	Mitigation Component [a]	Quantity of Mitigation to be Constructed	Monitoring Indicator [a]
	Riparian vegetation	Install 21 acres of riparian vegetation	Survival Health and vigor Natural recruitment Cover Non-native species Tree height Tree basal area
		OFFSITE MITIGATION COMPONENTS	
Reach A	SRA cover	Install 7,848 linear feet of SRA cover plantings	Survival Health and vigor Natural recruitment Non-native species Shaded stream surface Bank stability Instream cover Channel invert stability Measured water temperature Heat transfer Stream channel geometry Simulated water temperature Monthly thermal suitability Short-term thermal suitability
Guadalupe Creek	SRA cover	Install 12,044 linear feet of SRA cover plantings	Survival Health and vigor Natural recruitment Non-native species Shaded stream surface Bank stability Instream cover Channel invert stability Measured water temperature Heat transfer Stream channel geometry Simulated water temperature Monthly thermal suitability Short-term thermal suitability

[a] The mitigation components and associated monitoring indicators are described in the MMP (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000

mitigation is the creation of suitable steelhead rearing and spawning habitat in an upper tributary of the Guadalupe River, expanding the range of steelhead in the watershed. Even after full maturation of the onsite mitigation in Segments 1, 2, and 3, average maximum water temperature will remain higher than pre-project conditions. NMFS has stated that providing additional suitable steelhead habitat in other parts of the watershed will offset the effects of these long-term downtown temperature increases. For this reason, the range expansion of steelhead into Guadalupe Creek is considered by NMFS to be an essential component of the project's mitigation package, and is one of the terms and conditions of their draft Biological Opinion (BO).

Another agreement reached by the Collaborative, and in particular between the Corps, SCVWD and USFWS, is that the SRA cover mitigation on Guadalupe Creek be provided, without delay to address the needs of the resources dependent upon such habitat. Accordingly, SCVWD has

proceeded with the design and implementation of the Guadalupe Creek mitigation area. In winter 1998-1999, approximately 1,200 lf of the total 12,044 lf of SRA cover planned for Guadalupe Creek was installed. SCVWD will soon proceed with construction on the remaining 10,844 lf of SRA cover. The Corps has agreed with SCVWD that a reimbursement of costs of up to $5 million is appropriate (under the provisions of Section 215 of the 1968 Flood Control Act, as amended), since the need for the mitigation planned at Guadalupe Creek is tied to the added flood protection provided by Guadalupe River Project with Bypass System Alternative.

5 Estimated Costs of the MMP

Inspection of mitigation features and their costs shows that only the SRA cover component—trees planted in a 15-foot-wide strip along the stream river associated instream geomorphic features—have substantial variations in cost that can be analyzed incrementally. Table 4 shows outputs and costs for all MMP components. Table 5 is a breakdown of the SRA cover mitigation costs. A concise analysis of incremental costs for SRA mitigation is presented using histograms and tabulated material, as shown in the tables and figures that follow. Figures 1 and 2 are histograms comparing costs of SRA cover mitigation measures—output from IWR's Nine Easy Steps process.

Incremental analysis histograms and tabular results from the Nine Easy Steps process are provided, and detailed tables from the Nine Easy Steps process are presented in the Appendix. In addition to the CEICA's histograms and tables, the significance of affected resources and prior coordination and agreements made with the Resource Agencies and the Collaborative have been considered in interpreting the results of the CEICA.

Resource loss, mitigation, Nine Easy Steps results, and significance of affected resources are carefully evaluated. The CEICA evaluation is based on the "triple" variation of the Bypass Alternative evaluated in the SRA HEP analysis. The "triple bypass variation" of the Bypass System closely resembles the Bypass System Alternative (Proposed Action) and the Refined Bypass Alternative described in the integrated Draft GRR/EIR/SEIS which appropriately captures all possible adverse effects on SRA cover from any variation of the two GRR/EIR/SEIS action alternatives.

6 Results of the Incremental Analysis

Results from the Nine Easy Steps process and significance criteria have been evaluated as described in the following sections.

6.1 SRA Cover Mitigation

The HEP analysis evaluates both the quality and quantity of an affected resource to adequately mitigate for adverse effects. Based on the HEP analysis results, 2.42 Average Annual Habitat Units (AAHUs) is needed to replace lost quality and quantity of SRA cover, assuming a loss of 8,387 lf of existing SRA cover (see GRR/EIR-SEIS Section 5.4.3.2 Shaded Riverine Aquatic Habitat).

The goal of 2.42 AAHUs was used to appraise how existing SRA cover values at three mitigation sites could be improved to attain the mitigation goal. The resulting quantity goal—

TABLE 4 Management Measure Outputs and Estimated Costs
This table shows the outputs and costs of management measures, by mitigation component

Mitigation Component [a, b]	Management Measure Code [a]	Management Measure [a]	Outputs (units are as indicated)	Costs ($)
	No Action	No Action	0	0
Fish passage	LFC	Install 3,620 linear feet of low-flow channel onsite.	3,680 lf	826,000[c]
Fish-spawning gravels	FSG	Install 25,190 square feet of spawning gravels onsite.	25,190 sf	30,000[c]
Riparian vegetation	RIP	Install 21 acres of riparian vegetation onsite.	21 ac	975,000
Shaded riverine aquatic (SRA) cover	OS	Install 3,000 linear feet of SRA cover onsite [d]	0.25 AAHU [e]	3,755,000
	RA	Install 7,848 linear feet of SRA cover in Reach A.	1.98 AAHUs [e]	2,832,000
	GC	Install 12,044 linear feet of SRA cover in Guadalupe Creek.	0.33 AAHU[e]	4,091,000[f]
Subtotal Cost for SRA Cover Management Measures			**2.56 AAHUs [e]**	**10,678,000**
Total Cost for Mitigation Components				**11,534,000[g]**

[a] There are four primary mitigation components associated with the Guadalupe River Project with Proposed Action: fish passage, fish-spawning gravels, riparian vegetation, and shaded riverine aquatic (SRA) cover. The SRA cover mitigation component is further broken down into three management measures to represent the three different locations where SRA cover mitigation will be implemented: onsite (Segments 1-3 and Woz Way to Park Avenue Bypass Reach), Reach A, and Guadalupe Creek. Management measure code: OS = onsite, RA = Reach A, and GC = Guadalupe Creek.

[b] The only mitigation component evaluated under the HEP analysis is SRA cover (U.S. Army Corps of Engineers, 2000). As a result, it is the only mitigation component evaluated further in this incremental cost analysis because it can be evaluated incrementally using the non-monetary habitat value determined by the HEP analysis.

[c] Costs for fish passage and fish-spawning gravels are for construction; monitoring costs are not reflected. Fish passage construction costs are for Segments 3A and 3B; Segment 3C construction costs are not reflected.

[d] Costs associated with shade augmentation, which will occur in Segments 2, 3A, and 3B, are included in the onsite SRA cover costs.

[e] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers, 2000). These AAHUs are also referred to as SRA cover AAHUs in this incremental cost analysis. The rainbow trout evaluation species HSI model was selected for use in this incremental cost analysis because it represents the suite of species that resource agencies are primarily interested in with respect to the management of the Guadalupe River.

[f] Only a portion of this measure is considered project related mitigation and eligible to be included as a project cost. The cost of this eligible portion, $4,091,000, is the amount used in this incremental cost analysis.

[g] Costs shown in this table and used in this incremental cost analysis were developed by the Corps. Costs are based on actual cost data for mitigation components, or portions of mitigation components, constructed to-date or projected costs for mitigation components, or portions of mitigation components, yet to be constructed.

oriented to specific conditions found onsite, in Reach A and in Guadalupe Creek—is 22,892 lf of SRA cover which will provide 2.56 AAHUs at a cost of $8.5 million as described below.

Onsite Construction Area - The HEP analysis estimated that 2,459 lf of SRA mitigation should be provided to achieve 0.25 AAHU. The analysis assumed that volunteer SRA would occur which would assist in achieving water temperature requirements. Subsequent analysis and coordination increased the SRA mitigation to 3,000 lf (1,081 lf of SRA provided in Segment 2

TABLE 5 Estimated SRA Cover Mitigation Cost Breakdown by Mitigation Site [a]

Cost Item	Onsite (3,000 lf of SRA cover)	Reach A (7,848 lf of SRA cover)	Guadalupe Creek (12,044 lf of SRA cover)	Total Cost (22,892 lf of SRA Cover)
Land	$39,000	$5,000	$21,540	
Mobilization	$23,400	$10,000	$12,700	
Site grading	n/a	n/a	$1,733,700	
SRA cover features	$1,131,025	$1,273,302	$823,350	
(site preparation, planting, irrigation, instream geomorphic features)				
Shade augmentation	$1,035,000	n/a	n/a	
Levee raising	n/a	$500,000	n/a	
Maintenance	$203,710	$121,214	$269,800	
Monitoring	$506,501	$233,029	$238,000	
Planning, engineering, and design	$215,000	$192,000	$372,000	
Construction management	$260,000	$240,000	$248,000	
Contingency	$341,364	$257,455	$371,910	
Total	$3,755,000	$2,832,000	$4,091,900	$10,678,000

n/a = not applicable.
[a] Costs shown in this table and used in this incremental cost analysis were developed by the Corps (October 1999 price level). Costs are based on actual cost data for mitigation components, or portions of mitigation components, constructed to-date or projected costs for mitigation components, or portions of mitigation components, yet to be constructed. Refer to GRR/EIR/SEIS, Chapter 8, for specific Federal and non-federal cost apportionment (U.S. Army Corps of Engineers, 2000c).

instead of 540 lf) and also assumes that volunteer SRA would occur to assist in achieving water temperature requirements. The Nine Easy Steps process tabular data in the Appendix reports the 2,459 lf figure. The GRR/EIR/SEIS and MMP report a total of 22,892 lf of SRA mitigation, which includes 3,000 lf in the onsite construction area. The 3,000 lf of SRA cover costs $2.72 million ($10.88/AAHU).

If boxed shade trees are found to be needed and installed as an adaptive management measure to mitigate adverse temperature effects during a short term interim period immediately following construction, cost of onsite SRA cover would increase to $3.76 million.

Reach A - 7,848 lf of SRA cover providing 1.98 AAHU at a cost of $2.83 million ($1.43 million/AAHU)

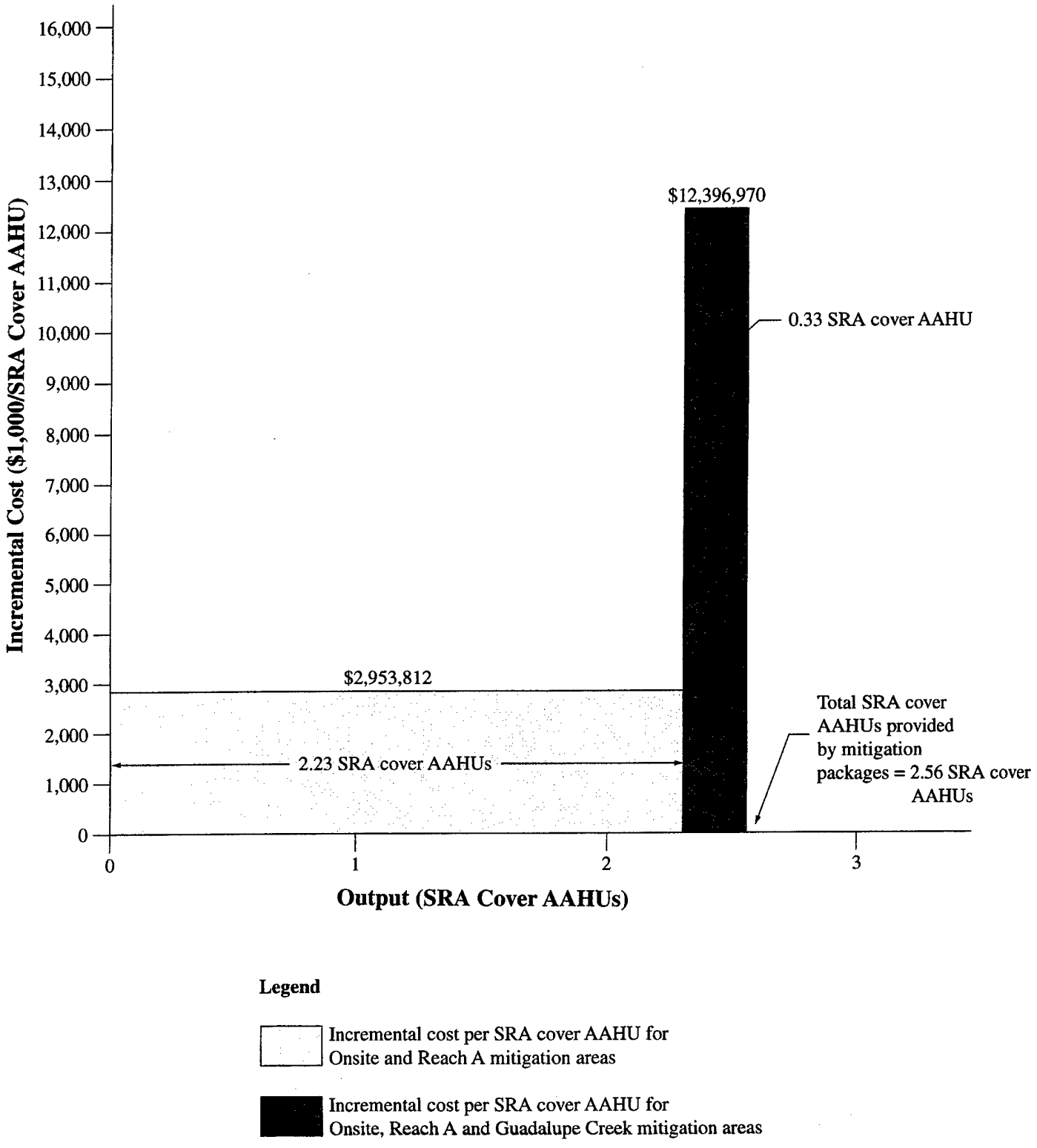
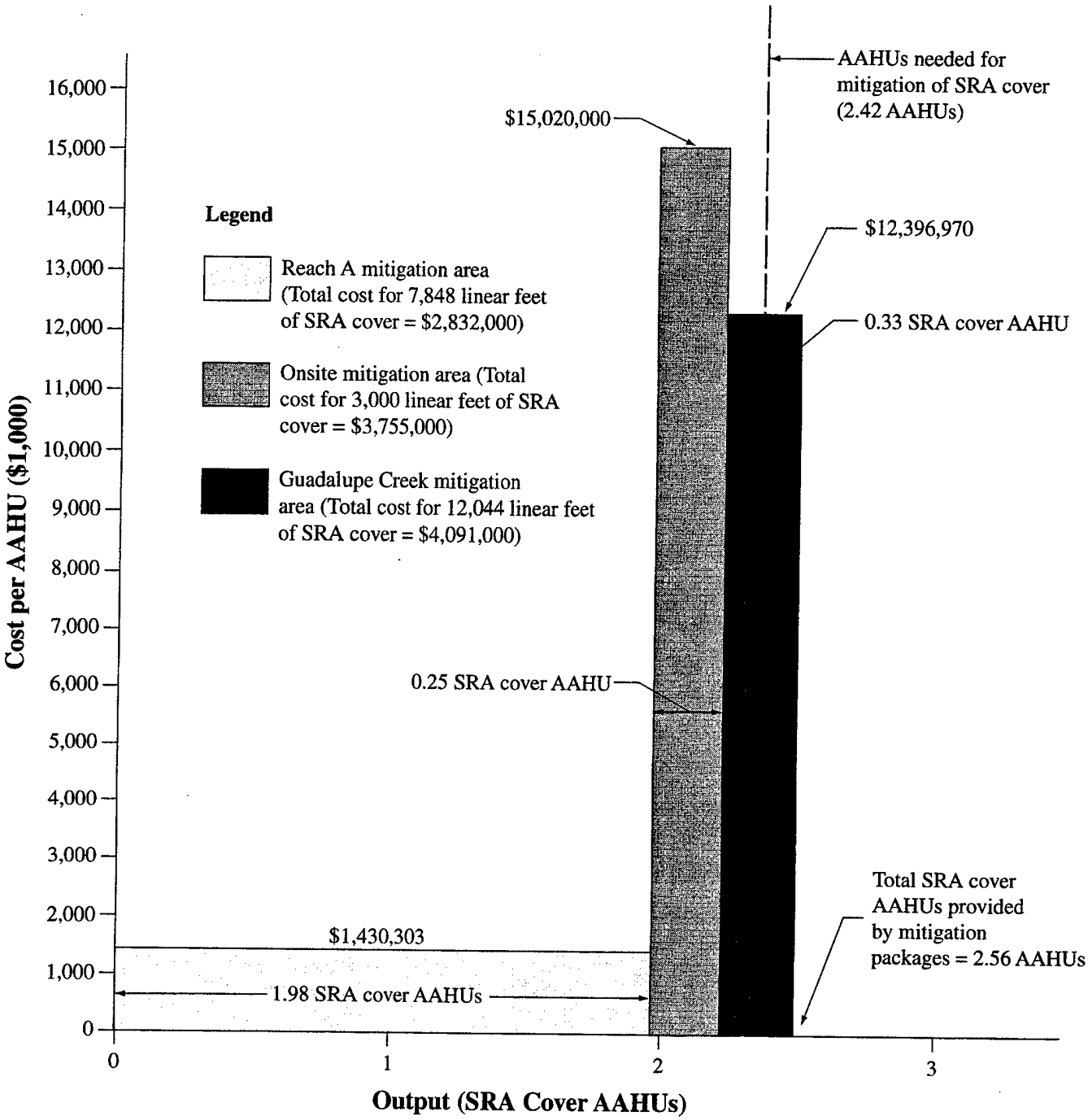


Figure 1 Incremental Cost of SRA Cover AAHUs for the Two Final Solutions from the CEICA



Notes:

1. Reach A SRA cover mitigation must accompany the Bypass System and onsite SRA cover mitigation to maintain Reach A water temperatures below 77° F.
2. All of the SRA cover mitigation generated on Guadalupe Creek is needed to maintain water temperatures below 77° F on Guadalupe Creek.
3. After assurance that water temperatures can be maintained below 77° F, 0.14 excess SRA cover AAHUs on Guadalupe Creek will be assigned for future use by the Santa Clara Valley Water District. Costs for excess SRA cover AAHUs are not Corps costs.

Figure 2 Average Cost per SRA Cover AAHU for the Three Individual Management Measures

Guadalupe Creek - 12,044 lf of SRA cover providing 0.33 AAHU at a cost of $4.96 million ($15.03 million/AAHU).

Although the mitigation plan produces 2.56 AAHUs compared to the need of 2.42 AAHUs resulting in an apparent 0.14 AAHU excess, the entire 2.56 AAHUs are needed for an effective mitigation plan as described below.

The bypass feature of the Proposed Action is the principal means used to maintain water temperature below 77 °F by reducing bank and channel invert armoring and the related removal of SRA cover vegetation. Maintaining adequate water temperatures requires mitigation by replacing lost SRA cover. SRA cover mitigation needed to replace SRA cover lost to construction is 2.42 AAHUs, but the need to maintain adequate water temperatures must also be considered. SRA cover consists of two primary components: a strip of riparian vegetation within 15 feet of the wetted perimeter of the river channel and instream geomorphic features that provide necessary biological and physical components. Trees provide shade and biological components; geomorphic features provide adequate depths at low flows. Both ameliorate water temperatures and provide the biological and physical infrastructure necessary for effective fish and wildlife habitat mitigation.

The first mitigation increment is onsite where 2,459 lf of SRA cover mitigation will provide 0.25 AAHU. The second increment is Reach A, immediately downstream from the construction area where 7,848 lf of SRA cover mitigation will provide 1.98 AAHUs, for a total of 2.23 AAHUs. In order to provide at least 2.42 AAHUs to meet the mitigation goal, the third increment is Guadalupe Creek where 12,044 lf of SRA cover mitigation will provide 0.33 AAHU for a project total of 2.56 AAHUs.

Although this third increment provides 0.14 AAHU greater than needed (Figure 2), studies by the HEP Team show that all of the SRA cover planned for Guadalupe Creek is necessary if any of that SRA cover is to be effective in maintaining water temperatures in Guadalupe Creek below 77 °F. Additionally, as a requirement of NMFS Biological Opinion, the inclusion of Guadalupe Creek as part of the mitigation package is necessary because it addresses effects on the threatened steelhead that cannot be completely captured by a HEP analysis. The Guadalupe Creek provides the opportunity to expand the range for rearing and spawning habitat for steelhead in the upper tributaries of the Guadalupe River watershed.

Recognizing that there is an excess of 0.14 AAHU in the planned 12,044 lf of SRA cover replacement for Guadalupe Creek, this feature was divided into two increments as described in paragraph 5.4.3.2 of the General Re-evaluation and Environmental Report and in the MMP. One increment of 7,178 lf of SRA cover is considered mitigation for the proposed action and its cost of $4,091,000 is included in the total cost of the flood protection project, which is being cost shared with the SCVWD. The other increment of 4,866 lf of SRA cover is not part of the proposed action and 100% of its cost is being paid by SCVWD, which may use it in the future for mitigation purposes.

Accordingly, the HEP Team and the Collaborative recommend that all of the mitigation of 2.56 AAHUs proceed.

6.2 Significance Criteria

There are three significant resources adversely affected by the project: threatened steelhead, candidate chinook salmon, and riparian habitat with its important sub-category of SRA cover.

Steelhead and chinook salmon are special-status fish species that occur in the Guadalupe River. Both species are in continuing scarcity as evidenced by their recognition under the ESA.

The central California coast steelhead evolutionarily significant unit (ESU) has been listed by the NMFS as threatened under the ESA, and the Guadalupe River is designated as critical habitat for the central California coast steelhead ESU. Steelhead are a valuable sports fishery providing important outdoor recreation benefit.

NMFS considers the chinook salmon in the Guadalupe River to be part of the Central Valley fall and late-fall run chinook salmon ESU. This ESU is considered a candidate species for listing under the ESA, and the Guadalupe River is considered essential habitat for chinook salmon. Chinook salmon are valuable in commercial and sports fisheries providing economic and outdoor recreation benefits to California and the Nation.

In addition to economic and legal/institutional significance criteria, both fishery resources are recognized by public perception criteria as significant. This is evidenced by the three organizations that joined the Collaborative to represent their constituents in seeking proper recognition and mitigation for damages to these fisheries, Guadalupe-Coyote Resource Conservation District, Pacific Coast Federation of Fishermen's Associations, and Trout Unlimited represented by the Natural Heritage Institute. Individual members of the public are active and continue to review and comment on plans developed by SCVWD as non-Federal partner for the Guadalupe River Project with Proposed Action and other projects of SCVWD in the Guadalupe River watershed affecting these fisheries.

Informal coordination/consultation with NMFS staff suggested strongly that the SRA cover mitigation measures, and specifically including those planned for the Guadalupe Creek mitigation site, will be required as reasonable and prudent measures pursuant to the ESA.

Riparian habitat in the western United States was always a comparatively limited resource concentrated along and closely adjacent to rivers and streams. SRA cover is an important sub-category of riparian habitat most important to fishery resources and to wildlife, which depend upon stream resources. In the arid west, this limited habitat provides resource values of great importance to fish and wildlife. Rangeland grazing practices, agricultural development, urbanization, and water resources development (dams and reservoirs for water supply, hydropower, flood protection and levees and channels for water supply distribution and flood protection) have greatly reduced the original limited resource converting it now into a scarce resource. Fish and wildlife species and populations dependent upon riparian habitat and SRA cover have been greatly reduced along with their habitat and many have been listed as endangered or threatened.

The USFWS, NMFS and DFG consistently advise the Corps under the Fish and Wildlife Coordination Act and the ESA on the importance of this resource throughout California and they consistently advise on the need to carefully appraise adverse effects from water resource developments and provide adequate mitigation. These significance criteria require project damage to SRA cover be fully mitigated and provide an important basis for establishing justification of mitigation.

6.3 Step 9: Is It Worth It?

Examination of these 3 mitigation increments using the Nine Easy Steps Process indicates that these mitigation management measures are worth their cost in order to meet or exceed the mitigation goal, although the last added increment is comparatively expensive. Figure 2 shows this relationship. Detailed tabular outputs from the Nine Easy Steps process are provided in the Appendix to this CEICA.

Two management measures, SRA cover mitigation located onsite and immediately downstream in Reach A, are combined. The combination is necessary since low flows cooled or maintained below 77 °F by SRA cover onsite continue downstream and assist in cooling or maintaining low flows in Reach A below 77 °F. Maintenance of water temperature below 77 °F is important in establishing SRA cover values for threatened steelhead and candidate chinook salmon.

7 Conclusions

7.1 Bypass System Alternative, with Incorporated Mitigation Commitments

The Bypass System Alternative is the Proposed Action and has been designed to reduce the requirements for bank and channel bed armoring and the resultant loss of SRA cover. Erosive forces will be reduced by bypassing a substantial portion of flood flows around Segment 3. The reduced armoring, accompanied by planned onsite SRA cover mitigation, maintains summer low-flow water temperatures below 77 °F, which is favorable for fish. The lower temperatures leaving the project reach result in effective SRA cover mitigation in Reach A, allowing SRA cover lost due to construction to be effectively replaced, resulting in successful mitigation. Special cost sharing for the SRA cover mitigation in Guadalupe Creek will reduce project mitigation costs to the appropriate amount equivalent to the mitigation goal of 2.42 AAHUs.

7.2 Mitigation Justification

It is concluded that mitigation of 22,892 lf of SRA cover at a cost of $10.68 million is justified by the need to meet the SRA cover mitigation goal of 2.42 AAHUs for replacing significant resource values lost due to project construction.

8 References

U.S. Army Corps of Engineers and Santa Clara Valley Water District. 2000. Integrated general re-evaluation report/environmental impact report/supplemental environmental impact statement: proposed modifications to the Guadalupe River project, downtown San Jose, California. Volumes 1 and 2. Draft. June 7. Prepared by U.S. Army Corps of Engineers, Sacramento District, Sacramento, California and Santa Clara Valley Water District, San Jose, California.

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APPENDIX – INTERPRETING THE OUTPUT FROM NINE-EASY STEPS PROCESS

The Appendix includes tables and a figure generated as part of the "Cost Effectiveness Analysis for Environmental Planning: Nine Easy Steps" process (Nine Easy Steps process) (U.S. Army Corps of Engineers 1994). Explanatory text is also provided to facilitate the reader's review of the tables and figure.

CONTENTS OF APPENDIX

1 Introduction

2 Task 1 - Formulation of Combinations

- 2.1 Step 1 – Display Outputs and Costs
- 2.2 Step 2 – Identify Combinable Management Measures
- 2.3 Step 3 – Calculate Outputs and Costs of Combinations

3 Task 2 – Cost Effectiveness Analysis

- 3.1 Step 4 – Eliminate Economically Inefficient Solutions
- 3.2 Step 5 – Eliminate Economically Ineffective Solutions

4 Task 3 – Development of Incremental Cost Curve

- 4.1 Step 6 – Calculate Average Costs
- 4.2 Step 7 – Recalculate Average Costs for Additional Output

5 Task 4 – Incremental Cost Analysis

- 5.1 Step 8 – Calculate Incremental Costs
- 5.2 Step 9 – Compare Successive Outputs and Incremental Costs

Tables

1. Tasks and Associated Steps from the Nine Easy Steps" Process.
2. Location of Mitigation Components.
3. Management Measures Outputs and Costs.
4. Ability to Combine Management Measures for the SRA Cover Mitigation Component.
5. Outputs and Costs of Combinations for All Solutions.
6. Outputs and Costs of Solutions Listed in Ascending Order of Outputs.
7. Outputs and Costs of Cost-Effective Least Cost Solutions for Each Level of Output.
8. Cost-Effective and Least Cost Solutions for SRA Cover Mitigation Component.
9. Cost-Effective and Least Cost Solutions for SRA Cover Mitigation Component.

10. Average Cost of Each Level of Output.

11. Average Cost for Additional Output, Recalculation.

12. Summary of Results of the Initial Calculation of Average Costs per AAHU and the Recalculation.

13. Remaining Solutions with Lowest Average Cost for Additional Output.

14. Supply Schedule of Incremental Costs.

15. Solutions with Lowest Average Costs for Additional Output.

16. Comparison of Outputs and Incremental Costs.

Figures

Figure 1. Incremental Cost of SRA Cover AAHUs for the Two Final Solutions from the Incremental Cost Analysis

INTERPRETING THE OUTPUT FROM THE NINE EASY STEPS PROCESS

1 Introduction

The "Cost Effectiveness Analysis for Environmental Planning: Nine Easy Steps" manual presents step-by-step instructions on how to conduct a mitigation cost effectiveness and incremental cost analysis (CEICA) using an analytical procedure (U.S. Army Institute for Water Resources 1994). The procedure consists of nine steps that are grouped into four tasks (Table 1-1). Several tables and a figure are generated as output from this process and are included in this appendix (Tables 3 through 16 and Figure 1). This discussion has been prepared to assist the reader with the interpretation of these tables and figure. The discussion is organized according to the tasks and steps from the process.

TABLE 1 Tasks and Associated Steps. This table lists the 4 tasks and 9 associated steps described in the "Cost Effectiveness Analysis for Environmental Planning: Nine Easy Steps" manual (U.S. Army Institute for Water Resources, 1994).

Task	Step	Corresponding Tables
1- Formulation of combinations	1- Display outputs and costs	3
	2 - Identify combinable management measures	4
	3 - Calculate outputs and costs of combinations	5
2 - Cost effectiveness analysis	4 - Eliminate economically inefficient solutions	6
	5 - Eliminate economically ineffective solutions	7, 8, 9
3 - Development of incremental cost curve	6 - Calculate average costs	10
	7 - Recalculate average costs for additional output	11, 12, 13
4 - Incremental cost analysis	8 - Calculate incremental costs	14, 15
	9 - Compare successive outputs and incremental costs	16

A mitigation package has been developed for the Guadalupe River Project with Proposed Action. The mitigation package consists of four primary mitigation components: fish passage, fish-spawning gravels, riparian vegetation, and shaded riverine aquatic (SRA) cover. These four primary mitigation components are being proposed onsite and/or offsite (Table 2). Onsite refers to Segments 1 to 3 and the Woz Way to Park Avenue Bypass Reach. Offsite refers to Reach A and Guadalupe Creek. The SRA cover mitigation component is further broken down into three management measures. A management measure represents the location where SRA cover will be installed. SRA cover mitigation is planned onsite, at Reach A, and at Guadalupe Creek. The SRA cover management measure for onsite is to install 3,000 linear feet of SRA cover

TABLE 2. Location of Mitigation Components

There are four primary mitigation components associated with the Guadalupe River Project with Proposed Action: fish passage, fish-spawning gravels, riparian vegetation, and shaded riverine aquatic (SRA) cover. These mitigation components will be located onsite (Segments 1-3 and Woz Way to Park Avenue Bypass Reach) and offsite (Reach A and Guadalupe Creek).

Mitigation Component	Location of Mitigation Component		
	Onsite	Reach A	Guadalupe Creek
Fish passage [a]	Yes	No	No
Fish-spawning gravels	Yes	No	No
Riparian vegetation[b]	Yes	No	No
SRA cover	Yes	Yes	Yes

[a] Installation of the fish passage mitigation component in Segments 1 and 2 was completed in 1996. Because this portion of the fish passage mitigation component was analyzed in the original incremental cost analysis prepared for the Guadalupe River Project (U.S. Army Corps of Engineers 1991), it is not included in this incremental cost analysis. Only the portion of the fish passage mitigation component in Segment 3 is considered in this incremental cost analysis.

[b] Installation of the riparian vegetation mitigation component was completed in 2000. Because this mitigation component was analyzed in the original incremental cost analysis prepared for the Guadalupe River Project (U.S. Army Corps of Engineers 1991), it is not considered in this incremental cost analysis.

plantings. The SRA cover management measure for Reach A is to install 7,484 linear feet of SRA cover plantings. The SRA cover management measure for Guadalupe Creek is to install 12,044 linear feet of SRA cover plantings.

A Habitat Evaluation Procedures (HEP) analysis was conducted for the SRA cover mitigation component to ensure that lost SRA cover quality, as well as quantity, was replaced by mitigation efforts (U.S. Army Corps of Engineers 2000). The output of the HEP analysis is reported in average annual habitat units (AAHUs). An AAHU is a non-monetary-based environmental output that quantifies project effects on the habitat value of SRA cover by looking at effects on species that use SRA cover along the Guadalupe River. To represent these species, several habitat suitability index (HSI) models were used in the HEP analysis. This incremental cost analysis uses the AAHU output from the rainbow trout evaluation species HSI model (referred to as SRA cover AAHUs in the incremental cost analysis). This HSI model output was selected for use in the incremental cost analysis because the model represents the suite of species that resource agencies are primarily interested in with respect to the management of the Guadalupe River.

The SRA cover mitigation component is evaluated in this incremental cost analysis because it is the only mitigation component with an environmental output (in the form of SRA cover AAHUs), as required by the Nine Easy Steps process. All other mitigation components did not have readily available environmental output data associated with them. Without environmental output, costs can only be reported in a non-incremental linear relationship; the more material that is installed, maintained, and monitored, the higher the cost.

While fish passage, fish-spawning gravel, and riparian vegetation are not included in this incremental cost analysis, the installation and monitoring costs for these mitigation components are included in a summary table (Table 3) to provide the reader with a general sense of the

potential cost for the complete proposed mitigation package for the Guadalupe River Project with Proposed Action.

2 Task 1 – Formulation of Combinations

Under Task 1, formulation of combinations, steps 1-3 (display outputs and costs, identify combinable management measures, and calculate outputs and costs of combinations, respectively) are undertaken. All possible combinations of management measures for the SRA cover mitigation component are identified (Table 4).

2.1 Step 1 - Display Outputs and Costs

The first step in identifying combinations of all possible management measures for the Guadalupe River Project with Proposed Action is to display the environmental outputs and cost estimates for each management measure (Table 3). The environmental outputs in AAHUs were determined as part of the HEP analysis (U.S. Army Corps of Engineers 2000). The costs were developed by the Corps. Costs are based on actual costs and projected costs for mitigation components, or portions of mitigation components, completed to-date or yet to be constructed. Generally, costs shown in Table 3 are aggregate costs for planning, design, engineering, and construction management; site preparation, grading, and installation; maintenance (years 1-3); and monitoring (years 1-3).

2.2 Step 2 - Identify Combinable Management Measures

The second step in identifying combinations of all possible management measures is to identify combinable management measures (Table 4). When determining combinable management measures, the overall AAHUs required to balance the HEP analysis were not considered. Rather, the assumptions in the HEP analysis were evaluated to see which management measures could be combined to provide the target AAHU values.

Table 4 shows that all 3 management measures for the SRA cover mitigation component can be combined or implemented individually except Reach A (RA). This limitation arises because RA relies on the implementation of mitigation onsite (OS). With the implementation of OS, water temperatures are cooled and this effect is carried into RA which further cools water temperatures, keeping water temperatures in RA below the critical HEP 77 degree F threshold for salmonid suitability.

2.3 Step 3 - Calculate Outputs and Costs of Combinations

The third step in identifying combinations of all possible management measures is to calculate outputs and costs of all possible combinations (Table 5). All possible combinations of the combinable management measures are identified, including output (in AAHUs) and cost (in dollars) through a systematic approach tiering off of Table 4.

3 Task 2 – Cost Effectiveness Analysis

Under Task 2, cost effectiveness analysis, steps 4 and 5 (eliminate economically inefficient solutions and eliminate economically ineffective solutions, respectively) are undertaken. The cost effectiveness analysis identifies and eliminates economically irrational solutions. Solutions refers to the management measures and their various combinations. The first step (step 4 in the overall process) is to eliminate inefficient solutions: If a given level of output can be produced in more than one way, the least expensive choice makes economic sense for that level of output.

TABLE 3 Management Measure Outputs and Costs

This table shows the outputs and costs of management measures, by mitigation component.

Mitigation Component [a, b]	Management Measure Code [a]	Management Measure [a]	Outputs (units are as indicated)	Costs($)
	No Action	No Action	0	0
Fish passage	LFC	Install 3,620 linear feet of low-flow channel onsite.	3,680 lf	826,000 [c]
Fish-spawning gravels	FSG	Install 25,190 square feet of spawning gravels onsite.	25,190 sq. ft.	30,000 [c]
Riparian vegetation	RIP	Install 21 acres of riparian vegetation onsite.	21 acres	975,000
Shaded riverine aquatic (SRA) cover	OS	Install 3,000 linear feet of SRA cover onsite [d]	0.25 AAHU [e]	3,755,000
	RA	Install 7,848 linear feet of SRA cover in Reach A.	1.98 AAHUs [e]	2,832,000
	GC	Install 12,044 linear feet of SRA cover in Guadalupe Creek.	0.33 AAHU[e]	4,091,000 [f]
		Subtotal Cost for SRA Cover Management Measures	**2.56 AAHUs [e]**	**10,678,000**
		Total Cost for Mitigation Components		**11,534,000 [g]**

[a] There are four primary mitigation components associated with the Guadalupe River Project with Proposed Action: fish passage, fish-spawning gravels, riparian vegetation, and shaded riverine aquatic (SRA) cover. The SRA cover mitigation component is further broken down into three management measures to represent the three different locations where SRA cover mitigation will be implemented: onsite (Segments 1-3 and Woz Way to Park Avenue Bypass Reach), Reach A, and Guadalupe Creek. Management measure code: OS = onsite, RA = Reach A, and GC = Guadalupe Creek.

[b] The only mitigation component evaluated under the Habitat Evaluation Procedures (HEP) analysis is SRA cover (U.S. Army Corps of Engineers 2000). As a result, it is the only mitigation component evaluated further in this incremental cost analysis because it can be evaluated incrementally using the non-monetary habitat value determined by the HEP analysis.

[c] Costs for fish passage and fish-spawning gravels are for construction; monitoring costs are not reflected. Fish passage construction costs are for Segments 3A and 3B; Segment 3C construction costs are not reflected.

[d] Costs associated with shade augmentation, which will occur in Segments 2, 3A, and 3B, are included in the onsite SRA cover costs.

[e] AAHU = average annual habitat unit for rainbow trout evaluation species habitat suitability index (HSI) model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000). These AAHUs are also referred to as SRA cover AAHUs in this incremental cost analysis. The rainbow trout evaluation species HSI model was selected for use in this incremental cost analysis because it represents the suite of species that resource agencies are primarily interested in with respect to the management of the Guadalupe River.

[f] The Corps and Santa Clara Valley Water District (SCVWD) have entered into a 215 Cost Sharing Agreement for the Guadalupe Creek mitigation site. As part of this cost sharing agreement, the Corps will be responsible for $4,091,000 of the total cost of $4,956,407. This incremental cost analysis uses the $4,091,000 amount to reflect Corps costs.

[g] Costs shown in this table and used in this incremental cost analysis were developed by the Corps and Jones & Stokes. Costs are based on actual cost data for mitigation components, or portions of mitigation components, constructed to-date or projected costs for mitigation components, or portions of mitigation components, yet to be constructed.

Table 4 Ability to Combine Management Measures for the SRA Cover Mitigation Component

This table shows possible combinations of the three SRA cover management measures. This incremental cost analysis only compares possible combinations of SRA cover management measures because the HEP analysis only determined average annual habitat unit (AAHU) values for the SRA cover mitigation component. "Yes" indicates that a management measure can be combined with, or implemented independent of, other management measures to provide the AAHU values assumed in the HEP analysis. "No" indicates that a management measure cannot be combined with, or implemented independent of, other management measures and achieve the AAHU values assumed in the HEP analysis.

