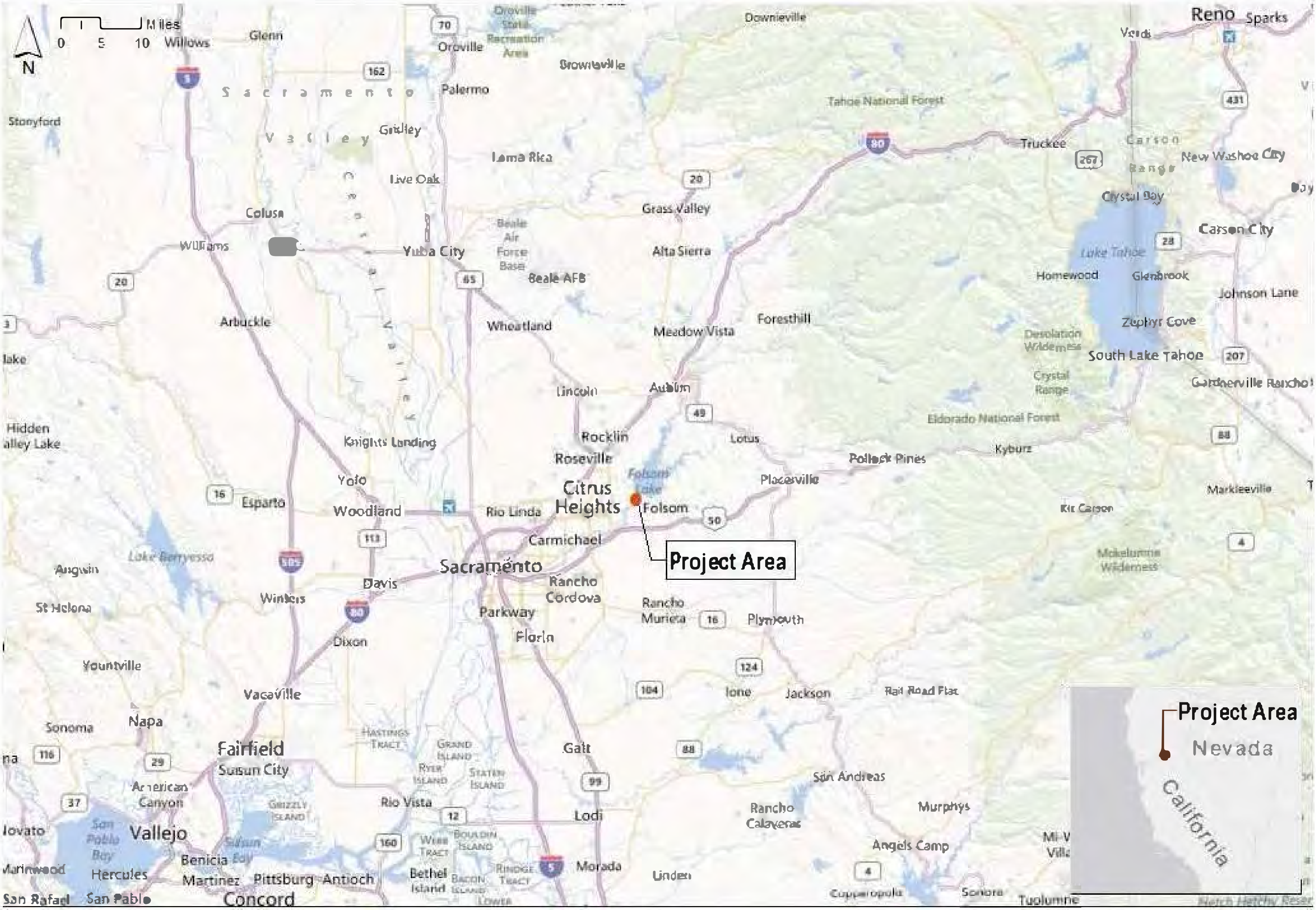
APPENDIX A

PROJECT LOCATION MAPS


N
Miles
0 5 10
Project Area
Project Area
Nevada
California
Reno
Sparks
Truckee
Tahoe National Forest
Carson Range
New Washoe City
Crystal Bay
Carson City
Lake Tahoe
Homewood
Glenbrook
Johnson Lane
Zephyr Cove
South Lake Tahoe
Desolation Wilderness
Crystal Range
Gardnerville Ranchos
Eldorado National Forest
Kyburz
Pollock Pines
Markleeville
Kit Carson
Mokelumne Wilderness
Downieville
Oroville
Oroville State Recreation Area
Brownsville
Palermo
Glenn
Willows
Sacramento Valley
Stonyford
Gridley
Loma Rica
Live Oak
Colusa
Williams
Yuba City
Beale Air Force Base
Beale AFB
Grass Valley
Alta Sierra
Arbuckle
Wheatland
Meadow Vista
Foresthill
Lincoln
Auburn
Rocklin
Roseville
Lotus
Knights Landing
Hidden Valley Lake
Yolo
Woodland
Esparto
Rio Linda
Citrus Heights
Folsom
Folsom Lake
Placerville
Carmichael
Sacramento
Rancho Cordova
Davis
Winters
Lake Berryessa
Angwin
St Helena
Rancho Murieta
Plymouth
Parkway
Florin
Dixon
Yountville
Vacaville
Ione
Jackson
Rail Road Flat
Sonoma
Napa
Fairfield
Suisun City
Galt
San Andreas
American Canyon
Vallejo
Rio Vista
Lodi
Rancho Calaveras
Murphys
Angels Camp
Novato
Benicia
Hercules
Martinez
Pittsburg
Antioch
Concord
San Rafael
San Pablo
Bethel Island
Morada
Linden
Copperopolis
Sonora
Tuolumne

APPENDIX B

PROJECT STAGING AREA MAPS

Map Extent

Dike 1

Dike 2

Park Road

Folsom Lake

Dike 3

Douglas Blvd

Legend

- Access Point
- HaulRoutes
- Staging Area
- Dikes

Imagery Source: World View 2 .4m, March 23, 2014

0 700 1,400 Feet

The information depicted in this GIS layer is the result of digital analyses performed on a database consisting of information from a variety of governmental and other credible sources. The accuracy of the information presented is limited to the collective accuracy of the database on the date of the analysis.

The information is believed accurate and reasonable efforts have been made to ensure the accuracy of the data. However, the US Army Corps of Engineers Sacramento District GIS Unit expressly disclaims responsibility for damages or liability that may arise from use of this data. This product is the property of the US Army Corps of Engineers Sacramento District GIS Team and its use is thereby restricted. This map was created using the EGIS Gateway map template.

AMERICAN RIVER WATERSHED PROJECT
FOLSOM DAM RAISE PROJECT

STAGING AREAS FOR DIKES 1-3

JUNE 2014

Date: 6/16/2014 Path: \\arctic\Project_data\CA\CIV\Folsom_MultiProjects\!Folsom_All_Data\GIS\GIS_Projects\FolsomDamRaise\FolsomDamRaise_ProjectFeatures_Dikes1-3.mxd

Dike 4

Map Extent

Dike 5

Dike 6

Right Wing Dam
Staging Area

Folsom Lake

Right Wing Dam

Legend

Access Point
HaulRoutes
Staging Area
Dikes

0 700 1,400
Feet

The information depicted in this GIS layer is the result of digital analyses performed on a data-base consisting of information from a variety of governmental and other credible sources. The accuracy of the information presented is limited to the collective accuracy of the database on the date of the analysis.

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Imagery Source: World View 2 .4m, March 23, 2014

AMERICAN RIVER WATERSHED PROJECT
FOLSOM DAM RAISE PROJECT

STAGING AREAS FOR DIKES 4-6 and RW

JUNE 2014

Date: 6/16/2014 Path: \\arctic\Project_data\CA\CIV\Folsom_MultiProjects\!Folsom_All_Data\GIS\GIS_Projects\FolsomDamRaise\FolsomDamRaise_ProjectFeatures_Dikes4-6-RW.mxd

Map Extent

Folsom Lake

Left Wing Dam

Left Wing Dam Staging Area

Dike 7

Dike 8

Legend

- Access Point
- HaulRoutes
- Staging Area
- Dikes

0 700 1,400
Feet

The information depicted in this GIS layer is the result of digital analyses performed on a database consisting of information from a variety of governmental and other credible sources. The accuracy of the information presented is limited to the collective accuracy of the database on the date of the analysis.

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AMERICAN RIVER WATERSHED PROJECT
FOLSOM DAM RAISE PROJECT

STAGING AREAS FOR DIKES 7, 8 and LW

JUNE 2014

Imagery Source: World View 2 .4m, March 23, 2014

Date: 6/16/2014 Path: \\arctic\Project_data\CA\CIV\Folsom_MultiProjects\!Folsom_All_Data\GIS\GIS_Projects\FolsomDamRaise\FolsomDamRaise_ProjectFeatures_Dikes7-8-RW.mxd

Map Extent

Folsom Lake

Mormon Island Dam

MIAD Staging Area (Proposed)

Dike 8

Legend

- Access Point
- HaulRoutes
- Staging Area
- Dikes

0 700 1,400 Feet

Imagery Source: World View 2 .4m, March 23, 2014

The information depicted in this GIS layer is the result of digital analyses performed on a database consisting of information from a variety of governmental and other credible sources. The accuracy of the information presented is limited to the collective accuracy of the database on the date of the analysis.

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AMERICAN RIVER WATERSHED PROJECT
FOLSOM DAM RAISE PROJECT

STAGING AREAS FOR MIAD

JUNE 2014

N

N
70
80
99
80
80
5
50
50

PACIFIC
SACRAMENTO
SAN FRANCISCO
NEVADA
CALIFORNIA
OCEAN

APPENDIX C

GIS MAPPING OF VEGETATION HABITAT

Table 1

Current Vegetation Within Boundary

Vegetation	Acreage
Annual Grassland	442.13
Blue Oak Woodland	214.61
Blue Oak Woodland/Foothill Pine	260.39
Wetlands	7.03
Valley Foothill Riparian	47.29

Table 2

Vegetation Removed

Vegetation	Acreage
Annual Grassland	97.53
Blue Oak Woodland	47.49
Blue Oak Woodland/Foothill Pine	16.02
Wetlands	3.61
Valley Foothill Riparian	2.53

Table 3: Results

Vegetation	Original Veg. When Dam was Built	Project Removed Veg.	Percentage Lost
Annual Grassland	492.85	97.53	19.79%
Blue Oak Woodland	257.83	47.49	18.42%
Blue Oak Woodland/Foothill Pine	276.41	16.02	5.79%
Wetlands	8.12	3.61	44.48%
Valley Foothill Riparian	49.81	2.53	5.07%

APPENDIX D

WETLAND DELINEATION MAP

United States Department of the Interior

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

In Reply Refer to:
08ESMF00-
2014-CPA-0010-1

JUL 10 2014

Ms. Alicia E. Kirchner
Chief, Planning Division
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814

Subject: Wetland Delineation Report for the Dikes 4-6 project area of the American River Watershed Investigation – Folsom Dam Raise Project, Placer County, California

Dear Ms. Kirchner:

The U.S. Fish and Wildlife Service's Wetland Delineation Report for the Dikes 4-6 project area of the American River Watershed Investigation – Folsom Dam Raise Project is attached. We are providing this report for the U. S. Army Corps of Engineers (Corps) to include in the Corp's environmental documents currently being prepared for the Folsom Dam Raise Project.

Thank you for providing the opportunity to contribute to your planning process. If you have any questions or comments, please contact either Harry Kahler at (916) 414-6612 or Mark Littlefield at (916) 414-6520.

Sincerely,

Daniel Welsh
Acting Field Supervisor

Enclosure

cc:
Brian Luke, COE, Sacramento, California

American River Watershed Investigation – Folsom Dam Raise Project
Wetland Delineation Report for Dikes 4-6, Folsom Lake, California

Prepared for:
United States Army Corp of Engineers
1325 J Street, 10th Floor
Sacramento, California

Prepared by:
United States Department of the Interior
U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
Sacramento, California

July 2014

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Figures

Tables

Appendices

Summary

On behalf of the U.S. Army Corps of Engineers (Corps), the U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office (Service) has conducted a delineation of waters of the United States (wetland delineation) for the proposed American River Watershed Investigation, Folsom Dam Raise Project (Folsom Dam Raise) in Granite Bay, Placer County, California. The project site involves Dikes 4-6, north of the right wing dam of Folsom Dam. This delineation identifies the type and extent of "navigable waters," "wetlands," and "other waters" that occur within or adjacent to the 69.9-acre, Dikes 4-6 project area. A total of 0.083 acre of seasonal wetlands in two distinct parts was delineated adjacent to the Dike 4-6 project area. The Dikes 4-6 project area, as currently proposed, would include Folsom Lake when the lake is at its maximum pool elevation, normally about 466 feet above sea level. The wetland delineation reported herein discusses two areas identified as wetlands; both in the vicinity of Dike 6. No wetlands were identified in the staging and construction areas of Dike 4 and Dike 5.

The delineation of waters of the United States, including wetlands, is subject to verification by the Corps. The Service advises all parties to treat the information contained herein as preliminary until the Corps provides written verification of the boundaries of its jurisdiction.

Introduction

The Corps regulates impacts to waters of the United States under the jurisdictional authority of Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act of 1972 (33 U.S.C. 403; 33 U.S.C. 1344). Jurisdictional waters of the United States include all navigable waters, interstate waters, their tributaries, and adjacent wetlands (Environmental Laboratory 1987).

The purpose of this report is to describe the extent and type of jurisdictional wetlands present within, or nearby, a portion of the proposed Folsom Dam Raise study area that fall under the jurisdiction of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Accordingly, this report addresses all identified potential jurisdictional waters of the United States, including wetlands, for the proposed project in the vicinity of Dikes 4-6. Data and conclusions contained in this report are based on information gathered in the field, the 1987 *U.S. Army Corps of Engineers Wetland Delineation Manual*, the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (U.S. Army Corps of Engineers 2008), and Federal regulations governing waters of the United States.

a) Definitions and Criteria

Navigable Waters of the United States. Generally, waters of the United States are subject to the ebb and flow of the tide shoreward to the mean high water mark, and/or are presently used, or have been used in the past, or may be susceptible to use transport interstate or foreign commerce (33 CFR §329).

Other waters of the United States. As used in this report, this term refers to features determined to be waters of the United States by the Corps, and includes unvegetated waterways and water bodies with a defined bed and bank and an ordinary high water mark, such as drainages, creeks, rivers, and lakes. Other waters of the United States typically lack hydrophytic vegetation and may also lack hydric soils (33 CFR §328.3).

Wetlands. For regulatory purposes, wetlands are a subgroup of waters of the United States defined as areas that are inundated, or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (33 CFR §328.3; 40 CFR §230.3).

Study Area Location

a) **Project Location**: The study area is located along the west boundary of Folsom Lake along Dikes 4 – 6 in Granite Bay, Placer County, California. The study area is located within the Folsom 7.5-minute U.S. Geological Survey quadrangle. Dike 5 lies between Dikes 4 and 6 at latitude 38° 43' 44.3" and longitude 121° 10' 15.8," which in Universal Transverse Mercator (UTM) Zone 10 coordinates is northing 4288289 and easting 658979.

b) **Acreage**: The Dikes 4-6 project area of the Folsom Dam Raise Project encompasses about 69.9 acres (Figure 1). Folsom Lake usually operates at pool elevations between 425 and 466 feet above sea level. The operational normal maximum pool elevation is 466 feet. Other adjacent areas with suitability as potential staging areas also were analyzed for wetlands and comprise about 35 acres. In total we analyzed an area of about 105 acres.

c) **Proximity to Major Highways and other roads**: Folsom-Auburn Road passes from Folsom through Granite Bay, northward to Auburn and within 300 feet to the west of the project area by Dike 5 (Figure 1). At the south end of Dike 6, the entrance to the Beals Point State Recreation Area crosses from Auburn-Folsom Road to a parking area for the recreation facility on the waterside.

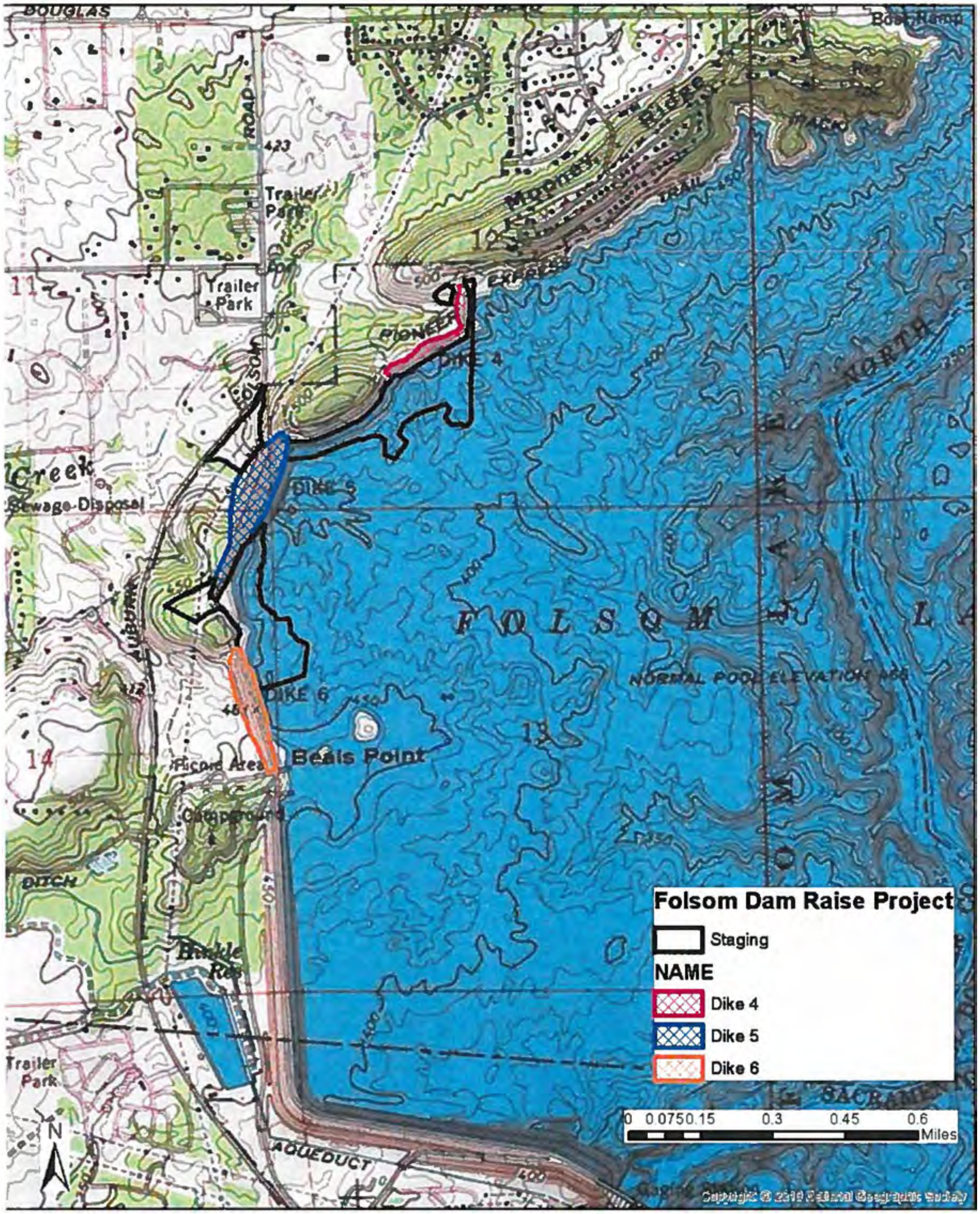
d) **USGS Hydrologic Unit**: The Dikes 4-6 mark the boundary between the North Fork American, California USGS Hydrologic Map Unit (Number 18020128) on the lakeside, and the Lower American, California USGS Hydrologic Map Unit (Number 18020111) to the landside.

Environmental Setting

a) **Current/Recent Land Use**: An access road runs north from the Beals Point Road north across the crowns of Dikes 4, 5, and 6. From the Beals Point Road northward, across the crown of Dike 6, to the southern end of Dike 5 is paved with asphalt. Otherwise the access roads are gravel.

The Beals Point State Recreation Area lies at the south end of Dike 6. A large, asphalt parking area, restrooms, and other recreational facilities are on the waterside, east of the south end of Dike 6. When the pool of the lake is at design level, most of the waterside

Figure 1. Dikes 4-6 project area, Granite Bay, Placer County, California. The outlined areas represent the dikes and potential staging areas.



of the Dikes 4-6 project area is submerged. A camping area occupies about 11.5 acres adjacent to the landside of Dike 6, just north of the Beals Point entrance road. A private, equestrian boarding facility is located on the east side of Auburn-Folsom Road, to the landside of Dike 4. Multipurpose trails for non-motorized use line the landside area north from the campground by Dike 6 to the equestrian facility by Dike 4 and beyond.

b) **Site Elevation**: The crowns of the dikes have an elevation of about 483 feet above mean sea level. The lowest area of the Dikes 4-6 project area lies to the landside of Dike 5, where the elevation is about 380 feet above mean sea level.

c) **Climate**: The climate is typically Mediterranean, with cool, wet winters and hot, dry summers. Annual precipitation recorded at Folsom Dam averages 23.92 inches, of which 20.48 inches fall from October through March (Western Regional Climate Center 2014). Water years 2012 and 2013 were dry years, and 2014 continues the drought trend (California Department of Water Resources 2014). The annual maximum air temperature for Folsom is 75.4°F, ranging from an average in July of 97.0 °F to 54.3 °F in January (Western Regional Climate Center 2014).

d) **Site Topography/Landscape**: The City of Folsom is located south of Folsom Dam, while Granite Bay is located along the western shores of the lake. The Dikes 4-6 project area is situated within the suburban landscape, with the dikes designed to keep lake waters from the lower lying areas to the west. The immediate area contains rolling hills and the dikes are among the highest points on the landscape.

e) **Hydrology/Hydrologic Features/Hydrologic Connectivity**: The dikes contain Folsom Lake to the east. The San Juan Water District facility, containing Hunkle Reservoir, lies directly south of the Dikes 4-6 project area, adjacent to the right wing dam of Folsom Dam. From Hunkle Reservoir, an open ditch flows westward about 0.25 mile, under Auburn-Folsom Road to Baldwin Reservoir. Groundwater drainage from each of the dikes collects to form the headwaters of Linda Creek. Linda Creek flows in a northwesterly direction toward the City of Roseville and into Dry Creek, which in turn flows into the Natomas East Main Drainage Canal and eventually the Sacramento River.

f) **Soils**: Appendix A contains a soil survey map for the Dikes 4-6 project area. The soils of the study area are predominantly Andregg coarse sandy loam (Soil Survey Staff 2014). However, much of the area directly occupied by the dikes appears to be Xerothents as well. The Dikes 4-6 project area also occupies areas of the Ink-Exchequer complex (Soil Survey Staff 2014).

Andregg Soils – Andregg soils occur on the project site on 2 to 50 percent slopes. This moderately deep, well-drained soil is located on foothill locations. Parent material for these soils is granitic. Slopes are complex and can be rocky. Typically surface layers are grayish-brown coarse sandy loam about 15 inches thick. Sub-soils are pale brown and very pale brown coarse sandy loam about 14 inches thick.

Inks Soils – Inks soils occur on the project site on 2 to 30 percent slopes. This shallow, well-drained cobbly soil is located on long, broad volcanic ridges and side slopes. Parent material for these soils is andesitic conglomerate. Inclusions of Exchequer soil may be present. Typically surface layers are yellowish brown cobbly loam about 5 inches thick. The sub-soils are brown very cobbly clay loam about 13 inches thick.

Xerothent Soils – Xerothent soils, or cut and fill areas, occur throughout the project site. This well-drained material consists of mechanically removed and mixed soil in which horizons are no longer discernable. Surface runoff is very rapid and the hazard for erosion is moderate. Permeability and available water capacity is variable.

g) **Plant communities**: Three major natural plant community cover-types were identified in the project area: valley oak woodland, riparian woodland, and annual grassland. Also, much of the land on the waterside of the dikes is bare ground that would be covered in standing water when not in drought years. These land cover-types include jurisdictional wetlands and other waters of the United States, as well as non-jurisdictional upland habitat.

Valley oak woodland – The valley oak woodland habitat is best developed on deep, well-drained alluvial soils, usually in valley bottoms. Most large, healthy valley oaks are probably rooted in permanent water supplies. These woodlands are dominated by valley oak, with black walnut, interior live oak, boxelder, and blue oak as common associates. Oak woodlands with little or no grazing tend to develop a bird-disseminated understory cover, which is best developed along natural drainage areas. Poison oak, blue elderberry, California buckeye, toyon, California coffeeberry, and California blackberry are common understory species. Ground cover includes wild oats, brome, barley, ryegrass, and needle-grass.

Verner (1980) reported that 30 bird species, known to use oak habitats in California, include acorns in their diet. Gaines (1977) reported two dozen breeding bird species in the habitat, including: California quail, plain titmouse, scrub jay, spotted towhee, Bewick's wren, bushtit, willow flycatcher, and acorn woodpecker. Western gray and fox squirrels, as well as mule deer, are common mammals that use the food and shelter of the habitat.

Riparian woodland – Riparian woodland is found on the waterside of the dikes within the study area. The upper canopy is dominated by several species including Fremont cottonwood, box elder, white alder, Chinese tallow, sycamore, valley oak, live oak, Goodding's willow, and other willow species. The lower shrub canopy is dense and thicket-like, with dominant species including California buckeye, California rose, blackberry, blue elderberry, poison oak, and shrub-like forms of the various willow species. The herbaceous understory ranges from very developed to sparse depending on the amount of light filtering through the upper canopies, but typically includes various grasses, sedges, and rushes.

Transition to non-riparian habitat types is usually abrupt and related to water and soil saturation. Shrubby willow thickets can last 15-20 years before becoming overtopped by cottonwoods. Wildlife guilds of the riparian woodlands are generally the same as those of valley oak woodlands.

Annual grassland – Annual grasslands occur on both the landside and waterside of the dikes. Grassland composition and structure is largely dependent on weather patterns and vegetation management (i.e., mowing). Generally, germination occurs in the fall and growth remains low in stature until temperatures rise in the spring. In areas of light grazing, dead plant material accumulates over the summer months, whereas heavy spring grazing favors the growth of summer-annual forbs. No grazing occurs in the Dikes 4-6 project area. In general, annual grassland habitat occurs mostly on flat plains to gently rolling foothills.

The dominant species of the annual grasslands are introduced grasses, including wild oats soft chess, Italian rye grass, ripgut brome, red brome, wild barley, and foxtail fescue. Common forbs include broadleaf filaree, redstem filaree, turkey mullein, true clovers, bur clover, and popcorn flower. In moist or lightly grazed areas perennial grasses also are found, including purple needlegrass and Idaho fescue. Species composition is mainly dependent on seasonal and annual fluctuations in precipitation levels.

Reptiles of annual grasslands include the western fence lizard, mountain garter snake, and northern Pacific rattlesnake (Basey and Sinclear 1980). Typical mammals include the black-tailed jackrabbit, California ground squirrel, Botta's pocket gopher, western harvest mouse, California vole, badger, and coyote (White et al. 1980). Breeding birds may include the short-eared owl, horned lark, and western meadowlark (Verner et al. 1980). Foraging birds include the turkey vulture, northern harrier, American kestrel, black-shouldered kite, and prairie falcon. Areas with annual grassland vegetation in the project area are dominated by a mixture of annual grasses and herbaceous, nonnative or ruderal, weedy species. This cover-type generally occurs on dike slopes and in areas subject to periodic disturbance. Ruderal areas are common along the edge of agricultural fields and on the faces of dikes.

Delineation Methods and References

a) **Review of aerial imagery:** Prior to making field observations, aerial imagery was reviewed to assess the study area for potential wetland acreage.

b) **Date of Field Observations:** The field observations for this delineation occurred on June 10, 2014. All observations were made by Service biologists Mark Littlefield, Harry Kahler, and Amber Aguilera. Completed Wetland Data Forms – Arid West Region are provided in Appendix B.

c) **Wetland Vegetation Indicator Status Reference**: Taxonomic nomenclature for plant species is in accordance with the *Jepson Manual* (Hickman 1993), wetland indicator status for plant species was determined using *National List of Plant Species That Occur in Wetlands: California (Region 0)* (Reed 1988), and the "Dominance Test" and "Prevalence Index" were applied to determine plant dominance (U.S. Army Corps of Engineers 2008).

d) **Hydric Soil Method of Determination Followed**: A soil pit to a depth of up to 12 inches was dug within each suspected wetland feature. Soils were examined in order to assess field indicators of hydric soils. Positive indicators of hydric soils were observed in the field in accordance with the criteria outlined in Field Indicators of Hydric Soils in the United States (Hurt 2006) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (U.S. Army Corps of Engineers 2008). The color of the soils was determined using a Munsell® soil color chart.

e) **Wetland Hydrology Method of Determination Followed**: Presence of primary and secondary wetland hydrology indicators were documented for each suspected wetland feature. These include inundation, saturation within the upper 12 inches of the soil profile, water marks, drift lines, sediment deposits, surface soil cracks, oxidized rhizospheres along living roots, presence of reduced iron, hydrogen sulfide odor, biotic crust, salt crust, and drainage patterns in wetlands.

f) **Wetland Mapping**: All sample points and wetland polygon boundaries were recorded using a Garmin Global Positioning System (GPS) unit capable of sub-meter accuracy (NAD 83 projection, UTM Zone 10). The data was then overlaid onto a site-specific topographic map and aerial National Agriculture Imagery Program images from 2012.

Delineation Results and Discussion

Two areas were identified as wetlands in our analyses of the Dikes 4-6 project area. The two wetland features were identified on the landside of Dike 6 (Figure 2). Although each wetland feature is outside the Dikes 4-6 project area as currently planned, the wetland features are within areas that potentially could be used as staging areas if the project is modified.

Wetland WM012 occupies a highly disturbed area near the landside toe of Dike 6. Although many non-native and upland plant species are present, indicators showed the presence of hydrophytic vegetation. A strong sulfur odor and redox features indicated a wetland soil. Also, the ground at the wetland WM012 site is saturated and shows drainage patterns. Wetland WM013 also is on the landside toe of Dike 6. Hydrophytic vegetation indicators, the gleyed soils with a sulfurous odor, and the presence of surface water indicate the site is a wetland.

After examining aerial imagery and ground truthing, we took soil sample points within areas where wetland species were readily visible within the vegetation strata. Plant species were noted and the percentage of absolute cover and dominant species were determined throughout the vegetation community. Species that could not be identified in the field were collected and identified by experts in the Sacramento Fish and Wildlife Office. The wetland indicator status for each plant species across all vegetation strata were recorded on data forms found in Appendix A.

Soil surveys were conducted in two areas where ocular estimations of plant communities indicated a potential for the area to meet the wetland definition. Vegetation data collected on a site on the waterside of Dike 6 indicated wetland status (Figure 3). The soils within that area consisted of a thin loamy layer (about 6-10 inches) above granite, with no mottling. However, roots along willow branches, about 10 feet above ground level, indicated the site was within the high water mark of normal pool flooding of Folsom Lake. No other hydrology indicators were present. At another site by Dike 5 the vegetation data collected indicated a prevalence and dominance of upland species (Figure 4). Furthermore, the soils were sandy and demonstrated no wetland characteristics. A drainage area flows nearby, but it is outside the current project boundary and is not likely to be included in any future staging plans. No potential wetland areas were identified in or adjacent to project boundaries near Dike 4.

The Dikes 4-6 project area contains portions of Folsom Lake when the pool elevation is at its operational maximum pool elevation of 466 feet. No waters of the United States were identified with the Dikes 4-6 project area, yet other waters (Folsom Lake) lie on the waterside of the dikes. The WM014 site is about 0.50 acre, yet would be covered by water when the lake is at the operational maximum pool elevation of 466 feet. Table 1 provides an acreage summary of waters of the United States.

Table 1. Acreage Summary of Waters of the United States, Dikes 4-6 project area, Granite Bay, Placer County, California.

WATERS OF THE UNITED STATES		
WETLANDS	**ACREAGE**	**LINEAR FEET**
Wetland WM012	0.067	N/A
Wetland WM013	0.016	N/A
Total Wetlands	0.083	N/A
OTHER WATERS	**ACREAGE**	**LINEAR FEET**
Folsom Lake*	58.243	5422
TOTAL WATERS OF THE UNITED STATES	58.326	5422

* The Dikes 4-6 project area includes only a portion of Folsom Lake. The WM014 acreage is not included within the Waters of the United States because it would be covered by water when the lake is at the operational maximum pool elevation.

Figure 2. Wetlands WM012 and WM013, adjacent to Dike 6, Dike 4-6 project area, Granite Bay, Placer County, California.

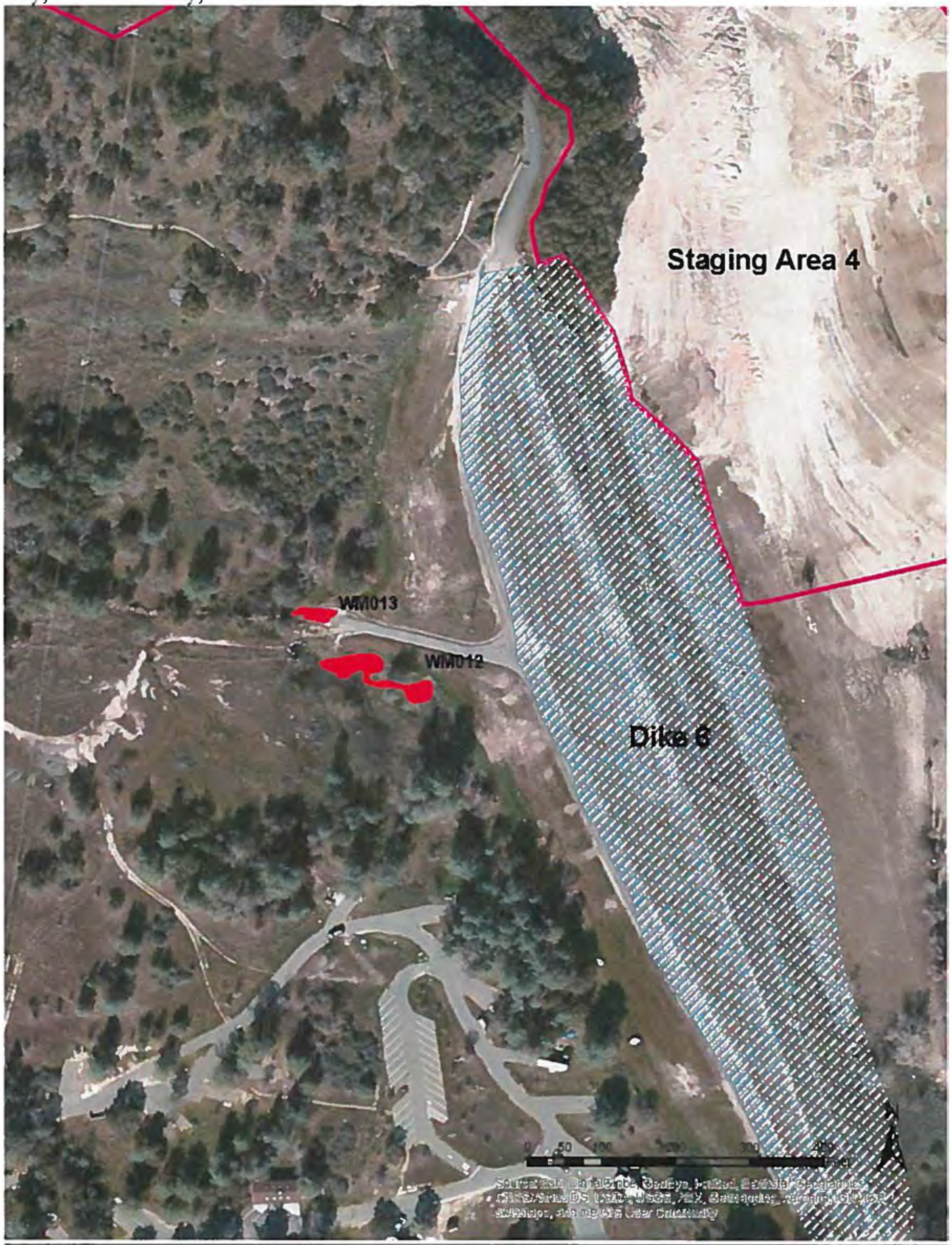


Figure 3. Area of wetland vegetation within the normal high water pool elevation of Folsom Lake, Granite Bay, Placer County, California. The site (WM014) was found to be non-wetland.

Figure 4. A data collection site (WM015) by Dike 5 that was found to be non-wetland, Granite Bay, Placer County, California.

References

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APPENDIX A

Natural Resources Conservation Service
Soil Survey Map
Folsom Dikes 4-6 Project

Soil Map—Placer County, California, Western Part
(Folsom Dikes 4-6 Project)

Map Scale: 1:5,770 if printed on B portrait (11" x 17") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Placer County, California, Western Part
Survey Area Data: Version 6, Dec 13, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 3, 2010—Apr 29, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Placer County, California, Western Part (CA620)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
106	Andregg coarse sandy loam, 2 to 9 percent slopes	4.2	6.0%
109	Andregg coarse sandy loam, rocky, 2 to 15 percent slopes	0.2	0.3%
110	Andregg coarse sandy loam, rocky, 15 to 30 percent slopes	7.4	10.7%
111	Andregg coarse sandy loam, rocky, 30 to 50 percent slopes	0.1	0.2%
152	Inks cobbly loam, 2 to 30 percent slopes	3.3	4.8%
196	Xerorthents, cut and fill areas	12.4	17.8%
198	Water	37.3	53.4%
DAM	Dams	4.8	6.9%
Totals for Area of Interest		**69.9**	**100.0%**

APPENDIX B

Wetland Determination Data Forms
Arid West Region

Acreage: 0.060171

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Folsom Dike 6 City/County: Placer Sampling Date: 6/10/14

Applicant/Owner: ______ State: CA Sampling Point: WM012

Investigator(s): AA, ML, HK, JA Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: 152 - NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ______ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ______
Hydric Soil Present?	Yes ✓	No ______
Wetland Hydrology Present?	Yes ✓	No ______

Is the Sampled Area within a Wetland? Yes ✓ No ______

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. Pine Pinus sabiniana	5		UPL
2. Oak Quercus lobata	10		FACU
3.			
4.			
Bare Ground — Total Cover:	10%		
Sapling/Shrub Stratum			
1. Spurge	1%		
2. Dandelion	1%		
3. Tallow	1%		
4. Vetch Vicia sativa	2%		FACU
5. Briza media	1%		FAC
Silver hair grass Aira caryophyllea — Total Cover:	3%	✓	FACU
Herb Stratum			
1. Monkey flower Mimulus spp.	1%		OBL
2. Pacific Iris, Iris hartwegii	15%	✓	FACU
3. Eleocharis palustris	2%	✓	OBL
4. Italian Rye grass, Lolium perenne	5%	✓	FAC
5. Polypogon [illegible] elongatus	5%	✓	OBL
6. Cattail Typha latifolia	5%	✓	OBL
7. Plantago	2%		
8. Soft Chess Bromus hordeaceus	3%		FACU
Blackberry Rubus discolor — Total Cover:	2%		FACW*
~~Woody Vine Stratum~~			
1. Pink unknown	5%		
2. Rumex crispus	1%		FAC
Nut sedge Cyperus spp. — ~~Total Cover~~:	4%		FAC
Gnaphalium (Slender cud weed) stramineum	5%		FACW

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	6	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	67%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	13	x 1 =	13
FACW species	7	x 2 =	14
FAC species	7	x 3 =	21
FACU species	23	x 4 =	92
UPL species	0	x 5 =	0
Column Totals	50 (A)		140 (B)

Prevalence Index = B/A = 2.8

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

? Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ✓ No ______

Remarks:

Site has been [illegible] recently, highly disturbed

SOIL

Sampling Point ____________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
12	10YR 3/3	50	10YR 5/8	50			Sandy	Graded

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- ✓ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ✓ No ____

Remarks:

Strong sulfur smell Iron streaking

Soil is disturbed, graded

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- __ Surface Water (A1)
- __ High Water Table (A2)
- ✓ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Plowed Soils (C6)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- ✓ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Thin Muck Surface (C7)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches): ____________

Water Table Present? Yes ____ No ____ Depth (inches): ____________

Saturation Present? (includes capillary fringe) Yes ____ No ____ Depth (inches): ____________

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Photo: 126-131 GPS VW011

Remarks:

Acreage: 0.0162

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Folsom Dike 6 City/County: Granite Bay / Placer Sampling Date: 6/10/14

Applicant/Owner: ______ State: CA Sampling Point: WM013

Investigator(s): AA JA HK ML Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: 106 NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ______ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ______	Is the Sampled Area within a Wetland? Yes ✓ No ______
Hydric Soil Present?	Yes ✓ No ______	
Wetland Hydrology Present?	Yes ✓ No ______	

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. Willow Salix gooddingii	10	✓	FACW
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1.		✓	
2. Cattail Typha latifolia	80%		OBL
3. Rabbits foot Polypogon elongatus	1%		OBL
4. Bare ground	19%		
5.			
6.			
7.			
8.			
Total Cover:			
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	81	x 1 = 81
FACW species	10	x 2 = 20
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	91 (A)	101 (B)

Prevalence Index = B/A = .9

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ✓ No ______

Remarks:

SOIL

Sampling Point: ______

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
12	2.5YR 3/0	100						Gley

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- ✓ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (LRR C)
- __ 1 cm Muck (A9) (LRR D)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- ✓ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- __ 1 cm Muck (A9) (LRR C)
- __ 2 cm Muck (A10) (LRR B)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ No ______

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ✓ Surface Water (A1)
- __ High Water Table (A2)
- ✓ Saturation (A3)
- __ Water Marks (B1) (Nonriverine)
- __ Sediment Deposits (B2) (Nonriverine)
- __ Drift Deposits (B3) (Nonriverine)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Plowed Soils (C6)
- ✓ Other (Explain in Remarks) *

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (Riverine)
- __ Sediment Deposits (B2) (Riverine)
- __ Drift Deposits (B3) (Riverine)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Thin Muck Surface (C7)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ____ Depth (inches): 1-2

Water Table Present? Yes ____ No ____ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ✓ No ____ Depth (inches): 1-2

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

GPS: VW012 Photos: 132-135

Remarks:

Non-veg. wetland. Drainage from Dike *Algae

Immediately downstream of [illegible]

acreage. 0.505342

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Folsom Dike #6 City/County: Placer Sampling Date: 6/10/14

Applicant/Owner: Andrea Kibler L. Wakefield State: ______ Sampling Point: WM014 (WM013)

Investigator(s): ~Photos 136-140 Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ______ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ______
Hydric Soil Present?	Yes X	No ______
Wetland Hydrology Present?	Yes ______	No X

Is the Sampled Area within a Wetland? Yes ______ No X

Remarks:

Not a wetland ↑

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. Black willow Salix gooddingii	30	✓	FACW
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum			
1. Plum Prunus spp.	T		NI*
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. Eleocharis palustris	60	✓	OBL
2. Aira caryophylla	2		FACU
3. Cocklebur Xanthium spp	2		FAC+
4. Phyla nodiflora	30	✓	FACW
5. Briza minor	2		FAC
6. Solidago spp.	5		?
7. Lotus corniculatus	T		FAC
8.			
Total Cover:			
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	60	x 1 = 60
FACW species	60	x 2 = 120
FAC species	5	x 3 = 15
FACU species	2	x 4 = 8
UPL species	1	x 5 = 5
Column Totals:	128 (A)	208 (B)

Prevalence Index = B/A = 1.62

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ______

Remarks:

Soils thin. Lots of organic matter, roots

SOIL

Sampling Point: WM 01

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
4	10YR 4/3	100						No mottling, streaking thin soil on granite

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ______ No ______

Remarks:

A horizon loamy 1-2 inches below loamy

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (inches): ______

Water Table Present? Yes ______ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No X Depth (inches): ______

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Evidence of flooding. Roots high (10 feet?) on willow branches, within lake pool.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Folsom Dike # 5 City/County: Placer Sampling Date: 6/10/14

Applicant/Owner: Andrew State: ______ Sampling Point: WM015

Investigator(s): Aguilera, Kohlo, L Hilfiker(?) Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ______ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ______ No X	Is the Sampled Area within a Wetland? Yes ______ No X
Hydric Soil Present?	Yes ______ No X	
Wetland Hydrology Present?	Yes ______ No X	

Remarks:

Pictures 146-149

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum			
1.			
2.			
3.			
4. Bromus hordeaceus	1		FACU
5. Centaurea solstitialis	40	✓	UPL
Total Cover:			
Herb Stratum			
1. slender wheatgrass Agropyron sp.	1		NI*
2. Lolium perenne	15	✓	FAC
3. Epilobium sativum	2		UPL
4. Foxtail Alopecurus spp.	1		–
5. Vetch Vicia sativa	15	✓	FACU
6. Rumex crispis	5		FAC
7. Clover sp.	2		
8. yellow mustard (?) sisy	T		FACU
Total Cover:			
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	20	x 3 =	60
FACU species	17	x 4 =	68
UPL species	42	x 5 =	210
Column Totals	79 (A)		338 (B)

Prevalence Index = B/A = 4.27

Hydrophytic Vegetation Indicators:

– Dominance Test is >50%

– Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ______ No X

Remarks:

SOIL

Sampling Point: ____________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ______ No ✓

Remarks: Sandy soils no wetland characteristics

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Plowed Soils (C6)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Thin Muck Surface (C7)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✓ Depth (inches) ____________

Water Table Present? Yes ______ No ✓ Depth (inches) ____________

Saturation Present? (includes capillary fringe) Yes ______ No ✓ Depth (inches) ____________

Wetland Hydrology Present? Yes ______ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available

Remarks

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Dike #4 - Waterside City/County: Placer Sampling Date: 6/10/11

Applicant/Owner: ______ State: ______ Sampling Point: ______

Investigator(s): Aguilera, Audrieux, Kahler, Littlefield Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ______ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ______ No ______	Is the Sampled Area within a Wetland?	Yes ______ No ______
Hydric Soil Present?	Yes ______ No ______		
Wetland Hydrology Present?	Yes ______ No ______		

Remarks: Photos → 150-159 - No Wetlands

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:			
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ______ No ✓

Remarks:

SOIL

Sampling Point: ____________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5) **(LRR C)**
__ 1 cm Muck (A9) **(LRR D)**
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)
__ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

__ 1 cm Muck (A9) **(LRR C)**
__ 2 cm Muck (A10) **(LRR B)**
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ______________________________

Depth (inches): ______________________

Hydric Soil Present? **Yes** ______ **No** ______

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1) **(Nonriverine)**
__ Sediment Deposits (B2) **(Nonriverine)**
__ Drift Deposits (B3) **(Nonriverine)**
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Plowed Soils (C6)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water Marks (B1) **(Riverine)**
__ Sediment Deposits (B2) **(Riverine)**
__ Drift Deposits (B3) **(Riverine)**
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Thin Muck Surface (C7)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ______ Depth (inches) ____________

