II. FOLSOM STEPPED RELEASE PLAN ALTERNATIVES: ANALYSIS AND RECOMMENDATIONS

AMERICAN RIVER WATERSHED INVESTIGATION

AUGUST 2001

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I. INTRODUCTION

This is the Fish and Wildlife Service's (Service) draft Fish and Wildlife Coordination Act (FWCA) report for the Corps'proposed Stepped Release Alternative, for the American River Watershed Investigation (ARWI), Long-Term Evaluation. This report supercedes our June 1996 FWCA report for this project by providing revised analyses for project alternatives which have been added or significantly modified. This FWCA report provides: (1) the Service's analyses of impacts to fish and wildlife that would result from construction due to levee modifications along the lower American River; Howe Avenue Bridge Raising; Guy West Bridge Raising; Union Pacific Trestle Raising; and the hydraulic mitigation area; and (2) recommendations to avoid, minimize, rectify or, as a last resort, compensate these impacts. The analysis herein is based on site visits, literature review, discussions with experts, and project plans provided by the Corps through July 2001. Due to time constraints, a comparison of each alternative to the other was not done in this draft FWCA report. Comparisons of the alternatives will be done for the next draft (if one is required) or for the final document.

Since the preliminary draft FWCA report was submitted in April 2001, the following main changes have been made: (1) we reanalyzed impacts to the hydraulic mitigation area, which replaces the study done in 1996, except for the Sacramento Weir and Bypass, where the repairs would remain the same; (2) we reviewed a sample of utilities and local drainages that would be modified and made some assumptions as to impacts to the remaining sites; (3) we ran a separate HEP for the Natomas East Main Drainage Canal (NEMDC) area, since we were advised that this would be impacted under the Stepped Release Plan to 160,000 cfs as well as the Plan to 180,000 cfs; and (4) we incorporated additional operations impact analyses.

II. DESCRIPTION OF THE STUDY AREA

The ARWI covers an area of about 2,100 square miles within El Dorado, Placer, Sacramento, Sutter, and Yolo Counties. The investigation in this section focuses on two Stepped Release Plans: (a) Stepped Release Plan to 180,000 cfs which includes levee modification areas, bridge raising sites, hydraulic mitigation area, utilities modifications, and operational impact area; and (b) Stepped Release Plan to 160,000 cfs which includes the NEMDC levee modifications, hydraulic mitigation area, utilities modifications, and operational impact area. More specific information follows.

A. LOWER AMERICAN RIVER

The project area is in the American River watershed, and would affect the lower American River, which is the river's reach downstream of Folsom Dam. The American River is the second largest tributary to the Sacramento River. The three forks (north, middle, and south) of the river originate in the Sierra Nevada Mountains at an elevation of about 10,400 feet (mean sea level), and generally flow in a southwesterly direction. The Middle Fork joins the North Fork near the City of Auburn, just upstream of Folsom Reservoir; the North Fork then joins the South Fork just

upstream of Folsom Dam. All three forks of the American River above Folsom Reservoir are nationally popular areas for white-water sports, and the reach of the South Fork from Coloma to the reservoir is the state's most popular white-water rafting run. The proposed project is designed to provide increased flood protection to areas which may be affected by flooding of the lower American River. Just downstream of Folsom Dam is Lake Natoma, formed by Nimbus Dam, which also began operation in 1955. Lake Natoma acts as a re-regulating reservoir to dampen diurnal flow fluctuations caused by operation of the Folsom hydropower plant. Releases from Folsom Dam flow into Lake Natoma (8,800 acre-foot capacity), and through Nimbus Dam into the lower American River. From Nimbus, the lower American River flows 23 miles through the Sacramento metropolitan area before joining the Sacramento River. This reach is part of the State and Federal Wild and Scenic Rivers systems, and is largely administered by the County of Sacramento as the American River Parkway (Parkway). The design capacity of the lower American River levee system is 115,000 cfs; at this flow, about 228,000 acre-feet would pass down the lower American River during a 24-hour period (USACE 1994).

Historically, floods occurred almost annually in the region of the American River and Sacramento River confluence (USFWS 1991a). Much of the land in what is now Sacramento was a highly productive natural riparian ecosystem, which benefitted from frequent flooding. This ecosystem was characterized by dense riparian forest along the rivers and a complex of grasslands, emergent freshwater marsh, and woodlands in the floodplains (Thompson 1961; USFWS 1991b). The first flood control efforts in the Sacramento Region were low levees built by farmers to protect crops; by 1894 low levees had been privately built along most of the major rivers and streams in the region. The Federal Flood Control Act of 1917 authorized Federal funding for a major flood control project for the Sacramento River, which included construction of a system of canals, levees, bypass channels and weirs. These and subsequent flood control measures have enabled the conversion of highly productive wetlands and other natural habitats to agriculture and, increasingly, to urban uses.

B. HYDRAULIC MITIGATION AREA

The Yolo Basin lies west of the Sacramento River roughly between Cache Creek to the north, and the Sacramento-San Joaquin Delta (Delta) to the south. The Basin is near the center of what was historically one of the largest and most spectacular riparian and wetland areas in central California. It was here that unimpaired drainage from the Sierra Nevada Mountains, Trinity Mountains, and coastal mountains converged in the Yolo Basin via the Sacramento, Feather, and American Rivers, and Putah and Cache Creeks. However, since the early 1900s, intensive agriculture has dramatically altered the Yolo Basin by draining former wetlands, resulting in a significant changing of the landscape (JSA 1990).

Historically, within the Yolo Basin, permanent marshes were located in the lowest, central part of the basin, while outlying areas provided seasonal wetlands during winter and spring flood periods. Only small remnants of natural wetlands now remain in the basin, many of which are seasonally-flooded agricultural lands and pastures on private duck-hunting clubs.

Within the Yolo Basin, the Yolo Bypass is an important feature of the Sacramento River Flood Control Project. The Bypass has a design capacity of 490,000 cubic feet per second (cfs) between the Sacramento Weir and Cache Slough, and is composed of a complex series of levee and channel improvements extending from the terminus of the Sutter Bypass to near Rio Vista on the Sacramento River. The Bypass receives flow from westerly tributaries, including Cache and Putah Creeks; overflow weirs along the Sacramento River, including Fremont and Sacramento Weirs, and sometimes from the American River. When the combined flow of the Sacramento and Feather Rivers and Sutter Bypass exceeds 70,000 cfs, most of the excess spills over the Fremont Weir into the Yolo Bypass. Also, when flows in the Sacramento River (measured at the "I" Street bridge) reach about 94,000 cfs, gates at the Sacramento Weir are opened sequentially, allowing excess water to flow into the Yolo Bypass. Likewise, on the American River, if an extremely high flow of about 100,000 cfs occurs, the water surface will be highest at the confluence of the Sacramento and American Rivers, and will cause a reverse flow in the Sacramento River to about 3 miles north where the Sacramento Weir enters the Bypass. Thus, the Sacramento Weir acts as a "safety valve" to pass American River flood flows in excess of the available capacity in the Sacramento River, away from Sacramento via the Yolo Bypass.

The Fremont Weir is also an integral part of the Bypass System. This weir is located near the junction of the Sacramento River and Sutter Bypass, about 12 miles north of Sacramento, just upstream from Verona and the Natomas Cross Canal. During high flows, water from the Sacramento River flows over the Fremont Weir into the Yolo Bypass. Because of the relative capacity of the Sacramento River and Yolo Bypass, the majority of flood flows from Sutter Bypass cross the Sacramento River and enter the Yolo Bypass. Fremont Weir is the first weir to admit flood waters to the Yolo Bypass area. As a result, various seasonal wetland cover-types have developed in the area.

III. DESCRIPTION OF PROJECT ALTERNATIVES

The Stepped Release Plan is described below. Project descriptions are summarized from the Corps' August 1999 Information Paper and from information provided by Corps staff.

A. NO ACTION ALTERNATIVE

Under the no action alternative, the operational modifications (revised flood control release schedule, revised reservoir storage schedule, and a release schedule for Spring refill) to Folsom Reservoir implemented by SAFCA and the U.S. Bureau of Reclamation would continue. Interim reoperation of the Folsom Dam and Reservoir would continue in accordance with the provisions contained in the 1996 Water Resources Development Act (WRDA). The no-action alternative also includes the advanced release scenario, which would reduce the risk of flooding to about a 1 in 164 chance in any year. Additionally, the following authorized projects would be implemented: (1) Folsom Dam Modifications, (2) North Area Local Project, (3) Common Features Project, (4) Sacramento River Bank Protection Project (SRBPP), and (5) South Sacramento County Stream Group Project. The risk of flooding would be reduced by the year

2007 to about a 1 in 140 chance in any year by these projects. Even with these projects in place, however, Sacramento would still be subject to catastrophic flooding in the event of a levee failure. If levees broke around the City of Sacramento, the extent of flooding would be 86 square miles and cause damage to 111,000 structures. The Reclamation Board and SAFCA have indicated that their flood control goal is for Sacramento to have at least a 200-year level of protection. The chance that the current flood control system could pass a 200-year storm without levee failure and major flooding in Sacramento is about 38% (USACE 2000a and 2000b).

B. FOLSOM STEPPED RELEASE PLAN TO 160,000 CFS

The Folsom Stepped Release Plan to 160,000 cubic feet per second (cfs) would allow increased objective flow releases down the lower American River; peak flow releases would increase from the existing 115,000 cfs to 145,000 cfs for the more frequent floods, then to 160,000 cfs for the rarer flood events. The with-project flood risk for the 160,000 cfs plan would reduce the probability of flooding from 1 chance in 164 to 1 chance in 185 in any year. The major features of this plan are the following (from USACE 1999):

1. **Modify Levees along the Natomas East Main Drainage Canal (NEMDC)**
   The levees would be strengthened by building a stability berm with drain rock (25 feet wide by 12,000 feet long) and reshaping the landside levee slope along 5,000 feet. These levee modifications would occur from Discovery Park to Northgate Blvd., from RM 0-2.0 R.

2. **Modify local utilities and drainage facilities, and water intake facilities**. To date, it is proposed that 19 existing city and county drainage pumps and related facilities would be upgraded, and at least 2 new pumping stations would be constructed at existing gravity outfalls to maintain the current capacity of these facilities to discharge interior drainage into the American River. The higher water surface elevations caused by the proposed increased releases could adversely affect the operation of many pumping and drainage facilities located in the City and County of Sacramento. These facilities collect rainfall runoff from the protected areas of Sacramento and convey it to the American River by pumping or gravity flow. The facilities are under evaluation to determine if they would be negatively impacted by changes from the Stepped Release Plan. Modifications to the drainage facilities are based on impacts from the expected 145,000 cfs objective release profile. Impacts from higher releases would be ameliorated by the flood protection provided by the alternative for these less frequent events. Three water intake facilities would also be modified. The aspects of the modifications are as follows:
   a. **Raise existing pump discharge invert**. The existing pumping plants have pipes passing through the levees. The pipes would be raised so that the low invert elevation would be above the probable failure point at that location. This would be done to ensure that the levees could safely pass the objective release without backflow to the landside. The raises range from 2.2 to 10.5 feet. A minimum of 2 feet of cover would be required over the top of the raised discharge lines. This would require the levee crown to be ramped over the discharge lines. The raised pipes would be welded steel lines.
   b. **New pumps and motors**. The increased head on the pumps due to the change in

elevation would reduce the capacity of the pumps. The flow rate of the pumps would be reduced, which would cause overloading of the motors. These motors would be replaced with larger units and the pumps and electrical equipment would be modified to maintain capacity. For some utilities, only motors may need to be modified.

c. **New pump discharge lines**. For some utilities, the higher capacity pumps would require construction of a new discharge line through the levee.

d. **New pump station**. The existing Del Rio and Tiffany Lane gravity drains would require the addition of new pump stations, pumps, motors, and possibly new discharge lines. At the Del Rio drain, new 36-inch pumps with a 26,900-gpm capacity would be required. Two 36-inch welded steel discharge lines would convey flows to the river channel. At the Tiffany Lane drain, two new 8-inch pumps with a 900-gpm capacity would be required. Two 8-inch welded steel discharge lines would convey flows to the river channel. The new pumping plants would be fenced.

e. **Modification of water intake facilities**. Three water intake facilities and wells operated by local districts would be affected by higher flow. To mitigate potential damage due to scour damage, the facilities would need to strengthened or armored.

3. **Hydraulic mitigation areas.** The hydraulic mitigation features downstream of the American River would be based on a release of 145,000 cfs. The objective release would not be increased to 180,000 cfs until inflows to Folsom Reservoir were of the magnitude exceeding a 100-year storm event. Under without-project conditions, a storm of this magnitude would result in flows exceeding 180,000 cfs downstream from the American River. Because conditions downstream of the mouth of the American River for these very rare events would be no worse with the project, the hydraulic mitigation would be limited to the 145,000 cfs release that would be experienced during the more frequent floods (USACE 2000a). Specific construction measures are as follows:

a. **Widen the Sacramento Weir and Bypass**.

Relocation of the north levee of the Sacramento Bypass. The Sacramento Weir would be lengthened 1,000 feet and the bypass would be widened an equal amount. This widening was sized to accommodate an objective release of 145,000 cfs. About one-third of the existing north levee would be used to construct the new levee 1,000 feet to the north. The rest of the existing north levee would be graded and seeded to provide mounds for wildlife habitat. The remainder of the fill material needed for levee construction would be obtained from the Port of Sacramento. The new weir would have the same configuration and section as the existing weir. The new weir would consist of 25, 40-foot-wide bays and would be located to the north of the existing weir along the alignment of the railroad line. A temporary railroad line and road would be constructed that would bypass the weir construction. The temporary railroad alignment would use a 750-foot radii with transition segments. The speed of the train would be about 15 mph on the temporary bypass. The Sacramento River Road would be connected along a new alignment to the existing road after passing over the new weir. Upon completion of construction of the new weir, the temporary railroad and road bypass would be removed. In addition, there is an old landfill that would have to be removed when the bypass is widened. The landfill occupies about 20

acres of land and averages about 5 feet in depth. Two agricultural pumping plants and a gaging station would be relocated, along with four buildings.

b. Raise and strengthen levees in the Yolo Bypass, associated Yolo Bypass sloughs, and Delta sloughs. To avoid any reduction in the level of flood protection currently provided by the Yolo Bypass levees, about 18.7 miles of these levees and their associated sloughs would be repaired using various construction methods that would consist of seepage/ stability berms, drainage collector systems, drain rock and berms, slurry walls, and lime treatment. These fixes would consist of the following:

Alternative B. Alternative B would consist of a 45-foot-wide seepage stability berm. The impact assessment is based on a total of 80 feet from the levee toe (60-foot permanent and 20-foot temporary construction easements). From the levee toe to the levee crown, 15 feet would be impacted.

Alternative C. Alternative C would consist of a 25-foot-wide drainage collector system at the levee toe. The impact assessment is based on a total of 55 feet from the levee toe (35-foot permanent and 20-foot temporary easements). From the levee toe to the levee crown, 15 feet would be impacted.

Alternative C-1. Alternative C-1 would consist of a 25-foot-wide drainage collector system, anywhere from 0 to 50 feet from the levee toe, depending on the site. The impact assessment is based on a 35-foot-wide permanent easement. The area between the levee toe and the existing drainage ditch would be used for staging. From the levee toe to the levee crown, 15 feet would be impacted.

Alternative D. Alternative D would consist of a 12-foot-wide seepage/stability berm. The impact assessment is based on a total of 45 feet from the levee toe (25-foot permanent and 20-foot temporary easements). From the levee toe to the levee crown, 15 feet would be impacted. In areas where the landside work would extend into a ditch, construction would proceed by placing drain rock into the ditch to form a working surface, and then building up with soil to create a berm.

Slurry walls. Slurry wall width would be 3 feet, depth would range from 40 to 70 feet (depending on site), and length would be 6,000 feet. A temporary construction easement would be acquired from the levee toe out 100 feet to the landside. Work within this easement would include all staging and slurry batch mixing activities. Irrigation ditches that are located landside of the sites would be protected in place by placing pre-cast "double T's" across the ditches. For impact assessment, we assumed one-half of the linear length of the ditch (3,000 feet) would be encased with the double T's. At some sites, seepage/stability berms would also be required. Construction would be completed in 2 years.

Lime treatment. Lime treatment would be done only in Index Area 1L, from I-5 downstream to the north levee of the Yolo Bypass. Construction would consist of stripping and stockpiling the topsoil on the levee crown and landside levee slope. About 4 feet of levee material would then be excavated and mixed with lime. A wet lime would be used to reduce dust. The levee would be reconstructed using soil/lime mixture. The stockpiled topsoil would then be placed back on the levee crown and landside slope. In addition, the existing ditch would be relocated a maximum of about 140 feet from the existing toe. The total impact area would extend 150 feet from the levee toe. This would

allow 140 feet for staging and ditch relocation and 10 feet for a temporary construction easement on the other side of the ditch. Construction of Index Area 1L would take about 2 years.

The location of, reason for, and description of each repair are shown in Table 1.

Table 1. Location, reason for repair, and description of proposed repairs for the American River Watershed Investigation, Long-Term Evaluation, Stepped Release Plan.

