Appendix E
Folsom DS/FDR Revised Draft
Fish and Wildlife Coordination Act Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:
HC BOR/COE

MAR 1 6 2007

Memorandum

To: Regional Director, U.S. Bureau of Reclamation, Sacramento, California

From: Acting Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Draft Fish and Wildlife Coordination Act Report for the Folsom Dam Safety and Flood Damage Reduction Project

This memorandum transmits the Fish and Wildlife Service's revised Draft Fish and Wildlife Coordination Act Report for the Folsom Dam Safety and Flood Damage Reduction project. This report is prepared under the authority of, and in accordance with, the provisions of section 2(b) of the Fish and Wildlife Coordination Act (48 stat. 401, as amended: 16 U.S. C. 661 et seq.).

The report assesses potential project effects on fish and wildlife resources and provides our preliminary recommendations to avoid, minimize, rectify or compensate for potential adverse effects. The report is primarily based on the Service's review of: 1) the September 2006, Folsom Dam Safety and Flood Damage Reduction Draft III- Environmental Impact Statement /Environmental Impact Report (EIS/EIR); 2) the revised project footprint received January 2007; and 3) the Administrative Draft Final EIS/EIR posted for agency review on March 6, 2007. This report is being submitted to the California Department of Fish and Game, National Marine Fisheries Service and the U.S. Army Corps of Engineers for review. Comments on this report need to be received in our office prior to March 27, 2007. Details of the project's effects on federally listed species, pursuant to section 7 of the Endangered Species Act of 1973, as amended, are being addressed separately.

If you have any questions regarding this report, please contact Stephanie Rickabaugh at (916) 414-6724.

Attachment

cc:
Mike Finnegan, USBR, Folsom, California
Rosemary Stefani, USBR, Sacramento, California
Shawn Oliver, USBR, Folsom, California
Becky Victorine, USCOE, Sacramento, California (without attachment)
John Baker, NOAA Fisheries, Sacramento, California (without attachment)
Kent Smith, CDFG, Region 2, Rancho Cordova, California (without attachment)

United States Department of the Interior

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Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:
HC-Folsom Dam Safety and Flood Damage Reduction

MAR 1 6 2007

Colonel Ronald N. Light
District Engineer
Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814-2922

Dear Colonel Light:

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Any questions or comments regarding this report should be directed to Stephanie Rickabaugh at (916) 414-6724.

Sincerely,

David L. Harlow
Acting Field Supervisor

Enclosure

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United States Department of the Interior

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In reply refer to:
HC- BOR/COE

MAR 16 2007

Mike Aceituno
Sacramento Area Supervisor
National Marine Fisheries Service
650 Capitol Mall Rm 8-300
Sacramento, California 95814

Regional Manager
California Department of Fish and Game
Region 2
1701 Nimbus Road, Suite A
Rancho Cordova, California 95670

Dear Mr. Aceituno and Regional Manager:

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Kent Smith, CDFG, Region 2, Rancho Cordova, California

REVISED DRAFT FISH AND WILDLIFE COORDINATION ACT REPORT

FOLSOM DAM SAFETY AND FLOOD DAMAGE REDUCTION PROJECT

PREPARED BY:
SACRAMENTO FISH AND WILDLIFE OFFICE
FISH & WILDLIFE SERVICE
SACRAMENTO, CALIFORNIA

MARCH 2007

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FOLSOM DAM SAFETY AND FLOOD DAMAGE REDUCTION PROJECT

EXECUTIVE SUMMARY

The U.S. Bureau of Reclamation (Reclamation) and the U.S. Army Corps of Engineers (Corps) are currently evaluating alternatives for the Folsom Dam Safety and Flood Damage Reduction (Folsom DS/FDR) project. This is one of many projects being pursued by the Corps under the authority of the American River Watershed Investigation. Reclamation is evaluating dam safety at the Folsom Facilities through their Safety of Dams Program. Reclamation recognizes the need to expeditiously implement engineering measures for the Folsom Facilities in order to reduce potential failure due to seismic, static, and hydrologic conditions. The Corps recognizes the need to incrementally increase minimum flood protection through increasing flood storage capacity and/or reservoir pool release mechanisms. Therefore, Congress modified the existing authorities under the Energy and Water Appropriations Act of 2006, which directed the Secretary of the Army and the Secretary of the Interior to collaborate on authorized activities to maximize flood damage reduction improvements and address dam safety needs at Folsom Dam and Reservoir as one Joint Federal Project. The project objectives are:

- Expeditiously reduce hydrologic risk of overtopping-related failure of any impoundment structure during a probable maximum flood (PMF) event in accordance with Reclamation's Public Protection Guidelines;
- Expeditiously reduce the risk of structural failure of any impoundment structure during a potential seismic event in accordance with Reclamation's Public Protection Guidelines;
- Expeditiously reduce the risk of structural failure of any impoundment structure during a potential static event in accordance with Reclamation's Public Protection Guidelines; and
- Expeditiously improve the flood damage reduction capacity of the facilities in a manner consistent with existing Corps authorities.

The project area encompasses primarily Federal lands in and around Folsom Reservoir and Folsom Dam, including parts of both the north and south forks of the American River.
The Folsom Facilities to be addressed by one or more of the engineering options include the main concrete dam, the right and left wing dams, Mormon Island Auxiliary Dam (MIAD), and eight dikes (1 through 8). The concrete dam and earthen wing dams serve to impound water associated with the main stem of the American River. MIAD was built within an historic river channel, while the earthen dikes serve to contain water at low spots in the topography during periods when the reservoir is full or nearly full.

This project identifies unique opportunities to expedite Federal funds for planning, design and implementation of a flood control and dam safety risk reduction action. Reclamation and the Corps analyzed five action alternatives along with the no action alternative before choosing a Preferred Alternative that considers the current hydrologic, seismic, static, and flood damage risks posed by the Folsom Facilities.

The five action alternatives include designs for an auxiliary spillway, enlargement of the reservoir (a dam raise) as well as several construction zones, and borrow and stockpile areas. The four auxiliary spillway designs being evaluated are a fuseplug, fuseplug with a tunnel, a four-submerged tainter gate and a six-submerged tainter gate spillway. The five reservoir enlargement designs being evaluated include: minimal to 4-foot embankment raise, 3.5-foot parapet wall raise, 4-foot embankment raise, 7-foot embankment raise and a 17-foot embankment raise.

The U.S. Fish and Wildlife Service (Service) has evaluated the potential fish and wildlife impacts of all five alternatives proposed under the Folsom DS/FDR project. This report contains an evaluation of the adverse impacts to important fish and wildlife resources of the various alternatives outlined in the *Folsom Dam Safety and Flood Damage Reduction, Final Environmental Impact Statement/ Environmental Impact Report, March 2007*.

The recommendations in this report constitute what the Service believes, from a fish and wildlife resource perspective and consistent with our Mitigation Policy, to be the best present recommendations for the project. The outcome of consultation under section 7 of the Endangered Species Act or future consultations under the Fish and Wildlife Coordination Act, could affect the recommendations herein.

The Service recommends that Reclamation and the Corps:

- Select a flood control alternative which avoids, to the extent possible, unmitigable impacts and minimizes other impacts to fish and wildlife resources.

- Consult with the Service and the National Marine Fisheries Service pursuant to section 7 of the Endangered Species Act, to minimize adverse affects to federally listed species and their habitats.

- Consult with the California Department of Fish and Game regarding potential impacts to State listed threatened and endangered species.

- Avoid impacts to oak-grey pine woodland, riparian areas and seasonal wetlands adjacent to, but outside of, construction easement areas through use of construction fencing.

- Avoid impacts to woody vegetation at all staging areas, borrow sites, and haul routes by enclosing them with fencing.

- Avoid impacts to water quality at Lake Natoma and Folsom Reservoir when loading, unloading, and transporting materials to be used for the Folsom

DS/FDR project by taking appropriate measures to prevent soil, fuel, oil, lubricants, etc. from entering into these waters.

- Minimize impacts to wildlife by using eco-friendly erosion control blankets that do not create wildlife entrapment issues. Using flexible joint netting or another erosion control alternative that doesn't include monofilament fixed-joint netting would avoid entrapment issues that may occur with the fixed joint netting commonly used in erosion control blankets.

- Minimize impacts to annual grassland habitat and other disturbed areas, by re-seeding all disturbed areas with appropriate native grass species as construction elements are completed.

- Minimize impacts to fish and phytoplankton during spillway construction (dredging and blasting) by implementing conservation and minimization measures (such as a curtain) during in-reservoir activities to minimize sedimentation and localize methylmercury dispersal.

- Compensate for unavoidable impacts to oak-grey pine woodland habitat by acquiring suitable lands and developing oak woodland habitat using the assumptions contained in Appendix A. Compensation acreages by project components are summarized in Appendix C.

- Compensate for unavoidable impacts to riparian habitat by acquiring suitable lands and developing riparian habitat using the assumptions contained in Appendix A. Compensation acreages by project components are summarized in Appendix C.

- Compensate for unavoidable impacts to seasonal wetland habitat by acquiring suitable lands and developing seasonal wetland habitat using the assumptions contained in Appendix A. Compensation acreages by project components are summarized in Appendix C.

- Compensate for unavoidable impacts to chaparral habitat by acquiring suitable lands and developing the needed mitigation of chaparral habitat using the assumptions contained in Appendix A. Compensation acreages by project components are summarized in Appendix C.

- Develop a monitoring and adaptive management program with the other agencies, to monitor vegetation around the reservoir over the life of the project. Baseline conditions would be established and updated at intervals (10 years). After major flood events (those which encroach above the existing maximum flood pool elevation), vegetation would be surveyed and damages attributable to inundation would be mitigated as deemed appropriate using best management practices at the time (replanting on-site would be the first priority). Budget in advance for this monitoring and adaptive management program.

- Develop a monitoring and adaptive management plan with the other agencies, to monitor the hydrology and vegetation at Mormon Island Preserve. Baseline conditions would be established before construction begins in the area and would continue for 4 years after construction has been completed. Post-construction surveys would monitor for potential changes in wetland hydrology, water quality, and vegetation. If changes in wetland hydrologic function are detected from the baseline condition, implement adaptive management mitigation to return affected systems to baseline conditions considering the long-term conservation of the Mormon Island Preserve.

- Develop operation and maintenance manuals (O&M Manual) for all mitigation sites developed for the project. Coordinate with the Service on the development of the all O&M Manuals.