Water Table Present? Yes ______ No ______ Depth (inches) ____________

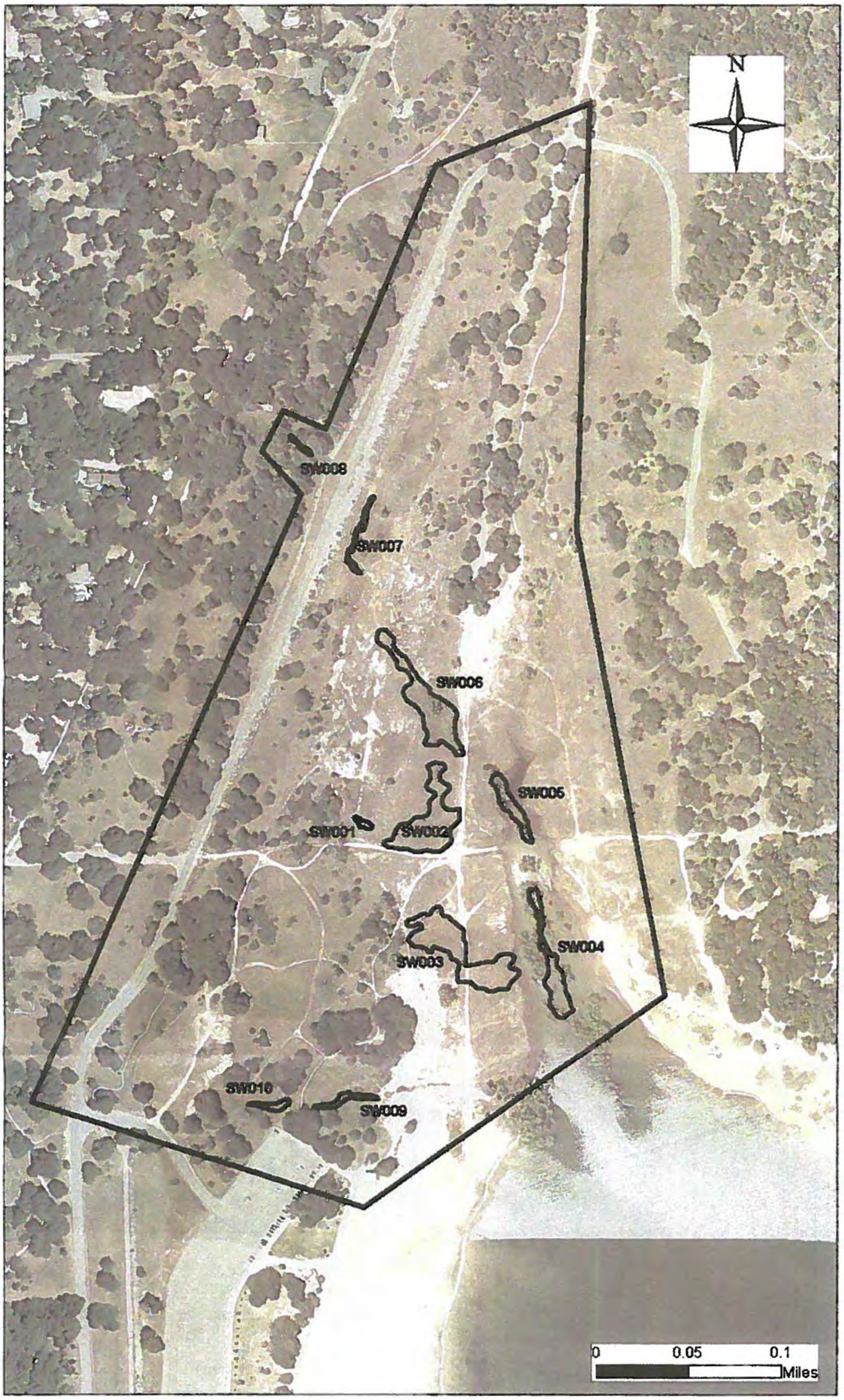
Saturation Present? (includes capillary fringe) Yes ______ No ______ Depth (inches) ____________

Wetland Hydrology Present? **Yes** ______ **No** ______

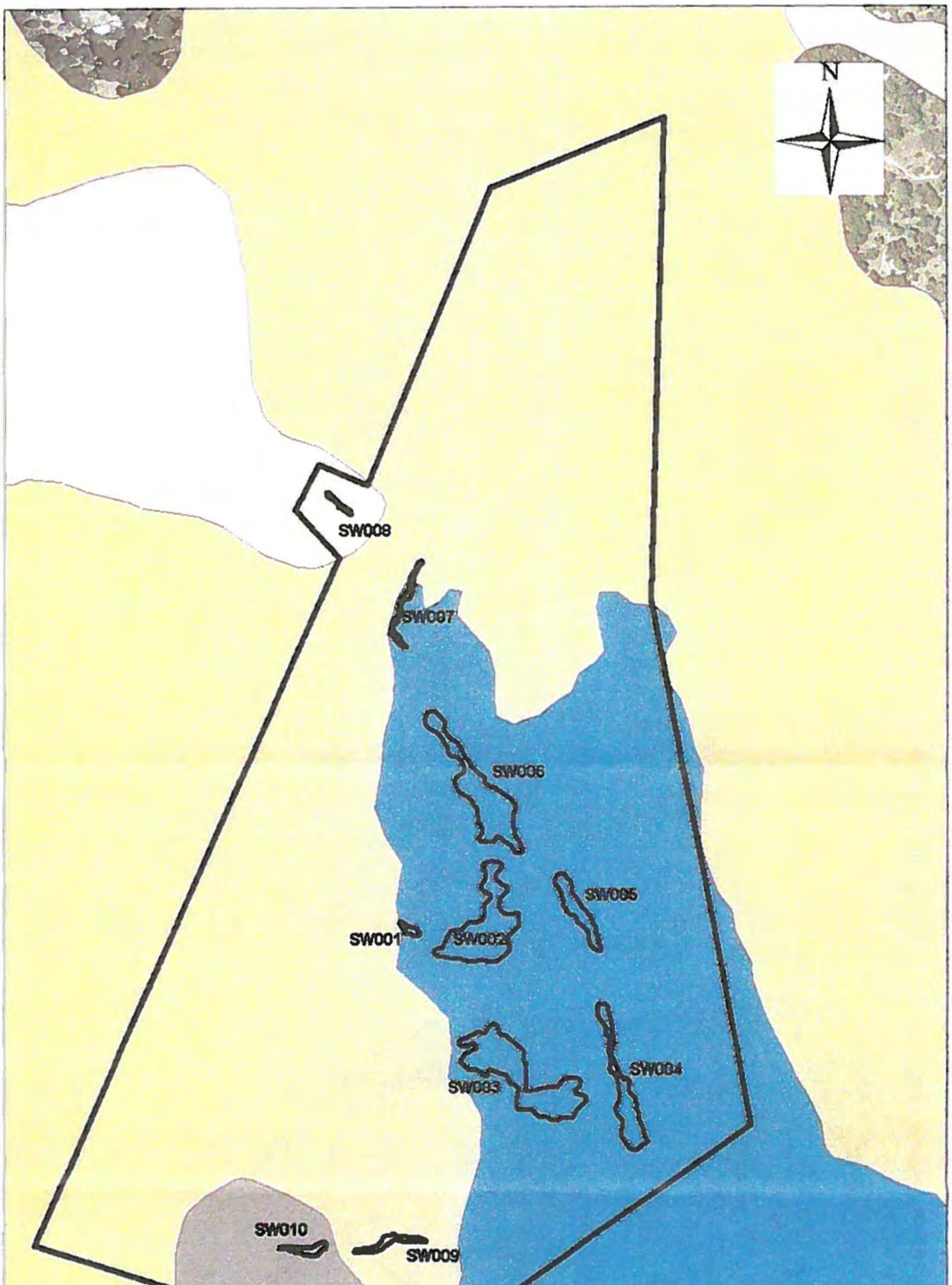
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available

Remarks:

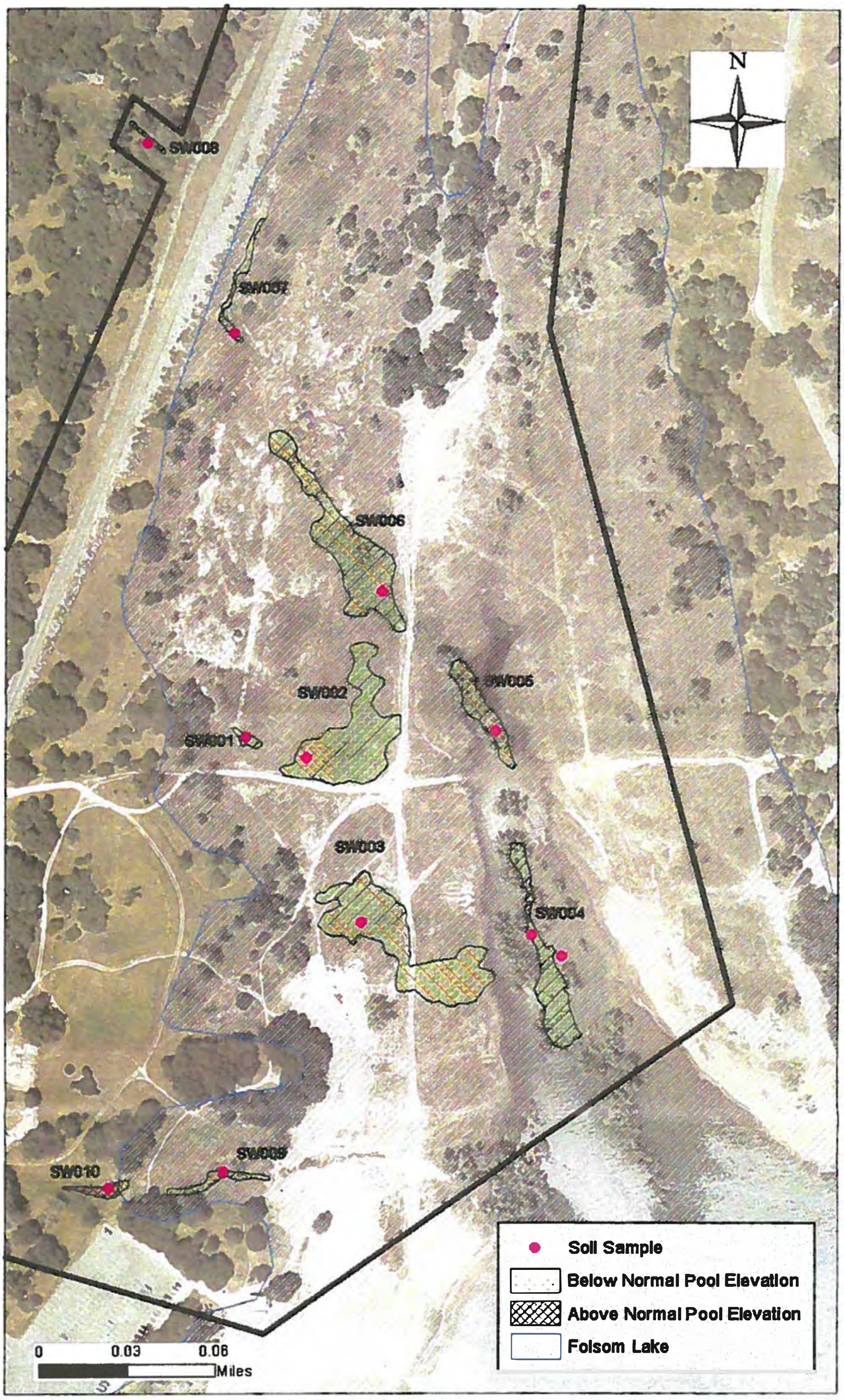
Study Area


N
SW008
SW007
SW006
SW005
SW001
SW002
SW004
SW003
SW010
SW009
0
0.05
0.1
Miles

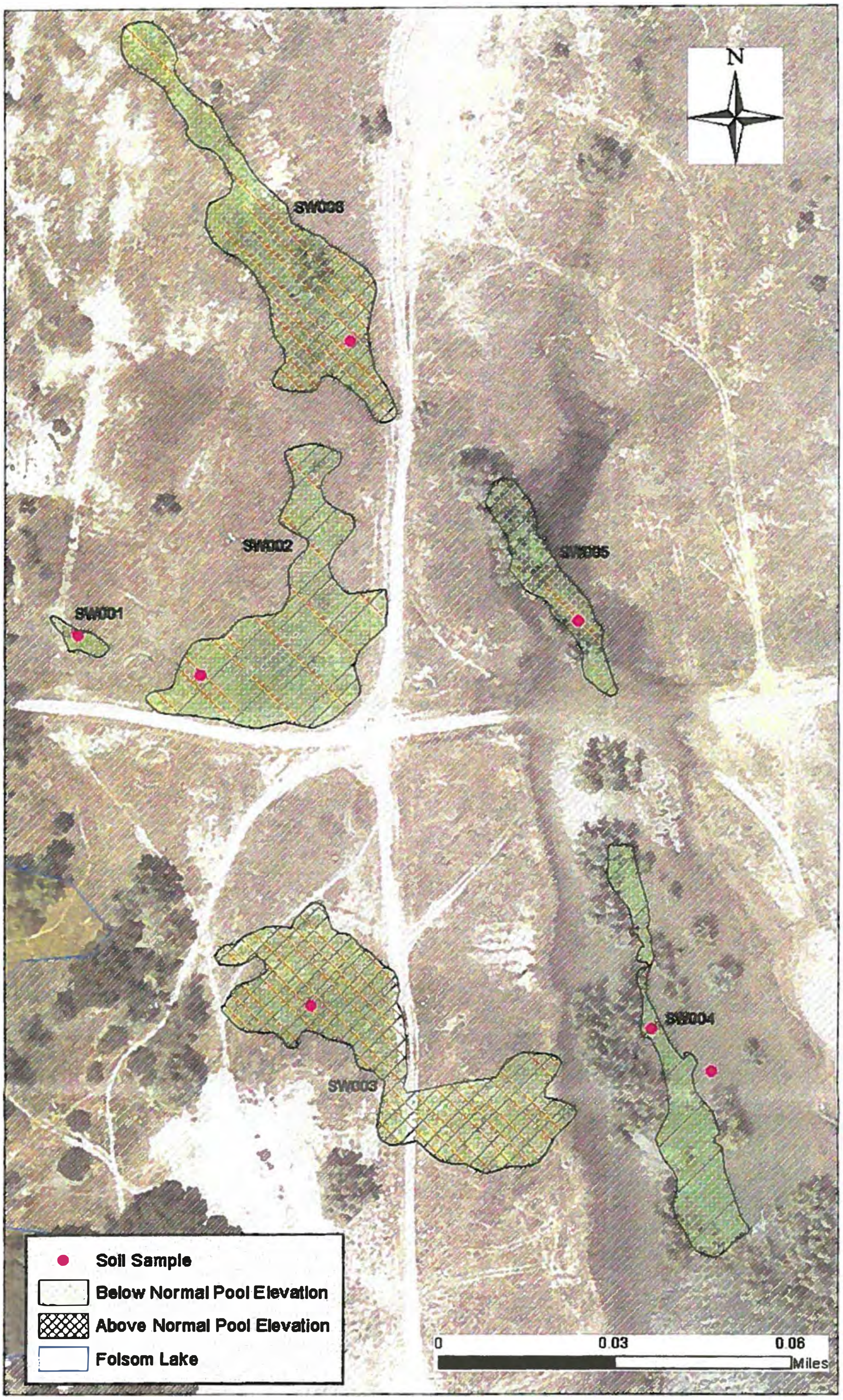
Soil Types


N
SW008
SW007
SW006
SW005
SW001
SW002
SW004
SW003
SW010
SW009
Soil Type
Andregg coarse sandy loam, 2 to 9 percent slopes
Andregg coarse sandy loam, rocky, 2 to 15 percent slopes
Water
Xerorthents, cut and fill areas
0
0 05
0 1
Miles

Jurisdictional Wetlands and Other Waters of the U.S. near Dike 1



SW001 - SW006


N
SW006
SW002
SW005
SW001
SW004
SW003
Soil Sample
Below Normal Pool Elevation
Above Normal Pool Elevation
Folsom Lake
0
0.03
0.06
Miles

SW007 and SW008

APPENDIX E

USFWS COORDINATION ACT REPORT

United States Department of the Interior

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

In Reply Refer to:
FF08ESMF00-
2014-CPA-0010

APR 2 0 2015

Alicia E. Kirchner
Chief, Planning Division
Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814-2922

Dear Ms. Kirchner:

The U.S. Army Corps of Engineers (Corps) has requested supplemental coordination under the Fish and Wildlife Coordination Act (FWCA) for the Folsom Dam Raise Project, in Sacramento, El Dorado, and Placer Counties, California. This letter transmits the U.S. Fish and Wildlife Service's (Service) draft supplemental FWCA report for the proposed project (enclosed). By copy of this letter, we are requesting the agencies listed below to provide any review comments to the Service so that they can be incorporated into a final report for inclusion in the Corps' environmental documents.

If you have any questions regarding this report on the proposed project, please contact Amber Aguilera, Fish and Wildlife Biologist, or Doug Weinrich, Assistant Field Supervisor at (916) 414-6600.

Sincerely,

Jennifer M. Norris
Field Supervisor

Enclosure

cc:
Lisa Aley, COE, Sacramento, CA
Howard Brown, NOAA Fisheries, Sacramento, CA
Tina Bartlett, CDFW, Rancho Cordova, CA

DRAFT SUPPLEMENTAL FISH AND WILDLIFE COORDINATION ACT REPORT FOR THE FOLSOM DAM RAISE PROJECT

FEBRUARY 2015

BACKGROUND

Folsom Dam and its associated facilities (collectively referred to as the Folsom Facility) are located 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 Facility is made up of the main concrete dam, the right and left wing dams, Mormon Island Auxiliary Dam (MIAD), and 8 dikes that collectively impound 1,010,000 acre-feet (AF) of water at a reservoir water surface elevation of 466 feet. The concrete dam and earthen wing dams serve to impound water associated with the main stem of the American River. MIAD serves to dam water within a historic river channel, while the earthen dikes serve to contain water at low areas in the topography during periods when the reservoir is full or nearly full.

The Folsom Dam Safety/Flood Damage Reduction Project (FDS/FDR Project), also referred to as the Folsom Dam Modification Project or the Folsom Joint Federal Project, is a cooperative effort among the U.S. Army Corps of Engineers (Corps), the U.S. Bureau of Reclamation (Reclamation), the State of California Central Valley Flood Protection Board, and the Sacramento Area Flood Protection Agency. The FDS/FDR Project includes measures to remedy dam safety issues associated with seismic, static, and hydrologic concerns, and to provide increased flood damage protection by increasing the flood storage capacity and/or pool release mechanisms of the Folsom Facility. The potential effects of the Folsom FDS/FDR Project on environmental resources were evaluated in the 2007 Final Environmental Impact Statement/Environmental Impact Report (FEIS/EIR) and 2007 Fish and Wildlife Coordination Act (FWCA) Report. The evaluation in the 2007 FEIS/EIR and 2007 FWCA report were based on technical studies and the level of project design available at the time.

Portions of the FDS/FDR Project have been constructed or are currently in construction. This includes construction of a new auxiliary spillway to address dam safety and flood damage reduction concerns related to the discharge of flood waters from Folsom Dam, the replacement of three existing emergency spillway gates at the main dam, modifications to the main dam and 6 of the 11 earthen structures to address seismic and static concerns, security improvements, and development of an updated water control manual for Folsom Dam.

The Folsom Dam Raise Project is an element of the FDS/FDR Project that would increase the flood storage capacity by increasing the height of Dikes 1 through 8, the left and right wing dams, and MIAD by 3.5 feet. These facilities would be raised utilizing either an earthen embankment raise or a reinforced concrete flood wall. Dikes 1 through 8 and MIAD would be raised using earthen engineered fill material similar to the existing dike and auxiliary dam composition, and a reinforced 3.5 foot concrete floodwall would be constructed on the left and right wing dams. In addition, the main spillway and emergency spillway gates would be modified to improve flow capacity. This supplemental FWCA report only addresses the work specific to raising the associated facilities of Folsom Dam by 3.5 feet and the modification of the main spillway and emergency spillway gates.

PROJECT DESCRIPTION

The Folsom Dam Raise Project includes increasing the height of Dikes 1through 8, the left and right wing auxiliary dams, and MIAD by 3.5 feet by means of an earthen embankment raise or a reinforced concrete flood wall. Raising the associated facilities by 3.5 feet would provide an increased surcharge storage capacity which would require modification of the main spillway and emergency spillway gates. Modification of the gates include adding top seal bulk heads to the tainter gates, raising the hoist motors and gate lifting mechanisms, and reinforcing the support struts on the gates.

Dikes 1 through 8 and MIAD would be raised using an engineered fill material similar to the existing composition of the earthen dikes that would allow the proper amount of seepage and pore pressure to be maintained through the interface between the old and new material. The slopes and crest widths would conform to Corps standards while maintaining Reclamations requirements for security and maintenance.

The Corps would also construct a reinforced concrete flood wall on the left and right wing dams that would tie into the main dam, the new control structure, and the existing terrain. Construction of the flood wall would involve excavating a small portion of the top of each earthen structure to receive the base for the wall, constructing forms to receive cement, pouring the cement, removing the forms for the next construction length, and replacing the embankment fill along with a drainage element to control pore pressures (Figure 1 in Appendix A).

The haul routes for the project predominantly use existing service routes along the immediate toes of the existing embankments and/or are in-reservoir (Figures 2-6 in Appendix A). The identified routes avoid surveyed cultural resource sites, incorporate public safety measures, and provide temporary alternate public access detours at major recreation area access points. Staging areas for all eight dikes, both wing dams, and MIAD are identified on Figures 2-6 in Appendix A.

The purpose of the project is the reduction of flood risk. The 3.5 foot raise increases the flood risk reduction capability of Folsom Dam and Lake by allowing better use of the existing surcharge storage capacity. The addition of the top seal bulkheads over the service and emergency gates would allow Reclamation to pass the probable maximum flood event without over-topping the gates while utilizing the additional surcharge storage space.

BIOLOGICAL RESOURCES

Existing Conditions

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

Vegetation

Surrounding Folsom Lake and Upstream
The area surrounding Folsom Lake 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 and interior live oaks. Small areas of chaparral extend to the reservoir's upper edge, particularly along the south fork of the American River. Annual grassland areas are interspersed throughout the area, and human-disturbed habitats occur around recreation facilities. Relatively small areas of riparian habitats can be found along tributaries to the reservoir and within seep areas. Willow stands and individual trees have become established within some areas of the reservoir pool.

Vegetation at MIAD consists mainly of annual grasses with a small portion of oak woodland and occasional freshwater marsh wetlands at the base of MIAD along Green Valley Road. MIAD was constructed to dam water within an historic river channel, creating several perennial wetlands on the landside, in addition to a wetland preserve (Mormon Island Preserve) that is run by the California Department of Parks and Recreation. The major vegetation communities identified in this area in 2008 were cattail emergent wetland and cottonwood/willow riparian woodland.

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 downstream of Folsom Dam encompasses about 4,000 acres, the majority of which are in a State designated floodway and contains large areas of annual grasslands, riparian forest and scrub-shrub, oak-woodlands, bare sand and gravel, and surface waters of the river and its associated sloughs and dredge ponds (Service 2003).

Fish

Folsom Lake and Upstream
When full, Folsom Lake 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; warm water species such as bass (largemouth, smallmouth, spotted), sunfish (redear, bluegill) and crappie (white, black) in the upper portion of the water column, and trout and landlocked salmon (kokanee and Chinook) in deeper portions of the water column. Various catfish and bullhead species can also be found near the bottom of the lake in shallower waters. Fish habitat is present within the inundation zone in the form of young willow dominated riparian habitat which grows during extended periods of drought. Both warm and cold water fisheries tend to benefit from increased peak spring water storage since it results in better cold water reserves for the salmonids and increased spawning and rearing habitat for warm water fish (Service 2001). Sport fishing is an economically important and popular recreational activity at Folsom Lake.

Sediment associated with the Folsom Facility may contain mercury from historic mining operations and metals from historic activities or geology in the American River drainage (Reclamation 2006). 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 (Service 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 (Service 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 the California Department of Fish and Wildlife (CDFW). The average annual production of fall-run Chinook salmon in the American River from 1992-2009 is 109,574 (Service 2013).

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. The anadromous fish trap count for steelhead at the Nimbus Hatchery was 3,371 adults during the 2012/2013 season (CDFW 2015). 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 (Setvice 1994).

Wildlife

Surrounding Folsom Lake and Upstream

The area surrounding Folsom Lake 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 (Service 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 wood duck, common merganser, mallard, black phoebe, greater yellowlegs, and belted kingfisher. The Mormon Island Preserve also provides a perennial wetland for many species including pond turtles.

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 for wintering and/or breeding.

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 Lake, 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 (Service 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 River 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
(No Action Alternative)

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

Under the without-project condition, the Corps would not implement the 3.5 foot raise of Dikes 1-8, the left and right wing dams, and MIAD, and the emergency spillway gate modifications would not be implemented. Consequently, improved flood risk management benefits would not occur.

Vegetation

Surrounding Folsom Lake and Upstream
Without-project conditions for the project area are not expected to change significantly from the existing conditions over the life of the project.

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, would 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 (Service 1991).

Sediment deposition needed for the establishment of these riparian species would continue to be limited by upstream impoundments. Forest complexes would be dominated by species adapted to relatively low water needs. Riparian species would gradually mature then die out, giving way to more drought-tolerant plant species such as ash, box elder, and valley and live oaks. Vegetation would 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 currently exists would continue to develop over time into mature riparian woodland habitat.

Fish

Folsom Lake and Upstream
Without-project conditions for the project area are not expected to change significantly from the existing condition over the life of the project.

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 conditions change is difficult to predict. With continued implementation of the Anadromous Fish Restoration Program of the Central Valley Project Improvement Act (Service 1995), conditions in the lower American River are expected to improve for fishery resources.

Other variables would determine the way in which flows are managed on the lower American River; including meeting the needs of downstream water quality standards, existing and renewed water contracts, and any additional new water contract quantities.

Wildlife

Surrounding Folsom Lake and Upstream
Without-project conditions for the project area are not expected to change significantly from the existing condition over the life of the project.

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 (Service 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 habitat, 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

Vegetation

Folsom Lake

Four cover-types: oak/grey pine woodland, riparian woodland, seasonal wetland, and annual grassland would be directly impacted by construction of the Folsom Dam Raise Project. The impact acreage for the oak/grey pine woodland, riparian woodland, and seasonal wetland cover-types for the project are shown in Table 1.

Table 1. Summary of cover-types and impacted acres for the construction of the Folsom Dam Raise Project, Sacramento, El Dorado, and Placer Counties, California

Cover-Type Impacted	Impacted Acres[1]
Oak/grey pine woodland	4.9
Riparian Woodland	0.05
Seasonal Wetland	0.32
Total	**5.27**

Construction impacts include a 50 foot construction area from the landside toe. Impacts to seasonal wetlands from raising MIAD may occur from changes in water quality or the discontinued/muted flow of water from Folsom Lake into/out of the wetlands.

Impacts to annual grassland would be minimized by seeding all impacted areas with native grasses as soon as construction activities are complete in that specific area. It was anticipated that the work would be phased, so the annual grassland areas would not all be disturbed at the same time. In addition, the impacts to other disturbed lands can be minimized by replanting with native annual grasses, when possible.

Lower American River

No change in the existing conditions for vegetation in the lower American River is anticipated because the project's construction impacts would be focused on the flood control space within the reservoir, on the main dam for spillway gate modifications, and lands adjacent to the existing reservoir. At the current time, neither Reclamation nor the Corps has the authority to deviate from

1 Note: The impact acreages calculated for construction of the project were provided by the Corps using aerial imagery and the Northern Sierra Nevada Foothills Vegetation Project: Vegetation Mapping Report (CDFW 2011).

the current water control manual, thus operations of the dam would remain the same until an updated water control manual for Folsom Dam is completed.

Fish

Lower American River
No change in fish species numbers or species composition in the lower American River is anticipated to occur from construction of the project. However, 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, if any, during project construction.

Wildlife

Lower American River
No change in wildlife species numbers or species composition is expected to occur along the lower American River as a result of construction of the project.

Operational Impacts

Folsom Lake
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 Lake from the current interim operation of 400,000 - 670,000 AF to a 400,000 - 600,000 AF permanent variable flood space operation once the Folsom Dam 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 cubic feet per second (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 Service completed a FWCA report for the American River Watershed Investigation Folsom Dam Modification Project in 2001 (Service 2001).

When the Folsom DS/FDR project is completed, Folsom Dam would 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 new 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 2006a).

Lower American River
Implementation of the project 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 would maintain outflows at not more than 115,000 cfs, while the without-project conditions would be uncontrolled, resulting in very high outflows of 180,000-315,000 cfs.

The Corps and Reclamation, along with other agencies and water groups, are in the process of developing an updated water control manual for Folsom Dam that incorporates the flood risk reduction benefits of the American River Watershed Investigation Common Features Project and the new auxiliary spillway. The updated water control manual is scheduled to be implemented after the completion of the new auxiliary spillway and would be updated again to incorporate the flood control benefits of the Folsom Dam Raise Project. The development of the updated water control manual is a collaborative process with the appropriate level of environmental analysis, public, agency and stakeholder coordination, and appropriate NEPA/CEQA documentation. If an updated water control manual is not developed, Folsom Dam would be operated under the existing operating criteria. Under this scenario, the same amount of water would be released with and without the project.

Vegetation

Folsom Lake

The enlargement of Folsom Lake 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. About 813.7 acres would be affected by raising Folsom Dam 3.5 feet. Some of these lands are already developed or contain otherwise disturbed habitat, that provide little or no value for wildlife species, and some support vegetation that is tolerant of flooding. Table 2 summarizes the acreage of each cover-type which provides value for wildlife that is expected to receive inundation over the life of the project. Inundation effects around Folsom Lake would occur in large part by the frequency, timing, and duration of flooding. Inundation impacts are shown for the 3.5 foot raise operating under the current water control manual/dam operations.

Table 2. Preliminary summary of cover-types and impacted acres for the inundation of Folsom Lake as part of the Folsom Dam Raise Project, Sacramento, El Dorado, and Placer Counties, California

Cover-Type Impacted by Inundation	Impacted Acres
Oak/grey pine woodland	781.5
Chaparral	32.2
Total	**813.7**

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* Service 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 (Service 1980). Folsom Lake can be expected to fill during a spring flood event, when oaks are actively growing. The absence of blue oaks within the inundation zone of Folsom Lake and other foothill impoundments indicates that blue oaks cannot tolerate the flooding regime that exists 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 within the Folsom Lake area are generally between 5 and 25% (Corps 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% (Corps 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 2007 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 2007 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. Existing 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.

Lower American River

Dikes 1-8, MIAD, and both wing dams of Folsom Dam would be raised 3.5 feet with the project, which would allow for additional space within Folsom Lake to detain flood flows. Meanwhile, outflows would remain, to the extent possible, within the 115,000 cfs objective capacity of the downstream channel. The additional 3.5 feet of freeboard would reduce peak flows, while increasing the duration of flows, relative to existing conditions. The project would also modify the main and emergency spillway gates to allow for improved flow capacity. The moderated flows may reduce erosive energy compared to existing conditions, and could have a cumulative or indirect effect on carryover storage.

Fish

Folsom Lake
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.

Lower American River
No long-term operational effects for fish species are anticipated.

Wildlife

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

Lower American River
No long-term operational effects for wildlife species area anticipated.

Endangered Species

Based on a search of the Clarksville, Folsom, Pilot Hill, and Rocklin USGS quadrangle maps there are several listed species which could occur within or near the project area. The species under the jurisdiction of the Service which may be affected by the project include the valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp, and California red-legged frog. The other species (anadromous fish) are under the jurisdiction of National Marine Fisheries Service (NOAA Fisheries). The complete list is included in Appendix C, as well as a summary of Federal agencies responsibilities under the Endangered Species Act of 1973, as amended.

DISCUSSION

Service Mitigation Policy

The recommendations provided herein for the protection of fish and wildlife resources are in accordance 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 or conserve fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of the most important and valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's natural resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife 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. However, the Mitigation Policy does not apply to threatened and endangered species, Service recommendations for completed Federal projects or projects permitted or licensed prior to enactment of Service authorities, or Service recommendations related to the enhancement of fish and wildlife resources.

In applying the Mitigation Policy during an impact assessment, the Service first identifies each specific habitat or cover-type that may be impacted by the project. Evaluation species[2] which utilize each habitat or cover-type are then selected for Resource Category analysis. Selection of evaluation species can be based on several rationale, as follows: (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 Fish and Wildlife Service. 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 planning goals range from "no loss of existing habitat value" (i.e., Resource Category 1) to "minimize loss of habitat value" (i.e., Resource Category 4). The planning goal of Resource Category 2 is "no net loss of in-kind habitat value." To achieve this goal, any unavoidable losses would need to be replaced in-kind. "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. The planning goal of Resource Category 3 is "no net loss of habitat while minimizing loss of in-kind value." To achieve this goal any unavoidable losses would be replaced in-kind or if it is not desirable or possible out-of-kind mitigation would be allowed. The planning goal of Resource Category 4 is "minimize loss of habitat value." To achieve this goal the Service would recommend ways to rectify, reduce, or minimize loss of habitat value.

In addition to mitigation planning goals based on habitat values, Region 8 of the Service, which includes California, has a mitigation planning goal of no net loss of acreage and value for wetland habitat. This goal is applied in all impact analyses.

In recommending mitigation for adverse impacts to fish and wildlife habitat, 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 of measures, measures to reduce or eliminate impacts over time, and compensation.

Seven fish and/or wildlife habitats were identified in the project area which had potential for impacts from the project: oak/grey pine woodland, riparian woodland, chaparral, seasonal wetland, annual grassland, lacustrine, and other. The resource categories, evaluation species, and mitigation planning goal for the habitats impacted by the project are summarized in Table 3.

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,

2 Note: Evaluation species used for Resource Category determinations may or may not be the same evaluation species used in a HEP application, if one is conducted.

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 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 30-80% 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 the oak/grey pine woodland are acorn woodpecker, turkey, and breeding birds. Acorn woodpeckers utilize oak woodlands for nearly all their life requisites; 50-60 percent of the acorn woodpecker's annual diet consists of acorns. Acorn woodpeckers can also represent impacts to other canopy-dwelling species. Turkeys forage and breed in oak woodlands and are abundant in the project area. Mule deer also heavily depend on acorns as a dietary item in the fall and spring; the abundance of acorns and other browse influence the seasonal pattern of habitat use by deer. These latter species represent species which utilize the ground component of the habitat and both have important consumptive and non-consumptive human uses (i.e., hunting and bird watching). Based on the high value of oak woodlands to the evaluation species, and their declining abundance, the Service has determined oak/grey pine woodlands which would be affected by the project should be placed in Resource Category 2, with an associated mitigation planning goal of "no net loss of in-kind habitat value."

Table 3. Resource categories, evaluation species, and mitigation planning goal for the habitats possibly impacted by the proposed Folsom Dam Raise Project, Sacramento, El Dorado, and Placer Counties, California.

COVER-TYPE	EVALUATION SPECIES	RESOURCE CATEGORY	MITIGATION GOAL
Oak/Grey Pine Woodland	Acorn woodpecker, turkey, Mule deer	2	No net loss of in-kind habitat value or acreage.
Riparian Woodland	Belted kingfisher, Raptor guild	2	No net loss of in-kind habitat value or acreage.
Chaparral	Breeding birds	3	No net loss of habitat value while minimizing loss of in-kind habitat value.
Seasonal Wetland	Marsh wren, red-winged blackbird, great blue heron	2	No net loss of in-kind habitat value or acreage.
Annual grassland	Raptor guild, ground foraging birds	3	No net loss of habitat value while minimizing loss of in-kind habitat value.
Open Water	Sport fish	4	Minimize loss of habitat value
Other	None	4	Minimize loss of habitat value

Riparian Woodland

Riparian woodlands occur extensively along the lower American River, and in patches along perennial and intermittent streams and rivers flowing into Folsom Lake. 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 scrub shrub), 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 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 is California's largest urban riparian area (County of

Sacramento 2011) and is managed through the policies set forth in the Parkway Plan (County of Sacramento 2008), which has been adopted into the county general plan.

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 to 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 the riparian woodland because these species are all predators, playing a key role in the community ecology of the area. In addition, the evaluation species have a non-consumptive human use (e.g., bird watching) and are migratory birds, for which the Service has management responsibility under the Migratory Bird Treaty Act.

Riparian habitat is of generally high value to the evaluation species and is scarce in the project area and general eco-region. Therefore, the Service has determined riparian woodlands which would be affected by the project should be placed in Resource Category 2, with an associated mitigation planning goal of "no net loss of in-kind habitat value."

Chaparral

Chaparral occurs in patches around Folsom Lake, along the south arm of Folsom Lake, and along the North and South Forks of the American River. Chaparral has a dense overstory of woody evergreen shrubs, and is usually 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 (Service 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).

The evaluation species selected for chaparral habitat are breeding birds because they are important to the overall chaparral ecology as predators, prey, and seed dispersers. In addition, they were chosen because of the Service's responsibility for their protection and management under the Migratory Bird Treaty Act and they provide non-consumptive human use (e.g., bird watching, bird song). Chaparral habitat is a native habitat of generally high value to the evaluation species and is moderately scarce in the project area, but fairly abundant in the eco-region. Therefore, the Service has determined chaparral habitats which would be affected by the project should be placed in Resource Category 3, with an associated mitigation planning goal of "no net loss of habitat value while minimizing loss of in-kind habitat value."

Seasonal Wetland

Seasonal wetlands occur in small patches near seeps and springs, and in drainages entering Folsom Lake. Seasonal wetlands in the project area 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 the great blue heron, were chosen to evaluate the seasonal wetlands. 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. All three evaluation species have a non-consumptive human use (e.g., bird watching, bird song) and are migratory birds for which the Service has management responsibility under the Migratory Bird Treaty Act.

In the project vicinity, and in the eco-region in general, seasonal wetlands are relatively scarce and would be of high value to the evaluation species. Therefore, the Service designates the seasonal wetland cover-type in the project area as Resource Category 2, with an associated mitigation planning goal of "no net loss of in-kind habitat value."

Annual Grassland

Annual grasslands differ from woodland by lacking dominant tree cover and it appears that much of the treeless grassland found within 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 the western meadowlark, California quail, sparrows, and finches, and for small mammals such as voles and pocket gophers. These areas provide important foraging habitat for breeding raptors, including red-tailed hawks, American kestrels, and great horned owls. It also provides habitat for wintering raptors. Lastly, waterfowl, notably Canada geese, graze or green vegetation in the grasslands adjacent to Folsom Lake.

The evaluation species selected for the annual grassland cover-type are the raptor guild and passerine ground-foraging birds. The raptor guild was chosen because as a predator, raptors play a key role in the community ecology of the project area. Both evaluation species were selected because of the Service's responsibility for their protection and management under the Migratory Bird Treaty Act, and their overall high non-consumptive value to humans (e.g., birdwatching). While the values of this habitat vary according with season and grazing intensity, much of the grassland habitat in the project area provides medium to high value foraging habitat for diverse assemblages of birds of prey and ground-foraging passerine birds. Furthermore, the value of these habitats is often enhanced by their continuity with other adjacent habitats, such as wooded areas, cliffs, and ponds which provide nest and shelter sites. Grassland habitat within the project area is relatively abundant. Therefore, the Service designates the annual grassland cover-type in the project area as Resource Category 3. Our associated mitigation planning goal for these areas is "no net loss of habitat value while minimizing loss of in-kind habitat value."

Open Water

The evaluation species chosen for the open water cover-type are freshwater sport fish. The open water habitat is comprised of Folsom Lake. This evaluation species was chosen because of their consumptive and recreational value to humans and their importance as a prey item for many species of raptors and wading birds. This area has been highly impacted by recreational activities and contains mostly non-native sport fish. Therefore, the Service designates the open water cover-type as Resource Category 4. Our associated mitigation planning goal for these areas is "minimize loss of in-kind value."

Other

Other habitat includes disturbed areas such as parking lots, roads, and boat ramps. Evaluation species were not chosen for this cover-type because use by wildlife is minimal. In view of the extremely low habitat value for most wildlife species provided by these areas, the Service designates any highly disturbed habitats meeting the other habitat definition that would be impacted by the project as Resource Category 4, with a mitigation planning goal of "minimize loss of habitat value."

A habitat assessment using Habitat Evaluation Procedures (HEP) was completed in February 2007 to develop the compensatory mitigation acreage for the oak/grey pine woodland, riparian woodland, and seasonal wetland cover-types, and is included in Appendix B. The team evaluating the updated project proposal determined the 2007 HEP results were still valid as habitat attributes (tree height, crown cover, percent shrub cover, tree diameter at breast height, tree composition, etc.) have not changed significantly. Based on the results of the 2007 HEP, compensation ratios are: 1.2:1 for oak/grey pine woodland; 1.1:1 for riparian woodland; and 4:1 for seasonal wetland. The impact and compensation acreage for the oak/grey pine woodland, riparian woodland, and seasonal wetland cover-types for construction of the project are summarized in Table 4. The impact and compensation acreage for the oak/grey pine woodland and chaparral cover-types under the worst case scenario of complete inundation and loss of all vegetation within the inundation zone of the reservoir due to the project are summarized in Table 5.

Table 4. Summary of cover-types, impacted acres, and compensation recommended for the construction of the Folsom Dam Raise Project, Sacramento, El Dorado, and Placer Counties, California

Cover-Type Impacted	Impacted Acres: Compensation Acres Needed
Oak/grey pine woodland	4.9 : 5.9
Riparian Woodland	0.05 : 0.06
Seasonal Wetland	0.32 : 1.3
Total	**5.27 : 7.26**

Table 5. Preliminary summary of cover-types, impacted acres, and compensation recommended for the inundation of Folsom Lake as part of the Folsom Dam Raise Project, Sacramento, El Dorado, and Placer Counties, California

Cover-Type Impacted by Inundation	Impacted Acres: Compensation Acres Needed
Oak/grey pine woodland	781.5 : 939.4
Chaparral	32.2 : 34.1
Total	**813.7 : 973.5**

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 the 2007 HEP analyses (Appendix B) 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 outlines 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 could affect a site's suitability for restoration or creation. Therefore, any proposed mitigation site selection should be considered preliminary until such time as complete evaluation of a site is completed (i.e., evaluations of soil condition, surface hydrology, groundwater depth, and conditions in regard to salinity, alkalinity or toxins).

The 2007 HEP evaluation of conceptual 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 2007 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 2007 HEP analysis would need to be reviewed.

Construction Impact Mitigation Sites

The following tables (Tables 6-9) summarize the actions proposed at each hypothetical mitigation site used to complete the 2007 HEP analyses. Additional information is contained in the HEP report (Appendix B).

Table 6. Oak/Grey Pine Woodland Mitigation Site Development Criteria, Folsom Dam Raise Project, Sacramento, El Dorado, and Placer Counties, 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 plots. ·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 an Operations and Maintenance Manual.

Table 7. Riparian Woodland Mitigation Site Development Criteria, Folsom Dam Raise Project, Sacramento, El Dorado, and Placer Counties, 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 an Operations and Maintenance Manual.

Table 8. Seasonal Wetland Mitigation Site Development Criteria, Folsom Dam Raise Project, Sacramento, El Dorado, and Placer Counties, 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 an Operations and Maintenance Manual.

Table 9. Chaparral Mitigation Site Development Criteria, Folsom Dam Raise Project, Sacramento, El Dorado, and Placer Counties, 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, 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 an Operations and Maintenance Manual.

Operation Impact Mitigation Sites (Folsom Lake)

Since there are uncertainties on the effects 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 that encroach above the current maximum flood pool elevation of 466 feet), 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 than under the 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. As additional project information is developed these recommendations may be further refined.

The Service recommends that the Corps implement the following:

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

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

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

4. Avoid future impacts to the site by ensuring all fill material is free of contaminants.

5. Avoid impacts to migratory birds nesting in trees or on the ground along the access routes and adjacent to the proposed repair sites. Impacts can be avoided by conducting pre-construction surveys for active nests along proposed haul roads, staging areas, and construction sites. This would especially apply if construction begins in the spring or early summer. Work activity around active nests should be avoided until the young have fledged. The following protocol from the CDFW for Swainson's hawk would suffice for the pre-construction survey for raptors nesting in trees.

A focused survey for Swainson's hawk nests will be conducted by a qualified biologist during the nesting season (February 1 to August 31) to identify active nests within 0.25 mile of the project area. The survey will be conducted no less than 14 days and no more than 30 days prior to the beginning of construction. If nesting Swainson's hawks are found within 0.25 mile of the project area, no construction will occur during the active nesting season of February 1 to August 31, or until the young have fledged (as determined by a qualified biologist), unless otherwise negotiated with the California Department of Fish and Wildlife. If work is begun and completed between September 1 and February 28, a survey is not required.

6. Minimize impacts to wildlife from by selection materials least likely to lead to entrapment.

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

8. Minimize project impacts by reseeding all disturbed areas at the completion of construction with forbs and grasses.

9. Minimize the impact of removal and trimming of all trees and shrubs by having these activities supervised and/or completed by a certified arborist.

10. Compensate for the loss of 4.9 acres of oak/grey pine woodland habitat by developing 5.9 acres of oak/grey pine woodland habitat at a site jointly selected with the Service.

11. Compensate for the loss of 0.05 acre of riparian woodland habitat by developing 0.06 acre of riparian woodland habitat at a site jointly selected with the Service.

12. Compensate for the loss of 0.32 acre of seasonal wetland habitat by developing 1.3 acres of seasonal wetland habitat at a site jointly selected with the Service.

13. Develop a monitoring and adaptive management program 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 that 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. Implementation of the monitoring and adaptive management program should be budgeted in advance.

14. Develop operation and maintenance manuals for all mitigation sites developed for this project. Coordinate with the Service on the development of these manuals.

15. Contact the NOAA Fisheries for possible effects of the project on federally-listed species under their jurisdiction.

16. Contact the CDFW regarding possible effects of the project on State listed species.

17. Re-survey the construction and staging areas, borrow sites, and access/haul roads for the presence of any new elderberry shrubs prior to construction activity.