LOCATION	REASON FOR REPAIR	DESCRIPTION OF PROPOSED REPAIRS
Site 3-2, Steamboat Slough, left bank, landside	Stability	·Alternative D, stability berm ·12 feet wide x 8,000 feet long ·15 foot impact on levee slope ·25 feet permanent easement beyond toe ·20 feet temporary easement beyond toe
Site 349-00-1, Sutter Slough, LM 2.39 left, landside	Boils & seepage	·Alternative C-1, drainage collector system ·15 foot impact on levee slope ·25 feet wide x 730 feet beyond toe ·35 feet total permanent easement beyond toe
Site 349-00-1, Sutter Slough, LM 2.39 left, landside	Boils & seepage	·Alternative C, drain rock and berm ·25 feet wide x 600 feet long ·15 foot impact on levee slope ·35 permanent easement beyond toe ·20 temporary easement beyond toe
Site 349-1, Sutter Slough, left bank, landside	Boils	·Alternative C, drain rock and berm ·25 feet wide x 1,500 feet long ·15 foot impact on levee slope ·35 feet permanent easement beyond toe ·20 feet temporary easement beyond toe
Site 3-3, Steamboat Slough, left bank, landside	Seepage	·Alternative C, drain rock & berm ·25 feet wide x 300 feet long ·20-foot impact on levee slope beyond toe ·35 feet permanent easement beyond toe
Site 501-00-1, Steamboat Slough, Ryer Island, LM 1.62 right, landside	Boils	·Alternative B, seepage/stability berm ·45 feet wide x 2,500 feet long ·15 foot impact on levee slope ·60 feet permanent easement beyond toe ·20 feet temporary easement beyond toe
Site 501-8, Steamboat Slough, Ryer Island, right bank, landside	Boils & seepage	Alternative B, seepage/ stability berm/ toe french drain ·45 feet wide x 2,000 feet long ·15 foot impact on levee slope ·60 feet permanent easement beyond toe ·20 feet temporary easement beyond toe

Site 501-9, Steamboat Slough, Ryer Island, right bank, landside	Slumping	Alternative B, seepage/ stability berm ·45 feet wide x 2,500 feet long ·15 foot impact on levee slope ·60 feet permanent easement beyond toe ·20 feet temporary easement beyond toe
Site 501-1A, Cache Slough, Ryer Island, left bank, landside	Stability/ seepage	Alternative B, seepage/ stability berm ·45 feet wide x 1,200 feet long ·15 foot impact on levee slope ·60 feet permanent easement beyond toe ·20 feet temporary easement beyond toe
Site 3-00-6, Sacramento River, LM 8.09-8.15 right, landside	Boils	·Alternative D, seepage/ stability berm ·12 feet wide x 1,000 feet long ·15 foot impact on levee slope ·25 feet permanent easement beyond toe ·20 feet temporary easement beyond toe
Site 3-00-1, Steamboat Slough, LM 3.1 left, landside	Slumping	·Alternative D, seepage/ stability berm ·12 feet wide x 1,500 feet long ·15 foot impact on levee slope ·25 feet permanent easement beyond toe ·20 feet temporary easement beyond toe
Site 2098-10, Cache Slough, left bank, landside	Stability	·Alternative D, stability berm ·12 feet wide x 2,500 feet long ·15 foot impact on levee slope ·25 feet permanent easement beyond toe ·20 feet temporary easement beyond toe
Site 2098-10A, Cache Slough, left bank, landside	Stability/ seepage	·Alternative C-1, seepage/stability berm ·25 feet wide x 400 feet long ·15 foot impact on levee slope ·35 feet total permanent easement beyond toe
Site 2068-1, Yolo Bypass, right	Stability	·Alternative D, stability berm ·12 feet wide x 2,500 feet long ·15 foot impact on levee slope ·25 feet permanent easement beyond toe (15' on berm & 10' into ditch)
Site 2068-2, Yolo Bypass, right	Stability	·Alternative D, stability berm ·12 feet wide x 10,000 feet long ·15 foot impact on levee slope ·25 feet permanent easement beyond toe (15' on berm & 10' into ditch)
Index Area 1R, landside of Yolo Bypass, **RM 49.4** (midpoint), west side of Yolo Bypass,	Under-seepage due to sand layers below the levee foundation	·Slurry wall ·60 feet deep x 3 feet wide x 6,000 feet long ·Slurry wall will extend 3,000' upstream and 3,000' downstream of midpoint ·100' impact zone (for staging & mixing) from levee toe on out.

upstream of Willow Slough		
Index Area 1R, landside of Yolo Bypass, **RM 47.2** (midpoint), west side of Yolo Bypass, upstream of Willow Slough	Under-seepage due to sand layers below the levee foundation	·Slurry wall ·60 feet deep x 3 feet wide x 6,000 feet long ·Slurry wall will extend 3,000' upstream and 3,000' downstream of midpoint ·100' impact zone (for staging & mixing) from levee toe on out.
Index Area 1R, landside of Yolo Bypass, **RM 44.9** (midpoint), upstream of Willow Slough	Under-seepage due to sand layers below the levee foundation	·Slurry wall ·40 feet deep x 3 feet wide x 6,000 feet long ·Slurry wall will extend 3,000' upstream and 3,000' downstream of midpoint ·100' impact zone (for staging & mixing) from levee toe on out.
Index Area 3 - Hydraulically Separate (HS) Area 1, landside of Yolo Bypass, **RM 23.3** (midpoint), along Shag Slough	Underseepage	·Slurry wall ·60 feet deep x 3 feet wide x 6,000 feet long ·Slurry wall will extend 3,000' upstream and 3,000' downstream of midpoint ·100' impact zone (for staging & mixing) from levee toe on out.
Index Area 3 - HS Area 1, landside of Yolo Bypass, **RM 22.1** (midpoint), along Shag Slough	Underseepage	·Slurry wall ·70 feet deep x 3 feet wide x 6,000 feet long ·Slurry wall will extend 3,000' upstream and 3,000' downstream of midpoint ·100' impact zone (for staging & mixing) from levee toe on out.
Index Area 1L- left bank of Yolo Bypass, from I-5 downstream to the north end of the Sacramento Bypass	To increase strength of levee	·Lime treatment on the upper 4 feet of the levee crown and the landside levee slopes along 6 miles (~31,680 feet) ·Relocate existing irrigation ditch that parallels the levee, a maximum of 140 feet from the levee toe ·10-foot easement next to new ditch
Sacramento Bypass and Weir	To accommodate objective release of 145,000 cfs	·Lengthen the Sacramento Weir and Bypass by 1,000 feet.

C. FOLSOM STEPPED RELEASE PLAN TO 180,000 CFS

The Folsom Stepped Release Plan to 180,000 cfs would allow increased objective flow releases down the lower American River; peak flow releases would increase from the existing 115,000 cfs to 145,000 cfs, then to 180,000 cfs for the rarer, larger flood events. It is estimated that this plan would reduce the probability of flooding from about 1 chance in 164 to about 1 chance in 196 in any 1 year (USACE 2000a). The major features of this plan are the following (from USACE 1999):

1. **Modify Lower American River levees (for the 180,000 cfs Stepped Release plan)**
   a. **Raise levees**. Federal and non-Federal levees would be raised along about 12.6 miles on the north and south banks of the American River. Raises would occur at the following four reaches: river miles (RM) 5.0-13.0 right bank (R), RM 7.0-12.0 left bank (L), RM 13.0-13.2 L, and 13.8-14.0 L. The raises would vary from up to 2 feet for the Federal levees and up to 4 feet for the non-Federal levees upstream of Mayhew Drain. The width of impacted areas associated with levee raising would be about 30 feet (USACE 2000a).
   b. **Strengthen levees**. Erosion protection (riprap) would be placed along 5.7 river miles of the levees to accommodate flows up to 180,000 cfs (USACE 1999). Erosion protection would be placed at the following six reaches: RM 0 L, RM 2.7-3.2 L, RM 4.3-5.1 L, RM 7.1-7.3 L, RM 9.3-9.9 L, and RM 6.0-8.9 R.
   c. **Build new levees**: Construction of new levees would occur along about 2.5 river miles to accommodate flows up to 180,000 cfs. New levees would be built at the following five reaches: RM 13.4L, RM 15.0-15.7 L, RM 18.0 R, RM 19.5-20.0 L, and 21.3-22.0 L. The total width of impact area associated with the new levees would be about 75 feet (USACE 2000a).
   d. **Build new floodwalls**. Construction of new floodwalls would occur along about 2.7 river miles to accommodate flows up to 180,000 cfs. The new floodwalls would be constructed around Goethe Park and the Nimbus Hatchery. The Goethe Park floodwall would have an average height of 3 feet, with a 9-foot permanent easement, and a 10-foot temporary easement. The Nimbus Hatchery floodwall would have an average height of 2 feet, with a 5-foot permanent easement, and a 10-foot temporary easement (USACE 2000a). New floodwalls would be built at the following three reaches: RM 12.5 L, RM 13.8-14.5 R, and RM 22.0-23.0 L.

2. **Raise Howe Avenue and Guy West bridges and raise Union Pacific Railroad trestle (for the 180,000 cfs Stepped Release Plan)**
   a. **Howe Avenue Bridge**. Two alternatives are proposed:
   Alternative 1. The first alternative consists of constructing a new higher bridge east of the existing spans to leave four lanes of traffic open on the existing spans. The new bridge would be based on the design of the existing spans so they would look the same. Once the new bridge has been constructed, the existing northbound bridge span would be raised 5.25 feet. There would be three spans with two open while the middle span is raised. The third span would be demolished.
   Alternative 2. The second alternative would consist of constructing a higher new bridge between the spans of the existing bridge, leaving four lanes open for traffic. The design style of this bridge would be different than those of the existing spans. One of the existing bridges would be demolished. A second higher new bridge with the same design style as the first new bridge would be constructed near the same location as the demolished bridge. The second existing bridge would be demolished, leaving the possibility to expand traffic capacity by constructing a third span. In both alternatives, the approaches and smaller bridges across La Riveria to the south and University Avenue to the north would have to be raised/replaced.

b. Guy West Bridge. This bridge consists of a 600-foot main suspension span and two 72-foot truss approach spans. The bridge links the Campus Commons neighborhood to the California State University, Sacramento campus. The bridge was constructed in 1966 and is owned by the City of Sacramento. For flows of 180,000 cfs, the bridge would need to be raised 3.5 feet. The existing suspension span would be progressively raised from 0 feet at mid-span to 3.5 feet at the piers, by shortening the suspenders and making modifications to the existing bearings. About 140 feet on each end of the suspension span would be raised. The approach spans would also be raised by modifying the bearings. Raising the suspension span would flatten the profile. This would reduce the vertical clearance between the bridge deck and the lowest tower strut from 14 feet to about 10.5 feet. Both approaches would have to be raised 3 feet. Because of the limited area, this would steepen the approach slope to the bridge. Retaining walls would be constructed on both sides of both approaches to make the raising without requiring a new right-of-way.

c. Union Pacific Railroad (UPRR). This area is located near the intersection of Highway 160 and Northgate Blvd. The proposed plan is to strengthen the existing trestle, and construct a floodgate on top of the right bank levee.

3. Modify local utilities and drainage facilities, and water intake facilities.
See the Stepped Release Plan to 160,000 cfs.

4. Hydraulic mitigation areas.
See the Stepped Release Plan to 160,000 cfs.

IV. BIOLOGICAL RESOURCES

A. EXISTING CONDITIONS

Existing conditions are those conditions which exist in the project area at the time of the impact analysis.

1. LOWER AMERICAN RIVER

a. Vegetation

There are essentially six cover-types found along the Lower American River: these are (1) riparian woodland, (2) oak woodland, (3) SRA Cover, (4) agricultural lands (rice and non-rice), (5) "other" (habitat that does not need to be mitigated for, which includes developed lands, barren ground, and orchards), and (6) upland herbaceous. The vegetation within the American River corridor gradually changes across the transition of low foothills to valley floor. At the upper end, downstream of Nimbus Dam, typical valley floor riparian habitats are restricted to a narrow band immediately along the river's edge. The uplands support mainly evergreen hardwood forests dominated heavily by foothill live oaks, and a few occurrences of foothill grasslands. At the lower end of the river corridor, near the confluence with the Sacramento River, the generally flat topography supports a typical valley floor habitat complex of grassland,

emergent freshwater marsh, riparian scrub-shrub, and deciduous hardwood forest (USFWS 1991a). The lower American River supports sparse to dense riparian vegetation with an understory of annual grasses and forbs. Typical species found in these areas are valley oak, live oak, willow, black walnut, cottonwood, locust, and elderberry shrubs.

b. Fish

The American River from Nimbus Dam to the Sacramento River confluence supports at least 41 fish species, about half of which are game fish. Common game species include chinook salmon, steelhead, American shad, striped bass, and resident species include rainbow trout, smallmouth and largemouth bass, and bluegill. Non-game species include carp, Sacramento sucker, hardhead, and other species (USFWS 1991a).

c. Wildlife

Due to the proximity of the lower American River to Sacramento, it receives much attention. Parkway recreationists are abundant, as are permanent and seasonal wildlife species. Although reservoirs, levees, diversions and other developments have drastically altered the river and adjacent lands, they remain a valuable and productive wildlife habitat area. More than 220 species of birds, including great blue heron, mallard, red-tailed and red-shouldered hawks, California quail, belted kingfisher, and American robin, to name a few, are commonly observed. In the uplands, more than 30 species of mammals including Virginia opossum, raccoon, western gray squirrel, black-tailed deer, and coyote are commonly seen. Beaver, muskrat, and occasionally river otter, are seen in the open water and backwater areas. Riparian woodland along the Parkway supports many egrets, herons, hawks, and owls (USFWS 1991c). Reptiles and amphibians such as the Pacific treefrog, common gopher snake, and western pond turtle are also found along the lower American River (USFWS 1986).

2. HYDRAULIC MITIGATION AREA

a. Vegetation

There are seven cover-types found in the hydraulic mitigation area: (1) riparian woodland, (2) oak woodland, (3) seasonal freshwater emergent marsh (small irrigation ditches), (4) open water (larger irrigation canals), (5) agricultural lands, (6) "other" (habitat that does not need to be mitigated for; includes developed lands, barren ground, and orchards), and (7) upland herbaceous. During high flow years, when the Bypass floods, various acreages of seasonal wetlands, seasonal mudflat, and deep, open water are created. Habitat quality of emergent wetlands ranges from fairly large areas of high-quality, to narrow strips of emergent marsh along canals, ditches and drains, where habitat quality is sometimes low because of ditch maintenance practices, including herbicide use.

Most of the area within the Bypass is intensively farmed; the primary crops include sugar beets, tomatoes, castor beans, safflower, and corn and other grains. The present acreages of the native habitats in the area are relatively small in relation to the agricultural acreages.

b. Fish

i. Cache Creek, Willow Slough, Willow Slough Bypass, and Sacramento Bypass.
Cache Creek and South Fork Putah Creek are relatively small streams which are perennial in most years, since their flows are controlled by various dams and diversions. Despite their variable flows, these waterways sometimes support a substantial diversity of aquatic fauna, including fish. These areas support typical warmwater fishes of the Central Valley. Common game fish species caught are largemouth bass, black and white crappie, bluegill, redear and green sunfish, white and channel catfish, and black bullhead. Several nongame fish such as carp, goldfish, inland silverside, mosquito fish, bigscale logperch, and other minnows are also present.

ii. Sacramento River.
The Sacramento River flows east of the Yolo Bypass project areas, and thus many of the species found in the Sacramento River system enter the Yolo Bypass when it floods. The Sacramento River supports an array of anadromous and resident fish species. Anadromous fish species include chinook salmon, steelhead, striped bass, American shad, white sturgeon and Pacific lamprey; resident warmwater fish include largemouth bass, crappie, white and channel catfish, bluegill, tule perch, Sacramento pike minnow, Sacramento sucker, and various sculpins and minnows. Several nongame fish such as carp, goldfish, other minnows, and mosquito fish are also present. During large flood events, many of these species enter the Yolo Bypass and are occasionally present in the toe drains and several borrow ditches within the Bypass.

SRA Cover is a unique, nearshore aquatic zone of importance to fish and other wildlife occurring where riparian vegetation overhangs or protrudes into a stream or river channel. This cover-type, which provides shade, cover, and other important attributes, is scarce in the project areas, with only occasional occurrences where shrubs or trees are present in the slough channels.

c. Wildlife
The abundance and distribution of wildlife resources in the project area is directly related to the types and amounts of available habitat. Currently, wildlife in the project area is much less abundant and diverse than before agricultural development removed much of the natural oak woodland, riparian woodland and other wetland habitats. Early accounts of the Yolo Basin describe huge tracts of tule marsh and inland lakes stretching for miles and covering thousands of acres. Hundreds of species of birds and mammals, including the California grizzly bear, tule elk, and pronghorn antelope, once thrived within the Basin. The Basin was also a major wintering area for waterfowl of the Pacific Flyway prior to wetland drainage for agricultural development (JSA 1990). Many of the wildlife species which were found in riparian woodlands, oak woodlands, and annual grasslands have declined markedly in response to development of the Basin.

Riparian woodland and riparian shrub habitats support a highly diverse plant and wildlife community. Species numbers are relatively large in relation to the area of available habitat. The diversity of species supported by these riparian habitats is due to a combination of surface and ground water availability, soil fertility, nutrient availability, vegetative layering to form a variety of microclimates, and the role of this cover type in providing movement and migration corridors.

Estimates indicate that, within California, about 25% of native land mammal species, 50% of reptile species, and 75% of amphibian species are dependent on riparian habitats (Leopold 1985). Invertebrates, both terrestrial and aquatic forms, are also supported in high numbers by such habitats. Invertebrates provide essential prey sources for a wide array of wildlife within the riparian ecosystem.

The various wetland habitats also support a wide variety of mammals and birds, especially waterfowl, shorebirds, wading birds, and other water birds. The Central Valley is still the most important waterfowl wintering area in the Pacific Flyway, supporting about 60% of the total population. Prior to wetland drainage, about 4 million acres of wetlands, mostly surrounded by grasslands and riparian woodlands, provided valuable wintering and breeding habitat for waterfowl and other wildlife dependent on wetland habitats (Central Valley Habitat Joint Venture 1990). Within the Yolo Basin, waterfowl use during winter can be extensive, particularly when areas are temporarily flooded due to wet-season runoff or by management of private waterfowl hunting clubs. The seasonal wetlands and, at certain times, the unflooded agricultural lands, provide important feeding and resting areas for a wide range of migratory and resident birds, including waterfowl, shorebirds, and other water birds.

Aerial surveys conducted by the California Department of Fish and Game (CDFG) showed that an average of about 320,000 wintering waterfowl used the Yolo Basin during a 10-year period from 1978 to 1987 (JSA 1990). Generally during drier winters, however, the Yolo Bypass and Basin provide rather limited wetland habitat, and migrating waterfowl must generally bypass this critical area and use the wetlands, mainly State and Federal refuges, located to the north and south.

B. FUTURE CONDITIONS WITHOUT THE PROJECT

Future without-project conditions are those conditions expected to occur over the life of the project if the project were not implemented.

1. LOWER AMERICAN RIVER AND HYDRAULIC MITIGATION AREA

a. Vegetation

Under without-project conditions, vegetation in and along the lower American River would continue to undergo changes typically associated with a riparian system, but constrained and limited by the adjacent levee system, upstream dams, and regulated flow releases. Regeneration of riparian species, particularly cottonwood and willows, will slowly decline, as continued lateral erosion, net downstream sediment movement, and increased amount of higher terrace areas, exposed to less frequent flooding, develop as a result of increased channel stability. These processes have resulted from the construction of Folsom Dam and channel modifications along the lower American River (USFWS 1991a).

Sediment deposition needed for the establishment of these riparian species will continue to be limited by upstream impoundments. Forest complexes would be dominated by species adapted to relatively low water needs. Riparian species will gradually mature then die out, giving way to

more drought-tolerant plant species such as ash, box elder, and valley and live oaks. Vegetation will continue to be affected by its location in a major metropolitan area. Associated impacts include vandalism, burning, and mowing for firebreaks, among the more common human disturbances. Some younger riparian vegetation that exists under baseline conditions will continue to develop over time into mature riparian woodland habitat. Habitat abundance and diversity is not expected to change significantly over time in the hydraulic mitigation areas.

b. Fish

Conditions for fish in the lower American River are likely to change in the future without the project. However, the way in which it will change is difficult to predict. With implementation of the Anadromous Fish Restoration Program (AFRP) of the Central Valley Project Improvement Act (CVPIA) (USFWS 1995), conditions in the lower American River would improve for fishery resources.

