# Hamilton City Flood Damage Reduction and Ecosystem Restoration, California

*Final Feasibility Report and Environmental Impact Statement/Environmental Impact Report*

July 2004

Sacramento and San Joaquin River Basins Comprehensive Study

US Army Corps of Engineers Sacramento District

CALIFORNIA BAY-DELTA AUTHORITY

# HAMILTON CITY FLOOD DAMAGE REDUCTION AND ECOSYSTEM RESTORATION, CALIFORNIA

## FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT/ ENVIRONMENTAL IMPACT REPORT

**July 2004**

**Type of Statement.** Final Feasibility Report and Environmental Impact Statement/Environmental Impact Report (FR/EIS/EIR).

**Lead Federal Agency:** U.S. Army Engineer District, Sacramento.

**Lead State Agency:** The Reclamation Board of the State of California, State Clearinghouse #2002122048.

**Proposed Action:** The U.S. Army Corps of Engineers and The Reclamation Board propose to increase flood protection and restore the Sacramento River floodplain near Hamilton City, along the west bank of the Sacramento River, in Glenn County, California, about 85 miles north of the city of Sacramento by constructing a setback levee, removing most of the existing "J" levee, and actively restoring about 1,500 acres of native vegetation.

**Abstract:** The final FR/EIS/EIR describes the affected environment in the Hamilton City area; evaluates the direct, indirect, and cumulative environmental effects and the benefits of the recommended plan and three alternative plans; and recommends avoidance, minimization, and mitigation measures. Most potential adverse effects would either be short term and insignificant, or would be avoided or reduced to less-than significance using best management practices. Beneficial effects on vegetation, wildlife, fisheries, other resources, and the historic floodplain from the alternative plans are also discussed.

**Public Review and Comment:** A draft FR/EIS/EIR underwent a 45-day public and agency review April 9 through May 24, 2004. A public meeting was held in Hamilton City on May 6, 2004. All comments received were considered and incorporated as appropriate into the final FR/EIS/EIR. Comments and responses are included as an appendix to the final FR/EIS/EIR. Requests for the final can be directed to the Corps at the following address: U.S. Army Engineer District, Sacramento, Attn: Ms. Alicia Kirchner, 1325 J Street, Sacramento, California, 95814-2922. Ms. Kirchner can also be reached at (916) 557-6767.

# SUMMARY

This report: (1) assesses the risk of flooding to Hamilton City from the Sacramento River and the degradation of the river's ecosystem; (2) describes a range of alternatives to increase flood protection to Hamilton City and to restore the ecosystem; and (3) identifies a recommended plan for implementation. This report constitutes both a Feasibility Report that describes the planning process followed to identify the recommended plan and an Environmental Impact Statement/Environmental Impact Report (EIS/EIR). This final Feasibility Report/EIS/EIR submitted to higher Corps authority for review and approval, then transmitted to Congress for potential project authorization and funding of the Federal share of the project.

## BACKGROUND

Hamilton City is along the west bank of the Sacramento River in Glenn County, California, about 85 miles north of the City of Sacramento. The community has long been at risk of flooding from the Sacramento River. Portions of Hamilton City and the surrounding area flooded in 1974. Extensive flood fighting has been necessary in 1983, 1986, 1995, 1997, and 1998 to avoid failure of the private "J" levee. Residents of the town were evacuated six times in the past 20 years: 1983, 1986, twice in 1995, 1997, and 1998. The community of Hamilton City relies on the existing "J" levee to contain flows in the Sacramento River. The "J" levee does not meet Corps or any other levee construction standards and could fail at river levels well below the top of the levee. Although with flood fighting the "J" levee has historically passed high flood events, statistically it only has about a 66 percent reliability of passing a 10-year event assuming significant flood fighting efforts. This would also equate to a 90 percent reliability of passing an event smaller than a 10-year event. Another way to state this is that on an annual basis, there is a 9 percent chance of flooding in any given year, again assuming flood-fighting efforts. For some perspective, the flood event in 1997 was considered to be an 11-year event.

In the Hamilton City area, native habitat and natural function of the Sacramento River have been altered by construction of the "J" levee and conversion of the floodplain to agricultural and rural development. The Sacramento River, Chico Landing to Red Bluff Project placed bank protection at 29 bank protection sites totaling approximately 86,915 feet (16.5 miles). Sites are situated primarily at outer bends of meanders in the river, which has limited the rivers ability to meander. Native habitat has been reduced to remnant patches along the river and in historic oxbows. These ecosystem alterations greatly diminished the abundance, richness, and complexity of riparian and other floodplain habitat in the study area and the species dependent upon that habitat.

The Corps initiated the feasibility study at the request of The Reclamation Board of the State of California (The Reclamation Board), as part of the Sacramento and San Joaquin River Basins Comprehensive Study (Comprehensive Study) initiated by the Corps and The Reclamation Board in 1998. The Comprehensive Study was authorized in the 1998 Energy and Water Development Appropriations Act, Public Law (PL)105-62 and by the California State Legislature in September 1997. It was recognized that a multipurpose project could be developed in the Hamilton City area to demonstrate how a project could reduce flood damages and restore the ecosystem simultaneously. The Corps and The Reclamation Board

are the lead agencies in the Hamilton City Flood Damage Reduction and Ecosystem Restoration Feasibility Study and shared the cost of the study equally. The Reclamation Board received a State of California grant from the CALFED Bay-Delta Authority to help fund the non-Federal share of the feasibility study cost.

## CONSIDERATION OF ALTERNATIVE PLANS

During the feasibility study, the Federal planning process for development of water resource projects was followed to identify a recommended plan for implementation. Following definition of flood and ecosystem-related problems and opportunities, specific planning objectives and planning constraints were identified. Then various management measures were identified to achieve the planning objectives and avoid the planning constraints. Management measures were screened and retained management measures served as the building blocks of alternative plans.

Guidelines to developing multipurpose projects (in this case flood damage reduction and ecosystem restoration) were followed in developing alternative plans. First, a primary project purpose was identified. For this study, it was anticipated that ecosystem restoration would be identified as the primary purpose because there is strong interest by the Sacramento River Conservation Area Forum (SRCAF), The Nature Conservancy (TNC), and the CALFED Bay-Delta Authority in restoring the ecosystem of this area, which indicated that there was high ecosystem restoration potential. Further, based on previous flood damage reduction studies, it was considered unlikely that a flood damage reduction-only project would be cost-effective.

Next, a preliminary and then a final array of single-purpose ecosystem restoration alternative plans were formulated from retained management measures, evaluated and compared to identify a plan that reasonably maximizes the National Ecosystem Restoration (NER) net benefits (outputs minus costs). The preliminary array of ecosystem restoration alternative plans primarily consisted of various setback levee alignments with habitat restoration to the waterside of the new levee. Early on local interests expressed various concerns regarding the potential location of the setback levee. In order to ensure their concerns were addressed, stakeholders actively participated in the alternative formulation process. Community representatives developed two alternative plans (Alternatives 1 and 4). The NER plan was identified, indicating that there is likely Federal interest in implementing an ecosystem restoration-only alternative plan.

Finally, a preliminary and then a final array of multi-purpose (or "combined" alternative plans were formulated, evaluated and compared to identify a plan that reasonably maximizes total net NER and National Economic Development (NED) benefits. This array of alternative plans is identified as combined alternative plans. After evaluation and comparison of these combined alternative plans, a combined plan (NER/NED plan) has been identified as having Federal interest. Table S-1 summarizes the combined alternative plans.

**TABLE S-1: SUMMARY OF FINAL ARRAY COMBINED ALTERNATIVE PLANS**

| Consideration | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| Total acres restored | Not applicable | 1,300 | 1,600 | 1,500 |
| Levee length (miles) | Not applicable | 6.6 | 6.4 | 6.8 |
| Protects agricultural land south of town | Not applicable | Yes | Yes | Yes |
| Protects waste water treatment facility | Not applicable | Yes | No | Yes |
| Avoids wetlands | Not applicable | Yes | No | Yes |

## RECOMMENDED PLAN

Alternative 6 is determined to be the alternative plan that reasonably maximizes both ecosystem restoration and flood damage reduction benefits compared to costs and therefore has been identified as the recommended plan. Figure S-1 shows the recommended plan. It should be noted that, because Alternative 5 has the greatest habitat benefits, Alternative 5 was identified as both the USFWS Preferred Alternative and the Environmentally Preferred Alternative. However, since the additional output of Alternative 5 is relatively small and the cost is relatively great, Alternative 6 was determined to be the recommended plan.

This plan consists of constructing a setback levee about 6.8 miles long that would have varying heights and consequently, varying levels of performance for flood damage reduction. The entire length of setback levee would have gravel road for patrolling, and would be fenced along the landside. From the northern part of the study area to south of Dunning Slough, a distance of 4.4 miles, the levee would be on average 7.5 feet high (6 feet for the "J" levee replacement levee, and an additional 1.5 feet for the flood damage reduction increment). This portion of the levee would provide a 90 percent confidence of passing a 75-year event thereby providing improved flood protection to the community of Hamilton City. The top-of-levee elevation for this portion of the levee would be set at the 320-year water surface elevation (WSEL). Some agricultural lands north of the community of Hamilton City would have improved protection but would not be removed from the FEMA regulated floodplain.

South of Dunning Slough, the levee height would drop to 6 feet for a distance of about 4,000 feet, providing a 90 percent confidence of passing a 35-year event. The top-of-levee would be set at the 100-year wsel. This change reflects the difference in land use behind the levee at this point, which is largely agricultural. Just north of County Road 23, the setback levee would become a training dike, dropping down to a height of 3 feet for about 1.6 miles. The training dike would perform with a 90 percent confidence of passing the 11-year event and the top-of-levee would be set at the 20-year wsel. The training dike would reduce the frequency of flooding to adjacent agricultural lands and reduce damages from scouring flows. Large flood events would overtop the training dike, spilling into the orchards without the damaging scouring flows and avoid adverse hydraulic effects to downstream property owners. The training dike would also reduce the potential for backwaters flooding Hamilton City.

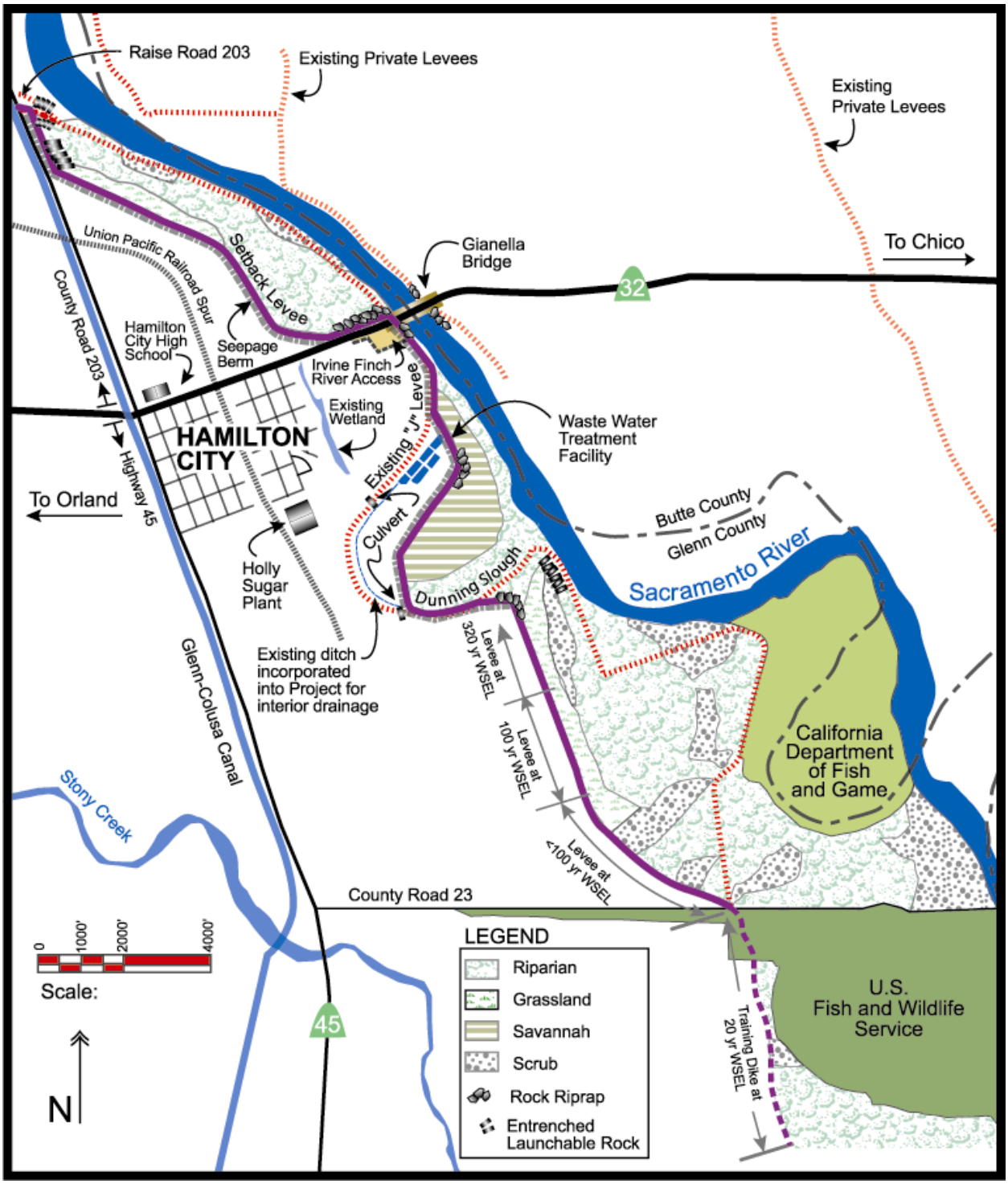



**Figure S-1: Recommended Plan**

In order to accomplish ecosystem restoration within the project area, most of the existing "J" levee would be removed to reconnect the river to the floodplain, allow overbank flooding and increase capacity in the Sacramento River. Established riparian vegetation waterside of the existing "J" levee would be avoided wherever possible during construction.

The new setback levee would begin about 2 miles north of Hamilton City, tying into high ground near the northern end of the "J" levee. Tying into high ground at this location would prevent flows greater than the 250-year event from wrapping around the setback levee and over County Road 203. The setback levee would be extended to a point just west of County Road 203, which would be ramped approximately 2.5 feet from its current height over the setback levee. As a flood fighting measure, Glenn County constructed a short setback levee near the northern end of the "J" levee in 2003, which would provide additional protection to the new setback levee against potential erosion from the Sacramento River. Entrenched rock would also be placed on the waterside of this training dike as an additional protection for the new setback levee from erosion.

The new setback levee would run southeast along the County Road 203 until turning easterly and running roughly parallel to and about 1,300 feet to the west of the Sacramento River, along higher ground. A seepage berm would be constructed on the landside of the setback levee from the northern end of the levee south to Dunning Slough. The setback levee performance would be 90 percent confidence of passing the 75-year event.

At Highway 32, the setback levee would turn east and run parallel to the highway until tying into the approach to the Gianella Bridge. The highway would not need to be raised, but rock riprap would be placed to protect the levee embankment from induced overland flows. Grouted and/or rock riprap would be placed under the bridge below the surface of the river to protect the bridge from potential increased velocities and potential scouring. South of Highway 32 the alignment would follow the existing "J" levee adjacent to the Irvine Finch River Access (just south of the highway). Some modification to the existing boat ramp would be required. South of Irvine Finch, the setback levee would be aligned away from the river to open up the floodplain.

The alignment would cut across a portion of Dunning Slough and provide protection to the Hamilton City wastewater treatment plant, some abandoned holding ponds for the old Holly Sugar plant, and a lime disposal pile. An existing ditch within Dunning Slough would be used to drain runoff from the agricultural fields and Hamilton City. This drain would be connected to the floodplain via a culvert in the setback levee south of Dunning Slough.

South of Dunning Slough, the alignment would roughly follow along the western edge of the habitat restoration area before turning east and merging with the southern end of the "J" levee at County Road 23. As the levee turns east, the levee height would gradually decrease from 7.5 feet to 6 feet and would continue at this height for approximately 4,000 feet. The setback levee performance would be 90 percent confidence of passing the 35-year event for this area. The setback levee height would then gradually decrease from 6 feet to approximately 3 feet. At this point the new levee would become a "training dike" meant to redirect flows rather than control them. This height reduction reflects a combination of economic justification and avoidance of negative hydraulic effects to downstream property owners.

The training dike's performance would be 90 percent confidence of passing the 11-year event. The training dike would continue for about a mile south of County Road 23, running along the western edge of the U.S. Fish and Wildlife Service (USFWS) property boundary. A small ramp with culverts on either side would be constructed over the training dike at County Road 23 to maintain the river access. This alignment does not tie into high ground and therefore allows some backwater flooding of agricultural lands, as currently happens with the "J" levee. In fact, the training dike would be designed to allow floodwaters to flow over the top and spread out into the agricultural areas while reducing the high velocities that cause extensive damage to the orchards.

Native vegetation would be restored on all project lands waterside of the new setback levee. Restoration would also occur on the land within Dunning Slough and the land south of the USFWS property. Existing USFWS and DFG lands would not be restored as part of the project. Existing orchards in the proposed restoration areas would be removed and native vegetation planted. The native vegetation (total 1,500 acres) would include riparian, scrub, oak savannah, and grassland cover types, based on hydrologic, topographic, and soil conditions. An exception to this is the land in the middle of Dunning Slough. This land is relatively higher in elevation than the rest of the restoration area and oak savannah vegetation is anticipated to be more appropriate for these lands.

Results from hydraulic modeling have shown that by widening the floodway on the western side of the Sacramento River, water surface elevations in Butte County would be reduced. In addition, the water surface elevation near Big Chico Creek would have reduced stages resulting in less overflow to Butte Basin. The reduction in flow has been on the order of magnitude of two thousand cubic feet per second (cfs) when the Sacramento River is conveying roughly 343,000 cfs (320 year flood event).

## SIGNIFICANT ENVIRONMENTAL IMPACTS

An evaluation of environmental effects determined that the proposed action could have significant environmental effects on water quality, air quality, transportation, and special status species. With mitigation, effects to these resources were reduced to less than significant levels. Table S-2 summarizes environmental impacts of the final array of combined alternative plans. A description of each effect and corresponding mitigation is included in Chapter 5, Environmental Consequences.

The Corps has determined that this project as recommended is consistent with the Section 404(b)(1) guidelines and in compliance with the Clean Water Act and meets the Section 404(r) exemption criteria. The Corps plans to seek an exemption from the requirement to obtain State water quality certification under section 404(r) of the Clean Water Act.

## TABLE S-2: SUMMARY OF ENVIRONMENTAL IMPACTS OF COMBINED ALTERNATIVE PLANS

| Resource | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| **Water Quality** | | | | |
| Temporary Effects | Water quality would be similar to existing conditions. | Levee removal may result in temporary degradation of water quality. **S** | Levee removal may result in temporary degradation of water quality. **S** | Levee removal may result in temporary degradation of water quality. **S** |
| Mitigation | Not applicable. | Use best management practices (BMPs) to prevent sediment runoff from entering the river. **LS** | Use BMPs to prevent sediment runoff from entering the river. **LS** | Use BMP's to prevent sediment runoff from entering the river. **LS** |
| Permanent Effects | Projects assumed under the future with-out project condition such as CALFED, Central Valley Improvement Act (CVPIA), and the TNC Sacramento River Project seek to maintain high water quality. | Water quality of surface runoff is expected to improve due to increased vegetative cover, reduced tillage, reduced use of well water, and reduced application of agricultural chemicals. Benefits from recharge of groundwater supplies due to temporary storage area created. New levee would be constructed between the wastewater treatment facility and the Sacramento River. Would decrease the risk of sewage spills **B** | Beneficial effects would be similar to those discussed for Alternative 1, except no benefit due to improved protection of the wastewater treatment plant. The setback levee would be constructed through the existing Hamilton City Irrigation Ditch, considered a seasonal wetland habitat by the USFWS. **S** | Water quality of surface runoff is expected to improve due to increased vegetative cover, reduced tillage, reduced use of well water, and reduced application of agricultural chemicals. Benefits from recharge of groundwater supplies due to temporary storage area created. New levee would be constructed between the wastewater treatment facility and the Sacramento River. Would decrease the risk of sewage spills due to the new levee. **B** |
| Mitigation | Not applicable. | No mitigation required. | In kind wetland of 45 acres would be created. Construction would occur during dry season. **B** | No mitigation required. |
| **Air Quality** | | | | |
| Temporary Effects | Present trends in degradations to air quality can be expected to continue. | Construction would result in temporary degradation of air quality from dust and emissions from construction equipment. **S** | Construction would result in temporary degradation of air quality from dust and emissions from construction equipment, though construction time would be less than Alternative 1. **S** | Construction would result in temporary degradation of air quality from dust and emissions from construction equipment, and construction time would be more than Alternative 1. **S** |
| Mitigation | Not applicable. | Use BMP's to reduce fugitive dust and pollutant emissions during construction. **LS** | Use BMP's to reduce fugitive dust and pollutant emissions during construction. **LS** | Use BMP's to reduce fugitive dust and pollutant emissions during construction. **LS** |
| Permanent Effects | An Air Quality Attainment Plan for the air basin has been developed to regulate air emissions although overall emissions are expected to increase. | Air quality would be improved in the long term with the restoration of habitat and the reduction of the amount of agriculture related emissions. **B** | Air quality would be improved in the long term with the restoration of habitat (1,600 acres) and the reduction of the amount of agriculture related emissions. **B** | Air quality would be improved in the long term with the restoration of habitat (1,500 acres) and the reduction of the amount of agriculture related emissions. **B** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Transportation** | | | | |
| Temporary Effects | Not applicable. | Construction activities would generate additional traffic and potential disruptions due to construction-related detours. Increased truck | Construction activities would generate additional traffic and potential disruptions due to construction-related | Construction activities would generate additional traffic and potential disruptions due to construction-related |

| Resource | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| | | traffic may adversely affect safety and roadway conditions. **S** | detours. Increased truck traffic may adversely affect safety and roadway conditions. **S** | detours. Increased truck traffic may adversely affect safety and roadway conditions. **S** |
| Mitigation | Not applicable. | An access management plan would be prepared and implemented prior to initiation of construction. **LS** | An access management plan would be prepared and implemented prior to initiation of construction. **LS** | An access management plan would be prepared and implemented prior to initiation of construction. **LS** |
| Permanent Effects | More roads and other transportation infrastructure is expected and traffic is expected to increase. | Transportation on Highway 32 would benefit from increased flood protection. **B** | Transportation on Highway 32 would benefit from increased flood protection. **B** | Transportation on Highway 32 would benefit from increased flood protection. **B** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Special Status Species** | | | | |
| Temporary Effects | Conversion of one crop to another or agriculture to urban uses may affect special status species. | 1. Yellow-billed cuckoo, bank swallow, and Swainson's hawk may experience temporary disturbance and/or displacement due to construction. **S** 2. Anadromous fish may be subject to short-term exposure to increased turbidity during construction. **S** | 1. Yellow-billed cuckoo, bank swallow, and Swainson's hawk may experience temporary disturbance and/or displacement due to construction. **S** 2. Anadromous fish may be subject to short-term exposure to increased turbidity during construction. **S** | 1. Yellow-billed cuckoo, bank swallow, and Swainson's hawk may experience temporary disturbance and/or displacement due to construction. **S**<br>2. Anadromous fish may be subject to short-term exposure to increased turbidity during construction. **S** |
| Mitigation | Not applicable. | 1. Surveys would be conducted prior to construction to determine presence or absence of special status species in the project area and specific avoidance and minimization measures (BMPs) would be implemented, if necessary. **LS** 2. BMP's to minimize turbidity effects to fish would be implemented. **LS** | 1. Surveys would be conducted prior to construction to determine presence or absence of special status species in the project area and specific avoidance and minimization measures (BMPs) would be implemented, if necessary. **LS**<br>2. BMP's to minimize turbidity effects to fish would be implemented. **LS** | 1. Surveys would be conducted prior to construction to determine presence or absence of special status species in the project area and specific avoidance and minimization measures (BMPs) would be implemented, if necessary. **LS**<br>2. BMP's to minimize turbidity effects to fish would be implemented. **LS** |
| Permanent Effects | Compliance with Federal and State ESA could slow negative impacts of urban development on special status species. | 1. Anadromous fish would be adversely affected by placement of rock in bank habitat. Increased access to the floodplain would increase the risk of stranding. **S** 2. The quantity and variety of special status species, in particular the anadromous fish, valley elderberry longhorn beetle, Swainson's hawk, and western yellow-billed cuckoo, are expected to increase as a result of the restoration. **B** | 1. Anadromous fish would be adversely affected by placement of rock in bank habitat. Increased access to the floodplain would increase the risk of stranding. **S** 2. The quantity and variety of special status species, in particular the anadromous fish, valley elderberry longhorn beetle, Swainson's hawk, and western yellow-billed cuckoo, are expected to increase as a result of the restoration. **B** | 1. Anadromous fish would be adversely affected by placement of rock in bank habitat. Increased access to the floodplain would increase the risk of stranding. **S**<br>2. The quantity and variety of special status species, in particular the anadromous fish, valley elderberry longhorn beetle, Swainson's hawk, and western yellow-billed cuckoo, are expected to increase as a result of the restoration. **B** |

| Resource | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| Mitigation | Not applicable. | 1. Improved access to floodplain habitat and aquatic habitat improvements due to restoration would more than offset any adverse effects. **B**<br>2. No mitigation required; but elderberry shrub plantings (3,146 bushes) would be included in the planting plan to benefit the VELB. **B** | 1. Improved access to floodplain habitat and aquatic habitat improvements due to restoration would more than offset any adverse effects. **B**<br>2. No mitigation required; but elderberry shrub plantings (3,223 bushes) would be included in the planting plan to benefit the VELB. **B** | 1. Improved access to floodplain habitat and aquatic habitat improvements due to restoration would more than offset any adverse effects. **B**<br>2. No mitigation required; but elderberry shrub plantings (3,357 bushes) would be included in the planting plan to benefit the VELB. **B** |

[1]Levels of significance are provided before and after mitigation for each effect.
[2]NE = No effect.
B = Beneficial effect.
LS = Less-than-significant effect.
S = Significant effect.

## ESTIMATED COST AND COST SHARING

The estimated total project first cost $44,876,000. First costs were allocated by project purpose in the preliminary cost allocation process presented in Chapter 3. Alternative Plans, Table S-3 breaks down this cost by primary project element and feature. The total amount allocated to the flood damage reduction project purpose is $4,266,000. The total amount allocated to the ecosystem restoration project purpose is $40,440,000. Cultural Resource Preservation costs of $170,000 will be added as part of the Federal costs. A summary of cost sharing responsibilities is presented in Table S-4.

## AREAS OF CONTROVERSY OR UNRESOLVED ISSUES

There is one area of controversy associated with this project. There are no unresolved issues.

### Agricultural Prime and Unique Farmlands

An area of potential controversy is associated with effects of the potential project from converting farmland. The California Department of Conservation recommended that the California Agricultural Land Evaluation and Site Assessment (LESA) model be used to evaluate potential effects for the recommended plan. The LESA model is an optional methodology that can be utilized in a CEQA assessment to ensure that significant effects on the environment of agricultural land conversions are quantitatively and consistently considered in the environmental review process (Section 21095, Public Resource Code). This model was applied experimentally for this project. Preliminary application of the model indicated that conversion of the lands would constitute a significant adverse effect. A closer look was then taken at the use of the LESA model as an impact assessment tool for ecosystem restoration projects. The fundamental premise of the LESA model is that a change in the use of important farmland may be a significant effect on the environment. In fact, habitat restoration projects provide a benefit to soils. The model was found to be an inadequate

application for assessing the potential effects of ecosystem restoration projects and was subsequently not used.

**TABLE S-3: ECONOMIC COSTS AND BENEFITS OF RECOMMENDED PLAN[1] ($1,000)**

| Item | FDR | | Ecosystem | | Total Costs | |
|---|---|---|---|---|---|---|
| | Allocated Costs | Benefits | Allocated Costs | Benefits | Allocated Costs | Benefits |
| Investment Cost | | | | | | |
| First Cost[2] | 4,260 | | 40,446 | | 44,706 | |
| Interest During Construction | 271[4] | | 3,066[5] | | 3,337[5] | |
| Total | 4,531 | | 43,512 | | 48,043 | |
| Annual Cost | | | | | | |
| Interest and Amortization | 272 | | 2,615 | | 2,887 | |
| OMRR&R[3] | 47[6] | | 8 | | 55 | |
| Subtotal | 319 | | 2,623 | | 2,942 | |
| Annual Benefits | | | | | | |
| Monetary (FDR) | | 577 | | | | 577 |
| Non-monetary (Ecosystem) | | | | 888 AAHU's | | 888 AAHU's |
| Net Annual FDR Benefits | | 258 | | | | 258 |
| FDR Benefit-Cost Ratio | | 1.8 to 1 | | | | 1.8 to 1 |

[1]Based on October 2003 price levels, 5 5/8 percent rate of interest, and a 50-year period of analysis.
[2]Excludes Cultural Resource Preservation.
[3] Operation, Maintenance, Repair, Replacement, and Rehabilitation
[4] Two year period of construction assumed for J levee removal and construction of setback levee
[5] Three year period construction assumed for overall project
[6] Excludes environmental O&M costs.

**TABLE S-4: SUMMARY OF COST SHARING RESPONSIBILITIES RECOMMENDED PLAN[1] ($1,000)**

| Project Purpose | Federal | Non-Federal |
|---|---|---|
| Ecosystem Restoration | 26,286 | 14,154 |
| Flood Damage Reduction | 2,773 | 1,493 |
| Cultural Resource Preservation | 170 | |
| Total | 29,229 | 15,647 |
| Breakdown of Non-Federal | | |
| LERRDs | | 13,910 |
| Cash | | 1,737 |
| Total | | 15,647 |

[1] Based on October 2003 price levels, 5 5/8 percent rate of interest, and a 50-year period of analysis and preliminary cost allocation presented in Chapter 3.

The California Departments of Conservation and Food and Agriculture maintain that the LESA model is an appropriate tool for measuring potential effects for the project. The Reclamation Board is the non-Federal sponsor for the project and the State California

Environmental Quality Act lead agency. As such, The Reclamation Board staff has coordinated with the departments of Conservation and Food and Agriculture, as well as with the departments of Fish and Game and Water Resources, the California Bay-Delta Authority, and the State Attorney General's office to ensure that all aspects of this debate were considered prior to determining the applicability of the LESA model

**Physical Effect**

The Reclamation Board has determined, with input from other State agencies, that the LESA model was not an appropriate tool to measure the potential effects from the conversion of agricultural land for ecosystem restoration projects.

The basis of significance for conversion of prime and unique farmlands was determined to be that an alternative would be considered to have a significant effect if it would result in an irretrievable conversion of a substantial acreage of farmland. An irretrievable conversion was considered to be one that would involve the conversion to land uses that would cause serious degradation of the quality of soils and/or result in expenditures of substantial development costs that would likely preclude the practicality of future conversion back to agriculture. It has been concluded that conversion for ecosystem restoration would not degrade soils but improve them and, acknowledging that the project would be intended to continue in perpetuity, that expenditures would not be of a magnitude that would preclude future conversion back to agriculture if future policies and priorities indicated this would be in the public interest. Table S-5 shows the environmental effect of alternative plans on prime and unique farmlands as considered in Chapter 5. It has been determined that the recommended plan would not result in a significant impact to prime and unique farmlands.

**TABLE S-5: EFFECTS TO AGRICULTURAL/PRIME AND UNIQUE FARMLANDS FROM COMBINED ALTERNATIVE PLANS**

| Consideration | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| Temporary Effects | Not applicable. | Not applicable. **LS** | Not applicable. **LS** | Not applicable. **LS** |
| Mitigation | Not applicable. | No mitigation required. **LS** | No mitigation required. **LS** | No mitigation required. **LS** |
| Permanent Effects | Conversion of agricultural land to urban uses will continue. | Conversion of 1300 acres of farmland would not be an irretrievable effect. Some farmlands would benefit from improved flood protection. Acreage in Williamson Act contracts is 283 acres plus 100.7 acres in Farmland Security Zone contracts. **LS** | Conversion of 1600 acres of farmland would not be an irretrievable effect. Some farmlands would benefit from improved flood protection. Acreage in Williamson Act contracts is 472 acres plus 100.7 acres in Farmland Security Zone contracts. **LS** | Conversion of 1500 acres of farmland would not be an irretrievable effect. Some farmlands would benefit from improved flood protection. Acreage in Williamson Act contracts is 472 acres plus 100.7 acres in Farmland Security Zone contracts. **LS** |
| Mitigation | Not applicable. | The project will be in compliance with the CALFED ROD requirements for conversion of agricultural lands to restoration. **LS** | The project will be in compliance with the CALFED ROD requirements for conversion of agricultural lands to restoration. **LS** | The project will be in compliance with the CALFED ROD requirements for conversion of agricultural lands to restoration. **LS** |

**Economic Effects**

Another concern related to the conversion of farmlands pertains to the economy. Some farm-related jobs would be lost as a result of this conversion. Conversely, implementation of the recommended plan is expected to increase jobs related to maintenance of the setback levee and native habitat. A requirement of the project is that the non-Federal sponsor assumes responsibility to operate and maintain the project. It is anticipated that the responsibility would be turned over to a local entity. The community of Hamilton City is currently working on developing a new levee maintenance district that could potentially generate jobs. The project would also significantly enhance regional recreation currently being developed by the State Department of Parks and Recreation in coordination with Glenn County. Additionally, the benefits of the recommended plan exceed the costs of constructing it.

**Important Considerations**

As part of considering the issue of converting prime and unique farmlands, it is important to understand the effects the Sacramento River has on existing agricultural lands in the study area. The study area is within the Red Bluff to Chico Landing reach of the Sacramento River, which the SRCAF Handbook (SRCAF, 2000 (rev.)) describes as the most erosion and flood prone land along the Sacramento River. Figure S-2 shows recent erosion in the study area. A comparison of land use shows that orchards are planted most closely to the river channel along the more stable reaches and that riparian habitat has developed along the unstable reaches (SRCAF, 2000 (rev.), page 4-8). Specific to the study area, the rate of channel movement is high in the very northern portion of the study area and also south of Dunning Slough. Agricultural lands in those areas are currently subject to seepage, erosion, flooding and scouring flood flows and would continue to be so without a project. Figure S-3 shows recent flooding to lands south of Dunning Slough. The area north of the Gianella Bridge (Highway 32) south to Dunning Slough has had very little channel movement recorded in the last one hundred years and adjacent lands have not been subject to the same forces.

**Figure S-2: Bank Erosion on the Sacramento River in the Study Area**

The SRCAF Handbook also states that this reach has the greatest potential for the re-establishment of a functioning riparian ecosystem. "*Protection of land within the inner river zone guidelines, either through landowner participation in voluntary programs or through purchase of these properties or easements by the proposed nonprofit management entity or cooperating public agencies, should receive top priority.*" (SRCAF, 2000 (rev.), page 4-14). Currently a majority of the land that would be restored as part of the potential project is in conservation ownership. Most of the lands that would be required for the recommended plan are owned and managed by TNC and were purchased from willing sellers. Figure S-4 shows the location of the study area within the SRCAF Inner River Zone and Conservation Area.

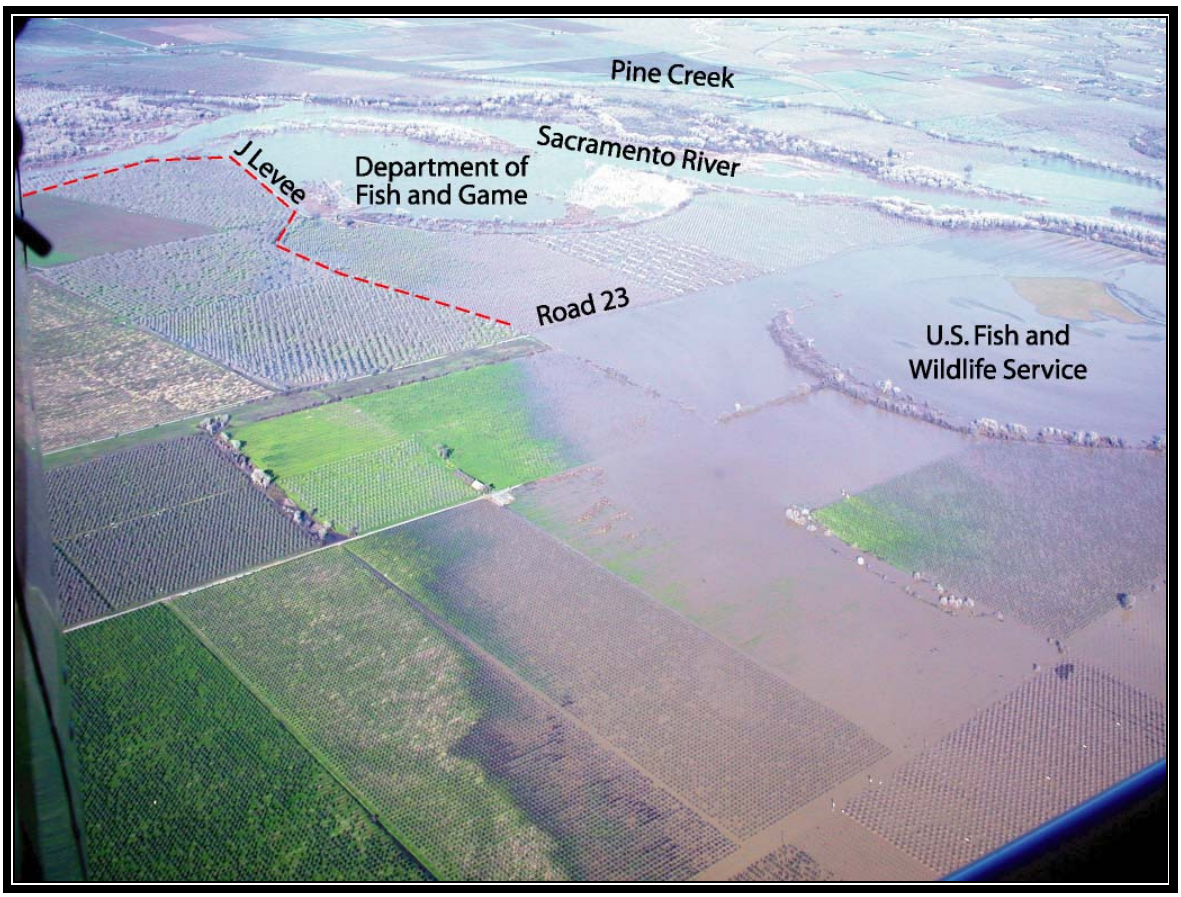



**Figure S-3: Flooding in Southern End of Study Area, February 2004.**

The recommended plan considers these factors. The recommended plan setback levee alignment would be setback from the river in areas where agricultural lands have been problematic to farm and would be set closer to the river in more stable reaches. Some landowners have already sold lands that have been problematic to farm. They retained ownership of lands located further from the river with the goal of reinvesting in their other farming operations. Construction of the recommended plan would benefit remaining agricultural lands that would be landside of a setback levee. Widening the floodplain would also affect timing and frequency of flooding in the region, benefiting other agricultural lands. South of Dunning Slough, the new setback levee would remove orchards from the floodway of the Sacramento River, which would reduce the amount of agricultural damages sustained during large flood events. The new setback levee would provide a wider floodway and reduce the flood risk of areas on the landside of the new setback levee. The new setback levee would provide improved flood protection for farmland on the landside of the setback levee largely through a reduction in scouring flood flows. These lands would continue to experience backwater flooding as they do currently, but the frequency of this flooding would be reduced.

The recommended plan would contribute to the goal of the CALFED Bay-Delta Authority and the Sacramento River Conservation Area Forum (SRCAF) by restoring

approximately 1,500 acres (up to 10 percent of the SRCAF goal of 15,000 additional acres of riparian habitat from Red Bluff to Colusa).

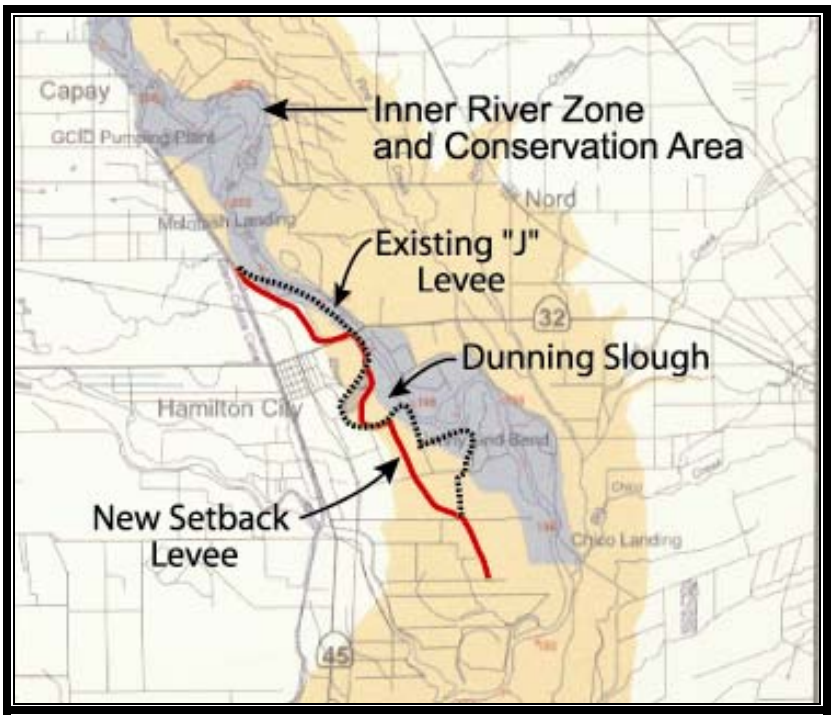



**Figure S-4: SRCAF Inner River Zone and Conservation Area near Hamilton City**

## MAJOR CONCLUSIONS

The preliminary recommendation of the District Engineer of the Sacramento District, U.S. Army Corps of Engineers is that the recommended plan be authorized for implementation as a Federal project. The estimated first cost of the recommended plan is $44,876,000 and the estimated annual OMRR&R cost is $55,000 (October 2003 price levels). The Federal portion of the estimated first cost is $29,229,000. The estimated fully funded Federal first cost, based on projected inflation rates specified by Corps budget guidance, is $31,310,000.

The non-Federal sponsor portion of the estimated first cost is $15,647,000. The non-Federal sponsor shall agree to provide all lands, easements, rights-of-way, relocations, and suitable borrow and disposal areas. The non-Federal sponsor shall also assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project. The non-Federal sponsor shall publicize floodplain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to ensure compatibility between future development and protection levels provided by the project.

# CHAPTER 1 – STUDY INFORMATION

## 1.1 PURPOSE AND NEED FOR THE PROJECT AND REPORT*

The community of Hamilton City relies on the existing "J" levee to contain flows in the Sacramento River. The "J" levee does not meet Corps or any other levee construction standards and could fail at river levels well below the top of the levee. Native habitat and natural river function in the study area have been degraded by construction of the "J" levee and conversion of the floodplain to agriculture and rural development. The purposes of a project for the Hamilton City area are to reduce flood damage and to restore the ecosystem.

This report presents the findings of the Hamilton City Flood Damage Reduction and Ecosystem Restoration, California, Feasibility Study (Feasibility Study). The purpose of the Feasibility Study is to determine if there is a Federal interest[1] in providing flood damage reduction and ecosystem restoration improvements in and around Hamilton City, California. This report integrates plan formulation with documentation of environmental effects. This report is also an Environmental Impact Statement/Environmental Impact Report (EIS/EIR). It serves to satisfy documentation requirements of the National Environmental Policy Act (NEPA) of 1969, as amended, and the requirements of the California Environmental Quality Act (CEQA). The report describes the flooding, ecosystem, and other related water resource problems and opportunities in the Hamilton City area and expresses desired changes as planning objectives. Alternative plans are then presented to achieve these objectives. These alternative plans include a plan of no action and various combinations of individual management measures[2]. The economic, social, and environmental effects of the alternative plans are described and a feasible plan is selected for recommendation. The report also presents details on the U.S. Army Corps of Engineers (Corps) and non-Federal sponsor (State of California) participation needed to implement the selected plan. The report concludes with a recommendation for authorization.

## 1.2 STUDY AUTHORITY

The Hamilton City Flood Damage Reduction and Ecosystem Restoration, California, Feasibility Study is part of the Sacramento and San Joaquin River Basins Comprehensive Study (Comprehensive Study) initiated by the Corps and The Reclamation Board of the State of California (The Reclamation Board) in 1998. The Comprehensive Study was authorized in the 1998 Energy and Water Development Appropriations Act, Public Law (PL) 105-62. The U.S. House of Representatives Report 105-190, which accompanied the 1998 act, directed the Corps to conduct a comprehensive assessment of the flood management system for the Sacramento and San Joaquin River Basins.

> ***Sacramento River and San Joaquin River Basins Comprehensive Study, California.*** *– In response to the devastating floods of 1997, the Committee has added funds and directs the Corps of Engineers to conduct a comprehensive assessment of the entire flood control*

[1] A project is said to be in the **Federal interest** if it is consistent with the mission of the Corps of Engineers and the project benefits are in excess of the project costs.

[2] A **management measure** is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives.

> *system within the existing study authorizations of the Sacramento River Watershed Management Plan (authorized by the Flood Control Act of 1962) and the San Joaquin River and Tributaries authority (authorized by 1964 Resolution of the House Committee on Public Works). These comprehensive investigations will include . . . development and formulation of comprehensive plans for flood control and environmental restoration purposes . . ..*

The Hamilton City area was identified early in the Comprehensive Study as a potentially feasible site for a multipurpose flood damage reduction and ecosystem restoration project consistent with the overall objectives of the Comprehensive Study. Preliminary evaluation of the problems and potential solutions in the Hamilton City area led to the initiation of this site-specific feasibility study.

The U. S. House Report 108-357, which is the Conference Report accompanying the Energy and Water Development Appropriations Act, 2004, P.L. 108-137, urged the Secretary of the Army to include in the study an area extending from 2 miles due north to four miles due south of State Highway 32, and extending at least 1.2 miles due south of County Road 23. The language also states that the study should incorporate locally preferred options that provide protection to agricultural lands and residential properties. The study area includes this specified area and considered locally developed features.

## 1.3 STUDY LOCATION

Hamilton City is located along the west bank of the Sacramento River in Glenn County, California, about 85 miles north of the City of Sacramento.

## 1.4 STUDY SPONSOR AND PARTICIPANTS

The Corps initiated the Feasibility Study at the request of The Reclamation Board, the non-Federal sponsor for the study. The Corps and The Reclamation Board are the lead agencies in the Feasibility Study and shared the cost of the study equally. The Reclamation Board received a State of California grant from the CALFED Bay-Delta Authority to help fund the non-Federal share of the study cost. This project has been developed to be consistent with the CALFED Record of Decision (ROD) (2000).

The local partners in the Feasibility Study include the Hamilton City Community Services District, the Hamilton City Citizens in Action, Glenn County, and The Nature Conservancy (TNC). Numerous other agencies, organizations, and individuals participated in the study including local landowners and residents, Glenn-Colusa Irrigation District, neighboring Butte County, California Department of Transportation, California Department of Fish and Game, California Department of Parks and Recreation, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration (NOAA Fisheries) , U.S. Environmental Protection Agency, Sacramento River Partners, and Sacramento River Preservation Trust. The Sacramento River Conservation Area Forum (SRCAF) helped to facilitate open discussion between all interests. Additional information on public involvement in the study is included in Chapter 6 – Public Involvement, Review and Consultation.

Chapter 6, Public Involvement, Review and Consultation, describes the concerns expressed during the public involvement process and how those concerns have been addressed during the study.

## 1.5 HISTORY OF HAMILTON CITY INVESTIGATIONS

In January 1974, high water in the Sacramento River induced flooding in portions of Hamilton City and the surrounding agricultural areas. In response to the flooding, Glenn County requested an investigation of "the Hamilton City flood problem." The Corps produced a reconnaissance report in March 1975 that recommended a setback levee be constructed. The study concluded that there was likely a positive benefit-to-cost ratio, although it never progressed to the feasibility study phase due to lack of local support.

In February 1986, floodwaters reached near the crown of the levee northeast of Hamilton City and residents of the town were evacuated. Flood fighting efforts prevented flows from overtopping the levee. A Section 205 Reconnaissance Investigation[3] was initiated in response to a letter from the Glenn County Board of Supervisors. The Corps produced a reconnaissance report in January 1991 that concluded that there was no Federal interest in participating in further studies for a flood control project because a cost-effective project could not be developed. (Similar studies conducted at different points in time could have different findings, based on construction costs and possible monetary benefits of the day.)

In March 1996, a feasibility study was initiated under Section 205 at the direction of Congress. A marginally cost-effective alternative was developed that consisted of building a setback levee along the existing railroad embankment continuing around the east side of Hamilton City and tying into the existing levee near Dunning Slough.

**Figure 1-1: Emergency crews flood fighting the existing "J" levee.**

Concurrently, the January 1997 flood prompted the initiation of the Comprehensive Study to investigate opportunities to improve the flood management system for the two river basins while also restoring the degraded river ecosystems. Figure 1-1 shows flood fighting of the existing "J" levee. It was recognized that a potential multipurpose project could be developed in the Hamilton City area as part of the Comprehensive Study to demonstrate how a project could reduce flood damages and restore the ecosystem simultaneously. Preliminary analyses determined there was a likely Federal interest in such a project.

In November 2002, The Reclamation Board, as the non-Federal sponsor, with funding from the CALFED Bay-Delta Authority, and the Corps continued a site-specific multi purpose feasibility investigation for the Hamilton City area and work on the Section 205 study was

[3] Section 205 is the Corps' small flood control project continuing authority program authorized by Congress in Section 205 of the Flood Control Act of 1948, as amended.

suspended. The cost of the feasibility study was shared equally between the Corps and the non-Federal sponsor. This report presents the results of the feasibility investigation.

## 1.6 EXISTING PROGRAMS, STUDIES, AND PROJECTS

There are several ongoing water resources related programs, projects, and studies that could affect flooding and ecosystem conditions in the Sacramento River basin and, specifically, in the Hamilton City area. Those efforts that pertain directly to this feasibility study are summarized here.

### 1.6.1 Programs

CALFED Bay-Delta Program (CALFED). CALFED was established in May 1995 as a cooperative effort among the State and Federal agencies that handle management and regulatory responsibilities in the Sacramento and San Joaquin River Delta. CALFED's mission is to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta. In July 2003, the State of California formalized the cooperative effort by creating the CALFED Bay-Delta Authority, a State agency responsible for overseeing implementation of the Bay-Delta Program. The Hamilton City study area is located within the Red Bluff to Chico Landing Reach of the Sacramento River as described in CALFED's Draft Ecosystem Restoration Program Plan[4]. This plan identifies an action to "protect, enhance and restore the meander belt between Red Bluff and Chico Landing."

Central Valley Project Improvement Act (CVPIA). The Central Valley Project (CVP) was authorized by Congress in 1937 as a multipurpose development to store and transfer surplus water primarily from the Sacramento and Trinity River basins to the water-deficient lands of the San Joaquin River and Tulare Lake Basins. The project is operated by the U.S. Bureau of Reclamation (USBR). The CVPIA amended previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic water supply uses, and fish and wildlife enhancement having an equal priority with power generation. The CVPIA gives first priority to measures that protect and restore natural channel and riparian habitat values through habitat restoration actions (CVPIA amendment b (1)(A)). USBR, in partnership with other agencies, used CVPIA funds to complete an upgrade of the fish screen at the Glenn-Colusa Irrigation District pumping facility located near the northern end of the study area.

Federal Emergency Management Agency (FEMA), Flood Mitigation Assistance Program and the Hazard Mitigation Grant Program. These programs seek to reduce or eliminate the loss of life and property damage resulting from natural and human-caused hazards. In order to qualify for these programs, a community must be enrolled in the National Flood Insurance Program (NFIP) and have a Flood Mitigation Plan approved by the FEMA Regional Director. This plan must include a description of the existing flood hazard and identification of the flood risk including estimates of the number and type of structures at risk, repetitive loss properties, and the extent of flood depth and damage potential. A project must be cost-effective, not costing more than the

[4] CALFED Bay-Delta Program, Final programmatic EIS/EIR, July 2000, Ecosystem Restoration Program Plan

anticipated value of the reduction in both direct damages and subsequent negative impacts to the area if future flooding were to occur, computed on a net present value basis. Applicants for these programs must compete for the funding. Glenn County is enrolled in the National Flood Insurance Program (NFIP), which includes Hamilton City as an unincorporated area of the county.

Sacramento River Conservation Area Forum (SRCAF). Passed by the State Legislature in 1986, Senate Bill 1086 called for a management plan for the Sacramento River and its tributaries that would protect, restore, and enhance both fisheries and riparian habitat. The law established an Advisory Council, composed of representatives of State and Federal agencies, county supervisors, and representatives of landowners, water contractors, commercial and sport fisheries, and general wildlife and conservation interests. This group produced the Upper Sacramento River Fisheries and Riparian Management Plan in 1989. Many of the fisheries actions were rapidly implemented. The Riparian Habitat Committee of the Advisory Council was created in 1993 to ensure that riparian habitat management along the Sacramento River addresses the dynamics of the riparian ecosystem and the reality of the local agricultural economy. The Riparian Habitat Committee prepared a handbook in 1998 (revised January 2002) to describe its goals to preserve remaining riparian habitat and to reestablish a continuous riparian ecosystem along the river, and the principles and management guidelines to achieve these goals. SRCAF has been established with a Board composed of representatives from the seven counties and landowners adjacent to the Sacramento River in the Conservation Area. This organization acts as a clearinghouse for projects affecting the Conservation Area and as a forum for information sharing and problem solving.

Designated Floodway Program. The Reclamation Board administers the Designated Floodway Program, which addresses land use management within the floodway. This program provides a nonstructural way to keep development from encroaching into flood-prone areas. It also reduces future potential flood damages by preserving the reasonable flood passage capacities of natural watercourses. The Reclamation Board controls the Designated Floodway Program by adopting floodway boundaries, developing plans for modifications of boundaries, and approving changes in acceptable use and types of structures within the floodways. The area between Hamilton City and the Sacramento River, including the existing "J" levee, is within the designated floodway. This designation stipulates that levees damaged by 50 percent or more must be removed.

### 1.6.2 Projects

The Nature Conservancy, Sacramento River Project. The long-term goal for TNC's Sacramento River Project is to establish and sustain a healthy floodplain ecosystem with functioning natural, political, social and economic processes to support the diversity of natural communities and native species along the Sacramento River. Over the past decade, TNC and its partners have secured over 15,000 acres for conservation within the 100-year floodplain of the Sacramento River and restored 2,200 of those acres to native riparian vegetation.

U.S. Fish and Wildlife Service (USFWS). Sacramento River National Wildlife Refuge.

The Sacramento River National Wildlife Refuge is one of six wildlife refuges in the USFWS Sacramento Wildlife Refuge Complex. The complex consists of a land acquisition and habitat restoration program that covers about 35,500 acres. Additional acres held in easements expand the complex to 59,000 acres in the Sacramento Valley. In 1989, Congress authorized the Sacramento River National Refuge as part of this complex. To date, USFWS has acquired slightly more than 14,000 of the 18,000 initially approved. The remaining lands will be purchased from willing sellers as funds are appropriated and as public disclosure in accordance with the National Environmental Policy Act (NEPA) is completed for each incremental expansion. The USFWS owns lands within and adjacent to the study area that are included the Sacramento River Nation Wildlife Refuge.

Sacramento River Floodplain Acquisition and Monitoring. TNC, the California Wildlife Conservation Board, California Department of Fish and Game (DFG), and the USFWS have requested funds for the acquisition and management of fee title or permanent conservation easement interests on floodplain lands within the conservation area of the Sacramento River between Keswick Dam and Verona. A floodplain restoration-monitoring program will be developed to enhance existing monitoring programs. The acquisitions will facilitate the recovery of ecological processes within the floodplain, including the regeneration of native riparian habitat. Ten thousand acres is the long-term goal for acquisition and restoration. Currently the reserve has acquired approximately 1,800 acres.

Shasta Dam. Shasta Dam and Lake, completed in 1945, are components of a multipurpose project built by the USBR and operated for flood management by the Corps. Constructed on the Sacramento River downstream from its confluence with the Pit River, 10 miles north of the City of Redding, the dam is a concrete gravity structure 487 feet high above the streambed and 3,500 feet long. Shasta Lake has a capacity of 4,552,100 acre-feet and a flood management reservation of 1,300,000 acre-feet. Keswick Dam is about 9 miles downstream from Shasta Dam and provides reregulation for Sacramento River flow releases. Shasta Dam provides flood protection to nearby communities and agricultural land downstream along the Sacramento River. Shasta Dam is operated for an objective release of 79,000 cubic feet per second (cfs) at Redding.

Black Butte Dam. Black Butte Dam is owned, operated and maintained by the Corps and is on Stony Creek, a westside tributary of the Sacramento River. Constructed in 1963, it consists of an earthfill dam 140 feet high above the streambed and 5,975 feet long, including six auxiliary earthfill dikes. Black Butte Lake has a capacity of 136,200 acre-feet and provides the entire capacity as flood management space reservation during the winter months. The specific flood management objectives of Black Butte Dam are to protect Hamilton City, the City of Orland, Interstate 5, and 64,000 acres of agricultural areas along Stony Creek from rain floods.

Sacramento River Flood Control Project, California. Congress directed the California Debris Commission in 1910 to prepare a flood management plan for the Sacramento River system. The proposal incorporated the leveed bypass concept, which became the basis of the present project. This major project was authorized by the 1917 Flood Control Act and was sponsored by The Reclamation Board. The Sacramento River

Flood Control Project consists of a comprehensive system of 1,000 miles of levees, 5 major overflow weirs, 2 sets of outfall gates, 3 major drainage pumping plants, 95 miles of bypass floodways, overbank floodway areas, and channel enlargement in the lower reach of the Sacramento River. The levees constructed during this project are known as "project levees". The project levees begin just south of Hamilton City near Chico Landing (see Figure 2-1). Details of the existing flood protection at Hamilton City may be found in Section 2.1.

Sacramento River Flood Control Project, Glenn-Colusa Irrigation District Fish Screen Improvement Project, California. Flood flows in the Sacramento River have altered the river channel and lowered the water surface at the Glenn-Colusa Irrigation Hamilton City pumping plant. Changing conditions cause significant adverse impacts to river stability, water supply and anadromous fishery resources in the area. The project includes a gradient facility, which includes use of multiple sheet piles coupled with stone to replicate a natural riffle in the river to restore river hydraulic gradient to appropriate pre-1970 conditions. The Glenn-Colusa Irrigation District, the Corps, and USBR and the State of California are implementing fish screen project to build new screens near the Glenn-Colusa Irrigation District plant.

Sacramento River Bank Protection Project, California. The Sacramento River Bank Protection Project (SRBPP) is a continuing construction project of the Corps and The Reclamation Board to repair and protect levees from erosion. Phase I was authorized in 1960 to preserve the integrity of the Sacramento River Flood Control Project's levee system. The levee system protects over 1 million acres, 2.2 million people, and $37 billion of property. Construction of the First Phase began in June 1965. Phase II of construction was authorized in 1974 and the remaining bank protection sites are located along the Sacramento River downstream from river mile 194 at Chico Landing, and along the Sacramento River tributaries and distributaries. Congressional authorization is needed for Phase III.

Sacramento River, Chico Landing to Red Bluff, California. Congress authorized the Sacramento River, Chico Landing to Red Bluff Project in 1958 as an extension and modification of the Sacramento River Flood Control Project to help stabilize the main river channel, to alleviate bank erosion, and to reduce downstream maintenance dredging. Continued construction was authorized in 1976, however, no additional bank protection has been placed under this authority since 1985, primarily for environmental reasons. The Reclamation Board is the non-Federal sponsor.

Sacramento River Major and Minor Tributaries. This project was initially authorized by the 1944 and 1950 Flood Control acts and first funded in 1948. It supplements the Sacramento River Flood Control Project in providing flood protection to all major cities along the river system and to 880,000 acres of prime agricultural land. The Reclamation Board is the sponsor of this project that provided for levee construction and channel modifications on the Sacramento River from Colusa to Chico Landing and on lower reaches of its tributaries.

### 1.6.3 Studies

Corps of Engineers. Hamilton City, California, Small Flood Control Project, Detailed Project Report. The Corps, The Reclamation Board, Glenn County, and the Hamilton

City Community Service District undertook a study under the authority of Section 205 of the Flood Control Act of 1948. The Corps initiated a feasibility-level study and in 1997 determined that there is potential Federal interest in implementing a small flood control project in the Hamilton City area. This study has been suspended and the information developed under the Section 205 study is incorporated in this feasibility study.

Corps of Engineers. Central Valley River Basins Enhanced Flood Response and Emergency Preparedness. The Corps and The Reclamation Board are studying as part of the Comprehensive Study. A plan to increase the effectiveness of the existing flood response and emergency preparedness system to warn residents of the Central Valley of impending flooding from the Sacramento and San Joaquin Rivers and their tributaries. The study has investigated flood warning system problems and opportunities; a measures evaluation; a description and comparison of alternatives; and an evaluation of the potential environmental effects of these alternatives. In addition, the document includes mitigation measures and performance standards to ensure that any potential effects on the environment identified during future site selection for flow and rain gages will be mitigated to a less than significant level.

The Nature Conservancy. Hydrologic and Hydraulic Model for the Sacramento River from Glenn-Colusa Irrigation District (GCID) to Princeton Incorporating Existing Butte Basin Model. Prepared By Ayres and Associates. This model was completed in 2002 and will be used in coordination with models prepared by the Corps in the development of this feasibility study.

The Bureau of Reclamation and Department of Water Resources. North-of-the-Delta Offstream Storage Investigations. Storing water in offstream reservoirs during high flow periods provides opportunities to increase water storage in an environmentally sensitive manner. The stored water is then made available for beneficial uses at times when conflicts over available supplies are most pronounced, such as during droughts. The North-of-the-Delta Offstream Storage Investigation has focused on four potential projects on the west side of the Sacramento Valley, including the Red Bank Project, Newville Reservoir, Colusa Reservoir, and Sites Reservoir. The Draft Feasibility Study and EIS/EIR are scheduled for completion in June 2005.

The Nature Conservancy, Floodplain Reconnection/Limited Channel Meander Investigation. TNC has completed a two-dimensional (2D) hydraulic model to (1) evaluate the potential flood damage reduction and ecosystem restoration benefits of a setback levee somewhere southwest of the existing levee, and (2) potentially remove the private levees within and around the USFWS Pine Creek Unit. Potential ecosystem restoration strategies would result in the reconnection of about 2,500 acres of floodplain for floodwater and debris storage and reestablishment of channel migration within a 3-mile-long reach of the channel. In addition, flood damage reduction benefits experienced by Hamilton City residents will be quantified through the modeling analysis. The first phase of the analysis includes building and calibrating a 2D model of existing conditions with all levees in place, reflecting current land uses and their respective roughness values. The second phase is running the model to reflect potential riparian restoration, a setback levee somewhere southwest of the existing levee, and removal of private levees on the USFWS Pine Creek Unit. The third

phase involves a preliminary setback levee design including a foundation investigation and flow net seepage analysis.

The Nature Conservancy. Riparian Recruitment Pilot Study. Cottonwoods (Populus species) are a keystone riparian species, and river regulation often results in a decrease in seedling recruitment. TNC, in partnership with California Department of Water Resources, has completed a draft pilot project to evaluate the current status of cottonwood recruitment with respect to the present altered flow regime of the Sacramento River. The pilot study involves topographic surveys across the floodplain, the development of site-specific stage discharge relations, and a dendrochronological analysis of existing stands of cottonwood forest. The pilot study is based on a model of cottonwood recruitment that has met with success on other rivers where river managers have mimicked some aspects of the flow regime that are critical to cottonwood recruitment. The successful natural recruitment of cottonwood seedlings serves as an indicator of ecosystem function. Successful cottonwood recruitment integrates many natural river processes, including a more natural flow regime; limited channel meander; creation of quality habitat for riparian species, accretion of new floodplain; and, at a longer temporal scale, the production of large woody debris serving critical habitat function for migrating Chinook salmon.

The Nature Conservancy. Integrating Floodplain Management. Various ongoing studies will be combined at the subreach scale to develop an integrated approach to floodplain management in this area. This may include integration of multi-agency ownership and policy (such as public access) the determination of the highest and best use for multiple parcels in the area, and locations of compatible agriculture and how to implement compatible agriculture in conjunction with restoration.

The Nature Conservancy. Restoration/Planning Proposal. TNC has submitted a restoration/planning proposal the to CVPIA Anadromous Fish Restoration Program. The proposal would fund the planning and restoration of one parcel at the confluence of the Sacramento River and Big Chico Creek as a demonstration of parcel-specific planning within the subreach-planning context. This proposal is not currently funded.

The Nature Conservancy. Sacramento River Public Recreation Access Study: Red Bluff to Colusa. This report was prepared by EDAW Consulting for the Nature Conservancy's Sacramento River Project. One of the goals of this study was to recommend future public recreation access opportunities and programs within the 100-mile long study area along the Sacramento River. The study identified that the area would benefit from increased facilities and amenities such as trails, picnicking, camping, improved boat ramps, and signage to anticipate the expected substantial population growth within the study area. The study also addresses increased coordination among land managers, law enforcement, and resource agencies with regard to recreation opportunities and public health and safety.

The Nature Conservancy. Socioeconomic Assessment of Proposed Habitat Restoration within the Riparian Corridor of the Sacramento River Conservation Area. This report was prepared by Jones and Stokes Associates with technical support from TWC Economics and Ayres & Associates for The Nature Conservancy's Sacramento River Project in March 2003. This document provides information regarding the social and

economic consequences that could result from the conversion of agricultural land along the river into a riparian corridor. The analysis is intended to describe possible future conditions on the basis of a number of broad assumptions, and to serve as a tool for those entities involved in habitat restoration programs along the Sacramento River. The document includes the potential socioeconomic consequences for recreation by creating the riparian corridor.

Numerous other prior studies and reports have valuable background information for the Feasibility Study. These studies and reports are listed in Chapter 12 references.

## 1.7 PLANNING PROCESS AND REPORT ORGANIZATION

The planning process consists of six major steps: (1) Specification of water and related land resources problems and opportunities; (2) Inventory, forecast and analysis of water and related land resources conditions within the study area; (3) of alternative plans; (4) Evaluation of the effects of the alternative plans; (5) Comparison of the alternative plans; and (6) Selection of the recommended plan based upon the comparison of the alternative plans.

This report documents the study process. It also serves as the environmental document for compliance with the NEPA and the CEQA. The chapter headings and order in this report generally follow the outline of an EIS. The report chapters relate to the six steps of the planning process as follows:

- The second chapter of this report, Need for and Objectives of Action, covers the first step in the planning process (Specification of water and related land resources problems and opportunities).
- The third chapter of this report, Alternative Plans, is the heart of the report and is therefore placed before the more detailed discussions of resources and effects. It covers the third step in the planning process (Formulation of alternative plans), the fifth step in the planning process (Comparison of alternative plans), and the sixth step of the planning process (Selection of the recommended plan based upon the comparison of the alternative plans).
- The fourth chapter of this report, Affected Environment, covers the second step of the planning process (Inventory, forecast and analysis of water and related land resources in the study area).
- And, the fifth chapter of this report, Environmental Consequences, covers the fourth step of the planning process (Evaluation of the effects of the alternative plans).
- The remaining chapters of the report discuss public involvement, review, and consultation (Chapter 6); list the report preparers (Chapter 7); describe compliance with applicable laws, policies, and plans (Chapter 8); present a description of the recommended plan (Chapter 9); and present the study recommendation (Chapter 10); a list of references (Chapter 11); and, a list of recipients of the March 2004 draft feasibility report/EIS/EIR (chapter 12). A list of acronyms and abbreviations and a glossary of terms precede Chapter 1. An index is at the end of the report.

# CHAPTER 2 – NEED FOR AND OBJECTIVES OF ACTION

## 2.1 STUDY AREA DESCRIPTION

Hamilton City is in Glenn County, California, along the west bank of the Sacramento River, about 85 miles north of the City of Sacramento (Figure 2-1 – Regional Map). The study area includes Hamilton City and the surrounding rural area (Figure 2-2 – Study Area Map). The study area is bounded by the Sacramento River to the east and the Glenn Colusa Canal to the west and extends about two miles north and six miles south of Hamilton City.[1]

Hamilton City has a population of about 2,000. Surrounding land use is agricultural with fruit and nut orchards being the primary crops. State Highway 32, an important transportation corridor, runs in an east-west direction through town and connects with Interstate 5 to the west and State Highway 99 and the City of Chico to the east. A Union Pacific Railroad spur line also provides service to the town. An abandoned sugar plant (Holly Sugar) is to the south of Hamilton City. A fertilizer company currently uses a small portion of the plant. The wastewater treatment facility for the community is located within Dunning Slough east of town. The Irvine Finch River Access, a California Department of Parks and Recreation facility, is located on west bank of the Sacramento River, immediately south of Highway 32.

An existing private levee, constructed by landowners in about 1904 and known as the "J" levee, provides some flood protection to the town and surrounding area (Figure 2-3). The "J" levee is not constructed to any formal engineering standards and is largely made of silty sand. It is extremely susceptible to erosion. Flood fighting is often necessary to prevent levee failure and flooding when river levels rise. Since the construction of Shasta Dam in 1945, flooding in Hamilton City due to failure of the "J" levee has occurred once, in 1974. In addition, extensive flood fighting has been necessary to avoid levee failure and flooding in 1983, 1986, 1995, 1997, and 1998. Currently, the Sacramento River is actively eroding into the toe of the "J" levee at the northern end of the study area. Glenn County built a backup levee, about 1,000 feet in length, to protect the community in the event the toe erosion causes failure at the northern end of the "J" levee. The southern end of the "J" levee does not tie into high ground and backwater can flood agricultural lands behind (west of) the "J" levee.

Native habitat and natural river function in the study area have been altered by construction of the "J" levee and conversion of the floodplain to agriculture and rural development. Hardening of the riverbank and levee in several locations through the years (typically with rock) has constrained the ability of the river to meander. Conversion of the floodplain to agriculture and rural development has reduced native habitat to remnant patches along the river and in historic oxbows. These ecosystem alterations greatly diminish the abundance, richness, and complexity of riparian and other floodplain habitat in the study area and the species dependent upon that habitat.

[1]The study area includes the area specified in the U. S. House Report 108-357, (Conference Report accompanying the Energy and Water Development Appropriations Act, 2004, P.L. 108-137) which urged the Secretary of the Army to include in the study an area extending from 2 miles due north to 4 miles due south of State Highway 32, and extending at least 1.2 miles due south of County Road 23.