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APPENDIX A

Figures

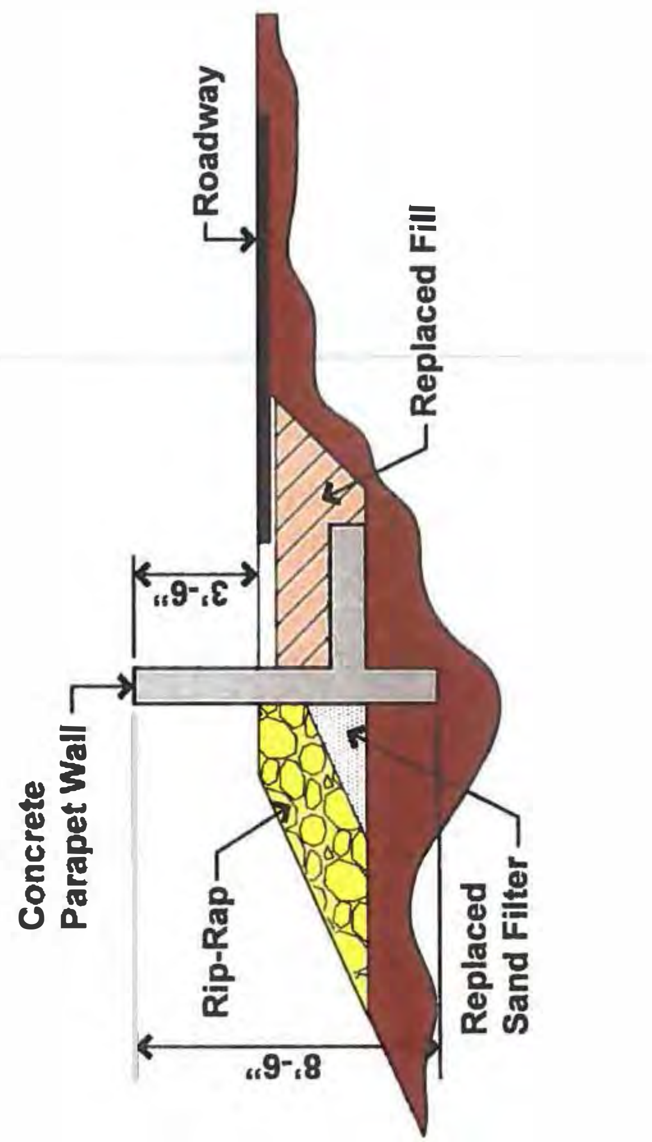


Figure 2-11
3.5 foot Raised Flood Wall

CDM

Figure 1. Conceptual illustration of a 3.5 foot reinforced concrete floodwall

Figure 2. Staging areas, haul routes, and Left Wing Dam

Figure 3. Staging areas, haul routes, and Dikes 1-3

Figure 4. Staging areas, haul routes, Dikes 4-6, and Right Wing Dam

Figure 5. Staging areas, haul routes, Dikes 7-8, and Left Wing Dam

Figure 6. Staging areas, haul routes, and Mormon Island Auxiliary Dam

APPENDIX B

Habitat Evaluation Procedures (HEP)
February 2007

INTRODUCTION

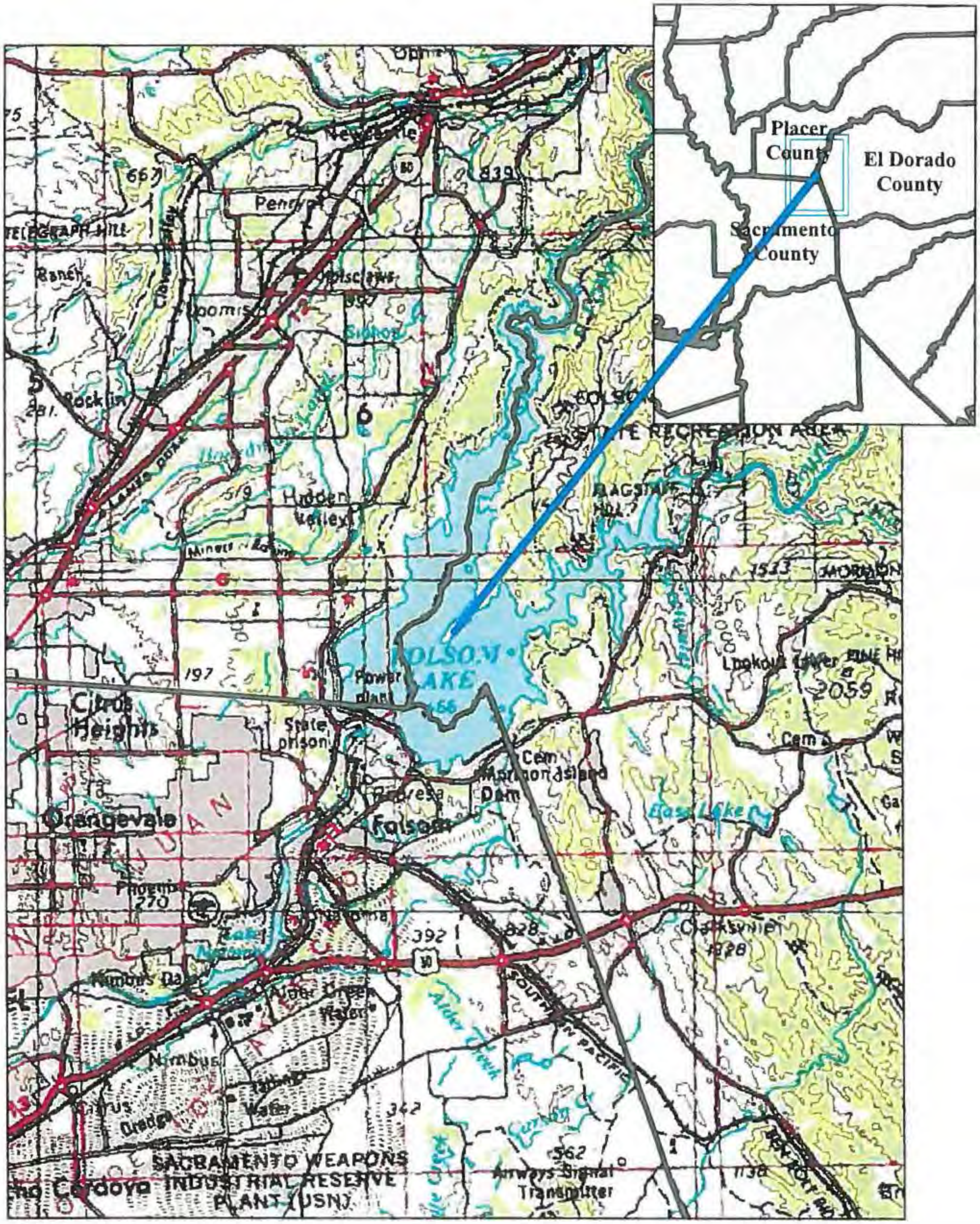
The U.S. Army Corps of Engineers (Corps) and the U.S. Bureau of Reclamation (Reclamation) seek to significantly reduce the risk of flooding along the main stem of the American River in the Sacramento area while meeting dam safety and public safety objectives. The project is authorized by the Corps' American River Watershed Investigation, Folsom Dam Modification project under section 101 (a) (6) of the Water Resources Development Act (WRDA) of 1999 and the Bureau's Dam Safety Program (static, earthquake, etc) (Reclamation 2006). 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 flood damage reduction improvements and address dam safety needs at Folsom Dam and Reservoir as one Joint Federal Project.

This application of Habitat Evaluation Procedures (HEP) is intended to provide a quantification of the impacts on fish and wildlife resources associated with Folsom Dam Safety and Flood Damage Reduction (Folsom DS/FDR). Any dam raise or spillway construction measure would be a major modification and would allow Folsom Dam to pass the probable maximum flood (PMF) volume without failure and meet Reclamation's Dam Safety Program.

PROJECT AREA

The project area is in the American River watershed, and would affect lands around Folsom Reservoir, and along the North and South Forks of the American River, which are impounded by Folsom Dam (Figure 1 and Figure 2). The project could also directly affect the Mormon Island Preserve located just downstream of Mormon Island Auxiliary Dam (MIAD) and the lower American River--the river's reach downstream of Folsom Dam (Figure 3).

The American River is the second largest tributary to the Sacramento River. The three forks (north, middle, and south) of the river originate in the Sierra Nevada Mountains at an elevation of about 10,400 feet (mean sea level), and generally flow in a southwesterly direction. The Middle Fork joins the North Fork near the City of Auburn, just upstream of Folsom Reservoir; the North Fork then joins the South Fork just upstream of Folsom Dam. All three forks of the American River above Folsom Reservoir are nationally popular areas for whitewater sports, and the reach of the South Fork from Coloma to the reservoir is the State's most popular whitewater rafting run.



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Project Vicinity- Folsom Reservoir

Figure 1

Prepared by the US Fish and Wildlife Service Sacramento Fish and Wildlife Office Flood and Waterway Planning Branch Sacramento CA September 18 2006

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

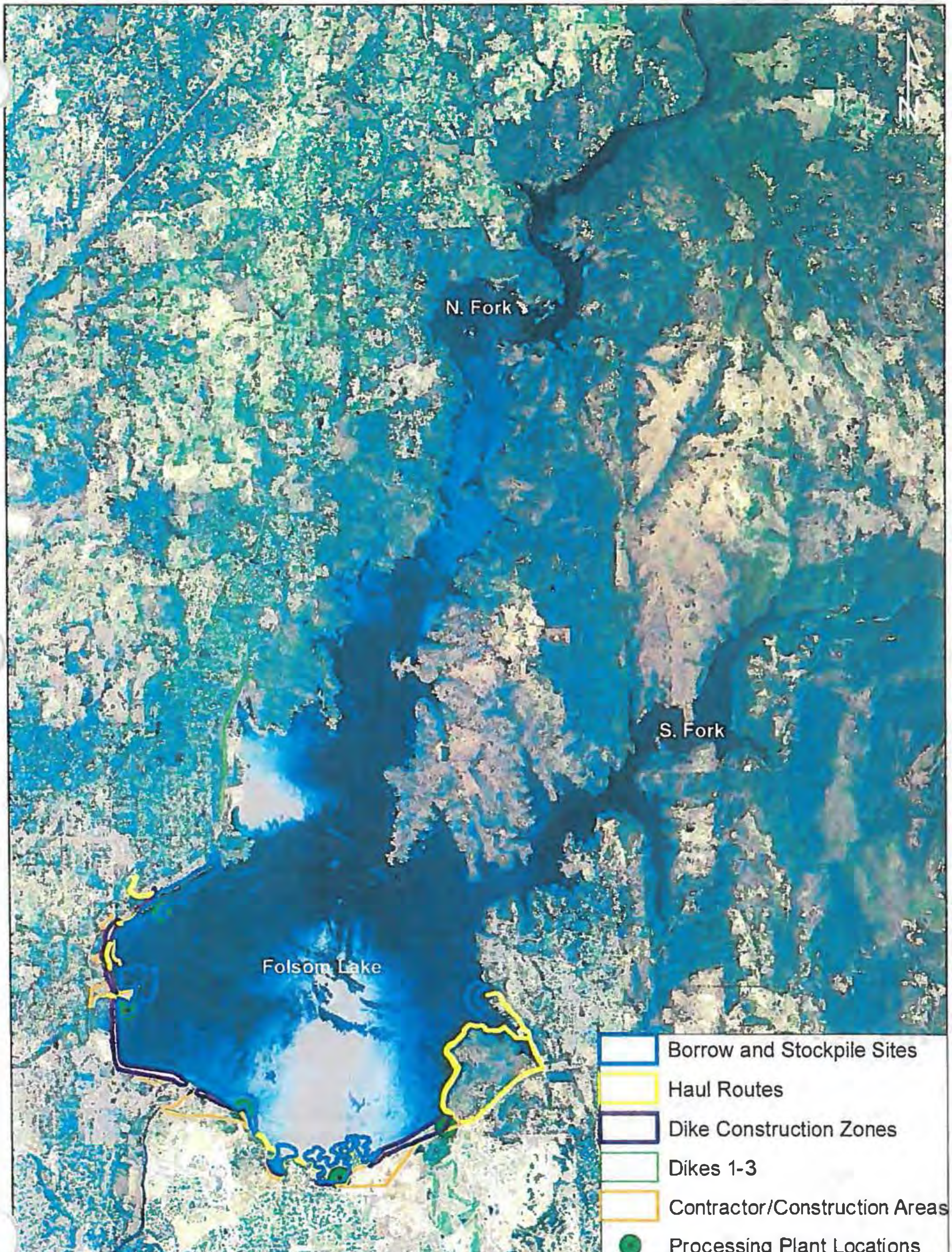


Figure 2- Project Location

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 herein.

0 0.5 1 2 Miles

Mormon Island Auxiliary Dam and **Morman Island Preserve** Figure 3

Dra... ...ject to Change

Folsom Dam, located near the city of Folsom, is a multi-purpose dam built by the Corps in 1955, and operated by Reclamation. It is the largest of about 20 dams in the American River watershed and, except for Nimbus Dam, is the furthest downstream. Five reservoirs in the upper American River watershed (Loon Lake, Ice House, Union Valley, French Meadows, and Hell Hole) represent 90% of the existing storage capacity upstream of Folsom Reservoir.

The main dam is a 345-foot high concrete gravity dam across the American River channel. Associated with Folsom Dam is a series of auxiliary dams and dikes which span topographic lows; these structures are needed to contain the reservoir. Mormon Island Dam is the largest of these structures, and is located on the southeast end of the reservoir. Folsom Reservoir blocks about 20 miles of the North Fork and 10 miles of the South Fork, and has a total storage capacity of 974,000 acre-feet, which fills the reservoir to an elevation of 466 feet above mean sea level (msl).

Reclamation operates Folsom Dam as an integrated component of the Central Valley Project. The dam's primary purposes have been to: provide flood control; provide instream flows; manage Sacramento-San Joaquin Delta water quality; produce hydropower; provide recreation; and more recently, protection and restoration of the region's fish and wildlife resources.

PROJECT DESCRIPTION

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 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 serves to dam water 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.

The improvements would be designed so that they could be constructed and operated without affecting ongoing water conservation and hydropower operations. The plan would maintain the current Folsom Dam design flood control release of 115,000 cubic feet per second (cfs) and an emergency release of 160,000 cfs. Four scales of enlargement alternatives were developed using maximum flood control pool elevations of 468, 486.5, 489.5 and 499.5 feet msl.

Several constraints were imposed on plan formulation for Folsom DS/FDR project, these are:

- dam raise measures are solely for flood control as stipulated in section 566 of WRDA 1999;

- o dam raise measures are to avoid disruptions to the normal operation of Folsom Dam for water supply, hydropower, and flood control;
- o no loss of flood protection from existing flood damage reduction projects is permitted;
- o minimize disturbance of habitat for threatened and endangered species.

The no action alternative serves as the base against which the proposed flood protection and Dam Safety alternatives will be evaluated to determine effectiveness and to identify effects that would result from them. Several actions that are currently authorized are expected to be completed prior to implementation of any Folsom DS/FDR project. Therefore, the effects and benefits associated with these actions are part of the no-action condition. See the accompanying Fish and Wildlife Coordination Act report for a complete description of the no action condition. A complete project description can be seen in the March 2007 Folsom DS/FDR FEIR/EIR.

Alternative 1 – No Dam Raise/Minimal Embankment Raise, Fuseplug 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 – 4-foot Dam and Embankment Raise

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 could 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 could be raised to address hydrologic concerns and to provide additional flood storage capacity.

Alternative 3; Preferred Alternative- Joint Auxiliary Spillway, 3.5-foot Parapet Wall 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.

A tentative schedule showing the sequencing of construction for the preferred alternative is shown in Table 1.

Table 1 Folsom DS/FDR Project Phase Sequencing		
Activity ID	**Folsom Facility**	**Construction Period**
1	Auxiliary Spillway Excavation Phase 1	September 2007 to March 2009
2	Right and Left Wing Dam Static Modifications	February 2008 to March 2009
3	Mormon Island Jet Grouting	July 2008 to December 2009
4	Auxiliary Spillway Excavation Phase 2	September 2010 to January 2014
5	Dike 5 Static Modifications	September 2009 to May 2010
6	Mormon Island Seismic Overlay	June 2015 to April 2017
7	Dike 4 and 6 Static Modifications	September 2017 to April 2018
8a	Pier Tendon Installation at Main Dam	January 2014 to March 2015
8b	Spillway Pier Wraps & Braces	August 2016 to April 2018
8c	Spillway Gate Repairs	January 2018 to August 2020
9	Auxiliary Spillway Approach Channel Excavation and Gate Structure Construction	September 2011 to December 2014
10	Raise of all Folsom Facilities	September 2018 to September 2019

Alternative 4 – 7-foot Dam and Embankment Raise

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 – 17-foot Dam and Embankment Raise

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.

METHODOLOGY

HEP is a methodology developed by the Fish and Wildlife Service (Service) and other State and Federal resource and water development agencies which can be used to document the quality and quantity of available habitat for selected fish and wildlife species. HEP provides information for two general types of habitat comparisons: (1) the relative value of different areas at the same point in time; and (2) the relative value of the same areas at future points in time. By combining the two types of comparisons, the impacts of proposed or anticipated land-use and water-use changes on habitat can be quantified. In a similar manner, any mitigation needs (in terms of acreage) for the project can also be quantified, provided a mitigation plan has been developed for specific alternative mitigation sites.

A HEP application is based on the assumption that the value of a habitat for selected species or the value of a community can be described in a model which produces a Habitat Suitability Index (HSI). This HSI value (from 0.0 to 1.0) is multiplied by the area of available habitat to obtain Habitat Units (HUs). The HUs and Average Annual Habitat Units (AAHUs) over the life of the project are then used in the comparisons described above.

The reliability of a HEP application and the significance of HUs are directly dependent on the ability of the user to assign a well-defined and accurate HSI to the selected evaluation elements or communities. Also, a user must be able to identify and measure the area of each distinct habitat being utilized by fish and wildlife species within the project area. Both the HSIs and the habitat acreage must also be reasonably estimable at various future points in time. The HEP team, comprised of Corps, Reclamation and Service staff, determined that these HEP criteria could be met, or at least reasonably approximated, for the Folsom DS/FRD project. Thus HEP was considered an appropriate analytical tool to analyze impacts of the proposed project alternatives[1]. Further the HEP team determined that HSI values for habitats impacted by the Folsom DS/FRD project would be taken from the American River Watershed Investigation, Folsom Bridge (Bridge) project, the American River Watershed Investigation Long-Term Evaluation (Long-Term) and the American River Watershed Investigation Folsom Dam Modification (MODS) project. HSI values for oak/grey pine woodland and seasonal wetland habitats were used from the data collected in Reach 1 and riparian woodland habitat HSI values were used from data collected in Reach 3 in 2005, from the Bridge project. Chaparral HSI values were taken from Long-Term data, collected in 2000 for the inundation impacts and the direct impacts for chaparral HSI values were taken from MODS data, collected in 2004, for the staging, borrow and construction use areas.

GENERAL HEP ASSUMPTIONS

Some general assumptions are necessary to use HEP and Habitat Suitability Index (HSI) Models in the impact assessment:

[1] For further information on HEP see ESM 100-104 which is available from the Service's Sacramento Fish and Wildlife Office

Use of HEP:

1. HEP is the preferred method to evaluate the impacts of the proposed project on fish and/or wildlife resources.
2. HEP is a suitable methodology for quantifying project-induced impacts to fish and wildlife habitats.
3. Quality and quantity of fish and wildlife habitat can generally be numerically described using the indices derived from the HSI models and associated habitat units.
4. The HEP assessment is applicable to the habitat types being evaluated.

Use of HSI Models

5. HSI models are hypotheses based on available data.
6. HSI models are conceptual models and may not measure all ecological factors that affect the quality of a given cover-type for the evaluation species (e.g. vulnerability to predation). In some cases, assumptions may need to be made by the HEP Team and incorporated into the analysis to account for loss of those factors not reflected by the model.

The additional HEP field work for the project was completed by staff from the Service's Sacramento Fish and Wildlife Office, the Corps (Sacramento District) and Reclamation and occurred during May 2006 and included vegetation mapping around the Folsom Reservoir. Six cover-types would be permanently impacted by the project including oak woodland, oak savannah, blue oak/grey pine woodland, riparian woodland, seasonal wetland, annual grassland and other[2]. These cover-types were mapped by the HEP Team on aerial photographs in the field then digitized into ArcGIS. Using the project footprint supplied by Reclamation and the Corps acreages were quantified using GIS. The cover-types and acreage affected by the proposed work is summarized in Table 2 and Table 3.

2. "Other" encompasses those areas which do not fall within the other cover-types such as gravel and paved roads, parking areas, buildings, bare ground, riprap, etc

Table 2. Summary of Cover-Types, Acres Impacted, and Compensation Recommended for the Alternatives Compared to the Preferred Alternative for the Construction of the Folsom DS/FRD 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**				

Table 3. Preliminary Summary of Cover-Types, Impacted Acres and Compensation Recommended for the Inundation 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 (Preferred)	**4-ft Raise**	**7-ft Raise**	**17-ft Raise**
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.

Eleven HSI models were used in this HEP application to quantify project impacts. A summary of the models applied for each cover-type is also included in Table 4. The western gray squirrel and plain titmouse models were selected to evaluate the oak woodland, and oak/grey pine woodland cover-types. These species were chosen because they utilize this cover-type for

Table 4. HEP Cover-types, proposed HSI models, and model variables for the Folsom DS/FDR Project, California.

COVER-TYPE	PROPOSED I	HSI MODEL VARIABLES
(1) Oak woodland	Western gray squirrel	V1 - Canopy closure of mast-producing species>5m tall V2 - Density of leaf litter layer V3 - Tree canopy cover V4 - Den site availability per acre
	Plain titmouse	V1 - Tree diameter V2 - Trees per acre V3 - % composition of tree species that are oaks
(2) Riparian woodland	Yellow wa bler	V1 - % deciduous shrub crown cover V2 – Average height of deciduous shrub canopy V3 - % deciduous shrub canopy comprised of hydrophytic shrubs
	Northern oriole	V1 - Average height of deciduous tree shrub V2 – % deciduous tree crown cover V3 – Stand width
	Western fence lizard	V1 - % ground cover V2 –Average size of ground cover objects V3 – Structural diversity/interspersion V4 - % canopy cover
(3) Seasonal wetlands	Great egret (feeding)	V1 - Percentage of area with water 10-23 cm deep V2 - Percentage of submerged or emergent vegetation cover in zone 10-23 cm deep
	California vole	V1 - Height of herbaceous vegetation V2 - Percent cover of herbaceous vegetation V3 - Soil type V4 - Presence of logs and other types of cover
	Red-winged blackbird	V1 - Predominance of narrow or broadleaf monocots V2 - Water presence throughout the yea V3 - Presence or absence of carp V4 - Presence or absence of damselflies or dragonflies V5 - Mix of herbaceous vegetation V6 - Suitability of foraging substrate
(4) Chaparral	Bobcat	V1 - % shrub cover V2 - % herbaceous cover V3– degree of patchiness V4 – rock outcroppings
	Wrentit	V1 - % shrub cover V2 - % shrub cover ≤5 feet
	California thrasher	V1 – Presence of low shrub openings V2 – Shrub/seedling cover
(5) Annual grassland	No HEP proposed; disturbed areas will be reseeded after construction is complete.	

nesting and foraging. The western fence lizard, yellow warbler, and northern oriole models were chosen to evaluate the project impacts to the riparian woodland cover-type. These species were selected because the bird species utilize the riparian tree canopy provided by the cover-type for nesting and foraging. For analysis purposes these two cover types were treated as one because the same models were chosen by the HEP Team. The western fence lizard utilizes the ground component of the cover-type including rocks boulders, and downed wood for shelter and foraging.

The red-winged blackbird, great egret (feeding) and California vole models were selected for evaluating impacts to the seasonal wetland cover-type because these species forage, nest, or inhabit this cover-type.

The bobcat, wrentit and California thrasher models were selected for evaluating impacts to the chaparral cover-type because these species forage, nest, or inhabit this cover-type.

The annual grassland and "other" cover-types were not included in the HEP analysis because they do not currently provide significant habitat for wildlife species or the conditions (habitat values) after the completion of work are expected to be similar to pre-project conditions.

The cover-type designations and HSI models were also selected in part to be consistent with previous impact analyses completed for the American River Watershed Investigation Folsom Dam Modification project which is occurring concurrently with the Folsom Bridge project. More information on the HEP for those projects can be found in the Service's Fish and Wildlife Coordination Act Report for those projects.

RESULTS AND DISCUSSION

This HEP analyzed the potential impacts of the proposed Folsom DS/FDR project. Impact areas were divided into five components to facilitate possible design changes and subsequent impact analyses as the planning process proceeds toward selection of a construction alternative. The components are: (1) the construction footprint of the spillway alternatives; (2) impacts associated with Safety of Dams construction at dikes 4 thru 8, both wing dams, and MIAD; (3) impacts from borrow and stockpile; (4) impacts associated with the Flood Damage Reduction construction as dikes 1 thru 3; and (5) the potential impacts to vegetation in the new reservoir inundation zone.

The HEP does not address potential impacts to aquatic resources at Folsom Reservoir during construction, nor are potential lower American River fishery impacts addressed for the construction period or subsequent reservoir operation.

Construction Impacts
The impacts and mitigation recommended for the Preferred Alternative for the Folsom DS/FDR project is summarized in Table 5. A specific compensation site was not analyzed in this HEP application. Instead a typical site was developed, and assumptions were made that the site would be an annual grassland area without existing woody vegetation for a baseline condition. For the riparian and seasonal wetland cover-types, a critical assumption was made that any site selected for compensation would require the appropriate hydrology to support these cover-types.

Folsom Reservoir Inundation
Between 811.74 and 1,323.35 acres could 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 which provides little or no value for wildlife species, and some support vegetation that is tolerant of flooding. Table 5 summarizes the acreages of each habitat which provides value for wildlife and is expected to receive inundation over the life of the project. Inundation effects around Folsom Reservoir would occur in large part by the frequency, timing, and duration of flooding. Studies to date indicate that predicting the effects of inundation on vegetation is not straightforward. The raising of Folsom Dam would have potential for at least two significant impacts on vegetation: (1) changes in vegetation composition caused by inundation affecting survival and reproduction of vegetation within 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 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 reasonably be expected to fill during a major spring flood event, when oaks are actively growing. The absence of blue oaks within the current inundation zone of Folsom Reservoir and other foothill impoundments indicate that blue oaks cannot tolerate the flooding regime existing there. Further, evergreen species, including grey pines and live oaks, occur commonly around the reservoir, 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 of the saturated soil in the new inundation area during a flood event from the water being drawn down or 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

Table 5. **Alternative 3, Preferred**- Summary of Cover-Types, Acres Impacted, Net Change in Average Annual Habitat Units With- and Without-Project, and Compensation Recommended for the Direct Impacts and Inundation Impacts of Construction and Raise of the Folsom DS/FDR Project, California.

Folsom Dam Auxiliary Spillway and Dike Construction						
	Cover-Type	**Acres Impacted**	**AAHUs W/O Project**	**AAHUs W/ Project**	**Net Change in AAHUs**	**Compensation Needed**
Construction, Haul Rds, Borrow & Stockpile	Oak - grey pine woodland	35.29	0.07	16.23	-16.16	42.37
	Riparian woodland	39.08	0.13	30.09	-19.96	43.88
	Seasonal wetland	0.89	0.00	0.18	-0.18	3.56
	Chaparral	0.26	0.04	0.15	-0.10	0.27
Dikes 4-8, Wing Dams & MIAD	Oak - grey pine woodland	16.04	7.38	0.04	-7.34	20.75
	Riparian woodland	1.93	1.49	0.01	-1.48	2.19
	Seasonal wetland	0.28	0.06	0.00	-0.06	1.12
	Chaparral	0.26	0.15	0.04	-0.10	0.28
Spillway (Six-Gate)	Oak - grey pine woodland	1.07	0.49	0.00	-0.49	1.38
	Riparian woodland	1.66	1.28	0.01	-1.27	1.88
	Seasonal wetland	0	0	0	0	0
	Chaparral	0.21	0.12	0.03	-0.08	0.22
Raise- 0 feet (Inundation)	Oak - grey pine woodland	773.08	355.62	1.57	-354.04	928.23
	Riparian woodland	45.45	35.00	35.00	0.00	0
	Seasonal wetland	0.58	0.12	0.12	0.00	0
	Chaparral	32.22	23.20	5.24	-17.96	34.08
[3]Dikes 1-3 Raise	Oak - grey pine woodland	8.46	3.89	0.02	-3.87	11.16
	Riparian woodland	0.02	0.02	0.54	-0.02	0.02
	Seasonal wetland	0	0	0	0	0
	Chaparral	0	0	0	0	0

[3] Construction at Dike 1-3 is dependent on the implementation of the raise component of the Folsom DS/FDR project. Impact acres for this component are preliminary in this document.

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 (except riparian and seasonal wetlands) 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 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 the best management practices at the time (replanting on site would be the first priority).

FOLSOM BRIDGE PROJECT

REACH 1 EAST NATOMA STREET TO PARKING LOT NEAR SOUTH END OF DAM

PA 1 - Future Without Project (Impact Area)

OAK WOODLAND

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured)
- V1 - % canopy closure of trees and shrubs that produce hard mast (65%)
- V2 - Density of leaf litter layer (M)
- V3 - % tree cover (61%)
- V4 - Den site availability (53)

HSI Food $= (V1 \times V2)^{1/2}$ HSI Cover/Reproduction $= (V3 \times V4)^{1/2}$

HSI = 0.46 (lowest of values)

TY 1
- V1 - no change from TY 0
- V2 - no change from TY 0
- V3 - no change from TY 0
- V4 - no change from TY 0

HSI = 0.46

TY 60
- V1 - no change from TY 1
- V2 - no change from TY 1
- V3 - no change from TY 1
- V4 - no change from TY 1

HSI = 0.46

PLAIN TITMOUSE

TY 0 - Baseline (measured)
- V1 - dbh
- V2 - Number trees/acre
- V3 - % trees that are oaks

$$HSI = \frac{V1 + V2 + V3}{3}$$

HSI = 0.65

TY 1
- V1 - no change from TY 0
- V2 - no change from TY 0
- V3 - no change from TY 0

HSI = 0.65

TY60 V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.65

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. temporary easement areas will not be replanted with woody vegetation

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured) HSI = 0.46

TY 1 -	V1 - no trees	SI = 0
	V2 - low leaf litter	SI = 0.2
	V3 - no trees	SI = 0
	V4 - no den sites	SI = 0

HSI Food = $(V1 \times V2)^{1/2}$ = $(0 \times 0.2)^{1/2}$ = 0

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$ = $(0 \times 0)^{1/2}$ = 0

HSI = 0

TY 60- V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0

TY 100 no change from TY60

PLAIN TITMOUSE

TY 0 - Baseline (measured) HSI = 0.65

TY 1 -	V1 - no trees	SI = 0.2
	V2 - no trees	SI = 0
	V3 - no trees	SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2}{3} = 0.06$$

TY 60- V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1

HSI = .06

TY 100 – no change from TY60

MP 1 - Management Area - Future Without Project (Compensation Site)

Assume: 1. Annual grassland area selected for conversion to oak woodland.

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated)

V1 - % canopy closure of trees and shrubs that produce hard mast (no trees) SI = 0
V2 - Density of leaf litter (low) SI = 0.2
V3 - Den site availability (no trees) SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0 \times 0.2)^{1/2}$
= 0

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(0 \times 0)^{1/2}$
= 0

HSI = 0

TY 1 -
V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0

TY 15 - no change from TY 1 HSI = 0
TY 60 - no change from TY 15
TY 100- no change from TY TY60

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

V1 - dbh (0) SI = 0.2
V2 - Number trees/acre (0) SI = 0
V3 - % trees that are oaks (0) SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = .06$$

TY 1 -
V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = .06

TY 15 - no change from TY 1 HSI = .06
TY 60 - no change from TY 15 HSI = .06
TY 100- no change from TY 60

MP 2 - Management Area - Future With Project (Compensation Site)

Assume:
1. Acquire lands (currently annual grasslands)
2. Annual grassland area prepared for planting in TY 1, provide access and maintenance roads
3. Plant 100% blue and live oak trees (4"x4"x14" tree pots) at a density of 400 trees/acre and cover crop
4. Moderate management intensity (assume 1.5 inches dbh after 10 yrs; 90 percent survival).
5. Watering, weed, pest control for minimum of 3 years and remedial actions as necessary to ensure plant establishment.
6. Assume maximum growth rate of 12"/year
7. Develop O&M manual
8. TY 51 values equal values measured for impact zone

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated) HSI = 0

TY 1 - V1 - tree species planted /no mast SI = 0
V2 - low SI = 0.2
V3 - 0 (no trees) SI = 0
V4 - 0 (no trees) SI = 0

HSI = 0

TY 15 - V1 - oak trees reach 16ft. high 8% SI = 0.15
V2 - low SI = 0.2
V3 - 8% SI = 0.15
V4 - 0 SI = 0

HSI Food = $(V1 \times V2)^{1/2}$ = $(0.15 \times 0.2)^{1/2}$ = .17

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$ = $(0.15 \times 0)^{1/2}$ = 0

HSI = 0

TY60 V1 - 40% SI = 0.8
V2 - medium SI = 0.8
V3 - 53% SI = 1.0
V4 - 24/ac SI = 1.0

HSI Food = $(V1 \times V2)^{1/2}$ = $(0.8 \times 0.2)^{1/2}$ = 0.40

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$ = $(1.0 \times 1.0)^{1/2}$ = 1.0

HSI = 0.40

TY 100 V1 - 60% SI = 1.0
V2 - high SI = 1.0
V3 - 53% SI = 1.0
V4 - 24/ac SI = 1.0

HSI Food = $(V1 \times V2)^{1/2}$ = $(1.0 \times 1.0)^{1/2}$ = 1.0

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$ = $(1.0 \times 1.0)^{1/2}$ = 1.0

HSI = 1.0

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

HSI = .06

TY 1 -	V1 - tree species planted (oak) (0 dbh)	SI = 0.2
	V2 - 400 (100% ≤ 16 ft tall; no trees)	SI = 0
	V3 - 100% (no trees)	SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = 0\ .06$$

TY 15 -	V1 - oak trees reach 16 ft. high (dbh = 1.75)	SI = 0.2
	V2 - ≥ 100 tree/ac	SI = 1.0
	V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = 0.73$$

TY 60 -	V1 - 13 dbh	SI = 0.6
	V2 - ≥ 100 tree/ac	SI = 1.0
	V3 - 100%	SI = 1.0

$$HSI = \frac{0.6 + 1.0 + 1.0}{3} = 0\ .86$$

TY 100- no change from TY60

PA 1 - Future Without Project (Impact Area)

SEASONAL WETLAND

GREAT EGRET

TY 0 – Baseline (measured)

V1 - % area with water 4-9 inches deep
V2 - % of substrate in zone 4-9 inches deep with sub- and emergent vegetation

$$HSI = \frac{V1 + V2}{2} = 0.23$$

TY 1 – no change from baseline HSI = 0.23
TY 60 – no change from baseline HSI = 0.23
TY 100- no change from baseline

RED-WINGED BLACKBIRD

TY 0 – Baseline (measured)

V6 quality of foraging areas within 620 feet of suitable nest areas

Condition C wetland $HSI = (0.1 \times V6)^{1/2} = 0.2$

TY 1 – no change from baseline HSI = 0.2
TY 60 – no change from baseline HSI = 0.2
TY 100 – no change from baseline

CALIFORNIA VOLE

TY 0 – Baseline (measured)

V1 – Height herbaceous vegetation
V2 - % herbaceous cover
V3 – Soil type

$$HSI = \frac{V1 + V2 + V3}{3} = 0.76$$

TY 1 – no change from baseline HSI = 0.76
TY 60 – no change from baseline HSI = 0.76
TY 100- no change from baseline

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. temporary easement areas will not be replanted with woody vegetation
3. existing drainages culverted under roads

GREAT EGRET

TY 0 – Baseline (measured)

V1 - % area with water 4-9 inches deep
V2 - % of substrate in zone 4-9 inches deep with sub- and emergent vegetation

$$HSI = \frac{V1 + V2}{2} = 0.23$$

TY 1 – V1 – 0 SI = 0
V2 - 0 SI = 0.1

$$HSI = \frac{0 + 0.1}{2} = 0.05$$

TY 60 – no change from TY 1 HSI = 0.05
TY 100 no change from TY60

RED-WINGED BLACKBIRD

TY 0 – Baseline (measured)

V6 quality of foraging areas within 620 feet of suitable nest areas

Condition C wetland $HSI = (0.1 \times V6)^{1/2} = 0.2$

TY 1 – no change from baseline HSI = 0
TY 60 – no change from baseline TY 1 HSI = 0
TY 100 – no change from baseline

CALIFORNIA VOLE

TY 0 – Baseline (measured)

V1 – Height herbaceous vegetation
V2 - % herbaceous cover
V3 – Soil type

$$HSI = \frac{V1 + V2 + V3}{3} = 0.76$$

TY 1 – V1 – 0 SI = 0
V2 – 0 SI = 0
V3 – not silty or loamy ; not friable SI = 0.2

$$HSI = \frac{0 + 0 + 0.2}{3} = 0.06$$

TY 60 – no change from TY 1 HSI = 0.06
TY 100 – no change from TY60

MP 1 - Future Without Project (Compensation Area)

Assumption: 1. Annual grassland area will be converted to wetlands

GREAT EGRET

TY 0 - Baseline (measured)
V1 - % of area with water 4-9 inches deep (0) SI = 0
V2 - % of area 4-9 deep with emergent/submergent vegetation (0) SI = .1

$$HSI = \frac{V1 + V2}{2} = \frac{0 + 0.1}{2} = .05$$

TY 1 no change from TY 0
TY 4 no change from TY 1
TY 60 no change from TY 4
TY 100 no change from TY 60

CALIFORNIA VOLE

TY 0 - Baseline (estimated)
V1 - Height of herbaceous vegetation (≥ 6in.) SI = 1.0
V2 - % cover of herbaceous vegetation (80%) SI = 6.7
V3 - soil type (mod. friable) SI = 0.5

TY 1 - V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{1.0 + 0.7 + 0.5}{3} = .73$$

TY 4 - V1 - no change from TY 1
TY 60 - V1 - no change from TY 4
TY 100- no change from TY 60

RED-WINGED BLACKBIRD

TY 0 - Baseline (estimated) - upland area unsuitable for species HSI = 0

TY 1 - no change from TY 0
TY 4 - no change from TY 1
TY 60 - no change from TY 4
TY 100 – no change from TY 60

MP 2 - Future With Project (Compensation Site)

Assumption:
1. Acquire annual grassland area
2. Portion of wetland area will have permanent water
3. Wetland will be designed to provide equal mix of open water and emergent vegetation
4. Carp will not be stocked
5. Site baseline is a Condition C wetland.
6. Site is minimum of 1-acre in size and access and maintenance roads are provided.
7. 40% of area designed for summer conditions of water 4-9 in deep
8. Plant appropriate wetland plant species, provide pest control and maintenance as needed for minimum of 3 years or until wetland is established.
9. Cover crop planted on all disturbed non-wetland areas.

GREAT EGRET

TY 0 - Baseline (estimated)
V1 - % of area with water 4-9 inches deep (0) SI = 0
V2 - % of area with water 4-9 deep with emergent/submergent vegetation SI = 0.1

$$HSI = \frac{V1 + V2}{2} = \frac{0 + 0.1}{2} = .05$$

TY 1 - V1 - 40% SI = 0.4
V2 - 5% SI = 0.2

$$HSI = \frac{0.4 + 0.2}{2} = \frac{0.6}{2} = .30$$

TY 4 - V1 - 40% SI = 0.4
V2 - 40% - 60% SI = 1.0

$$HSI = \frac{0.4 + 1.0}{2} = .70$$

TY 60 - no change from TY 4 HSI = .70
TY 100 no change from TY 60

CALIFORNIA VOLE

TY 0 - Baseline (estimated)
V1 - Height of herbaceous vegetation ($\geq$ 6 in.) SI = 1.0
V2 - % cover of herbaceous vegetation (80%) SI = 0.7
V3 - soil type (mod friable) SI = 0.5

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{1.0 + 0.7 + 0.5}{3} = .73$$

TY 1 -	V1 - ≥ 6 in	SI = 1.0
	V2 - 90%	SI = 0.85
	V3 - no change fro baseline	SI = 0.5

$$HSI = \frac{1.0 + 0.85 + 0.5}{3} = .78$$

TY 4 -	V1 - no change from TY 1	SI = 1.0
	V2 - 100%	SI = 0
	V3 - no change from TY 1	SI = 0.5

$$HSI = \frac{1.0 + 0.85 + 0.5}{3} = .78$$

TY 60- no change from TY 4
TY 100 –no change from TY 60

RED-WINGED BLACKBIRD

TY 0 - Baseline (estimated) - upland area unsuitable for species

HSI = 0

TY 1 -	V1 - Emergent vegetation is old/new growth monocot (other)	SI = 0.1
	V2 - Water present throughout year (yes)	SI = 1.0
	V3 - Carp presence (absent)	SI = 1.0
	V4 - larvae of dragonflies/damselflies presence (yes)	SI = 1.0
	V5 - vegetation density (sparse first year)	SI = 0.1

$$HSI = (V1 + V2 + V3 + V4 + V5)^{1/5} = (0.1 \times 1.0 \times 1.0 \times 1.0 \times 0.1)^{1/5} = 0.1$$

TY 4 -	V1 - old/new growth monocots	SI = 1.0
	V2 - no change	SI = 1.0
	V3 - no change	SI = 1.0
	V4 - no change	SI = 1.0
	V5 - 50%	SI = 1.0

$$HSI = (1.0 \times 1.0 \times 1.0 \times 1.0 \times 1.0)^{1/5} = 1.0$$

TY 60 - no change from TY 4 HSI = 1.0
TY 100- no change from TY 60

REACH 3 - FOLSOM PRISON ACCESS ROAD TO SOUTH END OF BRIDGE

RIPARIAN

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover
V2 - average height of deciduous shrub canopy
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs

$HSI = (V1 \times V2 \times V3)^{1/3}$

TY 1 – no change from baseline HSI = 0.22
TY 60 – no change from baseline HSI = 0.22
TY 100 – no change from baseline

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy
V2 - % deciduous tree crown cover
V3 – stand width

$HSI = (V1 \times V2 \times V3)^{1/3}$

TY 1 – no change from baseline HSI = 0.77
TY 58 – no change from baseline HSI = 0.77
TY 100 – no change from baseline

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover
V2 - average size of ground cover objects
V3 - structural diversity/interspersion
V4 - % canopy cover

$CI = (2V1 \times V2 \times V3)^{1/4}$
$TI = (V1 \times V4)^{1/2}$

$HSI = (CI \times TI)^{1/2}$ = 0.63 (average of transects)

TY 1 – no change from baseline HSI = 0.63

TY 60 – no change from baseline   HSI = 0.63
TY 100 – no change from basline

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1.
2. Temporary easement areas will not be replanted with woody vegetation.

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover
V2 - average height of deciduous shrub canopy
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs

HSI = (V1 x V2 x V3)[illegible]

TY 1 –	V1 – no shrubs	SI = 0
	V2 – no shrubs	SI = 0
	V3 - no shrubs	SI = 0

HSI = (V1 x V2 x V3)[illegible] = 0

TY 60 –	V1 – no shrubs	SI = 0
	V2 – no shrubs	SI = 0
	V3 - no shrubs	SI = 0

HSI = (V1 x V2 x V3)[illegible] = 0

TY 100- no change from TY 60

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy
V2 - % deciduous tree crown cover
V3 – stand width

HSI = (V1 x V2 x V3)[illegible]

TY 1 -	V1 – no trees	SI = 0
	V2 – no trees	SI = 0
	V3 – no trees	SI = 0

HSI = (V1 x V2 x V3)[illegible] = 0

TY 60 – V1 – no trees SI = 0
V2 – no trees SI = 0
V3 – no trees SI = 0

HSI = $(V1 \times V2 \times V3)^{1/3} = 0$

TY100 - no change from TY 60

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover
V2 - average size of ground cover objects
V3 - structural diversity/interspersion
V4 - % canopy cover

$CI = (2V1 \times V2 \times V3)^{1/3}$

$TI = (V1 \times V4)^{1/2}$

$HSI = (CI \times TI)^{1/2} = 0.63$ (average of transects)

TY 1 – V1 – no ground cover SI = 0
V2 – no cover objects SI = 0
V3 – A SI = 0.1
V4 – no canopy cover SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 60 – no change from TY 1
TY100 - no change from TY 60

<u>MP 1 – Management Area – Future Without the Project (Compensation Site)</u>

Assume: 1. Existing riparian river bank upstream of Rossmoor Bar can be enhanced by planting riparian species (south side of river).

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover (0) SI = 0
V2 - average height of deciduous shrub canopy (5 ft) SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (0) SI = 0

HSI = $(V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – no change from baseline	HSI = 0
TY 15 – no change from baseline	HSI = 0
TY 30 – no change from baseline	HSI = 0
TY 60 – no change from baseline	HSI = 0
TY100 - no change from TY 60	

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy (27 ft)	SI = 0.77
V2 - % deciduous tree crown cover (0)	SI = 0
V3 – stand width (1)	SI = 0.2

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – no change from baseline	HSI = 0
TY 15 – no change from baseline	HSI = 0
TY 30 – no change from baseline	HSI = 0
TY 60 – no change from baseline	HSI = 0
TY100 - no change from TY 60	

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover (0)	SI = 0
V2 - average size of ground cover objects (< 1 ft)	SI = 0.2
V3 - structural diversity/interspersion (A)	SI = 0.1
V4 - % canopy cover (0)	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/2} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 1 – no change from baseline	HSI = 0
TY 15 – no change from baseline	HSI = 0
TY 30 – no change from baseline	HSI = 0
TY 60 – no change from baseline	HSI = 0
TY100 - no change from TY 60	

MP 2 – Management Area – Future With Project (Compensation Site)

Assume:
1. Acquire lands.
2. Watering, weed and pest management for a minimum of 3 years and remedial actions as necessary to ensure plant establishment.
3. Willow species and cottonwoods (80% of woody plantings will be planted near the mean summer water surface elevation and less water tolerant plants (oaks, etc) will be planted higher on the bank.
4. The site will extend no more than 25 feet up the bank from mean summer water surface elevation
5. Assume average growth rate of 24 inches/year for willows and cottonwood trees..