Management Measure Code [a]	Management Measure	Can be combined with Management Measure: OS	RA	GC
OS	Install 3,000 linear feet of SRA cover plantings onsite.	Yes. OS can be implemented independent of other management measures and provide the AAHU value assumed in the HEP analysis.	Yes. OS and RA provide the AAHU values assumed in the HEP analysis.	Yes. OS and GC provide the AAHU values assumed in the HEP analysis.
RA	Install 7,848 linear feet of SRA cover plantings in Reach A.	Yes. RA and OS provide the AAHU values assumed in the HEP analysis.	No. RA only has AAHU value under the HEP analysis if it is implemented with OS.	No. RA and GC do not provide the AAHU values for RA assumed in the HEP analysis. RA only has AAHU value under the HEP analysis if it implemented with OS.
GC	Install 12,044 linear of SRA cover plantings in Guadalupe Creek.	Yes. GC and OS provide the AAHU values assumed in the HEP analysis.	No. GC and RA do not provide the AAHU values for RA assumed in the HEP analysis. RA only has AAHU value under the HEP analysis if it is implemented with OS.	Yes. GC can be implemented independent of other management measures and provide the AAHU value assumed in the HEP analysis.

a. OS = onsite, RA = Reach A, and GC = Guadalupe Creek.

The second step (step 5 in the overall process) is to then eliminate ineffective solutions: If a greater level of output can be produced for the same or less cost, than only the greater output choice makes economic sense. (U.S. Army Corps of Engineers 1994.)

3.1 A.3.1 Step 4 - Eliminate Economically Inefficient Solutions

The fourth step, eliminate economically inefficient solutions, requires that the list of solutions identified in Table 5 be reordered so that they are listed in ascending order of their outputs (Table 6). For each level of output, the least cost solution is then identified. Because each solution has a different level of output, no solutions are eliminated at this step.

3.2 Step 5 - Eliminate Economically Ineffective Solutions

The fifth step, eliminate economically ineffective solutions, requires that a pair-wise comparison of outputs and costs in Table 6 be conducted to identify and delete those solutions that will produce less output at equal or greater cost than subsequently ranked solutions (Table 7). In Table 7, the first level of output, 0.25 AAHU (representing OS), is produced at a cost of $3,755,000 (for an average cost per AAHU of $15,020,000). Assuming that it initially makes sense to spend $15,020,000 to produce 0.25 AAHU, the analysis must look at subsequently ranked solutions to see if the next level of output is more costly on a per AAHU basis. Because the first level of output represents the most cost per AAHU, all subsequently ranked solutions are considered cost effective because they have a lower cost per AAHU than the first level of output. As a result, no solutions are eliminated at this step and Table 7 is functionally the same as Table 6. Tables 8 and 9 are functionally the same as Table 7 except that they provide additional information for each solution for easier interpretation. Shorthand names for solutions and text description for management measures are included in Tables 8 and 9.

4 Task 3 – Development of Incremental Cost Curve

Under Task 3 development of an incremental cost curve, steps 6 and 7 (calculate average costs and recalculate average costs for additional output, respectively) are undertaken. The increments that can be evaluated for SRA cover are limited as a result of the way the HEP analysis was conducted. Only broad increments, based on the geographic location of the management measure, can be discerned and associated with AAHU outputs.

4.1 Step 6 - Calculate Average Costs

Task 2, "Cost Effectiveness Analysis," screened solutions to determine their cost effectiveness (Tables 7, 8, and 9). These solutions are further screened in the sixth step, calculate average costs, to identify irregular, non-continuously increasing cost changes that are uncharacteristic of a classic incremental cost curve. To identify any irregular cost changes, the average costs per AAHU have been calculated for each solution to progressively identify additional levels of output that can be produced at the lowest average cost. The initial calculation is shown in Table 10. As a result of the initial calculation, three solutions are eliminated from the analysis: OS, Guadalupe Creek (GC), OS + GC. Two solutions are left: OS + RA and OS + RA + GC.

4.2 Step 7 - Recalculate Average Costs for Additional Output

In the seventh step, recalculate average costs for additional output, the first recalculation of average costs is undertaken. As a result of the first recalculation, one of the two remaining outputs is eliminated (OS + RA), leaving only the output with the lowest average cost per output (OS + RA + GC) (Table 11). Table 12 summarizes the results of steps 6 and 7. Table 13 is

TABLE 5 Outputs and Costs of Combinations for All Solutions.

This table shows the outputs and costs of the SRA cover management measure combinations for all solutions for the Guadalupe River Project with Proposed Action.

Management Measure Combinations[a]	Outputs[b] (AAHUs)	Costs ($)
No Action	0	0
OS	0.25	3,755,000
OS + RA	2.23	6,587,000
OS + GC	0.58	7,846,000
OS + RA + GC	2.56	10,678,000
GC	0.33	4,091,000

[a] OS = onsite, RA = Reach A, and GC = Guadalupe Creek.

[b] AAHU = average annual habitat unit for rainbow trout evalution species habitat suitability index (HSI) model (as determined through the Habitat Evaluation Procedures [HEP] analysis) (U.S. Army Corps of Engineers 2000).

TABLE 6 Outputs and Costs of Solutions Listed in Ascending Order of Outputs.

This table lists all SRA cover solutions for the Guadalupe River Project with Proposed Action in order of ascending outputs. Because none of the solutions have the same output value, no solutions were eliminated.

Solutions[a] (SRA Cover)	Outputs[b] (AAHUs)	Costs ($)
No Action	0	0
OS	0.25	3,755,000
GC	0.33	4,091,000
OS + GC	0.58	7,846,000
OS + RA	2.23	6,587,000
OS + RA + GC	2.56	10,678,000

[a] OS = onsite, RA = Reach A, and GC = Guadalupe Creek.

[b] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

TABLE 7 Outputs and Costs of Cost-Effective Least Cost Solutions for Each Level of Output
This table shows outputs and costs of cost-effective least cost solutions for each level of output, by management measure. Assuming that it makes sense to produce 0.25 AAHU at a cost of $3,755,000 (or $15,020,000 per AAHU) for onsite mitigation (OS), all of the remaining management measures or solutions are considered to be cost effective because the per AAHU cost for these solutions is less than the per AAHU cost for OS (U.S. Army Corps of Engineers 1994).

Management Measure[a]	Outputs [b] (AAHUs)	Costs ($)	Average Cost ($ per AAHU)
No Action	0	0	0
OS	0.25	3,755,000	15,020,000
GC	0.33	4,091,000	12,396,970
OS + GC	0.58	7,846,000	13,527,586
OS + RA	2.23	6,587,000	2,953,812
OS + RA + GC	2.56	10,678,000	4,171,094

[a] OS = onsite, RA = Reach A, and GC = Guadalupe Creek.
[b] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

TABLE 8 Cost Effective and Least Cost Solutions for SRA Cover Mitigation Component.
This table summarizes the cost effective and least cost solutions for the SRA cover mitigation component. Text descriptions are provided to facilitate review.

Name of Solution	Management Measure [a]	Description	Outputs [b] (AAHUs)	Costs ($)	Average Cost ($ per AAHU)
No Action	No Action	No Action	0	0	0
solution 1	OS	Install 3,000 lf of SRA cover plantings onsite.	0.25	3,755,000	15,020,000
solution 2	GC	Install 12,044 lf of SRA cover plantings in Guadalupe Creek.	0.33	4,091,000	12,396,970
solution 3	OS + GC	Install 3,000 lf of SRA cover plantings onsite. Install 12,044 lf of SRA cover plantings in Guadalupe Creek.	0.58	7,846,000	13,527,586
solution 4	OS + RA	Install 3,000 lf of SRA cover plantings onsite. Install 7,848 lf of SRA cover plantings in Reach A.	2.23	6,587,000	2,953,812
solution 5	OS + RA + GC	Install 3,000 lf of SRA cover plantings onsite. Install 7,848 lf of SRA cover plantings in Reach A. Install 12,044 lf of SRA cover plantings in Guadalupe Creek.	2.56	10,678,000	4,171,094

[a] OS = onsite, RA = Reach A, and GC = Guadalupe Creek.
[b] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

TABLE 9 Cost-Effective and Least Cost Solutions for SRA Cover Mitigation Component.
This table condenses information provided in Tables A-7 and A-8.

Name of Solution	Management Measure [a]	Outputs [b] (AAHUs)	Costs ($)	Average Cost ($ per AAHU)
No Action	No Action	0	0	0
solution 1	OS	0.25	3,755,000	15,020,000
solution 2	GC	0.33	4,091,000	12,396,970
solution 3	OS + GC	0.58	7,846,000	13,527,586
solution 4	OS + RA	2.23	6,587,000	2,953,812
solution 5	OS + RA + GC	2.56	10,678,000	4,171,094

[a] OS = onsite, RA = Reach A, and GC = Guadalupe Creek.

[b] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

TABLE 10 Average Cost of Each Level of Output
Shaded cells identify the lowest average cost per AAHU of output. Outputs that are less than the output with the lowest average cost per AAHU will be eliminated from the incremental cost analysis.

Name of Solution	Management Measure [a]	Outputs [b] (AAHUs)	Costs ($)	Average Cost ($ per AAHU)
No Action	No Action	0	---	---
solution 1	OS	0.25	3,755,000	15,020,000
solution 2	GC	0.33	4,091,000	12,396,970
solution 3	OS + GC	0.58	7,846,000	13,527,586
solution 4	OS + RA	2.23	6,587,000	2,953,812
solution 5	OS + RA + GC	2.56	10,678,000	4,171,094

[a] OS = onsite, RA = Reach A, and GC = Guadalupe Creek.

[b] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

TABLE 11 Average Cost for Additional Output, Recalculation
Outputs and costs of levels of output greater than 2.23 AAHUs are displayed. Average cost for additional AAHU output was calculated by dividing each level's additional cost by its' additional output.

Outputs [a] (AAHUs)	Additional Outpu [a] (AAHUs)	Costs ($)	Additional Cost ($)	Average Cost for Additional Output ($ per AAHU)
2.23	0	6,587,000	0	---
2.56	0.33	10,678,000	4,091,000	12,396,970

[a] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

TABLE 12 Summary of Results of the Initial Calculation of Average Costs per AAHU and the Recalculation
Shaded cells identify the lowest average cost per AAHU of additional output for each calculation.

Outputs [a] (AAHUs)	Average Cost for Additional Output Initial Average Cost per AAHU ($)	Recalculation of Average Cost for Additional Output ($ per AAHU)
0	---	
0.25	15,020,000	
0.33	12,396,970	
0.58	13,527,586	
2.23	2,953,812	---
2.56	4,171,094	12,396,970

[a] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

TABLE 13 Remaining Solutions with Lowest Average Cost for Additional Output

Name of Solution	Management Measure [a]	Description	Outputs [b] (AAHUs)	Costs ($)
No Action	No Action	No Action	0	0
solution 4	OS + RA	Install 3,000 lf of SRA cover plantings onsite. Install 7,848 lf of SRA cover plantings in Reach A.	2.23	6,587,000
solution 5	OS + RA + GC	Install 3,000 lf of SRA cover plantings onsite. Install 7,848 lf of SRA cover plantings in Reach A. Install 12,044 lf of SRA cover plantings in Guadalupe Creek.	2.56	10,678,000

[a] OS = onsite, RA = Reach A, and GC = Guadalupe Creek.

[b] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

functionally the same as Table 12 except that it provides additional information for each solution for easier interpretation. Shorthand names and text description for solutions are included in Table 13.

5 A.5 Task 4 - Incremental Cost Analysis

Under Task 4, incremental cost analysis, steps 8 and 9 (calculate incremental costs and compare successive outputs and incremental costs, respectively) are undertaken.

5.1 Step 8 - Calculate Incremental Costs

In the eighth step, calculate incremental costs, changes in costs are identified and interpreted for increasing increments of outputs (Table 14). In this incremental cost analysis, incremental costs are generally associated with the addition of new geographic locations for SRA cover management measures. Table 15 is functionally the same as Table 13 except that incremental costs have been added from Table 14.

Figure 1 is a bar graph of the incremental costs listed in Tables 14 and 15. Interpreting this figure, it appears that to add a 0.33 AAHU increment to solution 4 (OS + RA), thereby creating solution 5 (OS + RA + GC), will cost $12,369,970.

5.2 Step 9 – Compare Successive Outputs and Incremental Costs

The ninth step, compare successive outputs and incremental costs, provides information to allow a progressive comparison and question process to determine if each proceeding level of output is worth the additional incremental cost. The first level of output, 2.23 AAHUs (OS + RA), is compared to 0 AAHU level of output (no action). The first level of output can be produced at a cost of $2,953,812 per AAHU (Table 16a). The next level of output provides 0.33 AAHU (GC) at an incremental cost of $12,396,970 per AAHU (Table 16b).

Cost considerations are just one aspect of evaluating the "worthiness" of the mitigation package for the Guadalupe River Project with Proposed Action. Solutions may continue to be "considered regardless of their 'worthiness' as judged through the MICA" (U.S. Army Institute for Water Resources, 1994). This is because other situations may also prevail that are equally important, or more so, than cost. As in the case of the Guadalupe River Project with Proposed Action, U.S. Fish and Wildlife Service has requested that all of Guadalupe Creek be restored for steelhead; SCVWD, the non-Federal sponsor, is also interested in restoring all Guadalupe Creek and cost sharing the expense with the Corps; and a large group of stakeholders brought together through a dispute resolution process are interested in restoration throughout the Guadalupe River watershed, including Guadalupe Creek. Lastly, all the outputs evaluated in Table 16 are required to balance the HEP analysis for adverse effects on SRA cover from the Guadalupe River Project with Proposed Action. A total of 2.42 SRA cover AAHUs are needed to fully compensate for project effects and these SRA cover AAHUs are generated by OS + RA + GC, which has a combined value of 2.56 SRA cover AAHUs. Chapters 6 and 7 of the CEICA text further justify the incremental cost of Guadalupe Creek (GC).

TABLE 14 Supply Schedule of Incremental Costs
Incremental cost is the difference in cost between mitigation solutions divided by the difference in output (AAHU).

Outputs [a] (AAHUs)	Initial Calculation ($)	Additional Output [a] (AAHU)	Additional Cost ($)	Incremental Cost ($ per AAHU)
0	0	---	---	---
2.23	6,587,000	2.23	6,587,000	2,953,812
2.56	10,678,000	0.33	4,091,000	12,396,970

[a] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

TABLE 15 Solutions with Lowest Average Costs for Additional Output

Name of Solution	Management Measure [a]	Description	Outputs [b] (AAHUs)	Costs ($)	Incremental Costs ($ per AAHU)
No Action	No Action	No Action	0	0	0
solution 4	OS + RA	Install 3,000 lf of SRA cover plantings onsite. Install 7,848 lf of SRA cover plantings in Reach A.	2.23	6,587,000	2,953,812
solution 5	OS + RA +GC	Install 3,000 lf of SRA cover plantings onsite. Install 7,848 lf of SRA cover plantings in Reach A. Install 12,044 lf of SRA cover plantings in Guadalupe Creek.	2.56	10,678,000	12,369,969

[a] OS = onsite, RA = Reach A, and GC = Guadalupe Creek.

[b] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

TABLE 16 Comparison of Outputs and Incremental Costs
Incremental cost is the difference in cost between mitigation solutions divided by the difference in output or AAHUs.

Table 16a Are the first 2.23 AAHUs worth an incremental cost of $2,953,812 apiece?

Outputs [a] (AAHUs)	Original Calculation ($)	Additional Output [a] (AAHU)	Additional Cost ($)	Incremental Cost ($ per AAHU)
0	0	---	---	---
2.23	6,587,000	2.23	6,587,000	2,953,812

Table 16b Is the next 0.33 AAHU worth an incremental cost of $15,019,415 apiece?

Outputs [a] (AAHUs)	Original Calculation ($)	Additional Output [a] (AAHU)	Additional Cost ($)	Incremental Cost ($ per AAHU)
2.23	6,587,000	2.23	6,587,000	2,953,812
2.56	10,678,000	0.33	4,091,000	12,396,970

[a] AAHU = average annual habitat unit for rainbow trout evaluation species HSI model (as determined through the HEP analysis) (U.S. Army Corps of Engineers 2000).

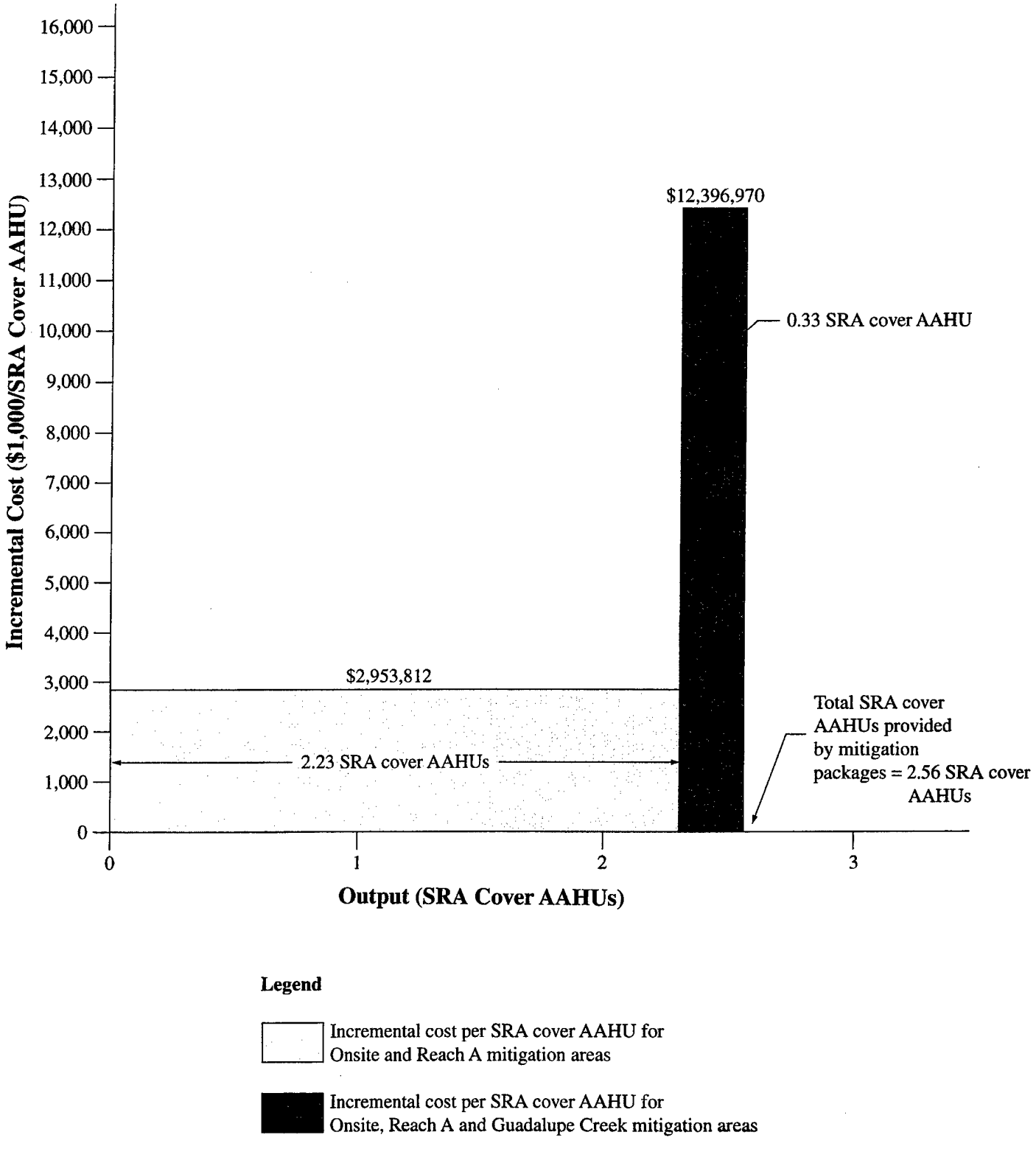
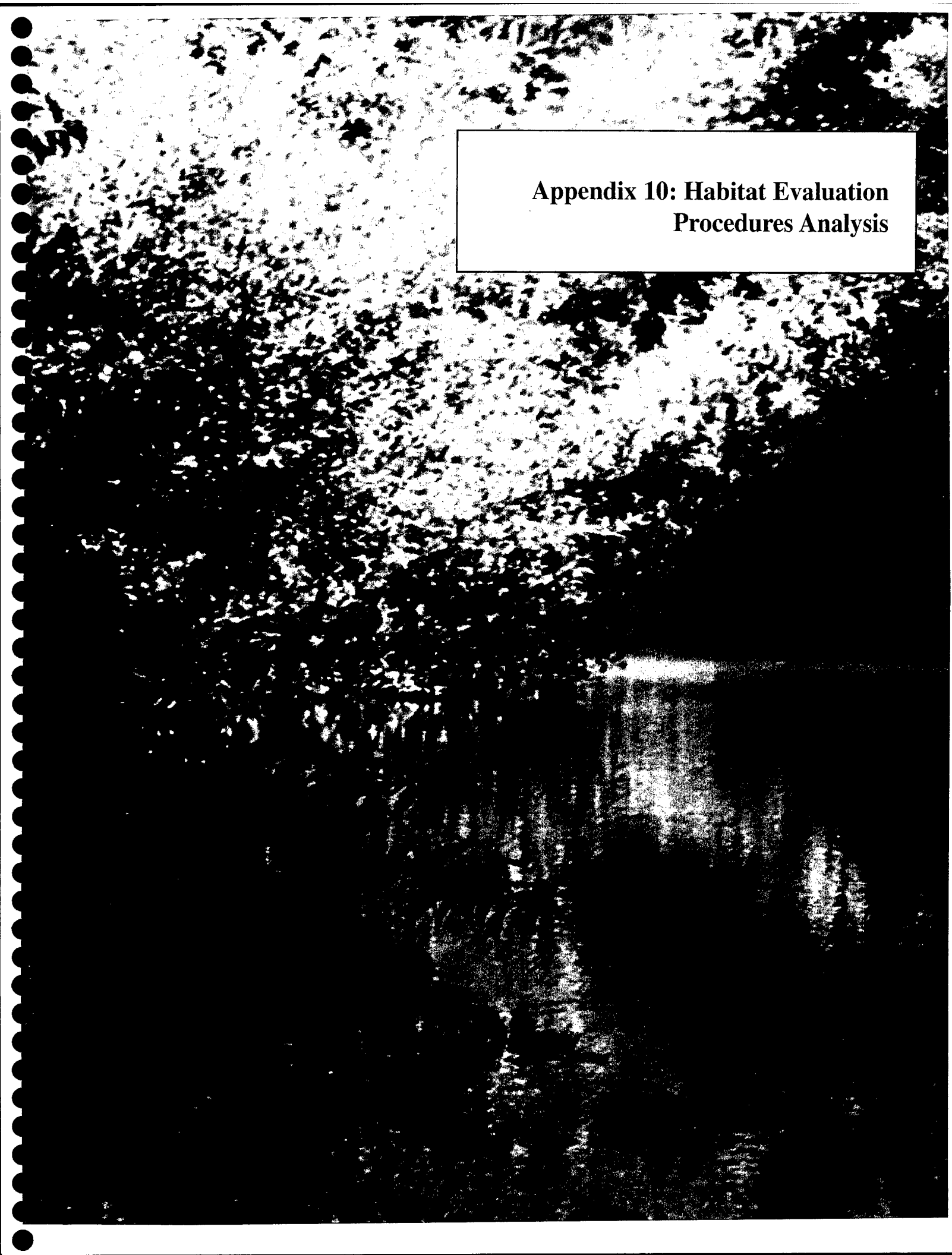


Figure 1 Incremental Cost of SRA Cover AAHUs for the Final Solutions from the CEICA



Appendix 10: Habitat Evaluation Procedures Analysis

Habitat Evaluation Procedures Analysis
Guadalupe River Project
Downtown San Jose, California

Prepared for:

U.S. Fish and Wildlife Service
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846
Contact: Steve Schoenberg
916/414-6600

Prepared by:

U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814-2922
Contact: Nina Bicknese
916/557-7948
e-mail: nbicknese@spk.usace.army.mil

December 21, 2000

This document should be cited as:

U.S. Army Corps of Engineers. 2000. Habitat evaluation procedures analysis, Guadalupe River project, downtown San Jose, California. December 21. Prepared for U.S. Fish and Wildlife Service, Sacramento, California. Assisted by Jones & Stokes (J&S F027). Sacramento, California.

Table of Contents

Page

Chapter 1. Introduction 1-1
1.1 REPORT AUDIENCE 1-1
1.2 DEFINITION OF SHADED RIVERINE AQUATIC COVER 1-1
1.3 PROJECT BACKGROUND 1-1
1.4 NEED FOR PROJECT MODIFICATION 1-2
1.5 NEED FOR SRA COVER HEP ANALYSES 1-3
1.5.1 History of SRA Cover HEP Analyses Conducted for the Project 1-3
1.6 PROJECT ALTERNATIVES EVALUATED IN THE SRA COVER HEP ANALYSIS 1-4
1.7 RELATIONSHIP OF BYPASS ALTERNATIVES EVALUATED IN THIS REPORT TO BYPASS ALTERNATIVES EVALUATED IN OTHER ENVIRONMENTAL DOCUMENTS 1-5
1.8 DOCUMENT ORGANIZATION 1-6

Chapter 2. Description of Project Alternatives and Associated Mitigation Packages 2-1
2.1 INTRODUCTION 2-1
2.1.1 Location of Project Alternatives and Mitigation Areas 2-1
2.1.2 Implementation Schedule for Project Alternatives by Segment 2-2
2.2 DESCRIPTION OF PROJECT ALTERNATIVES AND ASSOCIATED MITIGATION PACKAGES 2-3
2.2.1 Authorized Project Alternative 2-3
2.2.2 Double Bypass System Alternative 2-5
2.2.3 Triple Bypass System Alternative 2-6

Chapter 3. Habitat Evaluation Procedures Analysis and Results 3-1
3.1 METHODS 3-1
3.1.1 HEP Technical Team Involvement 3-1
3.1.2 HSI Modeling 3-1
3.1.3 HEP Modeling 3-5
3.2 RESULTS AND CONCLUSIONS 3-10
3.2.1 Authorized Project Alternative 3-10
3.2.2 Double Bypass System Alternative 3-12
3.2.3 Triple Bypass System Alternative 3-13
3.3 CONCLUSIONS 3-14

Chapter 4. Citations 4-1
4.1 PRINTED REFERENCES 4-1
4.2 PERSONAL COMMUNICATIONS 4-2

Appendix A Comparison of Shaded Riverine Aquatic Cover Adverse Effects and Channel Bed Armoring Length between the Triple Bypass System Alternative and the Proposed Action

Appendix B Habitat Evaluation Procedures Technical Team

Appendix C Habitat Suitability Index Model for Non-Salmonid Aquatic Guild

Appendix D Form C Output from Habitat Evaluation Procedures Model

Appendix E Suitability Indices and Future Assumptions for Project Alternatives

Appendix F Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Offsite Mitigation Sites

Appendix G Form D Output from Habitat Evaluation Procedures Model

Appendix H Form H Output from Habitat Evaluation Procedures Model

List of Tables

		On Page
2-1	Construction Status of Flood Protection Components by Segment	2-3
2-2	Summary of Construction and Mitigation Components Assumed for the Three Project Alternatives Evaluated in the Habitat Evaluation Procedure Analysis	Follows Page 2-4
2-3	Baseline, Affected, and Mitigation Planting Length of Shaded Riverine Aquatic Cover, by Project Alternative	Follows Page 2-6
3-1	Habitat Suitability Index Model Habitat Variables and Source of Data Used for Each Variable	Follows Page 3-2
3-2	Field Data Collection Dates by Location	3-2
3-3	Plan Alternative and Mitigation Plan Descriptors Used in the Habitat Evaluation Procedures Model Output Forms	3-6
3-4	Change in Average Annual Habitat Units For Evaluation Species and Cover Type for Without- Project, With-Project and With-Mitigation (Offsite) Conditions, by Project Alternative	3-7
3-5	Relative Value Index Assumptions for Rainbow Trout Evaluation Species and Non-Salmonid Pool Habitat Cover Type	3-8
3-6	Change in Average Annual Habitat Units For Evaluation Species and Cover Type for Without- Project, With-Project and With-Mitigation (Offsite) Conditions, by Project Alternative	Follows Page 3-10
3-7	Change in Average Annual Habitat Units for Evaluation Species/Cover Type from Without-Project Conditions for Offsite Mitigation Sites, by Project Alternatives	Follows Page 3-10

List of Figures

		Follows Page
1-1	Guadalupe River Project Vicinity Map	1-2
1-2	Guadalupe River Watershed	1-4
2-1	Authorized Project Alternative	2-2
2-2	Double Bypass System Alternative	2-2
2-3	Triple Bypass System Alternative	2-2
3-1	Schematic Diagram of Segments Used in the Guadalupe River Temperature Model	3-4

Chapter 1. Introduction

1.1 REPORT AUDIENCE

The U.S. Army Corps of Engineers, Sacramento District (Corps) has prepared this report for the U.S. Fish and Wildlife Service (USFWS). The report summarizes the results of a Habitat Evaluation Procedures (HEP) analysis of shaded riverine aquatic (SRA) cover for a flood protection project along the Guadalupe River in downtown San Jose, California. The anticipated audience for this report is a reader with a working knowledge of the basic HEP analysis process and terms (U.S. Fish and Wildlife Service 1994). The focus of this report is on the assumptions, methods, and results of the SRA cover HEP analysis.

1.2 DEFINITION OF SHADED RIVERINE AQUATIC COVER

SRA cover is defined as the unique, nearshore aquatic cover occurring at the interface between a river and adjacent riparian habitat. Two key features of SRA cover are:

- an adjacent bank composed of natural, often eroding, substrate that supports vegetation overhanging and protruding into the water (overhead feature) and
- a stream channel with variable amounts of woody material and detritus and variable water velocity and depth (instream feature) (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000b).

For the purposes of this report, the overhead feature of SRA cover is referred to as SRA cover and the instream feature of SRA cover is referred to as instream SRA cover.

1.3 PROJECT BACKGROUND

The multipurpose Guadalupe River Project is under phased construction along 2.6 miles of the Guadalupe River in downtown San Jose (Figure 1-1). When all phases are complete, the project will provide a 100-year level of flood protection up to the design flow of 17,000 cubic feet per second (cfs) to downtown San Jose and surrounding areas while avoiding, minimizing, or mitigating adverse project effects on fish and wildlife habitat, including SRA cover. The Corps is the lead Federal sponsor and the Santa Clara Valley Water District (SCVWD) is the lead non-Federal sponsor of the Guadalupe River Project.

The Guadalupe River Project was authorized by Congress in 1986 to provide flood protection and amended in 1990 and 1991 to add additional environmental protection and include features for recreation. Construction of the Authorized Project began in 1992 after State water quality certification was obtained, as required under Section 401 of the Clean Water Act (CWA). A condition of the 1992 water quality certification required that a Mitigation and Monitoring Plan

(MMP) be developed for the Authorized Project. A June 1992 MMP (U.S. Army Corps of Engineers 1992) specified mitigation measures for four resources: riparian vegetation, fish-spawning gravel, fish passage, and water temperature. Installation of these measures began in 1994 and has continued in cooperation with relevant resource agencies under current clearances and permits.

1.4 NEED FOR PROJECT MODIFICATION

Construction of the Authorized Project's flood protection components stopped in 1996 because of concerns about the adequacy of SRA cover mitigation, new and proposed listings of threatened and endangered species in the Guadalupe Rivershed watershed area (Central Coast steelhead and fall-run chinook salmon), and the receipt of a notice of intent to sue from several environmental organizations. These environmental organizations were concerned that (1) the third and final phase of the Authorized Project, which mainly consisted of concrete-lined channels, would harm steelhead and chinook salmon runs and (2) the riparian mitigation in the 1992 MMP did not adequately replace the quality as well as the quantity of SRA cover adversely affected by the project.

In June 1997, staff from the USFWS, National Marine Fisheries Service (NMFS), California Department of Fish and Game (CDFG), and the California State Water Resources Control Board (SWRCB) met with the Corps and SCVWD to express their concerns about the existing mitigation measures for the project. The following priorities were identified by the resource agencies:

- redesign the project to avoid adverse project effects and maximize onsite mitigation,
- maximize onsite revegetation to replace SRA cover,
- replace the quality as well as the quantity of affected SRA cover,
- provide additional fisheries mitigation, and
- provide thermal mitigation.

In December 1997, the Corps and SCVWD joined with the City of San Jose (City) and the San Jose Redevelopment Agency (SJRA) to initiate the Guadalupe River Flood Control Project Collaborative (Collaborative), a facilitated program designed to resolve resource mitigation disputes. Representatives of the Collaborative include the Corps, SCVWD, City, SJRA, USFWS, NMFS, CDFG, SWRCB, California Regional Water Quality Control Board (RWQCB) as well as the Guadalupe-Coyote Resource Conservation District, Pacific Coast Federation of Fishermen's Associations, and Trout Unlimited, all represented by Natural Heritage Institute (NHI).

In July 1998, the Corps and SCVWD agreed to redesign a portion of the Authorized Project to include an underground bypass that would minimize adverse effects on SRA cover and to revise the project's 1992 MMP. Since that time, the Corps and SCVWD, in coordination with resource agencies and the Collaborative, have been refining objectives, investigating project modifications that satisfy the Endangered Species Act (ESA) and CWA, and working to develop an acceptable MMP.

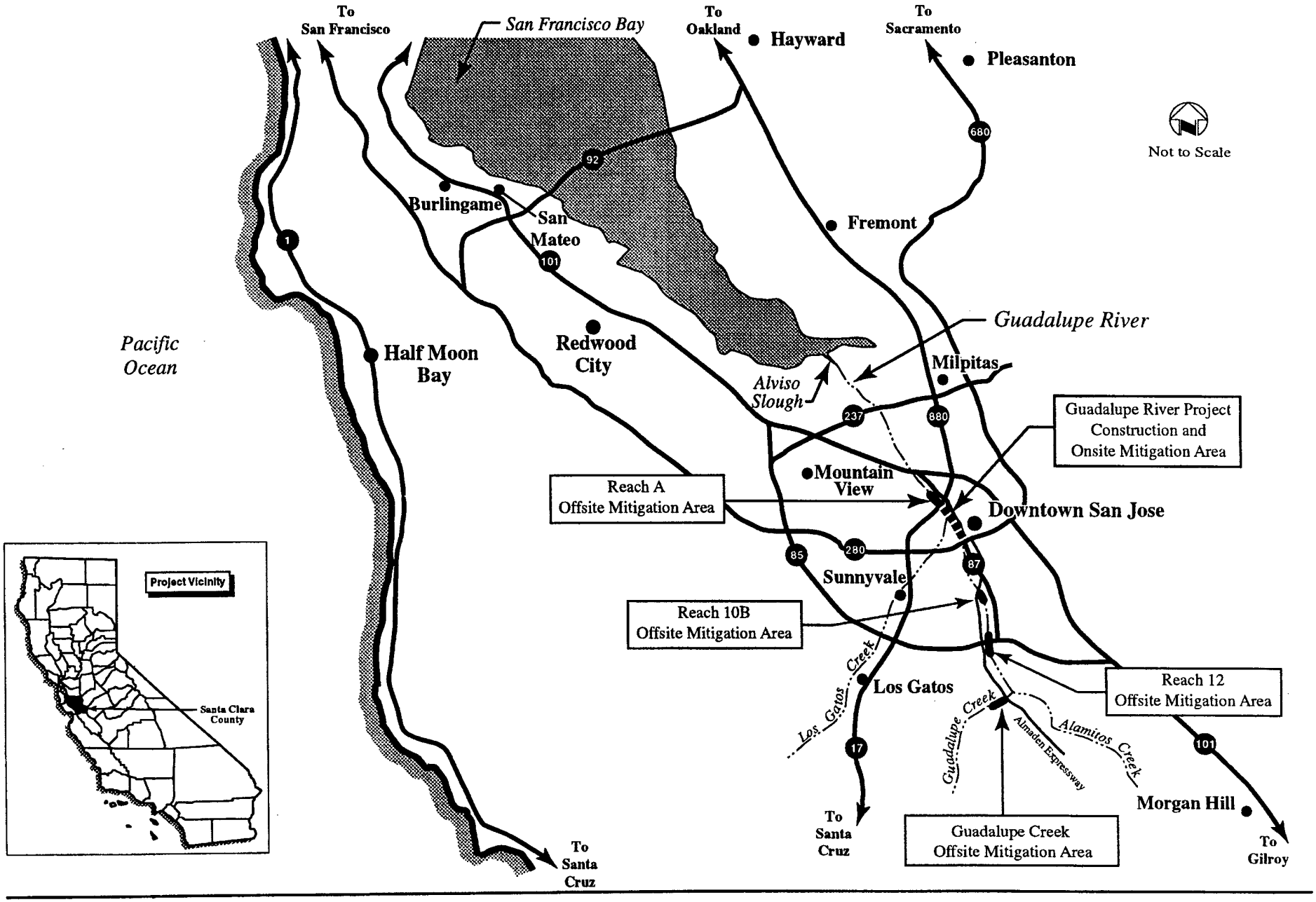


Figure 1-1
Guadalupe River Project Vicinity Map

1.5 NEED FOR SRA COVER HEP ANALYSES

To respond to resource agency concerns regarding the adequacy of SRA cover mitigation, both from a quality and quantity perspective, the Corps agreed to use a HEP analysis approach to guide development of acceptable mitigation for SRA cover losses caused by the Authorized Project and any project modifications. This SRA cover HEP analysis report builds on previous SRA cover HEP analyses described below, primarily the 1996–1997 SRA cover HEP analysis (Jones & Stokes Associates 1997).

1.5.1 History of SRA Cover HEP Analyses Conducted for the Project

Previous SRA cover HEP analyses have been conducted for the Authorized Project (U.S. Fish and Wildlife Service 1993, Jones & Stokes Associates 1997). In 1992–1993, an SRA cover HEP analysis was conducted by a HEP technical team made up of representatives from USFWS, CDFG, SWRCB, SCVWD, and the Corps. NMFS did not actively participate in the SRA cover HEP analysis but was periodically informed of the HEP technical team's activities. The 1992–1993 SRA cover HEP analysis evaluated the effects on SRA cover caused by construction of the first phase of the Authorized Project. This analysis used three evaluation species habitat suitability index (HSI) models: rainbow trout (*Oncorhynchus mykiss*) (Raleigh et al. 1984), green sunfish (*Lepomis cyanellus*) (Stuber et al. 1982), and belted kingfisher (*Ceryle alcyon*) (Prose 1985). The results of the 1992–1993 SRA cover HEP analysis were summarized in a 1993 report (U.S. Fish and Wildlife Service 1993). This report indicated that full mitigation of adverse effects on SRA cover caused by the first phase of the Authorized Project was possible; however, offsite mitigation would be necessary, in addition to onsite mitigation, because of project design constraints. The 1993 SRA cover HEP analysis report also recommended that a SRA cover HEP analysis be performed for the entire Authorized Project so that a comprehensive mitigation plan could be developed before an irretrievable commitment of resources could potentially occur (U.S. Fish and Wildlife Service 1993).