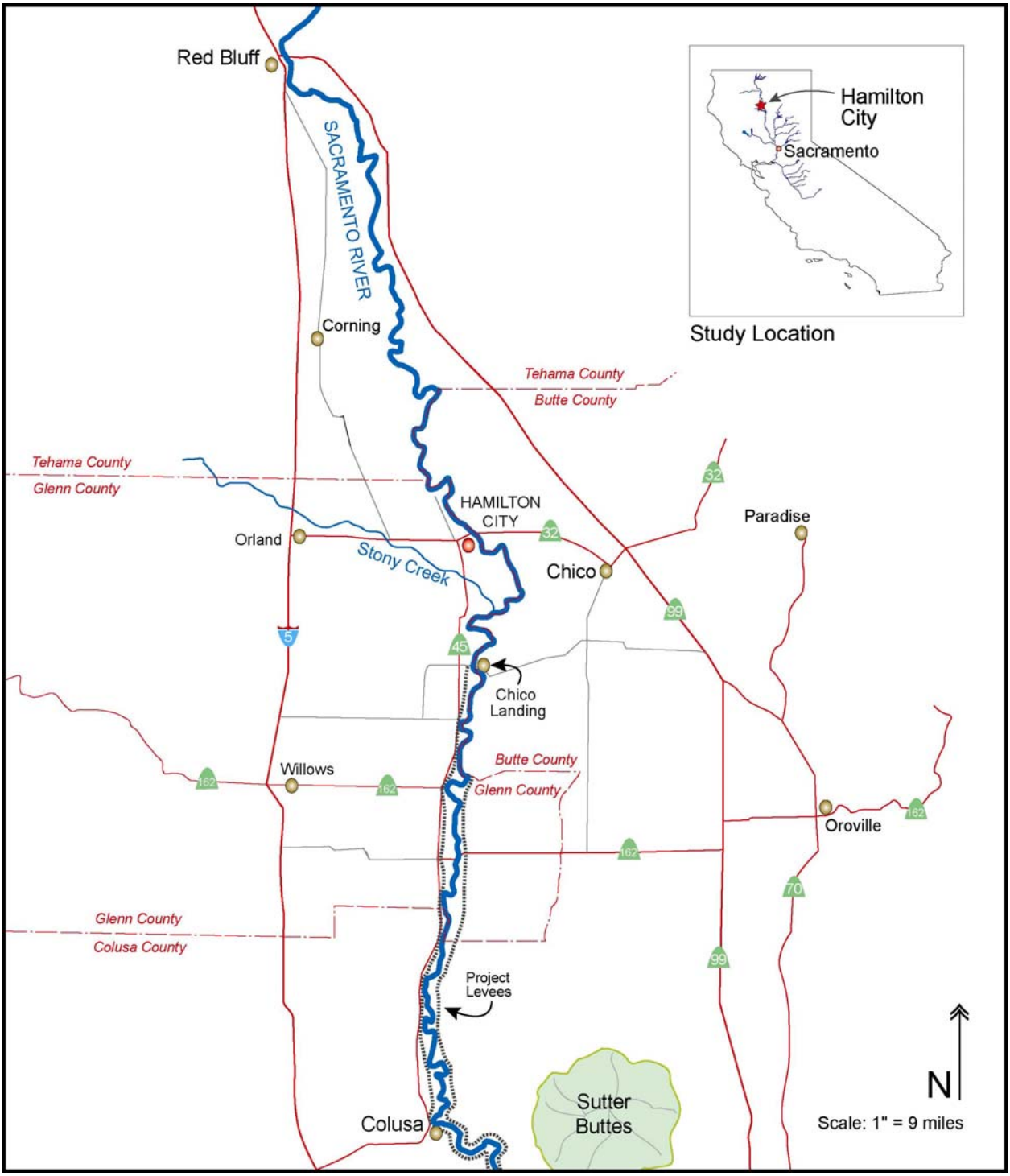



**Figure 2-1: Regional Map**

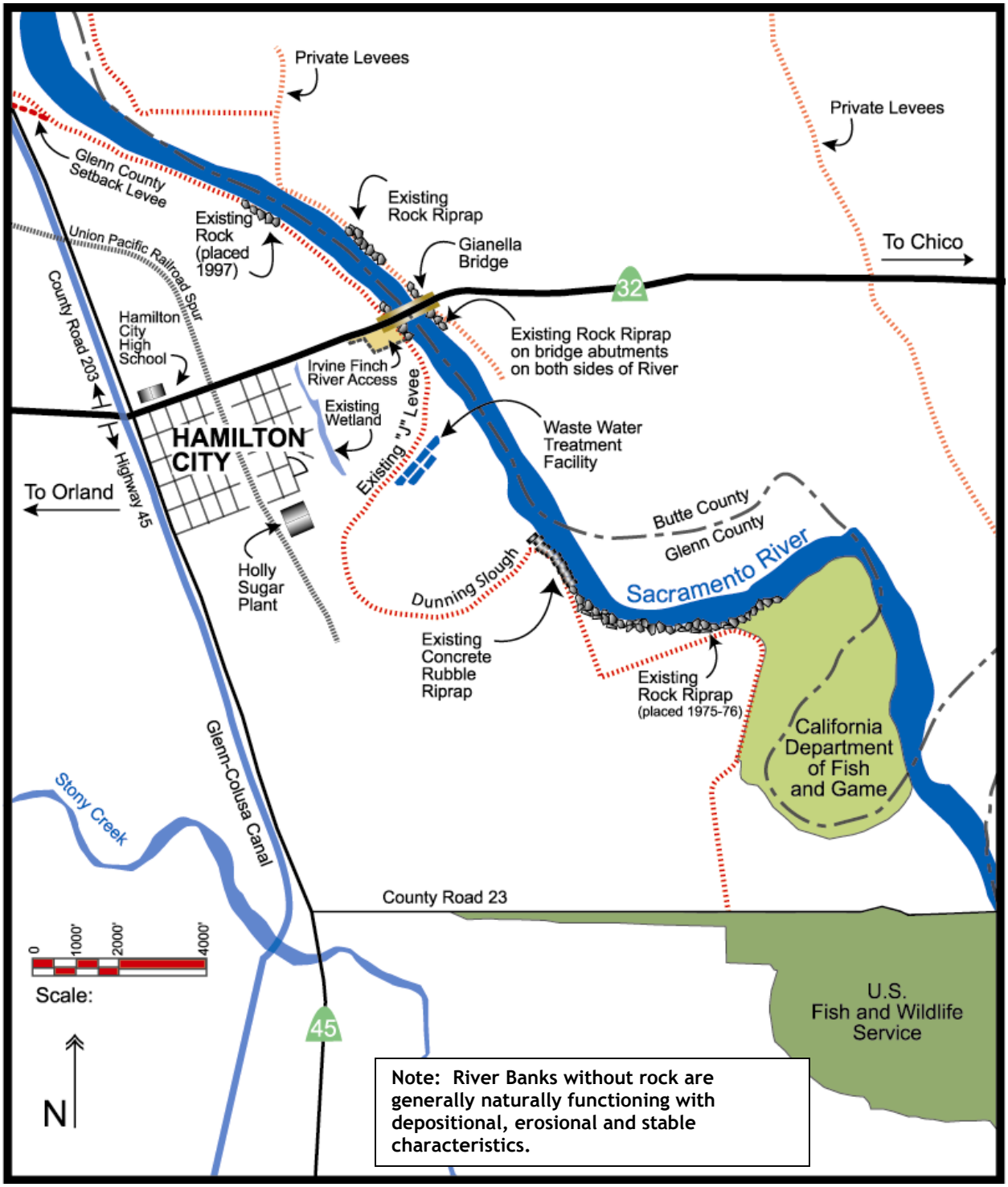



**Figure 2-2: Study Area Map**

Land ownership in the study area is a mix of public and private ownership. Much of the land in the study area along the Sacramento River is in conservation ownership, as shown in Figure 2-4. The California Department of Fish and Game (DFG) owns a large parcel of land known as the Pine Creek Unit located on either side of the Sacramento River in both Glenn and Butte Counties. The USFWS owns three parcels adjacent to the study area: one just north of the existing "J" levee in an area that is actively eroding, another across the River from Dunning Slough (known as the Pine Creek Unit) and the third just south of County Road 23 (known as the Capay Unit). The DFG and USFWS lands have been restored, or are proposed to be restored in the future. These parcels are not included in this project. TNC owns land north of Highway 32 between the Sacramento River and the Union Pacific Railroad tracks. TNC also owns land south of Hamilton City between Dunning Slough and County Road 23. The TNC land on the west side of the Sacramento River is the focus of the ecosystem restoration planning for this study.

**Figure 2-3: The "J" levee north of Hamilton City**

## 2.2 FEDERAL AND NON-FEDERAL OBJECTIVES

The Federal (Corps) and non-Federal sponsor (The Reclamation Board) objectives for water resources implementation studies establish the overall goals for the feasibility study. The specific objectives for this feasibility study were derived from the identification of the study problems and opportunities and are discussed in Section 2.3.

The Federal objective[2] of water and related land resources planning is to contribute to National Economic Development (NED) consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net economic benefits that accrue in the planning area and the rest of the nation.

The Corps has added a second national objective for ecosystem restoration in response to legislation and administration policy. This objective is to contribute to the nation's ecosystems (or National Ecosystem Restoration – NER) by restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Contributions to NER are increases in ecosystem value and productivity and are measured in non-monetary units such as acres or linear feet of habitat, average annual habitat units, or increased species number or diversity.

The CALFED Bay Delta Authority (CALFED), a funding partner for the study, has ecosystem restoration objectives that partner well with the national NER objectives stated

[2] The Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, established by the U.S. Water Resources Council on March 10, 1983, define the Federal objective for water resources implementation studies.

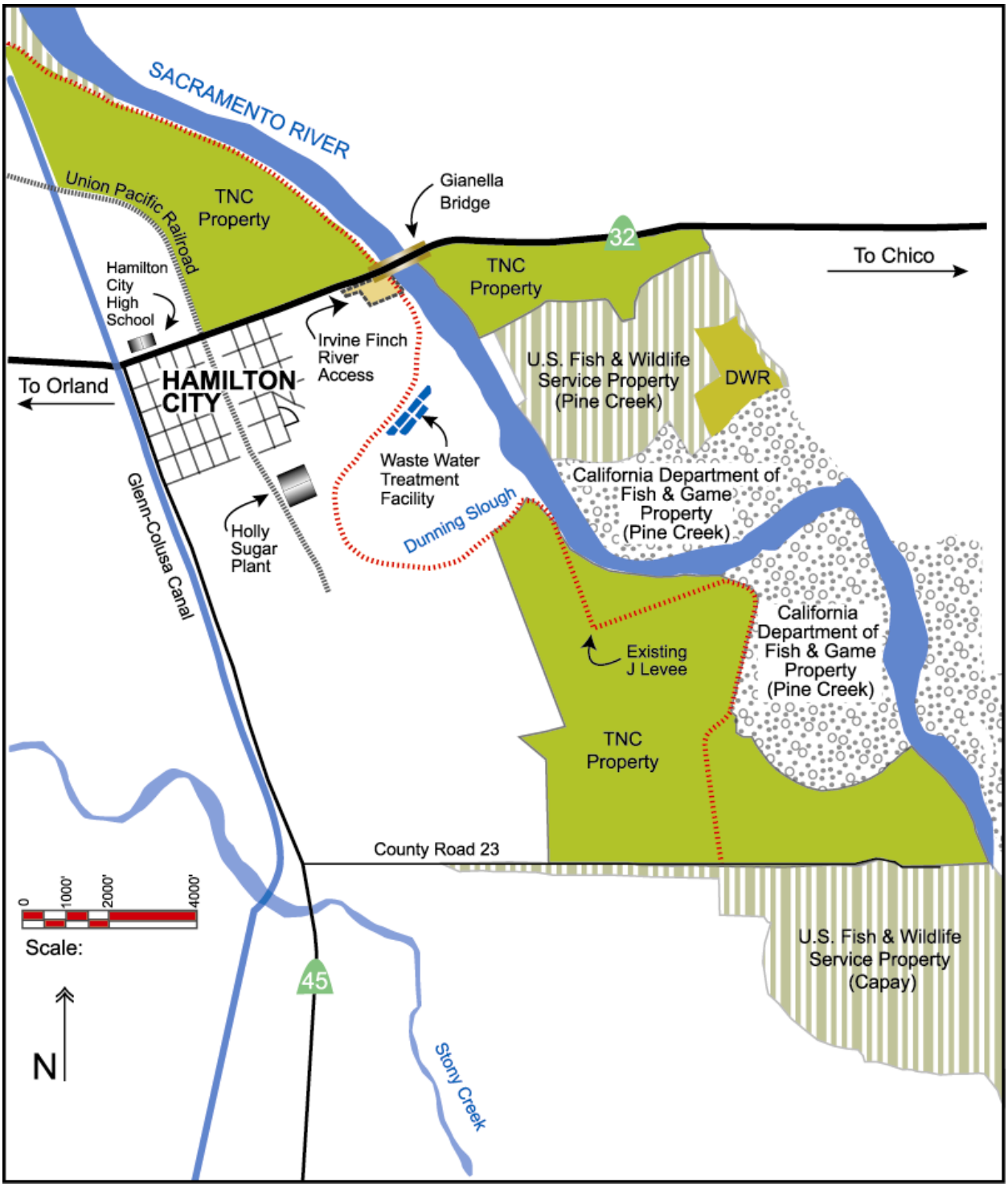



**Figure 2-4: Conservation Ownership Map**

above. CALFED's general goals for ecosystem restoration are to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species. Specifically, CALFED aims to protect, enhance and restore the meander belt of the Sacramento River within the reach that includes the Hamilton City area. The Reclamation Board, as the non-Federal sponsor, has flood protection objectives similar to the national NED objectives, but recognizes the benefits of the ecosystem restoration goals and believes they can be implemented while maintaining the integrity of the flood control system.

## 2.3 PROBLEMS AND OPPORTUNITIES

A problem is an existing undesirable condition to be changed. An opportunity is a chance to create a future condition that is desirable. Within the context of solving the problems, opportunities contribute to the overall beneficial outcome of the project. The difference between problems and opportunities is often indistinct, but in both cases a changed future condition is preferred. The purpose of this feasibility study is to develop an implementable and acceptable plan to change the future condition and address specific water and related land resources problems and opportunities in the Hamilton City area.

Problems and opportunities to be addressed were identified in several ways. The study team reviewed previous studies by the Corps, The Reclamation Board, TNC, and others to identify flooding and water resource related environmental problems. Public workshops and several brainstorming meetings were held to help define the existing conditions and identify problems and opportunities. Participants in these meetings included:

- Butte County Public Works Department
- California Department of Fish and Game
- California Department of Parks and Recreation
- California Department of Transportation (Caltrans)
- Glenn-Colusa Irrigation District
- Glenn County Public Works Department
- Hamilton City Community Services District
- Hamilton City Citizens In Action
- Local landowners and residents
- National Oceanic and Atmospheric Administration (NOAA) Fisheries
- Sacramento River Conservation Area Forum
- Sacramento River Partners
- Sacramento River Preservation Trust
- The Nature Conservancy
- U.S. Fish and Wildlife Service

Understanding of the problems and opportunities was further refined through analyses conducted during the Feasibility Study. The problems and opportunities addressed in the feasibility study are defined in the following sections.

### 2.3.1 Flooding and Ecosystem Problems

**PROBLEM: Flooding threatens public safety in and around the community of Hamilton City.**

The primary risk (highest probability) of flooding to Hamilton City is from upstream unregulated tributary streams along the Sacramento River between Shasta Dam and Hamilton City. Runoff from these streams can cause the Sacramento River water level to rise and break through or overtop the "J" levee. Extremely large storm events in the upper Sacramento River watershed result in high release flows from Shasta Dam, which could cause flooding in the Hamilton City area. Similarly, large storm events in the Stony Creek watershed can result in high release flows from Black Butte Dam, causing flooding in the Hamilton City area. In both cases, however, the probability of flooding due to dam releases is relatively low compared to the risk from the unregulated tributaries. The community relies on the "J" levee to contain flows in the Sacramento River. The "J" levee does not meet Corps or any other levee construction standards and could fail at river levels well below the top of the levee.

The estimated risk of failure[3] in any year, neglecting the effect of flood fighting, is about 12 percent. That is, in every year there is about a 1 in 8 chance the "J" levee will fail without flood fighting. Over the next 25 years, the estimated risk of the levee failing at least once is about 95 percent. Although it is difficult to assess the risk of failure with flood fighting because of the uncertainties associated with a flood fight such as resource requirements and availability, weather conditions and hydraulic conditions, such an analysis was performed and is described in Appendixes A (Plan Formulation) and E (Economics).

The threat to public safety includes exposure to flood waters, accidents during evacuation, and accidents during flood fighting. Over the past twenty years, flood fighting has been required to prevent flooding in 1983, 1986, 1995, 1997, and 1998. Over that same period, the community was evacuated six times: 1983, 1986, twice in 1995, 1997, and 1998.

**PROBLEM: Hamilton City and surrounding agricultural lands incur damages from flooding.**

Flooding in and around Hamilton City can cause significant economic damages. To estimate the amount of damages, floodplains[4] were developed based on analysis of runoff volumes, river flows and stages, and topography. Figures 2-5 and 2-6 show floodplains for the 50 percent, 10 percent, 4 percent, 2 percent, 1 percent, 0.2 percent, and 0.5 percent chance exceedence events; that is, floodplains associated with flows in the Sacramento River that have a 50 percent, 10 percent, 4 percent, 2 percent, 1 percent, 0.5 percent, and 0.2 percent chance of occurring or being exceeded in any year, respectively. The floodplains are based on several simplifying assumptions, including that the "J" levee is ineffective in preventing flooding (fails or

[3] Levee failure refers to either physical failure (such as erosion, seepage, or slope instability) or overtopping
[4] **Floodplain:** The portion of a river valley that has historically been inundated by a river during floods. Computer models predict how water moves through the floodplain, calculates its depth, and estimates the extent of flooding.

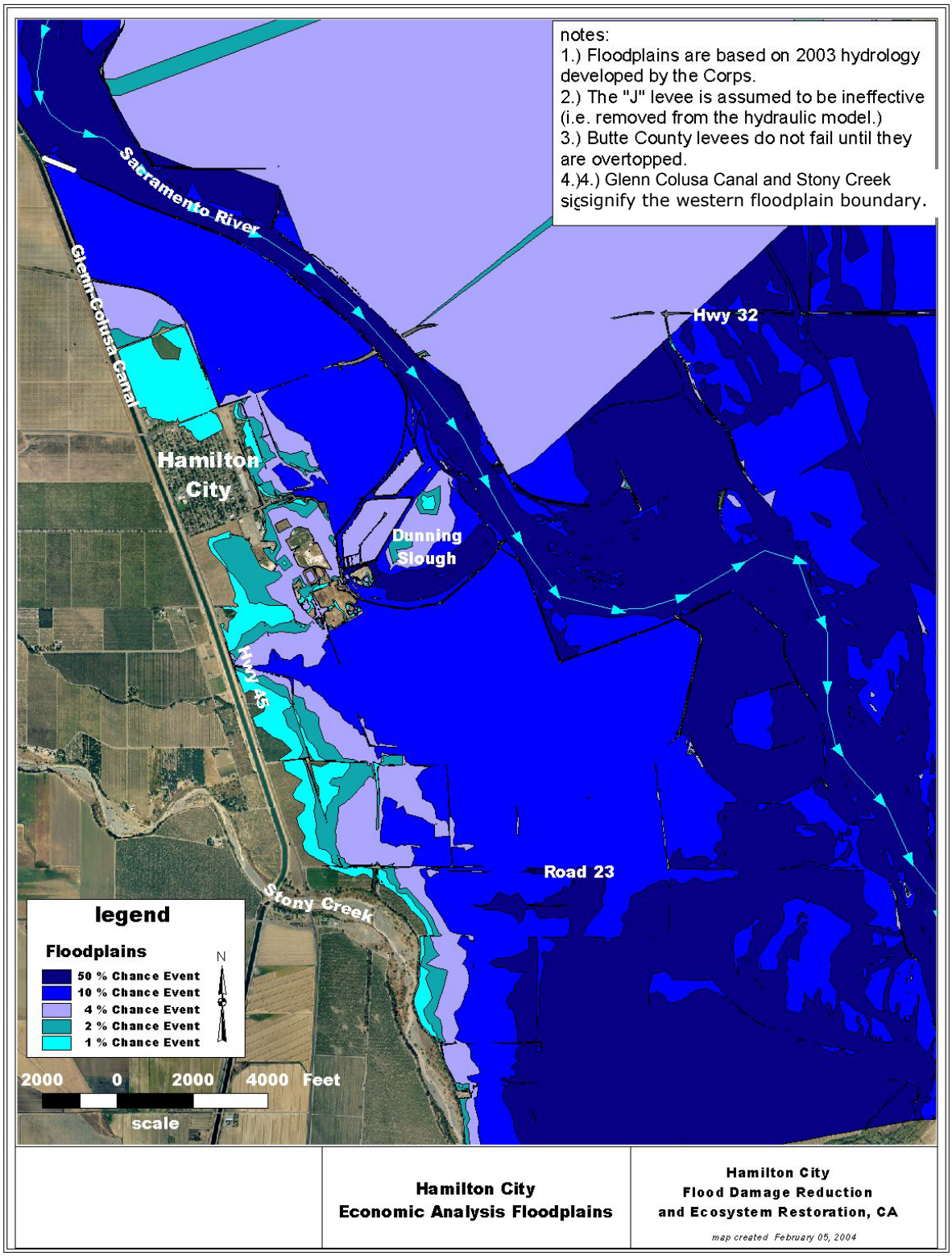



**Figure 2-5: Hamilton City Economic Analysis Floodplains, 50% to 1% Chance Events**

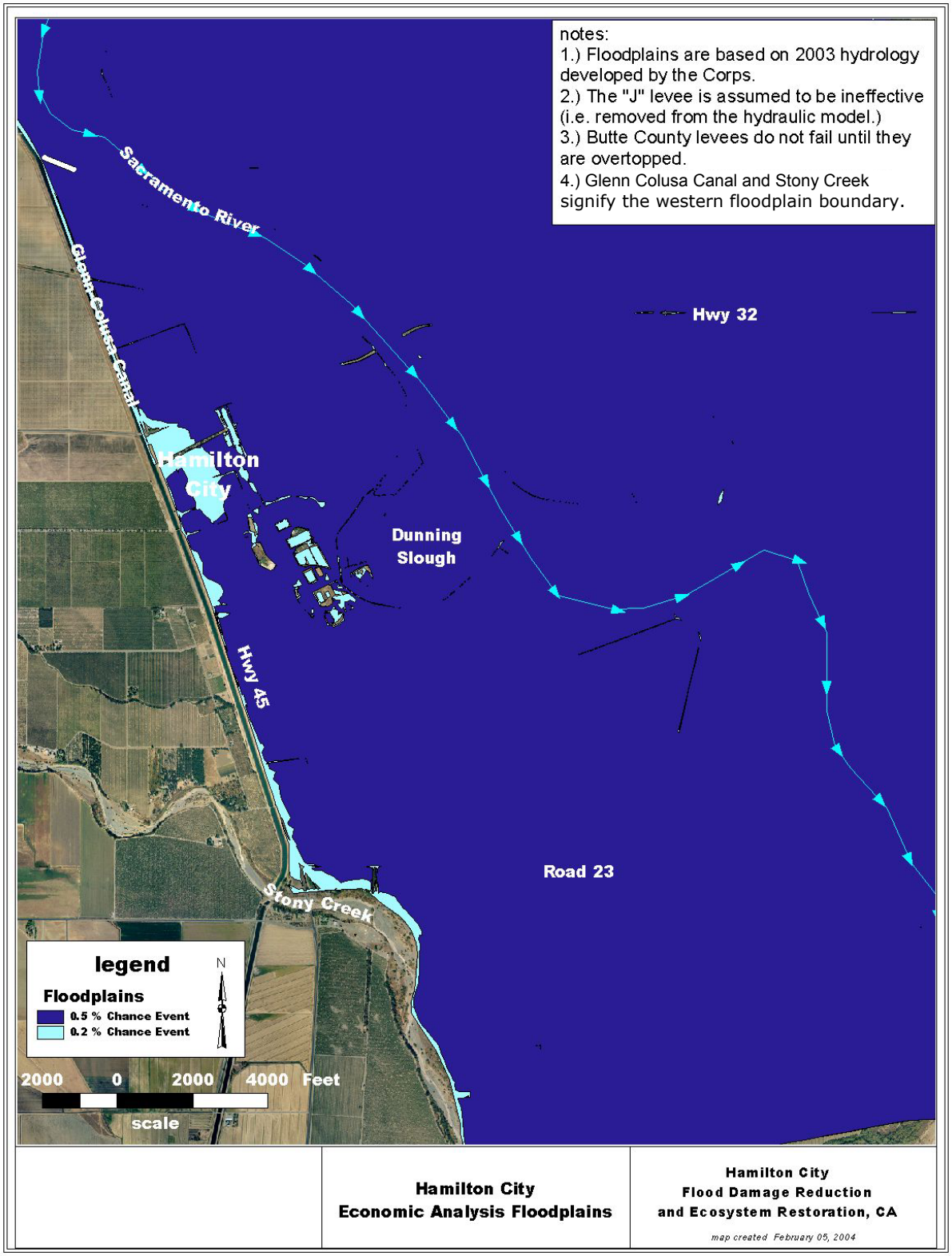



**Figure 2-6: Hamilton City Economic Analysis Floodplains, 0.5% to 0.2% Chance Events**

is overtopped). Floodplains provide a representative view of the areas at risk from flooding and are useful for economic analysis of expected flood damages.

The floodplains illustrate that flooding would be most frequent in the eastern portions of the town and on agricultural lands. In town, flood depths up to 10 feet, depending on the ground elevations and magnitude of the flood. To the north and south of town, the river could flood agricultural lands at depths up to 15 feet.

Property subject to damages in the various floodplains was inventoried and analyzed for expected annual damages. Damages considered in the analysis include flood damages to both structures and contents of residential, commercial, industrial, and public facilities; flood damages to crops; flood damages to automobiles and roads, emergency response costs, and clean up costs. Using the estimated damages for each floodplain and considering the risk of the "J" levee failing or being overtopped, the expected annual flood damages were estimated for the study area. The expected annual damages for the future without-project condition[5] are about $750,000.

**PROBLEM: The Sacramento River is prevented from meandering**.

**Figure 2-7: The Gianella Bridge (Highway 32) over the Sacramento River**

A primary problem of the riverine ecosystem in the study area is the loss of the river's natural function to erode its banks and migrate through its floodplain. In the region, the Chico Landing to Red Bluff Project placed bank protection at 29 sites totaling approximately 86,915 feet (16.5 miles). Sites are situated primarily at outer bends of meanders in the river. In the study area, confinement of the river by levees (about 42,200 linear feet (lf) on the west bank, 31,700 lf on the east bank), bank protection[6] (about 7,000 lf remaining on the west bank and 6,500 lf remaining on the east bank), and channel stabilization at Gianella Bridge have limited erosion and deposition of sediment and the formation of essential riverine and riparian habitats (see Figure 2-2 for levee and bank protection locations; Figure 2-7 shows Gianella Bridge). Bank revetment protection and channel stabilization have prevented the development of large cutbanks, shaded riverine aquatic (SRA) cover and mid-channel gravel bars. Bank swallow, a State listed threatened species, are dependent on vertical cutbanks for colony establishment. Stabilization of the banks has reduced or eliminated the supply or sediment, causing the channel to typically narrow or deepen.

Meander processes contribute to the development of diverse riparian ecosystems along the river. The high diversity of riparian plants is thought to be related to, among other

[5] The expected future condition if no project is implemented to address the problems and opportunities.

[6] Bank protection in the study area includes rock riprap placed by the Corps of Engineers' Chico Landing to Red Bluff Project, emergency rock riprap placed by the PL 84-99 program and privately dumped rubble.

factors, the intensity and frequency of floods and small-scale variations in topography and soils as a result of lateral migration of river channels (Corps 2001). The migration capacity of plants along riparian corridors is also an important factor in explaining the high biodiversity observed along stream/river channels (Corps 2001).

The Sacramento River within the study area experiences small movement and sinuosity changes. Riprap was installed between 1974 and 1980 along an approximate 1-mile stretch of the right bank of the river south of Dunning Slough as part of the Sacramento River, Chico Landing to Red Bluff Project.

**PROBLEM: The Sacramento River floodplain is not allowed to flood**.

In the Hamilton City area, private levees protecting agricultural lands and the community have severed the Sacramento River from its historic floodplain. Figure 2-8 shows the existing "J" levee. While this area is not as severely constrained as downstream (where the Sacramento River Flood Control Project levees and bank protection constrain the river), levees in the Hamilton City area do greatly reduce the area subject to relatively frequent, ecologically-significant flooding which reduces the establishment of riparian vegetation and associated components resulting in a reduction in the (1) colonization of woody plants such as cottonwoods and willows, (2) establishment of shaded riverine aquatic (SRA) cover, (3) establishment of large woody debris, and (4) establishment of natural banks, all of which results in a reduction in a variety of aquatic and terrestrial species.

**Figure 2-8: The "J" levee and the Sacramento River near north end of the study area**

The lack of the disturbance pattern from flooding in riparian areas has resulted in a reduction in the natural mosaic of vegetation patterns. River channel dynamics interact closely with the vegetation structure. The hydrologic regime and energy in the riparian corridor mainly determine the early stages of riparian plant development (Corps 2001). Cutting off flooding from the floodplain eliminates habitat complexity created by vegetative layers including various woody species, and reduces wildlife diversity.

Only a small fraction of the unique SRA habitat remains along the Sacramento River. SRA exists in areas along riverbanks where the bank, composed of natural material and riparian vegetation, overhangs or protrudes into the water. These attributes provide a highly productive and complex land-water interface to support an array of fish and wildlife species adapted to this habitat. The USFWS designated SRA cover as a Resource Category 1 under its Mitigation Policy as applied to the Sacramento River Bank Protection Project, which identifies SRA habitat as unique and irreplaceable on a national basis or in the ecoregion of the Central Valley and warrants no existing habitat value loss (USFWS 1981)."

Disconnecting flooding from the historic floodplain eliminates a source of large woody debris. A lack of large woody debris reduces the ability of the river to store inorganic sediment and organic matter, and reduces in-water cover for fish (USFWS 2000). Large pieces of debris generally store more sediment and organic material and smaller woody debris, such as branches, sticks, and twigs which create sieve-like accumulations and efficiently retain leaves (Gregory et al. 1989; Murphy and Meehan 1991 in USFWS 2000). From a biological perspective, large woody debris is required to gain the structural complexity for a functional riverine ecosystem.

Severing the river from its floodplain eliminates the river's ability to create natural banks. Natural banks create a unique zone that provides constant contact between the aquatic and terrestrial portions of the riparian corridor. Elimination of natural banks reduces species diversity and abundance that tend to be greatest at the aquatic and terrestrial habitat interface (USACE 2001).

**PROBLEM: The quantity and quality of riparian and related floodplain habitat and dependent species has been diminished.**

Riparian and related floodplain habitats were once widespread throughout the Sacramento Valley. Lands subject to regular flooding or occasional overflow covered about one-third of the Sacramento Valley in 1880, or about 1 million acres (Thompson, 1961). It is believed that most of these lands supported a mosaic of floodplain habitats in various stages of succession.

Riparian vegetation was widespread throughout the Sacramento River floodplain; dense bands up to 5 miles wide existed along the main stem of the river. Some 1,300,000 acres of riparian forest historically fringed the entire length of the mainstream Sacramento and San Joaquin River channel. Today, less than five percent of the mainstream riparian forest remains. Along most of the Sacramento River and its tributaries, remnants of riparian communities are all that remain of once very productive and extensive riparian areas. However, along the upper reaches of the Sacramento River, more riparian vegetation is still intact. Along the Sacramento River from Keswick (just downstream of Shasta Dam) to Verona (just north of the City of Sacramento) there are approximately 23,000 acres of riparian vegetation. In the reach from Red Bluff to Chico Landing where the study area is located, there are approximately 6,900 acres of riparian vegetation. (SRCAF, 2000)

Narrow and frequently degraded stands of riparian forest remain along levees and old oxbow lakes. There is a lack of habitat continuity along the river. Large reaches of little or low-value habitat separate patches of high-value habitat. This lack of a habitat "corridor" reduces wildlife movement among habitat patches, which reduces dispersal, migration, emigration and immigration of species. Many species have reduced numbers of individuals as well as population viability, both within habitat patches and regionally.

Within the study area, just as throughout the Sacramento River Valley, native habitats have been lost or degraded, negatively affecting those species dependent on the habitat. The floodplain is intensively farmed with walnut, almond, and prune orchards, as well as some row crops. Conversion to agriculture and river confinement

have caused a decline in the health of the riverine ecosystem over the last 150 years to the point that today, the system is no longer able to support sustainable populations of many species. Native species populations have declined and continue to decline throughout the Sacramento River basin. Most species, including threatened and endangered fisheries, passerine bird species, and numerous small mammals depend on the Sacramento River either for the entire, or for part, of their life cycle.

### 2.3.2 Opportunities

**OPPORTUNITY: Increase Valley Elderberry Longhorn Beetle habitat (VELB)**.

Restoring riparian and savannah habitats could include planting of elderberry shrubs, habitat for the Federally-threatened Valley Elderberry Longhorn Beetle.

**OPPORTUNITY: Restore the Ecosystem**

There is an opportunity to accomplish ecosystem restoration in the Hamilton City area because there is less infrastructure near the river than in other, more developed areas, and much of the land adjacent to the Sacramento River is owned by a non-governmental organization, TNC, interested in ecosystem restoration.

**OPPORTUNITY: Reduce risk to public safety and damages due to flooding**

There is an opportunity to reduce the risk to public safety and damages due to flooding in the Hamilton City area.

## 2.4 PLANNING OBJECTIVES

The planning objectives are statements of the study purpose. Planning objectives are more specific than the Federal and non-Federal objectives and reflect the problems and opportunities in the Hamilton City area; an objective is developed to address each of the identified problems and opportunities. Planning objectives represent desired positive changes in the without-project future conditions. The planning objectives for Hamilton City would be attained within the period of analysis for the study, a 50-year timeframe beginning in 2007. All of the objectives focus on activity within the study area.

The planning objectives are:

- Reduce the risk to public safety in the Hamilton City community from flooding.
- Reduce damages due to flooding in Hamilton City and the surrounding area.
- Increase the opportunity for the Sacramento River to meander.
- Increase the extent of overbank and recurrent flooding in the floodplain.
- Increase the quantity and quality of riparian and related floodplain habitat.
- Increase the availability of VELB habitat along the Sacramento River.

In most cases, planning objectives are consistent with one another. In some cases, however, the objectives may seem to conflict, for example, allowing the floodplain to flood and reducing flood damages. There is no actual conflict because in every situation where the floodplain is allowed to flood, damageable property would be removed from the flooded area or flood easements would be purchased to compensate the landowner. The goal of the feasibility study is to develop a range of alternative plans that balance the objectives and avoid conflicts or, where necessary, demonstrate the tradeoffs between conflicting objectives, enabling decisions to be made.

The Federal objective is to maximize net benefits. Because of this, it is not appropriate to identify targets within objectives. For example, no quality target flood frequency, minimum acreage of habitat, or minimum habitat value was ever identified for the project. Rather, the planning process includes formulation of alternative plans to maximize NED and NER benefits relative to costs. The Federal objective to maximize net benefits would supercede any project-specific target output.

## 2.5 PLANNING CONSTRAINTS

A constraint is a restriction that limits the extent of the planning process. It is a statement of things the alternative plans should avoid. Constraints are designed to avoid undesirable changes between without and with-project future conditions. The planning constraints are:

- Comply with all Federal, State, and local laws, regulations and policies.
- Avoid adverse hydraulic effects where they could result in economic damage to others.
- Because future flood events will expand the hydrologic record, there exists a high probability that the level of performance of a project will change. The Reclamation Board staff has required that a project's performance not be greater than a 90 percent chance of passing the 75-year event or less than a 90 percent chance of passing the 125-year event. This will avoid implementing a project that just meets FEMA-level criteria for flood insurance, only to later be redefined as not providing that level of performance, potentially necessitating implementation of further flood control measures to regain the FEMA-level criteria.

There are no other physical, ecological, cultural or social constraints associated with this project.

## 2.6 OTHER PLANNING CONSIDERATIONS

### 2.6.1 Williamson Act, Farmland Security Zone – Contracted Lands

The Williamson Act is a tool that the State of California uses to protect agricultural land by creating an arrangement whereby private landowners contract with counties and cities to voluntarily restrict land to agricultural and open-space uses in exchange for lower property taxes. A Farmland Security Zone is an option within the Williamson Act that is a more restrictive contract than the Williamson Act but offers greater tax savings to landowners. The arrangement is a 10-year contract under the Williamson

Act and a 20-year contract under the Farmland Security Zone designation during which time the restricted parcels are assessed at a lower tax rate. The State of California reimburses the counties for the lost tax revenue. The contract renews automatically each year. In order to terminate the contract, a landowner must file a notice of non-renewal that starts a 9-year process for contract termination for the Williamson Act and a 19-year process for contract termination for land within the Farmland Security Zone.

This contract may be canceled to avoid the 9-year or 19-year termination process, but is subject to a 12-½ percent fee (Williamson Act) or 25 percent fee (Farmland Security zone) based on the assessed value of the property. Cancellations are allowed when the public interest is no longer best served by the contractual restrictions placed on agricultural land, and if there is no other land suitable for the proposed alternative use. (Department of Conservation, 2001)

In the study area, there are currently 6 parcels under Williamson Act contracts totaling 1,577.87 acres. Two of these parcels are owned by TNC, two of these parcels are owned by the USFWS, and two parcels are privately owned. Also in the study area, there are two parcels under Farmland Security Zone Contracts totaling 612.62 acres. Both properties are privately owned.

Lands under Williamson Act and the Farmland Security Zone Act contracts are included as a planning consideration because coordination is necessary in developing planning assumptions, particularly regarding planning constraints, pertaining to timing implementation of restoration and projected benefits and costs.

### 2.6.2 Guiding Principles

A set of basic principles, called Guiding Principles, was developed as part of the Comprehensive Study to ensure that changes to the flood management system integrate flood damage reduction and ecosystem restoration, while considering system-wide implications of those changes. The Guiding Principles were designed in response to the need to (1) promote coordination and partnerships for the public good, (2) reduce or eliminate conflicts, and (3) serve as a guide for modifications to the flood management system. These principles were established and refined through agency coordination and public outreach during the Comprehensive Study to address the wide range of stakeholder concerns to integrate flood damage reduction and ecosystem restoration, and to ensure a system-wide approach in evaluating proposed changes.

Each of the Guiding Principles supports a system-wide approach for project planning. The Sacramento River functions as a hydrologic system, and ecosystem needs are tied to hydrologic processes. Accordingly, one must approach the river as a complete system when considering flood damage reduction and ecosystem restoration objectives. The fact that the river has not been consistently treated as comprehensive system in the past has led to some of the problems that are experienced today. Focusing on flood management within limited reaches without full consideration of hydraulic effects in reaches both upstream and downstream has resulted in modifications to the system that have shifted local problems to other

reaches. Likewise, the cumulative effects of modifications to the system have contributed to a general decline in the health of the ecosystem. The cumulative effects of habitat restoration projects can also reduce flood conveyance. It is important to ensure that the integrity and continuity of the system is maintained and enhanced to allow the river system to function in a manner where flood management and the ecosystem are compatible.

The following Guiding Principles are integral to achieving a system-wide approach to flood damage reduction and ecosystem restoration along the Sacramento River. An expanded description of the Guiding Principles can be found in Appendix A – Supplemental Plan Formulation.

- Recognize that public safety is the primary purpose of the flood management system.
- Promote effective floodplain management.
- Recognize the value of agriculture.
- Avoid hydraulic and hydrologic effects.[7]
- Plan system conveyance capacity that is compatible with all intended uses.
- Provide for sediment continuity.
- Use an ecosystem approach to restore and sustain the health, productivity, and diversity of the floodplain corridors.
- Optimize use of existing facilities.
- Integrate with the CALFED Bay-Delta Program and other programs.
- Promote multi-purpose projects to improve flood management and ecosystem restoration.
- Protect infrastructure.

The Guiding Principles were considered in the formulation, evaluation, and comparison of alternative plans.

### 2.6.3 Environmental Operating Principles

The Corps has reaffirmed its commitment to the environment by formalizing a set of "Environmental Operating Principles" applicable to all its decision-making and programs. These principles foster unity of purpose on environmental issues, reflect a new tone and direction for dialogue on environmental matters, and ensure that employees consider conservation, environmental preservation and restoration in all Corps activities. By implementing these principles, the Corps will continue its efforts to develop the scientific, economic, and sociological measures to judge the effects of its projects on the environment and to seek better ways of achieving environmentally sustainable solutions.

[7] This Guiding Principle refers to avoiding *adverse* hydraulic and hydrologic effects within the study area as well as upstream and downstream.

- Achieve Environmental Sustainability. An environment maintained in a healthy, diverse, and sustainable condition is necessary to support life.
- Consider Environmental Consequences. Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of Corps programs and act accordingly in all appropriate circumstances.
- Seek Balance and Synergy. Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.
- Accept Responsibility. Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that effect human health and welfare and the continued viability of natural systems.
- Mitigate Effects. Seek ways and means to assess and mitigate cumulative effects to the environment; bring systems approaches to the full life cycle of our processes and work.
- Understand the Environment. Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and effects of our work.
- Respect Other Views. Respect views of individuals and groups interested in Corps activities, actively listen, and learn from their perspective in the search to find innovative win-win solutions to the nation's problems, solutions that also protect and enhance the environment.

### 2.6.4 CalFed Bay Delta Authority Record of Decision

The Record of Decision (ROD) for the CALFED Bay-Delta Final Programmatic Environmental Impact Statement and Report represents the culmination of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) processes for the CALFED programmatic effort. The ROD reflects a final selection of a long-term preferred program alternative, which includes specific actions to fix the Bay-Delta, describes a strategy for implementing the plan, and identifies complementary actions the CALFED agencies will pursue. The ROD highlights the Corps and The Reclamation Board's Sacramento and San Joaquin River Basins Comprehensive Study that was concurrently investigating integrated flood management and ecosystem restoration for those basins. The CALFED ROD indicates that CALFED intends that final development and implementation of actions under the Comprehensive Study would be coordinated and consistent with the CALFED Bay-Delta Program. This feasibility study for Hamilton City has been developed to be consistent with the CALFED ROD.

### 2.6.5 Memorandum of Understanding between the Corps and TNC

The Corps and TNC developed a Memorandum of Understanding (MOU) in December 2000, to facilitate effective and efficient management of important biological resources within the context of the Corps' civil works and regulatory missions. This MOU focuses on the need to protect, restore, study and manage natural ecosystems

while meeting human needs. The goal of the MOU is to develop a partnership between the Corps and TNC which can avoid unnecessary duplication of effort, provide for the pooling of scarce resources, and promote coordinated, focused and consistent mutual efforts to resolve common problems and missions in a united effort that best benefits all concerned.

# CHAPTER 3 – ALTERNATIVE PLANS

## 3.1 PLAN FORMULATION METHODOLOGY

The formulation, evaluation, and comparison of alternative plans comprises the third, fourth, and fifth steps of the Corps' planning process. These steps are often referred to collectively as plan formulation. Plan formulation is a highly iterative process that involves cycling through the formulation, evaluation, and comparison steps many times to develop a reasonable range of alternative plans and then narrow those plans down to a final array of feasible plans from which a single plan can be identified for implementation.

Plan formulation for flood damage reduction (FDR) and ecosystem restoration (ER) presents a challenge because alternative plans produce both monetary and non-monetary benefits. Comparison of the trade-offs among alternative plans is difficult because monetary and non-monetary benefits cannot be directly compared. To facilitate the plan formulation process, the methodology outlined in the Corps' Engineering Circular 1105-2-404, "Planning Civil Work Projects Under the Environmental Operating Principles," 1 May 2003, was used. The steps in the methodology are summarized below:

- Formulate and screen management measures (referred to hereafter simply as measures) to achieve planning objectives and avoid planning constraints. Measures are the building blocks of alternative plans.
- Identify a primary project purpose. For this study, it is anticipated that ecosystem restoration will be identified as the primary purpose. This is because there is strong interest by the SRCAF, TNC, and CALFED in restoring this area, indicating that there is high restoration potential. Also, based on previous studies, it is unlikely a feasible plan can be developed for flood damage reduction only.
- Formulate, evaluate, and compare an array of alternative plans to achieve the primary purpose (ecosystem restoration) and identify a feasible plan that reasonably maximizes National Ecosystem Restoration (NER) outputs (outputs minus costs). This plan is called the National Ecosystem Restoration plan.
- Formulate and screen plans that achieve both ecosystem restoration and flood damage reduction (combined plans).
- Evaluate and compare trade-offs among the combined plans and rank them. The highest ranked combined plan is the plan that reasonably maximizes total net NER and National Economic Development (NED) outputs.
- Determine whether the highest ranked combined plan is justified; that is, whether the benefits of the plan exceed the costs. If the highest ranked plan is not justified, move to the next ranked plan. Continue to move down through the ranked plans until a justified plan is identified. The highest ranked, justified, combined plan is the NED/NER plan or the Combined Plan. If no combined plan is justified, the NER plan shall be recommended for implementation.

## 3.2 PLANNING CRITERIA

Planning criteria are used to formulate, screen, evaluate, and compare measures and alternative plans. Four specific screening criteria are required in Corps water resource studies: completeness, effectiveness, efficiency, and acceptability. These criteria are

generally subjective and are useful in narrowing down the array of possible alternative plans. With the exception of completeness, these criteria are also useful in screening potential measures.

- Completeness. Completeness is a determination of whether or not the plan includes all elements necessary to achieve the objectives of the plan. It is an indication of the degree that the outputs of the plan are dependent upon the actions of others. Plans that depend upon the actions of others to achieve the desired output were dropped from consideration.
- Effectiveness. Effectiveness is the extent to which a measure or alternative plan achieves the planning objectives. Measures or alternative plans that clearly make little or no contribution to the planning objectives were dropped from consideration.
- Efficiency. Efficiency is a measure of the cost effectiveness of the plan expressed in net benefits. Benefits can be both monetary and non-monetary. Measures or alternative plans that provided little benefit relative to cost were dropped from consideration.
- Acceptability. Acceptability is a measure of the ability to implement a measure or alternative plan. In other words, acceptability means a measure or plan is technically, environmentally, economically, and socially feasible. Unpopular plans are not necessarily infeasible, just unpopular. Measures or plans that were clearly not feasible were dropped from consideration.

Measures and plans that pass the screening criteria are evaluated and compared against more specific evaluation criteria. Evaluation criteria are described later in this chapter in Section 3.5. Evaluation criteria can include costs, outputs, or effects and reflect the planning objectives or constraints. Some or all of the evaluation criteria may be used at various stages in the plan formulation process to compare alternative plans. Effective evaluation criteria must be measurable and reveal differences or trade-offs between alternative plans.

## 3.3 MEASURES

A measure is a feature or an activity that can be implemented at a specific geographic site to address one or more planning objectives. Table 3-1 lists the various measures identified for this study and identifies the individual objectives to which they contribute.[1]

[1]The U. S. House Report 108-357 (Conference Report accompanying the Energy and Water Development Appropriations Act, 2004, P.L. 108-137) urged the Secretary of the Army to incorporate locally preferred options that provide protection to agricultural lands and residential properties. Measures considered include such options.

**TABLE 3-1: OBJECTIVES AND MEASURES**

| General Measures | Objectives | | | | | |
|---|---|---|---|---|---|---|
| | Reduce flood risk | Reduce flood damages | Increase river meander | Increase flooding in floodplain | Increase quantity and quality of habitat | Increase VELB habitat |
| Raise/Floodproof Community | x | x | | | | |
| Raise/Floodproof Individual Structures | x | x | | | | |
| Relocate Community | x | x | | | | |
| Relocate Individual Structures | x | x | | | | |
| Acquire Flowage Easements or Fee Title Floodplain Lands | x | x | | | | |
| Enhance Flood Warning System | | x | | | | |
| Modify Existing Reservoirs | x | x | | | | |
| Construct New Reservoirs | x | x | | | | |
| Construct High Flow Bypass Channel | x | x | | | | |
| Increase Flows into Butte Basin | x | x | | | | |
| Strengthen "J" Levee | x | x | | | | |
| Construct Setback Levee | x | x | | x | x | |
| Construct Training Dike | x | x | | | | |
| Passive Restoration | | | | | x | |
| Restoration of Native Vegetation | | | | | x | x |
| Remove Non-native Seed Source | | | | | x | |
| Remove Non-native Species from Riparian Areas | | | | | x | |
| Remove Orchards | | | | | x | |
| Reestablish Hydrologic Connection of River and Floodplain | | | | x | x | |
| Remove Bank Protection | | | x | x | x | |
| Passive Removal Bank Protection | | | x | x | x | |

Measures are the building blocks that are grouped together to form alternative plans. The wide variety of measures listed above were screened to determine whether each measure should be retained for use in the formulation of alternative plans. Descriptions of the

measures and the decision to retain or drop each measure from further consideration are presented next.

### 3.3.1 Flood Damage Reduction Measures

These measures primarily achieve flood damage reduction objectives in the study area, but may also contribute to the ecosystem restoration objectives. Flood damage reduction measures can be nonstructural or structural. Nonstructural measures reduce flood damages without significantly altering the nature or extent of flooding. Damage reduction from nonstructural measures is accomplished by changing the use made of the floodplains, or by accommodating existing uses to the flood hazard. In contrast, structural measures alter the nature or extent of flooding. Structural measures accomplish flood damage reduction by modifying the magnitude, duration, extent, or timing of flooding.

When considering if there are opportunities to apply flood damage reduction measures in the study area, an understanding of the basic magnitude of costs to construct the measures is useful when compared to the maximum potential flood damage reduction benefits possible. Reduction in flood damages translates into monetary benefits that are used to determine if the benefits of doing something outweigh the costs, which in turn helps determine if the Federal government can participate in a project. For a frame of reference, the maximum flood damage reduction benefits possible in the Hamilton City area would not economically justify flood damage reduction measures exceeding $11 million in total costs.

**Non-Structural Measures**

- Raise/floodproof community. Dropped as a measure. There is little community support for this measure as the method of reducing flood damages. The measure does not reduce the threat to public safety and it does not appear to be cost effective on a large scale, based upon the current number of structures within the floodplain.
- Raise/floodproof individual structures. Dropped as a measure. There are no opportunities in the potential project area to raise or floodproof individual structures.
- Relocate community. Dropped as a measure. There is little community support for this measure as a method of reducing flood damages and it does not appear cost effective on a large scale, based upon the current number of structures within the floodplain.
- Relocate individual structures subject to flooding. Dropped as a measure. There are no opportunities in the potential project area to relocate individual structures.
- Acquire flowage easements or fee title interest in floodplain lands. Retained for further consideration. Acquiring flowage easements or purchasing lands in fee title to allow flooding and limit future development can reduce flood damages and provide opportunities for ecosystem restoration. The availability of willing sellers is uncertain for some potential project lands.
- Enhance Flood Warning System. Dropped as a measure. The existing County Emergency Response Plan was found to be up to date and thorough. Potential improvements to the flood warning system considered included the addition of

gages along Stony Creek, which was determined to be too far downstream to have benefits to Hamilton City. Other potential improvements include the addition of gages in the upper tributaries like Cottonwood Creek, which would benefit a much larger region. (Because there are many communities throughout approximately a 50-mile region that could benefit from such improvements, this measure was considered to be more appropriately considered in a regional context and was not retained for further consideration in this feasibility study. (A regional approach is being investigated by the Corps and the Reclamation Board in a separate study, the Enhanced Flood Response and Emergency Preparedness Feasibility Study.)

**Structural Measures**

- Modify existing reservoirs. Dropped from further consideration. The primary risk of flooding to Hamilton City is from unregulated tributary streams along the Sacramento River between Shasta Dam and Hamilton City. Modification of Shasta Dam (Sacramento River) or Black Butte Dam (Stony Creek) would affect only relatively rare flooding events and not address the more frequent high flows caused by runoff from the unregulated tributaries.
- Construct new reservoirs. Dropped from further consideration. New reservoirs on several of the unregulated tributaries upstream of Hamilton City would likely be required. Construction of the new reservoirs is considered too costly and environmentally damaging.
- Construct high flow bypass channel. Dropped from further consideration. Constructing a bypass channel to convey high flows around Hamilton City would not likely be cost effective.
- Increase flows into the Butte Basin. Dropped from further consideration. Increasing flows into the Butte Basin could reduce stages in the Hamilton City area, but would be expensive, have significant effects to landowners in the basin, and have little support from Butte Basin residents.
- Strengthen "J" levee. Dropped from further consideration. Strengthening the "J" levee would likely cause significant environmental effects to existing riparian habitat along the levee without creating opportunities for habitat replacement. Strengthening the "J" levee would also require a substantial amount of rock to be placed on the waterside of the levee to reduce the risk of erosion to the levee. The requirement for rock on the levee makes this measure cost prohibitive.
- Construct setback levee. Retained for further consideration. Constructing a setback levee could reduce flood risk and flood damages. Past reconnaissance study efforts indicate that it is not likely cost effective for a single-purpose flood damage reduction project. However, construction of a setback levee would be necessary as part of the ecosystem restoration measure "Reestablish hydrologic connection between the Sacramento River and its floodplain." Construction of a setback levee has potential to be cost effective as a single-purpose ecosystem restoration measure. This presents an opportunity that the measure could be cost effective as part of a combined project that would provide both flood damage reduction and ecosystem restoration benefits. Construction of any levee would include acquiring a flood protection easement for the levee.

- Construct Training Dike. Retained for future consideration. A training dike, considerably less costly than a levee, could be cost effective based on damages prevented. Construction of a training dike would include acquiring a flood protection easement for the levee.

### 3.3.2 Ecosystem Restoration Measures

These measures primarily achieve ecosystem restoration objectives in the study area, but may also contribute to the flood damage reduction objectives. Ecosystem restoration measures can involve the removal of the cause of degradation and manipulating the ecosystem to re-establish the desired function. Removing the cause of degradation improves the ecosystem by eliminating the stressors that depleted the ecosystem to begin with and allowing the natural processes to return the ecosystem to health. Reviving ecosystem function through manipulation of the environment involves actively restoring the area to "jump start" the recovery process. The ecosystem restoration measures considered in the study were:

- Passive restoration of vegetation. Dropped from further consideration. Passive restoration is a technique whereby the restoration area is left to recruit native vegetation naturally with little or no intervention. On the Sacramento River, planting, irrigating, and weed control are all required for successful restoration of riparian vegetation due to the high risk that non-native species would out-compete native species (Alpert et al. 1999; Peterson, unpubl.).
- Restoration of native vegetation. Retained for further consideration. Restoration of natural habitats by active means such as planting trees and shrubs or removing exotic plants and animals. Active restoration is necessary as a measure to reduce the potential for the spread of invasive species, reduce the seed predation and girdling of young trees by rodents, reduce browse pressure from herbivores, and reduce the amount of erosion from exposed areas.
- Remove non-native seed source. Dropped from further consideration. Removal of non-native seed source requires a regional involvement to alleviate non-native seed sources that are outside the immediate study area. Removal of the non-native seed source was dropped as a measure due to the expansive nature of the problem. Non-native seed sources extend throughout the watershed and removal of these sources would be expensive and the probability of success low.
- Remove non-native species from existing riparian areas. Dropped from further consideration. The removal of non-native species from established riparian areas outside of proposed restoration areas was found to be extremely costly as a separate restoration measure. The removal of non-native species, along with orchards, hay, and grain is included in the restoration areas prior to any planting.
- Remove orchards. Retained for further consideration. In areas of highly humid and relatively temperate climates, abandoned orchards are susceptible to a variety of pests and diseases. Orchard areas need to be kept clean of trash and weeds. Trees need to be well pruned to facilitate good air movement in order to keep pest populations at an acceptable level. Common pests that may attack trees include: codling moth that attacks walnuts and plums; peach twig borer that attacks almond, plum and prune trees; brown rot fungus that attacks almond trees; leaf

curling aphids that attack plum trees; red humped caterpillars that attack plum, prune, and walnut trees; and, fruit worms and thrips that attack a host of orchard trees. Abandoned orchards are seen as a sort of "incubator" for many of these pests and diseases. Surrounding orchards are considered at risk to infestation and must be monitored closely to control pests and diseases from entering into health orchards.

- Reestablish hydrologic connection between the Sacramento River and its floodplain. Retained for further consideration. In order to reestablish the hydrologic connection between the Sacramento River and its floodplain, the "J" levee or other private levees could be lowered or removed. Degrading or removing the existing "J" levee would reconnect the Sacramento River to its historic floodplain by allowing the river to overflow its banks. The restoration of this important hydrologic function would provide conditions for the restoration of a diverse mosaic of riverine habitats. Additional measures, such as constructing a setback levee, may be necessary to offset negative effects of degrading an existing levee. Construction of a setback levee also has potential to reduce damages from flooding. Construction of any levee would include acquiring a flood protection easement for the levee.
- Remove bank protection. Dropped from further consideration. There is potential to remove about 5,000 linear feet of bank protection (predominately rock) from the west bank of the Sacramento River near Hamilton City south of Dunning Slough, but it would add an estimated $5 to $10 million in setback levee reinforcement costs. The removal of rock would increase erosion and, therefore, sediment, gravel, and woody debris contribution to the system, allowing for the creation of cutbanks and mid-channel bars. In this reach, however, the river has historically migrated extensively and it is difficult to accurately predict how the river would respond if the bank protection were removed. Due to the uncertainty in river movement which would require extensive study, the physical and public safety concerns (largely due to the controversial nature of the subject), and the anticipated increase in maintenance costs to protect a new setback levee and/or private lands from accelerated river migration, this measure was dropped from further consideration as part of this study.
- Passive removal bank protection. Dropped from further consideration. There is potential to cease maintenance of existing bank protection (predominately rock) placed as part of the Chico Landing to Red Bluff Bank Protection Project from the west bank of the Sacramento River near Hamilton City south of Dunning Slough. Cessation of maintenance would increase erosion and, therefore, sediment, gravel and woody debris contribution to the system, allowing for the creation of cutbanks and mid-channel bars. In this reach, however, the river has historically migrated extensively and it is difficult to accurately predict how the river would respond if the bank protection were no longer maintained. Due to the uncertainty in river movement which would require extensive study, the physical and public safety concerns (largely due to the controversial nature of the subject), and the anticipated increase in maintenance costs to protect a new setback levee and/or private lands from accelerated river migration, this measure was dropped from further consideration as part of this study.

It should be noted that none of the measures that would contribute to the planning objective to increase river meander were retained. Since no measures were retained that would address river meander, the planning objective to increase river meander will not be attained as part of a potential project.

The next step in the plan formulation process is to formulate alternative plans for the primary project purpose. Results from the measures identification and screening process verify that the primary project purpose for this study is ecosystem restoration. Table 3-2 summarizes the measures screening process.

## 3.4 FORMULATION AND EVALUATION OF PRELIMINARY ECOSYSTEM RESTORATION ALTERNATIVE PLANS

Guidelines to developing multipurpose projects (in this case flood damage reduction and ecosystem restoration) were followed in evaluating and comparing alternative plans. First, a primary project purpose was identified. For this study, it was anticipated that ecosystem restoration would be identified as the primary purpose because there is strong interest by the SRCAF, TNC, and the CALFED Bay-Delta Authority in restoring the ecosystem of this area, which indicated that there was high ecosystem restoration potential. Further, based on previous flood damage reduction studies, it was considered unlikely that a flood damage reduction-only project would be cost-effective.

A preliminary and then a final array of single-purpose ecosystem restoration alternative plans were developed, evaluated and compared to identify a plan that reasonably maximizes the NER outputs (outputs minus costs). The preliminary array of ecosystem restoration alternative plans primarily consisted of various setback levee alignments with habitat restoration to the waterside of the new levee. The NER plan was identified, indicating that there is likely Federal interest in implementing an ecosystem restoration-only alternative plan.

Alternatives were formulated through coordination with agencies, landowners and other stakeholders. The retained ecosystem restoration measures generally needed to be combined with the other retained ecosystem restoration measures in order to develop complete preliminary ecosystem restoration alternative plans. While each individual measure contributes to the ecosystem objectives, most need to be applied in combination with the others to accomplish ecosystem restoration. Therefore, all preliminary ecosystem restoration alternative plan includes all of the retained ecosystem restoration measures.

For analysis purposes, the study area was split into nine potential restoration zones (see Figure 3-1: Restoration Zones Map). These zones are used in various combinations in the preliminary alternative plans. Each of the preliminary alternative plans formulated fit into one of four general categories:

**TABLE 3-2: SUMMARY OF MEASURES RETAINED OR DROPPED**

| Measures | Retained | Dropped |
|---|---|---|
| **Flood Damage Reduction** | | |
| ***Non-Structural Measures*** | | |
| Raise/Floodproof Community | | X |
| Raise/Floodproof Individual Structure | | X |
| Relocate Community | | X |
| Relocate Individual Structures | | X |
| Acquire Flowage Easements or Fee Title in Floodplain Lands | X | |
| Enhance Flood Warning System | | X |
| ***Structural Measures*** | | |
| Modify Existing Reservoirs | | X |
| Construct New Reservoirs | | X |
| Construct High Flow Bypass | | X |
| Increase Flows into the Butte Basin | | X |
| Strengthen "J" Levee | | X |
| Construct Setback Levee | X | |
| Construct Training Dike | X | |
| **Ecosystem Restoration Measures** | | |
| Passive Restoration of Vegetation | | X |
| Restoration of Native Vegetation | X | |
| Remove Non-native Seed Source | | X |
| Remove Non-native Species from Existing Riparian Areas | | X |
| Remove Orchards | X | |
| Reestablish Hydrologic Connection of River and Floodplain | X | |
| Remove Bank Protection | | X |
| Passive Removal of Bank Protection | | X |

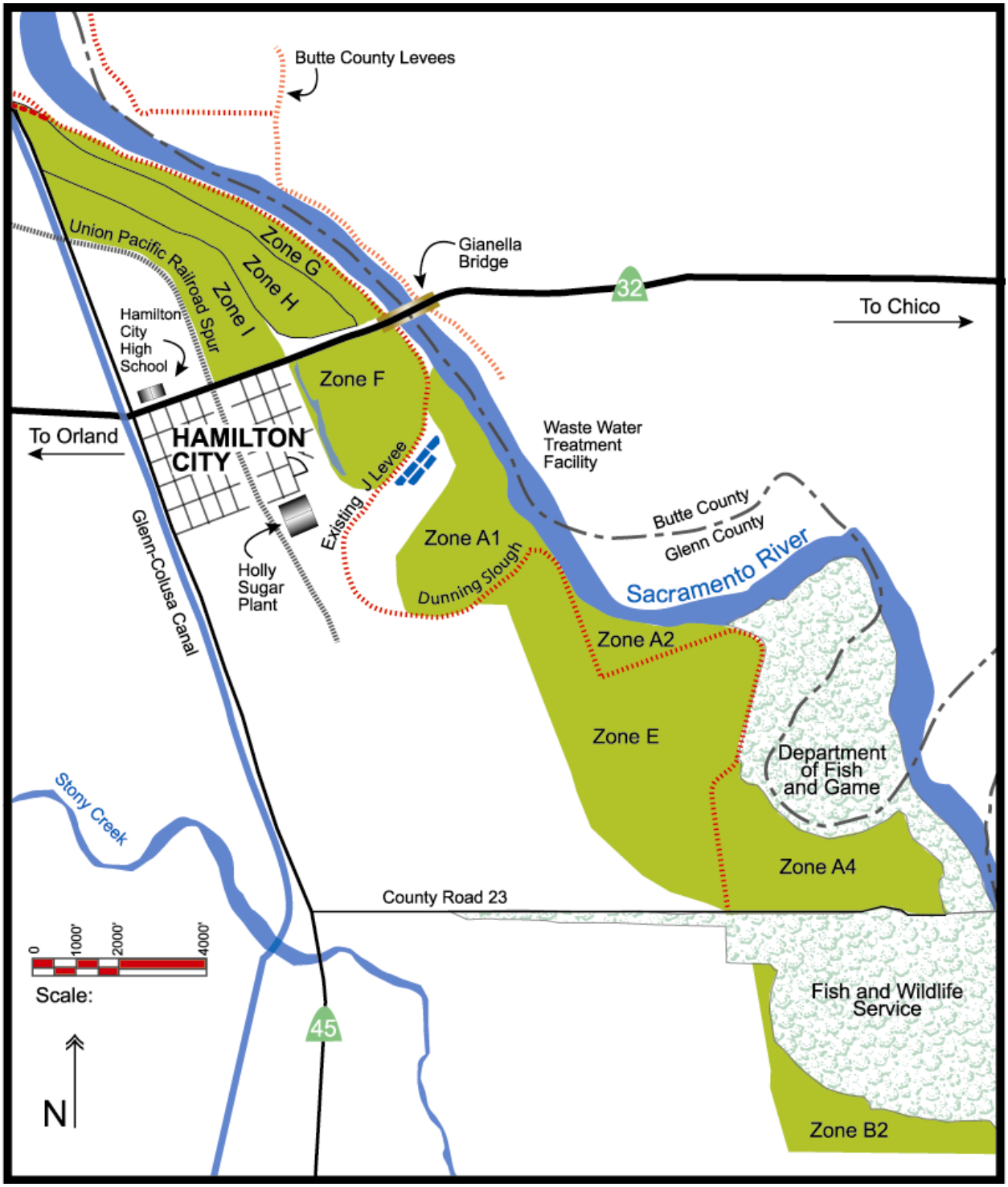



**Figure 3-1: Restoration Zones Map**

The first category was the alternative of doing nothing. The Corps is required to consider the option of "*No-Action*" as one of the alternative plans in order to comply with the requirements of the National Environmental Policy Act (NEPA). With the No-Action alternative, which is synonymous with the future without-project condition, it is assumed that no project would be implemented by the Federal Government or by local interests to achieve the planning objectives. The No-Action Alternative serves the planning process by providing the base against which all other alternatives are measured and ensuring that any action taken is more in the public interest than doing nothing.

The second category was alternative plans that restored native vegetation without removing or degrading the existing "J" levee. For these alternatives, it was assumed the "J" levee would continue to function as a private flood control levee, but that some amount of land within the study area would be restored to native habitat. The areas proposed for restoration were predominately lands owned by TNC (see Figure 2-4, Conservation Ownership Map). Two additional areas in other private ownership were also considered for restoration. These areas were the land to the east of Hamilton City, between Highway 32 and Dunning Slough, and a portion of the land within Dunning Slough (excluding the Hamilton City Wastewater Treatment Facility and adjacent areas to the west). These lands were identified for potential restoration because they could be combined with other lands to create continuous blocks of native habitat.

Numerous amounts and combinations of restored areas were investigated. In most cases, the effectiveness of the restoration (as measured against the planning objectives) was limited because the "J" levee was not degraded.

The "J" levee constrains the Sacramento River, preventing it from overflowing or meandering into the floodplain. This has numerous adverse effects on the ecosystem (as described in Chapter 2) and limits the value of riparian habitat restored on the landside of the levee (opposite the river) because the habitat is not periodically flooded as it would be under more natural conditions. Due to these limitations, an alternative plan in this category was not carried forward for further analysis.

The third category was alternative plans that restore native vegetation, degrading or removing the "J" levee, and relocate or raise structures to avoid induced flooding. Degrading or removing the "J" levee allows the Sacramento River to flood the floodplain and improves habitat quality, but it also increases the risk of flooding in and around Hamilton City. Both treatments of the "J" levee would accomplish reconnection of the river and floodplain. The question then first becomes one of cost effectiveness. It was initially thought that "breaching" the existing "J" levee would be less expensive than removing the "J" levee. However, subsequent hydraulic modeling determined that in order to avoid an increase in stage from the construction of the setback levee, most of the existing "J" levee would need to be removed. Thus in keeping with the planning constraint to avoid adverse hydraulic effects, the alternatives were refined to include the more costly method of floodplain reconnection – to remove most of the existing "J" levee.

Raising or relocating flood-prone structures could minimize this effect but, as noted in the discussion of measures earlier in this chapter, relocating or raising structures on a large scale are not cost effective for the conditions in the study area. Furthermore, raising or relocating a large number of structures within Hamilton City would be strongly resisted by the

residents, particularly to offset the effects of removing the "J" levee for environmental restoration. No alternatives in this category were carried forward for further analysis, but raising or relocating structures on a limited scale were considered as potential components of alternative plans in the fourth category.

The fourth category included alternative plans that restore native habitat, degrade the "J" levee, and provide a new levee setback from the river to prevent induced flooding. Numerous potential setback levee alignments were considered, including alignments set back varying distances from the river, alignments that wrapped closely around the southern side of town, and alignments that extended south of town to protect agricultural areas.

Following is a list of the preliminary ecosystem restoration plans considered. A description of each preliminary ecosystem restoration alternative plan can be found in Appendix A – Supporting Plan Formulation Information. Table 3-3 shows the restoration zones occurring in each alternative plan.

- No-Action
- Alternative 1 – Locally Developed Setback Levee
- Alternative 2 – Intermediate Setback Levee
- Alternative 3 - Ring Levee
- Alternative 4 - Locally Developed Setback Upstream of Dunning Slough, Intermediate Setback Levee Downstream of Dunning Slough
- Alternative 5 - Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough
- Alternative 6 - Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32

In general, the most cost efficient plans aligned the new levee as far from the river as possible. This allowed the greatest extent of floodplain flooding and habitat restoration, maximizing ecosystem restoration benefits, which in turn reduced the cost of constructing the levee relative to the benefits. Aligning the levee away from the river also reduced the risk that the river channel could meander into the toe of the levee, requiring substantial expense to protect the levee.

Exceptions to this general rule were levee alignments that hugged the town closely. These alignments tended to require significant modifications to infrastructure, raising overall project costs. In addition, the purchase of flowage easements was necessary for levee alignments that wrapped around the south of town and did not extend as far south as the "J" levee. The flowage easements were used to offset the induced flooding caused by removing the "J" levee. Residents voiced strong opposition to alignments that were aligned too closely to town due to fear of levee failure, particularly near residences and schools, and to perceived constraints on future growth. Flowage easements were equally unpopular with farmers, who wanted less frequent flooding, not more frequent.

**TABLE 3-3: ZONES INCLUDED IN EACH PRELIMINARY ECOSYSTEM RESTORATION ALTERNATIVE PLAN**

| | Ecosystem Restoration Zones | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Preliminary Alternatives | Zone A1 | Zone A2 | Zone A4 | Zone B2 | Zone E | Zone F | Zone G | Zone H | Zone I |
| 1-Locally Developed Setback Levee | X | X | X | X | X | | X | | |
| 2-Intermediate Setback Levee | X | X | X | | X | X | X | X | |
| 3-Ring Levee | X | X | X | | X | X | X | X | X |
| 4-Locally Developed Setback Upstream of Dunning Slough, Intermediate Setback Levee Downstream of Dunning Slough | X | X | X | | X | | X | | |
| 5-Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough | X | X | X | X | X | X | X | X | |
| 6-Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32 | X | X | X | X | X | | X | X | |

The top of levee elevation for all setback levee alignments would be approximately the same elevation as the top of the "J" levee. This criterion reflects that in the past, with intense flood fighting, the "J" levee has withstood river stages to near the top of the levee without failing. Constructing a setback levee to the same elevation as the "J" levee provides the community the possibility of passing similar river stages in the future.

The preliminary ecosystem restoration alternative plans were screened against the four planning criteria. Standards were established to determine if the alternative plans meet each planning criteria. For an alternative plan to be carried forward for further consideration, minimum standards had to be met. The No-Action alternative plan was not included in this screening process because it must be carried forward in the process in order to serve as the baseline against which all retained alternative plans are compared.

Standards established for each criterion and results of each screening are:

- Completeness. To be complete, an alternative must not rely on other activities to function. An alternative plan is either complete or it is not complete. Each alternative plan is considered to be complete.
- Effectiveness. An alternative must contribute to at least 1 of the 4 ecosystem planning objectives to be considered effective enough to be retained for further consideration. Each alternative plan's ability to meet those objectives is identified in Table 3-4. Each of the alternative plans would meet at least one of the ecosystem restoration planning objectives.
- Efficiency. To be considered efficient, an alternative plan must be cost effective. For this screening, all cost effective plans are retained. Cost effective means that for a given level of non-monetary output, no other plan costs less, and no other plan yields more output for less money.

**TABLE 3-4: EFFECTIVENESS OF PRELIMINARY ECOSYSTEM RESTORATION PLANS IN ATTAINING ECOSYSTEM RESTORATION PLANNING OBJECTIVES**

| Preliminary Alternatives | Ecosystem Restoration Planning Objectives | | | |
|---|---|---|---|---|
| | River Meander | Flooding Floodplain | Floodplain Habitat | Increase VELB Habitat |
| 1-Locally Developed Setback Levee | No | Yes | Yes | Yes |
| 2-Intermediate Setback Levee | No | Yes | Yes | Yes |
| 3-Ring Levee | No | Yes | Yes | Yes |
| 4-Locally Developed Setback Upstream of Dunning Slough, Intermediate Setback Levee Downstream of Dunning Slough | No | Yes | Yes | Yes |
| 5-Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough | No | Yes | Yes | Yes |
| 6-Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32 | No | Yes | Yes | Yes |

When there is no monetary measure of benefits but project outcomes can be described and quantified in some dimension, cost effectiveness analysis can be used to assist on the decision making process. Cost effectiveness analysis seeks to answer the question: given an adequately described objective, what is the least-costly way of attaining the objective? The ability to identify the least costly among several alternatives having the same outcome is very useful. Cost effectiveness can also aid choice among projects that differ in their outcomes, but in the absence of monetized benefit estimates cannot remove all ambiguity.

Results of the cost effectiveness analysis are shown in Table 3-5 and in Figure 3-2. Information presented in Table 3-5 was used to conduct a cost effectiveness analysis. IWR-PLAN Decision Support software version 3.33 was used for the analysis. The program assisted in identifying the plans that are best financial investments and displaying the effects of each on a range of decision variables.

**TABLE 3-5: COST EFFECTIVENESS SCREENING FOR EFFICIENCY OF PRELIMINARY ECOSYSTEM RESTORATION ALTERNATIVE PLANS ($1,000)[1]**

| Preliminary Alternatives[2] | Increase in Habitat Units (AAHU) | Restoration Costs[3] | Setback Levee Cost | Real Estate Cost[4] | EDSA[5] | Total First Cost | Annualized First Costs | Total Annual Costs[6] | Cost Effective |
|---|---|---|---|---|---|---|---|---|---|
| 3-Ring Levee | 895 | $15,742 | $7,042 | $30,630 | $5,278 | $58,692 | $3,527 | $3,558 | No |
| 5-Intermediate Upstream of Dunning Slough, Locally Developed Downstream of Dunning Slough | 937 | $16,606 | $9,689 | $17,284 | $5,943 | $49,522 | $2,976 | $3,021 | Yes |
| 2-Intermediate Setback | 795 | $14,524 | $7,409 | $21,595 | $5,112 | $48,640 | $2,923 | $2,957 | No |
| 6-Intermediate Setback Upstream of Hwy 32, Locally Developed Downstream of Hwy 32 | 888 | $14,725 | $9,816 | $13,909 | $5,147 | $43,597 | $2,620 | $2,669 | Yes |
| 1-Locally Developed Setback | 783 | $13,068 | $9,652 | $14,459 | $5,161 | $42,340 | $2,545 | $2,592 | Yes |
| 4-Locally Developed Upstream of Dunning Slough, Intermediate Downstream of Dunning Slough | 642 | $10,986 | $7,486 | $18,464 | $4,291 | $41,227 | $2,478 | $2,515 | No |

[1] Based on October 2003 price levels, 5 5/8 percent rate of interest, and a 50-year period of analysis.

[2] Alternatives are ordered from highest to lowest total annual costs.

[3] Restoration costs include remove orchards, plant, irrigate and establish, removal of majority of "J" Levee

[4] Includes relocation costs

[5] Excludes Lands and Relocation costs.

[6] Total annualized first costs and annual OMRR&R (which assumes $8,000 for habitat restoration and $7,000 per mile of setback levee.)

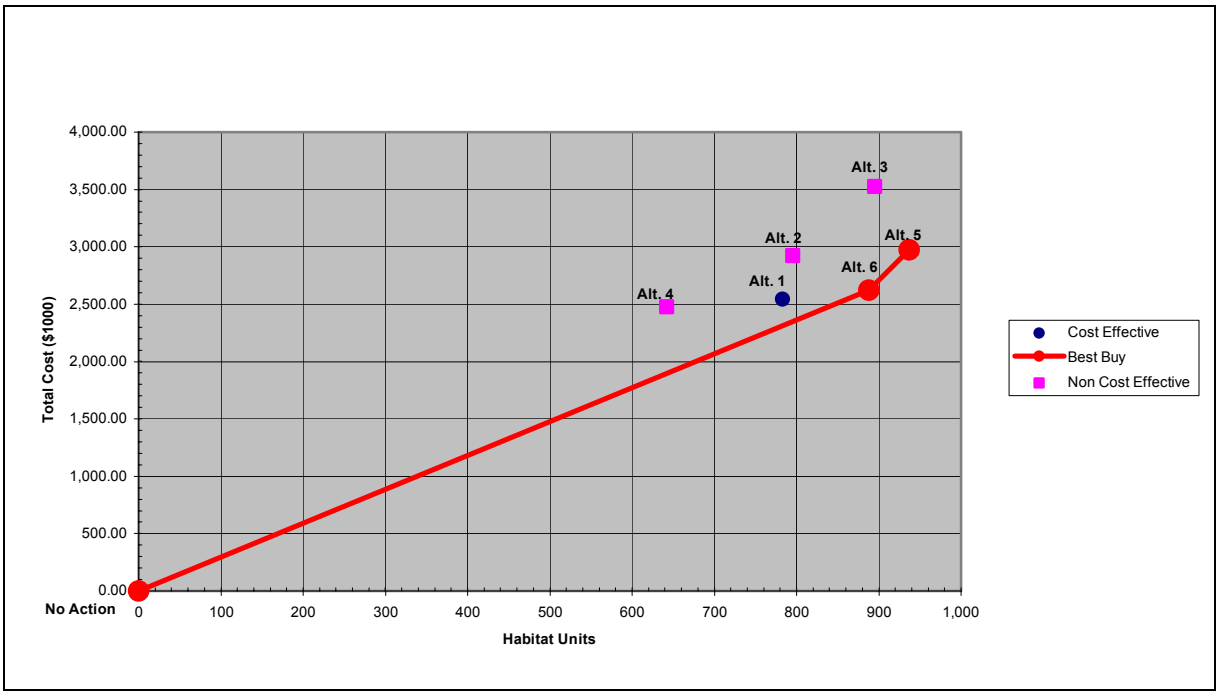



**Figure 3-2. Cost Effectiveness Analysis of Preliminary Ecosystem Restoration Alternative Plans**

Ecosystem benefits are characterized in terms of average annual habitat units (AAHU). The increase in habitat units was calculated using USFWS Habitat Evaluation Procedures (HEP) models. The HEP analysis measures habitat value for wildlife at baseline or without project conditions in the project area and compares that value with the estimated value at various points in time throughout the 50-year period of analysis. The HEP analysis is based on the assumption that the value of habitat to a selected species or group of species can be described in models that use variables that represent habitat suitability for wildlife. Because each of the proposed alternatives would result in an increase in both quality and quantity of habitat, there is also a net gain in the AAHU's as compared to the baseline or future without project conditions. Results of the HEP analysis can be found in Appendix B.8. Results from the HEP analysis were used as input into IWR-Plan for the cost effectiveness analysis.