- Monitor methylmercury levels in water and suspended sediment of water being released from Folsom Dam during in-reservoir construction activities until levels return to baseline.

- Complete a more thorough assessment of freshwater sediment effect levels for contaminants of concern, in particular mercury and nickel. Many of the references used in Reclamations' Sediment Characterization document to identify effect levels were inappropriate for fish and wildlife assessment needs. Other references such as MacDonald et al. (2000) and EPA (2004) provide good assessment guidelines for freshwater sediment.

INTRODUCTION

The U.S. Army Corps of Engineers (Corps) and the U.S. Bureau of Reclamation (Reclamation) seek to significantly reduce the risk of flooding along the main stem of the American River in the Sacramento area while meeting dam safety and public safety objectives.

This report provides: (1) the U.S. Fish and Wildlife Service's (Service) analysis of impacts to fish and wildlife that would result from construction and operation of the various Folsom Dam Safety and Flood Damage Reduction (Folsom DS/FDR) project alternatives; (2) recommendations to avoid, minimize, rectify or, as a last resort, compensate these impacts; and (3) the Service's assessment of project alternatives based on a fish and wildlife conservation perspective. The analysis herein is based on the February/March 2007, project description provided by the Reclamation and Corps as well as site visits, literature review, discussions with experts, and a revised project footprint provided January 2007.

The current study was implemented under several existing authorizations. The Corps project authorities are the: Folsom Dam Modification, authorized under section 101(a) (6) of the Water Resources Development Act (WRDA) of 1999 (Public Law (PL) 106-53) and the Folsom Dam Raise, authorized in the Energy and Water Resources Development Act of 2004, dated December 1, 2003 (PL 108-137) both of which are to enhance flood protection. Reclamation has also been pursing dam safety risk reduction improvements separately through its existing Dam Safety Program. Investigations by Reclamation have identified dam safety risk reduction needs at Folsom Dam and appurtenant facilities. Reclamation has commenced a Corrective Action Study (CAS) to identify possible, probable, and preferable design modification alternatives to address identified risk reduction needs for submittal to Congress for approval.

However, recent modifications to the existing authorities were made in the Energy and Water Appropriations Act of 2006, which directed the Secretary of the Army and the Secretary of the Interior to collaborate on authorized activities to maximize enhanced flood protection improvements and address dam safety risk reduction needs at Folsom Dam and Reservoir as one Joint Federal Project. The text of this most recent authorization follows:

> *SEC. 128. American River Watershed, California (Folsom Dam and Permanent Bridge)*
>
> *(a) COORDINATION OF FLOOD DAMAGE REDUCTION AND DAM SAFETY- The Secretary of the Army and the Secretary of the Interior are directed to collaborate on authorized activities to maximize flood damage reduction improvements and address dam safety needs at Folsom Dam and Reservoir, California. The Secretaries shall expedite technical reviews for flood damage reduction and dam safety improvements. In developing improvements under this*

section, the Secretaries shall consider reasonable modifications to existing authorized activities, including a potential auxiliary spillway. In conducting such activities, the Secretaries are authorized to expend funds for coordinated technical review and joint planning, and preliminary design activities.

Both Reclamation and the Corps have conducted engineering studies to identify potential corrective measures for the Folsom Facility to alleviate seismic, static, and hydrologic dam safety issues, and flood management concerns. These two Federal agencies have combined their efforts resulting in (1) a Joint Federal Project for addressing Reclamation's dam safety hydrologic risk and the Corps' flood damage reduction objectives and (2) other stand-alone flood damage reduction and dam safety actions to be completed by the respective agencies in a coordinated manner.

DESCRIPTION OF THE PROJECT AREA

The Folsom Facility is located about 23 miles northeast of Sacramento, near the City of Folsom, California. The Folsom Facility impounds waters from the North and South Forks of the American River and was constructed to provide flood damage reduction, water supply and hydropower. The Folsom DS/FDR project is located around Folsom Reservoir which is within Sacramento, Placer and El Dorado counties (Figure 1). Figure 2 shows several of the project components in relation to the Folsom Reservoir. The Folsom Facility is made up of 12 dams and dikes that impound about 977,000 acre-feet at a reservoir water surface elevation of 466 feet.

The Folsom DS/FDR project includes measures to remedy dam safety issues associated with seismic, static, and hydrologic concerns, and to provide increased flood damage protection. These measures include several different options to remedy the various issues at the Folsom Facilities. The Folsom Facilities to be addressed by one or more of the engineering options include the main concrete dam, the right wing dam and left wing dam, Mormon Island Auxiliary Dam (MIAD), and eight dikes (1 through 8). The concrete dam and earthen wing dams serve to impound water associated with the main stem of the American River. MIAD was built within an historic river channel, while the earthen dikes serve to contain water at low spots in the topography during periods when the reservoir is full or nearly full.

DESCRIPTION OF THE PROJECT ALTERNATIVES

NO ACTION ALTERNATIVE

The No Action/No Project Alternative describes the reasonably foreseeable future without the Folsom DS/FDR project. Without the project the hydrologic, seismic, static, and flood damage risks currently posed by the Folsom Facilities would continue into the future.

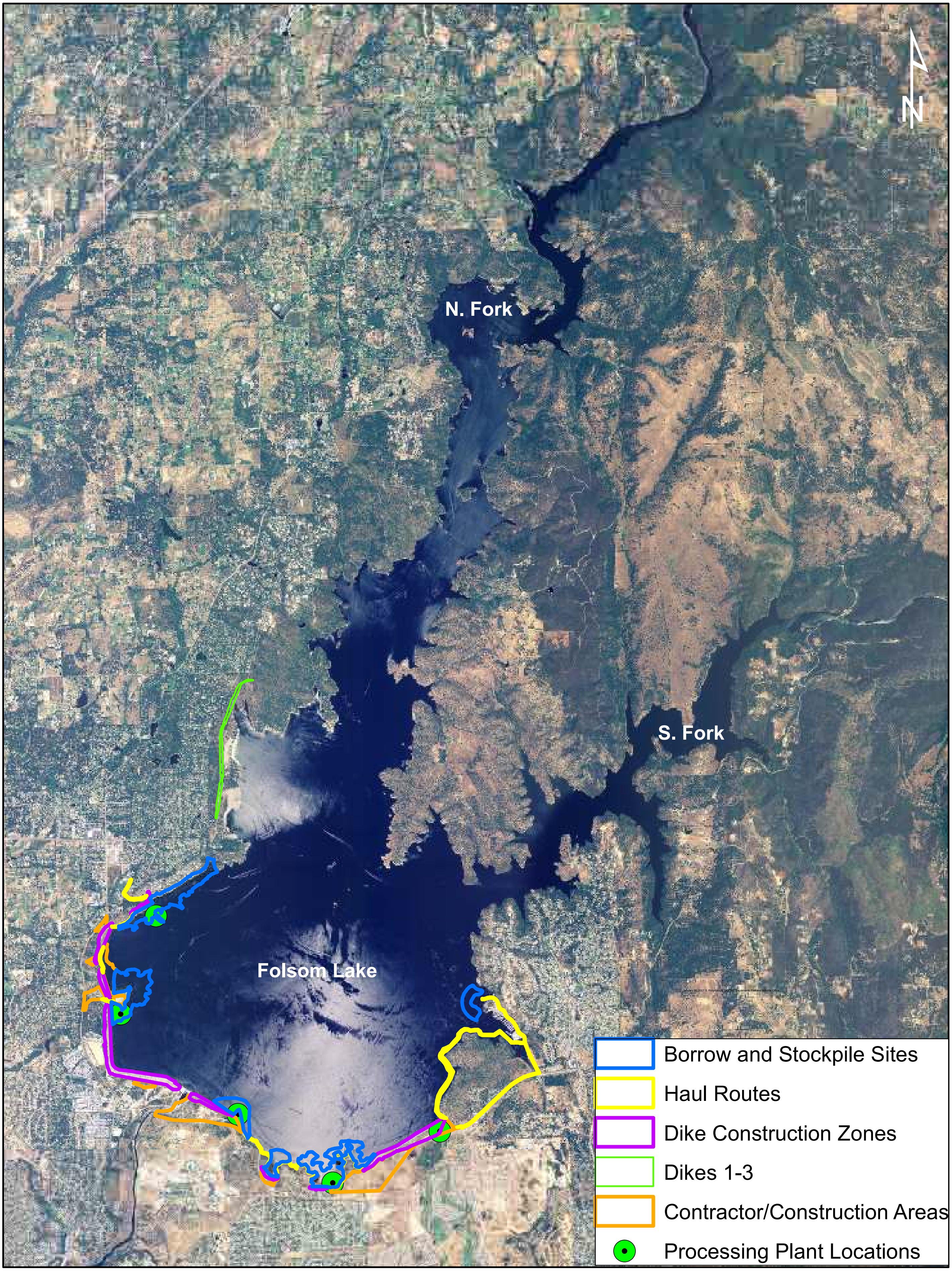
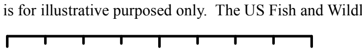


Figure 2- Project Location

Prepared by the US Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Flood and Waterway Planning Branch; February 27, 2007

This map is for illustrative purposed only. The US Fish and Wildlife Service shall not be held liable for improper or incorrect use of the data described and/or contained hereein.



Action Alternatives
In addition to the No Action/No project Alternative, the Folsom DS/FDR project evaluates five action alternatives. The basic features of the five alternatives are outlined below.

CONSTRUCTION ALTERNATIVES

1. Auxiliary Spillway

The auxiliary spillway would consist of an approach channel on the water side of the control structure, a control structure section consisting of either a segmented earthen fuseplug control structure or a four-or six-submerged tainter gate control structure, and a discharge chute on the downstream side of the control structure. The spillway would convey the reservoir discharge to the American River channel without impact to the left wing dam. The discharge chute linings would be either a short lined-chute, constructed in the upper portion of the spillway, or a fully-lined chute constructed completely to the river discharge point. The spillway chute would be lined either with roller compacted concrete, or structural, formed, and poured concrete. The auxiliary spillway would be constructed by excavating an elongated trench in the area adjacent to and downstream of the left wing dam, diagonal from the current overlook parking lot. The excavation of the approach and discharge channels would be done in three stages. The first stage would include removing common material and some excavation of the rock. The underlying competent bedrock would be excavated using standard drill and blast techniques. The second stage would involve additional excavation and possibly the construction of a rock plug. A rock plug and/or coffer dam would be used to close off the partially excavated approach channel. The third stage would involve excavating the approach and discharge channel to the final grade as the auxiliary spillway is being completed. In-reservoir material would be removed by a clamshell dredge, although some material would have to be removed through blasting as the primary means of excavation. The spillway would be controlled by either an earthen fuseplug control section that would meet the dam safety objectives of passing the probable maximum flood (PMF) or submerged tainter gates that would meet both dam safety and flood control objectives. Features of the fuseplug spillway and tainter gate spillway are provided in the following sections.

