Topic: **Summary of NODOS Biological Resources Surveys** **2021 May 26**

Subject: **Overview and Summary of the NODOS Biological and Botanical Surveys as They Relate to the Sites Reservoir Project Area**

The information in this memo has been excised and summarized from the following documents:

- North of the Delta Offstream Storage (NODOS) Investigation Progress Report to CALFED, July 2000
- North-Of-The-Delta Offstream Storage Investigation Final Initial Alternatives Information Report, May 2006
- Preliminary Administrative Draft North-Of-The-Delta Offstream Storage Project EIR/EIS. California Department of Water Resources (DWR) and U.S Department of the Interior (DOI), Bureau of Reclamation, Mid-Pacific Region (Reclamation). December 2013

Initial surveys were performed in the NODOS "Sites and Colusa Project Area" from approximately 1997 to 2000, additional surveys by the California Department of Water Resources (DWR) and the California Department of Fish and Wildlife (CDFW) were performed from 2001 – 2004, then again in 2010 to 2011 at newer proposed Project facility locations (Delevan Pipeline and associated facilities).

## *Reptiles and Amphibian*

Surveys for reptiles and amphibians were conducted by CDFW from August 1997 through spring 1999 in the Sites and Colusa Project areas. Amphibian and reptile surveys included night driving, dip-netting, seining, ground searches, habitat assessment, consultation with United States Fish and Wildlife (USFWS), and the use of the USFWS and CDFW's protocol guidelines for red-legged frog and California tiger salamander surveys.

The major objectives of these surveys were to search for California red-legged frogs, federally threatened; California tiger salamanders, candidate for federal listing and California Species of Special Concern; and to conduct general herpetology surveys. Four species listed as federal and California State Species of Concern that could potentially occur in the Sites and Colusa Project areas—foothill yellow-legged frogs, western pond turtles, western spadefoot toads, and California horned lizard—were also looked for during the course of this survey.

*Results*

A total of 2,400 hours in the spring and summer of 1998 and 1999 were spent in the Sites and Colusa Project areas looking for reptiles and amphibians. A total of 19 species, 5 amphibians and 14 reptiles, were found during this survey. Only one special species targeted by these surveys was found in the Sites Project study area, the western pond turtle. California red-legged frogs and California tiger salamanders were not found.

### *Mammal Surveys*

A variety of field survey methods were used by CDFW biologists in 1998 and 1999 to sample the mammal populations at the Sites Project study area. These methods included small mammal trapping, mist netting, acoustical surveys, roost searches, track plates, camera stations, spotlighting, general habitat measurements and assessment, and incidental observation.

*Results for Sites Project Area*

No federally or state listed species were found during field surveys in the Sites Project study area. Six mammal California State Species of Special Concern were documented at the four project areas. Table 1 identifies those found within the Sites Reservoir study area.

**Table 1. Special Status Mammals Observed in the Sites Project Study Area**

| Species | Status |
|---|---|
| American badger | SSC |
| Pallid bat | SSC |
| San Joaquin pocket mouse | SSC |
| Western red bat | SSC |

*SSC = California Species of Special Concern*

*Source: North-Of-The-Delta Offstream Storage Investigation Final Initial Alternatives Information Report, May 2006*

### *Avian Surveys*

Avian surveys in the Sites Reservoir study area included general line transects and focused bank swallow, yellow-billed cuckoo, and owl surveys. The most relevant studies were confined primarily to the area of the reservoir footprint. However, line transects extended up to 2.5 miles from the reservoir footprint along key drainages. In addition to the surveys in the reservoir footprint, surveys were also initiated at Funks Reservoir to document which state or federally listed avian species would use a reservoir within low elevation grassland habitats. Sites Reservoir data are most comprehensive, being surveyed monthly from March 1997 to at least March 2000.

*Results for Sites Project Area*

No federally or state listed species identified as potentially occurring were found during field surveys in the Sites Project study area. Eleven avian species classified as either California Species of Special Concern or federal Migratory Nongame Birds of Management Concern were observed during the surveys at Funks Reservoir and are listed in Table 2.

**Table 2. Special Status Bird Species Observed at Funks Reservoir**

| Species | Status |
|---|---|
| American white pelican | SSC (breeding only) |
| Common loon | SSC (breeding only) |
| Golden eagle | FP |
| Grasshopper sparrow | SSC (breeding only) |
| Lawrence's goldfinch | MNBMC |
| Loggerhead shrike | SSC (breeding only) |
| Long-billed curlew | MNBMC |
| Northern harrier | SSC (breeding only) |
| Short-eared owl | SSC (breeding only), MNBMC |
| Bald eagle | SE |
| White-tailed kite | FP |

*SSC = California Species of Special Concern*
*MNBMC = Migratory Nongame Birds of Management Concern (USFWS)*
*SE = State Endangered*
*FP = State Fully Protected*

*Source: North-Of-The-Delta Offstream Storage Investigation Final Initial Alternatives Information Report, May 2006.*

### *Valley Elderberry Longhorn Beetle (VELB)*

A survey of all potential reservoir sites for the VELB and its habitat was conducted during the periods January through July 1998 and April through June 1999. Surveys focused on identifying potential habitat for VELB, the number of elderberry stems found measuring more than one inch, and the presence of exit holes. A total of 45 days was spent field surveying the drainages.

*Results for Sites Project Area*

Six hundred seventy-two stems were counted within the proposed Sites Project area. Emergence holes were found on 18 individual stems. The plants within this area tend to be individuals with multiple trunks and range from unhealthy stressed plants to occasional large healthy individuals. The majority of plants at this site and the riparian vegetation in general tend to be in poor condition.

**Table 3. Elderberry Stems and Emergence Holes Found in the Sites Project Study Area**

| | |
|---|---|
| Number of elderberry stem | 672 |
| Number of stems with emergence hole | 18 |
| Percentage of stems with emergence holes: | 2.7 |

### Vernal Pool Brachiopods

Surveys of potential special status shrimp habitat at the potential reservoir sites were performed in 1998 and 1999. The 1999 surveys were conducted to verify potential special status shrimp habitat mapped in 1998 and to survey in areas where access was unavailable in the previous surveys because of flooded creeks, washed-out roads, and property access limitations.

Special status shrimp include species in the following categories:

- Shrimp listed or proposed for listing as Threatened or Endangered Species under the federal Endangered Species Act (50 Code of Federal Regulations [CFR] 17.11 for listed animals and various Federal Register notices for proposed species).

- Other shrimp species meeting the definition of Rare, Threatened, or Endangered Species under the California Environmental Quality Act (CEQA) Guidelines (Section 15380).

Potential special status shrimp habitat is defined as seasonal wetlands and other temporarily ponded areas of sufficient size (depth and area) and seasonality to support specific vegetation. Grasslands and vernal pools characterize the majority of the potential landcover where special status shrimp could be found within the Sites Reservoir study area.

*Results for Sites Project Area*

A summary of potential special status shrimp habitat mapped in the 1998 and 1999 surveys is presented in Table 4. The majority of the areas identified as potential habitat was identified as degraded by cattle activity, erosion, and debris from cattle feeding areas.

**Table 4: Total Acreage of Potential Special Status Shrimp Habitat in the Sites Project Study Area**

| Survey Year | Total Extent (Acres) of Potential Habitat |
|---|---|
| 1998 | 73 |
| 1999 | 71 |

### Plant Surveys

Focused habitat-specific surveys were conducted, using wandering transect methodology, between February and October 1998 and 1999 and within potential routes for conveyances, recreation areas, and road relocations for the Sites Project area in 2000 through 2003. These months coincided with the appropriate flowering and fruiting stages necessary for the identification of most plant species occurring in the area, including all special-status species.

*Results for Sites Project Area*

No federally or state listed species identified as potentially occurring were found in the Sites Project study area. Five species with California Rare Plant Rank (CNPR) status were found during field surveys that were conducted within the Primary Study Area. This status is considered for purposes of CEQA analysis.

**Table 5. Rare Plant Species Found in the Sites Project Study Area**

| Species | Status |
|---|---|
| Adobe lily | CRPR of 1B.2 |
| Bent-flowered fiddleneck | CRPR of 1B.2 |
| Red-flowered bird's-foot trefoil | CRPR of 1B.1 |
| Brittlescale | CRPR of 1B.2 |
| San Joaquin spearscale | CRPR of 1B.2 |
| *California Rare Plant Rank:*<br>*1B = rare, threatened, or endangered in California and elsewhere*<br>*0.1 = seriously endangered in California*<br>*0.2 = fairly endangered in California* | |

DRAFT

North of the Delta
Offstream Storage Investigation

# Progress Report

## Appendix A:
## Botanical Resources Report

**January 2000**

Integrated
Storage
Investigations

CALFED
BAY-DELTA
PROGRAM

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e. Dippingvat Vegetation

5. 1998-1999 plant species observed
6. 1998-1999 plant voucher collection
7. a. Explanation of prioritized plant species name and spreadsheet column acronyms

   b. 1998-1999 prioritized plant species population occurrence records
8. 1998-1999 photographs of prioritized plants and vegetation communities

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Tables



Figures

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## SUMMARY

This report summarizes a botanical resource assessment of the Sites, Colusa cell, Newville, and Red Bank reservoir sites in 1998 and 1999. The assessment included rare plant field surveys, mapping and analysis of vegetation communities, and an inventory of vascular plants in the reservoir inundation zone.

There were no State or federally threatened or endangered plants found in the reservoir areas during the course of the study. Populations of federal Species of Concern were identified in the Newville and Red Bank alternatives. Several rare and limited distribution species were also found in all of the alternatives. The Newville and Red Bank sites yielded the greatest number of populations of sensitive plant species.

Vegetation communities which may be affected by the proposed reservoirs include California annual grassland, valley and blue oak woodland, willow riparian scrub, cottonwood riparian woodland, foothill pine woodland, chaparral, vegetated wetlands, and vernal pools. More than 80 percent of the Sites, Colusa cell, and Newville reservoir areas support annual grassland, in contrast with Red Bank which is more than 80 percent oak and foothill pine woodland. Among the reservoir alternatives, the maximum oak woodland loss may be 1,800 acres. Vernal pool impacts vary between the sites from 0 to 23 acres.

A vascular plant inventory was prepared for each site, showing that species diversity is highest at the Newville site and lowest in the Colusa cell. Non-native species representation was also greatest at Newville. The annual grassland is dominated by non-native species such as yellow star thistle (*Centaurea solstitialis),* brome grasses (*Bromus* sp.), and medusa head (*Taeniatherum caput-medusae).* Non-native species density or cover was not quantified.

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## INTRODUCTION

This report is a summary of a two year botanical resource assessment for four proposed Offstream Storage Reservoir alternatives: Sites, Colusa cell, Newville, and Red Bank. Colusa cell is defined for this study as the northern half of the Colusa Reservoir. Studies included a comprehensive literature background search, rare plant surveys and inventory of the inundation zones, and analysis of the vegetative communities in the proposed project areas. These studies were conducted in compliance with statutes and guidelines set forth in the California Environmental Quality Act, the California Endangered Species Act, and the Federal Endangered Species Act to determine the extent to which sensitive botanical resources would be affected by the proposed project.

## 1 METHODOLOGY

### 1.1. General Vegetation

The California Native Plant Society and the California Department of Fish and Game have classified natural plant communities in California for broad scale resource inventory and assessment. This classification system provides parameter definition for general vegetation types and of rare communities, as set forth in the CNPS Manual of California Vegetation (Sawyer and Keeler-Wolf 1995). The manuals classifications were used to define the natural communities which may be affected by the Offstream Storage Reservoirs. Plant communities were delineated on aerial photos (1:6,000; 1:12,000). The photos were field verified and digitized, with computer mapping software, to obtain acreage estimates of the existing vegetation communities. These data were used to prepare a plant community profile illustrating the percent cover of dominant vegetation types within each reservoir.

1.2. Sensitive Plants

The CNPS, CDFG, and U.S. Fish and Wildlife Service have all developed standard classification systems for sensitive plants. To simplify these standards for the purpose of this report, sensitive plant species are defined by DWR as high priority, priority, and low priority. High priority species are either State or federally threatened, endangered, proposed threatened, or candidate species (State). Priority species are either federal Species of Concern, or CNPS List 1A, 1B, 2, or 3 species. The CNPS categories include species that are either believed to be extinct, may become listed, or are rare throughout their California range. Low priority species are defined as plants of limited distribution: CNPS List 4 (CDFG 1997, 1998, 1999; Harlow 1998; Skinner and Pavlik 1994; White 1997; USFWS 1996, 1997).

High priority plant species either are, or will soon be designated “threatened” or “endangered” under the CESA of 1985, or “rare” or “endangered” under the National Plant Protection Act of 1977 (CDFG code 1904, 2074.2, 2075.5). High priority species may also be protected under Section 7(c) of the FESA of 1973 (50 CFR). Since 1985, “threatened” plants are protected pursuant to CESA; “endangered” plants may be protected by CESA and NPPA. However, consideration of plants listed as “rare” are directed primarily by NPPA (CDFG code 1900, 1913(c).) and by guidelines set forth in the CEQA (1970,Cal. Pub. Res. Code 21000(a), 21151(a).) (Skinner and Pavlik 1994). Protection under State and federal law requires that a full environmental impact assessment will identify means to avoid impacts to the greatest extent possible and, where a significant impact would occur, acceptable measures will be identified to minimize or mitigate the impacts to below the level of significance.

References and regional specialists were consulted to identify documented occurrences of prioritized species and rare communities within the project area and adjacent USGS 7.5 minute quadrangles (Abrams 1923,1944,1951; Abrams and Ferris 1960; Griggs 1997; Isle 1998, 1999; Hickman 1993; Horenstein 1998, 1999; Lis 1998, 1999; Munz and Keck 1973; USDA Forest Service 1994):

CDFG, California Natural Diversity Data Base, 1998, 1999
A Manual of California Vegetation
CDFG List of Endangered and Threatened Species, April 1999
CNPS Electronic Inventory, 1999
United States Fish and Wildlife Service list of federally endangered, threatened, proposed and candidate species, December 1998
CDFG Region I, Redding, California
CDFG, Region 2, Sacramento, California

1.2.1. High Priority Species Background

Ten high priority plant species were identified from the literature search as previously documented within 30 miles of the proposed reservoirs (Table I.2.1). The probability for finding these species in the project was predicted by using known habitat parameters and proximity of the nearest occurrence (Table 1.2.2.).

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Table 1.2.1. High Priority Plant Species with Potential to Occur in the Vicinity of the Offstream Storage Reservoir Projects, Tehama, Glenn, and Colusa Counties, California.

| Species Common Name[1] | State Status[2] | USFWS listing [3] | CNPS status[4] | Distribution by County | Habitat Type (typical elevation ) |
|---|---|---|---|---|---|
| *Brodiaea coronaria* ssp. *rosea* Indian Valley broadiaea | CE | SC | List 1B | COL GLE LAK TEH | chaparral, cismontane woodland, valley & foothill grassland/ serpentinite (0-100 m) |
| *Chamaesyce hooveri* Hoover's spurge | none | FT | List 1B | BUT GLE MER STA TEH TUL | vernal pools (25-250 m) |
| *Cordylanthus palmatus* palmate-bracted bird's-beak | CE | FE | List 1B | ALA COL FRE GLE MAD SJQ YOL | chenopod scrub, valley & foothill grassland/alkaline (5-155 m) |
| *Gratiola heterosepala* Bogg's Lake hedge-hyssop | CE | none | List 1B | FRE LAK LAS MAD MOD PLA SAC SHA SJQ SOL TEH OR | marshes, swamps (lake margins), vernal pools (0-1,200 m) |
| *Lupinus milo-bakeri* Milo Baker's lupine | CT | SC | List 1B | COL MEN | cismontane woodland, valley & foothill grassland (395-430 m) |
| *Neostaphia Colusana* Colusa grass | CE | FT | List 1B | COL GLE MER SOL STA YOL | vernal pools/adobe (5-200 m) |
| *Orcuttia pilosa* hairy Orcutt grass | CE | FE | List 1B | BUT GLE MAD MER STA TEH | vernal pools (55-200 m) |
| *Orcuttia tenuis* slender Orcutt grass | CE | FT | List 1B | LAK LAS PLU SAC SHA SIS TEH | vernal pools (200-1,100 m) |
| *Silene campanulata* ssp. *campanulata* Red Mtn. catchfly | CE | FC | List 1B | COL MEN | chaparral, lower montane coniferous forest/serpentinite rocky (425-1,230 m) |
| *Tuctoria greenei* Greene's tuctoria | CR | FE | List 1B | BUT FRE MAD MER SHA SJQ STA THE TUL | vernal pools (<200 m) |

Notes:[1] Nomenclature corresponds to Skinner and Pavlik 1994;[2] CE State Listed as endangered; CR State Listed as rare (Section 1904, DFG code,1994);[3] SC federal Species of Concern; FC federal candidate; FE Listed as endangered by federal government; FP federally proposed threatened; FT Listed as threatened by federal government (USFWS, December 1998); [4] Listed 1B plants rare, threatened, or endangered in California and elsewhere (California Native Plant Society).

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The following information includes the most current literature and resource knowledge of known populations, ecological requirements, range and distribution, and potential or existing threats to high priority species.

**Indian valley brodiaea** (*Brodiaea coronaria* ssp. *rosea*) is listed as California Endangered and a Federal Species of Special Concern. This perennial herb in the Liliaceae family flowers from May to June. Its habitat includes closed-cone coniferous forest, chaparral, cismontane woodland, and valley and foothill grasslands with serpentinite soils at elevations ranging from 0 to 100 meters.

Range CNDDB information indicates that 14 occurrences of this species have been reported in Colusa, Glenn, Lake, and Tehama counties (one of which is possibly extirpated). These sites are on Bureau of Land Management, U.S. Forest Service, private, and unknown ownership properties. Potential habitat exists at all the reservoir sites and known populations occur within 6 miles of Sites, within about 8 miles of Colusa cell, within about 10 miles of Red Bank, and within 2 miles of Newville.

Threats Various threats to these populations have been identified, including inundation by reservoir construction, mining, off-road recreational vehicle activity, road or trail construction, horticultural collecting, vandalism, and dumping. Populations are protected in part at a BLM Area of Critical Environmental Concern in Lake County.

**Hoover's spurge** (*Chamaesyce hooveri*) is listed as Federally Threatened with no State status. This annual herb in the Euphorbiaceae family flowers in July and August. Its habitat is vernal pools at elevations ranging from 25 to 250 meters.

Range According to CNDDB records Hoover's spurge has been reported from 30 occurrences in Butte, Glenn, Stanislaus, Merced, Tehama, and Tulare counties. These plants are on CDFG, The Nature Conservancy, USFWS, private, and unknown ownership properties. Potential habitat exists at Sites and Colusa cell and known populations occur within 7 miles of these reservoirs.

Threats Threats include agriculture, altered hydrology, competition from non-native plants, erosion or runoff, trampling, and grazing. Populations are protected in part at the CDFG Stone Corral Ecological Reserve, USFWS Sacramento National Wildlife Refuge, and TNC Vina Plains Preserve.

**Palmate-bracted bird's beak** (*Cordylanthus palmatus*) is listed as California Endangered and Federally Endangered. This annual herb in the Scrophulariaceae family flowers from May through October. Its habitat is chenopod scrub and alkaline areas in valley and foothill grassland at elevations ranging from 5 to 155 meters.

Range CNDDB information indicates that 21 occurrences of this plant are known from Alameda, Colusa, Fresno, San Joaquin, and Yolo counties. This species is thought to be extirpated from Madera and Glenn counties. These populations occur on land owned by the City of Woodland, CDFG, City of Livermore, USFWS, and private entities. Known sites occur within 5 miles of Colusa cell and 7 miles of Sites reservoirs.

Threats Threats include agriculture, altered hydrology, competition from exotic plants, biocides, grazing, off road vehicle use, vandalism/dumping, and road and trail construction. Populations are protected at the CDFG Alkali Sink Ecological Reserve and Mendota Wildlife Area and at the Sacramento National Wildlife Refuge.

**Bogg's Lake hedge-hyssop** (*Gratiola heterosepala*) is listed as California Endangered with no Federal status. This annual herb in the Scrophulariaceae family flowers from

April to June. Its habitat includes shallow water in marshes, swamps (lake margins), and vernal pools at elevations ranging from 0 to 1,200 meters.