Total annual costs include annualized project first cost (cost to initially implement the plan) and annual operation, maintenance, repair, replacement and rehabilitation (OMRR&R) costs. First costs were annualized at a rate of 5 $^{5}/_{8}$ percent for a 50-year period of analysis. These costs were used as input into IWR-Plan for the cost effectiveness analysis.

Alternatives 1, 5, and 6 were considered to be cost effective. Table 3-5 shows the efficiency screening.

- Acceptability. Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations and pubic policies. An alternative plan must be considered within these parameters to be a satisfactory way of addressing problems identified. For the purposes of this screening, the question

asked is, "In general, do the State, local entities and public find construction of setback levees and/or habitat restoration to be an acceptable method of accomplishing ecosystem restoration, consistent with existing laws, regulations and public policies?" An alternative plan is either considered acceptable or not acceptable. Each of the alternative plans includes a setback levee and/or habitat restoration, which are generally acceptable features to accomplish ecosystem restoration. For the purposes of this screening, all of the alternative plans are considered to be acceptable.

To recap, the preliminary ecosystem restoration alternative plans that meet all four planning criteria standards are Preliminary Alternatives 1, 5, and 6. Alternatives 2, 3 and 4 did not meet the standard for efficiency and were not retained. The results of the screening of preliminary ecosystem restoration alternatives are shown in Table 3-6.

The retained preliminary alternative plans were carried forward as the final array of ecosystem restoration alternative plans, which were next evaluated and compared to identify the NER plan.

## 3.5 ANALYSIS OF FINAL ARRAY ECOSYSTEM RESTORATION ALTERNATIVE PLANS

Following is a description of the final array of ecosystem restoration alternative plans.

### 3.5.1 Description of Final Array Ecosystem Restoration Plans

The basic features of each plan are described below. A detailed description of each final array ecosystem restoration plan, along with corresponding maps, is included in Appendix A, Supporting Plan Formulation.

**No-Action**

The No-Action alternative assumes that no project would be implemented by the Federal government or by local interests to achieve the planning objectives. Refer to the Study Area Map (Figure 2-2) for a depiction of the No-Action Alternative. A description of assumptions for the No-Action alternative are provided in Appendix A, Supporting Plan Formulation, as well as later in this chapter as part of the discussion of Combined Alternative Plans.

**Ecosystem Alternative 1 – Locally Developed Setback Levee.**

This alternative is based on a levee alignment developed by the Hamilton City Community Services District and several landowners in the study area. This alternative consists of constructing a levee about 5.5 miles long and about 6 feet high, set back roughly 500 to 7,600 feet from the river, and removal of most of the existing "J" levee. It includes actively restoring about 1,300 acres of native habitat in Zones A1, A2 and A4, E, G, and B2, waterside of the setback levee.

**Accomplishments**. This alternative plan would restore 1,300 acres of habitat and provide 783 AAHU's.

**Costs**. Total project first cost for this alternative plan is estimated to be $42,340,000. The average annual OMRR&R cost is estimated to be $47,000, of which $39,000 is for levee maintenance and $8,000 is for habitat restoration.

**TABLE 3-6: SCREENING OF PRELIMINARY ECOSYSTEM RESTORATION ALTERNATIVE PLANS**

| Preliminary Alternatives | Completeness | Effectiveness | Efficiency | Acceptability | Overall |
|---|---|---|---|---|---|
| 1-Locally Developed Setback Levee | Yes | Yes | Yes | Yes | Retained |
| 2-Intermediate Setback Levee | Yes | Yes | No | Yes | Dropped |
| 3-Ring Levee | Yes | Yes | No | Yes | Dropped |
| 4-Locally Developed Upstream of Dunning Slough, Intermediate Downstream of Dunning Slough | Yes | Yes | No | Yes | Dropped |
| 5-Intermediate Upstream of Dunning Slough, Locally Developed Downstream of Dunning Slough | Yes | Yes | Yes | Yes | Retained |
| 6-Intermediate Upstream of Hwy 32, Locally Developed Downstream of Hwy 32 | Yes | Yes | Yes | Yes | Retained |

**Ecosystem Alternative 5: Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough**

This alternative plan consists of actively restoring about 1,600 acres of native vegetation, constructing a setback levee about 5.3 miles long, and about 6 feet high, and removing most of the existing "J" levee. The alternative plan includes restoration of Zones A1, A2, and A4, B2, E, F, G, and H waterside of the setback levee.

**Accomplishments.** This alternative plan would restore 1,600 acres of habitat and provide 937 AAHU's.

**Costs.** The total project first cost for this alternative plan is estimated to be $49,522,000. The average annual OMRR&R costs are estimated to be $45,000, of which $37,000 per year is for levee maintenance and $8,000 per year for habitat restoration.

**Ecosystem Alternative 6: Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32**

This alternative plan consists of actively restoring about 1,500 acres of native vegetation, constructing a setback levee about 5.7 miles long, and about 6 feet high, and removal of most of the existing "J" levee. The alternative plan includes Zones A1, A2, A4, B2 E, G, and H waterside of the setback levee.

**Accomplishments.** This alternative plan would restore 1,500 acres and provide 888 AAHU's.

**Costs.** The total project first cost for this alternative plan is estimated to be $43,597,000. The average annual OMRR&R costs are estimated to be $48,000, of which $40,000 per year is for levee maintenance and $8,000 per year for habitat restoration.

### 3.5.2 Evaluation and Comparison of Alternative Plans for Ecosystem Restoration for Determination of National Ecosystem Restoration Plan

**Action Versus No-Action**

The No-Action alternative ranks lower than the action alternatives in that it is not effective in meeting any of the planning objectives. It has no positive benefits or effects, since it is the basis from which the effects and benefits are measured. It does not, however, involve incurring the implementation cost or adverse effects of the action alternatives.

**Action Alternative Plans**

To identify the NER plan, an incremental cost analysis was performed using the information in Table 3-5 and IWR-Plan software. Earlier, the efficiency of each cost effective plan was determined and used as a basis for screening out preliminary ecosystem restoration alternative plans. Of the cost effective plans, the most efficient in production of outputs are identified as "Best Buy" plans. The decision rule in incremental analysis is to identify the cost-effective plan with the lowest cost per unit of output as the first "Best Buy" and then remove from consideration any plans that provide a smaller output level than the first "Best Buy" plan. Each remaining plan is then compared to the first "Best Buy" plan. The remaining plan with the lowest additional cost per unit of additional output is identified as the second "Best Buy" plan, and any remaining plans that provide a smaller output level than the second "Best Buy" plan are eliminated. This iterative process continues until there is only one remaining plan, which is the final "Best Buy" plan. These "Best Buy" plans provide the greatest increase in output for the least increase in cost and have the lowest incremental costs per unit of output relative to the other cost effective plans. Through this process, Alternatives 5 and 6 were identified as "best buys." Because Alternative 1 was not identified as a "best buy" plans, it was no longer considered in identifying the NER plan.

The comparison of the incremental outputs for Alternatives 5 and 6 are displayed in Figure 3-3. Based upon the cost effectiveness analysis and the incremental cost analysis, Alternative 6 produces outputs at an incremental cost per AAHU of $4,900. The next level of output (Alternative 5) produces an incremental cost per AAHU of $7,300. The question now becomes is the next level of output "worth" the cost; that is, whether the environmental

benefits of the additional output in the next level are worth the additional cost. Since the additional output of Alternative 5 is relatively small and the cost is relatively great, Alternative 6 is determined to be the alternative plan that reasonably maximizes ecosystem restoration benefits compared to costs and is therefore identified as the NER plan.

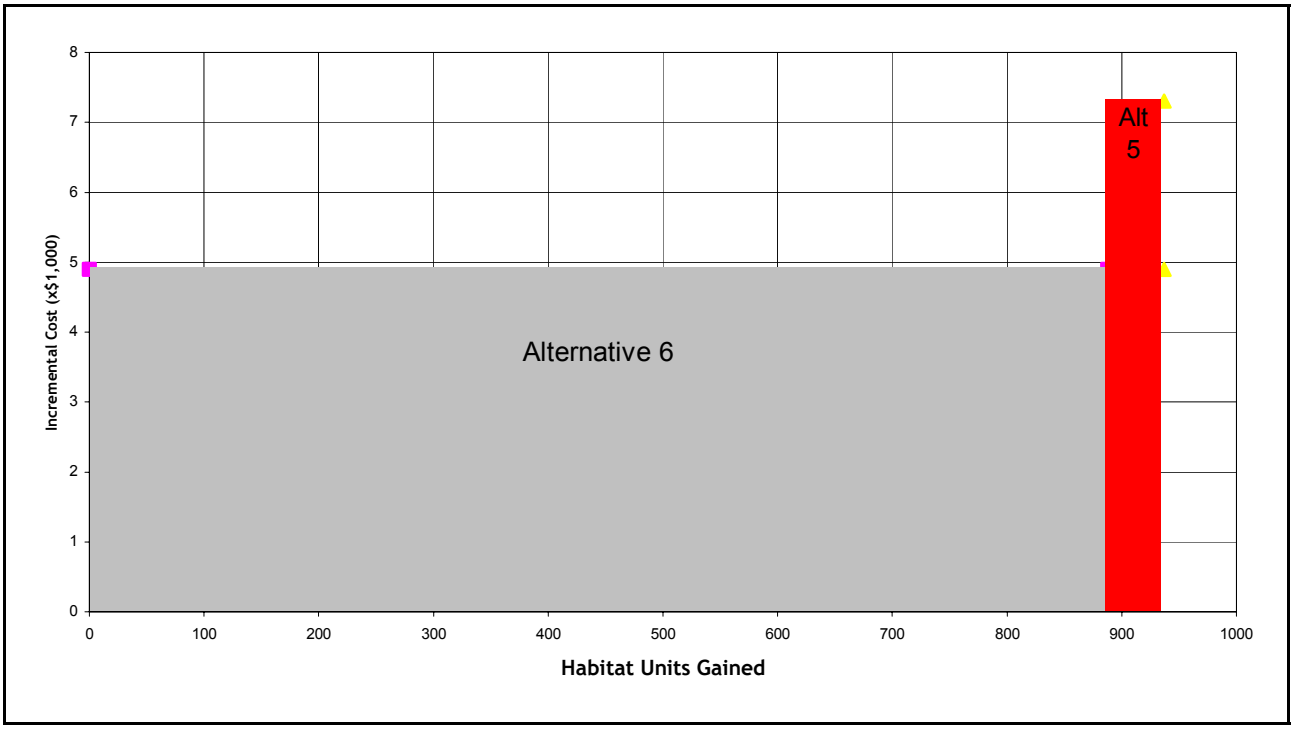



**Figure 3-3. Comparison of Incremental Outputs of Ecosystem Restoration Alternatives 5 and 6 (Best-Buy Plans)**

## 3.6 FORMULATION OF PRELIMINARY COMBINED ALTERNATIVE PLANS

Following identification of the NER Plan, combined alternative plans were formulated that address other problems and opportunities as well as the primary problem under study. The emphasis of the formulation process will be on formulating alternatives that take advantage of the synergies created by the plans that address both the primary purpose (ecosystem restoration) and flood damage reduction.

### 3.6.1 Opportunities for Flood Damage Reduction

Formulation of combined plans consisted of developing a preliminary array of combined alternative plans, using flood damage reduction and ecosystem restoration measures retained.

Additional formulation to arrive at combined plans consists of exploring construction of setback levees. Since the ecosystem restoration alternative plans explored an array of

setback levee alignments, formulation of combined plans begins with consideration of those ecosystem restoration alternative plans that included construction of setback levees and their contributions to the combined purposes. The accomplishments of Alternatives 1, 2, 3, 4, 5, and 6 (now combined alternative plans) in terms of flood damage reduction benefits were identified.

Combined alternative plans with a setback levee that extends south to County Road 23 (as opposed to a ring levee) include a "training dike" at the southern end of the setback levee. The training dike would be a few feet high and extent for about 1 mile south of County Road 23 in order to provide additional reduction of flood damages to structures, contents and agriculture. This feature has been added to Combined Alternatives 1, 5 and 6.

### 3.6.2 Maximization of Preliminary Combined Alternative Plans For Flood Damage Reduction Opportunities

In order to reasonably maximize net benefits for flood damage reduction for each preliminary combined alternative plan, an array of levels of performance was evaluated. These different levels of performance were attained through raising each levee height by varying degrees and identifying corresponding levels of flood damage reduction. For each combined alternative, three levee heights were evaluated. Risk-based procedures were used to formulate and identify a reasonably optimized flood damage reduction component to define each preliminary combined alternative plan (Table 3-7). Table 3-7 shows the annual net benefits for each combined alternative.

Not all the combined alternative plans were optimized due to the planning constraint that project performance not be greater than a 90 percent chance of passing the 75-year event and not less than a 90 percent chance of passing the 125-year event. Both lower and higher levels of project performance may be considered. Lower levels of project performance have been included in the analysis. Based on current estimates of incremental costs and benefits, optimized combined alternatives 1, 5 and 6 are thought to provide around the 90 percent chance of passing the 113-year event, which is within the range precluded by a planning constraint. As such, optimized alternatives 1, 5 and 6 have not been included. Because of this, if the recommended plan is either combined alternatives 1, 5 or 6, it will be identified as a locally preferred plan (LPP). Optimized combined alternatives 2, 3 and 4 are thought to provide around the 90 percent chance of passing the 190-year event. No additional benefits will occur past the 90 percent chance of passing the 190-year event due to a combination of flood waters outflanking the project levee and backwaters.

Based upon information presented in Table 3-7, the constrained maximum flood damage reduction component for combined alternatives 1, 5 and 6 is an increase in height of the setback levee so as to provide a 90 percent reliability of passing a 75-year flood event in the Northern Impact area. In order to accomplish this, the setback levee would be constructed to the 320-year water surface elevation in the Northern Impact area. The reasonably optimized flood damage reduction component for combined alternatives 2, 3, and 4 is an increase in height of the setback levee so as to provide a 90 percent reliability of passing a 190-year flood event in the Northern Impact area. In order to accomplish this, the setback levee would be constructed to the 500-year water surface elevation in the Northern Impact area. In addition, Combined Alternatives 1, 5 and 6 would have a 1.1 mile training

## TABLE 3-7: OPTIMIZATION OF PRELIMINARY COMBINED ALTERNATIVE PLANS FOR FLOOD DAMAGE REDUCTION

| Preliminary Combined Alternative Plan | Average Levee Height (Feet) | 90 Percent Reliability by Flood Event[1] | Increase in Habitat Unit Benefits (AAHU) | Flood Damage Reduction Benefits ($1,000) | Incremental Benefit ($1,000)[2] | Total Project Annualized First Cost ($1,000)[3] | Incremental Cost ($1,000)[2] | Justified Increment |
|---|---|---|---|---|---|---|---|---|
| Alt. 1 | 6.0 | 26 | 783 | 465 | 43 | 2,575.6 | 31 | Yes |
| | 7.0 | 59 | 783 | 549 | 84 | 2,584.6 | 9 | Yes |
| | 7.5 | 75 | 783 | 576 | 27 | 2,596.0 | 11 | Yes |
| | 9.0 | 190 | 783 | 667 | 91 | 2,712.1 | 116 | No |
| Alt. 2 | 6.0 | 26 | 795 | 331 | 0 | 2,913.1 | 0 | Yes |
| | 7.0 | 59 | 795 | 411 | 80 | 2,922.8 | 10 | Yes |
| | 7.5 | 75 | 795 | 437 | 26 | 2,930.5 | 8 | Yes |
| | 9.0 | 190 | 795 | 526 | 89 | 2,959.9 | 29 | Yes |
| Alt. 3 | 7.0 | 26 | 895 | 327 | 0 | 3,517.2 | 0 | Yes |
| | 8.0 | 59 | 895 | 402 | 75 | 3,531.6 | 14 | Yes |
| | 8.5 | 75 | 895 | 428 | 26 | 3,539.2 | 8 | Yes |
| | 10.0 | 190 | 895 | 513 | 85 | 3,580.2 | 41 | Yes |
| Alt.4 | 6.0 | 26 | 642 | 334 | 0 | 2,467.5 | 0 | Yes |
| | 7.0 | 59 | 642 | 418 | 84 | 2,476.0 | 9 | Yes |
| | 7.5 | 75 | 642 | 446 | 28 | 2,484.5 | 9 | Yes |
| | 9.0 | 190 | 642 | 536 | 90 | 2,531.0 | 47 | Yes |
| Alt. 5 | 7.0 | 26 | 937 | 462 | 43 | 3,007.3 | 31 | Yes |
| | 8.0 | 59 | 937 | 542 | 80 | 3,025.9 | 19 | Yes |
| | 8.5 | 75 | 937 | 568 | 26 | 3,038.1 | 12 | Yes |
| | 10.0 | 190 | 937 | 657 | 89 | 3,154.7 | 117 | No |
| Alt. 6 | 6.0 | 26 | 888 | 467 | 43 | 2,651.2 | 31 | Yes |
| | 7.0 | 59 | 888 | 540 | 73 | 2,664.8 | 14 | Yes |
| | 7.5 | 75 | 888 | 577 | 37 | 2,676.6 | 12 | Yes |
| | 9.0 | 190 | 888 | 667 | 90 | 2,796.6 | 120 | No |

1 Northern Economic Impact Area, which includes the community of Hamilton City

2 The Incremental Benefits and Incremental Costs are listed with respect to ecosystem restoration single purpose plans. First increment adds training dike for Alternatives 1, 5 and 6 only.

3 Does not include cultural resource preservation ($10,200 annualized).

dike extending south of County Road 23 that would provide an additional flood damage benefit to agriculture and urban structures in southern Hamilton City. The training dike would be constructed to the 20-year water surface elevation.

- Preliminary Combined Alternative 1 – Locally Developed Setback Levee (7.5-foot levee).
- Preliminary Combined Alternative 2 - Intermediate Setback Levee (9.0-foot levee).
- Preliminary Combined Alternative 3 - Ring Levee (10.0-foot levee).
- Preliminary Combined Alternative 4 - Locally Developed Setback Upstream of Dunning Slough, Intermediate Setback Levee Downstream of Dunning Slough (9.0-foot levee).
- Preliminary Combined Alternative 5 - Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough (10.0-foot levee).
- Preliminary Combined Alternative 6 - Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32 (9.0-foot levee).

Ecosystem restoration and flood damage reduction elements are included in each of the preliminary combined alternative plans (Table 3-8). Now that the preliminary combined alternative plans have been defined, the next step is to screen them.

## 3.7 SCREENING OF PRELIMINARY COMBINED ALTERNATIVE PLANS

The preliminary combined alternative plans were screened against the four planning criteria. This process is similar to the screening performed for the preliminary ecosystem restoration alternative plans, except now both ecosystem restoration and flood damage reduction purposes are considered. Standards were established to determine if the alternative plans meet each planning criteria. For a combined alternative plan to be carried forward for further consideration, minimum standards had to be met. The No-Action alternative plan was not included in this screening process because it must be carried forward in the process in order to serve as the baseline against which all retained combined alternative plans are compared.

Standards established for each criterion and results of each screening are:

- Completeness. To be complete, an alternative must not rely on other activities to function. An alternative plan is either complete or it is not complete. Each alternative plan is considered to be complete.
- Effectiveness. An alternative must contribute to at least 1 of the 6 planning objectives to be considered effective enough to retain for further consideration. Each alternative plan's ability to meet those objectives is identified in Table 3-9. All plans were considered to be effective.

**TABLE 3-8: ER AND FDR INCLUDED IN EACH PRELIMINARY COMBINED ALTERNATIVE PLAN**

| | Restoration Zones | | | | | | | Infrastructure | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Preliminary Combined Alternatives | Zones A1, A2, and A3 | Zone B2 | Zone E | Zone F | Zone G | Zone H | Zone I | Protects Waste Water Treatment Facility | Protects Holly Sugar Plant | Protects Agricultural Land South of Town with Levee |
| 1-Locally Developed Setback Levee | X | X | X | | X | | | X | X | X |
| 2-Intermediate Setback Levee | X | | X | X | X | X | | | X | |
| 3-Ring Levee | X | | X | X | X | X | X | | | |
| 4-Locally Developed Upstream of Dunning Slough, Intermediate Setback Downstream of Dunning Slough | X | | X | | X | | | X | X | |
| 5-Intermediate Upstream of Dunning Slough, Locally Developed Downstream of Dunning Slough. | X | X | X | X | X | X | | | X | X |
| 6-Intermediate Upstream of Hwy 32, Locally Developed Downstream of Hwy 32 | X | X | X | | X | X | | X | X | X |

- Efficiency. To be considered efficient, an alternative plan must be cost effective. Please refer to section 3.4. Formulation of Preliminary Ecosystem Restoration Alternative Plans, Efficiency, for a description of cost effectiveness. To be considered cost-effective, an alternative must provide more total benefits than less expensive alternatives. Monetary (flood damage reduction) and non-monetary (ecosystem restoration) benefits were combined for this analysis by subtracting the flood damage reduction benefits from the total project costs to calculate "remaining costs." An alternative that has higher total costs and lower restoration benefits than another alternative can be cost-effective only if the first alternative has additional monetary benefits that exceed its additional costs, resulting in lower remaining costs for the first alternative than for the second alternative. Therefore, a cost-effective alternative must provide more restoration benefits (AAHU's) than any alternative with lower remaining costs. Cost effectiveness based on total costs is also indicated in Table 3-10 for use in the trade-off analysis. An alternative cannot be eliminated based on total costs unless it has lower restoration benefits and lower flood damage

reduction benefits than a less expensive alternative. Results of the cost effectiveness analysis are shown in Table 3-10 and Figure 3-4.

**TABLE 3-9: EFFECTIVENESS OF PRELIMINARY COMBINED ALTERNATIVE PLANS IN ATTAINING PLANNING OBJECTIVES**

| Preliminary Combined Alternatives | Planning Objectives | | | | | |
|---|---|---|---|---|---|---|
| | Ecosystem | | | | Flood Damage Reduction | |
| | River Meander | Flooding Floodplain | Floodplain Habitat | Increase VELB Habitat | Reduce Risk from Flooding | Reduce Damages |
| 1-Locally Developed Setback Levee | No | Yes | Yes | Yes | Yes | Yes |
| 2-Intermediate Setback Levee | No | Yes | Yes | Yes | Yes | Yes |
| 3-Ring Levee | No | Yes | Yes | Yes | Yes | Yes |
| 4-Locally Developed Setback Upstream of Dunning Slough, Intermediate Setback Levee Downstream of Dunning Slough | No | Yes | Yes | Yes | Yes | Yes |
| 5-Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough | No | Yes | Yes | Yes | Yes | Yes |
| 6-Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32 | No | Yes | Yes | Yes | Yes | Yes |

- Acceptability. An alternative plan must be considered by the general public to be a satisfactory way of addressing problems identified. For the purposes of this screening, the question asked is "In general, does the public find construction of setback levees and habitat restoration to be an acceptable method of accomplishing ecosystem restoration?" An alternative plan is either considered acceptable or not acceptable. Each of the alternative plans includes a setback levee and habitat restoration, which are generally acceptable features to accomplish ecosystem restoration. Similarly, setback levees are generally considered to be an acceptable form of flood damage reduction. For the purposes of this screening, each of the alternative plans is considered to be acceptable.

**TABLE 3-10: COST EFFECTIVENESS SCREENING FOR EFFICIENCY OF ANNUALIZED PRELIMINARY COMBINED ALTERNATIVE PLANS[1]**

| Preliminary Combined Alternatives[2] | Increase in Habitat Units (AAHU) | Flood Damage Reduction Benefits[3] ($1,000) | Total Costs[4] ($1,000) | Cost Effective (Total Costs) | Remaining Costs[5] ($1,000) | Cost Effective (Remaining Costs) |
|---|---|---|---|---|---|---|
| 3-Ring Levee | 895 | 513 | 3,590 | No | 3,077 | No |
| 5-Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough | 937 | 568 | 3,048 | Yes | 2,480 | Yes |
| 2-Intermediate Setback Levee | 795 | 526 | 2,970 | No | 2,444 | No |
| 6-Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32 | 888 | 577 | 2,687 | Yes | 2,110 | Yes |
| 1-Locally Developed Setback Levee | 783 | 576 | 2,606 | Yes | 2,030 | Yes |
| 4-Locally Developed Setback Upstream of Dunning Slough, Intermediate Setback Levee Downstream of Dunning Slough | 642 | 536 | 2,541 | Yes | 2,005 | Yes |
| | | | | | | |

[1]Based on October 2003 price levels, 5 5/8 percent rate of interest and a 50-year period of analysis.
[2]Alternatives are ordered from highest to lowest remaining costs.
[3]All benefits and costs are average annual equivalents.
[4]Total costs and remaining costs includes CRP costs of $10,200 annualized
[5]Remaining Costs equal total costs less flood damage reduction benefits.

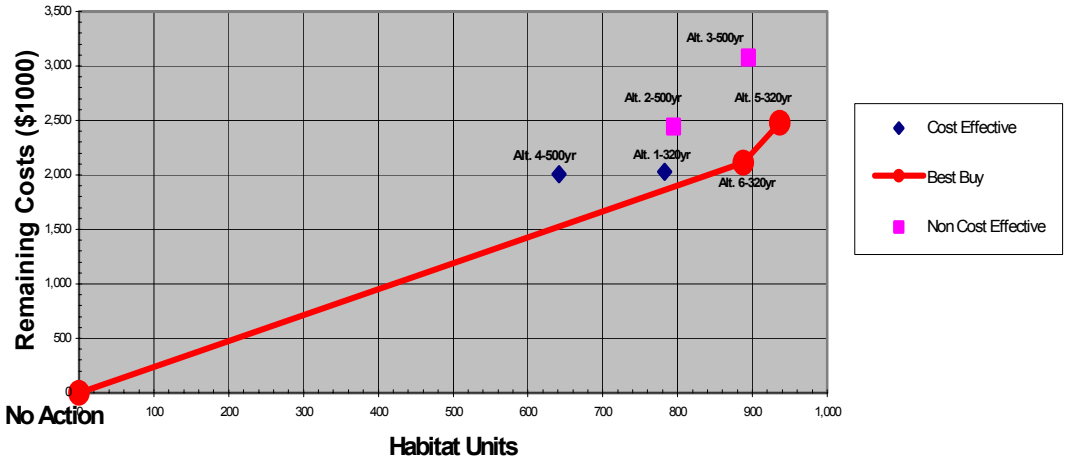



**Figure 3-4. Cost Effectiveness Analysis of Preliminary Combined Alternative Plans**

To recap, the preliminary combined alternative plans that meet all four planning criteria standards are Alternatives 1, 4, 5 and 6. Alternatives 2 and 3 did not meet the meet the standard for efficiency and were not retained. The results of the screening of preliminary combined alternatives are shown in Table 3-11.

The screening process eliminated preliminary Combined Alternatives 2 and 3 from further consideration. All other preliminary combined alternative plans are retained for further evaluation. Combined alternative plans were carried forward as the final array of combined alternative plans, which were next evaluated and compared to identify the alternative plan with Federal interest.

## 3.8 ANALYSIS OF COMBINED ALTERNATIVE PLANS

Following is a description of the final array of combined alternative plans.

### 3.8.1 Description of Combined Alternative Plans*

Following is a description of each alternative in terms of its features, accomplishments, uncertainties, effects, operation, maintenance, repair, replacement and rehabilitation (OMRR&R) requirements, and costs.

**No-Action**

The No-Action alternative assumes that no project would be implemented by the federal government or by local interests to achieve the planning objectives. Refer to the Study Area Map (Figure 2-3) for a depiction of the No-Action Alternative. Critical assumptions in defining the No-Action alternative include:

- The "J" levee would continue to be privately owned. Some periodic maintenance could be expected to occur as limited funding allows. The "J" levee would remain in relatively poor geotechnical condition. No improved method of flood protection would be accomplished because the community and county, who in past years has expended its flood control budget protecting Hamilton City, would not likely have enough funding to implement a project on their own.
- Extensive flood fighting of the "J" levee would continue to be necessary to maintain the integrity of the levee when water levels rise in the Sacramento River.
- The existing level of flood protection would not change. Although with flood fighting the "J" levee has historically passed high flood events, statistically it only has about a 66 percent chance of passing a 10-year event assuming significant flood fighting efforts. This would also equate to a 90 percent chance of passing an event smaller than a 10-year event. Another way to state this is that on an annual basis, the community currently has about a 9 percent chance of flooding in any given year, again assuming flood-fighting efforts.
- Erosion of the levee toe at the northern end of the "J" levee would continue, but the Glenn County backup levee would maintain the flood control function of the "J" levee.
- Hydrologic and hydraulic conditions in the study area would remain similar to existing conditions with no significant changes.

**TABLE 3-11: SCREENING OF PRELIMINARY COMBINED ALTERNATIVE PLANS**

| Preliminary Combined Alternatives | Completeness | Effectiveness | Efficiency | Acceptability | Overall |
|---|---|---|---|---|---|
| 1–Locally Developed Setback Levee | Yes | Yes | Yes | Yes | Retained |
| 2-Intermediate Setback Levee | Yes | Yes | No | Yes | Dropped |
| 3-Ring Levee | Yes | Yes | No | Yes | Dropped |
| 4-Locally Developed Setback Upstream of Dunning Slough, Intermediate Setback Levee Downstream of Dunning Slough | Yes | Yes | Yes | Yes | Retained |
| 5-Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough | Yes | Yes | Yes | Yes | Retained |
| 6-Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32 | Yes | Yes | Yes | Yes | Retained |

- Agricultural lands would continue to decline due to seepage, erosion, flooding and scouring that are associated with the close proximity of the lands to the Sacramento River.
- Future development in the study area was estimated to be limited to the build-out of homes in a new subdivision on the east side of Hamilton City (scheduled for completion in 2004) and construction of an adjacent middle school (assumed completion in 2010).
- TNC property within the study area would remain in agricultural production, as would other privately owned agricultural lands. Neither funds nor permits are in place to allow for restoration work to occur.
- The DFG and USFWS lands in the study area would be restored with native habitat.
- Glenn County would continue to flood fight the Glenn-Colusa Irrigation District (GCID) canal berm at a low spot north of the study area.
- The problems and opportunities in the study area would remain unresolved.

- Glenn County would continue to operate the existing flood warning system and utilize the existing emergency preparedness plan.
- The State of California has the responsibility to operate and maintain the Chico Landing to Red Bluff Project. Any future placement of rock as part of that project would need to consider a jeopardy opinion issued by the USFWS that pertains to the valley elderberry long-horned beetle and includes the study area.
- Based on historical migration rates, it is estimated that 200 feet of migration could be expected for an exceedence interval of 50 years specific to River Mile 186 to 198. Rock riprap bank protection usually lasts about 50-years with significant deterioration starting about 20-years from its time of placement. Existing rock riprap bank in the future. About 20 to 25 percent of existing riprap cover has eroded from the bank, mostly to the south end of the study area.
- A small portion of the urban area of Hamilton City is within the FEMA 100 year floodplain and the structures within this area have been elevated above the FEMA 100-year floodplain. The unincorporated area of Glenn County, including Hamilton City, is enrolled in the National Flood Insurance Program, but does not have a Flood Mitigation Plan, both of which are requirements for applications for FEMA floodplain buyout programs. Glenn County has not considered participating in these buyout programs ( Thomas, 2004) and it is unlikely to do so in the future.

**Combined Alternative 1 – Locally Developed Setback Levee**

This alternative is based on a levee alignment developed by the Hamilton City Community Services District and several landowners in the study area and is 6.6 miles long. On average, the levee would be 7.5 feet high (6 feet for the prevention of induced flooding due to ecosystem restoration, and an additional 1.5 feet for flood damage reduction) set back roughly 500 to 7,600 feet from the river, and removal of most of the existing "J" levee. It includes actively restoring about 1,300 acres of native habitat in Zones A1, A2 and A4, E, G, and B2, waterside of the setback levee. The plan is shown in Figure 3-5. The levee would have a 90 percent reliability of passing a 75-year event in the Northern impact area (which includes Hamilton City).

In order to accomplish ecosystem restoration, most of the existing "J" levee would be removed to reconnect the river to the floodplain. While this action would enable ecosystem restoration, it would lower the community's existing flood protection. The Federal and State governments would be obligated to mitigate the effect of removing the private levee that protects Hamilton City. In order to ensure that the replacement levee would have the same possibility of passing a flood as the existing "J" levee could with flood-fighting, the replacement levee would be of the same height as the existing "J" levee.

In order to compensate for removing the "J" levee, it is important to consider existing rock on the "J" levee. The existing "J" levee has about 11,250 square feet of rock greater than 20 inches in diameter (450 feet long by about 25 feet high). This rock was placed during flood fighting efforts in 1997 because the levee was eroding. This rock was placed because the existing "J" levee is of poor quality and subject to erosion. A replacement levee would be constructed to Corps' standards, so this rock would not need to be replaced.

The new setback levee would begin about 2 miles north of Hamilton City, tying into high ground near the northern end of the "J" levee. Tying into high ground at this location

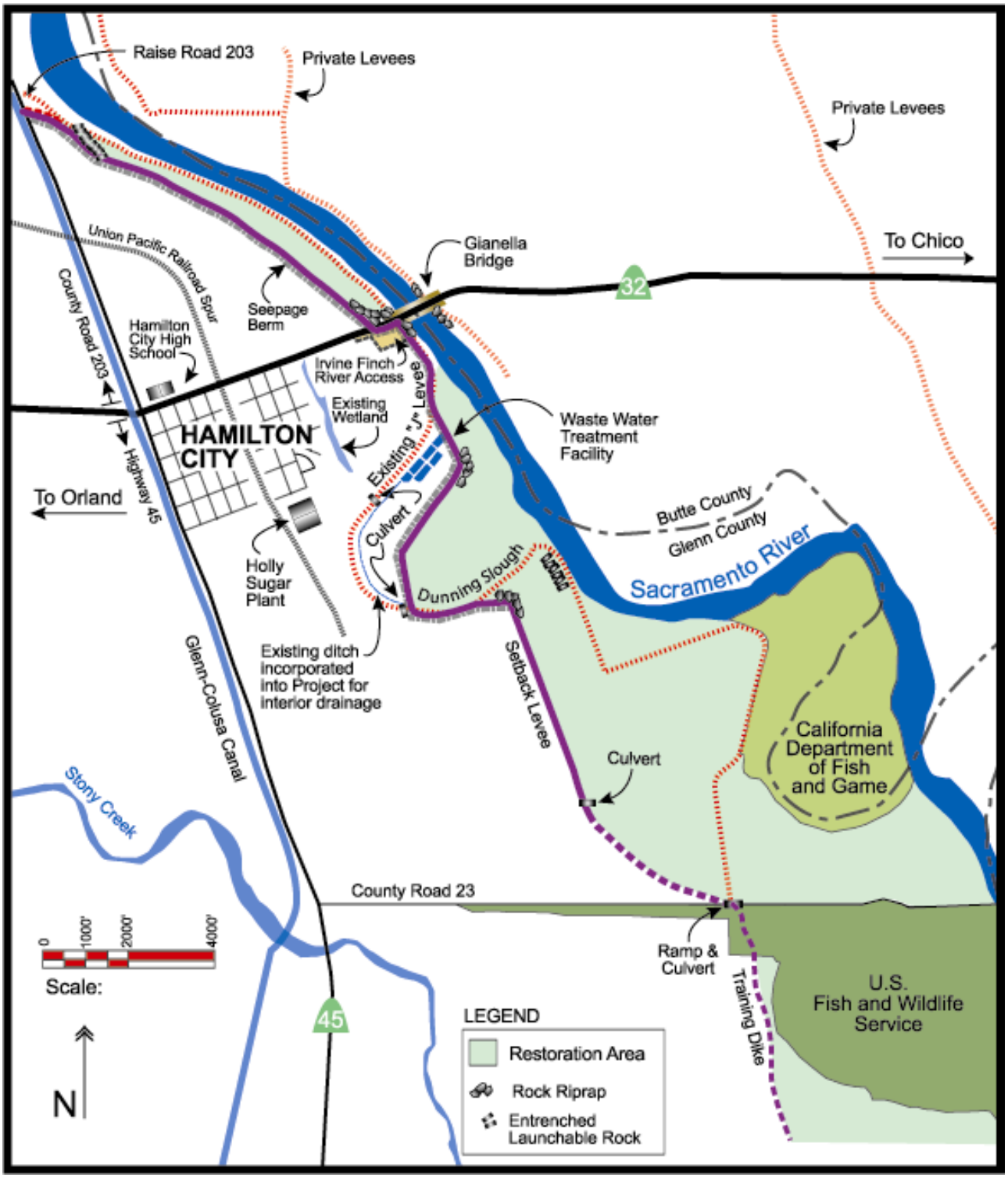



**Figure 3-5: Combined Alternative 1 - Locally Developed Setback Levee**

would prevent flows greater than the 250-year event from possibly wrapping around the setback levee and over County Road 203. The setback levee would be extended to a point just west of County Road 203, and County Road 203 would be ramped approximately 2.5 feet from its current height over the setback levee. Glenn County constructed a short setback levee near the northern end of the "J" levee in 2003, which would be incorporated into the new setback levee. Entrenched rock would be placed on the waterside of the setback levee to direct flows and possible river migration away from the setback levee.

South of Dunning Slough, the alignment would roughly follow along the western edge of the habitat restoration area before turning east and merging with the southern end of the "J" levee at County Road 23. As the levee turns east, the levee height would gradually decrease from 7.5 feet to approximately 3 feet. At this point the new levee would become a "training dike" meant to direct flows rather than control them. This height reduction is to avoid negative hydraulic effects to downstream property owners. The training dike would be constructed to the 20-year water surface elevation. The training dike would continue for about a mile south of County Road 23, running along the western portion of the USFWS property. A small ramp with culverts on either side would be constructed over the training dike at County Road 23 to maintain the river access. This alignment does not tie into high ground and therefore allows some backwater flooding of agricultural lands, as currently happens with the "J" levee. In fact, the training dike is designed to allow flood waters to flow over it's top and gently spread out into the agricultural areas while reducing the high velocities that cause extensive damage to the orchards.

All lands to the waterside of the setback levee would be actively restored with a mixture of riparian, scrub, oak savannah, and grassland habitat (except the DFG and USFWS lands, which are assumed to be restored under the without-project condition). The "J" levee would be removed, except for portions where it would serve to reduce velocities of the Sacramento River for establishment of newly planted habitat. Established riparian vegetation waterside of the existing "J" levee would be avoided wherever possible.

Many in the local community favor this alternative because it is located the greatest distance from Hamilton City of any of the alternatives and it protects the wastewater treatment plant and agricultural land south of town.

**Erosion Control.** Placement of rock (entrenched and revetment) was considered necessary at some points along the replacement levee to ensure the existing flood protection is not lessened and to offset potential scouring from changes in flows. Placement of rock would be as follows:

- North end of the Project. Entrenched rock would be buried in a 1,500 foot-long trench in Zone G, parallel to County Road 203 and approximately 200 feet from the toe of the levee. When the river erodes away the bank at the location of the trench, the rock would fall and armor the bank preventing erosion beyond that point.
- Highway 32 Gianella Bridge. Because a replacement levee would be set back from the existing "J" levee, the northern bridge approach would be exposed to direct flows. It is not currently exposed to these direct flows, which could scour the approach. In order to ensure that bridge is not compromised by the potential project, 1,000 feet of rock riprap would be placed on and around the abutment. Because this rock would be necessary to maintain the existing condition, it is

considered a part of equitable replacement of the existing "J" levee. Also, up to 100 feet of rock would be placed under the Gianella Bridge at Highway 32 abutment specifically to protect it from exposure to the 320-year water surface elevation attainable by the flood damage reduction component of the project.

- Dunning Slough. Because a replacement levee would be set back from the existing "J" levee, a bend in the replacement levee would be exposed to overland flows from multiple angles, which could erode a replacement levee. In order to ensure that the replacement levee is not subject to this erosion, 1,600 feet of rock riprap would be placed along the levee at the bend. Because this rock would be necessary to maintain the existing condition, it is considered a part of equitable replacement of the existing "J" levee. South of Dunning Slough, 1,600 feet of entrenched rock would be placed to protect the new levee from erosion and river migration.
- Southernmost extent. A replacement levee would not affect the existing erosion conditions south of Dunning Slough. It is assumed that the Chico Landing to Red Bluff Project (local site constructed in 1975-1976) would remain authorized and continue to be maintained. For the new levee to perform to the same level as the existing "J" levee, erosion control at the end of the levee would consist of planting significant amounts of vegetation (about 20 feet or so from the levee toe) to reduce velocities at the levee.

**Hydraulic Effects.** This alternative plan would be constructed to avoid hydraulic impacts, primarily through slightly decreasing the habitat restoration.

**Uncertainty**. Average yearly river migration is 6 feet per year. However, the extreme northern and southern ends of the potential project area have experienced rates above that average. (Larson, Anderson, Avery, Dole, 2002.) The study area is also within the Sacramento River Chico Landing to Red Bluff Bank Protection Project limits that authorized placement of bank protection in areas of high erosion, which has constrained the river's ability to move. Based upon aerials from the past 100 years, risk of levee failure due to river meandering seems very low. This information is being refined through continuing hydraulic studies.

**Accomplishments**. This alternative plan would restore 1,300 acres of habitat and provide 783 AAHU's. Expected annual flood damages would be reduced by about $576,000 (including avoided flood fighting costs). Residual expected annual flood damages would be $264,000. This damage reduction is smaller than what is shown in Table 3-9 because the levee height decreases from north to south (from 7.5 to 3 feet).

**Costs**. The total project first cost for this alternative plan is estimated to be $43,534,000. Annual OMRR&R costs are estimated to be $54,000. Levee maintenance costs are estimated to be $46,000. Maintenance costs for habitat restoration are estimated to be $8,000 per year.

**Combined Alternative 4 - Locally Developed Setback Upstream of Dunning Slough, Intermediate Setback Levee Downstream of Dunning Slough**

This alternative would consist of constructing a levee about 4.1 miles long and set back roughly 500 to 2,700 feet from the river, removing the existing "J" levee, and actively restoring about 1,100 acres of native habitat. The levee alignment is shown in Figure 3-6. On average, the levee would be 9 feet high (6 feet for the ecosystem restoration increment of levee, and an additional 3 feet for the flood damage reduction increment). The levee would provide the community with a 90 percent level of confidence of passing the 190-year event. The levee alignment follows that of Combined Alternative 1 from the north down to the southern end of Dunning Slough. At that point, the alignment would wrap around the Holly Sugar Plant and tie into high ground along Highway 45. It would protect the wastewter treatment plan and Holly Sugar plant, but not the agricultural lands south of town. The lands restored in this alternative would be the same as Combined Alternative 1, with the exception of Zone B2, which would not be included. The existing "J" levee would be removed to allow overbank flooding of the flooplain. Flowage easements may need to be purchased south of the Holly Sugar Plant and west of the existing "J" levee to compensate landowners for increased flooding due to the removal of the existing "J" levee.

**Erosion Control.** Erosion protection would be the same as for Combined Alternative 1, except that in Dunning Slough there would be 500 feet of rock.

**Uncertainty.** See Combined Alternative 1.

**Hydraulic Effects.** This alternative would not result in any adverse hydraulic effects.

**Accomplishments.** This alternative plan would restore 1,050 acres and provide 642 AAHU's. Reduces expected annual flood damages by about $536,000 (including avoided flood fighting costs). Residual expected annual flood damages would be $190,000.

**Costs**. The total project first cost for this alternative plan is estimated to be $42,453,000. The average annual OMRR&R cost is estimated to be $37,000, of which $29,000 is for levee maintenance and $8,000 is for habitat restoration.

**Combined Alternative 5 - Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough**

This alternative plan consists of actively restoring about 1,600 acres of native vegetation, constructing a setback levee about 6.4 miles long, and about 7.5 feet high (6 feet for the ecosystem restoration increment of levee, and an additional 1.5 feet) for the flood damage reduction increment), and removing most of the existing "J" levee. The alternative plan is shown in Figure 3-7 and includes restoration of Zones A1, A2, and A4, B2, E, F, G, and H waterside of the setback levee. The levee would have a 90 percent reliability of passing a 75-year event in the Northern impact area (which includes Hamilton City).

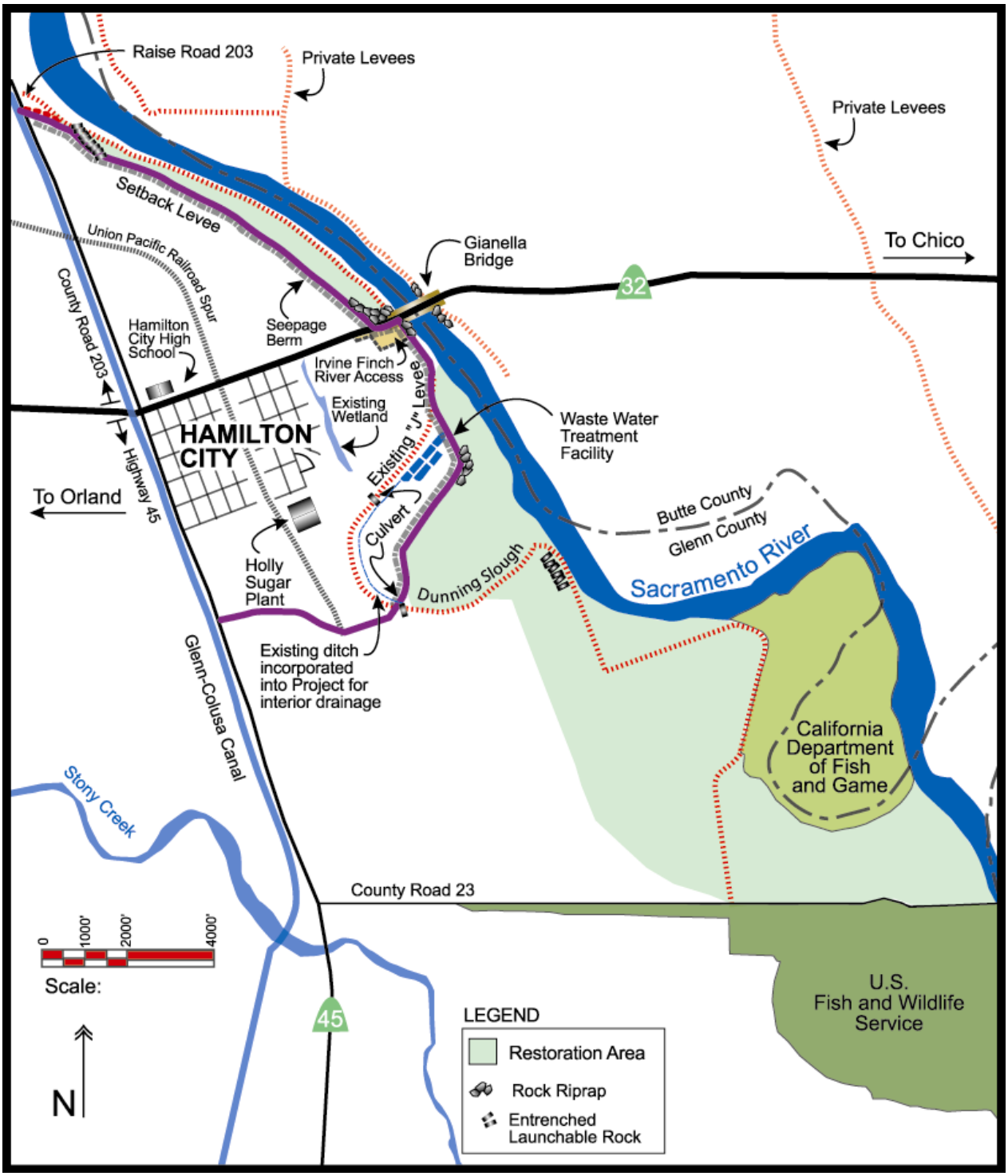



**Figure 3-6: Combined Alternative 4 - Locally Developed Setback Upstream of Dunning Slough, Intermediate Setback Levee Downstream of Dunning Slough**

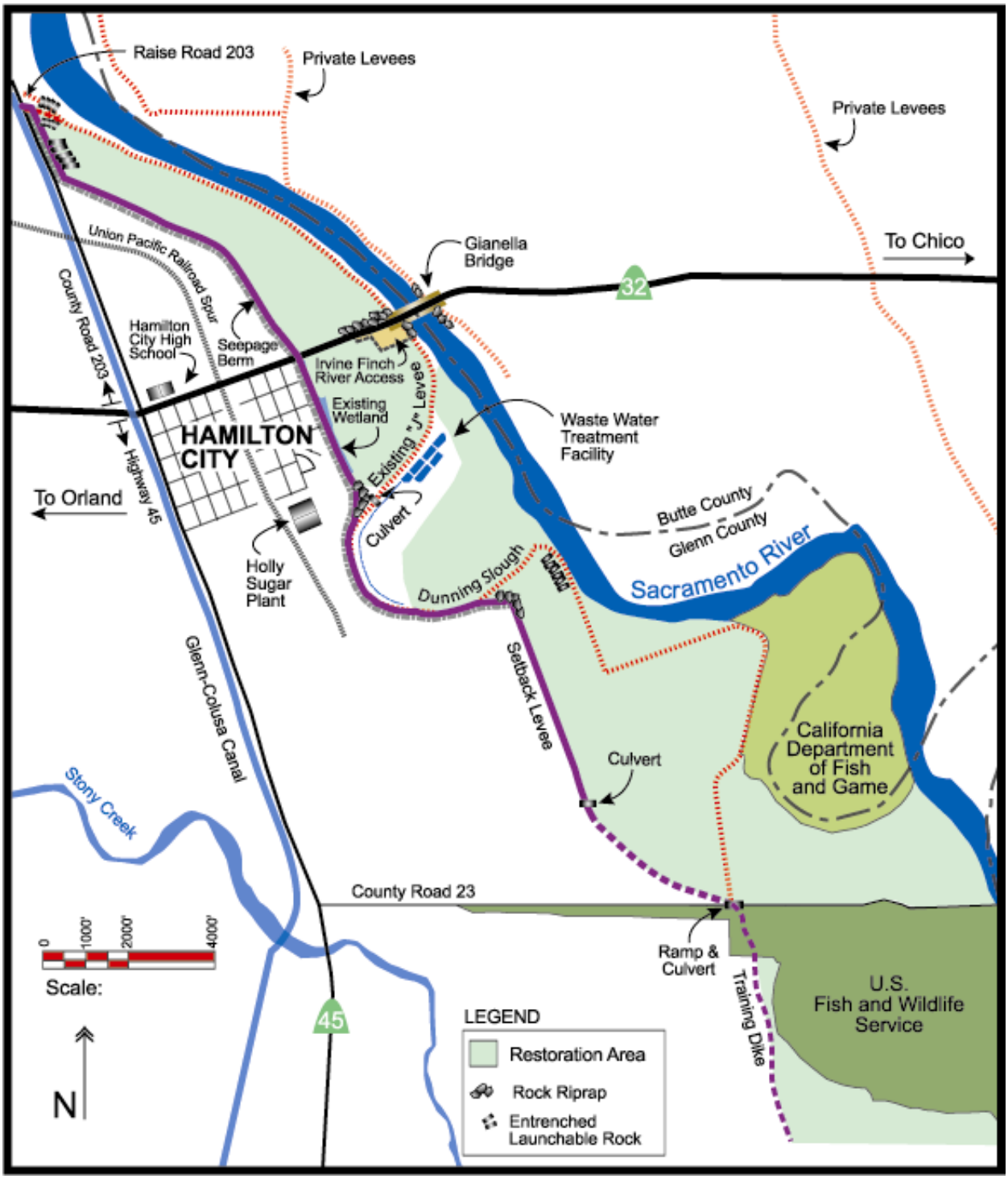



**Figure 3-7: Combined Alternative 5 - Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough**

The new setback levee would begin about 2 miles north of Hamilton City, tying into high ground near the northern end of the "J" levee. Tying into high ground at this location would prevent flows greater than the 250-year event from possibly wrapping around the setback levee and over County Road 203. The setback levee would be extended to a point just west of County Road 203, and County Road 203 would be ramped approximately 2.5 feet from its current height over the setback levee. Glenn County constructed a short setback levee near the northern end of the "J" levee in 2003, which would be used as a "training dike" for the new setback levee. Entrenched rock would be placed either on the waterside or the landside of this training dike to direct flows and possible river migration away from the new setback levee. The "training dike" south of County Road 23 would be the same as for Combined Alternative 1.

Lands waterside of the new levee would be restored to native habitat. Approximately 1,600 acres of native habitat would be restored including; 1050 acres of riparian, 300 acres of scrub, 150 acres of savannah, and 100 acres of grassland. The "J" levee would be removed, except for portions where it would serve to reduce velocities of the Sacramento River for establishment of newly planted habitat. Established riparian vegetation waterside of the existing "J" levee would be avoided wherever possible. The removal of most of the "J" levee would allow periodic overbank flooding, increasing the ecosystem value of riparian and scrub habitat in the floodplain (periodic flooding was assumed not to affect the value of grassland and oak savannah habitat).

Native vegetation would be restored on lands waterside of the new levee. Restoration would also occur on the land directly east of Hamilton City between Highway 32 and Dunning Slough (Zone F) and land within Dunning Slough (Zone A1). Existing orchards in the proposed restoration areas would be removed and native vegetation planted. The native vegetation would predominantly be riparian species, but some scrub, oak savannah and grassland species would also be included, based on hydrologic, topographic, and soil conditions. An exception to this is the land in the middle of Dunning Slough (Zone A1), which is a relatively higher elevation than the rest of the restored area, and oak savannah vegetation is anticipated to be more appropriate for these lands.

**Erosion Control.** Erosion protection would be the same as for Combined Alternative 1.

**Uncertainty.** See ecosystem alternative 1.

**Hydraulic Effects.** Hydraulic modeling of Combined Alternative 6 (which includes a levee set closer to the river than Combined Alternative 5) shows that there would be about a 0.1 to 0.6-foot decrease associated with the 342,600 cfs flow event in portions of Butte County. For the 75-year flood event, existing levees along the eastern side of the Sacramento River would be overtopped. By widening the floodway on the western side of the Sacramento River, this alternative plan could be expected to further reduce stages in Butte County landside of the eastern levees.

**Accomplishments.** This alternative plan would restore 1,600 acres and provide 937 AAHU's. Reduces expected annual flood damages by about $568,000 (including avoided flood fighting costs). Residual expected annual flood damages would be $272,000. This damage reduction is smaller than what is shown in Table 3-9 because the levee height decreases from north to south (from 7.5 to 3 feet).

**Costs**. The total project first cost for this alternative plan is estimated to be $50,890,000. The average annual OMRR&R cost is estimated to be $53,000, of which $45,000 is for levee maintenance and $8,000 is for habitat restoration.

**Combined Alternative 6 - Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32**

This alternative is largely the same as Alternative 6 (NER). This alternative plan consists of actively restoring about 1,500 acres of native vegetation, constructing a setback levee about 6.8 miles long, and about 7.5 feet high (6 feet for the ecosystem restoration increment of levee, and an additional 1.5 foot for the flood damage reduction increment), and removal of most of the existing "J" levee. The alternative plan is shown in Figure 3-8 and includes Zones A1, A2, A4, B2 E, G, and H waterside of the setback levee. The levee would have a 90 percent reliability of passing a 75-year event in the Northern impact area (which includes Hamilton City).

The new setback levee would begin about 2 miles north of Hamilton City, tying into high ground near the northern end of the "J" levee. Tying into high ground at this location would prevent flows greater than the 250-year event from possibly wrapping around the setback levee and over County Road 203. The setback levee would be extended to a point just west of County Road 203, and County Road 203 would be ramped approximately 2.5 feet from its current height over the setback levee. Glenn County constructed a short setback levee near the northern end of the "J" levee in 2003, which would be used as a "training dike" for the new setback levee. Entrenched rock would be placed either on the waterside or the landside of this training dike to direct flows and possible river migration away from the new setback levee.

North of Highway 32, the levee alignment ties into high ground at the northern end of the "J" levee, about 2 miles north of Hamilton City. The levee runs southeast along County Road 203 until turning easterly and running roughly parallel to and about 1,300 feet to the west of the Sacramento River, following higher ground.

At Highway 32, the levee turns east and runs parallel to the highway until tying into the approach to Gianella Bridge. The highway would not need to be raised in this alternative plan, but measures to protect the levee embankment and bridge from floodwaters would be necessary. South of Highway 32, the alignment follows the existing "J" Levee in order to minimize negative effects to the Irvine Finch River Access (just south of the highway). Some minor modifications to the River Access entrance and parking lot during levee construction may be required. The alignment also cuts across a portion of Dunning Slough providing protection to the Hamilton City wastewater treatment plant, some abandoned holding ponds for the old Holly Sugar plant (in which the community would like to expand the treatment plant in the future), and a lime disposal pile.

South of Dunning Slough, the alignment roughly follows along the western edge of the habitat restoration area before turning east and ending at the southern end of the "J" levee at County Road 23. This alignment does not tie into high ground and therefore allows some backwater flooding of agricultural lands, just as does the "J" levee. The "training dike" south of County Road 23 would be the same as for Combined Alternative 1.

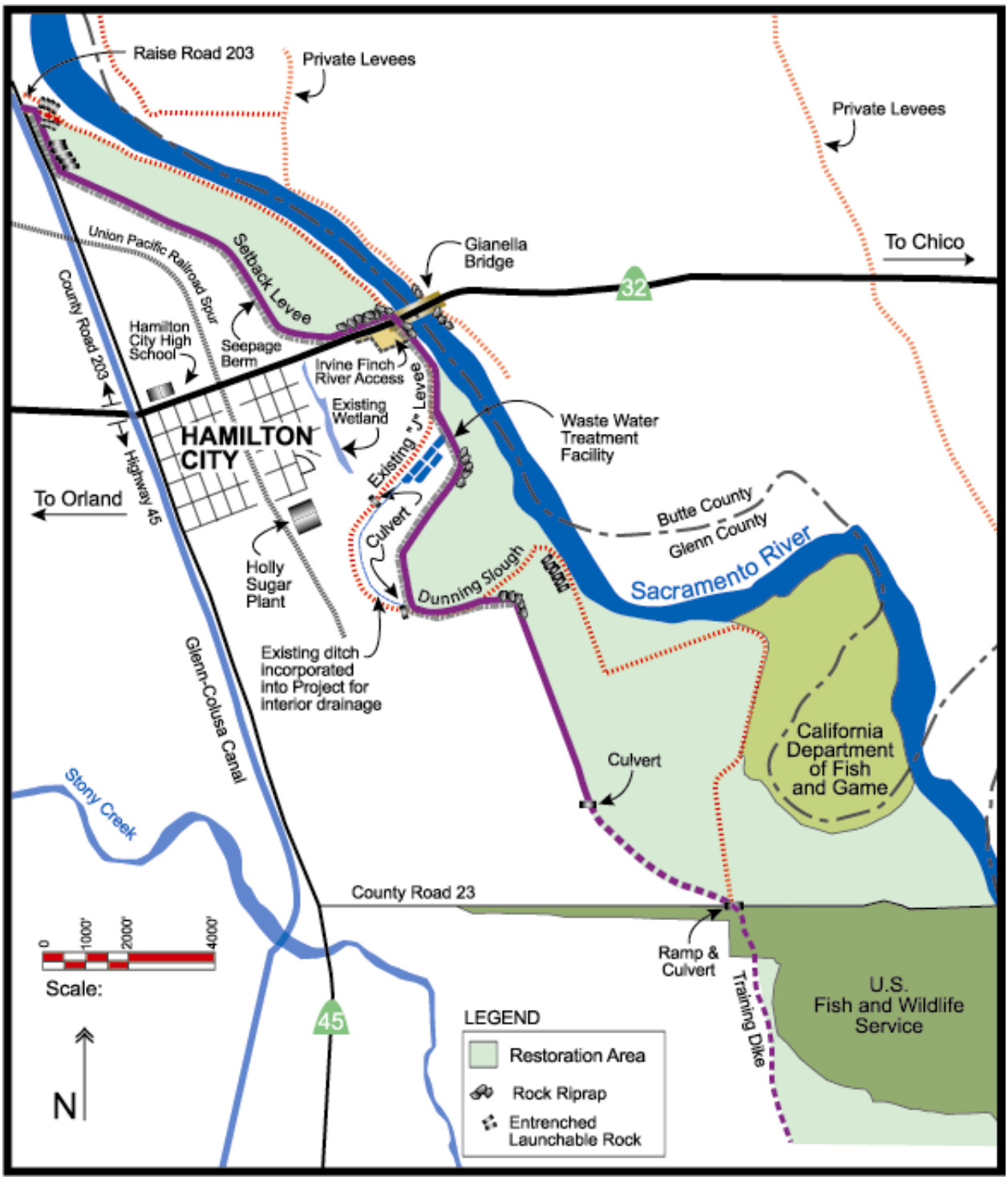



**Figure 3-8: Combined Alternative 6 - Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32**

The restored area under this alternative is the same as the previous alternative, except that the land directly east of Hamilton City between Highway 32 and Dunning Slough (Zone F) would not be restored. Existing orchards in the proposed restoration areas would be removed and native vegetation planted. The native vegetation would predominantly be riparian species, but some scrub, oak savannah and grassland species would also be included, based on hydrologic, topographic, and soil conditions. An exception is the land in the middle of Dunning Slough (Zone A1), which is relatively higher in elevation than the rest of the restored area and oak savannah vegetation is anticipated to be more appropriate for these lands.

The "J" levee would be removed, except for portions where it would serve to reduce velocities of the Sacramento River for establishment of newly planted habitat. Established riparian vegetation waterside of the existing "J" levee would be avoided wherever possible.

**Erosion Control.** Erosion protection would be the same as for Combined Alternative 1.

**Uncertainty.** See ecosystem Alternative 1.

**Hydraulic Effects.** Hydraulic modeling of the recommended plan shows that there would be about a 0.1 to 0.6-foot decrease associated with the 342,600 cfs flow event (320-year flood event) in portions of Butte County. For the 75-year flood event, existing levees along the eastern side of the Sacramento River would be overtopped. By widening the floodway on the western side of the Sacramento River, this alternative plan would reduce stages in Butte County landside of the eastern levees.

**Accomplishments.** This alternative plan would restore 1,500 acres of habitat and provide 888 AAHU's. Reduces expected annual flood damages by about $577,000 (including avoided flood fighting costs). Expected residual flood damages would be $263,000. This damage reduction is smaller than what is shown in Table 3-9 because the levee height decreases from north to south (from 7.5 to 3 feet).

**Costs.** The total project first cost for this alternative plan is estimated to be $44,876,000. Annual OMRR&R costs are estimated to be $55,000, of which $47,000 is levee maintenance and $8,000 is for habitat restoration.

### 3.8.2 Evaluation and Comparison of Combined Alternative Plans

**No-Action versus Action**

The No-Action alternative would not meet any of the planning objectives. It has no positive benefits or effects since it is the basis from which the effects and benefits are measured. It does not, however, involve incurring the implementation costs or adverse effects of the action alternatives.

**Trade-Off Analysis between Cost Effective Combined Alternative Plans**

Trade-off analysis is the procedure used to identify the potential gains and losses associated with producing a larger or lesser amount of a given output or outputs, and is required in the Corps' Engineering Circular 1105-2-404, "Planning Civil Work Projects Under the Environmental Operating Principles," 1 May 2003. This process is used to help identify the best Combined Plan to be further considered. Table 3-12 illustrates the comparison

between the cost-effective plans (Combined Alternatives 1, 4, 5, 6) by describing the advantages of each alternative over the other.

Percentage of Maximum method was used for trade-off analysis, as it is the most commonly used normalization technique. Criterion measurements used for trade-off included annual Flood Damage Reduction Benefits, Total Costs, and Average Annual Habitat Units gained. The weighting assigned for each criterion was 50 percent for Habitat Gained and 8 percent for Flood Damage Reduction benefits and 42 percent for Total Costs. (To make a dollar of flood damage reduction benefits equal in weight to a dollar of costs, the normalized units of cost must be given a weight that is 5.3 times as much as the weight given to the normalized units of flood damage reduction benefits, because the maximum annual costs ($3,048,000) represented by one normalized unit of cost is 5.3 times as much as the maximum annual flood damage reduction benefit ($577,000) represented by one normalized unit of flood damage reduction benefit.) Because of the normalization process used in the trade-off analysis, this subjective weighting implies that the maximum ecosystem restoration benefit (937 AAHU's) is equally as valuable as the sum of the maximum annual flood damage reduction benefit ($577,000) and the maximum total annual cost ($3,048,000). Table 3-13 shows the application of the Percentage of Maximum Method. Because ecosystem restoration and flood damage reduction are equally important to stakeholders in the study area, the Project Delivery Team selected an intermediate set of weightings that gives balanced consideration to environmental and economic factors. The total weight to economic factors (0.08 for monetary benefits and 0.42 for monetary costs) is equal to the total weight to non-monetary environmental benefits (0.50). Table 3-14 shows the entire array of preference assignments for sensitivity analysis, along with the ranking of each alternative. All four of the alternatives that were cost-effective based on total costs are included in the trade-off analysis.

**TABLE 3-12: TRADE-OFF ANALYSIS ($1,000)**

**ORIGINAL DECISION MATRIX[1]**

| Combined Alternative | Annual Flood Damage Reduction Benefits | Average Annual Habitat Units Gained | Total Annual Cost |
|---|---|---|---|
| 1 | 576 | 783 | 2,606 |
| 4 | 536 | 642 | 2,541 |
| 5 | 568 | 937 | 3,048 |
| 6 | 577 | 888 | 2,687 |

[1]Annualized costs.

**TABLE 3-13: DECISION MATRIX NORMALIZED BY PERCENT OF MAXIMUM METHOD WITH ASSIGNED WEIGHTED PRODUCT**

| Alternative | Flood Damage Reduction Benefits | Average Annual Habitat Units Gained | Total Annual Cost | Weighted Product | Ranking |
|---|---|---|---|---|---|
| 1 | 0.9983 | 0.8356 | -0.8550 | 0.1386 | 3 |
| 4 | 0.9289 | 0.6852 | -0.8337 | 0.0668 | 4 |
| 5 | 0.9844 | 1.0000 | -1.0000 | 0.1588 | 2 |
| 6 | 1.0000 | 0.9477 | -0.8816 | 0.1836 | 1 |
| Preference Assignment | 0.08 | 0.50 | .42 | | |

**TABLE 3-14: SENSITIVITY ANALYSIS SUMMARY**

| Preference Assignments | | | Ranking |
|---|---|---|---|
| AAHU Gained | Total Costs | FDR Benefits | |
| 0.10 | 0.76 | 0.14 | 1, 4, 6, 5 |
| 0.20 | 0.67 | 0.13 | 6, 1, 4, 5 |
| 0.30 | 0.59 | 0.11 | 6, 1, 5, 4 |
| 0.40 | 0.5 | 0.10 | 6, 1, 5, 4 |
| 0.50 | 0.42 | 0.08 | 6, 5, 1, 4 |
| 0.60 | 0.34 | 0.06 | 6, 5, 1, 4 |
| 0.70 | 0.25 | 0.05 | 5, 6, 1, 4 |
| 0.80 | 0.17 | 0.03 | 5, 6, 1, 4 |
| 0.90 | 0.08 | 0.02 | 5, 6, 1, 4 |

**Final Ranking**

Alternative 6 is the highest ranked plan, which means it performs best relative to all other plans formulated, the criteria identified and the determined set of preferences. It should be noted that Combined Alternative 4 did not rank first in any of the sensitivity iterations. Since Combined Alternatives 1, 5 and 6 did rank first in some of the sensitivity iterations, they constitute the final array of combined alternative plans that are considered in further detail.

**Incremental Cost Analysis of "Best Buy" Combined Alternative Plans**

Of the cost effective plans, the most efficient in production of outputs are identified as "Best Buy" plans. These "Best Buy" plans provide the greatest increase in outputs for the least increase in cost and have the lowest incremental cost per unit of output relative to the other cost effective plans. Through this process, Combined Alternatives 5 and 6 were identified as "best buy" plans. Because Alternative 1 was not identified as "best buy" plan, it was no longer considered in determining Federal interest in a combined plan. However, it should be noted that the Federal government could potentially participate to some degree in implementing any of the cost effective alternative plans.

An incremental analysis of Combined Alternatives 5 and 6 was performed to assist in the decision-making process. The incremental analysis considered ecosystem restoration benefits and "remaining costs" (total costs less flood damage reduction benefits). Using incremental cost analysis to help maximize ecosystem restoration benefits relative to remaining costs is equivalent to using incremental cost analysis to help maximize total benefits relative to total costs.

The comparison of the incremental outputs for Alternatives 5 and 6 are displayed in Table 3-15 and in Figure 3-9. Based upon the cost effectiveness analysis and the incremental cost analysis, Alternative 6 produces outputs at an incremental remaining cost per AAHU of $2,380. The next level of output (Alternative 5) produces an incremental remaining cost per AAHU of $7,550. The question now becomes is the next level of output "worth" the cost; that is, whether the environmental benefits of the additional output in the next level are worth the additional cost. Since the additional output of Alternative 5 is relatively small and the cost is relatively great, Alternative 6 is determined to be the alternative plan that reasonably maximizes both ecosystem restoration and flood damage reduction benefits compared to costs and is therefore identified as the Combined Plan. Table 3-16 presents a summary of the best buy plans.

**TABLE 3-15: INCREMENTAL COST ANALYSIS OF "BEST BUY" COMBINED ALTERNATIVE PLANS**

| Preliminary Combined Alternatives[2] | Increase in Habitat Units (AAHU) | Flood Damage Reduction Benefits[3] ($1,000) | Total Costs[4] ($1,000) | Remaining Costs[5] ($1,000) | Incremental Remaining Costs per AAHU ($1,000) |
|---|---|---|---|---|---|
| 5-Intermediate Setback Upstream of Dunning Slough, Locally Developed Setback Downstream of Dunning Slough | 937 | 568 | 3,048 | 2,480 | 7.55 |
| 6-Intermediate Setback Upstream of Highway 32, Locally Developed Setback Downstream of Highway 32 | 888 | 577 | 2,687 | 2,110 | 2.38 |

[1]Based on October 2003 price levels, 5 5/8 percent rate of interest and a 50-year period of analysis.

[2]Alternatives are ordered from highest to lowest remaining costs.

[3]All benefits and costs are average annual equivalents, includes CRP costs of $10,200 annualized.

[4]Total Costs and Remaining costs included CRP costs of $10,200 annualized.

[5]Remaining Costs equal total costs less flood damage reduction benefits.

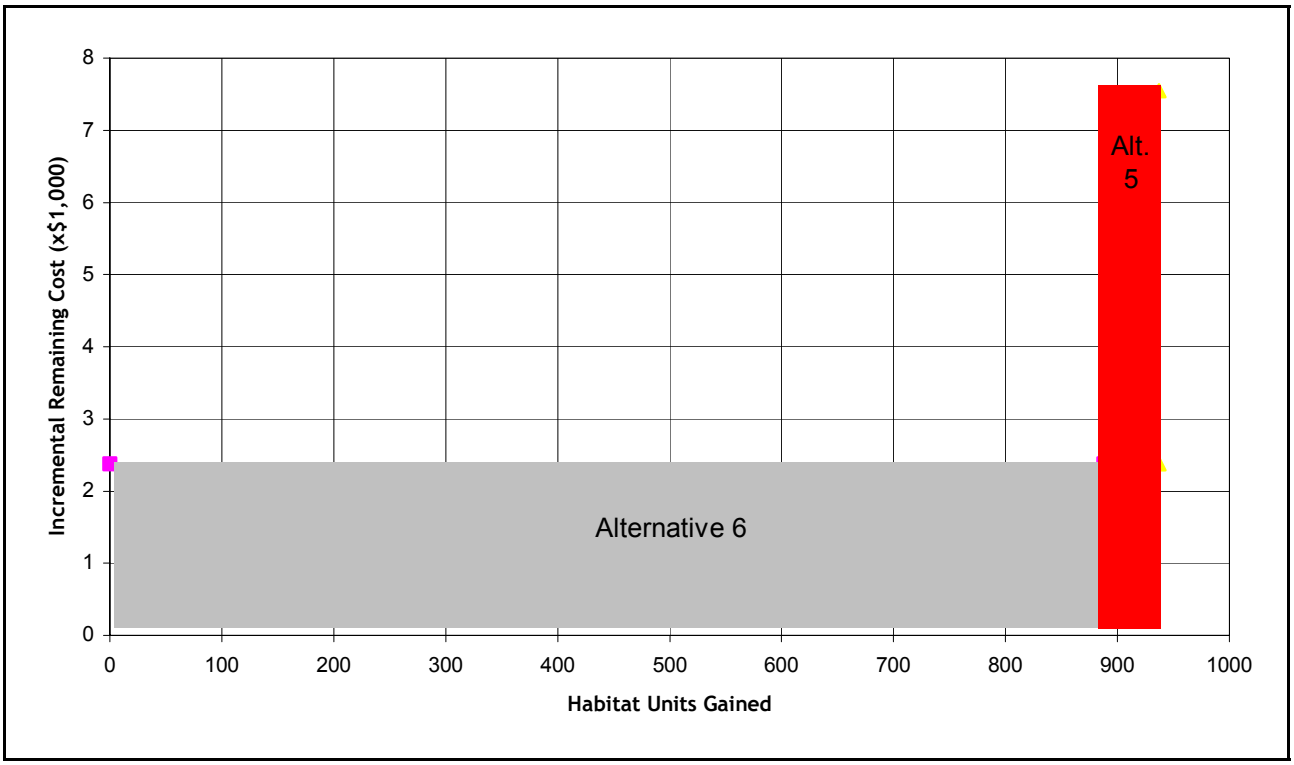



**Figure 3-9: Incremental Cost Analysis for "Best Buy" Combined Plans**

**TABLE 3-16: BEST BUY PLANS SUMMARY**

| Alternative | Incremental Output | Incremental Cost/ Unit Output |
|---|---|---|
| No Action | 0 | 0 |
| Alternative 6 | 888 | $2,380 |
| Alternative 5 | 49 | $7,550 |

## Preliminary Cost Allocation

Multiple-purpose projects are cost shared in accordance with the cost sharing policies applicable to each project purpose. Before determining the required cost sharing for projects, an allocation of total project costs to each purpose must be accomplished. Table 3-17 presents the preliminary cost allocation for Combined Alternative 6. A preliminary cost allocation was conducted for the recommended plan. All separable and joint costs include associated PED costs. Separable costs were assigned to their respective project purposes, and all joint costs were allocated to the purposes for which the project was formulated.