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover (0)	SI = 0
V2 - average height of deciduous shrub canopy (5 ft)	SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (0)	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 –	V1 - % deciduous shrub crown cover (5%)	SI = 0.15
	V2 - average height of deciduous shrub canopy (1 ft)	SI = 0.17
	V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%)	SI = 0.80

$HSI = (0.15 \times 0.17 \times 0.80)^{1/3} = 0.14$

TY 15 –	V1 - % deciduous shrub crown cover (75%)	SI = 1.0
	V2 - average height of deciduous shrub canopy (5ft)	SI = 0.82
	V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%)	SI = 0.80

$HSI = (1.0 \times 0.82 \times 0.80)^{1/3} = 0.81$

TY 30 –	V1 - % deciduous shrub crown cover (75%)	SI = 1.0
	V2 - average height of deciduous shrub canopy (5ft)	SI = 0.82
	V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%)	SI = 0.80

$HSI = (1.0 \times 0.82 \times 0.80)^{1/3} = 0.81$

TY 60 – no change from TY 30
TY 100 - no change from TY 60

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy (27 ft)	SI = 0.77
V2 - % deciduous tree crown cover (0)	SI = 0
V3 – stand width (1)	SI = 0.2

HSI = (VI x V2 x V3)^⅓ = 0

TY I –	VI - average height of deciduous tree canopy (27 ft)	SI = 0.77
	V2 - % deciduous tree crown cover (0)	SI = 0
	V3 – stand width (< 300 ft)	SI = 0.5

HSI = (VI x V2 x V3)^⅓ = 0

TY 15 –	VI - average height of deciduous tree canopy (16 ft)	SI = 0.77
	V2 - % deciduous tree crown cover (25%)	SI = 1.0
	V3 – stand width (< 300 ft)	SI = 0.5

HSI = (0.77 x 1.0 x 0.5)^⅓ = 0.54

TY 30 –	VI - average height of deciduous tree canopy (40 ft)	SI = 1.0
	V2 - % deciduous tree crown cover (50%)	SI = 1.0
	V3 – stand width (< 300 ft)	SI = 0.5

HSI = (1.0 x 1.0 x 0.5)^⅓ = 0.79

TY 60 -	VI - average height of deciduous tree canopy (>40 ft)	SI = 1.0
	V2 - % deciduous tree crown cover (75%)	SI = 0.9
	V3 – stand width (< 300 ft)	SI = 0.5

HSI = (1.0 x 0.9 x 0.5)^⅓ = 0.77

TY 100- no change from TY 60

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

VI - % ground cover (0)	SI = 0
V2 - average size of ground cover objects (< 1 ft)	SI = 0.2
V3 - structural diversity/interspersion (A)	SI = 0.1
V4 - % canopy cover (0)	SI = 1.0

CI = (2VI x V2 x V3)^⅓ = 0

TI = (VI x V4)^½ = 0

HSI = (CI x TI)^½ = 0

TY 1 –	VI - % ground cover (0)	SI = 0
	V2 - average size of ground cover objects (< 1 ft)	SI = 0.2
	V3 - structural diversity/interspersion (A)	SI = 0.1
	V4 - % canopy cover (0)	SI = 1.0

CI = (2VI x V2 x V3)^⅓ = 0

TI = (VI x V4)^½ = 0
HSI = (CI x TI)^½ = 0

TY 15 –	V1 - % ground cover (5%)	SI = 0
	V2 - average size of ground cover objects (≤ 1 ft)	SI = 0.2
	V3 - structural diversity/interspersion (A)	SI = 0.1
	V4 - % canopy cover (40%)	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 30 –	V1 - % ground cover (25%)	SI = 1.0
	V2 - average size of ground cover objects (2 ft)	SI = 0.8
	V3 - structural diversity/interspersion (C)	SI = 1.0
	V4 - % canopy cover (75%)	SI = 0.33

$CI = (2V1 \times V2 \times V3)^{1/3} = 1.16\ (1.0)$

$TI = (V1 \times V4)^{1/2} = 0.57$

$HSI = (CI \times TI)^{1/2} = 0.75$

TY 60 –	V1 - % ground cover (50%)	SI = 1.0
	V2 - average size of ground cover objects (2 ft)	SI = 0.8
	V3 - structural diversity/interspersion (C)	SI = 1.0
	V4 - % canopy cover (75%)	SI = 0.33

$CI = (2V1 \times V2 \times V3)^{1/3} = 1.16\ (1.0)$

$TI = (V1 \times V4)^{1/2} = 0.57$

$HSI = (CI \times TI)^{1/2} = 0.75$

TY100 - no change from TY 60

PA 1 - Future Without Project (Impact Area)

CHAPARRAL

BOBCAT

TY 0 – Baseline (measured)

V1 - % shrub cover
V2 - % herbaceous cover
V3 - degree of patchiness
V4 – rock outcroppings

$$HSI = \frac{V1 + V2 + V3 + 2V4}{5} = 0.56$$

TY 1 V1 – no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 – no change from TY 0

HIS= 0.56

TY 60 V1 – no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 – no change from TY 1

HSI = 0.56
TY100 - no change from TY 60

WRENTIT

TY 0 – Baseline (measured)

V1 - % shrub cover
V2 - % shrub cover ≤ 5 feet(19%)
$HSI = (V1 \times V2)^{1/2} = 0.34$

TY 1 V1 – no change from TY 0
V2 - no change from TY 0
$HSI = (V1 \times V2)^{1/2} = 0.34$

TY 60 V1 – no change from TY 1
V2 - no change from TY 1

$HSI = (V1 \times V2)^{1/2} = 0.34$

TY100 - no change from TY 60

CALIFORNIA THRASHER

TY 0 – Baseline (measured)

	V1 – Presence of low shrub openings	SI=1.0
	V2 - Shrub/seedling cover	SI=1.0

$HSI = (V1 \times V2^2)^{1/3} = 1.0$

TY 1 - V1 – no change from TY 0
V2 - no change from TY 0

TY 60- V1 – no change from TY 1
V2 - no change from TY 1

TY100 - no change from TY 60

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. Temporary easement areas will not be replanted with woody vegetation

BOBCAT

TY 0 – Baseline (measured)

V1 - % shrub cover
V2 - % herbaceous cover
V3 - degree of patchiness
V4 – rock outcroppings

$$HSI = \frac{V1 + V2 + V3 + 2V4}{5} = 0.56$$

TY 1	V1 – no shrub cover	SI = 0.2
	V2 - no herbaceous cover	SI = 0.2
	V3 – patchiness (1)	SI = 0.2
	V4 – no rock outcroppings	SI = 0.1

$$HSI = \frac{0.2 + 0.2 + 0.2 + 0.2}{5} = 0.16$$

TY 60 V1 – no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1

V4 – no change from TY 1

HSI = 0.16

TY100 - no change from TY 60

WRENTIT

TY 0 - V1 - % shrub cover
V2 - % shrub cover ≤ 5 feet

$HSI = (V1 \times V2)^{1/2} = 0.34$

TY 1 V1 – no shrub cover SI = 0
V2 - no shrubs SI = 0

$HSI = (0 \times 0)^{1/2} = 0$

TY 60 V1 – no change from TY 1
V2 - no change from TY 1

HSI = 0

TY100 - no change from TY 60

CALIFORNIA THRASHER

TY 0 – Baseline (measured)

V1 – Presence of low shrub openings
V2 - Shrub/seedling cover

$HSI = (V1 \times V2^2)^{1/3} = 0.34$

TY 1 - V1 – no shrubs SI = 0
V2 - no shrubs/seedlings SI = 0

$HSI = (0 \times 0^2)^{1/3} = 0$

TY 60- V1 – no change from TY 1
V2 - no change from TY 1

TY100 - no change from TY 60

<u>PA 3 - Future Without Project (Inundation Area)</u>

<u>**CHAPARRAL**</u>

BOBCAT

TY 0 – Baseline (measured)

V1 - % shrub cover	SI=1.0
V2 - % herbaceous cover	SI=0.98
V3 - degree of patchiness	SI=0.6
V4 – rock outcroppings	SI=1.0

$$HSI = \frac{V1 + V2 + V3 + 2V4}{5} = 0.72$$

TY 1 V1 – no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 – no change from TY 0

HIS = 0.72

TY 60 V1 – no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 – no change from TY 1

HSI = 0.72

TY100 - no change from TY 60

WRENTIT

TY 0 – Baseline (measured)

V1 - % shrub cover	SI=0.40
V2 - % shrub cover ≤ 5 feet(19%)	SI=0.09

$HSI = (V1 \times V2)^{1/2} = 0.19$

TY 1 V1 – no change from TY 0
V2 - no change from TY 0

$HSI = (V1 \times V2)^{1/2} = 0.19$

TY 60 V1 – no change from TY 1
V2 - no change from TY 1

$HSI = (V1 \times V2)^{1/2} = 0.19$

TY100 - no change from TY 60

CALIFORNIA THRASHER

TY 0 – Baseline (measured)

V1 – Presence of low shrub openings SI=1.0
V2 - Shrub/seedling cover SI=1.0

$HSI = (V1 \times V2^2)^{1/3} = 1.0$

TY 1 - V1 – no change from TY 0
V2 - no change from TY 0

TY 60- V1 – no change from TY 1
V2 - no change from TY 1

TY100 - no change from TY 60

PA 4 - Future With Project (Inundation Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. Temporary easement areas will not be replanted with woody vegetation

BOBCAT

TY 0 – Baseline (measured)

V1 - % shrub cover SI=1.0
V2 - % herbaceous cover SI=0.98
V3 - degree of patchiness SI=0.6
V4 – rock outcroppings SI=1.0

$$HSI = \frac{V1 + V2 + V3 + 2V4}{5} = 0.72$$

TY 1 V1 – no shrub cover SI = 0.2
V2 - no herbaceous cover SI = 0.2
V3 – patchiness (1) SI = 0.2
V4 – no rock outcroppings SI = 0.1

$$HSI = \frac{0.2 + 0.2 + 0.2 + 0.2}{5} = 0.16$$

TY 60 V1 – no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 – no change from TY 1

HSI = 0.16

TY100 - no change from TY 60

WRENTIT

TY 0 - VI - % shrub cover
V2 - % shrub cover ≤ 5 feet

$HSI = (V1 \times V2)^{1/2} = 0.34$

TY 1 V1 – no shrub cover SI = 0
V2 - no shrubs SI = 0

$HSI = (0 \times 0)^{1/2} = 0$

TY 60 V1 – no change from TY 1
V2 - no change from TY 1

HSI = 0

TY 100 - no change from TY 60

CALIFORNIA THRASHER

TY 0 – Baseline (measured)

V1 – Presence of low shrub openings
V2 - Shrub/seedling cover

$HSI = (V1 \times V2^2)^{1/3} = 1.0$

TY 1 - V1 – no shrubs SI = 0
V2 - no shrubs/seedlings SI = 0

$HSI = (0 \times 0^2)^{1/3} = 0$

TY 60- V1 – no change from TY 1
V2 - no change from TY 1

TY 100 - no change from TY 60

MP 1 - Management Area - Future Without Project (Compensation Site)

Assume: 1. Annual grassland area selected for conversion to oak woodland.

BOBCAT

TY 0 – Baseline (estimated)

V1 - % shrub cover (no shrubs) SI = 0.2
V2 - % herbaceous cover (100%) SI = 0.8
V3 - degree of patchiness (1) SI = 0.2
V4 – rock outcroppings (no) SI = 0.1

$$HSI = \frac{V1 + V2 + V3 + 2V4}{5} = \frac{0.8 + 0.8 + 0.2 = 0.2}{5} = 0.28$$

TY 1 V1 – no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 – no change from TY 0

HSI = 0.28

TY 15 V1 – no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 – no change from TY 1

HSI = 0.28

TY 30 V1 – no change from TY 15
V2 - no change from TY 15
V3 - no change from TY 15
V4 – no change from TY 15

HSI = 0.28

TY 100 V1 – no change from TY 30
V2 - no change from TY 30
V3 - no change from TY 30
V4 – no change from TY 30

HSI = 0.28

WRENTIT

TY 0 – Baseline (estimated)

V1 - no shrub cover SI = 0
V2 – no shrubs SI = 0

$HSI = (V1 \times V2)^{1/2} = (0 \times 0)^{1/2} = 0$

TY 1 V1 – no change from TY 0
V2 - no change from TY 0

HSI = 0

TY 15 V1 – no change from TY 1
V2 - no change from TY 1

HSI = 0

TY 30 V1 – no change from TY 15
V2 - no change from TY 15

HSI = 0

TY 100 V1 – no change from TY 30
V2 - no change from TY 30

HSI = 0

CALIFORNIA THRASHER

TY 0 – Baseline (estimated)

V1 – no shrubs SI = 0
V2 – no shrubs seedlings SI = 0

$HSI = (V1 \times V2^2)^{1/3} = (0 \times 0^2)^{1/3} = 0$

TY 1 - V1 – no change from TY 0
V2 - no change from TY 0

HSI = 0

TY 15 - V1 – no change from TY 1
V2 - no change from TY 1

HSI = 0

TY 30 - V1 – no change from TY 15
V2 - no change from TY 15

HSI = 0

TY 100 - V1 – no change from TY 30
V2 - no change from TY 30

HSI = 0

MP 2 - Management Area - Future With Project (Compensation Site)

Assume:
1. Acquire lands (currently annual grasslands)
2. Annual grassland area prepared for planting in TY 1 , provide access and maintenance roads
3. Plant chaparral species at a density of 400 trees/acre and cover crop
4. Watering, weed, pest control for minimum of 3 years and remedial actions as necessary to ensure plant establishment.
5. Develop O&M manual

BOBCAT

TY 0 – Baseline (estimated)

V1 - % shrub cover (no shrubs)	SI = 0.2
V2 - % herbaceous cover (100%)	SI = 0.8
V3 - degree of patchiness (1)	SI = 0.2
V4 – rock outcroppings (no)	SI = 0.1

$$HSI = \frac{V1 + V2 + V3 + 2V4}{5} = \frac{0.8 + 0.8 + 0.2 = 0.2}{5} = 0.28$$

TY 1	V1 – area cleared and planted (1%)	SI = 0.2
	V2 – 100%	SI = 0.8
	V3 - no change from TY 0	SI = 0.2
	V4 – no change from TY 0	SI = 0.1

HSI = 0.28

TY 15	V1 – 30%	SI = 1.0
	V2 – 100%	SI = 0.8
	V3 – 2	SI = 0.6
	V4 – no change from TY 1	SI = 0.1

$$HSI = \frac{1.0 + 0.8 + 0.6 + 0.2}{5} = 0.52$$

TY30	V1 – 50%	SI = 1.0
	V2 – 100%	SI = 0.8
	V3 – 2	SI = 0.6
	V4 – no change from TY 1	SI = 0.1

$$HSI = \frac{1.0 + 0.8 + 0.6 + 0.2}{5} = 0.52$$

TY 100	V1 – 50%	SI = 1.0
	V2 – 100%	SI = 0.8
	V3 – 2	SI = 0.6
	V4 – no change from TY 1	SI = 0.1

$$HSI = \underline{1.0 + 0.8 + 0.6 + 0.2} = 0.52$$

5

WRENTIT

TY 0 – Baseline (estimated)

	V1 - no shrub cover	SI = 0
	V2 – no shrubs	SI = 0
	$HSI = (V1 \times V2)^{1/2} = (0 \times 0)^{1/2} = 0$	
TY 1	V1 – area cleared and planted (1%)	SI = 0
	V2 – area cleared and planted (100%)	SI = 1.0
	$HSI = (V1 \times V2)^{1/2} = (0 \times 1.0)^{1/2} = 0$	
TY 15	V1 – 30%	SI = 0.15
	V2 – 80%	SI = 0.8
	$HSI = (0.15 \times 0.8)^{1/2} = 0.49$	
TY 30	V1 – 50 %	SI = 0.33
	V2 – 80 %	SI = 0.8
	$HSI = (0.33 \times 0.8)^{1/2} = 0.64$	
TY 100	V1 – 50 %	SI = 0.33
	V2 – 80 %	SI = 0.8
	HSI = 0.64	

CALIFORNIA THRASHER

TY 0 – Baseline (estimated)

	V1 – no shrubs	SI = 0
	V2 – no shrubs/seedlings	SI = 0
	$HSI = (V1 \times V2^2)^{1/3} = (0 \times 0^2)^{1/3} = 0$	
TY 1 -	V1 – no	SI = 0
	V2 - 1%	SI = 0
	HSI = 0	
TY 15 -	V1 – yes	SI = 1.0
	V2 - 30%	SI = 0.35
	$HSI = (1.0 \times 0.35^2)^{1/3} = 0.50$	

TY 30 - V1 – yes SI = 1.0
V2 - 50% SI = 1.0

HSI = $HSI = (1.0 \times 1.0^{2})^{\frac{1}{3}} = 1.0$

TY 100 - V1 – no change from TY 30
V2 - no change from TY 30

HSI = 1.0

APPENDIX A-2

HSI MODELS

NORTHERN ORIOLE
HABITAT SUITABILITY INDEX MODEL

HABITAT SUITABILITY INDEX MODEL

NORTHERN ORIOLE (*Icterus spurius*)

BREEDING HABITAT, CENTRAL VALLEY

CALIFORNIA

U.S. Fish and Wildlife Service
Ecological Services
Sacramento, California

January 1988

COVER TYPE LIFE REQUISITE HABITAT VARIABLES

Average height of deciduous tree canopy (V_1)

Valley Woodland (W)

Reproduction/ Cover Percent deciduous tree

Riparian (R)

Crown cover (V_2)

Stand width (V_3)

FOOD

The diet of the northern oriole is comprised mainly of insects. Fruits, berries, and nectar are also utilized (Bent 1958; Martin et al. 1961). For purposes of this model, it is assumed that if suitable habitat is available for nesting and cover, food resources are not limiting.

Minimum habitat area

Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before an area will be occupied by a species. Based on reported pair densities (Walcheck 1970; Gaines 1974; Pleasant 1979), it is assumed that at least 0.25 acres of suitable habitat must be available for the northern oriole to occupy an area. If less than this amount is present, the HSI is assumed to be zero.

VARIABLE	HABITAT TYPE	SUGGESTED TECHNIQUE
V_1 Average height of deciduous tree canopy	R, W	Range finder and clinometer on belt transect
V_2 Percent deciduous tree crown cover	R, W	Line intercept
V_3 Stand width	R, W	Visual observation, aerial interpretation

HSI Determination

LIFE REQUISITE COVER TYPE EQUATION

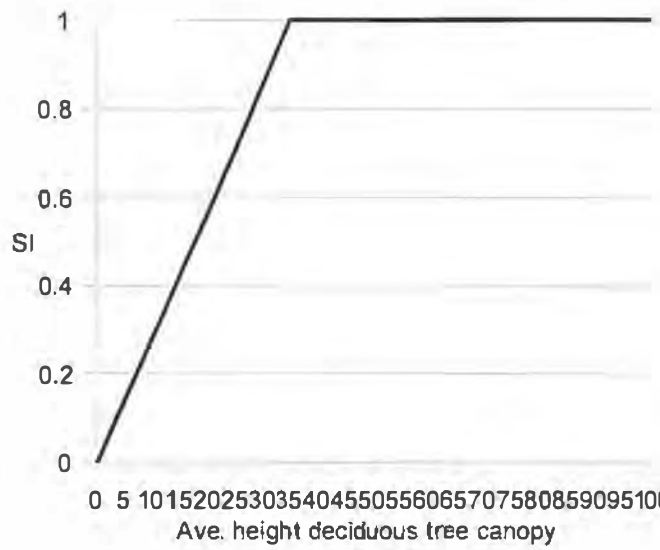
Reproduction R, W (V$_1$ x V$_2$ x V$_3$)$^{1/3}$

The HSI value for the northern oriole is equal to the reproduction/cover value.

Model Applicability
The model applies to breeding habitat of the northern oriole in the Central Valley of California up to 500 feet in elevation.

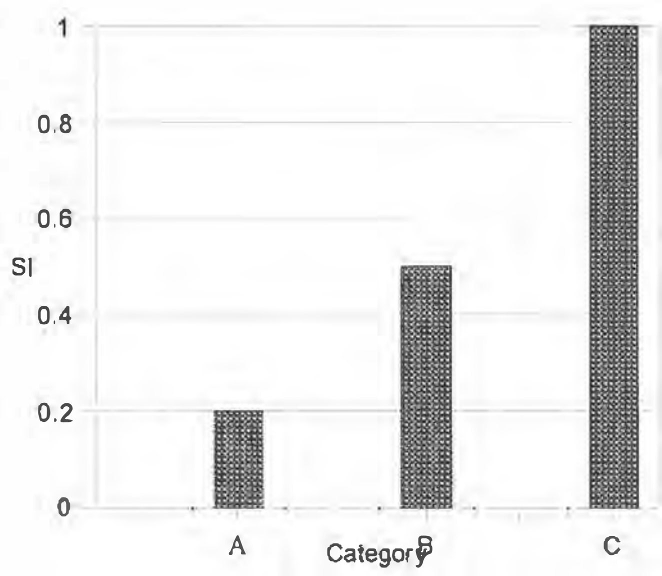
I. Average height of deciduous tree canopy.

Assumption: Orioles nest almost exclusively in large, preferably deciduous, trees (derived from nesting data of Schaefer (1976A)). Tree height of 35 feet or greater is optimum the dominant canopy strata equals those trees comprising 50% of total canopy closure.

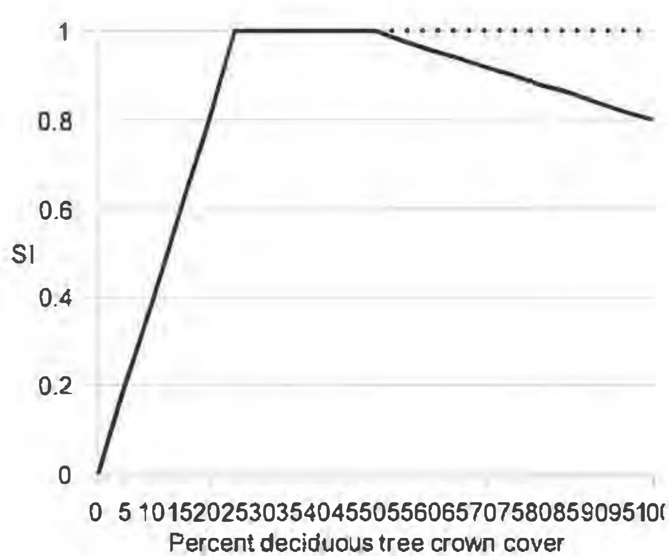


2. Percent deciduous tree crown cover.

Assumption: Orioles prefer open stands of deciduous trees for nesting (Grinnel and Miller 1944). Crown cover of 25-50% is assumed to be optimum.



3. Stand width
Assumption: Orioles prefer large blocks of riparian or oak woodland for nesting (USFWS 1981).



A - Woodland a narrow band comprising the width of one tree.
B - Woodland a strip less than 300 feet wide at its widest point.

C - Woodland greater than 300 feet wide at widest point.

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WESTERN FENCE LIZARD

HABITAT SUITABILITY INDEX MODEL

HABITAT SUITABILITY INDEX MODEL

WESTERN FENCE LIZARD (*Sceloporus occidentalis*)

by
Daniel H. Strait
U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

INTRODUCTION

The western fence lizard (*Sceloporus occidentalis*) ranges from British Columbia southward through Washington, Oregon and throughout California and the Great Basin to northwestern Baja California (Smith, 1948; Stebbins, 1985). It occupies a wide variety of habitats, excluding extreme desert conditions, from sea level to over 9500 feet in the Sierra Nevada. In California, four subspecies are present (Jennings, 1987). Preferring wooded, rocky areas, it frequents talus and rocky outcrops of hillsides, canyons and along streams. Western fence lizards are attracted to old buildings, woodpiles, fences, telephone poles, woodrat nests and banks with rodent burrows. It requires cover and, except for dispersing females (Jennings, personal communication) is seldom encountered in open fields or extremely barren areas (Stebbins, 1954). It is frequently a colonizer of disturbed habitats (Lillywhite, et. al., 1977).

The western fence lizard can be semi-arboreal (Cunningham, 1955; Davis and Verbeek, 1972). Trees apparently do not constitute a life requisite as was shown by *Sceloporus occidentalis* populations in chaparral (Lillywhite, Friedman and Ford 1972) and at high elevations (Grinnell and Storer, 1924). Trees may simply act as another type of available cover. This indicates the microhabitat plasticity of this species (Rose, 1978).

MODEL APPLICABILITY

This model was designed for use in plant communities found in the Central Valley of California and surrounding foothills up to an elevation of approximately 1500 feet and applies to the subspecies *S. o. occidentalis* and *S.o. biseriatus.* The model is based on both empirical data provided by expert review and information obtained from current literature.

Cover Type	Life Requisite	Habitat Variable
Riparian (R) Oak savannah (O) Oak woodland (W) Scrub (S) Annual Grassland (G)	Cover/Reproduction	Percent ground cover (V_1)
		Average size of ground cover objects (V_2)
		Structural diversity/ Interspersion (V_3)
	Thermoregulation	Percent ground cover (V_1)
		Percent canopy cover (V_4)

Habitat Variable	Cover Type	Suggested Techniques

V_1 - Percent ground cover	R.O.W.S,G	Line intercept, measurement of random points using a 3 feet diameter loop.
V_2 - Average size of ground cover objects	R.O.W.S,G	Line intercept
V_3 - Structural diversity/ interspersion	R.O.W.S,G	Ocular estimate
V_4 - Percent canopy cover	R.O.W.S,G	Spherical densiometer, line intercept, point intercept on aerial photos.

Variable 1. Percent ground cover

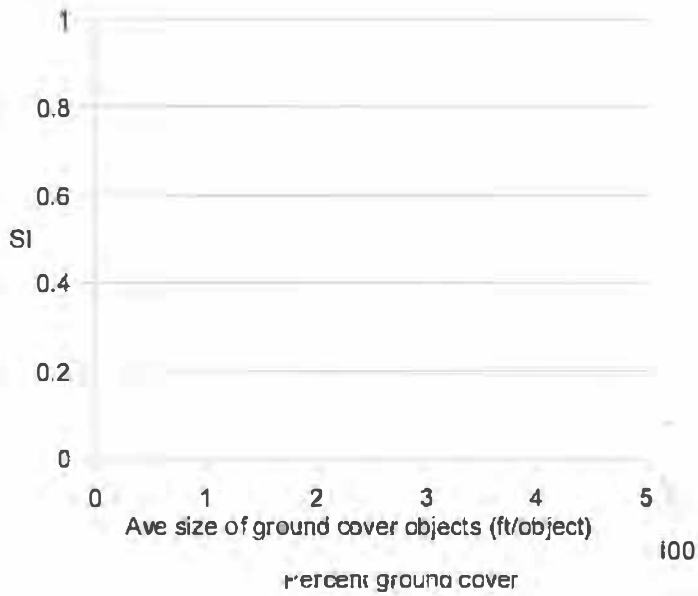
Assumes:

Only those objects less than 8 feet above the ground surface are considered. This includes rocks, logs, branches, tree trunks, fences, wood piles and live vegetation. Western fence lizards exhibit no well-defined habitat preference, but favor areas with logs, trees or other objects upon which they can climb, sun and display (Fitch, 1940). Brush piles and cavities under rocks and logs provide refuge (Marcellini and Mackey, 1979). An amount of ground cover beyond a particular density results in less than optimal conditions as it conceals predators and interferes with movement and the ability to defend a territory (Davis and Ford, 1983). Davis and Verbeek (1972) found that western fence lizards avoided dense grasslands. However, dispersing juveniles will cross dense grasslands and colonize any suitable isolated habitat found (Jennings, personal communication).

In California, western fence lizards centered their territorial activities about logs, fence posts, stumps and exposed boulders from which males display (Carpenter, 1980) and to observe mates or rival males (Fitch, 1940).

Eggs are placed in damp, friable, well-aerated soil from mid-May to mid-July in pits dug by the female and covered with loose soil (Stebbins, 1954) or under rocks and logs (Jennings, personal communication). In non-riparian conditions, nest sites are probably limited to areas within the shade of large cover objects.

Ground cover ranging from 25 to 70 percent is considered optimum for western fence lizards as it provides sufficient cover for maximum use of an area while not being so abundant as to interfere with movement. Western fence lizards undergo hibernation from November to February (Smith, 1946) and require cover for winter survival (Jennings, personal communication).



Variable 2. Average size of ground cover objects.

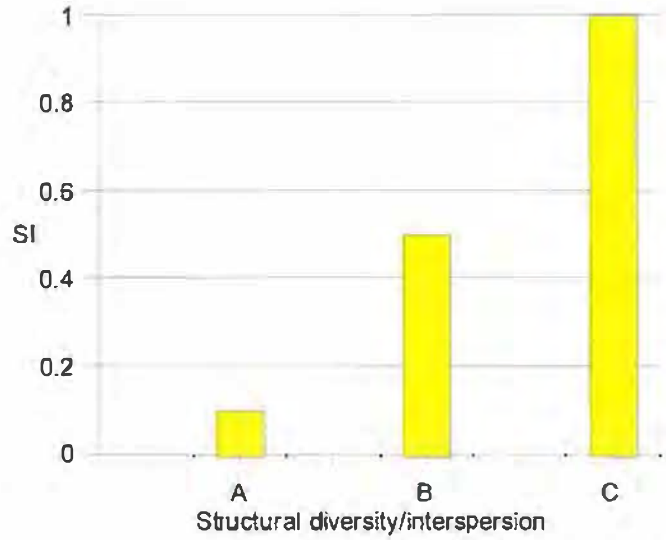
Assumes:

Ground cover objects include tree trunks but no other living material. The objects must be sufficiently large to provide escape cover. Western fence lizards have the habit of running to the opposite side of their perch (rock, log, etc.) when approached (Nussbaum et al., 1983). The objects must also be large enough to provide cover for hibernation, nest building, shade for summer thermoregulation, and to offer vantage points for territorial defense and mating display.

An average ground cover object size of 3.0 feet and larger is considered optimum as it is sufficiently large to provide for escape cover, thermoregulation and reproductive needs.

The average size of ground cover objects greater than 4 inches is diameter are measured in the field using the line intercept method and is determined by the formula:

$$\text{Average size of ground cover objects} = \frac{\text{Total feet of line intercepted}}{\text{Total number of ground cover objects intercepted}}$$



Variable 3. Structural diversity/interspersion

Assumes:

This variable is related to the habitat heterogeneity. The western fence lizard areas have a mixture and sufficient quantity of cover types (rocks, logs, living vegetation, rodent burrows, cracks and crevices) in a semi-open environment with lots of habitat edge allowing for sufficient exposure to the sun (Ruth, personal communication), escape cover and a production base for food organisms (Jennings, personal communication). These areas usually have a significant vertical component in the form of large boulders, trees, fence rows, old buildings or log piles (Nussbaum et al, 1983). Davis and Ford (1983) found optimal habitat was provided by large fallen oaks in various stages of decay or by large, standing oaks from which limbs and branches had fallen to the ground creating massive tangles. Western fence lizards commonly show low distributions in climax communities due to the homogeneity of the habitat(Ruth, personal communication).

A - Low habitat diversity. Ground cover limited to 1 or 2 types (i.e., grassland and bare soil). Site mostly homogeneous with little edge. Cover component mostly one dimensional without a significant vertical element (average less than 1 foot above ground). An exception may be rock talus which can be good (Ruth, communication).

B - Moderate habitat diversity. Two or more major ground cover types occur (i.e., large rocks, logs and woodpiles). A moderate amount of edge and interspersion is present between vegetation types and/or ground cover types. A significant vertical element to the cover component (average 1 -4 feet above ground) is present.

C - High habitat diversity. Three or more major ground cover types are present (i.e., large rocks, logs and woodpiles). Heterogeneity is high with logs of edge between evenly dispersed vegetation and cover types. Overall, habitat has a significant vertical component (average greater than 4 feet above ground). May include rock talus.

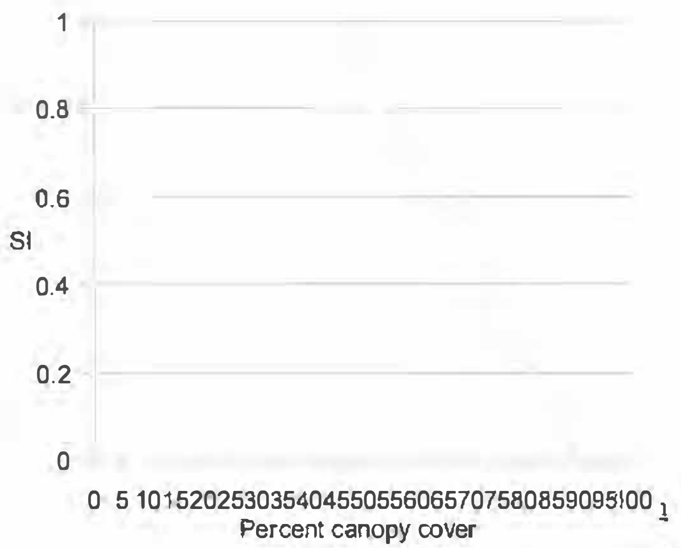
Variable 4. Percent canopy cover

Assumes:

The canopy is defined as standing live vegetation greater than 6 feet above ground. This variable relates directly to the ability of the habitat to provide sufficient exposure so that western fence lizards can thermoregulate.

The ability of a western fence lizard to thermoregulate in an area is a major determinant of its habitat occupancy. The ability of this species to absorb sunlight and warm quickly enables it to inhabit areas from sea level to over 9000 feet in elevation (Tanner and Hopkin, 1972). Western fence lizards typically move from areas of sunlight to shade to maintain their desired body temperature. Davis and Verbeek (1972) found this species shifted from rocks to trees and vice versa according to ambient temperature. Western fence lizards avoid dense, shaded woods (Stebbins, 1959).

A canopy cover ranging from 0 - 45 percent is considered optimum as it provides sufficient sunlight on the ground or ground cover surface for thermoregulation by western fence lizards. An area with a canopy cover greater than 90 percent is considered uninhabitable for western fence lizards due to a lack of sunlight on the ground surface for thermoregulation.



CALCULATIONS

Life Requisite

Cover//Reproduction $3)^{1/3}$

Thermoregulation R.O.W.S,G $TI = (V_1 \times V_4)^{1/2}$

HSI Determination $HSI = (CI \times TI)^{1/2}$

Assumes percent ground cover is the major determining factor due to its importance in reproduction, predator avoidance and thermoregulation.

An HSI value of 1.0 is considered optimum. An HSI value greater than 1.0 achieved through the use of this formula is to be considered 1.0.

ASSUMPTIONS

Feeding

It is assumed that where all necessary habitat components are present, food availability is not a factor limiting the use of an area by western fence lizards. Low availability of insects may be a limiting factor on winter recruitment of juveniles into the adult population (Jennings, personal communication). In arid areas, food can be limiting to adults in late summer (Ruth, personal communication).

The western fence lizard is an opportunistic insectivore which feeds on a variety of insects and other arthropods including leaf hoppers, aphids, beetles, wasps, termites, ants and spiders (Fitch, 1940; Johnson, 1965; Rose, 1976; Stebbins, 1954).

Rose (1976) found the three primary groups in the fence lizard diet to be ants (*Formicidae*), beetles (*Coleoptera*) and termites (*Isoptera*). Johnson (1965) found flies (*Diptera*), beetles and ants to be important prey while Clark (1973) found grasshoppers (*Acrididae*) the most common prey item. Otvos (1977) found moths or butterflies (*Lepidoptera*) the most common prey item in stomachs analyzed. Western fence lizards commonly bask or loaf in the shade and eat whatever arthropod comes close enough to attract their attention (Tanner and Hopkin, 1972). It can therefore be assumed that food availability is not a limiting factor under normal lizard population levels and habitat conditions.

Reproduction

It is assumed that, if ground cover of rocks, logs, trees, woodpiles, etc. of sufficient size and quantity are available for non-reproductive activities, then areas with moist, friable soil necessary for lizard nesting purposes would be present beneath the cover and should not be a limiting factor. Females may travel several hundred feed to find appropriate nesting conditions (Ruth, personal communication).

Water requirements

Considering the wide distribution of this species in all but the most extreme desert regions, it is unlikely that water availability would be a limiting factor to the western fence lizard though densities are often highest where water (seeps, ponds, etc.)are nearby (Ruth, personal communication). This assumes that sufficient ground cover exists for thermoregulation and nesting. This species receives the bulk of its moisture through metabolic water from its prey (Ruth, personal communication). These lizards may lower metabolic rates to compensate for higher body temperatures and water stress during warm seasons (Tsuji, 1985).

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FWS/OBS-82/10.27
July 1982

HABITAT SUITABILITY INDEX MODELS: YELLOW WARBLER

by

Richard L. Schroeder[4]
Habitat Evaluation Procedures Group
Western Energy and Land Use Team
U.S. Fish and Wildlife Service
Drake Creekside Building One
2625 Redwing Road
Fort Collins, CO 80526

Western Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior
Washington, DC 20240

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PREFACE

This document is part of the Habitat Suitability Index (HSI) Model Series (FWS/OBS-82/10), which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are provided. The Habitat Use Information Section is largely constrained to those data that can be used to derive quantitative relationships between key environmental variables and habitat suitability. The habitat use information provides the foundation for HSI models that follow. In addition, this same information may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model Section documents a habitat model and information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The application information includes descriptions of the geographic ranges and seasonal application of the model, its current verification status, and a listing of model variables with recommended measurement techniques for each variable.

In essence, the model presented herein is a hypothesis of species-habitat relationships and not a statement of proven cause and effect relationships. Results of model performance tests, when available, are referenced. However, models that have demonstrated reliability in specific situations may prove unreliable in others. For this reason, feedback is encouraged from users of this model concerning improvements and other suggestions that may increase the utility and effectiveness of this habitat-based approach to fish and wildlife planning. Please send suggestions to:

Habitat Evaluation Procedures Group
Western Energy and Land Use Team
U.S. Fish and Wildlife Service
2625 Redwing Road
Ft. Collins, CO 80526

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YELLOW WARBLER (*Dendroica petechia*)

HABITAT USE INFORMATION

General

The yellow warbler (*Dendroica petechia*) is a breeding bird throughout the entire United States, with the exception of parts of the Southeast (Robbins et al. 1966). Preferred habitats are wet areas with abundant shrubs or small trees (Bent 1953). Yellow warblers inhabit hedgerows, thickets, marshes, swamp edges (Starling 1978), aspen (*Populus* spp.) groves, and willow (*Salix* spp.) swamps (Salt 1957), as well as residential areas (Morse 1966).

Food

More than 90% of the food of yellow warblers is insects (Bent 1953), taken in proportion to their availability (Busby and Sealy 1979). Foraging in Maine occurred primarily on small limbs in deciduous foliage (Morse 1973).

Water

Dietary water requirements were not mentioned in the literature. Yellow warblers prefer wet habitats (Bent 1953; Morse 1966; Stauffer and Best 1980).

Cover

Cover needs of the yellow warbler are assumed to be the same as reproduction habitat needs are discussed in the following section.

Reproduction

Preferred foraging and nesting habitats in the Northeast are wet areas, partially covered by willows and alders (*Alnus* spp.), ranging in height from 1.5 to 4 m (5 to 13.3 ft) (Morse 1966). It is unusual to find yellow warblers in extensive forests (Hebard 1961) with closed canopies (Morse 1966). Yellow warblers in small islands of mixed coniferous-deciduous growth in Maine utilized deciduous foliage far more frequently than would be expected by chance alone (Morse 1973). Coniferous areas were mostly avoided and areas of low deciduous growth preferred.

Nests are generally placed 0.9 to 2.4 m (3 to 8 ft) above the ground, and nest heights rarely exceed 9.1 to 12.2 m (30 to 40 ft) (Bent 1953). Plants used for nesting include willows, alders, and other hydrophytic shrubs and trees (Bent 1953), including box-elders (*Acer negundo*) and cottonwoods (*Populus* spp.) (Schrantz 1943). In Iowa, dense thickets were frequently occupied by yellow warblers while open thickets with widely spaced shrubs rarely contained nests (Kendeigh 1941).

Males frequently sing from exposed song perches (Kendeigh 1941; Ficken and Ficken 1965), although yellow warblers will nest in areas without elevated perches (Morse 1966).

A number of Breeding Bird Census reports (Van Velzen 1981) were summarized to determine nesting habitat needs of the yellow warbler, and a clear pattern of habitat preferences emerged. Yellow warblers nested in less than 5% of census areas comprised of extensive upland forested cover types (deciduous or coniferous) across the entire country. Approximately two-thirds of all census areas with deciduous shrub-dominated cover types were utilized, while shrub wetlands types received 100% use. Wetlands dominated by shrubs had the highest average breeding densities of all cover types [2.04 males per ha (2.5 acre)]. Approximately two-thirds of the census areas comprised of forested draws and riparian forests of the western United States were used, but average densities were low [0.5 males per ha (2.5 acre)].

Interspersion

Yellow warblers in Iowa have been reported to prefer edge habitats (Kendeigh 1941); Stauffer and Best 1980). Territory size has been reported as 0.16 ha (0.4 acre) (Kendeigh 1941) and 0.15 ha (0.37 acre) (Kammeraad 1964).

Special Considerations

The yellow warbler has been on the Audubon Society's Blue List of declining birds for 9 of the last 10 years (Tate 1981).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographic area. This model has been developed for application within the breeding range of the yellow warbler.

Season. This model was developed to evaluate the breeding season habitat needs of the yellow warbler.

Cover types. This model was developed to evaluate habitat in the dominant cover types used by the yellow warbler. Deciduous Shrubland (DS) and Deciduous Scrub/Shrub Wetland (DSW) (terminology follows that of U.S. Fish and Wildlife Service 1981). Yellow warblers only occasionally utilize forested habitats and reported populated densities in forests are low. The habitat requirements in forested habitats are not well documented in the literature. For these reasons, this model does not consider forested cover types.

Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous that is required before an area will be occupied by a species. Information on the minimum habitat area for the yellow warbler was not located in the literature. Based on reported territory sizes, it is assumed that at least 0.15 ha (0.37 acre) of suitable habitat must be available for the yellow warbler to occupy an area. If less than this amount is present, the HSI is assumed to be 0.0.

Verification level. Previous drafts of the yellow warbler habitat model were reviewed by Douglass H. Morse and specific comments were incorporated into the current model (Morse, pers. comm.).

Model Description

Overview. This model considers the quality of the reproduction (nesting) habitat needs of the yellow warbler to determine overall habitat suitability. Food, cover, and water requirements are assumed to be met by nesting needs.

The relationship between habitat variables, life requisites, cover types, and the HSI for the yellow warbler is illustrated in Figure 1.

The following sections provide a written documentation of the logic and assumptions used to interpret the habitat information for the yellow warbler and to explain and justify and variable and equations that are used in the HSI model. Specifically, these sections cover the following: (1) identification of variables that will be used in the model; (2) definition and justification of the suitability levels of each variable; and (3) description of the assumed relationship between variables.

Reproduction component. Optimal nesting habitat for the yellow warbler is provided in wet areas with dense, moderately tall stands of hydrophytic deciduous shrubs. Upland shrub habitats on dry sites will provide only marginal suitability.

It is assumed that optimal habitats contain 100% hydrophytic deciduous shrubs and that habitats with no hydrophytic shrubs will provide marginal suitability. Shrub densities between 60 and 80% crown cover are assumed to be optimal. As shrub densities approach zero cover, suitability also approaches zero.

Figure 1. Relationship between habitat variables, life requisites, cover types, and the HSI for the yellow warbler.

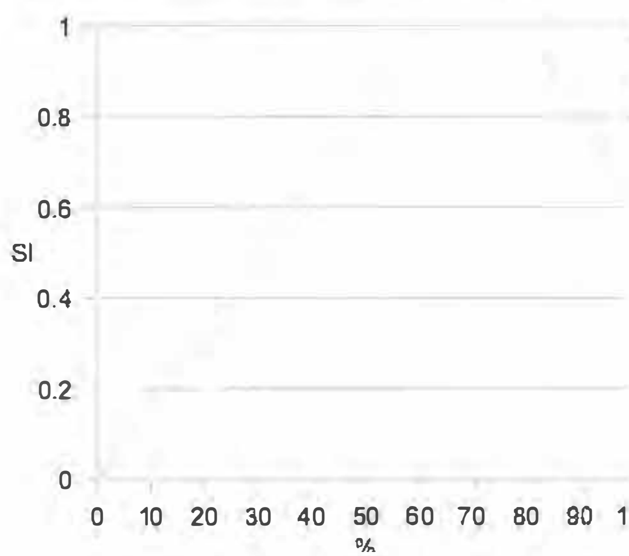
Habitat variable	Life requisite	Cover types	
Percent deciduous shrub crown cover Average height of deciduous shrub canopy Percent of shrub canopy comprised of hydrophytic shrubs	Reproduction	Deciduous Shrubland Deciduous Scrub/ Shrub Wetland	HSI

Totally closed shrub canopies are assumed to be of only moderate suitability, due to the probable restrictions on movement of the warblers in those conditions. Shrub heights of 2 m (6.6 ft) or greater are assumed to be optimal, and suitability will decrease as heights decrease to zero.

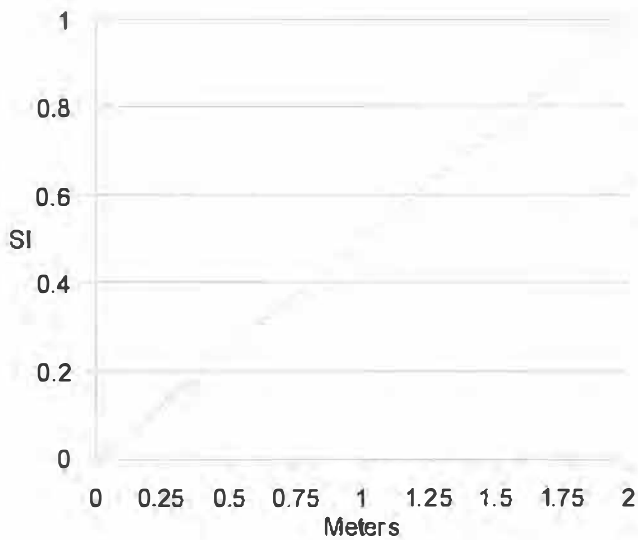
Each of these habitat variables exert a major influence in determining overall habitat quality for the yellow warbler. A habitat must contain optimal levels of all variables to have maximum suitability. Low values of any one variable may be partially offset by higher values of the remaining variables. Habitats with low values for two or more variables will provide low overall suitability levels.

Model Relationships

Suitability Index (SI) graphs for habitat variables. This section contains suitability index graphs that illustrate the habitat relationships described in the previous section.

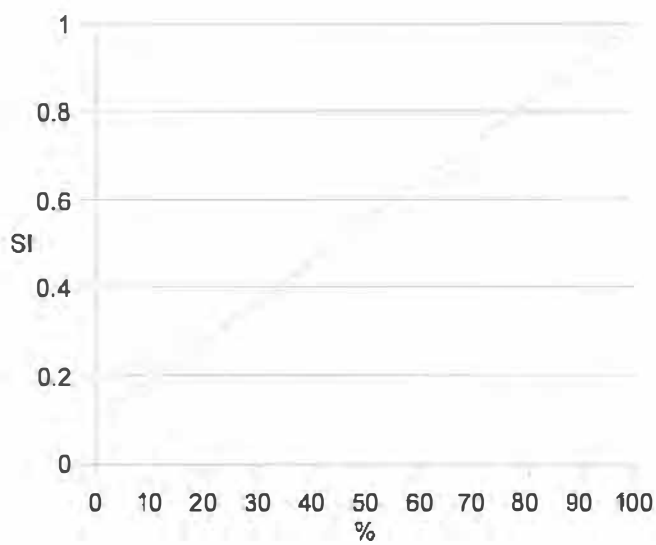


Cover-type Variable
DS,DSW $\mathbf{V_1}$
Percent deciduous shrub crown cover.



DS,DSW V_2
Average height of deciduous shrub canopy.

DS, DSW V_3
Percent of deciduous shrub canopy comprised of hydrophytic shrubs.



Equations. In order to obtain life requisite values for the yellow warbler, the SI values for appropriate variables must be combined with the use of equations. A discussion and explanation of the assumed relationship between variables was included under Model Description, and the specific equation in this model was chosen to mimic these perceived biological relationships as closely as possible. The suggested equation for obtaining a reproduction value is presented below.

Life requisite	Cover type	Equation
Reproduction	DS,DSW	$(V_1 \times V_2 \times V_3)^{1/3}$

HSI determination. The HSI value for the yellow warbler is equal to the reproduction value.

Application of the Model

Definitions of variables and suggested field measurement techniques (Hays et al. 1981) are provided in Figure 2.

Figure 2. Definitions of variables and suggested measurement techniques.

Variable (definition)	Cover types	Suggested techniques
V_1 Percent deciduous shrub crown cover (the percent of the ground that is shaded by a vertical projection of the canopies of woody deciduous vegetation which are less than 5 m (16.5 ft) in height).	DS,DSW	Line intercept
V_2 Average height of deciduous shrub canopy (the average height from the ground surface to the top of those shrubs which comprise the uppermost	DW,DSW	Graduated rod

shrub canopy).

V_3 Percent of deciduous shrub canopy comprised of hydrophytic shrubs (the relative percent of the amount of hydrophytic shrubs compared to all shrubs, based on canopy cover).	DW.DSW	Line Intercept

SOURCES OF OTHER MODELS

No other habitat models for the yellow warbler were located.

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HABITAT SUITABILITY INDEX MODELS: RED-WINGED BLACKBIRD

by

Henry L. Short
Habitat Evaluation Procedures Group
Western Energy and Land Use Team
U.S. Fish and Wildlife Service
2627 Redwing Road
Fort Collins, CO 80526-2899

Western Energy and Land Use Team
Division of Biological Services
Research and Development
Fish and Wildlife Service
U.S. Department of the Interior
Washington, DC 202240

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PREFACE

This document is part of the Habitat Suitability Index (HSI) Model Series [Biological Report 82(10)] which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are data that can be used to derive quantification relationships between key environmental variables and habitat suitability. This information provides the foundation for the HSI model and may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model Section documents the habitat and includes information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The HSI Model Section includes information about the geographic range and seasonal application of the model, its current verification status, and a list of the model variables with recommended measurement techniques for each variable.

The model is a formalized synthesis of biological and habitat information published in the scientific literature and may include unpublished information reflecting the opinions of identified experts. Habitat information about wildlife species frequently is represented by scattered data sets collected during different seasons and years and from different sites throughout the range of a species. The model presents this broad data base in a formal, logical, and simplified manner. The assumptions necessary for organizing and synthesizing the species-habitat information into the model are discussed. The model should be regarded as a hypothesis of species-habitat relationships and not as a statement of proven cause and effect relationships. The model may have merit in planning wildlife habitat research studies about species, as well as in providing an estimate of the relative quality of habitat for that species.