Range CNDDB information indicates that 77 occurrences of this species (one of which is possibly extirpated) have been reported in Fresno, Lake, Lassen, Madera, Modoc, Placer, Sacramento, San Joaquin, Shasta, Solano, and Tehama counties. These sites are on land owned by the BLM, CDFG, TNC, Sacramento County, Solano County Farmlands and Open Space, The Trust for Wildland Communities, US Forest Service, private, and unknown entities. Potential habitat exists at all the reservoir sites. However, the closest known location is 12 miles northeast of the Newville Reservoir alternative.

Threats Threats include agriculture, altered flood regime, development, herbicide use, feral pigs, grazing, foot traffic, recreational use, road and trail construction, and landfill construction. Populations are protected in private preserves, BLM Research Areas, a USFWS Botanical Special Interest Area, and CDFG Ecological Reserves.

**Milo Baker's lupine** (*Lupinus milo-bakeri*) is listed as California Threatened and Federal Species of Special Concern. This annual herb in the Fabaceae family flowers from June through September. Its habitat includes cismontane woodland (often along roads) and foothill and valley grasslands at elevations from 395 to 430 meters.

Range According to CNDDB records Milo Baker's lupine has been reported from 17 occurrences in Colusa and Mendocino counties. Four Mendocino County sites may have been extirpated. These sites are on land under Bureau of Indian Affairs, CALTRANS, and private ownership.

Threats This species is threatened by biocides, grazing, and road and trail construction.

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**Colusa grass** (*Neostapfia Colusana*) is listed as California Endangered and Federally Threatened. This annual grass flowers from May to August. Its habitat is vernal pools, alkali playas, or adobe soils at elevations ranging from 5 to 200 meters.

<u>Range</u> According to CNDDB records, this species is reported from 56 occurrences in Merced, Solano, Stanislaus, and Yolo counties. It has been extirpated from Colusa County and from some sites in Stanislaus, Merced, and Glenn counties. Colusa grass occurs on land owned by TNC, Solano County Farmlands and Open Space, Stanislaus County, the US Department of Defense, and private and unknown entities. Potential habitat occurs at Sites and Colusa cell reservoirs and known populations occur approximately 10 miles to the east.

<u>Threats</u> Various threats to these populations include agricultural practices and grazing, altered flood regime and surface water diversion, biocides, competition from exotics, inundation, foot traffic, off-road vehicle activity, and road construction. Some populations are protected by TNC and Solano County Farmlands and Open Space.

**Hairy Orcutt grass** (*Orcuttia pilosa*) is listed as California Endangered and Federally Endangered. This annual grass flowers from May to September. Its habitat is vernal pools ranging in elevation from 55 to 200 meters.

<u>Range</u> CNDDB information indicates that 39 occurrences of this species have been reported in Butte, Glenn, Madera, Merced, Stanislaus, and Tehama counties (11 of these occurrences have been extirpated). These populations occur on land owned by the USBR, CALTRANS, TNC, USFWS, and private parties. Potential habitat exists at Sites and Colusa cell reservoirs and known populations occur within 9 miles.

Threats Threats include agriculture, competition from exotic plants, development, grazing, off-road vehicle use, and road and trail construction. Some populations are protected at Vina Plains Nature Conservancy Preserve and at the Sacramento National Wildlife Refuge.

**Slender Orcutt grass** (*Orcuttia tenuis*) is listed as California Endangered and Federally Threatened. This annual grass flowers from May to July. Its habitat is vernal pools ranging in elevation from 200 to 1,100 meters.

Range CNDDB information indicates that 76 occurrences of this species have been found in Lake, Lassen, Plumas, Sacramento, Shasta, Siskiyou, and Tehama counties. Four of the sites in Shasta County have been extirpated. These plants occur on land under BLM, City of Redding, CDFG, USFS, TNC, Trust for Wildland Communities, and private and unknown ownership. Potential habitat occurs at all the reservoirs, but no known populations occur within 20 miles.

Threats Threats include altered hydrology and surface water, competition from exotics, development, trampling, grazing, landfills, logging, off-road vehicle activity, vandalism, and dumping. Populations are protected in part at TNC Vina Plains Preserve, CDFG's Dales Lake Ecological Reserve, BLM Alturas RA, and Redding RA.

**Red Mountain catchfly** (*Silene campanulata* ssp. *campanulata*) is listed as California Endangered and a federal candidate. This perennial herb in the Caryophyllaceae family flowers from May to June. Its habitat includes chaparral and lower montane coniferous forest with serpentinite or rocky soils at elevations ranging from 425 to 1,230 meters.

Range CNDDB information indicates that seven occurrences of this plant have been found in Colusa and Mendocino counties. These populations occur on land under BLM and private ownership. A known population of this species grows within 5 miles of Sites reservoir. However, the proposed reservoir maximum pool is well below the observed elevation range of the species.

Threats Threats include erosion or runoff and mining. One population may have been extirpated by logging activities.

**Greene's tuctoria** (*Tuctoria greenei*) is listed as California Rare and Federally Endangered. This annual grass flowers from May to July. Its habitat is vernal pools at elevations less than 200 meters.

Range CNDDB information indicates that 38 occurrences of this species have been found. Nineteen of those populations occur in Butte, Merced, Shasta, and Tehama counties. Other occurrences are thought to be extirpated from Fresno, Madera, Stanislaus, Tulare, and San Joaquin counties. These plants occur on private land, TNC, and unknown ownership properties. Potential habitat occurs at all of the north of the Delta offstream storage reservoir alternatives. However, the nearest known population is more than 20 miles from any of the reservoir sites.

Threats Threats include agriculture, altered hydrology and surface water diversions, and competition from exotic plants, grazing, and exotics. Populations are protected in part at TNC Vina Plains Preserve.

Table 1.2.2. Probability Estimates for Occurrence of High Priority Plant Species in the Four Offstream Storage Reservoirs (Probabilities are based on existing habitat and known occurrences).

| **Species** **Common Name**[1] | **Probability for occurrence** [2] | | | |
|---|---|---|---|---|
| | **Sites** | **Colusa cell** | **Newville** | **Red Bank** |
| *Brodiaea coronaria* ssp. *rosea* Indian Valley broadiaea | low | low | low | low |
| *Chamaesyce hooveri* Hoover's spurge | low | low | low | none |
| *Cordylanthus palmatus* palmate-bracted bird's-beak | low | low | low | none |
| *Gratiola heterosepala* Bogg's Lake hedge-hyssop | med | med | med | med |
| *Lupinus milo-bakeri* Milo Baker's lupine | low | low | low | low |
| *Neostaphia Colusalna* Colusa grass | low | low | low | none |
| *Orcuttia pilosa* hairy Orcutt grass | low | low | low | none |
| *Orcuttia tenuis* slender Orcutt grass | low | low | low | none |
| *Silene campanulata* ssp. *campanulata* Red Mtn. catchfly | none | none | low | low |
| *Tuctoria greenei* Greene's tuctoria | low | low | low | none |

Notes: [1] Nomenclature corresponds to Skinner and Pavlik 1994. [2] Probability based on closest known occurrence records and potential habitat within the reservoirs in 1998-99.

## 1.2.2. Priority and Low Priority Species

The literature and regional references identified 42 priority and 30 low priority species within 30 miles of the proposed reservoirs (Table 1.2.3; Table 1.2.4).

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Table 1.2.3. Priority Plant Species with Potential to Occur in the Vicinity of the Offstream Storage Reservoir Projects, Tehama, Glenn and Colusa Counties, California.

| Species<br>Common Name[1] | State Status | USFWS listing[2] | CNPS status[3] | Distribution by County | Habitat type |
|---|---|---|---|---|---|
| *Antirrhinum subcordatum*<br>dimorphic snapdragon | none | none | List 1B | COL GLE LAK THE | chaparral/sometimes serpentinite (85-800m) |
| *Astragalus rattanii* var. *jepsonianus*<br>Jepson's milk-vetch | none | none | List 1B | COL GLE LAK NAP TEH YOL | woodland, grassland/often serpentiinte (320-700m) |
| *Astragalus tener* var. *ferrisiae*<br>Ferris's milk-vetch | none | SC | List 1B | BUT COL GLE SOL SUT YOL | meadows, grassland, subalkaline flats (5-75m) |
| *Atriplex cordulata*<br>heartscale | none | SC | List 1B | ALA BUT CCA FRE GLE KNG KRN MAD MER SJQ SOL STA TUL YOL | meadows, grassland, saline/alkaline (1-275m) |
| *Atriplex depressa*<br>brittlescale | none | none | List 1B | ALA BUT CCA COL FRE GLE KRN MAD MER SOL STA TUL YOL | Chenopod scrub, meadows, playas, grassland, vernal pools/alkaline, clay (1-320m) |
| *Atriplex joaquiniana*<br>San Joaquin spearscale | none | SC | List 1B | ALA CCA COL GLE MER NAP SAC SBT SCL SJQ SOL TUL YOL | Chenopod scrub, meadows, playas, grassland, vernal pools/alkaline (1-320m) |
| *Atriplex persistens*<br>vernal pool saltbush | none | none | List 1B | GLE MER STA TUL | vernal pools/alkaline (10-115m) |
| *Balsamorhiza macrolepis* ssp *macrolepis*<br>big-scale balsamroot | none | none | List 1B | ALA BUT MPA NAP PLA SCL TEH | woodland, grassland/sometimes serpentinite (< 1,400m) |
| *Chlorogalum pomeridianum* var. *minus*<br>dwarf soaproot | none | none | List 1B | COL LAK SLO SON THE | chaparral/serpentinite (305-750m) |
| *Cryptantha crinita*<br>silky cryptantha | none | SC | List 1B | SHA THE | woodland, riparian, grasslands/gravelly streambeds (150-300m) |

*(continued)*

| **Species** ***(Table* 1.2.3. *page 2 of 4)*** **Common Name**[1] | **State Status** | **USFWS listing**[2] | **CNPS status**[3] | **Distribution by County** | **Habitat type** |
|---|---|---|---|---|---|
| *Delphinium recurvatum* recurved larkspur | none | SC | List 1B | ALA CCA COL FRE KNG KRN MER SLO SOL TUL | chenopod scrub, woodland, grassland, vernal pools/alkaline (3-750m) |
| *Downingia pusilla* dwarf downingia | none | none | List 1B | MER MPA NAP PLA SAC SOL SON STA TEH SA | mesic grassland, vernal pools (+ 150m) |
| *Eleocharis quadrangulata* four-angled spikerush | none | none | List 2 | BUT MER THE | freshwater marsh (<500m) |
| *Eriastrum brandegeae* Brandegee's eriastrum | none | SC | List 1B | COL GLE LAK SCL TEH TRI | chaparral, woodland/volcanic (315-1,030m) |
| *Eriogonum luteolum* var. *caninum* Tiburon buckwheat | none | none | List 3 | ALA CCA COL LAK MRN NAP SCL SMT | chaparral, grassland, serpentinite (< 500m) |
| *Eriogonum nervulosum* Snow Mtn. Buckwheat | none | SC | List 1B | COL GLE LAK NAP SON YOL | chaparral, serpentinite (300-2,105m) |
| *Eschscholzia rhombipetala* diamond-petaled California poppy | none | SC | List 1A | ALA CCA COL SLO STA | grassland/alkaline (0-975m) |
| *Fritillaria pluriflora* adobe lily | none | SC | List 1B | BUT COL GLE LAK NAP PLU SOL TEH YOL | chaparral, woodland, grassland/often adobe (60-705m) |
| *Hesperevax acaulis* var. *acaulis* *dwarf evax* | none | none | List 1B | AMA BUT COL ELD FRE MAD MNT SAC SCL SLO STA TEH TUL | woodland, grassland, vernal pools (30-1,000m) |
| *Hesperolinon drymarioides* drymaria-like western flax | none | SC | List 1B | COL GLE LAK NAP YOL | chaparral, woodland, grassland/often serpentinite (100-1,130m) |
| *Hesperolinon tehamense* Tehama Co. western flax | none | SC | List 1B | GLE THE | chaparral, woodland/often serpentinite (100-1,000m) |

*(continued)*

| Species *(Table* **1.2.3.** ***page 3 of 4)*** Common Name[1] | State Status | USFWS listing[2] | CNPS status[3] | Distribution by County | Habitat type |
|---|---|---|---|---|---|
| *Hibiscus lasiocarpus* California hibiscus | none | none | List 2 | COL GLE THE | freshwater marsh ((0-120m) |
| *Juglans californica* var *hindsii* Northern California black walnut | none | SC | List 1B | CCA NAP SAC SOL YOL | riparian forest and woodland (50-200 m) |
| *Juncus leiospermus* var. *leiospermus* Red Bluff dwarf rush | none | none | List 1B | BUT SHA THE | chaparral, woodland, grassland, vernal pools (35-1,020m) |
| *Layia septentrionalis* Colusayia | none | none | List 1B | COL GLE LAK MEN NPA SON SUT TEH YOL | chaparral, woodland grassland/sandy, serpentinite (100-1,095m) |
| *Legenere limosa* Legenere | none | SC | List 1B | LAK NAP PLA SAC SMT SOL SON STA TEH | vernal pools (<150) |
| *Lepidium latipes* var. *heckardii* Heckard's pepper-grass | none | none | List 1B | GLE SOL YOL | grassland/alkaline falts (10-200m) |
| *Limnanthes floccosa* ssp. *floccosa* woolly meadowfoam | none | none | List 2 | BUT LAK SHA SIS THE TRI OR | vernally mesic woodland, grassland (<400m) |
| *Lotus rubriflorus* Red-flowered lotus | none | SC | List 1B | COL STA THE | woodland, grassland (+/-200m) |
| *Lupinus sericatus* Cobb Mtn. Lupine | none | none | List 1B | COL LAK NAP SON | chaparral, woodland (500-1,500m) |
| *Madia hallii* Hall's madia | none | SC | List 1B | COL LAK NAP YOL | chaparral/serpentinite (50-670m) |
| *Madia stebbinsii* Stebbin's madia | none | none | List 1B | SHA TEH TRI | chaparral,/serpentinite (400-1,580m) (continued) |

| **Species** ***(Table*** **1.2.3.** ***page 4 of 4)*** **Common Name**[1] | **State Status** | **USFWS listing**[2] | **CNPS status**[3] | **Distribution by County** | **Habitat type** |
|---|---|---|---|---|---|
| *Microseris sylvatica*<br>woodland microseris | none | none | List 3 | BUT GLE LAX SBT | chaparral, woodland, grassland (60-1,500m) |
| *Myosurus minimus* ssp. *apus*<br>little mousetail | none | SC | List 3 | BUT COL KRN SOL STA OR | vernal pools/alkaline (>1,500m) |
| *Myosurus sessilis*<br>sessile mousetail | none | none | List 3 | CCA COL FRE GLE MER SBT DJQ SOL STA YOL OR | grassland, vernal pools (<150m) |
| *Navarretia leucocephala* ssp. *bakeri*<br>Baker's navarretia | none | none | List 1B | COL LAK MEN MRN NAP SOL SON TEH | woodland, meadows (mesic), grassland, vernal pools (<1,700m) |
| *Paronychia ahartii*<br>Ahart's paronychia | none | SC | List 1B | BUT SHA THE | woodland, grassland, vernal pools (<500m) |
| *Sagittaria sanfordii*<br>Sandford's arrowhead | none | SC | List 1B | BUT DNT FRE KRN MER MRN ORA SAC SHA SJQ TEH VEN | marsh & swamp (assorted shallow freshwater) (<300m) |
| *Sanicula tracyi*<br>Tracy's sanicle | none | SC | List 1B | BUT DNT HUM TEH TRI | woodland (100-1,000m) |
| *Trichocoronis wrightii* var. *wrightii*<br>Wright's trichocoronis | none | none | List 2 | COL MER RIV SJQ SUT TX | meadows, freshwater marsh, riparian, vernal pools/alkaline |
| *Tropidocarpum capparideum*<br>caper-fruited tropidocarpum | none | SC | List 1A | ALA CCA GLE MNT SCL SJQ | grassland/alkaline hills (1-455m) |
| *Viburnum ellipticum*<br>Western viburnum | none | none | List 3 | CCA FRE ELD GLE HUM MEN NAP SHA SON | chaparral, woodland (300-1,400m) |

Notes: 1. Nomenclature corresponds to Skinner and Pavlik 1994. 2. SC-federal Species of Concern 3. California Native Plant Society; List 1A-plants presumed to be extinct in California List 1B-plants rare, Threatened, or endangered in California and elsewhere; List 2-plants rare, threatened, or endangered in California but more common elsewhere; List 3-plants about which more information is needed.

Table 1.2.4. Low Priority Plant Species with Potential to Occur in the Vicinity of the Offstream Storage Reservoir Project, Tehama, Glenn and Colusa Counties, California (all are CNPS "Limited distribution" List 4).

| **Scientific Name** | **Common Name** |
|---|---|
| *Allium fimbriatum* var. *purdyi* | Purdy's onion |
| *Allium sanbornii* var. *sanbornii* | Sanborn's onion |
| *Androsace elongata* ssp. *acuta* | rock jasmine |
| *Antirrhinum cornutum* | spurred snapdragon |
| *Asclepias solanoana* | serpentine milkweed |
| *Astragalus breweri* | Brewer's milk-vetch |
| *Astragalus clevelandii* | Cleveland's milk-vetch |
| *Astragalus pauperculus* | depauperate milk-vetch |
| *Astragalus rattanii* var. *rattanii* | Rattan's milk-vetch |
| *Ceanothus jepsonii* var. *albiflorus* | musk brush |
| *Chamaesyce ocellata* ssp. *rattanii* | Stony Creek spurge |
| *Collinsia sparsiflora* var. *arvensis* | few-flowered collinsia |
| *Collomia diversifolia* | serpentine collomia |
| *Cryptantha excavata* | deep-scarred cryptantha |
| *Eriogonum luteolum* var. *caninum* | Tiberon buckwheat |
| *Eriogonum tripodum* | tripod eriogonum |
| *Erodium macrophyllum* | large-leaved filaree |
| *Helianthus exilis* | serpentine sunflower |
| *Hesperevax caulescens* | hogwallow evax |
| *Juncus articulatus* | jointed rush |
| *Linanthus latisectus* | linanthus |
| *Lomatium ciliolatum* var. *hooveri* | ciliate biscuitroot |
| *Mimulus glaucescens* | shield-bracted monkeyflower |
| *Navarretia eriocephala* | hoary navarrettia |
| *Navarretia heterandra* | Tehama navarretia |
| *Navarretia jepsonii* | Jepson's navarretia |
| *Navarretia subuligera* | awl-leaved navarretia |
| *Orobanche valida* ssp. *howellii* | Howell's broom-rape |
| *Polygonum bidwelliae* | Bidwell's knotweed |
| *Streptanthus drepanoides* | sickle-fruited jewel-flower |

Nomenclature corresponds to Skinner and Pavlik 1994.

Field personnel examined preserved specimens of prioritized species at the California Academy of Sciences, University of California Berkeley, U.C. Davis, and California State University Chico herbaria. The Jepson Manual (Hickman 1993) and A California Flora and Supplement (Munz and Keck 1973) were checked for species habitat descriptions and flowering periods. Regional botanists were consulted about local occurrences of sensitive species. For species with known soil associations, United States Department of Agriculture Natural Resource Conservation Service data were used to generate maps of Lodo shale and clay soils to assist in narrowing the focus of the surveys (Table 1.2.5.; Attachment I.a-d.) (Harradine 1948; USDA 1965).

Table 1.2.5. Acreage estimates of Lodo shale and clay soil which are associated with several prioritized plant species in the Offstream Storage Reservoirs.

| Soils | Number Of Acres Of Mapped Soil Units | | | |
|---|---|---|---|---|
| | **Sites** | **Colusa Cell** | **Newville** | **Red Bank** |
| **Lodo Shales** | 0 | 0 | 7,182 | 3,101 |
| **Clay** | 8,916 | 4,950 | 2,074 | 305 |

1.3. Field Survey Methods

Within the reservoir inundation elevations, field surveys were conducted for prioritized species according to established guidelines and protocols (CDFG 1984; USFWS 1996; Nelson 1985, 1987). Under these guidelines, focused habitat-specific surveys were conducted, using wandering transect methodology, between February and October 1998 and 1999. These months coincided with the appropriate phenological stages (flowering and fruiting) necessary for the identification of most plant species occurring in the area, including all prioritized species (Table 1.2.1 through 1.2.4). Transects were spaced 5 to 10 meters apart except in microhabitats, such as riparian areas, where they were 1 meter apart. Dense valley stands of star thistle (*Centaurea solstitialis*), ridge tops, vertical shale slopes, and impenetrable chaparral and woodland stands were perimeter surveyed only due to the lack of potential habitat. Where access and topography allowed, potential habitat was surveyed completely. Relatively minor areas at each reservoir could not be surveyed due to lack of authorized private property access.