**TABLE 3-17. PRELIMINARY COST ALLOCATION**
**Combined Alternative 6**
**Recommended Plan[1]**
**(Flood Damage Reduction and Ecosystem Restoration)**

| | **Annual Costs ($1,000)** |
|---|---|
| Total Project Cost (*a*+*b*+*c*) [2] | $2,687 |
| *a*) Flood Damage Reduction (FDR) Separable Costs | $ 67 |
| *b*) Ecosystem Restoration (ER) Separable Costs | $1,797 |
| *c*) Joint Costs | $ 823 |

| | Annual Costs and Benefits ($1,000) | | |
|---|---|---|---|
| | FDR | ER | Total |
| *d*) Average Annual Benefits | 577 | 888 *AAHU* | |
| *e*) Least Cost Alternative Plan (single purpose) | 922 (Alt 1) | 3,521 (Alt 3) | |
| *f*) Limited Benefits (lesser of *d* and *e*) | 577 | 3,521 | |
| *g*) Separable Costs (*a* and *b*) | 67 | 1,797 | |
| Remaining Benefits (*f* minus *g*) | 510 | 1,724 | 2,234 |
| *h*) Percentage of Remaining Benefits | 23 percent | 77 percent | |
| *i*) Allocated Joint Costs (*c* x *h*) | 189 | 634 | 823 |
| *j*) Total Allocated Costs (*i*+*a* and *i*+*b*) | 256 | 2,431 | 2,687 |

[1] Preliminary costs include PED and Construction Management and final cost allocation would be determined after construction.

[2] Total Project Cost include cultural resource preservation ($10,200 annualized).

**Separable Costs**

**Ecosystem Restoration**.

Habitat restoration activities are considered to be a separable ecosystem restoration cost. Annual costs would be $931,835.

Removal of most of the existing "J" levee, which would be done for ecosystem restoration purposes, would also be a separable ecosystem restoration cost. Annual costs would be $134,539.

Lands waterside of the setback levee would need to be acquired in fee title to enable habitat to be restored. All fee title lands would be a separable cost allocated to ecosystem restoration. Annual costs would be $730,430.

Total separable annual costs for ecosystem restoration would be $1,796,804.

**Flood Damage Reduction**

The additional levee height of 1.5 feet for the setback levee that is intended to provide additional flood damage reduction benefits would be considered a separable flood damage reduction cost. The annualized cost would be $23,928.

The training dike would be constructed specifically to reduce flood damages and would be considered a separable flood damage reduction cost. Annual costs would be $41,195.

Rock placed along the abutments under the Highway 32 bridge (Gianella Bridge) would be required for any additional flows that would be associated with the flood damage reduction increment. This higher design flow and associated rock would be considered a separable flood damage reduction cost. Annual costs would be $1,548.

Total separable flood damage reduction annual costs would be $66,671.

**Joint Costs**

The setback levee, up to the height of 6 feet, would be required for either ecosystem restoration or flood damage reduction. Costs consist of mobilization/demobilization, clearing and grubbing, levee material, the road crown, hydroseeding, fencing and the seepage berm. Annual costs would be $424,068.

Entrenched rock and riprap rock would be needed to protect the setback levee from river migration and erosion. Annual costs would be $286,801.

Construction of the setback levee would require various relocations of utilities, irrigation ditches and roads. Annual costs would be $40,737.

A levee easement would be acquired for lands associated with the setback levee and training dike (for both the levee footprint and for access). The training dike would be constructed on lands that would be acquired in fee title for ecosystem restoration if flood damage reduction was not a project purpose. Because levee easements are valued the same as fee title, there is no change in land costs associated with the training dike. Annual costs would be $71,712.

Total joint annual costs would be $823,318.

**Identification of the "Least Cost Alternatives"**

For cost allocation purposes, a "least cost alternative" must be identified for each project purpose that produces the same amount of benefits as the recommended plan. The least cost ecosystem restoration alternative identified for this analysis must meet the following criteria:

- Produce the same level of non-monetary output as would be provided by the multipurpose project;
- Be cost effective when compared to other single purpose plans, but not necessarily more cost effective than the multipurpose plan; and
- Be a dissimilar project.

**Ecosystem Restoration**. To identify the least cost alternative for ecosystem restoration, an alternative was identified that was closest to providing the same benefit outputs as the recommended plan and then prorated to adjust the costs and benefits. Alternative 5 is the most cost effective plan that would provide at least as much outputs as the recommended plan (Alternative 6). However, Alternative 5 is too similar to Alternative 6 to meet the third criteria of being a dissimilar project. Therefore, Alternative 3 was used as the basis for the least cost alternative for ecosystem restoration since Alternative 5 and 6 are excluded from consideration. Alternative 3 becomes the only cost-effective plan that would provide as much output as the combined plan (Alternative 6).

Ecosystem Restoration Alternative 3 was used for the ecosystem restoration least cost alternative plan. Alternative 3 produces 895 AAHU's and the recommended plan produces 888 AAHU's. The prorating factor of 0.992 was applied to the alternative 3 annual cost of $3,549,000, which sets the annual cost of the least cost ecosystem restoration alternative at $3,521,000.

**Flood Damage Reduction**. To identify the Least Cost Alternative for flood damage reduction, an alternative was identified that that provided similar benefit outputs ($577,000 annual benefits) as the recommended plan, then prorated to adjust the costs and benefits. The prorating factor of 1.002 was applied to the Alternative 1 ($576,000 annual benefits) annual cost of $919,000, which sets the annual cost of the least cost flood damage reduction alternative at $921,000. These costs were determined as follows: a variation of alternative 1 was used for the Flood Damage Reduction Least Cost alternative plan, with all ecosystem restoration features removed from the cost. The features included in the flood damage reduction least cost alternative plan are:

The total setback levee costs (which consist of site preparation, levee material, seepage berm, road crown, entrenched and riprap erosion protection, hydroseeding, and fencing) annual costs would be $687,642 x 1.002 = $689,017.

The flood damage reduction increment (which consist of the additional height of levee when optimized for flood damage reduction, erosion protection under the Highway 32 bridge, and the training dike (including site preparation, levee material, road crown, hydroseeding, and a seepage berm) annual costs would be $167,288 x 1.002 = $167,623.

The annual cost for lands (levee easement) would be $64,491 x 1.002 = $64,620.

The total annual cost for the least cost flood damage reduction alternative would be $922,000.

**Plan Justification**

Combined Alternative 6 was the top ranked plan and was subsequently determined to be justified. Combined Alternative 6 is identified as the Combined Plan.

**Comparison of Combined Plan and the NER Plan**

The final step in selecting the plan to be recommended is to compare the Combined Plan (Combined Alternative 6) with the single-purpose NER Plan identified in Section 3.5.2. Combined Alternative 6, while costing slightly more ($67,000 in annual costs) than the NER Plan produces $153,000 more annual flood damage reduction benefits and the same average annual habitat units as the NER Plan. The additional benefits of combined Alternative 6 exceed the additional costs. This comparison is shown in Table 3-18.

**TABLE 3-18: COMPARISON OF COMBINED ALTERNATIVE 6 AND THE NER PLAN**

| Alternative | AAHU's | Annual Flood Damage Reduction Benefits ($1,000) | Annual Total Cost ($1,000) |
|---|---|---|---|
| NER | 888 | 424 | 2,620 |
| Combined Alternative 6 | 888 | 577 | 2,687 |
| Difference | 0 | +153 | +67 |

**Identification of Recommended Plan**

To summarize, Combined Alternative 6 has been determined to reasonably maximize total ecosystem restoration and flood damage reduction benefits compared to costs within the planning constraints. Combined Alternative 6, while costing slightly more ($67,000 in annual costs) than the NER Plan, produces $153,000 more annual flood damage reduction benefits and the same average annual habitat units as the NER Plan. Therefore, Combined Alternative 6 is identified as the recommended plan. The non-Federal sponsor has indicated that they are willing to sponsor Combined Alternative 6. Since this plan is not fully optimized plan, due to the planning constraint regarding levels of protection requested by the sponsor, it is considered to be a locally preferred plan.

Under Corps guidance, the locally preferred plan qualifies for a categorical exception to recommendation of the NED plan for the flood damage reduction purpose because the with-project residual risk is not unreasonably high and the plan desired by the non-Federal sponsor has greater net benefits than smaller scale plans.

# CHAPTER 4 – AFFECTED ENVIRONMENT*

This chapter describes the existing or without-project conditions in the study area. The without-project conditions provide a framework to compare to with-project conditions and to determine the effects described in Chapter 5. Resources not evaluated in detail are described first, followed by the resources that may be significantly affected by the alternatives.

## 4.1 RESOURCES NOT EVALUATED IN DETAIL

This section describes the resources that would not be significantly affected by the alternatives. These resources are presented to add to the overall understanding of the study area.

### 4.1.1 Physical Environment

**Topography, Geology, and Soils**

As the major river in the Sacramento Basin, the Sacramento River originates in the northern part of the State and flows southward through Shasta Lake to the Sacramento Valley. On the is characterized by varied topography, consisting of natural levees along the river, abandoned river terraces, channels, oxbows and swales draining into the river or adjacent basins. Portions of these features have been leveled into fields of differing elevations. The original swale topography has been smoothed by earth moving, but not completely obliterated.

Soils in the area are derived from Modesto Formation on the west side of Dunning Slough. Soils from this formation are marked by a noticeable increase in silt content and a distinct, red color. The sedimentary Tehama Formation is exposed along vertical banks in a number of places such as Hamilton City. Sacramento River Conservation Area Forum (SRCAF) considers the area between river miles (RM) 193-198.5 as an area of high bank erosion with a meandering channel shape with a width of 1300-1600 feet. The area between RM 198.5 – 201 is considered an area of low bank erosion with a straight channel shape with a width of 800 feet.

Stream channel deposits are located within the historic meander belt between Dunning Slough and immediately north and south of the slough continuing toward the river. The SRCAF has identified the 100-year meander zone for the Sacramento River.

There are paleochannel deposits located along the eastern margin of the Sacramento River from RM 226 (Thomes Creek) to RM 144 (Colusa) (Robertson 1987). The paleochannels are braided with multiple branches and islands, suggesting a higher bedload, a higher width-to-depth ratio, and higher discharges than the present day Sacramento River (Robertson 1987). The western edge of the paleochannel is the eastern edge of the historic meander belt of the Sacramento River (Robertson 1987). The study reach is bound on the eastern side by paleodeposits from RM 193 to RM 185.

The Chico monocline is the dominant geological structure of the Chico domain. The Chico monocline and associated faults are the result of the uplift of the Sierra Nevada and fracturing along the major controlling fault (Harwood and Helley 1987). The Chico monocline trends northwest and bounds the northeast side of the Sacramento Valley between Chico and Red Bluff. The basement rocks beneath the monocline show a displacement of 350 meters and there is evidence that the monocline is still active (Harwood and Helley 1987).

West of the Chico domain is the Corning domain, with structures oriented northwest to north (Harwood and Helley 1987). The Willows fault and the Corning fault are within this domain. They are close to parallel orientation to the Chico monocline. The Willows fault is an active northwest trending fault that crosses the Sacramento River north of Colusa, with uplift to the east (Harwood and Helley 1987). The faults described above dominate the structure of the northern Sacramento Valley, however, the course and behavior of the Sacramento River is controlled by the smaller structures of the Los Molinos and Glenn synclines and the Corning Domes (Harwood and Helley 1987).

Once the Sacramento River flows down the Los Molinos and Glenn syncline axes, the channel and floodplain of the river widens. For this particular study reach, RM 201- RM 185, the river flows near the axis of the Glenn syncline. Upon entering the Glenn syncline at RM 205, the width of the channel and floodplain increases. The river is narrow from RM 200 to RM 197, and the river parallels the axis of the Glenn syncline from RM 197 to RM 193. The channel crosses the axis of the syncline at RM 191, and then generally flows along the axis of the syncline until RM 180. None of the alternatives would affect the topography, geology, or soils in the Hamilton City area.

**Climate**

The climate in the watershed varies with elevation. Ground-surface elevations in the northern portion of the Sacramento Valley range from about 14,000 feet in the headwaters of the Sacramento River to about 1,070 feet at Shasta Lake. In the headwater area, total annual precipitation averages between 60 and 70 inches and is as high as 95 inches in the Sierra Nevada and the Cascade Range. Lassen Peak in the Cascade Range exceeds 10,000 feet and receives as much as 90 inches of precipitation. Other mountainous areas bordering the valley reach elevations higher than 5,000 feet and receive an average of 42 inches of precipitation per year, with snow prevalent at higher elevations.

The study area is in the northern portion of the Sacramento River basin where the Sacramento Valley floor is relatively flat. Elevations range from sea level to about 300 feet above sea level. Hot, dry summers and mild winters characterize the valley floor. Precipitation on the valley floor occurs mostly as rain from October through May with an average of 20 inches of precipitation per year. Virtually no rain falls from June to September. Historically, large rainstorms in winter and early spring have resulted in maximum flows from December through March. None of the alternatives would affect the climate of the Hamilton City area. The average weather in Hamilton City, California, is shown in Table 4-1.

**TABLE 4-1: AVERAGE WEATHER IN HAMILTON CITY, CALIFORNIA**

| Item | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Precipitation (in) | 3.4 | 3.2 | 2.5 | 0.9 | 0.6 | 0.3 | 0.1 | 0.1 | 0.4 | 0.8 | 2.0 | 2.3 |
| Days with precip. | 10 | 9 | 9 | 5 | 3 | 1 | 0 | 0 | 1 | 3 | 7 | 9 |
| Average temp. (°F) | 44.4 | 49.3 | 52.8 | 57.3 | 64.1 | 70.4 | 74.8 | 74.1 | 70.3 | 62.5 | 51.4 | 44.0 |
| Max temperature (°F) | 53 | 59 | 64 | 70 | 79 | 87 | 92 | 91 | 87 | 77 | 62 | 53 |
| Min temperature (°F) | 36 | 40 | 42 | 44 | 49 | 54 | 57 | 57 | 54 | 48 | 40 | 35 |
| Wind speed (mph) | 6.8 | 7.1 | 8.2 | 8.4 | 8.7 | 9.2 | 8.6 | 8.1 | 7.1 | 6.2 | 5.8 | 6.2 |
| Morning humidity (%) | 89 | 87 | 84 | 81 | 80 | 76 | 75 | 76 | 76 | 78 | 86 | 87 |
| Afternoon humidity (%) | 68 | 58 | 50 | 42 | 36 | 31 | 28 | 28 | 30 | 36 | 55 | 65 |
| Sunshine (%) | 50 | 65 | 74 | 81 | 89 | 93 | 96 | 95 | 93 | 85 | 66 | 51 |
| Days clear of clouds | 7 | 8 | 10 | 11 | 16 | 21 | 26 | 25 | 23 | 18 | 10 | 8 |
| Partly cloudy days | 6 | 7 | 9 | 10 | 9 | 6 | 3 | 4 | 4 | 6 | 8 | 6 |
| Cloudy days | 19 | 13 | 13 | 9 | 6 | 3 | 1 | 1 | 2 | 6 | 12 | 17 |
| Snowfall (in) | 0.8 | 0.7 | 0.6 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.6 |

Source: Glenn County, 2003

**Hydrology**

The Sacramento Valley contains the Sacramento, Feather, and American River basins, covering an area of more than 26,300 square miles in the northern portion of the Central Valley. The Sacramento River basin encompasses four major sub-basins: the McCloud River, Pit River, and Goose Lake in the north; the Sacramento-San Joaquin River Delta in the south; the Sierra Nevada and Cascade Range in the east, and the Coast Range and Klamath Mountains in the west.

The Sacramento River is the largest river in California. It has an average annual runoff of 22.4 million acre-feet (maf) and yields 35 percent of the State's developed water supply. Upper Sacramento River flows are largely controlled by the Central Valley Project (CVP) storage and diversion facilities operated by the United States Bureau of Reclamation (USBR) and local irrigation districts. CVP facilities affecting upper Sacramento River flows include Shasta, Keswick, Trinity, Lewiston, and Whiskeytown, dams, and the Spring Creek Debris Dam, Red Bluff Diversion Dam, and the Tehama-Colusa and Corning Canals. Shasta is the largest CVP reservoir, storing up to 4.5 maf of water.

Scheduling water releases from Keswick Dam involves day-to-day operational adjustments by the USBR so that fisheries, navigation, the Glenn-Colusa Irrigation District (GCID), other water diversions, water transfer, and water quality needs are met. The Hamilton City Pumping Plant, located 3.5 miles north of Hamilton City, supplies water to the Glenn-Colusa Canal and can be a significant water diversion structure during the irrigation season – April to September.

A large drainage area contributes flow to the Sacramento River. The contributing drainage area is generally too large for most major storms to be centered over the entire basin. For example, the 1997 flood was the flood of record above Shasta Dam, but it was not the flood of record for most of the local tributaries between Keswick Dam and Bend Bridge. Various storms centered throughout the basin have resulted in several historical observed high flows of similar magnitude.

When the Sacramento River reaches the valley floor, flows spread out across low-lying basins, over weirs, and through wide bypasses. Flow distribution affects the computation of reliable estimates of unregulated flows. None of the alternatives would affect the hydrology of the Sacramento River.

**Wild and Scenic Rivers**

Near the study area, Upper Big Chico, Upper Butte Creek, Upper Deer Creek, and the middle fork of Upper Stony Creek above Black Butte Reservoir have been designated Wild and Scenic Rivers. These are all outside of the project area of effect and therefore no alternatives would have an effect on wild and scenic rivers.

## 4.2 SIGNIFICANT RESOURCES

This section highlights the existing conditions with respect to each resource. Assumptions regarding future projects are discussed. Each resource is described in terms of its location, quantity and quality, and significance.

### 4.2.1 Physical Environment

**Geomorphology**

The study covers the river reach from RM 195- RM 202. Ayres Associates evaluated historical migration of the river from 1896 to 2002 at river mile 197 and 201. Based on the historical data, both locations have seen migration rates as high as 200 feet/year. However, the geotechnical properties of the Modesto Formation in the two areas would indicate that migration rates and directions could be significantly different than recent observations. The river reach between RM 201-198 has been characterized by channel stability since 1904. The Pine Creek Bend (RM 199) became established after a cutoff between 1887 and 1896. The confluence of Pine Creek and the Sacramento River migrated east between the late 1800s and 1904. Pine Creek Bend migrated downstream over the years. This is as far east as the river channel has moved in recorded history. The main channel was abandoned and a secondary channel, or "cutoff channel," was occupied by 1980. The river essentially has not migrated again in this area. A more detailed explanation is presented in the Hydraulic Appendix C3.

The Chico Landing to Red Bluff Project consisted primarily of bank protection, in the form of riprap, on bank slopes at grades varying between 1 vertical to 2.5 horizontal to 1 vertical to 3 horizontal. Riprap was installed at 29 bank protection sites totaling approximately 86,915 feet or 16.5 miles. Sites are situated primarily at outer bends of meanders in the river. It is not certain how much of this bank protection remains on the banks.

While rock has constrained river meander to some extent in the study area, there is currently about 36,755 lf on the right bank and 38,477 lf on the left bank of the river with no bank protection. The Jenny Lind Bend, RM 196-193, has shown a decrease in the amplitude of the meander bends, but the wavelength has remained relatively constant. Between 1870 and 1920, the Jenny Lind Bend experienced a cutoff. This subreach of the river experiences small movement and sinuosity changes. The channel width has also been relatively constant since 1904. There is no obvious geological control on the channel. However, this is the location of

the axis of the Glenn Syncline. The full effects of the Glenn syncline on the Sacramento River are not known, but evidence suggests that channel location and shape is influenced by this subsurface structure. The apex of the bend at RM 198 migrated downstream until between 1974-1980, at which time, revetment was installed along the outer bank.

**River Hydraulics**

Over the years, a complex system of levees, weirs, bypasses, upstream dams and reservoirs, and related systems were built to help reduce flooding along the Sacramento River. This flood management system was designed to protect lives and property along the River and in the floodplain by increasing conveyance of floodwaters through the system. The design goal of the facilities was to aid navigation and flush sediment remaining from earlier hydraulic mining. These conveyance facilities improved flood protection and navigation and allowed continued agricultural and urban development. They also constrained the river to specific alignments, significantly reducing channel meandering and further isolating the river from its historic floodplains.

The flood management system along the Sacramento River includes portions of the CVP, the Sacramento River Flood Control Project (SRFCP), and the Chico Landing to Red Bluff Project. The Sacramento River is included in the Designated Floodway Program administered by the Reclamation Board. A discussion of each of these flood management systems is included in Section 1.6: Existing Programs, Studies and Projects

The Sacramento River enters the Sacramento Valley about 5 miles north of Red Bluff and meanders through alluvial deposits about 50 miles between Red Bluff (RM 244) and Chico Landing (RM 194). Major Tributaries enter from the east—Antelope, Mill, Deer, Big Chico, Rock, and Pine Creeks and from the west—Thomes, Elder, Reeds, Cottonwood, Red Bank and Stony Creeks. These tributaries influence Sacramento River flows during storms.

In the project area, the Sacramento River, Chico Landing to Red Bluff Project provides bank protection and channel modifications at many locations. The project helps reduce erosion and stabilizes the main river channel, thereby preserving and protecting mostly agricultural lands and reducing sediment in the river that can impair downstream flood control and navigation channels. An existing private levee, constructed by landowners in about 1904 and known as the "J" levee, also provides some flood protection to the town and surrounding area. The "J" levee is not constructed to any formal engineering standards and is largely made of silty sand. It is extremely susceptible to erosion. Flood fighting is often necessary to prevent levee failure and flooding when river levels rise. Since the construction of Shasta Dam in 1945, flooding in Hamilton City due to failure of the "J" levee has occurred once, in 1974. In addition, extensive flood fighting has been necessary to avoid levee failure and flooding in 1983, 1986, 1995, 1997, and 1998.

Currently, the Sacramento River is actively eroding into the toe of the "J" levee at the northern end of the study area. Glenn County built a backup levee, about 1,000 feet in length, to protect the community in the event the toe erosion causes failure at the northern end of the "J" levee. The southern end of the "J" levee does not tie into high ground and backwater can flood agricultural lands behind (west of) the "J" levee.

Although with flood fighting the "J" levee has historically passed high flood events, statistically it only has about a 66 percent chance of passing a 10-year event assuming

significant flood fighting efforts. This would also equate to a 90 percent chance of passing an event smaller than a 10-year event. Another way to state this is that on an annual basis, the community currently has about a 9 percent chance of flooding in any given year, again assuming flood-fighting efforts.

**Water Quality**

This section describes the water resources for existing water quality conditions for the Sacramento River as well as the study area. The study area is under the jurisdiction of the Central Valley RWQCB. Hamilton City is considered in the basin plan for the Sacramento and San Joaquin River Basins. The basin plan, developed by the regional board, is a prevention plan that covers specific watershed areas and establishes water quality objectives for specific water bodies.

The specifics in the plan for this area of the Sacramento River state that temperatures shall not be elevated above 56 degrees Fahrenheit (°F) in the reach from Keswick Dam to Hamilton City, nor above 68° F in the reach from Hamilton City to the I Street Bridge during periods when temperature increases will be detrimental to the fishery (RWQCB, 1998).

Water quality in Glenn County is generally good. Because the main source of domestic water in Glenn County is groundwater, maintenance of groundwater quality is of primary importance to county residents. The use of individual septic tank systems in areas containing extremely porous soils with a high groundwater table has caused reported cases of groundwater contamination. Other potential sources of groundwater pollutants include chemicals used in the growing and processing of agricultural products, gas well drilling and industrial sources. The Glenn County Health Department regulates the installation of individual septic systems and wells.

Hamilton City's wastewater treatment facility is located on the waterside of the "J" levee. The facility is currently protected by a private levee, and the integrity of that levee is unknown. Although it has not flooded in the past, the facility is at some risk of flooding. Flooding of the facility could cause contamination of surface waters with raw sewage and a risk to public health and safety.

The Sacramento River is the primary source of surface irrigation water in Glenn County. Water from the river is diverted into two major canals, the Glenn-Colusa and the Tehama-Colusa. Stony Creek is also a predominant source of surface water, supporting two reservoirs within the county, Stony Gorge and Black Butte. Hydroelectric power generating facilities are located at both of these reservoirs.

The eastern portion of the county overlies the Sacramento Valley Groundwater Basin, which contains abundant supplies of high quality groundwater to depths of 800 feet. Groundwater is the primary source of domestic water supply in the county and is also used for irrigation in areas where surface water is not available.

The Glenn County General Plan (Glenn County, 1993) promotes the zoning of floodways and stream channels in a manner that promotes protection of water quality.

Glenn-Colusa Irrigation District (GCID). Glenn-Colusa Irrigation District (GCID), the largest irrigation district in Northern California, draws its water primarily from the

Sacramento River at Hamilton City. GCID's delivery system consists of a 65-mile long main canal and 430 miles of lateral canals. With the demands of 141,000 acres of farming and 20,000 acres of wildlife refuge, GCID services 2,500 turnouts that deliver, on average, 500,000 to 800,000 acre/feet of irrigation water each year.

Water Quality Conditions in the Sacramento River. Average monthly water temperatures under existing conditions in the Sacramento River were simulated using USBR temperature models (see Table 4-2). The hydrologic period from 1922 to 1990 was simulated in order to determine the ranges of temperatures experienced in the river for various flows and current CVP operations. The results of the simulation are summarized in Table 4-2 for Vina and Butte City locations. The table includes the average, maximum, and minimum monthly temperatures over the 70-year period of record.

**TABLE 4-2: SIMULATED AVERAGE MONTHLY TEMPERATURES ($^{O}$F) IN THE SACRAMENTO RIVER - EXISTING CONDITIONS, 1922-1990**

| Vina | | | |
|---|---|---|---|
| **Month** | **Average** | **Maximum** | **Minimum** |
| October | 55.7 | 63.0 | 50.6 |
| November | 51.4 | 55.9 | 47.0 |
| December | 46.7 | 51.3 | 42.1 |
| January | 44.5 | 47.3 | 39.2 |
| February | 47.9 | 50.5 | 45.0 |
| March | 51.8 | 55.7 | 49.0 |
| April | 55.6 | 58.6 | 52.4 |
| May | 58.2 | 63.0 | 55.1 |
| June | 60.4 | 64.3 | 56.7 |
| July | 60.9 | 67.6 | 56.8 |
| August | 61.4 | 70.1 | 59.0 |
| September | 58.7 | 67.8 | 53.6 |
| **Butte City** | | | |
| October | 57.3 | 63.7 | 52.3 |
| November | 51.3 | 55.1 | 47.6 |
| December | 46.0 | 50.7 | 40.9 |
| January | 44.1 | 47.0 | 38.3 |
| February | 48.2 | 50.9 | 45.4 |
| March | 52.5 | 57.6 | 49.5 |
| April | 57.6 | 61.9 | 52.9 |
| May | 61.8 | 68.0 | 57.5 |
| June | 65.8 | 70.8 | 62.0 |
| July | 67.2 | 75.0 | 61.7 |
| August | 67.0 | 74.0 | 63.7 |
| September | 62.8 | 70.7 | 57.4 |

Water quality in the Sacramento River is variable and depends on flows in the river, temperature, agricultural return flow quality, and inflow from tributaries. Monitoring has shown levels of pesticides; disinfection by-product precursors, toxic metals, and other constituents of concern are generally not detectable or have been present in small concentrations (DWR, 1994). Levels of rice pesticides in the river water have been within performance goals since the early 1980's (Gorder and Lee, 1995). Electrical conductivity

levels in the Sacramento River above Knights Landing at the confluence of the Colusa Basin Drain and the river typically do not exceed water quality objectives (DWR, 1988).

Waters of the U.S. and associated wetlands subject to jurisdiction under Section 404 of the Clean Water Act and occurring in the project area were identified by the Corps. They included the Sacramento River and riparian habitat on the waterside of the J levee, including the riparian vegetation along and surrounding Dunning Slough. The Hamilton City Irrigation ditch runs along the eastern edge of Hamilton City. This irrigation ditch is considered a seasonal wetland habitat and was defined by the USFWS as providing a "small but significant parcel of emergent wetland habitat." However, the ditch is not considered to be a jurisdictional wetland due to the fact it is located on the landside of the J levee and does not connect with the Sacramento River.

A review of Environmental Data Resources, Inc. (EDR) ground water quality records indicated that water quality data exists for several wells within the subject study area. Five wells were sampled between 1984 and 1996 and samples were analyzed for inorganic and organic compounds and other parameters. The data indicate generally good water quality.

The Glenn County General Plan promotes the zoning of floodways and stream channels in a manner that promotes protection of water quality.

**Air Quality**

State and Federal Air Quality Standards are provided in Table 4-3.

Hamilton City is located within the Sacramento Valley Air Basin (SVAB). The SVAB consists of the northern half of the Central Valley and approximates the drainage of the Sacramento River. The Coast Range, Cascade Range, Sierra Nevada, and the San Joaquin Basin bound the basin.

The air quality in the SVAB is generally influenced by a variety of factors including wind direction and velocity, climate, vegetation, geography, and the volume of pollutants introduced into the air basin. Agricultural, industrial, and other human activities are the sources of pollutants in the Sacramento Valley. Motorized vehicles on the roadways are the greatest source of organic gases, carbon monoxide, and oxides of nitrogen. Agricultural equipment and activities in Glenn County also generate hydrocarbons and fugitive dust.

The Glenn County Air Pollution Control District (GCAPCD) regulates air quality within the cities, communities, and unincorporated areas of the Glenn County. Under the direction of the Glenn County Air Pollution Control Board, the GCAPCD uses the State's ambient air quality standards to monitor and regulate the outdoor air pollution in the county. An air quality monitoring station for Glenn County is located in Willows, 18 miles southwest from the project site. Because of the distance, this station does not serve as a good indicator for the current air quality conditions in Hamilton City. The nearest air quality monitoring station is about 8 miles to the east in Chico in Butte County. This station serves as a better indicator of the existing air quality in the study area. However, since the study area is not an urbanized area, it is expected that the Hamilton City area would have less pollutants than Chico.

**TABLE 4-3: STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS**

| Air Pollutant | State | Federal | Federal |
|---|---|---|---|
| | Concentration | Primary | Secondary |
| Ozone ($O_3$) | 0.09 ppm, 1-hr. avg. > | 0.08 ppm, 8-hr. avg. > | 0.12 ppm, 1-hr. avg. > |
| Carbon monoxide (CO) | 9 ppm, 8-hr. avg. > | 9 ppm 8-hr. avg. | 9 ppm, 8-hr. avg. |
| Nitrogen dioxide ($NO_2$) | 0.04 ppm, 24hr. avg. ≥ with ozone ≥ 0.10 ppm, 1-hr. avg. or TSP ≥ 100 µg/m$^3$, 24-hr. avg.<br><br>0.25 ppm, 1-hr. avg. > | 0.03 ppm, annual avg.<br><br>0.14 ppm, 24-hr. avg. | 0.50 ppm, 3-hr. avg. |
| Particulate matter (PM) | | | |
| <2.5 microns ($PM_{2.5}$) | N/A | 15 µg/m$^3$, annual arithmetic mean<br><br>65 µg/m$^3$, 24-hr. avg. | N/A |
| < 10 microns ($PM_{10}$) | 50 µg/m$^3$, 24-hr. avg. > | 150 µg/m$^3$, 24-hr. avg. | 150 µg/m$^3$, 24-hr. avg. |
| Sulfates ($SO_4$) | 25 µg/m$^3$, 24-hr. avg. ≥ | N/A | N/A |
| Lead (Pb) | 1.5 µ/m$^3$, 30-day avg. | 1.5 µ/m$^3$ calendar quarter | 1.5 µ/m$^3$, calendar quarter |
| Hydrogen sulfide (HS) | 0.03 ppm, 1-hr. avg. ≥ | N/A | N/A |
| Vinyl chloride $CH_2CHCl$ | 0.01 | N/A | N/A |
| Visibility reducing particles | In sufficient amount to reduce the visual range less that 10 miles at relative humidity less than 70%, 8-hr. avg.<br><br>(9 a.m.-5 p.m.) | N/A | N/A |

ppm - parts per million
µg/m$^3$ - micrograms per cubic meter
N/A - not applicable
Source: California Air Resources Board, 2001

The Federal and State attainment or non-attainment designations for criteria pollutions for Glenn and Butte counties are shown in Tables 4-4 and 4-5. Butte County is included because Hamilton City is located only about one-half mile from the boundary of

Butte County, which is under the jurisdiction of the Butte County Air Quality Control Board. Atmospheric gases are free to disperse from the Hamilton City area into nearby Butte County. These designations are based on current levels of pollutants measured at the monitoring stations.

**TABLE 4-4: FEDERAL AND STATE AIR QUALITY ATTAINMENT DESIGNATION FOR GLENN COUNTY**

| Criteria Pollutants | Federal Designation | State Designation |
|---|---|---|
| Ozone | Attainment | Nonattainment transitional [1] |
| Carbon monoxide | Attainment | Unclassified |
| PM10 | Unclassified | Nonattainment |
| Sulfate | -- | Attainment |
| Hydrogen sulfide | -- | Unclassified |

[1]Nonattainment/transitional is a subcategory of the nonattainment designation. An area is designated as nonattainment/transitional to signify that the area is close to attaining the standard for that pollutant. Source: California Air Resources Board, 2002

**TABLE 4-5: FEDERAL AND STATE AIR QUALITY ATTAINMENT DESIGNATIONS FOR BUTTE COUNTY**

| Criteria Pollutants | Federal Designation | State Designation |
|---|---|---|
| Ozone | Nonattainment | Nonattainment |
| Carbon monoxide | Attainment | Attainment |
| $PM_{10}$ | Unclassified | Nonattainment |
| Sulfate | -- | Attainment |
| Hydrogen sulfide | Unclassified | Unclassified |

Source: Williams, 2003

According to the GCAPCD, Glenn County has adopted no specific daily emission standards for construction (Stewart, 2003). Butte County has adopted a standard of 137 pounds per day for all criteria pollutants (Williams, 2003).

Sensitive Receptors. Sensitive receptors include sensitive land uses and those individuals and/or wildlife that could be affected by changes in air quality due to emissions from the alternatives. Examples of sensitive land uses include residences, schools, playgrounds and parks, and hospitals. Within Hamilton City, the sensitive land uses include family homes and schools, but there are no sensitive land uses outside the city in the undeveloped project area. Sensitive receptors in the project area include residents, visitors, motorists, and wildlife.

### 4.2.2 Biological Environment

**Vegetation**

Before European settlement in the early 1800s, there was a wide strip of riparian forest along the Sacramento River (WET 1988). The first type of land converted to agriculture was known as rimland, which is adjacent to the river and at a higher elevation than the tule (swamp and overflow lands) in the basins (Buer, 1994). By 1871, almost all of this area was privately owned and being converted to agriculture (Buer, 1994). The floodplains were also progressively converted from riparian forest and tule swamp to agriculture, primarily fruit and nut orchards (Katibah 1984). By 1989, 98 percent of the original forest was gone (SRCAF, 2000 (rev.)).

The natural hydrologic and geomorphic processes that prevailed historically on the middle and lower reaches of the Sacramento River have been largely lost as a result of confining flood flows in reservoirs and between engineered levees. Releases for water supply from Shasta Dam are made at rates that inhibit the re-propagation of riparian vegetation due to the timing that interferes with historic natural seed propagation. As a result of the loss of natural processes, fish and wildlife habitat has been eliminated or severely degraded. Bank protection from the Chico Landing to Red Bluff Project has destroyed riparian habitats and prevents new land surfaces from being formed consequently preventing new (primary succession) riparian forests from colonizing. The Sacramento River lacks a continuous riparian corridor. Colonization by exotic species adversely affects native populations.

Vegetative communities in the proposed project area, which encompasses a 7-mile reach of the river, include riparian woodland bordering the Sacramento River, shaded riverine aquatic (SRA) cover, grasslands, agricultural lands, and a seasonal emergent wetland. The area is intensively farmed with walnut, almond and plum orchards. The acreages of the cover-types are shown in Table 4-6.

**TABLE 4-6: ACREAGES OF COVER-TYPES**

| Cover-Type | Acreage |
|---|---|
| Riparian | 208 |
| Grassland | 690 |
| Orchards | |
| Almonds | 705 |
| Plums | 527 |
| Walnuts | 479 |
| Grain/Hay | 90 |

Areas next to the river are vegetated with riparian vegetation including SRA cover. However, private interests and public agencies have placed revetment or rubble on the banks in several locations to prevent erosion. The main channel of the Sacramento River was abandoned and a cutoff channel was occupied by 1980. This area has developed into a large riparian forest and has become one of the few remaining areas where the yellow-billed cuckoo, a state-listed endangered species, is known to nest. Riparian vegetation is found along the eastern boundary of the project area adjacent to the Sacramento River, and along

Dunning Slough located at the southern end of the project area. This riparian habitat consists of a narrow band of vegetation varying in width from 10 to 40 feet. This band is fairly consistent for a length of about 6 miles.

Riparian vegetation and its associated understory plants play a significant role in the area ecology. The canopy provides excellent nesting habitat for bird and mammal species. The canopy shades the edge of the river, blocking sunlight penetration, thereby providing water temperature control along the banks during the warmer summer and fall months. The canopy and other overhanging bank vegetation also provide physical cover for fish, and inputs nutrients such as falling insects, leaf and detritus matter. Tributary and groundwater flows are a major source of nutrient inflow for the stream ecosystem. Resident and migrant songbirds, reptiles, amphibians, and mammals use riparian forests entirely or during parts of the year.

Common riparian vegetation along the Sacramento River, adjacent to Hamilton City, consists of mature oaks, cottonwood, willows, wild grapes, wild rose, poison oak, and blackberry. Elderberry bushes are found in the project area. A survey was completed by the United States Fish and Wildlife Service (USFWS) of the elderberry bushes in the project area and a summary is attached in Appendix B.

Land use adjacent to the riparian corridor is primarily agricultural. Orchards, field crops, and row crops are the main crop types in agricultural production within and surrounding the project area. A large unpaved road is located adjacent to the riparian zone.

A seasonal wetland habitat exists in a low-lying area located along the eastern edge of Hamilton City and adjacent to a trailer park. This wetland occurs on the landside of the "J" levee, just south of Highway 32 (Figure 2-2). This low area frequently pools with Hamilton City's storm water drain system outfall, and provides a small (15 acres), but significant, parcel of emergent wetland habitat.

DWR measured 47.41 miles of SRA cover in this reach (36 percent of total bank length). In 1994, 2,300 acres (in Red Bluff – Chico Landing Reach) of mature riparian forests were privately owned. The area is intensively farmed with walnut, almond and prune orchards, as well as row crops. Areas next to the river contain riparian vegetation including SRA cover. However, private and public agencies have placed revetment or rubble on the banks in several locations to prevent erosion.

The area bordering the river in the southern half of the study area has a lower elevation than the rest of the area. There is a diverse array of riparian plant communities on the eastern portion of the study area, the area closer to the river. Willow dominated shrublands cover the swales where water tables and flood flow velocities are likely high. Cottonwood forest covers the ridge areas (in access of 100 meters wide) parallel to the river channel. This natural forest area includes native woody and herbaceous species. Cottonwood creates a canopy. Arroyo willow and box elder dominate the middle story. California blackberry, stinging nettle and mugwort form the understory.

Forest covering the Dunning Slough oxbow is dominated by sycamore, valley oak, cottonwood, and Gooding's willow. Buttonbush and sandbar willow dominate the shrub community. There is also tree of heaven in the community. Under the canopy of large mature trees a mixture of mid-canopy trees, such as box elders, a forb layer of native

blackberry, stinging nettle, mugwort, and goldenrod. Large amounts of woody debris and sandy soils indicate that this area floods frequently.

Borrow sites for the project include the existing "J" levee, which is included in the general project area described above, and the GCID dredged spoil pile found between the Glenn-Colusa Canal and County Road 203/Highway 45 from the fish screen south. This spoil pile is only very sparsely vegetated with ruderal species.

**Wildlife**

A wide variety of songbirds, small and large mammals, and various water-associated birds inhabit the Sacramento River Basin. Each vegetative community, including farmed areas, in the study area supports a different assemblage of wildlife species.

The riparian plant community along the Sacramento River supports a great diversity and abundance of animal life. Common wildlife species of the riparian corridor and adjacent areas include mammals such as striped skunk, opossum, brush and cottontail rabbits, black-tailed hare, raccoon, beaver, otter, muskrat, mink, coyote, deer, and many small rodents. Small mammals utilize the cover provided by streamside vegetation to move upstream and downstream while foraging for food.

Riparian forests provide habitat for a large number of bird species. Many small passerine birds (smaller perching birds) use riparian areas. Migrant songbirds nest in this habitat. Wild grape, elderberries, blackberries and wild California rose provide nectar, seeds and berries for birds. Reptiles and amphibians also utilize riparian areas include the king snake, garter snake, Western fence lizard, pond turtles, Pacific tree frog, western toad, California newt, and slender salamander.

An intact riparian forest, fallow fields with tall grasses and forbs, and the slough area, combine to create a diversity of habitats that sustain a high diversity of birds as well as a strong bird community. The site supports a diversity of cavity nesters, cup, and mid-canopy nester. Fall migrants pass through the area. Shore birds utilize the slough area and the fields support several raptor species. The area supports a large cowbird population.

SRA cover provides opportunities for birds to perch or seek cover in trees along banks. Other birds, such as the double crested cormorant, heron, belted kingfisher, and black phoebe forage in or above the water. The soft banks and woody vegetation of SRA also provide opportunities for various bat species, beavers and river otters. Large sections of riverbank occasionally become undermined and fall into the water, leaving a vertical cut bank. This provides nesting habitat for bank swallows.

Agricultural lands utilized for field crops, row crops, and orchards surrounding Hamilton City provide forage areas for small mammals; occasionally black-tailed deer, coyotes, and other mammals; upland game birds such as ring-necked pheasant; and various other bird species as well as raptor species. The small, but significant seasonal wetland area provides habitat for small mammals, a variety of passerine bird species, and various migratory waterfowl species.

**Fisheries and Aquatic Resources**

The Sacramento River provides important habitat for an array of anadromous and resident fish species. The Sacramento River supports anadromous fish including chinook salmon (*Oncorhynchus tshawytscha*), steelhead trout (*O. m. irideus)*, green sturgeon *(Acipenser medirostris),* white sturgeon *(Acipenser transmontanus)*, American shad *(Alosa sapidissima)*, striped bass (*Morone saxatilis)*, and Pacific lamprey (*Lampetra tridentata* ssp.1). Four different runs of chinook salmon utilize the river as a migration corridor: fall/late-fall and spring-run, winter-run, and late-fall-run. The Sacramento River system north of the confluence of the Feather River is the largest producer of chinook salmon in California (Richardson and Harrison 1990). The Sacramento River channel above Colusa provides an excellent supply of gravel (85 percent from bank erosion) essential to both young and adult salmon. About one third of the river's naturally spawning salmon, or 35,000 fish, spawn directly in the Sacramento River upstream of Colusa; it is also used for rearing and migration. The majority of winter-run chinook salmon spawning presently occurs just downstream of the Keswick Dam to the vicinity of Cottonwood Creek. Anadromous fish spawn in the river and the young rear in the SRA cover and use the river to migrate to the ocean. Most salmon spawning occurs where bank erosion and meandering processes are active and gravel is available. Peak spawning generally occurs from May through June. Salmonid spawning habitat occurs above the study area.

Resident fish include warm water fish such as largemouth bass *(Micropterus salmoides)*, white (*Pomoxis annularis)* and black crappie (*Pomoxis nigromaculatus)*, Sacramento pike minnow (formerly called Sacramento squawfish) (*Ptychochelius oregonesis)*, Sacramento sucker *(Catostomus occidentalis)*, channel catfish (*Ictalurus punctatus*), white catfish *(Genidens barbus)*, brown bullhead *(Ameiurus nebulosus)*, yellow bullhead *(Ictalurus natalis)*, threespine stickleback *(Gasterosteus aculeatus)*, bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), smallmouth bass (*Micropterus dolomieu*), Sacramento perch *(Archoplites interruptus)*, Tule perch (*Hysterocarpus traski*), and prickly sculpin (*Cottus asper*); as well as coldwater fish, such as and rainbow (*Oncorhynchus mykiss*) and brown trout (Salmo trutta).

Also of importance are the highly diverse channel characteristics, including naturally eroding and vegetated banks, runs, riffles, pools, and backwaters. The quality of the stream habitat bordering Hamilton City is moderate. Development has contributed to the degradation of the stream habitat through the removal of riparian vegetation and the placement of revetment along the bank. However, because of the value of riparian vegetation and its growing scarcity along the Sacramento River, its presence alone is important to the fishery resources in the area. Although some banks have been treated with revetment to prevent erosion by either government agencies (Chico Landing to Red Bluff Project by the Corps and The Reclamation Board) or private parties, the reach in the project area includes more SRA than most downstream reaches.

The Sacramento River provides a diversity of aquatic habitats, ranging from fast water riffles (relatively shallow, turbulent water flowing over cobbles) and glides (deeper, slower moving water) in the upper reaches to shallow-water pool and glide habitats under tidal influence in the lower reaches.

**Essential Fisheries Habitat**

Essential Fisheries Habitat (EFH) is defined by Congress as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The designation of EFH enables the National Marine Fisheries Service (NMFS) to provide guidance to Federal action agencies on ways to tailor their projects to minimize harm to EFH by requiring the consideration of impacts on EFH from both fishing and non-fishing activities. The Pacific Coast Salmon Fishery EFH includes those waters and substrate necessary for salmon production needed to support long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. In freshwater, the salmon fishery EFH includes all those streams, lakes, ponds, wetlands, and other currently viable water bodies and most of the habitat historically accessible to salmon (except above certain impassable natural barriers). The project area from the existing levee outboard toward the river is considered essential fish habitat.

**Special-Status Species**

The USFWS provided an official list dated April 11, 2001, of the Federally-recognized special status species that may occur within the proposed project area. The list was updated on October 21, 2002 and again on November 6, 2003 (Appendix B). A search of the California Natural Diversity Database (see Figure 4-1) was done on November 20, 2002 to determine presence of State listed special status species in the project area.

Table 4-7 identifies special status species that are potentially present in the vicinity of the study area. Special status species included in this list but not found or not likely to be found in the study area include Conservancy fairy shrimp (*Branchinecta conservatio*), vernal pool fairy shrimp *(Branchinecta lynchi)*, vernal pool tadpole shrimp *(Lepidurus packardi*), delta smelt (*H. transpacificus)*, California red-legged frog (*Rana aurora draytonii)*, giant garter snake (*Thamnophis gigas*), greater sandhill crane (*Grus canadensis)*, little willow flycatcher (*E. t. brewsteri* and *E.t. adastus*), Butte County (Shippee) meadowfoam (*Limnathes alba Benth*), and Hoover's spurge (*Chamaesyce hooveri* ). Of these species, the red-legged frog is extirpated from the Sacramento Valley, and the giant garter snake is not known to be present north of Gridley in Butte County. The Delta smelt, greater sandhill crane, little willow flycatcher, and vernal pool habitat and it's associated plants and animals are also not likely to be found in the project area. Special status species potentially present in the study area include valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*), Central Valley fall/late fall-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead, winter-run chinook salmon, bald eagle (*Haliaeetus leucocephalus)*, bank swallow (***Riparia riparia***), Swainson's hawk (*Buteo swainsoni)*, and Western yellow-billed cuckoo (***Coccyzus americanus)***. Table 4-8 identifies elderberry shrubs in the study area. Table 4-9 identifies the occurrence windows of the special status species.

The red-legged frog historically resided in the Sacramento Valley. The range of this species currently is restricted to drainages in the central coast range of California and an isolated location on Pinkard Creek in Butte County. No locations in the study area were registered in the California Natural Diversity Database (CNDDB) and no suitable habitat occurs in the study area. The giant garter snake occupies habitats that contain permanent or seasonal water, mud bottoms, and vegetated dirt banks. They are commonly found within irrigation canals, flooded rice fields, ditches, or agricultural drains. The present northern-

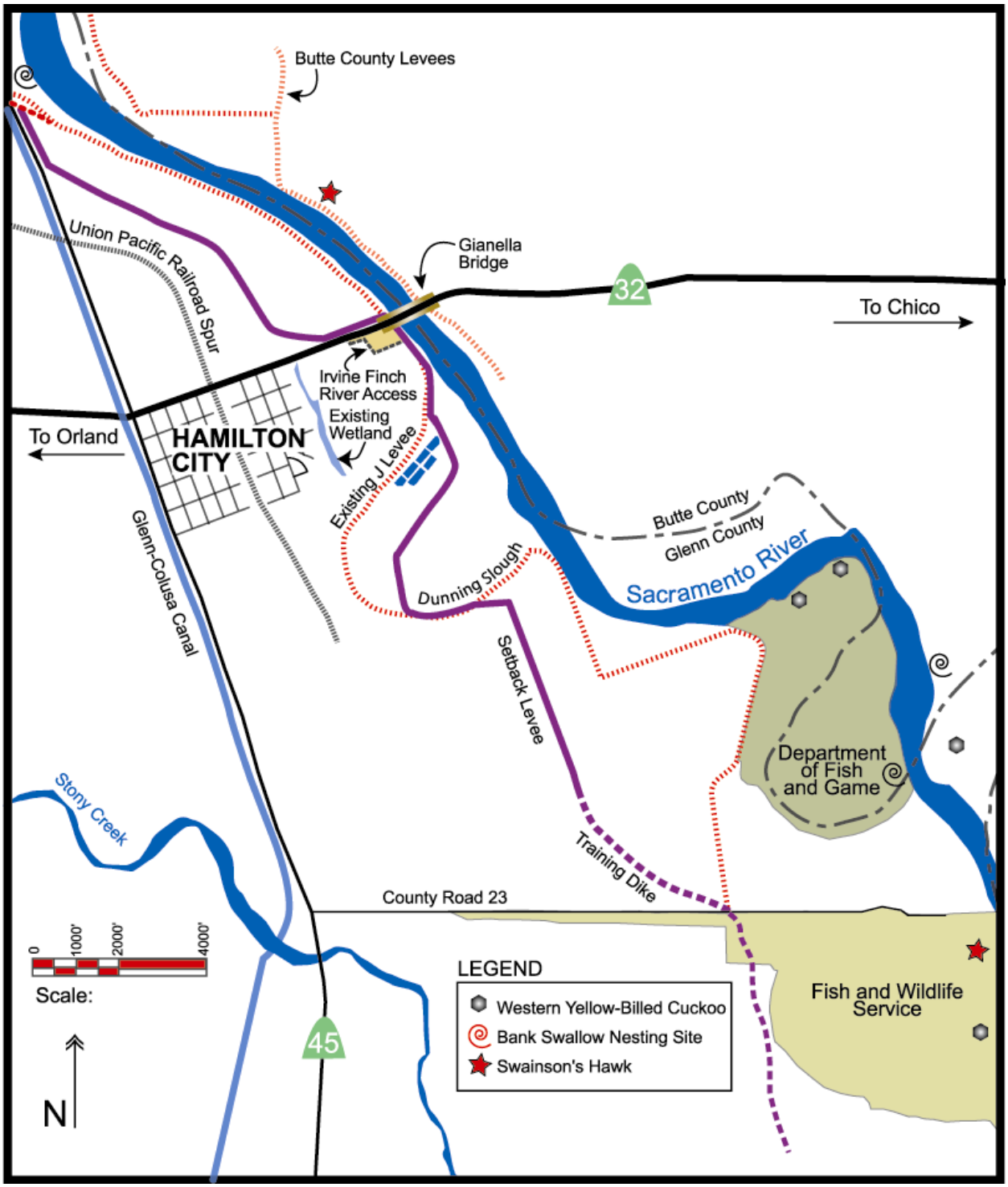



**Figure 4-1: Occurrence of Special Status Species in the Study Area from the National Diversity Database (NDDB).**

**TABLE 4-7: LISTED OR PROPOSED SPECIES POTENTIALLY PRESENT IN THE PROJECT AREA**

| Species | Federal/ State Status | California Distribution | Habitat Requirements | Occurrence in Project area |
|---|---|---|---|---|
| valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) | T/- | Occurs only in the Central Valley of California, in association with blue elderberry (*Sambucus mexicana*). Sacramento, American, San Joaquin, Kings, Kaweah, and Tule Rivers and their tributaries, including Butte and Glenn Counties. | Elderberry shrubs (*Sambucus* spp.) in riparian areas. Prefers to lay eggs in elderberry stems 2-8 inches in diameter; some preference shown for "stressed" elderberries. | Found in project area. |
| Central Valley fall/late fall-run chinook salmon *(Oncorhynchus tshawytscha*) | C/- | Currently spawn in the Merced, Tuolumne, Sacramento, and Stanislaus Rivers. | Ocean and freshwater rivers and streams. | Found in project area. |
| Central Valley spring-run chinook salmon *(Oncorhynchus tshawytscha)* | T/T | Sacramento River and tributaries downstream to and including San Francisco Bay to Golden Gate Bridge. | Ocean and freshwater rivers and streams. | Found in project area. |
| Central Valley steelhead *(Oncorhynchus mykiss)* | T/- | Sacramento River and tributaries; San Francisco Bay/Delta estuary and the open ocean. | Ocean and freshwater rivers and streams. | Found in project area. |
| winter-run chinook salmon *(Oncorhynchus tshawytscha)* | E/E | Sacramento River, tributaries, distributaries, and related riparian zones from Keswick Dam downstream to and including San Francisco Bay. | Freshwater rivers and streams. | Found in project area. |

| Species | Federal/ State Status | California Distribution | Habitat Requirements | Occurrence in Project area |
|---|---|---|---|---|
| bank swallow (*riparia riparia*) | -/T | The swallow has been extirpated from much of its range in California and now nests only on the Sacramento and Feather Rivers, including in Butte and Glenn Counties. | Colonial nester. Nests primarily in riparian and other lowland habitats west of the desert. Nests in vertical banks/cliffs, usually adjacent to water, where the soil consists of fine textured sand or sandy loam to allow digging nesting hole. Banks of rivers, creeks, and lakes; seashores. Originally only nested in steep, sandy riverbanks, but have adapted to humans and now nest in the sides of man-made excavations. | Found in project area. |
| Swainson's hawk (*buteo swainsoni*) | -/T | Butte and Glenn Counties. | Breeds in stands with few trees in juniper-sage flats, riparian areas, and in oak savannah. Nests in oaks or cottonwoods in or near riparian habitats. Forages in grasslands, irrigated pastures, alfalfa, and grain fields supporting rodent populations. | Found in project area. |

| Species | Federal/ State Status | California Distribution | Habitat Requirements | Occurrence in Project area |
|---|---|---|---|---|
| Western yellow-billed cuckoo (*Coccyzus Americanus Occidentalis*) | C/E | Butte and Glenn Counties. | Riparian forest nester, along the broad, lower flood-bottoms of larger river systems. Nests in riparian jungles of willow, often mixed with cottonwood, box elder, and white alder with a thick understory of blackberry, nettles, or wild grape. Sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley oak riparian habitats where scrub jays are abundant. | Found in project area. |

Federal status
E = listed as endangered under the Federal Endangered Species Act.
T = listed as threatened under the Federal Endangered Species Act.
P = proposed for Federal listing as endangered under the Federal Endangered Species Act.
C = species for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposed rule to list.
PX = proposed critical habitat
-- = no listing.

State status
E = listed as endangered under the California Endangered Species Act.
T = listed as threatened under the California Endangered Species Act.
-- = no listing.

most extent of the giant garter snake is in the Llano Seco area south of Chico. Giant garter snakes are also found at the Sacramento, Colusa, and Delevan national wildlife refuges. No locations are identified for this species in the vicinity of the study area.

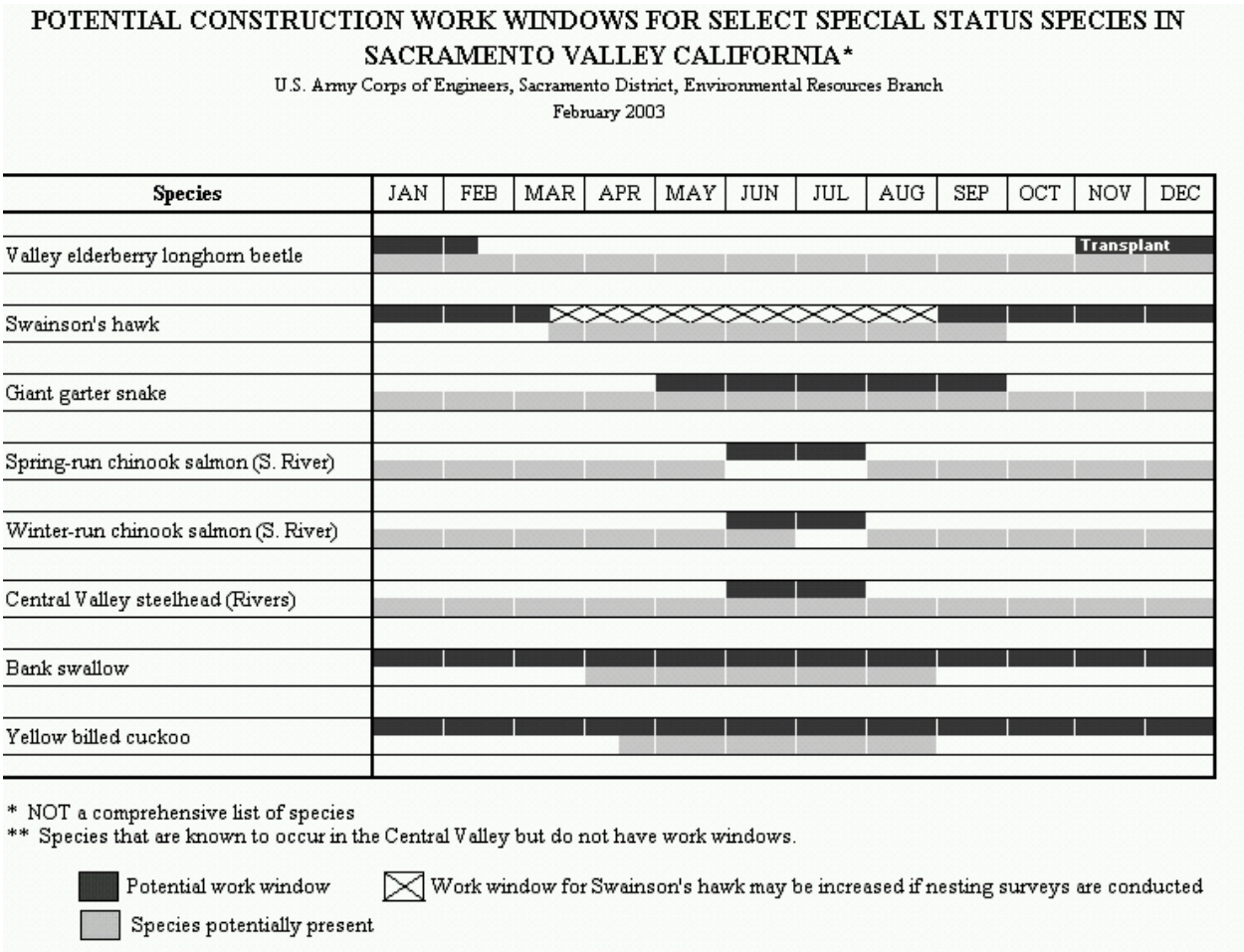
The Sacramento River supports four races of chinook salmon, fall-run, late fall-run, winter-run, and spring-run. In the Sacramento River, juvenile chinook salmon belonging to one or more of the four extant runs may be migrating in any month of the year (Nicholas and Hankin 1989). In the past, the river produced large numbers of salmon that were an important part of the diet of California's native peoples. Habitat destruction, first in the

form of mining debris and sediments that covered spawning grounds and muddied the waters, reduced the salmon populations beginning as early as the 1850's, and later 1860's and 1870's by the cutting of riparian trees for fuel for steamboats. In the twentieth century, agricultural conversion, dam building, gravel mining and flood protection works have further decimated the SRA cover, and the gravel spawning habitats the salmon depends on to complete its life cycle.

**TABLE 4-8: ELDERBERRY SHRUBS IN THE STUDY AREA**

| Location | Total Shrubs | 1-<3" stems | 3-<5" stems | 5" or greater | Shrubs showing presence of VELB exit holes |
|---|---|---|---|---|---|
| Hamilton City North | 41 | 37 | 36 | 53 | 16 |
| Dunning Slough | 66 | 95 | 93 | 71 | 5 |

**TABLE 4-9: SPECIAL STATUS SPECIES OCCURRENCE WINDOWS**



Of the four chinook salmon runs (fall, late fall, winter and spring) that use the river, the greatest concern is for the winter-run. In recent years, the winter-run has dwindled from an annual escapement of 80,000 adult fish to about 2,000; with a low of 191 winter-run chinook in 1991 (Federal Register, 1994). This steep decline, due to a variety of causes, including habitat degradation, has prompted the listing of the winter-run under both State and Federal Endangered Species Acts. Currently, the Federal and State Endangered Species Acts list the winter-run salmon as State-endangered, and Federally-endangered; the spring-run salmon as State-threatened and Federally-threatened; and fall/late fall salmon are Federal candidates. In December to August, the winter-run chinook salmon migrates past the area upstream, where it spawns. From August to December, winter-run juveniles use the SRA cover in the river for feeding, to rest and escape from predators. The NOAA Fisheries has classified the entire Sacramento River from Keswick Dam to San Francisco Bay as critical habitat for winter-run chinook.

Central Valley steelhead populations are all considered to be winter-run steelhead that typically spend two years rearing in fresh water before out-migrating to the ocean (McEwan and Jackson 1996, IEP Steelhead Project Workteam 1999). Like chinook salmon, steelhead primarily use habitat in the area during the juvenile rearing period. During the warmer parts of the year, steelhead parr appear to prefer habitat with cover provided by rocky substrates, overhanging vegetation and large woody debris (LWD), and low light intensities (Hartman 1965, Facchin and Slaney 1977, Ward and Slaney 1979, Fausch 1993). During the winter, when they are believed to be less active, juvenile steelhead use pools with large rocky substrates or LWD cover (Hartman 1965, Swales et al. 1986, Raleigh et al. 1984, Fontaine 1988). In winter and spring, when high flows inundate floodplains, backwaters, and side channels, these low-velocity areas may be important feeding areas and velocity refuge habitat for rearing juvenile steelhead and out-migrating smolts (Sommer et al., 1997). Rearing juvenile steelhead and out-migrating smolts may be present in the project area throughout the year. Adult steelhead require deep pools for resting during their upstream spawning migration. Some upstream migrants may use pools in the lower Sacramento River, where available.

Existing valley elderberry bushes provide potential habitat for the VELB. The VELB depends exclusively on the blue elderberry bush for its habitat. Both the larvae and adults feed on the plant, and much of its 2-year life span is spent as larvae inside the stems of the plant. Elderberry bushes are frequently found near the Sacramento River. The beetle occurs naturally in small populations. The beetle was recognized as a Federal threatened species because of loss and alteration of its habitat by agricultural expansion into riparian areas and flood control activities. Some elderberries do exist within the study area. The total elderberry shrubs located in the study area are presented in Table 4-8.

The large riparian forest that has developed near Pine Creek, just east of the project area, provides one of the few remaining areas where the yellow-billed cuckoo is known to nest. The yellow-billed cuckoo nests in large dense riparian areas such as the area that developed in Pine Creek when the Sacramento River abandoned its channel in 1974.

The bald eagle is a temporary visitor during the winter months. This species is not commonly found in the project area and would not even be potentially present during construction. Therefore, the bald eagle is not considered further in this document.

The Swainson's hawk nests in large trees surrounded by suitable foraging habitat, which consists of grasslands or agricultural fields with seasonal crops. Orchards are usually not suitable for the hawks. Swainson's hawks are reported from a variety of locations along the Sacramento River.

The bank swallow is listed as threatened by the State of California under the California Endangered Species Act. Bank swallows nest on eroding banks within the area. This type of swallow is a migratory bird that nests in burrows it digs into in vertical sandy banks in areas it can find food and where it is protected from most predators. In most instances, these banks are riverbanks, where erosion continually provides newly-cut banks. The swallow has been extirpated from much of its range in California. The majority of the population that remains is now centered in the Sacramento Valley along the Sacramento and Feather Rivers. The Department of Fish and Game has found that habitat loss is continuing to threaten the species and that bank protection is the main cause of its decline along the Sacramento River. The species is short lived; it lives only about 2 years, and is therefore very sensitive to changes in habitat conditions. Biologists from the Department of Fish and Game (DFG) counted 44 colonies in 2002 with a total of 16,150 burrows. Not all burrows are occupied, and DFG estimates the number of pairs to be 8,330. This is significantly below the estimated 10,000 pairs required for a stable population (Buechner, Population Viability Analysis, 1992). In 2002, 490 burrows active bank swallow nesting sites were located in the study area.

A summary of occurrence windows for various special status species are presented in Table 4-9.

### 4.2.3 Socioeconomic Conditions

This section describes the existing conditions of socioeconomic resources in the study area. Socioeconomic conditions include population, employment, and economic activity.

Glenn County population has increased from 24,798 to 26,453, a 6.7 percent increase, since 1990. The Hamilton City community has a population of about 1,800 (U.S. Bureau of Census, 2000). A socioeconomic profile of Hamilton City is presented in Table 4-10. Based on this table, the population of Hamilton City can be described as primarily a minority, low-income population. The 1999 Glenn County per capita income was about $18,015, which was about 60 percent of the California average (Table 4-10). The 1999 Hamilton City per capita income was about $9,015, which was about 50 percent of the Glenn County figure. Median household values in Hamilton City are below the state average. The foreign-born population percentage of Hamilton City is significantly above the state average.

The economy of the study area is based on the agricultural industry. The county has one of the highest unemployment rates in the State of California. At 13.8 percent, Hamilton City's unemployment rate is significantly above the state average. Employment, because of its historic dependence upon agriculture, fluctuates substantially on a seasonal basis. Agriculture, agriculturally dependent industries, and government employment comprise a disproportionately high percentage of employment in Glenn County. These sectors of the economy are potentially susceptible to economically disadvantageous characteristics such as low prevailing wages, seasonal fluctuations, (agriculture), and increasingly constrained funding resources (government). Several Federal Agencies have offices and staff in Willows, Glenn County, which contribute Federal funds to the County. Local government expenditures

are generally derived from locally raised tax dollars, and do not, therefore, bring net new income into the county from outside. Consumer expenditures are generally regarded to "leak" from Glenn County to larger retail trade centers, such as Chico and Sacramento. At the same time, economic expansion pressures in the Chico area are known to be creating residential demand in Glenn County, and creating demands for public services without a corresponding expansion of the County's tax base to help offset the costs of such services. Competition with Chico, Williams, and other regional locations for a new economic activities influences Glenn County's practical economic development potential.

**TABLE 4-10: SOCIOECONOMIC PROFILE OF HAMILTON CITY**

| **2000 Population** (2) | |
|---|---|
| Hispanic/Latino | 1,533 |
| White | 330 |
| American Indian | 10 |
| Asian | 6 |
| Black/African American | 5 |
| Other | 19 |
| Total | 1,903 |
| **1999 Per Capita Income** | |
| Hamilton City[1] | $9,050 |
| Glenn County[2] | $18,015 |
| California[3] | $29,910 |

[1] CDP = census designated place, which is a densely settled concentration of population that is not within an incorporated place but is locally identified by a name
[2]US Bureau of Census
[3] CA Department of Finance

As set forth in its General Plan, Glenn County is currently pursuing a pro-economic growth policy to enhance the socioeconomic conditions of the county, including measures such as preserving agriculture while increasing the stability of, and diversifying, the county's economy; expanding existing businesses; attracting new businesses and industry; capturing new or underutilized market potentials; creating new employment opportunities; increasing average income of residents; and expanding and diversifying the tax base.

The local community has developed a sense of community cohesion in their long and persistent efforts to address the flood damage problem that they have faced. This cohesion has been displayed by the community's response to an annual levee festival to develop support and raise funds for levee improvements. The community also displayed this cohesion by their efforts to support a workgroup that met every other month to provide a forum to discuss and coordinate water resources related studies, projects, and other issues affecting the Hamilton City area. Finally, the level of community involvement in public workshops held by the study team was noteworthy.

It is not clear whether current property values within Hamilton City are being negatively influenced by the flood threat. Most of the community lies outside of the FEMA 100-year floodplain and the community has not suffered major flood damage (primarily because of significant flood fighting efforts along the "J" levee). The only new major

development in the community (Pallisades subdivision with 116 single-family residential units) is located within the FEMA floodplain; however, the structures are on raised pads.

### 4.2.4 Agriculture/Prime and Unique Farmlands/Land Use

With the exception of cities/towns of Tehama, Hamilton City, and Nord, land use in the study area is primarily agricultural. Primary crops include barley, alfalfa, beans, sugar beets, and nut (walnut) and fruit (prune) orchards. Ongoing and planned development for Hamilton City includes the construction of a housing development and an elementary school. Lands west of Chico are predominantly agricultural orchards with the exception of the small residential area of Nord.

**Agriculture/Prime and Unique Farmlands**

The majority of lands within the project area are in agricultural production. As indicated in Table 4-6, the area is primarily in orchard crops, including almonds, plums, and walnuts. Some grain and hay crops are also being grown. These agricultural lands are currently subject to seepage, erosion, flooding, and scouring due to their proximity to the Sacramento River. This condition adversely affects the economic return on the agricultural management investment.

Lands located in Glenn County only are classified as Orchard and Field Crop in the County General Plan. The Orchard and Field Crop classification is used to identify those areas where it is desirable to preserve agriculture as the primary land use. Two zoning designations apply: (1) Agricultural with a minimum parcel size of 160 acres, and (2) Agricultural with a minimum parcel size of 40 acres. Public facilities are considered permitted uses in this zoning designation.

The California Department of Conservation uses the U.S. Department of Agriculture's modern classification when administering the Farmland Mapping and Monitoring Program to characterize the types and amounts of agricultural land in an area. Agricultural lands in the study area are primarily characterized as:

- Prime Farmland. Lands which are considered to be the best combination of physical and chemical features able to sustain long-term agricultural production;
- Farmland of Statewide Importance. Farmlands similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ambient moisture;
- Other Land. Land not included in any other mapping category, such as low-density rural development, wetland, and riparian areas not suitable for livestock grazing.

There are about 1,440 acres classified as Prime Farmlands; 61 acres classified as Farmlands of Statewide Importance; and 100 acres classified as Other Lands (see Figure 4-2).