Other variables will determine the way in which flows are managed on the lower American River; including Bay-Delta water quality standards, Bureau of Reclamation water contract renewals, and new contracts.

Overall, under existing conditions, spawning gravel for salmonid species will eventually become more scarce within the river. As a result of gravel mining and construction of Folsom and Natomas Dams, gravel replenishment sources are limited. Although spawning gravel quantity does not currently appear to be a limiting factor for salmonid spawning (Bill Snider, pers. comm. 1996 *in* USFWS 1996) we would expect losses of spawning sediments as time passes. Continued sediment losses would eventually degrade spawning habitat. This degradation could be reversed under restoration measures being considered under the CVPIA, which provide for restoration of lost spawning gravels (USFWS 1995).

c. Wildlife

The types of wildlife species found in the area will likely change somewhat along the lower American River under without project conditions, due primarily to the changes in vegetation described above and overall habitat abundance and diversity. Species which would decrease in number are those that prefer tree species such as cottonwood and willow for perching, foraging, and/or nesting (USFWS 1991c), as these plant species would likely decrease over time. Such wildlife species include birds such as woodpeckers, flickers, wrens, and raptors, and other avian species that use these riparian areas to meet their life requirements. Alternatively, species that prefer more arid habitats, such as oak woodland, would increase over time.

C. FUTURE CONDITIONS WITH THE PROJECT

Future with-project conditions are those conditions expected to occur over the life of the project if the project were implemented.

1. FOLSOM STEPPED RELEASE PLAN TO 160,000 CFS

a. Construction Impacts

Construction impacts from the 160,000 cfs plan would occur (1) in the hydraulic mitigation area, (2) along the NEMDC, and (3) at 21 local utilities and drainages sites, and 3 water intake structures and their associated facilities.

i. Hydraulic mitigation area

The Service completed an analysis of the hydraulic mitigation area in 1996 (USFWS 1996). The analysis that follows replaces this as well as the results stated in the Corps' 1996 SIR, except for the modification of the Sacramento Weir and Bypass, which would remain the same. In the interest of time, a HEP was not conducted for the hydraulic mitigation area sites. Instead, staff from the Service, Corps and Jones and Stokes Associates (JSA) conducted ground-truthing site reviews for each site, where we recorded the cover-types and area that would be impacted. Areas were visually estimated, and sites were located by using topographic quadrangle maps provided by the Corps, on which the proposed construction areas were delineated. Total acreage of each cover-type for each site was then calculated after returning from the field. We then used the mitigation ratios derived in the Service's 1996 HEP to arrive at mitigation acreages for these latest proposed construction sites. Table 2 shows the location, cover-types impacted, and acres impacted for each hydraulic mitigation site, Table 3 shows the borrow sites and staging areas, and Table 4 shows a summary of impacts.

a. Vegetation

Direct construction activities in the hydraulic mitigation area would result in elimination of an estimated 346.9 acres of wildlife habitat. Much of this impact acreage, (132.3 acres) would consist of temporary upland herbaceous impacts which would be restored immediately following construction. The remaining impacts to fish and wildlife habitat would be permanent. The hydraulic mitigation construction in the Sacramento Weir and Bypass area would eliminate 5.2 acres of oak woodland and 35.6 acres of upland herbaceous habitat. Within the Yolo Bypass and

Table 2. Location, cover-types impacted, and acres impacted for the hydraulic mitigation area for the American River Watershed Investigation, Long-Term Evaluation, Stepped Release Plan.

LOCATION	COVER-TYPES IMPACTED	ACRES IMPACTED
Site 3-2, Steamboat Slough, left bank, landside	Upland herbaceous (*Equisetum)* (*on levee slope)*	2.75
	Riparian woodland (112 trees) *(on levee slope)*	4.38[1]
	Developed (road) (*beyond toe*)	2.75
	Pear orchard (*beyond levee toe*)	5.51
Site 349-00-1, Sutter Slough, LM 2.39 left, landside	Upland herbaceous *(Equisetum*, grasses) (*on levee slope)*	0.25
	Seasonal freshwater emergent marsh *(beyond toe)*	0.13
	Developed (road) (*beyond toe*)	0.25
	Pear orchard (1 or 2 rows impacted) (*beyond toe*)	0.62
Site 349-00-1, Sutter Slough, LM 2.39 left, landside	Upland herbaceous (*Equisetum*, fennel, forbs, grasses, blackberry brambles) (*on levee slope)*	0.21
	Seasonal freshwater emergent marsh *(beyond toe)*	0.11
	Developed (road) (*beyond toe*)	0.21
	Pear orchard (*beyond toe*)	0.44
Site 349-1, Sutter Slough, left bank, landside	Upland herbaceous (grasses, *Equisetum*) (*on levee slope*)	0.52
	Individual trees (2 cottonwoods) (*on levee slope*)	0.04
	Seasonal freshwater emergent marsh *(beyond toe)*	0.10
	Developed (road) (*beyond toe*)	0.52
	Vineyard (*beyond toe*)	1.31
Site 3-3, Steamboat Slough, left bank, landside	Upland herbaceous (*Equisetum)* (*on levee slope)*	0.10
	Developed (farm road) (*beyond toe)*	0.10
	Agricultural lands (corn) (*beyond toe)*	0.28

[1]Staff from the Service, Corps and JSA decided that planimetering 1 tree on the blueline aerial photos would give us an acreage for 1 tree. 1 tree = 0.02 acre. 0.02 acre x 112 trees = 2.24 acres. We also delineated riparian woodland on the map which was 2.14 acres, for a total of 4.38 acres.

Site 501-00-1, Steamboat Slough, Ryer Island, LM 1.62 right, landside	Upland herbaceous (*on levee slope*)	0.86
	Individual trees (1 walnut) (*on levee slope*)	0.02
	Seasonal freshwater emergent marsh (*beyond toe)*	0.17
	Developed *(beyond toe*)	0.86
	Vineyard *(beyond toe*)	3.56
Site 501-8, Steamboat Slough, Ryer Island, right bank, landside	Upland herbaceous (grasses, wild rose) (*on levee slope*)	0.69
	Riparian woodland (16 walnuts & cottonwoods) (*on levee slope*)	0.32
	Developed (road) *(beyond toe*)	1.15
	Seasonal freshwater emergent marsh (*beyond toe)*	0.18
	Vineyard *(beyond toe*)	2.34
Site 501-9, Steamboat Slough, Ryer Island, right bank, landside	Upland herbaceous (*on levee slope*)	0.86
	Seasonal freshwater emergent marsh (*beyond toe)*	1.15
	Developed (road) *(beyond toe*)	1.15
	Pear orchard *(beyond toe*)	2.30
Site 501-1A, Cache Slough, Ryer Island, left bank, landside	Upland herbaceous (grasses) (*on levee slope*)	0.41
	Riparian woodland (30 trees consisting of walnuts, olives and figs) (*on levee slope*)	0.60
	Developed (road) *(beyond toe*)	2.20
Site 3-00-6, Sacramento River, LM 8.09-8.15 right, landside	Upland herbaceous (*Equisetum*) (*on levee slope*)	0.34
	Agricultural land (wheat field) (*beyond toe*)	1.03
Site 3-00-1, Steamboat Slough, LM 3.1 left, landside	Upland herbaceous (*Equisetum*, grasses, forbs) (*on levee slope*)	0.52
	Individual trees (1 valley oak tree) (*on levee slope*)	0.02
	Riparian woodland (mostly cottonwoods, some willows, 1 tobacco tree, nightshade) (*beyond toe*)	0.15
	Upland herbaceous (grasses) (*beyond toe*)	0.13
	Pear orchard (*beyond toe*)	1.27
Site 2098-10, Cache Slough, left bank, waterside (landside of Lookout Slough)	Upland herbaceous (star thistle, grasses, forbs) (*on levee slope*)	0.86
	Seasonal freshwater emergent marsh (cattails, mustard, sedges, etc.) (*beyond toe*)	2.58

Site 2098-10A, Cache Slough, left bank, landside	Upland herbaceous (grasses) (*on levee slope*)	0.14
	Open water (Lookout Slough, water hyacinth) (*beyond toe*)	1.15
	Developed (farm road) (*beyond toe*)	0.86
	Agricultural land (*beyond toe*)	0.86
Site 2068-1, Yolo Bypass, right (landside of Yolo Bypass and Waterside of Shag Slough)	Upland herbaceous (grasses, star thistle) (*on slope*)	0.86
	Open water (Shag Slough) (one clump of sedges) (*beyond toe*)	0.57
Site 2068-2, Yolo Bypass, right (landside of Yolo Bypass & Waterside of Shag Slough)	Upland herbaceous (grasses) (*on slope*)	3.44
	Open water and sedges (*beyond toe*)	2.30
Index Area 1R, landside of Yolo Bypass, **RM 49.4** (midpoint), west side of Yolo Bypass, upstream of Willow Slough	Upland herbaceous (grasses) (waterside of Yolo Bypass) (*on slope*)	0.69
	Developed (levee road)	2.07
	Upland herbaceous (grasses) (landside of Yolo Bypass) (*on slope*)	5.51
	Open water (irrigation ditch) (*beyond toe*)	1.38
	Upland herbaceous (on other side of canal) (*beyond toe*)	1.38
	Developed (farm road) (on other side of canal) (*beyond toe*)	2.07
	Agricultural land (on other side of canal) (*beyond toe*)	7.58
Index Area 1R, landside of Yolo Bypass, **RM 47.2** (midpoint), west side of Yolo Bypass, upstream of Willow Slough	Upland herbaceous (grasses) (waterside of Yolo Bypass) (*on slope*)	0.69
	Developed (levee road)	2.07
	Upland herbaceous (grasses) (landside of Yolo Bypass) (*on slope*)	5.51
	Seasonal freshwater emergent marsh (both sides of canal) (sedges, cattails) (*beyond toe*)	0.55
	Open water (irrigation ditch) (*beyond toe*)	0.69
	Upland herbaceous (on other side of canal) (*beyond toe*)	1.38
	Developed (farm road)(on other side of canal) (*beyond toe*)	2.07
	Agricultural land (rice field) (on other side of canal) (*beyond toe*)	8.40
Index Area 1R, landside of Yolo	Upland herbaceous (grasses) (waterside of Yolo Bypass) (*on slope*)	0.69

Bypass, **RM 44.9** (midpoint), upstream of Willow Slough	Developed (levee road)	2.07
	Upland herbaceous (grasses) (landside of Yolo Bypass) (*on slope*)	5.51
	Open water (irrigation ditch) (*beyond toe*)	2.41
	Upland herbaceous (on other side of canal) (*beyond toe*)	1.38
	Developed (farm road) (on other side of canal) (*beyond toe*)	3.44
	Agricultural land (rice field) (on other side of canal) (*beyond toe*)	4.13
Index Area 3 - Hydraulically Separate (HS) Area 1, landside of Yolo Bypass, **RM 23.3** (midpoint), along Shag Slough	Upland herbaceous (*on levee slope)*	2.07
	Open water (*(beyond toe)*	1.38
	Upland herbaceous (*beyond toe)*	2.75
	Developed (farm road) (*beyond toe)*	1.38
	Agricultural land	8.26
Index Area 3 - HS Area 1, landside of Yolo Bypass, **RM 22.1** (midpoint), along Shag Slough	Upland herbaceous (*on levee slope)*	2.07
	Open water (*(beyond toe)*	1.38
	Upland herbaceous (*beyond toe)*	2.75
	Developed (farm road) (*beyond toe)*	1.38
	Agricultural land	8.26
Index Area 1L- left bank of Yolo Bypass, from I-5 downstream to the north end of the Sacramento Bypass	Developed (levee road)	7.27
	Upland herbaceous (*above toe*)	29.09
	Upland herbaceous (*beyond toe)*	18.18
	Seasonal freshwater emergent marsh (*beyond toe)*	18.18
	Riparian woodland (willows along ditch) (*beyond toe)*	10.91
	Developed (farm road) (*beyond toe)*	7.27
	Agricultural land (*beyond toe)*	65.45
Sacramento Bypass and Weir	Oak woodland	5.15
	Upland herbaceous	35.60

Table 3. Proposed borrow sites and staging areas for the hydraulic mitigation area for the American River Watershed Investigation, Long-Term Evaluation, Stepped Release Plan.

LOCATION	COVER-TYPES IMPACTED	ACRES IMPACTED
Borrow sites		
Adjacent to Lake Washington by the Port of Sacramento turning basin	Site 1 - Upland herbaceous (thistles, weeds, forbs, willows, 1 small pine sp.) Site 2 - Upland herbaceous (thistles, weeds, forbs, willows)	72.0 52.0
Grand Island	Site 1 - Upland herbaceous (grasses, forbs). Site 2 - Upland herbaceous	4.8 1.9
Sacramento Bypass - the top 1/3 of the entire north levee of the Sacramento Bypass would be degraded to use for borrow material.	Upland herbaceous	7.8
Staging areas[1]		
Sutter Slough - 2 sites	Agricultural land	6.8
Steamboat Slough - 3 sites	Orchard Agricultural land	3.4 6.8
Yolo Bypass - 3 sites	Agricultural land	10.2
	TOTAL	165.7

[1]Each staging area is 3.4 acres.

associated sloughs, construction would eliminate 16.4 acres of riparian woodland, 23.2 acres of seasonal freshwater emergent marsh (lower-quality emergent marsh along some canals and ditches), 11.3 acres of open water (larger irrigation canals such as Shag and Cache Sloughs), 12.5 acres of agricultural lands (rice fields), 91.7 acres of agricultural lands (non-rice fields), 4 individual trees, 41.1 acres of developed lands, 10.1 acres of orchards, 7.2 acres of vineyards, and 128.2 acres of upland herbaceous habitat. Four borrow sites and eight staging areas have been identified. Impacts would occur to about 162.3 acres of upland herbaceous habitat and 3.4 acres of orchards (Table 3 and 4).

b. Fish

For the most part, construction activities would be associated with the landside slope of the levee, however, there are several sites where there are irrigation canals on the landside. Sites 2098-10A, 2068-2, RM 49.4, RM 47.2, and RM 44.9 all contain fairly large irrigation canals that would be either permanently or temporarily impacted. Construction of a seepage/stability berm would include placing drain rock into the irrigation canal, and then placing fill material for the

Table 4. Summary of construction impacts of the Stepped Release Plan to 160,000 cfs release for the American River Watershed Investigation, Long-Term Evaluation.

COVER-TYPES	SUMMARY OF ACRES OF IMPACTS FOR EACH COVER-TYPE FOR THE 160,000 CFS RELEASE			TOTAL ACREAGE/# OF INDIVIDUAL TREES/SHRUBS FOR EACH COVER-TYPE
	Hydraulic mitigation area	NEMDC area	Local drainages and utilities modifications[1]	
CONSTRUCTION AREAS				
Riparian woodland	16.4	5.7	0.6	22.7
Oak woodland	5.2	1.5	0	6.7
Seasonal freshwater emergent marsh (small irrigation ditches)	23.2	0	0	23.2
Open water (larger irrigation ditches)	11.3	0	0	11.3
Agricultural lands - rice	12.5	0	0	12.5
Agricultural lands - non-rice	91.7	0	0	91.7
Individual trees & shrubs	4 trees	0	1 shrub	5 trees/shrubs
Other[2]				
Developed	41.1	13.4	0.1	54.9
Barren habitat	0	4.9	0	4.9
Orchards	10.1	0	0	10.1
Vineyards	7.2	0	0	7.2
Upland herbaceous	128.2	3.8	0.3	132.3
SUB-TOTALS	**346.9**	**29.3**	**1.0**	**377.2**
BORROW SITES				
Upland herbaceous	138.5	see footnote[3]	see footnote[3]	138.5
STAGING AREAS				
Orchard	3.4	see footnote[3]	see footnote[3]	3.4
Upland herbaceous	23.8	see footnote[3]	see footnote[3]	23.8
SUB-TOTALS	**165.7**			**165.7**
TOTALS	**512.6**	**29.3**	**1.0**	**542.9**

[1]Acreages include only those sites that were visited in the field. If the Stepped Release Plans are selected, then further analyses will need to be done. [2]"Other" habitat consists of developed, barren ground, orchards, vineyards.

[3]Borrow sites and staging areas provided by the Corps are combined for the Lower American River levee modifications and local drainages, utilities and water intake facilities. Therefore, see Table 8 (summary of permanent impacts for the 180,000 cfs plan) for acreages.

berm to form a working surface. Slurry wall construction would consist of ditches being protected by "precast double T's", which are long concrete forms that look like two "T"'s put together. These would be fabricated off-site and put in place with a crane. These double T forms would be placed in the ditch to form a working surface, so that equipment could travel from one side of the ditch to the other. After construction, the forms would be removed, and the ditch returned to its pre-project condition. These forms would be placed along one-half of the linear feet of the ditch to be modified (i.e., if the linear feet for construction is 6,000, then the forms would be placed along 3,000 linear feet).