An independent review of the 1992–1993 SRA cover HEP analysis identified missing variables and calculation errors in the evaluation species' HSI models (Jones & Stokes Associates 1995). In 1996, the HEP technical team was reconvened, with representatives from USFWS, CDFG, SWRCB, SCVWD, and the Corps, to revise the 1992–1993 SRA cover HEP analysis. Again, NMFS was apprised of the HEP technical team's progress. A revised SRA cover HEP analysis was conducted in 1996–1997 that addressed the deficiencies of the 1992–1993 SRA cover HEP analysis. The 1996–1997 SRA cover HEP analysis evaluated effects on SRA cover caused by construction of the entire Authorized Project, using the same evaluation species HSI models that were used in the 1992–1993 SRA cover HEP analysis. However, some of the variable equations in the rainbow trout evaluation species HSI model were adjusted to make the HEP analysis more sensitive to water temperature requirements for steelhead (*O. mykiss*) and chinook salmon (*O. tshawytscha*). The results of the 1996–1997 SRA cover HEP analysis were summarized in a 1997 report, which indicated that even with offsite mitigation at Reaches A, 10B, and 12; Guadalupe Creek; and Alamitos Creek, adverse effects to SRA cover caused by the Authorized Project could not be fully mitigated for all three evaluation species HSI models (Jones & Stokes Associates 1997).

In 1998, the HEP technical team, with representatives from USFWS, NMFS (which took on a more active role), CDFG, SWRCB, SCVWD, and the Corps, was reconvened a second time to make revisions to the 1996–1997 SRA cover HEP analysis. Three environmental organizations, Guadalupe-Coyote Resource Conservation District, Pacific Coast Federation of Fishermen's Associations, and Trout Unlimited, also participated and were represented by NHI. Revisions to the 1996–1997 SRA cover HEP analysis were necessary because of project modifications to the Authorized Project (Section 1.4, "Need for Project Modification") and the addition of the non-salmonid pool habitat cover type HSI model to replace the green sunfish evaluation species HSI model. The switch to the non-salmonid pool habitat cover type HSI model was done in part to more accurately reflect the project's adverse effects and mitigation benefits specific to the Guadalupe River watershed. Additionally, the use of the non-salmonid pool habitat cover type HSI model instead of the green sunfish evaluation species HSI model helped to address public perception that non-native species, which have life history needs different from the salmonid species of primary interest, would be managed to the detriment of the salmonid species. The second revision of the SRA cover HEP analysis was conducted in 1998–2000 and focused on the Authorized Project and two bypass alternatives, which are described below. This report is the culmination of the 1998–2000 SRA cover HEP analyses and supersedes previous SRA cover HEP analysis reports.

1.6 PROJECT ALTERNATIVES EVALUATED IN THE SRA COVER HEP ANALYSIS

This SRA cover HEP analysis report evaluates the effects that the Authorized Project and two project alternatives will have on SRA cover. For the purposes of this SRA cover HEP analysis report, the Authorized Project and two alternatives are referred to as project alternatives. Thus, the three project alternatives evaluated in this HEP analysis report are the Authorized Project alternative, Double Bypass System alternative, and Triple Bypass System alternative. The Authorized Project alternative, which is generally the same project described in the General Design Memorandum (GDM) (U.S. Army Corps of Engineers 1991), is included in this analysis to provide a context for evaluating the two bypass alternatives. Unlike the Authorized Project alternative, the bypass alternatives include an underground bypass that will carry flood flows around a section of the Guadalupe River where significant stands of SRA cover and fish and wildlife habitat are present. The Double Bypass System alternative includes two box culverts with inlet and outlet structures, and the Triple Bypass System alternative includes three box culverts with inlet and outlet structures. Chapter 2, "Description of Project Alternatives and Associated Mitigation Packages", provides additional information on the three alternatives evaluated in this SRA cover HEP analysis.

Onsite and offsite mitigation is proposed to address the adverse effects on SRA cover caused by each of the three project alternatives. Onsite SRA cover mitigation will be maximized for all three project alternatives. The location of offsite SRA cover mitigation will depend on the project alternative selected. Offsite mitigation locations may include Reaches A, 10B, and 12, and Guadalupe Creek (Figure 1-2). Chapter 2, "Description of Project Alternatives and Associated Mitigation Packages", provides additional information on the mitigation packages proposed for each project alternative.

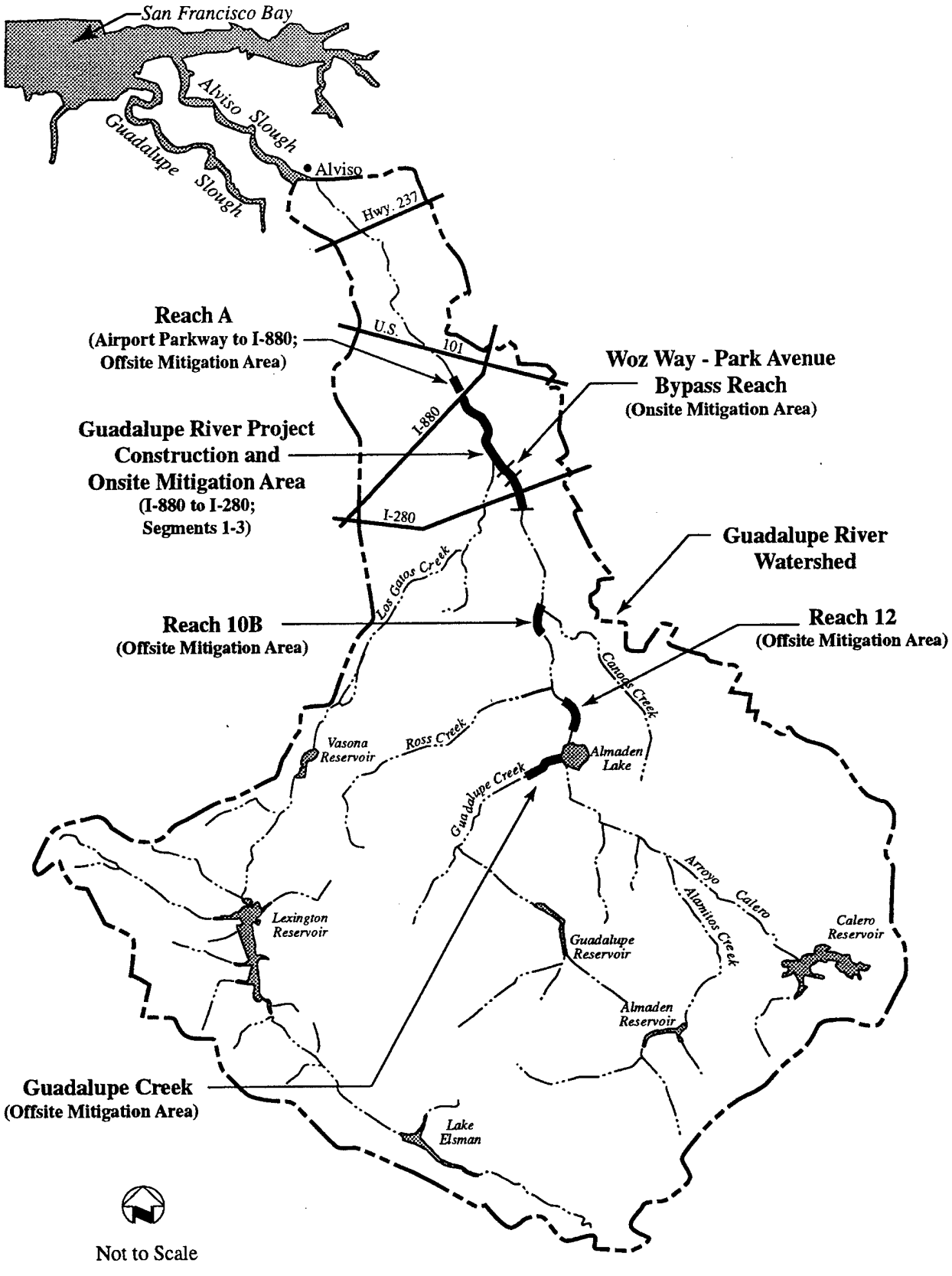


Figure 1-2
Guadalupe River Watershed

This figure shows Guadalupe River Project construction and onsite mitigation area and offsite mitigation areas.

1.7 RELATIONSHIP OF BYPASS ALTERNATIVES EVALUATED IN THIS REPORT TO BYPASS ALTERNATIVES EVALUATED IN OTHER ENVIRONMENTAL DOCUMENTS

As discussed in Section 1.4, "Need for Project Modification", the Corps and SCVWD agreed in July 1998 to redesign a portion of the Authorized Project to include an underground bypass. SCVWD initially took the lead in developing and evaluating bypass alternatives, eventually identifying six bypass alternatives: Alternatives 2-1 through 2-6 (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000a). Concurrent with the evaluation of the six bypass alternatives, the Collaborative requested that a revised SRA cover HEP analysis, which ultimately became the 1998–2000 SRA cover HEP analysis (Section 1.5.1, "History of SRA Cover HEP Analyses Conducted for the Project"), be conducted to quantify adverse effects on SRA cover caused by the bypass alternatives under evaluation. As a result, the 1998–2000 SRA cover HEP analysis was started prior to the final selection and design of a preferred bypass alternative.

Two of the six bypass alternatives were selected to be evaluated as part of the 1998–2000 SRA cover HEP analysis: Alternatives 2-1 and 2-6. Alternative 2-1 included two box culverts on the east bank of the Guadalupe River that extended from upstream of West Santa Clara Street to downstream in the vicinity of Coleman Avenue (Section 2.2.2, "Double Bypass System Alternative", and Table 2-2, "Summary of Construction and Mitigation Components Assumed for the Three Project Alternatives Evaluated in the Habitat Evaluation Procedures Analysis") (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000a). Alternative 2-1 was selected for SRA cover HEP analysis because it was thought to have the least adverse effects on SRA cover. Alternative 2-6 included two box culverts on the east bank of the Guadalupe River that extended from the confluence with Los Gatos Creek near St. John Street to upstream from Coleman Avenue (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000a). Alternative 2-6 was selected for SRA cover HEP analysis because it was thought to have the greatest adverse effects on SRA cover. By evaluating both Alternatives 2-1 and 2-6, the full range of possible adverse effects on SRA cover caused by any bypass alternative was captured in the 1998–2000 SRA cover HEP analysis.

After the six bypass alternatives had been evaluated, Alternatives 2-5 and 2-6 were selected for additional evaluation and Alternative 2-1 was dropped from consideration because of hydraulic factors. Alternative 2-5 was not specifically evaluated in the SRA cover HEP analysis because adverse effects on SRA cover caused by this alternative would be the same as for Alternative 2-6.

In March 1999, Alternative 2-6 was revised as part of the in-progress 1998–2000 SRA cover HEP analysis to reflect refinements made to Alternatives 2-5 and 2-6 as part of a more detailed bypass alternative evaluation that was begun in January 1999. The revised Alternative 2-6 is a hybrid of the original Alternative 2-1 and Alternative 2-6 and consists of three, rather than two, box culverts, with an additional inlet upstream of West Santa Clara Street. The revised Alternative 2-6 is identified as the Triple Bypass System alternative in this report; it was also identified as Alternative 8 in the detailed bypass alternative evaluation begun in January 1999.

Alternative 2-1 in the SRA cover HEP analysis was renamed the Double Bypass System alternative to more easily identify the distinguishing features between the two alternatives evaluated in the SRA cover HEP analysis.

The Triple Bypass System alternative evaluated in the SRA cover HEP analysis closely resembles the Proposed Action and the Refined Bypass Alternative in the integrated General Re-evaluation Report/environmental impact report/supplemental environmental impact statement (GRR/EIR/SEIS) (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000a) and appropriately captures all possible adverse effects on SRA cover caused by any variation of these two bypass alternatives that will have a bearing on the SRA cover HEP analysis. Appendix A provides summary tables that compare and document the differences between the Triple Bypass System alternative and the Proposed Action.

1.8 DOCUMENT ORGANIZATION

This SRA cover HEP analysis report is organized into the following chapters and appendices:

- Chapter 1, "Introduction", identifies the anticipated audience of the report, discusses pertinent background information on the project, explains the need for and history of SRA cover HEP analyses, and summarizes the project alternatives evaluated in this SRA cover HEP analysis.

- Chapter 2, "Description of Project Alternatives and Associated Mitigation Packages", describes the location of the construction area and mitigation sites for the project alternatives, summarizes the construction and mitigation components of the project alternatives, and provides a schedule for implementing these project alternatives.

- Chapter 3, "Habitat Evaluation Procedures Analysis and Results", describes the modeling assumptions that were made for the three project alternatives and associated mitigation packages and the results of the SRA cover HEP analysis for the three project alternatives.

- Chapter 4, "Citations", provides information about each reference and personal communication cited in this report.

- Appendix A, "Comparison of Shaded Riverine Aquatic Cover Adverse Effects and Channel Bed Armoring Length Between the Triple Bypass System Alternative and the Proposed Action", presents and documents the differences in SRA cover adverse effects and channel bed armoring length for the Triple Bypass System alternative evaluated in this report and the Proposed Action evaluated in the GRR/EIR/SEIS.

- Appendix B, "Habitat Evaluation Procedures Technical Team", lists agency representatives on the HEP technical team who conducted SRA cover HEP analyses for the project.

- Appendix C, "Habitat Suitability Index Model for Non-Salmonid Aquatic Guild", was prepared by USFWS and describes the need for, development of, and assumptions for the non-salmonid pool habitat cover type HSI model.

- Appendix D, "Form C Output from Habitat Evaluation Procedures Model", includes information on habitat units by target year for evaluation species/cover type for the three project alternatives and offsite mitigation sites under without- and with-project conditions.

- Appendix E, "Suitability Indices and Future Assumptions for Project Alternatives", includes information on the suitability indices and future assumptions in the construction area for the three project alternatives. Appendix E has been included in this report because there have been subsequent changes to the corresponding information in the 1997 SRA cover HEP analysis report (Jones & Stokes Associates 1997). For detailed background information on Appendix E, consult the 1997 SRA cover HEP analysis report.

- Appendix F, "Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Offsite Mitigation Sites", includes information on suitability indices and future assumptions for offsite mitigation sites. Appendix F has been included in this report because there have been subsequent changes to the corresponding information in the 1997 SRA cover HEP analysis report (Jones & Stokes Associates 1997). For detailed background information on Appendix F, consult the 1997 SRA cover HEP analysis report.

- Appendix G, "Form D Output from Habitat Evaluation Procedures Model", includes information on the change in average annual habitat units for evaluation species/cover type for the three project alternatives and offsite mitigation sites under without- and with-project conditions.

- Appendix H, "Form H Output from Habitat Evaluation Procedures Model", includes comparative information on habitat value losses in the construction area to habitat value gains at each offsite mitigation site for the three project alternatives.

Chapter 2. Description of Project Alternatives and Associated Mitigation Packages

2.1 INTRODUCTION

Three project alternatives are evaluated in this SRA cover HEP analysis:

- Authorized Project alternative,
- Double Bypass System alternative, and
- Triple Bypass System alternative.

2.1.1 Location of Project Alternatives and Mitigation Areas

2.1.1.1 Project Alternatives. Each project alternative has specific construction and mitigation components associated with it. Construction components for each project alternative are located within the same area. The construction area is located along 2.6 miles of the Guadalupe River in downtown San Jose, Santa Clara County, California, between Interstate 880 (I-880) and Grant Street, just upstream from Interstate 280 (I-280) (Figure 1-1). The construction area is further broken down into five major segments (Figures 2-1, 2-2, and 2-3):

- Segment 1 is located between I-880 and Hedding Street,
- Segment 2 is located between Hedding Street and Coleman Avenue,
- Segment 3A is located between Coleman Avenue and New Julian Street,
- Segment 3B is located between New Julian Street and Park Avenue, and
- Segment 3C is located between downstream from Woz Way to Grant Street and is further broken down into three construction phases, Segment 3C Phases 1-3.

The section of the Guadalupe River between Park Avenue and downstream from Woz Way (between Segments 3B and 3C) is not part of the construction area. This section of the river is referred to as the Woz Way to Park Avenue Bypass Reach (Figures 2-1, 2-2, and 2-3).

2.1.1.2 Mitigation Sites. Mitigation packages are associated with each project alternative. All mitigation packages have an onsite and offsite mitigation component. Onsite mitigation is mitigation that will be installed in the construction area and the Woz Way to Park Avenue Bypass Reach. Offsite mitigation is mitigation that will be installed at any of four sites in the Guadalupe River watershed (Figure 1-2):

- Reach A is located between Airport Parkway and I-880,
- Reach 10B is located between the Almaden Expressway southbound overcrossing and Koch Lane,
- Reach 12 is located between Branham Lane and Blossom Hill Road, and
- Guadalupe Creek is located between Almaden Expressway and downstream from Masson Dam.

The HEP technical team selected mitigation sites based on direction from resource agencies. In general, preference was given to potential mitigation sites that were in the construction area (onsite) or in close proximity to the construction area (Woz Way to Park Avenue Bypass Reach). Onsite mitigation sites were only considered if they were located in natural bank areas adjacent to the summer shoreline that were at least 20 feet long. It was assumed that at sites less than 20 feet long, volunteer vegetation or canopy from nearby trees would shade the site in a minimal amount of time.

After onsite mitigation was maximized, preference was given to offsite mitigation areas that met certain selection criteria. Reach A was selected because of its close proximity to the construction area and also because of its suitability for use by chinook salmon. Guadalupe Creek was selected because it provided the opportunity to expand the range for steelhead rearing and spawning habitat in the upper tributaries of the Guadalupe River watershed. Fish passage improvements undertaken by SCVWD now allow steelhead access to Guadalupe Creek. Additionally, SCVWD agreed to discontinue instream percolation operations in Guadalupe Creek if the creek was selected as a mitigation site for the project. Reaches 10B and 12 were selected as mitigation sites because they were available at the time mitigation sites were being selected.

The offsite mitigation package for the Authorized Project alternative includes Reaches A, 10B, and 12 and Guadalupe Creek. The offsite mitigation package for the Double and Triple Bypass System alternatives includes Reach A and Guadalupe Creek.

2.1.2 Implementation Schedule for Project Alternatives by Segment

The flood protection components in Segments 1, 2, and 3C are common to all three project alternatives. Construction of flood protection components was completed in Segment 1 in 1994, in Segment 2 in 1996, and in Segment 3C Phase 1 in 2000. Construction of flood protection components in Segment 3C Phase 2 is anticipated to be completed by 2001 and in Segment 3C Phase 3 in 2002.

The flood protection components planned for Segments 3A and 3B vary between the three project alternatives. Construction of flood protection components in Segments 3A and 3B is anticipated to be completed by 2002. The construction status of each segment is summarized in Table 2-1.

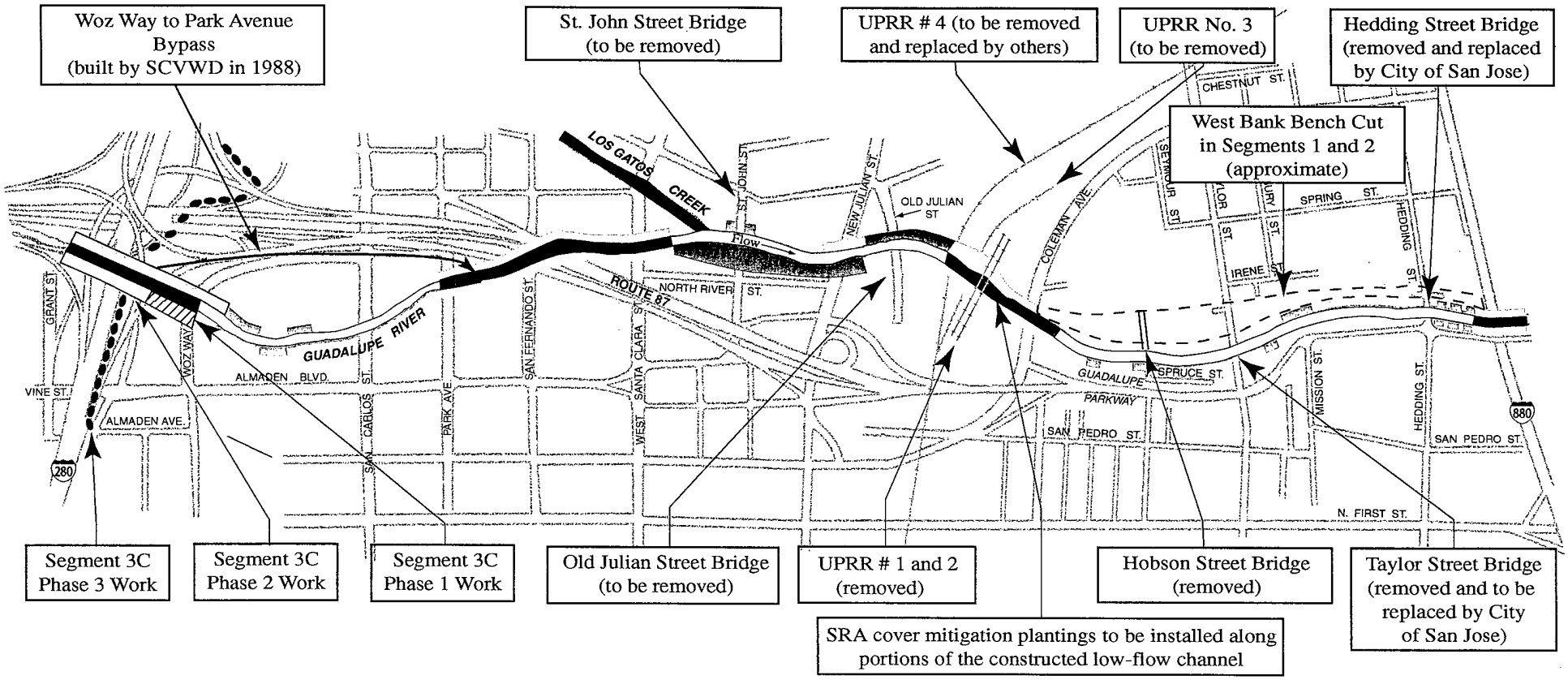


Figure 2-1
Authorized Project Alternative
Onsite SRA cover mitigation sites are shown in green.

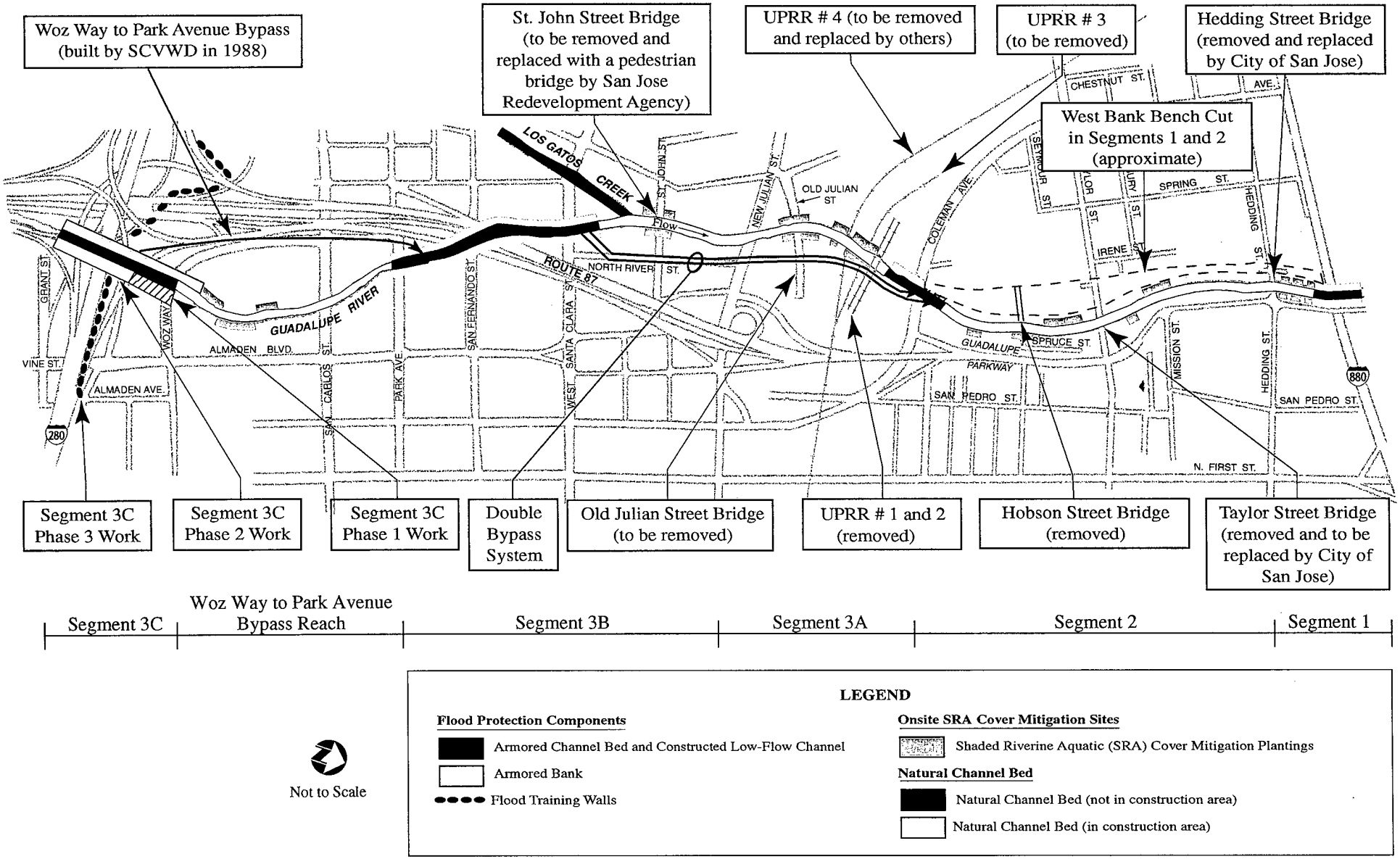


Figure 2-2
Double Bypass System Alternative
Onsite SRA cover mitigation sites are shown in green.

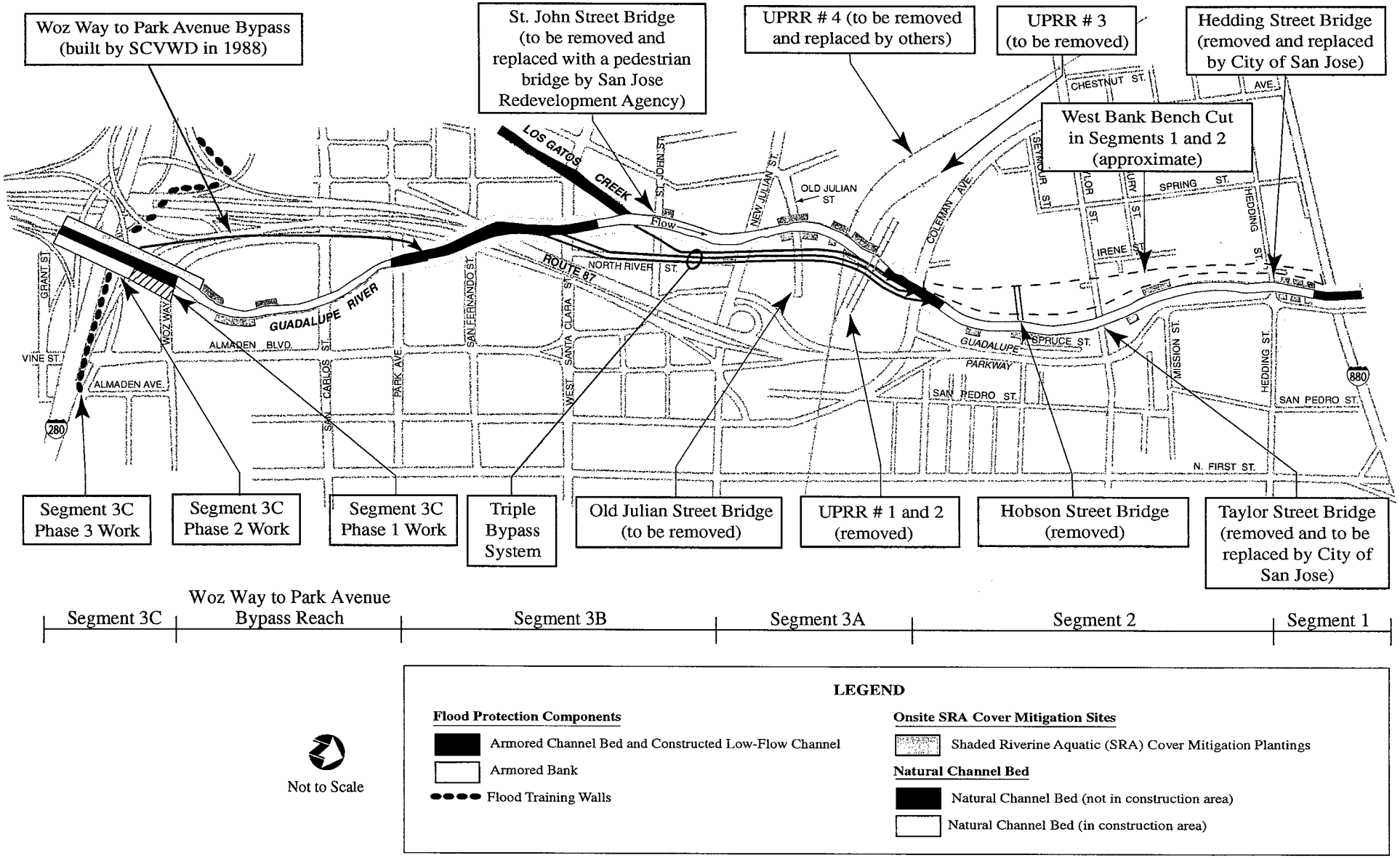


Figure 2-3
Triple Bypass System Alternative

Onsite SRA cover mitigation sites are shown in green.

TABLE 2-1. Construction Status of Flood Protection Components by Segment

Project Segment	Construction Status of Flood Protection Components	Construction Completion Date	
		Actual	Anticipated
Segment 1	Complete	1994	
Segment 2	Complete	1996	
Segment 3A	Pending		2002
Segment 3B	Pending		2002
Segment 3C Phase 1	Complete	2000	
Segment 3C Phase 2	Pending		2001
Segment 3C Phase 3	Pending		2002

2.2 DESCRIPTION OF PROJECT ALTERNATIVES AND ASSOCIATED MITIGATION PACKAGES

The project alternative descriptions in this SRA cover HEP analysis report focus on those project components that have a bearing on the SRA cover HEP analysis. A more detailed description of the Authorized Project alternative can be found in the GDM (U.S. Army Corps of Engineers 1991), and a more detailed description of the projects that closely resemble the Double and Triple Bypass System alternatives can be found in the GRR/EIR/SEIS (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000a).

The three project alternatives and their associated mitigation are summarized below and in Tables 2-2 and 2-3.

2.2.1 Authorized Project Alternative

The Authorized Project alternative is, for the most part, the same project that is described in the GDM (U.S. Army Corps of Engineers 1991) (Figure 2-1). A major difference between the Authorized Project alternative and the project described in GDM is the mitigation package. The mitigation package for the Authorized Project alternative now includes onsite mitigation in the construction area and offsite mitigation at Reaches A, 10B, and 12 and Guadalupe Creek (Figures 2-1 and 1-2). Flood protection and mitigation components of the Authorized Project alternative are summarized below, by location, and in Tables 2-2 and 2-3.

2.2.1.1 Construction Area and Onsite Mitigation Site. A brief description of flood protection components and onsite mitigation at each segment follows.

- **Segments 1 and 2.** Flood protection components in Segments 1 and 2 include a floodplain terrace and channel bank and bed armoring (Table 2-2, Figure 2-1). A floodplain terrace was constructed on the west bank of the Guadalupe River by making a bench cut in the bank. The elevation of the floodplain terrace in Segment 1, which was completed in 1994, is approximately 3 feet above the existing channel bed. The elevation of the floodplain terrace in Segment 2, which was completed in 1996, is

approximately 6 feet above the existing channel bed. Armoring in Segments 1 and 2 is primarily limited to the channel banks and bed in the vicinity of I-880 and Coleman Avenue. The SRA cover mitigation component in Segments 1 and 2 includes 1,045 linear feet of riparian vegetation planted within 15 feet of the summer shoreline on the east and west banks (Table 2-3, Figure 2-1). Other mitigation components occur in Segments 1 and 2 but were not evaluated directly in the SRA cover HEP analysis; these mitigation components include the planting of riparian vegetation in the floodplain terrace, stocking of fish-spawning gravel, and construction of a low-flow channel in the armored channel bed to provide for fish passage (Table 2-2).

- **Segments 3A and 3B.** Flood protection components proposed in Segments 3A and 3B include channel bank and bed armoring, bridge removal, and bridge removal and replacement (Table 2-2, Figure 2-1). The SRA cover mitigation component in Segments 3A and 3B includes 461 linear feet of riparian vegetation planted within 15 feet of the summer shoreline on the east and west banks (Table 2-3, Figure 2-1). Other mitigation components occur in Segments 3A and 3B but were not evaluated directly in the SRA cover HEP analysis; these mitigation components include the stocking of fish-spawning gravel and construction of a low-flow channel in the armored channel bed to provide for fish passage (Table 2-2).

- **Segment 3C.** Flood protection components in Segment 3C will be installed in three phases. Phase 1, which was completed in 1999, included grading and armoring the east bank from the downstream end of Woz Way to just downstream from the I-280/State Route 87 offramp. Phase 2, which is proposed to be constructed in 2001, would include grading and armoring the remainder of the segment. Phase 3, which is proposed to be constructed in 2002, would include the construction of flood training walls at the upstream end of the segment. In Segment 3C, the entire length of the channel banks and most of the channel bed would be armored (Table 2-2, Figure 2-1). No SRA cover mitigation component is planned for Segment 3C. A mitigation component occurs in Segment 3C but was not evaluated directly in the SRA cover HEP analysis; this mitigation component includes the construction of a low-flow channel in the armored channel bed to provide for fish passage (Table 2-2).

2.2.1.2 Offsite Mitigation Sites. Offsite mitigation is proposed for the Authorized Project alternative at all four offsite mitigation sites: Reaches A, 10B, and 12 and Guadalupe Creek (Figure 1-2). A brief description of the proposed mitigation at each site follows.

- **Reach A** - The Reach A SRA cover mitigation component will be designed and implemented by the Corps and SCVWD. The mitigation design objective is to increase SRA cover. To increase SRA cover, 7,800 linear feet of riparian vegetation will be planted on nongraded and graded channel banks within 15 feet of the summer shoreline (Tables 2-2 and 2-3).

- **Reach 10B** - Reach 10B SRA cover mitigation components will be designed and implemented by the Corps and SCVWD. The mitigation design objectives are to increase SRA cover and instream SRA cover. To increase SRA cover, 1,760 linear

TABLE 2-2. Summary of Construction and Mitigation Components Assumed for the Three Project Alternatives Evaluated in the Habitat Evaluation Procedures Analysis

Segment/ Reach	Construction/ Mitigation Components	Alternative		
		Authorized Project	**Double Bypass System**	**Triple Bypass System**
Segment 1 – I-880 to Hedding Street				
	Construction Components			
	Channel bank and bed armoring	Channel banks and bed armored downstream, under, and upstream from I-880 (448 lf).	Channel banks and bed armored downstream, under, and upstream from I-880 (448 lf).	Channel banks and bed armored downstream, under, and upstream from I-880 (448 lf).
	Bridge removal and replacement	Original Hedding Street bridge removed and replaced with new bridge. New bridge width is 75 ft.	Original Hedding Street bridge removed and replaced with new bridge. New bridge width is 75 ft.	Original Hedding Street bridge removed and replaced with new bridge. New bridge width is 75 ft.
	Vegetation-free zone around bridges	Hedding Street: Vegetation-free zone at downstream end of bridge is 150 ft for short-term construction conditions and 50 ft for long-term conditions.	Hedding Street: Vegetation-free zone at downstream end of bridge is 150 ft for short-term construction conditions and 50 ft for long-term conditions.	Hedding Street: Vegetation-free zone at downstream end of bridge is 150 ft for short-term construction conditions and 50 ft for long-term conditions.
	Mitigation Components			
	SRA cover	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (505 lf).	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (505 lf).	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (505 lf).
	Fish-spawning gravels	Install 1,000 sf of fish-spawning gravels.	Install 1,000 sf of fish-spawning gravels.	Install 1,000 sf of fish-spawning gravels.
	Fish passage (constructed low-flow channel in armored channel bed)	Constructed low-flow channel is a weir/pool design.	Constructed low-flow channel is a weir/pool design.	Constructed low-flow channel is a weir/pool design.
Segment 2 – Hedding Street to Coleman Avenue				
	Construction Components			
	Channel bank and bed armoring	Channel banks and bed armored downstream from Coleman Avenue (305 lf).	Channel banks and bed armored downstream from Coleman Avenue (305 lf).	Channel banks and bed armored downstream from Coleman Avenue (305 lf).
	Bridge removal (permanent)	Hobson Street bridge permanently removed.	Hobson Street bridge permanently removed.	Hobson Street bridge permanently removed.

TABLE 2-2. (Continued)

Segment/ Reach	Construction/ Mitigation Components	Alternative		
		Authorized Project	Double Bypass System	Triple Bypass System
	Vegetation-free zone around bridges	Hedding Street: Vegetation-free zone at upstream end of bridge is 50 ft. Taylor Street: Vegetation-free zone upstream and downstream end of bridge is 130 ft for short-term construction conditions and 50 ft for long-term conditions.	Hedding Street: Vegetation-free zone at upstream end of bridge is 50 ft. Taylor Street: Vegetation-free zone upstream and downstream end of bridge is 130 ft for short-term construction conditions and 50 ft for long-term conditions.	Hedding Street: Vegetation-free zone at upstream end of from bridge is 50 ft. Taylor Street: Vegetation-free zone upstream and downstream end of bridge is 130 ft for short-term construction conditions and 50 ft for long-term conditions.
	Mitigation Components			
	SRA cover	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (540 lf).	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (540 lf).	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (540 lf).
	Fish-spawning gravels	Install 3,335 sf of fish-spawning gravels.	Install 3,335 sf of fish-spawning gravels.	Install 3,335 sf of fish-spawning gravels.
	Fish passage (constructed low-flow channel in armored channel bed)	Constructed low-flow channel is a weir/pool design.	Constructed low-flow channel is a weir/pool design.	Constructed low-flow channel is a weir/pool design.
Segment 3A – Coleman Avenue to New Julian Street				
	Construction Components			
	Channel bank and bed armoring	Channel bed armored from downstream end of New Julian Street to end of low-flow channel transition zone and from upstream of proposed UPRR crossing to downstream end of Coleman Avenue (1,607 lf). East bank armored from downstream end of New Julian Street to end of low-flow channel transition zone and from proposed UPRR crossing to downstream end of Coleman Avenue (1,457 lf).	Both channel banks and bed armored upstream and under Coleman Avenue (609 lf). Bypass outlets are located within the armored section of the east bank.	Both channel banks and bed armored upstream and under Coleman Avenue (609 lf). Bypass outlets are located within the armored section of the east bank.