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RED-WINGED BLACKBIRD (*Agelaius phoeniceus L.*)

HABITAT USE INFORMATION

General

The red-winged blackbird (*Agelaius phoeniceus L*) nests in fresh-water and brackish herbaceous wetlands, bushes and small trees along watercourses, and certain upland cover types from (American Ornithologists' Union 1983:723):

> ... east-central, south-coastal and southern Alaska..., southern Yukon west-central and southern Mackenzie, northwestern and central Saskatchewan, central Manitoba, central Ontario, southern Quebec..., New Brunswick, Prince Edward Island, Nova Scotia and southwestern Newfoundland south to northern Baja California, through Mexico... and along both coasts of Central America to Nicaragua and northern Costa Rica .... and to southern Texas, the Gulf coast and southern Florida. [This blackbird winters] from southern British Columbia, Idaho, Colorado, Kansas, Iowa, the southern Great Lakes region, southern Ontario and New England... south throughout the remainder of the breeding range, with the southwestern and most of Middle American populations being sedentary.

The red-winged blackbird traditionally was considered to be a wetland nesting bird. It has adapted, within the last century, to habitat changes brought about by man; it now commonly nests in hayfields, along roadsides and ditches, and in other upland sites (Dolbeer 1980).

Food

Red-winged blackbirds vary their diet throughout the year, presumably in response to the nutritive demands of reproduction. The percent of waste grain and seeds in the diet of male blackbirds in one study in Ontario, Canada, was at least 80 to 87% in March and April, 46% in May, only 10% in July, and 85% in late July to October (McNicol et al. 1982). Insects amounted to 51 to 84% of the diet during May and July. The diet of female red-winged blackbirds varied between 67 and 79% insect parts in May and July but was only 15% insectivorous in late July-October, after fledging had occurred.

Water

References describing the dependency of the red-winged blackbird on surface water for drinking and bathing were not found in the literature. Nesting occurs in herbaceous wetlands and upland habitat near surface water and in suitable vegetation distant from free water. Red-winged blackbirds seem to prefer habitats near wetlands for foraging. Communal roosting, which occurs after fledging is completed, is either in herbaceous wetlands or dense communities of young trees with thick canopies growing on moist sites (Micacchion and Townsend 1983).

Cover

The red-winged blackbird nests in a variety of habitats. Blackbirds in southern Michigan prefer old and new hay fields, pastures, old fields, and wetlands with robust vegetation capable of supporting nests and dense cover that provides protection for nests (Albers 1978). They avoid cut or fallow fields, woodlots, agricultural croplands, open water, and tilled soil.

Areas with tall, dense, herbaceous vegetation seem to provide preferred nest sites. Blackbirds that nest early in the breeding season select tall, dense, old-growth herbaceous vegetation while blackbirds that nest late in the breeding season select tall, dense, new-growth herbaceous vegetation (Albers 1978). Upland nest sites of red-winged blackbirds in Ontario were in plant communities commonly dominated by goldenrod (*Solidago* spp.), alfalfa (*Medicago sativa*), fleabane (*Erigeron* spp.), clover (*Trifolium* spp.), various thistles (*Cirsium* spp.), and similar herbaceous weeds (Joyner 1978). Blackbirds in fresh water sites selected old- and new-growth of broad-leaved monocots, like cattails (*Typha* spp.) and broad-leaved sedges (*Carex* spp.), and commonly rejected old- and new-growth of narrow-leaved monocots and forbs (Albers 1978). Woody species, such as hightide bush (*Iva* frutescens) and groundselbush (*Baccharis halimifolia*), and robust herbaceous plants, like cattails, supported the most nests in tidal herbaceous wetlands (Meanley and Webb 1963).

The density of preferred plant cover is not adequately described either in the literature or in this model. The height of preferred plant cover is inferred, below, from descriptions of nest sites.

Red-winged blackbirds frequently use scattered trees and fence posts near their breeding territories as observation posts. Blackbirds use both herbaceous wetlands and trees for communal roosts after fledging is completed. Roost trees characteristically are young, occur at high densities, provide thick canopies, and are adapted to moist sites (Micacchion and Townsend 1983).

<u>Reproduction</u>
Red-winged blackbirds are migratory in the northern portion of their range. Males migrate to or congregate at future nesting habitats in late winter, and females arrive at the territories in early spring (Case and Hewitt 1963). In areas with resident populations, individuals of both sexes may remain near breeding territories throughout the year, even though the areas are not actively defended or used in winter except, perhaps, as roosting sites (Orians pers. comm.). Males are polygynous, and up to six females commonly nest within a male's territory (Holm 1973). Harem size was larger in herbaceous wetlands with open stands of cattails than in herbaceous wetlands dominated by bulrushes (*Scirpus* spp.) or by closed stands of cattails (Holm 1973). Harem size has sometimes been observed to exceed 10 to 12 females and, in one instance, numbered 32 females (Orians pers. comm.).

Males do not participate in nest building, incubation, or feeding of the incubating female (Orians pers. comm.). Males may help feed nestlings and are likely to help feed fledglings. The timing of breeding varies throughout the range of the red-winged blackbird. Nesting frequently begins in March or April and is completed by mid-July in the more temperate habitats. Most young in North America are fledged by late July.

Herbaceous wetlands dominated by cattails generally seem to be the most productive habitats for red-wing blackbirds in terms of nests/ha or number of young fledged/ha (Robertson 1972). Favorable herbaceous wetland sites produce more suitable food per unit area and have higher nest densities, highly synchronous nesting, higher nest survival rates. and lower nest predation rates than do upland nest sites.

Nests of red-winged blackbirds are placed on the edges of cattail clumps that border areas of open water (Wiens 1965). Herbaceous wetlands that are dominated by cattails and have open, permanent water have the optimum number of available nest sites. Early nests are placed in the old growth vegetation remaining from past growing seasons, while late nests may be built on new growth. Nest success in one herbaceous wetland habitat seemed related to: (1) increased depth of permanent water (up to 50 cm or more), which apparently reduced mammalian predation on nests; (2) nest placement close to water (greater nest success was observed for nests 20 cm above water than nests 100 cm above water), (3) nest placement in herbaceous wetland vegetation interspersed with open water, rather than in herbaceous wetland vegetation where no open water was present; and (4) nest placement in marsh grass and loosestrife (*Decadon verticillatus*), rather than in sweet gale (*Myrica gale*) and sedges (Weatherhead and Robertson 1977). Other studies have indicated that nests placed at 1.2 m heights were more successful than nests placed at 0.6 m heights in tidal herbaceous wetlands on Chesapeake Bay (Meanley and Webb 1963) and that nest success was higher when permanent water levels were greater than 25 cm (Robertson 1972).

Nests of red-winged blackbirds in upland sites typically are wound between and attached to stalks of herbaceous vegetation (Bent 1958). Early nests are entwined with old growth stems and late nests with the sturdiest stems of the new growth. Activities, such as intensive livestock grazing, mowing, and burning of old growth stubble, make herbaceous uplands unavailable for early nest placement. Mowing hayfields during the nesting season disrupts nesting success on upland sites (Albers 1978). Red-winged blackbirds seem to prefer areas with the densest, tallest herbaceous vegetation for nest placement. Vegetation that restricted visibility was more important than the number of plant stems and leaves per unit area. Trees greater than 5.0 m in height were in most territories (Albers 1978). The mean height of nest placement was 15 cm in monotypic stands of reed canarygrass (*Phalaris arundinacea*) 58 cm high (Joyner 1978). Nest sites often are close to open water (Joyner 1978), although no specific descriptions of acceptable distances of upland nest sites from open water were found in the literature.

Interspersion

The red-winged blackbird seems to be closely associated with the presence of standing water (Bent 1958) and certain types of dense herbaceous vegetation for nest placement. Herbaceous wetlands or sloughs I with extensive cattails, bulrushes, sedges, reeds (*Phragmites* spp.), or tules (*Scirpus* spp.), historically have provided important nesting habitat for the blackbird (Bent 1958). However, blackbirds also nest in dense herbaceous cover in hayfields, along roadsides and ditches, and in other upland sites (Dolbeer 1980). Red-winged blackbirds forage for insects in understory, midstory, and overstory canopies (Snelling 1968) during the nesting season.

The blackbird is primarily a seed eater, except during fledging. The species sometimes forms large communal flocks in wetland herbaceous habitats or in trees and brushlands and these birds may forage on agricultural crops or understory seed sources (Mott et al. 1972; Johnson and Caslick 1982). After the autumn migration from the northern portion of their range, red-winged blackbirds frequently roost in herbaceous wetland habitats, trees, or shrubs and feed on seeds within understory vegetation.

Special Consideration

Red-winged blackbirds shift from a dispersed insectivorous feeding behavior during the nesting season to a communal granivorous feeding habit after fledging has occurred. They frequently move into agricultural areas at this time. Costs related to their consumption of grain can become high and may exceed the benefits of insect control related to their foraging habits during fledging (Bendell et al. 1981). Damage to ripening corn (*Zea mays*) occurs during August and September (Somers et al. 1981; Stehn and de Becker 1982), when blackbirds often congregate at night in herbaceous wetlands or in roosts in young deciduous trees in great concentrations (perhaps up to 1 million birds) (Stehn and de Becker 1982). The distance from these autumn roosts to corn fields and the proximity of corn fields to traditional flightlines strongly influences the amount of damage inflicted on individual corn fields. Bird damage to crops in Ohio diminished consistently as distances from communal roosts increased from 3.2 to 8 km, and the level of damage remained constant and low at distances of 8 to 19.2 km (Dolbeer 1980).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographic area. This model will produce an HSI for nesting habitats of the red-winged blackbird. The breeding range and the year-round range of the blackbird occur throughout the contiguous 48 States.

Season. The model will produce an HSI for nesting habitat throughout the nesting seasons, which generally occurs from March to late July.

Cover types. This model was developed to evaluate habitat in herbaceous wetlands (HW) and upland herbaceous cover types, such as pasture and hayland (P/H), forbland (F), and grassland (G) (terminology follows that of U.S. Fish and Wildlife Service 1981).
Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before a species will live and reproduce in an area. Specific information on minimum areas required for red-winged blackbirds was not found in the literature. It is assumed, however, that a wetland area must contain at least 0.10 ha in emergent herbaceous vegetation, like cattails, to be considered nesting habitat for the blackbird. Several studies have described the minimum territory for male red-winged blackbirds as 0.02 ha (Weatherhead and Robertson 1977; Orians 1980). A 0.10 ha area of emergent herbaceous vegetation might, therefore, potentially provide territories for up to five male blackbirds. Territories in upland habitats are much larger than those in wetland habitats. It is assumed that a block of upland and habitat must be at least 1.0 ha in area to provide adequate breeding habitat for red-winged blackbirds.

Verification level. This model was developed from descriptive information about nesting cover and species-habitat relationships identified in the literature. The HSI derived from the use of this model describes the potential of an area for providing nesting habitat for the red-winged blackbird. The model is designed to rank the suitability of nesting habitat as would a biologist with expert knowledge about the reproductive requirements of the blackbird. The model should not be expected to rank habitats in the same way as population data because many nonhabitat-related criteria can significantly impact populations of wildlife species.

Model Description

Overview. The red-winged blackbird uses a variety of habitat layers throughout the year. Tall, dense, herbaceous vegetation seems to satisfy nesting, foraging, and cover requirements. The red-winged blackbird readily uses midstory and overstory layers of habitat at times but does not seem to be dependent on the presence of these layers.

The red-winged blackbird typically nests in tall (over 0.5 m), dense (undefined) herbaceous vegetation, although it occasionally nests in shrubs and trees. This nest site requirement is best met in herbaceous wetland habitats where nest sites are available in sturdy cattails over open, permanent water. Nesting requirements also can be met by suitable herbaceous vegetation in upland sites. Tall, sturdy, herbaceous stems or midstory or overstory components are used as display perches or observation posts. Red-winged blackbirds nesting in herbaceous wetland habitats may feed on insects associated with shrub, tree canopy, or herbaceous vegetation within the wetland or on insects associated with midstory and overstory canopies or in the grass understory outside the wetland boundary (Snelling 1968). Birds nesting in upland sites typically forage for insects in understory vegetation near the nest site.

This model attempts to evaluate the ability of a habitat to meet the food and reproductive needs of the red-winged blackbird during the nesting season. The logic used in this species-habitat model is described in Figure 1. The following sections document this logic and the assumptions used to translate habitat information for the red-winged blackbird into the variables selected for the HSI model. These sections also describe the assumptions inherent in the model, identify the variables used in the model, define and justify the suitability level of each variable, and describe the assumed relationships between variables.

FIGURE 1

Food and reproductive components (herbaceous wetland cover types). There are three conditions (A, B, and C) included in Figure 1. Condition A wetlands, with a minimum of 0.10 ha in emergent herbaceous vegetation, can be very productive nesting habitats for red-winged blackbirds if water is present throughout the year, water chemistry is favorable for photosynthesis, and abundant, persistent, emergent vegetation suitable for nest placement is present. The quality of such a wetland as nesting habitat for red-winged blackbirds can be estimated with the following five habitat variables.

Variable 1 (V1) refers to the type of emergent herbaceous vegetation available in the wetland.

V1 = 1.0 if emergent herbaceous vegetation is predominantly old or new growth of broad-leaved monocots, like cattails.

V1 = 0.1 if emergent herbaceous vegetation is predominantly narrow-leaved monocots or other herbaceous materials.

Variable 2 (V2) considers the water regime of the wetlands. The suitability index of V2 is 1.0 if the wetland is permanently flooded or intermittently exposed with water usually present throughout the year. This is a desirable condition because permanent water is necessary to support persistent populations of invertebrates that overwinter in various larval instars, maximizing the production of aquatic insects that emerge throughout the next spring and early summer. These insects seem to be the favored food source for blackbirds nesting in herbaceous wetlands (Orians 1980). The presence of permanent water within the wetland may reduce mammalian predation on nests of red-winged blackbirds (Robertson 1972).

V2 = 1.0 if water usually is present in the wetland throughout the year.

V2 = 0.1 if the wetland usually is dry during some portion of the year.

Variable 3 (V3) pertains to the abundance of carp (*Cyprinus carpio*) within the wetlands. Carp disturb submergent vegetation within the wetlands, which may destroy habitat for emergent aquatic insects (like Odonates) and reduce wetland food sources for blackbirds.

V3 = 1.0 if carp are absent from the wetland.

V3 = 0.1 if carp are present within the wetland.

Variable 4 (V4) in the model measures the abundance of larvae of emergent aquatic insects. The adult form of these species provides a potentially important food source for red-winged blackbirds nesting in wetland habitats. The biomass of these benthic invertebrates is variable within a herbaceous wetland at any one time, as well as between sampling periods (Hynes 1972). This biomass should not be regarded as a direct measure of productivity because production, in terms of both numbers and weight, is many times larger than that present at any one sample periods, and the assessment of numbers or biomass per unit of area presents formidable, perhaps insurmountable, difficulties (Hynes 1972). The presence or absence of suitable benthic invertebrates can be determined by sampling with a sieve net (Needham and Needham 1970) along the edge of clumps of emergent vegetation. Sampling is more likely to be accurate than inferences about the presence of benthic invertebrates based on measures of water chemistry that may inadequately consider pollutants that impact aquatic food chains. Inferences about the presence of benthic invertebrates based on the appearance of aquatic vegetation also are less accurate than sampling (Orians pers. comm.). Therefore, sampling to determine the presence or absence of important benthic invertebrates is the preferred assessment technique.

V4 = 1.0 if larvae of damselflies and dragonflies (Order Odonata) are present in the wetland.

V4 = 0.1 if larvae of damselflies and dragonflies are not present in the wetland.

Dense stands of emergent vegetation in wetlands prevent sunlight from penetrating to the water surface, which reduces aquatic productivity. A mat of vegetation can form a wetland "floor", which reduces the availability of arthropods to red-winged blackbirds and may result in increased nest predation. Open water, interspersed throughout the emergent herbaceous vegetation, supports submergent vegetation within the wetland boundaty that can be used by aquatic insects as food and cover. The openings also provide an interface between emergent vegetation and open water, which increases the vegetation surface area available to emerging insects and foraging red-winged blackbirds and may increase the presence of potential nest sites. Blackbirds frequently nest on the edge of cattail clumps that border open water (Wiens 1965). They are highly territorial, and the number of territories in a wetland is assumed to be dependent on the quantity of edge between emergent vegetation and open water that is available for nest sites. An exact measure of the amount of edge within a wetland can be difficult and unreliable because of the highly dynamic nature of the herbaceous vegetation, resulting from water level fluctuations, life cycles of the vegetation, and activities of animals like muskrats (*Ondatra zibethica*). Measures of the patchiness of emergent herbaceous vegetation and open water within a wetland is represented by variable 5 (V5) in the model.

Blackbirds prefer patchy stands of cattails interspersed with areas of open water over dense homogeneous stands of cattails (Robertson 1972). Variable 5 is assumed to have a suitability index of 1.0 when the quantity of open water and emergent vegetation is about even (about 40% to 60%). Robertson (1972) found a nesting density of about 96 nests/ha in herbaceous wetland habitat when patchy vegetation was about 41% of the total wetland area. Wetlands with large areas of emergent vegetation and small areas of open water receive relatively low SIs because of the small quantity of suitable nest sites. Case and Hewitt (1963) described the Inlet Valley Marsh in New York as a small, closed herbaceous wetland with upland trees and shrubs immediately adjacent for nesting and foraging sites. The red-winged blackbird nesting density in this herbaceous wetland was about 33/ha. Variable 5 is assigned an SI of 0.3 when a wetland is completely covered with emergent herbaceous vegetation, as described above.

Conditions where there are small areas of emergent vegetation and large areas of open water also receive a low SI because of the reduced availability of niche spaces. Moulton (1980) found red-winged blackbirds nesting in emergent vegetation along ditch banks that surrounded large areas of open water in rice (*Oryza sativa*) paddies in northern Minnesota. Nest densities averaged about 2.5 nests/ha of total wetland habitat, presumably because both nests and emergent vegetation were restricted to long, narrow strips of edge. The territorial behavior of red-winged blackbirds may have restricted the nest density along the ditch banks. An SI of 0.1 is assigned to V5 for wetland habitats with a limited amount of emergent herbaceous cover. The SI's for wetlands with different amounts of emergent herbaceous vegetation are listed below. User's can interpolate between listed values as needed.

V5 = 1.0 if the wetland area contains about an equal mix of emergent herbaceous vegetation and open water.

V5 = 0.3 if the wetland area is covered by a dense stand of emergent herbaceous vegetation.

V5 = 0.1 if the wetland area contains a few patches of emergent herbaceous vegetation and extensive areas of open water.

Condition B wetlands are wetlands that are likely to be dry sometime during the year or that do not have an aquatic insect resource. These wetlands may still provide some habitat for nesting red-winged blackbirds. Blackbirds will tend to use the available emergent vegetation as nest sites and rely on vegetation surrounding the wetland as a foraging substrate. The distance that red-winged blackbirds will fly from wetlands to forage on insects in upland habitats is not known. In this model, only foraging sites within 200 m of wetlands that contain nest sites are assumed to be useful to blackbirds. The quality of a wetland without permanent water or an aquatic insect resource is assumed to be no better than the quality of available foraging sites outside the wetland (V6). Wetlands that only have upland habitats with understory vegetation (such as old fields, pastures, or hay fields) available as foraging substrates are given an SI of 0.1. Wetlands near uplands that have a deciduous midstory or tree canopy as a foraging substrate are assumed to have an SI of 0. 4. Red-winged blackbirds nesting in one herbaceous wetland will forage on insects in other, close-by, herbaceous wetlands (Holm 1973). Condition B wetlands situated within 200 m of a condition A herbaceous wetland that has an emergent aquatic insect fauna (Odonates) and undefended foraging areas are given an SI of 0.9.

V6 = 0.1 if the only suitable foraging substrate is an understory layer.

V6 = 0.4 if the suitable foraging substrates include a midstory and/or an overstory layer.

V6 = 0.9 if the suitable foraging area is a condition A wetland.

Food and reproductive components (upland cover types). Upland habitats (Fig. 1; condition C) frequently are less productive than are wetland habitats. The number of young red-winged blackbirds fledged per territory may be as large in upland sites as in some wetland habitats (Dolbeer 1976). The number of young fledged/ha in upland sites, however, frequently is less than 10% of the number fledged/ha in good quality wetland habitat. For example, Robertson (1972) reported 133 young fledged/ha in one wetland study area, while only 5 young fledged/ha in nearby upland sites. The nesting density in the wetland habitat, with patches of emergent, herbaceous vegetation interspersed with patches of open water, was about 10 times higher than in upland habitats. Robertson found about 100 red-winged blackbird nests/ha in suitable wetland habitat, 2 to 13 nests/ha in hay fields, and 0.1 nests/ha in a Christmas tree plantation.

Robertson's (1972) data on the numbers of nests/ha and young fledged/ha suggest that, if the best wetland habitats have an HSI of 1.0, the best upland sites may have an HSI of about 0.1. Graber and Graber (1963) determined that summer populations of red-winged blackbirds (number/40 ha) in Illinois from 1958 to 1959 were 301 birds in herbaceous wetlands (whether condition A or B is unknown), 342 birds in edge shrubs, 204 birds in sweet clover, 158 birds along drainage ditches, 134 birds in mixed hay, 89 birds in red clover (*Trifolium pratense*), 65 birds in oat (*Avena sativa*) fields, 64 birds in ungrazed grasslands, 58 birds in alfalfa, 30 birds in wheat (*Triticum aestivum*), 27 birds in fallow fields, 24 birds in pastureland, 23 birds in shrub-grown areas, 5 birds in corn fields, and 3 birds in soybeans (Glycine max). The observed nest densities would not exceed the values measured by Robertson (1972) for upland habitats even if all of the birds in each of these different habitat types were nesting females.

The type of upland cover available as nest sites for the red-winged blackbird is represented by V7 in the model. Red-winged blackbirds nest in a wide variety of upland sites. For example, blackbirds nested in hay fields and old fields, but not in tilled and fallow fields, in southern Michigan (Albers 1978). Important characteristics of upland nest sites include the presence of dense, tall, herbaceous vegetation, the availability of fence posts and other structures that serve as display perches for males and as observation posts for both males and females, and a proximity to open water (Joyner 1978). Specific information on the preferred proximity of nest sites in upland habitats to open water were not found in the literature.

Variable 7 (V7) describes the availability of dense, sturdy herbaceous vegetation in forbland, grassland, and pasture/hayland upland sites. Variable 7 has a habitat suitability index of 0.1 if the herbaceous vegetation is dense and tall, like sweet clover (Melilotus spp.), mixed hay, alfalfa, and coarse weeds, which provide suitable nest sites and protective cover. Variable 7 has a suitability index of 0.0 if the habitat site has some other surface cover, such as cut or fallow fields, agricultural fields, woodlots, or tilled soils.

V7 = 0.1 if upland habitat provides dense, tall, herbaceous vegetation.
V7 = 0.0 if upland habitat has some other surface cover.

Early nests of red-winged blackbirds in upland sites are more productive than are late nests (Dolbeer 1976). Early nests are placed in robust, dense, old herbaceous growth. Activities that are destructive to this vegetation, such as mowing, heavy grazing pressure, or burning, reduce habitat suitability for red-winged blackbirds. The occurrence of disturbances that might impact nesting success in upland cover types is included as V8 in the model.

V8 = 0.1 if disturbances, such as mowing, heavy grazing, or burning, do not occur to the potential habitat site in most years.

V8 = 0.0 disturbances occur to the potential habitat site in most years.

HSI determination. Three types of habitat conditions (A, B, and C) are described in Figure 1. Condition A represents a wetland that contains the preferred vegetative structure for nest placement, permanent water that supports a population of emergent aquatic insects that are available as food, the absence of carp, and the interspersion of open water within emergent herbaceous vegetation. The equation combining the SIs for V1 to V5 to estimate an HSI for condition A wetlands is:

$$HSI = (V1 \times V2 \times V3 \times V4 \times V5)$$

Condition B habitats (Fig. 1) are wetlands where the emergent herbaceous vegetation does not have the preferred structure, there is no permanent water, carp are present, or benthic invertebrates are absent. Condition B habitats have a basic SI of 0.1, determined by the 0.1 SI for the unsuitable conditions of V1, V2, V3, or V4. The basic SI of 0.1 can be increased if suitable foraging substrate is available outside the boundary of the wetland. Food sources are considered more limiting if only an understory layer is available than if deciduous midstory and/or overstory layers also are available as foraging surfaces. A condition B habitat may be of highest value to red-winged blackbirds if the birds can readily feed on emergent aquatic insects in a nearby condition A herbaceous wetland habitat. The equation for estimating the HSI for condition B habitats is:

$$HSI = (0.1 \times V6)^{1/2}$$

Condition C habitats are upland sites, like grass, forb, and pasture/hayland cover types. Their HSI'S, which will be either 0.1 or 0, are described by the following equation:

$$HSI = (V7 \times V8)^{1/2}$$

The measure of habitat quality represented by the HSI actually reflects an estimate of the quantity of niche space available to the blackbird. Habitats with higher HSIs are assumed to contain more niche space than habitats with lower HSI'S. More niche space in a habitat frequently means that more individuals will occur in that habitat.

Application of the Model

Summary of model variables. This model can be applied by interpreting a recent, good quality, aerial photograph of the assessment area and making selected field measurements. The habitat to be evaluated is outlined on the aerial photograph. Each wetland within the assessment area is identified and a 200 m zone drawn around its perimeter. The wetlands within the assessment area are evaluated, on a per ha basis, with field observations and measurements that determine: (1) the type of emergent vegetation present; (2) the probable permanency of the water; (3) the presence or absence of carp; (4) the presence or absence of larval stages of emergent aquatic insects; (5) the mix of open water and emergent herbaceous vegetation; and (6) the nature of vegetative cover within 200 m surrounding the wetland (Fig. 2). The proportion of open water and emergent herbaceous vegetation within the wetland is estimated from a map made after boating or wading through the wetland. The presence of benthic invertebrates is determined from field sampling. Upland habitats within the assessment area are evaluated by ground truthing to determine cover types and land-use practices. Habitat conditions, like the presence of dense, tall herbaceous cover and the probability that disturbances such as grazing, burning, mowing, and tilling will occur during the March to July nesting season, are noted.

Definitions of variables and suggested field measurement techniques are provided in Figure 3.

Model assumptions. I have assumed that it is possible to synthesize results from many studies conducted in different seasons of the year different locations in North America into a model years, and a wide variety of nest sites throughout North America into a model describing the relative quality of breeding habitat for the red-winged blackbird. My basic assumptions about habitat criteria important to red-winged blackbirds are based on descriptive and correlative relationships expressed in the literature. My descriptors of habitat quality will obviously be in error if authors made incorrect judgements or measurements or if I have emphasized the wrong data sets or misinterpreted the meaning of published data.

I have assumed that the quality of some wetland habitats exceeds the quality of best upland habitats. This assumption was based largely on quality of the blackbirds fledged per hectare of wetland and upland habitats. I compiled and analyzed characteristics of wetland habitats that seemed to distinguish habitats where varying numbers of red-winged blackbirds were fledged. I assumed that I could meaningfully bound the size of study areas to be evaluated as nesting habitat as ≥ 0.1 ha for wetland sites and $\exists$ 1.0 ha for suitable upland sites. I arbitrarily selected distances (200 m) that blackbirds might fly from their nests in wetlands to forage on insects and seeds in surrounding vegetative cover. I assumed that the presence of dense, tall, herbaceous cover reasonably close to water, coupled with a strong probability that the dense cover would remain relatively undisturbed during the breeding season, would adequately indicate the value of upland habitats as nest sites for the red-winged blackbird.

The values for Variables 1 through 8 are estimates. The ecological information available does not seem sufficient to suggest: (1) other pertinent variables; (2) more appropriate values for the present variables; or (3) more definitive interrelationships between the variables. Finally, I have assumed that the multiplicative relationship described in the model is appropriate summary statement to provide a Habitat Suitability Index that reflects the relative importance of different habitats as nest sites for the red-winged blackbird.

Figure 3. Definitions of variables and suggested measurement techniques.

Variable (definition)		Cover type	Suggested technique
VI	Type of emergent	HW	Identify the dominant species of emergent herbaceous vegetation in the wetland. Determine if the dominant species is a broad-leaved monocot.
V2	Water regime	HW	Determine whether or not water will be retained in the wetland throughout the year in most years; use, if possible, indicators like muskrat houses and fish. Evaluate records describing permanence and level of water in wetland. Determine the classification type of wetland if the wetland has been classified.
V3	Abundance of carp within the wetland.	HW	Determine presence of carp by seining, using local data about presence of carp within wetland or observations to see if water is clear or generally murky, as it is when carp are feeding.

V4	Abundance of larval	HW	Collect insect larvae by dragging astages of emergent aquatic sieve net along water bottom near edge insects(Order Odonata) of clumps of emergent herbaceous within the wetland. vegetation. Sampling is done for some fixed time period. A second sampling procedure involves kicking up the substratum at the edge of clumps of emergent herbaceous vegetation in front of the mouth of a net in some standardized manner (Hynes 1972:240). The collected invertebrates are sorted and identified by comparison with illustrations in an appropriate manual (like Needham and Needham 1970) to determine the presence of damselfly and dragonfly larvae (Order Odonata).
V5	Percent emergent	HW	Determine the mix of open water and herbaceous canopy emergent herbaceous vegetation within the wetland study area. Estimate the mix from a map prepared after wading, walking, or boating through the wetland or from a map made from a recent, high quality, aerial photograph
V6	Types of foraging sites	HW	Use map measurer (Hays et al. 1981) available outside the wetland. to determine if another wetland with an emergent aquatic insect population occurs within 200 m of nest sites within the wetland being evaluated. Map vegetation within 200 m of the wetland and determine, using a dot grid (Hays et al. 1981) or a planimeter, if deciduous midstory and overstory layers comprise at least 10% cover when projected to the ground surface. If midstory and/or overstory do not provide at least 10% cover, and a condition. A wetland does not occur within 200 m of the wetland being evaluated assume only the understory layer is available as a foraging substrate.
V7	Presence of dense, sturdy	F,G,P/H	Interpret the aerial photograph or a herbaceous vegetation Vegetation on-site map prepared from the aerial photograph to determine areas of upland herbaceous vegetation. Ground truth to determine types of herbaceous vegetation occurring in the upland within the assessment

			area and determine if tall, dense, herbaceous cover covers at least 10% of the surface area.
V8	Occurrence of disturbances	F,G,P/H	Ground truth to predict past and future like grazing, mowing, burning, land-use practices (types of and tilling on potential uplanddisturbances that may impact nesting nest sites. success).

SOURCES OF OTHER MODELS

Weatherhead and Robertson (1977) identified and quantified some parameters that affected the nesting success of red-winged blackbirds in wetland habitats in Ontario, Canada. They determined that nesting success, as judged by numbers of young fledged per female, was positively correlated with territory quality scores based on nest placement. Nesting success seemed to be related to four parameters: (1) water depth within the wetland; (2) height of nest above the herbaceous wetland floor; (3) relative openness of nesting cover within the wetland; and (4) the identity of the support vegetation holding the nest. Two of these variables are represented in the present model of habitat suitability for the red-winged blackbird: (1) presence or absence of permanent water; and (2) the relative openness of vegetation within flooded herbaceous wetlands. No other models for use in predicting the quality of nesting habitat for red-winged blackbirds were found in the literature.

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HABITAT SUITABILITY INDEX MODELS: GREAT EGRET

by

Brian R. Chapman
Department of Biology
Corpus Christi State University
Corpus Christi, TX 78412

and

Rebecca J. Howard
National Coastal Ecosystems Team
U.S. Fish and Wildlife Service
1010 Gause Boulevard
Slidell, LA 70458

Project Officer

Paul L. Fore
Regional Office, Region 2
U.S. Fish and Wildlife Service
Albuquerque, NM 87103
Performed for
National Coastal Ecosystems Team
Division of Biological Services
Research and Development
Fish and Wildlife Service
U.S. Department of the Interior
Washington, DC 20240

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PREFACE

The habitat suitability index (HSI) model for the great egret presented in this report is intended for use in the habitat evaluation procedures (HEP) developed by the U.S. Fish and Wildlife Service (1980) for impact assessment and habitat management. The model was developed from a review and synthesis of existing information and is scaled to produce an index of habitat suitability between 0 (unsuitable habitat) and 1.0 (optimally suitable habitat). Assumptions used to develop the HSI model and guidelines for model applications, including methods for measuring model variables, are described.

This model is a hypothesis of species-habitat relations, not a statement of proven cause and effect. The model has not been field tested, but it has been applied to three hypothetical data sets that are presented and discussed. The U.S. Fish and Wildlife Service encourages model users to convey comments and suggestions that may help increase the utility and effectiveness of this habitat-based approach to fish and wildlife management. Please send any comments or suggestions you may have on the great egret HSI model to the following address.

National Coastal Ecosystems Team
U.S. Fish and Wildlife Service
1010 Gause Boulevard
Slidell, LA 70458

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Earlier versions of the habitat suitability index model and narrative for the great egret were reviewed by Dr. R. Douglas Slack and Jochen H. Wiese. The model's structure and functional relationships were thoroughly evaluated by personnel of the U.S. Fish and Wildlife Service's (FWS) National Coastal Ecosystems Team. Model and narrative reviews were also provided by FWS Regional personnel.

GREAT EGRET (*Casmerodius albus*)

INTRODUCTION

The great egret, also called common egret or American egret, is a large white heron in the order Ciconiiformes, family Ardeidae. Great egrets stand 37-41 inches tall and have a wing spread to 55 inches (Terres 1980). The species is associated with streams, ponds, lakes, mud flats, swamps, and freshwater and salt marshes. The birds feed in shallow water on fishes, amphibians, reptiles, crustaceans and insects (Terres 1980).

Distribution

The great egret is a common breeding species in all coastal areas south from southern Oregon on the Pacific coast and from Maine on the Atlantic coast; in riverine, palustrine and estuarine habitats along the coast of the Gulf of Mexico; and in the Eastern-Central United States (Palmer 1962; Erwin and Korschgen 1979; American Ornithologists' Union 1983). The great egret undergoes an extensive postbreeding dispersal that extends the range of the species to most of the United States exclusive of the arid Southwest (Byrd 1978). Young birds hatched in Gulf coast colonies tend to move northward for a short period (Byrd 1978; Ogden 1978). However, with the onset of colder weather most great egrets and other herons migrate south and many winter along the gulf coast in Texas, Louisiana, and Florida (Lowery 1974; Oberholser and Kincaid 1974; Byrd 1978). Analysis of banding data indicates that many birds winter in Cuba, the Bahamas, the Greater and Lesser Antilles, Mexico, and Central America (Coffey 1948). Lowery (1974) suggested that during severe winters, a higher proportion of the population winters farther south.

Life History Overview

Great egrets nest in mixed-species colonies that number from a few pairs to thousands of individuals. A colony may include other species of herons, spoonbills, ibises, cormorants, anhingas, and pelicans. Colony and nest-site selections begin as early as December along the gulf coast, but most great egrets do not initiate nesting activities until mid-February or early March (Bent 1926; Oberholser and Kincaid 1974; Chaney et al. 1978; Morrison and Shanley 1978). Eggs have been recorded from March through early August, and young have been observed in nests from mid-May through late August (Oberholser and Kincaid 1974; Chaney et al. 1978). Clutch size varies from one to six eggs per nest, but three to four eggs is most common (Bent 1926). Incubation period in a Texas colony ranged from 23 to 27 days (Morrison and Shanley 1978). The first flights of young have been noted about 42 days after hatching (Terres 1980).

SPECIFIC HABITAT REQUIREMENTS

Food and Foraging Habitat

Fish constitute up to 83% of the great egret's diet (Hoffman 1978). Most fish taken by great egrets are minnow-sized 3.9 inches, but fish up to 14 inches can be captured and swallowed (Willard 1977; Schlorff 1978). Other major food items include insects, crustaceans, frogs, and snakes, while small mammals, small birds, salamanders, turtles, snails, and plant seeds are occasionally taken (Baynard 1912; Bent 1926; Hunsaker 1959; Palmer 1962; Genelly 1964; Kushlan 1978b).

Little specific information exists on the food habits of various age classes of great egrets. An adult great egret weighing 32.3 ounces (oz) (Palmer 1962) may require approximately 3.9 oz of food per day (estimated by using the wading bird weight-daily food requirement model proposed by Kushlan 1978b). Daily food requirements are undoubtedly higher during the nesting season when adults are feeding young (Kushlan 1978b).

Great egrets usually forage in open, calm, shallow water areas near the margins of wetlands. They show no preference for fresh-, brackish, or saltwater habitat. Custer and Osborn (1978a,b) found that feeding habitat selection in coastal areas of North Carolina varied daily with the tidal cycle. During low tide, great egrets fed in estuarine seagrass beds. During high tide, freshwater ponds and the margins of *Spartina* marshes were used. Inland, great egrets feed near the banks of rivers or lakes, in drainage ditches, marshlands, rain pools (Bent 1926; Dusi et al. 1971; Kushlan 1976b), and occasionally in grassy areas (Weise and Crawford 1974). Feeding sites are generally not turbid and are fairly open with no vegetative canopy and few emergent shoots (Thompson 1979b), Great egrets forage singly, in single-species groups, and in mixed-species associations (Kushlan 1978b). Great egrets generally fly alone to feeding sites (Custer and Osborn 1978a,b) and may use the same feeding site repeatedly. The density and abundance of fish at a given location in estuarine habitats may vary with season, time of day, tidal stage, turbidity, and other factors. If feeding success is low, great egrets may move to other areas (Cypert 1958; Schlorff 1978) and join other conspecifics in good feeding habitats (Custer and Osborn 1978a,b). Most instances of group feeding have been observed during specific environmental conditions, such as lowered water levels, that tend to concentrate prey (Kushlan 1976a,b; Schlorff 1978).

Meyerriecks (1960, 1962) and Kushian (1976a, 1978a, b) provided detailed information on hunting techniques employed by great egrets. The "stand-and-wait" and "slow-wade" methods are used most frequently. Because of their long legs, great egrets can forage in somewhat deeper water than most other herons. In New Jersey, foraging depths ranged from 0 (standing on the bank while fishing) to 11 inches, but depths ranging from 4 to 9 inches were most commonly used (Willard 1977). In North Carolina, great egrets fed in water with a mean depth of 25.1 cm (9.8 inches) in *Spartina* habitat and of 6.8 inches in non-*Spartina* habitat (Custer and Osborn 1978b). Mean water depth was 7.9 inches for foraging great egrets in California (Hom 1983). In addition to wading, great egrets can feed by alighting on the surface of deep waters to catch prey, a method rarely employed (Reese 1973; Rodgers 1974, 1975).

Although recent declines of great egret populations in the central coastal region of Texas occurred simultaneously with declines in coastal marine and estuarine fish populations (Chapman 1980), no causal relationship has been proven. At present there are no known management practices that provide suitable food alternatives for piscivorous species, such as the great egret, during periods of fish population decline. Known fish nursery and feeding areas need protection from destruction or habitat alteration to ensure adequate prey populations for fish-eating birds.

Water

The physiologic water requirement of great egrets is probably met during feeding activities in aquatic habitats (Dusi et al. 1971). Water depth affects the quantity, variety, and distribution of food and cover; great egret food and cover needs are generally met between the shoreline and water 1.6 feet deep (Willard 1977).

Interspersion

Suitable habitat for the great egret must include (1) extensive shallow, open water habitat from 4 to 9 inches deep (Willard 1977); (2) food species present in sufficient quantity (Custer and Osborn 1977); and (3) adequate nesting or roosting habitat close to feeding habitat. Most great egrets at a colony in North Carolina flew less than 2.5 miles from nesting colonies (and presumably, from roosting sites) to feeding areas (Custer and Osborn 1978a), but flight distances of up to 22.4 miles have been recorded in the floodplain of the Upper Mississippi River (Thompson 1979b).

Several heronries may be close together. Great egrets from one colony may fly over or near an adjacent colony, but rarely feed in the same areas as conspecifics from the adjacent colony (Thompson 1979b).

HABITAT SUITABILITY INDEX (HSI) MODELS

Model Applicability

Geographic area. The habitat suitability index (HSI) models in this report were developed for application in coastal wetland habitats in Texas and Louisiana. Because there are few differences in habitat requirements along the Atlantic coast, the remainder of the gulf coast, and inland sites in the Southeastern United States, the HSI models may also be used to evaluate potential habitat in those areas.

Season. This model will produce an HSI values based upon habitat requirements of great egrets during the breeding season (February to August). Because there is no apparent seasonal difference in feeding habitat preference and because winter nocturnal roosts are similar to nesting sites, the HSI models may also be used to evaluate winter habitat for the great egret.

Cover types. Great egrets nest on upland islands and in the following cover types of Cowardin et al. (1979): Estuarine Intertidal Scrub-Shrub wetland (E2SS), Estuarine Intertidal Forested wetland (E2FO), Palustrine Scrub-Shrub wetland (PSS) (including deciduous and evergreen subclasses), and Palustrine Forested wetland (PFO) (including deciduous and evergreen subclasses). Great egrets may also feed in these wooded wetlands, but preferred feeding areas may be any one of a wide variety of wetland cover types.

Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous suitable habitat required before an area can be occupied by a particular species. Specific information on minimum areas required by great egrets was not found in the literature. If local information is available to define the minimum habitat area, and less than this amount of area is available, the HSI for the species will be zero.

Verification level. The output of these HSI models is an index between 0 and 1.0 that is believed to reflect habitat potential for great egrets. Two biologists reviewed and evaluated the great egret HSI model throughout its development: Dr. R. Douglas -Slack, Texas A&M University, College Station, and Jochen H. Wiese, Environmental Science and Engineering Company, Gainesville, Florida. Their recommendations were incorporated into the model-building effort. The authors, however, are responsible for the final version of the models. The models have not been field-tested.

Model Descriptions

Feeding HSI model. Great egret feeding habitat suitability is related to prey availability. Habitat suitability is optimal when two conditions are met: (1) the populations of minnow-sized fish are high; and (2) shallow open water (necessary for successful prey capture), aquatic vegetation (necessary for prey survival and reproduction), and deeper water are present in a ratio that maximizes prey density and minimizes hunting interference. Use of this model assumes that deep or permanent water environments are not limiting in coastal habitats and that fish populations are distributed uniformly. Because great egrets hunt a variety of species in many different habitat types, a general approach to modeling feeding habitat suitability is presented. Suitability of all wetland cover types for feeding is determined by integrating two factors: (1) the abundance of prey and (2) the accessibility of prey.

The abundance of prey is determined by the ability of the habitat to support the major prey species, especially minnow-sized fish. It is assumed that the abundance of major prey species is related to the primary and secondary productivity of the aquatic habitat; however, few field studies have documented this relationship. The model assumes that prey abundance is not limiting in coastal habitats. Therefore, the accessibility of prey is used as the indicator of feeding habitat suitability.

The accessibility of prey is determined by water depth and percentage cover of aquatic vegetation. A wetland with 100% of its area covered by water 4-9 inches deep is assumed to be optimal for feeding by great egrets (V_1). Although an absence of submerged or emergent vegetation would render fish species most vulnerable to capture, it is unlikely that many prey species would use such an area because it totally lacks cover. The model assumes, therefore, that optimal conditions for both the occurrence and susceptibility to capture of prey species exist when 40%-60% of the wetland substrate is covered by submerged or emergent vegetation (V_2). When such vegetation is lacking, the habitat has a low value for feeding great egrets because small fish may use unvegetated water that is too shallow for their larger aquatic predators.

	Habitat variable	Component
V_1	Percentage of area with water 10-23 cm deep.	

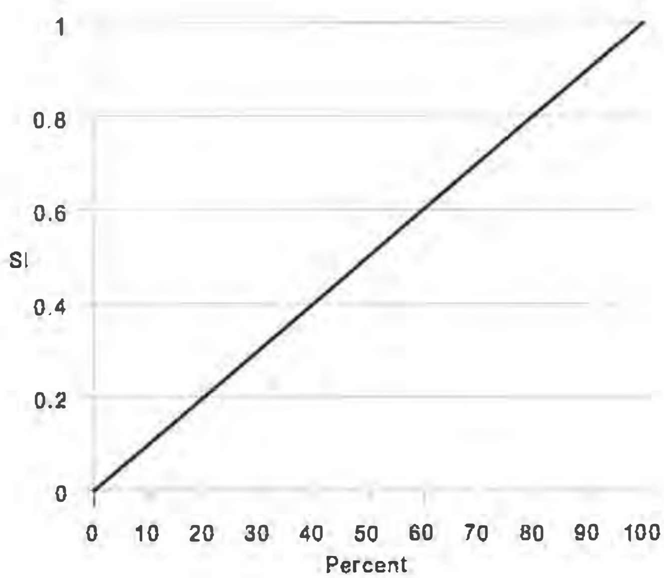
	Food	HSI (Feeding)
V_2 Percentage of submerged or emergent vegetation cover in zone 10-23 cm deep.		

Suitability Index (SI) Graphs for Model Variables

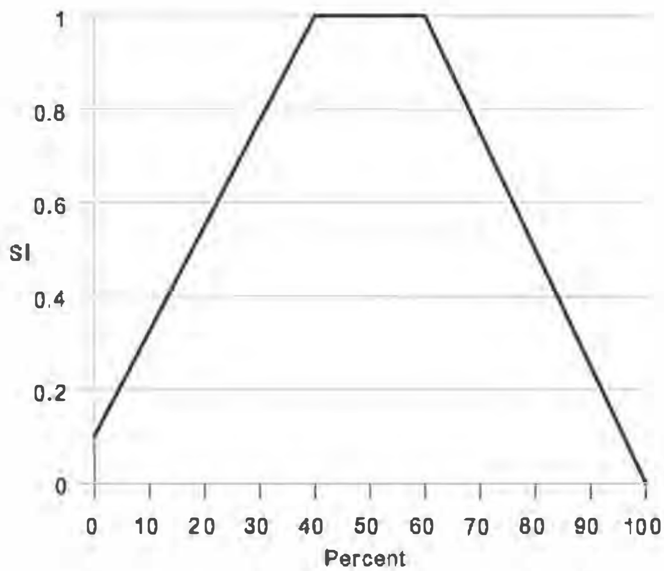
This section provides graphic representation of the relationship between habitat variables and habitat suitability for the great egret in wetland (see Table 2 for abbreviations) and upland (U) cover types. The SI values are read directly from the graph (1.0 = optimal suitability, 0.0 = no suitability) for each variable.

The SI graphs are based on the assumption that the suitability of a particular variable can be represented by a two-dimensional linear response surface. Although there may be interdependencies and correlations between many habitat variables, the model assumes that each variable operates independently over the range of other variables under consideration.

V_1 Percentage of study area with water 4-9 inches deep. In tidal areas, use depth at mean low tide. In nontidal areas, use average summer conditions.



V_2 Percentage of substrate in zone 4-9 inches deep covered by submerged or emergent vegetation.



Feeding HSI.

$$HSI = \frac{V_1 + V_2}{2}$$

Data representing three hypothetical study areas for great egret were used to calculate sample HSI values The HSI values obtained are believed to reflect the potential of the areas to support feeding or nesting great egrets.

Field Use of Models
The level of detail needed for application of these models will depend on time, money, and accuracy constraints. Detailed field sampling of all variables will provide the most reliable and replicable HSI values. Any or all variables can be estimated to reduce the amount of time or money required to apply the models. Increased use of the subjective estimates decreases reliability and replicability, and these estimates should be accompanied by appropriate documentation to insure that decision makers understand both the method of HSI determination and quality of data used in the model. Techniques for measuring habitat variables included in the great egret HSI models are suggested in Table 5.

A project area may contain both potential feeding and nesting habitat. To decrease the cost and time necessary to evaluate the area, assume that food is not limiting and apply only the nesting HSI model. This recommendation is based upon the following assumptions: (1) in most coastal areas of Texas and Louisiana, aquatic habitats suitable for feeding are abundant and are, therefore, less of a limiting factor to great egrets than are suitable nesting sites; and (2) nesting value is easier and more accurately estimated by using subjective methods than is food value. The variables used to measure food use of past colony sites, and (2) the enhancement of a site by the presence of other herons. These two factors are usually, but not always, interrelated. Great egrets tend to use the same colony site in successive years until the site is degraded, and the site may include great blue herons. When applying the HSI model , the user should be aware that an area known to be used by great egrets (or great blue herons) is more likely to be used in future years than an area with an equal HSI value not known to have a history as a colony site.