Glenn County administers the Williamson Act and Farmland Security Zone (Super Williamson Act) contracts within the study area (see Figure 4-3). Both are intended to preserve farmland although a landowner could have a permitted mining operation, a hunting club (without permanent facilities), or processing operations for agricultural products. The

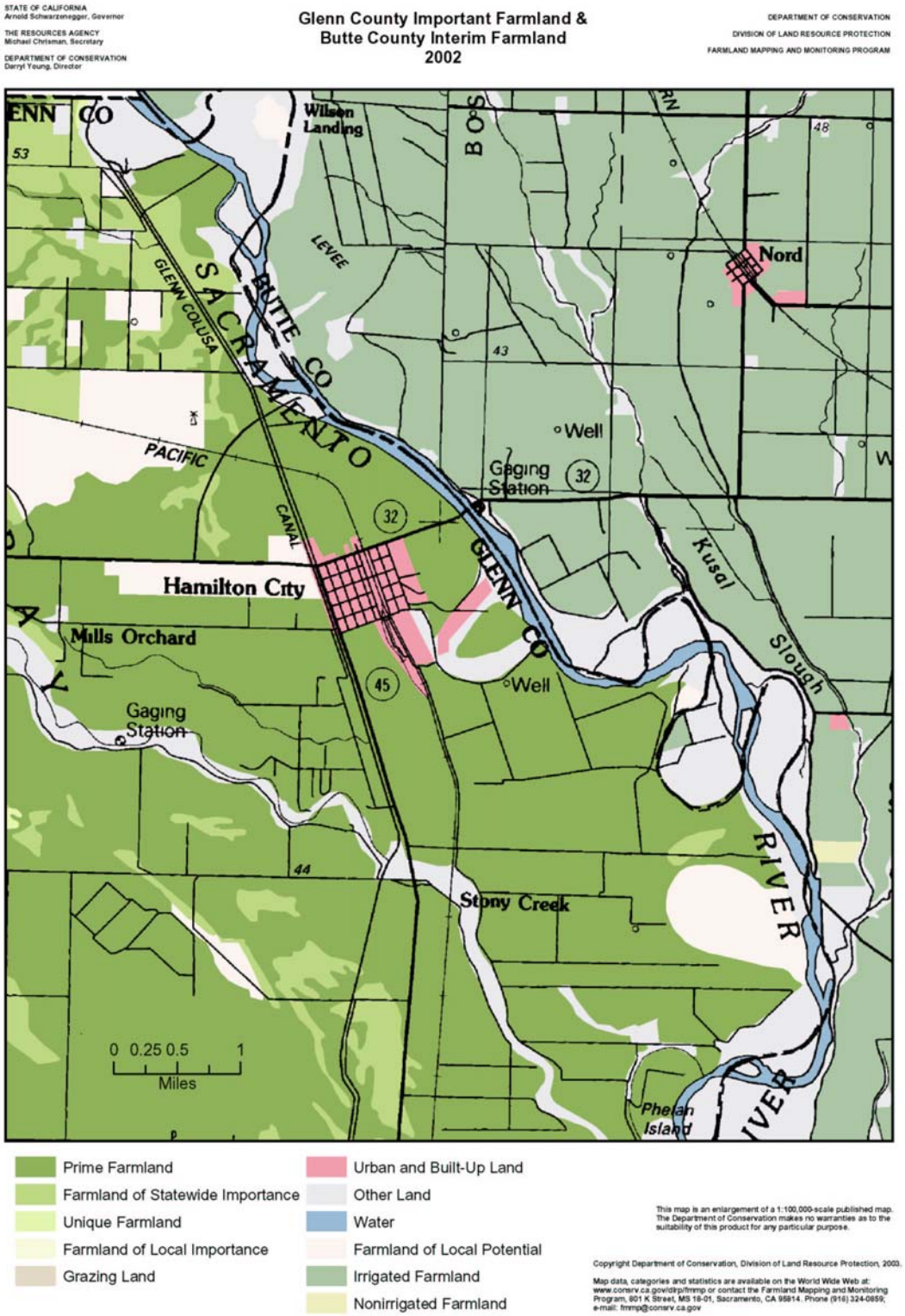



**Figure 4-2: Important Farmland in the Study Area**

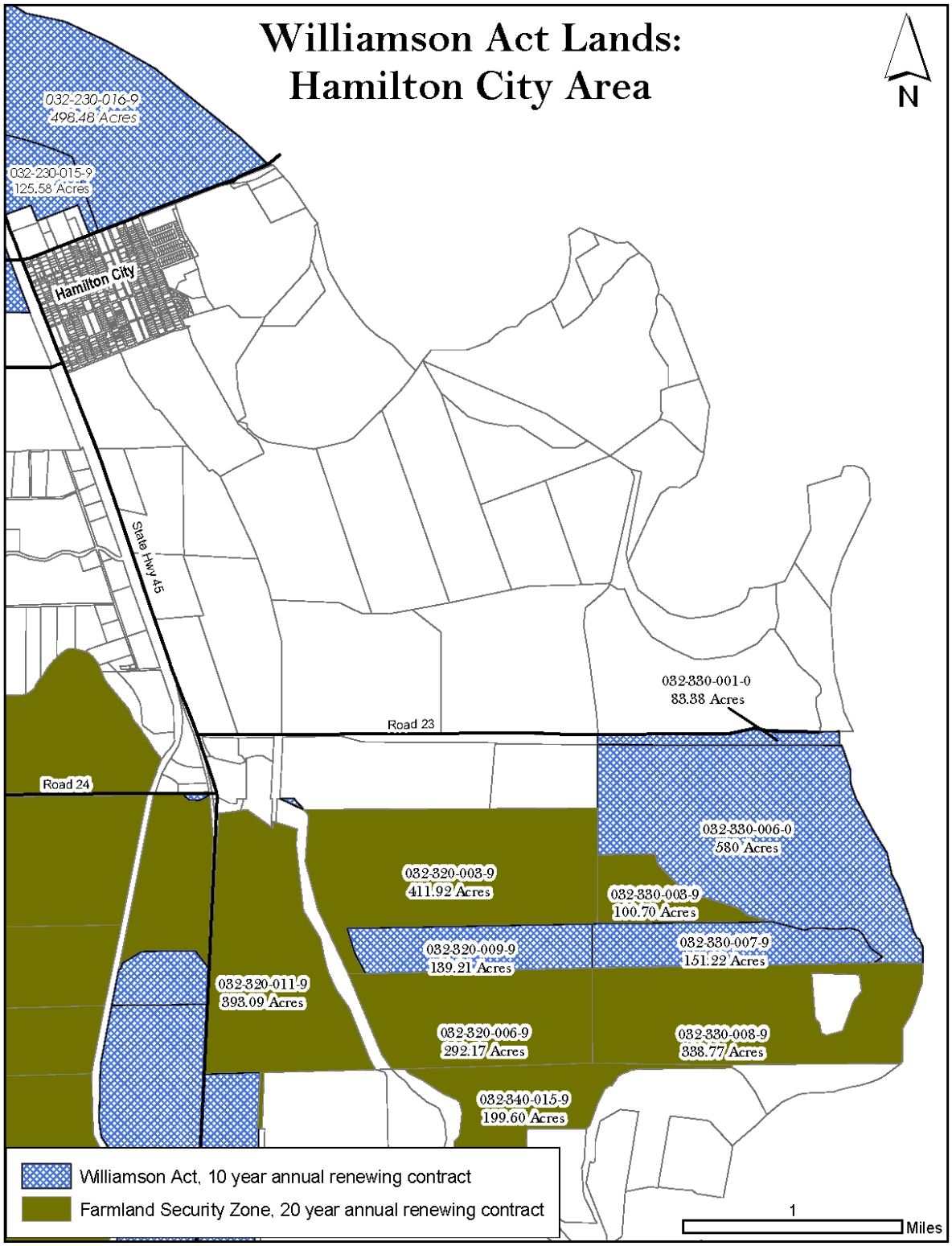



**Figure 4-3: Williamson Act Lands: Hamilton City Area**

only major difference in the Williamson Act Contracts that the County administers is the length of the renewing contract. For Williamson Act Contracts it is ten years and for the Farmland Security Zone Act it is 20 years.

In compliance with the Farmland Protection Policy Act (FPPA), the NRCS provided a Farmland Conversion Impact Rating, dated September 30, 2003 (on Form AD-1006, Appendix B), which indicated that there are 451,163 acres of farmable land in Glenn County. They also indicated that there are 212,005 acres of farmland in the county that are prime or unique farmlands, or farmland of statewide or local importance, as defined in the FPPA. As of 1998, Glenn County had 88,706 acres enrolled in Williamson Act Prime and Unique agriculture. A net total of 1,668 acres of prime agriculture was converted between 1998 and 2000.

The management of these prime and unique farmland soils for agricultural purposes exposes them to some degree of degradation. The processes under which these soils developed are adversely affected by the current management practices, such as protection from flooding and associated sediment deposition, tilling, and the application of agricultural chemicals. These practices adversely affect nutrient cycling, increase exposure to erosion, and inhibit natural soil microorganisms.

In the study area there are currently 6 parcels under Williamson Act contracts totaling 1,577.87 acres. Two of these parcels are owned by TNC, two of these parcels are owned by the USFWS, and two parcels are privately owned. Also in the study area there are two parcels under Farmland Security Zone Act Contracts totaling 612.62 acres. Both properties are privately owned.

**Urban Land Use**

Glenn County maintains a policy of developing urban limit lines that will accommodate growth based on population forecast for each community (see Figure 4-4). In addition urban limit lines should follow roads, railroads, watercourses or other physical boundaries and follow parcel lines. Expansion of the urban limit lines may occur only once full urban services and infrastructure have been established and the property is contiguous to existing development. A recent expansion to the city called the Pallisades sub-division has begun on the eastern boundary of the city limits (116 units). A total of about 80 units have been built to date, with the remainder estimated to be completed in about 2006. A school is part of the development plan. Figure 4-4 also depicts the FEMA 100-year regulatory floodplain.

### 4.2.5 Transportation

The study area is between Interstate Highway 5 (I-5) and State Highway 99, and the Sacramento River essentially parallels these north-south routes (Figure 2-1). State Highway 32 runs through Hamilton City and is an east-west connection for vehicles traveling between I-5 and State Highway 99 (Figure 4-5). The Gianella Bridge on State Highway 32 crosses the Sacramento River and connects Hamilton City with Chico. This route is particularly important locally since there are few major routes crossing the river in this area. State Highway 45 runs south from Hamilton City to Knights Landing. The California Northern Railroad connects the town to its main line, which in turn has connections to the Union Pacific Railroad.

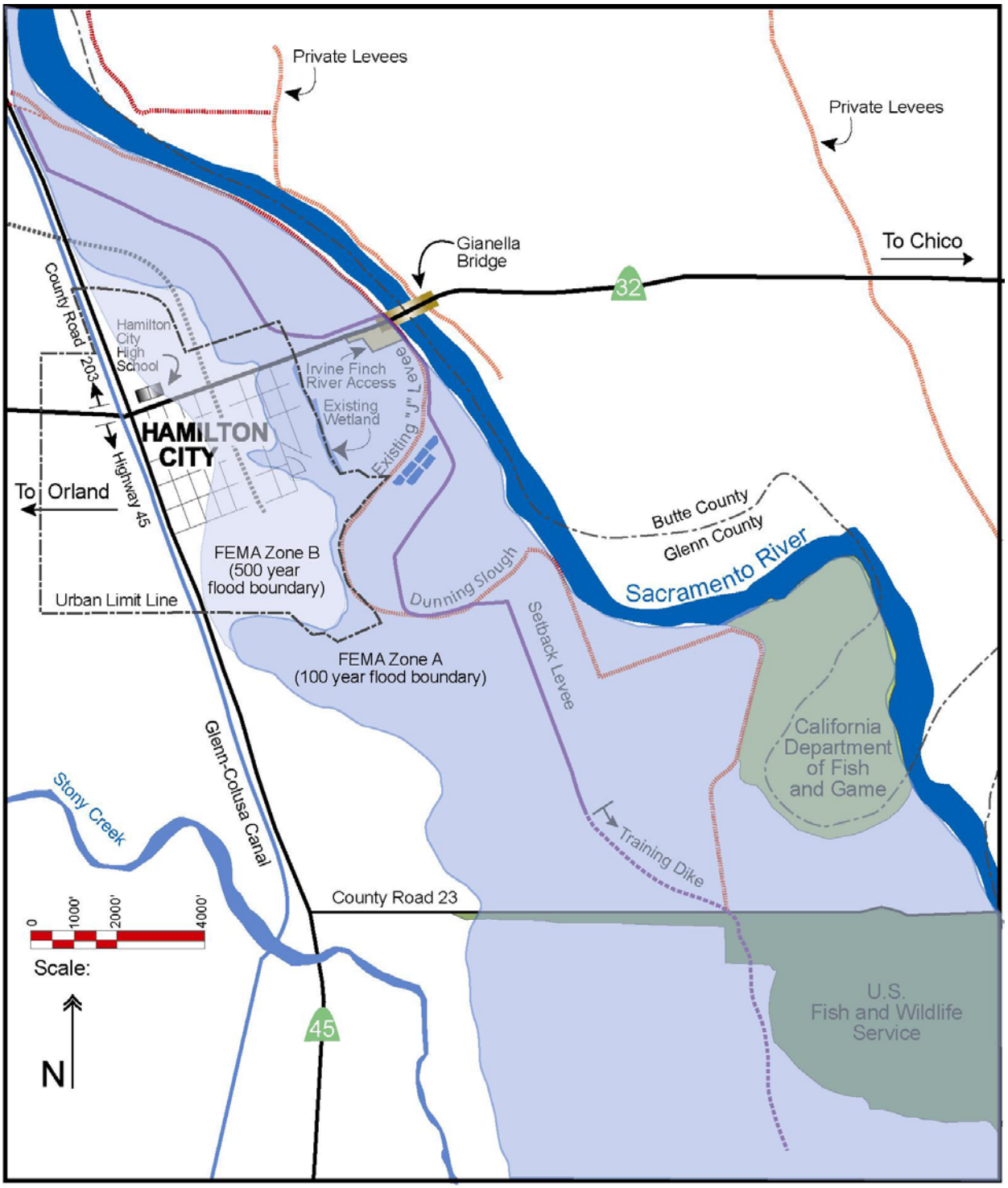



**Figure 4-4: Urban Limit Line and FEMA Floodplain Boundary: Hamilton City Area**

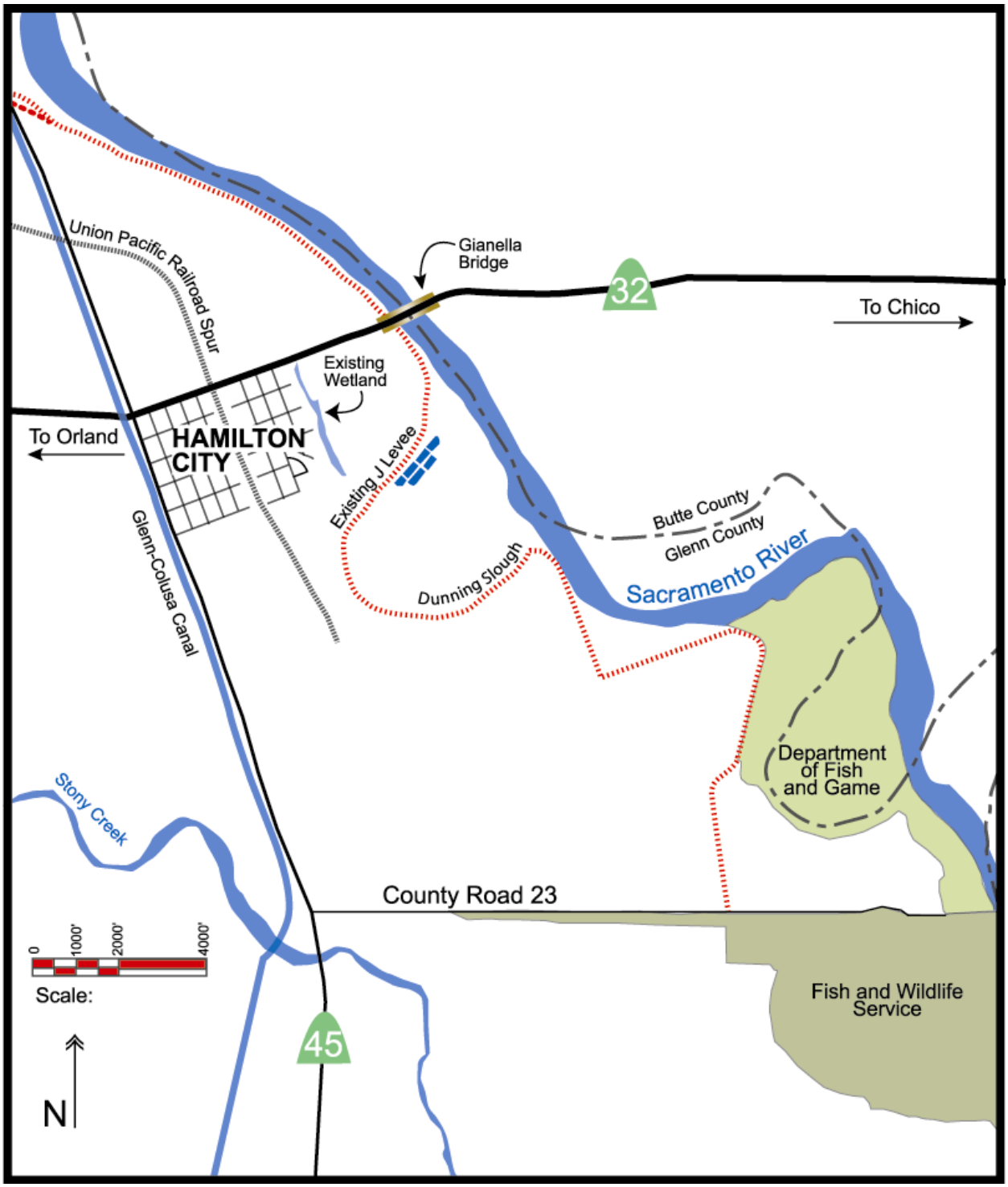



**Figure 4-5: Transportation Routes in the Hamilton City Area**

The Sacramento River forms the Glenn County (west) and Butte County (east) line. Bus service to the area is provided by Greyhound, which services Chico directly. Airplane travel is available from Sacramento International Airport, about 100 miles south via Interstate Highway 5.

### 4.2.6 Recreation

Within the affected area, the Sacramento River supports a variety of recreational activities. Recreational boating is the primary recreational activity and the region has a variety of sites for boat launching, including the Irvine Finch River Access within the study area, which is owned and maintained by the California Department of Parks and Recreation. Other recreational opportunities within the study area include hunting, fishing, hiking, day-use/picnicking and wildlife observation. Both motorized and nonmotorized boats use the section of the Sacramento River south of the Woodson Bridge. The most common type of boats used on this part of the river are fishing boats, canoes, rafts, and other inflatable craft. Jet sleds and jet skis are also used in this area during the summer months.

This section describes the recreation facilities available in the affected area. The recreation facilities and used are categorized by Federal, state, local, or private landowners. (See Table 4-11.) Each facility is described in terms of river miles reference, access, site amenities, and site characteristics. This information was taken from the Sacramento River Public Recreation Access Study: Red Bluff to Colusa (EDAW Consulting 2003) that was prepared for TNC. This document identified and characterized existing public recreation opportunities and needs and identified and made recommendations for future public recreation access opportunities and management programs throughout the study area.

### 4.2.7 Aesthetics

The project area is located in a rural setting adjacent to the Sacramento River. Prominent visual features include the Sacramento River, the Hamilton City Sewage Treatment facility, surrounding agricultural fields, and local roads. Sensitive visual receptors include local residents and river recreationists. The project area is remote, not easily accessible from the land by the general public and cannot be characterized as a destination for travelers, with the exception of recreationists.

### 4.2.8 Noise

Within Glenn County, typical non-transportation or industrial noise sources include, but are not limited to, the Glenn Growers rice drying facility, Manville Insulation industrial facility, Holly Sugar Corporation, Baldwin Contracting Company, Stony Creek Sand and Gravel, Valley Rock Products Inc., Martin Sand and Gravel, and miscellaneous agricultural operations. The only other non-transportation noise sources in the study area are those associated with mobile noise from agricultural operations on lands zoned for agricultural uses. These activities are exempt from noise ordinances.

Transportation noise sources are defined as traffic on public roadways, railroad line operations, and aircraft in flight. Noise created by new transportation noise sources,

including roadway improvement projects, are mitigated so as not to exceed the specified noise ordinance levels.

**TABLE 4-11: RECREATION FACILITIES LOCATED IN THE AFFECTED AREA**

| Name | Location | Access | Site Amenities | Site Characteristics |
|---|---|---|---|---|
| **Federal Facilities** | | | | |
| Foster Island | River Mile 211 | No public access | No amenities | Cut off from land by sloughs and bordered by private agriculture land. It is frequently submerged during the winter and spring and dense riparian vegetation |
| Sacramento River National Wildlife Refuge (SRNWR) | 11 sites from RM 182-RM 216 | No public access | No amenities | Vegetation consists of riparian, row and tree crops, and fallow farmland |
| **State Facilities** | | | | |
| Sacramento River Wildlife Area | 7 units from River Mile 180.5- RM 214 | 3 units have public access roads and 4 units do not. | None of these units provide facilities for boating, parking, picnicking, or camping. | Provide wildlife-related public recreation opportunities |
| Bidwell-Sacramento River State Park (includes Irvine Finch River Access) | 4 units from RM 193.2 – RM 200 | Public access roads | Regular and boat trailer parking, overnight camping, picnic facilities, drinking fountains, and flushable toilets, unpaved trails and walkways and is ADA accessible. | Provides hiking, fishing, and wildlife observation |
| Reclamation Board sites for maintaining flood control works | 5 sites from RM 190 – RM 196 | Public use Is neither allowed nor prohibited | No amenities | Vegetation on these sites is dense mixed riparian forest and gravel bars. |

| Name | Location | Access | Site Amenities | Site Characteristics |
|---|---|---|---|---|
| **Local Facilities** | | | | |
| Ord Bend Park | River Mile 184 | Public access via County Road 32 and the by the river | Boat ramp, paved parking, restrooms with flushable toilets, sinks, picnic facilities, and ball fields. | Primary recreation uses include fishing and wildlife observation. |
| **Private Facilities** | | | | |
| The Nature Conservancy | 7 units | No public access. | No amenities. | No public use is allowed |
| Scotty's Boat Landing | River Mile 196.5 | Public access via River Road or by the river | Unpaved parking, boat ramp, boat dock, tent and RV camping sites, picnic tables and potable water, a bar and grill restaurant, a store that sells bait and tackle equipment, and public phones. | The site is vegetated with sparse, mostly non-native species along the bank, however, a few mature cottonwoods are also present. |

The noise level standards for Glenn County are the average noise level for an hour period (A-weighted scale). Table 4-12 shows the maximum noise level standards for Glenn County. The Glenn County Planning Division enforces the noise level standards in Glenn County and determines the land use boundary lines, which determines the noise level standards. The noise level standards are established to protect the quality of human health in Glenn County (Glenn County 2003).

**TABLE 4-12: MAXIMUM ONE-HOUR AVERAGE NOISE LEVEL THRESHOLD**

| Item | A-Weighted Scale (dB) |
|---|---|
| **7:00 a.m. – 10:00 p.m.** | |
| Residential | 55 |
| Commercial | 60 |
| Industrial | 65 |
| **10:00 p.m. – 7:00 a.m.** | |
| Residential | 45 |
| Commercial | 55 |
| Industrial | 60 |

Note: the A-weighted is measured in decibels shown as (dB).

Noise production near sensitive receptors is held at a lower threshold than the thresholds found on Table 4-12. The type of land use the sensitive receptor is located in does not determine the noise level standards. The standards near a sensitive receptor are found on Table 4-13 (Glenn County 2003). Sensitive receptors may include schools, residential homes, and hospitals.

**TABLE 4-13: MAXIMUM ONE-HOUR AVERAGE NOISE THRESHOLDS NEAR A SENSITIVE RECEPTOR**

| Item | A-Weighted Scale (dB) |
|---|---|
| **7:00 a.m. – 10:00 p.m.** | |
| Threshold | 57 |
| **10:00 p.m. – 7:00 a.m.** | |
| Threshold | 50 |

Note: the A-weighted is measured in decibels shown as (dB).

Local noise standards do not apply to the construction site sounds between 7:00 a.m. and 7:00 p.m. The local noise standards also do not apply to agricultural equipment when operated on property zoned for agricultural activities provided standard, reasonable practices are being followed.

### 4.2.9 Hazardous, Toxic, and Radiological Waste

Federal, State, and local lists were identified and reviewed to determine the extent of known hazardous, toxic, and radiological waste (HTRW) sites in the study area that could require special consideration during further detailed studies. An expanded discussion of HTRW resources in the study area can be found in Appendix C.9, Hazardous, Toxic and/or Radiological Waste.

The Comprehensive Environmental Response, Compensation, and Liability Information System list (CERCLIS) and National Priorities List (NPL) were reviewed and indicated there are no suspected abandoned, inactive, or uncontrolled hazardous waste sites, or Superfund sites, within the study area. The Emergency Response Notification System database showed no hazardous materials spill sites within the study area.

No landfills are listed in the study area. However, the Holly Sugar Lime Disposal Site, which includes mounds of lime, is located ½ mile southeast of First Street. Some of the lime is being hauled and used for soil conditioning at a different location.

There are three Leaking Underground Fuel Tanks (LUFT) within the study area; Double E Market, Jackpot Food Mart, and Kaplan Almond Farm, all located within Hamilton City. There are six Underground Storage Tank (UST) sites; Double E Market, Benjamin's Service Inc., Hamilton High School, James Mills Orchards, James Mills Growers Service Co and Hamilton Elementary School, all located within Hamilton City.

Seven oil and gas wells were identified within the study area. All oil and gas wells are located on the outskirts of Hamilton City between the Glenn-Colusa Canal and the Sacramento River. These wells were drilled in the early to mid-1900's and all were found dry.

There are four hazardous waste generators in the study area: Art Avrit, Bob's Auto & Truck Repair, Martin Byron Vangundy III, and Hamilton Union Elementary School District.

Soils that are the result of a spill or improper disposal and have dichlorodiphenyltrichloroethane (DDT) derivatives including DDD (dichlorodiphyltrichloroethylene) (DDTR) at concentrations above 1 part per million (ppm), are classified as hazardous waste under California regulations. The samples collected in Glenn County are all below these limits. This does not rule out the possibility that greater concentrations may be encountered in the study area. Most of the study area, outside of Hamilton City has been orchards and farmlands for many years.

### 4.2.10 Cultural Resources

This section provides a summary of existing conditions of cultural resources in the study area. An expanded discussion of cultural resources can be found in Appendix B.

#### Prehistory

The study area lies within an archeological sub-region of the Central Valley Region referred to as the Sacramento Valley (Moratto 1984). The potential area of potential effect (APE) for this project crosses the prehistoric territory of the Konkow. Konkow was spoken in a number of dialects along the lower reaches of the Feather River Canyon and in the adjacent parts of the Sacramento Valley. The term Konkow refers only to the Northwestern Maidu whose regional boundaries would have included the lower reaches of the Feather River and adjacent parts of the Sacramento Valley (Riddell 1978). The Konkow territory included part of the Sacramento Valley floor as well as a section of the Sierra foothills east of Chico and Oroville.

#### Ethnography

The Konkow people derive their name from a native term meaning "meadowland" and their diversity to other Maidu groups, such as the Nisenan, is marked by changes in dialect and location of villages and territory. As a kind of division of the Maidu people, the Konkow share many similarities as well as differences. Precontact villages have been estimated at approximately 35 persons, with a gathering of seven houses per village and five persons per house. Several villages may have made up a village-community that probably did not exceed a population of 200.

#### Records and Literature Search

A records check at the Northeast Information Center at the California State University, Chico, California, was conducted in July 2001. According to the records check, a small portion of the study area has been previously surveyed for cultural resources. The most recent survey within the project area was conducted in 1997 and encompassed 42 acres of a proposed subdivision project located east of Hamilton City. Two basalt core isolates were noted as a result of the survey. Three other surveys were conducted in 1974, 1975, and 1984 within a ½- mile radius of the potential project area. An archeological reconnaissance survey of another proposed sub-division, east of Hamilton City and south of the 1997 survey was conducted in 1984. No cultural resources were located in this survey. In 1975, an

archeological survey was conducted at 26 erosion sites along the Sacramento River, east of Dunning Slough. Two previously recorded sites, historic debris and a prehistoric processing site, were noted as a result of this survey. In 1974, an archeological reconnaissance survey south east of Dunning Slough along the Sacramento River recorded three previously recorded sites. There is one recorded prehistoric site within the project area. This site is recorded as mounds of dirt with mortars, beds, and projectile points.

There are no previously recorded historic sites known to be located within the project area or within a 1/2-mile radius of the project boundaries. The U.S. Geological Survey (USGS) 15-inch quad maps (1949 and 1951) indicate a levee, a well, an oil tank, the Southern Pacific Railroad, the historic community of Hamilton City, a pump, the Central Irrigation Canal, Highway 32, St. John Road, other roads, and structures are within the project area, and the Southern Pacific Railroad, a well, a levee, Mills Orchard Road, a school, churches, the Chico-Orland Road, structures, and roads are in the vicinity of the study area.

The National Register of Historic Places and the Office of Historic Preservation (OHP) Directory of Properties in the Historic Property Data File for Glenn County lists the Gianella Bridge as an historic property. The OHP Directory lists three historic properties located within the community of Hamilton City and five historic properties in the vicinity of Hamilton City. The California Inventory of Historic Resources indicates Swift's Point and St. John as historic properties. The Points of Historical Interest indicates St. John, and Indian Dancehouse, Swift's Point, and Shotover Inn as historic properties.

## 4.3 FUTURE WITHOUT-PROJECT ASSUMPTIONS

This section describes changes expected in the study area over the period of analysis assuming a flood damage reduction/ecosystem restoration project is not built as a result of this study. This description of the assumed without-project condition serves as the baseline against which alternative plans will be evaluated to determine their effectiveness and to identify effects that would result from them.

The planning period for both the economic and environmental analysis is 50 years. Assuming a minimum of 10 years for planning and implementation, projections for socioeconomic and environmental resource conditions are based on year 2060. The future without-project conditions for the study area with regard to topography, geology, soils, and hydrology will remain relatively unchanged for the foreseeable future. These would remain as described earlier in this chapter.

California's climate may change over the next century due to global warming. With a change in California's climate, warmer temperatures and more severe droughts and floods could have a wide range of impacts. By 2100, temperatures in California could increase by about 5°F in the winter and summer (California Environmental Protection Agency, 2000). Appreciable increases in precipitation are projected at 20-30 percent in spring and fall, with somewhat larger increases in winter (California Environmental Protection Agency, 2000). Winter runoff most likely would increase, while spring and summer runoff would decrease. This shift could be problematic, because the existing reservoirs are not large enough to store the increased winter flows for release in the summer. More intense precipitation could increase flooding. Because evaporation is likely to increase with warmer climate, it could result in lower river flow and lower lake levels, particularly in the summer. Groundwater could also be reduced.

California is an ecologically diverse state and climate change could have an impact on many of California's species and ecosystems. Many species are adapted to specific climate conditions, and an increase in temperatures could force changes in species, geographic extent, and health and productivity. The ranges of many species of plants and animals are restricted and fragmented. Without natural corridors to allow migration, isolated species could be limited in their ability to adapt to climate change. Plant and animal species near the borders of their ranges are likely to be most affected. In addition, climate change could create more opportunity for the establishment and spread of weeds and pests. All these factors can add to existing stresses on resources caused by other influences such as population growth, land-use changes, and pollution.

Flood control and ecosystem restoration projects that have received authorization and/or funding are assumed to be in place. Those that would potentially affect the Hamilton City area are listed below.

Sacramento River Floodplain Acquisition and Monitoring. The Nature Conservancy (TNC), the California Wildlife Conservation Board (WCB), California Department of Fish and Game (DFG), and the USFWS have requested funds for the acquisition and management of fee title or permanent conservation easement interests on floodplain lands within the Conservation Area of the Sacramento River between Keswick and Verona. The acquisitions will facilitate the recovery of ecological processes within the floodplain, including the regeneration of native riparian habitat.

Sacramento River Wildlife Refuge. This USFWS refuge project is one of six refuges in the Sacramento Wildlife Refuge Complex and consists of a land acquisition and habitat restoration program along the Sacramento River from Red Bluff to Colusa. To date, USFWS has acquired slightly more than 14,500 acres of the 18,000 acres Congress authorized in 1989. The remaining lands will be purchased from willing sellers as funds are appropriated and the public disclosure (NEPA) process is completed for each incremental expansion. Much of the lands acquired to date have been used for various crops, and remain in agricultural use. The revenue generated from the crops is used to restore habitat on lands scheduled for conversion.

### 4.3.1 Geomorphology

Under the future without-project condition, levee removal is not planned for the right bank of the Sacramento River near the Hamilton City area.

While rock has constrained river meander to some extent in the study area, there is currently about 36,755 lf on the right bank and 38,477 lf on the left bank of the river with no bank protection. There is a high uncertainty in any bank erosion and/or channel migration estimate. Based on historical migration rates, current estimates that for RM 196-198, 200 feet of migration could be expected for an exceedence interval of 50-years (see Appendix C-3, and Tables 4-14 and 4-15). The rock riprap bank protection does not last indefinitely and will have less and less impact into the future. The rock riprap bank protection usually lasts about 50-years with significant deterioration starting about 20-years from its time of placement. About 20 percent to 25 percent of the riprap cover has already eroded from the bank, mostly to the south end of the study area.

The Federal government would continue to expect the State of California, as non-Federal sponsor for the existing Chico Landing to Red Bluff Project, to continue to operate and maintain that project. Any future maintenance would need to be accomplished in accordance with the jeopardy opinion issued for that project by the U.S. Fish and Wildlife Service that pertains to the valley elderberry long-horned beetle.

**TABLE 4-14. MEANDER BEND AT RIVER MILE 196 TO 198.**

| Period | Years | Migration Distance(ft) | Migration Rate (ft/yr) |
|---|---|---|---|
| 1896-1923 | 27 | 1,202 | 44.5 |
| 1923-1937 | 14 | 43 | 3.1 |
| 1937-1946 | 9 | 1,122 | 124.7 |
| 1946-1955 | 9 | 584 | 64.9 |
| 1955-1960 | 5 | 258 | 51.6 |
| 1960-1969 | 9 | 444 | 49.3 |
| 1969-1972 | 3 | 623 | 207.7 |
| 1972-1981[1] | 9 | 797 | 88.6 |
| 1981-1984 | 3 | 355 | 118.3 |
| 1984-1986 | 2 | 0 | 0.0 |
| 1986-1991 | 5 | 0 | 0.0 |
| 1991-1999 | 8 | 28 | 3.5 |
| 1999-2002 | 3 | 30 | 10.0 |
| 1896-2002 | 106 | 5,486 | 51.8 |
| 1946-2002 | 56 | 3,119 | 55.7 |
| 1960-1981 | 21 | 1,864 | 88.8 |
| 1981-2002 | 21 | 413 | 19.7 |

[1] Neck cutoff of tightly compressed meander bend between RM 196 and RM 197 occurred during this period

### 4.3.2 River Hydraulics

River hydraulics are expected to be much as described above for the affected environment. No significant changes in the flood management system that would alter river hydraulics are currently planned by flood control agencies. Potential future watershed activities could result in lower flood stages in places if some levees are removed or higher stages in places if increased vegetation impedes flood flows.

**TABLE 4-15. EROSION RATES ASSOCIATED WITH VARIOUS EXCEEDENCE PROBABILITIES FOR RIVER MILE 196 TO 198.**

| Flow (cfs) | Stream Power (lb/ft s) | Migration (feet) | Exceedance Interval (years) | Percent Chance Exceedance |
|---|---|---|---|---|
| 520,000 | 14.29 | 344 | 1,000.00 | 0.10 |
| 424,511 | 11.88 | 286 | 500.00 | 0.20 |
| 315,965 | 9.83 | 237 | 200.00 | 0.50 |
| 275,910 | 8.99 | 217 | 100.00 | 1.00 |
| 237,829 | 8.30 | 200 | 50.00 | 2.00 |
| 206,575 | 8.27 | 199 | 25.00 | 4.00 |
| 160,634 | 7.04 | 170 | 10.00 | 10.00 |
| 97,524 | 3.89 | 94 | 2.00 | 50.00 |
| 30,000 | 1.33 | 32 | 1.00 | 99.99 |

### 4.3.3 Flood Management

The flood management for the without-project condition would remain much as described above for the affected environment. Flood events will continue to reduce the structural integrity of levees, potentially causing levee failures. Major flood fights would be needed to reduce the risk of levee failures and emergency repairs would continue on an as needed basis. However, the need for flood fights and emergency repairs may increase since maintenance of the flood management system is becoming more difficult.

### 4.3.4 Water Quality

Water quality is expected to remain much as described above for the affected environment. While increased population will tend to degrade water quality, existing regulations require mitigation to offset the effects of a growing population. Potential future watershed activities are expected to improve water quality over the long term.

### 4.3.5 Air Quality

The area occasionally exceeds State levels for ozone. The area occasionally exceeds both Federal and State levels for particulate matter ($PM_{10}$). An Air Quality Attainment Plan (AQMP) for the Northern Sacramento Valley Air Basin has been adopted. The AQMP is designed to achieve a reduction in basin-wide emissions and proposes control measures to be adopted to achieve mandatory reduction. Under the future without-project scenario, total air emissions are expected to increase over existing conditions, even assuming that emissions allowable from individual and mobile sources would be regulated more strictly.

In the Central Valley, with no other changes in weather or emissions, a 7.2°F warming would increase ozone concentrations by 20 percent and almost double the size of the area not meeting national health standards for air quality. Currently, the national standards for ozone are not attained throughout much of the state. Ground-level ozone has been shown to aggravate existing respiratory illnesses such as asthma, reduce lung function, and induce respiratory inflammation. In addition, ambient ozone reduces agricultural crop yields and impairs ecosystem health.

### 4.3.6 Biological Conditions

**Vegetation and Wildlife**

Ongoing restoration efforts along the river are expected to improve the biological conditions. The existing private levee would be subject to continued erosion and potential failure from flood events. Vegetation that has become established on the levee would be subject to erosion. DFG property has been planted and USFWS properties can be expected to be restored as agricultural resources become non-economical; however, the majority of the study area which is currently in agriculture is expected to remain in agriculture.

**Fisheries and Aquatic Resources**

The without-project perspective is compounded by activities of CALFED, Central Valley Project Improvement Act (CVPIA), and others within the same geographical study area. To date, and potentially within the planning time frame, actions taken within the study area have been targeted at stabilizing downward wildlife population trends. Ongoing ecosystem restoration efforts will improve the quantity and value of fishery and aquatic resources. However, much of this improvement will be based on separate opportunities that are not integrated in a single plan. While many have visions for an integrated ecosystem plan, they lack authority to significantly alter the river system due to its flood management function, therefore, ongoing restoration will likely only provide localized benefits throughout the river corridor. Restoration work for fisheries can be expected to occur throughout the system predominantly where fisheries spawning and rearing habitat occurs.

**Special Status Species**

The projected conversion of some lands in the Sacramento Valley from production of rice or small grain crops to cotton could reduce habitat for the giant garter snake, and this transformation could also affect waterfowl abundance, indirectly affecting potential prey for Swainson's hawks and bald eagles. Future urban development effects on special-status species could be reduced by compliance with requirements in the Federal and State Endangered Species Act and local ordinances designed to conserve special status species. Overall the trend in increasing numbers of species becoming listed as state or Federal threatened and endangered can be expected to continue.

### 4.3.7 Socioeconomic Conditions

The projected population growth appears to drive other key trends in water use and land use. Population cannot be reliably estimated to year 2060. Based on California

Department of Finance estimates, the population of the Central Valley will increase from approximately 4 million people in 1995 to about 6.8 million people by 2020. An increase in the population of the Hamilton City area can be expected as population increases in nearby Chico.

### 4.3.8 Land Use

The population growth will result in conversion of agricultural and other rural land to urban uses. This will increase flood risk and further reduce land available for maintaining and restoring ecosystem values.

**Agriculture/Prime and Unique Farmlands**

Agriculture is the major industry within the study area, particularly orchards that are considered a long-term investment. Historically, orchards have been planted and grown in the surrounding area and it is expected that the current land use will continue. Land under Williamson Act or Farmland Security Zone Act contracts would remain in agricultural for the remainder of the contract, usually a 10-year or 20-year commitment respectively.

In the future, agricultural lands may decline due to seepage, erosion, flooding and scouring that are associated with the close proximity of the lands to the Sacramento River. Due to these factors, potential investments to keep such lands productive may diminish.

**Urban Land Use**

It is expected that the current urban growth boundaries for Hamilton City will be utilized with housing developments, business parks, schools, and parks. However, with the exception of the Pallisades subdivision and an associated school, no other housing developments are currently planned within Hamilton City urban use limits. An increase in the population of the Hamilton City area can be expected as population increases in nearby Chico. As the population of Hamilton City grows, there would be an associated increase in pressure for more urban development.

### 4.3.9 Transportation

The population growth will increase the need for new transportation facilities that will be at risk of flooding. Traffic levels on roadways within Glenn County are projected to be consistent with expected population growth, which countywide is forecast to be 3 percent per year.

### 4.3.10 Recreation

Recreation facilities within the study area are expected to remain the same; however, recreation use is expected to increase consistent with the increasing population. There will continue to be a demand for recreation facilities (including camping, hiking, sport fishing) as the population increases throughout the affected area.

### 4.3.11 Noise

Noise levels are expected to increase consistent with an increase in population and urban growth. County noise ordinances will mitigate for the increase in noise levels associated with this growth.

### 4.3.12 Hazardous, Toxic, and Radioactive Waste

Hazardous, toxic, and radioactive waste at risk of flooding that is currently in the study area is expected to remain, as there is currently no state plan to remove the materials.

### 4.3.13 Cultural Environment

Conditions of cultural resources sites within the proposed project area would remain the same. Levee failure and resultant flooding could damage archeological sites in the project area.

# CHAPTER 5 – ENVIRONMENTAL CONSEQUENCES*

## 5.1 ENVIRONMENTAL EVALUATION METHODOLOGY

This chapter describes the analysis of potential environmental effects of the no-action and final array of combined action alternative plans (combined alternatives 1, 5 and 6). In general, construction of the no-action and action alternatives could result in short-term environmental effects, while long-term effects of the alternatives could result from operation and maintenance activities throughout the period of analysis. Construction effects are measured from existing conditions and no-action conditions.

The evaluation of effects is based upon a comparison of conditions with and without the implementation of an alternative plan. Each description of an effect describes whether the effect is beneficial or adverse. In addition, the discussions identify direct, indirect and cumulative effects, as well as, any necessary mitigation measures.

Table 5-1: Summary of Environmental Effects, Mitigation, and Levels of Significance illustrates the potential effects and mitigation measures to both significant resources and those resources eliminated from detailed analysis. Additional information can be found in Appendix B – Environmental and Regulatory Agreement Documents.

**TABLE 5-1: SUMMARY OF ENVIRONMENTAL EFFECTS, MITIGATION, AND LEVELS OF SIGNIFICANCE**

| Resources | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| **Geomorphology** | | | | |
| Temporary Effects | The river would remain in the same channel it is today and not migrate | No temporary construction effects. **NE** | No temporary construction effects. **NE** | No temporary construction effects. **NE** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| Permanent Effects | The "J" levee would continue to be privately maintained and in relatively poor geotechnical condition. Extensive flood fighting would continue to be required. Erosion of the levee toe at the northern end of the "J" levee. Glenn County backup levee would maintain flood control. | Would neither increase nor decrease river migration rate. **NE** | Would neither increase nor decrease river migration rate. **NE** | Would neither increase nor decrease river migration rate. **NE** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation req'd. |
| **River Hydraulics** | | | | |
| Effects | No significant changes in the flood management system that would alter river hydraulics are currently planned by flood control agencies. | Implementation would result in positive effects on flood protection to the local community. No adverse hydraulic effects would occur. **NE** | Implementation would result in positive effects on flood protection to the local community. No adverse hydraulic effects would occur. **NE** | Implementation would result in positive effects on flood protection to the local community. No adverse hydraulic effects would occur. **NE** |

| Resources | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Water Quality** | | | | |
| Temporary Effects | Water quality would be similar to existing conditions. | Levee removal may result in temporary degradation of water quality. **S** | Levee removal may result in temporary degradation of water quality. **S** | Levee removal may result in temporary degradation of water quality. **S** |
| Mitigation | Not applicable. | Use BMP's to prevent sediment runoff from entering the river. **LS** | Use BMP's to prevent sediment runoff from entering the river. **LS** | Use BMP's to prevent sediment runoff from entering the river. **LS** |
| Permanent Effects | Projects assumed under the future with-out project condition such as CALFED, Central Valley Improvement Act (CVPIA), and the TNC Sacramento River Project seek to maintain high water quality. | Water quality of surface runoff is expected to improve due to increased vegetative cover, reduced tillage, reduced use of well water, and reduced application of agricultural chemicals. Benefits from recharge of groundwater supplies due to temporary storage area created. New levee would be constructed between the wastewater treatment facility and the Sacramento River. Would decrease the risk of sewage spills due to flooding. **B** | Beneficial effects would be similar to those discussed for Alternative 1, except no benefit due to improved protection of the wastewater treatment plant. The setback levee would be constructed through the existing Hamilton City Irrigation Ditch, considered a seasonal wetland habitat by the USFWS. **S** | Water quality of surface runoff is expected to improve due to increased vegetative cover, reduced tillage, reduced use of well water, and reduced application of agricultural chemicals. Benefits from recharge of groundwater supplies due to temporary storage area created. New levee would be constructed between the wastewater treatment facility and the Sacramento River. Would decrease the risk of sewage spills due to flooding. **B** |
| Mitigation | Not applicable. | No mitigation required. | In kind wetland of 45 acres would be created. Construction would occur in dry season. **LS** | No mitigation required. |
| **Air Quality** | | | | |
| Temporary Effects | Present trends in degradations to air quality can be expected to continue. | Construction would result in temporary degradation of air quality from dust and emissions from construction equipment. **S** | Construction would result in temporary degradation of air quality from dust and emissions from construction equipment, though construction time would be less than Combined Alternative 1. **S** | Construction would result in temporary degradation of air quality from dust and emissions from construction equipment, and construction time would be more than Combined Alternative 1. **S** |
| Mitigation | Not applicable. | Use BMP's to reduce fugitive dust and pollutant emissions during construction. **LS** | Use BMP's to reduce fugitive dust and pollutant emissions during construction. **LS** | Use BMP's to reduce fugitive dust and pollutant emissions during construction. **LS** |
| Permanent Effects | An Air Quality Attainment Plan for the air basin has been developed to regulate air emissions although overall emissions are | Air quality would be improved in the long term with the restoration of habitat and the reduction of the amount of agriculture related | Air quality would be improved in the long term with the restoration of habitat and the reduction of the amount of agriculture | Air quality would be improved in the long term with the restoration of habitat and the reduction of the amount of |

| Resources | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| | expected to increase. | emissions. **B** | related emissions. **B** | agriculture related emissions. **B** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Biological Environment** | | | | |
| **Vegetation** | | | | |
| Temporary Effects | Land currently in agriculture is expected to stay in agriculture. Vegetation on the levee would be maintained as it is today. | Temporary impacts to vegetation would result from the removal of orchards in the restoration areas and grasslands within the existing levee alignment. **LS** | Temporary impacts to vegetation would result from the removal of orchards in the restoration areas and grasslands within the existing levee alignment. **LS** | Temporary impacts to vegetation would result from the removal of orchards in the restoration areas and grasslands within the existing levee alignment. **LS** |
| Mitigation | Not applicable. | These losses are accounted for in the overall benefit evaluation. Therefore, no mitigation is required. | These losses are accounted for in the overall benefit evaluation. Therefore, no mitigation is required. | These losses are accounted for in the overall benefit evaluation. Therefore, no mitigation is required. |
| Permanent Effects | Younger orchards are expected to remain in production for many years. Older orchards are expected to be replanted. Some existing grassland may be converted to orchard. | Long term benefits to vegetation are expected with the restoration of 1,300 acres comprised of riparian, grassland, savannah, and scrub habitats. **B** | Long term benefits to vegetation are expected with the restoration of 1,600 acres comprised of riparian, grassland, Savannah, and scrub habitats. **B** In addition, 15 acres of seasonal wetland would be lost by construction of the new levee. **S** | Long term benefits to vegetation are expected with the restoration of 1,500 acres comprised of riparian, grassland, savannah, and scrub habitats. **B** |
| Mitigation | Not applicable. | No mitigation required. | In-kind seasonal wetland of 45 acres would be created. **LS** | No mitigation required. |
| **Wildlife** | | | | |
| Temporary Effects | Since no change in vegetation is expected, no change in wildlife values is anticipated. | Species present may experience temporary disturbance and/or displacement due to construction, but would return after construction was completed. **LS** | Species present may experience temporary disturbance and/or displacement due to construction, but would return after construction was completed. Fewer impacts due to shorter construction time and shorter levee length. **LS** | Species present may experience temporary disturbance and/or displacement due to construction, but would return after construction. As compared to the other 2 action alternatives, a slight increase in effects due to longer construction time and longer levee length. **LS** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| Permanent Effects | Ongoing restoration efforts in the region will likely provide some localized benefits. | An increase in vegetation along the river within the restored area would provide additional habitat for species, improving the biological diversity of surrounding | An increase in vegetation along the river within the restored area would provide additional habitat for species, improving the biological | An increase in vegetation along the river within the restored area would provide additional habitat for species, improving the |

| Resources | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| | | areas. In addition, the restoration area can serve as a pathway for movement between habitats along river corridor. **B** | diversity of surrounding areas. In addition, the restoration area can serve as a pathway for movement between habitats along river corridor. **B** | biological diversity of surrounding areas. In addition, the restoration area can serve as a pathway for movement between habitats along the river corridor. **B** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Fisheries and Aquatic Resources** | | | | |
| Temporary Effects | Not applicable. | Increased sediment contribution to the river during construction and removal of the levee may impact fisheries. **LS** | Increased sediment contribution to the river during construction and removal of the levee may impact fisheries. **LS** | Increased sediment contribution to the river during construction and removal of the levee may impact fisheries. **LS** |
| Mitigation | Not applicable. | Use BMP's to prevent sediment runoff from entering the river. | Use BMP's to prevent sediment runoff from entering the river. | Use BMP's to prevent sediment runoff from entering the river. |
| Permanent Effects | Restoration programs such as CALFED, which target fisheries, may improve fisheries in the future throughout the Sacramento watershed. | The restoration would serve as a seasonally inundated rearing habitat for fisheries. The restoration area of 1,300 acres provides LWD, SRA, natural banks, and natural plant propagation which benefits fisheries. **B** | The restoration would serve as a seasonally inundated rearing habitat for fisheries. The restoration area of 1,600 acres provides LWD, SRA, natural banks, and natural plant propagation which benefits fisheries. **B** | The restoration would serve as a seasonally inundated rearing habitat for fisheries. The restoration area of 1,500 acres provides LWD, SRA, natural banks, and natural plant propagation which benefits fisheries. **B** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Special Status Species** | | | | |
| Temporary Effects | Conversion of one crop to another or agriculture to urban uses may affect special status species. | 1. Yellow-billed cuckoo, bank swallow, and Swainson's hawk may experience temporary disturbance and/or displacement due to construction. **S**<br>2. Anadromous fish may be subject to short-term exposure to increased turbidity during construction. **S** | 1. Yellow-billed cuckoo, bank swallow, and Swainson's hawk may experience temporary disturbance and/or displacement due to construction. **S** 2. Anadromous fish may be subject to short-term exposure to increased turbidity during construction. **S** | 1. Yellow-billed cuckoo, bank swallow, and Swainson's hawk may experience temporary disturbance and/or displacement due to construction. **S**<br>2. Anadromous fish may be subject to short-term exposure to increased turbidity during construction. **S** |
| Mitigation | Not applicable. | 1. Surveys would be conducted prior to construction to determine presence or absence of special status species in the project area and specific | 1. Surveys would be conducted prior to construction to determine presence or absence of special status species in the project area and | 1. Surveys would be conducted prior to construction to determine presence or absence of special status species in the project area and |

| Resources | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| | | avoidance and minimization measures (BMPs) would be implemented, if necessary. **LS** 2. BMP's to minimize turbidity effects to fish would be implemented. **LS** | specific avoidance and minimization measures (BMPs) would be implemented, if necessary. **LS** 2. BMP's to minimize turbidity effects to fish would be implemented. **LS** | specific avoidance and minimization measures (BMPs) would be implemented, if necessary. **LS** 2. BMP's to minimize turbidity effects to fish would be implemented. **LS** |
| Permanent Effects | Compliance with Federal and State ESA could slow negative impacts of urban development on special status species. | 1. Anadromous fish would be adversely affected by placement of rock in bank habitat. Increased access to the floodplain would increase the risk of stranding. **S** 2. The quantity and variety of special status species, in particular the anadromous fish, valley elderberry longhorn beetle, Swainson's hawk, and western yellow-billed cuckoo, are expected to increase as a result of the restoration. **B** | 1. Anadromous fish would be adversely affected by placement of rock in bank habitat. Increased access to the floodplain would increase the risk of stranding. **S** 2. The quantity and variety of special status species, in particular the anadromous fish, valley elderberry longhorn beetle, Swainson's hawk, and western yellow-billed cuckoo, are expected to increase as a result of the restoration. **B** | 1. Anadromous fish would be adversely affected by placement of rock in bank habitat. Increased access to the floodplain would increase the risk of stranding. **S** 2. The quantity and variety of special status species, in particular the anadromous fish, valley elderberry longhorn beetle, Swainson's hawk, and western yellow-billed cuckoo, are expected to increase as a result of the restoration. **B** |
| Mitigation | Not applicable. | 1. Improved access to floodplain habitat and aquatic habitat improvements due to restoration would more than offset any adverse effects. **B** 2. No mitigation required; but elderberry shrub plantings (1-5/1,800 square feet in riparian and savannah habitats) would be included in the planting plan to benefit the VELB. **B** | 1. Improved access to floodplain habitat and aquatic habitat improvements due to restoration would more than offset any adverse effects. **B** 2. No mitigation required; but elderberry shrub plantings (1-5/1,800 square feet in riparian and savannah habitats) would be included in the planting plan to benefit the VELB. **B** | 1. Improved access to floodplain habitat and aquatic habitat improvements due to restoration would more than offset any adverse effects. **B** 2. No mitigation required; but elderberry shrub plantings (1-5/1,800 square feet in riparian and savannah habitats) would be included in the planting plan to benefit the VELB. **B** |
| **Cultural Environment** | | | | |
| **Cultural Resources** | | | | |
| Temporary Effects | Conditions of cultural resources sites within the proposed project area would remain the same. | A historic Indian mound site may be affected, though the site has been used for agriculture and likely has no effect. Other sites are outside the project area. **LS** | A historic Indian mound site may be affected, though the site has been used for agriculture and likely has no effect. Other sites are outside the project area. **LS** | A historic Indian mound site may be affected, though the site has been used for agriculture and likely has no effect. Other sites are outside the project area. **LS** |

| Resources | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| Mitigation | Not applicable. | A records and literature search and field survey would determine the existence of historic properties. The eligibility of any properties would be determined and the SHPO would be consulted. | A records and literature search and field survey would determine the existence of historic properties. The eligibility of any properties would be determined and the SHPO would be consulted. | A records and literature search was conducted and subsequent field survey would determine the existence of historic properties. The eligibility of any properties would be determined and the SHPO would be consulted. |
| Permanent Effects | Levee failure and resultant flooding could damage archeological sites in the project area. | Gianelli Bridge may undergo modifications. The bridge has been modernized and is no longer considered historic. **NE** | Gianelli Bridge may undergo modifications. The bridge has been modernized and is no longer considered historic. **NE** | Gianelli Bridge may undergo modifications. The bridge has been modernized and is no longer considered historic. **NE** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Socio-Economic Resources** | | | | |
| **Socio-economic** | | | | |
| Temporary Effects | Not applicable. | Construction related jobs would bring income to the region. **B** | Construction related jobs would bring income to the region. **B** | Construction related jobs would bring income to the region. **B** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| Permanent Effects | The county maintains a pro-economic growth policy and it is expected the county will continue to pursue these goals. | The loss of 1,300 acres of agricultural land would result in the loss of approximately 31 agricultural jobs. Economic gains would result from reduced flood damages, and an increase in jobs in construction, ecosystem management, and recreation. **LS** | The loss of 1,600 acres of agricultural land would result in the loss of approximately 39 agricultural jobs. Economic gains would result from reduced flood damages, and an increase in jobs in construction, ecosystem management, and recreation. **LS** | The loss of 1,500 acres of agricultural land would result in the loss of approximately 36 agricultural jobs. Economic gains would result from reduced flood damages, and an increase in jobs in construction, ecosystem management, and recreation. **LS** |
| Mitigation | Not applicable. | No mitigation is required. | No mitigation is required. | No mitigation is required. |
| **Agricultural/Prime and Unique Farmlands** | | | | |
| Temporary Effects | Not applicable. | Not applicable. **NE** | Not applicable. **NE** | Not applicable. **NE** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| Permanent Effects | Conversion of agricultural land to urban uses will continue. | Conversion of 1,300 acres of farmland would not be an irretrievable effect. Some farmlands would benefit from improved flood protection. Acreage in Williamson Act | Conversion of 1,600 acres of farmland would not be an irretrievable effect. Some farmlands would benefit from improved flood protection. Acreage in | Conversion of 1,500 acres of farmland would not be an irretrievable effect. Some farmlands would benefit from improved flood |

| Resources | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| | | contracts is 283 acres plus 100.7 acres in Farmland Security Zone contracts. **LS** | Williamson Act contracts is 472 acres plus 100.7 acres in Farmland Security Zone contracts. **LS** | protection. Acreage in Williamson Act contracts is 472 acres plus 100.7 acres in Farmland Security Zone contracts. **LS** |
| Mitigation | Not applicable. | The project would be consistent with the CALFED ROD for conversion of agricultural lands to restoration. | The project would be consistent with the CALFED ROD for conversion of agricultural lands to restoration. | The project would be consistent with the CALFED ROD for conversion of agricultural lands to restoration. |
| **Urban Land Use** | | | | |
| Temporary Effects | Not applicable. | No temporary effects. **NE** | No temporary effects. **NE** | No temporary effects. **NE** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| Permanent Effects | Urban development trends in California would continue with increasing population levels. Acres would continue to move from other categories to urban use. | Project is outside the urban growth limit for Hamilton City and would not have significant effects on urban land growth. Setback levee would increase flood protection to urban area. **B** | Project is outside the urban growth limit for Hamilton City and would not have significant effects on urban land growth. Setback levee would increase flood protection to urban area. **B** | Project is outside the urban growth limit for Hamilton City and would not have significant effects on urban land growth. Setback levee would increase flood protection to urban area. **B** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Transportation** | | | | |
| Temporary Effects | Not applicable. | Construction activities would generate additional traffic and potential disruptions due to construction-related detours. Increased truck traffic may adversely affect safety and roadway conditions. **S** | Construction activities would generate additional traffic and potential disruptions due to construction-related detours. Increased truck traffic may adversely affect safety and roadway conditions. **S** | Construction activities would generate additional traffic and potential disruptions due to construction-related detours. Increased truck traffic may adversely affect safety and roadway conditions. **S** |
| Mitigation | Not applicable. | An access management plan would be prepared and implemented prior to initiation of construction. **LS** | An access management plan would be prepared and implemented prior to initiation of construction. **LS** | An access management plan would be prepared and implemented prior to initiation of construction. **LS** |
| Permanent Effects | More roads and other transportation infrastructure is expected and traffic is expected to increase. | Transportation on Highway 32 would benefit from increased flood protection. **B** | Transportation on Highway 32 would benefit from increased flood protection. **B** | Transportation on Highway 32 would benefit from increased flood protection. **B** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Recreation** | | | | |
| Temporary Effects | Not applicable. | Recreation activities may be temporarily impacted during construction. Boat launching facilities would | Recreation activities may be temporarily impacted during construction. Boat | Recreation activities may be temporarily impacted during construction. Boat |

| Resources | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| | | be temporarily closed during construction but not during prime fishing season. **LS** | launching facilities would be temporarily closed during construction but not during prime fishing season. **LS** | launching facilities would be temporarily closed during construction but not during prime fishing season. **LS** |
| Mitigation | Not applicable. | Provide notice and signage to redirect use. Any structure at the Irvine Finch boat launch facility would be replaced. | Provide notice and signage to redirect use. Any structure at the Irvine Finch boat launch facility would be replaced. | Provide notice and signage to redirect use. Any structure at the Irvine Finch boat launch facility would be replaced. |
| Permanent Effects | The demands on recreation facilities is expected to increase with an increase in population. | Compatible with additional recreation planned for the area. **NE** | Compatible with additional recreation planned for the area. **NE** | Compatible with additional recreation planned for the area. **NE** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Aesthetics** | | | | |
| Temporary Effects | Not applicable. | Construction activities would temporarily affect aesthetics. **LS** | Construction activities would temporarily affect aesthetics. **LS** | Construction activities would temporarily affect aesthetics. **LS** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| Permanent Effects | Aesthetic conditions will likely remain the same as they currently are. | The restoration of riparian, scrub, savannah, and grassland habitats would improve aesthetic resources along the river. This would be a beneficial effect. **B** | The restoration of riparian, scrub, savannah, and grassland habitats would improve aesthetic resources along the river. This would be a beneficial effect. **B** | The restoration of riparian, scrub, savannah, and grassland habitats would improve aesthetic resources along the river. This would be a beneficial effect. **B** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **Noise** | | | | |
| Temporary Effects | Not applicable. | Temporary increase in noise levels during construction. **LS** | Temporary increase in noise levels during construction. **LS** | Temporary increase in noise levels during construction. **LS** |
| Mitigation | Not applicable. | Use BMP's to reduce noise levels caused by construction equipment. | Use BMP's to reduce noise levels caused by construction equipment | Use BMP's to reduce noise levels caused by construction equipment |
| Permanent Effects | Sources of noise levels are expected to remain the same in the future. | Conversion of agricultural areas to restoration would reduce noise from agricultural equipment. **B** | Conversion of agricultural areas to restoration would reduce noise from agricultural equipment. **B** | Conversion of agricultural areas to restoration would reduce noise from agricultural equipment. **B** |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |
| **HTRW** | | | | |
| Effects | Any existing HTRW would remain unless the State forces | Reduced potential for dispersal of agricultural chemicals in runoff. **B** | Reduced potential for dispersal of agricultural chemicals in runoff. **B** | Reduced potential for dispersal of agricultural |

| Resources | No Action | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|---|
| | remediation of the sites. | | | chemicals in runoff. B |
| Mitigation | Not applicable. | No mitigation required. | No mitigation required. | No mitigation required. |

[1]Levels of significance are provided before and after mitigation for each effect.
[2]NE = No effect; B = Beneficial effect; LS = Less-than-significant effect; S = Significant effect.

## 5.2 RESOURCES ELIMINATED FROM DETAILED ANALYSIS

Project alternatives would have no effect on topography, geology, soils, climate, hydrology, and wild and scenic rivers; therefore, these resources have been eliminated from detailed analysis.

## 5.3 EFFECTS ON SIGNIFICANT RESOURCES

### 5.3.1 Geomorphology

This section identifies and evaluates potential geomorphological effects of the proposed alternatives and recommends measures to avoid or minimize these effects.

Basis of Significance. The evaluation includes effects such as significant changes in the ability of the river to meander. The effects would be considered significant if there is a reduction in the river's ability to meander over the 50-year period of analysis. The proposed action would also be considered to have a significant effect if it would decrease channel stability, thereby threatening levee structures, local property, or infrastructure.

Effects

#### No-Action Alternative

The no-action alternative would not include removing the "J" levee or building a setback levee. In spite of the rock riprap bank protection that exists within the project area, the river will still migrate, particularly during large events. The non-Federal sponsor would continue to operate and maintain the rock placed as part of the Chico Landing to Red Bluff project, but deterioration of the riprap is expected over time. Any future maintenance would need to be accomplished in accordance with the jeopardy opinion, pertaining to the valley elderberry longhorn beetle, issued for that project by the USFWS. The "J" levee would continue to be privately maintained and in relatively poor geotechnical condition. Extensive flood fighting of the "J" levee would continue to be necessary to maintain the integrity of the levee when water levels rise in the Sacramento River. Erosion of the levee toe at the northern end of the "J" levee would continue, but the Glenn County backup levee would maintain the flood control function of the "J" levee.

#### Combined Alternative 1

Combined Alternative 1 would include setting back the levee for approximately 5.5 miles and allowing over bank flows within the area between the setback and the channel. To compensate for potential effects on the Gianella Bridge due to removal of the existing levee, 1,000 feet of rock revetment would be placed landside of the existing levee along the

road embankment at Highway 32 to prevent the river from migrating at the bridge. Also, up to 100 feet of rock and/or grouted rock and/or a concrete lining would be placed under the Gianella Bridge at Highway 32 abutment specifically to protect it from exposure to higher velocities resulting from passing higher flows. Another 1,000 feet of rock revetment would be placed at two turns in the setback levee in the Dunning slough area. In the northern end of the setback along County Road 45, approximately 1,600 feet of rock would be entrenched to protect the setback levee and prevent the river from migrating past this point. At the southern end of the levee dense vegetation would be planted to protect the levee from eroding.

Because rock is not being placed in the active channel and because the County's backup levee would continue to be maintained, this alternative plan would not additionally reduce the ability of the river to meander over the 50-year period of analysis. Furthermore, since removal of existing rock was dropped as a measure (see expanded discussion in Chapter 3), Combined Alternative 1 would not decrease channel stability, and therefore would not increase the rate of river migration.

**Combined Alternative 5**

Combined Alternative 5 would include setting back the levee for approximately 5.3 miles and allowing over bank flows within the area between the setback and the channel. To compensate for potential effects on the Gianella Bridge due to removal of the existing levee, one thousand feet of rock revetment would be placed landside of the existing levee along the road embankment at Highway 32 to prevent the river from migrating at the bridge. Also, up to 100 feet of rock and/or grouted rock and/or a concrete lining would be placed under the Gianella Bridge at Highway 32 abutment specifically to protect it from exposure to higher velocities resulting from passing higher flows. Another 1,000 feet of rock revetment would be placed at two turns in the setback levee in the Dunning slough area. In the northern end of the setback along County Road 45, approximately 1,600 feet of rock would be entrenched to protect the setback levee and prevent the river from migrating past this point. At the southern end of the levee, dense vegetation would be planted to protect the levee from eroding.

As for Combined Alternative 1, this plan would not reduce the ability of the river to meander over the 50-year period of analysis nor decrease channel stability, and therefore would not increase the rate of river migration.

**Combined Alternative 6**

Combined Alternative 6 would have similar geomorphological effects as Combined Alternative 5 with a reduction in the amount of rock revetment placed in the Dunning Slough area. Combined Alternative 6 would only include 500 feet of rock revetment placed in the Dunning Slough area. The southern end of the levee would be planted in vegetation and would extend approximately 1.1 miles south of Road 23.

This plan would not reduce the ability of the river to meander over the 50-year period of analysis nor decrease channel stability, and therefore would not increase the rate of river migration.

Mitigation Measures

Since there would be no effect on Geomorphology, no mitigation would be required.

### 5.3.2 River Hydraulics

The objectives of this study are ecosystem restoration and flood damage reduction. The conveyance characteristics of the river would be modified in the process of achieving these objectives. Any such modifications have the potential to create unintended changes in the behavior of flows within the project area or either upstream or downstream from the project area. This section identifies and evaluates potential effects of the proposed alternatives on river hydraulics and recommends measures to avoid or minimize these effects.

Basis of Significance. The evaluation of significance is based on changes in the water surface elevation of flood flows. The effects would be considered significant if there are any unintended measurable increases in flood stage outside of the river channel.

Effects

**No-Action Alternative**

The no-action alternative would not include removing the "J" levee or building a setback levee. The "J" levee would continue to be privately maintained and in relatively poor geotechnical condition. Extensive flood fighting of the "J" levee would continue to be necessary to maintain the integrity of the levee when water levels rise in the Sacramento River. Erosion of the levee toe at the northern end of the "J" levee would continue, but the Glenn County backup levee would maintain the flood control function of the "J" levee.

River hydraulics are not expected to change much relative to the existing condition. No significant changes in the flood management system that would alter river hydraulics are currently planned by flood control agencies. Potential future watershed activities could result in lower flood stages in places if some levees are removed or higher stages in places if increased vegetation impedes flood flows.

**Combined Alternative 1**

Combined Alternative 1 would provide the community of Hamilton City with a 90 percent confidence of passing a 75-year event. This protection would also be provided to lands north of Highway 32 and to about Holly Sugar Plant south of Highway 32. This alternative would provide a 90 percent confidence of passing a 35-year event from south of Dunning Slough to just north of County Road 23. The training dike would provide a 90 percent confidence of passing an 11-year event to lands south of County Road 23. The training dike would also reduce frequent scouring flood flows and provide additional flood damage reduction benefits to structures within Hamilton City by lowering backwater flows.

These flood protection improvements are achieved by increasing the floodplain in the project area through removing the existing levee and constructing a setback levee further from the main channel. These actions would increase the cross-sectional area over which flows would spread, thereby decreasing the stage, or water level, of the river under most conditions. However, the effect on stage is complicated by some additional factors. First, flow is constrained by the constriction of the channel at Gianella Bridge on Highway 32. Second, the increase in vegetation within the floodplain, which would result from the restoration efforts, would tend to slow flows and cause an increase in stage, counteracting the stage reduction benefits of a wider floodplain. Finally, as flows spread, they slow down, and as they slow down, stage tends to increase. To evaluate all of these factors and to

determine the height of the levee required for the desired flood protection, modeling efforts were undertaken.

Results from Hydraulic modeling have shown that widening the floodway on the western side of the Sacramento River has reduced stages in Butte County. In addition, the water surface elevation near Big Chico Creek has been reduced, resulting in less overflow to Butte Basin. The reduction in flow has been on the order of magnitude of 2,000 cubic feet per second (cfs) while the Sacramento River is conveying roughly 343,000 cfs.

Combined Alternative 1 would have positive effects for both Glenn and Butte counties and would provide regional benefits downstream by adding more storage in the system. In spite of these benefits, this alternative would also result in a local increase in the water surface elevation north of the Highway 32 Bridge, but only within the Sacramento River channel. The area just east of this zone, in Butte County, shows a decrease in water surface elevation. The decrease in water surface elevation on the Butte County side suggests that additional flow is being conveyed through the Sacramento River. With the increase in flow, the bridge acts as a control causing a localized increase in the water surface to push flow under the bridge.

Combined Alternative 1 could also provide regional attenuation of stage downstream of the project area due to more floodway storage from widening of the floodplain, which would be accomplished through removing the existing "J" levee and constructing the setback levee.

This alternative plan would provide benefits because it would provide protection from flooding to the community and would reduce stages in the floodplains of the region. Increases in water surface elevation would either occur in areas intended to be exposed to flooding (between the existing "J" levee and the setback levee) or would be contained in the river channel and would not constitute an adverse hydraulic effect.

**Combined Alternative 5**

Combined Alternative 5 would have similar effects on river hydraulics as Combined Alternative 1.

**Combined Alternative 6**

Combined Alternative 6 would have similar effects on river hydraulics as Combined Alternative 1.

Mitigation Measures

Since there would be no effect on river hydraulics, no mitigation would be required.

### 5.3.3 Water Quality

This section identifies and evaluates potential water quality effects of the proposed alternatives and recommends any necessary measures to avoid or minimize these effects.

Basis of Significance. Adverse effects on water quality would be significant if an alternative plan would result in any of the following:

- Substantially degrade surface-water or groundwater quality such that it would violate criteria or objectives identified in the Central Valley Regional Water Quality Control Board (RWQCB) basin plan or otherwise substantially degrade water quality to the detriment of beneficial uses;
- Substantially deplete groundwater supplies or interfere with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of local groundwater table level;
- Substantially increase sediment in the Sacramento River;
- Substantially alter water temperatures in the Sacramento River.

Effects

**No-Action Alternative**

The levee along the project area would likely continue to deteriorate and have the potential for failure. If this occurs, flood fight activities may occur, which could result in the placement of rock revetment. Rock revetment creates a "hard spot" in the levee and can result in deterioration of the adjoining earthen levee, resulting in increased sediment in the river. The rock revetment could also result in increased water temperatures due to lack of shaded riverine habitat.

The wastewater treatment facility would continue to be protected by a private levee, and the integrity of those levees is unknown. The facility would continue to be at risk of flooding. The Hamilton City drainage canal would remain in place under this alternative.

No areas within the study would be converted from permeable material to non-permeable material. Therefore, there would be no effect on groundwater supplies under this alternative. Pumping for irrigation would continue.

**Combined Alternative 1**

Construction of Combined Alternative 1 could have temporary adverse effects on water quality. Operation of heavy equipment, exposure of bare soil areas during storms, and removal of the existing levee could increase erosion, turbidity, and sedimentation in the Sacramento River. This effect is potentially a significant effect. However this effect would be short term, and once the area stabilizes, the turbidity would discontinue. The turbidity that does occur would be a naturally occurring process and would provide sediment to an area in the river that is in need of the deposits. The Corps would continue to coordinate with the RWQCB and would implement best management practices, as recommended by the RWQCB, to avoid or minimize the amount of sediment entering the river during construction. The new levee alignment would be constructed outside the waterway so there would be little risk of sediment entering the Sacramento River during construction. Active restoration would occur under this alternative to prevent erosion of the new levee.

This alternative would have several beneficial effects on water quality. Conversion of farmlands to native habitat would have a beneficial effect on water quality of surface runoff due to increased vegetative cover, reduced tillage, reduced use of well water, and reduced application of agricultural chemicals. In addition, Combined Alternative 1 would decrease the

risk of flooding to the wastewater treatment facility by construction of a setback levee between the facility and the Sacramento River. This levee would reduce the risk of sewage spills during flood events.

No areas within the study area would be converted from permeable material to non-permeable material. Therefore, there would be no adverse effect on groundwater supplies under this alternative. Instead, the alternative would increase the recharge of groundwater supplies by increasing the area of temporary floodwater storage on the floodplain.

The only activity associated with Combined Alternative 1 that would affect wetlands or other waters of the United States is the placement of rock at Gianella Bridge. Up to 100 feet of rock and/or grouted rock and/or a concrete lining would be placed under the Gianella Bridge at Highway 32 abutment specifically to protect it from exposure to higher velocities resulting from passing higher flows. The remainder of the riprap would be placed on the setback levee or the road embankment. This activity would be covered for Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act under Nationwide Permit # 14 for Linear Transportation Projects. The setback levee would be located to avoid impacts to the wetlands associated with Dunning's Slough. A 404(b)(1) analysis has been written for the placement of rock on the existing bank at the bridge.

**Combined Alternative 5**

Combined Alternative 5 would have similar water quality effects as Combined Alternative 1, but under this alternative, the water treatment facility would remain in the current location on the waterside of the levee. The facility would continue to be at risk of flooding. Flooding of the facility would cause a risk to public health and safety.

Combined Alternative 5 also includes building the setback levee through the existing Hamilton City Irrigation Ditch that is considered a seasonal wetland habitat. This irrigation ditch is not considered a jurisdictional wetland and therefore not subject to a Section 404 permit.

**Combined Alternative 6**

Combined Alternative 6 would have similar water quality effects as Combined Alternative 1. In addition, the wastewater treatment facility would remain in its current location under this alternative. However, the new levee would be constructed between the facility and the Sacramento River. Although the facility has not flooded in the past, this alternative would decrease the risk of flooding due to the new higher more stable levee. No relocation of the Hamilton City drainage canal would be needed. This alternative would have beneficial effects on water quality and groundwater recharge.

Mitigation Measures

Under all alternatives, there is potential for significant short-term construction impacts. The following best management practices would be implemented to reduce potential water quality effects to less than significant. Prior to the start of construction, a National Pollution Discharge Elimination System (NPDES) general permit for construction activities would be acquired from the Central Valley RWQCB, and a storm water pollution prevention plan (SWPPP) would be developed per the Guidelines of the general permit. The SWPPP would list all best management practices to be implemented during construction

activities for control of erosion, siltation, and any other pollutants that could potentially enter storm water or surface waters in the project area.

Best management practices would include, but not be limited to the following:

- Preserve all existing vegetation where possible.
- The contractor would prepare an erosion and sediment control plan incorporating a site drainage plan consistent with the RWQCB policies.
- All soils disturbed by construction would be stabilized and reseeded with native grasses after construction is complete.

Under Combined Alternative 5, a 45-acre seasonal wetland would be created on the waterside of the new setback levee, just east of its current location. This wetland creation would be considered mitigation for filling the irrigation ditch. Construction of the levee and wetland would occur during the dry season when the irrigation ditch would not be needed for runoff, and therefore effects to water quality from this construction would be mitigated to a less-than-significant effect.

### 5.3.4 Air Quality

Basis of Significance. An alternative is considered to have potentially significant effects on air quality if proposed construction or operational activities would result in emissions that exceed local emission thresholds or exceed emission thresholds that trigger a conformity analysis under Section 176(c) of the 1990 Clean Air Act Amendments.

Effects

**No-Action Alternative**

The area occasionally exceeds State levels for ozone. The area occasionally exceeds both Federal and State levels for particulate matter (PM10). Present trends in air quality can reasonably be expected to continue if no-action is taken, and pollutant levels would continue to occasionally exceed Federal and State standards.

**Combined Alternative 1**

Construction of the setback levee and restoration activities that utilize farming equipment would result in temporary degradation of air quality. There would be a temporary local increase in the amount of fugitive dust from construction and restoration activities and an increase in emissions from the operation of construction equipment. The proposed project would generate emissions of carbon monoxide, ozone precursors, and PM10 from construction of the authorized project features and increased project-related traffic.

Construction of the project features would result in pollution emissions from trucks hauling material to and from the site, and from construction equipment operating on the sites. Construction would also result in dust emissions from hauling and handling of soil and rock materials, wind erosion of disturbed ground, and any vehicle travel on unpaved roads. Construction of the project features could also cause a substantial quantity of dust to be emitted into the atmosphere. A major fraction of the dust would settle out, on, and immediately adjacent to the project area; while a minor fraction would contribute to the area's ambient PM10 level. Truck and construction equipment exhaust would also contribute

to the region's ozone and PM10 levels and to carbon monoxide levels in the immediate vicinity. Emission rates and corresponding emission thresholds are shown in Table 5-2.