TABLE 2-2. (Continued)

Segment/ Reach	Construction/ Mitigation Components	Alternative		
		Authorized Project	Double Bypass System	Triple Bypass System
		West bank armored from downstream end of New Julian Street to downstream end of Coleman Avenue (2,147 lf).		
	Bridge removal (permanent)	UPRR No. 1, 2 and 3 bridges and Old Julian Street bridge permanently removed.	UPRR No. 1, 2 and 3 bridges and Old Julian Street bridge permanently removed.	UPRR No. 1, 2 and 3 bridges and Old Julian Street bridge permanently removed.
	Bridge removal and replacement	Original UPRR No. 4 bridge removed and replaced with new bridge.	Original UPRR No. 4 bridge removed and replaced with new bridge.	Original UPRR No. 4 bridge removed and replaced with new bridge.
	Vegetation-free zone around bridges	Coleman Avenue: No riparian plantings occur along the constructed low-flow channel within 100 ft of upstream edge of bridge. UPRR No. 4 bridge: Vegetation-free zone at upstream and downstream end of bridge is 50 ft.	UPRR No. 4 bridge: Vegetation-free zone at upstream and downstream end of bridge is 50 ft. New Julian Street: No SRA cover plantings to occur immediately downstream from New Julian Street on west bank. Vegetation-free zone is 50 ft.	UPRR No. 4 bridge: Vegetation-free zone at upstream and downstream end of bridge is 50 ft. New Julian Street: No SRA cover plantings to occur immediately downstream from New Julian Street on west bank. Vegetation-free zone is 50 ft.
Mitigation Components				
	SRA cover	SRA cover mitigation plantings installed within ineffective flow area along constructed low-flow channel between proposed UPRR crossing and Coleman Avenue (335 lf). Riparian plantings installed on constructed low-flow channel side slopes from approximately 100 ft downstream of UPRR No. 4 bridge crossing to approximately 100 ft upstream of Coleman Avenue. Riparian plantings do not provide SRA cover mitigation credit but help to cool water temperatures.	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (878 lf).	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (878 lf).

TABLE 2-2. (Continued)

Segment/ Reach	Construction/ Mitigation Components	Alternative		
		Authorized Project	**Double Bypass System**	**Triple Bypass System**
	Fish-spawning gravels	Install 10,617 sf of fish-spawning gravels.	Install 10,617 sf of fish-spawning gravels.	Install 10,617 sf of fish-spawning gravels.
	Fish passage (constructed low-flow channel in armored channel bed)	Constructed low-flow channel is a trapezoid/boulder channel design with boulder clusters placed from side-to-side approximately every 90 ft (1,607 lf).	Constructed low-flow channel is a check structure design that overlays armored channel bed (609 lf).	Constructed low-flow channel is a check structure design that overlays armored channel bed (609 lf).
Segment 3B – New Julian Street to Park Avenue				
	Construction Components			
	Channel bank and bed armoring	Channel bed armored from upstream of Park Avenue to upstream end of low-flow channel transition zone downstream from West Santa Clara Street and from low-flow channel transition zone to downstream end of New Julian Street (2,266 lf). East bank armored from upstream end of Park Avenue to downstream end of New Julian Street (3,006 lf). West bank armored from upstream end of Park Avenue to end of low-flow channel transition zone downstream from West Santa Clara Street and from transition zone upstream from New Julian Street to downstream end of New Julian Street (2,291 lf).	Channel bed armored from upstream end of Park Avenue to end of low-flow channel transition zone downstream from West Santa Clara Street (1,891 lf). East bank armored from upstream of Park Avenue to end of low-flow channel transition zone downstream from West Santa Clara Street (1,891 lf). Bypass inlets are located within the armored section of the east bank, upstream from West Santa Clara Street. West bank armored from upstream end of Park Avenue to end of low-flow channel transition zone downstream from West Santa Clara Street (1,891 lf).	Channel bed armored from upstream of Park Avenue to end of low-flow channel transition zone downstream from West Santa Clara Street (1,891 lf) and at bypass channel inlet near St. John Street (300 lf). East bank armored from upstream end of Park Avenue to downstream end of New Julian Street (3,006 lf). Two bypass inlets are located within the armored section of the east bank, upstream from West Santa Clara Street. The third bypass inlet is located within the armored section of the east bank in the vicinity of St. John Street. West bank armored from upstream from Park Avenue to end of low-flow channel transition zone downstream from West Santa Clara Street (1,891 lf).
	Bridge removal and replacement	St. John Street bridge	St. John Street bridge	St. John Street bridge

TABLE 2-2. (Continued)

Segment/ Reach	Construction/ Mitigation Components	Alternative		
		Authorized Project	**Double Bypass System**	**Triple Bypass System**
		permanently removed and replaced with a pedestrian bridge that is 30 ft wide.	permanently removed and replaced with a pedestrian bridge that is 30 ft wide.	permanently removed and replaced with a pedestrian bridge that is 30 ft wide.
	Vegetation-free zone around bridges	n/a	New Julian Street: Vegetation-free zone on west bank is 50 ft upstream from bridge.	New Julian Street: Vegetation-free zone on west bank is 50 ft upstream from bridge.
	Mitigation Components			
	SRA cover	SRA cover mitigation plantings installed on west bank in vicinity of proposed pedestrian bridge (126 lf).	SRA cover mitigation plantings installed on east and west banks in vicinity of proposed pedestrian bridge (220 lf)	SRA cover mitigation plantings installed on west bank in vicinity of proposed pedestrian bridge (56 lf).
	Fish-spawning gravels	Install 10,238 sf of fish-spawning gravels.	Install 10,238 sf of fish-spawning gravels.	Install 10,238 sf of fish-spawning gravels.
	Fish passage (constructed low-flow channel in armored channel bed)	Constructed low-flow channel is a trapezoid/boulder channel design with boulder clusters placed from side-to-side approximately every 90 ft (2,266 lf).	Constructed low-flow channel is a check structure design that overlays armored channel bottom (1,891 lf).	Constructed low-flow channel is a check structure design that overlays armored channel bottom (2,191 lf).
Segment 3C Woz Way to Grant Street (Partial) - Phase 1				
	Construction Components			
	Channel bank and bed armoring	East bank armored under Woz Way to downstream from I-280/State Route 87 off-ramp (328 lf).	East bank armored under Woz Way to downstream from I-280/State Route 87 off-ramp (328 lf).	East bank armored under Woz Way to downstream from I-280/State Route 87 off-ramp (328 lf).
	Mitigation Components			
	General	No mitigation components are being installed in this segment as part of this phase.	No mitigation components are being installed in this segment as part of this phase.	No mitigation components are being installed in this segment as part of this phase.
Segment 3C Woz Way to Grant Street (Partial) - Phase 2				

TABLE 2-2. (Continued)

Segment/ Reach	Construction/ Mitigation Components	Alternative		
		Authorized Project	Double Bypass System	Triple Bypass System
	Construction Components			
	Channel bank and bed armoring	Channel bed armored from upstream project limit (Grant Street) to upstream of Woz Way (820 lf).	Channel bed armored from upstream project limit (Grant Street) to upstream of Woz Way (820 lf).	Channel bed armored from upstream project limit (Grant Street) to upstream of Woz Way (820 lf).
		East bank armored from upstream project limit (Grant Street) to upstream armoring limit of Segment 3C Phase 1 (535 lf).	East bank armored from upstream project limit (Grant Street) to upstream armoring limit of Segment 3C Phase 1 (535 lf).	East bank armored from upstream project limit (Grant Street) to upstream armoring limit of Segment 3C Phase 1 (535 lf).
		West bank armored from upstream project limit (Grant Street) to downstream from Woz Way (1,260 lf).	West bank armored from upstream project limit (Grant Street) to downstream from Woz Way (1,260 lf).	West bank armored from upstream project limit (Grant Street) to downstream from Woz Way (1,260 lf).
	Mitigation Components			
	Fish passage (constructed low-flow channel in armored channel bed)	Constructed low-flow channel is trapezoid/boulder channel design with boulder clusters placed from side-to-side approximately every 90 ft (820 ft).	Constructed low-flow channel is trapezoid/boulder channel design with boulder clusters placed from side-to-side approximately every 90 ft (820 ft).	Constructed low-flow channel is trapezoid/boulder channel design with boulder clusters placed from side-to-side approximately every 90 ft (820 ft).
Segment 3C Woz Way to Grant Street (Partial) - Phase 3				
	Construction Components			
	Flood training walls	No construction-related effects are assumed from structures.	No construction-related effects are assumed from structures.	No construction-related effects are assumed from structures.
	Mitigation Components			
	General	No mitigation components are being installed in this segment as part of this phase.	No mitigation components are being installed in this segment as part of this phase.	No mitigation components are being installed in this segment as part of this phase.
Woz Way to Park Avenue Bypass Reach				

TABLE 2-2. (Continued)

Segment/ Reach	Construction/ Mitigation Components	Alternative		
		Authorized Project	Double Bypass System	Triple Bypass System
	Construction Components			
	Vegetation-free zone around bridges	East bank immediately downstream from Woz Way does not have a vegetation-free zone requirement.	East bank immediately downstream from Woz Way does not have a vegetation-free zone requirement.	East bank immediately downstream from Woz Way does not have a vegetation-free zone requirement.
	Mitigation Components			
	SRA cover	SRA cover mitigation plantings installed at three separate locations, including Children's Discovery Museum site (260 lf), Rubble Removal site (140 lf), and Auzerias Point site (80 lf) (total of 480 lf).	SRA cover mitigation plantings installed at three separate locations, including Children's Discovery Museum site (260 lf), Rubble Removal site (140 lf), and Auzerias Point site (80 lf) (total of 480 lf).	SRA cover mitigation plantings installed at three separate locations, including Children's Discovery Museum site (260 lf), Rubble Removal site (140 lf), and Auzerias Point site (80 lf) (total of 480 lf).
Guadalupe Creek – Almaden Expressway to Downstream from Masson Dam				
	Construction Components			
	General	No construction effects on SRA cover or instream channel conditions were assumed.	No construction effects on SRA cover or instream channel conditions were assumed.	No construction effects on SRA cover or instream channel conditions were assumed.
	Mitigation Components			
	SRA cover	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (12,044 lf). Instream SRA cover also to be created using low-flow channel grading, biotechnical bank stabilization, rock/log weirs, and vane installation	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (12,044 lf). Instream SRA cover also to be created using low-flow channel grading, biotechnical bank stabilization, rock/log weirs, and vane installation	SRA cover mitigation plantings installed at various unvegetated, natural bank locations on east and west banks (12,044 lf). Instream SRA cover also to be created using low-flow channel grading, biotechnical bank stabilization, rock/log weirs, and vane installation
Reach 12 – Branham Lane to Blossom Hill Road				

TABLE 2-2. (Continued)

Segment/ Reach	Construction/ Mitigation Components	Alternative		
		Authorized Project	Double Bypass System	Triple Bypass System
	Construction Components			
	General	No construction components are associated with Authorized Project alternative	n/a	n/a
	Mitigation Components			
	SRA cover	SRA cover mitigation plantings installed at various unvegetated locations on east and west banks (9,547 lf).	n/a	n/a
Reach 10B – Almaden Expressway to Koch Lane				
	Construction Components			
General		No construction components are associated with Authorized Project alternative.	n/a	n/a
	Mitigation Components			
	SRA cover	SRA cover mitigation plantings installed at various unvegetated locations on east and west banks (1,760 lf). Planting surfaces include constructed earthen terraces and existing undisturbed banks. Riparian plantings will also be installed at toe of existing west bank gabions in downstream portion of reach (2,300 lf). Although these riparian plantings would be installed adjacent to the low-flow channel, the plantings do not provide SRA cover compensation due to the planting area conditions in which they would be installed.	n/a	n/a
Reach A – Airport Parkway to I-880				

TABLE 2-2. (Continued)

Segment/ Reach	Construction/ Mitigation Components	Alternative		
		Authorized Project	**Double Bypass System**	**Triple Bypass System**
	Construction Components			
	General	No construction effects on SRA cover or instream channel conditions were assumed.	No construction effects on SRA cover or instream channel conditions were assumed.	No construction effects on SRA cover or instream channel conditions were assumed.
	Mitigation Components			
	SRA cover	SRA cover mitigation plantings installed at various unvegetated locations on east and west banks (7,800 lf). For approximately 2,000 lf downstream from I-880, SRA cover plantings in this area will be planted at a low density due to hydraulic constraints.	SRA cover mitigation plantings installed at various unvegetated locations on east and west banks (7,800 lf). For approximately 2,000 lf downstream from I-880, SRA cover plantings in this area will be planted at a low density due to hydraulic constraints.	SRA cover mitigation plantings installed at various unvegetated locations on east and west banks (7,800 lf). For approximately 2,000 lf downstream from I-880, SRA cover plantings in this area will be planted at a low density due to hydraulic constraints.

Notes:

ft = feet

sf = square feet

lf = linear feet

I-280 = Interstate 280

I-880 = Interstate 880

n/a = not applicable

feet of riparian vegetation will be planted on nongraded channel banks, constructed floodplains, and the toe of the existing gabions within 15 feet of the summer shoreline (Tables 2-2 and 2-3). To increase instream SRA cover, a low-flow channel in the existing rock-lined channel will be constructed.

- **Reach 12** - Reach 12 SRA cover mitigation components will be designed and implemented by the Corps and SCVWD. The mitigation design objective is to increase SRA cover. To increase SRA cover, 9,547 linear feet of riparian vegetation will be planted on nongraded channel banks and constructed floodplains within 15 feet of the summer shoreline (Tables 2-2 and 2-3). The SRA cover HEP analysis assumed that SCVWD would not operate instream recharge ponds on Reach 12.

- **Guadalupe Creek** - The Guadalupe Creek Restoration Project is being designed and implemented by SCVWD. The mitigation design objectives are to increase SRA cover and instream SRA cover. To increase SRA cover, 12,044 linear feet of riparian vegetation will be planted on nongraded and graded channel banks and on constructed floodplains within 15 feet of the summer shoreline (Tables 2-2 and 2-3). To increase instream SRA cover, various fish habitat construction techniques will be used, including grading a low-flow channel, using biotechnical bank stabilization, and installing rock/log weirs and vanes. The SRA cover HEP analysis assumed that SCVWD would not operate instream recharge ponds on Guadalupe Creek.

2.2.2 Double Bypass System Alternative

The Double Bypass System alternative is described in Chapter 2 of the integrated GRR/EIR/SEIS, Section 2.2.5.1, "Six Bypass Alternatives" (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000a) (Figure 2-2). The mitigation package for the Double Bypass System alternative includes onsite mitigation in the construction area and offsite mitigation at Reach A and Guadalupe Creek (Figures 2-2 and 1-2). Flood protection and mitigation components of the Double Bypass System alternative are summarized below, by location, and in Tables 2-2 and 2-3.

2.2.2.1 Construction Area and Onsite Mitigation Site. A brief description of the flood protection components and onsite mitigation at each segment follows.

- **Segments 1, 2, and 3C** - Flood protection and SRA cover mitigation components in Segments 1, 2, and 3C Phases 1-3 for the Double Bypass System alternative are the same as described above for the Authorized Project alternative (Section 2.2.1.1, "Construction Area and Onsite Mitigation Site").

- **Segments 3A and 3B** - In addition to the flood protection components described for Segments 1, 2, and 3C, the Double Bypass System alternative also includes the installation of two underground box culverts, placed side by side, that would transport floodflows from upstream of West Santa Clara Street in Segment 3B to the vicinity of Coleman Avenue at the downstream end of Segment 3A. In Segment 3A, the channel banks would be armored upstream from Coleman Avenue to accommodate flows

from the two bypass outlets (Figure 2-2). In Segment 3B, the channel banks and bed would be armored from Park Avenue to downstream from West Santa Clara Street to accommodate the two bypass inlets (Figure 2-2). The SRA cover mitigation component in Segments 3A and 3B includes 1,098 linear feet of riparian vegetation planted within 15 feet of the summer shoreline on the east and west banks (Tables 2-2 and 2-3, Figure 2-2). Other mitigation components occur in Segments 3A and 3B but were not evaluated directly in the SRA cover HEP analysis; these mitigation components include the stocking of fish spawning gravel and construction of a low-flow channel in the armored channel bed to provide for fish passage (Table 2-2).

2.2.2.2 Offsite Mitigation Sites. Offsite mitigation is proposed for the Double Bypass System alternative at two of the mitigation sites: Reach A and Guadalupe Creek. The proposed mitigation design at these two sites is the same as described above for these sites for the Authorized Project alternative (Section 2.2.1.2, "Offsite Mitigation Sites").

2.2.3 Triple Bypass System Alternative

The Triple Bypass System alternative is generally described in the GRR/EIR/SEIS in Chapter 3, Section 3.4.2.1, "Bypass System" (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000a) (Figure 2-3). The mitigation package for the Triple Bypass System alternative includes onsite mitigation in the construction area and offsite mitigation at Reach A and Guadalupe Creek (Figures 2-3 and 1-2). Flood protection and mitigation components of the Triple Bypass System alternative are summarized below, by location, and in Tables 2-2 and 2-3.

2.2.3.1 Construction Area and Onsite Mitigation Site. A brief description of the flood protection components and onsite mitigation at each segment follows.

- **Segments 1, 2, and 3C** - Flood protection and SRA cover mitigation components in Segments 1, 2, and 3C Phases 1-3 for the Triple Bypass System alternative are the same as described above for the Authorized Project alternative (Section 2.2.1.1, "Construction Area and Onsite Mitigation Site").

- **Segments 3A and 3B** - In addition to the flood protection components described for Segments 1, 2, and 3C, the Triple Bypass System alternative also includes the installation of two underground box culverts, placed side by side, that would transport floodflows from upstream of West Santa Clara Street in Segment 3B to the vicinity of Coleman Avenue at the downstream end of Segment 3A. In Segment 3A, the channel banks would be armored upstream from Coleman Avenue to accommodate the flows from two bypass outlets (Figure 2-3). In Segment 3B, the channel banks and bed would be armored from Park Avenue to downstream from West Santa Clara Street to accommodate the two bypass inlets, similar to the Double Bypass System alternative (Figure 2-3).

The Triple Bypass System alternative differs from the Double Bypass System alternative in that a third box culvert is proposed with a bypass inlet in the vicinity of St. John Street in Segment 3B and a bypass outlet in the vicinity of Coleman Avenue (Figure 2-3). As a result of

TABLE 2-3. Baseline, Affected, and Mitigation Planting Length of Shaded Riverine Aquatic Cover, by Project Alternative
Shaded riverine aquatic (SRA) cover "baseline" represents without-project conditions.

		SRA Cover Baseline (1992) in Construction Area (linear feet)	SRA Cover Effects and Mitigation (linear feet), by Project Alternative					
			Authorized Project		Double Bypass System		Triple Bypass System	
	Segment/Reach		Affected	Mitigation	Affected	Mitigation	Affected	Mitigation
Construction Area and Onsite Mitigation Site	Segment 1	2,402	1,510	505	1,510	505	1,510	505
	Segment 2	6,252	2,060	540	2,060	540	2,060	540
	Segment 3A	3,062	2,792	335	1,258	878	1,259	878
	Segment 3B	3,839	3,403	126	2,430	220	3,036	56
	Segment 3C	1,102	956	0	956	0	956	0
	Woz Way to Park Avenue Bypass Reach	n/a	n/a	480	0	480	0	480
	Onsite Total	**16,657**	**10,721**	**1,986**	**8,214**	**2,623**	**8,821**	**2,459**
Offsite Mitigation Sites	Reach A	n/a	n/a	7,800	n/a	7,800	n/a	7,800
	Reach 10B	n/a	n/a	1,760	n/a	n/a	n/a	n/a
	Reach 12	n/a	n/a	9,547	n/a	n/a	n/a	n/a
	Guadalupe Creek	n/a	n/a	12,044	n/a	12,044	n/a	12,044
	Offsite Total	**n/a**	**n/a**	**31,151**	**n/a**	**19,844**	**n/a**	**19,844**
	Totals	**16,657**	**10,721**	**33,137**	**8,214**	**22,467**	**8,821**	**22,303**

n/a = not applicable.

the additional bypass inlet, the entire east bank between West Santa Clara Street and New Julian Street would be armored and an additional portion of the channel bed would be armored in the vicinity of St. John Street.

The SRA cover mitigation component in Segments 3A and 3B includes 934 linear feet of riparian vegetation planted within 15 feet of the summer shoreline on the east and west banks (Tables 2-2 and 2-3, Figure 2-3). Other mitigation components occur in Segments 3A and 3B but were not evaluated directly in the SRA cover HEP analysis; these mitigation components include the stocking of fish spawning gravel and construction of a low-flow channel in the armored channel bed to provide for fish passage (Table 2-2).

2.2.3.2 Offsite Mitigation Sites. Offsite mitigation is proposed for the Triple Bypass System alternative at two of the mitigation sites: Reach A and Guadalupe Creek. The proposed mitigation design at these two sites is the same as described above for these sites for the Authorized Project alternative (Section 2.2.1.2, "Offsite Mitigation Sites").

Chapter 3. Habitat Evaluation Procedures Analysis and Results

3.1 METHODS

3.1.1 HEP Technical Team Involvement

A HEP technical team was convened to conduct the 1998–2000 SRA cover HEP analysis described in this report. The HEP technical team was made up of representatives from USFWS, NMFS, CDFG, SWRCB, SCVWD, and the Corps. Three environmental organizations, Guadalupe-Coyote Resource Conservation District, Pacific Coast Federation of Fishermen's Associations, and Trout Unlimited, also participated and were represented by NHI. Agency representatives of the HEP technical team are listed in Appendix B.

The HEP technical team was responsible for:

+ formulating study objectives;
+ delineating study area boundaries, including the construction area and onsite and offsite mitigation sites;
+ selecting HSI models to represent all species that use SRA cover along the Guadalupe River;
+ collecting data for use in the HSI models;
+ selecting target years for evaluation; and
+ projecting future habitat variable values.

3.1.2 HSI Modeling

This SRA cover HEP analysis uses HSI models to identify the effects of the three project alternatives on SRA cover quality and quantity. HSI modeling considerations, including HSI model selection and data collected or simulated for the HSI model habitat variables, are described below.

3.1.2.1 HSI Model Selection. Three HSI models were selected by USFWS and approved by the HEP technical team for use in the 1998–2000 SRA cover HEP analysis. The selected HSI models are the rainbow trout evaluation species, belted kingfisher evaluation species, and non-salmonid pool habitat cover type. These HSI models represent all species that

use SRA cover along the Guadalupe River. The non-salmonid pool habitat cover type HSI model was developed by USFWS to replace the green sunfish evaluation species HSI model that was used in the two previous SRA cover HEP analyses. The HEP technical team decided to use the non-salmonid pool habitat cover type HSI model because it:

+ better characterizes the habitat values associated with the affected pool habitats in the construction area;

+ eliminates several elements in the green sunfish evaluation species HSI model that are not relevant to or conflict with the intended objectives of the SRA cover HEP analysis, including compensating for adverse project effects on cold-water fish species, such as steelhead and chinook salmon; and

+ alleviates concerns raised by the public and others that the status of the green sunfish as an introduced, warm-water species does not warrant its inclusion as an evaluation species.

A more complete discussion of the justification for the use of the non-salmonid pool habitat cover type HSI model, as well as a description of the model variables, has been prepared by USFWS and is provided in Appendix C. Table 3-1 lists the specific habitat variables for all three HSI models used in this SRA cover HEP analysis.

TABLE 3-2. Field Data Collection Dates by Location

Segment/Reach		Date of Data Collection			
		August 1992	August 1993	December 1995	October 1996
Construction Area and Onsite Mitigation Site	Segment 1	X			
	Segment 2		X		
	Segment 3		X		
Offsite Mitigation Sites	Reach A		X		
	Reach 10B				X
	Reach 12				X
	Guadalupe Creek			X	

3.1.2.2 Data Used in the HSI Models. Data used in the HSI models come from three sources: field data, agency records, and simulations (Table 3-1). The field data are physical measurements of habitat parameters and were collected by the HEP technical team members in the construction area and mitigation sites (Table 3-1). Table 3-2 summarizes field data collection dates. The 1993 SRA cover HEP report (U.S. Fish and Wildlife Service 1993) and the 1997 SRA cover HEP report (Jones & Stokes Associates 1997) present a detailed description of data collection efforts in the construction area and mitigation sites. The discussions include information on methods, survey crews, and survey dates.

One source of data used in the HSI models was field data. SRA cover data used in the SRA cover HEP analysis is an example of data that was collected in the field. To represent baseline SRA cover conditions, early 1992 was selected because project construction had not started. As part of the 1992–1993 SRA cover HEP analysis, SRA cover was calculated in the

TABLE 3-1. Habitat Suitability Index Model Habitat Variables and Source of Data Used for Each Variable

This table lists the habitat variables used in the habitat suitability index (HSI) models for rainbow trout and belted kingfisher evaluation species and non-salmonid pool habitat cover type and the source of the variable's data.

HSI Model Habitat Variable	Variable Description	Source of Data		
		Field Collection	Agency Records	Simulated
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)			X
V1B	(2A maximum temperature - chinook salmon prespawn adults)			X
V2A	Maximum temperature (smolts)			X
V2B	(V6 maximum temperature - chinook salmon spawning)			X
V3A	Minimum dissolved oxygen (water temperature <15ºC)		X	
V3B	Minimum dissolved oxygen (water temperature >15ºC)		X	
V4B	Average thalweg depth	X		
V5	Average water velocity (over spawning areas)	X		
V6J	Percent cover (juveniles)	X		
V6A	Percent cover (adults)	X		
V7	Substrate size (spawning areas)	X		
V8	Percent substrate size class (cover)	X		
V9	Substrate type in riffles/runs (food)	X		
V10	Percent pools	X		
V11	Vegetation index	X		
V12	Percent ground cover (erosion)	X		
V13	Annual max-min pH		X	
V14	Average annual base flow		X	
V15	Pool class rating	X		
V16A	Percent fines (spawning areas)	X		
V16B	Percent fines (riffle/run areas)	X		
V17	Percent shade (overhead)	X		
V18	Percent average daily flow (adult migration)		X	
Vs	Spawning site suitability index	X		
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	n/a	n/a	n/a
V2	Average water transparency (Secchi depth)	X		
V3	Percent water surface obstruction	X		
V4	Percent water area <= 24 inches deep	X		
V5	Percent riffles	X		
V6	Average number of perches	X		
V7	Distance to suitable soil bank (reproduction)	X		
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover (pool)	X		
V2	Percent pool area during summer	X		
V3	Dominant substrate	X		
V4	Edge vegetation development	X		
V5	Pool depth	X		
V6	Stream width	X		
V7	Water temperature			X
V8	Pool water velocity	X		
V9	Stream gradient (meters/kilometer)		X	

construction area by USFWS using transect data collected in 1992 for Segment 1 and 1993 for Segments 2 and 3 and Reach A. A total of 43 transects were spaced approximately every 100 feet perpendicular to the river channel. HSI habitat variable data were collected at each transect, including SRA cover (for example, percent shade) and instream SRA cover (for example, percent pools) variable data. In 1995, a full census mapping of SRA cover was performed in the construction area and Guadalupe Creek by USFWS, SCVWD, and the Corps. A full census survey approach provided more detailed information on without-project or baseline SRA cover amounts and allowed for a more accurate impact analysis than the transect approach. Aerial bluelines from 1990 were used to map SRA cover during the full census survey. Prior to the 1995 SRA cover full census survey, winter storms occurred that resulted in the loss of some trees due to high flows. Because the intent of the 1995 full census survey was to reconstruct 1992 baseline conditions, the downed trees were included in the SRA cover baseline. During the SRA cover impact analysis, downed trees were identified as lost or avoided by the project using the same approach as was used for standing trees. Field maps from the SRA cover full census survey were then digitized using computer-assisted drafting (CAD) software, and the linear feet and percent shade of SRA cover was calculated using a geographic information system (GIS). This information was incorporated into the 1996–1997 SRA cover HEP analysis and later updated for the 1998–2000 SRA cover HEP analysis. Table 2-3 lists baseline, affected, and mitigation planting length of SRA cover for the three project alternatives.

A second source of data used in the HSI models was agency records. Agency records that were reviewed include U.S. Geological Survey (USGS) historical streamflow and water quality data records (Table 3-1).

A third source of data used in the HSI models was simulated data from the JSATEMP model, a stream temperature model of the Guadalupe River System (Figure 3-1) (U.S. Army Corps of Engineers 2000). The JSATEMP model was developed to determine temperatures for the temperature-related variables in the rainbow trout evaluation species and non-salmonid pool habitat cover type HSI models (Table 3-1). Data used in the JSATEMP model include field measurements and observations of shade parameters and channel geometry, flow measurements collected at multiple locations by SCVWD and USGS, hourly water temperature measurements collected primarily by SCVWD, and meteorological data from the San Jose station of the California Irrigation Management Information System. The validity of the JSATEMP model simulations was confirmed by comparison with measured water temperature data. In addition, the JSATEMP model has been reviewed by USFWS, USGS, and the Corps (Sacramento District and Waterways Experiment Station) and found to be suitable for use in this SRA cover HEP analysis as a thermal modeling tool.

Water temperatures were simulated for two types of years, a wet year and a dry/median year. These two year types were chosen to represent the range of flow conditions that occur in the Guadalupe River system. Flow records from the USGS streamgage on the Guadalupe River below the confluence of Los Gatos Creek (Figure 3-1) indicate that 1995 was generally a wet year and 1994 was generally a dry year, except that flows in 1994 do not appear to be representative of the lowest range of flows that have occurred historically on the Guadalupe River (U.S. Army Corps of Engineers 2000). A dry/median year was developed to adequately represent the low range of flows. For October–April 1994, flow and meteorological conditions

were used (dry conditions). For May–September, a median value from 21 years of historic monthly average flow data and 1994 meteorological data was used (median conditions).

Water temperatures were simulated for without-project, with-project, and with-mitigation shading and channel geometry conditions. Without-project conditions are those conditions that existed before any construction of the alternatives began. With-project conditions are those conditions that will exist immediately after construction of the alternatives is completed and before SRA cover mitigation plantings provide shade benefits. With-mitigation conditions are those conditions that will exist after the mitigation plantings have reached maturity, which is assumed to occur 40 years after planting. Simulated average maximum temperatures were entered into the rainbow trout evaluation species and non-salmonid pool habitat cover type HSI models for the critical months for each life stage evaluated.

Water temperature simulations were performed for the three project alternatives and their associated mitigation packages. A detailed description of the temperature simulations is presented in Simulation of Water Temperature Using the JSATEMP Model for the Guadalupe River Project, Downtown San Jose, California (U.S. Army Corps of Engineers 2000). Key assumptions used in the water temperature simulations were:

+ No instream percolation ponds are present at any mitigation site.

+ No distinction is made between volunteer growth and SRA cover mitigation plantings since their effect on water temperatures is the same. For with-mitigation conditions, temperature simulations assume that 90% of all suitable natural bank areas will support riparian vegetation.

+ In the SRA cover calculations, 85% of the length of all planted banks provide SRA cover. The JSATEMP model, however, does not depend solely on SRA cover for its shade calculations. Shade can also be provided by non-SRA cover. A tree can shade the channel during the morning or evening even if it provides no SRA cover. The JSATEMP model simulations assume that 90% of the length of all planted banks will have successful growth that shades the channel during some part of the day.

+ For the Authorized Project alternative, the constructed low-flow channel in Segments 3A, 3B, and 3C will have a trapezoid/boulder design (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000b). At low flows, the trapezoid/boulder low-flow channel is expected to be shallow, with no depth at zero flow and less than a 0.5-foot depth at 1 cfs, and narrow, with a bottom width of 4 feet. For the Double and Triple Bypass System alternatives, the constructed low-flow channel in Segments 3A and 3B will have a check-structure design (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000b). Approximately five to seven check structures will be constructed of concrete sills, logs, boulders, and gravel placed at grade and on top of the channel bed armoring to concentrate flows in the check-structure low-flow channel. At low flows, the check-structure low-flow channel is expected to have average depths similar to preproject conditions of 1.2 feet at 0–1 cfs and a width of approximately 15 feet. It is anticipated that the check-structure low-flow channel

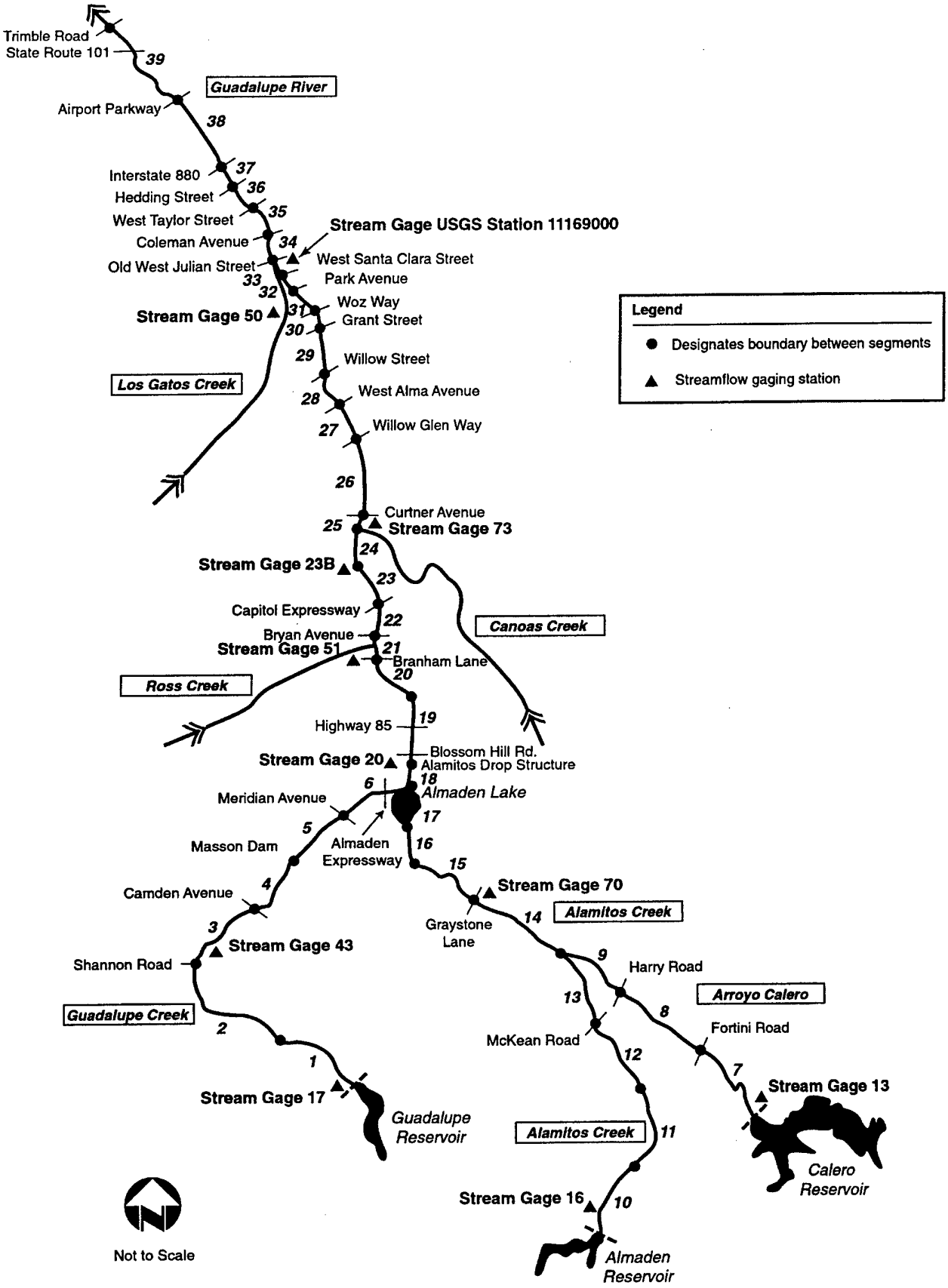


Figure 3-1
Schematic Diagram of Segments Used in the Guadalupe River Temperature Model

design will produce a relatively large backwater to achieve the assumed depth at low flows. The constructed low-flow channel in Segment 3C for the Double and Triple Bypass System alternatives is the same as described above for the Authorized Project alternative.

3.1.3 HEP Modeling

Future habitat values are based on predicted values of habitat variables for critical target years. These habitat values and the assumptions used to derive these target year suitability index (SI) values are presented in Appendices D–F. Habitat values for the selected target years were determined by substituting predicted Suitability Index (SI) values for each evaluation species and cover type into the respective HSI models. A predicted HSI score was then obtained for each evaluation species and cover type and subsequently entered into the HEP model pertaining to the appropriate target year. Appendix D presents the baseline and predicted future HSI scores by target year for each evaluation species and cover type HSI model.

3.1.3.1 Target Years. For this SRA cover HEP analysis, up to 8 target years were selected for the Authorized Project alternative (Table D-2 in Appendix D), 5 target years were selected for the Double Bypass System alternative (Table D-3 in Appendix D), and 7 target years were selected for the Triple System Bypass alternative (Table D-4 in Appendix D). Because the alternatives are being constructed in phases over a period of approximately 9 years, a 9-year "pre-start" period was added to the 100-year life of the project alternatives, which caused the last target year (target year 109) to be greater than the 100-year life of each project alternative. As a result of this pre-start period, habitat units (HU) decline from target year 1 to target year 9, when future habitat conditions are predicted to be at their lowest value in the period of analysis. Target year 9 represents habitat values in the construction area immediately following completion of all construction phases and prior to the onset of the positive effects of onsite mitigation.

After target year 9, the benefits of onsite mitigation are assumed to slowly improve habitat values linearly in the construction area until target year 49 (40 years following construction). For the Authorized Project alternative, habitat value gains for the rainbow trout evaluation species is not assumed to be linear in the first 20 years following construction because water temperatures during this period are predicted to exceed the suitability range for summer-rearing juveniles. Consequently, the resulting HSI score during this 20-year period (from target year 9 to target year 28) is zero (Table D-2 in Appendix D). The sudden increase in habitat values between target year 28 and target year 29 is due to the fact that other nontemperature-related variables, such as cover and shade, are improving during this 20-year period and the combined value of all of these variables are finally realized once water temperatures drop within the range of suitability for the species.

Target year 49 represents the time when all SRA cover mitigation is anticipated to reach its maximum potential and, consequently, when postmitigation values are anticipated to reach their maximum value. Beyond target year 49, predicted habitat values are assumed to be at equilibrium and, therefore, are constant.

3.1.3.2 HEP Accounting. To complete the SRA cover HEP analysis, the HSI scores for each target year (Appendix D) were entered into the HEP model for each of the project alternatives and mitigation sites. In the HEP analysis model, project alternatives are called plan alternatives (PA) and mitigation sites are called mitigation plans (MP) (Table 3-3). In this SRA cover HEP analysis, PA1 represents future without-project conditions during the period of analysis and is the baseline condition to which all other project alternatives are compared: Authorized Project alternative (PA2), Double Bypass System alternative (PA3), and Triple Bypass System alternative (PA4) (Table 3-3).