Table 5. Suggested measurement techniques for habitat variables used in the great egret HSI models.

Variable	Suggested technique
V_1	The percentage of the area with water 4-9 inches deep can be determined by line transect sampling of water depth.
V_2	The percentage of substrate in the 4-9 inches water depth zone covered by submerged or emergent vegetation can be determined from available cover maps, aerial photographs, or by line transect sampling.

HABITAT SUITABILITY INDEX MODEL

CALIFORNIA VOLE (*Microtus californicus*)

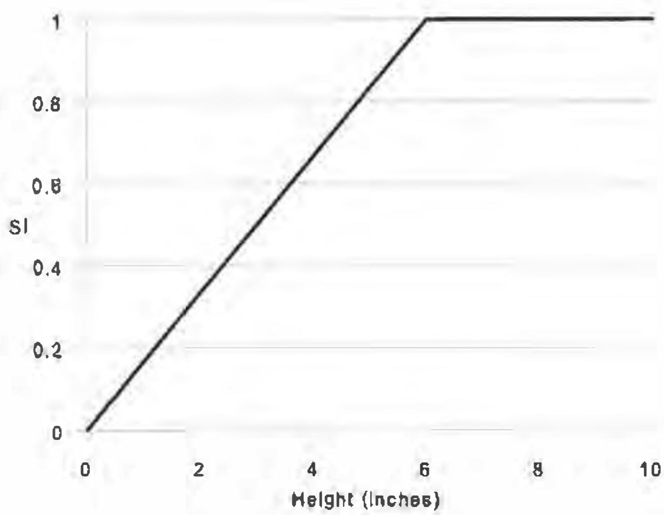
U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

Cover-Type	Life Requisite	Habitat Variable
Annual Grassland Seasonal Wetland	Food/Cover Reproduction	Height of herbaceous vegetation (V1) Percent cover o fherbaceous vegetation (V2) Soil Type (V3)
Riparian Woodland Oak Woodland	Reproduction Food/Cover	Height of herbaceous vegetation (V1) Percent cover herbaceous vegetation (V2) Soil Type (V3) Presence of logs and other types of cover (V4)

Variable	Cover-Type	Sampling Technique
V1 - Height of herbaceous	Annual Grassland Oak Woodland Riparian Woodland Seasonal Wetland	Average vegetation height in 1 m^2 quadrat
V2 - Percent cover of herbaceous vegetation	Annual Grassland Seasonal Wetland Oak Woodland Riparian Woodland	1 m^2 quadrat
V3 - Soil Type	Annual Grassland Seasonal Wetland Oak Woodland Riparian Woodland	Site inspection County Soil Survey
V4 - Presence of logs and other types of cover	Annual Grassland Seasonal Wetland Oak Woodland Riparian Woodland	Visual inspections Sample point

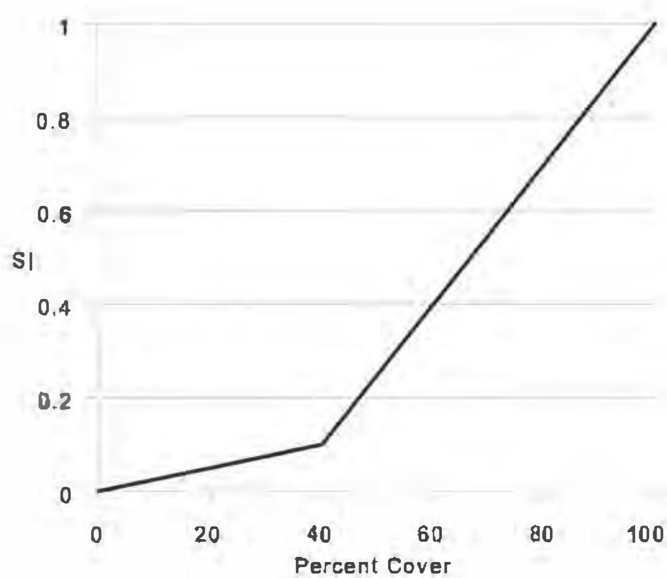
Variable 1: Height of herbaceous vegetation.

Assumes: California voles require relatively tall herbaceous vegetation for both food (Gill 1977. Batzil 1986) and cover (Ingles 1965). Herbaceous vegetation ≥ 6 in tall is considered optimum.



Variable 2: Percent cover of herbaceous vegetation.

Assumes: Relatively dense herbaceous vegetation is needed for cover percent cover ≥ 100 percent is considered optimum (CDFG undated).



Variable 3: Soil type

Assumes: Friable soils such as silts and loams are optimum because voles can dig their burrows (Ingles 1965). Soils such as sands and clays are not optimum.

Suitability Index (SI)

SI = 1.0 if soil type is silty or loamy and friable.

SI = 0.5 if soil type is not silty or loamy and is moderately friable

SI = 0.2 if soil type is not silty or loamy and is not friable.

Variable 4: Presence of logs and other cover types within the sample area.

Assumes: California voles will use logs, brush piles, and rocks for cover in addition to their burrows (California Department of Fish and Game). These sources of cover are more important in woodland habitats than grassland and wetland habitats.

SI = 1.0 logs, brush piles, and rocks are abundant and well distributed throughout the sample site (e.g., ≥ 4 per sample site).

SI = 0.7 if logs, brush piles, and rocks are moderate abundant and distributed throughout the sample site (e.g., 2-4 per sample site).

SI = 0.4 logs, brush piles, and rocks are absent or sparsely distributed throughout the sample site (≤ 1 per sample site).

SI = 0.1 if logs, brush piles, matted vegetation, and/or rocks are absent From sample area.

HSI Determination

For annual grasslands and seasonal wetlands.

$$HSI = \frac{V_1 + V_2 + V_3}{3}$$

For oak woodlands and riparian woodlands:

$$HSI = \frac{V_1 + V_2 + V_3 + V_4}{4}$$

All variables are assumed to contribute equally to the availability of a given habitat type for the California vole. Water is assumed not be a limiting factor and is represented by the herbaceous vegetation variables.

Model Applicability

This model is a hypothesis of the relationships between various attributes of grassland, wetland, and oak riparian woodland habitats and the suitability of these habitats to California voles. The model is designed for use in the Central Valley of California up to 2,500 feet in elevation. California voles are permanent year-round residents, and this model can be applied to these habitats at all times of the year.

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HABITAT SUITABILITY INDEX MODEL
Plain Titmouse (*Parus inornatus*)

by
Michael Long and Daniel Strait
U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

June 1989

Habitat Use Information

General
The plain titmouse inhabits oak and piñon-juniper woodlands from Oregon south and west to Texas. It is a year-round resident, and maintains a territory throughout the year. The species is generally a secondary cavity nester, although it may occasionally excavate its own hole.

Food
As a group, titmice take a wide variety of foods, but they are considered insectivorous during the summer, and consumers of fruit, seeds, and some insects in the winter (Ferrins 1979). Root (1967 - cited by Verner 1979), found that a large proportion of their food consisted of plant material and arthropods living on the bark of trees. Wagner (1981) found the plain titmouse took a great variety of arthropod taxa.

The titmouse is primarily a bark forager, although it also forages on tree foliage and occasionally on the ground (Hertz et. al. 1976). Most foraging by this species is done between 0-30 feet (0-9 m) of the ground (Wagner 1981; Hertz et. al. 1976). Hertz et al. found that plain titmice showed a preference for foraging in blue oaks (*Quercus douglasii*) over coast live oaks (*Q. agrifolia*). Hertz et. al. (1976) attributed the avoidance of live oaks to their smooth bark which is poor habitat for arthropods. Block and Morrison (1986) also found the titmouse to use blue oaks more than valley oaks (*Q. lobata*), black oak (*Q. kelloggii*), and canyon live oak (*Q. chrysolepis*) for foraging at Tejon Ranch, California. The plain titmouse will forage extensively in live oaks however, especially when other oak species are not present (Dixon 1964).

Reproduction
The plain titmouse is a secondary cavity nester, nesting in natural cavities, old woodpecker holes, or nest boxes. It prefers natural cavities over excavated cavities (Wilson, pers. comm.). Bent (1946) reported nests from 3-32 feet (1-10 m) above the ground. Bent, citing Dawson (1923), reported the titmouse to occasionally excavate its own nest cavity in blue oaks. The plain titmouse prefers wooded areas with intermediate to high percentage canopy coverage dominated by blue, live and valley oaks (Verner and Boss 1980).

Cover
Cover is provided by the oak woodlands and riparian areas in which the plain titmouse lives. Roost sites are provided by natural cavities, old woodpecker holes, or by dense foliage which simulates a cavity (Dixon 1949).

Interspersion
Plain titmice maintain year-round territories. Three territories observed by Hertz et. al. (1976) averaged 2.0 acres (0.8 ha) in California oak woodland. Dixon (1949) found 12 territories ranged located primarily in live oak woodland. These territories ranged in size from 3.3-12.5 acres (1.3-5.1 ha) with an average size of 6.3 acres (2.6 ha). According to Dixon (1956) 2.5 acres (1.0 ha) would probably be close to an absolute minimum size for a territory.

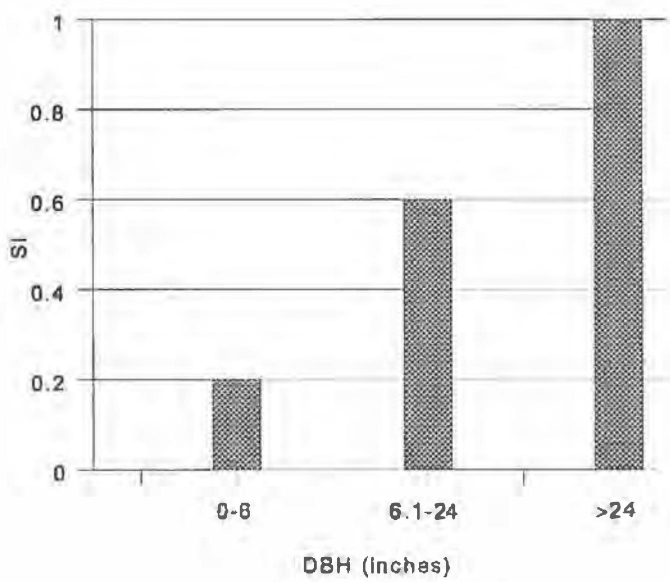
Water Requirements
In a study by Williams and Koenig (1980), the plain titmouse was classified as an occasional drinker.

Model Applicability
This model was developed for use in evaluating habitat suitability of oak savannah, oak woodland, and riparian woodland in Merced, Fresno, Stanislaus, and San Benito Counties in California from 500 - 2,500 ft in elevation. The basic assumptions for using the model are that meeting the reproductive needs of the plain titmouse will take care of its cover and food needs throughout the year. This assumption seems warranted. Verner (1979) believes that proper management for oaks for breeding birds should also provide the habitat needs for species that use oaks at other times of the year. In addition, it is assumed that water is not a limiting factor. It is assumed that the model is valid for use in riparian areas as well as the oak woodlands despite the fact that the model was initially developed for oak woodlands.

Model Description
Little quantitative data were found on the habitat needs of the plain titmouse. The most useful information was the information on habitat factors related to breeding for the species presented by Ohmann and Mayer (1986). Using data from the California Wildlife Habitat Relationships data base and the Forest Inventory and Analysis Research Unit inventory, Ohmann and Mayer developed a habitat suitability index model for the plain titmouse from which Variable 1 was derived.

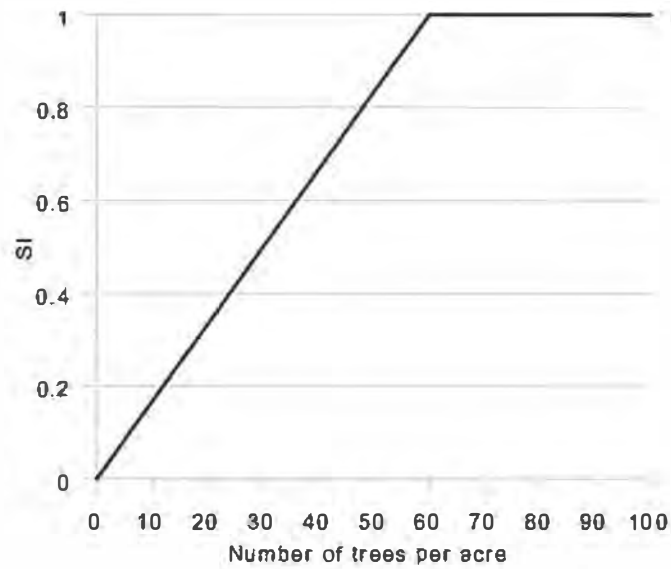
Variable 1. Tree diameter. (A tree is defined as a woody plant species 16 feet high or greater)

Ohmann and Mayer found tree size and percent canopy closure to be the major variables determining suitability of a habitat for the plain titmouse. Our model will assume that the diameter of a tree and the size of the canopy are correlated to the extent that they can be considered a single variable to be represented in this model by diameter at breast height (DBH). Presumably this variable best represents older trees with more cavities for nesting and greater bark surface which supports a greater prey base.



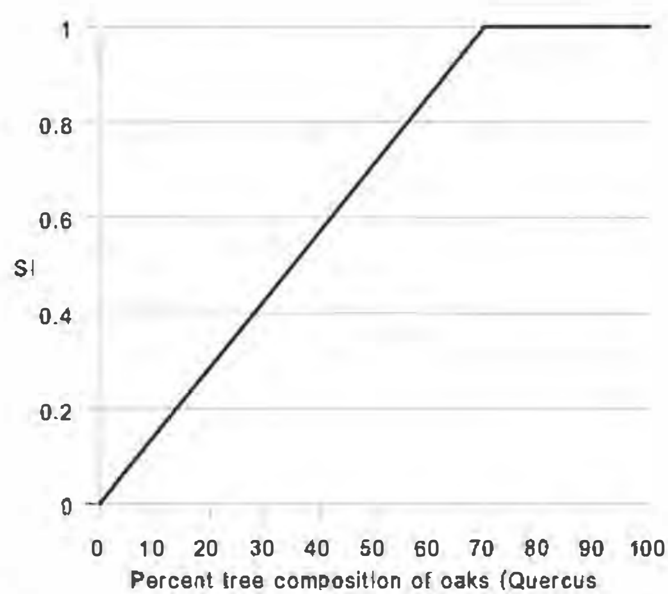
Variable 2. Trees per acre.

Plain titmouse abundance was found to increase as the number of trees increased (Wilson, pers. comm.). This may be particularly important in areas of low to moderate canopy cover. Studies at the Hopland, California field station found titmouse abundances to peak in areas with 60 trees/acre.



Both Variables 1 and 2 relate directly to the extent of a stand's canopy closure such that the importance placed on canopy closure by Ohmann and Mayer is incorporated into this model through the use of Variables 1 and 2.

Variable 3. Percent composition of tree species that are oaks (*Quercus*).
Verner and Boss (1980) stated that the plain titmouse prefers stands dominated by blue, live and valley oaks. We have been unable to find and studies documenting the presence of the plain titmouse in an area without a major proportion of oaks. For the sake of this model then, we will consider the presence of oaks to be a life requisite such that the optimum titmouse habitat is one dominated by oaks.



HSI Determination

In each sample area, tree diameter is measured along with the number of trees per acre and the percentage of those trees that are oaks. The Habitat Suitability Index for the sample site is then determined using the following formula:

$$HSI = \frac{V1 + V2 + V3}{3}$$

Suggestions for Applying the Model

1. The tree diameter classes for calculating Variable 1 (DBH) were not specified by Ohmann and Mayer. Therefore, all trees within the sample plot should be included in the DBH determination.

2. If no trees, 4-inch DBH or greater, are found in the sample plot, the HSI for the sample plot is 0.0. A 4-inch DBH tree is probably about the smallest tree that could have a cavity of sufficient size for the titmouse.

3. Ideally, all tree species in the study area should be fully leafed out when applying the model. Therefore, the best time for sampling is spring and summer.

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HABITAT SUITABILITY INDEX MODEL

BOBCAT (*Felis rufus*)

Pacific Gas and Electric Company

1986

Geographic Area: This HSI Model was developed for use on the west slope of the Sierra Nevada in Fresno County, California.

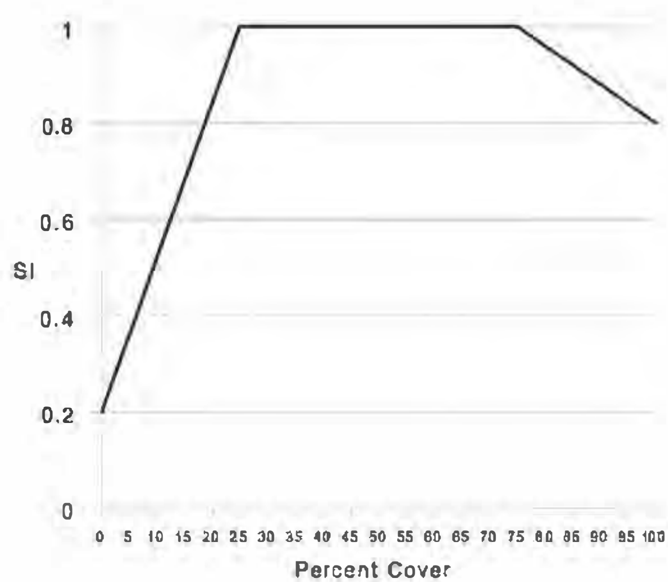
Season: This model was developed to evaluate year-round habitat suitability for the bobcat *(Felis rufus)*.

Cover Types: This model was designed to evaluate habitat suitability for the bobcat in the Chaparral cover type (terminology follows that of Verner and Boss 1980).

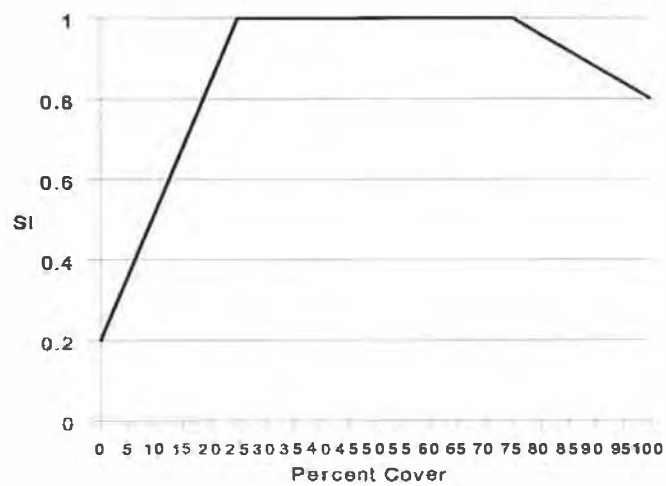
Guild:	Feeding	Breeding
	Surface	Subsurface

Equation: $$HSI = \frac{(V_1 + V_2 + V_3 + V_4)}{5}$$

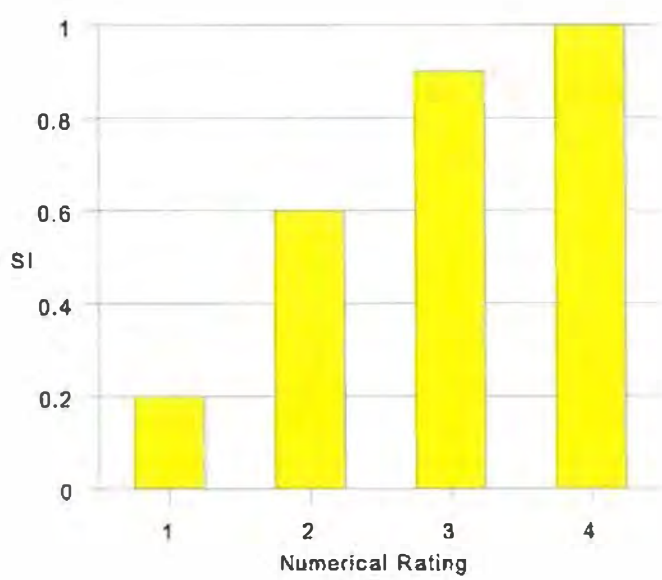
V1 - Percent Shrub Cover



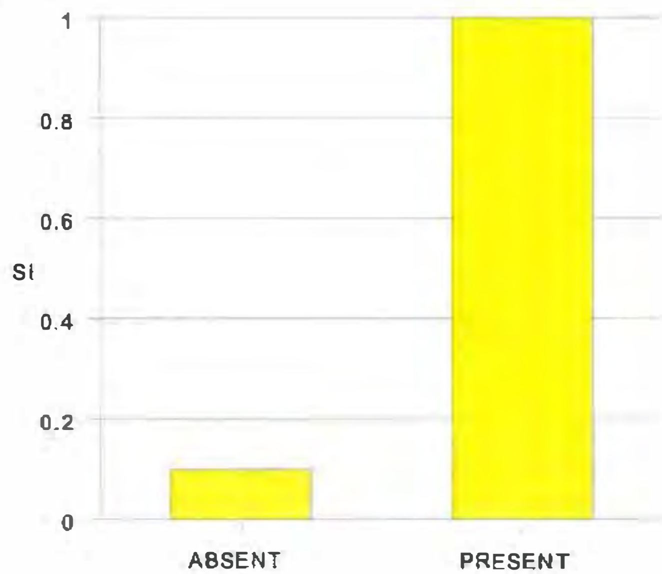
V2 - Herbaceous Cover



V3 - Degree of Patchiness



V4 - Rock Outcroppings



FISH AND WILDLIFE HABITAT CAPABILITY MODELS

AND

SPECIAL HABITAT CRITERIA

FOR THE NORTHEAST ZONE NATIONAL FORESTS

LASSEN NATIONAL FOREST
MENDOCINO NATIONAL FOREST
MODOC NATIONAL FOREST
PLUMAS NATIONAL FOREST

Kozo Shimamoto and Daniel Airola (editors)

JANUARY 15, 1981

INTRODUCTION

by Hal Salwasser and Karen Shimamoto

Under National Forest Management Act (NFMA) planning regulations (36 CFR 219), fish and wildlife management indicator species are selected by each Forest for planning and management attention. These species will help guide land allocations and shape multiple-resource prescriptions in meeting legal requirements and local resource demand. To support this role each species must have a documented description of the habitat conditions needed to sustain it at different population levels. The minimum habitat conditions necessary for sustaining population viability are also required. The development of prescriptions to favor certain management indicator species also requires a description of habitat conditions associated with high population levels of each species. The descriptions of habitat conditions associated with different population levels are called Habitat Capability Models (HCM).

NFMA regulations mandate that each Forest maintain habitat conditions to support wildlife and fish populations at or above the abundance and distribution needed for long-term population viability. However, neither managers nor scientists fully know what kinds, amounts, and distribution of habitats are necessary to maintain population viability. Therefore, existing knowledge of species ecology and habitat needs must serve to identify the habitat conditions needed. Models (standards and criteria) must be formulated to describe in quantitative and qualitative terms the habitat conditions by which to judge existing and projected habitat resources.

Most of the HCMs address the habitat conditions required by individual reproductive units within wildlife and fish populations. This is because land management projects usually affect small part of populations such as a breeding pair, a family unit, a small group of breeding pairs, or a small group of family units before whole population changes are noticed. Total population abundance and distribution on the Forest can be projected by aggregating and mapping those land areas that provide capable, available, and suitable habitat for reproductive units of populations.

The HCMs do not address some aspects of population viability. Minimum to optimum distances between reproductive units and population size are two important attributes of viability that must be addressed for relevant species outside the HCMs.

Special Habitat Criteria were first developed by biologists on the Shoshone National Forest as an extension of the HCM concept (Hurley et al 1981). While HCMs describe habitat conditions for individual management indicator species, the information in the Special Habitat Criteria models describes conditions necessary to maintain or optimize populations of fish and wildlife species closely associated with special habitats (riparian, aspen, snags, etc.).

HABITAT CAPABILITY MODELS

The following format was used in the construction of each habitat capability model.

11

Model Applicability

Life Stage(s) - Identify the appropriate life stages covered by the model e.g. egg, larval, fry, juvenile, adult, all

Season(s) - Identify the appropriate season(s) e.g. fall, winter, spring, summer

Geographic Area - The model may apply to the species' entire range. However, if regional differences in habitat use and preference occur, separate models may be appropriate.

Intended Application - Most models will be formulated with Forest planning in mind. Some models, however, may be detailed enough to apply to project work. Provide a clear statement of the intended use.

Expected Reliability - The following hierarchy was used:

Level 1 - Model predicts existing carrying capacity density with acceptable variance, i.e. 10-20%

Level 2 - Model habitat capability ratings directly correlate with density estimates

Level 3 - Model habitat capability ratings directly correlate with ratings of the same sites by species authorities

Level 4 - Model structure and outputs appear reasonable to species authorities

Level 5 - Model structure and outputs meet technical standards and appear reasonable to author(s), editor(s), and users.

Verification Status - The purpose of verification is to ensure that the model meets the expected reliability criteria and that it faithfully provides the intended outputs. Each step in verification depends on the expected reliability of the model. The following hierarchy was used:

1) Model is in draft.

2) Model reviewed by editor (the editor should check for conformance with model quality standards, sufficiency of documentation, and understandability).

3) Model reviewed by editor and users.

4) Model reviewed by species authority.

5) Model evaluated with sample data - apply the model with sample data sets which mimic various habitat conditions, e.g. high, medium, and low habitat capability. Evaluate model outputs as to how well they give a reasonable prediction of habitat conditions.

6. Model tested with field data - Field data must be available to provide measurements of both habitat variables and indicators of habitat capability. The latter can range from ratings of habitat capability by species authorities to density estimates to actual densities. Statistical and sampling expertise is required to design and perform these tests.

Model variables were restricted to physical, chemical, or biological characteristics of habitats. Species population variables, such as birth rates and sex ratios, are not suitable due to high cost of measurement, difficulty of prediction, and dependency on other factors beyond habitat. The critical question answered was, "What environmental variable, when changed, will affect the capability of an area to support a management indicator species?"

Each of the identified habitat variables were combined with the others to produce a habitat capability model. Each variable has values with different implications for habitat capability. For example, the variable average tree canopy cover has a high habitat value for goshawks when it is between 40-60%. Each of the variables and its respective values were ranked according to habitat capability:

High: the values are related to the highest densities of the species; the values are preferred over other values;

Medium: the values are related to moderate densities of the species; the values are required for the long-term viability of the population or reproductive unit of the population;

Low: the values are related to the lowest densities of the species; the values are denote marginal habitat capability for the species and would not be capable of supporting a viable population.

The variables were organized according to their importance in determining habitat capability and arrayed in rows under the headings high, medium, and low. An attempt was made to reduce redundant variables, retaining only those variables that are most practical to measure.

Documentation

As in model reliability and verification status, documentation for each model is in varying stages of completion. The levels of documentation are:

Level 1 - Literature references, written or personal communication, and the author's judgement are cited.

Level 2 - A narrative accompanies the model, summarizing why each variable was selected, how each variable is related to the species' habitat needs, and how habitat capability values were determined. This level also includes Level 1.

Level 3 - A narrative accompanies the model with documentation on the species ecology and habitat use. This information is related to the habitat variables in the model. It involves preparing a species note with the following information:

I. Distribution, Abundance, and Seasonality

II. Specific Habitat Requirements

- A. Feeding
- B. Cover
- C. Water
- D. Reproduction
- E. Pattern

III. Species Life History

- A. Activity Patterns
- B. Seasonal Movements/Migration
- C. Home Range/Territory
- D. Reproduction
- E. Niche

This level also includes Levels 1 and 2.

Level 4 - The habitat variables are aggregated to develop a mathematical formulation of the model (U.S. Fish and Wildlife Service 1980). Assumptions and limitations to be used when applying the model are provided and the necessary steps to correctly use the mathematical model is documented. The latter includes how to collect data on model variables, how to treat that data as model inputs, and how to interpret habitat capability based on the data. This level includes levels 1, 2, and 3.

Because many initial species models will be developed from scant data, modelers will rely on experiential evidence and intuition to establish the model variables and relationships. Such models will have level 1 or 2 documentation. As model application and verification improve, habitat relationships can be more accurately represented and the models made more quantitative. Models with level 3 or 4 documentation are examples of species where more information is known and the models have been "calibrated" with real data.

Vegetation Types and Successional Stages

The vegetation types and successional stages used in the habitat capability models are consistent with the California Wildlife Habitat Relationships Program for the Northeast Interior Zone (Laudenslayer in prep), the Western Sierra Zone (Verner and Boss 1980) and the North Coast-Cascades Zone (Marcot 1979). For convenience, the codes used for successional stages are defined in Table 1.

Rating Overall Habitat Capability

For any given area of land, habitat capability ratings (high, medium, low) will be different for each habitat variable. This makes rating the overall habitat capability difficult. Models for spotted owl and mule deer, have been developed to include a mathematical calculation of habitat capability where different ratings are quantitatively assessed and an overall capability index is mathematically calculated. The method for rating overall habitat capability for the other models, however, must be done using subjective biological judgement.

For such cases, the simplest approach is to assess the overall habitat capability rating in terms of a simple majority of variable ratings. For example, if three variables were rated as medium and one variable as high for bald eagle habitat, the overall rating could be considered medium.

In other situations, experience may justify identifying one or more variables as more important or possibly overriding other variables. Biologists should then weight these variables accordingly when determining overall habitat capability.

Table 1. Successional stage codes

Code	Definition
1	Barren/grass/forbs
2	Shrub/seedling/sapling; tree saplings <11" DBH
2a	<40% tree canopy closure
2b	40-70% tree canopy closure
2c	>70% tree canopy closure
3	Small sawtimber; 11-24" DBH
3a	<40% overstory canopy closure
3b	40-70% overstory canopy closure
3c	>70% overstory canopy closure
4	Medium to large sawtimber; >24" DBH
4a	<40% overstory canopy closure
4b	40-70% overstory canopy closure
4c	>70% overstory canopy closure
5	Two-storied stand: scattered overstory over a well-stocked understory (4a over 2c or 3c)

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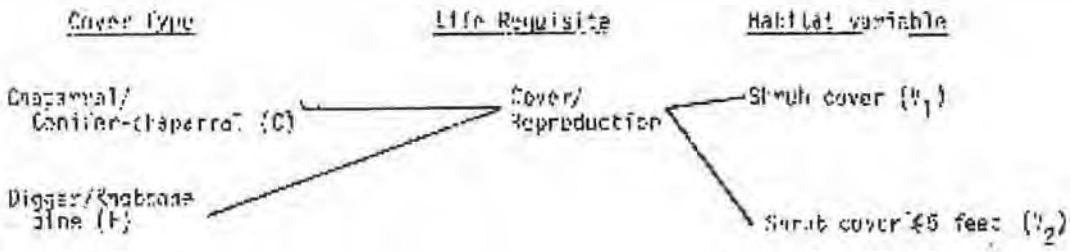
DRAFT
HABITAT SUITABILITY INDEX MODEL
WRENTIT (*Chamaea fasciata*)

U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

September 1984

VARIABLE		COVER TYPES	SUGGESTED TECHNIQUE
(V_1)	Shrub cover - % of ground shaded by a vertical projection of the shrub canopy	C,F	Line intercept
(V_2)	Shrub cover ≤5 feet	C,F	Line transect, graduated rod

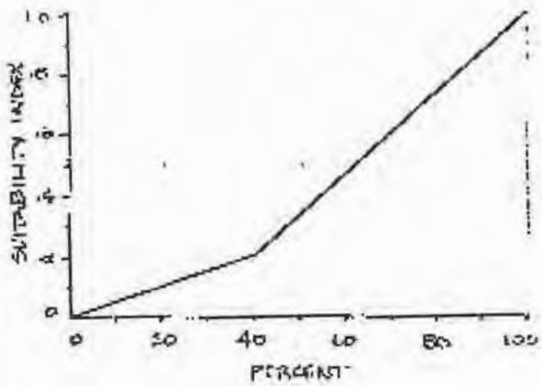

Cover Type
Life Requisite
Habitat variable
Chaparral/
Conifer-chaparral (C)
Digger/Knobcone
pine (P)
Cover/
Reproduction
Shrub cover (V_1)
Shrub cover ≤5 feet (V_2)

Variable 1. Shrub cover - % of ground shaded by a vertical projection of the shrub canopy

Assumes: 1) Dense stands of chaparral needed for optimum conditions.

2) Sample size should include an area of at least 2.0 acres

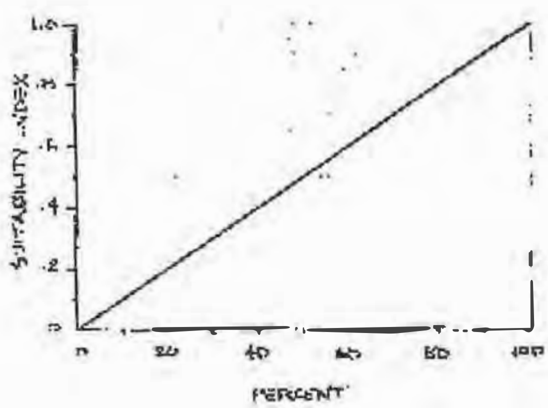
3) 40 percent canopy provides marginal quality and that 100 percent is optimum



Variable 2. Shrub cover ≤5 feet

Assumes: 1) Most nests are located within 1-4 feet from the ground.

2) Some additional height is needed for overhead protection.



4

Equation Used to Calculate Suitability Indices

Cover/Reproduction: $V_1 \times V_2$

HSI determination

Cover/reproduction was the only life requisite considered in this model, and the HSI for the wrentit is equal to the life requisite value for cover/reproduction.

==

General Assumptions

Overview

This model uses the reproductive habitat needs of the wrentit to determine overall habitat quality. It is assumed that cover needs are met by reproductive habitat needs and that neither food nor water will be more limiting than the wrentit's cover/reproductive needs. All of the life requirements of the wrentit can be provided in chaparral and other dense brush.

Cover/ reproduction component

Optimal nesting habitat for the wrentit is provided in moderately tall, dense stand of chaparral (Bent 1958, Small 1974). Dense stands of chaparral provides maximum protection for feeding and nesting. As such, it is assumed that optimal habitat contains 100 percent or greater of shrub crown canopy. Studies indicate that most of the nesting occurs between 1 and 4 feet off the ground and only occasionally have nests been found up to 7 feet from the ground (Bent 1939). Most of the wrentit's existence is spent beneath the crown foliage of brush not more than 5 feet from the ground (Bent 1939). Studies indicate that most of the life requisites of the wrentit are provided within an area ranging in size from 0.2 to 1.2 ha (0.5 to 3.0 acres) (Cogswell 1942, Bent 1958, Erickson 1938).

6

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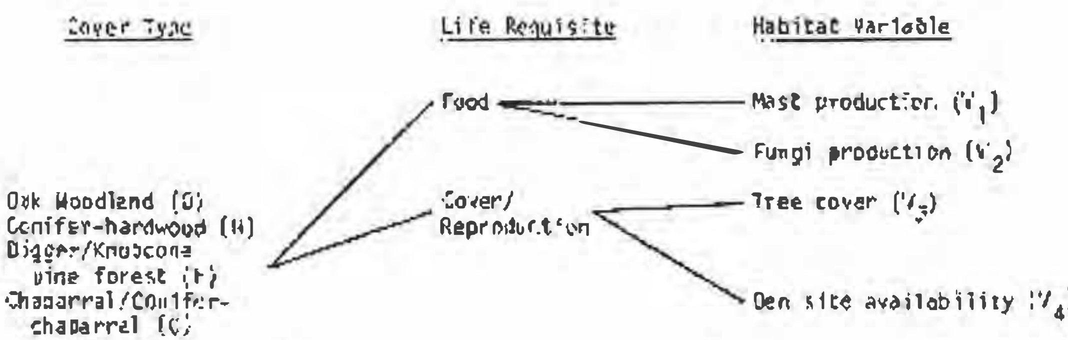
DRAFT HABITAT SUITABILITY INDEX MODEL
WESTERN GRAY SQUIRREL (*Sciurus griseus*)

U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, CA

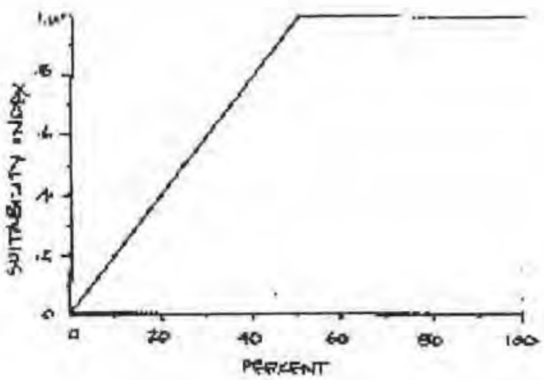
September 1984

Squirrel

VARIABLE		COVER TYPES	SUGGESTED TECHNIQUES
(V_1)	Mast production - % canopy closure of trees > 5 m (16.5 ft) tall and shrubs that produce hard mast	O,H,F,C	Line intercept
(V_2)	Fungi production - estimate of density of leaf litter layer	O,H,F,C	Ocular estimate along line intercept
(V_3)	Tree cover - % of ground surface shaded canopies of all woody vegetation > 5 m (16.5 ft) in height	O,H,F,C	Line intercept
(V_4)	Den site availability - number of trees per acre with dbh ≥38.1 cm (15 in).	O,H,F,C	Belt transect, diameter tape



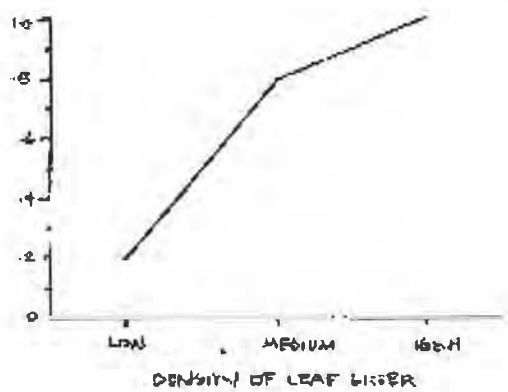
Variable 1. Hard mast production - % canopy closure of trees ≥ 5 m (16.5 ft) tall and shrubs that produce hard mast (e.g. oaks and conifers).



Assumes: 1) Optimum density of hard mast trees is between 40 - 100% canopy closure (derived from Shimamoto and Airola, 1981).

2) Trees ≤ 5 m (16.5 ft) tall will not produce significant mast (Allen, 1982).

Variable 2. Fungi production - an estimate of the density of the leaf litter layer.



Assumes: 1) Hypogeous fungi is a major component of the western gray squirrel diet (Steinecker, 1977).

2) Fungi is related to the amount of organic material (represented by leaf litter) in the uppermost soil layers (SCS, 1980).

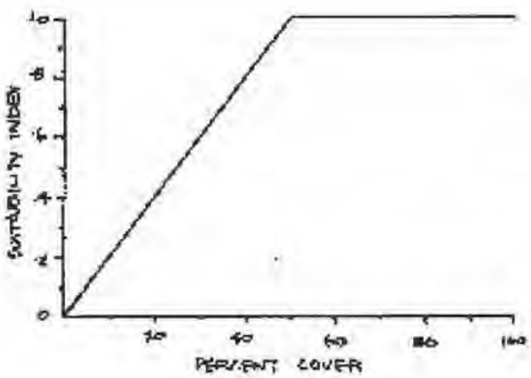
Density of Leaf Litter (from SCS, 1980):

High - leaf litter is abundant with thick identifiable layers of leaves over mulch.

Medium - leaf litter is moderately abundant with low to moderate separation of leaf-mulch layers.

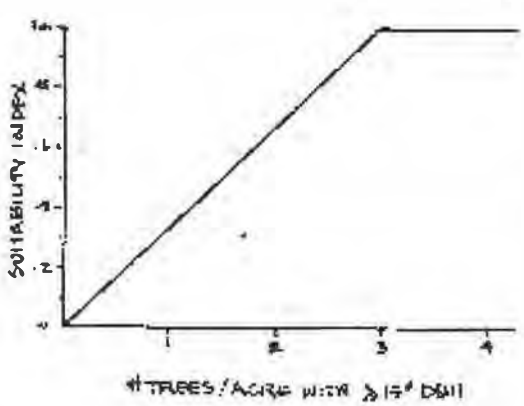
Low - leaf litter scarce with very thin leaf - mulch layers, little or no separation.

Variable 3. Tree cover - % of ground surface shaded by vertical projection of canopies of all woody vegetation ≥ 5 m (15 ft.) tall



Assumes: 1) Optimum conditions occur when tree cover ranges from 40 to 100% (derived from Shimamoto and Airola, 1981).

Variable 4. Den site availability - number of trees per acre with dbh ≥ 35.1 cm (15 in)



Assumes: 1) Western gray squirrels most often utilize oak, cottonwoods, maples, conifers, and sycamores for den sites (Ingles, 1947).

2) Optimum den sites are provided by trees having an average dbh of 15 inches (Shimamoto and Airola, 1981).

5

Equations Used to Calculate Suitability Indices

a) Food:

Cover Type	Equation
O,H,F,C	$(V_1 \times V_2)^{1/2}$

b) Cover/Reproduction:

Cover Type	Equation
O,H,F,C	$(V_3 \times V_4)^{1/2}$

HSI Determination:

1) The minimum habitat area equals the mean minimum home range. If habitat area is less than one acre, the HSI value equals zero. (Ingles, 1947).

2) The HSI for the western gray squirrel will equal the lowest of the values for the food and cover/reproduction component.

Literature Cited

Allen, A.W. 1982. Habitat Suitability index models. Gray squirrel. FWS/OBS (WELUT) - 82/10.19. 11 pp.

Ingles, L.G. 1947. Ecology and life history of the California gray squirrel. Calif. Fish and Game 33(3):139-158.

Shimamoto, K. and D. Airola. 1981. Fish and wildlife habitat capability models and special habitat criteria for the northeast zone national forests. U.S. Forest Service publ. 250 pp.

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Steinecker, W.E. 1977. Supplemental data on the food habits of the western gray squirrel. Calif. Fish and Game 55(1):36-48.

APPENDIX C

Endangered Species List

U.S. Fish & Wildlife Service
Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 150129120853
Current as of: January 29, 2015

Listed Species

Invertebrates

Branchinecta conservatio
Conservancy fairy shrimp (E)

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)

Rana draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

Plants

Calystegia stebbinsii
Stebbins's morning-glory (E)

Ceanothus roderickii
Pine Hill ceanothus (E)

Fremontodendron californicum ssp. decumbens
Pine Hill flannelbush (E)

Galium californicum ssp. sierrae
El Dorado bedstraw (E)

Orcuttia viscida
Critical habitat, Sacramento Orcutt grass (X)
Sacramento Orcutt grass (E)

Senecio layneae
Layne's butterweed (=ragwort) (T)

Quads Containing Listed, Proposed or Candidate Species:

CLARKSVILLE (511A)
FOLSOM (511B)
ROCKLIN (527C)
PILOT HILL (527D)

County Lists
No county species lists requested.

Key:
(E) Endangered - Listed as being in danger of extinction.
(T) Threatened - Listed as likely to become endangered within the foreseeable future.
(P) Proposed - Officially proposed in the Federal Register for listing as endangered or threatened.
(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
Critical Habitat - Area essential to the conservation of a species.
(PX) Proposed Critical Habitat - The species is already listed. Critical habitat is being proposed for it.
(C) Candidate - Candidate to become a proposed species.
(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
(X) Critical Habitat designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.
See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be April 29, 2015.