A. Fuseplug Spillway

A control structure with fuseplug embankment sections could serve on a permanent basis. The spillway would be excavated and constructed as described above, however the fuseplug section would consist of a zoned embankment with an impervious core, an internal coarse shell zone, and erosion protection on the upstream face. The fuseplug embankment sections would be designed to erode in a controlled manner when the reservoir elevation exceeds the elevation of a pilot channel (by about 1 foot) and would be 2 feet below the fuseplug embankment crest. The fuseplug spillway would have a 520-foot-wide control structure at the upstream end of a 1,100-foot-long, 300- to 520-foot-wide roller-compacted concrete-lined channel. This channel would lead to a 1,700-foot unlined channel discharging into the American River. The fuseplug control structure would be designed with multiple segments to allow progressive passage of smaller floods up to the PMF flow without affecting the complete fuseplug control structure.

The fuseplug alternatives would require placement of material in the reservoir at the Folsom Lake Observation Point on the left wing dam to increase the efficiency of the auxiliary spillway.

B. Gated Spillway

Another option for the auxiliary spillway control section would be the use of mechanical gate (submerged tainter gates) housed in a concrete structure to meet both dam safety and flood damage reduction objectives. A gated spillway would take longer to construct and would involve three construction phases. Construction of the spillway would be in phases by excavating an elongated trench in the area adjacent to and downstream of the left wing dam to a profile to safely pass the PMF. The gated auxiliary spillway would consist of an approach channel on the waterside of the gate, a control structure consisting of four or six submerged tainter gates, and a concrete-line chute leading to an energy dissipating structure and exit channel. The discharge chute would be fully lined with formed concrete and is inclusive of an energy-dissipating unit (stilling basin) at the river. The gated spillway would have a 190-foot-wide control structure at the head of a 1,700-foot-long channel and would have a discharge capacity of about 280,000 cubic feet per second (cfs) at pool elevation 477 feet. The gated sections would be designed to allow safe passage of more frequent, smaller flood events and maintain the capability to safely pass the PMF without overtopping the other retention structures.

2. New Stilling Basin

A new stilling basin would need to be constructed at the end of the new gated auxiliary spillway to dissipate the hydraulic energy during water releases and keep water released from the dam from backing up into the new spillway. Construction would include a temporary concrete coffer dam in the main channel to redirect releases coming from the dam. The coffer dam would remain until the spillway and new stilling basin are constructed. This component of the project is still in the design phase so subsequent environmental documentation will be prepared.

3. Existing Spillway

The existing stilling basin was designed so that it could contain hydraulic jump action for flows up to 200,000 cfs and prevent major damage during the existing spillway design flood event. Flows above 200,000 cfs would result in hydraulic jump farther downstream. Because releases from the main dam with an auxiliary spillway could be increased from the current 567,000 cfs maximum to 920,000 cfs with this project, an increase in spillway design flood capacity is warranted. To address this concern, the existing stilling basin would be extended 50 to 70 feet downstream.

A. Gate Improvements

Minor to moderate modifications are being considered to reduce seismic risks. These modifications range from reinforcing the existing gate wings to replacing the existing gate arms.

B. Gate Replacement

The existing concrete dam service and/or emergency spillway gates are proposed for replacement under a dam raise option because structural members for the existing gates would be impacted during passage of large flood releases. The proposed gates would be higher, and the new trunion would be outside of the stream flow for large flood releases. As a consequence of gate replacement, the existing spillway bridge would also need to be replaced.

C. Spillway Pier Reinforcements

To reduce seismic risks, spillway pier reinforcements may be comprised of bracing, post tensioned anchors, and/or pier wraps.

4. Main Dam Seismic Improvement

The main dam was constructed of concrete monoliths that may have the potential to slide on horizontal lift lines within the dam during a large earthquake event. Engineering options being considered to reduce the probability of main dam movement include upper and lower tendons, shear keys, and toe-blocks.

5. Filters

To better control seepage and piping (movement of water through the core that carries soil material) on the existing earthen structures (wing dams, dikes and MIAD), sand filters are proposed to be constructed within the downstream part of the earthen structures. Two alternative types of filters for dikes are being considered for the downstream face. The full-height filter would extend upward from the downstream toe of the dike to the crest of the dike. The half-height filter would extend from the downstream toe to half the vertical distance to elevation 466 feet. Additionally, on the left and right wing dams, crest filters in the upper portion of the dam and area where the soil and concrete adjoin is also being evaluated. Due to concerns about piping along the embankment interface with the concrete dam, filter zones are required along these contacts. This would be constructed by excavating a portion of the outer zones of the left wing dam and right wing dam so that filter material could be placed against the core materials of these dams. The filter zones would provide protection against both static and seismic loading conditions.

At the left and right wing dams, filter zones are required only in the upper portion of the dams. Sand filter zones would be constructed from the crest to an elevation about 40 feet below the dam crest. This filter zone would be constructed by excavating a 40-foot portion of the downstream shell and placing the filter material against the core. The filter zone would then be covered by a layer of excavated shell material. This filter zone would exit into the downstream face of the embankment. Construction zones at the dikes and wing dams varies to minimize habitat impacts, however, in general they range from 50 to 100 feet from the existing toe.

6. MIAD Jet Grouting and Seismic Alternatives

Part of MIAD is constructed over an historic river channel, Blue Ravine. This portion of the dam, towards the left end of the dam, is at risk of significant deformations should the foundation of the dam liquefy during a severe earthquake event. Two design alternatives are being considered to prevent these deformations from occurring. These alternatives are jet grouting the lower zones of liquefiable material in the downstream foundation material and increasing the size of the downstream side of MIAD by adding additional material.

Jet grouting would be used to stabilize the foundation of MIAD. Soil borings would be drilled using special drilling equipment and would be drilled through the potentially unstable dredged alluvial or historic alluvial material and then into the underlying bedrock. Once the desired depth is achieved, a concrete-based grout would be injected and extruded into the subsurface using jets along the side of the drill pipe. The grout would be injected under high pressure into the formation, filling voids. Exploratory borings would be drilled into the grout columns to verify the extent that voids are filled and the grout has set and hardened. The exploratory borings would be backfilled with concrete.

Approximately 1,360 borings would be drilled for jet grouting purposes. Within each boring, about 26 tons of grout would be injected. During grouting, drilling cuttings, water, and grout would be brought to the surface. This waste material would be directed to temporary, lined settling pits for solidification, removal, and disposal. Up to 70 cubic yards of waste material would be generated at each bore hole. This material would be dried and stockpiled on site. Eventually the dried material would be incorporated into the downstream overlay of MIAD pending review and approval by the Regional Water Quality Control Board.

The second construction activity for MIAD would be increasing the mass of MIAD by placing an overlay on the downstream side. Although the upstream toe of MIAD was treated with dynamic compaction in the 1990s, the lower portion of MIAD was too deep to have been effectively treated by that procedure. Therefore, there still is some risk for large sliding or deformation to occur due to upstream liquefaction. Because the presence of the reservoir makes it difficult to treat the upstream toe, the project would involve excavation of a portion of the downstream fill, placement of a filter layer, replacement of shell, and then placement of an overlay of up to 2 million cubic yards. The downstream overlay would not prevent upstream sliding and deformation, but it would reinforce MIAD with adequate mass to withstand a seismic event. The overlay would also incorporate the installation of a filter zone. Installation of the overlay could result in raising the height of MIAD up to 4 feet. The purpose of the overlay would be strictly for seismic and static concerns, and would not necessarily provide additional hydrologic control (temporarily increase flood storage), unless all other Folsom Facilities were also raised.

7. Borrow, Stockpile and Disposal Sites

Borrow sites would be on Federal property within and immediately outside of the reservoir. The number and extent of borrow site development would be dependent on the amount of earthen material required to accomplish the various project components. Potential borrow sites include:

along the low water shoreline opposite Beals Point Recreation Area and to the north along Mooney Ridge and Granite Bay; excavation material from the auxiliary spillway and/or tunnel; MIAD right abutment (Folsom Point), MIAD left abutment, D1 site, and D2 site. Borrow sites would also be used for stockpiling of material. However; depending on the alternative chosen excess material maybe permanently disposed of at Dike 7, Beals Point, Folsom Point, D1 and D2, Overlook parking lot, Hobie Cove, Granite Bay or MIAD as additional overlay.

8. Staging Areas and Haul Roads

There would be three primary staging areas: left wing dam/Overlook Point, D2, and on a constructed platform south of Beals Point; as well as several secondary staging sites set up at or immediately adjacent to the toes of Dikes 4, 5, and 6, and the right wing dam. This would include contractor's offices, parking, and staging of materials. Other potential staging areas include Beals Point and Dike 4 for screening and staging, Granite Bay and D1/D2 for both processing and staging, and MIAD for a jet grout plant and a staging area.

The main dam overlook parking lot staging area would include contractor offices and parking, materials storage, and a concrete mixing plant. This would be the longest occupied staging area given that the dam seismic work would be scheduled last.

Hauling of equipment, materials and supplies from the west to east side construction sites would be conducted on city streets or internal haul roads. Typical materials to be hauled on city streets include concrete, reinforcement steel, general supplies and if needed, aggregate and sand.

The internal haul roads would be developed to reduce construction traffic on city streets and to allow the use of oversized construction equipment. The internal haul roads would be graded into the weathered granite and have an earthen road base installed or use cut and fill techniques to establish the 40 foot-wide road to allow passage of oversized equipment. Internal haul roads include those constructed in-reservoir as well as the crests of the dikes, wing dams, MIAD and Folsom Dam Road. Given the space limitations of the crests, only conventional sized equipment would use the dikes, wing dams or MIAD.

9. Security Upgrades

To provide the required level of security for the dam the following would be installed: access controls, intrusion detection, supplemental lighting and closed circuit television throughout the power plant, pump plant, elevator tower, industrial area, administration area, recreational areas, Dikes 4-7, MIAD, the wing dams, Folsom Dam itself and Folsom Dam Road.