TABLE 3-3. Plan Alternative and Mitigation Plan Descriptors Used in the Habitat Evaluation Procedures Model Output Forms

Descriptor	Definition
Plan Alternative	
PA1	Without-project or baseline for construction area
PA2	Authorized Project alternative
PA3	Double Bypass System alternative
PA4	Triple Bypass System alternative
Mitigation Plan	
MP1	Without-project or baseline for Guadalupe Creek
MP2	Without-project or baseline for Reach 12
MP3	Without-project or baseline for Reach 10B
MP4	Without-project or baseline for Reach A
MP11	With-mitigation for Guadalupe Creek (all alternatives)
MP12	With-mitigation for Reach 12 (Authorized Project alternative)
MP13	With-mitigation for Reach 10B (Authorized Project alternative)
MP14	With-mitigation for Reach A (Authorized Project alternative)
MP15	With-mitigation for Reach A (Double Bypass System alternative)
MP6	With-mitigation for Reach A (Triple Bypass System alternative)

Each mitigation site is represented in the SRA cover HEP analysis by a without-mitigation, or baseline, condition and a with-mitigation condition. For example, Guadalupe Creek is represented by MP1 (without-mitigation) and MP11 (with-mitigation) (Table 3-3). The other two upstream offsite mitigation sites, Reaches 10B and 12, are represented in the SRA cover HEP analysis in similar fashion. However, a slightly different approach is used for Reach A. Because Reach A is contiguous with, and immediately downstream from, the construction area, with-project water temperatures in Reach A are affected differently by each of the project alternatives. For this reason, Reach A has four MP versions: without-project or baseline conditions (MP4), Authorized Project alternative conditions (MP14), Double Bypass System alternative conditions (MP15), and Triple Bypass System alternative conditions (MP6)

(Table 3-3). Net AAHU values for the alternatives and mitigation sites are then determined using the HEP analysis software. These results are printed out as Form D (Appendix G).

3.1.3.3 Relative Value Index. The proposed onsite and offsite mitigation packages are insufficient under all project alternatives to fully provide in-kind compensation for adverse project effects on the non-salmonid pool habitat cover type (Section 3.2, "Results and Conclusions") (Table 3-4). Because proposed onsite and offsite mitigation for the Double and Triple Bypass System alternatives more than fully compensates for adverse project effects on the rainbow trout evaluation species, USFWS determined that out-of-kind mitigation could be used for these two project alternatives to address the deficit in AAHUs for the non-salmonid pool habitat cover type. The out-of-kind mitigation would come from the rainbow trout evaluation species AAHUs not required to achieve full compensation for adverse project effects on rainbow trout evaluation species. To determine the amount of rainbow trout evaluation species AAHUs that could be applied as out-of-kind mitigation, USFWS applied its relative value index methodology.

Table 3-4. Change in Average Annual Habitat Units For Evaluation Species and Cover Type for Without- Project, With-Project and With-Mitigation (Offsite) Conditions, by Project Alternative

This table summarizes changes in average annual habitat units (AAHUs) for each evaluation species/cover type for without-project, with-project, and with-mitigation (offsite) conditions, by project alternative. "Without-Project" represents the total AAHU value in the construction area prior to project construction or under baseline conditions. "With-Project Plus Onsite Mitigation" represents the total AAHU value in the construction area after construction, assuming onsite mitigation has been implemented and has reached maturity. "Change" represents the net change in AAHUs between without-project and with-project plus onsite mitigation conditions. "With-Mitigation (Offsite)" represents the combined AAHU value of the offsite mitigation sites identified in the mitigation package for each project alternative. "HEP Model Balance" represents excess (+) or deficit (-) AAHUs achieved by the mitigation package to balance the requirements of the HEP analysis for each evaluation species/cover type. ***Non-salmonid pool habitat cover type AAHUs have not been converted to rainbow trout evaluation species AAHUs for the Double and Triple Bypass System alternatives.***

Project Alternative	Without-Project	With-Project Plus Onsite Mitigation	Change	With-Mitigation (Offsite)	HEP Model Balance
Rainbow Trout Evaluation Species					
Authorized Project	+7.21	+3.42	-3.78	+2.88	-0.90
Double Bypass System	+7.21	+5.42	-1.78	+2.34	+0.56
Triple Bypass System	+7.21	+5.25	-1.96	+2.31	+0.35
Belted Kingfisher Evaluation Species					
Authorized Project	+3.76	+2.85	-0.90	+2.05	+1.15
Double Bypass System	+3.76	+3.14	-0.62	+1.02	+0.40
Triple Bypass System	+3.76	+3.09	-0.67	+1.02	+0.35
Non-Salmonid Pool Habitat Cover Type					
Authorized Project	+9.08	+6.69	-2.40	+1.04	-1.36
Double Bypass System	+9.08	+7.35	-1.73	+0.67	-1.06
Triple Bypass System	+9.08	+7.20	-1.88	+0.67	-1.21

Relative value indexing is a method used in HEP analyses by USFWS for determining how habitat values, or AAHUs, among evaluation species/cover types can be equated. Relative value indexing is based on user-defined criteria developed from an assessment of socioeconomic and ecological factors relevant to the species and project. As an example, a project provides sufficient compensation to both fully mitigate adverse effects on Species A and to allow some of that compensation to be applied as out-of-kind compensation to fully offset adverse effects on Species B, which otherwise would not be fully mitigated. To develop the appropriate relative value index, a review of the status of each species indicates that populations of Species A are twice as rare and regionally vulnerable as Species B. In this example, it may be determined that the appropriate relative value indices are 1.0 and 0.5 for Species A and B, respectively. If 100 Species B AAHUs are required to fully compensate for adverse effects, application of the indices would indicate that out-of-kind compensation to fully mitigate adverse effects could be achieved by providing 50 Species A AAHUs. In other words, Species B 0.5 index multiplied by 100 Species B AAHUs equals 50 Species A AAHUs.

For this SRA cover HEP analysis, USFWS agreed that AAHUs provided for the rainbow trout evaluation species for the Double and Triple Bypass System alternatives, which more than fully compensate for adverse effects on this evaluation species, could be applied as out-of-kind mitigation to allow full compensation of adverse effects on the non-salmonid pool habitat cover type. To determine appropriate relative value indices for use in identifying out-of-kind mitigation needs, USFWS evaluated each of these evaluation species/cover type based on their local and regional abundance, vulnerability to adverse effects, and management efforts to determine the appropriate relative value index for each of these evaluation species/cover type. Each of these criterion were weighted based on their relative importance to the resources. Table 3-5 presents the relative value assigned by USFWS to the criteria, results of USFWS's assessment based on application of the criteria, and the numerical ratings assigned by USFWS to

TABLE 3-5. Relative Value Index Assumptions for Rainbow Trout Evaluation Species and Non-Salmonid Pool Habitat Cover Type

Criteria	Relative Value of Criteria	Rainbow Trout Evaluation Species		Non-Salmonid Pool Habitat Cover Type	
		Assessment	Rating	Assessment	Rating
Abundance	0.2	Anadromous salmonids are regionally rare, occasionally experiencing periods of absence.	1.0	Species are not in decline and generally have wider thermal and habitat tolerances than salmonids.	0.2
Vulnerability	0.3	Anadromous salmonids are vulnerable to the adverse effects of the project primarily on SRA cover and water temperatures.	1.0	Species are less vulnerable to local extirpation than salmonids.	0.1
Management Effort	0.5	Increasing in response to region-wide declines in abundance and populations of anadromous salmonids.	1.0	No special management efforts within the construction area.	0.2

Source: Schoenberg pers. comm.

the evaluation species/cover type for each criterion. The relative value index for each evaluation species/cover type is calculated by multiplying the relative value of each criterion by the evaluation species/cover type rating assigned for that criterion and summing the products. Based on this methodology, the relative value index for rainbow trout evaluation species and the non-salmonid pool habitat cover type is calculated as 1.0 and 0.17, respectively. These indices indicate that each rainbow trout evaluation species AAHU can be applied to provide approximately six non-salmonid pool habitat cover type AAHUs as out-of-kind mitigation.

Based on the relative value indexing approach described here, non-salmonid pool habitat cover type AAHUs for the Double and Triple Bypass System alternatives have been converted in this SRA cover HEP analysis report into rainbow trout evaluation species relative AAHUs. For comparison purposes, Table 3-4 and Appendix H present the unconverted non-salmonid pool habitat cover type AAHU values for the Double and Triple Bypass System alternatives.

3.1.3.4. Guadalupe Creek Offsite Mitigation Site Assumptions. A portion of the total AAHU value generated by the Guadalupe Creek mitigation is needed to compensate for project losses for the belted kingfisher evaluation species under the Double and Triple Bypass System alternatives and the non-salmonid pool habitat cover type under the Triple Bypass System alternative. In addition, under the Triple Bypass System alternative, a portion of the rainbow trout evaluation species AAHU credits are needed for out-of-kind mitigation for the remaining deficit in non-salmonid pool habitat AAHUs. For instance, under the Triple Bypass System alternative, 0.19 rainbow trout relative value AAHU are needed to compensate for project losses of non-salmonid pool habitat after onsite and Reach A mitigation credits are applied. This 0.19 AAHU represents 58% (0.19 of 0.33) of the total rainbow trout evaluation species AAHU value generated by the Guadalupe Creek mitigation site.

Although only 58% of the total amount of AAHUs gained in Guadalupe Creek are needed to fully compensate for project losses of non-salmonid pool habitat cover type, the entire mitigation design proposed for Guadalupe Creek must be implemented. This is necessary because one major component of SRA cover mitigation is the reduction of maximum daily temperatures associated with anticipated increases in stream shading from the expected increase in canopy coverage. The JSATEMP model was used to determine temperature changes in Guadalupe Creek based on the design concept described under Section 2.2.1.2, "Offsite Mitigation".

The JSATEMP model is a reach-based model that calculates water temperatures over a designated section of stream, referred to as a model segment (Figure 3-1). The thermal benefits predicted for the Guadalupe Creek mitigation site by the JSATEMP model are simulated based on future maximum shade values for the two model segments in the JSATEMP model that represent the Guadalupe Creek mitigation site (segments 5 and 6, Figure 3-1). The HEP model uses the average of the temperatures for the two Guadalupe Creek model segments in the calculation of rainbow trout evaluation species AAHUs. Therefore, the thermal benefits of the mitigation must extend throughout the entire length of the Guadalupe Creek mitigation site for the AAHU value to be captured in the HEP analysis model. This is consistent with how changes in AAHU values were estimated by the HEP model for the construction area.

3.2 RESULTS AND CONCLUSIONS

This section discusses the results of the SRA cover HEP analyses for the Authorized Project, Double Bypass System, and Triple Bypass System alternatives. The SRA cover HEP analysis results are organized by project alternative. The discussion for each alternative is organized as follows:

+ overall results for each project alternative;

+ rainbow trout evaluation species HSI model results for the construction area, which assume onsite mitigation benefits in the construction area, and the offsite mitigation sites;

+ belted kingfisher evaluation species HSI model results for the construction area, which assume onsite mitigation benefits in the construction area, and the offsite mitigation sites; and

+ non-salmonid pool habitat cover type HSI model results for the construction area, which assume onsite mitigation benefits in the construction area, and the offsite mitigation sites.

Non-salmonid pool habitat cover type AAHUs for the Double and Triple Bypass System alternatives have been converted into rainbow trout evaluation species AAHUs using a relative value index approach (Section 3.1.3.3, "Relative Value Index"). For comparison purposes, Table 3-4 and Appendix H present the unconverted non-salmonid pool habitat cover type AAHUs for the Double and Triple Bypass System alternatives.

Table 3-6 compares net gains and losses in AAHU values by evaluation species and cover type HSI models for each project alternative. Table 3-7 presents changes in AAHU values for the offsite mitigation sites for each project alternative.

3.2.1 Authorized Project Alternative

The overall results of the SRA cover HEP analysis for the Authorized Project alternative show that with proposed onsite mitigation and proposed offsite mitigation in Reaches A, 10B, and 12 and Guadalupe Creek this alternative does not balance for rainbow trout evaluation species or non-salmonid pool habitat cover type but does balance for belted kingfisher evaluation species (Table 3-6). SRA cover HEP analysis results for each evaluation species and cover type are discussed below.

For the rainbow trout evaluation species, AAHU values are most affected by the loss of SRA cover and the resulting increases in average maximum water temperatures caused by reduced overhead shade. Salmonids are particularly sensitive to changes in water temperature. The Authorized Project alternative is predicted to cause greater increases in average maximum water temperatures than the other two alternatives because it removes substantially more SRA

Table 3-6. Change in Average Annual Habitat Units For Evaluation Species and Cover Type for Without- Project, With-Project and With-Mitigation (Offsite) Conditions, by Project Alternative

This table summarizes changes in average annual habitat units (AAHUs) for each evaluation species/cover type for without-project, with-project, and with-mitigation (offsite) conditions, by project alternative. "Without-Project" represents the total AAHU value in the construction area prior to project construction or under baseline conditions. "With-Project Plus Onsite Mitigation" represents the total AAHU value in the construction area after construction, assuming onsite mitigation has been implemented and has reached maturity. "Change" represents the net change in AAHUs between without-project and with-project plus onsite mitigation conditions. "With-Mitigation (Offsite)" represents the combined AAHU value of the offsite mitigation sites identified in the mitigation package for each project alternative. "Net Result" represents excess (+) or deficit (-) AAHUs achieved by the mitigation package to balance the requirements of the HEP analysis for each evaluation species/cover type prior to applying relative value rainbow trout AAHUs, as applicable. "Rainbow Trout Relative Value AAHUs" applies to non-salmonid pool habitat cover type AAHU deficits for the Double and Triple Bypass System alternatives only. ""HEP Model Balance" represents excess (+) or deficit (-) AAHUs achieved by the mitigation package to balance the requirements of the HEP analysis for each evaluation species/cover type. ***Non-salmonid pool habitat cover type AAHUs have been converted to rainbow trout evaluation species AAHUs for the Double and Triple Bypass System alternatives.***

Project Alternative	Without-Project	With-Project Plus Onsite Mitigation	Change	With-Mitigation (Offsite)	Net Result	Rainbow Trout Relative Value AAHUs	HEP Model Balance
Rainbow Trout Evaluation Species							
Authorized Project	+7.21	+3.42	-3.78	+2.88	-0.90	n/a	-0.90
Double Bypass System	+7.21	+5.42	-1.78	+2.34	+0.56	n/a	+0.56
Triple Bypass System	+7.21	+5.25	-1.96	+2.31	+0.35	n/a	+0.35
Belted Kingfisher Evaluation Species							
Authorized Project	+3.76	+2.85	-0.90	+2.05	+1.15	n/a	+1.15
Double Bypass System	+3.76	+3.14	-0.62	+1.02	+0.40	n/a	+0.40
Triple Bypass System	+3.76	+3.09	-0.67	+1.02	+0.35	n/a	+0.35
Non-Salmonid Pool Habitat Cover Type							
Authorized Project	+9.08	+6.69	-2.40	+1.04	-1.36	n/a	-1.36
Double Bypass System	+1.54	+1.25	-0.29	+0.11	-0.18	+0.56	+0.38
Triple Bypass System	+1.54	+1.23	-0.32	+0.11	-0.21	+0.35	+0.14

TABLE 3-7. Change in Average Annual Habitat Units for Evaluation Species/Cover Type from Without-Project to With-Project Conditions for Offsite Mitigation Sites, by Project Alternatives

The change in average annual habitat units (AAHUs) is presented for each evaluation species/cover type by offsite mitigation site. "Without-Project" represents baseline AAHU values. "With-Project" represents AAHU values in mitigation sites after growth of SRA mitigation plantings. "Change" represents the net increase in AAHUs from mitigation. Positive AAHU values under "Change" mean that there would be a net increase in AAHUs at the mitigation sites associated with mitigation. Non-salmonid pool habitat cover type AAHUs have been converted to rainbow trout evaluation species AAHUs for the Double and Triple Bypass System alternatives.

Offsite Mitigation Area	Rainbow Trout Evaluation Species (AAHUs)			Belted Kingfisher Evaluation Species (AAHUs)			Non-Salmonid Pool Habitat Cover Type (AAHUs)		
	Without-Project	With-Project	Change	Without-Project	With-Project	Change	Without-Project	With-Project	Change
Authorized Project									
Reach A	0.00	0.00	0.00	+1.05	+1.28	+0.23	+4.41	+4.84	+0.42
Reach 12	0.00	+2.05	+2.05	+1.10	+1.85	+0.75	+3.15	+3.37	+0.22
Reach 10B	0.00	+0.50	+0.50	+0.28	+0.56	+0.28	+0.98	+1.13	+0.16
Guadalupe Creek	+1.52	+1.85	+0.33	+1.28	+2.07	+0.79	+2.14	+2.38	+0.24
Total			**+2.88**			**+2.05**			**+1.04**
Double Bypass System									
Reach A	0.00	+2.01	+2.01	+1.05	+1.28	+0.23	+0.75	+0.82	+0.07
Guadalupe Creek	+1.52	+1.85	+0.33	+1.28	+2.07	+0.79	+0.36	+0.40	+0.04
Total			**+2.34**			**+1.02**			**+0.11**
Triple Bypass System									
Reach A	0.00	+1.98	+1.98	+1.05	+1.28	+0.23	+0.75	+0.82	+0.07
Guadalupe Creek	+1.52	+1.85	+0.33	+1.28	+2.07	+0.79	+0.36	+0.40	+0.04
Total			**+2.31**			**+1.02**			**+0.11**

cover and modifies more of the channel, through channel widening and channel armoring, than the other two alternatives (U.S. Army Corps of Engineers 2000). The predicted increases in water temperature cause the average maximum water temperature to exceed 77 °F during the summer for 20 years following project construction. Habitat suitability for rearing juvenile steelhead drops to zero when temperatures reach 77 °F. This 20-year period of zero predicted habitat value has a substantial effect on with-project AAHUs. The reduction in total aquatic habitat area, from 9.58 to 7.56 acres, is also greater under this alternative than the other two alternatives. The combined effects of reduced habitat quality and loss of habitat area cause predicted rainbow trout AAHU values to be substantially lower under with-project conditions than under without-project conditions.

The rainbow trout evaluation species habitat value for without-project conditions in the construction area is 7.21 AAHUs (Table 3-6). Compared to a with-project habitat value of 3.42 AAHUs, the without-project habitat value results in a net loss of 3.78 AAHUs (Table 3-6). Mitigation values for the four offsite mitigation sites need to total at least 3.78 AAHUs for the mitigation package to adequately compensate for losses caused by the Authorized Project alternative. However, the results of the SRA cover HEP analysis show that these mitigation values total only 2.88 AAHUs (Table 3-7), leaving an overall deficit of 0.90 AAHU for the rainbow trout evaluation species (Table 3-6).

For the belted kingfisher evaluation species, AAHU values are most affected by the loss of habitat area, from 9.58 to 7.56 acres, and reduced habitat quality caused by removal of SRA cover. The belted kingfisher evaluation species habitat value for without-project conditions in the construction area is 3.76 AAHUs (Table 3-6). Compared to a with-project habitat value of 2.85 AAHUs, the without-project habitat value results in a net loss of 0.90 AAHU (Table 3-6). Mitigation values for the four offsite mitigation sites need to total at least 0.90 AAHU for the mitigation package to adequately compensate for losses caused by the Authorized Project alternative. The results of the SRA cover HEP analysis show that a combined total of 2.05 AAHUs is gained at the four mitigation sites (Table 3-7), resulting in an excess of 1.15 belted kingfisher evaluation species AAHUs beyond what is needed to fully compensate for losses caused by the Authorized Project alternative (Table 3-6).

For the non-salmonid pool habitat cover type, AAHU values are most affected by the loss of habitat area, from 9.58 to 7.56 acres, and, to a lesser extent, changes in water temperature. The non-salmonid pool habitat cover type AAHU value for without-project conditions in the construction area is 9.08 AAHUs (Table 3-6). Compared to a with-project habitat value of 6.69 AAHUs, the without-project habitat value results in a net loss of 2.40 AAHUs (Table 3-6). Mitigation values for the four offsite mitigation sites need to total at least 2.40 AAHUs for the mitigation package to adequately compensate for losses caused by the Authorized Project alternative. However, the results of the SRA cover HEP analysis show that these mitigation values total only 1.04 AAHUs (Table 3-7), leaving an overall deficit of 1.36 AAHUs for non-salmonid pool habitat cover type habitat (Table 3-6).

3.2.2 Double Bypass System Alternative

The overall results of the SRA cover HEP analysis for the Double Bypass System alternative show that with proposed onsite mitigation and proposed offsite mitigation in Reach A and Guadalupe Creek this alternative balances for rainbow trout and belted kingfisher evaluation species and non-salmonid pool habitat cover type (Table 3-6). SRA cover HEP analysis results for each evaluation species and cover type are discussed below.

For the rainbow trout evaluation species, AAHU values continue to be most affected by the loss of SRA cover and the resulting increases in average maximum water temperatures caused by a reduction in overhead shade. Unlike the Authorized Project alternative, the expected temperature increases are not so great as to cause average maximum water temperatures in summer to exceed the 77 °F threshold during postconstruction years (U.S. Army Corps of Engineers 2000). The smaller increases in water temperature anticipated with this project alternative mean that habitat conditions in the construction area remain suitable for salmonids in all postconstruction years, thereby keeping with-project AAHU values relatively high as compared to the Authorized Project alternative.

The rainbow trout evaluation species habitat value for without-project conditions in the construction area is 7.21 AAHUs (Table 3-6). Compared to a with-project habitat value of 5.42 AAHUs, the without-project habitat value results in a net loss of 1.78 AAHUs (Table 3-6). Mitigation values for the two offsite mitigation sites need to total at least 1.78 AAHUs for the mitigation package to adequately compensate for losses caused by the Double Bypass System alternative. The Reach A mitigation site will generate 2.01 rainbow trout AAHUs (Table 3-7). The 2.01 rainbow trout AAHUs will cover the loss of 1.78 rainbow trout AAHUs, while creating an excess of 0.23 rainbow trout AAHU. The Guadalupe Creek mitigation site will generate 0.33 rainbow trout AAHU, which, when added to the 0.23 rainbow trout AAHU excess from Reach A, will create an overall excess of 0.56 rainbow trout AAHUs (Table 3-7).

For the belted kingfisher evaluation species, AAHU losses are less under the Double Bypass System alternative than under the Authorized Project and Triple Bypass System alternatives because less habitat area is lost as a result of the underground bypass in Segments 3A and 3B. The belted kingfisher evaluation species habitat value for without-project conditions in the construction area is 3.76 AAHUs (Table 3-6). Compared to a with-project habitat value of 3.14 AAHUs, the without-project habitat value results in a net loss of 0.62 AAHU (Table 3-6). Mitigation values for the two offsite mitigation sites need to total at least 0.62 AAHU for the mitigation package to adequately compensate for losses caused by the Double Bypass System alternative. The Reach A mitigation site will generate 0.23 belted kingfisher AAHU and the Guadalupe Creek mitigation site will generate 0.79 belted kingfisher AAHU, resulting in an overall gain of 1.02 belted kingfisher AAHUs (Table 3-7). The 1.02 belted kingfisher AAHUs will cover the loss of 0.62 belted kingfisher AAHU, while creating an excess of 0.40 belted kingfisher AAHU.

For the non-salmonid pool habitat cover type, AAHU losses are less under the Double Bypass System alternative than under the Authorized Project and Triple Bypass System alternatives because the Double Bypass System alternative affects less SRA cover and pool

habitats. The non-salmonid pool habitat cover type habitat value for without-project conditions in the construction area is 1.54 rainbow trout relative value AAHUs (Table 3-6). Compared to a with-project habitat value of 1.25 rainbow trout relative value AAHUs, the without-project habitat value results in a net loss of 0.29 rainbow trout relative value AAHU (Table 3-6). Mitigation values for the two offsite mitigation sites need to total at least 0.29 rainbow trout relative value AAHU for the mitigation package to adequately compensate for losses caused by the Double Bypass System alternative. The Reach A mitigation site will generate 0.07 rainbow trout relative value AAHU (Table 3-7). The Guadalupe Creek mitigation site will generate 0.04 rainbow trout relative value AAHU, resulting in an overall gain of 0.11 rainbow trout relative value AAHU (Table 3-7). However, the combined total of 0.11 rainbow trout relative value AAHU still leaves a deficit of 0.18 rainbow trout relative value AAHU for the non-salmonid pool habitat cover type (Table 3-6). However, this deficit of 0.18 rainbow trout relative value AAHU for non-salmonid pool cover type is adequately compensated for by the excess 0.56 AAHU for the rainbow trout evaluation species (Table 3-6).

3.2.3 Triple Bypass System Alternative

The overall results of the SRA cover HEP analysis for the Triple Bypass System alternative show that with proposed onsite mitigation and proposed offsite mitigation in Reach A and Guadalupe Creek this alternative balances for rainbow trout and belted kingfisher evaluation species and non-salmonid pool habitat cover type (Table 3-6). SRA cover HEP analysis results for each evaluation species and cover type are discussed below.

For the rainbow trout evaluation species, AAHU values continue to be most affected by the loss of SRA cover and the resulting increases in average maximum water temperatures caused by a reduction in overhead shade. Unlike the Authorized Project alternative, the expected temperature increases are not so great as to cause average maximum water temperatures in summer to exceed the 77 °F threshold during postconstruction years (U.S. Army Corps of Engineers 2000). The smaller increases in water temperature anticipated with this project alternative mean that habitat conditions in the construction area remain suitable for salmonids in all postconstruction years, thereby keeping with-project AAHU values relatively high as compared to the Authorized Project alternative.

The rainbow trout evaluation species habitat value for without-project conditions in the construction area is 7.21 AAHUs (Table 3-6). Compared to a with-project habitat value of 5.25 AAHUs, the without-project habitat value results in a net loss of 1.96 AAHUs (Table 3-6). Mitigation values for the two mitigation sites need to total at least 1.96 AAHUs for the mitigation package to adequately compensate for losses from the Triple Bypass System alternative. The Reach A mitigation site will generate 1.98 rainbow trout AAHUs (Table 3-7). The 1.98 rainbow trout AAHUs will cover the loss of 1.96 AAHUs, while creating an excess of 0.02 rainbow trout AAHU. The Guadalupe Creek mitigation site will generate 0.33 rainbow trout AAHU, which, when added to the 0.02 AAHU excess from Reach A, will create an overall excess of 0.35 rainbow trout AAHUs (Table 3-6).

For belted kingfisher evaluation species, AAHU losses are less under the Triple Bypass System alternative than under the Authorized Project alternative because less habitat area is lost

as a result of the underground bypass in Segments 3A and 3B. However, AAHU losses under the Triple Bypass System are still higher than under the Double Bypass System alternative. The belted kingfisher evaluation species habitat value for without-project conditions in the construction area is 3.76 AAHUs (Table 3-6). Compared to a with-project habitat value of 3.09 AAHUs, the without-project habitat value results in a net loss of 0.67 AAHU (Table 3-6). Mitigation values for the two mitigation sites need to total at least 0.67 AAHUs for the mitigation package to adequately compensate for losses from the Triple Bypass System alternative. The Reach A mitigation site will generate 0.23 belted kingfisher AAHU and the Guadalupe Creek mitigation site will generate 0.79 AAHU, resulting in an overall gain of 1.02 belted kingfisher AAHUs (Table 3-7). This will cover the loss of 0.67 belted kingfisher AAHU, while creating an excess of 0.35 belted kingfisher AAHU (Table 3-6).

For the non-salmonid pool habitat cover type, AAHU losses are less under the Triple Bypass System alternative than under the Authorized Project alternative because the Triple Bypass System alternative affects less SRA cover and pool habitats. However, AAHU losses under the Triple Bypass System are still higher than under the Double Bypass System alternative. The non-salmonid pool habitat cover type habitat value for without-project conditions in the construction area is 1.54 rainbow trout relative value AAHUs (Table 3-6). Compared to a with-project habitat value of 1.23 rainbow trout relative value AAHUs, the without-project habitat value results in a net loss of 0.32 rainbow trout relative value AAHU (Table 3-6). Mitigation values for the two mitigation sites need to total at least 0.32 rainbow trout relative value AAHU for the mitigation package to adequately compensate for losses caused by the Triple Bypass System alternative. The Reach A mitigation site will generate 0.07 rainbow trout relative value AAHU (Table 3-7). The Guadalupe Creek mitigation site will generate 0.04 rainbow trout relative value AAHU, resulting in an overall gain of 0.11 rainbow trout relative value AAHU (Table 3-7). However, the combined total of 0.11 rainbow trout relative value AAHU still leaves a deficit of 0.21 rainbow trout relative value AAHU for the non-salmonid pool habitat cover type (Table 3-6). However, this deficit of 0.21 rainbow trout relative value AAHU for non-salmonid pool cover type is adequately compensated for by the excess 0.35 AAHU for the rainbow trout evaluation species (Table 3-6).

3.3 CONCLUSIONS

The results of the SRA cover HEP analysis show that implementing any one of the three project alternatives will reduce habitat values for the two evaluation species and cover type in the construction area relative to without-project conditions. Compared to without-project conditions, the Authorized Project alternative will result in the greatest loss in habitat values for the two evaluation species and cover type, followed by the Triple Bypass System alternative, and the Double Bypass System alternative. For all three project alternatives, rainbow trout evaluation species has the greatest habitat value loss between without-project and with-project conditions, followed by non-salmonid pool habitat cover type and belted kingfisher evaluation species (Table 3-6). The habitat value loss for these evaluation species and cover type occur despite the proposed onsite mitigation for each of the three project alternatives. Although onsite mitigation plays a significant role in minimizing effects in the construction area and in minimizing overall mitigation requirements for each of the project alternatives, offsite mitigation sites are needed to compensate for these losses. Even with offsite mitigation, the Authorized Project alternative

only fully compensates for project effects on the belted kingfisher evaluation species; it does not fully compensate for project effects on the rainbow trout evaluation species and non-salmonid pool habitat cover type. Both the Double and Triple Bypass System alternatives fully compensate for the two evaluation species and cover type with offsite mitigation.

Chapter 4. Citations

4.1 PRINTED REFERENCES

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4.2 PERSONAL COMMUNICATIONS

Schoenberg, Steven. Biologist. U.S. Fish and Wildlife Service, Sacramento, CA. June 7, 1999. Electronic correspondence with Jeff Kozlowski of Jones & Stokes regarding the use of relative value indexing in the 1998-2000 SRA cover HEP analysis.

Appendix A. Comparison of Shaded Riverine Aquatic Cover Adverse Effects and Channel Bed Armoring Length between the Triple Bypass System Alternative and the Proposed Action

TABLE A-1. Comparison of Shaded Riverine Aquatic Cover Adverse Effects between the Triple Bypass System Alternative and the Proposed Action

This table compares shaded riverine aquatic (SRA) cover adverse effects caused by the Triple Bypass System alternative evaluated in the SRA cover habitat evaluation procedures (HEP) report to the Proposed Action evaluated in the General Re-Evaluation/Environmental Impact Report/Supplemental Environmental Impact Statement (GRR/EIR/SEIS).

Segment	SRA Cover Adverse Effects (linear feet)		Difference in SRA Cover Adverse Effects Length (+/-) Between the Two Alternatives (linear feet)	Comments
	Triple Bypass System Alternative (evaluated in SRA Cover HEP analysis report)	Proposed Action (evaluated in GRR/EIR/SEIS)		
Segment 1	1,510	1,510	0	
Segment 2	2,060	2,060	0	
Segment 3A	1,259	1,431	+172	Increased SRA cover adverse effects caused by an increase in armored bank upstream from Coleman Avenue in the vicinity of the bypass outlets (west bank = +80 linear feet and east bank = +92 linear feet).
Segment 3B	3,036	2,430	-606	Under the Triple Bypass System alternative, the entire east bank between West Santa Clara Street and New Julian Street is armored. The amount of armoring on the east bank was revised under the Proposed Action to only include armoring for 340 linear feet downstream from West Santa Clara Street and in the vicinity of the bypass inlet near St. John Street.
Segment 3C	956	956	0	
Total	**8,821**	**8,387**	**-434**	

TABLE A-2. Comparison of Armored Channel Bed Length between the Triple Bypass System Alternative and the Proposed Action.

This table compares armored channel bed length between the Triple Bypass System alternative evaluated in the shaded riverine aquatic (SRA) cover habitat evaluation procedure (HEP) report and the Proposed Action evaluated in the General Re-Evaluation Report/Environmental Impact Report/Supplemental Environmental Impact Statement (GRR/EIR/SEIS).

Segment	Armored Channel Bed Length (linear feet)		Difference in Armored Channel Bed Length (+/-) Between the two Alternatives (linear feet)	Comments
	Triple Bypass System Alternative (evaluated in SRA Cover HEP analysis report)	Proposed Action (evaluated in GRR/EIR/SEIS)		
Segment 1	448	448	0	
Segment 2	305	305	0	
Segment 3A	609	695	+86	Increase in channel bed armoring upstream from Coleman Avenue in the vicinity of the bypass outlets.
Segment 3B	2,191	1,940	-251	The Triple Bypass System alternative assumed 300 linear feet of armored channel bed in the vicinity of St. John Street for the bypass inlet. This armoring was eliminated for the Proposed Action. The Triple Bypass System alternative also assumed 1,891 linear feet of armored channel bed from upstream of Park Avenue to 323 feet downstream from West Santa Clara Street. For the Proposed Action, the upstream limit of armored channel bed in this area was increased by 44 linear feet and the downstream limit was increased by 5 linear feet, for a total of 1,940 linear feet.
Segment 3C	820	1,045	+225	The Triple Bypass System alternative assumed 820 linear feet of armored channel bed from the upstream project limit at Grant Street to upstream from Woz Way. The remaining 225 linear feet of channel bed in the vicinity of Woz Way was identified as earthen channel bed. The Proposed Action assumes that the 225 linear feet of earthen channel bed will consist of densely compacted soils and therefore should be considered "armored" because it will not be "natural" channel substrate.
Total	**6,386**	**6,433**	**+60**	

Appendix B. Habitat Evaluation Procedures Technical Team

Appendix B. Habitat Evaluation Procedures Technical Team

Agency	Representative*
California Department of Fish and Game	Margaret Roper, Carl Wilcox
California State Water Resources Control Board	Oscar Balaguer
National Marine Fisheries Service	Chris Mobley, Ian Gilroy, Mark Helvey
Natural Heritage Institute	Stacy Li
Santa Clara Valley Water District	Terry Neudorf
U.S. Army Corps of Engineers	Matt Davis, Mike Welsh, Nina Bickenese
U.S. Fish and Wildlife Service	Steve Schoenberg

* Participants in the 1996-1997 and/or 1998-2000 SRA cover HEP analyses for the Guadalupe River Project.

Appendix C. Habitat Suitability Index Model for Non-Salmonid Aquatic Guild

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Non-Salmonid Aquatic Guild Model

For Application To The Guadalupe River Flood Control Project, Lower Reaches (Downtown Project)

Prepared by:

Dr. Steven Schoenberg
U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
Sacramento, California

May 1999

NON-SALMONID AQUATIC GUILD MODEL FOR APPLICATION TO THE GUADALUPE RIVER FLOOD CONTROL PROJECT, LOWER REACHES (DOWNTOWN PROJECT)

Introduction

The Guadalupe River, located in Santa Clara County, California, flows north from the confluence of Alamitos and Guadalupe Creeks through the City of San Jose, and empties into San Francisco Bay. The habitat can be characterized as a dense but narrow riparian corridor, at the margin of a moderately-incised river channel. The river includes a predominance of long pools as well as some riffles. Aquatic or semi-aquatic species known from this system include small runs of steelhead trout and chinook salmon, resident native and non-native warmwater fishes, and several reptile and amphibian species. The river is the subject of several distinct planned flood control projects, including the lower (downtown) project between Interstate 880 and Grant Street, for which this model has been developed. A Habitat Evaluation Procedures (HEP) study was reinitiated in 1992 to address impacts on Shaded Riverine Aquatic cover. In that study, the green sunfish Habitat Suitability Index (HSI) model (Stuber et al. 1982) was selected for evaluation of impacts to aquatic species other than salmonids, and to pool habitat.

Selection of the sunfish model for use in the HEP unfortunately resulted in a public perception that implied management for a non-native species whose life history needs are different from the salmonid species of primary interest. After further review by the HEP-team, several potential sources of bias were identified in the sunfish model as pertained to the temperature criteria and minimum pool proportions. More significantly, the sunfish model did not include bank conditions or associated over water vegetation which are of some importance to the non-salmonid guild. To fairly evaluate this project's impacts and mitigation benefits, a revised guild model has been developed with modified indices to accurately reflect habitat values for native species in this system other than salmonids and pool values in general, making use of much of the data already collected for the green sunfish model. The model adopts or modifies variables from existing published and draft HSI models, and employs an additional variable for substrate based on bank treatment.

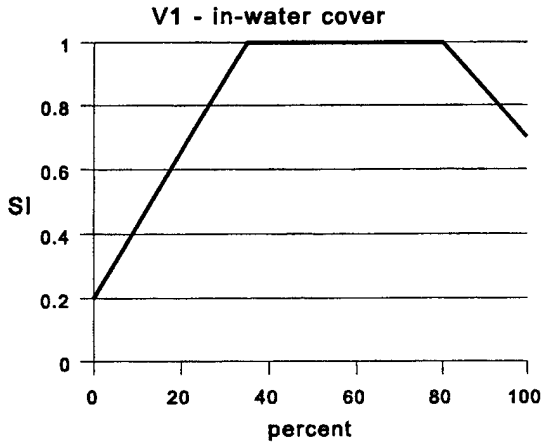
Model Applicability

This model is intended for application to the Guadalupe River flood control project construction areas known as Contracts 1, 2, and 3 (Interstate 880 to Grant Street), and mitigation sites within Reach A of the Guadalupe River (Interstate 880 to Route 101) and in lower Guadalupe Creek (Almaden Expressway southbound to Camden Road). The species which are intended to be reflected by the model include native fishes other than salmonids, such as hitch, roach, Pacific lamprey, sculpins, and sucker, as well as common reptiles (turtles, snakes), and amphibians. The model is generally applicable to similar-sized, low-gradient rivers in the south San Francisco Bay area with at least 10 percent pools by length. A summary of the variables and their derivations is given below, followed by a discussion of the variables grouped into structural cover, dimensional cover, substrate, and limiting variables:

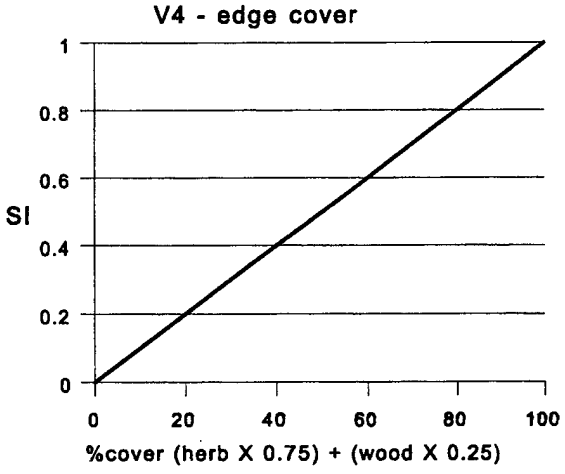
Habitat Variable	Derivation
V1 - in-water cover	same as green sunfish model variable V1
V2 - pool proportion	same as green sunfish model variable V2
V3 - substrate category	new variable on extent of bank and invert revetment
V4 - edge cover	modified from published bullfrog and in-house red-legged frog models; adds credit for wood features
V5 - pool depth	modified from smallmouth bass HSI model variable V4
V6 - stream width	same as green sunfish model variable V14
V7 – temperature	revised variable based on frog models and thermal ranges of native non-salmonid fishes
V8 - pool velocity (summer)	same as green sunfish model variable V11
V9 - stream gradient	same as green sunfish model variable V3

Structural Cover Variables (V1,V4):

In-water cover (V1) – In-water cover consists of boulders, logs and other features which provide places for fish and amphibians to rest, feed, or escape from predators. In-water cover also provides surface for attachment of invertebrate forage organisms, and sites of detritus accumulation. The green sunfish model variable V1 was utilized without modification (SI refers to the Suitability Index).