Field survey coverage areas were estimated for each reservoir based on the level of coverage accomplished. Survey coverage was divided into three effort classes: 0 percent, less than 50 percent, and 50-100 percent coverage. Land that was not surveyed (0 percent) included: areas that do not support suitable habitat for the prioritized species, unauthorized access properties, private residences and yards, cemeteries, bedrock stream channels, vertical slopes, ridge tops above reservoir elevation, 100 percent vegetated chaparral or scrub areas, and large solid stands of yellow star thistle (*Centaurea solstitialis*). Areas which were surveyed less than 50 percent included two types of effort. These areas were surveyed during less than half of the phenological time period for the prioritized species, or half of the area was actually surveyed. These areas consisted of marginal habitat, land lacking sensitive species habitat, or land in a degraded condition which would not warrant further surveys. In areas which were surveyed greater than 50 percent and up to 100 percent, both phenological and transect surveys were done.

Areas with high quality potential habitat were prioritized and surveyed throughout the phenological time period with more complete transect coverage. Habitat parameters, including mapped soils, aspect, and plant associates, defined the number of return visits and the level of coverage. One hundred percent coverage was accomplished only in potential habitat known to support the prioritized plant species.

Plant species were identified and recorded in the field whenever possible, or preserved in a voucher collection for identification at a later date. The voucher collection consists of plant specimens which were collected and preserved as proof for species on the plant inventory lists. A plant voucher database was prepared for collections. Previously undocumented populations of prioritized species were recorded in a DWR botanical inventory database. Data were collected about each sensitive plant population including habitat parameters, approximate number of individuals, phenological state, full location description, plant community associates, existing site conditions, and present or possible threats to the population. Population definitions in this report follow the CNDDB occurrence reporting standard of at least one-quarter of a mile separation between stands or colonies of a prioritized species. Surveys, inventories, and plant identification were conducted by DWR staff botanists (Attachment 2). Field survey activities were documented throughout the two year study, including dates, location, authorized property access, and assigned personnel (Attachment 3).

Annual precipitation totals, which significantly influence annual plant species germination, were noted for the 1998 and 1999 water years (Table I.2.6.).

Table 1.2.6. Total Precipitation and Percent of Average for Water Year 1998 and 1999 in Red Bluff, Orland, and East Park Reservoir, California.

| | WATER YEAR[1] Total Precipitation (inches) / Percent of Annual Average | |
|---|---|---|
| **STATION** | **October 1997-September 1998** | **October 1998-May 1999** |
| Red Bluff (Red Bank) | 21.51 / 213 | 17.02 / 83 |
| Orland (Newville) | 20.36 / 232 | 15.93 / 82 |
| East Park Reservoir (Sites/Colusa cell) | 18.98 / 232 | 16.46 / 90 |

Notes:1 California Department of Water Resources, Division of Flood Management, 1999.

## 2. RESULTS

### 2.1. General Vegetation: Summary of Findings

The following natural communities and vegetation types occur within the reservoir sites. These classifications or series are based on the dominant vegetation of a given area. These series are recognized in the literature as occurring in portions of the inner North Coast Range and Central Valley of California including Glenn, Colusa, and Tehama counties (Keeler-Wolf 1995).

Grassland *California annual (includes vernal pools and swales)*

This upland plant community of herbaceous annual grasses and herbs is characteristically composed of many non-native and native species. Species composition is highly variable among stands and throughout the growing season. Vernal pools and swales, within the annual grassland, support unique assemblages of native annuals. Annual grassland occurs at all the reservoir alternatives. Red Bank reservoir is the only site that did not have vernal pools.

*nodding needlegrass* (*Nassella cernua*)

This upland series is dominated by herbaceous plants with nodding needlegrass the sole or dominant grass in the ground layer. Other native and non-native perennial grasses and emergent shrubs and trees are present but the grass layer is less than 1 meter tall. Numerous small stands (less than 5 square meters) were observed on clay soil in blue oak woodland in all reservoirs although these were not large enough to be mapped from the aerial photographs.

*purple needlegrass* (*Nassella pulchra)*

Purple needlegrass, a perennial bunchgrass, is the sole or dominant grass in this upland series which may include other native or non-native perennial and annual grasses less than 1 meter tall. It was observed in all of the reservoir sites on clay soils, generally in openings in blue oak woodland, in small unmapped units.

Chaparral

*chamise* (*Adenostoma fasciculatum*)

Chamise is the sole or dominant shrub (greater than 60 percent) in continuous upland canopy in this series. Emergent trees may be present but native shrubs such as poison oak and manzanita form a mosaic with the chamise and the ground layer is sparse. Chamise chaparral was found on the western edges of the Red Bank and Newville sites.

*wedgeleaf ceanothus* (*Ceanothus cuneatus*)
Wedgeleaf ceanothus is the dominant canopy in this upland woody series. Other native shrub species form a mosaic with *Ceanothus* which can form a continuous or intermittent canopy with a very sparsely vegetated ground layer. This series occurs sporadically in the Red Bank, Newville, and Sites reservoirs.

Riparian

Riparian vegetation is associated with intermittently or seasonally flooded or saturated intermittent drainages, stream corridors or floodplain terraces. Dominant stands of Fremont's cottonwood (*Populus fremontii*), mixed willow (*Salix spp.*), and narrowleaf willow (*Salix exigua*) series were observed in the reservoir sites. Mexican elderberry (*Sambucus mexicanus*) series occurs in stands which were not large enough to be mapped as distinct vegetation units.

Woodland

Valley oak (*Quercus lobata*)
Valley oak woodland is the sole or dominant tree in a continuous, intermittent, or open canopy which may include other native tree and shrub species. Associated with intermittently flooded or seasonally saturated wetlands and uplands, openings are characteristically grassy. This series occurs along the major tributaries in the reservoir sites.

*Blue oak* (*Quercus douglasii*)

Blue oak is the sole or dominant tree in this woody upland series. Canopy density may be variable and the understory may include shrubs and a grassy ground layer. This series occurs in the reservoir sites in the valleys, on slopes, and in moderately rocky to well-drained areas.

Mixed oak (*Quercus* spp.)

Several species of oak may be present in this upland woody series, including blue oak (*Q. douglasii)*, interior live oak *(Q. wislizenii)*, and/or valley oak (*Q. lobata)*. Other native tree species including foothill pine (*Pinus sabiniana*) may be present in addition to native shrubs and a grassy ground layer. This series occurs in the Red Bank and Newville reservoir sites.

Foothill Pine (*Pinus sabiniana*)

Foothill pine is the sole or dominant canopy species, or may be an emergent tree over a continuous to intermittent shrub canopy.Other native tree and shrub species may also form a mosaic with a grassy to sparse ground layer. This series may occur in intermittent freshwater wetlands and rocky to well-drained uplands. This is the dominant vegetation community at the Red Bank site. Foothill pine community does not occur in the Sites,
Colusa cell, or Newville reservoir areas.

Ruderal — This category refers to weedy or disturbed conditions including areas surrounding residences, out-buildings, and stockyards. These areas may also include non-native, ornamental varieties of plants.

Cultivated grains/crop

Orchards, grain crops, and vineyards were observed in all the reservoirs. These include cultivar varieties of non-native plants.

Wetlands

Spikerush (*Eleocharis* sp.), and vernal pools are discussed here as mapped vegetated wetland series. Spikerush wetland was observed in the Sites, Colusa cell, and Newville sites. Vernal pools occur in all the reservoirs except Red Bank. Other wetlands and water, which occur in the reservoirs, but are not discussed here, include intermittent drainages, streams, and ponds.

Acreage estimates of mapped vegetation types were calculated in each reservoir (Table 2.1.; Figure 2.2).

Table 2.1. Acreage Estimates for the Dominant Vegetation Communities Mapped Within the Offstream Storage Reservoir Alternatives, 1999.

| **Vegetation**[1] | **Acreage By Reservoir** | | | | |
|---|---|---|---|---|---|
| | **Sites** | **Colusa Cell** | **Colusa Reservoir**[2] | **Thomes/ Newville** | **Red Bank** |
| **Grassland** | 12,602 | 13,540 | 26,142 | 14,492 | 565 |
| **Woodland (oak)** | 923 | 20 | 943 | 1,839 | 899 |
| **Woodland (foothill pine)** | 0 | 0 | 0 | 0 | 2826 |
| **Chaparral** | 5 | 0 | 5 | 363 | 98 |
| **Riparian** | 52 | 37 | 89 | 64 | 73 |
| **Vegetated wetland** | 23 | 15 | 38 | 0 | 1 |
| **Cultivated grain** | 277 | 0 | 277 | 0 | 0 |
| **Vegetation Subtotal** | 13,882 | 13,612 | 27,494 | 16,758 | 4,462 |
| **Other** | 280 | 51 | 331 | 315 | 142 |
| **Total reservoir acreage** | 14,162 | 13,663 | 27,825 | 17,073 | 4,604 |

January 4, 2000

Notes: [1] Other classification refers to disturbed/developed acreage within the inundation elevations.
[2].Colusa Reservoir is a northward extention of the Sites reservoir which expands to include the Colusa cell acreage.

2.2. Sensitive Plants: Summary of Findings

There were no high priority plant species found in the Offstream Storage Reservoir alternatives during 1998-1999 field surveys. Six priority and 8 low priority species were found within the project inundation areas, with a collective total of 143 populations (Table 2.2.1).

2.2.1. Sites and Colusa Cell Reservoirs There were no high priority or priority species found in the Sites or Colusa cell alternatives. Ten total occurrences of four low priority plant species were identified at Sites reservoir compared with six total occurrences of the same four species in Colusa cell (Table 2.2.1.). Thirty percent of the species identified from Sites are non-native, compared to 27 percent in Colusa cell (Table 2.2.2). Although only approximately one-third of all the species identified for these sites are non-native, qualitatively these non-natives make up the dominant vegetative cover in the annual grassland.

2.2.2. Newville Reservoir Thirty-one total occurrences of 4 low priority species and 23 total occurrences of 5 priority species were identified in the Newville reservoir (Table 2.2.1.). North and south-facing shale slopes and heavy clay deposits are associated with several prioritized species in this reservoir. In comparison with Sites and the Colusa cell reservoir sites, only 24 percent of the Newville species are non-native, however; they constitute the dominant cover at this site also. Newville has the greatest vascular plant diversity and the greatest number of plant families (85), genera (259), and species (522) represented (Table 2.2.2.).

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Red Bank Reservoir Ten prioritized plant species and 73 total populations were found in this location; 39 priority species populations and 34 populations of low priority species (Table 2.2.1.). Although 21 percent of all species identified in Red Bank are non-native, at this site non-natives are not the dominant vegetation relative to cover. Native woodland species constitute the dominant vegetative cover (78 percent) at this site (Table 2.1.).

January 4, 2000

Table 2.2.1. Summary of Prioritized Plant Species found in the Offstream Storage Reservoir project, 1998-1999.

| Reservoir | Common Name (scientific name)[1] | Number of Occurrences[2] | Status[3] State/USFWS/ CNPS |
|---|---|---|---|
| **RED BANK** | fairy candelabra (*Androsace elongata* ssp.acuta) | 1 | – / – / List 4 |
| | dimorphic snapdragon (*Antirrhinum subcordatum)* | 23* | – / -- / 1B |
| | Jepson's milkvetch (*Astragalus rattanii* var. *jepsonianus*) | *8** | – / -- / 1B |
| | Stony Creek spurge (*Chamaesyce ocellata* ssp *rattanii)* | 9 | – / -- / List 4 |
| | Brandegee's eriastrum (*Eriastrum brandegeae)* | 3* | – / SC / 1B |
| | adobe lily (*Fritillaria pluriflora)* | 5* | – / SC / 1B |
| | woolly meadowfoam *(Limnanthes floccosa* ssp. *floccosa*) | 1 | – / --/ List 4 |
| | Jepson's navarretia (*Navarretia jepsonii)* | 8 | – / – / List 4 |
| | Tehama navarretia (*Navarretia heterandra)* | 11 | – / -- / List 4 |
| | sickle-fruit jewel-flower *(Streptanthus drepanoides*) | 4 | --/ – / List 4 |
| **THOMES-NEWVILLE** | fairy candelabra (*Androsace elongata* ssp. acuta) | 13 | – / – / List 4 |
| | dimorphic snapdragon *(Antirrhinum subcordatum*) | 7* | – / -- / 1B |
| | Jepson's milk-vetch *(Astragalus rattanii* var. *jepsonianus)* | 1* | – / -- / 1B |
| | Stony Creek spurge (*Chamaesyce ocellata* ssp *rattanii)* | 7 | – / -- / List 4 |
| | adobe lily (*Fritillaria pluriflora)* | 12* | – / SC / 1B |
| | hogwallow evax (*Hesperevax caulescens*) | 4 | – / -- / List 4 |
| | Tehama dwarf flax (*Hesperolinon tehamense)* | 2* | – / SC / 1B |
| | N.California black walnut (Juglans californica var. hindsii) | 1* | – / SC / 1B |
| | Tehama navarretia (Navarretia heterandra) | 7 | – / -- / List 4 |
| **SITES** | fairy candelabra (*Androsace elongata* ssp. acuta) | 3 | – / – / List 4 |
| | hogwallow evax (*Hesperevax caulescens*) | 3 | – / -- / List 4 |
| | hoary navarretia (*Navarretia eriocephala*) | 1 | – / -- / List 4 |
| | Tehama navarretia (*Navarretia heterandra)* | 3 | – / -- / List 4 |
| **COLUSA CELL** | fairy candelabra (*Androsace elongata* ssp. acuta) | 2 | – / – / List 4 |
| | hogwallow evax (*Hesperevax caulescens*) | 2 | – / -- / List 4 |
| | hoary navarretia (*Navarretia eriocephala*) | 1 | – / -- / List 4 |
| | Tehama navarretia (*Navarretia heterandra)* | 1 | – / -- / List 4 |

Notes: [1] Nomenclature corresponds to Skinner and Pavlik 1994. [2] Occurrences are defined under CNPS 1999 guidelines as population findings separated by at least 0.25 miles;* = DWR Priority species. [3] USFWS 1998:SC (Species of Concern); Skinner and Pavlik 1994; CNPS IB; (Plants rare, threatened, or endangered in California and elsewhere); CNPS List 4 (Plants of limited distribution).

Table 2.2.2. Diversity of Vascular Plant Families, Genera, and Species by Reservoir, and Native and Non-native Species.

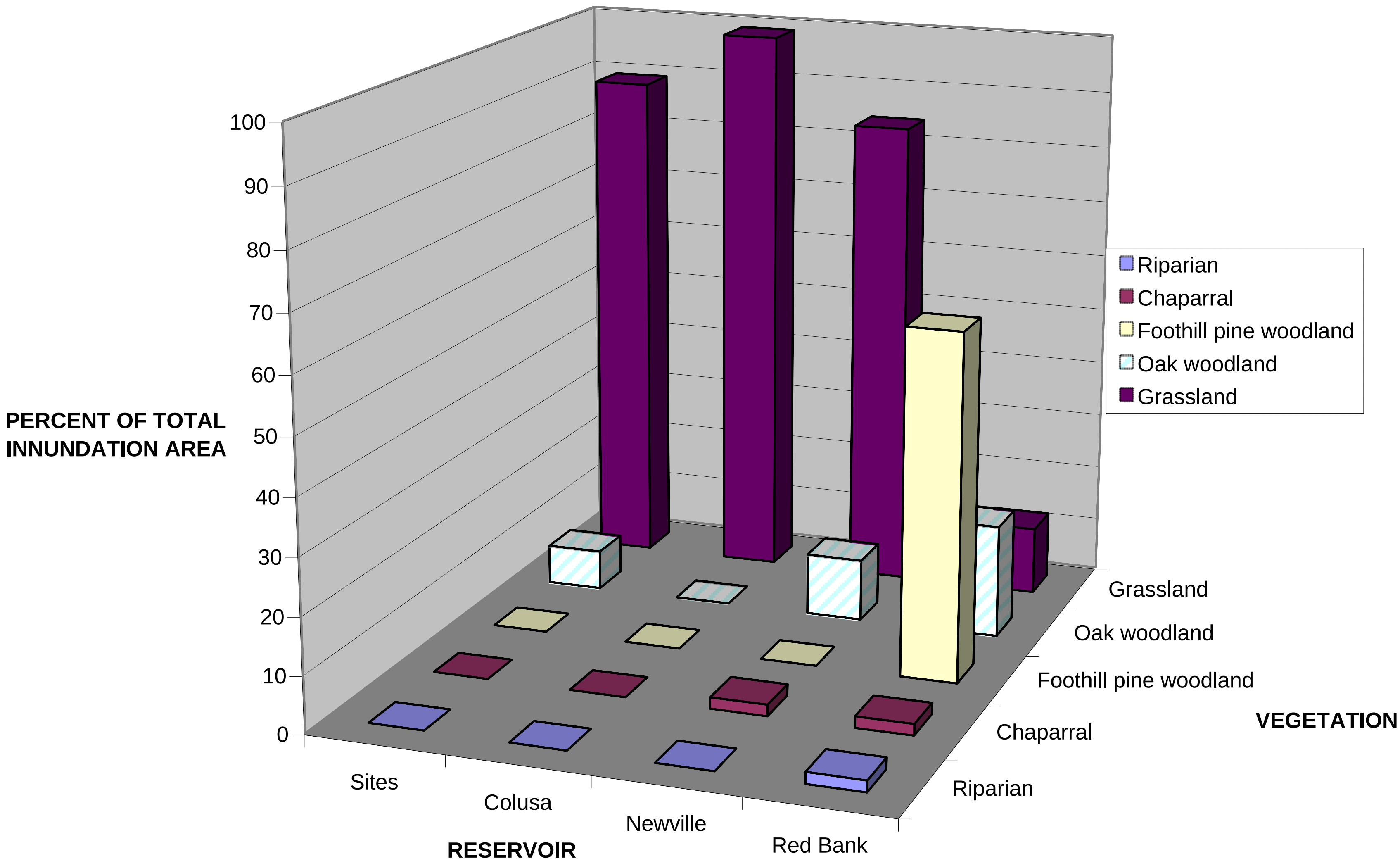
| VASCULAR PLANT DIVERSITY | Sites | Colusa Cell | Thomes/ Newville | Red Bank |
|---|---|---|---|---|
| **Number of families** | 62 | 58 | 85 | 76 |
| **Number of genera** | 219 | 193 | 259 | 229 |
| **Number of species** | 363 | 287 | 522 | 456 |
| **Native species** | 254 | 210 | 398 | 358 |
| **Nonnative species** | 109 | 77 | 124 | 98 |

2.2.4. Documentation Maps were prepared of the estimated survey coverage area and the level of survey effort (Figure 2.2.a-d). An inventory of identified vascular plants, including prioritized species, was compiled (Attachment 5). In addition, a plant voucher collection list was compiled for plants which were identified from preserved specimens (Attachment 6). Vouchers were placed in a preserved DWR collection. One hundred and fourty-three prioritized species population records were documented in the project areas (Attachment 7). Color photographs were taken of prioritized species, their habitat, and plant communities in the reservoir sites (Attachment 8).