10. Exploratory Work

A certain amount of exploratory geologic and geotechnical work has occurred to better characterize the subsurface conditions within the proposed auxiliary spillway location and around MIAD.

The Corps exploration program for the auxiliary spillway consisted of drilling about 20 rock core borings and conducting down-hole seismic surveys, optical televiewer logging, and in-situ testing within the proposed footprint of the auxiliary spillway and it appurtenances, with a future option of 10 additional borings. This exploratory work required initial earthwork to construct drill pads and access roads to the drill sites.

Reclamation also has an exploration program for the auxiliary spillway, which included drilling six core holes.

11. Processing Plants

Five material processing plants would be needed for filtering material and for concrete preparation. Plants would be located at MIAD, Folsom Point/Dike 8, Beals Point, Granite Bay and Mooney Ridge areas. Reclamation anticipates most of the material for filters (sand and gravel) would come from local off-site suppliers, so screening plants may only be needed in some instances.

12. New Embankment Raises

All earthen structures could be raised through the placement of additional earthen material, construction of concrete parapet walls, or a combination of the two measures, along the crest of the facilities. The purpose of the minimal embankment raises, as in Alternatives 1 and 2, would be to provide additional (up to 3 feet) freeboard to the existing facilities for dam safety concerns. Higher raise options could serve to provide additional flood damage reduction storage capacity during low frequency storm events. However, a raise is intended to provide additional freeboard to all impoundment facilities, not to increase reservoir water elevation above current operation

Several options exist for the raising of existing dikes and wing dams. Embankment raise options are conventional earth fill raise, reinforced earth wall raise, reinforced concrete retaining wall raise, and combination earthen raise and concrete wall raise. The raise component will undergo further design during the Corps' preconstruction engineering and design phase, and if needed supplemental environmental coordination and documentation would be prepared.

Work at Dikes 1 thru 3 is considered part of the raise component, therefore, in this document a construction buffer of 50 feet from the dike toe has been included for evaluating habitat impacts that would occur from any embankment raise at these three dikes. Raise activities at other locations would be within the existing footprint

Any of the alternatives involving a raise of Folsom Facility structures could result in a temporary increase in the reservoir water elevation during periods of maximum flood flows into the reservoir. This increase in the reservoir water elevation could result in the potential to flood property beyond the boundaries of Folsom Reservoir at locations with lower land elevations. However once completed, the auxiliary spillway would have the ability to increase the reservoir discharge capacity at a lower pool elevation with no increase in pool elevation. This allows a lowering of the maximum pool and a decrease in the need for use of surcharge storage space in the reservoir. However, a Folsom Dam Re-operations study will be completed prior to any releases from the newly constructed auxiliary spillway. Therefore, the need for easements, new embankments or other containment alternative will continue to be analyzed by the Corps. The Corps will continue to analyze the project hydrology and the need for a raise, essentially creating additional freeboard space in the reservoir. The Corps will issue its findings in a subsequent environmental document, if necessary.

Action Alternatives

Alternative 1– No Dam Raise/Minimal Embankment Raise/Fusplug Auxiliary Spillway

Under Alternative 1, there would be no raise to the concrete structure with minimal modifications to the existing spillway. A large auxiliary spillway would be constructed adjacent to the left wing dam to address hydrologic and flood control concerns. Some of the earthen structures would be raised to address hydrologic concerns, but not to increase the flood storage capacity of the reservoir since this alternative is a Dam Safety only alternative.

Alternative 2– Four-Foot Dam/Embankment Raise/Fuseplug Auxiliary Spillway with Tunnel

Alternative 2 incorporates a 4-foot dam raise with a fuseplug auxiliary spillway and gate-controlled tunnel spillway for better hydrologic control of large flood events. Under this alternative, there would be a 4-foot raise to the concrete structure with some modifications to the existing spillway gates. An auxiliary spillway with a chute or a tunnel would be constructed to address hydrologic and flood control concerns. All of the earthen structures would be raised to address hydrologic concerns and to provide additional flood storage capacity.

Preferred Alternative, Alternative 3 – Six-Submerged Tainter Gate Spillway/3.5-Ft Raise

Under the Preferred Alternative a smaller six-submerged tainter gate (six gate) auxiliary spillway would be constructed to address both Dam Safety and Flood Damage Reduction objectives including hydrologic and flood control concerns. Construction of the six gate auxiliary spillway would increase project discharge capacity. The 3.5-foot raise, in conjunction with modification and/or replacement of the three emergency spillway gates and the six-gate auxiliary spillway, would only serve as additional freeboard for the Folsom Facilities. Once construction is completed the raise would not exceed the existing take line for a 200-year design event and there would be an anticipated lower maximum water surface elevation. The 3.5-foot raise, modification and/or replacement of the three emergency spillway gates and the six-gate auxiliary spillway, have been identified by the Corps as their Selected Plan within the Corps' Post Authorization Change report. The remaining elements of Alternative 3 are Dam Safety Modification as revised above.

Alternative 4– Seven-Foot Dam/Embankment Raise/Four-Submerged Tainter Gate Spillway

Alternative 4 contains many of the same elements as Alternative 3 with the exception of a 7-foot raise that could result in increased reservoir flood storage during large flood events. Under this alternative all Folsom Facilities and earthen structures would be raised 7 feet. A smaller four-submerged tainter gate (four gate) auxiliary spillway would be constructed to address hydrologic and flood control concerns.

Alternative 5– Seventeen-Foot Dam/Embankment Raise/No Spillway

Alternative 5 was specifically developed as an alternative that would address both Dam Safety and Flood Damage Reduction requirements without the construction of an auxiliary spillway. Under this alternative all Folsom Facilities could be raised 17 feet which would increase reservoir storage capacity to control large flood events.

BIOLOGICAL RESOURCES

EXISTING CONDITIONS

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

FOLSOM DAM ENLARGEMENT

<u>Vegetation</u>

Around Folsom Reservoir and Upstream

The area surrounding Folsom Reservoir supports a mix of habitat types, dominated by blue oak-grey pine woodland. The lower foothill area near Folsom Dam contains large areas of oak woodland, with scattered blue oaks and interior live oaks. Small areas of chaparral extend to the reservoir's upper edge particularly along the South Fork arm. Annual grassland areas are interspersed throughout the area, and human-disturbed habitats occur around boat-launch facilities. Relatively small areas of riparian habitats can be found along tributaries to the reservoir and in seep areas. Willow stands and individual trees have become established within some areas of the reservoir pool.

MIAD serves to dam water within an historic river channel thus creating several perennial wetlands on the landside in addition to a wetland preserve (Mormon Island Preserve) run by California Department of Parks and Recreation on the east side of Green Valley Road. No studies have been completed to date that definitively show where the water for these wetlands originates. It is possible that during wet weather the hills to the east funnel the runoff into the Preserve and, using the old riverbed, water travels into the remaining wetland across the Green Valley Road. Another possibility is that water seeps from MIAD into the wetland and the Preserve. Any construction in and around MIAD may have direct impacts to these wetlands and will need to be monitored during and after construction of the Folsom DS/FDR project. The wetland acreage within Mormon Island Preserve has not been included in this impact analysis.

Lower American River

The lower American River, although highly modified from conditions of 150 years ago, supports a diverse and highly valuable area for biological resources. The 23-mile-long reach of the American River Parkway encompasses about 4,000 acres, the majority of which are in State designated floodway and contain large areas of grasslands and pasture, riparian cottonwood and oak woodlands, herbaceous plants and riparian scrub-shrub, bare sand and gravel, and surface waters of the river and associated sloughs and dredge ponds (USFWS 2003). Most of the area is high floodplain dominated by upland species, including oak woodland and grasslands (per. com. T. Burwell).

Fish

Folsom Reservoir and Upstream

When full (i.e., around 1 million ac-ft), Folsom Reservoir encompasses about 10,000 surface acres of water and 75 miles of shoreline, extending about 15 miles up the North Fork and 10.5 miles up the South Fork of the American River. It supports a "two-stage" fishery: warmwater species such as bass (largemouth, smallmouth, and spotted) and panfish (crappie, bluegill, and sunfish) in the upper waters, and trout and landlocked salmon (kokanee and Chinook) in the deeper waters. Various common catfish can also be found near the bottom of shallower waters. Fish habitat is present within the inundation zone in the forms of young willow dominated riparian habitat which grows during extended periods of drought, as well as brush piles placed there by the California Department of Fish and Game (CDFG) and sportsmen groups. Both warmwater and coldwater fisheries tend to benefit from increased peak spring water storage as this results in better coldwater reserves for the salmonid fishes as well as increased spawning and rearing area for warmwater fish (USFWS 2001). Sport fishing is an important and popular recreational activity at Folsom Reservoir.

Sediment associated with the Folsom DS/FDR project area in the Folsom Reservoir may contain mercury from historic mining operations and metals from historic activities or geology in the American River drainage (Reclamation 2006a). Most of the mercury in water, soil, sediments, or plants and animals is in the form of inorganic mercury salts and organic forms of mercury (e.g., methylmercury). Mercury cycles in the environment as a result of natural and human activities and can accumulate most efficiently in the aquatic food web. Predatory species at the top of the food web generally have higher mercury concentrations. Nearly all of the mercury that accumulates in fish tissue is methylmercury (EPA 2006).

Lower American River

The lower American River supports a diverse and abundant fish community; altogether, at least 41 species of fish are known to inhabit the river (USFWS 1986). In recognition of its "outstanding and remarkable" fishery resources, the entire lower American River was included in the Wild and Scenic Rivers System in 1981, which provides some protection for these resources (USFWS 1991). Four anadromous species are important from a commercial and recreational perspective. The lower river supports a large run of fall-run Chinook salmon, a species with both commercial and recreational values. The salmon run is sustained by natural reproduction in the river, and by hatchery production at the Nimbus Salmon and Steelhead Hatchery, operated by CDFG. The average annual run of salmon in the American River is 25,948 (CDFG 2006).

Steelhead, a popular sport fish, are largely sustained in the river by production from the Nimbus Hatchery, because summer water temperatures often exceed the tolerances of juvenile steelhead, which typically spend about 1 year in the river. American shad and striped bass enter the river to spawn; these two species, introduced into the Sacramento River system in the late 1800s, now support popular sport fisheries. In addition to species of economic interest, the lower American River supports many nongame species, including Sacramento pikeminnow, Sacramento sucker, tule perch, and hardhead (USFWS 1994).