APPENDIX F

USFWS AND CNDDP SPECIAL STATUS SPECIES LISTS

U.S. Fish & Wildlife Service
Sacramento Fish & Wildlife Office
Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the CLARKSVILLE (511A) U.S.G.S. 7 1/2 Minute Quad

Report Date: January 21, 2015

Listed Species

Invertebrates

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)

Rana draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

Plants

Calystegia stebbinsii
Stebbins's morning-glory (E)

Ceanothus roderickii
Pine Hill ceanothus (E)

Fremontodendron californicum ssp. decumbens
Pine Hill flannelbush (E)

Galium californicum ssp. sierrae
El Dorado bedstraw (E)

Senecio layneae
Layne's butterweed (=ragwort) (T)

Key:

- (E) Endangered - Listed as being in danger of extinction.
- (T) Threatened - Listed as likely to become endangered within the foreseeable future.
- (P) Proposed - Officially proposed in the Federal Register for listing as endangered or threatened.
- (NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
- Critical Habitat - Area essential to the conservation of a species.
- (PX) Proposed Critical Habitat - The species is already listed. Critical habitat is being proposed for it.
- (C) Candidate - Candidate to become a proposed species.
- (V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
- (X) Critical Habitat designated for this species

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the FOLSOM (511B) U.S.G.S. 7 1/2 Minute Quad

Report Date: January 21, 2015

Listed Species

Invertebrates

Branchinecta conservatio
Conservancy fairy shrimp (E)

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)

Rana draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

Plants

Orcuttia viscida
Critical habitat, Sacramento Orcutt grass (X)
Sacramento Orcutt grass (E)

Key:

- (E) Endangered - Listed as being in danger of extinction.
- (T) Threatened - Listed as likely to become endangered within the foreseeable future.
- (P) Proposed - Officially proposed in the Federal Register for listing as endangered or threatened.
- (NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
- Critical Habitat - Area essential to the conservation of a species.
- (PX) Proposed Critical Habitat - The species is already listed. Critical habitat is being proposed for it.
- (C) Candidate - Candidate to become a proposed species.
- (V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
- (X) Critical Habitat designated for this species

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the ROCKLIN (527C) U.S.G.S. 7 1/2 Minute Quad

Report Date: January 21, 2015

Listed Species

Invertebrates

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

Key:

- (E) Endangered - Listed as being in danger of extinction.
- (T) Threatened - Listed as likely to become endangered within the foreseeable future.
- (P) Proposed - Officially proposed in the Federal Register for listing as endangered or threatened.
- (NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
- Critical Habitat - Area essential to the conservation of a species.
- (PX) Proposed Critical Habitat - The species is already listed. Critical habitat is being proposed for it.
- (C) Candidate - Candidate to become a proposed species.
- (V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
- (X) Critical Habitat designated for this species

Selected Elements by Common Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad is (Folsom (3812162) or Rocklin (3812172) or Clarksville (3812161))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
bald eagle *Haliaeetus leucocephalus*	ABNKC10010	Delisted	Endangered	G5	S2	FP
Bisbee Peak rush-rose *Crocanthemum suffrutescens*	PDCIS020F0	None	None	G2Q	S2	3.2
Blennosperma vernal pool andrenid bee *Andrena blennospermatis*	IIHYM35030	None	None	G2	S2	
Boggs Lake hedge-hyssop *Gratiola heterosepala*	PDSCR0R060	None	Endangered	G2	S2	1B.2
Brandegee's clarkia *Clarkia biloba ssp. brandegeeae*	PDONA05053	None	None	G4G5T4	S4	4.2
burrowing owl *Athene cunicularia*	ABNSB10010	None	None	G4	S3	SSC
California black rail *Laterallus jamaicensis coturniculus*	ABNME03041	None	Threatened	G3G4T1	S1	FP
California linderiella *Linderiella occidentalis*	ICBRA06010	None	None	G2G3	S2S3	
California red-legged frog *Rana draytonii*	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Cooper's hawk *Accipiter cooperii*	ABNKC12040	None	None	G5	S4	WL
double-crested cormorant *Phalacrocorax auritus*	ABNFD01020	None	None	G5	S4	WL
dwarf downingia *Downingia pusilla*	PDCAM060C0	None	None	GU	S2	2B.2
El Dorado bedstraw *Galium californicum ssp. sierrae*	PDRUB0N0E7	Endangered	Rare	G5T1	S1	1B.2
El Dorado County mule ears *Wyethia reticulata*	PDAST9X0D0	None	None	G2	S2	1B.2
golden eagle *Aquila chrysaetos*	ABNKC22010	None	None	G5	S3	FP
great blue heron *Ardea herodias*	ABNGA04010	None	None	G5	S4	
great egret *Ardea alba*	ABNGA04040	None	None	G5	S4	
Layne's ragwort *Packera layneae*	PDAST8H1V0	Threatened	Rare	G2	S2	1B.2
merlin *Falco columbarius*	ABNKD06030	None	None	G5	S3S4	WL
Northern Hardpan Vernal Pool *Northern Hardpan Vernal Pool*	CTT44110CA	None	None	G3	S3.1	

Selected Elements by Common Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Northern Volcanic Mud Flow Vernal Pool *Northern Volcanic Mud Flow Vernal Pool*	CTT44132CA	None	None	G1	S1.1	
osprey *Pandion haliaetus*	ABNKC01010	None	None	G5	S4	WL
pallid bat *Antrozous pallidus*	AMACC10010	None	None	G5	S3	SSC
pincushion navarretia *Navarretia myersii ssp. myersii*	PDPLM0C0X1	None	None	G1T1	S1	1B.1
Pine Hill ceanothus *Ceanothus roderickii*	PDRHA04190	Endangered	Rare	G1	S1	1B.2
Pine Hill flannelbush *Fremontodendron decumbens*	PDSTE03030	Endangered	Rare	G1	S1	1B.2
purple martin *Progne subis*	ABPAU01010	None	None	G5	S3	SSC
Red Hills soaproot *Chlorogalum grandiflorum*	PMLIL0G020	None	None	G3	S3	1B.2
Ricksecker's water scavenger beetle *Hydrochara rickseckeri*	IICOL5V010	None	None	G2?	S2?	
Sacramento Orcutt grass *Orcuttia viscida*	PMPOA4G070	Endangered	Endangered	G1	S1	1B.1
Sanford's arrowhead *Sagittaria sanfordii*	PMALI040Q0	None	None	G3	S3	1B.2
silver-haired bat *Lasionycteris noctivagans*	AMACC02010	None	None	G5	S3S4	
steelhead - Central Valley DPS *Oncorhynchus mykiss irideus*	AFCHA0209K	Threatened	None	G5T2Q	S2	
Swainson's hawk *Buteo swainsoni*	ABNKC19070	None	Threatened	G5	S3	
tricolored blackbird *Agelaius tricolor*	ABPBXB0020	None	Endangered	G2G3	S1S2	SSC
valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	IICOL48011	Threatened	None	G3T2	S2	
Valley Needlegrass Grassland *Valley Needlegrass Grassland*	CTT42110CA	None	None	G3	S3.1	
vernal pool fairy shrimp *Branchinecta lynchi*	ICBRA03030	Threatened	None	G3	S2S3	
western pond turtle *Emys marmorata*	ARAAD02030	None	None	G3G4	S3	SSC
western spadefoot *Spea hammondii*	AAABF02020	None	None	G3	S3	SSC
white-tailed kite *Elanus leucurus*	ABNKC06010	None	None	G5	S3S4	FP

Record Count: 41

APPENDIX G

SMAQMD EMISSION THRESHOLDS ASSOCIATED WITH ALTERNATIVE 2

Emission Estimates for ->	Alternative 2: Vertical Top Seal Across All 8 Gates 2017			Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	**ROG (lbs/day)**	**CO (lbs/day)**	**NOx (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	**PM2.5 (lbs/day)**	**PM2.5 (lbs/day)**	**PM2.5 (lbs/day)**	**CO2 (lbs/day)**
Grubbing/Land Clearing	0.2	1.4	1.4	67.7	0.1	67.6	14.1	0.1	14.1	275.7
Grading/Excavation	13.5	65.7	115.1	74.6	7.0	67.6	20.5	6.4	14.1	11,355.9
Drainage/Utilities/Sub-Grade	1.0	6.1	7.1	68.1	0.5	67.6	14.5	0.4	14.1	1,180.9
Paving	1.7	9.2	13.9	0.9	0.9	-	0.8	0.8	-	1,670.5
Maximum (pounds/day)	13.5	65.7	115.1	74.6	7.0	67.6	20.5	6.4	14.1	11,355.9
Total (tons/construction project)	1.5	7.4	13.0	7.6	0.8	6.8	2.1	0.7	1.4	1,289.3
Notes: Project Start Year ->	2017									
Project Length (months) ->	12									
Total Project Area (acres) ->	14									
Maximum Area Disturbed/Day (acres) ->	3									
Total Soil Imported/Exported (yd^3/day)->	0									

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for ->	Alternative 2: Vertical Top Seal Across All 8 Gates 2018									
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	0.2	1.3	1.3	67.7	0.1	67.6	14.1	0.1	14.1	275.7
Grading/Excavation	12.3	65.2	105.9	73.9	6.3	67.6	19.9	5.8	14.1	11,356.9
Drainage/Utilities/Sub-Grade	0.9	5.8	6.5	68.0	0.4	67.6	14.4	0.4	14.1	1,181.1
Paving	1.6	9.0	12.7	0.8	0.8	-	0.7	0.7	-	1,670.7
Maximum (pounds/day)	12.3	65.2	105.9	73.9	6.3	67.6	19.9	5.8	14.1	11,356.9
Total (tons/construction project)	1.4	7.4	12.0	7.5	0.7	6.8	2.1	0.7	1.4	1,289.5
Notes: Project Start Year ->	2018									
Project Length (months) ->	12									
Total Project Area (acres) ->	14									
Maximum Area Disturbed/Day (acres) ->	3									
Total Soil Imported/Exported (yd^3/day)->	0									

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Project Phases (English Units)	Alternative 2: Work Package 1 (Dikes 4-6) Earthen Embankment Raise 2018 ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	1.8	9.6	19.4	98.4	0.9	97.5	21.1	0.8	20.3	2,805.6
Grading/Excavation	29.1	148.5	303.8	112.1	14.6	97.5	33.6	13.3	20.3	35,837.1
Drainage/Utilities/Sub-Grade	2.0	12.1	17.7	98.4	0.9	97.5	21.1	0.8	20.3	3,060.4
Paving	1.8	10.7	16.9	0.9	0.9	-	0.8	0.8	-	2,569.0
Maximum (pounds/day)	29.1	148.5	303.8	112.1	14.6	97.5	33.6	13.3	20.3	35,837.1
Total (tons/construction project)	3.3	16.9	34.4	12.0	1.7	10.3	3.7	1.5	2.1	4,076.6
Notes: Project Start Year ->	2018									
Project Length (months) ->	12									
Total Project Area (acres) ->	39									
Maximum Area Disturbed/Day (acres) ->	10									
Total Soil Imported/Exported (yd^3/day)->	100									

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for ->	Alternative 2: Vertical Top Seal Across All 8 Gates 2019			**Total**	**Exhaust**	**Fugitive Dust**	**Total**	**Exhaust**	**Fugitive Dust**	
Project Phases (English Units)	**ROG (lbs/day)**	**CO (lbs/day)**	**NOx (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	**PM2.5 (lbs/day)**	**PM2.5 (lbs/day)**	**PM2.5 (lbs/day)**	**CO2 (lbs/day)**
Grubbing/Land Clearing	0.2	1.3	1.2	67.7	0.1	67.6	14.1	0.1	14.1	275.8
Grading/Excavation	11.0	64.8	95.3	73.2	5.6	67.6	19.1	5.1	14.1	11,356.3
Drainage/Utilities/Sub-Grade	0.8	5.6	5.9	68.0	0.4	67.6	14.4	0.3	14.1	1,181.2
Paving	1.4	8.8	11.5	0.7	0.7	-	0.6	0.6	-	1,670.7
Maximum (pounds/day)	11.0	64.8	95.3	73.2	5.6	67.6	19.1	5.1	14.1	11,356.3
Total (tons/construction project)	1.2	7.3	10.8	7.4	0.6	6.8	2.0	0.6	1.4	1,289.4
Notes: Project Start Year ->	2019									
Project Length (months) ->	12									
Total Project Area (acres) ->	14									
Maximum Area Disturbed/Day (acres) ->	3									
Total Soil Imported/Exported (yd^3/day)->	0									

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Alternative 2: Work Package 1 (Dikes 4-6) Earthen Embankment Raise 2019 **Project Phases (English Units)**	**ROG (lbs/day)**	**CO (lbs/day)**	**NOx (lbs/day)**	**Total PM10 (lbs/day)**	**Exhaust PM10 (lbs/day)**	**Fugitive Dust PM10 (lbs/day)**	**Total PM2.5 (lbs/day)**	**Exhaust PM2.5 (lbs/day)**	**Fugitive Dust PM2.5 (lbs/day)**	**CO2 (lbs/day)**
Grubbing/Land Clearing	1.6	9.4	16.7	98.3	0.8	97.5	21.0	0.7	20.3	2,795.6
Grading/Excavation	25.3	148.1	259.5	109.7	12.2	97.5	31.4	11.2	20.3	35,813.0
Drainage/Utilities/Sub-Grade	1.7	11.7	15.2	98.3	0.8	97.5	21.0	0.7	20.3	3,057.9
Paving	1.6	10.4	14.5	0.8	0.8	-	0.7	0.7	-	2,568.9
Maximum (pounds/day)	25.3	148.1	259.5	109.7	12.2	97.5	31.4	11.2	20.3	35,813.0
Total (tons/construction project)	2.9	16.8	29.4	11.7	1.4	10.3	3.4	1.3	2.1	4,073.8

Notes:	
Project Start Year ->	2019
Project Length (months) ->	12
Total Project Area (acres) ->	39
Maximum Area Disturbed/Day (acres) ->	10
Total Soil Imported/Exported (yd^3/day)->	100

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Project Phases (English Units)	Alternative 2: Work Package 3 (Dikes 1-3) Earthen Embankment Raise 2019 ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	1.6	9.4	16.7	88.3	0.8	87.5	18.9	0.7	18.2	2,795.6
Grading/Excavation	25.2	148.0	259.3	99.7	12.2	87.5	29.4	11.2	18.2	35,752.4
Drainage/Utilities/Sub-Grade	1.7	11.7	15.2	88.3	0.8	87.5	18.9	0.7	18.2	3,057.9
Paving	1.6	10.4	14.5	0.8	0.8	-	0.7	0.7	-	2,568.9
Maximum (pounds/day)	25.2	148.0	259.3	99.7	12.2	87.5	29.4	11.2	18.2	35,752.4
Total (tons/construction project)	2.9	16.8	29.4	10.6	1.4	9.2	3.2	1.3	1.9	4,067.0

Notes:

Project Start Year ->	2019
Project Length (months) ->	12
Total Project Area (acres) ->	35
Maximum Area Disturbed/Day (acres) ->	9
Total Soil Imported/Exported (yd^3/day)->	89

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Alternative 2: Vertical Top Seal Across All 8 Gates 2020										
Project Phases (English Units)	**ROG (lbs/day)**	**CO (lbs/day)**	**NOx (lbs/day)**	**Total PM10 (lbs/day)**	**Exhaust PM10 (lbs/day)**	**Fugitive Dust PM10 (lbs/day)**	**Total PM2.5 (lbs/day)**	**Exhaust PM2.5 (lbs/day)**	**Fugitive Dust PM2.5 (lbs/day)**	**CO2 (lbs/day)**
Grubbing/Land Clearing	0.2	1.2	1.1	67.7	0.1	67.6	14.1	0.1	14.1	275.1
Grading/Excavation	9.9	64.5	86.3	72.5	4.9	67.6	18.5	4.4	14.1	11,352.7
Drainage/Utilities/Sub-Grade	0.7	5.5	5.3	67.9	0.3	67.6	14.3	0.3	14.1	1,178.6
Paving	1.3	8.7	10.4	0.6	0.6	-	0.5	0.5	-	1,668.8
Maximum (pounds/day)	9.9	64.5	86.3	72.5	4.9	67.6	18.5	4.4	14.1	11,352.7
Total (tons/construction project)	1.1	7.3	9.7	7.3	0.6	6.8	1.9	0.5	1.4	1,289.0

Notes:	
Project Start Year ->	2020
Project Length (months) ->	12
Total Project Area (acres) ->	14
Maximum Area Disturbed/Day (acres) ->	3
Total Soil Imported/Exported (yd^3/day)->	0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Alternative 2: Work Package 2 (Dikes 7 and 8, MIAD) Earthen Embankment Raise 2020										
Grubbing/Land Clearing	1.6	10.7	21.1	157.9	0.9	157.0	33.4	0.7	32.7	4,668.1
Grading/Excavation	24.5	159.1	252.7	168.5	11.5	157.0	43.0	10.3	32.7	40,720.4
Drainage/Utilities/Sub-Grade	1.9	14.1	15.3	157.8	0.8	157.0	33.3	0.7	32.7	4,258.8
Paving	1.6	11.5	13.0	0.7	0.7	-	0.6	0.6	-	2,958.5
Maximum (pounds/day)	24.5	159.1	252.7	168.5	11.5	157.0	43.0	10.3	32.7	40,720.4
Total (tons/construction project)	2.8	18.1	28.7	17.9	1.3	16.6	4.6	1.2	3.4	4,647.3

Notes: Project Start Year ->	2020
Project Length (months) ->	12
Total Project Area (acres) ->	63
Maximum Area Disturbed/Day (acres) ->	16
Total Soil Imported/Exported (yd^3/day)->	254

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Project Phases (English Units)	Alternative 2: Work Package 3 (Dikes 1-3) Earthen Embankment Raise 2020 ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	1.4	9.3	14.8	88.2	0.7	87.5	18.8	0.6	18.2	2,783.4
Grading/Excavation	23.0	147.7	231.1	98.3	10.8	87.5	28.0	9.8	18.2	35,719.6
Drainage/Utilities/Sub-Grade	1.6	11.4	13.5	88.2	0.7	87.5	18.8	0.6	18.2	3,049.9
Paving	1.5	10.2	12.9	0.7	0.7	-	0.6	0.6	-	2,565.0
Maximum (pounds/day)	23.0	147.7	231.1	98.3	10.8	87.5	28.0	9.8	18.2	35,719.6
Total (tons/construction project)	2.6	16.8	26.2	10.5	1.2	9.2	3.0	1.1	1.9	4,063.2

Notes:

Project Start Year ->	2020
Project Length (months) ->	12
Total Project Area (acres) ->	35
Maximum Area Disturbed/Day (acres) ->	9
Total Soil Imported/Exported (yd^3/day)->	89

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for ->	Alternative 2: Concrete Walls LWD and RWD 2020									
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	2.7	15.4	69.6	533.4	2.1	531.3	111.8	1.3	110.5	19,316.5
Grading/Excavation	14.3	88.4	175.6	538.5	7.2	531.3	116.3	5.8	110.5	39,252.7
Drainage/Utilities/Sub-Grade	2.5	21.0	26.7	532.6	1.3	531.3	111.3	0.8	110.5	10,704.5
Paving	1.4	12.0	7.4	0.6	0.6	-	0.4	0.4	-	3,526.1
Maximum (pounds/day)	14.3	88.4	175.6	538.5	7.2	531.3	116.3	5.8	110.5	39,252.7
Total (tons/construction project)	1.7	10.2	20.4	56.9	0.8	56.1	12.3	0.7	11.7	4,625.6

Notes:	
Project Start Year ->	2020
Project Length (months) ->	12
Total Project Area (acres) ->	213
Maximum Area Disturbed/Day (acres) ->	53
Total Soil Imported/Exported (yd^3/day)->	39

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Project Phases (English Units)	Alternative 2: Work Package 2 (Dikes 7 and 8, MIAD) Earthen Embankment Raise 2021 ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	1.5	10.6	18.2	157.8	0.8	157.0	33.3	0.6	32.7	4,614.4
Grading/Excavation	22.8	158.6	227.0	167.3	10.3	157.0	41.9	9.3	32.7	40,627.1
Drainage/Utilities/Sub-Grade	1.7	13.7	13.6	157.8	0.8	157.0	33.3	0.6	32.7	4,245.5
Paving	1.5	11.2	11.8	0.6	0.6	-	0.5	0.5	-	2,958.3
Maximum (pounds/day)	22.8	158.6	227.0	167.3	10.3	157.0	41.9	9.3	32.7	40,627.1
Total (tons/construction project)	2.6	18.0	25.8	17.8	1.2	16.6	4.5	1.1	3.4	4,636.4

Notes:	
Project Start Year ->	2021
Project Length (months) ->	12
Total Project Area (acres) ->	63
Maximum Area Disturbed/Day (acres) ->	16
Total Soil Imported/Exported (yd^3/day)->	254

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for ->	Alternative 2: Concrete Walls LWD and RWD 2021									
Project Phases (English Units)	**ROG (lbs/day)**	**CO (lbs/day)**	**NOx (lbs/day)**	**Total PM10 (lbs/day)**	**Exhaust PM10 (lbs/day)**	**Fugitive Dust PM10 (lbs/day)**	**Total PM2.5 (lbs/day)**	**Exhaust PM2.5 (lbs/day)**	**Fugitive Dust PM2.5 (lbs/day)**	**CO2 (lbs/day)**
Grubbing/Land Clearing	2.6	15.3	56.0	533.4	2.1	531.3	111.8	1.2	110.5	18,912.5
Grading/Excavation	13.5	87.4	151.2	537.9	6.6	531.3	115.8	5.3	110.5	38,839.0
Drainage/Utilities/Sub-Grade	2.4	20.0	22.1	532.5	1.2	531.3	111.2	0.7	110.5	10,585.2
Paving	1.3	11.4	6.6	0.5	0.5	-	0.4	0.4	-	3,526.4
Maximum (pounds/day)	13.5	87.4	151.2	537.9	6.6	531.3	115.8	5.3	110.5	38,839.0
Total (tons/construction project)	1.6	10.1	17.5	56.9	0.8	56.1	12.3	0.6	11.7	4,575.7

Notes: Project Start Year ->	2021
Project Length (months) ->	12
Total Project Area (acres) ->	213
Maximum Area Disturbed/Day (acres) ->	53
Total Soil Imported/Exported (yd^3/day)->	39

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

APPENDIX H

NOISE STANDARDS

Table A. Noise Ordinance Standards (City of Folsom).*

		Noise Levels not to be Exceeded in Residential Zone (dBA)**	
Maximum Time of Exposure	Noise Metric	7 a.m. to 10 p.m. (daytime)	10 p.m. to 7 a.m. (nighttime)
Exterior Noise Standards			
30 Minutes/Hour	L50	50	45
15 Minutes/Hour	L25	55	50
5 Minutes/Hour	L8.3	60	55
1 Minute/Hour	L1.7	65	60
Any period of time	Lmax	70	65
Interior Noise Standards			
5 Minutes/Hour	L8.3	45	35
1 Minute/Hour	L1.7	50	40
Any period of time	Lmax	55	45

*Construction Noise Exemption Times: 7:00 a.m. - 6:00 p.m. Weekdays
8:00 a.m. - 5:00 p.m. Weekends
**5 dBA reduction for impact noise during non-exempt times
SOURCE: City of Folsom, CA Municipal Code. Chapter 8.42, Table 8.42.040

Table B. Noise Ordinance Standards (Sacramento County).

			Noise Levels Not to Be Exceeded in Residential Zone (dBA)**	
Exterior Noise Standards	Maximum Time of Exposure	Noise Metric	7am to 10pm (daytime)	10pm to 7am (nighttime)
	30 Minutes/Hour	L_{50}	55	50
	15 Minutes/Hour	L_{25}	60	55
	5 Minutes/Hour	$L_{8.3}$	65	60
	1 Minute/Hour	$L_{1.7}$	70	65
	Any period of time	L_{max}	75	75
Interior Noise Standards				
	5 Minutes/Hour	$L_{8.3}$	-	-
	1 Minute/Hour	$L_{1.7}$	-	-
	Any period of time	L_{max}	-	-

*Construction Noise Exemption Times: 6:00 a.m. - 8:00 p.m. Weekdays
7:00 a.m. - 8:00 p.m. Weekends
** dBA reduction for impact noise during non-exempt times
Source: Sacramento County Municipal Code, Chapter 6.68.070

Table C. Noise Ordinance Standards (Placer County).*

	Noise Levels not to be Exceeded in Residential Zone (dBA)**	
Sound Level Descriptor	7 a.m. to 10 p.m. (daytime)	10 p.m. to 7 a.m. (nighttime)
Hourly Leq	55	45
Any Period of Time (L_{max})	70	65

*Construction Noise Exemption Times: 6:00 a.m. – 8:00 p.m. Weekdays
8:00 a.m. – 8:00 p.m. Weekends

**5 dBA reduction for impact noise during non-exempt times

SOURCE: Placer County Code, Chapter 9.36.

APPENDIX I

CULTURAL RESOURCES APPENDIX

Folsom Dam Raise Project Section 106 Consultation Record with Native American Tribes and Interested Parties*

***May not include all communication for project.**

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
1/29/2014	Outgoing Email	United Auburn Indian Community (UAIC)	Marcos Guerrero	Requested that if the UAIC is interested in meeting to discuss a Programmatic Agreement for future Corps Section 106 undertakings at Folsom Dam and Lake to send three available dates in February.
1/29/2014	Incoming Email	UAIC	Marcos Guerrero	In response to email above, proposed February 12, 14, or 21.
1/29/2014	Outgoing Email	UAIC	Marcos Guerrero	Response to Mr. Guerrero's proposed dates for a meeting to discuss Programmatic Agreement for future Corps Section 106 undertakings at Folsom, asked who UAIC would like to attend (other tribes or individuals) and who at the Corps should attend.
1/29/2014	Incoming Email	UAIC	Marcos Guerrero	In response to email above asking about who should attend meeting to discuss Programmatic Agreement, will ask the committee and reply back on 1/30/14.
1/30/2014	Outgoing Email	UAIC, Shingle Springs Band of Miwok Indians (SSBMI), Tsi-Akim Maidu (TAM), Wilton Rancheria (WR)	Marcos Guerrero, Jason Camp, Andrew Godsey, Daniel Fonseca, Steven Hutchason, Grayson Coney	Provided public meeting letter with dates, times, and locations of the Folsom Dam Raise public meetings on 2/19/14 and 2/24/14.
2/21/2014	Outgoing Email	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Andrew Godsey, Daniel Fonseca, Steven Hutchason, Grayson Coney	Proposed meeting dates in March on 3/19, 3/25, or 3/31 for meeting to discuss the Corps' Section 106 undertakings at Folsom: Water Control Manual, Dam Raise. Proposed general agenda to provide information on the projects, project schedules, the Corps' plan to comply with Section 106, and hear the tribes' concerns, areas of interest, how they want to be involved.
2/24/2014	Incoming Email	UAIC	Marcos Guerrero	Response from Mr. Guerrero that 3/31/14 would be best for a meeting with the UAIC, but all dates presently available.
2/24/2014	Outgoing Email	UAIC	Marcos Guerrero	Acknowledgement of email received 2/24/14, will follow up once additional information and responses received.
2/26/2014	Outgoing Email	SSBMI, TAM, WR	Andrew Godsey, Daniel Fonseca, Steven Hutchason, Grayson Coney	Follow up to email sent 2/24/14 to ask tribes who have not responded for their availability on 3/19, 3/25, or 3/31. Asked for a response in order to schedule a meeting by the end of the week (2/28/14).

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
2/28/2014	Outgoing Meeting Invitation	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Andrew Godsey, Daniel Fonseca, Steven Hutchason, Grayson Coney	Meeting invitation sent to tribes to request a meeting on 3/19/14 at DWR offices to discuss Corps Section 106 undertakings at Folsom (Water Control Manual and Dam Raise).
2/28/2014	Incoming Email	UAIC	Marcos Guerrero	Mr. Guerrero accepted meeting invitation for 3/19/14.
3/4/2014	Incoming Email	UAIC	Melodi McAdams	Ms. McAdams accepted meeting invitation for 3/19/14.
3/13/2014	Outgoing Meeting Invitation	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Andrew Godsey, Daniel Fonseca, Steven Hutchason, Grayson Coney	Meeting update for meeting invitation sent 2/28/14, stating that United Auburn has RSVPed, and that if other tribal representatives are not available to get in touch with Melissa Montag to schedule another date and time for a meeting.
3/13/2014	Incoming Email	SSBMI	Andrew Godsey	Mr. Godsey accepted meeting invitation for 3/19/14.
3/19/2014	Incoming Email	WR	Steven Hutchason	Mr. Hutchason accepted meeting invitation for 3/19/14.
3/19/2014	Meeting	UIAC, SSBMI, WR	Marcos Guerrero, Jason Camp, Andrew Godsey, Kara Perry, Steven Hutchason	Meeting held with Native American tribal representatives, the Bureau of Reclamation, California Department of Water Resources to discuss the Corps' Section 106 undertakings at Folsom (Water Control Manual and Dam Raise).
3/20/2014	Outgoing Email	UIAC, SSBMI, WR	Marcos Guerrero, Jason Camp, Andrew Godsey, Kara Perry, Steven Hutchason	Forwarded Reclamation Sedimentation Survey from 2005 for Folsom Lake and Dam, as requested during 3/19/14 meeting.
7/22/2014	Incoming Email	UAIC	Marcos Guerrero	Email from Mr. Guerrero with subject line "Folsom Dam Safety Project" indicated the UAIC is "under the impression the that project will definitely have an adverse effect on historic properties, human remains, and funerary objects." Referenced a July 16 letter for the supplemental V EA/DEIR and asked about the progress of the proposed PA.

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7/22/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	Response to 7/22/14 email from Mr. Guerrero asking if he is referring to the JFP Phase IV project and asking if UAIC believes historic properties will be adversely affect by the JFP that UAIC identify which historic properties within the JFP APE and how UAIC has determined the JFP will be adversely affecting those historic properties. Due to the many projects at Folsom, Ms. Montag responded to try and clarify which project Mr. Guerrero is referring to. Ms. Montag clarified that Dam Safety is specifically Reclamation's authority at Folsom and that a PA for the Dam Raise and Water Control Manual projects is still in progress and that UAIC's interest is known and they will be re-engaged with when there is additional information to provide. Offered to discuss by phone if there are further questions.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
1/13/2015	Outgoing Letter	Strawberry Valley Rancheria (SVR), California Valley Miwok Tribe, Ione Band of Miwok Indians (IBMI), UAIC, Yocha Dehe Wintun Nation, Tsi-Akim Maidu, Colfax-Todds Consolidated Tribe, Jackson Rancheria Band of Miwuk Indians, Mechoopda Indian Tribe of Chico Rancheria (Mechoopda), El Dorado Miwok Tribe, SSBMI, WR, Buena Vista Rancheria (BVR), Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, Enterprise Rancheria of Maidu Indians (ERMI), Mooretown Rancheria of Maidu Indians, Nashville-El Dorado Miwok, Cortina Wintun Environmental Protection Agency	Cathy Bishop, Silvia Burley, Anthony Burris, Jason Camp, Cynthia Clarke, Grayson Coney, Pamela Cubbler, Adam Dalton, Michael DeSpain, Rose Enos, Kesner Flores, Nicholas Fonseca, Daniel Fonseca, Andrew Franklin, Reno Franklin, Andrew Godsey, Marcos Guerrero, Steven Hutchason, Leland Kinter, Roselynn Lwenya, Judith Marks, Marshall McKay, Yvonne Miller, Ambar Mohammed, Eileen Moon, Glenda Nelson, April Wallace Moore, Rhonda Pope, Dennis Ramirez, Don Ryberg, Guy Taylor, Cosme Valdez, Gene Whitehouse, Charlie Wright, Randy Yonemura	Letters sent to Native American Tribes invited them to open forum meetings scheduled for 1/26/15 and 2/2/15 at locations in downtown Sacramento and Folsom. Letters included project descriptions for Folsom Dam Raise and Water Control Manual Update projects, information on partners on project, project purpose and description, maps of preliminary APEs.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
1/14/2015	Outgoing Email	SVR, UAIC, TAM, Mechoopda, IBMI, SSBMI, ERMI, WR, BVR	Cathy Bishop, Jason Camp, Grayson Coney, Michael DeSpain, Randy Yonemura, Kesner Flores, Yvonne Miller, Daniel Fonseca, Andrew Godsey, Kara Perry, Cynthia Franco, Reno Franklin, Marcos Guerrero, Steven Hutchason, Roselynn Lwenya, Rhonda Pope	Email transmittal to available email addresses of 1/13/15 letter.
1/14/2015	Incoming Email		Kesner Flores, IBMI	Emails to Mr. Flores and IBMI main email address were returned as undeliverable.
1/16/2015	Incoming Voice Mail	Mechoopda	Mike DeSpain	Left message to refer comments on the projects to UAIC, SSBMI, and BVR.
1/23/2015	Outgoing Email	Mechoopda	Mike DeSpain	In reply to voice message left on 1/16/15, acknowledged that the Corps has also sent information on the projects to UAIC, SSBMI, and BVR and that the tribe has referred comments on those projects to those tribes.
1/26/2015	Open Forum for Tribes	UAIC	Marcos Guerrero, Jason Camp, Donald Rey	Open forum included maps and project information, staff from Department of Water Resources, Bureau of Reclamation, Corps environmental and cultural resources. Three representatives from UAIC were present. They asked questions about the project scope, expressed concerns that the Corps had begun survey and inventory efforts without consulting or notifying the tribes, that the Corps was not operating in a way that was reasonable and in good faith, and expressed concerns that there could be areas of concern within the project and survey areas. Ms. Melissa Montag stated that surveys were undertaken as part of efforts to begin identification of historic properties, that the Corps will continue to work with the tribes within efforts to comply with Section 106, proposed a meeting in the field in March.

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1/28/2015	Incoming Email	UAIC	Marcos Guerrero	Mr. Guerrero reiterated UAIC's concerns about the survey and inventory undertaken without consulting or notifying the tribe, asked for availability for a follow up meeting, asked if it was necessary for the Corps to obtain an ARPA permit, asked how the survey would be reported, and requested contact information for the archeologist conducting the survey at Folsom.
1/29/2015	Outgoing Email	UAIC	Marcos Guerrero, Mark Gilfillan, Donald Rey, Jason Camp, John Williams	In response to 1/28/15 email, proposed three possible dates in March for a site visit to see project area, learn about areas of concern to the tribe, and of any sacred sites or traditional cultural areas. Stated that the Corps is committed to working together with Reclamation, DWR, and tribes on the project and will convey information when it is appropriate. Responded that an ARPA permit was not necessary and the inventory report will be provided when it is completed, a date for which is unknown at this time. Stated that the survey efforts are being conducted by an archeologist meeting the required qualifications and the Corps is not able to provided resume or cell phone as this is private information though the tribe may submit a FOIA request. Asked that questions or information be provided to Ms. Montag or Ms. Jane Rinck.
1/29/2015	Incoming Email	UAIC	Marcos Guerrero	In response to Ms. Montag's email on 1/29/15, Mr. Guerrero stated that it is standard ethical practice to include resumes and qualifications statements in all survey reports, and that most ethical archeologists do not have a problem sharing this information. Unsolicited Mr. Guerrero also included his resume and chart of current projects. Mr. Guerrero further stated that UAIC feels it would be better to wait for the site visit until after the tribe has reviewed the report, requested to know when the report would be completed. He also stated that UAIC considers "these places" (none specifically identified) as significant and eligible for listing in the NRHP, and that operations of Folsom Lake continue to adversely effect the integrity of the resources.

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1/30/2015	Outgoing Email	UAIC	Marcos Guerrero, Mark Gilfillan, Donald Rey, Jason Camp, John Williams	In response to Mr. Guerrero's email on 1/29/15, Ms. Montag stated that if it is UAIC's preference to wait until after the survey report is completed that is acceptable, but if UAIC would like to provide any information for the Corps to consider for inclusion into the survey report (information on sites, prehistoric context, ethnographic context) those would be topics that can be discussed at a meeting in March. The estimated completion date for the survey report is presently late March or early April. Suggested March 3, 4, or 18 to meet.
1/30/2015	Incoming Email	UAIC	Marcos Guerrero	Mr. Guerrero stated he would discuss the invitation from the Corps to provide information into the Corps' survey report with the tribal preservation committee and the UAIC THPO. Further stated: "Per previous discussions, since it would still be possible to have the draft survey updated to include the information we provide, it would probably be best to wait for this time to be sure that our comments and potential areas of concern get included into the final report." Suggested to have the site visit on March 3 to meet the archoelogist for the project and get a project update.
2/2/2015	Outgoing Email	UAIC	Marcos Guerrero, Mark Gilfillan, Donald Rey, Jason Camp, John Williams	In response to Mr. Guerrero's email on 1/30/15, Ms. Montag suggested the tenative March 3rd at 10AM time to meet, and to meet at Beals Point area. Stated that access to Dikes 1-6 would be possible, but if UAIC would like to see wing dams, Dikes 7-8, or MIAD that additional notice would be needed due to active construction and security concerns. Asked if there are additional Corps staff or other members of tribes to invite that UAIC let Ms. Montag know in order to coordinate with them.
2/2/2015	Open Forum for Tribes	None	None	Open forum included maps and project information, staff from Department of Water Resources, Bureau of Reclamation, Corps environmental and cultural resources. There were no attendees from tribes.
2/3/2015	Incoming Email	UAIC	Marcos Guerrero	Asked for confirmation of areas currently under construction.

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2/3/2015	Outgoing Email	UAIC	Marcos Guerrero	Clarified that areas under construction are for the Corps' JFP construction project and provided a map of the current APE where construction activities could be occurring. Also explained that areas around the right and left wing dams are considered high security and require an escort. Provided the information that archeologist who conducted survey for Folsom Dam Raise won't be back in March as planned but suggested still having site visit on March 3rd as planned to hear the tribe's concerns about the project, or the meeting could be deferred to April if the tribe would like to discuss more specifics of the survey. Asked the tribe to respond with their preference.
2/3/2015	Returned Letter	El Dorado Miwok Tribe		Returned 1/13/15 letter as "Unable to forward. Forward expired 2+ years ago."
2/5/2015	Outgoing Meeting Invitation	UAIC	Marcos Guerrero, Jason Camp	Meeting invitation sent to UAIC to meet at Beals Point on 3/3/15, included information that Dikes 1-6 can be visited, update on project will be provided, the Corps is interested in hearing about sites of concern, sacred sites, TCPs.
2/5/2015	Incoming Meeting Acceptance	UAIC	Jason Camp	Accepted 3/3/15 meeting invitation.
2/5/2015	Incoming Meeting Acceptance	UAIC	Marcos Guerrero	Accepted 3/3/15 meeting invitation.
2/5/2015	Returned Letter	Colfax-Todds Valley Consolidated Tribe	Pamela Cubbler	Returned 1/13/15 letter as "Not deliverable as addressed--unable to forward."
2/9/2015	Returned Letter		Kesner Flores	Returned 1/13/15 letter as "Not deliverable as addressed--unable to forward."
3/2/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	Sent email to remind parties about field visit on 3/3/15.
3/2/2015	Incoming Email	UAIC	Marcos Guerrero	Asked if the archeologist would be present at site visit and if inventory report would be done.

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3/2/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	In reply to Mr. Guerrero's 3/2/15 email, reiterated from email sent 2/3/15 that due to scheduling conflicts the archeologist who completed the survey will not be able to be present, Corps and Reclamation archeologists will be. Since the tribe has previously stated there are sites of concern, the site visit is an opportunity for the Corps to get information on those sites so they may be considered for inclusion in the survey report, which is not yet completed.
3/2/2015	Incoming Email	UAIC	Marcos Guerrero	In reply to 3/2/15, stated that the UAIC THPO, Jason Camp, would prefer to wait to have the site visit until after reviewing the draft inventory report. Asked if it would be possible for the archeologist who conducted survey to be present at site visit and when report might be complete. Further stated that the tribe is well aware of sites within the Corps' project area, that those properties listed in the tribe's inventory are considered eligible, and that ongoing activities at the reservoir are resulting in adverse effects.
3/3/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Mark Gilfillan	Cancelling site visit at the tribe's request, to be rescheduled when the inventory and survey report is complete. Stated that the Corps is not able to provide draft reports for review outside the Corps and that the Corps has been attempting to consult to UAIC to identofy historic properties the Corps should consider for the Dam Raise Project and to include that information in the inventory report. Reiterated that the tribe has expressed they are aware of locations of cultural sites in the project area but is choosing at this time not to participate in the Corps identification efforts. Stated the inventory report will likely be completed mid to late April and the Corps will consult with tribes and SHPO on the findings of the report at that time, and Ms. Montag will be back in touch then to schedule the site visit. Stated again the Corps is interested in information UAIC is willing to share to be considered in the Section 106 process. Stated that the ongoing reservoir opertions and the potential effects to historic properties are under Reclamation authority.

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3/3/2015	Outgoing Letters	UAIC, SSBMI, WR, TAM	Gene Whitehouse, Marcos Guerrero, Jason Camp, Nicholas Fonseca, Daniel Fonseca, Andrew Godsey, Andrew Franklin, Steven Hutchason, Dan Ryberg, Grayson Coney, Eileen Moon	Letters sent to Native American Tribes within project area for Folsom Dam Raise with project description for the Corps' Folsom Dam Project, maps of the preliminarily defined APE, invites consultion from tribe on the project, requests comments on the APE, and any information the tribe may be willing to share to assist the Corps with identifying historic properties.
3/3/2015	Incoming Email	UAIC	Marcos Guerrero, Jason Camp, Mark Gilfillan	In response to email sent 3/3/15, Mr. Guerrero responded that UAIC hopes the Corps would consider effects of the operation of Folsom Dam as negative to cultural resources, and that he recommends Folsom Lake as an archaeological district that should be evaluated as such. Stated he will discuss with UAIC committee how to disclose TCPs for evaluation and asked for a time to discuss this. Further started UAIC has been participating in consultation and that the Corps chose to complete surveys without consulting with the tribe who had expressed an interest to participate. Asked if UAIC would not be able to comment on the survey report. Stated that once the Corps has completed the survey report UAIC can compate locations with the UAIC inventory. Suggested that the Corps is not senstive to handling information on sacred sites and asked if since the project is on federal land if NAGPRA applies. Also stated that UAIC would welcome the Corps' tribal liaison to come and see the tribe's database if USACE needs to confirm information.
3/5/2015	Outgoing Email	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Daniel Fonseca, Andrew Godsey, Kara Perry, Steven Hutchason, Grayson Coney	Email transmittal to available email addressed of 3/3/15 letter. Asked tribe to contact Ms. Montag if they would like to schedule a consultation meeting or have any questions.
3/5/2015	Returned Letter	TAM	Eileen Moon, Don Ryberg	Letters dated 3/3/15 to Ms. Moon and Mr. Ryberg were returned as "Unclaimed Unable to Forward."
3/5/2015	Outgoing Email	TAM	Grayson Coney	Sent an email to Mr. Coney to ask if he has updated addresses for Ms. Moon and Mr. Ryberg to send the returned letters to.

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3/6/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Mark Gilfillan	In response to Mr. Guerrero's 3/3/15 email, replied that the Corps will consider comments from his email and suggested meeting to discuss locations of TCPs for consideration for the project. Asked for availability the week of March 16th and 23rd. Stated the Corps welcomes the opportunity for Mark to look at the UAIC database.
3/9/2015	Incoming Email	UAIC	Marcos Guerrero	In response to 3/6/15 email, proposed 3/23/15 at UAIC at 1PM to meet.
3/9/2015	Incoming Email	UAIC	Marcos Guerrero	In reply to 3/5/15 email, Mr. Guerrero stated that UAIC is aware of burials, arch sites and traditional cultural properties within the Corps' work areas. Asked for a copy of complete survey report.
3/10/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Mark Gilfillan	In reply to 3/9/15 email, confirmed 3/23/15 at UAIC at 1PM to meet would work. Asked that Mr. Guerrero let the Corps know if they would like other technical staff present.
3/10/2015	Incoming Email	UAIC	Marcos Guerrero	In reply to 3/10/15 email, Mr. Guerrero asked to meet when Mark Gilfillan is available in order to have time to include the committee.
3/10/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Melodi McAdams, Mark Gilfillan	In reply to 3/10/15 email, Ms. Montag stated meeting will attempt to be scheduled when Mark Gilfillan is available to attend in person or by phone. Asked Mark for his availability the week or March 30th or April 6th.
3/16/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	In reply to 3/9/15 email, Ms. Montag stated the survey report is not complete yet and UAIC will be notified when the report is available.
3/16/2015	Incoming Email	UAIC	Marcos Guerrero	In reply to 3/16/15 email, Mr. Guerrero stated that once UAIC receives the survey report they will be able to review and comment based on the tribe's previous inventories of the project area. Further stated that usually the tribe would have provided this information prior to identification and survey effort but because they have not been involved UAIC will wait until the survey report has been distributed. After they have reviewed the results UAIC would like to schedule a field visit.
4/21/2015	Incoming Email	UAIC	Marcos Guerrero	Reiterated UAIC's interest in the project, their wish to meet to discuss the survey report, requested a burial and treatment plan.
7/16/2015	Incoming Email	UAIC	Marcos Guerrero	Asked if the survey report has been completed and if UAIC could review the finds from the survey.
7/21/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	In response to 7/16/15 email, Ms. Montag stated that the survey report is not yet complete but should be done in a few weeks. The survey identified one site, site forms are being finalized and will be provided as soon as they are available.

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3/4/2016	Outgoing Email	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Kara Perry, Cynthia Franco, Daniel Fonseca, Steven Hutchason, Antonio Ruiz, Grayson Coney, TAM main email	Provided information about review of cultural resources inventory report for Folsom Dam Raise Project, that report would be available through AMRDEC for 14 days and comments are requested by COB 4/4/16. Requested any information the tribes are willing to share about sites within the project APE of importance to the tribes so it may be considered for the final survey report and upcoming draft EIS.
3/4/2016	Incoming Email	TAM	TAM main email	Email to the main TAM email (akimmaidu@att.net) failed to deliver.
3/4/2016	File Pick Up	SSBMI	Kara Perry	Ms. Perry downloaded the Folsom Dam Raise inventory report via AMRDEC.
3/7/2016	Incoming Email	UAIC	Marcos Guerrero	Mr. Guerrero asked if it would be possible to set up a working group meeting to discuss the report and project.
3/7/2016	File Pick Up	UAIC	Marcos Guerrero	Mr. Guerrero downloaded the Folsom Dam Raise inventory report via AMRDEC.
3/7/2016	Outgoing Email	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Kara Perry, Cynthia Franco, Daniel Fonseca, Steven Hutchason, Antonio Ruiz, Grayson Coney, TAM main email	In response to 3/7/16 email from Mr. Guerrero, Ms. Montag stated the Corps would be willing to meet with the tribes regarding the project and report. Requested information on what they envision the meeting would be in terms of meeting attendees, agenda topics, logistics. Also stated that as the details for the meeting get worked out the Corps is looking forward to receiving comments from the tribe by 4/4/16.
3/7/2016	Incoming Email	UAIC	Marcos Guerrero	In response to Ms. Montag's email on 3/7/16, Mr. Guerrero suggested a consultation meeting could address topics of concern to the tribes and should include the tribes in the email chain. He also suggested someone should take notes so the notes can be included in the official record.
3/10/2016	Outgoing Email	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Kara Perry, Cynthia Franco, Daniel Fonseca, Steven Hutchason, Antonio Ruiz, Grayson Coney, TAM main email	Ms. Montag asked tribes (per Mr. Guerrero's email) to please respond by 3/18/16 with their interest in attending a consultation meeting as suggested, specific agenda topics, and availability to meet the weeks of March 28th and April 4th.

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4/12/2016	Outgoing Email	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Kara Perry, Cynthia Franco, Daniel Fonseca, Steven Hutchason, Antonio Ruiz, Grayson Coney, TAM main email	Follow up to 3/4/16 and 3/10/16 emails extending review period of inventory report to 5PM 4/18/16 and asking the tribes to notify Ms. Montag if there is interest in scheduling a consultation meeting on the report or project.
4/22/2016	Incoming Email	UAIC	Marcos Guerrero	In reply to 4/12/16 email, Mr. Guerrero asked about results from cultural survey completed a few years ago and who to ask for results, as well as if a FOIA request is needed. Suggested a face-to-face meeting as appropriate, that tribes have interest in the project but little effort to consult with government or staff is occurring.
4/22/2016	Incoming Email	UAIC	Marcos Guerrero	Requested an electronic version of the report mentioned in 4/12/16 email and UAIC requested an extension on the comment review period.
4/22/2016	Outgoing Email	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Kara Perry, Cynthia Franco, Daniel Fonseca, Steven Hutchason, Antonio Ruiz, Grayson Coney, TAM main email	In response to 4/22/16 email requesting electronic version of the report, Ms. Montag noted the report was uploaded and downloaded by Mr. Guerrero on 3/7/16 and asked if he needed it uploading again. Report is too large to send by email but can be uploaded for those who request it. Ms. Montag also requested the date UAIC is requesting to extend their review period to and stated the Corps would consider the request.
4/22/2016	Incoming Email	UAIC	Marcos Guerrero	In reply to 4/22/16 email, Mr. Guerrero request the report be sent again to the group on the email.

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4/22/2016	Outgoing Email	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Kara Perry, Cynthia Franco, Daniel Fonseca, Steven Hutchason, Antonio Ruiz, Grayson Coney, TAM main email	In response to 4/22/16 email asking about survey results and if a FOIA request is needed, Ms. Montag asked for clarification on what survey results UAIC feels it has not received. Ms. Montag stated that all survey results have been provided in draft form in the draft report submitted to tribes for review on 3/4/16 and that the draft is being provided to give tribes the opportunity to comment before the document is finalized and before decisions are made. Letter correspondence has not occurred recently as these are draft documents provided to tribes to review. Ms. Montag stated a FOIA request may be submitted but any documents the tribe requests that the Corps is able to legally provide will be provided, but further clarification on what the tribe is looking for is needed. Further, the Corps is open to holding a meeting and has made several attempts to schedule a meeting but has not heard back from tribes. Ms. Montag requested available dates between May 26-June 10 to schedule a meeting.
4/22/2016	File Pick Up	SSBMI	Kara Perry	Ms. Perry downloaded the Folsom Dam Raise inventory report via AMRDEC.
4/22/2016	Incoming Email	SSBMI	Kara Perry	In reply to uploaded inventory report, Ms. Perry stated at that time the only concern the tribe has is the isolated find and further discussion can occur at the future meeting.
5/3/2016	Incoming Email	UAIC	Marcos Guerrero	UAIC provided availability for a meeting later in May. Expressed concern that there was little to no evidence of Native American occupation as this is contrary to information UAIC has on file. Requested copies of surveyer's resumes. Also stated the project is subject to NAGPRA and asked how the Corps will deal with this.
5/11/2016	Outgoing Email	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Kara Perry, Cynthia Franco, Daniel Fonseca, Steven Hutchason, Antonio Ruiz, Grayson Coney, TAM main email	Requested availability from tribes to meet the week of June 13th, and to reply to Jane Rinck by May 27th with availability. In reply to Mr. Guerrero's request for resumes, Ms. Montag stated it is Corps policy not to release resumes and that all individuals completing work meet the Secretary of the Interior's professional qualifications standards for their technical area.
5/12/2016	Incoming Email	UAIC	Marcos Guerrero	In response to 5/11/16 email, Mr. Guerrero stated UAIC is available June 13-16.