## 2.3. DISCUSSION

Percent cover calculations from the aerial photographs and the plant community profile show that annual grassland is the dominant plant community in the Sites, Colusa cell, and Newville reservoir areas (Figure 2.1; attachment 4.a-e). Grassland vegetation at these sites is 89, 99, and 84 percent of the total cover, respectively. Microhabitats within these annual grasslands support unique native annual plant species; these are northern clay hardpan vernal pools, swales, and seasonal wetlands. While the annual grasslands are highly variable with respect to species composition, the dominant species are European forage grasses,

**Figure II.1 OFFSTREAM STORAGE RESERVOIR INVESTIGATION:
Percent Dominant Vegetation by Reservoir Site**



## OFFSTREAM STORAGE RESERVOIR INVESTIGATION

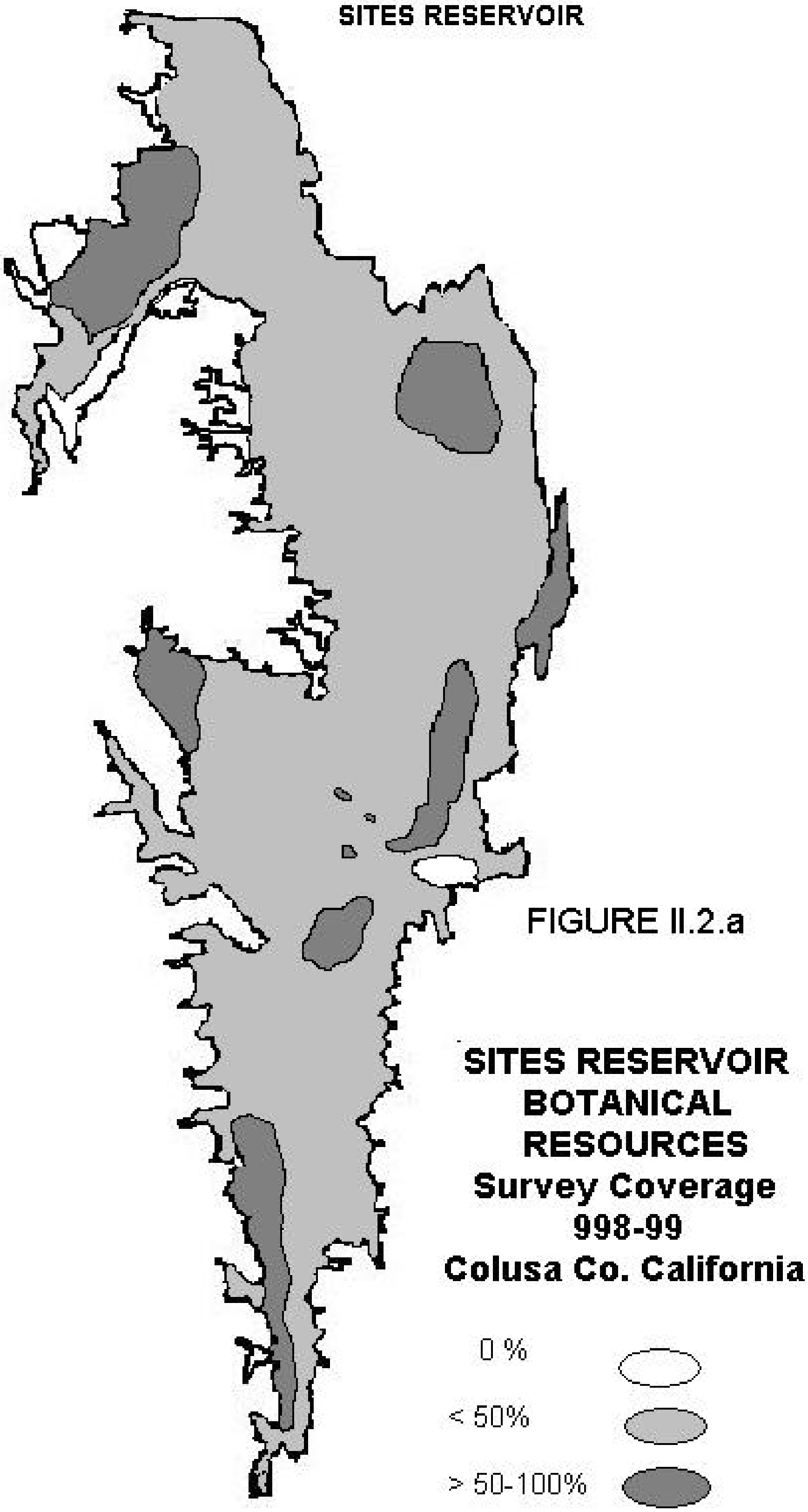



FIGURE II.2.a

OFFSTREAM STORAGE RESERVOIR INVESTIGATION
COLUSA CELL RESERVOIR

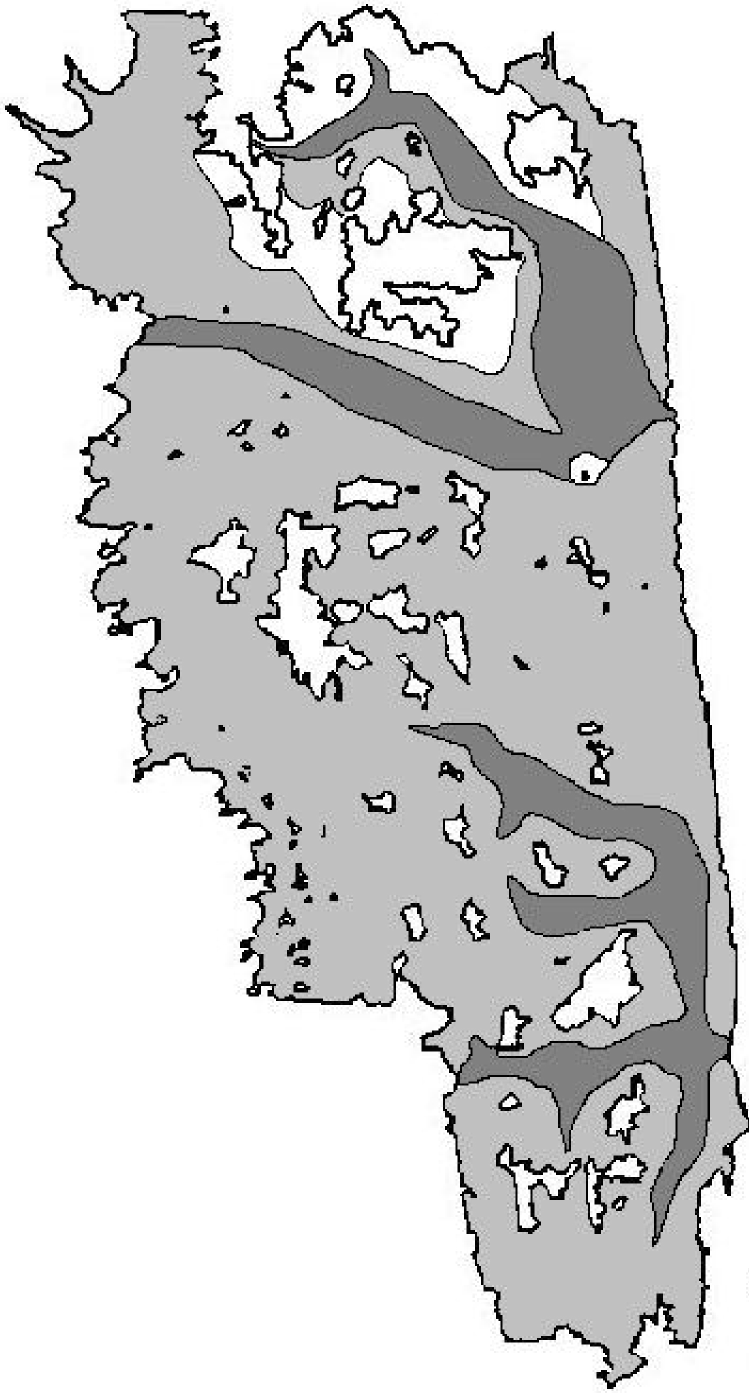


FIGURE II.2.b

BOTANICAL RESOURCES
SURVEY COVERAGE
1998-99
Colusa & Glenn Co. California

0%

<50%

50-100%

**OFFSTREAM STORAGE RESERVOIR INVESTIGATION**

NEWVILLE RESERVOIR

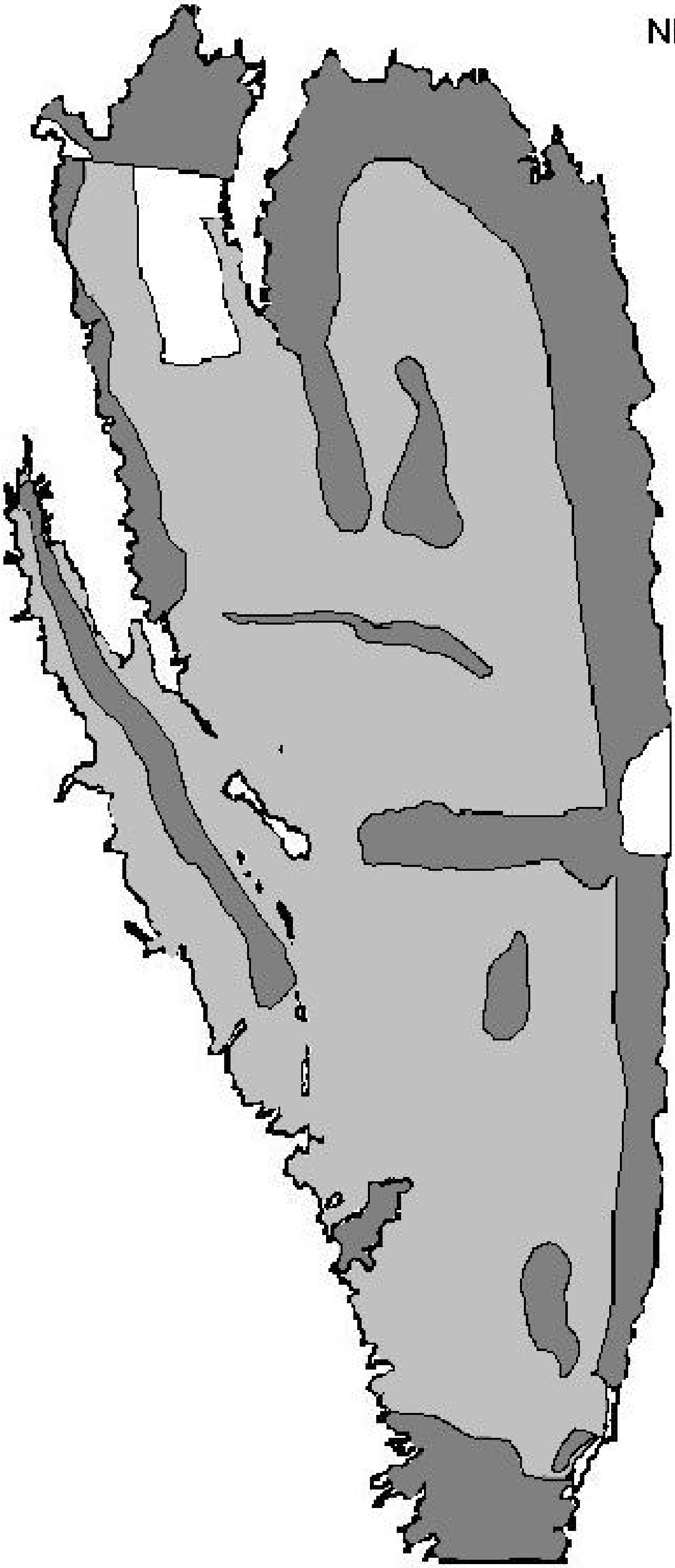


FIGURE II.2.c

**BOTANICAL RESOURCES SURVEY COVERAGE 1998-99 Glenn & Tehama Co.**

**0 %**

**<50%**

**50-100%**

**OFFSTREAM STORAGE RESERVOIR INVESTIGATION**
**RED BANK RESERVOIR**

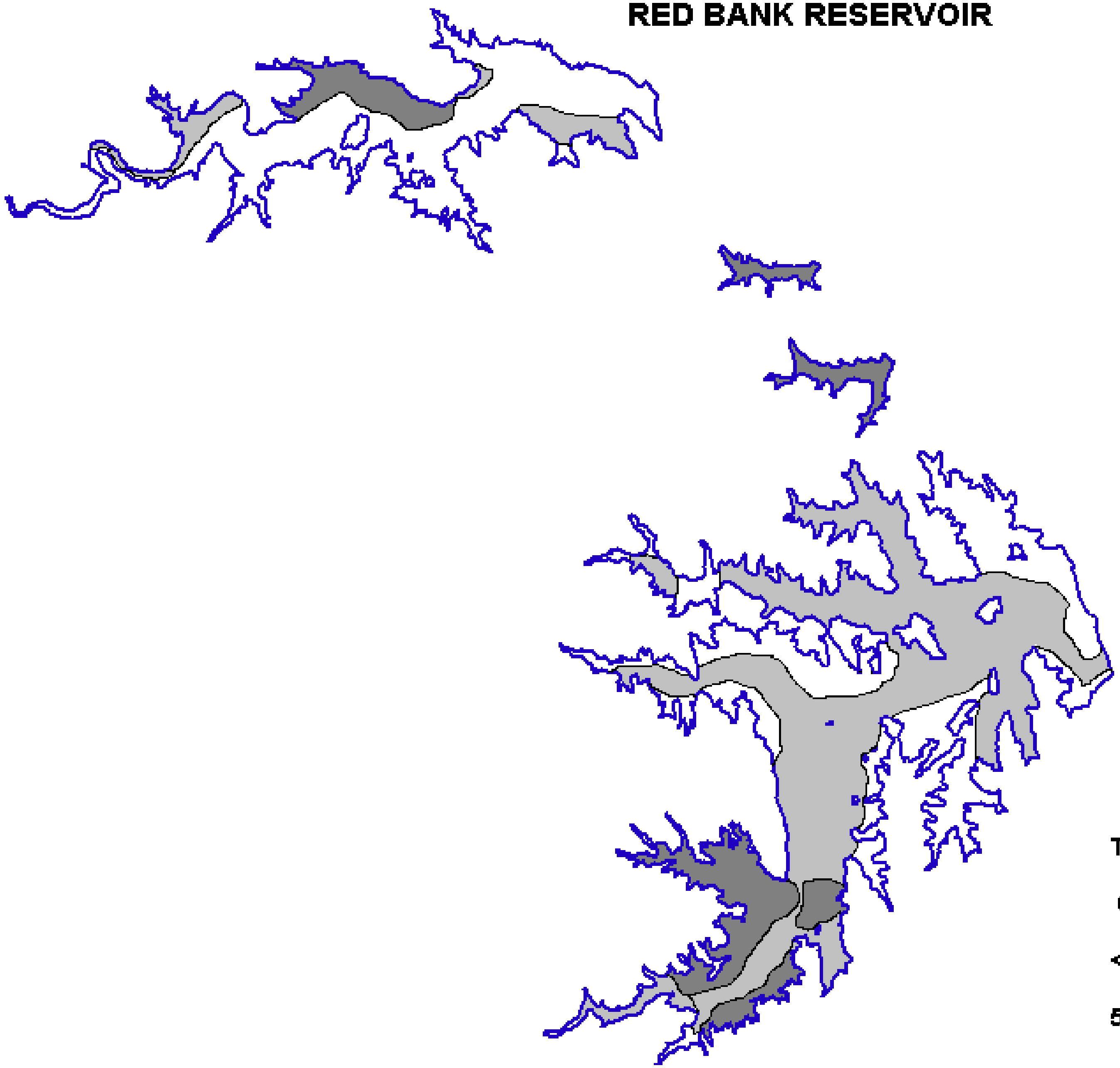
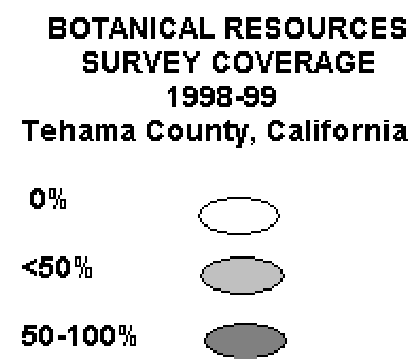


FIGURE II.2.d



such as Italian ryegrass (*Lolium* sp.), wild oats (*Avena* sp.), and the forb, yellow star thistle (*Centaurea solstitialis*).

2.3.1. <u>Sites and Colusa Cell Reservoirs</u> Sites and the Colusa cell receive less average annual rainfall than Newville and Red Bank, and have a predominance of annual grassland vegetation that is managed for high intensity cattle grazing. Less than 10 percent of the vegetation in these reservoirs is woodland (*Quercus* sp. or *Pinus sabiniana*), chaparral, riparian, or vegetated wetland (*Eleocharis* sp.). Only six percent (923 acres) of the total inundation area of the Sites Reservoir supports oak woodland. Some of the oak woodland includes scattered low density stands of valley oak (*Quercus lobata)* on high terrace floodplains adjacent to Funks, Grapevine, and Antelope Creeks. There are few seedlings and saplings in the existing valley oak stands, which consist of large mature and senescent trees. The blue oak stands, however, have a diverse age class representation. Oak age classes were not measured. Nine-hundred twenty-three acres of oak woodland would be lost at Sites, and 20 acres would be lost at the Colusa cell reservoir.

The Sites reservoir area and Colusa cell do not have shale soil or potential habitat for the plants associated with this soil type. However, approximately 65 percent (8,916 acres) of Sites inundation area is clay soils, and the Colusa cell is approximately 36 percent (4,950 acres) clay substrate. Three of the four prioritized plants species found in the reservoirs were on clay soil.

Approximately 5 acres of vernal pools occur in the Sites reservoir. Three acres of vernal pools occur in the Colusa cell. Although six of the potential high priority species are vernal pool endemics, the probability of finding them is low because of the existing land use conditions. Clay hardpan vernal pools and alkaline wetlands were variable in quality and species composition. Although several pools in the Sites reservoir support common vernal pool species, all of the vernal pools were grazed and no prioritized species were observed. The majority of the mapped clay substrates support non-native annual vegetation.

Potential habitat for high priority and priority species exists in Sites and Colusa cell reservoirs, however, current management practices may not be compatible with supporting the prioritized species. Potential habitat includes vernal pools, swales and alkali wetlands, and valley and foothill grassland.

2.3.2. Newville Reservoir This site receives more average annual rainfall than the Sites and Colusa cell alternatives and has greater inherent topographic variability and soil conditions compatible with suitable habitat for priority and low priority species. The diversity of the vegetation communities, as well as clay and shale substrates at Newville, resulted in an increase in the total number of species and occurrences of prioritized species. Annual grassland, blue oak woodland (*Quercus douglasii*), valley oak woodland (*Quercus lobata*), mixed willow riparian (*Salix* spp.), and chaparral communities occur in the site.

Newville reservoir site supports valley and blue oak woodland vegetation over 11 percent (1,839 acres) of the inundation area. The valley oak stands are primarily along Upper Stony Creek at this site. The existing oak woodlands do not appear to be as heavily grazed as the Sites and Colusa cell woodlands. There are oak seedling and juvenile age classes in some areas, although this parameter was not quantified.

This reservoir supports more populations of priority and low priority species than Sites, Colusa cell, or Red Bank alternatives. It should be noted that the current land use practices are compatible with and sustain these prioritized plant populations. Roughly 7,000 acres of Lodo shale soil was mapped in this reservoir, but not all of this was potential habitat for the associated species. North and south-facing slopes, chaparral vegetation, and slopes with less than 50 percent vegetative cover were some of the other necessary parameters to support the shale-associated species. Although over 2,000 acres of clay soil were mapped, the observed prioritized species populations tended to occur only on the moderate north-facing slopes or flats. All clay and Lodo shale soils were adequately surveyed.

Vernal pools and alkaline wetlands in the Newville reservoir area were variable in quality, ranging from 0 to 100 percent cover and moderate to extreme grazing effect. Twenty-three acres of vernal pools were mapped in the inundation zone. There were good quality vernal pools with representation of common vernal pool flora; however, all the pools were grazed. No high priority species were found in any of the vernal pool habitat.

2.3.3. Red Bank Reservoir The 4,600 acre Red Bank project area is dominated by native blue oak (*Quercus douglasii*), mixed oak (*Quercus* spp.), and foothill pine (*Pinus sabiniana*). Although oak woodlands represent approximately 20 percent (899 acres) of the project area, the total amount of woodland habitat including foothill pine woodland comprises 83 percent of vegetative cover. At this site, only 2 percent of the cover is chaparral scrub, and 12 percent (565 acres) is annual grassland. The grassland vegetation occurs on the high terrace floodplain of Red Bank Creek, and on several low hills (Attachment 4). Occasional native bunch grass (*Nassella* spp.) stands occur on moderate slopes under blue oak woodland.