**TABLE 5-2. COMPARISON OF EMISSION THRESHOLDS AND PROJECT EMISSIONS**

| Pollutant[1] | Glenn Co. Threshold | Maximum Project Emissions |
|---|---|---|
| $NO_x$ | 25 lbs/day | 399 lbs/day |
| ROG | 25 lbs/day | 17 lbs/day |
| $PM_{10}$ | 80 lbs/day | 23 lbs/day |
| CO | 500 lbs/day | 63 lbs/day |
| $SO_x$ | 80 lbs/day | 23 lbs/day |
| **Pollutant** | **EPA Threshold** | **Project Emissions** |
| $NO_x$ | 100 tons/year | 6 tons/year |
| ROG | 100 tons/year | 0.5 tons/year |
| $PM_{10}$ | 100 tons/year | 0.3 tons/year |
| CO | 100 tons/year | 1.9 tons/year |
| $SO_x$ | 100 tons/year | 0.3 tons/year |

[1] $NO_x$ = nitrogen oxides, ROG = reactive organic gases, $PM_{10}$ = particulate matter, CO = carbon monoxide, $SO_x$ = sulfur oxides

Construction related emissions would exceed the local daily threshold for nitrogen oxides only. This short-term construction effect is considered a significant impact. Because construction of the project features would be a temporary source of air pollutants, construction-related emissions that exceed local thresholds can be mitigated to less than significant if construction is accomplished using best available control technology to reduce pollutant emissions.

Construction related emissions, which are far in excess of any operational emissions, would not exceed any of the EPA annual thresholds. Therefore, a conformity determination is not required, and these emissions are also not considered to be significant on an annual basis.

Combined Alternative 1 would have long-term beneficial air quality effects with the restoration of 1,300 acres of habitat, which would contribute to an improvement in air quality. In addition, with the conversion of the agricultural land there would be a resultant reduction of the amount of agriculture related emissions, as agricultural equipment would no longer be utilized.

**Combined Alternative 5**

Combined Alternative 5 would have similar air quality effects as Combined Alternative 1 with a slight reduction in construction time due to a shorter levee length from 5.5 to 5.3 miles and an increase of 1,600 acres of habitat. In addition, with the conversion of the

agricultural land there would be beneficial affects due to the resultant reduction of the amount of agriculture related emissions, as agricultural equipment is no longer utilized.

**Combined Alternative 6**

Combined Alternative 6 would have similar air quality effects as Combined Alternative 1. The same construction equipment would be needed for both alternatives and a slightly longer time frame for construction would be involved due to the increase in levee length from 5.5 miles long to 6.8 miles long and a larger restoration area from 1,300 acres to 1,500 acres. The same area would be restored for both alternatives.

Combined Alternative 6 would have beneficial air quality effects with the restoration of 1,500 acres of habitat and the reduction of the amount of agriculture related emissions.

Mitigation Measures

Since there would be some potential significant short-term effects to air quality, mitigation would be required. Best available control technology to reduce pollutant emissions shall be used to reduce potential air quality effects to a less-than-significant level; this control technology includes the following measures:

- Construction equipment operating on the site and trucks used for hauling material to and from the site shall be properly equipped with required emission control devices operating properly to minimize exhaust pollutant emissions.
- Trucks hauling construction materials shall be covered or the material shall be sufficiently wetted to eliminate visible dust emissions.
- No burning of waste material or cleared vegetation shall occur.
- Watering shall be used to minimize dust emissions from any unpaved haul road and levee road. Watering shall be performed as needed to eliminate visible dust emissions from any unsurfaced haul roads and levee roads.
- Haul-truck speed shall be limited to a maximum of 10 mph on levee roads adjacent to residences, and 15 mph on other unpaved roads to minimize dust emissions and road throw.
- All disturbed soil areas or constructed soil bodies shall be wetted sufficiently to keep them damp at all times during construction hours to eliminate visible dust emissions.

These measures would substantially reduce pollutant emissions from the construction site. Through the use of the reduction measures and the temporary nature of the emissions, the air quality effects associated with the construction are considered to be less than significant.

The long-term effects of the project would be beneficial. Therefore, no mitigation would be required.

### 5.3.5 Vegetation

Basis of Significance. An alternative would be considered to have a significant effect on vegetation if it would result in any loss or degradation of native vegetation.

Four broad categories of habitat types are planned for restoration: Riparian, Savannah, Scrub, and Grassland. These categories were developed for the purposes of evaluating the habitat outputs of the alternatives for this feasibility study. For the actual planting design, these broad habitat categories would be further broken down into subcategories to develop habitat types suited for their specific locations, soil, flooding, and depth to groundwater conditions. Figures 5-1 through 5-4 show examples of habitat types.

**Figure 5-1: Riparian Habitat[1] (Photo: Corps)**

[1] A dense canopy cover dominated by a high diversity of tree species that grows in areas of frequent flood inundation (at least every 2 years). An assortment of shrubs, vines and grasses form the understory in areas of deeper wetter soils.

**Figure 5-2: Savanna Habitat[2](Photo: TNC)**

**Figure 5-3: Grassland Habitat[3] (Photo: TNC)**

[2] An intermittent canopy cover primarily consisting of trees and large shrubs with native grasses found in upland areas within the 5-year floodplain.
[3] An open area of native grasses and forbs that would be planted in upland areas adjacent to the setback levee where there is frequent flooding and coarse soils.

**Figure 5-4: Scrub Habitat[4] (Photo: SRCAF)**

Effects

**No-Action Alternative**

No change in vegetation is assumed on lands currently within the study area except for lands currently owned by DFG or USFWS. Vegetation on the levee would be maintained as it is today. The grassland and orchard habitats on the landside of the levee, and the riparian vegetation on the waterside of the levee, are not expected to change significantly. Maintenance practices and programs are expected to remain as they are today. Some existing grassland may be converted to orchard. Orchards in the project area that are young and just entering their prime production period are expected to remain in production for many years. Older orchards are likely to be replanted. Orchards are expected to be lost or removed from production in areas subject to erosion.

**Combined Alternative 1**

The long-term benefits of habitat restoration would result in approximately 1,300 acres of native habitat being restored. Acreages of restored habitat for Combined Alternative 1 are displayed in Table 5-3. The restored ecosystem would be dependent on the actively meandering river channel to sustain the sequence of plant community succession. However, the realigned levee would have no effect on the rate of river migration. The areas closest to the rivers edge would be vegetated with riparian and willow and the lands further back from the river would be planted in savannah and grassland. The newly reconnected

[4] This community would either be willow scrub, a very dense pioneer riparian community found on depositional areas along the river's edge or an upland scrub habitat of medium sized shrubs. This community is usually found within the 2 ½ -year floodplain with shallower soils.

overbank floodplain would be inundated during lower-level flood events. This frequent inundation would assist in the establishment of riparian vegetation in these areas.

Establishment of native vegetation within the setback levees would contribute to a vegetative corridor along the river. In the immediate area, Sacramento River Partners and the DFG have restored approximately 235 acres on the Pine Creek Unit. In the region, development of riparian vegetation in the Hamilton City area would contribute to the riparian restoration work by the Sacramento River Conservation Area Forum, Central Valley Project Improvement Act, Central Valley Habitat Joint Venture, Sacramento River National Wildlife Refuge, Department of Fish and Game's Sacramento River Wildlife Area, California Riparian Habitat Conservation Program, and Riparian Habitat Joint Venture (Partners in Flight).

Construction activities would result in some short-term effects on native habitat. Annual grassland and riparian habitat are present on the existing levee slopes. Some of these areas would be affected by excavation of material for the dual purpose of removing the levee and obtaining borrow material for constructing the new levee. Levee sections with existing riparian vegetation would be avoided during these activities. Additional borrow material would be obtained from the GCID dredged spoil pile, which lies between the Glenn-Colusa Canal and County Road 203/Highway 45, from the fish screen south along the canal. The loss of vegetation due to the excavation of material from this spoil pile is negligible since only very sparse ruderal vegetation exists. There would also be a loss of vegetation within the new levee alignment, which is currently in orchard. These losses and the compensation for them (i.e., planting the excavated area of the removed levee and the new levee with native grasses) have been accounted for in the overall benefit evaluation.

**TABLE 5-3: COMPARISON OF HABITAT ACREAGES - FUTURE WITHOUT-PROJECT CONDITION AND COMBINED ALTERNATIVE 1**

| Habitat Type | Without-Project (Acres) | Combined Alternative 1 (Acres) | Net Restored Habitat (Acres) |
|---|---|---|---|
| Riparian | 97 | 956 | 859 |
| Grassland | 84 | 146 | 62 |
| Savannah | 0 | 140 | 140 |
| Scrub | 0 | 227 | 227 |
| Agriculture | 1,288 | 0 | - |
| Total | 1,469 | 1,469 | 1,288[1] |

[1]Elsewhere in this document this acreage has been rounded to 1,300 acres.

**Combined Alternative 5**

Approximately 1,600 acres of native habitat would be restored. Forty-five acres of wetland would be created for mitigation purposes and are not considered a project benefit. These acres are not included in the total acres restored for the HEP analysis. Acreages of restored habitat for Combined Alternative 5 are displayed in Table 5-4. The restored ecosystem would be dependent on the actively flooding floodplain to sustain the sequence of plant community succession. However, the realigned levee would have no effect on the rate of river migration. The areas closest to the rivers edge would be vegetated with riparian and scrub and the lands further back from the river would be planted in savannah and grassland.

The newly reconnected overbank floodplain would be inundated during lower-level flood events. This frequent inundation would assist in the establishment of riparian vegetation in these areas.

Establishment of native vegetation within the setback levees would contribute to a vegetative corridor along the river. In the immediate area, Sacramento River Partners and the CA Department of Fish and Game have restored approximately 235 acres on the Pine Creek Unit. In addition, the USFWS is in the process of restoring their 681-acre Kaiser property immediately south of the study area. In the region, development of riparian vegetation in the Hamilton City area would contribute to the riparian restoration work by the Sacramento River Conservation Area Forum, Central Valley Project Improvement Act, Central Valley Habitat Joint Venture, Sacramento River National Wildlife Refuge, Department of Fish and Game's Sacramento River Wildlife Area, California Riparian Habitat Conservation Program, and Riparian Habitat Joint Venture (Partners in Flight).

The existing irrigation ditch, which is considered a seasonal wetland habitat, would be filled during construction of the setback levee, and a new wetland area would be created in an adjacent area on the waterside of the setback levee at a ratio of 3:1. This is considered to be a significant effect.

Construction activities would result in some short-term effects on native habitat. Annual grassland and riparian habitat are present on the existing levee slopes. Some of these areas would be affected by excavation of material for the dual purpose of removing the levee and obtaining borrow material for constructing the new levee. Levee sections with existing riparian vegetation would be avoided during these activities. Additional borrow material would be obtained from the GCID dredged spoil pile, which lies between the Glenn-Colusa Canal and County Road 203/Highway 45, from the fish screen south along the canal. The loss of vegetation due to the excavation of material from this spoil pile is negligible since only very sparse ruderal vegetation exists. There would also be a loss of vegetation within the new levee alignment, which is currently in orchard. These losses and the compensation for them (i.e., planting the excavated area of the removed levee and the new levee with native grasses) have been accounted for in the overall benefit evaluation.

**TABLE 5-4: COMPARISON OF HABITAT ACREAGES – FUTURE WITHOUT-PROJECT CONDITION AND COMBINED ALTERNATIVE 5**

| Habitat Type | Without-Project (Acres) | Combined Alternative 5 (Acres) | Net Restored Habitat (Acres) |
|---|---|---|---|
| Riparian | 97 | 1,161 | 1,064 |
| Grassland | 85 | 163 | 78 |
| Savannah | 0 | 154 | 154 |
| Scrub | 0 | 289 | 289 |
| Agriculture | 1,630 | 0 | - |
| Total | 1,812 | 1,767 | 1,585[1] |

[1]Elsewhere in this document this acreage has been rounded to 1,600 acres.

**Combined Alternative 6**

Combined Alternative 6 would have similar but slightly greater effects than Combined Alternative 1 due to the larger restoration area from 1,300 acres to 1,500 acres. Approximately 1,500 acres of native habitat would be restored. Acreages of restored habitat for Combined Alternative 6 are displayed in Table 5-5.

Construction activities would result in some short-term effects on native habitat. Annual grassland and riparian habitat are present on the existing levee slopes. Some of these areas would be affected by excavation of material for the dual purpose of removing the levee and obtaining borrow material for constructing the new levee. Levee sections with existing riparian vegetation would be avoided during these activities. Additional borrow material would be obtained from the GCID dredged spoil pile, which lies between the Glenn-Colusa Canal and County Road 203/Highway 45, from the fish screen south along the canal. The loss of vegetation due to the excavation of material from this spoil pile is negligible since only very sparse ruderal vegetation exists. There would also be a loss of vegetation within the new levee alignment, which is currently in orchard. These losses and the compensation for them (i.e., planting the excavated area of the removed levee and the new levee with native grasses) have been accounted for in the overall benefit evaluation.

**TABLE 5-5: COMPARISON OF HABITAT ACREAGES - FUTURE WITHOUT-PROJECT CONDITION AND COMBINED ALTERNATIVE 6**

| Habitat Type | Without-Project (Acres) | Combined Alternative 6 (Acres) | Net Restored Habitat (Acres) |
|---|---|---|---|
| Riparian | 97 | 1,094 | 997 |
| Grassland | 85 | 155 | 70 |
| Savannah | 0 | 148 | 148 |
| Scrub | 0 | 261 | 261 |
| Agriculture | 1,476 | 0 | - |
| Total | 1,658 | 1,658 | 1,476[1] |

[1]Elsewhere in this document this acreage has been rounded to 1,500 acres.

Mitigation Measures

The long-term effects to vegetation would be beneficial for all of the evaluated alternatives. The only exception is that there is an in-kind loss of seasonal wetlands for Combined Alternative 5. For this alternative, 45 acres of seasonal wetland habitat would be created within the restoration area waterside of the new setback levee in Zone F (see Figure 3-1) to mitigate in-kind for the loss of 15 acres of seasonal wetland. This mitigation would reduce the impact to less than significant.

### 5.3.6 Wildlife

Basis of Significance. Adverse effects on wildlife were considered significant if an alternative would result in a substantial net loss of important wildlife habitat over the period of analysis as compared to the existing conditions.

Effects of the proposed alternatives on the study area were analyzed during coordination with the USFWS under the Federal Fish and Wildlife Coordination Act. A Habitat Evaluation Procedures (HEP) analysis was conducted for the entire study area to determine the effects of the proposed alternatives on biological resources. This section includes a summary of the HEP analysis. A detailed discussion of the HEP analysis is included in the Draft Coordination Act Report, which can be found in Appendix B.

The HEP analysis combines acreage of habitats with measures of habitat value or quality of the habitat for wildlife at baseline or current conditions in the project area and compares that value with the estimated value at various points in time throughout the period of analysis (50 years). Quantifying habitat loss or gain only in terms of a loss or increase of acres does not reflect the varying quality of habitats to the species that inhabit them. The HEP analysis is based on the assumption that the value of habitat to a selected species or group of species can be described by models, which use variables that represent habitat suitability for wildlife. The models produce a Habitat Suitability Index, which is multiplied by the area of available habitat to obtain habitat units (HU's). The HU's and Average Annual Habitat Units (AAHU's) over the life of the project are then used in the comparison of the benefits of the various alternatives.

The HEP models that were used for this evaluation of project outputs were developed by the USFWS and include a red-tailed hawk model, a riparian forest model, and a scrub-shrub model. The red tail hawk model was applied to the savannah, grassland, and orchard habitats. The biggest adjustment made to the models was to include a floodplain variable, which considered plant germination, shaded riverine aquatic (SRA) components, large woody debris (LWD), and natural banks when the models were applied to the riparian and scrub habitat. These habitats account for approximately 91 percent of the potentially restored area and the floodplain variable better reflected the improved function of restoring flooding to the floodplain on these two habitat types.

Effects

**No-Action Alternative**

Since no change in vegetation is anticipated, no significant change in wildlife is anticipated with the No-Action Alternative. Population fluctuations of individual species would continue.

**Combined Alternative 1**

As discussed in Chapter 4, numerous wildlife species occupy the vegetative communities within the study area. Species present within the study area may experience temporary disturbance and/or displacement due to construction noise and activity for the duration of the project. Temporary effects to wildlife species that inhabit the existing vegetation would occur during construction due to the noise and vibration from the equipment and temporary habitat loss. Additionally, any displaced species would be expected to return to the area once construction is completed.

The quantity and variety of species is also expected to increase once the restored areas become established. The composition, abundance, and distribution of wildlife resources within the project area are directly related to the available habitat. Thus, an increase in vegetation along the river within the restored area would provide additional

habitat for species improving the biological diversity of surrounding areas. In addition, the restoration area can serve as a pathway for movement between habitats along the riparian corridor, which is being expanded by several ecosystem restoration projects in the region.

Amphibian habitat along the rivers may be more favorable due to an increase in the availability of pond-like areas, enhanced growth and vigor of riparian scrub, cottonwoods, and associated herbaceous vegetation due to the widening of the river channel. The increase in habitat provides more living space, breeding habitat, shade, cover, and prey substrate for young and adult amphibians. Reptiles would also benefit from the improved cover and prey base.

Populations of raptors and other species dependent on mature cottonwood trees area expected to be temporarily utilize other areas during construction, however, once construction has ended raptor species are expected to return. As riparian and savannah habitats mature, raptors would ultimately benefit from these habitats. As riparian and savannah habitats mature, raptors would ultimately benefit from these habitats. Populations of songbirds and cavity nesting species would likely be higher due to better growth and vigor of riparian vegetation, increases in the amount of scrub-shrub habitat, and increases in riparian regeneration. These changes in vegetation are expected to provide more nesting and foraging habitat for many species of birds, especially migratory songbirds. A greater abundance of prey may improve reproductive success, which can result in higher populations of birds along the rivers.

By making the habitat in this area more supportive of migratory species, this project would bolster breeding and wintering populations in areas physically removed, but ecologically linked to the Sacramento River. Examples include the habitat benefits to migratory neotropical migratory birds and waterfowl. Breeding and wintering habitat would be increased for double-crested cormorant, western grebe, Clark's grebe, pied-billed grebe, horned grebe, cinnamon teal, canvasback, eared grebe, American coot, and belted kingfisher. There could also be benefits to greater white-fronted goose, redhead, red-necked duck, and greater scarp.

Riparian habitat generation would also benefit local populations of mammals. Mature trees that provide better cover and foraging habitat would benefit the raccoon, beaver, weasel, skunk, and bat species.

Outputs, measured in AAHU's, from the HEP analysis for each of the Combined Alternative Plans is shown in Table 5-6. Because each of the proposed alternatives would result in an increase in both quality and quantity of habitat, there is also a net gain in AAHU's as compared to the without-project conditions. The output for Combined Alternative 1 is 783 AAHU's.

**Combined Alternative 5**

Combined Alternative 5 would have similar effects as Combined Alternative 1 but with shorter temporary adverse effects to wildlife species due to the shorter construction time with a shorter levee length from 5.5 miles to 5.3 miles. The output from the HEP analysis for Combined Alternative 5 is 936 AAHU's (Table 5-6).

**TABLE 5-6: COMPARISON OF NET OUTPUTS (AAHU'S) FOR ALTERNATIVE PLANS**

| Habitat Type | Combined Alternative 1 | Combined Alternative 5 | Combined Alternative 6 |
|---|---|---|---|
| Riparian | 844 | 1,028 | 965 |
| Grassland | 63 | 80 | 72 |
| Savannah | 137 | 150 | 144 |
| Scrub | 219 | 278 | 252 |
| Agriculture | -480 | -600 | -546 |
| Total | 783 | 936 | 888 |

**Combined Alternative 6**

Combined Alternative 6 would have similar effects as Combined Alternative 1 with but with more temporary adverse effects to wildlife species due to the longer construction time with a longer levee length. In addition, Combined Alternative 6 would include an increase in the beneficial effects to wildlife species due to an increase in the restoration area to 1,500 acres. The output from the HEP analysis for Combined Alternative 6 is 888 AAHU's (Table 5-6).

Mitigation Measures

Since the long-term effects to Wildlife would be beneficial, no mitigation would be required.

### 5.3.7 Fisheries and Aquatic Resources

Basis of Significance. Adverse effects on fisheries were considered significant if an alternative would result in a substantial net loss of important fisheries habitat or Essential Fisheries Habitat (EFH) over the period of analysis as compared to the existing conditions.

Effects

**No-Action Alternative**

Ongoing ecosystem restoration efforts of programs such as CALFED, CVPIA, and others may improve the quantity and value of fishery and aquatic resources. Most restoration work for fisheries can be expected to occur upstream of the study area as that is where the fisheries spawning habitat occurs.

**Combined Alternative 1**

There is also the potential need to place additional rock adjacent to the existing rock at the bridge abutment. NOAA Fisheries has agreed that this is not likely to affect fisheries and aquatic resources as long as the placement occurs outside fisheries occurrence windows.

Setting back the levee at Hamilton City and planting riparian trees would allow for the future input of LWD into the river, which would benefit fishes over the long term and ultimately contribute to shaded riverine aquatic vegetation (SRA). Overhanging or fallen

trees or branches on banks are important to the survival of many fish species. It moderates water temperatures, which is an important factor for all life stages of salmonid fishes as mortality can occur when temperatures are too high. River productivity is increased at all trophic levels by the organic materials and energy input from terrestrial vegetation. This vegetation provides food and habitat that in turn serves as food for numerous bird species and several fish species such as chinook salmon and steelhead. It also provides shaded escape cover for fish. The setback would contribute to the restoration of riverine function and therefore habitat forming processes that would result in beneficial effects to both important fish habitat and EFH. The restoration is consistent with other restoration programs in the area and regional restoration plans (SRCAF, CALFED) that would benefit habitat-forming processes by contributing to a larger scale effort for fisheries restoration. All the newly floodable area would be considered such habitat upon project implementation.

Restoring complex riparian habitat along the Sacramento River would improve habitat for fish and wildlife. Fish benefit from complex riparian areas that become flooded at high flows or that slow floodwaters down and provide refugia for young and juvenile fish (Sommer et al., 1997). The ecological benefits of our restoration activities extend far beyond the reaches of the study area. For many species, the main stem of the Sacramento River is a migratory pathway.

By making the habitat in this area more supportive of migratory species, this alternative would bolster breeding and wintering populations in areas physically removed, but ecologically linked to the Sacramento River. Examples include the habitat benefits to neotropical migratory birds and native anadromous fish. Additionally, improvements in water quality as a result of restoration efforts have beneficial effects all the way down the Sacramento River into the Bay-Delta.

**Combined Alternative 5**

There is also the potential need to place additional rock adjacent to the existing rock at the bridge abutment. NOAA Fisheries has agreed that this is not likely to affect fisheries and aquatic resources as long as the placement occurs outside fisheries occurrence windows.

Combined Alternative 5 would have similar effects as Combined Alternative 1 with an increase in the beneficial effects to fisheries and aquatic resources due to an increase in the restoration area to 1,600 acres. This Combined Alternative would contribute to the supply of SRA and LWD available in the future and would benefit both important fish habitat and EFH. All the newly floodable area would be considered EFH habitat upon project implementation.

**Combined Alternative 6**

There is also the potential need to place additional rock adjacent to the existing rock at the bridge abutment. NOAA Fisheries has agreed that this is not likely to affect fisheries and aquatic resources as long as the placement occurs outside fisheries occurrence windows.

Combined Alternative 6 would have similar effects as Combined Alternative 1 with an increase in the beneficial effects to fisheries and aquatic resources due to an increase in the restoration area to 1,500 acres. This Combined Alternative would contribute to the supply of SRA and LWD available in the future and would benefit both important fish habitat and EFH. All the newly floodable area would be considered EFH habitat upon project implementation.

Mitigation Measures

Any necessary placement of rock at the bridge abutment would occur outside fisheries occurrence windows and would therefore not likely affect fisheries. Since the long-term effects to Fisheries and Aquatic Resources would be beneficial, no mitigation would be required.

### 5.3.8 Special-Status Species

Basis of Significance. An alternative would be considered to have a significant effect on special status species if it would result in the take of a Federally or State-listed threatened or endangered species, adversely affect designated critical habitat, or substantially affect any other special status species, including degradation of its habitat. Table 4-5 in Chapter 4 summarizes the special status species, including the information on habitat requirements, distribution, and possible occurrence in the project area. Based on this information, each species listed was evaluated for its potential to occur in the study area and its likelihood of being adversely effected by the project. The following species including the VELB, central valley spring-run chinook salmon, central valley steelhead, winter-run chinook salmon and its critical habitat, bank swallow, Swainson's hawk, and western yellow-billed cuckoo have the potential to occur in the project area, and the potential effects of the alternatives are discussed.

Valley Elderberry Longhorn Beetle (VELB)

**Effects**

***No-Action Alternative***

Habitat for VELB in the project area is expected to remain similar to existing conditions under the future without-project conditions scenario. Future urban development effects on special-status species could be reduced by compliance with requirements in the Federal and State Endangered Species Act and local ordinances designed to conserve special status species.

***Combined Alternative 1***

Combined Alternative 1 could potentially have temporary effects to the VELB during construction activities. However, these potential effects will be avoided. The existing levee would be removed and the new levee constructed in a manner that would avoid effects to elderberry plants. During construction, vegetation (e.g., trees and shrubs) would be fenced and flagged for avoidance. No shrubs are expected to be removed as a part of this alternative. With the measures taken to avoid effects to VELB, potential adverse effects during construction would not be significant.

New areas of riparian woodland and savannah would be created within the restoration area. Within 10 percent of each of these habitat types, elderberry shrubs would be planted at a density of 1-5 plants for every 1,800 square feet depending on soil conditions. For Combined Alternative 1, a minimum of 2,400 elderberry bushes would be planted. Therefore, the long-term effects on VELB would be beneficial.

Future OMRR&R activities under the project may require effects to elderberry plants that were planted or otherwise established by the project's restoration activities. These activities are described in the project's "Elderberry Planting and Monitoring Plan for the

Valley Elderberry Longhorn Beetle" (Appendix B). The lead agencies for the project have obtained a take permit for these future activities. The biological assessment and corresponding Biological Opinion addressing all special status species is included in Appendix B.

***Combined Alternative 5***

Combined Alternative 5 would have similar effects as Combined Alternative 1 with an increase in the potential total of elderberry bushes planted. For Combined Alternative 5, a minimum of 2,760 elderberry bushes would be planted.

***Combined Alternative 6***

Combined Alternative 6 would have similar effects as Combined Alternative 5 with an increase in the potential total of elderberry bushes planted. For Combined Alternative 6, a minimum of 2,760 elderberry bushes would be planted.

**Conservation Measures**

The following conservation measures will be implemented to provide protection for elderberry shrubs planted during restoration activities in the project area:

1. For the purposes of flood fighting (i.e., placement of flood-fighting material, such as rock), it is permissible to remove any elderberry shrub within the proposed project area. The proposed management for the project includes maintaining the levee and a 300-foot buffer adjacent to the waterside of the levee in a grassland vegetation that is free of elderberry shrubs. Access to this area during flood-fighting would necessarily be via the landside of the levee, which would not include any elderberry plantings. Therefore, any flood-fighting activities on the levee or within the 300-foot buffer that would affect elderberry shrubs that may voluntarily establish within these areas would not require implementation of measures to protect elderberry shrubs. However, for any Corps flood-fighting activities affecting areas on the waterside of the buffer area, a Service-approved biologist familiar with elderberry shrubs shall join the flood-fighting efforts to provide assistance. Access routes, staging areas, and all project activities should be chosen in a manner that will cause the least amount of damage to beetle habitat without adversely affecting the flood-fighting efforts. Removal of elderberry shrubs should be limited to the minimum necessary to achieve the project goal. The biologist will have the authority to coordinate with the onsite engineer to ensure that appropriate consideration is given to avoiding effects to elderberry shrubs. State and local agencies should make similar efforts when flood-fighting without Corps assistance.

2. During Corps emergency flood-fighting activities in the project area on the waterside of the buffer area, a reasonable effort will be made to clearly demarcate access routes and work boundaries. As soon as possible after the initiation of flood-fighting, a Service-approved biologist shall identify sensitive habitat that could be avoided without affecting flood-fighting activities and place adequate high visibility flagging around the avoidance areas to prevent unnecessary encroachment of construction equipment and personnel into beetle habitat during project work activities. Such flagging shall be inspected and maintained daily by a Service-approved biologist until completion of the project, at which time the flagging shall be removed. The Service-

approved biologist shall have the authority to recommend alternatives to any action that might result in effects to the avoidance areas. If the Service-approved biologist exercises this authority, the Service shall be notified within one calendar day. State and local agencies should make similar efforts when flood-fighting without Corps assistance.

3. For the purposes of routine maintenance activities, which will be described in an O&M Manual (e.g., levee inspections, vegetation removal from the levee and a 300-foot buffer zone adjacent to the levee, or clearing vegetation within the restoration area to maintain hydraulic capacity of the floodplain), it is permissible to remove any elderberry shrub. If the routine maintenance activity will include vegetation removal, a Service-approved biologist familiar with elderberry shrubs shall be onsite during the activities to ensure that elderberry plants outside of the maintenance area are not disturbed.

4. During routine maintenance activities, elderberry shrubs within the maintenance activity project area that are not required to be removed will be clearly demarcated with adequate high visibility flagging by the Service-approved biologist. Such flagging shall be inspected and maintained daily by a Service-approved biologist until completion of the project, at which time the flagging shall be removed. The Service-approved biologist shall have the authority to recommend alternatives to any action that might result in effects to the avoidance areas. If the Service-approved biologist exercises this authority, the Service shall be notified within one calendar day.

5. Prior to maintenance activities and during Corps flood-fighting activities, all workers shall be informed of the importance of avoiding effects to elderberry shrubs. Workers shall be provided with information on their responsibilities with regard to listed-species and an overview of the life-history of the species and description of the restoration area.

6. After Corps flood-fighting activities take place in areas on the waterside of the buffer area, a report prepared by the monitoring biologist(s) shall be forwarded to the Chief of the Endangered Species Division (Central Valley) at the Sacramento Fish and Wildlife Office within 60 calendar days of the completion of the project. This report shall detail: (1) dates that flood-fighting activities occurred; (2) known project effects on federally-listed species, if any; (3) occurrences of incidental take of Federally-listed species, if any; and (4) other pertinent information. State and local agencies should make similar efforts when flood-fighting without Corps assistance.

7. After Corps flood-fighting activities take place on the waterside of the buffer area, the Corps shall revegetate all areas where VELB habitat was removed or similarly affected within the proposed project area with the native riparian species used in the original restoration. Replacement will be at a ratio of 1:1 for effects to VELB habitat in the project area. State and local agencies should make similar efforts when flood-fighting without Corps assistance.

8. During maintenance activities, all fueling and maintenance of vehicles and other equipment, stockpiling of construction materials, and storage of portable equipment,

vehicles and supplies, including chemicals, shall be restricted to designated staging areas, which shall be located at least 250 feet from any riparian habitat. The agency responsible for O&M shall ensure that all reasonable measures are taken to avoid contamination of habitat during such operations. All workers shall be informed of the importance of preventing spills and appropriate measures to take should a spill occur. Any spills of hazardous materials shall be cleaned up immediately. Such spills shall be reported in O&M activities reports.

**Mitigation Measures**

Since the project would avoid short-term construction effects, and long-term effects to the VELB would be beneficial, no mitigation would be required. However, elderberry shrub plantings would be included in the planting plan, which, together with implementation of the conservation measures, would benefit the VELB.

Special Status Anadromous Fish

This section includes discussion of potential effects to the special status anadromous fish species that occur within the project area. These species include Central Valley spring-run chinook salmon, Central Valley steelhead, and winter-run chinook salmon and its critical habitat.

**Effects**

***No-Action Alternative***

Habitat for anadromous fish in the project area is expected to remain similar to existing conditions under the future without-project conditions scenario. Future urban development effects on special-status species could be reduced by compliance with requirements in the Federal and State Endangered Species Act and local ordinances designed to conserve special status species.

***Combined Alternative 1***

Implementation of Combined Alternative 1 could result in short-term adverse effects on fish species present in the study area during construction. For example, orchard removal, infrastructure modification, and grading are construction activities that could result in minor temporary increases in sediment load to the river during a flood event. Increased input of sediment has the potential to increase turbidity, possibly reducing the feeding efficiency of juvenile and adult fish. But, because the Sacramento is typically a turbid system, additional sediment input resulting from project activity would be comparatively minimal, and would not have any noticeable effect relative to the overall condition of the river. Furthermore, sediment input from construction sites would occur only during storm events.

Longer-term effects to anadromous fish could result from the loss of habitat due to implementation of the project. Removal of the existing levee could affect small areas of important habitats such as SRA cover and riparian vegetation. The loss of trees could temporarily adversely affect fish by reducing the amount of shade and potential for instream woody debris. To avoid this loss, levee removal activities would avoid removal of riparian vegetation. Vegetation (e.g., trees and shrubs) would be fenced and flagged for avoidance. Construction would also be done in a manner to avoid in-water work. The exception would be for placement of 100 feet of rock riprap below the water surface to protect the Gianella

Bridge, which would also adversely affect instream habitat. By itself, this would be a significant adverse effect.

Removal of the existing levee would reestablish the natural connectivity between the river and its floodplain, which would greatly benefit anadromous fish by providing access to floodplain habitat. This improved access also increases the risk of fish becoming stranded as floodwaters recede. However, the net effect would be beneficial.

Under Combined Alternative 1, the conversion of agricultural lands to riparian areas would result in long-term beneficial effects on fish in the Sacramento River. In this alternative, 1,300 acres of agricultural land would be converted. This alternative would contribute complexity to the aquatic environment, providing cover, food and other habitat components for fish, including SRA and LWD.

Sacramento River, tributaries, distributaries, and related riparian zones from Keswick Dam downstream to and including San Francisco Bay are classified as critical habitat for the winter-run chinook salmon. From December through August, the winter-run chinook salmon migrates past the area upstream, where it spawns. From August to December, winter-run juveniles use the SRA cover and LWD in the river for feeding and to rest and escape from predators. This alternative would contribute to the sustainable creation of this habitat and would therefore benefit winter-run chinook salmon critical habitat.

***Combined Alternative 5***

Combined Alternative 5 would have similar effects as Combined Alternative 1. In this alternative 1,600 acres of agricultural land would be converted. Under Combined Alternative 5, the conversion of agricultural lands to riparian areas would result in long-term beneficial effects on fish in the Sacramento River.

Combined Alternative 5 would have similar effects to critical habitat for winter-run chinook salmon as Combined Alternative 1. This alternative would contribute to the sustainable creation of critical habitat components and would therefore benefit winter-run chinook salmon critical habitat.

***Combined Alternative 6***

Combined Alternative 6 would have similar effects as Combined Alternative 1. In this alternative 1,500 acres of agricultural land would be converted. Under Combined Alternative 6, the conversion of agricultural lands to riparian areas would result in long-term beneficial effects on fish in the Sacramento River.

Combined Alternative 5 would have similar effects to critical habitat for winter-run chinook salmon as Combined Alternative 1. This alternative would contribute to the sustainable creation of critical habitat components and would therefore benefit winter-run chinook salmon critical habitat.

**Mitigation Measures**

Potential short-term effects would require mitigation to minimize these effects. The implementation of best management practices as discussed under the Water Quality section, for sediment control would reduce the potential water quality effects to fisheries to less than significant. If construction is conducted that may affect the salmon, it would be conducted within appropriate work windows, approved either by the NMFS, USFWS, or RWQCB. Working at these times would minimize potential effects to these species.

Since the long-term effects to the Central Valley spring-run chinook salmon, Central Valley steelhead, and winter-run chinook salmon and its critical habitat would be beneficial, no other mitigation would be required.

Bank Swallow

**Effects**

***No-Action Alternative***

Habitat for bank swallow in the project area is expected to remain similar to existing conditions under the future without-project conditions scenario. Future urban development effects on special-status species could be reduced by compliance with requirements in the Federal and State Endangered Species Act and local ordinances designed to conserve special status species.

***Combined Alternative 1***

Earthmoving machinery during construction could disturb the bank swallow, through noise, vibration, and airborne dust, and the duration of such disturbance could be substantial. If such disturbance occurs during the nesting season for the bank swallow, mortality could occur if the adults leave the nest for prolonged periods of time. In addition, vibration from the machinery could cause the vertical banks with burrows to collapse.

Combined Alternative 1 would have no long-term adverse effects on the bank swallow.

***Combined Alternative 5***

Combined Alternative 5 would have similar effects as Combined Alternative 1.

***Combined Alternative 6***

Combined Alternative 6 would have similar effects as Combined Alternative 1.

**Mitigation Measures**

Measures to minimize the potential construction effects to bank swallows include: avoiding nesting periods of the species if present within the project area, performing a field survey (if applicable) prior to construction, and avoiding disturbance of nests during construction.

Since there would be no long-term effects to the bank swallow, no mitigation would be required.

Swainson's Hawk

**Effects**

***No-Action Alternative***

The projected conversion of some lands in the Sacramento Valley from production of rice or small grain crops to cotton could reduce waterfowl populations, thereby indirectly affecting potential prey for Swainson's hawks. Habitat for Swainson's hawk in the project area is expected to remain similar to existing conditions under the future without-project conditions scenario. Future urban development effects on special-status species could be

reduced by compliance with requirements in the Federal and State Endangered Species Act and local ordinances designed to conserve special status species.

***Combined Alternative 1***

Earthmoving machinery during construction could disturb the Swainson's hawk, through noise, vibration, and airborne dust, and the duration of such disturbance could be substantial. If such disturbance occurs during the nesting season for birds, mortality could occur if the adults leave the nest for prolonged periods of time.

Swainson's hawks may use riparian vegetation and oaks that occur on the existing levee to nest or perch. Levee removal activities could affect these trees. However, to avoid these potential effects, levee sections with existing riparian vegetation or large oaks would be avoided during excavation activities.

Foraging habitat for Swainson's hawk in the project area would be increased by implementation of Combined Alternative 1. New foraging habitat would be created through restoration of a total of 60 acres of grassland and 140 acres of savannah that may be utilized for foraging by the Swainson's hawk. These 200 acres would more than offset the loss of foraging habitat on approximately 90 acres of grain crops that would be converted to riparian. This alternative would provide an overall benefit to foraging habitat for the Swainson's hawk.

***Combined Alternative 5***

Combined Alternative 5 would have similar effects as Combined Alternative 1. Foraging habitat for Swainson's hawk in the project area would be increased by implementation of Combined Alternative 5. New foraging habitat would be created through restoration of a total of 80 acres of grassland and 150 acres of savannah that may be utilized for foraging by the Swainson's hawk. These 230 acres would more than offset the loss of foraging habitat on approximately 90 acres of grain crops that would be converted to riparian. This alternative would provide an overall benefit to foraging habitat for the Swainson's hawk.

***Combined Alternative 6***

Combined Alternative 6 would have similar effects as Combined Alternative 1. Foraging habitat for Swainson's hawk in the project area would be increased by implementation of Combined Alternative 6. New foraging habitat would be created through restoration of a total of 70 acres of grasslands and 150 acres of savannah that may be utilized for foraging by the Swainson's hawk. These 220 acres would more than offset the loss of foraging habitat on approximately 90 acres of grain crops that would be converted to riparian. This alternative would provide an overall benefit to foraging habitat for the Swainson's hawk.

**Mitigation Measures**

Measures to avoid or minimize the construction effects to Swainson's hawk include; avoiding nesting periods of the species if present within the project area (March 1 – September 15), performing a field survey (if applicable) prior to construction, and avoiding disturbing nests during construction. Also, every effort shall be made to avoid removal of riparian vegetation and heritage oaks. Vegetation (e.g., trees and shrubs) could be fenced and flagged for avoidance. Direct destruction of the nest, or disturbance to nesting pairs of Swainson's hawk by noise or dust disturbance, would be considered a potentially adverse effect. Due to the institution of mitigation measures, however, the species survival and recovery would not be adversely affected.

Since the long-term effects to the Swainson's hawk would be beneficial, no mitigation would be required.

Western Yellow-billed Cuckoo

**Effects**

***No-Action Alternative***

Habitat for western yellow-billed cuckoo in the project area is expected to remain similar to existing conditions under the future without-project conditions scenario. Future urban development effects on special-status species could be reduced by compliance with requirements in the Federal and State Endangered Species Act and local ordinances designed to conserve special status species.

***Combined Alternative 1***

Equipment operation during construction could disturb the western yellow-billed cuckoo, through noise, vibration, and airborne dust, and the duration of such disturbance could be substantial. If such disturbance occurs during the nesting season, mortality could occur if the adults leave the nest for prolonged periods of time. Effects to riparian vegetation on the existing levee would be avoided by leaving appropriate sections of the levee in place.

With the setback levee and the restoration effort proposed, new areas of riparian (860 acres), oak savannah (140 acres), scrub (225 acres), and native grassland (62 acres) habitat would be created. With the creation of the riparian restoration areas, there would be an overall beneficial effect on the western yellow-billed cuckoo.

***Combined Alternative 5***

Combined Alternative 5 would have similar effects as Combined Alternative 1, and new areas of riparian (1064 acres), oak savannah (150 acres), scrub (290 acres), and native grassland (80 acres) habitat would be created. With the creation of the riparian restoration areas, there would be an overall beneficial effect on the western yellow-billed cuckoo.

***Combined Alternative 6***

Combined Alternative 6 would have similar effects as Combined Alternative 1. New areas of riparian (1,000 acres), oak savannah (150 acres), scrub (261 acres), and native grassland (70 acres) habitat would be created. With the creation of the riparian restoration areas, there would be an overall beneficial effect on the western yellow-billed cuckoo.

**Mitigation Measures**

Short-term effects to the yellow-billed cuckoo can be avoided or minimized by implementing the following measures: avoid nesting periods of the species if present within the project area, perform a field survey (if applicable) prior to construction, and avoid disturbing nests during construction. Also, the removal of riparian vegetation will be avoided. Riparian vegetation (e.g., trees and shrubs) will be fenced and flagged for avoidance. Effects to riparian vegetation on the existing levee will be avoided by leaving appropriate sections of the levee in place. With these measures in place, short-term effects will be reduced to less than significant.

Since short-term effects can be avoided and the long-term effects to the western yellow-billed cuckoo would be beneficial, no additional mitigation would be required.

### 5.3.9 Socioeconomic Conditions

Basis of Significance. For NEPA purposes, an alternative would be considered to have a significant effect on socioeconomic resources if it would result in population changes, residential relocations, business losses, job losses, changes in public services, and/or losses of local tax revenue that are incompatible with local agency goals or projections. Socioeconomic effects are not treated as potentially significant effects under CEQA (CEQA Guidelines Section 15131 (a)).

Effects

**No-Action Alternative**

Under the no-action alternative, it is expected Glenn County would continue to pursue a pro-economic growth policy to enhance the socioeconomic conditions of the county.

**Combined Alternative 1**

Implementation of Combined Alternative 1 would result in a variety of economic gains and losses for the local region. Economic losses to the region result from the loss of agricultural jobs. The economic gains to the region result from the reduction of economic losses due to flooding, increased opportunity for growth within the Hamilton City community, and an increase in jobs associated with construction, ecosystem management, and increased recreation opportunities.

The loss of 1,300 acres of agricultural land would result in economic losses to the region due to the loss of agricultural jobs. TNC funded a study of the Socioeconomic Assessment of Proposed Habitat Restoration within the Riparian Corridor of the Sacramento River Conservation Area. This analysis determined that as a result of converting 2,696 acres from agriculture to restoration, approximately 66 jobs would be lost (see Table 5-7).

**TABLE 5-7: GLENN COUNTY DIRECT AND INDIRECT/INDUCED JOBS[1]**

| | Acres Restored | Direct Job Losses[2] | Indirect Job Losses[3] | Total Job Losses |
|---|---|---|---|---|
| Total | 2,696 | 30 | 36 | 66 |
| Per Acre | | 0.0111 | 0.0134 | |

[1] Source: Draft Socioeconomic Assessment of Proposed Habitat Restoration Within the Riparian Corridor of the Sacramento River Conservation Area, Nature Conservancy, September 2002.Table 6-13.
[2] Jobs directly involved with agricultural production (for example, farm workers)
[3] Jobs indirectly involved with agricultural production (for example, those who provide equipment)

Application of this percentage ratio to Combined Alternative 1 indicates a potential job loss of approximately 31 jobs (see Table 5-8). In Glenn County, there are approximately

11,851 jobs in the agricultural industry. A loss of 31 jobs would represent a 0.3 percent loss (U.S. Department of Commerce 2002).

**TABLE 5-8: HAMILTON CITY RESTORATION AGRICULTURE JOB LOSSES**

| Acres Restored | Direct Job Losses | Indirect Job Losses | Total Job Losses | County Employment | Loss as Percent of Total Employment |
|---|---|---|---|---|---|
| 1,000 | 11 | 13 | 24 | 11,851 | 0.21 percent |
| 1,300 | 14 | 17 | 31 | 11,851 | 0.27 percent |
| 1,500 | 17 | 20 | 37 | 11,851 | 0.31 percent |
| 1,600 | 18 | 21 | 39 | 11,851 | 0.33 percent |

The loss of agricultural jobs must be considered in context with economic gains that would result from implementation of this alternative. The jobs potentially lost by the project would be compensated for, in part, by the short-term creation of jobs in the construction sector of the local economy. This would be a short-term benefit during construction of the project. Long-term ecosystem management and recreation related jobs would also be generated by the project and would also compensate, in part, for the loss of agricultural jobs.

Additionally, implementation of the proposed project would enhance existing levels of flood protection along the river and in particular, the surrounding urban area. Studies on the effects of natural disasters on local economics indicate that flooding has the potential to create significant short-term economic effects on communities resulting from the disruption of business and governmental activities, destruction of capital equipment and public infrastructure, and temporary dislocation of various portions of the local workforce. Improvement of flood control would provide additional protection to the community and their local economy against the significant short-term effects of flooding. In addition to decreased negative effects of flooding on local economies, increased flood protection may encourage industries to locate in the area producing a net beneficial effect on the local economy. However, this alternative would not provide a 100-year level of protection under FEMA standards, and therefore would not alter the regulation of land use in the floodplain pursuant to the National Flood Insurance Program. The constraint on development due to flooding would not be eliminated. While it is conceivable that the project would have a positive effect upon property values within the community, the magnitude of such an effect, if it exists, would be very speculative, but possible.

The project would somewhat enhance community cohesion by reducing damages from flooding and contributing to a greater sense of well being. The community cohesion that resulted from the shared vision of improved flood protection and the shared experience of working together to find a solution would be further reinforced by the sense of accomplishment resulting from a successful project. The community has repeatedly provided strong overall support for the project based on participation at public meetings and community statements of support. Given the strong local support for reducing flood damages, the net socioeconomic effect to the local community, including Hamilton City and Glenn County, would likely be compatible with local goals. Thus, any socioeconomic effect would not be significant.

**Combined Alternative 5**

Combined Alternative 5 would have similar effects as Combined Alternative 1 with agricultural land converted, 1,600 acres, resulting in a potential job loss of approximately 39 jobs (or 0.3 percent of the total agricultural jobs in the county). Similar economic gains would also result from this alternative.

Given the strong local support for reducing flood damages, the net socioeconomic effect to the local community, including Hamilton City and Glenn County, would likely be compatible with local goals. Thus, any socioeconomic effect would not be significant.

**Combined Alternative 6**

Combined Alternative 6 would have similar effects as Combined Alternative 1 with agricultural land converted, 1,500 acres, resulting in a potential job loss of approximately 37 jobs (or 0.3 percent of the total agricultural jobs in the county). Similar economic gains would also result from this alternative.

Support for this alternative from the local community, including Hamilton City and Glenn County, is indicative that the net socioeconomic effects of the project are compatible with local goals. Thus, any socioeconomic effects are not significant.

Mitigation Measures

Since the effects to socioeconomic conditions would be less than significant, no mitigation would be required.

### 5.3.10 Agricultural /Prime and Unique Farmlands

Basis of Significance. An alternative would be considered to have a significant effect if it would result in an irretrievable conversion of a substantial acreage of farmland. An irretrievable conversion is considered to be one that involves the conversion to land uses that would cause serious degradation of the quality of the physical environment and/or result in expenditures of substantial development costs that would likely preclude future conversion back to agriculture.

NEPA focuses on agriculture as a land use with associated socioeconomic effects while CEQA considers only the effects on the physical conditions of the land including, but not limited to, air and water quality, flora, fauna, soils and ambient noise. Taking commercial agriculture out of production is not per se considered a significant effect to the physical environment under CEQA. The subsequent reuse of the land must be considered to determine whether there is an effect on the physical environment. The socioeconomic effects associated with the loss of commercial agriculture are not treated as significant effects under CEQA (CEQA Guidelines Section 15131(a)).

Effects

**No-Action Alternative**

Agriculture is the major industry in the study area, particularly orchards that are considered a long-term investment. Historically, orchards have been planted and grown in the surrounding area, and current land use is expected to continue. Land under Williamson

Act or Farmland Security Zone Act contracts would remain in agriculture for the remainder of the contract, usually a 10-year or 20-year commitment, respectively.

Glenn County maintains a policy that allows for the conversion of agriculture to other uses to provide for the necessary diversity and growth required in the local economy. Lands within the urban limit lines are to be converted prior to lands outside of the urban limit lines. In addition, agricultural lands may decline in the future due to seepage, erosion, flooding, and scouring associated with the lands along the Sacramento River. Due to these factors, potential investments to keep such lands productive may diminish.

**Combined Alternative 1**

Combined Alternative 1 would affect the agricultural land in the study area. Land currently in grain and orchards would become part of the floodplain between the river and the new setback levee. This alternative includes an area of 1,468 acres and would convert 1,288 acres (rounded to 1,300 in the rest of the document) from agriculture to native habitat. The new setback levee would provide improved flood protection for farmlands on the landside of the new levee.

The conversion of agricultural lands to habitat would occur on lands that lie on the waterside of the proposed setback levee. These lands are currently vulnerable to flooding and erosion, which adversely affects the viability of agriculture on these lands by increasing management costs and the risk of crop failure. The new setback levee would provide improved flood protection for farmlands on the landside of the new levee. This would improve economic conditions for growers that are farming these lands. In addition, conversion of agricultural lands for ecosystem restoration would be considered beneficial to the physical environment, including soils, due to reintroduction of natural organisms to the soil, deposition of sediment, decreased tillage, and reduction of exposure to chemicals used in agricultural production.

National Resource Conservation Service Rating. The NRCS conducted an analysis and provided the Corps with a Farmland Conversion Impact Rating letter for the alternative (see Appendix B). The NRCS determined that the relative value of farmland to be converted was rated at 75 out of a possible 100, based on an evaluation using the Storie Index. The Corps completed the site assessment portion of the rating, with a rating of 95 out of 160 points. Thus, the combined score was 170 out of 260 points. According to the Farmland Protection Policy Act, farmland receiving a rating less than 160 need not be given further consideration for protection, and alternative actions do not need to be considered. The U.S. Department of Agriculture recommends that sites receiving scores totaling 160 or more be given increasingly higher levels of consideration for protection. The other alternatives were reconsidered, but did still not meet study objectives or had similar ratings as Combined Alternative 1.

State Department of Conservation LESA Model. In an effort to assess the effect of the conversion of farmland to other uses, the California Department of Conservation recommended that the California Agricultural Land Evaluation and Site Assessment (LESA) model be used for this study. The LESA model is an optional method that can be used in a CEQA assessment to ensure that significant environmental effects of agricultural land conversions are quantitatively and consistently considered in the environmental review process (Public Resource Code, Section 21095).

The LESA model was used for this study, but found to be inappropriate for assessing the potential effects of conversion of farmland to ecosystem restoration projects for several reasons. First, the model does not analyze whether or not there would be significant effects on the physical environment. Rather, the model assumes that there would be significant adverse effects. The model quantifies the degree of the effect based on limited parameters such as quality and location of soils. There are many important factors that the model does not take into consideration. These include the following: restoration projects actually provide a benefit to the physical environment, including soils; conversion of agricultural lands for restoration can be reversed much more easily than conversion to urban use; and agricultural lands would benefit from increased flood protection.

The Reclamation Board has agreed that based on the limitations of the LESA model, requirements of CEQA, and with input from other State agencies, that the LESA model was not appropriate to assess the potential effects from the conversion of agricultural land for ecosystem restoration projects.

Williamson Act and Farmland Security Zone Act Contracts. Combined Alternative 1 would affect two parcels under a Williamson Act contract. One parcel, which covers 143.5 acres north of Highway 32 in Zone G, is owned by TNC. The other parcel covers 139.5 acres south of Road 23 in Zone B2 and is privately owned. The combined acreage is 283 acres. Two other parcels in the study area under a Williamson Act contract are on USFWS property and are not included as part of the proposed restoration. The alternative would also affect a 100.7-acre parcel protected by a Farmland Security Zone Act contract in Zone B2, south of Road 23.

Summary. The conversion of prime and unique farmlands for ecosystem restoration would not result in an irretrievable adverse environmental effect on these farmlands and thus would not be considered a significant effect. The conversion of these lands to native habitat would not degrade soils, but would instead improve the soils due to reintroduction of natural organisms to the soil, deposition of sediment, decreased tillage, and reduction of exposure to chemicals used in agricultural production. The conversion of these farmlands for ecosystem restoration would also not require huge expenditures as would be required for conversion to urban development. Therefore, if public priorities and policies change in the future, these lands could be converted back to agriculture without major socioeconomic effects. However, any future conversion of areas restored with native vegetation to commercial agricultural production would likely be considered to be a significant adverse effect under CEQA.

**Combined Alternative 5**

Combined Alternative 5 would have similar effects on agricultural land as Combined Alternative 1. Land currently in grain and orchards would become part of the floodplain between the river and the new setback levee. This alternative includes an area of 1,812 acres and would convert 1,600 acres from agriculture to native habitat. The new setback levee would provide improved flood protection for farmlands on the landside of the new levee.

The conversion of prime and unique farmlands for ecosystem restoration associated with Combined Alternative 5 would not result in an irretrievable effect on these farmlands and thus would not be considered a significant effect. The conversion of agricultural lands to native habitat would have a significant beneficial effect on the physical environment.

Combined Alternative 5 includes the proposed restoration of three parcels under a Williamson Act contract. Two of these properties are owned by TNC and are located north of Highway 32 in Zone G (144 acres) and Zone H (189 acres). The third parcel, located south of Road 23 in Zone B2, covers 139.5 acres and is privately owned. The total acreage in Williamson Act contracts is 472 acres. Two other parcels in the study area under a Williamson Act contract are on USFWS property and are not included as part of the proposed restoration. The alternative would also affect a 100.7-acre parcel protected by a Farmland Security Zone Act contract in Zone B2, south of Road 23.

**Combined Alternative 6**

Combined Alternative 6 would have similar effects on agricultural land as Combined Alternative 1. Land currently in grain and orchards would become part of the floodplain between the river and the new setback levee. This alternative includes an area of 1,658 acres and would convert 1,500 acres from agriculture to native habitat. The new setback levee would provide improved flood protection for farmlands on the landside of the new levee.

The conversion of prime and unique farmlands for ecosystem restoration associated with combined Alternative 6 would not result in an irretrievable effect on these farmlands and thus would not be considered a significant effect. The conversion of agricultural lands to native habitat would have a significant beneficial effect on the physical environment.

Combined Alternative 6 includes the proposed restoration of three parcels currently under a Williamson Act contract. Two of these properties are owned by TNC and are located north of Highway 32 in Zone G (144 acres) and Zone H (189 acres). The third parcel, located south of Road 23 in Zone B2, covers 139.5 acres and is privately owned. The total acreage under Williamson Act contracts for Combined Alternative 6 is 472 acres. Two other parcels in the study area under a Williamson Act contract are on USFWS property and are not included as part of the proposed restoration. Combined Alternative 6 would also affect a 100.7-acre parcel protected by a Farmland Security Zone Act contract in Zone B2 south of Road 23.

Mitigation Measures

Although the NCRS rating exceeded 160, no mitigation is required since other alternatives were reconsidered, but either did not meet study objectives or had similar ratings. Since the conversion of farmland to habitat under this project is not considered to have a significant adverse effect on the physical environment under CEQA, no mitigation is required under CEQA.

Glenn County has indicated that due to strong local and agency support for this project, it is in the best public interest to release these lands from Williamson Act and Farmland Security Zone Act contracts, convert these agricultural lands to native habitat, and construct a setback levee to increase flood protection to Hamilton City and surrounding agricultural lands behind the new setback levee.

The alternatives would be consistent with the CALFED ROD requirements for conversion of agricultural lands to restoration. All alternatives are considered to have less-than-significant effects on agriculture and Prime and Unique Farmlands. The numerous requirements regarding agriculture and Prime and Unique Farmland in the CALFED ROD are

being met by the project. A list of the requirements, as well as a detailed description of how this project meets each of these requirements, is included in Chapter 9 and Appendix B-7.

### 5.3.11 Urban Land Use

Basis of Significance. Adverse effects on urban land use were considered significant if implementation of an alternative would conflict with any applicable land use plan or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan or zoning ordinance), or if the alternative were to divide an established community.

Effects

**No-Action Alternative**

Urban development trends in California would continue, as population levels are projected to increase. Acres would continue to move from other categories to the urban land use category. Projects primarily would be implemented on agricultural lands, natural habitat, or land use categories other than urban.

Under the no-action alternative, the TNC lands would continue to be farmed at least in the short-term. However, the TNC lands are under threat of flooding and erosion from the Sacramento River under the no-action alternative and the long-term productivity of these lands is doubtful. These lands are currently outside the urban limit lines for Hamilton City.

**Combined Alternative 1**

The realigned levee would limit the eastward urban growth potential of Hamilton City; however, the levee alignment is outside of the urban growth limit for Hamilton City and would therefore not have significant negative effects on urban land use. This combined alternative would not provide a 100-year level of protection under FEMA standards, and therefore would not alter the regulation of land use in the floodplain pursuant to the National Flood Insurance Program. The constraint on development due to flooding would not be eliminated in the eastern portion of Hamilton City, which is within the FEMA regulatory floodplain.

**Combined Alternative 5**

The realigned levee would limit the eastward urban growth potential of Hamilton City; however, the levee alignment is outside of the urban growth limit for Hamilton City and would therefore not have significant negative effects on urban land use. This combined alternative would not provide a 100-year level of protection under FEMA standards, and therefore would not alter the regulation of land use in the floodplain pursuant to the National Flood Insurance Program. The constraint on development due to flooding would not be eliminated in the eastern portion of Hamilton City, which is within the FEMA regulatory floodplain.

**Combined Alternative 6**

The realigned levee would limit the growth potential of Hamilton City; however, the levee alignment is outside of established growth limits and would therefore not have significant adverse effects on urban land use. This combined alternative would not provide a

100-year level of protection under FEMA standards, and therefore would not alter the regulation of land use in the floodplain pursuant to the National Flood Insurance Program. The constraint on development due to flooding would not be eliminated in the eastern portion of Hamilton City, which is within the FEMA regulatory floodplain.

Mitigation Measures

Since the combined alternatives would not alter the constraint on development due to flooding in the eastern portion of Hamilton City, there would be no significant effects requiring mitigation.

### 5.3.12 Transportation

Basis of Significance. An alternative would be considered to have a significant effect on transportation if it would cause an increase in traffic that is substantial in relation to the existing load and capacity of a roadway, an increase in safety hazards on area roadways, or cause substantial deterioration of the physical condition of area roadways.

Effects

**No-Action Alternative**

As population increases and Hamilton City expands, traffic and safety hazards on area roadways are likely to increase. However, the area will continue to be essentially a rural community. As the area grows, more roads and other transportation infrastructure can be expected.

**Combined Alternative 1**

Temporary effects may occur to local roads during construction due to the hauling of materials used for levee construction. Some of the materials would come from the existing levee, which would not cause any effects to transportation resources. However, approximately one-half of the materials required for construction would be obtained from the GCID dredged spoil pile, which lies between the Glenn-Colusa Canal and County Road 203/Highway 45, from the fish screen south along the canal. Implementation of the alternative would increase traffic and vibration levels along the project access routes from this borrow source to the project area. Although the construction area is some distance from town, residential and commercial land uses in the vicinity of the construction sites would experience increased traffic and vibration levels from both haul trucks and onsite construction equipment. Construction activities would generate additional traffic to the site resulting from mobilization activities; commuting of construction workers; hauling of workers, equipment, and materials; and supervision and inspection activities. This alternative would result in temporary effects to County Roads 203 and 23 as construction would be required on these roads to ramp them over the new levee. Transportation disruptions would occur as a result of construction-related detours and temporary levee access, staging and construction activities. Increased truck traffic on area roadways may also pose an increased safety hazard and may adversely impact the condition of area roadways. These effects would be potentially significant effects.

There would be no long-term adverse effects on the area roadways. The Highway 32 approach to Gianella Bridge would be reinforced with rock to avoid an increased risk of

erosion at the bridge due to removal of the existing levee. The new levee alignment would not change flooding effects to County Road 23.

The reduced likelihood of flooding would increase transportation capabilities, particularly for Highway 32, within the protected area behind the new levee by increasing levels of protection to transportation-related infrastructure during high-river flows.

**Combined Alternative 5**

This alternative has similar effects to Combined Alternative 1, with the exception that the levee alignment for this alternative ties into Road 203 approximately 1,600 feet south of the existing "J" Levee. Road 203 would be reinforced at this intersection. This alignment also differs in that it crosses Highway 32 well to the west of the existing levee. Highway 32 between the new alignment and the river would be raised to ensure no increase in flooding due to the setback alignment. The raising of Highway 32 would have substantial effects to transportation due to the detour and delay in traffic resulting from construction.

**Combined Alternative 6**

Temporary construction effects to transportation would be similar to those discussed under Combined Alternative 1. The benefits to transportation from increasing levels of protection to transportation-related infrastructure would also be similar to those discussed under Combined Alternative 1.

Mitigation Measures

To promote efficient, safe access to construction staging areas, an Access Management Plan would be prepared and implemented prior to the initiation of construction activities. The following would be considered in this plan:

- The ability of proposed access routes to accommodate high levels of construction vehicle and truck traffic. Factors would include road width, surface conditions, and vertical clearance.
- Securing necessary easements for roads and staging areas, including consideration of improvement and maintenance costs, construction traffic signs, restoration activities, and damage provisions.

Affected people would be informed about the expected changes in traffic levels, and reasonable accommodations to help ensure safety (e.g., temporary fencing and slower construction speed limits) would be considered. Mitigation with best management practices would result in less than significant effects.

### 5.3.13 Recreation

Basis of Significance. An alternative would be considered to have a significant effect on recreation if the project increases use of existing recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated, if it would result in the loss of recreational facilities, or if it would cause a substantial disruption in a recreational activity or opportunity.

Effects

**No-Action Alternative**

The no-action alternative would not have adverse impacts to current recreation facilities or recreational activities. The demand for recreation in the study area (camping, fishing, etc.) is expected to increase consistent with the population growth rate.

As a result, the no-action alternative could result in increased use of current facilities, which could degrade the facilities more quickly or have a negative impact on the user's experience due to overcrowding. Additionally, no improvement to public river access and recreational facilities may increase the possibility of trespassing onto public and private property, which could increase environmental damage.

**Combined Alternative 1**

No long-term adverse impacts to recreation are anticipated with implementation of the proposed project. Existing facilities would not be lost or experience any increased use. This alternative would be compatible with planned recreation facilities within the study area. Creating a setback levee would have temporary effects to the boat launching facility at Irvine Finch, requiring the implementation of mitigation measures. This temporary effect would not occur during the prime fishing season (fall and winter) but would occur when fishing is at it's lowest (spring and summer). However, the boat launching facility is used heavily during the late spring and summer and these users would be redirected to neighboring river access sites.

**Combined Alternative 5**

Combined Alternative 5 would have similar impacts as Combined Alternative 1. This alternative would not result in any significant effects to recreation.

**Combined Alternative 6**

Combined Alternative 6 would have similar impacts as Combined Alternative 1. This alternative would not result in any significant effects to recreation only temporary effects to the Irvine Finch boat launching facility.

Mitigation Measures

Mitigation would only be required for short-term construction impacts to recreation resulting from temporary closure of designated recreation facilities (e.g., parking areas, boat ramps, restrooms, picnic facilities, walkways, etc.). These effects shall be minimized through advance communication. Prior to completion of final plans and specifications, the Department of Parks and Recreation (DPR) shall review the plans and specifications to ensure that they contain language requiring that signs be posted at every parking facility that is temporarily unavailable at least one month in advance of construction; the signs must indicate the proposed construction schedule and alternative parking facilities that can be used during the construction period. This measure would be monitored and enforced by the DPR. This measure would likely be necessary near the Irvine Finch River Access during project construction. Any facilities damaged or destroyed during construction would be repaired or replaced.

### 5.3.14 Aesthetics

Basis of Significance. An alternative would be considered to have a significant effect on aesthetics if changes in landform, vegetation, or structural features create substantially increased levels of visual contrast as compared to surrounding conditions.

Effects

**No-Action Alternative**

Without the project, aesthetic conditions would likely remain the same as they are now.

**Combined Alternative 1**

Restoration of 1,300 acres of riparian, scrub, savannah, and grassland habitats would improve the visual resources along the river. Aesthetics may be temporarily affected during construction phases because of the presence of construction and earth-moving equipment. Temporary effects to aesthetics during construction would not be considered significant. The restoration of riparian, scrub, savannah, and grassland habitats would improve visual resources along the river. This would be a beneficial effect.

**Combined Alternative 5**

Restoration of 1,600 acres of riparian, scrub, savannah, and grassland habitats would improve the visual resources along the river. Aesthetics may be temporarily affected during construction phases because of the presence of construction and earth-moving equipment. Temporary effects to aesthetics during construction would not be considered significant. The restoration of riparian, scrub, savannah, and grassland habitats would improve visual resources along the river. This would be a beneficial effect.

**Combined Alternative 6**

Combined Alternative 6 would have similar effects as Combined Alternative 1 with the same number of acres proposed for restoration at 1,500. Temporary effects to aesthetics during construction would not be considered significant. The restoration of riparian, scrub, savannah, and grassland habitats would improve visual resources along the river. This would be a beneficial effect.

Mitigation Measures

Since the long-term effects of Aesthetics would be beneficial, no mitigation would be required.

### 5.3.15 Noise

Basis of Significance. An alternative would be considered to have a significant effect on noise if it would substantially increase the ambient noise levels for adjoining areas. The significance of temporary noise effects is evaluated with reference to existing noise levels, the duration of the noise, and the number of sensitive receptors affected.

Effects

**No-Action Alternative**

Noise levels are expected to increase with increasing population, traffic, and urban development in the Hamilton City area.

**Combined Alternative 1**

Noise levels would increase temporarily from the operation of equipment during construction. Conversion of agricultural land, approximately 1,300 acres, to restoration would decrease long-term noise effects from the decrease in use of farming equipment. This alternative would have an overall beneficial effect on noise.

**Combined Alternative 5**

Noise levels would increase temporarily from the operation of equipment during construction. Conversion of agricultural land, approximately 1,600 acres, to restoration would decrease long-term noise effects from the decrease in use of farming equipment. This alternative would have an overall beneficial effect on noise.

**Combined Alternative 6**

Combined Alternative 6 would have similar effects as Combined Alternative 1, however with a increase in the construction period due to the longer levee length from 5.5 miles to 6.8 miles. A larger area would be restored in Combined Alternative 6 and more agricultural land would be converted, approximately 1,500 acres, therefore a greater long-term decrease in noise from farming equipment would result. This alternative would have an overall beneficial effect on noise.

Mitigation Measures

Best management practices would be used to lessen the short-term effects of construction noise.

### 5.3.16 Hazardous, Toxic, and Radiological Waste

Basis of Significance. An alternative would be considered to have a significant effect if it would involve substances identified as potentially hazardous (for example, by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); and/or 40 CFR Parts 260 through 270); and (1) expose workers to hazardous substances in excess of Federal Occupational, Safety, and Health Administration standards, or (2) contaminate the physical environment, thereby posing a hazard to people, animals, or plant populations by exceeding Federal exposure, threshold, or cleanup limits.

Effects

**No-Action Alternative**

Without the project, any existing but previously unidentified Hazardous, Toxic, and Radioactive Waste (HTRW) would remain on site. Existing conditions may continue or the situation may become worse if contaminated soil or ground water migrates through resource areas with high concentrations of petroleum, hydrocarbons, or agricultural chemicals.

Contamination of ground water and soils could result from the flooding of agricultural land where continued farming practices such as irrigation and chemical application of pesticides occurs.

**Combined Alternative 1**

Since the only identified HTRW sites are outside of the project area, Combined Alternative 1 would not affect any known HTRW sites. Conversion of 1,300 acres of agricultural land would decrease dispersal of pesticides due to flooding of agricultural areas. This is expected to have an overall beneficial effect.

**Combined Alternative 5**

Since the only identified HTRW sites are outside of the project area, Combined Alternative 5 would not affect any known HTRW sites. Conversion of 1,600 acres of agricultural land would decrease dispersal of pesticides due to flooding of agricultural areas. This is expected to have an overall beneficial effect. Irvine Finch River Access near the Sacramento River and the State Highway 32 may flood, but effects to the environment would be minimal based on the site inspections conducted on July 12, 2001, and March 28, 2003.

**Combined Alternative 6**

Since the only identified HTRW sites are outside of the project area, Combined Alternative 6 would not affect any known HTRW sites. Combined Alternative 6 would have similar effects as Combined Alternative 1 with 1,500 acres converted from agriculture. This is expected to have an overall beneficial effect. There would be no significant negative impact on the Hamilton City community and the surrounding farmlands.

Mitigation Measures

Since the effects of Hazardous, Toxic, and Radiological Waste would be beneficial, no mitigation would be required.

### 5.3.17 Cultural Resources

Basis of Significance. An alternative would be considered to have a significant adverse effect on cultural resources if it would diminish the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association. Types of effects include physical destruction, damage, or alteration; isolation or alteration of the character of the setting; introduction of elements that are out of character with the property; neglect; and transfer, lease, or sale of the property.

Effects

**No-Action Alternative**

Conditions of cultural resources sites within the proposed project area would remain the same. Levee failure and resultant flooding could damage archeological sites in the project area.

**Combined Alternative 1**

The alternative could have an effect on an historic Indian mound site, however; this site has been in agriculture for a number of years and it is likely that no effect would result. Any effects to the St. John site, Indian Dance house, Swift's Point, and Shotover Inn, identified historic properties, would be avoided as these sites are located outside of the project area. In addition, Combined Alternative 1 could require alterations to the Gianelli Bridge which is listed as a historic property; however, the entire bridge has been modernized and replaced and is no longer considered historic. There should be no effects to cultural resources.

**Combined Alternative 5**

Combined Alternative 5 would have similar impacts as Combined Alternative 1. There should be no effects to cultural resources.

**Combined Alternative 6**

Combined Alternative 6 would have similar effects as Combined Alternative 1. Combined Alternative 6 is not likely to have significant effects to cultural resources.

Mitigation Measures

Since there is not likely to be an effect to Cultural Resources, no mitigation would be required.

## 5.4 GROWTH-INDUCING EFFECTS

The growth-inducing section of the Feasibility Report/EIR/EIS is required by CEQA. According to CEQA Guidelines, a growth-inducing effect is one that could foster economic or population growth, directly or indirectly bringing about construction of additional housing in the surrounding environment (Section 15126[g]). This section addresses existing population growth and densities in and near the study area and examines existing and with project growth-inducing conditions.

Effects

**No-Action**

The study area is not currently subject to rezoning and remains mostly in agricultural land. Since the no-action alternative would not increase levels of flood protection, it is not expected that this alternative would induce additional growth or development within the study area. Areas subject to 100 year flooding are currently considered a constraint to development in the Glenn County General Plan and the urban growth boundary for Hamilton City is delineated as such. The no-action alternative would not change the current growth boundaries.

**Combined Alternative 1**

Combined Alternative 1 is outside the urban growth boundary for Hamilton City. Growth in Hamilton City is expected to continue as overflow from the city of Chico spreads to the Hamilton City area. Development would not occur in the restoration area, approximately 1,300 acres. The alternative would increase the level of flood protection to 90 percent

confidence of passing the 75-year flood event (not FEMA-level certification). This combined alternative would not provide a 100-year level of protection under FEMA standards, and therefore would not alter the regulation of land use in the floodplain pursuant to the National Flood Insurance Program.

Hamilton City currently has a well-defined growth boundary, as defined in the Glenn County General Plan. Much of the undeveloped area within the urban growth limits of Hamilton City is outside of the limits of the FEMA 100-year floodplain (Figure 4-4). Thus, the City has adequate room for growth regardless of whether any additional flood protection is provided. One of the most recent developments within Hamilton City occurred in an area near the eastern boundary of the City, within the 100-year floodplain, but included the requirement to place structures on pads that raised the structures out of the floodplain. This kind of development is indicative that the growth of the City is not seriously constrained by the limits of the 100-year floodplain. Since areas within the FEMA 100-year floodplain can be developed under existing conditions, and since most of the undeveloped areas are currently outside of this floodplain, it is reasonable to conclude that the increased level of flood protection provided by this alternative would have little to no effect on growth.

**Combined Alternative 5**

Combined Alternative 5 is outside the urban growth boundary for Hamilton City. Growth in Hamilton City is expected to continue as overflow from the city of Chico spreads to the Hamilton City area. Development would not occur in the restoration area, approximately 1,600 acres. The Alternative would increase the level of flood protection 90 percent confidence of passing the 75-year flood event (not FEMA-level certification). This combined alternative would not provide a 100-year level of protection under FEMA standards, and therefore would not alter the regulation of land use in the floodplain pursuant to the National Flood Insurance Program.

For the reasons described under Combined Alternative 1, it is reasonable to conclude that the increased level of flood protection provided by this alternative would have little to no effect on growth.

**Combined Alternative 6**

Combined Alternative 6 would have similar effects as Combined Alternative 5; however, the levee alignment just east of Hamilton City is further to the east than the levee for Combined Alternative 5. Development would not occur in the restoration area, approximately 1,500 acres. The Alternative would increase the level of flood protection 90 percent confidence of passing the 75-year flood event (not FEMA-level certification). This combined alternative would not provide a 100-year level of protection under FEMA standards, and therefore would not alter the regulation of land use in the floodplain pursuant to the National Flood Insurance Program. Combined Alternative 6 would have a negligible effect on long-term regional growth.

For the reasons described under Combined Alternative 1, it is reasonable to conclude that the increased level of flood protection provided by this alternative would have little to no effect on growth.

Mitigation Measures

There are no mitigation measures proposed for growth-inducing impacts because, the combined alternatives would not provide a 100-year level of protection under FEMA standards, and therefore would not alter the regulation of land use in the floodplain pursuant to the National Flood Insurance Program. The constraint on development due to flooding would not be eliminated in the eastern part of Hamilton City.