These construction methods would temporarily impact aquatic organisms within the various slough channels and irrigation ditches in the project area. Warmwater fish species likely found in the larger drainage canals (e.g., Shag Slough, Cache Slough, Lookout Slough, etc.) include American shad, black crappie, bluegill, largemouth bass, smallmouth bass, striped bass, and sturgeon. These activities would cause erosion and sedimentation problems, temporarily degrading water quality and possibly causing immediate mortalities to existing aquatic life. Increases in turbidity and water temperature (loss of streamside vegetation) would occur to the detriment of aquatic species, including benthic macroinvertebrates, in both immediate and downstream areas. Recovery of these benthic populations, major components of the aquatic food chain base, would depend greatly on the degree to which the bank substrate and in-stream habitat would be altered, and the level of maintenance that would occur.

c. Wildlife

Any construction activities which would require the removal or disturbance of riparian vegetation would result in the loss of escape cover, shade and forage material for terrestrial wildlife species, which could resulting in mortalities of individuals and habitat loss. Wildlife inhabiting these areas would be eliminated directly during construction or displaced to neighboring areas of similar habitat. Animals that are displaced and able to move to adjacent areas would increase competition for resources in the adjoining areas, with subsequent overall loss of individuals.

ii. <u>NEMDC Area</u>

a. Vegetation

The NEMDC area would be impacted on both the landside of Bannon Slough. Impacts would occur to about 5.7 acres of riparian woodland, 1.5 acres of oak woodland, 13.4 acres of developed lands, 3.8 acres of upland herbaceous habitat, and 4.9 acres of barren ground (Table 4). Woody vegetation consists of live oak, valley oak, black walnut, and cedar. Non-woody vegetation consists of mustard, grasses, forbs, and blackberry brambles.

b. Fish

No waterside work would occur in this area, therefore, no fisheries would be impacted.

c. Wildlife

On the landside of Bannon Slough, the impacted areas consist of woody and non-woody vegetation, as briefly described above. Grasses, forbs, mustard, and blackberry brambles provide habitat for small mammals such as voles and ground squirrels, while trees such as oaks and walnuts provide roosting, resting, and nesting habitat for a variety of birds. However, since the landside of the levee is greatly disturbed due to residential and commercial development, it is doubtful that the area provides a significant source of wildlife habitat.

iii. Local utilities and drainages and water intake facilities

In the interest of time, the Service was unable to visit a majority of the 21 local drainage facilities
(pumping plants, gravity drains, and sumps), and the 3 water intake facilities (Tables 5 and 6). The only sites we visited were Pumping Plant D-05, Sump 091, Sump 151, Del Rio Gravity Drain, Tiffany Lane Gravity Drain, Fairbairn Water Treatment Plant, and one Rossmoor Bar collection well. From these, it was projected that the impacts at these sites would be similar to the other sites. If it is determined that the Stepped Release Plans will be pursued as feasible, more in-depth analyses will be required, i.e., each site will need to be visited and analyzed for impacts.

a. Vegetation

Impacts to vegetation would be minimal. At Pumping Plant D-05, 0.03 acre of upland herbaceous habitat, 1 black walnut shrub, and 0.04 acre of barren land (levee road) would be impacted. At the Del Rio Gravity Drain site, 0.02 acre of upland herbaceous habitat would be impacted. At the Tiffany Lane Gravity Drain site, about 0.6 acre of riparian woodland, 0.006 acre of upland herbaceous habitat, and 0.009 acre of barren land (levee road) would be impacted. At Sump 091, 0.14 acre of upland herbaceous habitat and 0.02 acre of barren land (levee road) would be impacted. At Sump 151, 0.1 acre of upland herbaceous habitat and 0.04 acre of barren land (levee road) would be impacted. Upland herbaceous habitat is the dominant habitat type at most of the sites we visited. At the water intake facilities, no significant terrestrial or aquatic habitat would be impacted.

b. Fish

The only site that in-water work would occur would be at the Fairbairn Water Treatment Plant and related structures. As described, the intake structure would require modifications to account for additional scour from the proposed project. Six sheet piles would be driven 18 feet deep and tied into the existing tower footings. Riprap, that would be 3 feet thick and 18 inches in diameter, would extend a minimum of all directions from the tower footings. At each of the bridge towers, similar work would be done. At the sewer interceptor line located downstream of the Fairbairn Water Treatment Plant, 3-foot-thick riprap, that would be 8 inches in diameter, 20 feet wide, and 700 feet long, would be placed over and around the sewer interceptor line. The depth would extend 8 feet. The work would be done in riverine habitat. Due to time constraints, the Service was unable to determine the substrate on the bottom of the river channel in these impact areas. We assume it is unconsolidated fines. Placing rock on the bottom of the channel would change the substrate and the benthic habitat. However, because of the intake structures,

Table 5. Facility, location, owner, proposed repair, and cover-types impacted for modifications of local utilities and drainages for the American River Watershed Investigation, Long-Term Evaluation, Stepped Release Plan.

FACILITY	RIVER MILE/ BANK LOCATION	OWNER	PROPOSED REPAIR[1]	COVER-TYPES IMPACTED[2]	ACRES IMPACTED
Pumping Plant D-01	11.7/Right	County of Sacramento	·Raise 3 existing discharge lines 5.5 feet	not seen in field	
Pumping Plant D-02	9.0/Right	County of Sacramento	·Raise existing discharge lines 2.2 feet	not seen in field	
Pumping Plant D-05	5.5/Right	County of Sacramento	·Raise existing discharge lines 6.5 feet ·New pump(s) & motors ·New discharge line	·Upland herbaceous (grasses) , ·1 black walnut shrub ·Developed (levee road)	0.03 1 shrub 0.04
Pumping Plant D-06	10.9/Left	County of Sacramento	·Raise existing discharge lines 8.5 feet ·Modify/replace existing pumps	not seen in field	
Pumping Plant D-10	10.0/Left	County of Sacramento	·Raise existing discharge lines 5.5 feet ·Modify/replace existing pumps	not seen in field	
Pumping Plant D-11	13.2/Left	County of Sacramento	·Raise existing discharge lines 2.5 feet	not seen in field	
Pumping Plant D-43	10.0/Right	County of Sacramento	·Raise existing discharge lines 10.5 feet ·Modify/replace existing pumps	not seen in field	
Del Rio Gravity Drain	11.9/Left	County of Sacramento	·Raise existing discharge lines 3.5 feet ·New pump station	Upland herbaceous	0.02
Tiffany Lane Gravity	13.2/Left	County of Sacramento	·New pump station	Riparian woodland	0.57

Drain				Developed (levee road) Upland herbaceous	0.009 0.006
Mayhew Drain Channel	10.9/Left	County of Sacramento	·New structure with gravity drains at low flow ·6 new pumps	not seen in field	
Sump 010	4.6/Left	City of Sacramento	·Raise existing discharge lines 2.5 feet ·Modify/replace existing pumps	not seen in field	
Sump 058	1.3/Right	City of Sacramento	·Raise existing discharge lines 2.8 feet	not seen in field	
Sump 091	7.4/Left	City of Sacramento	·Raise existing discharge lines 7.8 feet ·New pump(s) & motors	·Upland herbaceous (grasses, forbs, bare ground, star thistle) ·Developed (levee road)	0.14 0.02
Sump 092	8.0/Left	City of Sacramento	·Raise existing discharge lines 7.7 feet ·New pump(s) & motors	not seen in field	
Sump 095	6.4/Right	City of Sacramento	·Raise existing discharge lines 5 feet ·Modify/replace existing pumps	not seen in field	
Sump 099	3.9/Left	City of Sacramento	·Raise existing discharge lines 4 feet ·Modify/replace existing pumps	not seen in field	
Sump 101	6.1/Left	City of Sacramento	·Raise existing discharge lines 4.8 feet ·Modify/replace existing pumps	not seen in field	
Sump 109	8.2/Right	City of Sacramento	·Raise existing discharge lines 7.5 feet	not seen in field	

			·Modify/replace existing pumps ·New pump(s) & motors		
Sump 111	0.9/Left	City of Sacramento	·Raise existing discharge lines 1 foot	not seen in field	
Sump 151	3.1/Right	City of Sacramento	·Raise existing discharge lines 4 feet ·Modify/replace existing pumps	·Upland herbaceous (grasses, forbs, star thistle, mustard) ·Developed (levee road)	0.11 0.04
Sump 152	4.8/Right	City of Sacramento	·Raise existing discharge lines 5.5 feet ·Modify/replace existing pumps	not seen in field	

[1]Raising existing pump discharge lines and raising the existing pump discharge invert would require that 100-125 feet of levee road, and the entire berm area on both sides of the levee road, be impacted (G. Kreinberg, pers. comm., 2001). [2]In the interest of time, it was decided that only a sample of the sites would be visited. From these, it was assumed that the other sites would have similar impacts. The only sites we looked at were: Pumping Plant D-05, Sump 091, Sump 151, Del Rio Gravity Drain, and Tiffany Lane Gravity Drain.

this area is very poor habitat for fish. A high degree of striped bass predation occurs at the intakes, and fish tend to become entrained and impinged at the intake structures. Therefore, the Service assumes no impacts to fish due to the poor habitat conditions caused by the intake structures.

c. Wildlife

The local drainage facilities and water intake facilities that we visited were located in fairly disturbed locations (e.g., next to bike trails, levee roads, surface streets, bridges, etc.), however, some of the surrounding areas consisted of fairly dense stands of riparian woodland at Sump 151 and Sump 091, and at the Tiffany Lane Gravity Drain site, about 0.0.57 acre of riparian woodland would be directly impacted due to construction of a new pump station and its associated new pipe. Riparian woodland provides nesting, resting and cover for a variety of riparian bird species such as yellow warbler, northern oriole, woodpecker spp., raptor spp., etc. The levee slopes at all of the sites are very degraded, and consist of various grasses, forbs, mustard, and star thistle. It is likely that small mammal species, such as voles, use the slopes for cover, and species such as ground squirrels use the slopes to excavate burrows.

Table 6. Facility, location, owner, proposed repair, cover-types impacted, and acres impacted for water treatment facilities for the American River Watershed Investigation, Long-Term Evaluation, Stepped Release Plan.

FACILITY	LOCATION	OWNER	PROPOSED REPAIR	COVER-TYPES IMPACTED	ACRES IMPACTED
Fairbairn Water Treatment Plant	Lower American River, downstream of Howe Avenue RM 7.4	City of Sacramento	Protect intake structure and sewer interceptor from scour by placing riprap.	None[1]	0
Rossmoor Bar collection wells	Lower American River, Rossmoor Bar, Ancil Hoffman Park RM 17.5	Carmichael Water District	Place gabions around the collection wells to protect against additional scour.	None	0
Infiltration wells	Lower American River, RM 11.7	Arcade Water District	Place gabions around the collection wells to protect against additional scour.	None	0

[1]Because of the water intake facility, the site is extremely unsuitable for fish. Therefore, whatever habitat would be impacted (e.g., riverine) would require no mitigation.

b. <u>Operational Impacts</u>

The physical features of the Stepped Release Plan include a variety of levee and bank protection elements which would increase both the objective capacity of the downstream channel and, as necessary, the probable non-failure point of the levees. The outlets would be operated in a step-like manner to increase outflows as needed to prevent encroachment and uncontrolled releases from the dam. This discussion considers only the effects of operating the Stepped Release Plan on the lower American River, and does not include physical impacts of construction, or potential impacts in the inundation zone of the reservoir. Increased flows of the Stepped Release Plan may impact riverine and riparian habitat due to the increased erosive energy, and cumulative effects on carryover storage due to revision of the flood control diagram. Since our preliminary comments, the Corps has developed additional information on peak discharge-frequency relationships and representative flood routings, including a pre-release option that assumes improved forecasting (Appendix A), all of which take into account the most recent hydrologic record. Some information on flow-related parameters above 115,000 cfs (velocity, depth, critical shear exceedence, tractive force) is still not available. Our analysis of the operational implications of the Stepped Release Plan is restricted to the most recent information.

a. <u>Background</u>

For the preliminary draft FWCA report (April 2001), we evaluated a different variant of the Stepped Release Plan, a single step from 145,000 to 180,000 cubic feet per second (cfs)(USFWS

1996). It was assumed that releases would be more frequent at 145,000 cfs than at 180,000 cfs, however, the general form of the operation was not specified. The basis for our analysis was a series of administrative draft reports including simulated flows as a result of permanent reoperation of Folsom Dam and Reservoir. Our findings (USFWS 1996) were that fall temperatures would be increased, and spring mean and peak flows would be reduced. Unfortunately, these conclusions do not relate specifically to the flood control operation of the Stepped Release Plan; but are more a consequence of the reoperation and other facilities, including the outlet modifications. We did note that peak flows would increase by 15,000-30,000 cfs on a relatively frequent basis, and the duration of these flows would decrease slightly. The implications of these flows and durations were not discussed further.

More recently, we evaluated the effects of another element of ARWI, the Folsom Outlet Modification Project (USFWS 2001). In that analysis, we considered only the effects that increasing the lower outlet and surcharge capacities would have under the existing flood control diagram. For the lower river, we considered the operational effects of increasing the frequency of high flows on salmonid redds, spawning gravel availability, bank erosion and associated riparian vegetation, and splittail spawning habitat. For the surcharge zone, we evaluated potential changes in the frequency and duration of inundation around the reservoir and associated effects on vegetation. Using information developed previously for the detention dam at Auburn (Ayres 1997), it was determined that high flows may result in some impact, but this could be largely avoided through a rule limiting outflows to 60% of inflow. This "60% rule" is applied to peak inflows less than the 10-year event. Flows in excess of 115,000 cfs, as is proposed for the Stepped Release Plan, were not evaluated. Our April 2001, preliminary report on the subject consisted of general comments only, noting the need for traditional flow-frequency diagrams and flood routings. The Corps has since provided much of this information, which serves as the basis for this discussion.

b. <u>Project Description</u>

For the purpose of this analysis, it is assumed that the baseline would be the existing facilities and operation, as further modified by the Folsom Dam Outlet Modification Project. Existing operations are a variable 400/670 thousand acre-feet (TAF) flood control diagram, in which the space required in Folsom Reservoir is increased when space available in three major upstream reservoirs is limited. Improvements from that project would increase the capacity of the lower outlets to an objective release of 115,000 cfs, and increase the surcharge space so as to limit downstream flows to 160,000 cfs, the point of non-failure of the existing levees. These improvements would provide flood protection up to about a 140-year event. The Stepped Release Plan involves increasing the objective release, depending on the severity of the storm and storage in Folsom Reservoir. As discussed, two variations of the Stepped Release Plan are proposed, each with two steps: (a) Stepped Release to 180,000 (from 115,000 to 145,000, then 180,000 cfs) and (b) Stepped Release to 160,000 cfs (from 115,000 to 145,000 to 160,000). Modifications necessary to conduct this stepped operation, including levee reinforcement, modifications of the Sacramento Weir and Bypass as well as other actions, are described elsewhere in this report.

Two release options were considered: no pre-release (existing conditions), and pre-release assuming technological advancement in forecasting that would achieve the equivalent of an additional 100,000 acre-feet of space. The assumptions for the purposes of this analysis are perfect forecasting, triggering of pre-release at inflows of 300,000 cfs or more (60-year event), that releases will be no more than 50,000 cfs when the main storm wave hits, and that additional releases will not be made until the flood control space is encroached.

c. Operations

Under without-project conditions, the outlets and/or spillway would be operated to release 60% of the inflow, which would reach the existing objective capacity of the downstream channels (115,000 cfs) at about the 10-year event[2]. Above the 25-year event, the release would be maintained to the extent possible up to the expected level of protection with the assumption of enlarged outlet and surcharge capacity (about the 140-year event). Flows in excess of the 140-year event would be uncontrolled.

With the Stepped Release Plan to 160,000 cfs alternative, the objective capacity would be increased in a linear manner beginning at the 10-year event, and achieving 145,000 cfs at the 20-year event. Between the 50- and 100-year events, the objective capacity would be "stepped" a second time to 160,000 cfs. The Stepped Release Plan to 180,000 cfs alternative is identical to the 160,000 cfs alternative, except that the second step is larger, to 180,000 cfs. The alternatives would increase flood protection to around the 200-year event.

The magnitude of the differences between with and without-project conditions was estimated by examining representative flood routings and flow-frequency plots from the range of events in which differences were expected (i.e., the 20 and 100 year events). A summary of the effects in terms of duration and frequency for the Stepped Release Plan is shown in Table 7. For the 20-50 year event (peak inflow of 180,000-270,000 cfs), either Stepped Release Plan would increase the outflow from 115,000 cfs without the project, to 145,000 cfs with the project. At the 100-year event and larger, the outflow would be increased from 115,000 cfs without the project to either 160,000 (SR160) or 180,000 cfs (SR180). Durations of flow during this stepped operation are expected to vary (3-60 hours), with a slightly longer duration of flow for the SR160 alternative (up to 12 additional hours) compared to the SR180 alternative. The pre-release option would decrease the duration of the peak for event sizes of 150 years or less. For larger events, operations with pre-release would have shorter duration but much larger peak flows than without pre-release.

[2]-We note that the flow-frequency plots differ significantly between earlier information provided for the outlet modification project (Appendix B), and preliminary plots of without-project conditions for this project (Appendix A). The reason for this discrepancy is not known at this time, but may be related to pre-release (discussed later in this report).

Table 7. Discharge peak (for flows above 115,000 cfs) and peak duration as a function of event size for Stepped Release alternatives for the American River Watershed Investigation, Long-Term Evaluation project (estimated from interpretation of Corps flood routings). For pre-release assumptions, see text. Parenthetical discharges would exceed the probable non-failure point of the channel levees.

FLOOD EVENT SIZE (years)	BASELINE PEAK DISCHARGE, 1000 cfs no-pre/prerelease	NO PRE-RELEASE				PRE-RELEASE			
		Duration (hours)		Peak Discharge (1000 cfs)		Duration (hours)		Peak Discharge (1000 cfs)	
		SR160	SR180	SR160	SR180	SR160	SR180	SR160	SR180
20	115	30	3	145	145	--------	3	145	145
50	115	19	11	145	145	18	18	145	145
100	115	24	18	160	180	22	16	160	180
150	150/(200)	60	41	160	180	12	8	160	180
200	(275)/(325)	35	44	(180)	180	40	28	160	180
250	(375)/(420)	5	7	(320)	(240)	12	84	(230)	180

SR = Stepped Release

d. Areas of Concern

i. Impacts of Higher Outflows on Spawning Gravels

Spawning of chinook salmon and steelhead trout is largely localized in the upper 5 to 10 miles of the lower American River. During our previous analysis for the outlet enlargement project, we commented that the increased frequency of outflows in excess of 50,000 cfs may result in disturbance or redds, or even loss of usable spawning gravels (USFWS 2001). Disturbance of redds might result in direct mortality of eggs and fry, or indirect mortality through premature movement of fry downstream. This impact was initially recognized in a study that included dimensionless shear calculations for the lower American River at a number of flows. The model results indicated that area or the river bed in which surface materials begin to move expands as flows increase above 50,000 cfs (Fig. 4.31 *in* Ayres 1997). This concern is even more serious for outflows of 145,000 cfs and larger as it was for outflows of 115,000 cfs. Substantial and significant exceedence of critical shear stress was occurs at these higher flows, including in the vicinities of known spawning locations. These early results must be viewed with caution owing to the limited spatial resolution (one dimensional, 1/4-mile transects, limited substrate sampling).

During the preparation of the draft FWCA for the outlet enlargement project, the Service's Instream Flow Branch completed its evaluation of the 1997 flood event on flow-habitat relationships for spawning salmonids (USFWS 2000). Although it was concluded that the

relationship did not change, this finding does not discount the possibility that some temporal impact occurred as a result of gravel movement disturbing the redds, during the year of this event. We also cautioned that a two-dimensional model would be more accurate. In any case, these results do not apply to the 145,000 cfs and larger outflows proposed for the Stepped Release Plan.