Wildlife

Around Folsom Reservoir and Upstream

The area around Folsom Reservoir supports an animal community characteristic of the lower Sierra Nevada western slope. Although the range of elevation is small, habitats are diverse, in part because the reservoir extends about 20 miles into the Sierra Nevada foothills, from gentle hills near the dam to steep-walled canyons along the forks of the American River. More than 50 species of mammals live in these areas (USFWS 1986). Common species include mule deer, striped skunk, black-tailed jackrabbit, brush rabbit, raccoon, California ground squirrel, and a diverse assemblage of small mammals including mice, voles, and pocket gophers. Less common mammals include river otters, mountain lions, badgers and bobcats. Birds typical of oak-dominated habitats include acorn woodpeckers, scrub jays, ash-throated flycatchers, and California quail. Oaks provide acorns, a nutrient-rich and important food source for mule deer, acorn woodpecker, northern flicker, Nuttall's woodpecker, white-breasted nuthatch, and scrub jay. In addition to a diverse community of small passerine birds, other birds such as woodpeckers, California quail, introduced wild turkeys, Canada geese, and various birds of prey are fairly common near the reservoir.

The presence of year-round water provides habitat for many water-associated species such as raccoon, wood duck, common merganser, mallard, black phoebe, great blue heron, greater yellowlegs, belted kingfisher, and common yellowthroat. The Mormon Island Preserve also provides a perennial wetland for many species including pond turtles.

Mammals likely found in the study area include California vole, ringtail, black-tailed jackrabbit, coyote, striped skunk, and mule deer; the typical mix of species found in riparian and woodland habitats with a herbaceous understory.

Reptile and amphibian species likely found in the study area include western fence lizard, gopher snake, western rattlesnake, common kingsnake, Pacific treefrog, and western toad.

Wildlife species that forage or breed in oak woodlands also include dusky-footed woodrat, western bluebird, and southern alligator lizard.

Areas dominated by annual grassland provide foraging habitat and cover for California ground squirrel, pocket gopher, turkey vulture, coyote, western fence lizard, western rattlesnake, western kingbird, and western meadowlark. Grassland areas are important to many foraging raptors; red-tailed hawk, golden eagle, ferruginous hawk, rough-legged hawk, American kestrel, and prairie falcon all spend time in the area, as wintering and/or breeding birds.

Lower American River
The lower American River corridor provides a mosaic of riparian, riverine, grassland, and oak woodland habitat. These diverse habitats support a corresponding diversity of wildlife.

The lower American River provides feeding, resting, and/or nesting habitat for many bird species, many of which require the aquatic areas of the river and backwaters, or the riparian vegetation of the ecosystem. Riparian areas are known to support a species-rich songbird community (Gaines 1977), and the lower American River also provides habitat for many raptors, including Swainson's hawks, red-shouldered hawks, Cooper's hawks, and great-horned owls, all of which require or are closely associated with riparian vegetation. Bald eagles, which are more common around Folsom Reservoir, occasionally use the lower river, which provides roosting and foraging habitat. Waterfowl, particularly mallards and Canada geese, also use the area extensively.

More than 50 species of mammals have been recorded for the area (USFWS 1986). Common species include beaver, black-tailed jackrabbit, striped skunk, Virginia opossum, raccoon, California ground squirrel, gophers, and many small rodents and insectivores including voles, moles, shrews, deer mice, and pocket gophers. Uncommon species include mule deer, and several carnivores, such as badger, long-tailed weasel, river otter, gray fox, coyote, bobcat, and mink.

Reptile species of the lower American include common kingsnake, Gilbert and western skinks, southern alligator lizard, western fence lizard, gopher snake, and several garter snakes. Common amphibians include Pacific treefrog, California newt, California slender salamander, western toad, and the introduced bullfrog.

Relatively little is known about invertebrates of the lower American River, but elderberry plants are fairly common in areas, and provide habitat for the endangered valley elderberry longhorn beetle.

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.

Vegetation

Around Folsom Reservoir and Upstream
Without-project conditions for this project area are not expected to change significantly from the baseline condition over the life of the project. Refer to the baseline condition described under the no action alternative.

Lower American River
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 1991).

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.

Fish

Around Folsom Reservoir and Upstream
Without-project conditions for this project area are not expected to change significantly from the baseline condition over the life of the project. Refer to the baseline condition described under the no action alternative.

Lower American River
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 continued implementation of the Anadromous Fish Restoration Program (AFRP) of the Central Valley Project Improvement Act (USFWS 1995), conditions in the lower American River are expected to improve for fishery resources.

Other variables will determine the way in which flows are managed on the lower American River; including meeting the needs of Bay-Delta water quality standards, Reclamation's existing and renewed water contracts, and any additional new water contract quantities.

Wildlife

Around Folsom Reservoir and Upstream
Without-project conditions for this project area are not expected to change significantly from the baseline condition over the life of the project. Refer to the baseline condition described under the no action alternative.

Lower American River
The types of wildlife species found in the area would 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 1991a), 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.

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.

CONSTRUCTION IMPACTS

A. Folsom Reservoir

Vegetation
Four cover-types: oak/grey pine woodland, riparian woodland, chaparral and seasonal wetland, would be directly impacted by construction of the Folsom DS/FDR project. The compensation acreage of Alternatives 1, 2, 4 and 5 are compared to that of Alternative 3, the Preferred Alternative, for these cover-types in Table 1.

Table 1. Summary of Cover-Types, Acres Impacted, and Compensation Recommended by Alternatives Compared to the Preferred Alternative for the Construction of the Folsom DS/FDR Project, California.

Folsom DS/FRD Project					
Alternative	**3 (Preferred)**	**1**	**2**	**4**	**5**
Cover-Type	Impacted Acres: Compensation Needed	Difference from the Preferred Alternative Impacted Acres	Difference from the Preferred Alternative Impacted Acres	Difference from the Preferred Alternative Impacted Acres	Difference from the Preferred Alternative Impacted Acres
Oak/grey pine woodland	52.4 : 64.5	0.39	0.39	0.70	-1.07
Riparian woodland	42.7 : 48.0	-0.28	-0.62	-0.15	-1.66
Chaparral	0.7 : 0.8	0	0	0	-0.21
Seasonal wetland	1.2 : 4.7	0	0	0	0
Total	**97.0 : 117.9**				

A habitat assessment using Habitat Evaluation Procedures (HEP) was used to develop the compensatory mitigation acreage and is included in Appendix A. Based on the HEP, compensation ratios are: 1.2:1 oak/grey pine woodland; 1.1:1 riparian woodland; 1:1 chaparral; and 4:1 seasonal wetland.

B) Auxiliary Spillway

Three cover-types: oak/grey pine woodland, riparian woodland and chaparral would be directly impacted from the construction of the auxiliary spillway; a component of the Folsom DS/FDR project. The four spillway alternatives impact almost the same amount of acres in each of the cover-types (2.71 to 3.49 acres). Table 2 summarizes the cover-types impacted by the four spillway alternatives and their compensation needs based on the HEP results.

Table 2. Summary of Cover-Types, Acres Impacted, and Compensation Recommended for the Construction of the Auxiliary Spillway Alternatives of the Folsom DS/FDR Project, California.

Folsom Dam Auxiliary Spillway Alternatives				
	Six-gate (Preferred)	**Fuseplug**	**Fuseplug with Tunnel**	**Four-gate**
Alternative	3	1	2	4
Cover Type	Impacted Acres: Compensation Needed	Impacted Acres: Compensation Needed	Impacted Acres: Compensation Needed	Impacted Acres: Compensation Needed
Oak/Grey pine woodland	1.07 : 1.38	1.46 : 1.89	1.46 : 1.89	1.77 : 2.29
Riparian woodland	1.66 : 1.88	1.38 : 1.57	1.04 : 1.18	1.51 : 1.71
Chaparral	0.21 : 0.22	0.21 : 0.22	0.21 : 0.22	0.21 : 0.22
Total	**2.94 : 3.48**	**3.05 : 3.68**	**2.71 : 3.29**	**3.49 : 4.22**

The spillway site would be developed in three construction phases by excavating about 860,000 cubic yards of material during the first phase, an additional 2.5 million cubic yards during the second phase and excavation of the approach channel would require removal of about 500,000 cubic yards during the third phase. The material would be placed in haul trucks and taken to one of the staging areas. Some of the material may be utilized as riprap where needed. At the processing plant sites, the material would be screened and crushed to size required to reinforce MIAD (MIAD overlay), the wing dams, and Dikes 4, 5 & 6. Following processing, the material would be hauled to a given structure for immediate use, or the material could be stored either temporarily and/or permanently at Dike 8/Folsom Point, Dike 7, and near MIAD including D2. At Dike 7 and Dike 8/Folsom Point, excess excavation material may be placed permanently in the reservoir to create staging areas upstream of the structure. These areas would remain once construction is complete resulting in the loss of riparian woodland habitat.

The third phase of construction of the spillway is the 900-foot-long waterside approach channel which would be constructed through dredging and blasting of materials. The approach channel invert and vertical sides would be concrete lined for about 50 feet upstream from the face of the control structure. The invert elevation for this concrete lining would be at the 368-foot sill elevation for the gates. Most of the approach channel would be excavated in rock to be resistant to erosion. Construction of the approach channel would require underwater blasting, dredging and excavating about 500,000 cubic yards of material.

Permanent fill would need to be placed in-reservoir around the main dam observation point to increase the efficiency of the auxiliary spillway fuseplug alternative.

C) Dike Zones, Borrow and Stockpile Sites

For this analysis the earthen dike construction impacts include varying widths for the construction area from the landside toe of the dike: Dikes 4, 6, 7 and 8 assume 75 feet of impact from the toe; Dike 5 assumes 100 feet; Dikes 1-3, and right wing dam assumes 50 feet; MIAD and the left wing dam both have additional construction/staging impacts up to the toe.

Impacts to seasonal wetlands from the construction and jet grouting to MIAD may occur from changes in water quality or the discontinued/muted flow of water from Folsom Reservoir into/out of the wetlands.

D) Construction and Contractor Use Sites

For this analysis all proposed construction and contractor use sites are the same for all the alternatives except below the left wing dam, where the proposed spillway would be located.