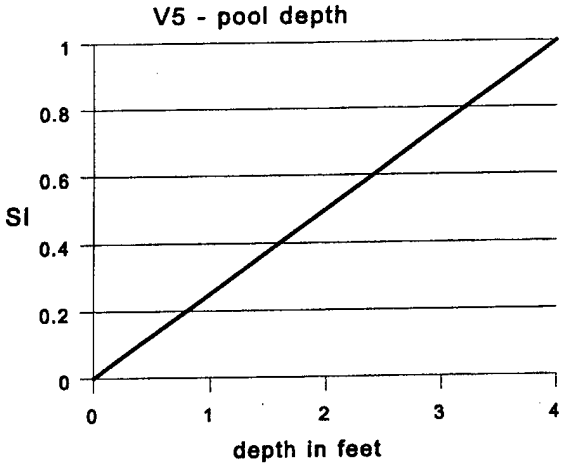


Edge Cover (V4) – Both herbaceous and woody vegetation at pool margins provide escape and spawning areas for amphibians and overhead cover for fishes at low water (USFWS 1992), foraging areas for wading birds, and additional in-water cover during higher flows for all aquatic species. Though herbaceous cover is of primary importance, woody debris on the bank is also used for concealment by toads, snakes, and newts (USFWS 1985). To integrate herbaceous and woody components, edge cover is calculated as a weighted sum: vegetative cover X 0.75 plus woody cover X 0.25. This variation of the bullfrog model variable V5 (Graves and Anderson 1985), which assumed a linear relationship of total cover to suitability, better reflects the additional diversity supplied by mixing of edge cover components.

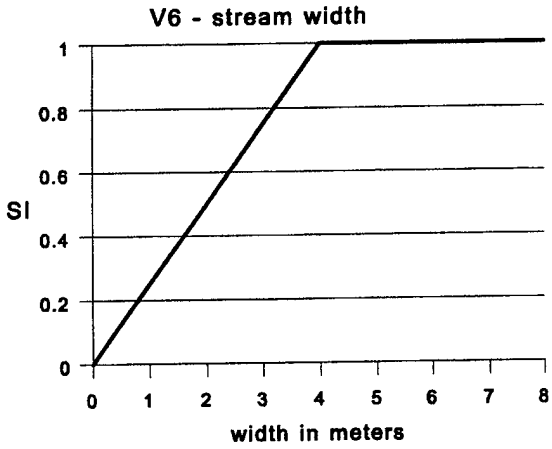


Dimensional Cover (V5, V6):

Pool Depth (V5) – Deeper waters provide refugia from predators for fish and other aquatic organisms in the presence or absence of other cover. Pool depth is inversely related to the risk of drying up in low-water years. Thermal refugia may be provided in deeper pools because of thermal stratification. Certain fish species feed on detritus and associated insect forage which accumulate with increasing depth. The suitability index is calculated using the ascending limb of the pool depth variable from the smallmouth bass model (Edwards et al. 1983) based on that species' preference, which is considered to also reflect the optimum depth for native fishes of the Guadalupe River. The data for this variable had been previously obtained for the rainbow trout HSI model variable V4b.



V6 - Stream Width – The concept of this variable is that escape cover decreases as streams become very narrow, exposing fish and invertebrates to a greater predation risk. Narrowing of habitat occurs in portions of the project where a low-flow channel replaces much wider deep pools. Width should also be considered in those mitigation areas which are either much narrower (Guadalupe Creek) or wider (Reach A) than the impact area. Both riverine fishes such as sunfish, native reptiles like turtles, and frogs are associated with wider streams, possibly as a result of the correlation between stream width and perenniality, and because wider streams more often provide the dual needs of shallow and deep water for some amphibians (Graves and Anderson 1985). The stream width variable is identical to the green sunfish variable V14.



Substrate (V3) - Substrate is treated as a >scaling = factor in the HSI formula which gives it equal influence to all cover variables. The term substrate applies to the stream banks as well as the stream invert because of the additional functions provided by natural banks as a surface which can be burrowed by animals or their forage, as well as a region which can form pockets, undercuts, or other surfaces that provide microhabitats to fishes. A minimum non-zero value is imposed so that absence of natural substrate function will not completely cancel values imparted by the dimensional and structural cover variables. A category determination is used to describe the condition which best fits the stream reach:

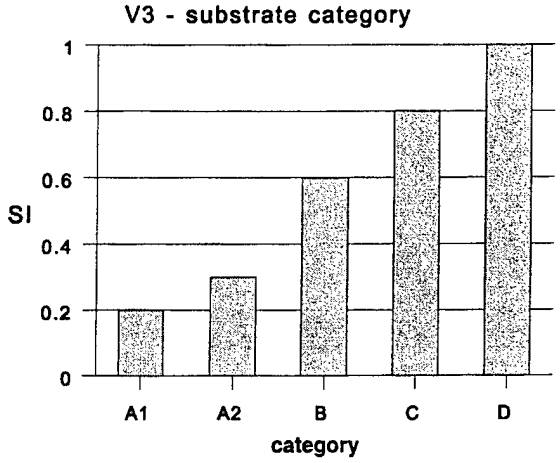
A1 Both banks and the invert are hard structure (e.g., rip-rap, cabled concrete mattress or "ccm", natural rock) and are rigorously maintained, minimizing food production. (SI = 0.2)

A2 Both stream banks and the invert are hard structures. Maintenance occurs on regular intervals, but there are intermediate periods during which some benthic production can occur (SI = 0.3).

B Both stream banks are hard structure, but the invert is soft bottom (either gravel or fines). These areas would also be maintained, but are subject to lower scouring velocities, and the natural invert base provides for the development of some, persistent benthic community, and depth diversity (SI = 0.6)

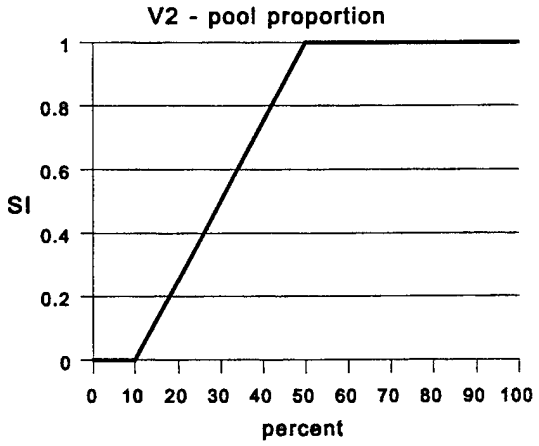
C One stream bank is hard structure (gabions), but the opposite bank and invert are natural substrate (SI = 0.8).

D Both banks and the invert are natural. (SI = 1.0)

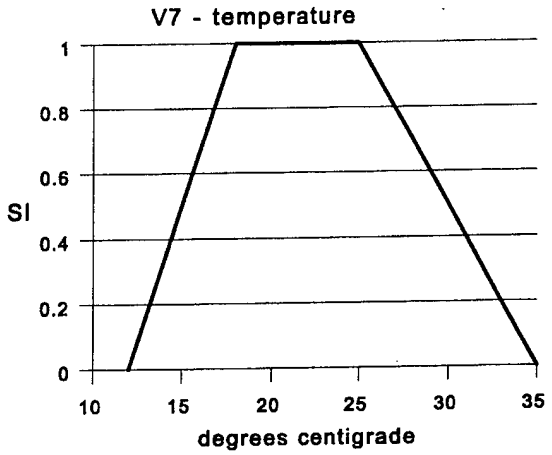


Limiting Variables (V2, V7, V8,V9):

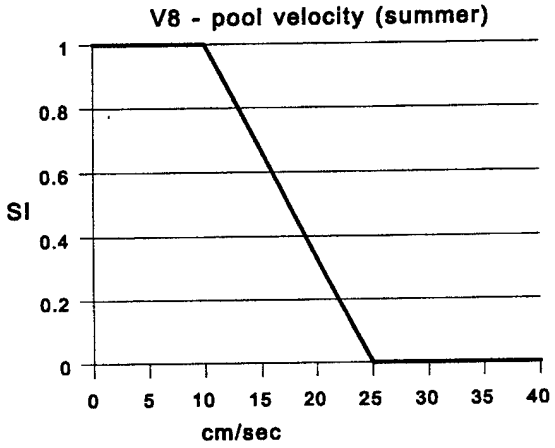
Pool proportion (V2) - A minimum proportion of 10 percent is assumed to obtain any value, the same as for the green sunfish model. As explained below, the revised HSI equation averages this variable with the gradient function, under the presumption that low gradient areas will impart some of the same functions and values as pool areas, and that low gradient and pool proportion in the project area are correlated (i.e., cancellation of value occurs only if both variables are zero). Slow-moving water is an important breeding habitat component for frog species in general, whether or not in pools.



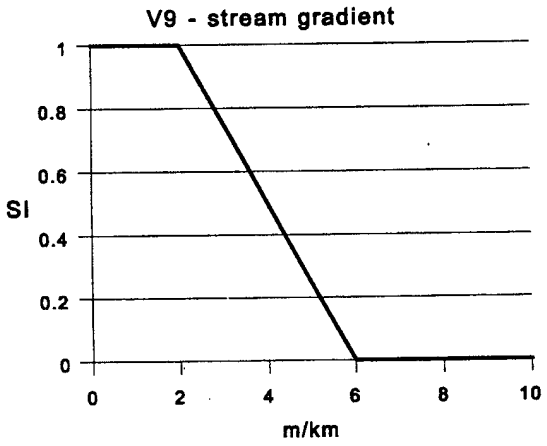
Temperature (V7) – Other than salmonids, temperature tolerances are broader for most native fishes and amphibians; for example, Moyle (1976) characterizes California roach is a species which "...lives where others cannot", tolerating temperatures up to 35BC, and notes that other species like prickly sculpin and Sacramento sucker are considerably more temperature tolerant than are salmonids. A draft HSI model for red-legged frog (Jennings 1988) includes an optimum temperature range for that species of 4-21BC, whereas the published HSI model for bullfrog (Graves and Anderson 1985) has a similar variable with an optimum range of 15-30BC. For the non-salmonid guild model discussed here, a moderately-broad optimum temperature range was selected (18-25BC), although it is acknowledged that certain species may have a lower range (i.e., sculpins), and some a higher range (i.e., frogs).



Pool velocity (V8) – Pool velocity preferences in the range of 0-10 centimeters per second are considered optimum for spawning of native frog species, such as the foothill yellow-legged frog (USFWS 1992). This is identical to that described for the green sunfish model variable.



Stream gradient (V9) – In part, stream gradient is correlated with slower-moving water and an increasing proportion of pools. Native warmwater species such as sucker and roach, as well as amphibians and turtles, are associated with these lower gradient areas. The suitability index is the same as variable V3 for the green sunfish model.



HSI equation:

Subscores for food/cover components (designated C-fs) and the limiting functions (designated C-L) are calculated separately, as follows:

$$\text{Food/Cover (C-fs)} = \frac{(((V1 + V4) + (V5 + V6)/2)) * V3)^{1/2}}{3}$$

$$\text{Limiting Function (C-L)} = ((V2 + V9)/2 * V7 * V8)^{1/3}$$

The overall HSI is then calculated as the geometric mean of the subscores:

$$HSI = (C\text{-fs} * C\text{-L})^{1/2}$$

In the food/cover subscore, structural cover components are given two-thirds of the total "weight" in the HSI formulation because they contribute food as well as cover values, with the dimensional attributes providing one-third of the weight. The bank and invert substrate variable is treated as having equivalent weight to the combination both structural and dimensional variables. In the limiting function, gradient and pool proportion SIs are averaged because of their functional similarity. Failure to achieve the minimum range value for limiting variables (temperature, pool velocity, pools and/or low gradient) results in a complete loss of habitat suitability.

REFERENCES

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Moyle, P. B. 1976. Inland Fishes of California. University of California Press. Berkeley. 300 pp.

Stuber, R.J., Gebhart, G., and O.E. Maughan. 1982. Habitat Suitability Index Models: Green Sunfish. Western Energy and Land Use Team. U.S. Fish and Wildlife Service. FWS/OBS-82/10.15.

USFWS. 1985. Draft Habitat Suitability Index Model: Western Spadefoot Toad (*Scaphiopus hammondii*). Sacramento Field Office. U.S. Fish and Wildlife Service.

USFWS. 1992. Draft Habitat Suitability Index Model: Foothill Yellow-legged Frog (*Rana boylii*). Sacramento Field Office. U.S. Fish and Wildlife Service.

Appendix D. Form C Output from Habitat Evaluation Procedures Model

Appendix D. Form C Output from Habitat Evaluation Procedures Model

CONTENTS OF APPENDIX D

U.S. Fish and Wildlife Service has developed a model to assist habitat evaluation procedures (HEP) analysis practitioners in conducting HEP analyses. One of the output forms from the HEP model is Form C. Form C shows habitat units by target year for evaluation species/cover type based on habitat suitability indices and area values. Appendix D includes this information for the three project alternatives and offsite mitigation areas under without- and with-project conditions. The following tables are included in Appendix D:

D-1. Habitat Units by Target Year for Evaluation Species/Cover Type for Segments 1–3 under Without-Project Conditions

D-2. Habitat Units by Target Year for Evaluation Species/Cover Type for Authorized Project Alternative under With-Project Conditions

D-3. Habitat Units by Target Year for Evaluation Species/Cover Type for Double Bypass System Alternative under With-Project Conditions

D-4. Habitat Units by Target Year for Evaluation Species/Cover Type for Triple Bypass System Alternative under With-Project Conditions

D-5. Habitat Units by Target Year for Evaluation Species/Cover Type for Guadalupe Creek Offsite Mitigation Area under Without-Project Conditions

D-6. Habitat Units by Target Year for Evaluation Species/Cover Type for Reach 12 Offsite Mitigation Area under Without-Project Conditions

D-7. Habitat Units by Target Year for Evaluation Species/Cover Type for Reach 10B Offsite Mitigation Area under Without-Project Conditions

D-8. Habitat Units by Target Year for Evaluation Species/Cover Type for Reach A Offsite Mitigation Area under Without-Project Conditions

D-9. Habitat Units by Target Year for Evaluation Species/Cover Type for Guadalupe Creek Offsite Mitigation Area under With-Project Conditions

D-10. Habitat Units by Target Year for Evaluation Species/Cover Type for Reach 12 Offsite Mitigation Area under With-Project Conditions

D-11. Habitat Units by Target Year for Evaluation Species/Cover Type for Reach 10B Offsite Mitigation Area under With-Project Conditions

D-12. Habitat Units by Target Year for Evaluation Species/Cover Type for Reach A (Authorized Project Alternative) under With-Project Conditions

D-13. Habitat Units by Target Year for Evaluation Species/Cover Type for Reach A (Double Bypass System Alternative) under With-Project Conditions

D-14. Habitat Units by Target Year for Evaluation Species/Cover Type for Reach A (Triple Bypass System Alternative) under With-Project Conditions

Table D-1.
Habitat Units by Target Year for Evaluation Species/Cover Type for Segments 1–3 under Without-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 1 (without project) PROJ AREA BASELINE
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 7.21

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.69	6.61
1	9.58	0.69	6.61
109	9.58	0.69	6.61

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 1 (without project) PROJ AREA BASELINE
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 9.08

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.87	8.33
1	9.58	0.87	8.33
109	9.58	0.87	8.33

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 1 (without project) PROJ AREA BASELINE
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 3.76

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.36	3.45
1	9.58	0.36	3.45
109	9.58	0.36	3.45

Table D-2.
Habitat Units by Target Year for Evaluation Species/Cover Type for Authorized Project Alternative under With-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 2 (with project) FED AUTHORIZED ALT.
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 3.42

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.69	6.61
1	9.58	0.61	5.84
4	9.58	0.38	3.64
9	7.56	0.00	0.00
28	7.56	0.00	0.00
29	7.56	0.28	2.12
49	7.56	0.55	4.16
109	7.56	0.55	4.16

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 2 (with project) FED AUTHORIZED ALT.
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 6.69

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.87	8.33
1	9.58	0.87	8.33
4	9.58	0.82	7.86
9	7.56	0.78	5.90
28	7.56	0.79	5.97
29	7.56	0.79	5.97
49	7.56	0.80	6.05
109	7.56	0.80	6.05

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 2 (with project) FED AUTHORIZED ALT.
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 2.85

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.36	3.45
1	9.58	0.36	3.45
4	9.58	0.35	3.35
9	7.56	0.34	2.57
28	7.56	0.34	2.57
29	7.56	0.34	2.57
49	7.56	0.34	2.57
109	7.56	0.34	2.57

Table D-3.
Habitat Units by Target Year for Evaluation Species/Cover Type for Double Bypass System Alternative under With-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 3 (with project) DOUBLE CULVERT BYPSS
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 5.42

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.69	6.61
1	9.58	0.68	6.51
9	8.16	0.57	4.65
49	8.16	0.61	4.98
109	8.16	0.61	4.98

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 3 (with project) DOUBLE CULVERT BYPSS
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 7.35

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.87	8.33
1	9.58	0.87	8.33
9	8.16	0.81	6.61
49	8.16	0.82	6.69
109	8.16	0.82	6.69

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 3 (with project) DOUBLE CULVERT BYPSS
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 3.14

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.36	3.45
1	9.58	0.36	3.45
9	8.16	0.35	2.86
49	8.16	0.35	2.86
109	8.16	0.35	2.86

Table D-4.
Habitat Units by Target Year for Evaluation Species/Cover Type for Triple Bypass System Alternative under With-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 4 (with project) TRIPLE CULVERT BYPSS
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 5.25

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.69	6.61
1	9.58	0.68	6.51
9	8.02	0.56	4.49
18	8.02	0.56	4.49
19	8.02	0.57	4.57
49	8.02	0.60	4.81
109	8.02	0.60	4.81

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 4 (with project) TRIPLE CULVERT BYPSS
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 7.21

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.87	8.33
1	9.58	0.87	8.33
9	8.02	0.80	6.42
18	8.02	0.80	6.42
19	8.02	0.80	6.42
49	8.02	0.82	6.58
109	8.02	0.82	6.58

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 4 (with project) TRIPLE CULVERT BYPSS
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 3.09

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	9.58	0.36	3.45
1	9.58	0.36	3.45
9	8.02	0.35	2.81
18	8.02	0.35	2.81
19	8.02	0.35	2.81
49	8.02	0.35	2.81
109	8.02	0.35	2.81

Table D-5.
Habitat Units by Target Year for Evaluation Species/Cover Type for Guadalupe Creek Offsite Mitigation Area under Without-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 1 (without project) LOWER GUADALUPE CRK
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 1.52

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	2.73	0.51	1.39
1	2.73	0.51	1.39
109	2.73	0.51	1.39

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 1 (without project) LOWER GUADALUPE CRK
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 2.14

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	2.73	0.72	1.97
1	2.73	0.72	1.97
109	2.73	0.72	1.97

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 1 (without project) LOWER GUADALUPE CRK
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 1.28

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	2.73	0.43	1.17
1	2.73	0.43	1.17
109	2.73	0.43	1.17

Table D-6.
Habitat Units by Target Year for Evaluation Species/Cover Type for Reach 12 Offsite Mitigation Area under Without-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 2 (without project) REACH 12
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 0.00

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	3.48	0.00	0.00
1	3.48	0.00	0.00
109	3.48	0.00	0.00

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 2 (without project) REACH 12
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 3.15

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	3.48	0.83	2.89
1	3.48	0.83	2.89
109	3.48	0.83	2.89

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 2 (without project) REACH 12
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 1.10

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	3.48	0.29	1.01
1	3.48	0.29	1.01
109	3.48	0.29	1.01

Table D-7.
Habitat Units by Target Year for Evaluation Species/Cover Type for Reach 10B Offsite Mitigation Area under Without-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 3 (without project) REACH 10B
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 0.00

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	1.30	0.00	0.00
1	1.30	0.00	0.00
109	1.30	0.00	0.00

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 3 (without project) REACH 10B
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 0.98

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	1.30	0.69	0.90
1	1.30	0.69	0.90
109	1.30	0.69	0.90

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 3 (without project) REACH 10B
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 0.28

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	1.30	0.20	0.26
1	1.30	0.20	0.26
109	1.30	0.20	0.26

Table D-8.
Habitat Units by Target Year for Evaluation Species/Cover Type for Reach A Offsite Mitigation Area under Without-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 4 (without project) REACH A
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 0.00

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.00	0.00
1	4.82	0.00	0.00
109	4.82	0.00	0.00

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 4 (without project) REACH A
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 4.41

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.84	4.05
1	4.82	0.84	4.05
109	4.82	0.84	4.05

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 4 (without project) REACH A
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 1.05

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.20	0.96
1	4.82	0.20	0.96
109	4.82	0.20	0.96

Table D-9.
Habitat Units by Target Year for Evaluation Species/Cover Type for Guadalupe Creek Offsite Mitigation Area under With-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 11 (with project) LOWER GUAD CRK W/MIT
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 1.85

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	2.73	0.51	1.39
1	2.73	0.51	1.39
9	2.73	0.51	1.39
49	2.73	0.66	1.80
109	2.73	0.66	1.80

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 11 (with project) LOWER GUAD CRK W/MIT
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 2.38

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	2.73	0.72	1.97
1	2.73	0.72	1.97
9	2.73	0.72	1.97
49	2.73	0.83	2.27
109	2.73	0.83	2.27

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 11 (with project) LOWER GUAD CRK W/MIT
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 2.07

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	2.73	0.43	1.17
1	2.73	0.43	1.17
9	2.73	0.43	1.17
49	2.73	0.79	2.16
109	2.73	0.79	2.16

Table D-10.
Habitat Units by Target Year for Evaluation Species/Cover Type for Reach 12 Offsite Mitigation Area under With-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 12 (with project) REACH 12 W/MIT
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 2.05

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	3.48	0.00	0.00
1	3.48	0.00	0.00
9	3.48	0.00	0.00
18	3.48	0.00	0.00
19	3.48	0.60	2.09
49	3.48	0.66	2.30
109	3.48	0.66	2.30

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 12 (with project) REACH 12 W/MIT
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 3.37

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	3.48	0.83	2.89
1	3.48	0.83	2.89
9	3.48	0.83	2.89
18	3.48	0.83	2.89
19	3.48	0.85	2.96
49	3.48	0.91	3.17
109	3.48	0.91	3.17

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 12 (with project) REACH 12 W/MIT
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 1.85

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	3.48	0.29	1.01
1	3.48	0.29	1.01
9	3.48	0.29	1.01
18	3.48	0.35	1.22
19	3.48	0.36	1.25
49	3.48	0.56	1.95
109	3.48	0.56	1.95

Table D-11.
Habitat Units by Target Year for Evaluation Species/Cover Type for Reach 10B Offsite Mitigation Area under With-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 13 (with project) REACH 10B W/MIT
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU s: 0.50

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	1.30	0.00	0.00
1	1.30	0.00	0.00
9	1.30	0.00	0.00
48	1.30	0.00	0.00
49	1.30	0.63	0.82
109	1.30	0.63	0.82

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 13 (with project) REACH 10B W/MIT
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 1.13

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	1.30	0.69	0.90
1	1.30	0.69	0.90
9	1.30	0.69	0.90
48	1.30	0.84	1.09
49	1.30	0.84	1.09
109	1.30	0.84	1.09

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 13 (with project) REACH 10B W/MIT
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 0.56

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	1.30	0.20	0.26
1	1.30	0.20	0.26
9	1.30	0.20	0.26
48	1.30	0.46	0.60
49	1.30	0.47	0.61
109	1.30	0.47	0.61

Table D-12.
Habitat Units by Target Year for Evaluation Species/Cover Type for Reach A (Authorized Project Alternative) under With-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 14 (with project) REACH A:FED AUTH ALT
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 0.00

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.00	0.00
1	4.82	0.00	0.00
9	4.82	0.00	0.00
49	4.82	0.00	0.00
109	4.82	0.00	0.00

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 14 (with project) REACH A:FED AUTH ALT
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 4.84

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.84	4.05
1	4.82	0.84	4.05
9	4.82	0.84	4.05
49	4.82	0.95	4.58
109	4.82	0.95	4.58

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 14 (with project) REACH A:FED AUTH ALT
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 1.28

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.20	0.96
1	4.82	0.20	0.96
9	4.82	0.20	0.96
49	4.82	0.26	1.25
109	4.82	0.26	1.25

Table D-13.
Habitat Units by Target Year for Evaluation Species/Cover Type for Reach A (Double Bypass System Alternative) under With-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 15 (with project) REACH A:DOUBLE CULVT
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 2.01

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.00	0.00
1	4.82	0.00	0.00
9	4.82	0.00	0.00
48	4.82	0.00	0.00
49	4.82	0.69	3.33
109	4.82	0.69	3.33

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 15 (with project) REACH A:DOUBLE CULVT
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 4.84

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.84	4.05
1	4.82	0.84	4.05
9	4.82	0.84	4.05
48	4.82	0.95	4.58
49	4.82	0.95	4.58
109	4.82	0.95	4.58

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 15 (with project) REACH A:DOUBLE CULVT
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 1.28

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.20	0.96
1	4.82	0.20	0.96
9	4.82	0.20	0.96
48	4.82	0.26	1.25
49	4.82	0.26	1.25
109	4.82	0.26	1.25

Table D-14.
Habitat Units by Target Year for Evaluation Species/Cover Type for Reach A (Triple Bypass System Alternative) under With-Project Conditions

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 6 (with project) REACH A:TRIPLE CULVT
Life of Project: 100
Evaluation Species: 1 RAINBOW TROUT AAHU's: 1.98

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.00	0.00
1	4.82	0.00	0.00
9	4.82	0.00	0.00
48	4.82	0.00	0.00
49	4.82	0.68	3.28
109	4.82	0.68	3.28

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 6 (with project) REACH A:TRIPLE CULVT
Life of Project: 100
Evaluation Species: 2 NON-SALMONID AAHU's: 4.84

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.84	4.05
1	4.82	0.84	4.05
9	4.82	0.84	4.05
48	4.82	0.95	4.58
49	4.82	0.95	4.58
109	4.82	0.95	4.58

Form C: Average Annual Habitat Units

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 6 (with project) REACH A:TRIPLE CULVT
Life of Project: 100
Evaluation Species: 3 BELTED KINGFISHER AAHU's: 1.28

Target Year	Area of Habitat	Habitat Suitability Index	Habitat Units
0	4.82	0.20	0.96
1	4.82	0.20	0.96
9	4.82	0.20	0.96
48	4.82	0.26	1.25
49	4.82	0.26	1.25
109	4.82	0.26	1.25

Appendix E. Suitability Indices and Future Assumptions for Project Alternatives

Appendix E. Suitability Indices and Future Assumptions for Project Alternatives

CONTENTS OF APPENDIX E

The suitability indices and future assumptions for the three project alternatives evaluated in this shaded riverine aquatic (SRA) cover habitat evaluation procedures (HEP) analysis are presented in this appendix. The appendix is broken into three subsections to reflect each of the project alternatives, each with its own list of contents.

E-1. Suitability Indices and Future Assumptions for Segments 1–3 for the Authorized Project Alternative

E-1.1. Baseline and Postproject Suitability Indices and Postproject Assumptions for Natural Bank Areas (Section A) of Segments 1–3 for the Authorized Project

E-1.2. Baseline and Postproject Suitability Indices and Postproject Assumptions for Armored Areas (Section B) of Segments 1–3 for the Authorized Project

E-1.3. Baseline and Postproject Suitability Indices and Postproject Assumptions for Bridge Sites (Section C) of Segments 1–3 for the Authorized Project

E-1.4. Baseline and Postproject Suitability Indices and Postproject Assumptions for Bypass Reach (Section D) of Segments 1–3 for the Authorized Project

E-1.5. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Natural Bank Areas (Section A) of Segments 1–3 for the Authorized Project

E-1.6. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Armored Areas (Section B) of Segments 1–3 for the Authorized Project

E-1.7. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bridge Sites (Section C) of Segments 1–3 for the Authorized Project

E-1.8. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bypass Reach (Section D) of Segments 1–3 for the Authorized Project

Table E-1.1
Baseline and Postproject Suitability Indices and Postproject Assumptions for Natural Bank Areas (Section A) of Segments 1-3 for the Authorized Project

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.00	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.48	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.29	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.92	0.76	Reduced by 16% based on SRA cover vegetation impact results
V6A	Percent cover (adults)	0.84	0.68	Reduced by 16% based on SRA cover vegetation impact results
V7	Substrate size (spawning areas)	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.68	0.68	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.56	No change relative to baseline conditions
V10	Percent pools	0.96	0.96	No change relative to baseline conditions
V11	Vegetation index	1.00	0.84	Reduced by 16% based on SRA cover vegetation impact results
V12	Percent ground cover (erosion)	0.95	0.79	Reduced by 16% based on SRA cover vegetation impact results
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.54	No change relative to baseline conditions
V16A	Percent fines (spawning areas)	0.44	0.44	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.60	No change relative to baseline conditions
V17	Percent shade (overhead)	0.96	0.61	Shade reduced by 16 % (from 48% to 22%)
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.69	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.70	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.73	0.73	No change relative to baseline conditions
V5	Percent riffles	0.32	0.32	No change relative to baseline conditions
V6	Average number of perches	1.00	0.74	Reduced by 26% based on SRA cover vegetation impact results
V7	Distance to suitable soil bank (reproduction)	1.00	0.50	50% reduction in habitat area from bank cuts
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.45	0.45	No change relative to baseline conditions
V2	Percent pool area during summer	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.95	0.80	Shoreline vegetation reduced
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.91	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-1.2

Baseline and Postproject Suitability Indices and Postproject Assumptions for Armored Areas (Section B) of Segments 1-3 for the Authorized Project

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.00	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.48	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.29	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.50	0.5 ft. water depth at 2.2 cfs (flow at baseline conditions)
V5	Average water velocity (over spawning areas)	0.75	0.26	0.5 fps - some areas faster, some slower depending on gradient
V6J	Percent cover (juveniles)	0.92	0.20	Minimal cover premitigation; lowest SI value possible
V6A	Percent cover (adults)	0.84	0.20	Minimal cover premitigation; lowest SI value possible
V7	Substrate size (spawning areas)	0.99	1.00	Gravels of optimal size for spawning placed in constructed low-flow channel
V8	Percent substrate size class (cover)	0.68	0.00	Armoring provides no cover value - lowest SI value possible
V9	Substrate type in riffles/runs (food)	0.56	0.30	Armoring provides limited food production; lowest SI value possible
V10	Percent pools	0.96	0.30	No pool area; lowest SI value possible
V11	Vegetation index	1.00	0.05	No vegetation premitigation; lowest SI value possible
V12	Percent ground cover (erosion)	0.95	0.20	Armoring does not promote undercut bank formation; lowest SI value possible
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.30	No pool area; lowest SI value possible
V16A	Percent fines (spawning areas)	0.44	1.00	Replaced spawning gravels will have minimal fines
V16B	Percent fines (riffle/run areas)	0.60	0.00	No gravels in constructed low-flow channel other than mitigation gravels for spawning
V17	Percent shade (overhead)	0.96	0.30	No vegetation premitigation; lowest SI value possible
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.64	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.75	25% obstruction from boulder clusters in constructed low-flow channel
V4	Percent water area <= 24 inches deep	0.73	1.00	100% of stream will be <= 24 inches deep at baseline flow (i.e., 2.2 cfs)
V5	Percent riffles	0.32	0.20	No gravels immediately following construction (therefore, no riffles); lowest SI value possible
V6	Average number of perches	1.00	0.20	No vegetation premitigation (therefore, no perches); lowest SI value possible
V7	Distance to suitable soil bank (reproduction)	1.00	0.33	No suitability within armored areas; suitability based on nearness of adjacent natural bank areas
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.45	0.20	Lowest SI value possible
V2	Percent pool area during summer	1.00	0.00	No pool area; greater than 10% needed for minimal suitability
V3	Dominant substrate	1.00	0.20	Lowest SI value possible
V4	Edge vegetation development	0.95	0.00	No vegetation in armored areas
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.58	Stream width reduced
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-1.3

Baseline and Postproject Suitability Indices and Postproject Assumptions for Bridge Sites (Section C) of Segments 1-3 for the Authorized Project

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.00	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.48	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.29	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.52	0.51	Weighted average of armoring (0.50) and baseline value (0.52) for bridges
V5	Average water velocity (over spawning areas)	0.75	0.43	Weighted average of armoring (0.26) and baseline value (0.75) for bridges
V6J	Percent cover (juveniles)	0.98	0.47	Weighted average of armoring (0.20) and baseline value (0.98) for bridges
V6A	Percent cover (adults)	0.91	0.45	Weighted average of armoring (0.20) and baseline value (0.91) for bridges
V7	Substrate size (spawning areas)	0.15	0.05	Weighted average of armoring (0.00) and baseline value (0.15) for bridges
V8	Percent substrate size class (cover)	1.00	0.35	Weighted average of armoring (0.00) and baseline value (1.00) for bridges
V9	Substrate type in riffles/runs (food)	0.88	0.50	Weighted average of armoring (0.30) and baseline value (0.88) for bridges
V10	Percent pools	0.60	0.21	Weighted average of armoring (0.00) and baseline value (0.60) for bridges
V11	Vegetation index	0.23	0.11	Weighted average of armoring (0.05) and baseline value (0.23) for bridges
V12	Percent ground cover (erosion)	0.21	0.20	Weighted average of armoring (0.20) and baseline value (0.21) for bridges
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.30	0.30	Remaining pools will still have 0.30 SI value; V10 reduced to reflect pool loss
V16A	Percent fines (spawning areas)	0.63	0.22	Weighted average of armoring (0.00) and baseline value (0.63) for bridges
V16B	Percent fines (riffle/run areas)	0.90	0.31	Weighted average of armoring (0.00) and baseline value (0.90) for bridges
V17	Percent shade (overhead)	0.41	0.40	100% shade under bridges; SI value = 0.40
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.41	0.17	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.51	0.51	No change relative to baseline conditions
V3	Percent water surface obstruction	1.00	0.84	Weighted average of armoring (0.75) and baseline value (1.00) for bridges
V4	Percent water area <= 24 inches deep	0.97	0.99	Weighted average of armoring (1.00) and baseline value (0.97) for bridges
V5	Percent riffles	0.33	0.25	Weighted average of armoring (0.20) and baseline value (0.33) for bridges
V6	Average number of perches	0.25	0.22	Weighted average of armoring (0.20) and baseline value (0.25) for bridges
V7	Distance to suitable soil bank (reproduction)	0.95	0.45	Based on average of SI values for armoring and natural sections adjacent to bridges
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.25	0.22	Weighted average of armoring (0.20) and baseline value (0.25) for bridges
V2	Percent pool area during summer	0.25	0.09	Weighted average of armoring (0.00) and baseline value (0.25) for bridges
V3	Dominant substrate	0.40	0.20	Lowest substrate suitability score
V4	Edge vegetation development	0.30	0.20	Some loss of vegetation
V5	Pool depth	0.50	0.50	No change relative to baseline conditions
V6	Stream width	0.91	0.58	Stream width reduced
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-1.4
Baseline and Postproject Suitability Indices and Postproject Assumptions for Bypass Reach (Section D) of Segments 1-3 for the Authorized Project

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.00	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.48	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.29	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.92	0.92	No change relative to baseline conditions
V6A	Percent cover (adults)	0.84	0.84	No change relative to baseline conditions
V7	Substrate size (spawning areas)	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.68	0.68	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.56	No change relative to baseline conditions
V10	Percent pools	0.96	0.96	No change relative to baseline conditions
V11	Vegetation index	1.00	1.00	No change relative to baseline conditions
V12	Percent ground cover (erosion)	0.95	0.95	No change relative to baseline conditions
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.54	No change relative to baseline conditions
V16A	Percent fines (spawning areas)	0.44	0.44	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.60	No change relative to baseline conditions
V17	Percent shade (overhead)	0.96	0.96	No change relative to baseline conditions
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.69	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.70	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.73	0.73	No change relative to baseline conditions
V5	Percent riffles	0.32	0.32	No change relative to baseline conditions
V6	Average number of perches	1.00	1.00	No change relative to baseline conditions
V7	Distance to suitable soil bank (reproduction)	1.00	1.00	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.45	0.45	No change relative to baseline conditions
V2	Percent pool area during summer	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.95	0.95	No change relative to baseline conditions
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.91	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-1.5

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Natural Bank Areas (Section A) of Segments 1-3 for the Authorized Project

Evaluation Species/Cover Type	Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A Maximum temperature (resident trout)	0.47	0.00	0.05	JSATEMP model results for postmitigation conditions
V1B (V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.48	0.53	JSATEMP model results for postmitigation conditions
V2A Maximum temperature (smolts)	0.64	0.29	0.39	JSATEMP model results for postmitigation conditions
V2B (V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B Average thalweg depth	0.87	0.87	0.87	No change relative to baseline conditions
V5 Average water velocity (over spawning areas)	0.75	0.75	0.75	No change relative to baseline conditions
V6J Percent cover (juveniles)	0.92	0.76	0.84	Vegetation maximized in all areas except "vegetation-free" zones; SI value determined by weighted average
V6A Percent cover (adults)	0.84	0.68	0.76	Vegetation maximized in all areas except "vegetation-free" zones; SI value determined by weighted average
V7 Substrate size (spawning areas)	0.99	0.99	0.99	No change relative to baseline conditions
V8 Percent substrate size class (cover)	0.68	0.68	0.68	No change relative to baseline conditions
V9 Substrate type in riffles/runs (food)	0.56	0.56	0.56	No change relative to baseline conditions
V10 Percent pools	0.96	0.96	0.96	No change relative to baseline conditions
V11 Vegetation index	1.00	0.84	0.92	84% of channel length vegetated at optimal (1.0) levels; 16% at 0.50
V12 Percent ground cover (erosion)	0.95	0.79	0.87	Bank protection improved in revegetated areas
V13 Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14 Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15 Pool class rating	0.54	0.54	0.54	No change relative to baseline conditions
V16A Percent fines (spawning areas)	0.44	0.44	0.44	No change relative to baseline conditions
V16B Percent fines (riffle/run areas)	0.60	0.60	0.60	No change relative to baseline conditions
V17 Percent shade (overhead)	0.96	0.75	0.92	84% of channel length vegetated at optimal (1.0) levels; 16% at 0.50
V18 Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs Spawning site suitability index	0.69	0.69	0.69	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1 Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2 Average water transparency (Secchi depth)	0.72	0.72	0.72	No change relative to baseline conditions
V3 Percent water surface obstruction	0.70	0.70	0.70	No change relative to baseline conditions
V4 Percent water area <= 24 inches deep	0.73	0.73	0.73	No change relative to baseline conditions
V5 Percent riffles	0.32	0.32	0.32	No change relative to baseline conditions
V6 Average number of perches	1.00	0.84	0.92	84% of channel length vegetated at optimal (1.0) levels, 16% at 0.50; perches restored accordingly
V7 Distance to suitable soil bank (reproduction)	1.00	0.50	0.50	50% reduction in habitat area from bank cuts
Non-Salmonid Pool Habitat Cover Type				
V1 Percent bottom cover	0.45	0.45	0.45	No change relative to baseline conditions
V2 Percent pool area during summer	1.00	1.00	1.00	No change relative to baseline conditions
V3 Dominant substrate	1.00	1.00	1.00	No change relative to baseline conditions
V4 Edge vegetation development	0.95	0.80	0.95	Revegetation restored to baseline
V5 Pool depth	0.75	0.75	0.75	No change relative to baseline conditions
V6 Stream width	0.91	0.91	0.91	No change relative to baseline conditions
V7 Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8 Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9 Stream gradient (meter/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