For the purpose of evaluating the outlet improvements (assumed as a baseline condition for the current study), Ayres recently completed a draft two-dimensional model and analysis for spawning bed mobilization up to 115,000 cfs (Ayres 2001). The results of this analysis has several important findings. First, they confirm the earlier results, that movement of gravels begins to occur at 50,000 cfs and increases in spatial extent at 115,000 cfs. Second, the grain size contours, while sometimes larger than samples, was not so excessive as to completely exceed the potential range of sizes used by chinook salmon. Third, there were substantial regions where the grains size which moved remained low, generally in the vicinity of existing bars. The results suggest that outflows of 115,000 cfs could cause some coarsening and movement of gravel in portions of spawning areas, such as near Sunrise Boulevard, but no effect in some of the important bar complexes.

ii. Riparian Impacts Due to Erosion of Banks, Benches and/or Islands

Larger outflows have had substantial impacts throughout the lower American River, particularly in the lowermost (River Mile, RM, 0 - 4.8) and uppermost (RM 17 - 23) reaches (Fig. 2.24 *in* Ayres 1997), but also localized sections between Howe and Watt Avenues. Excessive bank erosion not only may result in loss of riparian vegetation, but could lead to spot repairs with rock which would limit or preclude future vegetation. The potential effects of high flows on such erosion are especially difficult to estimate, but could be severe. Recently, Ayres developed a two-dimensional model of velocity distributions in the lower 12 miles of the Lower American River at 115,000 cfs. Several areas were expected to achieve sufficiently high velocities at that flow (6-8 feet per second), that indicates a potential for bank erosion. The higher flows associated with the Stepped Release Plan could have an even greater impact, possibly extending to loss of vegetation on islands and benches.

As options to a dry dam at Auburn, Ayres (1997) estimated the long term effects of several operations (although not a Stepped Release Plan), on bank stability by considering both duration and magnitude of a range of events 30 critical locations on the lower American River. Using calculated bank work as an erosion index, Ayres expected the net effect to be relatively small in the leveed reach, but that alternatives that caused an increase in duration of high to moderate in bank flows, also increased the potential for lateral instability in upper reaches of the lower American River. The extent to which this impact occurs under a Stepped Release Plan is completely unknown, and would require similar detailed analysis and calculations, using the expected hydrology during operation of a Stepped Release Plan over a range of flood events.

iii. Cumulative Impacts

Although the Stepped Release Plan may not affect total outflows by itself, it may have an additional effect in combination with modification of the interim 400/670 TAF operation to some other form (e.g., 400/600 TAF). Such a reoperation would have a wide range of effects,

including benefits such as increased coldwater reserves in the reservoir, as well as impacts such as reduced outflow to the Sacramento-San Joaquin Delta or compensatory releases from other reservoirs. The additional carryover could be especially beneficial if available for fishery purposes.

e. Discussion

Currently, there is a without-project risk that operation of the baseline facilities could result in additional disturbance or loss of both spawning gravels and SRA Cover during a flood larger than the 140-year event. The Stepped Release Plan would involve relatively frequent peak outflows of 145,000 cfs or more every 10 years, much more than the existing condition. Although only a small, 0.5 mile portion of the spawning bed below Nimbus Dam is fully armored by large cobbles, a larger section below it is "in the green" (i.e., in motion) at 115,000 cfs (Ayres 2001). Because of this condition, we speculate that the larger and more frequent outflows associated with the Stepped Release Plan could cause more substantial armoring, extensive gravel loss, and significant grade loss. We further expect there to be additional impacts of these stepped flows to SRA Cover and riparian resources in specific areas already identified at risk of erosion by Ayres (1997). Although some of these have since been variously treated by berms and rock toe due to high bank work indices, others with intermediate indices (or new sites) might be significantly impacted by the 145,000-180,000 cfs flows associated with stepped release. The baseline risk, the frequent high outflows of the Stepped Release Plan, and the physical impacts related to hydraulic mitigation are all associated with potential adverse impacts of the Stepped Release Plan.

Finally, it is difficult to evaluate the pre-release option separately, but the risks already identified by the Corps in its preliminary EIS,raise similar concerns about the effects on habitat and fisheries, namely: the risk of non-refill, and the inability to make early releases if the reservoir is too low or the channel is already at capacity. Non-refilling could affect the ability to make fishery releases in the spring to supply the Delta, or to maintain temperature in the spring and early summer for salmon.

2. FOLSOM STEPPED RELEASE PLAN TO 180,000 CFS

a. Construction Impacts

i. Lower American River, levee modifications

a. Vegetation

Levee modifications to the lower American River levee system, as proposed, would result in significant impacts to wildlife in the project area. Impacts to habitat would occur from 12.6 miles of levee raising, 2.5 miles of new levees, 2.7 miles of new floodwalls, and 5.7 miles of erosion protection. Impacts would eliminate about 25.0 acres of riparian woodland, 20.1 acres of oak woodland, 57.0 acres of agricultural lands (non-rice fields), 6.2 acres of barren ground, 48.4 acres of developed areas, 66.7 acres of upland herbaceous habitat, and 0.4 acre of orchards, for a total of about 223.8 acres (Table 8) (see Appendix C to review the HEP report). Please note that these modifications include the NEMDC area.

Twenty-four staging areas have been identified for levee modifications. Fourteen of these sites have also been identified for use for the ARWI Common Features project. Table 9 shows location, acres and cover-types that would be impacted with the project. For the most part, the staging areas consist of degraded or non-vegetated areas, that would pose minimal impacts to wildlife species at and surrounding the staging area sites. About 25.6 acres of upland herbaceous, 5.8 acres of barren land, and 9.4 acres of developed lands would be impacted. These

Table 8. Summary of construction impacts of the Folsom Stepped Release Plan to 180,000 cfs release for the American River Watershed Investigation, Long-Term Evaluation.

COVER-TYPES	ACRES OF IMPACTS FOR EACH COVER-TYPE FOR THE 180,000 CFS RELEASE					TOTAL ACREAGE/# TREES/SHRUBS FOR EACH COVER-TYPE
	Levee modifications[1]	Howe Ave. Bridge Raising	Guy West Bridge Raising	Hydraulic mitigation areas[2]	Local drainage & utilities modifications[3]	
CONSTRUCTION AREAS						
Riparian woodland	25.0	6.1[4]	0.1 (0.13)[5]	16.4	0.6	48.2
Oak woodland	20.1	0	0	5.2	0	25.3
Seasonal freshwater emergent marsh (smaller irrigation ditches)	0	0	0	23.2	0	23.2
Open water (larger irrigation ditch)	0	0	0	11.3	0	11.3
SRA Cover	0	0.3	0	0	0	0.3
Agricultural lands - rice	0	0	0	12.5	0	12.5
Agricultural lands - non-rice	57.0	0	0	91.7	0	148.7
Individual trees/shrubs	0	0	0	4 trees	1 shrub	5 trees/shrubs
Other[6]						
Developed	48.4	2.2	0[7] (0.03)	41.1	0.1	91.8
Barren ground	6.2	1.7	0 (.007)	0	0	7.9
Orchard	0.4	0	0	10.1	0	10.5
Vineyard	0	0	0	7.2	0	7.2
Upland herbaceous	66.7	2.8	0.5	128.2	0.3	198.5
SUB-TOTALS	**223.8**	**13.1**	**0.6**	**346.9**	**1.0**	**585.4**
BORROW SITES						
Upland herbaceous	130.4	see footnote[8]	see footnote[8]	138.5	see footnote[8]	268.9
STAGING AREAS						
Orchard	0	see footnote[8]	see footnote[8]	3.4	see footnote[8]	3.4
Upland herbaceous	25.6	see footnote[8]	see footnote[8]	23.8	see footnote[8]	49.4
Barren land	5.8	see footnote[8]	see footnote[8]	0	see footnote[8]	5.8
Developed	9.4	see footnote[8]	see footnote[8]	0	see footnote[8]	9.4
SUB-TOTALS	**171.2**	**see footnote[8]**	**see footnote[8]**	**165.7**	**see footnote[8]**	**336.9**
TOTALS	**395.0**	**13.1**	**0.6**	**512.6**	**1.0**	**922.3**

[1] Levee raising, new levees, new floodwalls, erosion protection, including along the NEMDC area. [2]Field work and analyses were conducted for the hydraulic mitigation areas since the preliminary draft FWCA report was submitted in April 2001. The sites analyzed replace all sites analyzed in 1996, except for the Sacramento Bypass and Weir widening. [3] Due to time constraints, only a sample of drainage facilities and water intake facilities were visited, therefore, the acreages reflect only those sites visited. [4]Includes about 0.1 acre of non-native riparian, and 0.80 acre of ornamentals. [5]This consists of native species and non-native species, including ornamentals and fruit trees. [6]Other habitat consists of developed, barren ground, orchards, vineyards. [7]Rock riprap. [8]The borrow sites and staging areas for the levee modifications work is assumed to be the same sites as for the Howe Avenue Bridge Raising, Guy West Bridge, and local utilities, drainages, and water intake facilities.

Table 9. Staging areas and borrow sites for levee modifications, bridge raising, local drainages, local utilities and water intake facilities modifications for the American River Watershed Investigation, Long-Term Evaluation, Stepped Release Plan.

LOCATION	COVER-TYPES IMPACTED	ACRES IMPACTED
STAGING AREAS		
Site L-1[1], left bank	Upland herbaceous	1.10
Site L-2[1], left bank	Barren	1.40
Site L-3, left bank	Barren	1.50
Site L-4[1], left bank	Barren	0.57
Site L-5[1], left bank	Barren Upland herbaceous	0.40 0.40
Site L-6[1], left bank	Barren	1.15
Site L-7[1], left bank	Developed (parking lot)	1.01
Site L-8[1], left bank	Upland herbaceous with 1 tree	1.30
Site L-9, left bank	Upland herbaceous with scattered trees	0.90
Site L-10A, left bank	Developed (parking lot)	0.44
Site L-10B, left bank	Barren	0.77
Site L-11, left bank	Developed (parking lot)	0.67
Site L-12, left bank	Developed (parking lot)	0.92
Site R-1, right bank	Upland herbaceous	6.60
Site R-2[1], right bank	Upland herbaceous	1.73
Site R-3[1], right bank	Upland herbaceous with scattered trees	2.28
Site R-4[1], right bank	Upland herbaceous with scattered trees	0.85
Site R-5[1], right bank	Upland herbaceous with scattered trees	1.89
Site R-6[1], right bank	Upland herbaceous	0.66
Site R-7, right bank	Upland herbaceous	0.25
Site R-8[1], right bank	Upland herbaceous	2.35
Site R-9[1], right bank	Upland herbaceous	4.71
Site R-10, right bank	Upland herbaceous	0.55
Site R-11, right bank	Developed (parking lot), 1 pine & 6 walnuts	6.34
	SUB-TOTAL	**40.74**
BORROW SITES		
Borrow sites - adjacent to Lake Washington by the Port of Sacramento turning basin	Site 1 - Upland herbaceous (thistles, weeds, forbs, willows, 1 small pine sp.)	72.0
	Site 2 - Upland herbaceous (thistles, weeds, forbs, willows)	52.0
Between Bradshaw Road and Happy Lane, south of Hwy 50	Upland herbaceous	6.4? (or 6.2?)
	SUB-TOTAL	**130.4**

	TOTAL	**171.14**

[1]Same locations identified for ARWI, Common Features project.

sites would also be used for bridge raising and local drainages, utilities, and water intake structure modifications.

b. Fish

Construction impacts to fish along the lower American River would be minor to none, as the majority of the levee modification work is to be conducted away from the channel banks.

c. Wildlife

Construction activities would cause direct mortalities of ground-dwelling amphibians, reptiles and/or mammals through vehicle strikes and crushing of burrows, and removal of habitat for escape cover, foraging, and breeding. Construction activities occurring during the breeding season of these species or ground-nesting bird species would likely cause destruction of nests and young. Elimination of habitat would also result in the loss of individuals. Animals that survive construction would be displaced; those that are able to move to adjacent areas may increase competition for resources in the adjoining areas, with subsequent overall loss of individuals.

ii. Lower American River, bridge modifications

a. Vegetation

Howe Avenue Bridge

We assumed that both bridge raising alternatives (*see* "Description of Project Alternatives") would impact the same amount of habitat. Habitat would be impacted on both sides of the river. It was determined that about 6.1 acres of riparian woodland (including 0.8 acre of ornamentals), 1.7 acres of barren ground, 2.2 acres of developed areas, 2.8 acres of upland herbaceous habitat, and 0.3 acre of SRA Cover, for total of 13.1 acres, would be impacted by construction activities (Table 8).

Guy West Bridge

With the project, about 0.13 acre of riparian woodland, negligible amounts of barren ground (0.007 acre), negligible amounts of developed areas (0.03 acre), and 0.5 acre of upland herbaceous habitat would be impacted, for a total of 0.6 acre. The riparian woodland habitat consists of scattered trees in a degraded area. A site inspection revealed the area contains about 17 trees and 4 shrubs, both native and non-native tree. Native species include live oak, cottonwood, sycamore, and native blackberry. Non-native species include Himalayan blackberry, grapefruit, and black locust (Table 8).

Union Pacific Railroad Bridge

No vegetation would be impacted with construction activities at this site.

b. Fish

Howe Avenue Bridge. Raising the Howe Avenue bridge would likely have temporary and local adverse affects on fish in the lower American River, because raising the bridge would take 6.5 years, and would likely require work in the stream channel in order to raise some of the bridge piers.

Guy West Bridge

The Service has assumed that no in-channel work would occur and, therefore, no impacts would occur to fisheries.

Union Pacific Railroad Bridge
No impacts to fish would occur since this area is not adjacent the river.

c. Wildlife
Howe Avenue Bridge
On the left bank of the river, some of the area is quite degraded, mainly due to use by homeless people who have made their homes and cut trails through the area, and maintenance roads that have been constructed through the property. However, there is a substantial amount of native and non-native riparian woodland, that presumably provides habitat for a variety of wildlife species. On the right bank of the river, more riparian habitat exists, though in a smaller footprint, and has a bike trail located adjacent to it, which causes disturbance to wildlife in the area. Overall impacts of this alternative to wildlife in the project area would be moderate. Construction activities would cause direct mortalities of ground-dwelling amphibians, reptiles and/or mammals through vehicle strikes and crushing of burrows, and removal of habitat for escape cover, foraging, and breeding. Construction activities occurring during the breeding season of these species or ground-nesting bird species would likely cause destruction of nests and young. Elimination of habitat would also result in the loss of individuals. Indirect impacts could occur from disturbance from construction activities, which may cause some species to move out of the area. Animals that survive construction would be displaced; those that are able to move to adjacent areas may increase competition for resources in the adjoining areas, with subsequent overall loss of individuals.

Guy West Bridge.
Guy West Bridge is heavily used by bicycle and pedestrian commuters. The left bank of the river has been rocked and planted with seedlings. Riparian habitat is very degraded and minimal on both sides of the river, and consists of many non-native tree and shrub species. Overall, wildlife use is presumed to be very low due to the degraded quality of the area, therefore, impacts would be very minimal.

Union Pacific Railroad Bridge
This area is also very degraded due to the railroad tracks that run through the area and the homeless people who have set up camps here. It is expected there would be no direct impacts to wildlife. Indirect impacts could affect wildlife inhabiting surrounding riparian areas, due to disturbance from construction activities, which may cause some species to move out of the area.

iii. Utilities and local drainage modifications
See above, under "construction impacts" for the 160,000 cfs plan.

iv. Hydraulic Mitigation Area
See above, under "construction impacts" for the 160,000 cfs plan.

b. Operation impacts
See above, under "construction impacts" for the 160,000 cfs plan.

D. THREATENED AND ENDANGERED SPECIES

Appendix D provides a list of the federally listed species dated July 12, 2001, and a summary of a Federal agency's responsibilities under section 7(a) and (c) of the Endangered Species Act (Act) of 1973, as amended. The Corps should request in writing from the Service a list of all federally listed and proposed threatened and endangered species within the project area, or an

updating of any list more than 90 days old at the time preparation of a Biological Assessment for this project is undertaken. Species accounts may be obtained from the Sacramento Fish and Wildlife Office. The National Marine Fisheries Service (NMFS) has responsibility for federally listed marine fish and wildlife species, including all anadromous salmonids. They should be contacted if any of these species may be impacted by project activities. Appendix E provides a list of the State listed species updated as of July 18, 2001. The CDFG has responsibility for State listed species and species of concern.

a. Lower American River

Federally listed species lists were obtained for the following quadrangles: Carmichael, Citrus Heights, Folsom, Sacramento East, and Sacramento West. Endangered species are: (1) winter-run chinook salmon (and its endangered critical habitat), (2) vernal pool tadpole shrimp, and (3) Sacramento Orcutt grass. Threatened species are: (1) bald eagle, (2) giant garter snake, (3) California red-legged frog, (4) delta smelt (and its threatened critical habitat), (5) Central Valley steelhead, (6) Central Valley spring-run chinook salmon, (and its threatened critical habitat), (7) Sacramento splittail, (8) vernal pool fairy shrimp, and (9) valley elderberry longhorn beetle (and its threatened critical habitat). There is one proposed threatened species, the mountain plover (Table 10)

A summary report from the CDFG's RareFind Data Base was retrieved for the project area for the same quadrangles as the federally listed species (*see above*) on July 17, 2001. State listed endangered species are the Boggs Lake hedge-hyssop and the Sacramento Orcutt grass. Threatened species are the bank swallow and the Swainson's hawk (Table 11).

b. Hydraulic mitigation area

Federally listed species lists were obtained for the following quadrangles: Courtland, Davis, Grays Bend, Isleton, Jersey Island, Liberty Island, Rio Vista, Sacramento West, Taylor Monument, and Verona. Endangered species are: (1) riparian woodrat, (2) riparian brush rabbit, (3) winter-run chinook salmon (and its endangered critical habitat), (4) Conservancy fairy shrimp, (5) vernal pool tadpole shrimp, (6) Antioch Dunes evening-primrose, and (7) palmate-bracted bird's beak. Threatened species are: (1) bald eagle, (2) giant garter snake, (3) California red-legged frog, (4) delta smelt (and its threatened critical habitat), (5) Central Valley steelhead, (6) Central Valley spring-run chinook salmon (and its threatened critical habitat), (7) Sacramento splittail, (8) vernal pool fairy shrimp, (9) valley elderberry longhorn beetle, and (10) delta green ground beetle. There is one proposed threatened species, the mountain plover (Table 10).

Table 10. Federally listed and proposed species for the American River Watershed Investigation, Long-Term Evaluation, Stepped Release Plan.