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5/12/2016	Outgoing Meeting Invitation	UAIC	Marcos Guerrero, Melodi McAdams, Matthew Moore	Jane Rinck sent meeting request for June 14th to discuss the Corps' Folsom Dam Raise Project to UAIC staff.
5/23/2016	Incoming Email	Wilton Rancheria	Antonio Ruiz	Mr. Ruiz stated Wilton Rancheria is unavailable to meet the week or June 13th but asked to be kept appraised of what occurs at the meeting, future site visits, and electronic/hard copies of documents provided at the meeting, sign in sheet, and meeting minutes.
6/6/2016	Outgoing Meeting Invitation	SSBMI, TAM	Cynthia Franco, Kara Perry, Daniel Fonseca, Grayson Coney	Ms. Montag forwarded 6/14/16 meeting request to SSBMI and TAM, stated that if that meeting date does not work for the tribes and they would like to meet separately to contact Ms. Montag.
6/9/2016	Incoming Email	UAIC	Marcos Guerrero	Mr. Guerrero request GIS shapefiles of the APE to prepare for meeting on 6/14/16.
6/10/2016	Outgoing Email	UAIC	Marcos Guerrero, Melodi McAdams, Matthew Moore	In reply to 6/9/16 email, Ms. Montag provided the GIS shapefiles for the APE to include recreation trails, haul roads, dikes and 50 foot buffer, and staging areas.
6/14/2016	Consultation Meeting	DWR, Reclamation, Corps, UAIC	Jacqueline Wait, David Martasian, Laureen Perry, Scott Williams, Melissa Montag, Jane Rinck, Mariah Brumbaugh	As requested by UAIC, this meeting was scheduled for 6/14/16 and invitations sent 5/12/16. No representatives from UAIC attended the meeting and no notification of cancellation was received prior to the meeting.
6/14/2016	Incoming Email	UAIC	Marcos Guerrero	Mr. Guerrero responded in an email to Ms. Rinck several hours after the scheduled meeting time that the meeting fell off his calendar but that was perhaps better since other tribes had not been available. He asked about rescheduling the meeting.
6/15/2016	Outgoing Email	UAIC, SSBMI, WR, TAM, DWR, Reclamation	Marcos Guerrero, Melodi McAdams, Matthew Moore, Cynthia Franco, Kara Perry, Daniel Fonseca, Grayson Coney, Antonio Ruiz, Steven Hutchason, Jacqueline Wait, David Martasian, Laureen Perry, Scott Williams	In response to Mr. Guerrero's 6/14/16 email, Ms. Rinck stated that in consideration of everyone's time and in light of agency heads being available to attend a meeting the tribes did not, that it would be best to wait on scheduling a meeting until specific comments on the survey report are submitted. Updated APE maps were provided, and comments requested by 7/1/16, at which point the Corps will finalize the report. Ms. Rinck also stated that 36 CFR 800.13 will be followed in the event of previously unknown historic properties, and NAGPRA in the event of items subject to that law. Provided information that the draft EIS will be released in late June and tribes will receive the document for review and comment.

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6/30/2016	Incoming Email	UAIC	Melodi McAdams	Ms. McAdams forwarded an ethnohistory written as part of work completed in Old Folsom. In a separate email Ms. McAdams provided sensivity maps of the Folsom Dam Raise Project APE and areas of sensitivity as well as "known cultural resources," some of which overlap with the Corps' APE. Ms. McAdams also provided a brief list of several sites known to the tribe and stated they are significant, but no further elaboration was provided regarding the specifics of why sites are important, simply that they exist within or near the APE.
7/5/2016	Incoming Email	UAIC	Marcos Guerrero	In reference to a Reclamation trail restoration project, Mr. Guerrero included Ms. Montag on an email stating the tribe would like to set up a site visit in conjunction with a site visit UAIC is trying to set up for the "folsom dam levee raise project."
7/5/2016	Incoming Email	Reclamation	John Fogerty	In reply to Mr. Guerrero's 7/5/16 email, Mr. Fogerty stated he would be happy to meet with UAIC around a site visit for the Corps project.
7/6/2016	Outgoing Email	UAIC	Marcos Guerrero, Melodi McAdams, Matthew Moore, Jane Rinck	In reply to Ms. McAdams' email on 6/30/16, Ms. Montag requested additional specific information on the sites identified by the tribe in order to make National Register determinations and in order to evaluate possible effects to historic properties as a result of the Corps' project. Also requested to be allowed to share information sent by UAIC with Reclamation and DWR, and asked for clarification on if a buffer area was applied around the sites noted by UAIC on their sensitivity maps. Requested information be provided by 7/22/16 for consideration in the Section 106 compliance process.
7/6/2016	Outgoing Email	UAIC	Marcos Guerrero, Matthew Moore, Laureen Perry, John Fogerty, Scott Williams	In reply to 7/5/16 emails, Ms. Montag stated although scheduling a meeting for the Corps project is not something she is aware of occuring, the Corps is not opposed to meeting. Suggested including Scott Williams as the Reclamation contact person, and that UAIC propose some dates for a meeting.

Folsom Dam Raise Project Section 106 Consultation Record with SHPO*

***May not include all communication for project.**

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
3/3/2015	Outgoing Letter	SHPO	Jessica Tudor	Initial letter identifying the area of potential effects (APE) for project and requesting comments. Provided project description, proposed identification efforts, any comments.
3/6/2015	Incoming Email	SHPO	Jessica Tudor	Responded that 3/3/15 letter has been received and SHPO will wait to comment until the Corps has submitted a document that fully addresses the identification efforts and results.
3/16/2015	Outgoing Email	SHPO	Jessica Tudor	In response to 3/6/15 letter, Ms. Montag replied that the letter was to provide the SHPO the opportunity to comment on the APE and description of identification efforts, there is no issue if the SHPO chooses not to comment on those at this time. The results of identification efforts should be complete in a month or so and will be followed up with SHPO at that time.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JAN 13 2015

TO NATIVE AMERICAN TRIBES:

The U.S. Army Corps of Engineers, Sacramento District (Corps) and the Central Valley Flood Protection Board (CVFPB) will be holding two open forums to provide information on the Folsom Dam Raise (Dam Raise) and Folsom Dam Water Control Manual Update (Manual Update) and to solicit input from the Native American tribes. The Dam Raise was most recently authorized in the 2004 Energy and Water Development Appropriations Act, Public Law (PL) 108-137, and the Manual Update was authorized in the Water Resources Development Act of 1999, PL 106-53. The Corps and CVFPB are preparing two separate draft Supplemental Environmental Impact Statement/ Environmental Impact Reports (SEIS/SEIR), one for the Dam Raise and one for the Manual Update, to evaluate potential impacts as a result of the independent projects. The Corps will serve as lead agency for compliance with the National Environmental Policy Act (NEPA) and the National Historic Preservation Act of 1966, as amended (NHPA), and CVFPB will serve as lead agency for compliance with the California Environmental Quality Act (CEQA). For the Dam Raise the U.S. Bureau of Reclamation (Reclamation) is an involved party and for the Manual Update Reclamation is a cooperating agency. The Sacramento Area Flood Control Agency is a responsible agency for both projects.

Pursuant to 36 CFR § 800.3(f)(2), the implementing regulations of Section 106 of the NHPA, the Corps has identified you as a Native American tribe that may be interested in consulting on the Dam Raise and the Manual Update. These forums will only be open to Native American tribes.

Folsom Dam and Lake is a multipurpose project operated by Reclamation as a part of the Central Valley Project. The Corps is responsible for prescribing operations pertaining to use of the storage allocated for flood risk management. The dam provides flood risk management benefits to the city of Sacramento and its surrounding areas by regulating runoff from approximately 1,860 square miles of drainage area.

The purpose of the Dam Raise is flood risk management and ecosystem restoration. The Dam Raise is authorized for 4 components: 1) emergency spillway gate modifications; 2) raising the right and left wings of the main dam, Mormon Island Auxiliary Dam (MIAD), and the reservoir dikes (1-8) by 3.5 feet; 3) temperature control shutter automation and reconfiguration; and 4) downstream ecosystem restoration of Bushy Lake and Woodlake. The current Dam Raise analysis will address the flood damage reduction components, the emergency spillway gate modifications and the 3.5 foot raise, which are being prioritized for construction. The Dam Raise project will address the proposed structural modifications to the Folsom Dam, MIAD, and the dikes only. Any changes in operation as a result of the construction of these projects, downstream ecosystem restoration, temperature control shutter automation, and reconfiguration components of the Dam Raise will be addressed in the future. A preliminary area of potential effects (APE) for the Dam Raise is shown in Enclosure 1.

The Folsom Dam Joint Federal Project, currently under construction, consists of a new auxiliary spillway with a crest elevation 50 feet lower in elevation than the current gated spillways on the main dam. In order to fully realize the benefits of the new auxiliary spillway, the current Folsom Dam and Lake Water Control Manual must be updated. The Manual Update will identify, evaluate, and recommend changes to the flood management operation rules of Folsom Dam and Lake to reduce flood risk to the Sacramento area by utilizing the new auxiliary spillway and by incorporating an improved understanding of the American River watershed upstream of Folsom Dam. The findings of the evaluation will be used to help define the Dam's new flood operations plan, with the intention of meeting flood risk management objectives and dam safety requirements in a manner that conserves as much water as possible and maximizes all authorized Folsom Dam project uses to the extent practicable. The Manual Update will not cover operational activities of Folsom Dam and Lake that Reclamation is responsible for. A preliminary APE for the Manual Update is shown in Enclosure 2.

In accordance with Section 106 of the NHPA, the Corps is required to take into account the effects of their undertakings on historic properties. This includes the identification of historic properties, finding of effect, and the resolution of adverse effects through the process identified in 36 CFR § 800. As part of our efforts to identify historic properties and consider the views of Native American tribes, we are inviting you to attend the open forums and consult on the Dam Raise and Manual Update projects. Your input on the above topics and any associated items that are important to you will be used to:

- Further determine the scope of the analysis in the SEIS/SEIR documents and in the efforts to identify historic properties.

- Provide input on the range of alternatives to be evaluated in the SEIS/SEIR.

- Obtain local knowledge or information to assist in the environmental analysis and assessment of adverse effects on historic properties.

Project team staff will be on hand to accept comments and address questions regarding the projects. You will be given the opportunity to provide written and verbal comments at the open forums.

Written comments and suggestions about the Dam Raise and Manual Update may be submitted to Melissa Montag, Corps Cultural, Recreational, & Social Assessment Section. For e-mailed comments, please include "Folsom Dam Raise" or "Folsom Manual Update" in the subject line, attach comments in MS Word format, and include the commenter's U.S. Postal Service mailing address. Questions about the projects and the SEIS/SEIR should be addressed to:

Melissa Montag,
CESPK-PD-RC
1325 J St, Sacramento,
CA 95814
Phone: 916-557-7907
Fax: 916-557-7856
e-mail: Melissa.L.Montag@usace.army.mil

The open forums will be held at the following locations:

Sacramento Library Galleria
828 I Street, Sacramento, CA
January 26th, 2015
5pm to 7pm

Folsom Community Center
52 Natoma Street, Folsom, CA
February 2nd, 2015
5pm to 7pm

For more information please visit the Folsom Dam Raise website at http://www.spk.usace.army.mil/Missions/CivilWorks/FolsomDamRaise.aspx or the Folsom Dam Manual Update website at http://www.spk.usace.army.mil/Missions/CivilWorks/FolsomWaterControlManualUpdate.aspx.

Sincerely,

Alicia E. Kirchner for
Chief, Planning Division

cc: (w/enclosures)
Cathy Bishop, Chairperson, Strawberry Valley Rancheria, 1540 Strader Avenue, Sacramento, CA 95815
Silvia Burley, Chairperson, California Valley Miwok Tribe, 10601 N. Escondido PL, Stockton, CA 95212-9231

Anthony Burris, Ione Band of Miwok Indians, P.O. Box 699, Plymouth, CA 95699
Jason Camp, Tribal Historic Preservation Officer, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, CA 95603
Cynthia Clarke, Yocha Dehe Wintun Nation, P.O. Box 18, Brooks, CA 95606
Grayson Coney, Tsi-Akim Maidu, P.O. Box 1316, Colfax, CA 95713
Pamela Cubbler, Colfax-Todds Valley Consolidated Tribe, P.O. Box 734, Foresthill, CA 95631
Adam Dalton, Chairperson, Jackson Rancheria Band of Miwuk Indians, P.O. Box 1090, Jackson, CA 95642
Michael D. DeSpain, Director of OEPP, Mechoopda Indian Tribe of Chico Rancheria, 125 Mission Ranch Boulevard, Chico, CA 95926
El Dorado Miwok Tribe, P.O. Box 711, El Dorado, CA 95623
Rose Enos, 15310 Bancroft Road, Auburn, CA 95603
Kesner Flores, P.O. Box 1047, Wheatland, CA 95692
Nicolas Fonseca, Chairperson, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, CA 95682-1340
Daniel Fonseca, Tribal Historic Preservation Officer, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, CA 95682
Andrew Franklin, Chairperson, Wilton Rancheria, 9728 Kent Street, Elk Grove, CA 95624
Reno Franklin, Tribal Historic Preservation Officer, Enterprise Rancheria of Maidu Indians, 2133 Monte Vista Avenue, Oroville, CA 95966
Andrew Godsey, Assistant Director, Cultural Resources Department, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, CA 95682
Marcos Guerrero, Cultural Resources Manager, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, CA 95603
Steven Hutchason, Executive Director of Environmental Resources, Wilton Rancheria, 9728 Kent Street, Elk Grove, CA 95624
Leland Kinter, Yocha Dehe Wintun Nation, P.O. Box 18, Brooks, CA 95606
Roselynn Lwenya, Tribal Historic Preservation Officer, Buena Vista Rancheria, 1418 20th Street, Suite 200, Sacramento, CA 95811
Judith Marks, Colfax-Todds Valley Consolidated Tribe, 1068 Silverton Circle, Lincoln, CA 95648
Marshall McKay, Yocha Dehe Wintun Nation, P.O. Box 18, Brooks, CA 95606
Yvonne Miller, Chairperson, Ione Band of Miwok Indians, P.O. Box 699, Plymouth, CA 95669-0699
Ambar Mohammed, Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, 3730 State Highway 45 # B, Colusa, CA 95932
Eileen Moon, Vice Chairperson, Tsi-Akim Maidu, 1239 East Main Street, Grass Valley, CA 95945

Glenda Nelson, Chairperson, Enterprise Rancheria of Maidu Indians, 2133 Monte Vista Avenue, Oroville, CA 95966
April Wallace Moore, 19630 Placer Hills Road, Colfax, CA 95713
Rhonda Morningstar Pope, Chairperson, Buena Vista Rancheria, 1418 20th Street, Suite 200, Sacramento, CA 95811
Dennis Ramirez, Chairperson, Mechoopda Indian Tribe of Chico Rancheria, 125 Mission Ranch Boulevard, Chico, CA 95926
Don Ryberg, Chairman, Tsi-Akim Maidu, 1239 East Main Street, Grass Valley, CA 95945
Guy Taylor, Representative, Mooretown Rancheria of Maidu Indians, 31 Alverde Drive, Oroville, CA 95966
Cosme Valdez, Interim Chief Executive Officer, Nashville-El Dorado Miwok, P.O. Box 580986, Elk Grove, CA 95758
Gene Whitehouse, Chairperson, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, CA 95603
Charlie Wright, Chairperson, Cortina Wintun Environmental Protection Agency, P.O. Box 1630, Williams, CA 95987
Randy Yonemura, 4305 39th Avenue, Sacramento, CA 95824

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Gene Whitehouse, Chairperson
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

Dear Mr. Whitehouse:

We are writing with regard to the proposed Folsom Dam Raise Flood Risk Management (Dam Raise FRM) Project. The U.S. Army Corps of Engineers, Sacramento District (Corps), in coordination with the U.S. Bureau of Reclamation (USBR), Central Valley Flood Protection Board, and the Sacramento Area Flood Control Agency, is implementing the Dam Raise FRM in order to provide flood risk management benefits while also resolving certain dam safety issues associated with passing the probable maximum flood. The Dam Raise FRM Project was authorized in the Energy and Water Development Appropriation Act of 2004 based on recommendations contained in the November 2002 Chief of Engineers' Report that were based on findings in the 2002 American River Watershed Long-Term Study Final Supplemental Plan Formulation Report Environmental Impact Statement/Environmental Impact Report.

We would like to invite your consultation under Section 106 of the National Historic Preservation Act of 1966, as amended. The area of potential effects (APE) for the Dam Raise FRM Project is located at the Folsom Dam Left and Right Wing Dam embankments, Dikes 1-8, and Mormon Island Auxiliary Dam (MIAD) around Folsom Lake in Sacramento, Placer, and El Dorado Counties. The project is located on the Folsom, Rocklin, and Clarkeville, California, 7.5-minute U.S.G.S. topographic maps. A preliminary APE for the Dam Raise FRM Project is shown in the enclosure. The APE includes a 50-foot buffer area around where construction activities may occur at the wing dams, dikes, and MIAD, as well as areas for staging of equipment during construction. Access to these locations will be by existing paved roads around Folsom Lake.

Raising the wing dams, dikes, and MIAD by 3.5 feet would allow for holding discharges longer at 160,000 cubic feet per second, the downstream constraint, by creating additional surcharge space (temporary water storage space utilized during rare flood events) in the reservoir. The authorized top of flood pool would remain at reservoir water surface elevation 468.34 feet NAVD 88. The Section 106 undertaking for the current Dam Raise FRM Project addresses the proposed structural modifications to the wing dams, MIAD, and dikes only. Construction of any of the proposed actions would not substantially alter current overall operations of Folsom Dam, MIAD, and Dikes

1-8. The Dam Raise FRM Project is a construction project that includes emergency spillway gate modifications, and raising the right and left wings of the main dam, MIAD, and the reservoir dikes (1-8) by 3.5 feet.

We have preliminarily determined that the APE includes those areas highlighted and outlined in the enclosure. We have completed a records and literature search at the North Central Information Center at California State University, Sacramento as well as a search of surveys and sites within USBR's records. The only known cultural resources within the APE for the Dam Raise FRM Project are Folsom Dam (CA-SAC-937H), Dikes 1-8 (CA-SAC-1103H), MIAD (CA-ELD-2868H), and CA-SAC-659, a large granite boulder with bedrock mortar cupules. Since the previous surveys for the JFP were conducted in 2006 and 2007 we have begun to conduct updated pedestrian surveys of the APE.

We are sensitive toward the protection of traditional cultural properties and sacred sites, and make every effort to avoid them. If you have comments on the APE, our efforts to identify historic properties, or if you have knowledge of locations of archaeological sites, sacred sites, or areas of traditional cultural value or concern in or near the Dam Raise FRM Project APE, we request that you contact us. Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

cc:
Jason Camp, Tribal Historic Preservation Officer, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603
Marcos Guerrero, Cultural Resources Manager, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAR 0 3 2015

Mr. Nicolas Fonseca, Chairperson
Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, CA 95682-1340

Dear Mr. Fonseca:

We are writing with regard to the proposed Folsom Dam Raise Flood Risk Management (Dam Raise FRM) Project. The U.S. Army Corps of Engineers, Sacramento District (Corps), in coordination with the U.S. Bureau of Reclamation (USBR), Central Valley Flood Protection Board, and the Sacramento Area Flood Control Agency, is implementing the Dam Raise FRM in order to provide flood risk management benefits while also resolving certain dam safety issues associated with passing the probable maximum flood. The Dam Raise FRM Project was authorized in the Energy and Water Development Appropriation Act of 2004 based on recommendations contained in the November 2002 Chief of Engineers' Report that were based on findings in the 2002 American River Watershed Long-Term Study Final Supplemental Plan Formulation Report Environmental Impact Statement/Environmental Impact Report.

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Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

cc:
Daniel Fonseca, Tribal Historic Preservation Officer, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, CA 95682
Andrew Godsey, Assistant Director, Cultural Resources Department, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, CA 95682

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAR 03 2015

Mr. Don Ryberg, Chairman
1239 East Main Street
Grass Valley, California 95945

Dear Mr. Ryberg:

We are writing with regard to the proposed Folsom Dam Raise Flood Risk Management (Dam Raise FRM) Project. The U.S. Army Corps of Engineers, Sacramento District (Corps), in coordination with the U.S. Bureau of Reclamation (USBR), Central Valley Flood Protection Board, and the Sacramento Area Flood Control Agency, is implementing the Dam Raise FRM in order to provide flood risk management benefits while also resolving certain dam safety issues associated with passing the probable maximum flood. The Dam Raise FRM Project was authorized in the Energy and Water Development Appropriation Act of 2004 based on recommendations contained in the November 2002 Chief of Engineers' Report that were based on findings in the 2002 American River Watershed Long-Term Study Final Supplemental Plan Formulation Report Environmental Impact Statement/Environmental Impact Report.

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Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

cc:
Grayson Coney, Tsi-Akim Maidu, P.O. Box 1316, Colfax, California 95713
Eileen Moon, Vice Chairperson, 1239 East Main Street, Grass Valley, California 95945

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch MAR 03 2015

Mr. Gene Whitehouse, Chairperson
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

Dear Mr. Whitehouse:

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Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

cc:

Jason Camp, Tribal Historic Preservation Officer, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603

Marcos Guerrero, Cultural Resources Manager, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAR 0 3 2015

Mr. Andrew Franklin, Chairperson
Wilton Rancheria
9728 Kent Street
Elk Grove, California 95642

Dear Mr. Franklin:

We are writing with regard to the proposed Folsom Dam Raise Flood Risk Management (Dam Raise FRM) Project. The U.S. Army Corps of Engineers, Sacramento District (Corps), in coordination with the U.S. Bureau of Reclamation (USBR), Central Valley Flood Protection Board, and the Sacramento Area Flood Control Agency, is implementing the Dam Raise FRM in order to provide flood risk management benefits while also resolving certain dam safety issues associated with passing the probable maximum flood. The Dam Raise FRM Project was authorized in the Energy and Water Development Appropriation Act of 2004 based on recommendations contained in the November 2002 Chief of Engineers' Report that were based on findings in the 2002 American River Watershed Long-Term Study Final Supplemental Plan Formulation Report Environmental Impact Statement/Environmental Impact Report.

We would like to invite your consultation under Section 106 of the National Historic Preservation Act of 1966, as amended. The area of potential effects (APE) for the Dam Raise FRM Project is located at the Folsom Dam Left and Right Wing Dam embankments, Dikes 1-8, and Mormon Island Auxiliary Dam (MIAD) around Folsom Lake in Sacramento, Placer, and El Dorado Counties. The project is located on the Folsom, Rocklin, and Clarkeville, California, 7.5-minute U.S.G.S. topographic maps. A preliminary APE for the Dam Raise FRM Project is shown in the enclosure. The APE includes a 50-foot buffer area around where construction activities may occur at the wing dams, dikes, and MIAD, as well as areas for staging of equipment during construction. Access to these locations will be by existing paved roads around Folsom Lake.

Raising the wing dams, dikes, and MIAD by 3.5 feet would allow for holding discharges longer at 160,000 cubic feet per second, the downstream constraint, by creating additional surcharge space (temporary water storage space utilized during rare flood events) in the reservoir. The authorized top of flood pool would remain at reservoir water surface elevation 468.34 feet NAVD 88. The Section 106 undertaking for the current Dam Raise FRM Project addresses the proposed structural modifications to the wing dams, MIAD, and dikes only. Construction of any of the proposed actions would not substantially alter current overall operations of Folsom Dam, MIAD, and Dikes

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We have preliminarily determined that the APE includes those areas highlighted and outlined in the enclosure. We have completed a records and literature search at the North Central Information Center at California State University, Sacramento as well as a search of surveys and sites within USBR's records. The only known cultural resources within the APE for the Dam Raise FRM Project are Folsom Dam (CA-SAC-937H), Dikes 1-8 (CA-SAC-1103H), MIAD (CA-ELD-2868H), and CA-SAC-659, a large granite boulder with bedrock mortar cupules. Since the previous surveys for the JFP were conducted in 2006 and 2007 we have begun to conduct updated pedestrian surveys of the APE.

We are sensitive toward the protection of traditional cultural properties and sacred sites, and make every effort to avoid them. If you have comments on the APE, our efforts to identify historic properties, or if you have knowledge of locations of archaeological sites, sacred sites, or areas of traditional cultural value or concern in or near the Dam Raise FRM Project APE, we request that you contact us. Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

cc:
Stevenson, Hutchason, Executive Director of Environmental Resources, Wilton Rancheria, 9728 Kent Street, Elk Grove, California 95642

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch MAR 03 2015

Mr. Gene Whitehouse, Chairperson
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

Dear Mr. Whitehouse:

We are writing with regard to the proposed Folsom Dam Raise Flood Risk Management (Dam Raise FRM) Project. The U.S. Army Corps of Engineers, Sacramento District (Corps), in coordination with the U.S. Bureau of Reclamation (USBR), Central Valley Flood Protection Board, and the Sacramento Area Flood Control Agency, is implementing the Dam Raise FRM in order to provide flood risk management benefits while also resolving certain dam safety issues associated with passing the probable maximum flood. The Dam Raise FRM Project was authorized in the Energy and Water Development Appropriation Act of 2004 based on recommendations contained in the November 2002 Chief of Engineers' Report that were based on findings in the 2002 American River Watershed Long-Term Study Final Supplemental Plan Formulation Report Environmental Impact Statement/Environmental Impact Report.

We would like to invite your consultation under Section 106 of the National Historic Preservation Act of 1966, as amended. The area of potential effects (APE) for the Dam Raise FRM Project is located at the Folsom Dam Left and Right Wing Dam embankments, Dikes 1-8, and Mormon Island Auxiliary Dam (MIAD) around Folsom Lake in Sacramento, Placer, and El Dorado Counties. The project is located on the Folsom, Rocklin, and Clarkeville, California, 7.5-minute U.S.G.S. topographic maps. A preliminary APE for the Dam Raise FRM Project is shown in the enclosure. The APE includes a 50-foot buffer area around where construction activities may occur at the wing dams, dikes, and MIAD, as well as areas for staging of equipment during construction. Access to these locations will be by existing paved roads around Folsom Lake.

Raising the wing dams, dikes, and MIAD by 3.5 feet would allow for holding discharges longer at 160,000 cubic feet per second, the downstream constraint, by creating additional surcharge space (temporary water storage space utilized during rare flood events) in the reservoir. The authorized top of flood pool would remain at reservoir water surface elevation 468.34 feet NAVD 88. The Section 106 undertaking for the current Dam Raise FRM Project addresses the proposed structural modifications to the wing dams, MIAD, and dikes only. Construction of any of the proposed actions would not substantially alter current overall operations of Folsom Dam, MIAD, and Dikes

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We are sensitive toward the protection of traditional cultural properties and sacred sites, and make every effort to avoid them. If you have comments on the APE, our efforts to identify historic properties, or if you have knowledge of locations of archaeological sites, sacred sites, or areas of traditional cultural value or concern in or near the Dam Raise FRM Project APE, we request that you contact us. Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

cc:
Jason Camp, Tribal Historic Preservation Officer, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603
Marcos Guerrero, Cultural Resources Manager, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAR 0 3 2015

Mr. Andrew Franklin, Chairperson
Wilton Rancheria
9728 Kent Street
Elk Grove, California 95642

Dear Mr. Franklin:

We are writing with regard to the proposed Folsom Dam Raise Flood Risk Management (Dam Raise FRM) Project. The U.S. Army Corps of Engineers, Sacramento District (Corps), in coordination with the U.S. Bureau of Reclamation (USBR), Central Valley Flood Protection Board, and the Sacramento Area Flood Control Agency, is implementing the Dam Raise FRM in order to provide flood risk management benefits while also resolving certain dam safety issues associated with passing the probable maximum flood. The Dam Raise FRM Project was authorized in the Energy and Water Development Appropriation Act of 2004 based on recommendations contained in the November 2002 Chief of Engineers' Report that were based on findings in the 2002 American River Watershed Long-Term Study Final Supplemental Plan Formulation Report Environmental Impact Statement/Environmental Impact Report.

We would like to invite your consultation under Section 106 of the National Historic Preservation Act of 1966, as amended. The area of potential effects (APE) for the Dam Raise FRM Project is located at the Folsom Dam Left and Right Wing Dam embankments, Dikes 1-8, and Mormon Island Auxiliary Dam (MIAD) around Folsom Lake in Sacramento, Placer, and El Dorado Counties. The project is located on the Folsom, Rocklin, and Clarkeville, California, 7.5-minute U.S.G.S. topographic maps. A preliminary APE for the Dam Raise FRM Project is shown in the enclosure. The APE includes a 50-foot buffer area around where construction activities may occur at the wing dams, dikes, and MIAD, as well as areas for staging of equipment during construction. Access to these locations will be by existing paved roads around Folsom Lake.

Raising the wing dams, dikes, and MIAD by 3.5 feet would allow for holding discharges longer at 160,000 cubic feet per second, the downstream constraint, by creating additional surcharge space (temporary water storage space utilized during rare flood events) in the reservoir. The authorized top of flood pool would remain at reservoir water surface elevation 468.34 feet NAVD 88. The Section 106 undertaking for the current Dam Raise FRM Project addresses the proposed structural modifications to the wing dams, MIAD, and dikes only. Construction of any of the proposed actions would not substantially alter current overall operations of Folsom Dam, MIAD, and Dikes

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Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

cc:
Stevenson, Hutchason, Executive Director of Environmental Resources, Wilton Rancheria, 9728 Kent Street, Elk Grove, California 95642

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAR 0 3 2015

Mr. Don Ryberg, Chairman
1239 East Main Street
Grass Valley, California 95945

Dear Mr. Ryberg:

We are writing with regard to the proposed Folsom Dam Raise Flood Risk Management (Dam Raise FRM) Project. The U.S. Army Corps of Engineers, Sacramento District (Corps), in coordination with the U.S. Bureau of Reclamation (USBR), Central Valley Flood Protection Board, and the Sacramento Area Flood Control Agency, is implementing the Dam Raise FRM in order to provide flood risk management benefits while also resolving certain dam safety issues associated with passing the probable maximum flood. The Dam Raise FRM Project was authorized in the Energy and Water Development Appropriation Act of 2004 based on recommendations contained in the November 2002 Chief of Engineers' Report that were based on findings in the 2002 American River Watershed Long-Term Study Final Supplemental Plan Formulation Report Environmental Impact Statement/Environmental Impact Report.

We would like to invite your consultation under Section 106 of the National Historic Preservation Act of 1966, as amended. The area of potential effects (APE) for the Dam Raise FRM Project is located at the Folsom Dam Left and Right Wing Dam embankments, Dikes 1-8, and Mormon Island Auxiliary Dam (MIAD) around Folsom Lake in Sacramento, Placer, and El Dorado Counties. The project is located on the Folsom, Rocklin, and Clarkeville, California, 7.5-minute U.S.G.S. topographic maps. A preliminary APE for the Dam Raise FRM Project is shown in the enclosure. The APE includes a 50-foot buffer area around where construction activities may occur at the wing dams, dikes, and MIAD, as well as areas for staging of equipment during construction. Access to these locations will be by existing paved roads around Folsom Lake.

Raising the wing dams, dikes, and MIAD by 3.5 feet would allow for holding discharges longer at 160,000 cubic feet per second, the downstream constraint, by creating additional surcharge space (temporary water storage space utilized during rare flood events) in the reservoir. The authorized top of flood pool would remain at reservoir water surface elevation 468.34 feet NAVD 88. The Section 106 undertaking for the current Dam Raise FRM Project addresses the proposed structural modifications to the wing dams, MIAD, and dikes only. Construction of any of the proposed actions would not substantially alter current overall operations of Folsom Dam, MIAD, and Dikes

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We have preliminarily determined that the APE includes those areas highlighted and outlined in the enclosure. We have completed a records and literature search at the North Central Information Center at California State University, Sacramento as well as a search of surveys and sites within USBR's records. The only known cultural resources within the APE for the Dam Raise FRM Project are Folsom Dam (CA-SAC-937H), Dikes 1-8 (CA-SAC-1103H), MIAD (CA-ELD-2868H), and CA-SAC-659, a large granite boulder with bedrock mortar cupules. Since the previous surveys for the JFP were conducted in 2006 and 2007 we have begun to conduct updated pedestrian surveys of the APE.

We are sensitive toward the protection of traditional cultural properties and sacred sites, and make every effort to avoid them. If you have comments on the APE, our efforts to identify historic properties, or if you have knowledge of locations of archaeological sites, sacred sites, or areas of traditional cultural value or concern in or near the Dam Raise FRM Project APE, we request that you contact us. Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

cc:
Grayson Coney, Tsi-Akim Maidu, P.O. Box 1316, Colfax, California 95713
Eileen Moon, Vice Chairperson, 1239 East Main Street, Grass Valley, California 95945

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAR 0 3 2015

Mr. Nicolas Fonseca, Chairperson
Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, CA 95682-1340

Dear Mr. Fonseca:

We are writing with regard to the proposed Folsom Dam Raise Flood Risk Management (Dam Raise FRM) Project. The U.S. Army Corps of Engineers, Sacramento District (Corps), in coordination with the U.S. Bureau of Reclamation (USBR), Central Valley Flood Protection Board, and the Sacramento Area Flood Control Agency, is implementing the Dam Raise FRM in order to provide flood risk management benefits while also resolving certain dam safety issues associated with passing the probable maximum flood. The Dam Raise FRM Project was authorized in the Energy and Water Development Appropriation Act of 2004 based on recommendations contained in the November 2002 Chief of Engineers' Report that were based on findings in the 2002 American River Watershed Long-Term Study Final Supplemental Plan Formulation Report Environmental Impact Statement/Environmental Impact Report.

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We have preliminarily determined that the APE includes those areas highlighted and outlined in the enclosure. We have completed a records and literature search at the North Central Information Center at California State University, Sacramento as well as a search of surveys and sites within USBR's records. The only known cultural resources within the APE for the Dam Raise FRM Project are Folsom Dam (CA-SAC-937H), Dikes 1-8 (CA-SAC-1103H), MIAD (CA-ELD-2868H), and CA-SAC-659, a large granite boulder with bedrock mortar cupules. Since the previous surveys for the JFP were conducted in 2006 and 2007 we have begun to conduct updated pedestrian surveys of the APE.

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Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

cc:
Daniel Fonseca, Tribal Historic Preservation Officer, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, CA 95682
Andrew Godsey, Assistant Director, Cultural Resources Department, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, CA 95682

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAR 0 3 2015

Dr. Carol Roland-Nawi
State Historic Preservation Officer
Department of Parks and Recreation
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 94296-0001

Dear Dr. Roland-Nawi:

In accordance with Section 106 of the National Historic Preservation Act, as amended, we are writing to inform you of the proposed Folsom Dam Raise Flood Risk Management (Dam Raise FRM) Project. The Dam Raise FRM Project was authorized in the Energy and Water Development Appropriation Act of 2004 based on recommendations contained in the November 2002 Chief of Engineers' Report that were based on findings in the 2002 American River Watershed Long-Term Study Final Supplemental Plan Formulation Report Environmental Impact Statement/Environmental Impact Report. The U.S. Army Corps of Engineers, Sacramento District (Corps), in coordination with the U.S. Bureau of Reclamation (USBR), Central Valley Flood Protection Board, and the Sacramento Area Flood Control Agency, is implementing the Dam Raise FRM in order to provide flood risk management benefits while also resolving certain dam safety issues associated with passing the probable maximum flood. Pursuant to 36 CFR Part 800.3 we are initiating the Section 106 process for the Dam Raise FRM Project and we are asking for your comments on our proposed efforts to identify historic properties under 36 CFR Part 800.4. We are also asking for your concurrence with our determination of the area of potential effects (APE) for the Dam Raise FRM Project in accordance with 36 CFR Part 800.4(a)(1).

The APE for the Dam Raise FRM Project is located at the Folsom Dam Left and Right Wing Dam embankments, Dikes 1-8, and Mormon Island Auxiliary Dam (MIAD) around Folsom Lake in Sacramento, Placer, and El Dorado Counties. The project is located on the Folsom, Rocklin, and Clarkeville, California, 7.5-minute U.S.G.S. topographic maps. A preliminary APE for the Dam Raise FRM Project is shown in the enclosure. The APE includes a 50 foot buffer area around where construction activities may occur at the wing dams, dikes, and MIAD, as well as areas for staging of equipment during construction. Access to these locations will be by existing paved roads around Folsom Lake.

Raising the wing dams, dikes, and MIAD by 3.5 feet would allow for holding discharges longer at 160,000 cubic feet per second, the downstream constraint, by creating additional surcharge space (temporary water storage space utilized during rare flood events) in the reservoir. The authorized top of flood pool would remain at reservoir water surface elevation 468.34 feet NAVD 88. The Section 106 undertaking for the current Dam Raise FRM Project addresses the proposed structural modifications to the wing dams, MIAD, and dikes only. Construction of any of the proposed actions would not substantially alter current overall operations of Folsom Dam, MIAD, and Dikes 1-8. The Dam Raise FRM Project is a construction project that includes emergency spillway gate modifications, and raising the right and left wings of the main dam, MIAD, and the reservoir dikes (1-8) by 3.5 feet.

We have preliminarily determined that the APE includes those areas highlighted and outlined in the enclosure. We invite any comments you may have on our preliminary determination of the APE for the Dam Raise FRM Project. Most of the APE was included in Section 106 consultation conducted by the USBR for their Dam Safety Project under the Joint Federal Project (JFP) in 2006 and 2007 (reference number BUR061114A) and during our previous consultation for the Phases I-IV of the Corps' JFP (reference number COE081120C). We would also like to ask for your comments on our proposed efforts to identify historic properties as outlined below.

We have completed a records and literature search at the North Central Information Center at California State University, Sacramento as well as a search of surveys and sites within USBR's records. The only known cultural resources within the APE for the Dam Raise FRM Project are Folsom Dam (CA-SAC-937H), Dikes 1-8 (CA-SAC-1103H), MIAD (CA-ELD-2868H), and CA-SAC-659, a large granite boulder with bedrock mortar cupules. Since the previous surveys for the JFP were conducted in 2006 and 2007 we have begun to conduct updated pedestrian surveys of the APE.

The United Auburn Indian Community of the Auburn Rancheria, Shingle Springs Band of Miwok Indians, Wilton Rancheria, and Tsi-Akim Maidu have expressed interest in the Dam Raise FRM Project. We held two open forums on January 26, 2015 and February 2, 2015 to solicit input from Native American tribes regarding the Dam Raise FRM Project. As part of our efforts to identify potential historic properties, we plan to continue to inquire if tribes have knowledge of locations of archeological sites, sacred sites, or areas of traditional cultural value or concern in or near the Dam Raise FRM Project APE.

Pursuant to 36 CFR Part 800.4(a)(1), we request your comments on our preliminary determination of the APE for the Dam Raise FRM Project. We also request any comments your office may have on our proposed efforts to identify historic properties under 36 CFR Part 800.4. Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information, please contact Ms. Montag by email at: Melissa.L.Montag@usace.army.mil or by phone at (916) 557-7907.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

cc: (w/o enclosures)
Jason Camp, Tribal Historic Preservation Officer, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603
Grayson Coney, Tsi-Akim Maidu, P.O. Box 1316, Colfax, California 95713
Daniel Fonseca, Cultural Resources Director, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, California 95682
Nicholas Fonseca, Chairperson, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, California 95682
Andrew Franklin, Chairperson, Wilton Rancheria, 9300 W. Stockton Blvd, Suite 200, Elk Grove, California 95758
Andrew Godsey, Assistant Director, Cultural Resources Department, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, California 95682
Marcos Guerrero, Cultural Resources Manager, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603
Steven Hutchason, Executive Director of Environmental Resources, Wilton Rancheria, 9300 W. Stockton Blvd, Suite 200, Elk Grove, California 95758
Eileen Moon, Vice Chairperson, Tsi-Akim Maidu, 1239 East Main Street, Grass Valley, California 95945
Don Ryberg, Chairman, Tsi-Akim Maidu, 1239 East Main Street, Grass Valley, California 95945
Gene Whitehouse, Chairperson, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603

cc: (w/enclosure)
Scott Williams, U.S. Department of the Interior, Bureau of Reclamation, 2800 Cottage Way, MP-153, Sacramento, California 95825
Jacqueline Wait, Department of Water Resources, Division of Environmental Services, Environmental Compliance & Evaluation Branch, Cultural, Recreation, and Environmental Planning Section, 3500 Industrial Boulevard, West Sacramento, California 95691

APPENDIX J

LIST OF RECIPIENTS

Elected Officials		
Honorable Ami Bera, M.D.	1535 Longworth House Office Building	Washington, DC 20515
Honorable Doris Matsui	2311 Rayburn Building	Washington, DC 20515
Honorable Ted Gaines	State Capitol, Room 3070	Sacramento, CA 95814
Honorable Beth Gaines	8799 Auburn-Fosom Road, Suite #A	Granite Bay, CA 95746
Honorable Tom McClintock	2331 Rayburn House Office Building	Wasington, DC 20515
Honorable Barbara Boxer	112 Hart Senate Office Building	Washington, DC 20510
Honorable Dianne Feinstein	331 Hart Senate Office Building	Washington, DC 20510

Agencies		
Bureau of Reclamation	7794 Folsom Dam Road	Folsom, CA 95630
California Air Resources Board	P.O. Box 2815	Sacramento, CA 95812
California Department of Corrections and Rehabilitation	9838 Old Placerville Road, Suite B,	Sacramento, CA 95827
California Department of Fish and Wildlife	1701 Nimbus Road	Rancho Cordova, CA 95670
Central Valley Regional Water Quality Control Board	11020 Sun Center Drive, Suite 200	Rancho Cordova, CA 95670
California Department of Parks and Recreation	7806 Folsom-Auburn Road	Folsom, CA 95630
City of Folsom	50 Natoma Street	Folsom, CA 95630
Department of Water Resources (DWR)	3464 El Camino Ave, Suite 200	Sacramento, CA 95821
SAFCA	1007 7th Street, 7th Floor	Sacramento, CA 95814
SMAQMD	777 12th Street, 3rd Floor	Sacramento, CA 95814
U.S. Environmental Protection Agency	1001 I Street	Sacramento, CA 95814
US Fish and Wildlife Service	2800 Cottage Way, W-2605	Sacramento, CA 95825-1888

Tribes		
Shingle Springs Band of Miwok Indians	P.O. Box 1340	Shingle Springs, CA 95682
T'si-Akim Maidu	1239 East Main Street	Grass Valley, CA 95945

United Auburn Indian Community of the Auburn Rancheria	10720 Indian Hill Road	Auburn, CA 95603
Wilton Rancheria	9728 Kent Street	Elk Grove, CA 95642

Residents		
CURRENT RESIDENT	753 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	756 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	757 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	760 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	761 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	764 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	767 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	768 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	771 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	783 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	788 LORENA LN	FOLSOM, CA 95630
CURRENT RESIDENT	1509 GIONATA WAY	FOLSOM, CA 95630
CURRENT RESIDENT	765 CRISTINA CT	FOLSOM, CA 95630
CURRENT RESIDENT	766 CRISTINA CT	FOLSOM, CA 95630
CURRENT RESIDENT	805 CRISTINA CT	FOLSOM, CA 95630
CURRENT RESIDENT	809 CRISTINA CT	FOLSOM, CA 95630
CURRENT RESIDENT	810 CRISTINA CT	FOLSOM, CA 95630
CURRENT RESIDENT	813 CRISTINA CT	FOLSOM, CA 95630
CURRENT RESIDENT	814 CRISTINA CT	FOLSOM, CA 95630
CURRENT RESIDENT	355 MOUNTAIN VIEW DR	FOLSOM, CA 95630
CURRENT RESIDENT	361 MOUNTAIN VIEW DR	FOLSOM, CA 95630
CURRENT RESIDENT	363 MOUNTAIN VIEW DR	FOLSOM, CA 95630
CURRENT RESIDENT	365 MOUNTAIN VIEW DR	FOLSOM, CA 95630
CURRENT RESIDENT	170 ELVIES LN	FOLSOM, CA 95630
CURRENT RESIDENT	195 ELVIES LN	FOLSOM, CA 95630
CURRENT RESIDENT	245 ELVIES LN	FOLSOM, CA 95630
CURRENT RESIDENT	295 ELVIES LN	FOLSOM, CA 95630
CURRENT RESIDENT	365 ELVIES LN	FOLSOM, CA 95630
CURRENT RESIDENT	850 NATURE WAY	FOLSOM, CA 95630
CURRENT RESIDENT	856 NATURE WAY	FOLSOM, CA 95630
CURRENT RESIDENT	862 NATURE WAY	FOLSOM, CA 95630
CURRENT RESIDENT	868 NATURE WAY	FOLSOM, CA 95630
CURRENT RESIDENT	874 NATURE WAY	FOLSOM, CA 95630
CURRENT RESIDENT	880 NATURE WAY	FOLSOM, CA 95630
CURRENT RESIDENT	900 E NATOMA ST	FOLSOM, CA 95630
CURRENT RESIDENT	1000 E NATOMA ST	FOLSOM, CA 95630
CURRENT RESIDENT	1360 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1363 QUICLEY CT	FOLSOM, CA 95630

CURRENT RESIDENT	1364 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1367 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1368 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1371 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1372 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1375 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1376 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1379 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1380 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1383 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1387 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1388 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1391 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1392 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1395 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1396 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1399 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1400 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1492 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1497 QUIGLEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	1420 CUMMINGS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1421 CUMMINGS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1425 CUMMINGS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1433 CUMMINGS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1437 CUMMINGS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1441 CUMMINGS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1445 CUMMINGS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1475 CUMMINGS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1465 DURFEE CT	FOLSOM, CA 95630
CURRENT RESIDENT	1466 DURFEE CT	FOLSOM, CA 95630
CURRENT RESIDENT	1469 DURFEE CT	FOLSOM, CA 95630
CURRENT RESIDENT	1474 DURFEE CT	FOLSOM, CA 95630
CURRENT RESIDENT	1473 DURFEE CT	FOLSOM, CA 95630
CURRENT RESIDENT	1477 DURFEE CT	FOLSOM, CA 95630
CURRENT RESIDENT	1478 DURFEE CT	FOLSOM, CA 95630
CURRENT RESIDENT	1482 DURFEE CT	FOLSOM, CA 95630
CURRENT RESIDENT	1486 DURFEE CT	FOLSOM, CA 95630
CURRENT RESIDENT	1467 LEONARD CT	FOLSOM, CA 95630
CURRENT RESIDENT	1468 LEONARD CT	FOLSOM, CA 95630
CURRENT RESIDENT	1469 LEONARD CT	FOLSOM, CA 95630
CURRENT RESIDENT	1471 LEONARD CT	FOLSOM, CA 95630
CURRENT RESIDENT	1472 LEONARD CT	FOLSOM, CA 95630
CURRENT RESIDENT	1475 LEONARD CT	FOLSOM, CA 95630

CURRENT RESIDENT	1476 LEONARD CT	FOLSOM, CA 95630
CURRENT RESIDENT	1479 LEONARD CT	FOLSOM, CA 95630
CURRENT RESIDENT	1480 LEONARD CT	FOLSOM, CA 95630
CURRENT RESIDENT	1415 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1416 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1419 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1420 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1423 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1424 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1427 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1428 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1432 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1436 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1444 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1448 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1452 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1455 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1456 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1460 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1463 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1464 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1468 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1472 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1476 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1480 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1483 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1484 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1487 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1488 BICKER CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1477 JIM HILL LN	FOLSOM, CA 95630
CURRENT RESIDENT	1481 JIM HILL LN	FOLSOM, CA 95630
CURRENT RESIDENT	1482 JIM HILL LN	FOLSOM, CA 95630
CURRENT RESIDENT	1485 JIM HILL LN	FOLSOM, CA 95630
CURRENT RESIDENT	1489 JIM HILL LN	FOLSOM, CA 95630
CURRENT RESIDENT	1490 JIM HILL LN	FOLSOM, CA 95630
CURRENT RESIDENT	1591 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1595 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1599 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1603 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1607 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1611 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1615 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1619 BALLOU CIR	FOLSOM, CA 95630

CURRENT RESIDENT	1623 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1627 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1631 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1635 BALLOU CIR	FOLSOM, CA 95630