Table E-1.6

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Armored Areas (Section B) of Segments 1-3 for the Authorized Project

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species					
V1A	Maximum temperature (resident trout)	0.47	0.00	0.05	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.48	0.53	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.64	0.29	0.39	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	0.50	Same as postproject conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	0.26	Same as postproject conditions
V6J	Percent cover (juveniles)	0.92	0.76	0.35	Cover approaches 5% in vegetated portions of constructed low-flow channel;20% in non-vegetated portions
V6A	Percent cover (adults)	0.84	0.68	0.27	Cover improved in vegetated portions of constructed low-flow channel; overall SI value less than V6j by same difference recorded for baseline conditions
V7	Substrate size (spawning areas)	0.99	0.99	0.99	Over the long-term, spawning gravel quality in low-flow channel will approach baseline value
V8	Percent substrate size class (cover)	0.68	0.68	0.68	Over the long-term, substrate will approach baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.56	0.56	Over the long-term, substrate will approach baseline conditions
V10	Percent pools	0.96	0.30	0.30	No pool area; lowest SI value possible
V11	Vegetation index	1.00	0.84	0.26	26% of constructed low-flow channel length will be revegetated
V12	Percent ground cover (erosion)	0.95	0.79	0.20	Same as postproject conditions
V13	Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.54	0.30	No pool area; lowest SI value possible
V16A	Percent fines (spawning areas)	0.44	0.44	0.44	Over the long term, substrate will approach baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.60	0.60	Over the long term, substrate will approach baseline conditions
V17	Percent shade (overhead)	0.96	0.75	0.48	26% of constructed low-flow channel shaded at 1.0; 74% not shaded (0.30); SI value equals weighted average
V18	Percent average daily flow (aduit migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.69	0.48	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species					
V1	Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.70	0.68	50% obstruction in vegetated portion of constructed low-flow channel; 25% in non-vegetated portion
V4	Percent water area <= 24 inches deep	0.73	1.00	1.00	100% of stream will be <= 24 inches deep
V5	Percent riffles	0.32	0.32	0.26	Riffles to form where gravels deposit; assume median between baseline and postproject conditions
V6	Average number of perches	1.00	0.84	0.20	Sandbar willows will not serve as perches
V7	Distance to suitable soil bank (reproduction)	1.00	0.50	0.33	Same as postproject conditions
Non-Salmonid Pool Habitat Cover Type					
V1	Percent bottom cover	0.45	0.20	0.45	Over the long-term, substrate will approach baseline conditions
V2	Percent pool area during summer	1.00	0.00	0.00	No pool area; greater than 10% needed for suitability
V3	Dominant substrate	1.00	0.20	0.20	Lowest SI value possible
V4	Edge vegetation development	0.95	0.00	0.00	No vegetation in armored areas
V5	Pool depth	0.75	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.58	0.58	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

Table E-1.7

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bridge Sites (Section C) of Segments 1-3 for the Authorized Project

Evaluation Species/Cover Type	Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A Maximum temperature (resident trout)	0.47	0.00	0.05	JSATEMP model results for postmitigation conditions
V1B (V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.48	0.53	JSATEMP model results for postmitigation conditions
V2A Maximum temperature (smolts)	0.64	0.29	0.39	JSATEMP model results for postmitigation conditions
V2B (V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B Average thalweg depth	0.52	0.51	0.51	Same as postproject conditions
V5 Average water velocity (over spawning areas)	0.75	0.43	0.43	Same as postproject conditions
V6J Percent cover (juveniles)	0.98	0.47	0.47	Same as postproject conditions
V6A Percent cover (adults)	0.91	0.45	0.45	Same as postproject conditions
V7 Substrate size (spawning areas)	0.15	0.05	0.70	Weighted average of armoring (0.99) and baseline value (0.15) for bridges
V8 Percent substrate size class (cover)	1.00	0.35	1.00	Over the long-term, substrate will approach baseline conditions
V9 Substrate type in riffles/runs (food)	0.88	0.50	0.88	Over the long-term, substrate will approach baseline conditions
V10 Percent pools	0.60	0.21	0.21	Same as postproject conditions
V11 Vegetation index	0.23	0.11	0.11	Same as postproject conditions
V12 Percent ground cover (erosion)	0.21	0.20	0.20	Same as postproject conditions
V13 Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14 Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15 Pool class rating	0.30	0.30	0.11	Weighted average of armoring (0.00) and baseline value (0.30) for bridges
V16A Percent fines (spawning areas)	0.63	0.22	0.63	Over the long-term, substrate will approach baseline conditions
V16B Percent fines (riffle/run areas)	0.90	0.31	0.90	Over the long-term, substrate will approach baseline conditions
V17 Percent shade (overhead)	0.41	0.40	0.40	100% shade under bridges; SI value = 0.40
V18 Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs Spawning site suitability index	0.41	0.17	0.57	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1 Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2 Average water transparency (Secchi depth)	0.51	0.51	0.51	Same as postproject conditions
V3 Percent water surface obstruction	1.00	0.84	0.84	Same as postproject conditions
V4 Percent water area <= 24 inches deep	0.97	0.99	0.99	Same as postproject conditions
V5 Percent riffles	0.33	0.25	0.28	Weighted average of armoring (0.26) and baseline value (0.33) for bridges
V6 Average number of perches	0.25	0.22	0.22	Same as postproject conditions
V7 Distance to suitable soil bank (reproduction)	0.95	0.45	0.45	Same as postproject conditions
Non-Salmonid Pool Habitat Cover Type				
V1 Percent bottom cover	0.25	0.22	0.25	Over the long-term, substrate will approach baseline conditions
V2 Percent pool area during summer	0.25	0.09	0.09	Same as postproject conditions
V3 Dominant substrate	0.40	0.20	0.20	Lowest substrate suitability score
V4 Edge vegetation development	0.30	0.20	0.20	Average of armored and natural channel areas
V5 Pool depth	0.50	0.50	0.50	No change relative to baseline conditions
V6 Stream width	0.91	0.58	0.58	Weighted average of armoring and natural channel areas
V7 Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8 Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9 Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

Table E-1.8

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bypass Reach (Section D) of Segments 1-3 for the Authorized Project

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species					
V1A	Maximum temperature (resident trout)	0.47	0.00	0.05	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.48	0.53	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.64	0.29	0.39	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	0.87	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.92	0.92	0.92	No change relative to baseline conditions
V6A	Percent cover (adults)	0.84	0.84	0.84	No change relative to baseline conditions
V7	Substrate size (spawning areas)	0.99	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.68	0.68	0.68	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.56	0.56	No change relative to baseline conditions
V10	Percent pools	0.96	0.96	0.96	No change relative to baseline conditions
V11	Vegetation index	1.00	1.00	1.00	No change relative to baseline conditions
V12	Percent ground cover (erosion)	0.95	0.95	0.95	No change relative to baseline conditions
V13	Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.54	0.54	No change relative to baseline conditions
V16A	Percent fines (spawning areas)	0.44	0.44	0.44	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.60	0.60	No change relative to baseline conditions
V17	Percent shade (overhead)	0.96	0.96	0.96	No change relative to baseline conditions
V18	Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.69	0.69	No change relative to baseline conditions
Belted Kingfisher Evaluation Species					
V1	Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.70	0.70	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.73	0.73	0.73	No change relative to baseline conditions
V5	Percent riffles	0.32	0.32	0.32	No change relative to baseline conditions
V6	Average number of perches	1.00	1.00	1.00	No change relative to baseline conditions
V7	Distance to suitable soil bank (reproduction)	1.00	1.00	1.00	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type					
V1	Percent bottom cover	0.45	0.45	0.45	No change relative to baseline conditions
V2	Percent pool area during summer	1.00	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.95	0.95	0.95	No change relative to baseline conditions
V5	Pool depth	0.75	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.91	0.91	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

E-2. Suitability Indices and Future Assumptions for Segments 1–3 for the Double Bypass System Alternative

E-2.1. Baseline and Postproject Suitability Indices and Postproject Assumptions for Natural Bank Areas (Section A) of Segments 1–3 for the Double Bypass System Alternative

E-2.2. Baseline and Postproject Suitability Indices and Postproject Assumptions for Armored Areas (Section B) of Segments 1–3 for the Double Bypass System Alternative

E-2.3. Baseline and Postproject Suitability Indices and Postproject Assumptions for Bridge Sites (Section C) of Segments 1–3 for the Double Bypass System Alternative

E-2.4. Baseline and Postproject Suitability Indices and Postproject Assumptions for Bypass Reach (Section D) of Segments 1–3 for the Double Bypass System Alternative

E-2.5. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Natural Bank Areas (Section A) of Segments 1–3 for the Double Bypass System Alternative

E-2.6. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Armored Areas (Section B) of Segments 1–3 for the Double Bypass System Alternative

E-2.7. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bridge Sites (Section C) of Segments 1–3 for the Double Bypass System Alternative

E-2.8. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bypass Reach (Section D) of Segments 1–3 for the Double Bypass System Alternative

Table E-2.1

Baseline and Postproject Suitability Indices and Postproject Assumptions for Natural Bank Areas (Section A) of Segments 1-3 for the Double Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.09	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.53	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.41	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.92	0.76	Reduced by 16% based on SRA cover vegetation impact results
V6A	Percent cover (adults)	0.84	0.68	Reduced by 16% based on SRA cover vegetation impact results
V7	Substrate size (spawning areas)	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.68	0.68	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.56	No change relative to baseline conditions
V10	Percent pools	0.96	0.96	No change relative to baseline conditions
V11	Vegetation index	1.00	0.84	Reduced by 16% based on SRA cover vegetation impact results
V12	Percent ground cover (erosion)	0.95	0.79	Reduced by 16% based on SRA cover vegetation impact results
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.54	No change relative to baseline conditions
V16A	Percent fines (spawning areas)	0.44	0.44	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.60	No change relative to baseline conditions
V17	Percent shade (overhead)	0.96	0.55	Shade reduced by 16 % (from 48% to 18%)
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.69	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.70	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.73	0.73	No change relative to baseline conditions
V5	Percent riffles	0.32	0.32	No change relative to baseline conditions
V6	Average number of perches	1.00	0.70	Reduced by 30% based on SRA cover vegetation impact results
V7	Distance to suitable soil bank (reproduction)	1.00	0.50	50% reduction in habitat area from bank cuts
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.45	0.45	No change relative to baseline conditions
V2	Percent pool area during summer	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.95	0.80	Decrease associated with minimal loss of SRA cover vegetation
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.91	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-2.2

Baseline and Postproject Suitability Indices and Postproject Assumptions for Armored Areas (Section B) of Segments 1-3 for the Double Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.09	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.53	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.41	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	0.5 ft water depth at 2.2 cfs (flow at baseline conditions)
V5	Average water velocity (over spawning areas)	0.75	0.26	0 5 fps - some areas faster, some slower depending on gradient
V6J	Percent cover (juveniles)	0.92	0.20	Minimal cover premitigation; lowest SI value possible
V6A	Percent cover (adults)	0.84	0.20	Minimal cover premitigation; lowest SI value possible
V7	Substrate size (spawning areas)	0.99	1.00	Gravels of optimal size for spawning placed in constructed low-flow channel
V8	Percent substrate size class (cover)	0.68	0.68	Armoring provides no cover value - lowest SI value possible
V9	Substrate type in riffles/runs (food)	0.56	0.30	Armoring provides limited food production; lowest SI value possible
V10	Percent pools	0.96	0.30	No pool area; lowest SI value possible
V11	Vegetation index	1.00	0.05	No vegetation premitigation; lowest SI value possible
V12	Percent ground cover (erosion)	0.95	0.20	Armoring does not promote undercut bank formation; lowest SI value possible
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.30	No pool area; lowest SI value possible
V16A	Percent fines (spawning areas)	0.44	1.00	Replaced spawning gravels will have minimal fines
V16B	Percent fines (riffle/run areas)	0.60	0.60	No gravels in constructed low-flow channel other than mitigation gravels for spawning
V17	Percent shade (overhead)	0.96	0.30	No vegetation premitigation; lowest SI value possible
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.64	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.75	25% obstruction from boulder clusters in constructed low-flow channel
V4	Percent water area <= 24 inches deep	0.73	1.00	100% of stream will be <= 24 inches deep at baseline flow (2.2 cfs)
V5	Percent riffles	0.32	0.20	No gravels immediately following construction (therefore, no riffles); lowest SI value possible
V6	Average number of perches	1.00	0.20	No vegetation premitigation (therefore, no perches); lowest SI value possible
V7	Distance to suitable soil bank (reproduction)	1.00	0.33	No suitability within armored areas; suitability based on nearness of adjacent natural bank area
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.45	0.20	Lowest SI value possible
V2	Percent pool area during summer	1.00	0.00	No pool area; greater than 10% needed for minimal suitability
V3	Dominant substrate	1.00	0.20	Lowest SI value possible
V4	Edge vegetation development	0.95	0.00	No vegetation in armored areas
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.58	Narrower stream in sections with constructed low-flow channel
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-2.3

Baseline and Postproject Suitability Indices and Postproject Assumptions for Bridge Sites (Section C) of Segments 1-3 for the Double Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.09	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.53	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.41	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.52	0.51	Weighted average of armoring (0.50) and baseline value (0.52) for bridges
V5	Average water velocity (over spawning areas)	0.75	0.43	Weighted average of armoring (0.26) and baseline value (0.75) for bridges
V6J	Percent cover (juveniles)	0.98	0.47	Weighted average of armoring (0.20) and baseline value (0.98) for bridges
V6A	Percent cover (adults)	0.91	0.45	Weighted average of armoring (0.20) and baseline value (0.91) for bridges
V7	Substrate size (spawning areas)	0.15	0.05	Weighted average of armoring (0.00) and baseline value (0.15) for bridges
V8	Percent substrate size class (cover)	1.00	0.35	Weighted average of armoring (0.00) and baseline value (1.00) for bridges
V9	Substrate type in riffles/runs (food)	0.88	0.50	Weighted average of armoring (0.30) and baseline value (0.88) for bridges
V10	Percent pools	0.60	0.21	Weighted average of armoring (0.00) and baseline value (0.60) for bridges
V11	Vegetation index	0.23	0.11	Weighted average of armoring (0.05) and baseline value (0.23) for bridges
V12	Percent ground cover (erosion)	0.21	0.20	Weighted average of armoring (0.20) and baseline value (0.21) for bridges
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.30	0.30	Remaining pools will still have 0.30 SI value; V10 reduced to reflect pool loss
V16A	Percent fines (spawning areas)	0.63	0.22	Weighted average of armoring (0.00) and baseline value (0.63) for bridges
V16B	Percent fines (riffle/run areas)	0.90	0.31	Weighted average of armoring (0.00) and baseline value (0.90) for bridges
V17	Percent shade (overhead)	0.41	0.40	100% shade under bridges; SI value = 0.40
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.41	0.17	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.51	0.51	No change relative to baseline conditions
V3	Percent water surface obstruction	1.00	0.84	Weighted average of armoring (0.75) and baseline value (1.00) for bridges
V4	Percent water area <= 24 inches deep	0.97	0.99	Weighted average of armoring (1.00) and baseline value (0.97) for bridges
V5	Percent riffles	0.33	0.25	Weighted average of armoring (0.20) and baseline value (0.33) for bridges
V6	Average number of perches	0.25	0.22	Weighted average of armoring (0.20) and baseline value (0.25) for bridges
V7	Distance to suitable soil bank (reproduction)	0.95	0.45	Based on average of SI values for armoring and natural sections adjacent to bridges
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.25	0.22	Weighted average of armoring and baseline value for bridges
V2	Percent pool area during summer	0.25	0.09	Weighted average of armoring and baseline value for bridges
V3	Dominant substrate	0.40	0.20	Lowest substrate suitability score
V4	Edge vegetation development	0.30	0.20	Average of armored and natural channel areas
V5	Pool depth	0.50	0.50	No change relative to baseline conditions
V6	Stream width	0.91	0.58	Weighted average of armored and natural channel areas
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-2.4

Baseline and Postproject Suitability Indices and Postproject Assumptions for Bypass Reach (Section D) of Segments 1-3 for the Double Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.09	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.53	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.41	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.92	0.92	No change relative to baseline conditions
V6A	Percent cover (adults)	0.84	0.84	No change relative to baseline conditions
V7	Substrate size (spawning areas)	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.68	0.68	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.56	No change relative to baseline conditions
V10	Percent pools	0.96	0.96	No change relative to baseline conditions
V11	Vegetation index	1.00	1.00	No change relative to baseline conditions
V12	Percent ground cover (erosion)	0.95	0.95	No change relative to baseline conditions
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.54	No change relative to baseline conditions
V16A	Percent fines (spawning areas)	0.44	0.44	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.60	No change relative to baseline conditions
V17	Percent shade (overhead)	0.96	0.96	No change relative to baseline conditions
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.69	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.70	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.73	0.73	No change relative to baseline conditions
V5	Percent riffles	0.32	0.32	No change relative to baseline conditions
V6	Average number of perches	1.00	1.00	No change relative to baseline conditions
V7	Distance to suitable soil bank (reproduction)	1.00	1.00	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.45	0.45	No change relative to baseline conditions
V2	Percent pool area during summer	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.95	0.95	No change relative to baseline conditions
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.91	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-2.5

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Natural Bank Areas (Section A) of Segments 1-3 for the Double Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species					
V1A	Maximum temperature (resident trout)	0.47	0.09	0.26	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.53	0.58	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.64	0.41	0.50	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	0.87	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.92	0.76	0.84	Vegetation maximized in all areas except "vegetation-free" zones; SI value determined by weighted average
V6A	Percent cover (adults)	0.84	0.68	0.76	Vegetation maximized in all areas except "vegetation-free" zones; SI value determined by weighted average
V7	Substrate size (spawning areas)	0.99	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.68	0.68	0.68	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.56	0.56	No change relative to baseline conditions
V10	Percent pools	0.96	0.96	0.96	No change relative to baseline conditions
V11	Vegetation index	1.00	0.84	0.92	84% of channel length vegetated at optimal (1.0) levels; 16% at 0.50
V12	Percent ground cover (erosion)	0.95	0.79	0.87	Bank protection improved in revegetated areas
V13	Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.54	0.54	No change relative to baseline conditions
V16A	Percent fines (spawning areas)	0.44	0.44	0.44	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.60	0.60	No change relative to baseline conditions
V17	Percent shade (overhead)	0.96	0.75	0.92	84% of channel length vegetated at optimal (1.0) levels; 16% at 0.50
V18	Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.69	0.69	No change relative to baseline conditions
Belted Kingfisher Evaluation Species					
V1	Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.70	0.70	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.73	0.73	0.73	No change relative to baseline conditions
V5	Percent riffles	0.32	0.32	0.32	No change relative to baseline conditions
V6	Average number of perches	1.00	0.84	0.92	84% of channel length vegetated at optimal (1.0) levels, 16% at 0.50; perches restored accordingly
V7	Distance to suitable soil bank (reproduction)	1.00	0.50	0.50	50% reduction in habitat area from bank cuts
Non-Salmonid Pool Habitat Cover Type					
V1	Percent bottom cover	0.45	0.45	0.45	No change relative to baseline conditions
V2	Percent pool area during summer	1.00	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.95	0.80	0.95	Revegetation restores edge vegetation to preproject levels
V5	Pool depth	0.75	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.91	0.91	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

Table E-2.6

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Armored Areas (Section B) of Segments 1-3 for the Double Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species					
V1A	Maximum temperature (resident trout)	0.47	0.02	0.26	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.51	0.58	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.64	0.37	0.5	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.50	0.87	Same as postproject conditions
V5	Average water velocity (over spawning areas)	0.75	0.26	0.26	Same as postproject conditions
V6J	Percent cover (juveniles)	0.92	0.20	0.20	Cover approaches 0.5 in vegetated portions of constructed low-flow channel; 0.20 in non-vegetated portions
V6A	Percent cover (adults)	0.84	0.20	0.20	Cover improved in vegetated portions of constructed low-flow channel; overall SI value less than V6j by same difference recorded for baseline conditions
V7	Substrate size (spawning areas)	0.99	1.00	0.99	Over the long-term, spawning gravel quality in constructed low-flow channel will approach baseline value
V8	Percent substrate size class (cover)	0.68	0.00	0.68	Over the long-term, substrate will approach baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.30	0.56	Over the long-term, substrate will approach baseline conditions
V10	Percent pools	0.96	0.30	0.30	No pool area; lowest SI value possible
V11	Vegetation index	1.00	0.05	0.05	26% of constructed low-flow channel length will be revegetated
V12	Percent ground cover (erosion)	0.95	0.20	0.20	Same as post-project conditions
V13	Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.30	0.30	No pool area; lowest SI value possible
V16A	Percent fines (spawning areas)	0.44	1.00	0.44	Over the long-term, substrate will approach baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.00	0.60	Over the long-term, substrate will approach baseline conditions
V17	Percent shade (overhead)	0.96	0.30	0.85	26% of constructed low-flow channel shaded at 1.0; 74% not shaded (0.30); SI value equals weighted average
V18	Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.64	0.48	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species					
V1	Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.75	0.68	50% obstruction in vegetated portion of constructed low-flow channel; 25% in non-vegetated portion
V4	Percent water area <= 24 inches deep	0.73	1.00	1.00	100% of stream will be <= 24 inches deep
V5	Percent riffles	0.32	0.20	0.26	Riffles to form where gravels deposit; assume median between baseline and post-project conditions
V6	Average number of perches	1.00	0.20	0.20	Sandbar willows will not serve as perches
V7	Distance to suitable soil bank (reproduction)	1.00	0.33	0.33	Same as post-project conditions
Non-Salmonid Pool Habitat Cover Type					
V1	Percent bottom cover	0.45	0.20	0.45	Over the long-term, substrate will approach baseline conditions
V2	Percent pool area during summer	1.00	0.00	0.00	No pool area; greater than 10% needed for minimal suitability
V3	Dominant substrate	1.00	0.20	0.20	Lowest SI value possible
V4	Edge vegetation development	0.95	0.00	0.00	No vegetation in armored areas
V5	Pool depth	0.75	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.58	0.58	Narrower stream in sections of constructed low-flow channel
V7	Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

Table E-2.7

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bridge Sites (Section C) of Segments 1-3 for the Double Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species					
V1A	Maximum temperature (resident trout)	0.47	0.02	0.26	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.51	0.58	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.64	0.37	0.5	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.52	0.51	0.51	Same as postproject conditions
V5	Average water velocity (over spawning areas)	0.75	0.43	0.43	Same as postproject conditions
V6J	Percent cover (juveniles)	0.98	0.47	0.47	Same as postproject conditions
V6A	Percent cover (adults)	0.91	0.45	0.45	Same as postproject conditions
V7	Substrate size (spawning areas)	0.15	0.05	0.70	Weighted average of armoring (0.99) and baseline value (0.15) for bridges
V8	Percent substrate size class (cover)	1.00	0.35	1.00	Over the long-term, substrate will approach baseline conditions
V9	Substrate type in riffles/runs (food)	0.88	0.50	0.88	Over the long-term, substrate will approach baseline conditions
V10	Percent pools	0.60	0.21	0.21	Same as postproject conditions
V11	Vegetation index	0.23	0.11	0.11	Same as postproject conditions
V12	Percent ground cover (erosion)	0.21	0.20	0.20	Same as postproject conditions
V13	Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.30	0.30	0.11	Weighted average of armoring (0.00) and baseline value (0.30) for bridges
V16A	Percent fines (spawning areas)	0.63	0.22	0.63	Over the long-term, substrate will approach baseline conditions
V16B	Percent fines (riffle/run areas)	0.90	0.31	0.90	Over the long-term, substrate will approach baseline conditions
V17	Percent shade (overhead)	0.41	0.40	0.40	100% shade under bridges; SI value = 0.40
V18	Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.41	0.17	0.57	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species					
V1	Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.51	0.51	0.51	Same as postproject conditions
V3	Percent water surface obstruction	1.00	0.84	0.84	Same as postproject conditions
V4	Percent water area <= 24 inches deep	0.97	0.99	0.99	Same as postproject conditions
V5	Percent riffles	0.33	0.25	0.28	Weighted average of armoring (0.26) and baseline value (0.33) for bridges
V6	Average number of perches	0.25	0.22	0.22	Same as postproject conditions
V7	Distance to suitable soil bank (reproduction)	0.95	0.45	0.45	Same as postproject conditions
Non-Salmonid Pool Habitat Cover Type					
V1	Percent bottom cover	0.25	0.22	0.25	Over the long-term, substrate will approach baseline conditions
V2	Percent pool area during summer	0.25	0.09	0.09	No change in percent pool area relative to postproject conditions
V3	Dominant substrate	0.40	0.20	0.20	Lowest suitability score
V4	Edge vegetation development	0.30	0.20	0.20	No vegetation proposed under bridges
V5	Pool depth	0.50	0.50	0.50	No change relative to baseline conditions
V6	Stream width	0.91	0.58	0.58	Narrower channel in sections with constructed low-flow channel
V7	Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

Table E-2.8

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bypass Reach (Section D) of Segments 1-3 for the Double Bypass System Alternative

Evaluation Species/Cover Type	Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A Maximum temperature (resident trout)	0.47	0.02	0.26	JSATEMP model results for postmitigation conditions
V1B (V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.51	0.58	JSATEMP model results for postmitigation conditions
V2A Maximum temperature (smolts)	0.64	0.37	0.50	JSATEMP model results for postmitigation conditions
V2B (V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B Average thalweg depth	0.87	0.87	0.87	No change relative to baseline conditions
V5 Average water velocity (over spawning areas)	0.75	0.75	0.75	No change relative to baseline conditions
V6J Percent cover (juveniles)	0.92	0.92	0.92	No change relative to baseline conditions
V6A Percent cover (adults)	0.84	0.84	0.84	No change relative to baseline conditions
V7 Substrate size (spawning areas)	0.99	0.99	0.99	No change relative to baseline conditions
V8 Percent substrate size class (cover)	0.68	0.68	0.68	No change relative to baseline conditions
V9 Substrate type in riffles/runs (food)	0.56	0.56	0.56	No change relative to baseline conditions
V10 Percent pools	0.96	0.96	0.96	No change relative to baseline conditions
V11 Vegetation index	1.00	1.00	1.00	No change relative to baseline conditions
V12 Percent ground cover (erosion)	0.95	0.95	0.95	No change relative to baseline conditions
V13 Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14 Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15 Pool class rating	0.54	0.54	0.54	No change relative to baseline conditions
V16A Percent fines (spawning areas)	0.44	0.44	0.44	No change relative to baseline conditions
V16B Percent fines (riffle/run areas)	0.60	0.60	0.60	No change relative to baseline conditions
V17 Percent shade (overhead)	0.96	0.96	0.96	No change relative to baseline conditions
V18 Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs Spawning site suitability index	0.69	0.69	0.69	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1 Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2 Average water transparency (Secchi depth)	0.72	0.72	0.72	No change relative to baseline conditions
V3 Percent water surface obstruction	0.70	0.70	0.70	No change relative to baseline conditions
V4 Percent water area <= 24 inches deep	0.73	0.73	0.73	No change relative to baseline conditions
V5 Percent riffles	0.32	0.32	0.32	No change relative to baseline conditions
V6 Average number of perches	1.00	1.00	1.00	No change relative to baseline conditions
V7 Distance to suitable soil bank (reproduction)	1.00	1.00	1.00	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type				
V1 Percent bottom cover	0.45	0.45	0.45	No change relative to baseline conditions
V2 Percent pool area during summer	1.00	1.00	1.00	No change relative to baseline conditions
V3 Dominant substrate	1.00	1.00	1.00	No change relative to baseline conditions
V4 Edge vegetation development	0.95	0.95	0.95	No change relative to baseline conditions
V5 Pool depth	0.75	0.75	0.75	No change relative to baseline conditions
V6 Stream width	0.91	0.91	0.91	No change relative to baseline conditions
V7 Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8 Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9 Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

E-3. Suitability Indices and Future Assumptions for Segments 1–3 for the Triple Bypass System Alternative

E-3.1. Baseline and Postproject Suitability Indices and Postproject Assumptions for Natural Bank Areas (Section A) of Segments 1–3 for the Triple Bypass System Alternative

E-3.2. Baseline and Postproject Suitability Indices and Postproject Assumptions for Armored Areas (Section B) of Segments 1–3 for the Triple Bypass System Alternative

E-3.3. Baseline and Postproject Suitability Indices and Postproject Assumptions for Bridge Sites (Section C) of Segments 1–3 for the Triple Bypass System Alternative

E-3.4. Baseline and Postproject Suitability Indices and Postproject Assumptions for Bypass Reach (Section D) of Segments 1–3 for the Triple Bypass System Alternative

E-3.5. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Natural Bank Areas (Section A) of Segments 1–3 for the Triple Bypass System Alternative

E-3.6. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Armored Areas (Section B) of Segments 1–3 for the Triple Bypass System Alternative

E-3.7. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bridge Sites (Section C) of Segments 1–3 for the Triple Bypass System Alternative

E-3.8. Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bypass Reach (Section D) of Segments 1–3 for the Triple Bypass System Alternative

Table E-3.1.

Baseline and Postproject Suitability Indices and Postproject Assumptions for Natural Bank Areas (Section A) of Segments 1-3 for the Triple Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.06	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.53	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.41	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.92	0.76	Reduced by 16% based on SRA cover vegetation impact results
V6A	Percent cover (adults)	0.84	0.68	Reduced by 16% based on SRA cover vegetation impact results
V7	Substrate size (spawning areas)	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.68	0.68	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.56	No change relative to baseline conditions
V10	Percent pools	0.96	0.96	No change relative to baseline conditions
V11	Vegetation index	1.00	0.84	Reduced by 16% based on SRA cover vegetation impact results
V12	Percent ground cover (erosion)	0.95	0.79	Reduced by 16% based on SRA cover vegetation impact results
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.54	No change relative to baseline conditions
V16A	Percent fines (spawning areas)	0.44	0.44	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.60	No change relative to baseline conditions
V17	Percent shade (overhead)	0.96	0.57	Shade reduced by 29% (from 48% to 19%)
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.69	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.70	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.73	0.73	No change relative to baseline conditions
V5	Percent riffles	0.32	0.32	No change relative to baseline conditions
V6	Average number of perches	1.00	0.71	Reduced by 29% based on SRA cover vegetation impact results
V7	Distance to suitable soil bank (reproduction)	1.00	0.50	50% reduction in habitat area from bank cuts
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.45	0.45	No change relative to baseline conditions
V2	Percent pool area during summer	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.95	0.80	Decrease associated with minimal loss of SRA cover vegetation
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.91	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-3.2

Baseline and Postproject Suitability Indices and Postproject Assumptions for Armored Areas (Section B) of Segments 1-3 for the Triple Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.06	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.53	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.41	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	0.5 ft water depth at 2.2 cfs (flow at baseline conditions)
V5	Average water velocity (over spawning areas)	0.75	0.26	0.5 fps - some areas faster, some slower depending on gradient
V6J	Percent cover (juveniles)	0.92	0.20	Minimal cover premitigation; lowest SI value possible
V6A	Percent cover (adults)	0.84	0.20	Minimal cover premitigation; lowest SI value possible
V7	Substrate size (spawning areas)	0.99	1.00	Gravels of optimal size for spawning placed in constructed low-flow channel
V8	Percent substrate size class (cover)	0.68	0.68	Armoring provides no cover value - lowest SI value possible
V9	Substrate type in riffles/runs (food)	0.56	0.30	Armoring provides limited food production; lowest SI value possible
V10	Percent pools	0.96	0.30	No pool area; lowest SI value possible
V11	Vegetation index	1.00	0.05	No vegetation premitigation; lowest SI value possible
V12	Percent ground cover (erosion)	0.95	0.20	Armoring does not promote undercut bank formation; lowest SI value possible
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.30	No pool area; lowest SI value possible
V16A	Percent fines (spawning areas)	0.44	1.00	Replaced spawning gravels will have minimal fines
V16B	Percent fines (riffle/run areas)	0.60	0.60	No gravels in constructed low-flow channel other than mitigation gravels for spawning
V17	Percent shade (overhead)	0.96	0.30	No vegetation premitigation; lowest SI value possible
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.64	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.75	25% obstruction from boulder clusters in constructed low-flow channel
V4	Percent water area <= 24 inches deep	0.73	1.00	100% of stream will be <= 24 inches deep at baseline flow (i.e., 2.2 cfs)
V5	Percent riffles	0.32	0.20	No gravels immediately following construction (therefore, no riffles); lowest SI value possible
V6	Average number of perches	1.00	0.20	No vegetation premitigation (therefore, no perches); lowest SI value possible
V7	Distance to suitable soil bank (reproduction)	1.00	0.33	No suitability within armored areas; suitability based on nearness of adjacent natural bank areas
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.45	0.20	Lowest SI value possible
V2	Percent pool area during summer	1.00	0.40	No pool area in constructed low-flow channel sections
V3	Dominant substrate	1.00	0.20	Lowest SI value possible
V4	Edge vegetation development	0.95	0.00	No vegetation in armored areas
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.58	Narrower stream in sections with constructed low-flow channel
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-3.3

Baseline and Postproject Suitability Indices and Postproject Assumptions for Bridge Sites (Section C) of Segments 1-3 for the Triple Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.06	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.53	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.41	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.52	0.51	Weighted average of armoring (0.50) and baseline value (0.52) for bridges
V5	Average water velocity (over spawning areas)	0.75	0.43	Weighted average of armoring (0.26) and baseline value (0.75) for bridges
V6J	Percent cover (juveniles)	0.98	0.47	Weighted average of armoring (0.20) and baseline value (0.98) for bridges
V6A	Percent cover (adults)	0.91	0.45	Weighted average of armoring (0.20) and baseline value (0.91) for bridges
V7	Substrate size (spawning areas)	0.15	0.05	Weighted average of armoring (0.00) and baseline value (0.15) for bridges
V8	Percent substrate size class (cover)	1.00	0.35	Weighted average of armoring (0.00) and baseline value (1.00) for bridges
V9	Substrate type in riffles/runs (food)	0.88	0.50	Weighted average of armoring (0.30) and baseline value (0.88) for bridges
V10	Percent pools	0.60	0.21	Weighted average of armoring (0.00) and baseline value (0.60) for bridges
V11	Vegetation index	0.23	0.11	Weighted average of armoring (0.05) and baseline value (0.23) for bridges
V12	Percent ground cover (erosion)	0.21	0.20	Weighted average of armoring (0.20) and baseline value (0.21) for bridges
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.30	0.30	Remaining pools will still have 0.30 SI value; V10 reduced to reflect pool loss
V16A	Percent fines (spawning areas)	0.63	0.22	Weighted average of armoring (0.00) and baseline value (0.63) for bridges
V16B	Percent fines (riffle/run areas)	0.90	0.31	Weighted average of armoring (0.00) and baseline value (0.90) for bridges
V17	Percent shade (overhead)	0.41	0.40	100% shade under bridges; SI value = 0.40
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.41	0.17	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.51	0.51	No change relative to baseline conditions
V3	Percent water surface obstruction	1.00	0.84	Weighted average of armoring (0.75) and baseline value (1.00) for bridges
V4	Percent water area <= 24 inches deep	0.97	0.99	Weighted average of armoring (1.00) and baseline value (0.97) for bridges
V5	Percent riffles	0.33	0.25	Weighted average of armoring (0.20) and baseline value (0.33) for bridges
V6	Average number of perches	0.25	0.22	Weighted average of armoring (0.20) and baseline value (0.25) for bridges
V7	Distance to suitable soil bank (reproduction)	0.95	0.45	Based on average of SI values for armoring and natural sections adjacent to bridges
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.25	0.22	Weighted average of armoring and baseline value for bridges
V2	Percent pool area during summer	0.25	0.09	Weighted average of armoring and baseline value for bridges
V3	Dominant substrate	0.40	0.20	Lowest substrate suitability score
V4	Edge vegetation development	0.30	0.20	Average of armored and natural channel areas
V5	Pool depth	0.50	0.50	No change relative to baseline conditions
V6	Stream width	0.91	0.58	Weighted average of armored and natural channel areas
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-3.4.

Baseline and Postproject Suitability Indices and Postproject Assumptions for Bypass Reach (Section D) of Segments 1-3 for the Triple Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postproject Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.47	0.06	JSATEMP model results for postproject conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.53	JSATEMP model results for postproject conditions
V2A	Maximum temperature (smolts)	0.64	0.41	JSATEMP model results for postproject conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	JSATEMP model results for postproject conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.92	0.92	No change relative to baseline conditions
V6A	Percent cover (adults)	0.84	0.84	No change relative to baseline conditions
V7	Substrate size (spawning areas)	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.68	0.68	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.56	No change relative to baseline conditions
V10	Percent pools	0.96	0.96	No change relative to baseline conditions
V11	Vegetation index	1.00	1.00	No change relative to baseline conditions
V12	Percent ground cover (erosion)	0.95	0.95	No change relative to baseline conditions
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.54	No change relative to baseline conditions
V16A	Percent fines (spawning areas)	0.44	0.44	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.60	No change relative to baseline conditions
V17	Percent shade (overhead)	0.96	0.96	No change relative to baseline conditions
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.69	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.70	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.73	0.73	No change relative to baseline conditions
V5	Percent riffles	0.32	0.32	No change relative to baseline conditions
V6	Average number of perches	1.00	1.00	No change relative to baseline conditions
V7	Distance to suitable soil bank (reproduction)	1.00	1.00	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.45	0.45	No change relative to baseline conditions
V2	Percent pool area during summer	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.95	0.95	No change relative to baseline conditions
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.91	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postproject conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table E-3.5.

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Natural Bank Areas (Section A) of Segments 1-3 for the Triple Bypass System Alternative

Evaluation Species/Cover Type	Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A Maximum temperature (resident trout)	0.47	0.02	0.23	JSATEMP model results for postmitigation conditions
V1B (V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.50	0.57	JSATEMP model results for postmitigation conditions
V2A Maximum temperature (smolts)	0.64	0.36	0.48	JSATEMP model results for postmitigation conditions
V2B (V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B Average thalweg depth	0.87	0.87	0.87	No change relative to baseline conditions
V5 Average water velocity (over spawning areas)	0.75	0.75	0.75	No change relative to baseline conditions
V6J Percent cover (juveniles)	0.92	0.76	0.84	Vegetation maximized in all areas except "vegetation-free" zones; SI value determined by weighted average
V6A Percent cover (adults)	0.84	0.68	0.76	Vegetation maximized in all areas except "vegetation-free" zones; SI value determined by weighted average
V7 Substrate size (spawning areas)	0.99	0.99	0.99	No change relative to baseline conditions
V8 Percent substrate size class (cover)	0.68	0.68	0.68	No change relative to baseline conditions
V9 Substrate type in riffles/runs (food)	0.56	0.56	0.56	No change relative to baseline conditions
V10 Percent pools	0.96	0.96	0.96	No change relative to baseline conditions
V11 Vegetation index	1.00	0.84	0.92	84% of channel length vegetated at optimal (1.0) levels; 16% at 0.50
V12 Percent ground cover (erosion)	0.95	0.79	0.87	Bank protection improved in revegetated areas
V13 Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14 Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15 Pool class rating	0.54	0.54	0.54	No change relative to baseline conditions
V16A Percent fines (spawning areas)	0.44	0.44	0.44	No change relative to baseline conditions
V16B Percent fines (riffle/run areas)	0.60	0.60	0.60	No change relative to baseline conditions
V17 Percent shade (overhead)	0.96	0.75	0.92	84% of channel length vegetated at optimal (1.0) levels; 16% at 0.50
V18 Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs Spawning site suitability index	0.69	0.69	0.69	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1 Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2 Average water transparency (Secchi depth)	0.72	0.72	0.72	No change relative to baseline conditions
V3 Percent water surface obstruction	0.70	0.70	0.70	No change relative to baseline conditions
V4 Percent water area <= 24 inches deep	0.73	0.73	0.73	No change relative to baseline conditions
V5 Percent riffles	0.32	0.32	0.32	No change relative to baseline conditions
V6 Average number of perches	1.00	0.84	0.92	84% of channel length vegetated at optimal (1.0) levels, 16% at 0.50; perches restored accordingly
V7 Distance to suitable soil bank (reproduction)	1.00	0.50	0.50	50% reduction in habitat area from bank cuts
Non-Salmonid Pool Habitat Cover Type				
V1 Percent bottom cover	0.45	0.45	0.45	No change relative to baseline conditions
V2 Percent pool area during summer	1.00	1.00	1.00	No change relative to baseline conditions
V3 Dominant substrate	1.00	1.00	1.00	No change relative to baseline conditions
V4 Edge vegetation development	0.95	0.80	0.95	Revegetation restores edge vegetation to pre-project levels
V5 Pool depth	0.75	0.75	0.75	No change relative to baseline conditions
V6 Stream width	0.91	0.91	0.91	No change relative to baseline conditions
V7 Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8 Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9 Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

Table E-3.6.