FEDERALLY LISTED AND PROPOSED SPECIES	LEVEE MODIFICATIONS ALONG LOWER AMERICAN RIVER	HYDRAULIC MITIGATION AREA
Winter-run chinook salmon and its critical habitat (E)	**X**	**X**
Sacramento Orcutt grass (E)	**X**	
Vernal pool tadpole shrimp (E)	**X**	**X**
Riparian woodrat (E)		**X**
Riparian brush rabbit (E)	**X**	
Conservancy fairy shrimp (E)	**X**	
Antioch Dunes evening-primrose (E)		**X**
Palmate-bracted bird's beak (E)		**X**
Bald eagle (T)	**X**	**X**
Giant garter snake (T)	**X**	**X**
California red-legged frog (T)	**X**	**X**
Delta smelt and its critical habitat (T)	**X**	**X**
Central Valley Steelhead (T)	**X**	**X**
Central Valley spring-run chinook salmon and its critical habitat (T)	**X**	**X**
Sacramento splittail (T)	**X**	**X**
Vernal pool fairy shrimp (T)	**X**	**X**
Valley elderberry longhorn beetle (T)	**X**	**X**
Valley elderberry longhorn beetle critical habitat (T)	**X**	
Delta green ground beetle (T)		**X**
Mountain plover (PT)	**X**	**X**

T = threatened; E = endangered; PT = proposed threatened

A summary report of State listed species was also retrieved from the CDFG's RareFind Data Base for these quadrangles on July 18, 2001. State listed endangered species are the palmate-bracted bird's beak and Antioch dunes evening primrose. Threatened species are the Swainson's

Table 11. State listed and rare species for American River Watershed Investigation, Long-Term Evaluation, Stepped Release Plan.

STATE LISTED AND PROPOSED SPECIES	LEVEE MODIFICATIONS ALONG LOWER AMERICAN RIVER	HYDRAULIC MITIGATION AREA
Boggs Lake hedge-hyssop (E)	X	**X**
Sacramento Orcutt grass (E)	X	
Palmate-bracted bird's beak (E)		X
Antioch dune's evening primrose		X
Bank swallow (T)	X	X
Swainson's hawk (T)	X	X
California black rail (T)		X
Giant garter snake (T)		X
Soft bird's beak (R)		X

T = threatened; E = endangered; R = Rare

hawk, California black rail, bank swallow, and giant garter snake. There is one rare species, the soft bird's beak (Table 11).

V. DISCUSSION

A. MITIGATION PLANNING GOALS

The recommendations provided herein for mitigation and the protection of fish and wildlife are in conformance with the Fish and Wildlife Service's Mitigation Policy as published in the Federal Register (46:15; January 23, 1981). The Mitigation Policy provides Service personnel with guidance in making recommendations to protect, conserve, and enhance fish and wildlife and their habitats. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of important and valuable fish and wildlife resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife habitat values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife.

In applying the Mitigation Policy during an impact assessment, each specific habitat or cover-type that may be impacted by the project is identified.

Evaluation species which utilize each habitat or cover-type are then selected for Resource Category determination. Selection of evaluation species can be based on several rationales,

including: (1) species known to be sensitive to specific land and water use actions, (2) species that play a key role in nutrient cycling or energy flow, (3) species that utilize a common environmental resource, or (4) species that are associated with important resource problems, such as anadromous fish and migratory birds, as designated by the Director or Regional Directors of the Service. Evaluation species used for Resource Category determinations may or may not be the same evaluation elements used in an application of Habitat Evaluation Procedures (HEP). Selection of evaluation elements for HEP analyses are limited by species status (listed species cannot be used in HEP studies) and availability and suitability of HSI models. Finally, based on the relative importance of each specific habitat to its selected evaluation species, and the habitat's relative abundance, the appropriate Resource Category and associated mitigation planning goal are determined.

Mitigation goals are: (1) no loss of existing habitat value (Resource Category 1); no net loss of in-kind habitat value (Resource Category 2); no net loss of habitat value while minimizing loss of in-kind habitat value (Resource Category 3); and minimize loss of habitat value (Resource Category 4). As defined in the Service's Mitigation Policy, "in-kind replacement" means providing or managing substitute resources to replace the habitat value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate those lost.

Under Pacific Region Service guidance, we are also pursuing a goal of no net loss of wetland acreage, while seeking a net overall gain in the quality and quantity of wetlands through restoration, development and enhancement. Furthermore, the Service believes that wetlands compensation, which is the creation of wetlands to offset losses, should only be deemed acceptable when losses are determined to be unavoidable and compensation is known or believed to be technically feasible. Restoration of former or degraded wetlands is the preferred form of compensatory mitigation, followed by wetlands creation. However, accordant with Regional wetlands policy, either of these methods must result in no net loss of wetland acreage. These general goals regarding wetlands are used in the Service's analyses and recommendations relative to all proposed projects.

In recommending mitigation for adverse impacts to any of these habitats, the Service uses the same sequential mitigation steps recommended in the Council on Environmental Quality's regulations. These mitigation steps (in order of preference) are: avoidance, minimization, rectification, reduction or elimination of impacts over time, and compensation.

The habitats that would be impacted by the various alternatives proposed in the ARWI, the corresponding evaluation species selected by the Service to determine Resource Categories, the designated Resource Categories, and associated mitigation planning goals are discussed below (Table 12).

1. STEPPED RELEASE PLAN - LOWER AMERICAN RIVER AND HYDRAULIC MITIGATION AREA

Impacts to 8 habitat types were evaluated along the lower American River, along the NEMDC, and in the hydraulic mitigation area. They are: (1) riparian woodland; (2) oak woodland; (3) seasonal freshwater emergent marsh (found in small irrigation ditches); (4) open water (larger irrigation ditches); (5) SRA Cover; (6) agricultural lands (rice and non-rice); (7) other cover-types (consists of developed lands, barren ground, orchards, and vineyards); and (8) upland herbaceous. These habitats, and their corresponding evaluation species, designated Resource

Categories and associated mitigation planning goals are discussed below, and summarized in Table 12.

a. Riparian woodland

Riparian habitats occur extensively along the lower American River, and to a somewhat limited extent in the hydraulic mitigation area. Two forms of riparian habitat occur in the study area: riparian woodland, dominated by mature or maturing trees, and riparian shrub, consisting mostly of low shrubs or young trees. Riparian shrub habitat occurs as a stage in regeneration of riparian woodland following disturbance and in more frequently disturbed areas (e.g., by flood-scouring or human activities). Dominant tree species within this habitat in the study area include Fremont cottonwood, arborescent willows, and oaks; understory plants include wild grape, blackberries , poison oak, willows, and elderberry. Riparian shrub habitat is frequently dominated by willows, and often contains other shrubby riparian species and immature trees listed above.

Riparian woodlands were formerly widespread in the region, but have been severely reduced by agricultural development, flood control measures (including channel modifications and vegetation removal), and decreased stream flows resulting from diversions and dams upstream. The riparian woodland along the lower American River today is one of the larger and better-protected remnants of this habitat, and has been recognized as a "natural area of special significance" in the county general plan (County of Sacramento 1993). Riparian vegetation provides feeding, nesting, and shelter habitat for many species which use the riparian zone and surrounding lands. Vegetation which overhangs or protrudes into the water also provides fish with cover, rearing, and food resources. Riparian habitat provides feeding and nesting habitat for a species-rich assemblage of both migratory and resident breeding birds, as well as a movement corridor for mammals and migratory birds. Large, unfragmented blocks of riparian vegetation are critical to the survival of songbirds, including neotropical migrants, those birds that breed in North America and migrate to the tropics during the winter. There has been increasing concern over the decline in songbird populations in recent years (Primack 1993; Terborgh 1989). Much of the decline is thought to be a result of habitat fragmentation and disturbance; these conditions give rise to increased nest parasitism by cowbirds and nest predation by mammals such as opossums and raccoons which are attracted to disturbed areas (Primack 1993). Water-dependent avian species such as belted kingfisher, and wood duck, raptors including red-shouldered hawk, osprey, and black-shouldered kite, and neotropical migrants such as western kingbird, violet-

Table 12. Evaluation Species, Resource Categories, and mitigation goals selected for habitat types to be impacted with the Stepped Release Plan to 160,000 and 180,000 cfs, for the American River Watershed Investigation, Long-Term Evaluation.

COVER-TYPE FOR EACH PLAN OR COMPONENT OF THE PROJECT	EVALUATION SPECIES	RESOURCE CATEGORY	MITIGATION PLANNING GOALS
Riparian woodland	Belted kingfisher, neotropical migrant songbirds, raptor guild	2	No net loss of in-kind habitat value or acreage
Oak woodland	Woodpecker guild, oak insect community	2	No net loss of in-kind habitat value or acreage
Seasonal freshwater emergent wetlands (small irrigation ditches)	Marsh wren, red-winged blackbird, great blue heron	2	No net loss of in-kind habitat value or acreage
Open water (large irrigation canals)	Great blue heron, warm-water fish	3-4	No net loss of habitat value while minimizing loss of in-kind habitat value (3), and minimize loss of habitat value (4)
SRA Cover	Salmonids, belted kingfisher, great egret, great blue heron	2	No net loss of in-kind habitat value or acreage
Agricultural land	Sandhill crane, northern pintail, Pacific greater white-fronted goose, tundra swan, shorebird guild, Swainson's hawk	2-4	No net loss of in-kind habitat value (2), no net loss of habitat value while minimizing loss of in-kind habitat value (3), and minimize loss of habitat value (4)
Other (includes developed lands, barren ground, orchards, and vineyards)[1]	none	4	Minimize loss of habitat value
Upland herbaceous	raptor guild, ground-foraging birds	3	No net loss of habitat value while minimizing loss of in-kind habitat value

[1]No evaluation species were chosen because use by wildlife is minimal to none.

green swallow, warbling vireo, and yellow warbler were chosen to evaluate riparian habitat because: (1) they play a key role in community ecology of the study area; (2) they have important human non-consumptive benefits (e.g., birdwatching); and (3) the Service has responsibility for protection and management of these species under the Migratory Bird Treaty Act. Riparian habitat in the project area is of high value to the evaluation species, and is currently very scarce in many parts of the project area ecoregion. Therefore, the Service finds that any riparian habitats that would be impacted by the project should have a mitigation goal of "no net loss of in-kind habitat value or acreage" (Resource Category 2).

b. Oak woodland

Oak woodland occurs along the lower American River, particularly at the higher elevations and at lower foothill elevations, near Nimbus Dam. Typical oak woodland is characterized by a fairly open canopy layer with 20-70% cover of valley and live oaks, and a grassy ground cover. A woody understory may be present, but is typically sparse. There has been poor recruitment of oaks in California over the past century, threatening the future persistence of oak habitats. Oaks provide breeding sites, shelter, and feeding opportunities for a diversity of wildlife species. For example, an average of 24 bird species nested in study plots of valley oak woodlands along the lower American River, and 30 bird species supported by oak habitats in California are known to forage on acorns (Ritter 1988).

Non-native annual grasses form an understory for oaks in most of the study area, and the transition from woodland to savanna is not clearly demarcated, but rather part of a continuum from closed canopy woodland to open, treeless grasslands. As a result, habitat types can grade imperceptibly from one to another. Where tree or shrub cover falls below about 20 to 30%, in oak-dominated habitat, grasses show a distinctive importance and presence in the vegetation (USFWS 1991c), and are treated in this analysis as grassland, with individual trees identified separately from oak woodland for mitigation purposes. Where trees are absent, the habitat is designated as herbaceous upland.

The evaluation species selected for oak woodland and individual oak trees found in low density areas were the woodpecker guild, including acorn woodpecker, northern oriole, Nuttall's woodpecker , and Lewis's woodpecker, and the oak insect community. Oaks are important to woodpeckers as nest and foraging sites, and woodpeckers excavate nest holes in live and dead trees and provide nest sites for other cavity-nesting species including ash-throated flycatcher, plain titmouse, and white-breasted nuthatch. Isolated savanna oaks also provide scarce shade and shelter to many other species. Several species are closely linked to oak forest, including acorn woodpeckers and western gray squirrel. Acorns are a nutrient-rich food used by many wildlife species.

Oaks also support a rich and complex insect community, including leaf-miners (Opler 1974), and many species of gall-forming insects, which in turn are host to many parasitic insects. Oak insect communities have been the subject of many important studies of ecological community structure and dynamics. Because of the high value of oak woodland to the evaluation species, and because native oaks are a scarce and dwindling habitat in the Sacramento Valley, the Service finds that oak woodland affected by the project should have a mitigation planning goal of "no net loss of in-kind habitat value" (Resource Category 2).

c. Seasonal freshwater emergent wetlands (includes small irrigation ditches)

Seasonal wetlands occur in small patches near seeps and springs, and in drainages entering along levees. The most extensive areas of freshwater emergent wetlands in the project area are found

in agricultural ditches landside of project levees along the Yolo Bypass and associated sloughs. Seasonal wetlands in the project vicinity are characterized by non-woody emergent vegetation including cattails, rushes and sedges. Two marsh-nesting passerine birds, the marsh wren and red-winged blackbird, as well as great blue heron were chosen to evaluate emergent wetland. The marsh wren and red-winged blackbird are passerine species which nest and feed in emergent wetlands, and could therefore be present in any occurrences of this cover type which may be found in the project area. Great blue herons forage extensively in wetlands on aquatic vertebrates; these herons are a highly visible species, which many people take great pleasure in observing. All of the evaluation species are also migratory birds for which the Service has management responsibility under the Migratory Bird Act.

In the project vicinity, and the ecoregion (Central Valley) in general, emergent wetlands are relatively scarce, and would be of high value to the evaluation species. Emergent wetland in the project area is therefore designated as Resource Category 2, with a mitigation planning goal of "no net loss of in-kind acreage or habitat values, whichever is greater".

d. Open water (larger irrigation canals)

Open water in the project area occurs in large drainage canals such as Shag Slough, Lookout Slough, and Cache Slough. These drainages would be impacted temporarily by the construction methods. Most of these drainages consist only of scattered to no emergent vegetation. Warmwater fish species (e.g., bluegill, carp, largemouth bass, sturgeon, white crappie, etc.), and the heron and egret families were chosen to evaluate open water. Herons, such as the great blue, forage extensively in open water on aquatic vertebrates and fish. The heron and egret family was selected because of Service responsibilities for their management under the Migratory Bird Treaty Act, and their relatively high value for non-consumptive human uses such as bird-watching; these herons are a highly visible species, which many people take great pleasure in observing. Warmwater fish species are found in the larger drainage canals in the project area. These species are important because they provide food for birds such as herons and egret, and because they provide recreation for fishermen. In the project vicinity, open water would be of medium to low value to the evaluation species, mainly because the canals provided little to no emergent vegetative cover for either fish or birds. Open water in the project area is therefore designated as ranging between “no net loss of habitat value while minimizing loss of in-kind habitat value” to “minimize loss of habitat value” (Resource Categories 3 or 4).

e. Shaded Riverine Aquatic (SRA) Cover

In the project area, Shaded Riverine Aquatic (SRA) Cover that would be affected by project construction is found only in a small area being impacted at the Howe Avenue Bridge Raising site. SRA Cover includes any nearshore riverine aquatic areas with value to fish and wildlife. The areas where impacts to SRA Cover habitat values would occur consist of natural banks or an existing rocked substrate and riparian vegetation has grown on top of the revetment. The riparian vegetation is usually composed of a mix of willows, cottonwoods, box elders, Oregon ash, and blackberry vines, and usually, one or more of the following attributes are also present: (1) living roots, branches, and tree trunks exposed within the water; (2) fallen plant material, including logs, branches, and leaves within the water; (3) relatively irregular and uneven natural banks, often with many depressions, cavities, and crevices; (4) comparatively shallow, low-velocity areas near the shoreline; (5) more detritus and greater primary food-chain production than nearby unshed areas; and (6) in some instances, lower water temperatures than comparable unshaded areas.

The evaluation species selected for SRA Cover of the project area are juvenile salmonids (salmon and steelhead) and the heron and egret family of waterbirds. Salmonids were selected because their serious declines are among the most important resource problems of this region and they have very high commercial and sportfishing values. The heron and egret family was selected because of Service responsibilities for their management under the Migratory Bird Treaty Act, their relatively high value for non-consumptive human uses such as bird-watching, and their value as indicator species for many other birds which utilize SRA Cover along the Sacramento River.

SRA Cover on the Sacramento River and its major tributaries has been rapidly lost over the past 30 years, primarily due to flood control or bank protection projects such as the Sacramento River Bank Protection Project (SRBPP). Since 1961, the Corps has constructed over 140 miles of riprapped riverbanks in the Sacramento River system. The only mitigation for the estimated 80 miles of SRA Cover losses associated with this construction is about 900 lineal feet of berm structures constructed from dredged materials on the lower Sacramento River, downstream of Sacramento, and about 2,000 feet of palisades structures (an unsuccessful attempt at mitigation) and fish groins in the upper Sacramento River. As a result of the extensive losses coupled with the inadequate mitigation, we estimate that now only about 7% of the historic SRA Cover remains in the Sacramento River downstream of Colusa, and along its four major distributary sloughs. The upper river reaches have experienced a less catastrophic, but nevertheless serious decline of SRA Cover due to flood protection efforts.

SRA Cover must be considered unique because of its special attributes which support a diverse array of fish, wildlife, and invertebrates. Most all past SRBPP contracts provided no mitigation for losses of SRA Cover. Mitigation which has been attempted (e.g., dredge berms, fish groins) has fallen far short of replacing the habitat quantity or quality which was lost. The Service and all other involved agencies have worked towards developing effective replacement mitigation for SRA Cover but, due to the unique biological attributes of the cover-type and institutional constraints preventing any significant revegetation to occur on riprapped SRBPP riverbanks, no mutually acceptable mitigation solution has been developed for implementation. Furthermore, our HEP analyses herein and elsewhere of replacement mitigation scenarios proposed by the Corps show that little, if any, habitat values associated with SRA Cover would be recovered by those proposed actions. Thus, we have concluded that, with current bank protection and maintenance strategies, SRA Cover impacted by the SRBPP is irreplaceable.

Because of the high value of SRA Cover to the evaluation species in the project area, its uniqueness and irreplaceability, and its increasing scarcity, the Service finds that SRA Cover in portions of the Sacramento River system should have a mitigation planning goal of "no loss of existing habitat value" (i.e., Resource Category 1). A report by the Service (USFWS 1992) documents the recent reclassification of SRA Cover from Resource Category 2 to Resource Category 1.

It should be noted that this classification affects only portions of the project area. The American River, Sacramento River, and Miner, Sutter, and Steamboat sloughs are included in the Resource Category 1 classification. Other portions of the project area were considered, but not included because they are not utilized as heavily by anadromous salmonid fishes of the Sacramento River system. SRA Cover that would be impacted by the project in areas other than those mentioned above have been assigned a mitigation planning goal of "no net loss of in-kind habitat value or acreage" (i.e., Resource Category 2). In many of the hydraulic mitigation areas, SRA Cover may also be important for Delta smelt as spawning habitat.