The Red Bank alternative receives the most annual rainfall of the reservoir sites, has the most variable topography and vegetation, and moderate to light cattle grazing influence.

Several prioritized species were found on clay and Lodo shale soil. The 3,101 acres of mapped Lodo shale soil (67 percent) was not all potential habitat for the associated sensitive plant species. Prioritized species were found with additional microsite parameters, such as north- or south-facing aspect, moderate slope, less than 50 percent vegetative cover, or chaparral plant associates. Much of the Lodo shale soil was not suitable habitat for the prioritized species because these other microsite conditions were lacking.

Approximately 305 acres of clay soil was mapped but only three populations of a clay-associated priority species were found. The Lodo shale and clay soil areas were adequately surveyed except where no access was allowed or where terrain or vegetation made it infeasible.

Potential habitat exists at this site for the chaparral, valley and foothill woodland, and valley and foothill grassland prioritized species. There was no vernal pool or alkaline wetland habitat observed in the Red Bank reservoir site.

### 2.3.4. Future Needs

Surveys will be needed in each reservoir alternative where property access was not allowed in 1998 and 1999. Secondary effect areas, or areas just around the reservoirs, which may experience environmental impacts related to the reservoir projects include power lines, road realignments, conveyance facilities, recreation areas, or mitigation lands. These areas will require rare plant and inventory surveys and vegetation community mapping. Continued surveys of vernal pools, swales, and alkaline wetlands in the reservoir inundation zones are recommended by CDFG if property access allows (Lis 1999; Horenstein 1999).

January 4, 2000
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January 4, 2000

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January 4, 2000

ATTACHMENT 1.

OFFSTREAM STORAGE RESERVOIR INVESTIGATION:

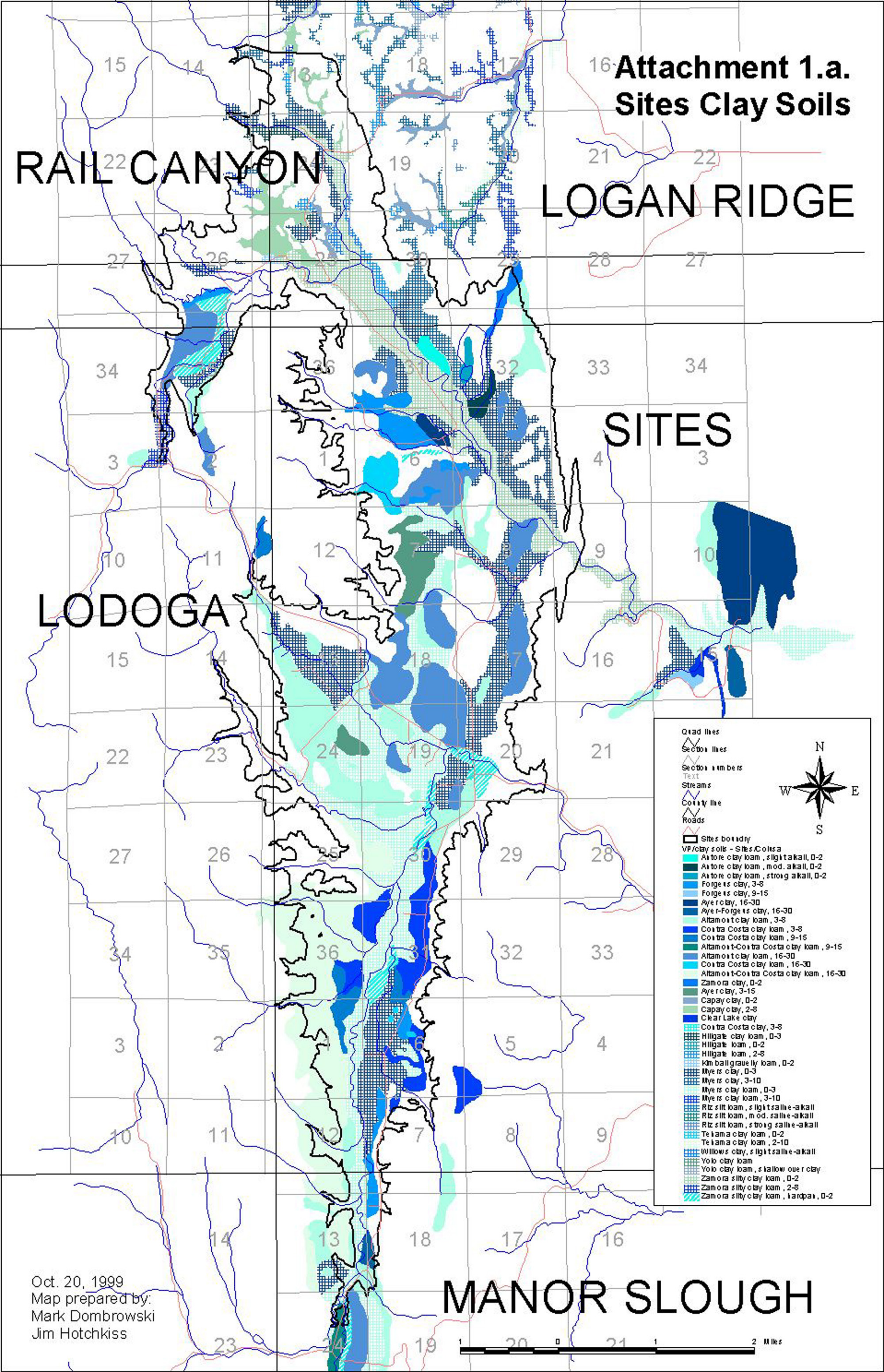
Mapped Lodo shale and clay soils

a. Sites clay soil

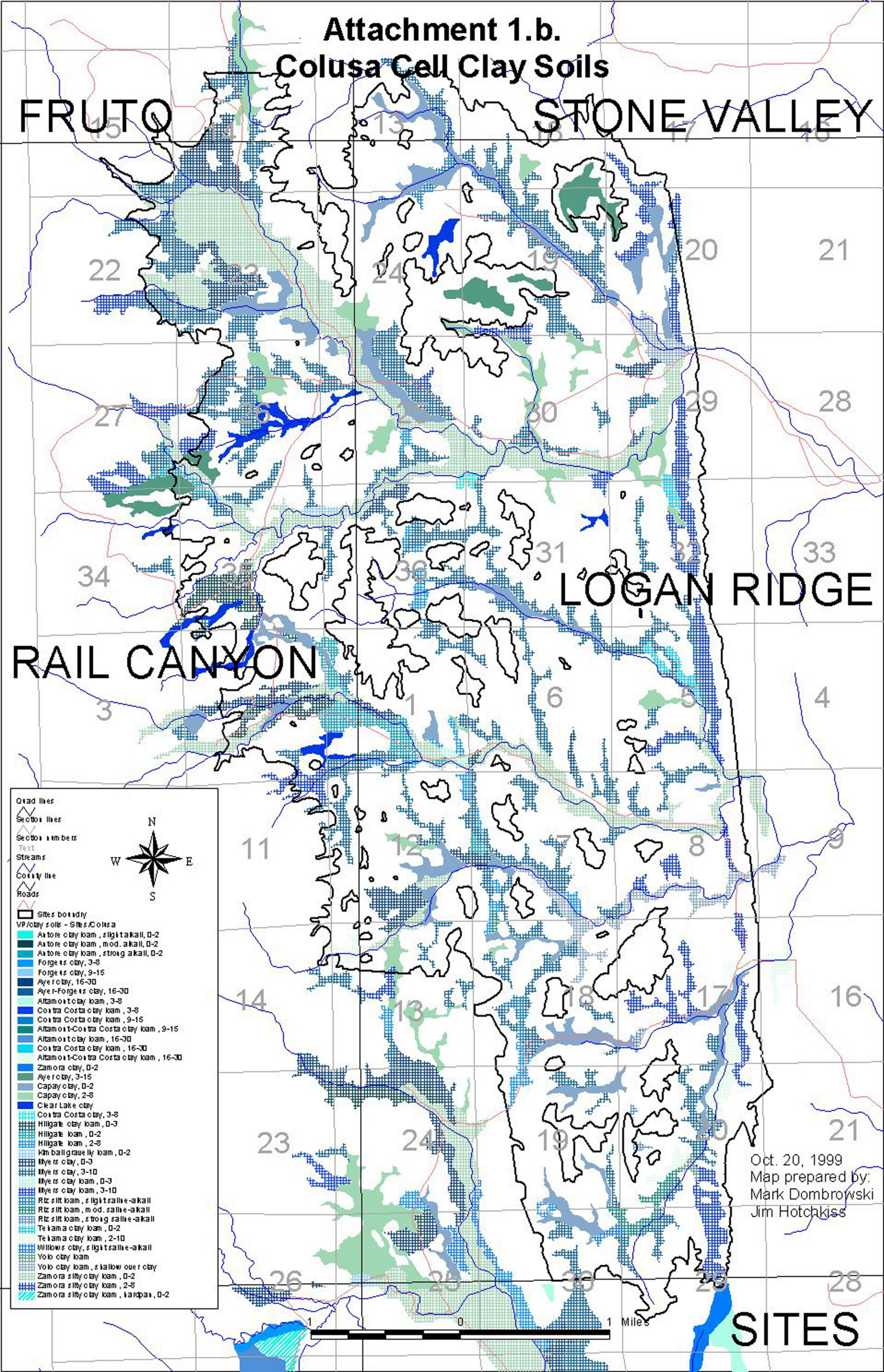
b. Colusa cell clay soil

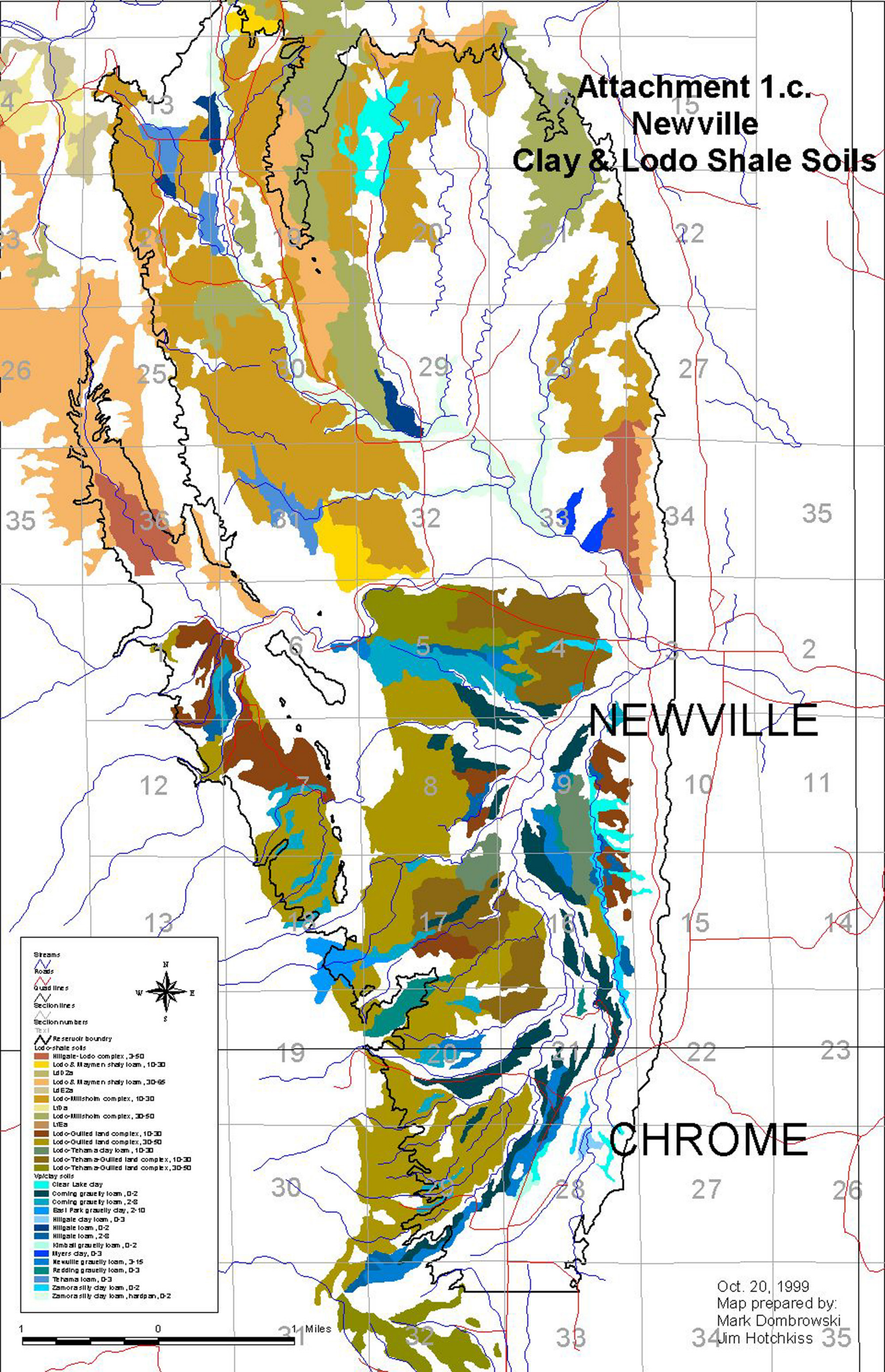
c. Newville Lodo shale and clay soil

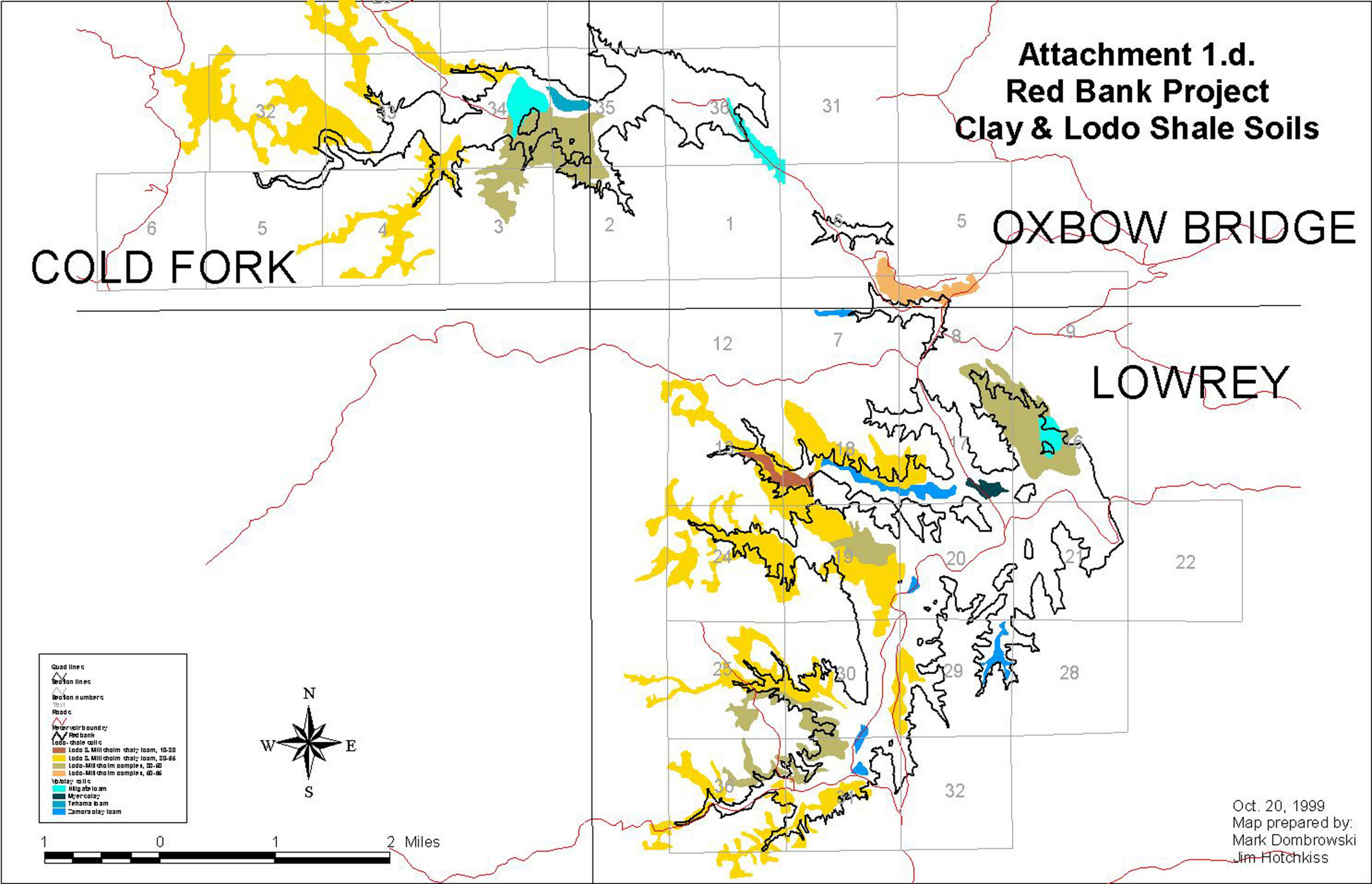
d. Red Bank Lodo shale and clay soil


Attachment 1.a.
Sites Clay Soils
RAIL CANYON
LOGAN RIDGE
SITES
LODOGA
MANOR SLOUGH
Quad lines
Section lines
Section numbers
Text
Streams
County line
Roads
Sites boundry
VP/clay soils - Sites/Colusa
Antore clay loam, slight alkali, 0-2
Antore clay loam, mod. alkali, 0-2
Antore clay loam, strong alkali, 0-2
Forgeus clay, 3-8
Forgeus clay, 9-15
Ayer clay, 16-30
Ayer-Forgeus clay, 16-30
Altamont clay loam, 3-8
Contra Costa clay loam, 3-8
Contra Costa clay loam, 9-15
Altamont-Contra Costa clay loam, 9-15
Altamont clay loam, 16-30
Contra Costa clay loam, 16-30
Altamont-Contra Costa clay loam, 16-30
Zamora clay, 0-2
Ayer clay, 3-15
Capay clay, 0-2
Capay clay, 2-8
Clear Lake clay
Contra Costa clay, 3-8
Hillgate clay loam, 0-3
Hillgate loam, 0-2
Hillgate loam, 2-8
Kimball gravelly loam, 0-2
Myers clay, 0-3
Myers clay, 3-10
Myers clay loam, 0-3
Myers clay loam, 3-10
Ritz silt loam, slight saline-alkali
Ritz silt loam, mod. saline-alkali
Ritz silt loam, strong saline-alkali
Tehama clay loam, 0-2
Tehama clay loam, 2-10
Willows clay, slight saline-alkali
Yolo clay loam
Yolo clay loam, shallow over clay
Zamora silty clay loam, 0-2
Zamora silty clay loam, 2-8
Zamora silty clay loam, hardpan, 0-2
N
S
W
E
1
0
1
2 Miles
Oct. 20, 1999
Map prepared by:
Mark Dombrowski
Jim Hotchkiss

# Attachment 1.b.
# Colusa Cell Clay Soils




Attachment 1.c.
Newville
Clay & Lodo Shale Soils
NEWVILLE
CHROME
Streams
Roads
Quad lines
Section lines
Section numbers
Text
Reservoir boundry
Lodo-shale soils
Hillgate-Lodo complex, 3-50
Lodo & Maymen shaly loam, 10-30
LdD2a
Lodo & Maymen shaly loam, 30-65
LdE2a
Lodo-Millsholm complex, 10-30
LtDa
Lodo-Millsholm complex, 30-50
LtEa
Lodo-Gullied land complex, 10-30
Lodo-Gullied land complex, 30-50
Lodo-Tehama clay loam, 10-30
Lodo-Tehama-Gullied land complex, 10-30
Lodo-Tehama-Gullied land complex, 30-50
Vp/clay soils
Clear Lake clay
Corning gravelly loam, 0-2
Corning gravelly loam, 2-8
East Park gravelly clay, 2-10
Hillgate clay loam, 0-3
Hillgate loam, 0-2
Hillgate loam, 2-8
Kimball gravelly loam, 0-2
Myers clay, 0-3
Newville gravelly loam, 3-15
Redding gravelly loam, 0-3
Tehama loam, 0-3
Zamora silty clay loam, 0-2
Zamora silty clay loam, hardpan, 0-2
N
W
E
S
1
0
1 Miles
Oct. 20, 1999
Map prepared by:
Mark Dombrowski
Jim Hotchkiss



Attachment 1.d.
Red Bank Project
Clay & Lodo Shale Soils
COLD FORK
OXBOW BRIDGE
LOWREY
Quad lines
Section lines
Section numbers
Text
Roads
Reservoir boundary
Red bank
Lodo-shale soils
Lodo & Millsholm shaly loam, 10-30
Lodo & Millsholm shaly loam, 30-65
Lodo-Millsholm complex, 30-50
Lodo-Millsholm complex, 50-65
Vp/clay soils
Hillgate loam
Myer clay
Tehama loam
Zamora clay loam
N
S
E
W
1 0 1 2 Miles
Oct. 20, 1999
Map prepared by:
Mark Dombrowski
Jim Hotchkiss

January 4, 2000

ATTACHMENT 2.