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Armored Areas (Section B) of Segments 1-3 for the Triple Bypass System Alternative

Evaluation Species/Cover Type	Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A Maximum temperature (resident trout)	0.47	0.29	0.23	JSATEMP model results for postmitigation conditions
V1B (V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.55	0.57	JSATEMP model results for postmitigation conditions
V2A Maximum temperature (smolts)	0.64	0.41	0.48	JSATEMP model results for postmitigation conditions
V2B (V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B Average thalweg depth	0.87	0.87	0.87	Same as postproject conditions
V5 Average water velocity (over spawning areas)	0.75	0.26	0.26	Same as postproject conditions
V6J Percent cover (juveniles)	0.92	0.20	0.20	Cover approaches 5% in vegetated portions of constructed low-flow channel; 20% in non-vegetated portions
V6A Percent cover (adults)	0.84	0.20	0.20	Cover improved in vegetated portions of constructed low-flow channel; overall SI value less than V6j by same difference recorded for baseline conditions
V7 Substrate size (spawning areas)	0.99	1.00	0.99	Over the long-term, spawning gravel quality in constructed low-flow channel will approach baseline value
V8 Percent substrate size class (cover)	0.68	0.68	0.68	Over the long-term, substrate will approach baseline conditions
V9 Substrate type in riffles/runs (food)	0.56	0.30	0.56	Over the long-term, substrate will approach baseline conditions
V10 Percent pools	0.96	0.30	0.30	No pool area; lowest SI value possible
V11 Vegetation index	1.00	0.05	0.26	26% of constructed low-flow channel length will be revegetated
V12 Percent ground cover (erosion)	0.95	0.20	0.20	Same as postproject conditions
V13 Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14 Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15 Pool class rating	0.54	0.30	0.30	No pool area; lowest SI value possible
V16A Percent fines (spawning areas)	0.44	1.00	0.44	Over the long-term, substrate will approach baseline conditions
V16B Percent fines (riffle/run areas)	0.60	0.60	0.60	Over the long-term, substrate will approach baseline conditions
V17 Percent shade (overhead)	0.96	0.85	0.85	26% of constructed low-flow channel shaded at 1.0; 74% not shaded (0.30); SI value equals weighted average
V18 Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs Spawning site suitability index	0.69	0.64	0.48	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species				
V1 Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2 Average water transparency (Secchi depth)	0.72	0.72	0.72	No change relative to baseline conditions
V3 Percent water surface obstruction	0.70	0.75	0.68	50% obstruction in vegetated portion of constructed low-flow channel; 25% in non-vegetated portion
V4 Percent water area <= 24 inches deep	0.73	1.00	1.00	100% of stream will be <= 24 inches deep
V5 Percent riffles	0.32	0.20	0.26	Riffles to form where gravels deposit; assume median between baseline and postproject conditions
V6 Average number of perches	1.00	0.20	0.20	Sandbar willows will not serve as perches
V7 Distance to suitable soil bank (reproduction)	1.00	0.33	0.33	Same as postproject conditions
Non-Salmonid Pool Habitat Cover Type				
V1 Percent bottom cover	0.45	0.20	0.45	Over the long-term, substrate will approach baseline conditions
V2 Percent pool area during summer	1.00	0.40	0.40	No pool area; greater than 10% needed for suitability
V3 Dominant substrate	1.00	0.20	0.20	Lowest SI value possible
V4 Edge vegetation development	0.95	0.00	0.00	No vegetation in armored areas
V5 Pool depth	0.75	0.75	0.75	No change relative to baseline conditions
V6 Stream width	0.91	0.58	0.58	Narrower stream in sections with constructed low-flow channel
V7 Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8 Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9 Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

Table E-3.7.

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bridge Sites (Section C) of Segments 1-3 for the Triple Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species					
V1A	Maximum temperature (resident trout)	0.47	0.02	0.23	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.50	0.57	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.64	0.36	0.44	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.52	0.51	0.51	Same as postproject conditions
V5	Average water velocity (over spawning areas)	0.75	0.43	0.43	Same as postproject conditions
V6J	Percent cover (juveniles)	0.98	0.47	0.47	Same as postproject conditions
V6A	Percent cover (adults)	0.91	0.45	0.45	Same as postproject conditions
V7	Substrate size (spawning areas)	0.15	0.05	0.70	Weighted average of armoring (0.99) and baseline value (0.15) for bridges
V8	Percent substrate size class (cover)	1.00	0.35	1.00	Over the long-term, substrate will approach baseline conditions
V9	Substrate type in riffles/runs (food)	0.88	0.50	0.88	Over the long-term, substrate will approach baseline conditions
V10	Percent pools	0.60	0.21	0.21	Same as postproject conditions
V11	Vegetation index	0.23	0.11	0.11	Same as postproject conditions
V12	Percent ground cover (erosion)	0.21	0.20	0.20	Same as postproject conditions
V13	Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.30	0.30	0.11	Weighted average of armoring (0.00) and baseline value (0.30) for bridges
V16A	Percent fines (spawning areas)	0.63	0.22	0.63	Over the long-term, substrate will approach baseline conditions
V16B	Percent fines (riffle/run areas)	0.90	0.31	0.90	Over the long-term, substrate will approach baseline conditions
V17	Percent shade (overhead)	0.41	0.40	0.40	100% shade under bridges; SI value = 0.40
V18	Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.41	0.17	0.57	(V5 X V7 X V16A)^1/3
Belted Kingfisher Evaluation Species					
V1	Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.51	0.51	0.51	Same as postproject conditions
V3	Percent water surface obstruction	1.00	0.84	0.84	Same as postproject conditions
V4	Percent water area <= 24 inches deep	0.97	0.99	0.99	Same as postproject conditions
V5	Percent riffles	0.33	0.25	0.28	Weighted average of armoring (0.26) and baseline value (0.33) for bridges
V6	Average number of perches	0.25	0.22	0.22	Same as postproject conditions
V7	Distance to suitable soil bank (reproduction)	0.95	0.45	0.45	Same as postproject conditions
Non-Salmonid Pool Habitat Cover Type					
V1	Percent bottom cover	0.25	0.22	0.25	Over the long-term, substrate will approach baseline conditions
V2	Percent pool area during summer	0.25	0.09	0.09	No change in percent pool area relative to post project conditions
V3	Dominant substrate	0.40	0.20	0.20	Lowest substrate suitability score
V4	Edge vegetation development	0.30	0.20	0.20	Revegetation
V5	Pool depth	0.50	0.50	0.50	No change relative to baseline conditions
V6	Stream width	0.91	0.58	0.58	Narrower stream in sections with constructed low-flow channels
V7	Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

Table E-3.8.

Baseline, Postproject, and Postmitigation Suitability Indices and Postmitigation Assumptions for Bypass Reach (Section D) of Segments 1-3 for the Triple Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postproject Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species					
V1A	Maximum temperature (resident trout)	0.47	0.02	0.23	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.63	0.50	0.57	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.64	0.36	0.48	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.57	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.87	0.87	0.87	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.92	0.92	0.92	No change relative to baseline conditions
V6A	Percent cover (adults)	0.84	0.84	0.84	No change relative to baseline conditions
V7	Substrate size (spawning areas)	0.99	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.68	0.68	0.68	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.56	0.56	0.56	No change relative to baseline conditions
V10	Percent pools	0.96	0.96	0.96	No change relative to baseline conditions
V11	Vegetation index	1.00	1.00	1.00	No change relative to baseline conditions
V12	Percent ground cover (erosion)	0.95	0.95	0.95	No change relative to baseline conditions
V13	Annual max-min pH	0.80	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.54	0.54	0.54	No change relative to baseline conditions
V16A	Percent fines (spawning areas)	0.44	0.44	0.44	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.60	0.60	0.60	No change relative to baseline conditions
V17	Percent shade (overhead)	0.96	0.96	0.96	No change relative to baseline conditions
V18	Percent average daily flow (adult migration)	1.00	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.69	0.69	0.69	No change relative to baseline conditions
Belted Kingfisher Evaluation Species					
V1	Percent shoreline affected by wave action	N/A	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.72	0.72	0.72	No change relative to baseline conditions
V3	Percent water surface obstruction	0.70	0.70	0.70	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.73	0.73	0.73	No change relative to baseline conditions
V5	Percent riffles	0.32	0.32	0.32	No change relative to baseline conditions
V6	Average number of perches	1.00	1.00	1.00	No change relative to baseline conditions
V7	Distance to suitable soil bank (reproduction)	1.00	1.00	1.00	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type					
V1	Percent bottom cover	0.45	0.45	0.45	No change relative to baseline conditions
V2	Percent pool area during summer	1.00	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.95	0.95	0.95	No change relative to baseline conditions
V5	Pool depth	0.75	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.91	0.91	0.91	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	1.00	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	0.80	No change relative to baseline conditions

Appendix F. Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Offsite Mitigation Sites

Appendix F. Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Offsite Mitigation Sites

CONTENTS OF APPENDIX F

The following tables are included in Appendix F:

F-1. Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Guadalupe Creek

F-2. Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Reach 12

F-3. Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Reach 10B

F-4. Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Reach A for the Authorized Project

F-5. Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Reach A for the Double Bypass System Alternative

F-6. Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Reach A for the Triple Bypass System Alternative

Table F-1

Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Guadalupe Creek

Evaluation Species/Cover Type		Baseline Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.05	0.43	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.40	0.57	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.25	0.40	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.33	0.43	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.68	0.68	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.33	0.33	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.85	1.00	Cover maximized with revegetation and instream structures
V6A	Percent cover (adults)	0.82	1.00	Cover maximized with revegetation and instream structures
V7	Substrate size (spawning areas)	1.00	1.00	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.76	0.76	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.61	0.61	No change relative to baseline conditions
V10	Percent pools	0.80	1.00	Pool numbers optimized
V11	Vegetation index	0.70	1.00	Vegetative cover along banks optimized
V12	Percent ground cover (erosion)	0.29	1.00	Bank protection optimized through revegetation and biotechnical bank stabilization
V13	Annual max-min pH	0.73	0.73	No change relative to baseline conditions
V14	Average annual base flow	0.43	0.43	No change relative to baseline conditions
V15	Pool class rating	0.50	0.60	Instream habitat structures increase existing pool quality to 0.60 on average
V16A	Percent fines (spawning areas)	0.62	0.62	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.74	0.74	No change relative to baseline conditions
V17	Percent shade (overhead)	0.47	1.00	Revegetation optimizes stream shading
V18	Percent average daily flow (adult migration)	0.91	0.91	No change relative to baseline conditions
Vs	Spawning site suitability index	0.59	0.59	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	1.00	1.00	No change relative to baseline conditions
V3	Percent water surface obstruction	0.79	0.79	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	1.00	1.00	No change relative to baseline conditions
V5	Percent riffles	1.00	1.00	No change relative to baseline conditions
V6	Average number of perches	0.43	1.00	Revegetation optimizes perch numbers
V7	Distance to suitable soil bank (reproduction)	1.00	1.00	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.73	1.00	Cover in pools optimized through revegetation and instream structures
V2	Percent pool area during summer	0.32	0.75	Pool numbers increased to optimize habitat value for rainbow trout
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.50	0.95	Revegetation increases streamside vegetation
V5	Pool depth	0.50	0.50	No change relative to baseline conditions
V6	Stream width	0.91	0.91	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	0.50	0.50	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table F-2

Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Reach 12

Evaluation Species/Cover Type		Baseline Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.00	0.27	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.38	0.50	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.24	0.51	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.50	0.53	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.57	0.57	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.50	0.50	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.85	1.00	Cover maximized with revegetation and instream structures
V6A	Percent cover (adults)	0.76	1.00	Cover maximized with revegetation and instream structures
V7	Substrate size (spawning areas)	1.00	1.00	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.64	0.64	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.58	0.58	No change relative to baseline conditions
V10	Percent pools	0.90	1.00	Pool numbers optimized
V11	Vegetation index	0.77	1.00	Vegetative cover along banks optimized
V12	Percent ground cover (erosion)	0.85	1.00	Bank protection optimized through revegetation and biotechnical bank stabilization
V13	Annual max-min pH	0.73	0.73	No change relative to baseline conditions
V14	Average annual base flow	0.23	0.23	No change relative to baseline conditions
V15	Pool class rating	0.87	1.00	Instream habitat structures increase existing pool quality to 1.00
V16A	Percent fines (spawning areas)	0.37	0.37	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.48	0.48	No change relative to baseline conditions
V17	Percent shade (overhead)	0.32	1.00	Revegetation optimizes stream shading
V18	Percent average daily flow (adult migration)	0.75	0.75	No change relative to baseline conditions
Vs	Spawning site suitability index	0.57	0.57	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	1.00	1.00	No change relative to baseline conditions
V3	Percent water surface obstruction	0.58	0.58	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.88	0.88	No change relative to baseline conditions
V5	Percent riffles	1.00	1.00	No change relative to baseline conditions
V6	Average number of perches	0.29	1.00	Revegetation optimizes perch numbers
V7	Distance to suitable soil bank (reproduction)	0.74	0.74	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.90	1.00	Cover in pools optimized through revegetation and instream structures
V2	Percent pool area during summer	0.45	0.75	Pool numbers increased to optimize rainbow trout value and improve non-salmonid values
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.50	0.95	Revegetation increases streamside vegetation
V5	Pool depth	0.40	0.40	No change relative to baseline conditions
V6	Stream width	1.00	1.00	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	0.88	0.88	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.78	0.78	No change relative to baseline conditions

Table F-3

Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Reach 10B

Evaluation Species/Cover Type		Baseline Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.00	0.01	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.37	0.48	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.23	0.33	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.51	0.54	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.68	0.68	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.33	0.33	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.85	1.00	Cover maximized with revegetation and instream structures
V6A	Percent cover (adults)	0.82	1.00	Cover maximized with revegetation and instream structures
V7	Substrate size (spawning areas)	1.00	1.00	No change relative to baseline conditions
V8	Percent substrate size class (cover)	0.76	0.76	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.61	0.61	No change relative to baseline conditions
V10	Percent pools	0.80	1.00	Pool numbers optimized
V11	Vegetation index	0.70	1.00	Vegetative cover along banks optimized
V12	Percent ground cover (erosion)	0.29	1.00	Bank protection optimized through revegetation and biotechnical bank stabilization
V13	Annual max-min pH	0.73	0.73	No change relative to baseline conditions
V14	Average annual base flow	0.43	0.43	No change relative to baseline conditions
V15	Pool class rating	0.50	0.60	Instream habitat structures increase existing pool quality to 0.60 on average
V16A	Percent fines (spawning areas)	0.62	0.62	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.74	0.74	No change relative to baseline conditions
V17	Percent shade (overhead)	0.47	1.00	Revegetation optimizes stream shading
V18	Percent average daily flow (adult migration)	0.91	0.91	No change relative to baseline conditions
Vs	Spawning site suitability index	0.59	0.59	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	1.00	1.00	No change relative to baseline conditions
V3	Percent water surface obstruction	0.59	0.59	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	1.00	1.00	No change relative to baseline conditions
V5	Percent riffles	0.89	0.89	No change relative to baseline conditions
V6	Average number of perches	0.20	1.00	Revegetation optimizes perch numbers
V7	Distance to suitable soil bank (reproduction)	0.47	0.47	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.97	1.00	Cover in pools optimized through revegetation and instream structures
V2	Percent pool area during summer	0.28	0.75	Pool numbers increased to optimize rainbow trout value and improve non-salmonid values
V3	Dominant substrate	0.80	0.80	No change relative to baseline conditions
V4	Edge vegetation development	0.75	0.95	Revegetation increases streamside vegetation
V5	Pool depth	0.50	0.50	No change relative to baseline conditions
V6	Stream width	1.00	1.00	No change relative to baseline conditions
V7	Water temperature	0.50	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	0.64	0.64	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	1.00	1.00	No change relative to baseline conditions

Table F-4

Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Reach A for the Authorized Project Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.00	0.00	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.51	0.56	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.34	0.40	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature >15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.84	0.84	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.90	1.00	Cover maximized with revegetation and instream structures
V6A	Percent cover (adults)	0.76	1.00	Cover maximized with revegetation and instream structures
V7	Substrate size (spawning areas)	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	1.00	1.00	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.70	0.70	No change relative to baseline conditions
V10	Percent pools	1.00	1.00	No change relative to baseline conditions
V11	Vegetation index	0.82	1.00	Vegetative cover along banks optimized
V12	Percent ground cover (erosion)	1.00	1.00	No change relative to baseline conditions
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.45	0.80	Instream habitat structures increase existing pool quality to 0.80 on average
V16A	Percent fines (spawning areas)	0.77	0.77	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.98	0.98	No change relative to baseline conditions
V17	Percent shade (overhead)	0.36	0.75	Revegetation increases stream shading to 32%
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.83	0.83	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.64	0.64	No change relative to baseline conditions
V3	Percent water surface obstruction	0.49	0.49	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.77	0.77	No change relative to baseline conditions
V5	Percent riffles	0.30	0.30	No change relative to baseline conditions
V6	Average number of perches	0.20	1.00	Revegetation optimizes perch numbers
V7	Distance to suitable soil bank (reproduction)	1.00	1.00	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.20	1.00	Cover in pools optimized through revegetation and instream structures
V2	Percent pool area during summer	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.70	0.90	Revegetation increases streamside vegetation
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.68	0.68	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table F-5

Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Reach A for the Double Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.00	0.02	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.51	0.56	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.34	0.42	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.84	0.84	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.90	1.00	Cover maximized with revegetation and instream structures
V6A	Percent cover (adults)	0.76	1.00	Cover maximized with revegetation and instream structures
V7	Substrate size (spawning areas)	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	1.00	1.00	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.70	0.70	No change relative to baseline conditions
V10	Percent pools	1.00	1.00	Pool numbers optimized
V11	Vegetation index	0.82	1.00	Vegetative cover along banks optimized
V12	Percent ground cover (erosion)	1.00	1.00	Bank protection optimized through revegetation and biotechnical bank stabilization
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.45	0.80	Instream habitat structures increase existing pool quality to 0.80 on average
V16A	Percent fines (spawning areas)	0.77	0.77	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.98	0.98	No change relative to baseline conditions
V17	Percent shade (overhead)	0.36	0.75	Revegetation increases stream shading to 32%
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.83	0.83	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.64	0.64	No change relative to baseline conditions
V3	Percent water surface obstruction	0.49	0.49	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.77	0.77	No change relative to baseline conditions
V5	Percent riffles	0.30	0.30	No change relative to baseline conditions
V6	Average number of perches	0.20	1.00	Revegetation optimizes perch numbers
V7	Distance to suitable soil bank (reproduction)	1.00	1.00	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.20	1.00	Cover in pools optimized through revegetation and instream structures
V2	Percent pool area during summer	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.70	0.90	Revegetation increases streamside vegetation
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.68	0.68	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Table F-6.

Baseline and Postmitigation Suitability Indices and Postmitigation Assumptions for Reach A for the Triple Bypass System Alternative

Evaluation Species/Cover Type		Baseline Suitability Index	Postmitigation Suitability Index	Postmitigation Assumptions
Rainbow Trout Evaluation Species				
V1A	Maximum temperature (resident trout)	0.00	0.01	JSATEMP model results for postmitigation conditions
V1B	(V2A maximum temperature - chinook salmon prespawn adults)	0.51	0.56	JSATEMP model results for postmitigation conditions
V2A	Maximum temperature (smolts)	0.34	0.41	JSATEMP model results for postmitigation conditions
V2B	(V6 maximum temperature - chinook salmon spawning)	0.55	0.55	JSATEMP model results for postmitigation conditions
V3A	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V3B	Minimum dissolved oxygen (water temperature <15°C)	1.00	1.00	No change relative to baseline conditions
V4B	Average thalweg depth	0.84	0.84	No change relative to baseline conditions
V5	Average water velocity (over spawning areas)	0.75	0.75	No change relative to baseline conditions
V6J	Percent cover (juveniles)	0.90	1.00	Cover maximized with revegetation and instream structures
V6A	Percent cover (adults)	0.76	1.00	Cover maximized with revegetation and instream structures
V7	Substrate size (spawning areas)	0.99	0.99	No change relative to baseline conditions
V8	Percent substrate size class (cover)	1.00	1.00	No change relative to baseline conditions
V9	Substrate type in riffles/runs (food)	0.70	0.70	No change relative to baseline conditions
V10	Percent pools	1.00	1.00	Pool numbers optimized
V11	Vegetation index	0.82	1.00	Vegetative cover along banks optimized
V12	Percent ground cover (erosion)	1.00	1.00	Bank protection optimized through revegetation and biotechnical bank stabilization
V13	Annual max-min pH	0.80	0.80	No change relative to baseline conditions
V14	Average annual base flow	0.12	0.12	No change relative to baseline conditions
V15	Pool class rating	0.45	0.80	Instream habitat structures increase existing pool quality to 0.80 on average
V16A	Percent fines (spawning areas)	0.77	0.77	No change relative to baseline conditions
V16B	Percent fines (riffle/run areas)	0.98	0.98	No change relative to baseline conditions
V17	Percent shade (overhead)	0.36	0.75	Revegetation increases stream shading to 32%
V18	Percent average daily flow (adult migration)	1.00	1.00	No change relative to baseline conditions
Vs	Spawning site suitability index	0.83	0.83	No change relative to baseline conditions
Belted Kingfisher Evaluation Species				
V1	Percent shoreline affected by wave action	N/A	N/A	N/A
V2	Average water transparency (Secchi depth)	0.64	0.64	No change relative to baseline conditions
V3	Percent water surface obstruction	0.49	0.49	No change relative to baseline conditions
V4	Percent water area <= 24 inches deep	0.77	0.77	No change relative to baseline conditions
V5	Percent riffles	0.30	0.30	No change relative to baseline conditions
V6	Average number of perches	0.20	1.00	Revegetation optimizes perch numbers
V7	Distance to suitable soil bank (reproduction)	1.00	1.00	No change relative to baseline conditions
Non-Salmonid Pool Habitat Cover Type				
V1	Percent bottom cover	0.20	1.00	Cover in pools optimized through revegetation and instream structures
V2	Percent pool area during summer	1.00	1.00	No change relative to baseline conditions
V3	Dominant substrate	1.00	1.00	No change relative to baseline conditions
V4	Edge vegetation development	0.70	0.90	Revegetation increases streamside vegetation
V5	Pool depth	0.75	0.75	No change relative to baseline conditions
V6	Stream width	0.68	0.68	No change relative to baseline conditions
V7	Water temperature	1.00	1.00	JSATEMP model results for postmitigation conditions
V8	Pool water velocity	1.00	1.00	No change relative to baseline conditions
V9	Stream gradient (meters/kilometer)	0.80	0.80	No change relative to baseline conditions

Appendix G. Form D Output from Habitat Evaluation Procedures Model

Appendix G. Form D Output from Habitat Evaluation Procedures Model

CONTENTS OF APPENDIX G

U.S. Fish and Wildlife Service has developed a model to assist habitat evaluation procedures (HEP) analysis practitioners in conducting HEP analyses. One of the output forms from the HEP model is Form D. Form D shows average annual habitat units (AAHUs) for evaluation species/cover type. Appendix G includes this information for the three project alternatives and offsite mitigation areas under without- and with-project conditions. The following tables are included in Appendix G:

G-1. Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Segments 1–3 under the Authorized Project

G-2. Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Segments 1–3 under the Double Bypass System Alternative

G-3. Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Segments 1–3 under the Triple Bypass System Alternative

G-4. Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Reach A (Authorized Project Alternative)

G-5. Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Reach A (Double Bypass System Alternative)

G-6. Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Reach A (Triple Bypass System Alternative)

G-7. Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Reach 10B

G-8. Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Reach 12

G-9. Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Guadalupe Creek

Table G-1.
Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Segments 1–3 under the Authorized Project

Form D: Net Change in AAHU's

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 2 (with project) FED AUTHORIZED ALT.
Compared To: PA 1 (without project) PROJ AREA BASELINE
Life of Project: 100

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	RAINBOW TROUT	3.42	7.21	-3.78
2	NON-SALMONID	6.69	9.08	-2.40
3	BELTED KINGFISHER	2.85	3.76	-0.90

Table G-2.
Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Segments 1–3 under the Double Bypass System Alternative

Form D: Net Change in AAHU's

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 3 (with project) DOUBLE CULVERT BYPSS
Compared To: PA 1 (without project) PROJ AREA BASELINE
Life of Project: 100

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	RAINBOW TROUT	5.42	7.21	-1.78
2	NON-SALMONID	7.35	9.08	-1.73
3	BELTED KINGFISHER	3.14	3.76	-0.62

Table G-3.
Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Segments 1–3 under the Triple Bypass System Alternative

Form D: Net Change in AAHU's

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: PA 4 (with project) TRIPLE CULVERT BYPSS
Compared To: PA 1 (without project) PROJ AREA BASELINE
Life of Project: 100

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	RAINBOW TROUT	5.25	7.21	-1.96
2	NON-SALMONID	7.21	9.08	-1.88
3	BELTED KINGFISHER	3.09	3.76	-0.67

Table G-4.
Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Reach A (Authorized Project Alternative)

Form D: Net Change in AAHU's

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 14 (with project) REACH A:FED AUTH ALT
Compared To: MP 4 (without project) REACH A
Life of Project: 100

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	RAINBOW TROUT	0.00	0.00	0.00
2	NON-SALMONID	4.84	4.41	0.42
3	BELTED KINGFISHER	1.28	1.05	0.23

Table G-5.
Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Reach A (Double Bypass System Alternative)

Form D: Net Change in AAHU's

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 15 (with project) REACH A:DOUBLE CULVT
Compared To: MP 4 (without project) REACH A
Life of Project: 100

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	RAINBOW TROUT	2.01	0.00	2.01
2	NON-SALMONID	4.84	4.41	0.43
3	BELTED KINGFISHER	1.28	1.05	0.23

Table G-6.
Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Reach A (Triple Bypass System Alternative)

Form D: Net Change in AAHU's

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 6 (with project) REACH A:TRIPLE CULVT
Compared To: MP 4 (without project) REACH A
Life of Project: 100

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	RAINBOW TROUT	1.98	0.00	1.98
2	NON-SALMONID	4.84	4.41	0.43
3	BELTED KINGFISHER	1.28	1.05	0.23

Table G-7.
Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Reach 10B

Form D: Net Change in AAHU's

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 13 (with project) REACH 10B W/MIT
Compared To: MP 3 (without project) REACH 10B
Life of Project: 100

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	RAINBOW TROUT	0.50	0.00	0.50
2	NON-SALMONID	1.13	0.98	0.16
3	BELTED KINGFISHER	0.56	0.28	0.28

Table G-8.
Change in Average Annual Habitat Units Between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Reach 12

Form D: Net Change in AAHU's

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 12 (with project) REACH 12 W/MIT
Compared To: MP 2 (without project) REACH 12
Life of Project: 100

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	RAINBOW TROUT	2.05	0.00	2.05
2	NON-SALMONID	3.37	3.15	0.22
3	BELTED KINGFISHER	1.85	1.10	0.75

Table G-9.
Change in Average Annual Habitat Units between the Without- and With-Project Conditions for Evaluation Species/Cover Type for Guadalupe Creek

Form D: Net Change in AAHU's

Study Name: DOWNTOWN GUADALUPE RIVER FCP
Action: MP 11 (with project) LOWER GUAD CRK W/MIT
Compared To: MP 1 (without project) LOWER GUADALUPE CRK
Life of Project: 100

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	RAINBOW TROUT	1.85	1.52	0.33
2	NON-SALMONID	2.38	2.14	0.24
3	BELTED KINGFISHER	2.07	1.28	0.79

Appendix H. Form H Output from Habitat Evaluation Procedures Model

Appendix H. Form H Output from Habitat Evaluation Procedures Model

CONTENTS OF APPENDIX H

U.S. Fish and Wildlife has developed a model to assist habitat evaluation procedures (HEP) analysis practitioners in conducting HEP analyses. One of the output forms from the HEP model is Form H. Form H is a side-by-side comparison of AAHU losses in the construction area to AAHU gains at each offsite mitigation site. Appendix H includes this information for the three project alternatives and offsite mitigation sites under with- and without-project conditions and with- and without-mitigation conditions. The following tables are included in Appendix H:

H-1.1. Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach A for the Authorized Project Alternative

H-1.2. Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach 10B for the Authorized Project Alternative

H-1.3. Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach 12 for the Authorized Project Alternative

H-1.4. Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Guadalupe Creek for the Authorized Project Alternative

H-1.5. Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach A for the Double Bypass System Alternative

H-1.6. Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach A for the Triple Bypass System Alternative

H-2.1. Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach A for the Double Bypass System Alternative, with Non-Salmonid Pool Habitat Cover Type Average Annual Habitat Units Converted to Rainbow Trout Average Annual Habitat Units

H-2.2. Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Guadalupe Creek for the Double Bypass System Alternative, with Non-Salmonid Pool Habitat Cover Type Average Annual Habitat Units Converted to Rainbow Trout Average Annual Habitat Units

H-2.3. Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach A for the Triple Bypass System Alternative, with Non-Salmonid Pool Habitat Cover Type Average Annual Habitat Units Converted to Rainbow Trout Average Annual Habitat Units

H-2.4. Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Guadalupe Creek for the Triple Bypass System Alternative, with Non-Salmonid Pool Habitat Cover Type Average Annual Habitat Units Converted to Rainbow Trout Average Annual Habitat Units

Table H-1.1.
Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach A for the Authorized Project Alternative

Area Needed For In-Kind Compensation
(Form H Results)

Study Name:	DOWNTOWN GUADALUPE RIVER FCP		
Plan Alternative:	PA 2	(with project)	FED AUTHORIZED ALT.
Compared To:	PA 1	(without project)	PROJ AREA BASELINE
Management Plan:	MP 14	(with project)	REACH A:FED AUTH ALT
Compared To:	MP 4	(without project)	REACH A
Candidate Management Area Size:	4.82		

Evaluation Species ID#	Name	Net Change In AAHU's: Plan Alternative	Management Plan	Area Needed For Compensation
1	RAINBOW TROUT	-3.78	0.00	LOSS
2	NON-SALMONID	-2.40	0.42	27.24
3	BELTED KINGFISHER	-0.90	0.23	18.84

Table H-1.2.
Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach 10B for the Authorized Project Alternative

Area Needed For In-Kind Compensation
(Form H Results)

Study Name:	DOWNTOWN GUADALUPE RIVER FCP		
Plan Alternative:	PA 2	(with project)	FED AUTHORIZED ALT.
Compared To:	PA 1	(without project)	PROJ AREA BASELINE
Management Plan:	MP 13	(with project)	REACH 10B W/MIT
Compared To:	MP 3	(without project)	REACH 10B
Candidate Management Area Size:	1.30		

Evaluation Species ID#	Name	Net Change In AAHU's: Plan Alternative	Management Plan	Area Needed For Compensation
1	RAINBOW TROUT	-3.78	0.50	9.93
2	NON-SALMONID	-2.40	0.16	19.85
3	BELTED KINGFISHER	-0.90	0.28	4.20

Table H-1.3.
Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach 12 for the Authorized Project Alternative

Area Needed For In-Kind Compensation
(Form H Results)

Study Name:	DOWNTOWN GUADALUPE RIVER FCP		
Plan Alternative:	PA 2	(with project)	FED AUTHORIZED ALT.
Compared To:	PA 1	(without project)	PROJ AREA BASELINE
Management Plan:	MP 12	(with project)	REACH 12 W/MIT
Compared To:	MP 2	(without project)	REACH 12
Candidate Management Area Size:	3.48		

Evaluation ID#	Species Name	Net Change In AAHU's: Plan Alternative	Management Plan	Area Needed For Compensation
1	RAINBOW TROUT	-3.78	2.05	6.43
2	NON-SALMONID	-2.40	0.22	37.99
3	BELTED KINGFISHER	-0.90	0.75	4.18

Table H-1.4.
Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Guadalupe Creek for the Authorized Project Alternative

Area Needed For In-Kind Compensation
(Form H Results)

Study Name:	DOWNTOWN GUADALUPE RIVER FCP		
Plan Alternative:	PA 2	(with project)	FED AUTHORIZED ALT.
Compared To:	PA 1	(without project)	PROJ AREA BASELINE
Management Plan:	MP 11	(with project)	LOWER GUAD CRK W/MIT
Compared To:	MP 1	(without project)	LOWER GUADALUPE CRK
Candidate Management Area Size:	2.73		

Evaluation Species ID#	Name	Net Change In AAHU's: Plan Alternative	Management Plan	Area Needed For Compensation
1	RAINBOW TROUT	-3.78	0.33	31.53
2	NON-SALMONID	-2.40	0.24	27.24
3	BELTED KINGFISHER	-0.90	0.79	3.14

Table H-1.5.
Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach A for the Double Bypass System Alternative

Area Needed For In-Kind Compensation
(Form H Results)

Study Name:	DOWNTOWN GUADALUPE RIVER FCP		
Plan Alternative:	PA 3	(with project)	DOUBLE CULVERT BYPSS
Compared To:	PA 1	(without project)	PROJ AREA BASELINE
Management Plan:	MP 15	(with project)	REACH A:DOUBLE CULVT
Compared To:	MP 4	(without project)	REACH A
Candidate Management Area Size:	4.82		

Evaluation Species ID#	Name	Net Change In AAHU's Plan Alternative	Management Plan	Area Needed For Compensation
1	RAINBOW TROUT	-1.78	2.01	4.27
2	NON-SALMONID	-1.73	0.43	19.54
3	BELTED KINGFISHER	-0.62	0.23	12.77

Table H-1.6.
Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach A for the Triple Bypass System Alternative

Area Needed For In-Kind Compensation
(Form H Results)

Study Name:	DOWNTOWN GUADALUPE RIVER FCP		
Plan Alternative:	PA 4	(with project)	TRIPLE CULVERT BYPSS
Compared To:	PA 1	(without project)	PROJ AREA BASELINE
Management Plan:	MP 6	(with project)	REACH A:TRIPLE CULVT
Compared To:	MP 4	(without project)	REACH A
Candidate Management Area Size:	4.82		

Evaluation Species ID#	Name	Net Change In AAHU's: Plan Alternative	Management Plan	Area Needed For Compensation
1	RAINBOW TROUT	-1.96	1.98	4.76
2	NON-SALMONID	-1.88	0.43	21.19
3	BELTED KINGFISHER	-0.67	0.23	13.82

Table H-2.1.
Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach A for the Double Bypass System Alternative, with Non-Salmonid Pool Habitat Cover Type Average Annual Habitat Units Converted to Rainbow Trout Average Annual Habitat Units

Area Needed For Relative Compensation
(Form H Results)

Study Name:	DOWNTOWN GUADALUPE RIVER FCP		
Plan Alternative:	PA 3	(with project)	DOUBLE CULVERT BYPSS
Compared To:	PA 1	(without project)	PROJ AREA BASELINE
Management Plan:	MP 15	(with project)	REACH A:DOUBLE CULVT
Compared To:	MP 4	(without project)	REACH A
Candidate Management Area Size:	4.82		
Source of Relative Value Indices:	FF 7		

Evaluation Species ID#	Name	Net Change In AAHU's: Plan Alternative	Management Plan
1	RAINBOW TROUT	-1.78	2.01
2	NON-SALMONID	-0.29	0.07
	Area Needed For Compensation:		4.80

Table H-2.2.
Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Guadalupe Creek for the Double Bypass System Alternative, with Non-Salmonid Pool Habitat Cover Type Average Annual Habitat Units Converted to Rainbow Trout Average Annual Habitat Units

Area Needed For Relative Compensation
(Form H Results)

Study Name:	DOWNTOWN GUADALUPE RIVER FCP		
Plan Alternative:	PA 3	(with project)	DOUBLE CULVERT BYPSS
Compared To:	PA 1	(without project)	PROJ AREA BASELINE
Management Plan:	MP 11	(with project)	LOWER GUAD CRK W/MIT
Compared To:	MP 1	(without project)	LOWER GUADALUPE CRK
Candidate Management Area Size:		2.73	
Source of Relative Value Indices:	FF 7		

Evaluation Species ID#	Name	Net Change In AAHU's Plan Alternative	Management Plan
1	RAINBOW TROUT	-1.78	0.33
2	NON-SALMONID	-0.29	0.04
	Area Needed For Compensation:		15.39

Table H-2.3.
Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Reach A for the Triple Bypass System Alternative, with Non-Salmonid Pool Habitat Cover Type Average Annual Habitat Units Converted to Rainbow Trout Average Annual Habitat Units

Area Needed For Relative Compensation
(Form H Results)

Study Name:	DOWNTOWN GUADALUPE RIVER FCP		
Plan Alternative:	PA 4	(with project)	TRIPLE CULVERT BYPSS
Compared To:	PA 1	(without project)	PROJ AREA BASELINE
Management Plan:	MP 6	(with project)	REACH A:TRIPLE CULVT
Compared To:	MP 4	(without project)	REACH A
Candidate Management Area Size:	4.82		
Source of Relative Value Indices:	FF 7		

Evaluation Species ID#	Name	Net Change In AAHU's: Plan Alternative	Management Plan
1	RAINBOW TROUT	-1.96	1.98
2	NON-SALMONID	-0.32	0.07
	Area Needed For Compensation:		5.34

Table H-2.4.
Comparison of Losses in Average Annual Habitat Units in the Construction Area to Gains in Average Annual Habitat Units in Guadalupe Creek for the Triple Bypass System Alternative, with Non-Salmonid Pool Habitat Cover Type Average Annual Habitat Units Converted to Rainbow Trout Average Annual Habitat Units

Area Needed For Relative Compensation
(Form H Results)

Study Name:	DOWNTOWN GUADALUPE RIVER FCP		
Plan Alternative:	PA 4	(with project)	TRIPLE CULVERT BYPSS
Compared To:	PA 1	(without project)	PROJ AREA BASELINE
Management Plan:	MP 11	(with project)	LOWER GUAD CRK W/MIT
Compared To:	MP 1	(without project)	LOWER GUADALUPE CRK
Candidate Management Area Size:	2.73		
Source of Relative Value Indices:	FF 7		

Evaluation Species ID#	Name	Net Change In AAHU's: Plan Alternative	Management Plan
1	RAINBOW TROUT	-1.96	0.33
2	NON-SALMONID	-0.32	0.04
	Area Needed For Compensation:		16.87