Ensuring no further losses of SRA Cover along the Sacramento River is also highly important from an endangered species perspective. Recently, the NMFS designated the critical habitat that is considered essential for the survival and recovery of the Sacramento River's federally-threatened winter-run chinook salmon (Federal Register 58(114):33212-33219). The critical habitat includes the waters, river bottom, and *adjacent riparian zone* of the Sacramento River from Keswick Dam (RM 302) to Chipps Island (RM 0). Riparian zones along the river are considered essential for the conservation of winter-run salmon primarily because they provide important areas for fry and juvenile rearing. Any impacts to critical habitat would constitute a "take" of this listed species.

f. Agricultural lands,

Some agricultural lands provide important foraging and roosting habitat for migratory waterbirds, such as waterfowl, shorebirds, and cranes, as well as predatory birds such as hawks. The value of this habitat may vary widely, depending on farming and flooding practices, land use, weather, and foraging preferences of waterbirds and predatory birds. As a result, this habitat may range from high to low value for the evaluation species, and be anywhere from relatively scarce to abundant. Rice fields, for example, provide important foraging habitat for a variety of waterfowl and shorebirds. Crops such as alfalfa, certain grain and row crops, and lightly-grazed fields, where some portion of the ground is visible and accessible, provides high value foraging habitat for hawks such as the Swainson's hawk (Bloom 1980, Estep 1989). Low value foraging habitat, such as orchards, rice, cotton and vineyards, do not support adequate prey populations for Swainson's hawks and other raptors, and/or the ground is inaccessible. Except for rice fields, as mentioned, these habitats are also very poor for waterbirds.

The evaluation species selected for agricultural habitat within the project area are sandhill crane, northern pintail, Pacific greater white-fronted goose, tundra swan, shorebird guild, and Swainson's hawk. The Service finds that agricultural land to be affected by the proposed project should have a mitigation planning goal ranging from "no net loss of in-kind habitat value" to merely "minimizing loss of habitat value" (i.e., either Resource Category 2, 3 or 4).

g. Other

"Other" habitats include developed land, barren ground, orchards, and vineyards. Developed lands consist of highly degraded and disturbed areas such as parking lots, boat ramps, roads, houses, etc. Barren ground is often found along both the landside and waterside of levees and is devoid of vegetation. Orchards in the project area consisted mostly of pear. Evaluation species were not chosen for any of these habitats because wildlife use is so minimal. In view of the extremely low value to most wildlife of much of these habitats in the project area, the Service finds that these "other" habitats that would be impacted by the project should have a mitigation planning goal of "minimize loss of habitat value" (Resource Category 4).

h. Upland herbaceous

For this project, upland herbaceous habitat includes annual grassland and ruderal scrub. It appears that much of the treeless grassland found in the study area is a result of tree loss due to human activities. Perennial grass species once dominated native grasslands, but introduced annual species have largely displaced native perennial and annual grasses. Typical annual grass species are foxtail, brome, wild oats, and Italian ryegrass, native perennial grasses include needlegrasses, California onion grass, and fescue. Grassland areas provide habitat for granivorous birds such as western meadowlarks, California quail, sparrows, and finches, and for mammals such as California voles and pocket gophers. These areas provide important foraging

habitat for breeding raptors, including red-tailed hawks, American kestrels, and great horned owls, and other wintering raptors.

The evaluation species selected for upland herbaceous habitat in the project area are the raptor guild, and passerine ground-foraging birds (including western meadowlark and white-crowned sparrow. We have chosen these as evaluation species because: (1) raptors, as predators, play a key role in the community ecology of the study area; (2) they have important human nonconsumptive benefits (e.g., birdwatching); and (3) the Service has responsibilities for many of these species' protection and management under the Migratory Bird Treaty Act. While the values of these habitats vary according with numerous factors, much of the grassland habitat in the study area provides medium-to-high value foraging habitat for diverse assemblages of birds of prey and ground-foraging passerine birds. Furthermore, the value of these habitats is often enhanced by their continuity with other adjacent habitats, such as wooded areas, cliffs, and ponds, which provide nest and shelter sites. Upland herbaceous habitat has medium-to-high value for the evaluation species, and is relatively abundant in the project area. The Service therefore finds that upland herbaceous habitat in the project area should have a mitigation planning goal of "no net loss of habitat value while minimizing loss of in-kind habitat value" (i.e., Resource Category 3).

B. RECOMMENDED COMPENSATION PLANS

The results and recommendations in the discussion that follows are for compensatory mitigation of impacts due to implementation of the project. They do not supersede our primary recommendation for impact avoidance. The results and mitigation recommendations based on our HEP analyses are found in Appendix C. Mitigation recommendations for operational impacts associated with the Stepped Release Plan will not be determined using HEP, but instead through analysis of the best available information to be received from the Corps. Our recommended compensation plans are based on the fundamental assumption that compensatory mitigation, namely creation or restoration of the desired habitats, will succeed in replacing the habitat functions, values, and acreage lost with project implementation. However, in regard to wetland habitats, including woody riparian habitats, the results of a number of studies fail to support this assumption (e.g., see DeWeese 1994). At this time, the long-term success of created wetland habitats is uncertain at best.

An extensive literature review of wetland restoration and creation projects by Schneller-McDonald *et al.* (1990) found that these projects do not effectively provide the functional values and self-sustaining ecosystem characteristics of the original wetland lost. A study conducted by the Florida Department of Environmental Regulation to assess success of wetland creation projects concluded that only 12% of permitted freshwater wetland mitigation projects in that state were or were likely to become successful in replacing the functional wetland values originally lost (Florida Department of Environmental Regulation 1991). The primary reasons for unsuccessful wetlands creation were cited as poor site location (soil substrate, hydrology) and overall lack of implementation, maintenance, and monitoring of the creation project by the responsible party.

Certainly, the probability of successful creation of these ecosystems depends upon many factors, including time, funding, compliance, staff availability, technology, and agency commitment. Even with these factors at an optimum, successful long-term compensation of wetland habitats are questionable. We therefore again stress that impact avoidance is our most favored mitigation method.

To provide assurance that any implemented compensatory mitigation measures will achieve their intended objective of replacing lost habitat values, detailed, long-term mitigation monitoring and remedial-action plans must be incorporated into the project design. These plans should include planting design, monitoring methods, specific success criteria, and remedial measures in the event of failure in meeting success criteria. The Service would be willing to participate in monitoring of construction activities, and development and implementation of the mitigation and monitoring programs.

State legislation (State Water Code Sections 8610 and 8611) requires the Reclamation Board to develop such monitoring plans to ensure no net losses of fish and wildlife habitat values. The plans are also required to contain a schedule of implementation and a financing plan. Such plans should incorporate sufficient funding for the remedial actions necessary to replace any habitat values which could potentially be lost or are otherwise not obtained.

The recommendations provided below for compensation of project impacts are based on field surveys, review of aerial photographs, review of the literature and discussions with plant ecologists and other experts familiar with the project area and its ecological processes. These plans were selected based on what the Service views as most appropriate for replacing habitat values that would be lost with the project. They are conceptual in nature, with management goals outlined in each section below. Mitigation site selection was based on this conceptual framework, and designed to coincide as much as possible with the Corps' construction plans in order to minimize project costs. In addition, numerous factors which are currently unknown, such as groundwater depth, surface hydrology, and presence of soil contaminants, also could affect the site's suitability for restoration or creation. Therefore, until such time as complete evaluation of suitability is completed, (i.e., evaluations of soil condition, surface hydrology, groundwater depth, and conditions in regard to salinity, alkalinity or toxic substances), the recommendation of these sites for mitigation is only preliminary.

Our HEP evaluations of compensation sites are based upon the assumption that woody vegetation would be allowed to grow to maximum plant and canopy densities. These areas would not be disced or burned as part of any operation and maintenance plans, so predicted habitat values would be gained by this management plan. For the HEP analyses, we assumed that these areas would be free from human disturbance. If alternative areas would be used for mitigation that have greater exposure to human disturbance, the HEP analysis will need to be revised to reflect this condition.

1. STEPPED RELEASE PLAN TO 160,000 CFS

a. Construction Impacts

i. Hydraulic Mitigation Area

Again, in the interest of time, the Service and other HEP team members did not conduct a HEP for the hydraulic mitigation area. Instead, staff from the Service, Corps and JSA ground-truthed each construction site to determine habitat and acres to be impacted. After acres were derived, we applied the mitigation ratios determined for the 1996 HEP to the 2001 impact areas. Overall mitigation goals for offsetting adverse impacts to habitat in the hydraulic mitigation area consist primarily of replacing the function and value of the habitats lost through project construction. Potential sites for mitigation for loss of habitats in the hydraulic mitigation area are to be determined by JSA, and will be provided in the next rendition of this report.

a. Riparian woodland

For the hydraulic mitigation area, the loss of 16.4 acres of riparian woodland could be mitigated by revegetating 18.0 acres of riparian woodland (Table 13). Again, specific mitigation sites have not yet been identified. More information will be provided once a site has been selected.

Table 13. Mitigation acres needed to offset construction-related impacts for the Stepped Release Plan to 160,000 cfs release for the American River Watershed Investigation, Long-Term Evaluation

COVER-TYPES	MITIGATION ACRES FOR EACH COVER-TYPE FOR THE 160,000 CFS RELEASE			TOTAL MITIGATION ACREAGE FOR EACH COVER-TYPE
	Hydraulic mitigation areas	NEMDC area	Local drainage & utilities modifications[5]	
Riparian woodland	18.0[1]	5.7	0.6	24.3
Oak woodland	17.7[1]	5.4	–	23.1
Seasonal freshwater emergent marsh (irrigation ditches)	see footnote[2]	–	–	–
Open water (larger irrigation canals)	see footnote[2]	–	–	–
Agricultural lands - rice	see footnote[3]	–	–	–
Agricultural lands - non-rice	reseed	–	–	reseed
Individual trees & shrubs	20 trees[4]	–	3 shrubs[6]	20 trees & 3 shrubs
Other	none	none	none	none
Upland herbaceous	reseed	reseed	reseed	reseed
TOTALS	35.7 acres 20 trees	11.1 acres	0.6 acres 3 shrubs	47.4 acres 20 trees & 3 shrubs

[1]Since a HEP was not conducted for the hydraulic mitigation area for the 2001 analysis, we used the mitigation ratios derived in the Service's 1996 HEP; riparian has a 1.1:1 mitigation ratio and oak woodland has a 3.5:1 mitigation ratio. [2]Impacts will be addressed in the Biological Opinion during the section 7 consultation for the giant garter snake, delta smelt and Sacramento splittail. [3]Impacts will be addressed in the Biological Opinion during the section 7 consultation for the giant garter snake. [4]The Service assumed a 5:1 mitigation ratio. [5]Mitigation ratio is the same used for the levee modifications impacts. [6]Mitigation ratio is 3:1.

b. Oak woodland

To compensate the loss of 5.2 acres of oak woodland in the hydraulic mitigation area, 17.7 acres of this habitat would need to be planted in the hydraulic mitigation area (Table 13). At this time, the most feasible site consists of agricultural land located in the area south of the Sacramento Bypass. This area likely contains suitable soils and hydrologic conditions, and planting at this site would not impair flood management goals of the ARWI project. The site would need to be surveyed to ensure that ground elevation would be appropriate for oak plantings, and contoured accordingly.

c. Seasonal freshwater emergent marsh

The loss of 23.2 acres of emergent marsh along project sloughs and in irrigation channels would need to be analyzed in the Biological Opinion for the project during the section 7 consultation

process for the federally listed threatened giant garter snake, delta smelt, and Sacramento splittail.

d. Open water

The loss of 11.3 acres of open water found in larger irrigation canals such as Shag and Cache Sloughs, would need to be analyzed in the Biological Opinion for the project during the section 7 consultation process for the federally listed threatened giant garter snake, delta smelt, and Sacramento splittail.

e. Agricultural lands

The loss of 12.5 acres of rice fields would need to be analyzed in the Biological Opinion for the project during the section 7 consultation process for the federally listed threatened giant garter snake. The loss of 91.7 acres of agricultural lands that are not rice fields should be mitigated by reseeding the areas with a native grass seed mix.

f. Individual trees

To compensate for the loss of 4 individual, scattered trees, 20 trees (5:1 mitigation ratio) would need to be planted, preferably on-site.

g. Other

"Other" cover-types, which are developed lands, barren land, orchards, and vineyards, do not provide significant habitat values to wildlife and, therefore, do not require mitigation.

h. Upland herbaceous

For upland herbaceous habitat that would be impacted by the project, we assumed that with-project conditions would result in annual grassland values and acreage approximately equal to those found under existing conditions, due to replacement of topsoil and reseeding in construction areas which would undergo temporary impacts (levee raising, berm construction, etc.). Therefore, the grassland impacts would be mitigated on-site by reseeding with a native grass seed mix, and no additional replacement mitigation would be needed.

About 138.5 acres of upland herbaceous habitat would be impacted at the borrow sites, and about 23.8 acres of upland herbaceous habitat would be impacted at the staging areas. Again, we assumed that with-project conditions would result in annual grassland values and acreage approximately equal to those found under existing conditions, due to replacement of topsoil and reseeding in construction areas which would undergo temporary impacts. Therefore, the grassland impacts would be mitigated on-site by reseeding with a native grass seed mix, and no additional replacement mitigation would be needed. It is assumed that all woody vegetation would be avoided.

ii. NEMDC Area

a. Riparian woodland

After a review of areas along the Parkway, we have preliminarily determined that the a portion of Mississippi Bar may be a suitable site for mitigation of riparian woodland habitat along the NEMDC. The site consists of mining tailings surrounded by riparian woodland. However, more research and analyses need to be done to determine the site's (1) soil and hydrological suitability conditions, (2) degree of human disturbance, and (3) whether the existing mining tailings contain contaminants such as mercury. Positive aspects of the site are that it is situated among existing riparian woodland habitat, is near a water source (Lake Natomas), and is free from roadways.

To compensate for adverse impacts to about 5.7 acres of riparian woodland habitat and associated losses of wildlife along the NEMDC area, 5.7 acres of riparian habitat would need to be created on suitable lands in the Parkway (Table 13). If the Mississippi Bar site is deemed suitable, restoration of the site to riparian habitat would involve grading of the ground surface to an appropriate elevation to create suitable hydrologic conditions. The area could then be planted with riparian trees and shrubs. The ground surface should be "ripped" before planting to decompact soil and dislodge cobble. The site should be planted with acorns (pre-germinated, three to a hole), cuttings, and seedlings (4-inch x 4-inch x 14-inch deepots that consist of shrubs and trees). Species composition should include: live oak, black oak, blue oak, ash, cottonwood, foothill pine, box elder, wild rose, baccharis, California blackberry, coffeeberry, red willow, and Goodding's willow. Irrigation would likely be provided from Lake Natomas, and should be provided in the form of a drip irrigation system for 2 years during the summer months (one outlet per plant, two for oak species). Native grass seeds should be planted for erosion control and to supplement the soil. The seeds should be drilled and include mychorrizal innoculate (60 lbs. per acre), California brome, meadow barley, California buckwheat, zorro fescue, baltic rush, arroyo lupine, California poppy, and blue wildrye. Because compensation ratios were calculated using the above assumptions, any alternate compensation plans which would use sites that do not meet these criteria will need to be reevaluated using HEP, as they may not provide equally suitable conditions.

b. Oak woodland

After a review of areas along the Parkway, we have preliminarily determined that the a portion of Rossmoor Bar may be a suitable site for mitigation of the loss of oak woodland habitat along the NEMDC area. The site consists of a disced field on about 86 acres. We have selected this site because it occurs near the river, is adjacent to existing oak woodland habitat, and is buffered, to some degree, from urban development. However, the site will need to be evaluated for such suitability factors as (1) soil and hydrological conditions, and (2) degree of human disturbance. Positive aspects of the site are that it is situated among existing oak woodland habitat, is near a water source (lower American River), and is free from roadways. To compensate the loss of about 1.5 acres of oak woodland habitat along the NMDC, 5.4 acres of this habitat would need to be created on suitable lands in the Parkway (Table 14). If the Rossmoor Bar site is determined suitable, restoration of the site to oak woodland habitat would involve rototilling the site before planting. The area could then be planted with oaks. The site should be augured 8-10 inches and planted with acorns (pre-germinated, three to a hole), 1-year seedlings (4-inch x 4-inch by 14-inch deepots). At least 400 trees per acre should be planted. Species composition should be 65% valley oaks, 30% black oaks, and 5% baccharis. Irrigation should be provided in the form of a drip irrigation system by drilling a well for a water source, and include deep watering every 10 days for the first year, then every 4 weeks thereafter for 4 years. Native grass seeds should be planted for erosion control and to supplement the soil. The seeds should be drilled and include mychorrizal innoculate (60 lbs. per acre), California brome, blue wildrye, meadow barley, baltic rush, nodding needlegrass, California broom, California buckwheat, coyote brush, and tomcat clover. As stated above, because compensation ratios were calculated using the above assumptions, any alternate compensation plans which would use sites that do not meet these criteria will need to be reevaluated using HEP, as they may not provide equally suitable conditions.

c. Upland herbaceous

To compensate for the temporary loss of 3.8 acres of upland herbaceous habitat, the impacted areas should be reseeded with a native grass seed mix.

iii. Utilities and local drainages

a. Riparian woodland

To compensate for the loss of 0.6 acre of riparian woodland at the Tiffany Lane Gravity Drain site, 0.6 acre of riparian woodland should be planted at a suitable mitigation site. The Mississippi Bar site (described above under the NEMDC section) would be a suitable mitigation site, and the same criterion would apply.

b. Individual trees and shrubs

The walnut shrub located at Pumping Plant D-05 should be replaced 3:1 on-site, if possible.

c. Upland herbaceous

Where uplands have been impacted, which is the case with virtually all of the sites we visited, the site should be reseeded with native grass seed mix.

b. Operation Impacts from 160,000 cfs

Mitigation recommendations will be determined once all information on operational impacts is received from the Corps.

2. STEPPED RELEASE PLAN TO 180,000 CFS

a. Construction Impacts

i. Levee Modifications along Lower American River

The Service has developed preliminary conceptual mitigation plans for impacts to riparian woodland and oak woodland habitats along the lower American River based upon specific

Table 14. Mitigation needed to offset construction-related habitat losses for 180,000 Stepped Release Plan, for the American River Watershed Investigation, Long-Term Evaluation.