Impacts to annual grassland would be minimized by seeding all disturbed areas with native grasses as soon as construction activities are complete in the disturbed area. It was anticipated that the work would be phased, so the entire annual grassland area would probably not be disturbed at the same time. Similarly, the impacts to other disturbed lands (these areas are roads, parking lots, riprap, etc, that do not currently provide significant values for fish and wildlife species) can be minimized by replanting with native annual grasses, when possible.

E) Existing and New Stilling Basins

The habitat impacts from the proposed extension of the existing stilling basin by 50 to 75 feet and the construction of a new stilling basin at the foot of the spillway has not been fully evaluated in this report. Construction plans for these two components are still in the preliminary design phase; therefore, subsequent environmental documents will be needed.

<u>Fish</u>

Impacts from blasting and dredging are expected to directly and indirectly affect plankton in the surrounding water column and fish in the reservoir. Blasting and dredging could increase the amount of mercury and methylmercury in the water column, as well as sediment, thus decreasing the amount of light available. However, sediment suspended during construction would be minimized, to the extent possible with the use of sediment curtains, sheetpiles or other methods that minimize the suspended sediment and keep it localized. It is anticipated that these impacts would be temporary, although they could affect fish in the area. Although total mercury levels in the sediment are at or below toxicity guidelines, those guidelines are based only upon direct sediment mercury toxicity to benthic organisms and do not address mercury methylation and bioaccumulation in the food chain.

Wildlife

About 97 acres of existing habitat for wildlife species (does not include the "other" or annual grassland cover-types) would be temporarily lost with implementation of the project. The compensatory mitigation is intended to offset this loss of habitat value over the life of the project.

Impacts from dredging and blasting are expected to temporarily increase the amount of mercury and methylmercury in the water column and in aquatic species including fish and some terrestrial species around the work area. Animals that feed on the aquatic species subject to this higher than typical level of mercury could be adversely affected through impaired reproduction.

Lower American River

Vegetation

No change in the existing conditions for vegetation in the Lower American River is anticipated; because the construction impacts of any Folsom Dam raise would be focused on the flood control space within the reservoir and lands adjacent the existing reservoir. At the current time neither Reclamation nor the Corps has the authority to deviate from the current Water Control Manual thus operations of the dam will remain the same.

Fish

The Lower American River has been designated as impaired under the Clean Water Act, section 303(d) for methylmercury and Lake Natoma has health advisories for mercury in fish. Efforts should be made to minimize suspension of sediments during the blasting and dredging operations, monitor suspended sediment transport out of the reservoir during those operations, and monitor methylmercury in unfiltered water and suspended sediment that does move out of the reservoir to assess methylmercury loading into the Lower American River during the blasting and dredging operations.

Wildlife

No change in wildlife species numbers or species composition is expected to occur along the Lower American River as a result of the proposed work at the Folsom Facilities.

OPERATIONAL IMPACTS

In 2001, the Corps proposed enlargement of the existing Folsom Dam outlets as part of the authorization under the American River Watershed Investigation, Folsom Dam Modification Project, which directed the Corps to change the variable flood storage space at Folsom Reservoir from the current interim operation of 400,000 acre-ft to 670,000 acre-feet to a 400,000 acre-feet to 600,000 acre-feet (400/600) permanent variable flood space operation once the Folsom

Modification Project had been implemented. This change would increase the level of flood protection by enabling operators to balance outflows with inflow early in the storm hydrograph, and attain a maximum discharge of 115,000 cfs through the enlarged outlets for a 10-year or larger event. At that time the Service analyzed the impact of the revised Folsom Dam Modification Project to the cold water pool, gravel movement and seed dispersal. The Services' Fish and Wildlife Coordination Act Report for the American River Watershed Investigation, Folsom Dam Outlet Modification Project is located in Appendix D.

When the Folsom DS/FDR project is completed, Folsom Dam will have four methods of discharging flows from the reservoir: three power penstocks, eight flood control outlets, tainter/radial spillway gates set near the main spillway crest (five service and three emergency), and six submerged tainter gates in the proposed auxiliary spillway. To ensure adequate tailwater, the three emergency spillway gates may not be used unless the total outflow from the dam exceeds 240,000 cfs. This restriction makes the emergency gates unusable for normal flood control purposes and limits the use of the gates to dam safety outflows (Reclamation 2006b).

The Corps and Reclamation, along with other agencies and water groups, will develop a new flood control manual for Folsom Dam for implementation prior to completion of the auxiliary spillway. The new flood control manual is currently being scoped as a parallel process. The parallel flood control manual development (Re-Operations Study) and study will include variable flood storage space, including analysis of forecast based operations, new flood release schedules and a plan component for repayment of potential water supply losses resulting from implementation of this flood control manual. This parallel study will be a collaborative process with the appropriate level of environmental analysis, public, agency and stakeholder coordination, and appropriate NEPA/CEQA documentation. However, if this does not occur, the project features would be operated under the existing operating criteria. Under this scenario, the same amount of water would ultimately be released with and without the project features (due to operational constraints).

A) Folsom Reservoir

Vegetation

The enlargement of Folsom Reservoir through a raise would allow for additional flood surge storage capacity, on a temporary basis, and not for increasing the storage capacity of the reservoir. Between 805.30 and 1,389.44 acres would be affected by enlarging Folsom Dam, depending on which dam raise alternative is selected. Some of these lands are already developed or otherwise disturbed habitat, that provide little or no value for wildlife species, and some support vegetation that is tolerant of flooding. Table 3 summarizes the acreage of each cover-type which provides value for wildlife that is expected to receive inundation over the life of the project (the "Other" cover-type is not included in Table 3). Inundation effects around Folsom Reservoir would occur in large part by the frequency, timing, and duration of flooding. Inundation impacts shown are for the raise components operating under the current water control manual/dam operations.

Table 3. Preliminary Summary of Cover-Types, Impacted Acres and Compensation Recommended for the Inundated and Construction at Dikes 1-3 of the Folsom Reservoir for the Folsom Dam Raise Alternatives 3.5, 4.0, 7.0, or 17 feet as part of the Folsom DS/FDR Project, California.

	Folsom Dam Raise Alternatives			
	3.5-ft Raise	**4-ft Raise**	**7-ft Raise**	**17-ft Raise**
Alternative	3-Preferred	2	4	5
Cover Type	Impacted Acres: Compensation Needed	Impacted Acres: Compensation Needed	Impacted Acres: Compensation Needed	Impacted Acres: Compensation Needed
Oak/Grey Pine woodland	781.5 : 939.4	820.2 : 985.8	935.1 : 1,123.8	1,331.8 : 1,600.1
Riparian woodland*	45.47 : 0.02	48.68 : 0.02	56.5 : 0.02	48.68 : 0.02
Chaparral	32.2 : 34.1	34.3 : 36.3	40.8 : 43.2	34.3 : 36.3
Seasonal wetland*	0.58 : 0.0	0.58 : 0.0	0.58 : 0.0	0.58 : 0.0
Total	**859.8 : 973.5**	**903.8 : 995.12**	**1,033 : 1,167**	**1,415.4 : 1,636.4**

*No permanent impacts to riparian woodland and seasonal wetland are expected from the short inundation that would occur from a raise component of the Folsom DS/FDR project. Acres shown are from the construction at Dikes 1-3.

Studies to date indicate that predicting the effects of inundation on vegetation is not straightforward. Raising Folsom Dam would have the potential for two significant impacts on vegetation: (1) changes in vegetation composition caused by inundation affecting survival and reproduction of vegetation in the zone between current and proposed maximum reservoir levels; and (2) effects of inundation on soil erosion and slippage, especially on steep slopes as are found along the upper reservoir and the forks of the American River.

The vegetation types exposed to flooding are not, in general, highly tolerant of prolonged flooding. With the exception of riparian and riverine habitats, natural flooding does not occur in the areas which would be flooded by raising Folsom Dam. Studies of the effects of inundation on blue oaks (1975 *in* USFWS 1980; MWA-JSA 1994) have found that blue oaks can survive some flooding, but may be sensitive to periods of inundation of as little as 7 days. It is not clear from these studies, however, at what time of year flooding occurred, and the ability of vegetation to tolerate inundation depends on the time of year. For example, deciduous trees, such as oaks, tend to be much more sensitive to flooding during their period of active growth (i.e., in the spring), while winter-dormant plants appear to be more tolerant of flooding (USFWS 1980). Folsom Reservoir can be expected to fill during spring flood event, when oaks are actively growing. The absence of blue oaks within the inundation zone of Folsom Reservoir and other foothill impoundments indicates that blue oaks cannot tolerate the flooding regime existing there. Further, evergreen species, including grey pines and live oaks, occur commonly around the reservoir above current pool elevations, and tend to be more sensitive to inundation than deciduous trees such as blue oaks (MWA-JSA 1994).

The other factor which could affect vegetation is erosion (slippage) of the saturated soil in the new inundation area during a flood event as the water is drawn down or from wind driven wave wash during a major storm event. Slopes in the Folsom Reservoir area are generally between 5 and 25% (USACE 2001). Slopes in the Mooney Ridge area in the northwestern corner of the reservoir and the shoreline just west of the South Fork of the American River exceed 30% (USACE 2001). It is likely that during a major flood event some, or all, of the soil on steep slopes would experience some erosion. The extent of erosion and its effect on vegetation would be difficult to predict.

Assuming a worst case scenario that over the life of the project all of the existing vegetation in the inundation zone would be lost, a mitigation need was developed for each cover-type using the HEP results. Statistically, there is a relatively small chance of complete inundation coupled with total loss of vegetation. However, it is reasonable to expect some impacts, especially at the lower zones due to the potential for more frequent inundation, over the life of the project.

Given the uncertainties on effects of inundation on vegetation and soil erosion, the HEP Team decided to recommend that a monitoring and adaptive management program be developed to monitor vegetation around the reservoir over the life of the project. Baseline conditions would be managed and updated at 10-year, or some other predetermined interval. After major flood events (those which encroach above the existing maximum flood pool elevation), vegetation would be surveyed and damages attributable to inundation would be mitigated as deemed appropriate using best management practices at the time (replanting on site would be the first priority).

Fish

Impacts from the rise and fall of reservoir levels could result in fish becoming stranded in isolated water bodies or on land, particularly if in-reservoir construction, borrow, stockpiling, disposal areas and haul roads are not properly re-contoured to allow complete drainage as reservoir levels fall.

Wildlife

No operational effects for wildlife species are anticipated provided there is no accelerated erosion associated with the new inundation zone.