OFFSTREAM STORAGE RESERVOIR INVESTIGATION:

Botanical survey personnel

**Department of Water Resources**
**Red Bluff, California:**

Barbara Castro
Fish and Wildlife Scientific Aid

Julie Cunningham
Environmental Specialist III

Lawrence Janeway
Fish and Wildlife Scientific Aid

Jenny Marr
Environmental Specialist III

Joyce Lacey-Rickert
Environmental Specialist IV

Caroline Warren
Fish and Wildlife Scientific Aid

Heidi West
Fish and Wildlife Scientific Aid

Natalie Wight
Graduate Student Assistant

**Department of Water Resources**
**Sacramento, California:**

Beth Hendrickson
Environmental Specialist III

Jean Witzman
Environmental Specialist III

January 4, 2000

# ATTACHMENT 3.

# OFFSTREAM STORAGE RESERVOIR INVESTIGATION:

## 1998-1999 Botanical field survey log

# APPENDIX 3.
## Botany Survey Dates and Personnel

| DATE | RESERVOIR | PERSONNEL | HOURS |
|---|---|---|---|
| 3/13/98 | C | JM CW HW JL | 36 |
| 4/6/98 | C | JM CW JM | 18 |
| 4/7/98 | C | JM CW | 18 |
| 4/8/98 | C | JM CW | 18 |
| 4/21/98 | C | JM HW CW NW | 36 |
| 4/22/98 | C | JM HW JL JC | 36 |
| 6/17/98 | C | JM CW HW JC | 36 |
| 6/23/98 | C | HW CW NW JL | 36 |
| 8/28/98 | C | JM HW | 18 |
| 9/2/98 | C | HW +? | 18 |
| 3/2/99 | C | CW HW | 18 |
| 3/3/99 | C | JM CW MG BC | 36 |
| 3/4/99 | C | JM BC MG NW | 36 |
| 3/16/99 | C | HW BC | 18 |
| 3/18/99 | C | HW BC | 18 |
| 3/30/99 | C | JM BH | 18 |
| 3/31/99 | C | JM BC LJ HW | 36 |
| 4/1/99 | C | JM BH HW NW BC LJ | 54 |
| 4/2/99 | C | BH CW | 18 |
| 4/6/99 | C | CW MG | 18 |
| 4/7/99 | C | CW MG | 18 |
| 4/8/99 | C | MG NW | 18 |
| 4/13/99 | C | CW LJ MG | 27 |
| 7/9/99 | C | BH, JW | 18 |
| 2/18/98 | R/B | JM CW HW JC | 36 |
| 4/1/98 | R/B | JM CW HW JL | 36 |
| 4/2/98 | R/B | JM CW HW JC JL | 45 |
| 4/27/98 | R/B | JC HW CW | 27 |

# APPENDIX 3.
## Botany Survey Dates and Personnel

| DATE | RESERVOIR | PERSONNEL | HOURS |
|---|---|---|---|
| 5/20/98 | R/B | JM CW HW | 27 |
| 5/21/98 | R/B | JM HW JL | 27 |
| 6/9/98 | R/B | JM CW HW NW | 36 |
| 6/15/98 | R/B | JM HW CW NW | 36 |
| 6/25/98 | R/B | HW NW JC | 27 |
| 7/2/98 | R/B | JM HW CW NW JL | 45 |
| 7/3/98 | R/B | JM HW CW NW | 36 |
| 7/6/98 | R/B | JM HW CW JC NW | 45 |
| 7/7/98 | R/B | HW CW JC | 27 |
| 7/8/98 | R/B | JM CW | 18 |
| 7/9/98 | R/B | JM HW CW NW | 36 |
| 8/21/98 | R/B | HW CW JC NW | 36 |
| 8/27/98 | R/B | JM CW HW | 27 |
| 9/23/98 | R/B | HW CW?? | 18 |
| 9/24/98 | R/B | JM HW CW | 27 |
| 10/7/98 | R/B | CW HW | 18 |
| 10/8/98 | R/B | CW JM | 18 |
| 10/13/98 | R/B | JM HW | 18 |
| 10/20/98 | R/B | JM HW CW | 27 |
| 10/21/98 | R/B | JM CW HW?? | 18 |
| 3/2/99 | R/B | JM MG BC LJ | 36 |
| 3/3/99 | R/B | HW LJ | 18 |
| 3/4/99 | R/B | HW LJ | 18 |
| 3/5/99 | R/B | CW MG | 18 |
| 3/16/99 | R/B | LJ CW | 18 |
| 3/18/99 | R/B | LJ MG | 18 |
| 3/22/99 | R/B | LJ BC | 18 |
| 3/23/99 | R/B | LJ BC | 18 |

# APPENDIX 3.
# Botany Survey Dates and Personnel

| DATE | RESERVOIR | PERSONNEL | HOURS |
|---|---|---|---|
| 3/25/99 | R/B | BC LJ | 18 |
| 3/29/99 | R/B | BC LJ BH | 27 |
| 4/7/99 | R/B | BC HW | 18 |
| 4/20/99 | R/B | LJ HW | 18 |
| 4/27/99 | R/B | LJ CW | 18 |
| 4/28/99 | R/B | CW JM | 18 |
| 4/29/99 | R/B | HW NW JM | 27 |
| 5/12/99 | R/B | JM CW | 18 |
| 5/18/99 | R/B | BC LJ | 18 |
| 5/19/99 | R/B | JW BH BC LJ | 36 |
| 5/20/99 | R/B | BH JW | 18 |
| 5/21/99 | R/B | BH JW | 18 |
| 5/24/99 | R/B | BC LJ | 18 |
| 5/27/99 | R/B | JM BH | 18 |
| 5/28/99 | R/B | JM BH | 18 |
| 6/1/99 | R/B | LJ CW | 18 |
| 6/3/99 | R/B | BC LJ | 18 |
| 6/8/99 | R/B | BC CW LJ | 27 |
| 6/9/99 | R/B | BC LJ HW CW | 36 |
| 6/10/99 | R/B | BC LJ CW HW | 36 |
| 6/14/99 | R/B | BC LJ | 18 |
| 6/15/99 | R/B | LJ CW | 18 |
| 6/21/99 | R/B | BC LJ | 18 |
| 6/24/99 | R/B | JW BH BC LJ CW | 45 |
| 8/11/99 | R/B | JM LJ BC CW | 36 |
| 5/13 99 | R/B | BC NW | 18 |
| 2/17/98 | S | JM HW CW JL NW | 45 |
| 3/2/98 | S | JM CW HW JC | 36 |

# APPENDIX 3.
# Botany Survey Dates and Personnel

| DATE | RESERVOIR | PERSONNEL | HOURS |
|---|---|---|---|
| 3/3/98 | S | JM CW HW NW | 36 |
| 3/6/98 | S | JM CW JC | 27 |
| 4/14/98 | S | HW CW JM HW JL JC | 54 |
| 4/15/98 | S | HW JC | 18 |
| 4/16/98 | S | JW CW | 18 |
| 5/4/98 | S | JM CW JL HW | 36 |
| 5/8/98 | S | JM HW CW JL | 36 |
| 5/26/98 | S | HW CW JL JC | 36 |
| 5/27/98 | S | JM CW HW JC | 36 |
| 6/11/98 | S | JM HW CW NW | 36 |
| 6/22/98 | S | HW CW | 18 |
| 7/1/98 | S | JM HW CW | 27 |
| 7/22/98 | S | JM CW HW NW | 36 |
| 8/3/98 | S | CW HW NW | 27 |
| 8/4/98 | S | HW CW NW | 27 |
| 8/5/98 | S | HW CW JC | 27 |
| 8/12/98 | S | HW CW | 18 |
| 8/18/98 | S | HW NW | 18 |
| 2/18/99 | S | JM BH | 18 |
| 2/22/99 | S | BH CW | 18 |
| 2/23/99 | S | BH CW | 18 |
| 2/25/99 | S | JM BH JW NW | 36 |
| 2/26/99 | S | BH JW | 18 |
| 3/2/99 | S | BH JW | 18 |
| 3/3/99 | S | BH JW | 18 |
| 3/4/99 | S | BH JW | 18 |
| 3/5/99 | S | BH JW | 18 |
| 3/8/99 | S | BH | 9 |

# APPENDIX 3.
## Botany Survey Dates and Personnel

| DATE | RESERVOIR | PERSONNEL | HOURS |
|---|---|---|---|
| 3/9/99 | S | CW BH | 18 |
| 3/10/99 | S | CW BH | 18 |
| 3/11/99 | S | MG BH | 18 |
| 3/12/99 | S | BH MG | 18 |
| 3/16/99 | S | BH JW MG | 27 |
| 3/17/99 | S | JW BH | 18 |
| 3/19/99 | S | BH +? | 18 |
| 3/23/99 | S | BH HW | 18 |
| 3/24/99 | S | BH +? | 18 |
| 3/25/99 | S | BH HW NW | 27 |
| 3/26/99 | S | BH NW | 18 |
| 4/7/99 | S | BH JW | 18 |
| 4/9/99 | S | BH JW | 18 |
| 4/12/99 | S | BC BH LJ MG | 36 |
| 4/19/99 | S | JW BH | 18 |
| 4/21/99 | S | JW BH | 18 |
| 4/22/99 | S | JW BH | 18 |
| 4/23/99 | S | JW BH | 18 |
| 5/3/99 | S | BH JW | 18 |
| 5/5/99 | S | BH JW | 18 |
| 5/6/99 | S | BH JW | 18 |
| 6/7/99 | S | CW BH | |
| 6/8/99 | S | BH +? | 18 |
| 7/7/99 | S | BH JW | 18 |
| 2/26/98 | T/N | JM HW CW JL JC | 45 |
| 2/27/98 | T/N | JM CW JC | 27 |
| 3/4/98 | T/N | JM HW CW JC JL | 45 |
| 3/5/98 | T/N | JM HW CW | 27 |

# APPENDIX 3.
# Botany Survey Dates and Personnel

| DATE | RESERVOIR | PERSONNEL | HOURS |
|---|---|---|---|
| 3/9/98 | T/N | HW CW JL JC | 36 |
| 3/10/98 | T/N | JM CW HW JC | 36 |
| 3/16/98 | T/N | JM CW HW JC | 36 |
| 3/17/98 | T/N | JM CW HW JL JC | 45 |
| 3/18/98 | T/N | JM CW | 18 |
| 3/19/98 | T/N | JM CW HW JL | 36 |
| 3/20/98 | T/N | JM HW CW JL | 36 |
| 3/26/98 | T/N | JM CW JL JW JC | 45 |
| 3/30/98 | T/N | CW HW JC JL | 36 |
| 4/6/98 | T/N | HW JC | 18 |
| 4/7/98 | T/N | HW JC | 18 |
| 4/8/98 | T/N | HW JC | 18 |
| 4/15/98 | T/N | JM CW | 18 |
| 4/20/98 | T/N | JM CW JC JL | 36 |
| 4/28/98 | T/N | JM CW NW JC JL | 45 |
| 4/29/98 | T/N | JM HW CW JL JC | 45 |
| 4/30/98 | T/N | JM HW | 18 |
| 5/11/98 | T/N | JM CW JC | 27 |
| 5/14/98 | T/N | HW CW JC | 27 |
| 5/18/98 | T/N | JM HW CW | 27 |
| 5/19/98 | T/N | JM CW HW JL NW JC | 54 |
| 6/1/98 | T/N | JM HW CW NW | 36 |
| 6/2/98 | T/N | JM CW HW NW | 36 |
| 6/5/98 | T/N | HW CW NW | 27 |
| 6/16/98 | T/N | JM HW CW NW | 36 |
| 6/18/98 | T/N | JM CW NW JC | 36 |
| 6/19/98 | T/N | HW NW JC | 27 |
| 7/14/98 | T/N | JM HW CW JC NW | 45 |

# APPENDIX 3.
# Botany Survey Dates and Personnel

| DATE | RESERVOIR | PERSONNEL | HOURS |
|---|---|---|---|
| 7/15/98 | T/N | JM HW CW JL | 36 |
| 7/29/98 | T/N | JM CW NW | 27 |
| 8/6/98 | T/N | CW NW JC | 27 |
| 8/11/98 | T/N | HW CW NW | 27 |
| 9/1/98 | T/N | HW CW | 18 |
| 2/23/99 | T/N | JM, HW | 18 |
| 2/24/99 | T/N | JM, HW, CW | 27 |
| 3/9/99 | T/N | JM BC MG LJ | 36 |
| 3/10/99 | T/N | JM HW BC MG LJ | 45 |
| 3/11/99 | T/N | HW NW | 18 |
| 3/17/99 | T/N | JM CW LJ | 27 |
| 3/18/99 | T/N | JM NW | 36 |
| 3/22/99 | T/N | JM MG | 18 |
| 3/23/99 | T/N | JM MG CW | 27 |
| 3/26/99 | T/N | JM | 9 |
| 4/6/99 | T/N | LJ HW | 18 |
| 4/7/99 | T/N | JM LJ | 18 |
| 4/9/99 | T/N | BC MG | 18 |
| 4/13/99 | T/N | JM HW | 18 |
| 4/14/99 | T/N | JM BC BH CW LJ MG HW JW | 72 |
| 4/15/99 | T/N | BC BH CW LJ MG JW HW NW | 72 |
| 4/16/99 | T/N | BH BC | 18 |
| 4/20/99 | T/N | JM CW | 18 |
| 4/21/99 | T/N | JM HW LJ BC | 36 |
| 4/22/99 | T/N | LJ CW BC | 27 |
| 4/26/99 | T/N | CW LJ | 18 |
| 4/28/99 | T/N | BH BC | 18 |
| 4/29/99 | T/N | BH BC | 18 |

## APPENDIX 3.
## Botany Survey Dates and Personnel

| DATE | RESERVOIR | PERSONNEL | HOURS |
|---|---|---|---|
| 5/4/99 | T/N | CW BC LJ | 27 |
| 5/5/99 | T/N | HW CW BC LJ | 36 |
| 5/6/99 | T/N | NW HW BC LJ | 36 |
| 5/10/99 | T/N | BH BC LJ | 27 |
| 5/11/99 | T/N | BC LJ | 18 |
| 5/12/99 | T/N | BC LJ HW JW | 36 |
| 5/13/99 | T/N | LJ CW HW JW | 36 |
| 6/1/99 | T/N | BC HW | 18 |
| 6/2/99 | T/N | LJ CW BH HW | 18 |
| 6/3/99 | T/N | BH HW | 18 |
| 6/9/99 | T/N | BH JW | 18 |
| 6/10/99 | T/N | BH JW | 18 |
| 6/14/99 | T/N | BH HW | 18 |
| 6/16/99 | T/N | BH CW | 18 |
| 6/17/99 | T/N | BH LJ HW | 27 |
| 6/18/99 | T/N | HW BH | 18 |
| **COLUSA** | **TOTAL** | **HOURS** | **621** |
| **RED BANK** | **TOTAL** | **HOURS** | **1467** |
| **SITES** | **TOTAL** | **HOURS** | **1251** |
| **THOMES-NEWVILLE** | **TOTAL** | **HOURS** | **2214** |
| **WORK** | **COMPLETED** | **1998 & 1999** | **5553** |
| | | | |

January 4, 2000

ATTACHMENT 4.

OFFSTREAM STORAGE RESERVOIR INVESTIGATION:

ArcView (ESRI 1998) mapped vegetation

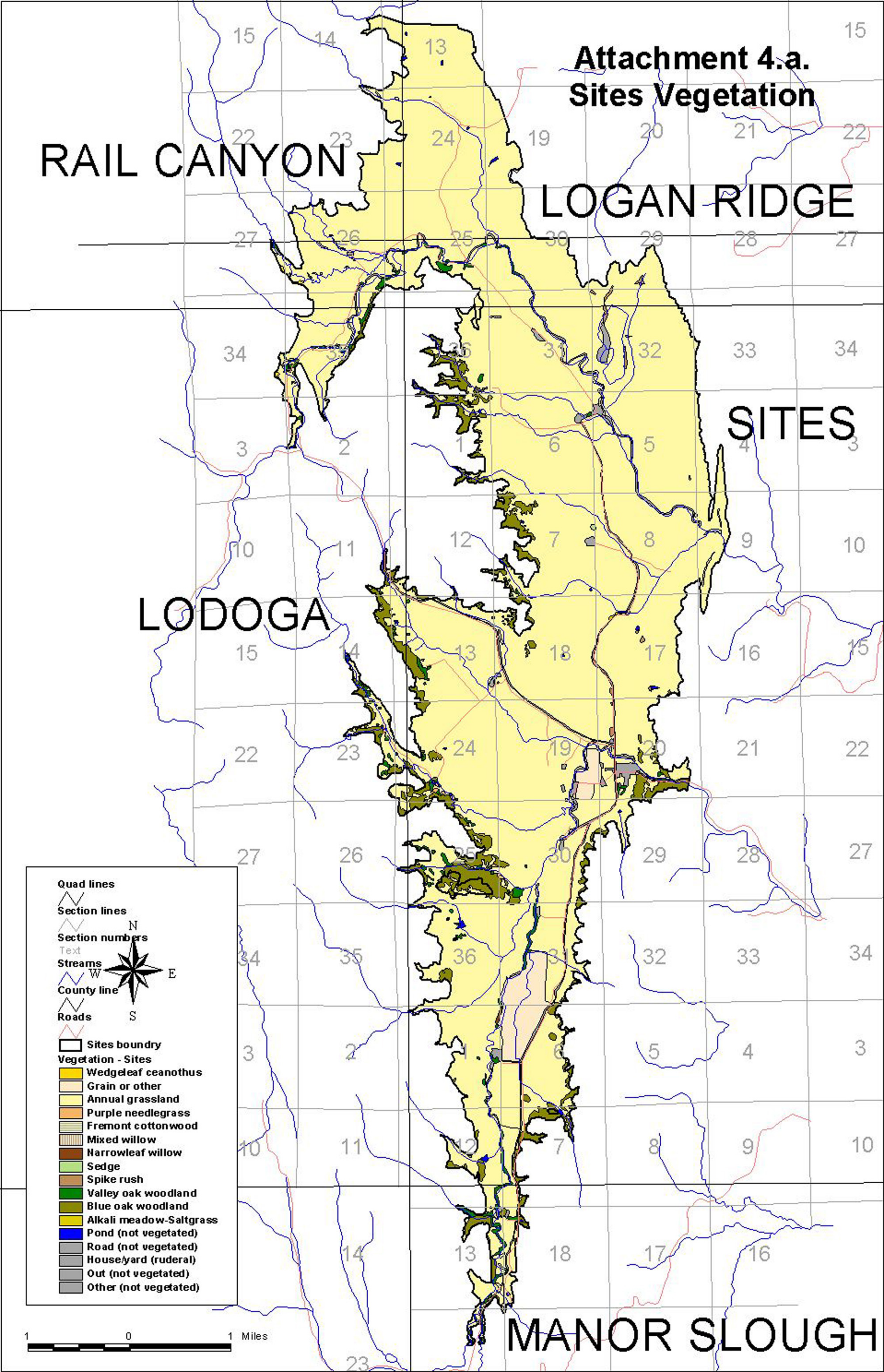
a. Sites Vegetation

b. Colusa cell Vegetation

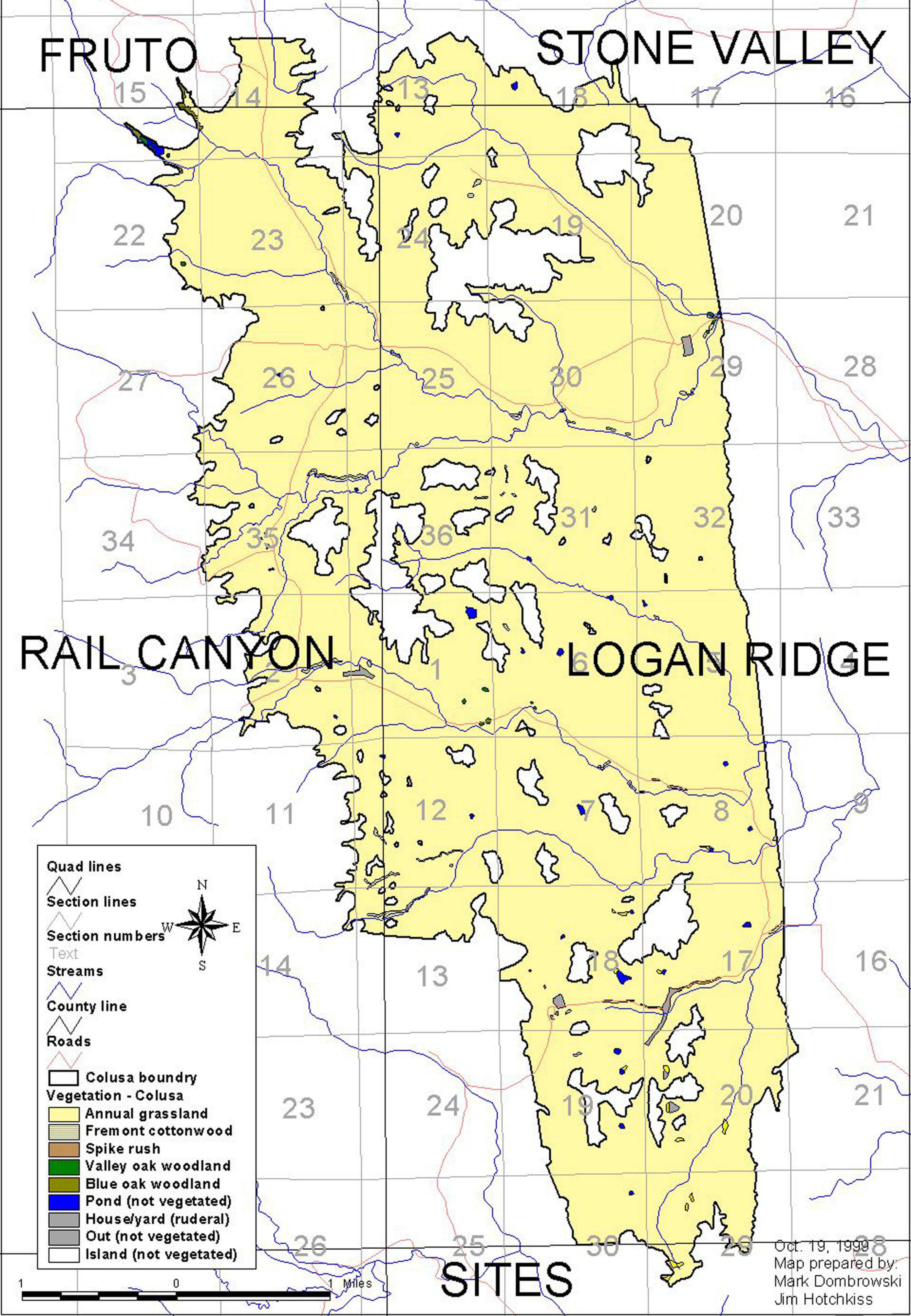
c. Newville Vegetation

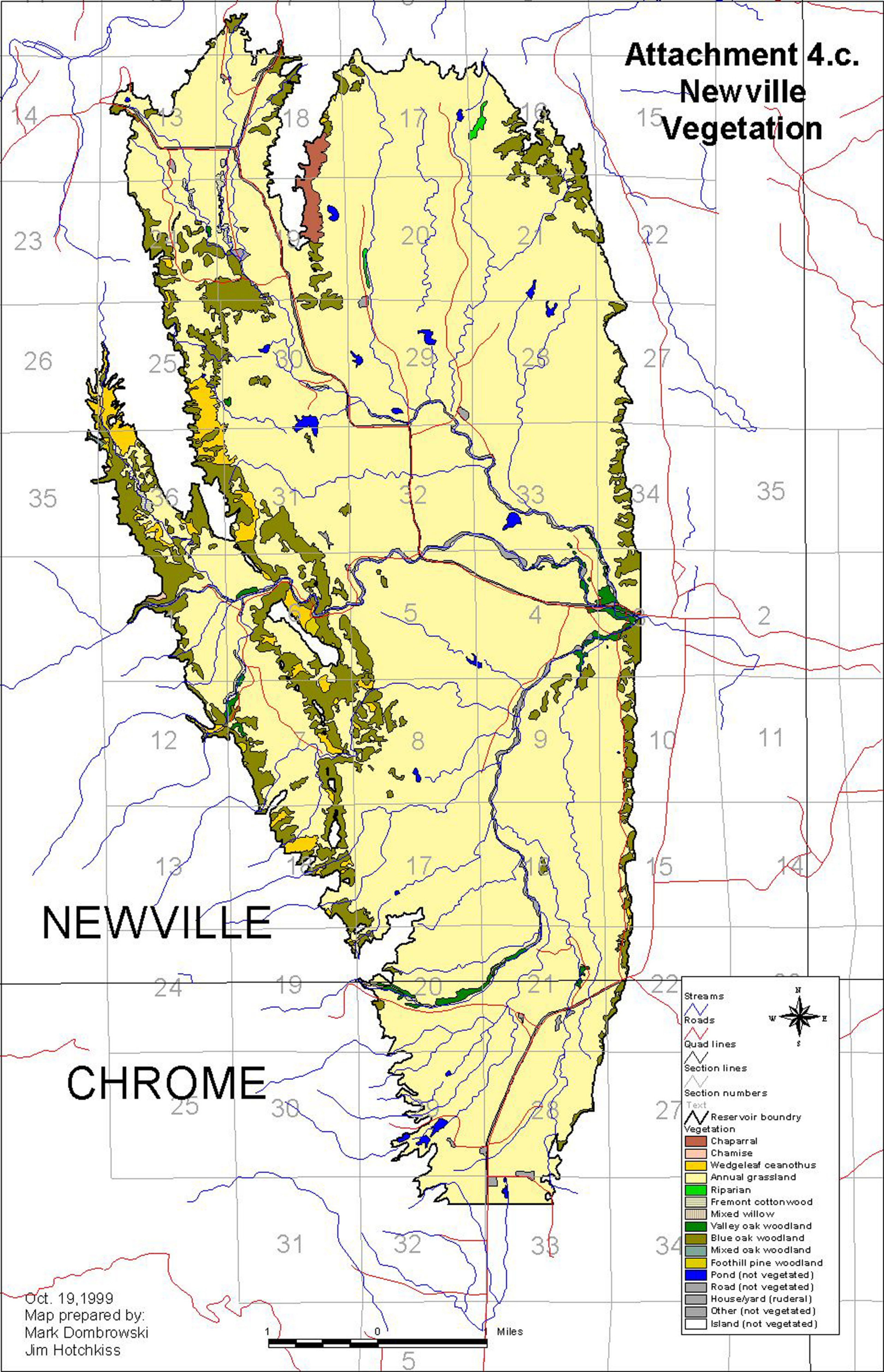
d. Schoenfield Vegetation

e. Dippingvat Vegetation


Attachment 4.a.
Sites Vegetation
RAIL CANYON
LOGAN RIDGE
SITES
LODOGA
MANOR SLOUGH
Quad lines
Section lines
Section numbers
Text
Streams
County line
Roads
N
S
E
W
Sites boundry
Vegetation - Sites
Wedgeleaf ceanothus
Grain or other
Annual grassland
Purple needlegrass
Fremont cottonwood
Mixed willow
Narrowleaf willow
Sedge
Spike rush
Valley oak woodland
Blue oak woodland
Alkali meadow-Saltgrass
Pond (not vegetated)
Road (not vegetated)
House/yard (ruderal)
Out (not vegetated)
Other (not vegetated)
1
0
1 Miles

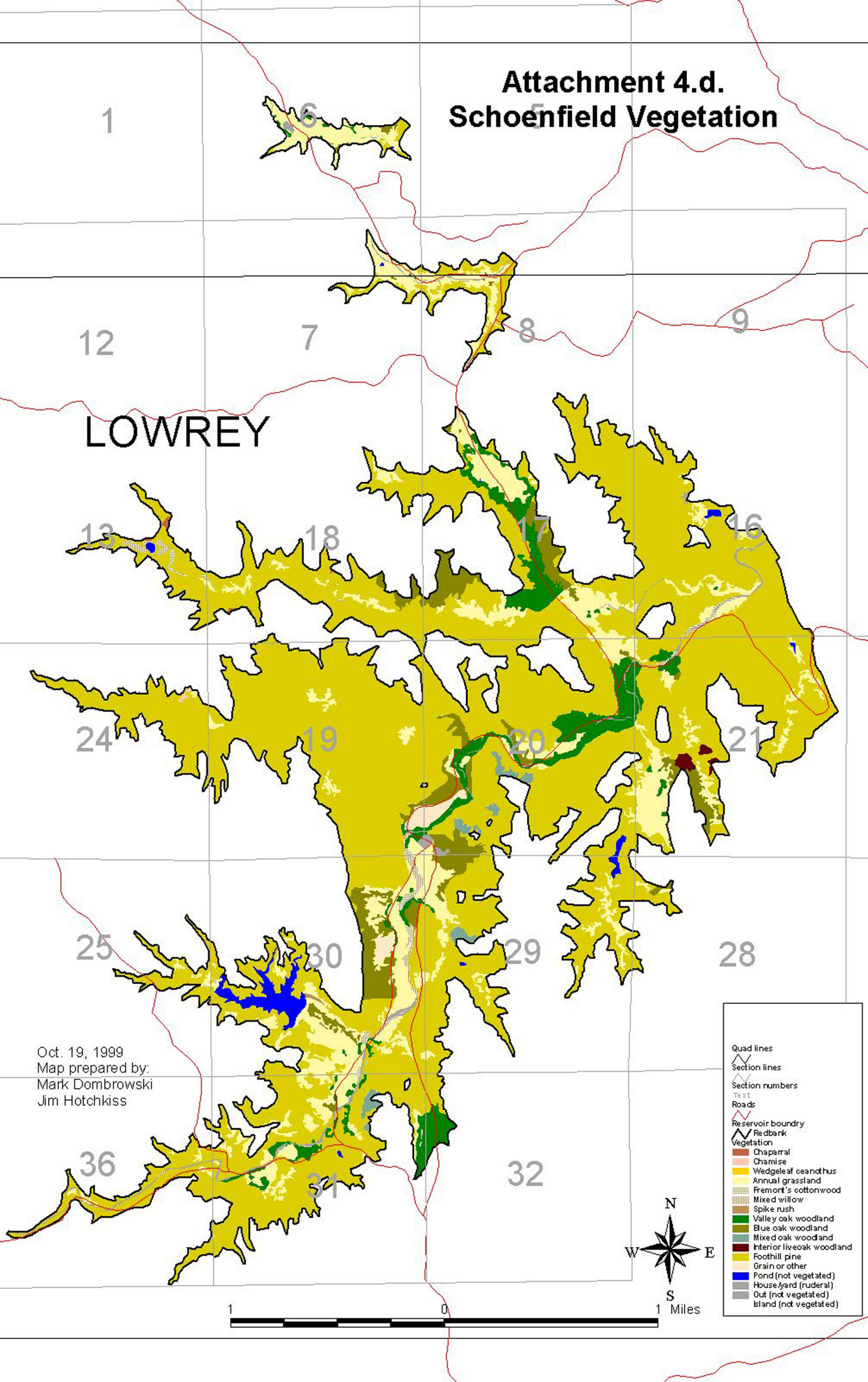
# Attachment 4.b.
# Colusa Cell Vegetation



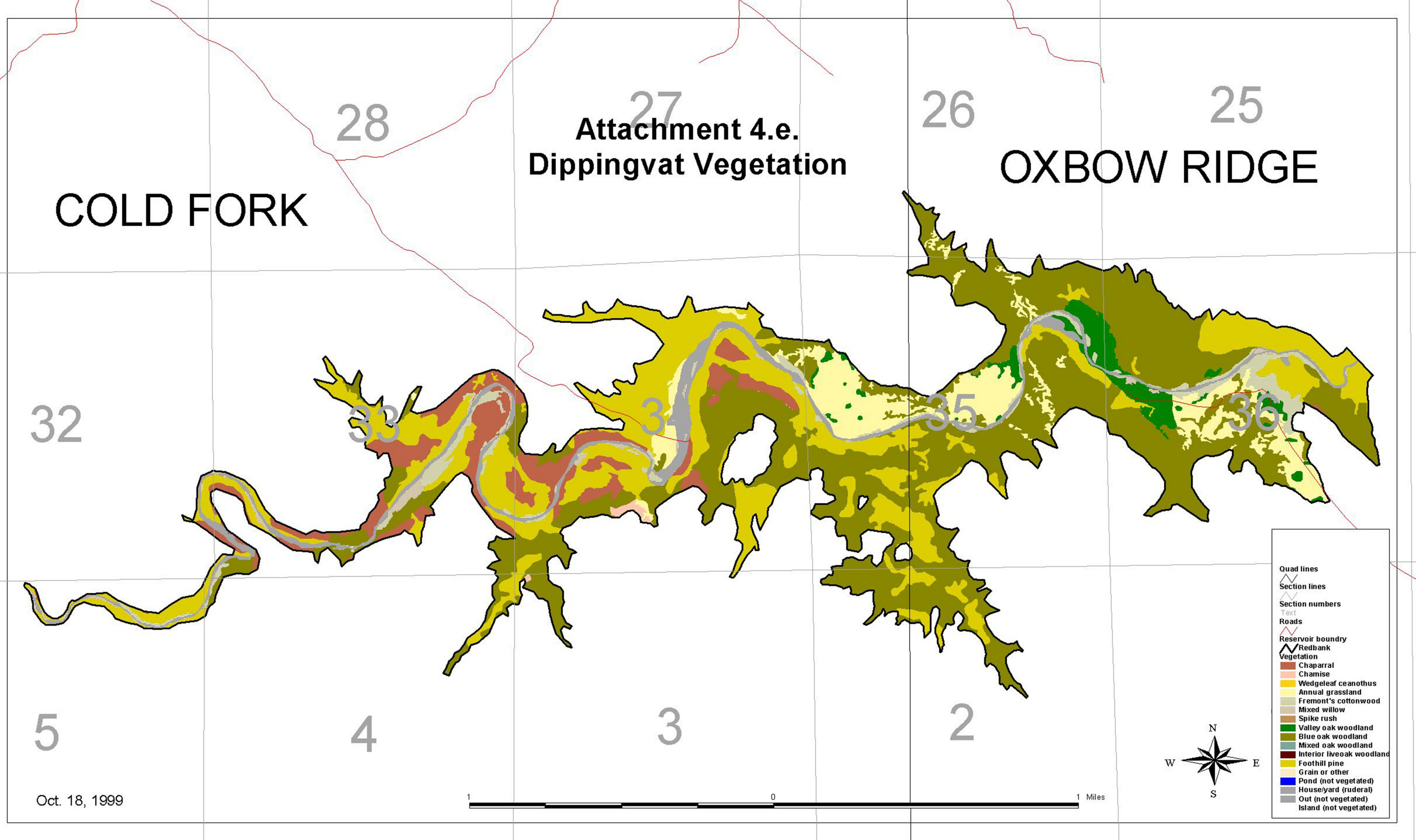


Attachment 4.c.
Newville
Vegetation
NEWVILLE
CHROME
Streams
Roads
Quad lines
Section lines
Section numbers
Text
Reservoir boundry
Vegetation
Chaparral
Chamise
Wedgeleaf ceanothus
Annual grassland
Riparian
Fremont cottonwood
Mixed willow
Valley oak woodland
Blue oak woodland
Mixed oak woodland
Foothill pine woodland
Pond (not vegetated)
Road (not vegetated)
House/yard (ruderal)
Other (not vegetated)
Island (not vegetated)
N
S
E
W
1
0
1 Miles
Oct. 19,1999
Map prepared by:
Mark Dombrowski
Jim Hotchkiss