COVER-TYPES	MITIGATION ACRES FOR EACH COVER-TYPE FOR THE 180,000 CFS RELEASE					TOTAL ACREAGE FOR EACH COVER-TYPE
	Levee modifications	Howe Ave. Bridge Raising	Guy West Bridge Raising	Hydraulic mitigation areas[2]	Local drainage & utilities modifications[3]	
Riparian woodland	25.0	6.1[1]	0.1	18.0	0.6	49.8
Oak woodland	70.9	–	–	17.7	–	88.6
Seasonal freshwater emergent marsh (smaller irrigation ditches)	–	–	–	see footnote[4]	–	–
Open water (larger irrigation canals)	–	–	–	see footnote[4]	–	–
SRA Cover	–	0.3[5]	–	–	–	0.3
Agricultural lands - rice	–	–	–	see footnote[6]	–	–
Agricultural lands - non-rice	reseed	–	–	reseed	–	reseed
Individual trees & shrubs	–	–	–	20 trees	3 shrubs	20 trees & 3 shrubs
Other	none	none	none	none	none	none
Upland herbaceous	reseed	reseed	reseed	reseed	reseed	reseed
TOTALS	**95.9**	**6.4**	**0.1**	**35.7 acres 20 trees**	**0.6 acres 3 shrubs**	**138.7 acres 20 trees & 3 shrubs**

[1]0.08 acres of ornamentals to be replaced with native trees. [2]Mitigation ratios are the same as those used in the Service's 1996 FWCA report (USFWS 1996). [3]Mitigation ratios are the same as those used for the levee modifications. [4]Impacts will be addressed in the Biological Opinion during the section 7 consultation for the giant garter snake, delta smelt, and Sacramento splittail. [5]A minimum of 0.3 acre should be planted on-site, and possibly more, pending section 7 consultation for the Sacramento splittail. [6]Impacts will be addressed in the Biological Opinion during the section 7 consultation for the giant garter snake.

ecological needs of neotropical migrant birds, and other species that use these habitats. The linear formation of habitat along the Parkway provides an important movement and migration corridor for certain wildlife species including mammals such as coyote and deer, and neotropical migrant bird species. There has been a marked decline in the abundance of neotropical migrants along the Parkway and in the Central Valley as a whole (Tim Manolis, pers. comm. 1995 *in* USFWS 1996). As discussed earlier, habitat loss and fragmentation, and resulting nest predation by brown-headed cowbirds and other wildlife that frequent such disturbed areas, are thought to be primary causes of this decline. The Service therefore preliminarily proposes a mitigation plan that would work toward creating a refugia for these rapidly-declining songbird species through creation of a parcels of riparian woodland and oak woodland habitat at the Mississippi Bar and Rossmoor Bar sites respectively. Valley foothill riparian and valley oak woodland habitats were recently determined to be the top two most important habitats for neotropical migrant bird species in California (USFS 1995). These habitats were determined to be a top priority for habitat conservation to preserve neotropical migrants.

Seven cover-types were identified for evaluation of baseline conditions within the levee modifications impact area. These are: (1) riparian woodland, (2) oak woodland, (3) agriculture, (4) barren ground, (5) developed areas (structures, roads, etc.), (6) upland herbaceous, and (7) orchard. A HEP was conducted only on riparian woodland and oak woodland. Jones & Stokes Associates (JSA) provided input on specifics of the mitigation and management goals as described below. Please note that the NEMDC area is included in this analysis.

a. Riparian woodland

As discussed above for the NEMDC area, 160,000 Stepped Release Plan, we have reviewed areas along the Parkway, and preliminarily determined that the a portion of Mississippi Bar may be a suitable site for mitigation of riparian woodland habitat along the lower American River. Again, the site consists of mining tailings surrounded by riparian woodland. However, more research and analyses need to be done to determine the site's (1) soil and hydrological suitability conditions, (2) degree of human disturbance, and (3) whether the existing mining tailings contain contaminants such as mercury. Positive aspects of the site are that it is situated among existing riparian woodland habitat, is near a water source (Lake Natomas), and is free from roadways.

To compensate for adverse impacts to about 25.0 acres of riparian woodland habitat and associated losses of wildlife along the lower American River, 25.0 acres of riparian habitat would need to be created on suitable lands in the Parkway (Table 14). If the Mississippi Bar site is deemed suitable, restoration of the site to riparian habitat would involve grading of the ground surface to an appropriate elevation to create suitable hydrologic conditions. The area could then be planted with riparian trees and shrubs. The ground surface should be "ripped" before planting to decompact soil and dislodge cobble. The site should be planted with acorns (pre-germinated, three to a hole), cuttings, and seedlings (4-inch x 4-inch x 14-inch deepots that consist of shrubs and trees). Species composition should include: live oak, black oak, blue oak, ash, cottonwood, foothill pine, box elder, wild rose, baccharis, California blackberry, coffeeberry, red willow, and Goodding's willow. Irrigation would likely be provided from Lake Natomas, and should be provided in the form of a drip irrigation system for 2 years during the summer months (one outlet per plant, two for oak species). Native grass seeds should be planted for erosion control and to supplement the soil. The seeds should be drilled and include mychorrizal innoculate (60 lbs. per acre), California brome, meadow barley, California buckwheat, zorro fescue, baltic rush, arroyo lupine, California poppy, and blue wildrye. Because compensation ratios were calculated using the above assumptions, any alternate compensation plans which would use sites that do not meet

these criteria will need to be reevaluated using HEP, as they may not provide equally suitable conditions.

b. Oak woodland

As discussed above for the NEMDC area, Stepped Release to 160,000 plan, a review of areas along the Parkway, has preliminarily led to a determination that the a portion of Rossmoor Bar may be a suitable site for mitigation of oak woodland habitat along the lower American River. The site consists of a disced field on about 86 acres. We have selected this site because it occurs near the river, is adjacent to existing oak woodland habitat, and is buffered, to some degree, from urban development. However, the site will need to be evaluated for such suitability factors as (1) soil and hydrological conditions, and (2) degree of human disturbance. Positive aspects of the site are that it is situated among existing oak woodland habitat, is near a water source (lower American River), and is free from roadways. To compensate the loss of about 20.1 acre of oak woodland habitat along the American River, 70.9 acres of this habitat would need to be created on suitable lands in the Parkway (Table 14). If the Rossmoor Bar site is determined suitable, restoration of the site to oak woodland habitat would involve rototilling the site before planting. The area could then be planted with oaks. The site should be augured 8-10 inches and planted with acorns (pre-germinated, three to a hole), 1-year seedlings (4-inch x 4-inch by 14-inch deepots). At least 400 trees per acre should be planted. Species composition should be 65% valley oaks, 30% black oaks, and 5% baccharis. Irrigation should be provided in the form of a drip irrigation system by drilling a well for a water source, and include deep watering every 10 days for the first year, then every 4 weeks thereafter for 4 years. Native grass seeds should be planted for erosion control and to supplement the soil. The seeds should be drilled and include mychorrizal innoculate (60 lbs. per acre), California brome, blue wildrye, meadow barley, baltic rush, nodding needlegrass, California broom, California buckwheat, coyote brush, and Tomcat clover. As stated above, because compensation ratios were calculated using the above assumptions, any alternate compensation plans which would use sites that do not meet these criteria will need to be reevaluated using HEP, as they may not provide equally suitable conditions.

c. Agricultural lands

To compensate for impacts to 57.0 acres of agricultural lands (non-rice), the area should be reseeded with a native grass seed mix.

d. Developed lands

No compensation would be required for the 48.4 acres of developed lands that would be impacted in the construction areas and 9.4 acres that would be impacted in the staging area.

e. Barren land

No compensation would be required for the 6.3 acres of barren ground that would be impacted in the construction area and 5.8 acres that would be impacted in the staging area.

f. Orchard

No compensation would be required for the 0.4 acre of orchard that would be impacted in the construction area.

g. Upland herbaceous

To compensate for the 66.7 acres of upland herbaceous habitat that would be impacted in the construction area, the areas should be reseeded with a native grass seed mix. No other compensation would be required. About 130.4 acres of upland herbaceous habitat would be

impacted at the borrow sites, and about 25.6 acres would be impacted at the staging areas. Again, this cover-type should be compensated by planting the sites with a non-native grass seed mix after construction.

ii. Howe Avenue Bridge Raising site

a. Riparian woodland

In the interest of time, no HEP data were collected at the site for riparian woodland. However, a HEP was conducted on other areas along the lower American River (*see* "Levee modifications" above), and those HSI values for baseline and futures were used for this site. From these values, data were analyzed with a HEP. Compensation acreage needed is 5.3 acres. This habitat could be replaced in-kind at the Mississippi Bar site, as described above (Table 14).

b. SRA Cover

Data were collected and a HEP was conducted for SRA Cover impacts found on both sides of the river at the Howe Avenue Bridge Raising site. About 0.27 acre of SRA Cover, found intermittently along about 700 linear feet (0.13 mile), would be impacted from activities related to raising and/or moving the existing bridge. A preliminary HEP was conducted at the site, and the results show that compensation acreage is 0.3 acre (Table 14).

Methods for mitigating SRA Cover impacts have been developed by the Service, in coordination with the Corps, on other Corps projects, such as for the bank protection on the lower American River, in conjunction with the Lower American River Task Force. Those designs include several features to recover SRA Cover values: (1) creating low, riparian-vegetated, soil berms on the waterside of levees, which would provide overhead cover at low flows, and instream cover when inundated, (2) riparian plantings in a broad (>15' wide band) adjacent to the water's edge, (3) a variable shoreline edge of created low berms, to provide more diverse hydraulic conditions, and (4) instream woody cover placed to provide cover for fish as well as habitat for numerous other aquatic organisms.

In the interest of time, we assumed the SRA Cover would be replaced in-kind and on-site after construction is completed. Please note that the 0.3 acre of compensation is a minimum, however, pending section 7 consultation under the Endangered Species Act for the Sacramento splittail. The scenario we used was that vegetation would be reestablished on the stripped, natural banks on both sides of the river. This option would involve planting nursery stock, followed by 3 years of irrigating, maintaining, and replacing vegetation, and 10 years of monitoring. If the Stepped Release Plan is selected for further investigation, we will look more closely at one of the options listed in the previous paragraph, and determine which is more feasible and optimum for the impact area. Should off-site mitigation be determined to be required, any mitigation site should have attributes which facilitate restoring habitat and habitat values comparable to those lost, including the following: (1) close proximity to the project area, (2) low existing or baseline habitat values for both riparian habitat and SRA Cover, (3) minimal human disturbance (including levee maintenance activities), and (4) physical attributes that permit use of mitigation features needed to attain the best possible, albeit partial, recovery of habitat values associated with SRA Cover.

SRA Cover in this reach of the American River is typically designated as Resource Category 1, "no loss of existing habitat value". However, because the habitat here is very degraded, especially on the left bank of the river, and because of the small impact area, the Service believes that revegetating the area, and attempting to improve it, seems a more reasonable approach to

leaving it in its degraded condition. Therefore, although SRA Cover mitigation is experimental, we believe it is reasonable to attempt compensation by replacing and restoring it in this reach.

c. Barren lands
To compensate for 1.7 acres of barren land that would be impacted in the construction area, the site should be reseeded with native grass seed mix.

d. Developed lands
No compensation would be required for impacts to 2.2 acres of developed lands at the construction sites.

e. Upland herbaceous
To compensate for 2.8 acres of upland herbaceous habitat, the site should be reseeded with a native grass seed mix.

iii. Guy West Bridge raising site
Riparian woodland
As discussed, the riparian woodland habitat at this site consists of scattered trees in a degraded area, made up of native and non-native tree and shrub species, and totaling about 0.13 acre. As mentioned, native species include live oak, cottonwood, sycamore, and native blackberry, and non-native species include Himalayan blackberry, grapefruit, and black locust. Because the area is so degraded, the trees are so scattered, and much of the habitat consists of non-native species, we recommend on-site 1:1 acreage replacement with all native tree and shrub species (Table 14).

iv. Utilities and local drainage modification sites
Please see above, under "160,000 cfs, Stepped Release Plan".

v. Hydraulic Mitigation Area
Please see above, under "160,000 cfs, Stepped Release Plan".

b. Operational Impacts from 180,000 cfs
Mitigation recommendations will be determined once all information is received from the Corps.

VI. RECOMMENDATIONS

The recommendations contained within this section constitute what the Service believes, from a fish and wildlife resource perspective and consistent with our Mitigation Policy, to be appropriate for the current project. The outcomes of any new or renewed consultations, as required under Section 7 of the Endangered Species Act or the FWCA, could also affect the recommendations herein. Rationale for most of the recommendations were discussed earlier within this report.

The Council on Environmental Quality and the Service's Mitigation Policy define mitigation as including the following elements: avoiding impacts, minimizing impacts, rectifying impacts, reducing impacts over time, and compensating for impacts. The Service considers these elements to represent the most desirable sequence of steps in the mitigation planning process. In determining when to move from any one element to the next in the sequence, success or failure of particular techniques or approaches in the past under similar circumstances (as reflected in the results of previous (e.g., DeWeese 1994) mitigation evaluation studies) are taken into account. Our preferred alternative for mitigation of project impacts is to avoid them altogether.

A. GENERAL RECOMMENDATIONS

(1) Avoid impacts to all native trees and shrubs and freshwater emergent marsh vegetation during construction activities.

(2) Avoid impacts to woody vegetation at all staging areas, borrow sites, and haul routes by enclosing them with orange construction fencing.

(3) Avoid placement of rock riprap or rock fill where it was not present prior to the 1998 floods, and limit use of rock and other non-soil fill to only those areas and sections of levee slopes where rock was present prior to the 1997/1998 damage.

(4) Minimize adverse impacts by selecting a flood control alternative which avoids unmitigable impacts and minimizes other impacts to fish and wildlife resources.

(5) Develop detailed mitigation, monitoring, and remedial action plans for each mitigation action and site. Coordinate all phases of mitigation plan development and implementation with the Service and CDFG.

(6) Direct staff with biological expertise to monitor construction activities and provide technical assistance to ensure avoidance of additional construction impacts.

(7) Select a flood control alternative which avoids unmitigable impacts and minimizes other impacts to fish and wildlife resources.

(8) Enhance habitat conditions for fish in the lower American River, by working with the Service, CDFG, NMFS, the Bureau of Reclamation and other parties to implement improved flow conditions for anadromous fish, as outlined in the Service's draft report for the CVPIA (USFWS 1995).

(9) Modify Corps levee maintenance regulations to allow tree growth on existing (and proposed) levees, thereby reducing impacts to riparian woodland and oak woodland habitats.

B. SPECIFIC RECOMMENDATIONS

Specific recommendations for each Stepped Release Plan area as follows:

Stepped Release Plan to 160,000 cfs

Hydraulic Mitigation Area

(10) Reevaluate proposed construction work to ensure that modification features are necessary to meet intended flood control objectives. Deleting project features in these areas would greatly reduce losses and associated mitigation needs for woody riparian, oak woodland vegetation, seasonal freshwater marsh, and open water.

(11) Avoid impacting woody vegetation at all borrow and staging areas.

(12) Mitigate the loss of 16.4 acres of riparian woodland by planting 18.0 acres of riparian woodland at a site(s) still to be determined.

(13) Mitigate the loss of 5.2 acres of oak woodland by planting 17.7 acres of oak woodland at a site(s) still to be determined.

(14) Mitigate the loss of 91.7 acres of agricultural lands by reseeding the site with a non-native grass seed mix.

(15) Mitigate the loss of four individual trees by replanting native trees on-site (e.g, cottonwood, valley oak).

(16) Mitigate loss of 128.2 acres of upland herbaceous habitat at construction sites, and 162.3 acres at staging and borrow sites, by reseeding with a native grass seed mix.

NEMDC Area

(17) Avoid impacting woody vegetation at all borrow and staging areas.

(18) Mitigate the loss of 5.7 acres of riparian woodland impacts by planting 5.7 acres of riparian woodland at an appropriate site, such as Mississippi Bar.

(19) Mitigate the loss of 1.5 acres of oak woodland impacts by planting 5.4 acres of oak woodland at an appropriate site, such as Rossmoor Bar.

(20) Mitigate the loss of 3.8 acres of upland herbaceous habitat by reseeding the site with a native grass seed mix, including staging and borrow sites.

Local drainages, utilities, and water intake structure modifications areas

(21) Avoid impacting woody vegetation at all borrow and staging areas.

(22) Mitigate the loss of 0.6 acre of riparian woodland by replanting 0.6 acre of riparian woodland on-site, if possible.

(23) Mitigate the loss of one shrub by replacing it with three native shrubs on-site, if possible.

(24) Mitigate the loss of 0.3 acre of upland herbaceous habitat by reseeding the site with a native grass seed mix, including staging and borrow sites.

Operational Impacts

(25) Provide further information on flow-related parameters above 115,000 cfs (velocity, depth, critical shear exceedence, tractive force) in order to fully evaluate the operational impacts.

(26) Provide additional information on whether combinations of the dam raise alternatives, pre-release, Stepped Release Plan, and/or changing the variable flood control space could enable increased water supply.

(27) Complete a detailed analysis of operations that considers both the effect on water supply and on duration of inundation in the flood control space created, under all possible permutations of reoperation, raise options, and advanced release.

Stepped Release Plan to 180,000 cfs

Levee modifications

(28) Avoid impacting woody vegetation at all borrow and staging areas.

(29) Mitigate the loss of 25.0 acres of riparian woodland by planting 25.0 acres of native woody riparian vegetation at optimum densities at the Mississippi Bar mitigation site in the American River Parkway (pending a suitability analysis).

(30) Mitigate the loss of 20.1 acres of oak woodland by planting 70.9 acres of oak woodland vegetation at optimum densities at the Rossmoor Bar mitigation site in the American River Parkway (pending a suitability analysis).

(31) Mitigate the loss of 57.0 acres of agricultural lands (non-rice) by reseeding the area with a native grass seed mix.

(32) Mitigate losses to 66.7 acres of upland herbaceous habitat by reseeding areas with a native grass seed mix, including staging and borrow sites.

Howe Avenue Bridge Raising Site

(33) Mitigate the loss of 6.1 acres of riparian woodland by planting 6.1 acres of riparian woodland at the Mississippi Bar mitigation site.

(34) Mitigate the loss of 0.3 acre of SRA Cover by planting a minimum of 0.3 acre of SRA Cover on-site, and possibly more, pending the section 7 consultation for the Sacramento splittail.

(35) Mitigate the loss of 2.8 acres of upland herbaceous habitat by reseeding areas with a native grass seed mix, including staging and borrow sites.

Guy West Bridge Raising Site

(36) Mitigate for the elimination of 0.1 acre of degraded native and non-native riparian woodland habitat that would result from raising the Guy West Bridge, by planting 0.1 acre of native riparian habitat on-site.

(37) Mitigate the loss of 0.5 acre of upland herbaceous habitat by reseeding areas with a native grass seed mix, including staging and borrow sites.

Hydraulic Mitigation Area

See “Specific recommendations for Stepped Release Plan to 160,000 cfs”.

Local drainages, utilities, and water intake structure modifications areas

See “Specific recommendations for Stepped Release Plan to 160,000 cfs”.

Operational Impacts

See “Specific recommendations for Stepped Release Plan to 160,000 cfs”.

C. ENDANGERED SPECIES ACT RECOMMENDATIONS

(38) Complete the appropriate consultation with the Service, as required under the Endangered Species Act, for such potential effects on listed species.

(39) Consult with the CDFG regarding potential impacts to State listed threatened and endangered species.

(40) Complete the appropriate consultation with NMFS, as required under section 7 of the Endangered Species Act, for potential impacts to anadromous fish species.

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