Lower American River

The raise plans would be identical to the without-project condition up to inflows of around 300,000 cfs, or about the 140-year event. Between the 140-year event (0.7% probability of occurrence) and about the 200-year event (0.5% probability of occurrence), the raise plan would maintain outflows at no more than 115,000 cfs, while the without-project conditions would be uncontrolled, resulting in very high outflows of 180,000-315,000 cfs.

Vegetation

Folsom Dam would be raised 3.5, 4.0, 7.0, or 17 feet with the project, and the additional space used to detain flood flows while outflows remain to the extent possible within the 115,000 cfs objective capacity of the downstream channel. This detention would reduce peak flows, while increasing the duration of flows, relative to existing conditions. The moderated flows may reduce erosive energy compared to existing conditions, and could have a cumulative or indirect effect on carryover storage.

Fish
No long-term operational effects for fish species are anticipated.

Wildlife
No long-term operational effects for wildlife species are anticipated.

THREATENED AND ENDANGERED SPECIES

Appendix B provides a list of the federally listed species for the Folsom DS/FDR project (Sacramento, Placer, and El Dorado counties), dated September 15, 2006, 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. Reclamation and the Corps should get an official list of all federally listed and proposed threatened and endangered species and their designated critical habitat within the project area, or an update of any list more than 90 days old at the time preparation of any additional or updated Biological Assessment for this project is undertaken by accessing the Service's Sacramento Fish and Wildlife Office's website. The National Oceanic and Atmospheric Administration (NOAA) 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. The CDFG has responsibility for State listed species and species of concern. Species accounts for most of the species discussed below may be obtained from the Service's Sacramento Fish and Wildlife Office.

Based on the county lists there are 13 federally listed threatened species which may occur in the project area. These are: bald eagle, giant garter snake, California red-legged frog and its critical habitat, delta smelt and its critical habitat, Lahontan cutthroat trout, Central Valley steelhead, Central Valley spring-run Chinook salmon and its critical habitat, valley elderberry longhorn beetle and its critical habitat, vernal pool fairy shrimp, Layne's butterweed, California tiger salamander and its critical habitat, slender Orcutt grass (and critical habitat for vernal pool plants), and delta green ground beetle.

There are nine federally listed endangered species which may occur in the project area. These are: vernal pool tadpole shrimp, Conservancy fairy shrimp (and critical habitat for vernal pool invertebrates), winter-run Chinook salmon and its critical habitat, Stebbin's morning glory, Pine Hill ceanothus, Pine Hill flannelbush, El Dorado bedstraw, Antioch Dune evening-primrose, and Sacramento Orcutt grass (and critical habitat for vernal pool plants).

DISCUSSION

Mitigation Planning Goals
The recommendations provided herein for mitigation and the protection of fish and wildlife are in conformance with the 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 provide leadership to conserve, protect and enhance fish and wildlife species and their habitats.

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 HEP. 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 mitigation, which is the creation of wetlands to offset losses, should only be deemed acceptable when losses are determined to be unavoidable and mitigation 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.

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.

Impacts to four habitat types were evaluated for the Folsom DS/FDR project. These habitats, and their corresponding evaluation species, designated Resource Categories and associated mitigation planning goals are discussed below, and summarized in Table 4.

Table 4. Evaluation Species, Resource Categories, and Compensation Planning Goals selected for cover-types impacted by the Folsom DS/FDR Project, California.

Cover-Types	Evaluation Species	Resource Category	Mitigation Planning Goals
Oak - grey pine woodland	breeding birds	2	No net loss of in-kind habitat value
Riparian woodland	belted kingfisher, raptor guild	2	No net loss of in-kind habitat value
Chaparral	breeding birds	3	No net loss of habitat value while minimizing loss of in-kind habitat value
Seasonal wetlands	marsh wren, red-winged blackbird, great blue heron	2	No net loss of in-kind habitat value
Annual grasslands	raptor guild, ground-foraging birds	4	Minimize loss of habitat value
Other[1]	none	4	Minimize loss of habitat value

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

a. Oak-grey pine woodland

Oak-grey pine woodland is usually dominated by a blue oak overstory, with grey pines interspersed at low density among the oaks. Other trees associated with this habitat type are California buckeye, which occurs as scattered individuals or small clumps, and interior live oak. On more mesic sites, such as north-facing slopes along the South Fork near Salmon Falls, live oaks and California black oaks replace blue oaks as the dominant oak. Understory shrubs such as manzanita, toyon, and shrubby oaks are often present, though typically at low densities, relative to tree cover.

Oak woodland (including oak savanna) also occurs widely in the project area, particularly along the lower American River, and at lower foothill elevations, near Folsom Dam. Typical oak woodland is characterized by a fairly open canopy layer with 20-70% cover of blue and live oaks, and a grassy ground cover. A woody understory may be present, but is typically sparse where present.

The canopy of blue oaks is typically 30 to 50 feet tall, and varies from about 30 to 80% canopy closure (Barbour 1988), with open areas containing shrubs and grasses. The understory is primarily annual grasses and forbs. Most existing stands of this type are in mature stages, with oaks to heights of up to 50 feet. Mature grey pines typically rise above the oaks, to heights of up to 75 to 100 feet. The long-term survival of this habitat type has been an issue of concern, because oak regeneration has been minimal for over 100 years (Holland 1976). Many factors have been implicated as causes for low recruitment of oaks, including browsing of seedlings, consumption of acorn crops by livestock and native wildlife, changes in fire dynamics, and possibly climatic changes and competition with introduced annual grasses (Barbour 1988; Verner 1988). Blue oak woodland provides high-quality wildlife habitat for a rich assemblage of species. In the western Sierra Nevada, 29 species of amphibians and reptiles, 79 species of birds, and 22 species of mammals find mature stages of this habitat suitable or optimum for breeding, where other, special habitat requirements are met (Verner and Boss 1980).

Non-native annual grasses form an understory 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 trees are absent, the habitat is designated as annual grassland. Because scattered oaks provide food, cover and nesting habitat unavailable in grasslands, we treated oak savanna as a component of oak woodland.

The evaluation species selected for Resource Category determination are breeding birds. These species were selected because: (1) their ecological roles (prey, predator, scavenger, etc.); (2) the Service has responsibilities to protect and manage many of these species under the Migratory Bird Treaty Act; (3) their high nonconsumptive value for bird watching; and (4) this habitat provides required nesting, foraging, and cover habitat for many breeding bird species. Blue oak-grey pine woodland habitat is still relatively common in the project area and region, but is increasingly being degraded in value and in general not exhibiting regeneration (blue oaks). Therefore, the Service has placed this habitat in Resource Category 2 with its mitigation planning goal of no net loss of in-kind habitat value.

c. Riparian woodland

Riparian woodlands occur extensively along the lower American River, and in patches along perennial and intermittent streams and rivers flowing into Folsom Reservoir. Two forms of riparian habitat occur in the study area: riparian forest, dominated by large trees, and riparian scrub-shrub, consisting mostly of low shrubs. Scrub-shrub habitat occurs in more frequently disturbed areas (e.g., by flood-scouring or human activities), and as a stage in regeneration of riparian forest following disturbance. The two forms are often interspersed (e.g., a clump of cottonwoods in an area of shrub-scrub), and are treated together in this report, as the existing data is inadequate to separate them. Trees characteristic of this habitat in the study area include cottonwoods, arborescent willows, and oaks; understory plants include wild grape, blackberries, poison oak, willows, and elderberry. Scrub-shrub habitat is frequently dominated by willows, and often contains other shrubby riparian species and immature trees listed above. Small areas of emergent wetlands, characterized by cattails, occur along the lower American River, and may reasonably be expected to occur in riparian areas upstream of Folsom Dam.

Riparian forests 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 forest 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 supports a species-rich assemblage of breeding birds, and provides food and cover for migratory birds. Because of its linear distribution and the extensive edge which that provides, the value of riparian areas to wildlife typically far exceeds the value of an equally-sized block of non-riparian woody habitat. Belted kingfishers, and raptors (including red-shouldered hawk, osprey, and American kestrel) were chosen to evaluate riparian habitat because: (1) as predators, they play a key role in community ecology of the study area; (2) they have important human nonconsumptive benefits (e.g., bird watching); and (3) the Service has responsibility for protection and management of many of these species under the Migratory Bird Treaty Act. Riparian habitat is of generally high value to the evaluation species, and is today very scarce in the project area and general Eco-region. 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"--i.e., Resource Category 2.

d. Chaparral

Chaparral occurs in patches around Folsom Reservoir as well as along the south arm of Folsom Reservoir, and along the North and South Forks. Chaparral has a dense overstory of woody evergreen shrubs, and usually is found on drier sites, e.g., on southwest-facing slopes, and on shallow soils. Chaparral in the study area is often dominated by chamise, with manzanita, ceanothus, toyon, and shrubby oaks. Understory growth tends to be sparse, and is mostly annual grasses with a few forbs. Chaparral plants are notable for their high tolerance to drought, ability of seeds and/or plants to survive fire, and their high value as watershed cover (USFWS 1991). Chaparral provides food resources, shelter, and breeding sites to many wildlife species; for example, chaparral on the western slope of the Sierra Nevada provides suitable or optimal nesting or breeding habitat for about 90 avian species, 10 amphibians, 18 reptiles and 41 mammals (Verner and Boss 1980).

Breeding birds were chosen to evaluate chaparral habitat because: (1) they play multiple roles in chaparral ecology, as predators, prey, and as seed dispersal agents; (2) they provide nonconsumptive recreational and other values to humans (e.g., bird watching, bird song); and (3) the Service is responsible for protection and management of many of these species under the Migratory Bird Treaty Act. Chaparral habitat is a native habitat of generally high value to the evaluation species, and is today moderately scarce in the project area, but fairly abundant in the eco-region. Therefore, the Service finds that any chaparral habitats that would be impacted by the project 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.

e. Seasonal wetlands

Seasonal wetlands occur in small patches near seeps and springs, and in drainages entering Folsom Reservoir. 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 Treaty Act.

In the project vicinity, and the eco-region (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."

f. Annual grasslands
Annual grasslands differ from woodland by lacking dominant tree cover; it appears that much of the treeless grassland found on 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 meadowlark, California quail, and sparrows and finches, and for 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 for wintering raptors. Lastly, waterfowl, notably Canada geese, graze on green vegetation in the grasslands adjacent to Folsom Reservoir.