## 5.5 CUMULATIVE EFFECTS

NEPA regulations and CEQA Guidelines require that an EIR/EIS discuss project effects that, when combined with the effects of other projects, result in significant cumulative effects. The purpose of this analysis is to identify cumulative adverse effects. The NEPA regulations define cumulative effect as:

"The effect on the environment which results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor or collectively significant actions taken over a period of time" (40 CFR 1508.7).

The CEQA Guidelines require that an EIR discuss cumulative effects "when they are significant" (Section 15130). The CEQA Guidelines define cumulative effects as "two or more individual effects which, when considered together, compound or increase other environmental effects" (Section 15355). Additionally, the CEQA Guidelines state: "The cumulative effect from several projects is the change in the environment which results from the incremental effect of the project when added to the other closely related past, present, and foreseeable probable future projects" (Section 15355).

Cumulative effects are evaluated by identifying other projects that, in addition to the alternatives, could have significant effects in the study area. The existing restoration projects in the study area include: Pine Creek, RX Ranch, and Bidwell Park. There is also an overall restoration effort within the Sacramento River conservation area being coordinated under the Sacramento River Conservation Area Forum (SRCAF), which includes both riparian restoration and the restoration of the meander zone for the Sacramento River (see Figure S-4).

Although urbanization is not a particular problem in the project area, it has been identified as a significant cause of the loss of agricultural lands in the Central Valley. Urbanization is occurring in mostly small, but sometimes large increments throughout the Central Valley. Between 1998 and 2000, 137 acres of prime farmlands and 223 acres of other important farmland were converted to urban uses in Glenn County. Figure 4-4 shows the existing urban limit line for Hamilton City. Prime farmland currently occurs within this boundary. How much of this prime farmland will be converted for urban use in the future and when it would be converted will depend upon many factors. However, it is reasonable to assume that much of it will be converted at some point in time. If land currently zoned for urban development is to be converted to urban uses, those projects would need to comply with environmental laws to evaluate potential effects. The proposed project would not affect growth trends within the existing urban limits.

The existing flood protection efforts in the study area are the Sacramento River, Chico Landing to Red Bluff project, emergency bank protection under PL84-99, and placement of rubble by private parties for bank protection. In addition, the Sacramento River Flood

Control Project, Glenn-Colusa Irrigation District Fish Screen Improvement Project was recently completed just upstream of the project area.

The project effects caused by the current project that could contribute to potentially significant cumulative effects are the effects to prime and unique farmlands and the effects caused by the placement of rock revetment along the riverbank. For other resources, effects are not adverse, only beneficial, or only short-term and do not contribute to any known cumulative effects. The proposed project would contribute to the collective beneficial effects of other restoration projects in the vicinity of the project. This collective beneficial effect would include the synergistic effect among restoration activities associated with increased connectivity, increased diversity of habitat, and the increased size of the overall restoration effort.

The alternatives considered in this EIS/EIR would contribute to the cumulative effects of the conversion of prime and unique farmland in the vicinity of the project area and throughout the valley due to other restoration efforts and to urbanization. As discussed under agricultural impacts these alternatives would not have a significant effect on prime and unique farmlands but would contribute between 1,300 and 1,600 acres to the overall conversion of agricultural land in the region. This amounts to between 0.29 percent and 0.35 percent of the total farmland in Glenn County. The conversion of agricultural lands attributed to the project is primarily occurring on lands with diminishing long-term productivity because of their current vulnerability to flooding and erosion. The improved flood protection provided by this project would contribute to higher long-term productivity on agricultural lands on the landside of the new levee. Nevertheless, the project would contribute to the loss of prime and unique farmland in the area. A total of 1,032 acres of important farmland was converted to urban or to other non-agricultural land uses in Glenn County between 1998 and 2000. This projected cumulative loss of agricultural lands may be significant.

This project has been developed to be consistent with the CALFED Programmatic Record of Decision (ROD) (August 2000). The CALFED ROD determined that the collective effect of CALFED associated activities on conversion of farmlands was a significant effect. The Corps and The Reclamation Board considered the strategies described in the ROD, Attachment A, in developing the project. In addition, the agencies considered the programmatic commitments related to implementation of CALFED actions to ensure this project would be consistent with the ROD. A more detailed discussion of how the project is consistent with these strategies and commitments is included in Section 9.1.4.

The Chico Landing to Red Bluff project provides for bank protection totaling sixteen miles at 29 sites. A total of 6,800 feet of rock was placed within the project area as part of this project. No bank protection has been placed under this authority since 1985. Another 450 feet of rock was placed in the project area under PL84-99 for emergency bank protection. Finally, private efforts to increase bank stability have resulted in the placement of 6,300 feet of rubble along the bank. Under the current project, up to 100 feet of rock and/or grouted rock and/or a concrete lining would be placed under the Gianella Bridge at Highway 32 abutment specifically to protect it from exposure to higher velocities resulting from passing higher flows. Although the current project is responsible for only 100 feet of rock placement along the existing bank, the rock is being placed to protect an existing structure, and the overall project would have long-term beneficial effects on biological resources and

water quality, there is a significant adverse cumulative effect associated with the placement of rock revetment.

## 5.6 UNAVOIDABLE ADVERSE EFFECTS

The CEQA Guidelines state that any significant environmental effects, which cannot be avoided if the project is implemented, must be described. This description extends to those significant adverse effects that can be mitigated, but not reduced to a level of insignificance.

### 5.6.1 No-Action

Under the No-Action Alternative, no unavoidable adverse effects would occur.

### 5.6.2 Combined Alternative 1

Under Combined Alternative 1, no significant unavoidable adverse effects would occur.

### 5.6.3 Combined Alternative 5

Under Combined Alternative 5, no significant unavoidable adverse effects would occur.

### 5.6.4 Combined Alternative 6

Under Combined Alternative 6, no significant unavoidable adverse effects would occur.

## 5.7 RELATIONSHIP OF SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Although changes to CEQA have eliminated the need for the EIR to address the relationship between local short-term uses of the human environment and maintenance of long-term productivity, the requirement still exists in NEPA.

### 5.7.1 No-Action

The study area is not currently subject to rezoning and remains mostly in agriculture. Since the no-action alternative would not increase levels of flood protection, it is not expected that this alternative would induce additional growth or development within the study area.

### 5.7.2 Combined Alternative 1

Combined Alternative 1 includes short-term uses of the environment that would result from restoration of the floodplain. Adverse effects could result from construction-related activities such as reduced air quality and increased noise and traffic. These short-term uses would occur only during the construction phase of the project and would not adversely affect the long-term productivity of the environment. In the long-term, planting to restore habitat would enhance the long-term productivity of the Sacramento River watershed. The long-term productivity of the restoration area would provide an overall beneficial effect from Combined Alternative 1.

### 5.7.3 Combined Alternative 5

Combined Alternative 5 would have similar effects as Combined Alternative 1. The long-term productivity of the restoration area would provide an overall beneficial effect from Combined Alternative 5.

### 5.7.4 Combined Alternative 6

Combined Alternative 6 would have similar effects as Combined Alternative 1. The long-term productivity of the restoration area would provide an overall beneficial effect from Combined Alternative 6.

## 5.8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

In accordance with the CEQA Guidelines (Sections 21083 and 21087), this Feasibility Report/EIR/EIS discusses any irreversible and irretrievable commitment of resources that would be involved in the Alternatives. Significant irreversible environmental changes are defined as uses of nonrenewable resources during the initial and continued phases of the alternatives that may be irreversible since a large commitment of these resources makes future removal or nonuse unlikely.

No-Action

The no-action alternative would not have any effect on irreversible and irretrievable commitments of resources.

Combined Alternative 1

Combined Alternative 1 would include construction activities that would include the consumption of fossil fuels and other energy resources needed to remove levees and construct a new setback levee. This work would permanently affect approximately 5.5 miles where the new levee would be constructed.

Combined Alternative 5

Combined Alternative 5 would include construction activities that would include the consumption of fossil fuels and other energy resources needed to remove levees and construct a new setback levee. This work would permanently affect approximately 5.3 miles where the new levee would be constructed.

Combined Alternative 6

Combined Alternative 6 would have similar effects as Combined Alternative 1 with an increase in the levee length to 6.8 miles. The area where the levee would be built would have a permanent change in land use.

## 5.9 IDENTIFICATION OF ENVIRONMENTAL PREFERENCES FOR ALTERNATIVES

### 5.9.1 Least Environmentally Damaging Practicable Alternative

The Congress of the United States enacted the Clean Water Act (CWA) to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Section 404 of the CWA regulates the discharge of dredge and fill materials into waters of the United

States, and establishes a permit program to ensure that such discharges comply with environmental requirements. The Corps and the U.S. Environmental Protection Agency (EPA) administer the Section 404 program. The Section 404(b)(1) Guidelines contain the substantive environmental criteria used in evaluating all Section 404 permit applications. While the Corps does not formally permit actions by its own agency, Corps is required to follow the intent of the Section 404 (b)(1) permit requirements and as such, may only propose discharges of dredged or fill material into waters of the United States that represent the **least environmentally damaging practicable alternative (LEDPA)**, so long as the alternative does not have other significant adverse environmental consequences. Generally, this is the practicable alternative that either avoids waters of the United States or impacts the smallest areas of waters, but exceptions can occur as a result of the alternative analysis process.

The tentatively selected plan (TSP) is the LEDPA for the Hamilton City Flood Damage Reduction and Ecosystem Restoration Feasibility Study. The TSP has been shown to be the most effective and efficient method of achieving the identified planning objectives consistent with plans and guidance (P&G) and other guidance. The TSP is complete, has net positive effects on environmental resources including wetland and aquatic resources and needs no other features or actions to achieve the intended objectives. Accordingly, this alternative is the LEDPA for this study. It has the least adverse impact on the aquatic ecosystem; does not cause or contribute to violations of any applicable State water quality standards, 40 CFR Section 230.10 (b) (1); complies with the Endangered Species Act (ESA) and does not jeopardize the continued existence of species listed as endangered or threatened under the 1973 ESA, 40 CFR 230.10(b)(3); does not cause or contribute to significant degradation of waters of the United States; and includes mitigation to assure that any remaining impacts are addressed. (40 CFR Section 230.10 (d)).

### 5.9.2 Environmentally Preferred Alternative

CEQ regulations implementing the National Environmental Policy Act require the identification of an environmentally preferred alternative in the Record of Decision for an EIS. After weighing the ecosystem restoration benefits against the environmental consequences of each alternative, Combined Alternative 5 was selected as the environmentally preferred alternative. It produces the greatest ecosystem restoration benefits.

### 5.9.3 USFWS Preferred Alternative

Combined Alternative 5 was identified by the USFWS in their Draft Fish and Wildlife Coordination Act Report (Appendix B) as their preferred alternative. They cite the facts that this alternative has the highest outputs of ecosystem restoration benefits and restores the largest acreage as the reasons for their selection. They also indicated that any of the proposed alternatives would be acceptable to them.

# CHAPTER 6 – PUBLIC INVOLVEMENT, REVIEW AND CONSULTATION

## 6.1 PUBLIC INVOLVEMENT PROGRAM

Public outreach and involvement in the Hamilton City Flood Damage Reduction and Ecosystem Restoration Study began under the Comprehensive Study. Public involvement for the Comprehensive Study had two main functions: to inform the stakeholders about the Comprehensive Study and to generate comments, identify concerns, and potential solutions on key issues for flood damage reduction and ecosystem restoration.

One result of the early phase of the public outreach and involvement program was the identification of several potential Initial Projects (IP's). IP's were developed as small-in-scope, site-specific projects. IP's were required to meet or be consistent with both objectives of flood damage reduction and ecosystem restoration, be vigorously supported by a non-Federal sponsor and other local and regional interests, and be complete projects, not dependent on other future actions. One IP identified for further study was the Hamilton City Flood Damage Reduction and Ecosystem Restoration Project.

Scoping and public involvement activities were conducted under the original Notice of Intent (NOI) issued for the Comprehensive Study. A series of scoping and outreach meetings, including meetings held in Chico, California, were held in February through May 1998, November through December 1998, February 1999, June 1999, October through November 2001, and August through September 2002. Initially, development of an EIS/EIR for the Comprehensive Study was intended to be at a programmatic level with the site-specific evaluation for the Hamilton City Flood Damage Reduction and Ecosystem Restoration Study packaged as an attachment to the main programmatic document. When it became apparent that there would not be an EIR/EIS developed for the overall Comprehensive Study, a separate NOI to support the Feasibility Report and EIS/EIR for Hamilton City Flood Damage Reduction and Ecosystem Restoration study was submitted on December 13, 2002. The Hamilton City NOI invited the public to comment on the results of the preliminary analysis conducted during the Comprehensive Study and to provide input to the Hamilton City Feasibility Study, including the scoping of the environmental issues that should be addressed throughout the Feasibility Study. The notice announced a public workshop, which was held on January 9, 2003, in the Hamilton Union High School Cafeteria, Hamilton City, California. The workshop was an opportunity for the study team to discuss the problems, opportunities, significant resources, and potential measures and alternatives with residents and other interested parties. The purpose of the workshop was to provide local residents and interested parties with information about the Hamilton City Feasibility Study and to provide a forum for public comment and input concerning the study.

Concerns expressed at the public scoping meeting were:

1) Water Treatment Facility
   - Protection of the water treatment facility
   - Do not relocate water treatment facility near homes or schools

2) Hydraulic Impacts
   - Avoid negative impacts to Mud and Chico Creeks
   - Avoid flooding Highway 32
   - Don't increase flows to Butte Basin

3) New Levee
   - Concern that a "ring levee" would constrain growth
   - Must rock any new levee

4) Agriculture
   - Conversion of agriculture to native habitat restoration would result in a direct loss of money to the community
   - Agricultural flooding south of Department of Fish and Game (DFG) property
   - Agriculture needs protection from higher velocity flows from the north
   - Prior to Department of Fish and Game acquisition of the property, agricultural lands flooded primarily from backwater only
   - A levee was constructed to protect the agricultural lands, but it was overtopped
   - Landowners not allowed to obtain equivalent (past) protection

5) Other
   - Why should a government agency and a conservation organization have the right to decide to let the river meander in such a manner that it is destroying private property and homes?

The study has evaluated potential adverse effects that could result from the alternative plans evaluated. The study considered both relocation and protection of the water treatment facility and ultimately determined that it could be protected as part of the potential project. The study has investigated potential hydraulic effects of potential projects to ensure that there is no adverse effect to these and other areas. Construction of a new levee has been considered as part of this study. Evaluation and comparison of alternative plans took into consideration this concern expressed by many in the community. Similarly, rock protection requirements of possible new levees were identified. The study has included an evaluation of potential effects to agriculture from a potential project.

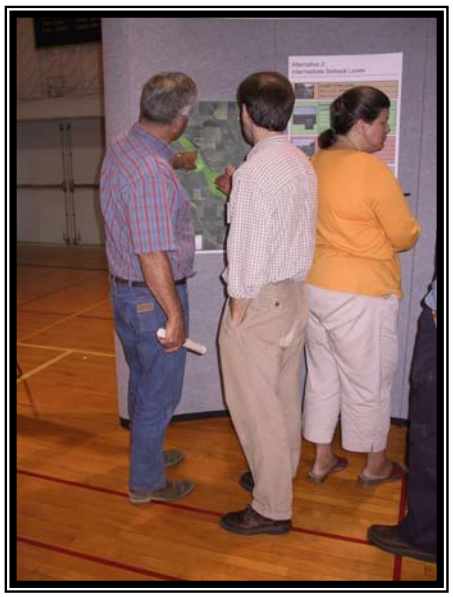


**Figure 6-1: Public Workshop June 12, 2003**

Another public meeting was held Thursday, June 12, 2003, at the Hamilton Union High School Gymnasium, Hamilton City, California (Figure 6-1). The meeting was held to present alternative plans for flood damage reduction and ecosystem restoration in the Hamilton City area; update the Feasibility Study progress; and collect public comments to further refine the study and answer questions.

Throughout the stakeholder coordination process, and at all public workshops a bilingual translator was present to ensure the entire audience was informed about study information. A bilingual project fact sheet was additionally made available to the public. The study team also had a booth at the local "Levee Festival" in which approximately 95 percent of the attendees were minority groups (Figure 6-2). The announcements were given in both English and Spanish and all of the handouts for the Hamilton City project were in both English and Spanish. The levee festivals alone help represent the Community Cohesion that has been enhanced by the development of this project.

**Figure 6-2: Hamilton City Levee Festival, October 19, 2003**

In addition to the public workshops, a series of plan formulation meetings were held from December 2002 through January 2003 to discuss the problems, opportunities, significant resources, and potential measures and alternatives. The meetings included study team members and representatives from the local community and interested agencies and organizations. Participants in the meetings included:

- Local Landowners and Residents
- Hamilton City Community Services District
- Glenn County Public Works Department
- Butte County Public Works Department
- Glenn Colusa Irrigation District
- U.S. Fish and Wildlife Service
- NOAA Fisheries
- The Nature Conservancy
- California Department of Fish and Game
- Sacramento River Partners
- Sacramento River Conservation Area Forum
- Sacramento River Preservation Trust
- California Department of Transportation (Caltrans)
- California Department of Parks and Recreation

A final public meeting was held May 6, 2004 in Hamilton City at the local high school upon the release of the draft Feasibility Report/EIR/EIS to present the findings of the feasibility study and to provide the public an opportunity to express their views on the results and recommendations of the Hamilton City Feasibility Study. Comments received both at the

public meeting and during the 45-day comment period, as well as responses, are presented in Appendix F, Comments and Responses.

## 6.2 INSTITUTIONAL INVOLVEMENT

### 6.2.1 Study Team

The Hamilton City Feasibility study team is a joint State/Federal interdisciplinary team. Study team activities include developing study scope, gathering and sharing data, formulating measures and alternative plans, and developing criteria for evaluating measures and plans. Project managers from the Corps and DWR provide direction to the study team.

### 6.2.2 Agency Participation

The study team hosts routine meetings to facilitate agency coordination by engaging other agencies that may be affected by the potential project and its implementation. Executive level direction is provided by the Executive Committee which was originally established as a part of the Comprehensive Study. The Executive Committee provides policy oversight and project managers lead the study team to ensure project execution. The Executive Committee is co-chaired by the Corps and the Reclamation Board. The role of the committee is to: 1) provide broad study direction and scope; 2) ensure adequate resources are available to the study team; 3) assist in resolving emerging policy issues; 4) ensure that evolving study results and policies are consistent and coordinated; and 5) review the comprehensive reports that the study team produces. Table 6-1 shows the Executive Committee agencies:

**TABLE 6-1: EXECUTIVE COMMITTEE**

| State Agencies | Federal Agencies |
|---|---|
| California Resources Agency | U.S. Bureau of Reclamation |
| California Department of Transportation | U.S. Army Corps of Engineers |
| California State Water Resources Control Board | U.S. National Marine Fisheries Service |
| California Department of Water Resources | U.S. Forest Service |
| California Office of Emergency Services | U.S. Natural Resources Conservation Service |
| California Department of Parks and Recreation | U.S. Environmental Protection Agency |
| California Department of Boating and Waterways | U.S. Fish and Wildlife Service |
| California State Lands Commission | U.S. Geological Survey |
| California Department of Fish and Game | Federal Emergency Management Agency |
| The Reclamation Board of California | U.S. Bureau of Land Management |
| California Department of Food and Agriculture | |
| California Bay-Delta Authority | |

During the feasibility study, coordination with the U.S. Fish and Wildlife Service (USFWS) was conducted in accordance with the Fish and Wildlife Coordination Act. The USFWS provided the Corps with a draft/final Coordination Act Report that includes their views on the tentatively selected plan. All USFWS recommendations were given full consideration. The USFWS coordinated their report with the National Marine Fisheries Service and the California Department of Fish and Game.

### 6.2.3 Local and Regional Interests

Members of the study team regularly attended Hamilton City Workgroup meetings to report on the progress of the study, solicit feedback from the workgroup, and answer questions. These meetings were held at the Hamilton City Fire Hall approximately every two months over the course of the study. The Hamilton City Community Services District led the meetings and the Sacramento River Conservation Area Forum helped with meeting facilitation. The purpose of the meetings was to provide a forum to discuss and coordinate water resources related studies, projects, and other issues affecting the Hamilton City area. Local landowners and residents, representatives of local, State, and Federal agencies, representatives from State and Federal elected officials, representatives from non-profit organizations, and others attended the meetings. Information provided by the local and regional interest groups and individuals guided the identification of resources problems and helped formulate the alternative plans to address the problems and identification of the tentatively selected plan. The Hamilton City Feasibility Study has also periodically been discussed at the SRCAF Board meetings.

## 6.3 INFORMATION MATERIALS

Available documents, announcements of upcoming meetings, meeting summaries, and other information is posted on the Comprehensive Study website (http://www.compstudy.org).

A database mailing list gleaned from past Federal and State project lists, Federal, State and local elected officials and agency staff is periodically updated by deleting and adding names to ensure a current broad-based list. The public can add themselves to the mailing list at this website.

## 6.4 PUBLIC VIEWS AND RESPONSES

A complete list of public comments and a discussion on how the Hamilton City Feasibility Study has been changed to address those comments is included in the final Feasibility Report/EIR/EIS.

# CHAPTER 7 – LIST OF PREPARERS*

The individuals listed in the following table were primarily responsible for the preparation of this report.

**TABLE 7-1: LIST OF PREPARERS**

| Name | Discipline | Credentials | Role in the Study |
|---|---|---|---|
| Jerry Gianelli, Project Manager | 31 years Corps of Engineers; Military and Civil Works Projects, Project Management and Construction – CA, GA, and Germany | BSCE: University Santa Clara; BS General Science, University of San Francisco | Project Manager, Report Review |
| William Craig Gaines, Project Manager | 16 years Corps of Engineers, 13 years private engineering experience | BS: Petroleum Engineering University of Tulsa 1975, University of Tulsa Law School 1975-1978 | Project Manager, Report Review |
| Gary Lemon, Project Manager | DWR Project Engineer 2 years SDDENR<br>3 years DWR | BS: Geological Engineering, Montana Tech of the University of Montana, 1998 | State Project Manager, GIS, Modeling, Report Preparation, Report Review, Engineering Technical Lead preliminary draft document |
| Alicia Kirchner, Water Resources Planning Specialist | 14 years Corps of Engineers | BA: History, CSUS 1993; Regional plan formulation specialist | Guidance and Review, report preparation, Project Manager |
| Mark Cowan, Water Resources Planner | 11 years Corps of Engineers; Program, Project Manager and Water Resources Planner | BS: Mining Engineering, University of Nevada 1993 | Lead Planner; plan formulation and evaluation, Engineering Technical Lead; for post draft document, report preparation |
| Eric Thaut, Water Resources Planner | 9 years Corps; Civil Engineer and Water Resources Planner | BS: Civil Engineering, University of Washington, 1994 | Lead Planner; plan formulation and evaluation, report preparation |
| Sara Schultz, Water Resources Planner | 5 years Corps of Engineers Planning, 2 years private Landscape Architecture | BA: Art History, UC Berkeley, 1990. MLA: CSU Pomona, 1996. | Plan Formulation and evaluation. Report Preparation Graphic Preparation |
| Erin Taylor, Environmental Manager | 5 years planning studies, Corps of Engineers | BS: Environmental Biology and Management, UC Davis | Plan formulation and evaluation,<br>Impact Assessment, Report Preparation |

| Name | Discipline | Credentials | Role in the Study |
|---|---|---|---|
| Ed Flint, Geotechnical Engineer | 10 years Corps of Engineers; 4 years US Government DOD-Executive Office | BS: Geological Sciences; MS: Civil Engineering; U of Washington | Engineering Technical Lead for public review document |
| Robert Koenigs, Environmental Manager | 20 years Corps of Engineers civil works planning; 7 years resource management | BA: Environmental Biology, UC Santa Barbara; MS: Range Management; PhD: Ecology, UC Davis | Environmental Impact Analysis, report preparation |
| Melisa Helton, Environmental Manager | Corps Environmental Manager, 3 years of resource management and environmental compliance | MS: Wildlife Ecology and Management | Recreation Plan Formulation and Evaluation |
| Mike Welsh, Environmental Manager | 27 years Corps of Engineers | BS: Biology | Ecosystem Function Model |
| Elizabeth Holland, Environmental Manager | 18 years Corps of Engineers | NEPA Compliance | Water Quality for EIS/EIR |
| Josh Garcia, Environmental Manager | 5 years planning studies, Corps of Engineers | BS: Natural Resources Planning | Report Preparation and Impact Assessment |
| Sandra Jaenicke, Technical Editor/Writer | 2 years planning studies, Corps of Engineers; 14 years technical writing experience | BA: English, University of Oregon | Document Editing and Preparation |
| Lynne Stevenson, Environmental Writer | 24 years Corps of Engineers; 6 years professional librarian | BA: Biological Sciences, 1972; MLS: Library Science, 1974; MS: Water Science, 1983 | Review of Air Quality and Water Quality, Ag/Prime and Unique Farmland |
| Richard Perry, Cultural Resources Specialist | 14 years Corps of Engineers; | BA: Anthropology; Metropolitan State College of Denver, Coursework completed towards MA: Cal State University, Los Angeles; Anthropology | Cultural Resources |
| Melissa Montag, Historian | 3 years Corps of Engineers, 2.5 year cultural resources | BA: History; MA: History, concentration in Public History, California State University Sacramento | Cultural Resources |

| Name | Discipline | Credentials | Role in the Study |
|---|---|---|---|
| Annalena Bronson | 20 years DWR Environmental (CEQA) | BA: Environmental Studies | Environmental Documentation |
| Kim Emerick, Environmental Engineer | 3 years Corps of Engineers and 12 years of Environmental Engineering experience with other government entity | BS: Chemical Engineering and Cross Connection Specialist | HTRW Analysis and Report Preparation |
| Steve Cowdin, Economist | 25 years DWR Economist | BA: Economics, CSU Chico, 1972; MS: Public Administration, CSU Chico, 1977 | Economic Analysis, Report Preparation |
| Kurt Keilman, Economist | 9 Years with the Corps of Engineers; 2 Years with Tetra Tech, Inc. | M.A.- Economics- University California Santa Barbara B.A.- Economics- California State University, Sacramento | Economic Analysis, Report Preparation |
| Gary Bedker, Agricultural Economist | 3 years Corps of Engineers; 20 years of Land and Water Resource Economics | BA: Agricultural Economics; MA: Agricultural Economics | Agriculture Economic Damage Assessment |
| Brett Whitin, Hydraulic Engineer | Hydrologic/Hydraulic Engineering | MS: Civil Engineering Hydrology/Reservoir Operations | Hydrology |
| Laurine White, Hydrologist | 34 years Corps of Engineers Hydrology studies | BA: Mathematics, Sacramento State College | Hydrology |
| Don Twiss, Hydraulics | 29 years Water Resource Projects 14 years Corps of Engineers | BS, Civil Engineering, CSUS PE: Civil Engineering | Hydraulics Sediment Trans-Geomorphology |
| Nathan Cox, Hydraulic Design | 1 year Corps of Engineers | EIT, MS: Civil Engineering | Hydraulic Analysis |
| Jane Bolton, Geotechnical Engineer | 15 years Corps of Engineers | BS: Geology, Univ. of Massachusetts; MS: Civil Engineering, Colorado State Univ. PE: Civil Engineering | Geotechnical Analysis and Report Preparation |

| Name | Discipline | Credentials | Role in the Study |
|---|---|---|---|
| Jeff Taylor, Geotechnical Engineer | 1 year Corps of Engineers | MS: Civil Engineering, University of Colorado at Boulder | Geotechnical Analysis and Report Preparation |
| James Lee, Landscape Architect | 11 years Landscape Architecture, 4 years with Corps of Engineers | BS: Landscape Architecture: Cal Poly, San Luis Obispo | Landscape Architectural technical team member |
| Jerry Blevins, Civil Engineer, Engineering Division Design Branch, Civil Design Section | 32 years professional experience Corps of Engineers; Licensed PE in California, Nevada | BSAE: Aerospace Engineer Cal Poly, SLO; MSAE Program: USC; BSCE: Civil Engineering | Civil Design |
| Kevin Leahy, Cost Engineer | 32 years with USACE, 23 years Cost Engineering | AA: Civil Engineering Technology "Certified Cost Engineering Technician" by the DoD Tri-Service Cost Engineering Certification Board | Cost Engineering |
| James Oliver, GIS/Mapping Specialist | 1 year Corps of Engineers; 5.5 years GIS | BS: Management Information | GIS Analysis |
| George Heubeck, Real Estate (Appraisals) | Real Estate Appraiser, 30 years USACE, 8 years District Review Appraiser, 2 years | BA: International Affairs/Economics Florida State University | Real Estate Valuation |
| Jim Henriksen, Real Estate Mapping | 8 years Corps of Engineers, 30 years Real Estate Appraisal | | Real Estate Mapping |
| Judy Fong, Real Estate | Real Estate Planning & Control, 6 years Corps of Engineers Budget Analyst | BS: Accounting; MS: Business Administration; Real Estate Broker License | Real Estate Cost Estimating |
| Kerry Curtis, Attorney, Corps of Engineers | 15 years private sector, 2 year Corps of Engineers | BA: Communication; JD: Alabama School of Law | Legal Review |
| Debra M. Odle, Budget Analyst | 18 years Corps of Engineers; Budget Analyst | | Budgeting and programming |

| Name | Discipline | Credentials | Role in the Study |
|---|---|---|---|
| **Independent Technical Review Team** | | | |
| Matt Davis, NEPA Compliance Technical Specialist | 19 years Corps of Engineers, environmental planning | BA: Zoology 1982, Humboldt State University MS: Biological Sciences 1990, Sacramento State University | Independent Technical Review (ITR) Chairperson and reviewer |
| Scott Miner, Ecosystem Restoration Planner | 24 years Corps of Engineers | BA: Biology 1979; MS: Wildland Resource Science, 1981 | ITR Plan Formulation and Ecosystem Restoration |
| Jerry Fuentes, Environmental Compliance | 12 years Corps of Engineers | MA: History | ITR Environmental Compliance |
| Mike Dietl, Fisheries Biologist | 7 years Fisheries Biologist, 5 years Corps of Engineers | BS: Fisheries, California State University at Humboldt | ITR/Value Engineering |
| Daniel Sulzer, Economist, Corps of Engineers | 14 years Corps of Engineers Economics | BA: Economics, Occidental College, 1984 | ITR Economics |
| Bob Collins, Hydrologist | 34 years Corps of Engineers | Registered Hydrologist | ITR Hydrology |
| Bob Vrchoticky, Hydraulics/Geomorphology | 19 years Corps of Engineers | BS: Civil Engineering, University of Iowa, 1984 PE: Civil Engineering | ITR Hydraulics Design |
| Joe Sciandrone, Geotechnical Engineer | 19 years Corps of Engineers | BS: Civil Engineering, California State University – Sacramento; California Licensed Civil Engineer, License No. C-42918; Member of the American Society of Civil Engineers | ITR Geotechnical Engineering |
| Paul Hsia, Civil Design | 14 years Corps of Engineers/13 years of TVA, & 2 years in private. | MS: Civil/Structural Engineering, & BS: Civil Engineer. | ITR Civil Design |
| Sid Jones, Landscape Architect | 15 years Corps of Engineers; 20 years Landscape Architecture | Landscape Architecture License; California | ITR Revegetation Plan |
| Sherman Fong, Cost Engineering | 19 years Corps of Engineers | BS: Civil Engineering | ITR Cost Estimating |

| Name | Discipline | Credentials | Role in the Study |
|---|---|---|---|
| Dan Fodrini, Real Estate | 10 years Corps of Engineers, 20 years private sector | | ITR Real Estate |

# CHAPTER 8 – COMPLIANCE WITH APPLICABLE LAWS, POLICIES, AND PLANS

The regulatory requirements discussed below must be met before any of the project alternatives are implemented.

## 8.1 FEDERAL REQUIREMENTS

### 8.1.1 National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) (42 U.S. Government Code [USC] 4321, 40 Code of Federal Regulations [CFR] 1500.1) applies to any action that requires permits, entitlement, or funding from a Federal agency; is jointly undertaken with a Federal agency; or is proposed on Federal land. NEPA requires every Federal agency to disclose the environmental effects of its actions for public review purposes and for assisting the Federal agency in assessing alternatives to and the consequences of the proposed action. NEPA requires that an environmental document be prepared that considers, discloses, and discusses all major points of view on the environmental impacts of the recommended plan and alternatives.

This portion of the Integrated Feasibility Report/EIR/EIS is in support of a proposed levee realignment and ecosystem restoration project that would be built by the Corps. This document provides the information required by NEPA for the decision-makers to consider the environmental consequences of the no-action and action alternatives. The Corps is the lead Federal agency for NEPA for this project.

The draft Feasibility Report/EIR/EIS was distributed for a 45-day public review in April 2004. Full compliance will be achieved when this final Feasibility Report/EIR/EIS and Record of Decision are filed with the EPA.

### 8.1.2 Endangered Species Act (ESA) of 1973, as Amended

The Endangered Species Act of 1973 requires any Federal agency to consult with the USFWS before taking any action that may affect a listed species. The Federal agency must first avoid an action that may adversely affect a listed species. If the Federal action cannot avoid an adverse effect on listed species then the Federal agency must enter into formal Section 7 consultation with USFWS and/or NOAA Fisheries to identify appropriate measures to avoid, minimize, and compensate for the effect (USFWS 1996).

The lead agencies have been informally consulting with the USFWS and NOAA Fisheries since 1998 in anticipation of a programmatic document for the Sacramento and San Joaquin River Basins Comprehensive Study. As part of the Hamilton City study, the lead agencies have begun informal consultation in accordance with Section 7 of the ESA. The lead agencies requested and received from the USFWS, a list of endangered, threatened, and proposed species. This list was dated April 11, 2001, and updated lists were received on October 21, 2003 and November 6, 2003 (Appendix B1).

Informal consultation with USFWS has continued throughout the planning process and has included site visits with the Endangered Species Section. It has been assessed that the recommended plan would have only beneficial effects to threatened and endangered species under USFWS jurisdiction. However, future OMRR&R activities under the project may require affects to elderberry plants that were planted or otherwise established by the projects restoration activities. These effects to elderberry plants may in turn affect the VELB. A Biological Assessment was provided to the USFWS on April 1, 2004 to initiate formal consultation under the ESA for the purpose of acquiring an incidental take permit for VELB for future OMRR&R activities.

The USFWS responded with a Biological Opinion (BO; Appendix B1), dated June 30, 2004 and amended August 3, 2004, that concluded the proposed project, including proposed conservation measures, "is not likely to jeopardize the continued existence of the beetle" and would "result in the establishment of a significant amount of habitat for the valley elderberry longhorn beetle that will be of long-term benefit to this listed animal, and any adverse effects will be temporary and relatively minor in nature." The BO includes an incidental take statement, which provides an exemption from prohibitions against take of VELB due to project related activities, including OMRR&R and flood-fighting activities.

The Corps has also conducted informal consultation with NOAA Fisheries for anadromous fish that are found in the study area. Although the recommended plan overall is expected to be beneficial for anadromous fish, addition of a rock protection feature at the Gianella Bridge could have some adverse effects. The Corps submitted a Biological Assessment (BA) to NOAA Fisheries with the finding that the recommended plan "may affect" listed or proposed species under their jurisdiction. The BA requested initiation of formal Section 7 consultation.

NOAA Fisheries responded with a letter, dated June 23, 2004 (Appendix B1), Based on avoidance, minimization, and restoration measures included in the project design, including the scheduling of the placement of in-water riprap for the period from June 1 to July 15, NOAA Fisheries concluded that the risk of adverse effects to anadromous fish, designated critical habitat, and essential fish habitat would be negligible. Therefore, they concluded that formal consultation would not be required.

### 8.1.3 Fish and Wildlife Coordination Act (FWCA)

The Fish and Wildlife Coordination Act was authorized on March 19, 1934, to authorize State and Federal agencies to work together to protect, rear, stock, and increase the populations of game and fur-bearing species. The Coordination Act was amended in 1946, adding the requirement to consult with USFWS and State fish and wildlife agencies when a Federal project would affect a body of water. The consultation was to prevent the loss or damage to wildlife habitat and resources. The 1958 amendments recognized the importance of wildlife resources to the United States and required coordination with other water resource agencies for the purpose of protecting wildlife resources. The amendments expanded the types of water projects that were required to consult with USFWS (USFWS, 2003).

The USFWS has prepared the Coordination Act Report (CAR), which contains the Habitat Evaluation Procedure (HEP) analysis as an appendix. The CAR and the HEP can be found in Appendix B.8. The HEP analysis was completed in 2003 to determine the anticipated

Future benefits to fish and wildlife resources as a result of implementation of the alternatives. The HEP team includes representatives from the Corps and USFWS. The results of the HEP analysis show that habitat values for all alternatives increase over the baseline condition.

The CAR was prepared in compliance with the FWCA and documents the consultation between the Corps and the USFWS on the effects of the alternatives on fish and wildlife resources. The CAR was sent July 9, 2004 and includes the following recommendations:

- Choose Alternative 5.
- Use native grasses when planting grass species.
- Develop and implement a vegetation monitoring program as part of the project. Monitoring the riparian restoration effort should focus on recording tree survival rates, the quantification of improved habitat values for wildlife (primarily bird species) by measuring percent tree and shrub cover, average height of overstory trees, canopy layering, and total woody riparian vegetation, and developing recommendations for alternative methods of riparian restoration should initial efforts fail. A vegetation monitoring report should be submitted annually for the first 5 years after planting activities, and on the 10$^{th}$, 15$^{th}$, and 20$^{th}$ year after planting. The monitoring reports should also identify any shortcomings in the restoration effort and include remedial actions on how to improve restoration efforts. All phases of the revegetation and monitoring programs should be coordinated with, and approved by, the Service, CDFG, and NOAA Fisheries.
- Comply with the Proposed Conservation Measures in the biological opinion from the USFWS .
- Complete the appropriate consultation with the CDFG regarding impacts to State listed species, and NOAA Fisheries, as required under section 7 of the Endangered Species Act, for potential impacts to anadromous fish and marine species under NOAA Fishery's jurisdiction.

The Corps has reviewed these recommendations and has the following responses:

- Alternative 6 was identified as the recommended plan because it reasonably maximizes both ecosystem restoration and flood damage reduction benefits compared to costs.
- Native grasses will be used whenever planting grasses.
- The Corps will conduct vegetation monitoring over the first 5 years after planting as part of construction costs. Recommendations made by the Service for this monitoring will be incorporated into the monitoring plans. Coordination with NOAA Fisheries during the revegetation and monitoring program will not be conducted since this work would be outside their area of jurisdiction. Monitoring during the 10$^{th}$, 15$^{th}$, and 20$^{th}$ year after planting would be incorporated into the project's O&M plan and conducted by the project sponsor.
- The Corps will comply with a set of Proposed Conservation Measures that are agreeable to the Service, the Corps, and the Reclamation Board.

- Appropriate consultations regarding special status species have been completed with the Service, CDFG, and NOAA Fisheries.

### 8.1.4 Section 106 of the National Historic Preservation Act (NHPA)

Section 106 of the National Historic Preservation Act (NHPA) requires a Federal agency to consider the effects of Federal undertakings on historical and archeological resources. Under these requirements, the area of potential effect (APE) of the selected project shall be inventoried and evaluated to identify historical or archeological properties that have been placed on the National Register of Historic Places and those that the agency and the State Historic Preservation Officer (SHPO) agree are eligible for listing in the National Register. If the project is determined to have an effect on such properties, the agency must consult with the SHPO and the Advisory Council on Historic Preservation (ACHP) to develop alternatives or mitigation measures and afford the ACHP an opportunity to comment with regard to undertakings that may affect historic properties. The implementing regulation for Section 106 is 36 CFR Part 800 (revised 2001), "Protection of Historic Properties" which requires Federal agencies to initiate Section 106 consultation with the SHPO.

The evaluation of historic properties as part of this Feasibility Report/EIR/EIS complies with the NHPA as it applies to the no action and action alternatives. A records check of known cultural resources and past surveys was completed in July 2001. In accordance with Section 106 of the NHPA, the Corps has consulted with the California SHPO in a letter dated August 4, 2003, asking for their comments on the APE. A letter dated January 22, 2004, from the SHPO concurred with the Corps' identification of the APE. Some sites in the area of potential affect (APE) have not been recently surveyed; necessary surveys will be completed. If additional cultural resources are identified during the field surveys, evaluations and effect determinations will be made in accordance with Section 106 review process. Unavoidable adverse effects to historic properties will be mitigated in accordance with the NHPA. Prior to the initiation of construction, an updated records check and thorough field surveys will be conducted.

### 8.1.5 Farmland Protection Policy Act (FPPA)

The FPPA was authorized to minimize the unnecessary and irreversible conversion of farmland to nonagricultural use due to Federal projects. FPPA protects prime and unique farmland, and land of statewide or local importance. The FPPA protects forestland, pastureland, cropland, or other land that is not water or urban developed land.

The FPPA requires a Federal agency to consider the effects of its action and programs on the Nation's farmlands. The FPPA is regulated by the NRCS. The NRCS is authorized to review Federal projects to see if the project is regulated by the FPPA and establish what the farmland conversion impact rating is for a Federal project. The Corps is required to provide the Natural Resources Conservation Service (NRCS) with project maps and descriptions to assess impacts on prime and unique farmlands.

Project maps and descriptions of the alternatives were sent to NRCS. The NRCS, in turn, conducted an analysis and responded with a Farmland Conversion Impact Rating letter (see Appendix B). The NRCS determined that the relative value of farmland to be converted was rated at 75, out of a possible 100, based on an evaluation using the Storie Index. The

Corps completed the site assessment portion of the rating, giving the site a rating of 95 out of a possible 160 points. Thus, the combined score was 170. According to the Farmland Protection Policy Act, farmland receiving a farmland conversion impact rating less than 160 need not be given further consideration for protection, and alternative actions do not need to be considered. The U.S. Department of Agriculture recommends that sites receiving scores totaling 160 or more be given increasingly higher levels of consideration for protection. Alternatives were considered, but all alternatives had similar ratings. Project objectives constrained the consideration of alternative locations for the project. The effects of alternatives on these farmlands are discussed in Chapter 5.

### 8.1.6 Clean Water Act (CWA)

Federal and State laws regulate the physical, chemical, and biological characteristics of the Nation's water systems. The Clean Water Act (CWA) is the Federal law that establishes the baseline that all other State and local water quality laws must meet. The CWA's objectives are to regulate water pollution and water quality so that the Nation's waterways can be restored and maintained. The U.S. EPA is the agency that enforces the CWA. The CWA's first goal is to eliminate all pollution discharge into the Nation's waterways. The second goal is to make all the Nation's waterways safe for all animal and human use. The CWA regulates oceans, lakes, river, and any other water systems, water or chemical discharges, and the action of any Federal agency. The CWA establishes standards; enforces procedures; and develops regulatory programs, permits, grants, and procedures on other water quality related issues. All State and local laws must meet the standards and regulations established by the CWA.

Section 404 of the CWA regulates the discharge of the dredged or fill material into wetlands and waters of the United States. The Corps and the U.S. EPA both have responsibilities in administering this program and typically issue permits for these regulated activities after notice and opportunity for public hearings. Individual permits and general permits are issued for activities that may affect wetlands and waters of the United States. The General permit program, which includes Nationwide permits, is for activities that are similar in nature or that would likely cause minimal environmental effects. Although the Corps does not issue itself permits for its own Civil Works projects, Corps regulations state that the Corps does have to comply with the intent of the Regulatory permitting process and must apply the guidelines and substantive requirements of Section 404 to its activities.

The only activity associated with the recommended plan that would affect wetlands or other waters of the US is the placement of rock at Gianella Bridge. This activity would be covered for Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act under Nationwide Permit #14 for Linear Transportation Projects. The setback levee would be located to avoid impacts to the wetlands associated with Dunning's Slough. A 404(b)(1) analysis has been written for the potential in-water work of placement of rock at the bridge, in compliance with the Federal Register December 24, 1980 Section 230.12 guidelines (Appendix B). The Corps has determined that this project as proposed is consistent with the Section 404(b)(1) guidelines and in compliance with the Clean Water Act and meets the Section 404(r) exemption criteria. The Corps plans to seek an exemption from the requirement to obtain State water quality certification under Section 404(r) of the Clean Water Act.

### 8.1.7 Clean Air Act (CAA)

The Federal Clean Air Act (CAA) was enacted in 1969 to protect public health by regulating the amount of pollutants in the air. The act established primary and secondary National Ambient Air Quality Standards (NAAQS) that all states must regulate and maintain (Table 4-3). The NAAQS include the amount of pollutants allowed in the air based on the sensitivity level of the public. Primary pollution levels are pollution levels safe for sensitive receptors such as children, elderly, and asthmatics. Secondary pollution levels are levels of pollutants safe for the general public.

The Federal CAA also delegated primary enforcement to the states. In California, the Air Resources Board (ARB) has been designated as the responsible agency for all air quality regulation. The State must promulgate rules and regulations that promote the goals of the Federal CAA and assist in their attainment. The State's rules and regulations must be at least as stringent as the mandated Federal requirements. In states where one or more of the criteria pollutants exceed the NAAQS, the state is required to prepare a State Implementation Plan, which determines how the state intends to meet the standards in a timely manner as detailed in the Federal CAA . In California, the Air Resources Board develops and implements the State Implementation Plan.

In 1990, the Federal CAA was amended. New criteria were established for non-attainment classifications, emission control requirements, and compliance dates for geographic areas that are in non-attainment for one or more pollutants. In addition, the amended act requires that any Federally-funded project must comply with the air quality standards and regulations that have been established by State Implementation Plans.

The U.S. Environmental Protection Agency (EPA) developed the General Conformity Rule, which became effective on January 31, 1994, to implement Section 176c of the Federal CAA. The underlying principle of the General Conformity Rule is that Federal actions must not cause or contribute to any violation of a NAAQS. A conformity determination is required for each pollutant where the total of direct and indirect emissions caused by a Federal action in a non-attainment area exceeds *de minimis* threshold levels listed in the General Conformity Rule (40 CFR 93.153).

The proposed alternatives would not violate any standards, increase violations, exceed the U.S. Environmental Protection Agency's conformity de minimis thresholds, or hinder the attainment of air quality objectives in the local air basin. A letter from the Glenn County Air Pollution Office received July 2003 included mitigation measures, which have been included in the Air Quality discussion in Chapter 5. The Corps has determined that the work would have no significant adverse effects on the future air quality of the area if these mitigation measures are implemented. Since the proposed alternatives would not exceed *de minimis* thresholds, a conformity determination is not required.

### 8.1.8 Wild and Scenic Rivers Act

The purpose of this act is to preserve and protect wild and scenic rivers and immediate environments for the benefit of present and future generations. Congress must approve any action that would affect a Congressionally-designated river.

Near the study area, Upper Big Chico, Upper Butte Creek, Upper Deer Creek, and the middle fork of Upper Stony Creek above Black Butte Reservoir have been designated Wild and Scenic Rivers. These river reaches are all outside the project area of impact.

### 8.1.9 Executive Order 11988, Floodplain Management

To comply with this Executive Order (EO), the policy of the Corps is to formulate projects that, to the extent possible, avoid or minimize adverse effects associated with use of the without-project floodplain, and avoid inducing development in the existing floodplain unless there is no practicable alternative. One objective of the study is to return flooding to the floodplain; in addition, project alternatives have been developed to reduce flood damages in the Hamilton City area. All proposed alternatives restore function to the floodplain and are therefore in full compliance with this EO.

### 8.1.10 Executive Order 11990, Wetlands

Executive Order 11990, Wetlands, directs the Corps to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands implementing Civil Works projects. For the recommended plan, wetlands would be avoided through the design and siting of the setback levee.

### 8.1.11 Executive Order 12898, Environmental Justice

Executive Order 12898, Environmental Justice, requires that environmental analyses of proposed Federal actions address any disproportionately high adverse human health or environmental effects on minority or low-income communities. Federal agencies' responsibility under this order shall also apply equally to Native American programs. In addition, each Federal agency must ensure that public documents, notices, and hearings are readily accessible to the public.

Based on Table 4-10, the population of Hamilton City can be described as primarily a minority, low-income population, thereby falling under the protection of Executive Order 12898, titled "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations." The 1999 Glenn County per capita income was about $18,015, which was about 60 percent of the California average (Table 4-10). The 1999 Hamilton City per capita income was about $9,015, which was about 50 percent of the Glenn County figure. Median household values in Hamilton City are below the state average. The foreign-born population percentage of Hamilton City is significantly above the state average.

The fair treatment of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies has been included in the development of this study. The EIS has not identified any adverse human health or environmental effects that could be disproportionately high for selected populations within the community. The impacts of the project alternatives would affect the farming community, and those economically linked to the farming community, equally.

Mailing notices and distribution of other project information included property owners and potentially affected persons and institutions without any distinction based on minority or income status. The local farming community has been invited to all public meetings and their representatives have attended plan formulation meetings to ensure input into the planning process. A bilingual translator has been present at stakeholder meetings and public workshops.

The recommended plan would benefit the low-income community of Hamilton City by decreasing the potential flood damages to the community and restoring the ecosystem of the surrounding area. For 30 years, it was not economically feasible to develop a flood damage reduction only project for the Hamilton City area due to the lack of a benefit/cost ratio greater than 1.00. The inclusion of ecosystem restoration into the project allows for the minority, low-income community to receive increased flood protection and ultimately has an overriding beneficial effect on the local community. The local farming community has been invited to all public meetings and their representatives have attended plan formulation meetings. Loss of agricultural land could have a targeted effect on the agricultural workers; however, the amount of converted land would result in a 0.3 percent countywide reduction of jobs, which is not considered significant.

Members of the study team regularly attended Hamilton City Workgroup meetings to report on the progress of the study, solicit feedback from the workgroup, and answer questions. These meetings were held at the Hamilton City Fire Hall approximately every two months over the course of the study. The Hamilton City Community Services District led the meetings and the Sacramento River Conservation Area Forum helped with meeting facilitation. The purpose of the meetings was to provide a forum to discuss and coordinate water resources related studies, projects, and other issues affecting the Hamilton City area. Local landowners and residents, representatives of local, State, and Federal agencies, representatives from State and Federal elected officials, representatives from non-profit organizations, and others attended the meetings. Information provided by the local and regional interest groups and individuals guided the identification of resources problems and helped formulate the alternative plans to address the problems and identification of the tentatively selected plan. The Hamilton City Feasibility Study has also periodically been discussed at the Sacramento River Conservation Area Forum (SRCAF) Board meetings.

### 8.1.12 Noxious Weed Act of 1974 (NWA)

The Noxious Weed Act (NWA) was authorized to control and manage the spread of nonnative plant species that may have adverse affect on agriculture, commerce, wildlife resources, or public health. The NWA inhibits the transport, trade, or sells of noxious plant species in the United States. The NWA gave the Secretary of Agriculture the authority to determine which plants species are noxious plant species and to establish measures to control them. The NWA requires all Federal Agencies to establish a management plan to control the spread of noxious plant species in the agencies jurisdictions. A Federal agency has the authority to stop the spread of noxious plant species within their jurisdictions (Federal Wildlife Laws Handbook 2003).

### 8.1.13 Executive Order 11514, Protection and Enhancement of Environmental Quality

Executive Order 11514 was signed by the President on March 1, 1970, with the purpose of protecting the U.S. environmental quality and the quality of human environment (Executive Order 11514). Executive Order 11514 requires Federal agencies to develop policies, programs, or measures that meet national environmental goals established by NEPA and other environmental laws. Federal agencies shall monitor, evaluate, and control activities so that they protect and enhance the quality of the environment. Agencies must consult with the appropriate Federal, State, and local agencies to develop and modify activities or measures to protect and enhance environmental quality.

Executive Order 11514 requires Federal agencies to provide the public with information on any activity that may affect environmental quality and the quality of human life, and obtain the public's opinion on these activities. The project, program, or activity information provided to the public shall include the alternatives that can be taken, and encourage State and local agencies to provide the public with information on any activity they may take that could affect environmental quality Executive Order 11514). The recommended plan would restore 1,500 acres of native habitat, thereby contributing to the protection and enhancement of environmental quality.

### 8.1.14 Migratory Bird Treaty Act of 1918 (MBTA)

The Migratory Bird Treaty Act (MBTA) formed an agreement between Canada, Japan, Mexico, and Russia to protect migratory birds (Department of Energy Environmental Policy and Guidance 2001). The MBTA establishes treaties and conventions to establish policies and management approaches to protect the migratory birds that migrate between the participating countries (USFWS, 2003). The MTBA regulates the trapping, capturing, killing, transportation, trade, or sales of migratory birds, their eggs, parts, and nests. The MTBA is regulated and enforced by the Department of Interior. Section 704 of the MBTA gives the Secretary of the Interior the authority to determine the management measure required to ensure that take is compatible with the protection of migratory bird species according to distribution and population in the U.S. (Department of Energy Environmental Policy and Guidance 2001). The recommended plan would create an additional 1,500 acres of native habitat that would be available as a layover and rest area for migratory birds. The recommended plan would not have any negative effects on migratory birds.

### 8.1.15 Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act)

Congress passed the Magnuson-Stevens Act in 1976, which gave the National Marine Fisheries Service (NOAA Fisheries) the authority to regulate fisheries in the United States. The area of authority covers a range of 3 nautical miles from the land edge to 200 nautical miles out to sea. This area of authority is called the Exclusive Economic Zone (EEZ). The goals of the Magnuson-Stevens Act were to phase out foreign fishing operations in the EEZ, prevent overfishing, allow overfished species to recover, and protect and manage fishery resources (Pacific Fishery Management Council 2003).

The Magnuson-Stevens Act was amended in 1996, to place the focus on sustainability of fisheries resources, habitat conservation, and the standard for maximum sustainable levels for fisheries. The FMP now includes the protection of essential fish habitat (EFH). EFH is habitat that is essential for the spawning, foraging, breeding, and growth of aquatic species

The 1996 amendments established the National Standards. The National Standards prevent overfishing while having optimum fish harvest yields, not favoring residents of one state over another. The National Standards promote efficiency, minimize cost, and avoid duplication and ensure that economic reasons are not the sole purpose for conservation and management plans. The National Standards also establish contingencies for fisheries management plans. Fisheries management plans should recognize the importance of fishery resources to fishing communities, be consistent with conservation guidelines, prevent overfishing, allow for recovery if overfished, and minimize bycatch or mortality from bycatch. The National Standards also promote human safety while at sea (Pacific Fishery Management Council 2003).

Effects of the recommended plan to EFH are expected to be beneficial. All the newly floodable area may be considered EFH habitat upon project implementation. The conclusion of the EFH analysis is that there are no adverse effects, and no consultation is required with NOAA Fisheries.

### 8.1.16 Federal Water Project Recreation Act

The Federal Water Project Recreation Act (16 USC Sec. 460L-5, 460L-12 et seq., 662) requires Federal projects to consider features that would lead to enhancement of recreational opportunities. Recreation features are not included in the recommended plan. There is a separate ongoing study for implementation of recreation features in the area by the Department of Parks and Recreation.

### 8.1.17 Americans with Disabilities Act (ADA), Rehabilitation Act, and Architectural Barriers Act (ABA)

The Americans with Disabilities Act (ADA) of 1991, the Rehabilitation Act, and the Architectural Barriers Act (ABA) Title II, require projects administered by State and local governments to provide program accessibility to persons with disabilities as long as providing accessibility would not fundamentally change the purpose of the project. Section 504 of the Rehabilitation Act requires program accessibility for persons with disabilities to any program or activity receiving Federal financial assistance. The ABA requires accessibility for persons with disabilities to Federally-financed facilities constructed or altered on behalf of the United States. The recommended plan does not construct any facilities that would be required to conform to the ADA, Rehabilitation Act, and ABA.

### 8.1.18 Noise Control Act of 1972 (NCA)

Congress passed the Noise Control Act (NCA) on October 27, 1972, to protect the quality of human life from adverse affects from noise. The NCA requires Federal agencies activities that may produce noise to comply with all Federal, State, and local laws and regulations that regulate noise levels. Federal agencies are required to furnish to the EPA

information regarding the nature, scope, and results of noise research or noise-control programs upon request. Mitigation measures have been incorporated into the project development to reduce noise levels to less than significant levels. However, Federal agencies may be required to purchase equipment that is certified "low-noise emission" if the Administrator of General Services determines the price of the equipment to be reasonably priced, reliable, and available (Environmental Desk Reference 1996).

## 8.2 STATE REQUIREMENTS

### 8.2.1 California Environmental Quality Act (CEQA)

The California Environmental Quality Act (CEQA) applies to an action that is directly undertaken by a California public agency; is supported in whole or part by California public agency contracts, grants, subsidies, loans, or other assistance for a public agency; or involves the issuance by a California public agency of a permit, lease, license, certificate, or other entitlement for use by a public agency. CEQA requires State, regional, and local agencies to prepare environmental documents assessing the significant environmental impacts of the recommended plan, to circulate these documents to other agencies and the public for comment, and to consider comments in their decision-making.

The CEQA lead agency for this project is the Reclamation Board. This Feasibility Report/EIR/EIS has been prepared jointly with the Federal lead agency to meet State lead agency CEQA requirement. Upon certifying the document, the CEQA lead agency will adopt a reporting or monitoring program for the changes made to the project or the conditions of project approval to mitigate or avoid significant effects on the environment. The draft Feasibility Report/EIR/EIS constitutes partial compliance with CEQA. Full compliance will be achieved when the final Feasibility Report/EIR/EIS and Notice of Determination is submitted to the Office of Planning and Research.

### 8.2.2 California Endangered Species Act (CESA)

Compliance with the California Fish and Game Code is required if a species listed as a candidate, threatened, or endangered under the California Endangered Species Act (CESA) may be present in the project area and a State agency is acting as lead agency for CEQA compliance (Section 2090) or if the action may result in the "take" of a species listed under CESA (Section 2081). Section 2081 of the California Fish and Game Code allows the California Department of Fish and Game (DFG) to issue incidental take permits for the take of State-listed threatened and endangered species. Take includes hunting, pursuing, catching, capturing, or killing, or attempting such activity.

This Act requires that non-Federal lead agencies include within their CEQA documentation an assessment of project effects on State-listed species. The lead agency has completed a search of the Natural Diversity Database to identify State-listed threatened and endangered species that have been recorded in the area. The database search was conducted on November 20, 2002. Informal consultation with DFG has continued throughout the planning process. It has been determined that there are potential adverse effects to threatened and endangered species during construction. These potential effects can be avoided or

adequately minimized by implementation of suitable measures. More information on the findings of this assessment can be found in Section 5.3.8 of this report.

DFG reviewed the report and coordinated with the USFWS under the FWCA. The results of the coordination are included in the Coordination Act Report (CAR). The findings were based upon the agency's determination that the recommended plan would not jeopardize the continued existence of any State-listed species or result in the destruction or adverse modification of habitat essential to the continued existence of the species.

The Natural Community Conservation Planning Act (NCCPA) was added to the CESA in 1991. The purpose of the NCCPA is to preserve species and their habitat while allowing for reasonable development to continue. The NCCPA encourages cooperation between DFG, landowners, and other interested parties to develop natural community cooperation plans. The natural community cooperation plans allow for early coordination to protect species and their habitat that are not listed yet (California Resources Agency 2003).

### 8.2.3 Clean Water Act (CWA)

The State Water Resources Control Board and the California Regional Water Quality Board for the Central Valley Region review activities that affect water quality. The Boards administer the requirements mandated by State and Federal law (Clean Water Act). The Regional Water Quality Control Board establishes water quality standards and review individual projects for compliance with the standards. Any permits or approvals will be acquired from the Central Valley Regional Water Quality Control Board before construction activities begin. Appropriate 401 water quality certification and a National Pollutant Discharge Elimination System (NPDES) general permit for storm water discharges will be acquired from the Central Valley Regional Water Quality Control Board (RWQCB).

The State RWQCB adopted the General Permit for Storm Water Discharges Associated with Construction Activity, which applies to all storm water discharges from construction sites disturbing one or more acres. This general permit requires all landowners who propose construction activities on one or more acres to (1) eliminate or reduce non-storm water discharges to storm sewer systems and other waters of the nation, (2) develop and implement a storm water pollution prevention plan, and (3) perform inspections of storm water pollution prevention measures. The general permit is implemented and administered by the nine regional boards of the State. To receive coverage under this general permit, a notice of intent must be submitted prior to commencing any soil-disturbing construction activities. In addition, a storm water pollution prevention plan must be developed and implemented along with a monitoring and reporting program.

Corps regulations require a 404 (b)(1) analysis to determine the extent of water quality impacts. The 404(b)(1) water quality impacts analysis has been written and is included in the appendix which will be used to get the 401 State Water Quality Certification. An NPDES permit is required as a separate permitting action from the Regional Water QualityControl Board for construction areas over 5 acres. An NPDES permit would be obtained prior to construction.

### 8.2.4 Clean Air Act (CAA)

In 1988, California passed the California Clean Air Act (CAA), which parallels the Federal CAA and calls for the designation of areas of attainment or non-attainment to State Ambient Air Quality Standards. The act established the State's standards and authority to regulate air quality issues. The California Air Resources Board (ARB), a division of the California EPA, is the State agency responsible for regulating air quality. The State standards are more stringent than Federal standards and include pollution regulations not covered by the Federal standards.

The State is divided into 15 air quality basins based on meteorological and geographic features. These air basins are then divided into 35 air districts that address local air pollution issues. Each district has primary responsibility for attainment and maintenance of air quality standards within their jurisdictional boundaries. Local air districts develop plans and programs to maintain clean air that is within the air quality standards of Federal and State laws.

Local air districts achieve this goal by implementing programs, regulations, and standards in several specific categories. The focus areas are motor vehicles, clean burning fuels, consumer products, stationary source, air quality plans, monitoring and research, and several other possible pollution sources (California Air Resources Board, 2001). Local air districts are required to prepare and submit progress reports and attainment plans to the Air Resources Board. A report was provided to the Corps concurring with the EIS/EIR findings of no significant effect.

**Sacramento Valley Basinwide Air Pollution Control Council.** The proposed action would not violate any standards, increase violations, exceed the U.S. Environmental Protection Agency's conformity *de minimis* thresholds, or hinder the attainment of air quality objectives in the local air basin. A letter from the Glenn County Air Pollution Office received July 2003 included mitigation measures which have been included in the Air Quality write-up in Chapter 5. The work would have no significant adverse effects on the future air quality of the area. Since the project would not exceed *de minimis* thresholds, a conformity determination is not required.

### 8.2.5 Encroachment Permit

Under California law, no reclamation project of any kind may be started or carried out on or near the Sacramento and San Joaquin Rivers or their tributaries until plans have first been approved by The Reclamation Board. The Reclamation Board's efforts focus on controlling floodwater; reducing flood damage; protecting land from floodwater erosion that would affect project levees; and controlling encroachment into flood plains and onto flood-control works, such as levees, channels, and pumping plants.

Although the project is within the Sacramento River Designated Floodway, the affected levees are not Federal Flood Control Project levees. The Reclamation Board is the non-Federal sponsor for the project; therefore, an encroachment permit is not required for the project.

### 8.2.6 California Wild and Scenic Rivers Act of 1972

The purpose of this act is to preserve and protect wild and scenic rivers and their immediate environments for the benefit of present and future generations. The legislature must approve any action that would affect a designated river. The primary difference between this act and the Federal act is that the Federal Energy Regulating Committee may issue a license to build a dam on a State-listed river, thus overriding the State statute.

### 8.2.7 Title 24 of the California Code of Regulations: California Building Code

The California Building Standards Commission (BSC) is an independent commission within the State and Consumer Services Agency that codify and publish approved building standards in one state building standards code (California Code of Regulations, Title 24). The State BSC provides guidance to architects, engineers, insurance companies, etc., when making decisions about the building industry. The BSC ensures that the California building codes effectively address areas such as health, fire and panic safety, employee safety, energy conservation, and handicapped accessibility. The BSC determines if such codes and standards are in the public interest.

### 8.2.8 Williamson Act (California Land Conservation Act), Farmland Security Zone Act (Super Williamson Act)

The Williamson Act and the Farmland Security Zone Act reduce property taxes on qualifying agricultural land in exchange for a commitment from the landowner not to develop the land with uses other than those compatible with and supportive of agriculture. The Williamson Act creates an arrangement whereby private landowners contract with counties and cities to voluntarily restrict land to agricultural and open-space uses. This arrangement is a 10-year contract during which time the restricted parcels are assessed at a lower tax rate. The Farmland Security Zone Act is a 20-year contract. These contracts renew automatically each year. In order to terminate the contract, a landowner must file a notice of non-renewal that starts a 9-year process for contract termination. The contract may be canceled to avoid the 9-year termination process, but is subject to a 12-½ percent fee based on the assessed value of the property. Cancellations are allowed when the public interest is no longer best served by the contractual restrictions placed on agricultural land, and if there is no other land suitable for the proposed alternative use. The Department of Conservation will be notified of the intent to convert any lands in Williamson Act and Farmland Security Protection Act by the landowner following potential authorization of the project by Congress.

## 8.3 LOCAL PLANS AND POLICIES

### 8.3.1 Air Pollution Control Districts

The project construction falls under the jurisdiction of the California Air Resources Board and the Glenn County Air Pollution Control District. The State Board and the District determines whether project emission levels significantly affect air quality, based on standards established by the USEPA, and the California Air Resources Board. A letter from the Glenn County Air Pollution Office received July 2003 included mitigation measures, which

have been included in the Air Quality discussion in Chapter 5. The District would first issue a permit to construct, followed by a permit to operate, which would be evaluated to determine whether all facilities have been constructed in accordance with the authority-to-construct permit.

### 8.3.2 Public Works and Transportation Departments

An encroachment permit must be obtained when encroachments are proposed within, under, or over a county or city road, or cover rights-of-way. The non-Federal sponsor would consult the appropriate local agencies to obtain the encroachment permits prior to construction.

### 8.3.3 Mosquito Abatement District

The Glenn County Mosquito and Vector Control District is responsible for conducting mosquito abatement and vector control in Glenn County. In addition, Glenn County maintains a Mosquito Surveillance Task Force. Both of these organizations serve under the County Board of Supervisors. The recommended plan would not create areas of stagnant water and therefore would not likely require mosquito abatement.

### 8.3.4 Glenn County General Plan

The Glenn County Planning Division established landscaping standards for the county based on the type of land use zone of the landscaped area. Undeveloped land should have permanent vegetation that prevents runoff from entering the streets and waterways. Landscaping should not cause accumulation of silt, mud, or standing water, or cause aesthetic or public safety problems on the property, adjacent land, streets, or sidewalks (Glenn County 2003).

All landscaped areas must have a drip irrigation system, in-ground sprinklers, a portable irrigation system, or drought-resistant plants. A landscape plan, as an overlay of a proposed site plan or as a separate drawing, shall be provided to Planning Division for review and approval. The landscape plan must provide the size, type, and spacing of any trees or shrubs planted in the landscaped areas. The location of existing trees and shrubs including the size, type, and spacing must be included in the landscape plans and the irrigation system layout (Glenn County 2003).

The Glenn County Planning Division determines the zoning areas within Glenn County. The establishment of the county zoning is based on the Glenn County General Plan, public health, and safety, and was established to stimulate and guide the growth of residents and business in Glenn County. The zones are labeled according to a land use, called principal districts. Some of the principal districts are, but not limited to timberland preserve zone, agriculture preserve zone, industrial zone, flood zone, and single-family resident zone. There are 22 different principal districts in Glenn County (Glenn County 2003).

The Planning Division has county ordinances that regulate the land use in all the principal districts. The ordinances regulate the type of activities that can occur in each principal district with and without permits, building sizes and heights, minimum distances

between buildings, and other issues that could affect the quality of human health (Glenn County 2003).

The Glenn County General Plan (Volume I, Policy Plan) indicates that an increasing emphasis will be placed on recreation as an economic generator, including hunting and other active use of public and private lands. The General Plan promotes the acquisition of public lands to be used for the preservation of wildlife and to generate economic activity through public use and viewing. The county will retain its abundant recreation opportunities and urban development will be complemented by parks and other open space areas.

# CHAPTER 9 – RECOMMENDED PLAN

This chapter describes the recommended plan, as well as procedures and cost sharing required to implement the plan. A schedule and list of further studies are also included.

## 9.1 RECOMMENDED PLAN

The plan identified as the recommended plan is Combined Alternative 6 (see Figure 9-1). The recommended plan is described in detail below.

### 9.1.1 Features and Accomplishments

The principle features of the recommended plan are (1) construction of 6.8 miles of setback levee to provide a more reliable form of flood protection to the community and agricultural areas, (2) degradation of the existing "J" levee to allow for reconnection of the river to the flood plain, and (3) restoration of about 1,500 acres of native habitat between the new setback levee and the Sacramento River.

**Setback Levee/Training Dike**. The 6.8-mile-long setback levee would have varying heights and consequently varying levels of performance. The entire length of setback levee would have a gravel road for patrolling, and would be fenced along the landside.

The new setback levee would begin about 2 miles north of Hamilton City, tying into high ground near the northern end of the "J" levee. Tying into high ground at this location would prevent flows greater than the 250-year event from possibly wrapping around the setback levee and flowing over County Road 203. The setback levee would be extended to a point just west of County Road 203, which would be ramped approximately 2.5 feet from its current height over the setback levee. Glenn County constructed a short setback levee near the northern end of the "J" levee in 2003. This short levee would provide additional protection against potential erosion along the Sacramento River. Entrenched rock would also be placed either on the waterside or the landside of the Glenn County setback levee additional protection for the new setback levee from erosion.

From the northern part of the study area to south of Dunning Slough, a distance of 4.4 miles, the levee would be on average of 7.5 feet high (6 feet for the "J" levee replacement levee and an additional 1.5 feet for the flood damage reduction increment). The new setback levee would run southeast along the County Road 203 until turning east and running along higher ground roughly parallel to, and about 1,300 feet to the west of, the Sacramento River. A seepage berm would be constructed on the landside of the setback levee from the northern end of the levee south to Dunning Slough. This portion of the levee would provide a 90 percent confidence of passing a 75-year event, thereby providing improved flood protection to the community of Hamilton City. The top-of-levee elevation for this portion of the levee would be set at the 320-year water-surface elevation (wsel). Some agricultural lands north of the community of Hamilton City would have improved protection, but would not be removed from the FEMA regulated flood plain.

At Highway 32, the levee would turn east and run parallel to the highway until tying into the approach to the Gianella Bridge. The highway would not need to be raised, but rock riprap would be placed to protect the levee embankment from induced overland flows. Grouted and/or

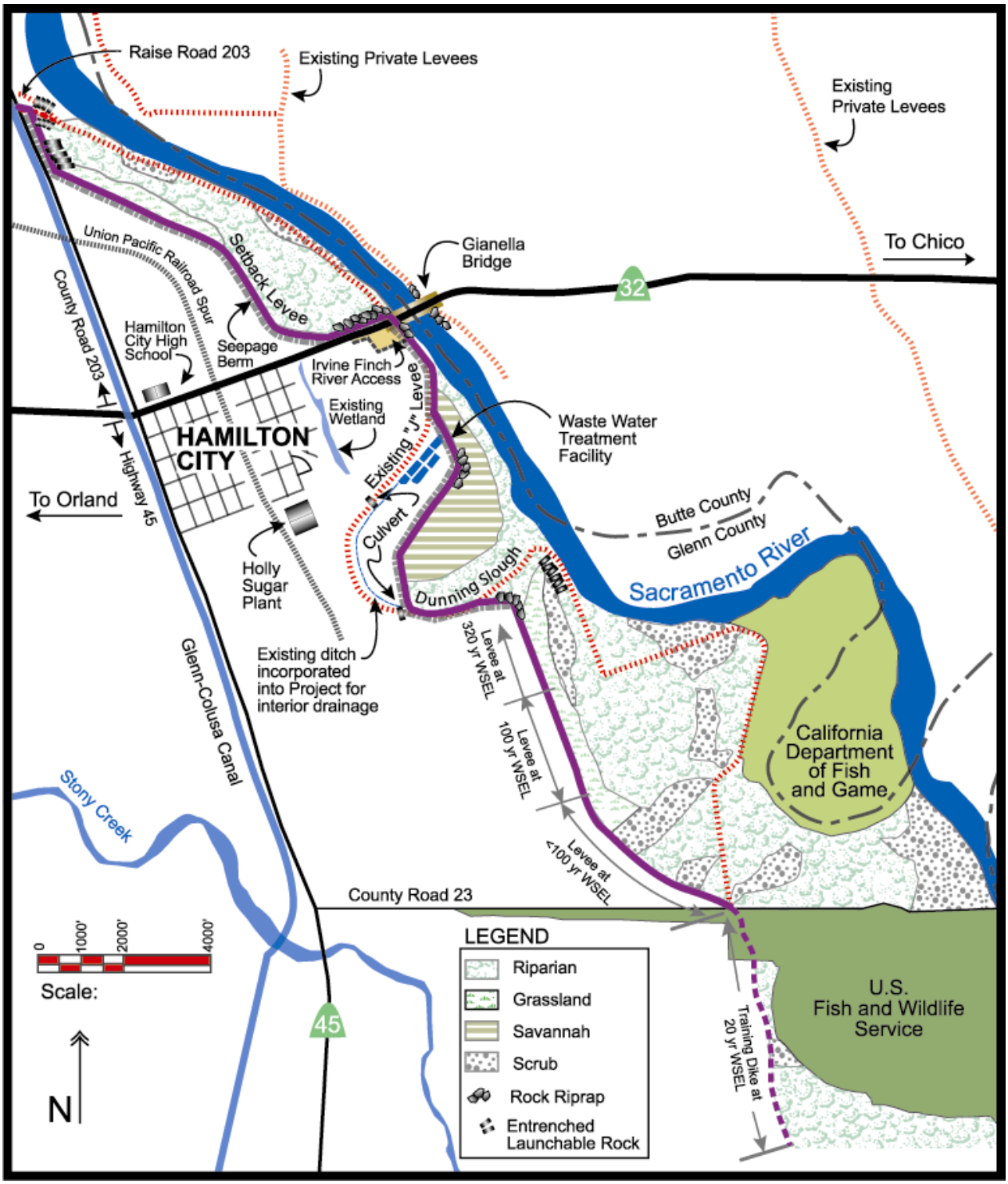



**Figure 9-1: Recommended Plan**

rock riprap would be placed under the bridge below the surface of the river to protect the bridge from potential increased velocities and potential scouring. South of Highway 32, the alignment would follow the existing "J" levee adjacent to the Irvine Finch River Access (just south of the highway). Some modification to the existing boat ramp may be required. South of the Irvine Finch River Access, the setback levee would be aligned away from the river to open up the flood plain.

The alignment would cut across a portion of Dunning Slough and provide protection to the Hamilton City wastewater treatment plant, some abandoned holding ponds for the old Holly Sugar plant, and a lime disposal pile. An existing ditch within Dunning Slough would be used to drain runoff from the agricultural fields and Hamilton City. This ditch would be connected to the flood plain via a culvert in the setback levee south of Dunning Slough.