The evaluation species selected for annual grasslands in the area near Folsom Reservoir are the raptor guild, and passerine ground-foraging birds (including western meadowlark, white-crowned sparrow. We have chosen these as evaluation species because: (1) raptors, as predators, play a key role in community ecology of the study area; (2) they have important human nonconsumptive benefits (e.g., bird watching); and (3) the Service's responsibilities for many of these species protection and management under the Migratory Bird Treaty Act. While the values of these habitats vary according with season and grazing intensity, 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, ponds, which provide nest and shelter sites. Grassland habitat has medium-to-high value, and is relatively abundant in the project area. Therefore, the Service finds that grasslands in the project 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).

g. "Other" habitat
"Other" habitat includes disturbed areas such as parking lots, roads, and boat ramps. Evaluation species were not chosen, because use by wildlife is so minimal. In view of the extremely low habitat value for most wildlife species provided by these areas in the project footprint, the Service finds that any highly disturbed habitats meeting the "other" habitat definition that would be impacted by the project should have a mitigation planning goal of "minimize loss of habitat value" (Resource Category 4).

Our recommended mitigation plans are based on the fundamental assumption that in-kind compensatory mitigation, namely creation or restoration of the desired habitats, will succeed in replacing the habitat functions, values, and acreage lost with project implementation.

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.

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, as discussed previously in this report. The results and mitigation recommendations are based on our HEP analyses (Appendix A) which include: field surveys, review of aerial photographs, data collection, 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 cover-type impact section below. Mitigation site selection should be based on this conceptual framework, and designed to coincide as much as possible with the construction plans in order to minimize project costs. Adverse construction impacts at a proposed mitigation site, such as the removal of topsoil in borrow areas could, however, reduce or negate the suitability of the site for revegetation efforts. In addition, numerous site-specific factors which are currently unknown, such as groundwater depth, surface hydrology, and presence of soil contaminants, also can affect a site's suitability for restoration or creation. Therefore, mitigation site selection should be considered preliminary until such time as complete evaluation of suitability of a site is completed (i.e., evaluations of soil condition, surface hydrology, groundwater depth, and conditions in regard to salinity, alkalinity or toxic substances).

The HEP evaluation of mitigation sites is 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 would need to be reviewed.

Construction Impact Mitigation Sites (Folsom Reservoir)

The following tables (Tables 5-8) summarize the actions proposed at each hypothetical mitigation site used to complete the HEP analyses. Additional information is contained in the HEP report (Appendix A).

Table 5. Oak - Grey Pine Woodland Mitigation Site Development Criteria, Folsom DS/FDR Project, California.

OAK-GREY PINE WOODLAND
·Acquire land. ·Site is currently annual grassland. ·Provide access and maintenance roads. ·Plant native cover crop (seed). ·Construct site specific irrigation system. ·Plant 400 trees per acre using 4"x4"x14" tree pots. ·Plant 90% oak tree species (blue and live oak); 10% grey pine. ·Provide watering, weeding, non-native and invasive species control. ·Provide pest control as needed. ·Provide general maintenance and cleanup of site in perpetuity. ·Monitor plantings for 3 years and take remedial actions as needed to ensure plant establishment and overall success of the mitigation effort. ·Prepare and submit monitoring reports to the Service for 3 years. ·Develop O&M Manual.

Table 6. Riparian Mitigation Site Development Criteria, Folsom DS/FDR Project, California

RIPARIAN WOODLAND
·Acquire land. ·Site is currently annual grassland. ·Provide access and maintenance roads. ·Complete earthwork to facilitate seasonal natural flooding ·Construct irrigation system. ·Plant overstory comprised of oaks, willows and cottonwood trees using 4"x4"x14" tree pots at density of 200/acre. ·Plant understory comprised of wild rose and wild grape at a density of 200/acre. ·Plant native cover crop (seed). ·Provide watering, weeding, non-native and invasive species control. ·Provide pest control as needed. ·Provide general maintenance and cleanup of site in perpetuity. ·Monitor plantings for 3 years and take remedial actions as needed to ensure plant establishment and overall success of the mitigation effort ·Prepare and submit monitoring reports to the Service for 3 years. ·Develop O&M Manual.

Table 7. Seasonal Wetland Mitigation Site Development Criteria, Folsom DS/FDR Project, California.

SEASONAL WETLAND
·Acquire land. ·Site is currently annual grassland. ·Provide access and maintenance roads ·Construct wetland so that 40% of the area has water 4-9 inches deep in summer. ·Plant native cover crop on area disturbed from construction area. ·Plant appropriate wetland species. ·Provide weeding, non-native and invasive species control. ·Provide irrigation, pest control and monitoring reports for a minimum of 3 years or until the vegetation is self-sustaining. ·Provide general maintenance and cleanup of site in perpetuity. ·Develop O&M Manual.

Table 8. Chaparral Mitigation Site Development Criteria, Folsom DS/FDR Project, California.

CHAPARRAL
·Acquire land. ·Site is currently annual grassland. ·Provide access and maintenance roads. ·Complete earthwork to facilitate seasonal natural flooding ·Construct irrigation system. ·Plant chaparral species. ·Plant native cover crop (seed). ·Provide watering, weeding and non-native and invasive species control. ·Provide general maintenance and cleanup of site in perpetuity. ·Monitor plantings for 3 years and take remedial actions as needed to ensure plant establishment and overall success of the mitigation effort ·Prepare and submit monitoring reports to the Service for 3 years. ·Develop O&M Manual.

Operation Impact Mitigation Sites (Folsom Reservoir)

Since there are uncertainties on effects of inundation on vegetation and soil erosion and relatively small chances for a major flood event, it is recommended that a monitoring and adaptive management program be developed to monitor vegetation around the reservoir over the life of the project. Baseline conditions would be established and updated at intervals (10 years). After major flood events (those which encroach above the existing maximum flood pool elevation), vegetation would be surveyed and damages attributable to inundation would be mitigated as deemed appropriate using best management practices at the time (replanting on site would be the first priority). However, because the maximum pool could be lower with the Preferred Alternative than under existing conditions, potential impacts to vegetation and wildlife from inundation resulting from extreme hydrologic events may be less with the project than under existing conditions.

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 the best present recommendations for the project. The outcomes of any new or renewed consultations, as required under section 7 of the Endangered Species Act or the Fish and Wildlife Coordination Act, could also affect the recommendations herein. Rationale for most of the recommendations was discussed earlier within this report.

The Service recommends that Reclamation and the Corps implement the following preliminary recommendations if a Folsom DS/FDR project is pursued. As additional project information is developed these basic recommendations will be further refined.

GENERAL

- Select a flood control alternative which avoids, to the extent possible, unmitigable impacts and minimizes other impacts to fish and wildlife resources.

- Consult with the Service and the National Marine Fisheries Service pursuant to section 7 of the Endangered Species Act, to minimize adverse affects to federally listed species and their habitats.

- Consult with the California Department of Fish and Game regarding potential impacts to State listed threatened and endangered species.

- Avoid impacts to oak-grey pine woodland, riparian areas and seasonal wetlands adjacent to, but outside of, construction easement areas through use of construction fencing.

- Avoid impacts to woody vegetation at all staging areas, borrow sites, and haul routes by enclosing them with fencing.

- Avoid impacts to water quality at Lake Natoma and Folsom Reservoir when loading, unloading, and transporting materials to be used for the Folsom DS/FDR project by taking appropriate measures to prevent soil, fuel, oil, lubricants, etc. from entering into these waters.

- Minimize impacts to wildlife by using eco-friendly erosion control blankets that do not create wildlife entrapment issues. Using flexible joint netting or another erosion control alternative that doesn’t include monofilament fixed-joint netting would avoid entrapment issues that may occur with the fixed joint netting commonly used in erosion control blankets.

- Minimize impacts to annual grassland habitat and other disturbed areas, by re-seeding all disturbed areas with appropriate native grass species as construction elements are completed.

- Minimize impacts to fish and phytoplankton during spillway construction (dredging and blasting) by implementing conservation and minimization measures (such as a curtain) during in-reservoir activities to minimize sedimentation and localize methylmercury dispersal.

- Compensate for unavoidable impacts to oak-grey pine woodland habitat by acquiring suitable lands and developing oak woodland habitat using the assumptions contained in Appendix A. Compensation acreages by project components are summarized in Appendix C.

- Compensate for unavoidable impacts to riparian habitat by acquiring suitable lands and developing riparian habitat using the assumptions contained in Appendix A. Compensation acreages by project component are summarized in Appendix C.

- Compensate for unavoidable impacts to seasonal wetland habitat by acquiring suitable lands and developing seasonal wetland habitat using the assumptions contained in Appendix A. Compensation acreages by project components are summarized in Appendix C.

- Compensate for unavoidable impacts to chaparral habitat by acquiring suitable lands and developing the needed mitigation of chaparral habitat using the assumptions contained in Appendix A. Compensation acreages by project component are summarized in Appendix C.

- Develop a monitoring and adaptive management program with the other agencies, to monitor vegetation around the reservoir over the life of the project. Baseline conditions would be established and updated at intervals (10 years). After major flood events (those which encroach above the existing maximum flood pool elevation), vegetation would be surveyed and damages attributable to inundation would be mitigated as deemed appropriate using best management practices at the time (replanting on-site would be the first priority). Budget in advance for this monitoring and adaptive management program.

- Develop a monitoring and adaptive management plan with the other agencies, to monitor the hydrology and vegetation at Mormon Island Preserve. Baseline conditions would be established before construction begins in the area and would continue for 4 years after construction has been completed. Post-construction surveys would monitor for potential changes in wetland hydrology, water quality, and vegetation. If changes in wetland hydrologic function are detected from the baseline condition, implement adaptive management mitigation to return affected systems to baseline conditions considering the long-term conservation of the Mormon Island Preserve.

- Develop operation and maintenance manuals (O&M Manual) for all mitigation sites developed for the project. Coordinate with the Service on the development of the all O&M Manuals.

- Monitor methylmercury levels in water and suspended sediment of water being released from Folsom Dam during in-reservoir construction activities until levels return to baseline.

- Complete a more thorough assessment of freshwater sediment effect levels for contaminants of concern, in particular mercury and nickel. Many of the references used in Reclamations' Sediment Characterization document to identify effect levels were inappropriate for fish and wildlife assessment needs. Other references such as MacDonald et al. (2000) and EPA (2004) provide good assessment guidelines for freshwater sediment.

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