South of Dunning Slough, the alignment would roughly follow along the western edge of the habitat restoration area before turning east and merging with the southern end of the "J" levee at County Road 23. As the levee turns east, the levee height would gradually decrease from 7.5 feet to 6 feet and would continue at this height for approximately 4,000 feet. The setback levee performance would be 90 percent confidence of passing the 35-year event. The top-of-levee would be set at the 100-year wsel. This change reflects the difference in land use behind the levee at this point (largely agricultural).

The setback levee height would then gradually decrease from 6 feet to approximately 3 feet. Just north of County Road 23, the new levee would become a "training dike" meant to redirect flows rather than control them. The training dike would perform with an 90 percent confidence of passing the 11-year event, and the top-of-levee would be set at the 20-year wsel. The training dike would reduce the frequency of flooding on the adjacent agricultural lands and reduce damages from scouring flows. Large flood events would overtop the training dike, spilling into the orchards without the damaging scouring flows and avoiding adverse hydraulic effects to downstream property owners. The training dike would also reduce the potential for backwater flooding in Hamilton City.

The training dike would continue for about 1 mile south of County Road 23, running along the western edge of the USFWS property boundary. A small ramp with culverts on either side would be constructed over the training dike at County Road 23 to maintain the river access. This alignment would not tie into high ground and would therefore allow some backwater flooding of agricultural lands, as currently happens with the "J" levee. In fact, the training dike would be designed to allow floodwaters to flow over the top and spread out onto the agricultural areas while reducing the high velocities that cause extensive damage to the orchards.

**"J" Levee**. In order to accomplish ecosystem restoration within the project area, most of the existing "J" levee would be removed to reconnect the river to the flood plain, allow overbank flooding, and increase capacity in the Sacramento River. The "J" levee would remain in place where it would serve to reduce velocities of the Sacramento River for establishment of newly planted habitat. Established riparian vegetation waterside of the existing "J" levee would be avoided wherever possible.

**Native Habitat**. Native habitat would be restored on all project lands waterside of the new setback levee. Restoration would also occur on the land within Dunning Slough and the land south of the USFWS property (Zones A-1 and B-2, respectively, on Figure 3-1). Existing orchards in the proposed restoration areas would be removed, and native vegetation would be planted. The predominant native vegetation would be riparian species, with some scrub, oak savannah,

and grassland species based on hydrologic, topographic, and soil conditions. An exception is the land in the middle of Dunning Slough. This land is relatively higher in elevation than the rest of the restored area, and oak savannah vegetation is anticipated to be more appropriate for these lands.

### 9.1.2 Hydraulic Effects

The recommended plan would provide the community of Hamilton City with a 90 percent confidence of passing a 75-year event. This protection would also be provided to lands north of Highway 32 and south to about Holly Sugar Plant south of Highway 32. The recommended plan would provide a 90 percent confidence of passing a 35-year event from south of Dunning Slough to just north of County Road 23. The training dike would provide a 90 percent confidence of passing an 11-year event to lands south of County Road 23. The training dike would also reduce frequent scouring floodflows and provide additional flood damage reduction benefits to structures within Hamilton City by lowering backwater flows.

Results from hydraulic modeling have shown that widening the floodway on the western side of the Sacramento River has reduced stages in Butte County. In addition, the water-surface elevation near Big Chico Creek has reduced stages, resulting in less overflow to Butte Basin. The reduction in flow would be about 2,000 cubic feet per second (cfs), while the Sacramento River is conveying about 343,000 cfs (320-year flood event).

Although the recommended plan would benefit both Glenn and Butte Counties and would provide regional benefits downstream by increasing storage in the system, a local increase in the water-surface elevation in the Sacramento River channel occurs only north of the Highway 32 bridge. Butte County just east of this area shows a decrease in water-surface elevation. This decrease suggests that additional flow is being conveyed through the Sacramento River. With the increase in flow, the bridge acts as a control, causing a localized increase in the water-surface elevation to push flow under the bridge.

The recommended plan could also provide regional attenuation of stage downstream of the project area due to more floodway storage from widening of the flood plain accomplished through removing the existing "J" levee and constructing the setback levee.

The recommended plan would provide hydraulic benefits because it would provide protection from flooding to the community and would reduce stages in the flood plains in the region. Increases in water-surface elevation would either occur in areas intended to be exposed to flooding (between the existing "J" levee and the setback levee) or would be contained in the river channel and would not constitute an adverse hydraulic effect.

### 9.1.3 Erosion Control

Placement of rock (entrenched and revetment) would be necessary at some points along the setback levee to ensure that the existing condition (community's ability to flood fight and pass the 12-year flood event) is not reduced and to offset potential scouring from changes in flows. Placement of rock would be as follows:

**North End of the Project**. Entrenched rock would be buried in a 1,500-foot-long trench in Zone G, parallel to County Road 203 and approximately 200 feet from the toe of the levee. When the river erodes away the bank at the location of the trench, the rock would fall and armor the bank, preventing erosion beyond that point. Figure 9-2 shows existing erosion at the north end of the study area.

**Figure 9-2: Erosion Along the Sacramento River Near North End of Study Area**

**Highway 32 Gianella Bridge**. Because the new levee would be set back from the existing "J" levee, the northern bridge approach would be exposed to direct flows. Since the bridge is not currently exposed to these direct flows, they could scour the approach. To ensure that the bridge is not compromised, 1,000 feet of rock riprap would be placed on and around the abutments. Because this rock would be necessary to maintain the existing condition, it is considered a part of equitable replacement of the existing "J" levee. Also, up to 100 feet of rock and/or grouted rock and/or a concrete lining would be placed under the Gianella Bridge at Highway 32 abutment specifically to protect it from exposure to higher velocities resulting from passing higher flows.

**Dunning Slough**. Because the levee would be set back from the existing "J" levee, a bend in the setback levee would be exposed to overland flows from multiple angles, which could erode the levee. To ensure that the levee is not subject to this erosion, 1,400 feet of rock riprap would be placed along the levee at the bend. Because this rock would be necessary to maintain the existing condition, it is considered a part of equitable replacement of the existing "J" levee. South of Dunning Slough, 1,500 feet of entrenched rock would be placed to protect the new levee from erosion and river migration.

**Southernmost Extent**. The setback levee would not affect the existing erosion conditions south of Dunning Slough. It is assumed that the Chico Landing to Red Bluff Project (local site constructed in 1975-1976) would remain authorized and continue to be maintained. For the new levee to perform to the same level as the existing "J" levee, erosion control at the end of the levee would consist of planting significant amounts of vegetation about 20 feet from the levee toe to reduce velocities at the levee.

### 9.1.4 Regional Benefits

Although designed to stand alone, the recommended plan complements a set of other projects that TNC and the SRCAF members are developing (see Figure 9-3). Collectively, these projects accomplish habitat protection, habitat restoration, improved ecosystem processes, coordinated flood plain management, and habitat restoration monitoring, thereby addressing

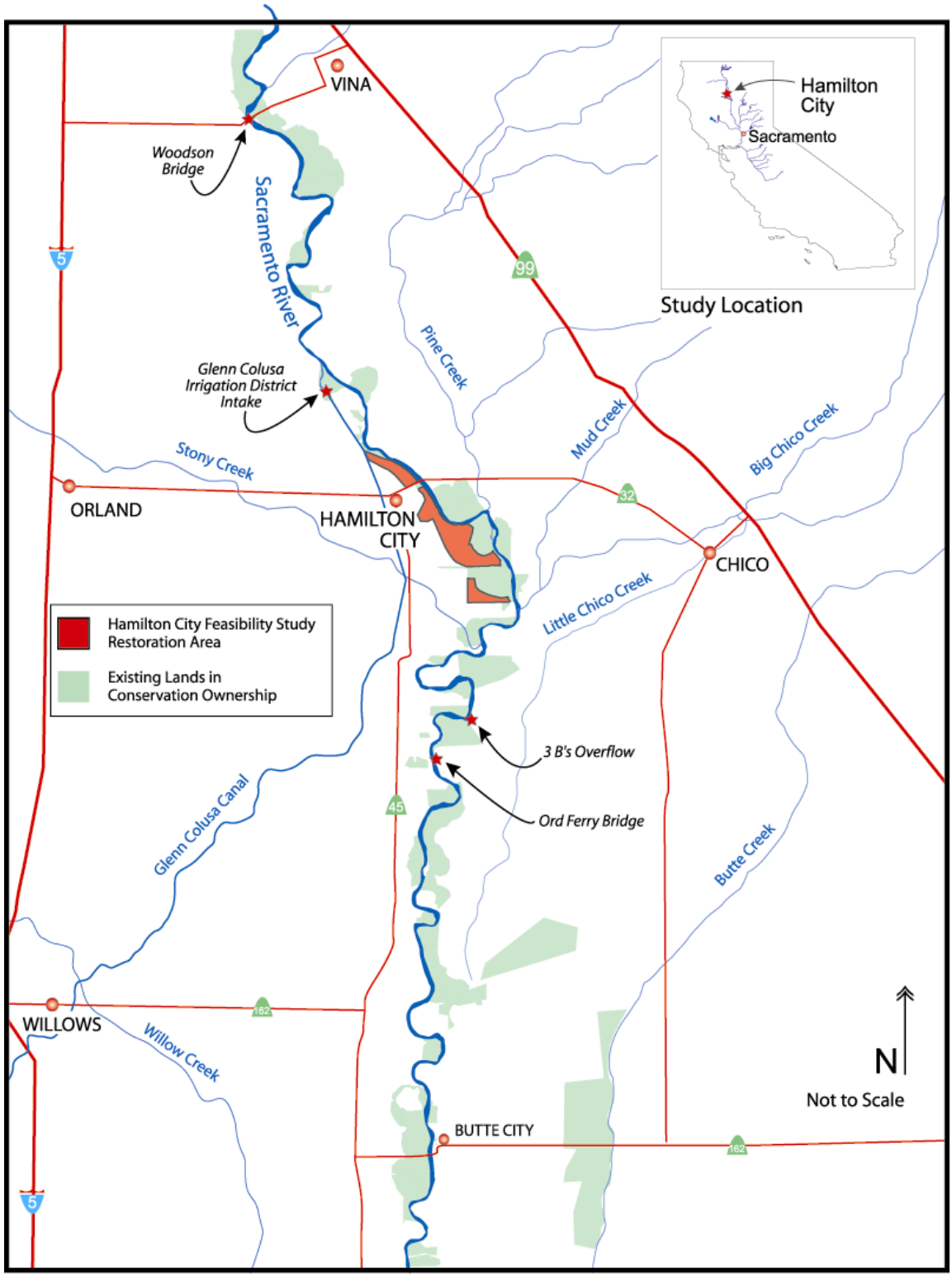



**Figure 9-3: Regional Conservation Lands**

many of CALFED Implementation Plan goals; Central Valley Project Improvement Act (CVPIA) goals and priorities; Sacramento Region Priorities 1, 3, 4, and 7; CALFED Ecosystem Restoration Program (ERP) Goals 1, 2, 4, 5, and 6; Key CALFED Science Program goals, and CVPIA goals.

The regional restoration proposal specifically addresses many of the CALFED ERP and Science Program goals, and CVPIA priorities. TNC has worked closely with the SRCAF within the guidelines of the Sacramento River Conservation Area Handbook (SRCAF 2000) to develop regional restoration activities. Increasing riparian habitat in the Sacramento River Conservation Area is designed to help protect and restore the stream meander corridor between Red Bluff and Colusa (PSP SR-1). The SRCAF projects to add 1,218 acres of riparian habitat to the Chico Landing Sub-reach, for a total of approximately 4,863 acres of nearly contiguous protection (restored plus conservation lands) to help alleviate habitat loss and fragmentation throughout the reach.

At-risk riparian species, as well as common riparian species, would benefit from protection and restoration of large expanses of habitat along the main stem of the Sacramento River (CALFED ERP Goals 1 and 4).

Specifically within the study area, there are two areas targeted for restoration. The first is by TNC through SRCAF, Capay Ranch, and the second by DFG, the Pine Creek Unit of the Sacramento River Wildlife Area. Capay Ranch has been fallow and dominated by nonnative invasive species vegetation for several years. Successfully establishing native understory and overstory vegetation in the parcels proposed for restoration would help control and reduce the number of acres dominated by nonnative invasive species along the Sacramento River, thereby reducing their adverse biological and economic effects (MR-1, CALFED ERP Goal 5).

Restoration of the proposed tracts would allow natural processes such as flooding on the flood plain in select areas along these tracts. Additionally, a long-term benefit of restoring these tracts would help to provide instream complexity in the form of large woody debris (LWD) that falls into the river as the tracts erode (PSP SR-2 and SR-4, CALFED ERP Goal 2).

Restoration of flood-prone land along the Sacramento River would help improve water and sediment quality in the river. Replacing flood-prone agriculture with riparian habitat decreases pesticide and herbicide use on land adjacent to the river, thereby contributing to improved water quality. Additionally, riparian forests act as a buffer and filter for toxic runoff of manmade sources of organic matter that originate farther away from the river, thereby helping to improve water and sediment quality (ERP Goal 6). The regional goals address the following specific CVPIA goals and Anadromous Fish Restoration Program (AFRP) objectives:

- Protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California;
- Improve habitat for all life stages of anadromous fish by providing flows of suitable quality, quantity, and timing, and improved physical habitat; and
- Involve partners in the implementation and evaluation of restoration actions.

Restoring complex riparian habitat along the Sacramento River would improve habitat for fish and wildlife. Fish benefit from complex riparian areas that become flooded at high flows or that slow floodwaters down and provide refugia for young and juvenile fish (Sommer et al. 2001).

These regional projects build on over 3,000 acres of habitat restoration along the Sacramento River between Red Bluff and Colusa. The Chico Landing Sub-reach is the site of recent acquisitions and subsequent management planning to address ecosystem restoration

funded by CALFED (97 NO-2). The recommended plan would also contribute to CALFED's Draft Multi-Year Program plan and Year 4 Work Plan, including focusing restoration efforts on acquiring lands that can meet ecosystem restoration goals from willing sellers where at least part of the reason to sell is economic hardship (for example, lands that flood frequently or where levees are too expensive to maintain). In addition, this project contributes to using farmer-initiated and developed restoration and conservation projects as a means of reaching program goals. Hydraulic and geomorphic modeling, Hamilton City hydraulic modeling and foundation investigation, baseline assessments, and restoration plant designs have been funded through the 97 NO-2 grant agreement.

This framework furthers the goals of the following programs: SRCAF Non-Profit, CVPIA, Central Valley Habitat Joint Venture, Sacramento River National Wildlife Refuge, Department of Fish and Game's Sacramento River Wildlife Area, California Riparian Habitat Conservation Program, and Riparian Habitat Joint Venture (Partners in Flight).

Through work with partners and stakeholders, this approach offers substantial systemwide ecosystem benefits. By using both horticultural and natural restoration in an adaptive management framework, these collective efforts are successfully restoring the viability of native species and reducing the proliferation and adverse effects of nonnative invasive species. Specifically, the effort to establish a continuous riparian corridor along the Sacramento River is already improving the health of local wildlife populations by promoting the recolonization of areas where local elimination of species has taken place. Several taxa, including the State-endangered yellow-billed cuckoo and the Federally threatened valley elderberry longhorn beetle (VELB), have colonized and successfully bred on restoration tracts (Small et al. 2000).

The ecological benefits of restoration activities extend far beyond the reaches of the study area. For many species, the main stem of the Sacramento River is a migratory pathway.

By making the habitat in this area more supportive of migratory species, this project would bolster breeding and wintering populations in areas physically removed, but ecologically linked to the Sacramento River. Examples include the habitat benefits to neotropical migratory birds and native anadromous fish. Additionally, improvements in water quality as a result of restoration efforts have beneficial effects all the way down the Sacramento River into the Bay-Delta.

The ecological benefits gained by removing rock must be weighed against the potential costs that could result from its removal. Historically, the Sacramento River has been very active in the vicinity of the revetment below Dunning Slough. It is expected that removal of this rock would increase channel migration rates to a point that the setback levee would be threatened well within the 50-year period of analysis of the project. Protecting the setback levee is estimated to cost $5 million per mile. A geomorphic study conducted by Ayres (see Appendix C.3-Hydraulics) estimates river migration rates.

The long-term viability of species inhabiting the Sacramento River ecosystem depends on the restoration of important physical processes, including appropriately timed flooding. The project could significantly contribute to restoring these species and related resources of the river. The proposed project would allow a large riparian zone along the river to establish and restore much of the natural fluvial processes by allowing the floodplain to flood. Removal of the existing "J" levee would restore frequent flooding to the area. This would significantly help to restore fish and wildlife habitats and benefit Federally and State-listed species. Additional

detailed hydrologic and geomorphic study is needed to ensure that the potential project features are designed and implemented in a way to not induce adverse effects.

### 9.1.5 Operation, Maintenance, Repair, Replacement, and Rehabilitation

Once project construction is complete, the project would be turned over to the non-Federal sponsor. The non-Federal sponsor would then be responsible for the operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the project in accordance with the OMRR&R manual.

Periodic maintenance of the new levee would be required to maintain the levee to pass the design flow. Erosion and excessive vegetal growth on levee sideslopes could require maintenance. Maintenance requirements will be discussed in detail in the OMRR&R manual. In general, the project is inspected and maintained periodically as well as during and after floods by the non-Federal sponsor. The Corps also inspects the project features and recommends corrective action to ensure that the project functions as designed.

The restoration plantings are expected to be self-sufficient, therefore requiring no maintenance. A minimal amount of maintenance of such items as gates, locks, signs, fencing, and other items that protect the restoration areas would be required. Also, periodic checklist type inspections on an annual or biannual basis would be required to monitor the site for severe adverse effects. The grassland buffer would require periodic burning, mowing, or grazing (estimate three times per decade).

Subsequent to the completion of the design of the project features and prior to construction, a draft OMRR&R manual would be prepared in coordination with the non-Federal sponsor and affected agencies. The manual would be provided to the non-Federal sponsor. A final OMRR&R manual would be prepared after the completion of construction.

Annual OMRR&R costs are estimated to be $55,000, of which $47,000 is for levee maintenance and $8,000 is for habitat restoration.

### 9.1.6 Real Estate

Acquisition of about 1,500 acres in fee title along with about 145 acres of permanent easements and about 28 acres of temporary work easements are required for the recommended plan. This consists of lands under and waterside of the proposed setback levee. The non-Federal sponsor would acquire these lands as part of the project.

Real estate acquisition for the recommended plan is split among 14 landowners. Relocations are estimated to be about $563,000, which would consist of raising County Road 203 about 2.5 feet to tie into the new levee, ramping County Road 23 over the new levee, and relocating affected utilities and irrigation ditches.

### 9.1.7 Plan Economics and Cost Sharing

The project first cost was estimated on the basis of October 2003 price levels and amounts to $44,876,000. Table 9-1 breaks down this cost by primary project feature. Estimated average annual costs were based on a 5 5/8 percent interest rate, a period of analysis of 50 years, and construction ending in 2010. Monitoring of plantings would continue until 2013. Table 9-2

shows the project first costs and benefits. The total average annual habitat units are 888, and the total average annual flood damage reduction benefits are $577,000. The total area of habitat restored would be 1,500 acres. Expected residual annual flood damages would be about $263,000.

**TABLE 9-1: ESTIMATED COSTS OF RECOMMENDED PLAN[1] ($1,000)**

| MCACES Account[2] | Description | Total First Cost |
|---|---|---|
| 01 | Lands and Damages[3] | 13,347 |
| 02 | Relocations[4] | 563 |
| 06 | Fish and Wildlife[5] | 24,540 |
| 11 | Levees[6] | 921 |
| 18 | Cultural Resources[7] | 170 |
| 30 | Planning, Engineering, Design[8] | 3,123 |
| 31 | Construction Management[9] | 2,212 |
| | Total First Cost | 44,876 |

[1]Based on October 2003 price levels, 5 5/8 percent rate of interest, and a 50-year period of analysis.
[2]Micro Computer-Aided Cost Engineering System (MCACES) is the software program and associated format used by the Corps in developing cost estimates. Costs are divided into various categories identified as "accounts." Detailed costs estimates are presented in Appendix C, part 8, Cost Engineering.
[3]Real Estate land costs, which include no damages.
[4]Relocations include raising County Road 203, ramping County Road 23, and relocating affected utilities and irrigation ditches.
[5]Includes habitat restoration, removal of "J" levee, levee costs allocated to restoration, plus 25 percent contingency.
[6]Includes levee costs allocated to flood damage reduction and training dike, plus 25 percent contingency.
[7]Assumes approximately 0.4 percent of project first cost.
[8]12 percent of 02, 06, 11, and 18 accounts. PED is cost shared 75 percent Federal and 25 percent non-Federal during PED, then adjusted as part of the total project cost sharing to 65 percent Federal and 35 percent non-Federal during construction.
[9]8.5 percent of 02, 06, 11 and 18 accounts.

The total project first cost of $44,876,000 was allocated by project purpose in the preliminary cost allocation process detailed in Chapter 3. The total amount allocated to the flood damage reduction project purpose is $4,260,000. The total amount allocated to the ecosystem restoration project purpose is $40,446,000. These amounts were then apportioned as either Federal or non-Federal costs, with the additional costs for cultural resource preservation ($170,000) being apportioned 100 percent to the Federal cost. The post authorization costs of cultural resource preservation are excluded from the allocation of costs in accordance with Corps guidance (ER 1105-2-100, Appendix E, paragraph E-63), but are included as a separate line item in Table 9-6.

Table 9-3 presents the allocated project first costs by project purpose. Table 9-4 presents the Federal and non-Federal apportionment of the flood damage reduction costs of the project for cost-sharing purposes. Table 9-5 presents the Federal and non-Federal apportionment of the ecosystem restoration costs of the project for cost-sharing purposes.

Table 9-6 presents the total Federal and non-Federal costs for the project. The non-Federal sponsor's financial capability is presented later in this chapter.

**TABLE 9-2: ECONOMIC COSTS AND BENEFITS OF RECOMMENDED PLAN[1] ($1,000)**

| Item | FDR | | Ecosystem | | Total Costs | |
|---|---|---|---|---|---|---|
| | Allocated Costs | Benefits | Allocated Costs | Benefits | Allocated Costs | Benefits |
| Investment Cost | | | | | | |
| First Cost[2] | 4,260 | | 40,446 | | 44,706 | |
| Interest During Construction | 271[4] | | 3,066[5] | | 3,337[5] | |
| Total | 4,531 | | 43,512 | | 48,043 | |
| Annual Cost | | | | | | |
| Interest and Amortization | 272 | | 2,615 | | 2,887 | |
| OMRR&R[3] | 47[6] | | 8 | | 55 | |
| Subtotal | 319 | | 2,623 | | 2,942 | |
| Annual Benefits | | | | | | |
| Monetary (FDR) | | 577 | | | | 577 |
| Non-monetary (Ecosystem) | | | | 888 AAHU's | | 888 AAHU's |
| Net Annual FDR Benefits | | 258 | | | | 258 |
| FDR Benefit-Cost Ratio | | 1.8 to 1 | | | | 1.8 to 1 |

[1]Based on October 2003 price levels, 5 5/8 percent rate of interest, and a 50-year period of analysis.
[2]Excludes Cultural Resource Preservation.
[3] Operation, Maintenance, Repair, Replacement, and Rehabilitation
[4] Two year period of construction assumed for J levee removal and construction of setback levee
[5] Three year period construction assumed for overall project
[6] Excludes environmental O&M costs.

### 9.1.8 Risk and Uncertainty

In general, the ability of the plan to provide the expected accomplishments depends on the validity of pertinent assumptions, base data, and analytical techniques used in this study; the successful completion of future studies, designs, and construction; and appropriate operation, maintenance, repair, replacement, and rehabilitation after construction.

Other risks include natural environmental risks such as extreme flooding, wildfire, and herbivore damage to the restored lands. It is possible that an extremely large flood event could damage young restoration plantings before they are sufficiently mature to withstand extended flooding. Likewise it is also possible for wildfire to destroy plantings, both young and mature. It is also possible for damage from heavy grazing by deer, beaver, rabbits, voles, gophers, and insects to do considerable damage to restoration plantings severely affecting the accomplishments of the project.

The HEP, used to quantify ecosystem restoration benefits, provides a reasonable representation of the outputs of the project. During detailed design of the project, additional soil and groundwater information would be collected to develop the specific habitat-planting regime. These additional data would likely result in a modification to the conceptual planting plan upon which the HEP was based. An example modification could be a reduction in the

**TABLE 9-3: TOTAL ALLOCATED FIRST COST OF RECOMMENDED PLAN BY PROJECT PURPOSE BASED ON PRELIMINARY COST ALLOCATION[1] ($1,000)**

| Item | Ecosystem Restoration | Flood Damage Reduction |
|---|---|---|
| Lands | | |
| Separable Costs | 12,154 | 0 |
| Allocated Joint Costs | 919 | 274 |
| Subtotal | 13,073 | 274 |
| Relocations | | |
| Separable Costs | 0 | 0 |
| Allocated Joint Costs | 434 | 129 |
| Total LERRD's | 13,507 | 403 |
| Project Features | | |
| Separable Costs | 14,725 | 921 |
| Allocated Joint Costs | 7,557 | 2,258 |
| Subtotal | 22,282 | 3,179 |
| Post Feasibility | | |
| Planning, Engineering & Design | 2,726 | 397 |
| Construction Management | 1,931 | 281 |
| Subtotal | 4,657 | 678 |
| Total Project First Cost[2] | 40,446 | 4,260 |

[1]Based on October 2003 price levels, 5 5/8 percent rate of interest, and a 50-year period of analysis and preliminary cost allocation presented in Chapter 3.
[2]Excludes Cultural Resource Preservation.

**TABLE 9-4: COST APPORTIONMENT OF RECOMMENDED PLAN FLOOD DAMAGE REDUCTION BASED ON PRELIMINARY COST ALLOCATION[1] ($1,000)**

| | Federal | Non-Federal | Total |
|---|---|---|---|
| Item | | | |
| Project Features | 3,179 | | 3,179 |
| LERRD's | | 403 | 403 |
| PED | 397 | | 397 |
| Construction Management | 281 | | 281 |
| Subtotal | 3,857 | 403 | 4,260 |
| 5 percent cash contribution | -213 | 213 | |
| Subtotal | 3,644 | 616 | 4,260 |
| Additional cash contributions | -875 | 875 | |
| Total[2] | 2,769 | 1,491 | 4,260 |
| Percent of Total | 65 percent | 35 percent | |

[1]Based on October 2003 price levels, 5 5/8 percent rate of interest, and a 50-year period of analysis and preliminary cost allocation presented in Chapter 3.
[2]Excludes Cultural Resource Preservation.

**TABLE 9-5: COST APPORTIONMENT OF RECOMMENDED PLAN ECOSYSTEM RESTORATION BASED ON PRELIMINARY COST ALLOCATION[1] ($1,000)**

| | Federal | Non-Federal | Total |
|---|---|---|---|
| Item | | | |
| Project Features | 22,282 | | 22,282 |
| LERRD's | | 13,507 | 13,507 |
| PED | 2,726 | | 2,726 |
| Construction Management | 1,931 | | 1,931 |
| Subtotal | 26,939 | 13,507 | 40,446 |
| Cash Contribution | -649 | 649 | |
| Total[2] | 26,290 | 14,156 | 40,446 |
| Percent of Total | 65 percent | 35 percent | |

[1]Based on October 2003 price levels, 5 5/8 percent rate of interest, and a 50-year period of analysis and preliminary cost allocation presented in Chapter 3.
[2]Excludes Cultural Resource Preservation.

**TABLE 9-6: SUMMARY OF COST-SHARING RESPONSIBILITIES RECOMMENDED PLAN[1] ($1,000)**

| Project Purpose | Federal | Non-Federal |
|---|---|---|
| Ecosystem Restoration | 26,290 | 14,156 |
| Flood Damage Reduction | 2,769 | 1,491 |
| Cultural Resource Preservation | 170 | |
| Total | 29,229 | 15,647 |
| Breakdown of Non-Federal | | |
| LERRD's | | 13,910 |
| Cash | | 1,737 |
| Total | | 15,647 |

[1]Based on October 2003 price levels, 5 5/8 percent rate of interest, and a 50-year period of analysis and preliminary cost allocation presented in Chapter 3.

proportion of riparian habitat anticipated and increase in the proportion of oak woodland savannah habitat. The final revegetation plan would be based on the specific soil and groundwater parameters at the restoration site in order to ensure a successful project.

## 9.2 Consistency with the CALFED Bay-Delta Authority Record of Decision

Several State agencies have contributed funds to prior efforts leading up to this project and to the non-Federal funding for this study. CALFED funded half of the funding necessary to complete the study. A CALFED State agency may be the non-Federal sponsor for implementing the project. Accordingly, this project has been developed to be consistent with the CALFED Programmatic Record of Decision (ROD) (August 2000).

The following paragraph from the CALFED ROD describes the relationship between the CALFED Bay-Delta Program Final Programmatic EIS/EIR and projects developed within the purview of the Sacramento and San Joaquin River Basins Comprehensive Study, of which Hamilton City is part: "The following action which was not analyzed in the Final Programmatic EIS/EIR and will, therefore, require additional environmental review; The CALFED Agencies intend that final development and implementation of actions under the Comprehensive Study will be coordinated and consistent with the CALFED Bay-Delta Program" (CALFED ROD p. 38).

Because this project is intended to be consistent with the CALFED ROD, the Corps and the Reclamation Board considered the strategies described in the ROD, Attachment A, in developing the project description and the alternatives. In addition, the agencies considered the programmatic commitments related to implementation of CALFED actions to ensure that this project would be consistent with the ROD. The project would be consistent with both specific measures in the ROD, as well as programmatic commitments related to implementation of CALFED actions to ensure that this project would be consistent with the ROD.

**Specific Measures.** The specific measures in the ROD are:

- **Site and align program features to avoid or minimize effects on agriculture.**

  The Hamilton City levee alignment is based on flood plain topography, frequency, and depth of flooding, hydraulic analyses, location of land available for habitat restoration, input from local landowners, and protection of existing infrastructure, including agricultural operations. A 157-acre parcel of land that is currently owned by TNC is not included in the project because it was not needed based on the above analyses. Some type of permanent agricultural protection for this parcel is under consideration.

- **Examine structural and nonstructural alternatives to achieve project goals in order to avoid effects on agricultural land.**

  The Corps is required to consider nonstructural measures in the planning process. The Corps defines nonstructural measures as project features that would not significantly alter the nature or extent of flooding, generally by changing the use made of the flood plains or by accommodating existing uses to the flood hazard. Nonstructural measures were considered as part of the alternative plan formulation process. Most were not considered further because they lacked local support and were not cost effective.

  A goal (or objective per Federal planning guidelines) of the project is to reduce damages from flooding in the area. A large portion of the without-project damages in the area is related to the flooding of agricultural lands. Therefore, part of the intent of the project is to reduce damages to agricultural lands, including removal of elements vulnerable to damage from the flooding.

- **Implement features that are consistent with local and regional land use plans.**

  Although designed to stand alone, the project complements a set of other projects that TNC and the SRCAF members are developing. Collectively, these projects accomplish

habitat protection, habitat restoration, improved ecosystem processes, coordinated flood plain management, and habitat restoration monitoring, thereby addressing many of CALFED Implementation Plan goals; CALFED Ecosystem Restoration Program (ERP) Goals 1, 2, 4, 5, and 6; Key CALFED Science Program goals; Sacramento Region Priorities 1, 3, 4, and 7; and Central Valley Project Improvement Act (CVPIA) goals and priorities.

- **Involve all affected parties, especially landowners and local communities, in developing appropriate configurations to achieve the optimal balance between resource effects and benefits**.

  Landowners and the local community have been extensively involved in this project and have helped develop the alternative plans that were analyzed. The project has regularly been discussed at the Hamilton City Community Service District meetings and at the Sacramento River Conservation Area Forum meetings. A public scoping meeting was held in Hamilton City on January 9, 2003, and an additional public workshop, which focused on the development of alternative plans, was held in Hamilton City on June 12, 2003. In addition to the public workshops, a series of plan formulation meetings were held from December 2002 through January 2003 to discuss the problems, opportunities, significant resources, and potential measures and alternatives. The meetings included study team members, representatives from the local community, and interested agencies and organizations. Participants in the meetings included:

  - Local landowners and residents
  - Hamilton City Community Services District
  - Glenn County Public Works Department
  - Butte County Public Works Department
  - Glenn Colusa Irrigation District
  - U.S. Fish and Wildlife Service
  - NOAA Fisheries
  - The Nature Conservancy
  - California Department of Fish and Game
  - Sacramento River Partners
  - Sacramento River Conservation Area Forum
  - Sacramento River Preservation Trust
  - California Department of Transportation (Caltrans)
  - California Department of Parks and Recreation

  Members of the study team regularly attended Hamilton City Workgroup meetings to report on the progress of the study, solicit feedback from the workgroup, and answer questions. These meetings were held at the Hamilton City Fire Hall approximately every 2 months over the course of the study. The Hamilton City Community Services District led the meetings, and the Sacramento River Conservation Area Forum helped with meeting facilitation. The purpose of the meetings was to provide a forum to discuss and coordinate water resources studies, projects, and other issues affecting the Hamilton City area. Local landowners and residents; representatives of local, State, and Federal agencies; representatives from State and Federal elected officials; representatives from non-profit organizations; and others attended the meetings. Information provided by the local and regional interest groups and individuals guided the identification of resources

problems and helped formulate the alternative plans to address the problems and identification of the recommended plan. The Hamilton City Feasibility Study has also periodically been discussed at the Sacramento River Conservation Area Forum (SRCAF) Board meetings.

A final public meeting was held in Hamilton City on May 6, 2004, during a 45-day public and agency review of the draft Feasibility Report/EIR/EIS to present the findings of the feasibility study and to provide the public an opportunity to express their views on the results and recommendations of the Hamilton City Feasibility Study.

- **Restore existing degraded habitat as a priority before converting agricultural land.**

  Restoration of about 181 acres of existing degraded habitat in the study area is included as part of the project. Restoration of that land alone was not considered to be a significant contribution to the goals and objectives of the study and project. Using State grant funding[1], TNC acquired additional lands from willing sellers that were also included in the project in order to achieve the goals and objectives of the project. These parcels of land experience erosion, seepage, and scouring floodflow problems.

- **If public lands are not available for restoration efforts, focus restoration efforts on acquiring land that can meet ecosystem restoration goals from willing sellers where at least part of the reason to sell is an economic hardship (for example, lands that flood frequently or where levees are too expensive to maintain).**

  The recommended plan includes native habitat restoration on lands predominantly acquired by TNC from willing sellers. Those lands have been at a frequent risk of flooding, and the recommended plan would alleviate the flood risk for remaining agricultural parcels landside of the new setback levee. The recommended plan includes a training dike; that is, a short, levee-like structure that while not preventing backwater, would reduce high frequency, damaging flows that currently scour agricultural lands.

- **Use a planned or phased habitat development approach in concert with adaptive management.**

  The restoration plan includes planting the restoration area before the "J" levee is removed and as the setback levee is being built. The restoration plan is based on a vegetative predictive model developed by TNC that determines habitats to be planted based on soils, topography, frequency of flooding, and depth to groundwater. As more information regarding soils and depth to groundwater is developed, the restoration plan would be adapted.

[1] Funding came from the River Protection Program under Proposition 13. The funds were appropriated to Department of Water Resources for allocation to TNC. The agreement goes on to say that TNC would use these funds to acquire lands near the Sacramento River in the Hamilton City area for the protection and restoration of various riparian habitats and to provide those lands for a future flood damage reduction project.

- **Develop buffers and other tangible support for remaining agricultural lands. Vegetation planted on these buffers should be compatible with farming and habitat objectives.**

  The recommended plan includes a buffer from the landside toe of the levee to the waterside restoration plantings. The buffer would be planted with native grasses, which is compatible with both farming and habitat restoration objectives. The final buffer distance would be determined during PED. These grasses would require burning or mowing as a part of the O&M manual. This buffer includes the setback levee with a gravel road on top for maintenance and inspection. The planting plan includes limiting the area of planting elderberries on areas adjacent to agricultural fields. The width of the elderberry buffer would be 300 feet, consistent with the current TNC "good neighbor" practices. It is anticipated that the restoration plan would allow the non-Federal sponsor to remove elderberries under 1-inch diameter from the buffer strip, though this is pending issuance of a take permit from the USFWS.

- **Implement erosion control measures to the extent possible during and after project construction activities.**

  Restoration would begin before the "J" levee is removed and as the new levee is being built. Best management practices would be implemented for erosion control as the levee is removed to prevent any water quality degradation. Prior to the start of construction, a National Pollution Discharge Elimination System (NPDES) general permit for construction activities would be obtained from the Central Valley Regional Water Quality Control Board, and a storm water pollution prevention plan (SWPPP) would be developed per the guidelines of the general permit. The SWPPP would list all best management practices to be implemented during construction activities for control of erosion, siltation, and any other pollutants that could potentially enter stormwater or surface waters in the project area.

  Temporary fast-growing cover crops would be seeded over all restoration areas. Permanent native vegetative cover would be no-till-drill seeded into the temporary cover. Areas disturbed by construction of flood control measures would be seeded with an erosion control seed mix and also would receive straw mulch. Areas disturbed by construction with steeper topography that generate sheetflow would receive appropriate erosion control best management practices such as straw mulch, bonded fiber matrix hydro mulch, and erosion control fabric, in addition to the vegetative cover. Areas disturbed by construction with topography that concentrates flow or conveys concentrated runoff offsite would receive best management practices for erosion control, such straw mulch, bonded fiber matrix hydro mulch, cobble dissipaters, and erosion control fabric, in addition to the vegetative cover.

  Sedimentation best management practices would consist of straw rolls, silt fences, and/or sedimentation ponds, which would be implemented, where necessary, to prevent discharge of sediment-laden runoff into receiving waters. Additionally, vegetative buffer strips 50 feet in width would be used on the downslope edges of sites bordering receiving waters. These strips may be native grass established before soil disturbing activities or may be existing vegetation left in place.

- **Protect exposed soils with mulches, geotextiles, and vegetative ground covers to the extent possible during and after project construction activities in order to minimize soil loss.**

  The recommended plan includes a vegetation barrier of 20 feet waterside of the setback levee and vegetation landside of the setback levee, where necessary, for protection from wave action. Long-term wave-wash protection would be provided by the restoration plantings. Areas that would not be protected in the long term may be protected by constructing vegetative barriers, using riprap, or reducing levee slope and planting with suitable erosion control grasses. In addition, a SWPPP would be implemented to reduce erosion and sediment discharges listed under the previous bulleted item.

- **When it appears that land within an agricultural preserve may be acquired from a willing seller by a State CALFED agency for a public improvement as used in Government Code Section 51920, advise the Director of Conservation and the local governing body.**

  There are currently lands covered by the Williamson Act and Farmland Protection Act in the project area. TNC and the non-Federal sponsor own most of these lands. The Director of Conservation and the local governing body would be advised of the removal of the lands from these programs.

- **Implement seepage control measures.**

  The levee would be built to Corps engineering standards and includes a training dike and rock revetment to prevent erosion and seepage. The levee would be designed to provide adequate seepage control and interior drainage. The interior drainage would be collected near the water treatment plant and pumped over to the other side.

**Programmatic Commitments**. The programmatic commitments are related to implementation of CALFED actions are:

- **Local Leadership** – This project was initially developed by leadership within Glenn County and the Hamilton City Community Services District, working in conjunction with TNC and local landowners.
- **Stakeholder Consultation** – Locals have been involved in every step of the development of this project from its conception. The project team conducted two public workshops in Hamilton City as well as an information booth at the local levee festival.
- **Environmental Justice** – The primary beneficiary of the flood damage reduction portion of the proposed project is the Hamilton City community, which is low income.
- **Tribal Consultation** – Funding for consultation with Tribal representatives would be included in the project budget to enable outreach efforts. Up to 1 percent of the Federal portion of the project first costs would be allocated for cultural resources data recovery.
- **Land Acquisition** - Most of the land required for the project has already been purchased from willing sellers because of the flood-prone nature of the land. The project has been

designed to consider third party and redirected effects such as level of flood protection and hydraulic effects.

- **CALFED Agency Coordination** – This project has been coordinated with CALFED and has been reviewed by the CALFED Independent Review Panel (IRP).
- **Integration of Non-Signatory Agencies** – This project would continue to be coordinated with all affected agencies.
- **Environmental Documentation** – This proposed project is documented in an integrated Feasibility EIS/EIR report.
- **Permit Clearinghouse** – A permit clearinghouse has been established for the CALFED Bay-Delta Program to coordinate and facilitate permit applications and approvals and compliance with NEPA and CEQA. Since this document is not tiered off the CALFED EIR/EIS, but rather is a stand alone EIS/EIR, the Corps and non-Federal sponsor would be obtaining all the necessary permits and approvals.
- **Adaptive Management/Science** – The restoration project would be managed to support the vegetative composition that occurs naturally over time.
- **Beneficiaries Pay** – The local sponsors would pay a portion of the project first costs along with ongoing O&M costs.
- **Compliance with Water Rights Laws** – The project would use water rights currently associated with the parcels to be restored.
- **Project Operations** – This is not applicable to the Hamilton City project.
- **Coordinated Operation Agreement** - This is not applicable to the Hamilton City project.

## 9.3 PLAN IMPLEMENTATION

This section describes the remaining steps to potential authorization of the project by Congress.

### 9.3.1 Report Completion

The draft feasibility report/EIS/EIR was circulated for public and agency review for 45 days. On May 6, 2004, a public meeting was held to obtain comments from the public, agencies, and other interested parties. After completion of the public review period, comments were considered and incorporated into the feasibility report/EIS/EIR, as appropriate. Comments received during the public and agency review period, as well as responses to them, are presented in Appendix F – Comments and Responses. The final feasibility report/EIS/EIR has been provided to any public agency that provided comments on the draft report. The State lead agency will certify that the final EIR was prepared in compliance with CEQA.

### 9.3.2 Report Approval

As required by NEPA, the Corps' South Pacific Division (SPD) Engineer would issue a notice of completion of the final report, submit the report to Corps Headquarters, and file the report with the U.S. EPA. The Division Engineer's notice of completion would be published in the *Federal Register*, starting a 30-day public review period. Corps Headquarters would coordinate

the public comments, receive comments from affected Federal and State agencies, and complete its own independent review of the final report.

After its review of the final feasibility report/EIS/EIR, including consideration of public comments, Corps Headquarters would prepare the Chief of Engineers' Report. This report would be submitted to the Assistant Secretary of the Army for Civil Works, who would coordinate with the Office of Management and Budget and submit the report to Congress.

Assuming that the non-Federal sponsor is willing to cost-share the project, detailed engineering studies and design efforts for the selected plan would be initiated. A project management plan outlining Federal and non-Federal obligations, requirements, tasks, costs, and schedule from PED through construction would also be prepared.

### 9.3.3 Project Authorization and Construction

Once the final report is approved by the Chief of Engineers and the project is authorized by Congress, construction funds must be appropriated for the project by Congress before a Project Cooperation Agreement can be signed by the Corps and sponsor to begin construction.

### 9.3.4 Division of Responsibilities

**Federal**. The Corps would accomplish Preconstruction Engineering and Design (PED) studies. Once the project is authorized, funds are appropriated, the non-Federal sponsor provides the cash contribution, lands, easements, rights-of-way, relocations, and disposal areas, as well as assurances, the Federal Government would construct the project.

**Non-Federal Responsibilities**. Specific items of local cooperation are identified in Chapter 10. The non-Federal sponsor plans to enter into local cost-sharing flood control agreements with Glenn County, the Hamilton City Community Services District, and possibly others to cost share the non-Federal project flood damage reduction cost with local entities in accordance with State law. Glenn County and the Hamilton City Community Services District intend to form a local levee district to operate and maintain the flood control portions of the project. It is anticipated that the local levee district would be formed prior to construction of the project. The non-Federal ecosystem restoration costs and maintenance would likely be cost shared according to State law and would involve State agencies and possibly other non-government entities.

**Views of Non-Federal Sponsor**. The non-Federal sponsor supports the recommended plan. Local interests have been supportive of the study and project. Throughout development of this feasibility report, there has been significant coordination with the State, Hamilton City Community Service District, Glenn County, the Sacramento River Conservation Area Forum, private landowners, and TNC.

**Financial Capability of Sponsor**. Prior to submittal of the final feasibility report, the State of California will pursue nonfederal funding from the California Bay-Delta Authority through their Ecosystem Restoration Program. As mentioned, the total estimated non-Federal first cost of the project is $15,647,000 (including LERRD's) using October 2003 price levels. Actual costs may be slightly greater at the time of construction due to inflation. The total estimated value for the project lands (LERRD's) is $13,910,000.

**Project Cost-Sharing Agreements**. A Design Agreement must be executed between the Corps and the non-Federal sponsor in order to cost share the development of detailed plans and specifications. Before construction is started, the Federal Government and the non–Federal sponsor would execute a Project Cooperation Agreement (PCA). This agreement would define responsibilities of the non-Federal sponsor for project construction as well as operation, maintenance, repair, replacement, and rehabilitation and other assurances.

## 9.4 SCHEDULE

If the project is authorized in 2004, construction activities could start as early as 2006. Following is a schedule showing the approval and construction phases of the project.

| | |
|---|---|
| The Reclamation Board Public Hearing | July 16, 2004 |
| Division Commander's Notice | September 2004 |
| Chief of Engineers Report | December 2004 |
| Potential Authorization | October 2004 |
| Corps and Sponsor sign Design Agreement | potentially September 2004 |
| PED | 2004-2006 |
| Initiate Construction | 2006 |
| Complete Physical Construction | 2008 |
| Complete Plant Establishment Period | 2010 |
| Complete Monitoring | 2013 |

## 9.5 FURTHER STUDIES

During PED, some additional studies would be undertaken as part of developing detailed designs for the project. Upon initiation of PED, any new information that has been collected by others such as TNC would be considered before undertaking these additional studies. These studies include:

- Topographic surveys for project design;
- Investigation (by the Corps' Engineering Research and Development Center - Waterways Experiment Station) of installation of in-situ rock for cost-effective erosion protection;
- Foundation explorations for levee design;
- Soil borings for habitat planting;
- Cultural resource surveys;
- Develop operation and maintenance manual.

# CHAPTER 10 – RECOMMENDATIONS

I recommend that the recommended plan (Combined Alternative 6) be authorized for implementation, as a Federal project, with such modifications thereof as in the discretion of the Commander, U.S. Army Corps of Engineers, may be advisable. The estimated first cost of the recommended plan is $44,876,000 and the estimated annual OMRR&R cost is $55,000 (October 2003 price levels). The Federal portion of the estimated first cost is $29,229,000. The estimated fully funded Federal first cost, based on projected inflation rates specified by Corps budget guidance, is $31,310,000. The non-Federal sponsor shall, prior to implementation, agree to perform the following items of local cooperation:

a. Provide 35 percent of total project costs allocated to ecosystem restoration and at least 35 percent, but no more than 50 percent of total project costs allocated to structural flood control, as further specified below:

(1) Enter into an agreement, which provides, prior to execution of the Project Cooperation Agreement, 25 percent of design costs;

(2) Provide, during the first year of construction, any additional funds needed to cover the non-Federal share of design costs;

(3) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(4) 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 or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(5) Provide, during construction, a cash contribution equal to 5 percent of total project costs allocated to structural flood damage reduction, and any additional costs as necessary to make its total contribution equal to 35 percent of the total project cost allocated to ecosystem restoration and at least 35 percent of total project costs allocated to structural flood control.

b. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor 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.

c. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

d. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

e. Hold and save the Government free from all damages arising from the construction and operating, maintaining, replacing, repairing, and rehabilitating the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

f. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

g. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

h. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, or maintenance of the project.

i. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

j. Prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

k. 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, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

l. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and

Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of flood plain management plans; and all applicable federal labor standards requirements including, but not limited to, 40 U.S.C.3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)).

m. Provide the non-Federal cost share of that portion of the costs of archeological data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement.

n. Inform affected interests, at least annually, regarding the limitations of the protection afforded by the project.

o. Publicize flood plain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to ensure compatibility between future development and protection levels provided by the project.

p. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

q. Agree that any part of the project identified as approved for proposed advanced work for credit under Section 104 of Public Law 99-662 must be compatible with recommended flood control project, and that any credit granted shall not relieve the non-Federal sponsor of its requirement to pay, in cash, 5 percent of total project costs allocated to structural flood control.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to

transmittal to the Congress, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Ronald N. Light

Colonel,

Corps of Engineers

District Engineer

# CHAPTER 11 – LIST OF RECIPIENTS*

The following agencies, organizations, and persons were sent copies of the Draft Feasibility Report/EIS/EIR. Comments received during the 45-day public and agency comment period and responses to those comments are presented in Appendix F – Comments and Responses.

## 11.1 ELECTED OFFICIALS AND REPRESENTATIVES

Governor of California
Honorable Arnold Schwarzenegger

U.S. Senate
Honorable Dianne Feinstein
Honorable Barbara Boxer

House of Representatives
Honorable Wally Herger

California Senate
Honorable Sam Aanestad

California Assembly
Honorable Doug LaMalfa

## 11.2 U.S. GOVERNMENT DEPARTMENTS AND AGENCIES

Council on Environmental Quality

USDA, Natural Resources Conservation Service

National Oceanic and Atmospheric Administration (NOAA) Fisheries

Department of the Interior
Bureau of Reclamation
Fish and Wildlife Service

Department of Transportation
Federal Highway Administration, Western Resource Center

Environmental Protection Agency

Federal Emergency Management Agency

## 11.3 STATE OF CALIFORNIA GOVERNMENT AGENCIES

Bay-Delta Authority (CALFED)

California Department of Transportation

Governor's Office of Emergency Services

The Resources Agency
- Department of Conservation
- Department of Fish and Game
- Department of Parks and Recreation
- Department of Water Resources
- The Reclamation Board

Office of Historic Preservation

State Clearinghouse

California Environmental Protection Agency
- Air Resources Board
- State Water Resources Control Board
  - Regional Water Quality Control Board, Central Valley Region

## 11.4 LOCAL GOVERNMENT

Hamilton City Community Services District

Glenn County
- Board of Supervisors
- Public Works
- Mosquito/Vector Control

Butte County
- Board of Supervisors
- Public Works

## 11.5 LOCAL AGENCIES

Hamilton City Library

Glenn Colusa Irrigation District

## 11.6 SPECIAL INTEREST GROUPS

Sacramento River Conservation Area Forum

Sacramento River Partners

Sacramento River Preservation Trust

The Nature Conservancy

# CHAPTER 12 – REFERENCES

The following sources were used in preparation of this document.

## 12.1 PRINTED REFERENCES


Alpert, P, FT Griggs and DR Peterson, 1999. Riparian forest restoration along large river: Initial results from the Sacramento River Project. Restoration Ecology 7:360-368.

Buechner, M. 1992. Preliminary population viability analysis for bank swallows (*Riparia riparia*) on the Sacramento River, California. California Department of Fish and Game, Wildlife Management Division, Non-game Bird and Mammal Sec. Rep. 92-01. 29pp + appendix.

Buer, K. 1994. Sacramento River bank erosion investigation memorandum progress report. *In*: The controls on and evolution of channel morphology of the Sacramento River: A case study of River Miles 201-185. Larsen, E., E. Anderson, E. Avery, K. Dole. University of California, Davis, December 2002.

California Department of Finance. 1999. Web address: http://www.dof.ca.gov/

California Environmental Protection Agency. 2000. Web address: http://www.calepa.ca.gov/

California Environmental Protection Agency. 2003. Web address: http://yosemite.epa.gov/oar/globalwarming.nsf/content/ImpactsStateImpactsCA.html

California Resource Agency. 2003. Web address: http://ceres.ca.gov/wetlands/permitting/cesn_summary.html

Department of Water Resources. 1988. Web address: http://wwwdwr.water.ca.gov/

Environmental Desk Reference. 1996. "Farmland Protection Policy."

Faachin, A., and P. A. Slaney. 1977. Management implications of substrate utilization during summer by juvenile steelhead (*Salmo gairdneri*) in the South Alouette River. Fisheries Technical Circular 32. British Columbia Fish and Wildlife Bureau.

Fausch, K.D. 1993. Experimental analysis of microhabitat selection by juvenile steelhead (*Oncorhynchus mykiss*) and coho salmon (*O. kisutch*) in a British Columbia stream. Canadian Journal of Fisheries and Aquatic Sciences 50(6):1198-1207.

Fontaine, B.L. 1988. An evaluation of the effectiveness of in-stream structures for steelhead trout rearing habitat in the Steamboat Creek basin. Masters thesis. Oregon State University, Corvallis.

Federal Register. Vol. 59, No. 2. 1994. Web address: http://www.nwr.noaa.gov/reference/frn/1994/59FR440.pdf

Federal Wildlife Laws Handbook. 2003. "Federal Noxious Weed Act of 1974." Web address: http://pl.unm.edu/cwl/fedbook/fedweod/html

Glenn County. 2003. "Glenn County Code." Book Publishing Company. Seattle, Washington. Web address: http://www.countyofglenn.net/common/

Glenn County. 1993. Glenn County General Plan, Volume 1. Prepared by QUAD Consultants.

Gorder, N.K.N., and J.M. Lee. Information on Rice Pesticides Submitted to the California Regional Water Quality Control Board, Central Valley Region. California Environmental Protection Agency, Department of Pesticide Regulation, Environmental Monitoring and Pest Management Branch, Environmental Hazards Assessment Program, Sacramento CA. December 28, 1995.

Gregory, S.V., G.A. Lamberti and K.M.S. Moore. 1989. Influence of valley floor landforms on stream ecosystems. Pages 3-8 *In*: Proceedings from the California Riparian Systems Conference: protection, management and restoration for the 1990s; 1988 September 22-24; Davis, California. Gen. Tech. Rep. PSW-110, Berkeley, CA. USDA, Forest Service, Pacific Southwest Forest and Range Experiment Station. 544 pp.

Hartman, G.F. 1965. The role of behavior in the ecology and interaction of underyearling coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Salmo gairdneri*). Journal of the Fisheries Research Board of Canada 22: 1035-1081.

Harwood and Helley. 1987. Late Cenozoic Tectonism of the Sacramento Valley, California *In*: The controls on and evolution of channel morphology of the Sacramento River: A case study of River Miles 201-185. Larsen, E., E. Anderson, E. Avery, K. Dole. University of California, Davis. December 2002.

Hoover, et al. 1990. Historic Spots in California: Fourth Edition. Stanford: Stanford University Press.

Katibah, E.F. 1984. A brief history of riparian forests in the Central Valley of California. *In*: Conservation Guidelines for the Valley Elderberry Longhorn Beetle. U.S. Fish and Wildlife Service, Ecological Services Office: Sacramento, California. July, 1999 (rev).

Larsen, E., E. Anderson, E. Avery, K. Dole. 2002. The controls on and evolution of channel morphology of the Sacramento River: A case study of River Miles 201-185. University of California, Davis.

Moratto, Michael J. 1984. California Archaeology. Orlando: Academic Press, Inc.

National Oceanic and Atmospheric Administration (NOAA). 2003. Web address: http://www.nwr.noaa.gov/habcon/habweb/msa.htm

Pacific Fishery Management Council. 2003. Web address: http://www.pcouncil.org/operations/msact.html

Peterson, D.R. 2003 (unpublished). Initial development of a plant design model for hydraulic analysis of ecosystem restoration and flood damage reduction projects in the Chico Landing Sub-Reach of the Sacramento River. Chico, CA.

Raleigh, R.F., T. Hickman, R.C. Solomon, and P.C. Nelson. 1984. Habitat suitability information: rainbow trout. FWS/OBS-82/10.60. U.S. Fish and Wildlife Service, Washington D. C.

Riddell, Francis A. 1978. Handbook of North American Indians. Volume 8. Washington: Smithsonian Institution.

Regional Water Quality Control Board (RWQCB). 1998. Web address: http://www.swrcb.ca.gov/

Robertson. 1987. In: The controls on and evolution of channel morphology of the Sacramento River: A case study of River Miles 201-185. Larsen, E., E. Anderson, E. Avery, K. Dole. University of California, Davis. December 2002.

Small, S.L., N. Nur, A. Black, G.R. Greupel, D. Humple, and G. Ballard. 2000. Riparian bird populations of the Sacramento River System: Results from the 1993-1999 field sessions. Report to TNC and the USFWS. Point Reyes Bird Observatory. Stinson Beach, CA. 76 pp.

Sommer, T., R. Baxter, and B. Herbold. 1997.Resilience of splittail in the Sacramento-San Joaquin Estuary. Transactions of the American Fisheries Society 126:961-976.

Swales, S., R.B. Lauzier, and C.D. Levings. 1986. Winter habitat preferences of juvenile salmonids in two interior rivers in British Columbia. Canadian Journal of Zoology 64: 1506-1514.

Thompson, K. 1961. Riparian Forests of the Sacramento Valley, California. In: *Annals of the Association of American Geographers*. Vols. 1 - 88, 1911-1998. Web address: http://www.jstor.org/journals/00045608.html

University of Minnesota. 2003. Web address: http://www.tc.umn.edu/~devo0028/laws.htm

U.S. Bureau of Census. 2000. American Factfinder ®. Web address: http://factfinder.census.gov/servlet/BasicFactsServlet

U.S. Department of Commerce. 2002. Web address: http://www.commerce.gov/

U. S. Department of Energy, Environmental Policy and Guidance. 2001. "Migratory Bird Act." Web address: http://tis.eh.doe.gov/oepa/law_sum/mnta.html

U.S. Department of Energy Environmental Policy and Guidance. 2001. Web address: http://tis.eh.doe.gov/oepa/

U.S. Department of Energy. 1997. "Executive Law 12898"

Ward, B.R., and P.A. Slaney. 1979. Evaluation of in-stream enhancement structures for the steelhead trout and coho salmon in the Keogh River: Progress 1977 and 1978. Fisheries Technical Circular 45. Ministry of Environment, Province of British Columbia.

## 12.2 PRIOR STUDIES AND REPORTS

**CALFED Bay-Delta Program (CALFED)**

Record of Decision, August 2000. Web address: http://calwater.ca.gov/Archives/GeneralArchive/RecordOfDecision2000.shtml
Final Programmatic EIS/EIR, July 2000. Web address: http://calwater.ca.gov/
Ecosystem Restoration Program Plan, July 2000.
Economic Evaluation of Water Management Alternatives – Screening Analysis and Scenario Development, October 1999.
Revised Phase II Report, June 1999.
Draft Water Management Strategy Evaluation Framework, December 1999.

**California Air Resources Board**

California Air Districts. 2001 Web address: www.arb.ca.gov/emisinv/map/statemap/dismap.htm
Area Designation Map, State/National. 2002. Web address: http://www.arb.ca.gov/desig/adm/adm.htm#state

**California Department of Conservation**

Williamson Act Program, Division of Land Resource Protection, August 2001.

**California Department of Parks and Recreation**

Upper Sacramento River Public Lands, Access, and Recreation Facilities Inventory: Maps and Database Table, 1994.
Land Use Changes in the Sacramento River Riparian Zone, Redding to Colusa, Third Update, 1982 to 1987.
Sacramento River Bank Erosion Investigation, Memorandum Progress Report, 1994.

**California Department of Water Resources (DWR)**

Memorandum Report-Sacramento River Meander belt - Future Erosion Investigation, 1995.
Flood Data for the Sacramento River and Butte Basin, Sacramento Valley, California 1980-1990, 1994.
Middle Sacramento River Spawning and Gravel Study, 1984.
Retention of Riparian Vegetation, Atlas, 1978.

**California Governor's Flood Emergency Action Team**

Final Report, May 1997.

**California Resources Agency**
Sacramento River Environmental Atlas. 1978.
Upper Sacramento River Fisheries and Riparian Habitat Management Plan, 1989.

**California State Lands Commission**
California Rivers: A Public Trust Report, 1987.

**California State University, Chico, Geographical Information Center**
1995 Butte and Glenn County Riparian Vegetation Study, 1995.

**Central Valley Project Improvement Act (CVPIA)**
Final Programmatic Environmental Impact Statement, October 1999.

**Sacramento River Conservation Area Forum (SRCAF)**
Sacramento River Conservation Area (SRCA) Handbook, January 2000 (rev.).

**The Nature Conservancy**
Cultural Resource Overview and Management Plan: Sacramento River Conservation Area, Tehama, Butte, Glenn and Colusa Counties, California. California State University, Chico, Archaeological Research Program Reports, No. 50. 2003
Sacramento River Public Recreation Access Study: Red Bluff to Colusa, EDAW Consulting for Sacramento River Project. January 2003.
The Nature Conservancy Sacramento River Project 2003. Modeling plant community types as a function of physical site characteristics. Web address:http://www.sacramentoriverportal.org/eco_indicators/modeling_plant_community_types.htm

**U.S. Army Corps of Engineers**
Sacramento and San Joaquin River Basins Comprehensive Study, California, Interim Report, December 2002.
Sacramento and San Joaquin River Basins Comprehensive Study, California, Technical Studies Documentation, December 2002.
Environmental Considerations for Vegetation in Flood Control Channels, ERDC TR-01-16. Prepared by J. C. Fischenich and R.R.Copeland, U.S. Army Engineer Research and Development Center. Flood Damage Reduction Research Program, Vicksburg, Mississippi. 2001. Web address: http://www.wes.army.mil/el/elpubs/pdf/tr01-16.pdf
Sacramento and San Joaquin River Basins Comprehensive Study, California, Post-Flood Assessment, March 1999.
Hamilton City, California, Feasibility Investigation, July 1997.
Civil Works Environmental Desk Reference. IWR Report 96-PS-3. Institute for Water Resources. Alexandria, VA. 1996.
Upper Sacramento River Revegetation, California, Reconnaissance Report, March 1994.

Sacramento River Near Hamilton City, Reconnaissance Investigation, Section 205, January 1991.
Sacramento River at Hamilton City, Reconnaissance Report for Flood Control, March 1975.

**U.S. Bureau of Reclamation**
Central Valley Project Improvement Act (CVPIA) Final Programmatic Environmental Impact Statement, October 1999.

**U.S. Fish and Wildlife Service**
Alaska Field Office. 2003. Web address: http://alaska.fws.gov
(FWS 1996). 2003. Web address: http://endangered.fws.gov.esasum.html
Web address: http://laws.fws.gov/lawdigest/fwcoord.html
Biological Opinion for Contract 42 E of the Sacramento River Bank Protection Project at River Mile 149 of the Sacramento River for Sacramento split tail, Delta smelt, giant garter snake, and valley elderberry longhorn beetle.
Impacts of riprapping to ecosystem functioning, lower Sacramento River, California. U.S. Department of Interior, Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California. June 2000.
Evaluation of Primary Environmental Mitigation Measures Implemented for the Sacramento River, Chico Landing to Red Bluff Bank Protection Project, March 1987.
Fish and Wildlife Service Mitigation Policy of January 23, 1981. Federal Register 46(15):7656-7663.

**U.S. Geological Survey**
Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California, 1985.
Floodflow Characteristics of the Sacramento River in the Vicinity of Gianella Bridge, Hamilton City, May 1981.

**Water Engineering & Technology, Inc.**
Riverbed Gradient Restoration Sacramento River Mile 206 California, 30% Basis of Design (BOD) Report. Prepared for the U.S. Army Corps of Engineers, BOD Report 14. December 1991.

## 12.3 PERSONAL COMMUNICATIONS

Stewart, R. 2003. Air Quality Planner, Glenn County Air Pollution Control District. Personal communication. July 9, 2003.

Thomas, Mardy. 2004. Associate Planner, Glenn County Planning Division. Personal communication. January 20, 2004.

Williams, Gail. 2003. Air Quality Planner, Butte County Air Quality Management District. Personal communication. July 9, 2003.

# INDEX*


***A***[1]

*Adaptive Management* • 9-8, 9-16, 9-19, 10-9, 10-16
*Affected Environment* • 1-10, 4-1, 4-37/38[2]
*Air quality* • 4-8/10, 4-38/39, 5-2, 5-15/17, 5-53, 7-2, 8-6, 8-13/14, 12-6
*Approval* • 8-11/12, 8-15, 9-19, 9-21
*Approved* • 1-4, 1-6, 5-29/30, 5-32, 8-3, 8-13/14, 9-20, 10-3

***C***

*Candidate* • 4-21, 8-11
*Climate* • 3-6, 4-2, 4-8, 4-35/36, 5-9
*Comparison of alternatives* • 1-8
*Compliance* • 1-10, 4-27, 4-39, 5-5, 5-28, 5-30/34, 7-2, 7-5, 8-1, 8-3, 8-5/7, 8-11/12, 9-19
*Complies* • 5-54, 8-4
*Conclusion* • 8-10
*Constraint* • 2-14/15, 3-1/2, 3-11/12, 3-14, 3-21/22, 3-24, 3-47, 5-37, 5-42, 5-50
*Cultural resources* • 4-34, 4-39, 4-41, 5-5 5-48/49, 7-3, 8-4, 9-10, 9-18, 10-3
*Cumulative effect* • 2-15, 2-17, 5-1, 5-51/52

***E***

*Endangered* • 2-13, 4-11, 4-19/22, 4-39, 5-28, 5-30/34, 5-54/55, 8-1/3, 8-11, 9-8, 12-6
*Environmental consequences* • 1-10, 2-16, 5-1, 5-53, 5-54/55, 8-1

***F***

*Fisheries* • 1-2, 1-5, 2-6, 2-13, 4-3, 4-14/15, 4-21, 4-39, 5-4, 5-26/28, 5-32, 6-3/4, 7-5, 8-1/4, 8-9/10, 9-15, 11-1, 12-1/5
*Flood(s), flooding* • 1-1/9, 2-1, 2-6/7, 2-9/17, 3-1, 3-3/9, 3-11/12, 3-14, 3-20/21, 3-22/27, 3-28/29, 3-31/33, 3-36/37, 3-39/42, 3-44/47, 4-2/3, 4-5/6, 4-8, 4-11, 4-13, 4-15, 4-19/21, 4-23/24, 4-27/28, 4-31, 4-35/37, 4-38/41, 5-1/2, 5-5/7, 5-9, 5-11/14, 5-18/21, 5-24, 5-27, 5-29/31, 5-36/43, 5-47/51, 5-53/54, 6-1/2, 8-3, 8-7/8, 8-10, 8-13, 8-15, 9-1, 9-3/5, 9-7/20, 10-1/3, 12-3/6
*Flood Damage* • 1-1/3, 1-5, 1-8, 2-10, 2-14, 2-15, 2-16, 3-1, 3-3/6, 3-8/9, 3-20/26, 3-29, 3-32, 3-36/37, 3-39/42, 3-44/47, 4-23, 4-35, 5-6, 5-11, 5-37/38, 5-55, 6-1/2, 8-3, 8-7/8, 8-13, 9-1, 9-4, 9-10/13, 9-16, 9-18, 9-20, 10-1, 12-3, 12-5
*Formulation* • 1-1/2, 1-10, 2-7, 2-16, 3-1/3, 3-8, 3-12, 3-17, 3-20/21, 3-24, 3-47, 6-3, 7-1/2, 7-5, 8-8, 9-14/15, 10-3

***G***

*Growth- inducing* • 5-49/50

***H***

*Hazardous* • 4-33/34, 4-41, 5-31, 5-47/48, 10-2

***I***

*Irreversible* • 5-54, 8-4

***L***

*Land use* • 1-5, 1-8, 2-1, 4-10, 4-12, 4-24, 4-25, 4-27, 4-32/33, 4-39, 4-40 5-7, 5-37/38, 5-41/43, 5-49/51, 5-54, 8-15, 9-3, 9-14, 12-4

***M***

*Management Measures* • 1-1
*Mitigation* • 1-4, 1-8, 2-11, 4-38, 5-1/9, 5-10/12, 5-14/15, 5-17, 5-21, 5-23, 5-26, 5-28/29, 5-32/35, 5-38, 5-41/42, 5-43/48, 5-49/50, 5-54/55, 8-4, 8-6, 8-11, 8-13/14, 10-1, 10-3
*Monitoring* • 1-6, 3-7, 4-7/8, 4-10, 4-24, 4-36, 5-28, 5-30, 8-3, 8-12/13, 9-5, 9-9, 9-15, 9-21, 10-1, 12-2

***N***

*Native American* • 8-7
*Need* • 1-1, 1-7, 1-10, 2-1, 2-15, 2-17, 3-6, 3-8, 3-11, 3-29, 3-33, 3-35, 3-37, 3-45, 4-37/38, 4-40, 4-39, 5-9, 5-13, 5-26/27, 5-39, 5-51/52, 5-53/55, 6-12, 8-5, 9-1, 9-9, 9-14, 10-1
*Noise* • 4-30/33, 4-41, 5-8, 5-24, 5-32/34, 5-38, 5-46/47, 5-53, 8-10/11
*Non-Federal* • 1-1/4, 1-6/7, 2-4, 2-6, 2-13, 3-47, 4-37, 5-9, 5-51, 6-1, 8-11, 8-13, 8-15, 9-13, 9-17/21, 10-1/3
*Not evaluated* • 4-1

**O**

*Objectives* • 1-1/2, 1-6, 1-10, 2-1, 2-4, 2-6, 2-13/15, 3-1/4, 3-6, 3-8, 3-11, 3-14, 3-17, 3-19, 3-23, 3-25, 3-27, 3-39, 4-6, 4-8, 5-11, 5-13, 5-30/31, 5-39/41, 5-55, 6-1, 8-4/6, 8-13, 9-7, 9-16/17
*Operation and Maintenance, O&M, OMRRRs* • 5-1, 8-3, 9-11, 9-17, 9-19
*Opportunity, Opportunities* • 1-1, 1-3, 1-8/10, 2-4, 2-6, 2-10, 2-13, 3-4/5, 3-20/21, 3-28, 4-13, 4-23, 4-30, 4-31, 4-36, 4-39, 5-36, 5-44, 6-1, 6-3, 8-4/5, 8-10, 8-16, 9-15/16, 10-3

**P**

*Preparers* • 1-10, 7-1
*Problem* • 1-1/3, 1-5, 1-8, 1-10, 2-4, 2-6/7, 2-10/13, 2-15, 2-17, 3-4, 3-6, 3-16, 3-20, 3-25, 3-28, 3-30, 4-23, 4-35, 5-51, 6-1, 6-3, 6-5, 8-8, 8-15, 9-15/16
*Project Cooperation Agreement* • 9-20/21, 10-1
*Public* • 1-1/3, 1-6, 1-9/10, 2-4, 2-6/7, 2-10, 2-13, 2-15/16, 3-4, 3-7, 3-11, 3-16/17, 3-25, 4-6, 4-11/12, 4-23/24, 4-30/32, 4-36, 5-14, 5-36, 5-37, 5-39, 5-40/41, 5-45, 6-1/5, 7-2/3, 8-1, 8-6, 8-8/9, 8-11, 8-14/16, 9-15/16, 9-18/21, 10-2/3, 11-2, 12-4/5
*Public Involvement* • 1-2/3, 6-1
*Purpose* • 1-1/4, 1-6, 2-6, 2-13, 2-16, 3-1, 3-4/5, 3-8, 3-16/17, 3-20/21, 3-23, 3-25, 3-43/47, 4-27, 5-18, 5-21/23, 5-29/30, 5-36, 5-51, 6-1, 6-5, 8-2, 8-6, 8-8/10, 8-12/13, 9-10, 9-12/13, 9-15, 10-1/2

**R**

*Recommendations* • 4-30, 6-3/4, 8-2/3, 9-16, 10-1, 10-3
*Recreation* • 1-2, 1-9/10, 2-1, 2-6, 4-30/32, 4-40, 5-6/8, 5-36/37, 5-44/45, 6-3, 7-2, 8-10, 8-16, 9-15, 11-2, 12-4/5/3
*Review, reviewed* • 1-2/3, 1-10, 2-6, 4-8, 4-33, 5-39, 5-45, 6-1, 6-4, 7-1/2, 7-4/5, 8-1, 8-3/4, 8-12, 8-15, 9-14, 9-16, 9-19/20, 10-3
*Risk and Uncertainty* • 9-11

**S**

*Schedule* • 3-28, 4-36, 5-45, 9-20/21
*Socioeconomic* • 4-22/23, 4-35, 4-39, 5-36/38, 5-40
*Soils* • 2-11, 4-1/2, 4-6, 4-13, 4-27, 4-34/35, 5-9, 5-15, 5-18/20, 5-38/40, 5-47, 9-16, 9-18
*Special status species* • 4-15/16, 4-20, 4-22, 4-39, 5-4/5, 5-28/29, 5-31/33, 5-34/35, 8-4
*Study area* • 1-1/2, 1-4, 1-6, 1-9/10, 2-1, 2-3/4, 2-10/13, 2-15/16, 3-4, 3-6, 3-8, 3-11, 3-17, 3-27/29, 3-32, 3-40, 4-1/2, 4-4/6, 4-8, 4-12/16, 4-19/22, 4-24/25, 4-27, 4-30, 4-33/36, 4-39/41, 5-14, 5-20, 5-22/24, 5-26/28, 5-31, 5-38/41, 5-44, 5-49/51, 5-53, 8-2, 8-7, 9-1, 9-5, 9-7/8, 9-16

**T**

*Threatened* • 2-10, 2-13, 4-19, 4-21/22 4-39, 5-28, 5-55, 8-1/2, 8-11, 9-8
*Topography* • 2-7, 2-11, 4-1/2, 4-35, 5-9, 9-14, 9-16/17
*Traffic* • 4-30, 4-40, 5-7, 5-15, 5-42/44, 5-46, 5-53, 6-3/4

**U**

*Unavoidable adverse* • 5-52/53, 8-4

**V**

*Vegetation* • 1-5, 2-11/12, 3-3, 3-6, 3-9, 3-11, 3-18/19, 3-31/33, 3-36/37, 3-39, 4-8, 4-11/14, 4-21, 4-31, 4-37, 4-39, 5-3, 5-10/11, 5-15, 5-17, 5-20/29, 5-31, 5-34/35, 5-40, 5-45, 7-6, 8-3, 8-15, 9-3/5, 9-7, 9-13, 9-17/18, 12-4/5
*Visual Resources* • 5-46

**W**

*Water quality* • 3-15, 4-3, 4-6/8, 4-38, 5-2, 5-12/15, 5-27, 5-32, 5-38, 5-52, 5-55, 7-2, 8-5, 8-12, 9-7/8, 9-17, 11-2, 12-2/3
*Wildlife* • 1-2, 1-4/6, 2-6, 2-11/12, 3-16, 4-7, 4-10/13, 4-19, 4-30, 4-31/32, 4-36/37, 4-39, 5-3, 5-21/27, 5-30, 5-55, 6-3/4, 7-2, 8-2/3, 8-8, 8-16, 9-7/8, 9-10, 9-15, 11-1, 12-1/3, 12-6

[1] The Summary is not included in the Index.
[2] "*/*" Indicates the word is found on consecutive pages.