# Attachment 4.d. Schoenfield Vegetation



# Attachment 4.e.
# Dippingvat Vegetation




Oct. 18, 1999

January 4, 2000

# ATTACHMENT 5.

## OFFSTREAM STORAGE RESERVOIR ALTERNATIVES:

## 1998-1999 plant species observed

| **FAMILY *Genus species*** | | **Common Name** | | **Origin** | | **Listing** |
|---|---|---|---|---|---|---|
| **Sites** | | | | | | |
| | | | | | | |
| ALISMATACEAE | | | | | | |
| *Alisma plantago-aquatica* | | Water-plantain | | native | | |
| *Damasonium californicum* | | Fringed water-plantain | | native | | |
| | | | | | | |
| AMARANTHACEAE | | | | | | |
| *Amaranthus blitoides* | | Mat amaranth | | non | | |
| | | | | | | |
| ANACARDIACEAE | | | | | | |
| *Toxicodendron diversilobum* | | Poison oak | | native | | |
| | | | | | | |
| APIACEAE | | | | | | |
| *Anthriscus caucalis* | | Bur-chervil | | non | | |
| *Daucus pusillus* | | Rattlesnake-weed | | native | | |
| *Eryngium castrense* | | Coyote thistle | | native | | |
| *Lomatium marginatum* var. *purpureum* | | Purple lomatium | | native | | |
| *Sanicula bipinnata* | | Poison sanicle | | native | | |
| *Sanicula bipinnatifida* | | Purple sanicle | | native | | |
| *Scandix pecten-veneris* | | Shepherd's needle | | non | | |
| *Torilis arvensis* | | Common hedge-parsley | | non | | |
| *Torilis nodosa* | | Knotted hedge-parsley | | non | | |
| *Yabea microcarpa* | | False hedge-parsley | | non | | |
| | | | | | | |
| ASCLEPIADACEAE | | | | | | |
| *Asclepias* sp. | | Milkweed | | native | | |
| | | | | | | |
| ASTERACEAE | | | | | | |
| *Achillea millifolium* | | Yarrow | | native | | |
| *Achyrachaena mollis* | | Blow-wives | | native | | |
| *Agoseris heterophylla* | | Agoseris | | | | |
| *Ancistrocarphus filagineus* | | Woolly fishhooks | | native | | |
| *Anthemis cotula* | | Mayweed | | non | | |
| *Artemisia douglasiana* | | Mugwort | | native | | |
| *Baccharis salicifolia* | | Mule fat | | native | | |
| *Blennosperma nanum* | | Yellow carpet | | native | | |
| *Calycadenia multiglandulosa* | | Sticky calycadenia | | native | | |
| *Calycadenia pauciflora* | | Few-flowered calycadenia | | native | | |
| *Carduus pycnocephalus* | | Italian plumeless-thistle | | non | | |
| *Centaurea calcitrapa* | | Purple star-thistle | | native | | |
| *Centaurea melitensis* | | Tocalote | | native | | |
| *Centaurea solstitialis* | | Yellow star thistle | | non | | |
| *Chamomilla suaveolens* | | Pineapple-weed | | non | | |
| *Cichorium intybus* | | Chicory | | non | | |
| *Cirsium occidentale* var. *venustum* | | Venus thistle | | native | | |
| *Cirsium vulgare* | | Bull thistle | | non | | |
| *Conyza floribunda* | | Many-flowered horseweed | | non | | |
| *Cotula coronopifolia* | | Brass-buttons | | non | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Eriophyllum lanatum* | | Woolly sunflower | | native | | |
| *Eryngium castrense* | | Coyote thistle | | native | | |
| *Filago gallica* | | Narrow-leaved filago | | non | | |
| *Gnaphalium luteo-album* | | Weedy cudweed | | non | | |
| *Gnaphalium palustre* | | Western marsh cudweed | | native | | |
| *Grindelia camporum* var. *camporum* | | Valley gumplant | | native | | |
| *Hemizonia congesta* ssp. *luzulifolia* | | Hayfield tarweed | | native | | |
| *Hemizonia pungens* ssp. *pungens* | | Common spikeweed | | native | | |
| *Hesperevax acaulis* var. *robustior* | | Robust evax | | native | | |
| *Hesperevax caulescens* | | Hogwallow starfish | | native | | CNPS 4 |
| *Hesperevax sparsiflora* | | Sparse-flowered evax | | native | | |
| *Heterotheca grandiflora* | | Telegraph-weed | | non | | |
| *Hypochaeris glabra* | | Smooth cat's ear | | non | | |
| *Hypochaeris radicata* | | Rough cat's-ear | | non | | |
| *Lactuca saligna* | | Willow-leaved lettuce | | non | | |
| *Lactuca serriola* | | Prickly lettuce | | non | | |
| *Lagophylla glandulosa* | | Glandular hareleaf | | native | | |
| *Lasthenia californica* | | California goldfields | | native | | |
| *Lasthenia glaberrima* | | Smooth goldfields | | native | | |
| *Layia chrysanthemoides* | | Smooth tidytips | | native | | |
| *Layia fremontii* | | Tidytips | | native | | |
| *Leontodon taraxacoides* ssp. *taraxacoides* | | Short-beaked hawkbit | | non | | |
| *Lessingia nemaclada* | | Slender-stemmed lessingia | | native | | |
| *Madia elegans* ssp. *densifolia* | | Common madia | | native | | |
| *Madia exigua* | | Thread-stemmed madia | | native | | |
| *Madia glomerata* | | Mountain tarweed | | native | | |
| *Madia gracilis* | | Slender tarweed | | native | | |
| *Malacothrix floccifera* | | Woolly malacothrix | | native | | |
| *Micropus californicus* var. *californicus* | | Slender cottonweed | | native | | |
| *Microseris douglasii* ssp. *douglasii* | | Douglas' microseris | | native | | |
| *Microseris douglasii* ssp. *tenella* | | | | | | |
| *Monolopia major* | | | | native | | |
| *Picris echioides* | | Bristly oxtongue | | non | | |
| *Psilocarphus brevissimus* var. *brevissimus* | | Dwarf woolly marbles | | native | | |
| *Psilocarphus tenellus* var. *tenellus* | | Slender woolly marbles | | native | | |
| *Rigiopappus leptocladus* | | Rigiopappus | | native | | |
| *Senecio vulgaris* | | Old-man-in-the-spring | | non | | |
| *Silybum marianum* | | Milk-thistle | | non | | |
| *Sonchus oleraceus* | | Sow-thistle | | non | | |
| *Taraxacum officinale* | | Common dandelion | | non | | |
| *Wyethia angustifolia* | | Narrow-leaved mule's ears | | native | | |
| *Xanthium spinosum* | | Spiny cocklebur | | native | | |
| *Xanthium strumarium* | | Cocklebur | | native | | |
| | | | | | | |
| BETULACEAE | | | | | | |
| *Alnus rhombifolia* | | Alder | | native | | |
| | | | | | | |
| BORAGINACEAE | | | | | | |
| *Amsinckia lycopsoides* | | Bugloss fiddleneck | | native | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Amsinckia menziesii* | | Menzie's fiddleneck | | native | | |
| *Cryptantha flaccida* | | Weak-stemmed cryptantha | | native | | |
| *Cryptantha intermedia* | | Common cryptantha | | native | | |
| *Heliotropium curassavicum* | | Wild heliotrope | | native | | |
| *Heliotropium europaeum* | | European heliotrope | | non | | |
| *Pectocarya pusilla* | | Little pectocarya | | native | | |
| *Plagiobothrys bracteatus* | | Bracted popcornflower | | native | | |
| *Plagiobothrys canescens* | | Valley popcornflower | | native | | |
| *Plagiobothrys fulvus* | | Fulvous popcornflower | | native | | |
| *Plagiobothrys greenei* | | Greene's popcornflower | | native | | |
| *Plagiobothrys nothofulvus* | | Common popcornflower | | native | | |
| *Plagiobothrys stipitatus* var. *stipitatus* | | Lg-flwd stalked popcornflower | | native | | |
| *Plagiobothrys stipitatus* var. *micranthus* | | Sm-flwd stalked popcornflower | | native | | |
| | | | | | | |
| BRASSICACEAE | | | | | | |
| *Athysanus pusillus* | | Petty athysanus | | native | | |
| *Brassica nigra* | | Black mustard | | non | | |
| *Capsella bursa-pastoris* | | Shepherd's purse | | non | | |
| *Cardamine oligosperma* | | Western bittercress | | non | | |
| *Draba verna* | | Spring whitlow-grass | | native | | |
| *Erysimum capitatum* | | Western wallflower | | native | | |
| *Lepidium latipes* var. *latipes* | | Dwarf peppergrass | | native | | |
| *Lepidium nitidum* var. *nitidum* | | Shining peppergrass | | native | | |
| *Lepidium strictum* | | Upright peppergrass | | native | | |
| *Raphanus sativus* | | Radish | | non | | |
| *Rorippa nasturtium-aquaticum* | | Water cress | | native | | |
| *Thysanocarpus curvipes* | | Fringepod | | native | | |
| *Thysanocarpus laciniatus* | | | | native | | |
| *Sisymbrium officinale* | | Hedge-mustard | | non | | |
| *Tropidocarpum gracile* | | Slender tropidocarpum | | native | | |
| | | | | | | |
| CALLITRICHACEAE | | | | | | |
| *Callitriche marginata* | | Water-starwort | | native | | |
| | | | | | | |
| CAMPANULACEAE | | | | | | |
| *Downingia insignis* | | Harlequin downingia | | native | | |
| *Githopsis specularioides* | | Common bluecup | | native | | |
| *Nemacladus montanus* | | Mountain nemacladus | | native | | |
| | | | | | | |
| CAPRIFOLIACEAE | | | | | | |
| *Sambucus mexicana* | | Blue elderberry | | native | | |
| | | | | | | |
| CARYOPHYLLACEAE | | | | | | |
| *Herniaria hirsuta* | | Hairy herniaria | | non | | |
| *Minuartia californica* | | California sandwort | | native | | |
| *Minuartia douglasii* | | Douglas' sandwort | | native | | |
| *Petrorhagia dubia* | | Grass-pink | | non | | |
| *Sagina apetala* | | Dwarf pearlwort | | native | | |
| *Sagina decumbens* | | Pearlwort | | native | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Silene gallica* | | Windmill pink | | non | | |
| *Spergularia marina* | | Salt marsh sandspurry | | native | | |
| *Stellaria media* | | Common chickweed | | non | | |
| *Stellaria nitens* | | Shiny starwort | | native | | |
| | | | | | | |
| CHENOPODIACEAE | | | | | | |
| *Atriplex fruticulosa* | | | | native | | |
| *Atriplex rosea* | | Tumbling oracle | | non | | |
| *Chenopodium album* | | Lamb's-quarters | | non | | |
| *Chenopodium californicum* | | California goosefoot | | native | | |
| | | | | | | |
| CONVOLVULACEAE | | | | | | |
| *Convolvulus arvensis* | | Bindweed | | non | | |
| *Cressa truxillensis* | | Alkali weed | | native | | |
| | | | | | | |
| CRASSULACEAE | | | | | | |
| *Crassula connata* | | Pygmy weed | | native | | |
| *Dudleya cymosa* ssp. *cymosa* | | Canyon dudleya | | native | | |
| | | | | | | |
| CUCURBITACEAE | | | | | | |
| *Marah fabaceus* | | California manroot | | native | | |
| | | | | | | |
| CUPRESSACEAE | | | | | | |
| *Juniperus* sp. | | Juniper | | | | |
| | | | | | | |
| CYPERACEAE | | | | | | |
| *Carex* sp. | | | | | | |
| *Cyperus eragrostis* | | Tall cyperus | | native | | |
| *Eleocharis macrostachya* | | Spike-rush | | native | | |
| *Scirpus acutus* var. *occidentalis* | | Hard-stemmed tule | | native | | |
| *Scirpus americanus* | | American bulrush | | native | | |
| *Scirpus californicus* | | California bulrush | | native | | |
| *Scirpus maritimus* | | Saltmarsh bulrush | | native | | |
| *Scirpus tuberosus* | | Tuberous bulrush | | non | | |
| | | | | | | |
| ERICACEAE | | | | | | |
| *Arctostaphylos manzanita* ssp. *manzanita* | | Big manzanita | | native | | |
| | | | | | | |
| EUPHORBIACEAE | | | | | | |
| *Chamaesyce glyptosperma* | | Rib-seeded spurge | | | | |
| *Chamaesyce ocellata* | | Valley spurge | | native | | |
| *Chamaesyce seryillifolia* ssp. *serpyllifolia* | | Thyme-leaved spurge | | native | | |
| *Eremocarpus setigerus* | | Turkey mullein | | native | | |
| *Euphorbia spathulata* | | Warty spurge | | native | | |
| | | | | | | |
| FABACEAE | | | | | | |
| *Astragalus gambelianus* | | Gambel's milkvetch | | native | | |
| *Cercis occidentalis* | | Western redbud | | native | | |
| *Glycyrrhiza lepidota* | | American licorice | | native | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Lotus corniculatus* | | Birdfoot trefoil | | non | | |
| *Lotus humistratus* | | Foothill lotus | | native | | |
| *Lotus purshianus* var. *purshianus* | | Spanish lotus | | native | | |
| *Lupinus albifrons* var. *albifrons* | | Silver bush lupine | | native | | |
| *Lupinus bicolor* | | Bicolored lupine | | native | | |
| *Lupinus latifolius* var. *latifolius* | | Broad-leaved lupine | | native | | |
| *Lupinus microcarpus* | | Chick lupine | | native | | |
| *Lupinus succulentus* | | Succulent lupine | | native | | |
| *Medicago polymorpha* | | California bur-clover | | non | | |
| *Melilotus officinalis* | | Yellow sweetclover | | non | | |
| *Trifolium bifidum* var. *bifidum* | | Notch-leaved clover | | native | | |
| *Trifolium bifidum* var. *decipiens* | | Deceptive clover | | native | | |
| *Trifolium depauperatum* var. *amplectans* | | Involucrate cowbag clover | | native | | |
| *Trifolium depauperatum* var. *depauperatum* | | Dwarf cowbag clover | | native | | |
| *Trifolium fragiferum* | | Strawberry clover | | non | | |
| *Trifolium fucatum* | | Sour clover | | native | | |
| *Trifolium hirtum* | | Rose clover | | non | | |
| *Trifolium obtusiflorum* | | Clammy clover | | native | | |
| *Trifolium willdenovii* | | Tomcat clover | | native | | |
| *Trifolium wormskioldii* | | Springbank clover | | native | | |
| *Vicia benghalensis* | | Red-flowered vetch | | non | | |
| *Vicia sativa* | | Garden vetch | | non | | |
| *Vicia villosa* ssp. *varia* | | Winter vetch | | non | | |
| *Vicia villosa* ssp. *villosa* | | Winter vetch | | non | | |
| | | | | | | |
| FAGACEAE | | | | | | |
| *Quercus* sp. (evergreen) | | Live oak | | native | | |
| *Quercus douglasii* | | Blue oak | | native | | |
| *Quercus lobata* | | Valley oak | | native | | |
| | | | | | | |
| FRANKENIACEAE | | | | | | |
| *Frankenia salina* | | Alkali heath | | native | | |
| | | | | | | |
| GERANIACEAE | | | | | | |
| *Erodium botrys* | | Long-beaked stork's bill | | non | | |
| *Erodium cicutarium* | | Red-stemmed filaree | | non | | |
| *Erodiuim moschatum* | | White-stemmed filaree | | non | | |
| *Geranium carolinianum* | | Carolina geranium | | native | | |
| *Geranium dissectum* | | Cut-leaved geranium | | non | | |
| *Geranium molle* | | Dove's-foot geranium | | non | | |
| | | | | | | |
| HIPPOCASTANACEAE | | | | | | |
| *Aesculus californica* | | California buckeye | | native | | |
| | | | | | | |
| HYDROPHYLLACEAE | | | | | | |
| *Eriodictyon californicum* | | California yerba santa | | native | | |
| *Nemophila heterophylla* | | Variable-leaved nemophila | | native | | |
| *Nemophila pedunculata* | | Meadow nemophila | | native | | |
| *Phacelia egena* | | Rock phacelia | | native | | |

| | | | |
|---|---|---|---|
| *Phacelia imbricata* | Imbricate phacelia | native | |
| | | | |
| JUGLANDACEAE | | | |
| *Juglans californica* var. *hindsii* | Northern California black walnut | native | CNPS 1B |
| | | | |
| JUNCACEAE | | | |
| *Juncus balticus* | Baltic rush | native | |
| *Juncus bufonius* var. *bufonius* | Common toad rush | native | |
| *Juncus bufonius* var. *congestus* | Congested toad rush | native | |
| *Juncus xiphioides* | Iris-leaved rush | native | |
| | | | |
| LAMIACEAE | | | |
| *Marrubium vulgare* | Horehound | non | |
| *Monardella* sp. | Mint | native | |
| *Salvia columbariae* | Chia | native | |
| *Salvia spathacea* | Pitcher sage | native | |
| *Stachys pycnantha* | Short-spiked hedge-nettle | native | |
| *Stachys ajugoides* var. *ajugoides* | Hedge-nettle | native | |
| *Trichostema lanceolatum* | Vinegar weed | native | |
| | | | |
| LILIACEAE | | | |
| *Allium amplectens* | Clasping onion | native | |
| *Allium serra* | Serrate onion | native | |
| *Brodiaea elegans* ssp. *elegans* | Harvest brodiaea | native | |
| *Calochortus luteus* | Yellow mariposa lilly | native | |
| *Chlorogalum pomeridianum* | Soap plant | native | |
| *Dichelostemma capitatum* ssp. *capitatum* | Bluedicks | native | |
| *Dichelostemma volubile* | Twining ookow | native | |
| *Muilla maritima* | Common muilla | native | |
| *Odontostomum hartwegii* | Hartweg's odontostomum | native | |
| *Triteleia hyacinthina* | Wild hyacinth | native | |
| *Triteleia laxa* | Ithuriel's-spear | native | |
| | | | |
| LOASACEAE | | | |
| *Mentzelia laevicaulis* | Giant blazing star | native | |
| | | | |
| LYTHRACEAE | | | |
| *Lythrum californicum* | California loosestrife | native | |
| *Lythrum hyssopifolium* | Hyssop loosestrife | non | |
| *Lythrum tribracteatum* | Slender-fruited loosestrife | non | |
| | | | |
| MALVACEAE | | | |
| *Malva parviflora* | Little mallow | non | |
| *Malvella leprosa* | Alkali mallow | native | |
| *Sidalcea diploscypha* | Fringed sidalcea | native | |
| | | | |
| MARTYNIACEAE | | | |
| *Proboscidea louisianica* ssp. *louisianica* | Common unicorn plant | non | |
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|---|---|---|---|---|---|---|
| MORACEAE | | | | | | |
| *Ficus carica* | | Edible fig | | non | | |
| | | | | | | |
| OLEACEAE | | | | | | |
| *Olea europaea* | | Olive | | non | | |
| | | | | | | |
| ONAGRACEAE | | | | | | |
| *Camissonia graciliflora* | | Hill suncup | | native | | |
| *Clarkia affinis* | | | | native | | |
| *Clarkia purpurea* ssp. *quadrivulnera* | | Purple clarkia | | native | | |
| *Epilobium cleistogamum* | | Cleistogamous spike-primrose | | native | | |
| *Epilobium densiflorum* | | Dense-flowered spike-primrose | | native | | |
| *Epilobium torreyi* | | Torrey's spike-primrose | | native | | |
| | | | | | | |
| OROBANCHACEAE | | | | | | |
| *Orobanche fasciculata* | | Clustered broom-rape | | native | | |
| | | | | | | |
| PAPAVERACEAE | | | | | | |
| *Eschscholzia caespitosa* | | Foothill poppy | | native | | |
| *Eschscholzia californica* | | California poppy | | native | | |
| *Eschscholzia lobbii* | | Fryingpans | | native | | |
| | | | | | | |
| PINACEAE | | | | | | |
| *Pinus sabiniana* | | Foothill pine | | native | | |
| | | | | | | |
| PLANTAGINACEAE | | | | | | |
| *Plantago coronopus* | | Cut-leaved plantain | | non | | |
| *Plantago elongata* | | Elongate plantain | | native | | |
| *Plantago erecta* | | Erect plantain | | native | | |
| *Plantago ovata* | | Ovate plantain | | native | | |
| | | | | | | |
| POACEAE | | | | | | |
| *Aegilops cylindrica* | | Jointed goatgrass | | non | | |
| *Aegilops triuncialis* | | Barbed goatgrass | | non | | |
| *Alopecurus saccatus* | | Vernal pool foxtail | | native | | |
| *Aristida ternipes* var. *hamulosa* | | Hook three-awn | | native | | |
| *Avena barbata* | | Slender wild oat | | non | | |
| *Avena fatua* | | Wild oat | | non | | |
| *Bromus diandrus* | | Ripgut grass | | non | | |
| *Bromus hordeaceus* | | Softchess | | non | | |
| *Bromus madritensis* ssp. *rubens* | | Foxtail chess | | non | | |
| *Crypsis schoenoides* | | Swamp pricklegrass | | non | | |
| *Cynodon dactylon* | | Bermuda grass | | non | | |
| *Cynosurus echinatus* | | Hedgehog dogtail | | non | | |
| *Deschampsia danthonioides* | | Annual hairgrass | | native | | |
| *Distichlis spicata* | | Saltgrass | | native | | |
| *Elymus glaucus* | | Wild rye | | native | | |
| *Gastridium ventricosum* | | Nitgrass | | non | | |
| *Hordeum brachyantherum* ssp. *brachyantherum* | | Meadow barley | | native | | |

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|---|---|---|---|
| *Hordeum marinum* ssp. *gussoneanum* | Mediterranean barley | non | |
| *Hordeum murinum* ssp. *leporinum* | Hare wall barley | | |
| *Hordeum murinum* ssp. *murinum* | Pale barley | non | |
| *Koeleria macrantha* | June grass | native | |
| *Koeleria phleoides* | Bristly Koeler's-grass | non | |
| *Lolium multiflorum* | Italian ryegrass | non | |
| *Melica californica* | California melic | native | |
| *Muhlenbergia rigens* | Deergrass | native | |
| *Nassella cernua* | Nodding needlegrass | native | |
| *Nassella pulchra* | Purple needlegrass | native | |
| *Panicum capillare* | Witchgrass | native | |
| *Parapholis incurva* | Sickle grass | non | |
| *Paspalum dilatum* | Dallisgrass | non | |
| *Phalaris paradoxa* | Paradox canary grass | non | |
| *Poa annua* | Annual bluegrass | non | |
| *Poa bulbosa* | Bulbous bluegrass | non | |
| *Poa secunda* ssp. *secunda* | One-sided bluegrass | native | |
| *Polypogon maritimus* | Mediterranean beardgrass | non | |
| *Polypogon monspeliensis* | Annual beardgrass | non | |
| *Scribneria bolanderi* | Scribner's grass | native | |
| *Taeniatherum caput-medusae* | Medusa-head | non | |
| *Triticum aestivum* | Bread wheat | non | |
| *Vulpia bromoides* | Six-weeks fescue | non | |
| *Vulpia microstachys* var. *ciliata* | Fringed fescue | native | |
| *Vulpia myuros* var. *myuros* | Rattail fescue | non | |
| | | | |
| POLEMONIACEAE | | | |
| *Gilia tricolor* | Bird's eye gilia | native | |
| *Linanthus bicolor* | Bicolored linanthus | native | |
| *Linanthus ciliatus* | Whiskerbrush | native | |
| *Navarretia eriocephala* | Hoary navarretia | native | CNPS 4 |
| *Navarretia heterandra* | Tehama navarretia | native | CNPS 4 |
| *Navarretia intertexta* | Needle-leaved navarretia | native | |
| *Navarretia leucocephala* ssp. *leucocephala* | White-flowered navarretia | native | |
| *Navarretia nigelliformis* ssp. *nigelliformis* | Adobe navarretia | native | |
| *Navarretia pubescens* | Downy navarretia | native | |
| *Phlox gracilis* | Slender phlox | native | |
| | | | |
| POLYGONACEAE | | | |
| *Chorizanthe membranacea* | Pink spineflower | native | |
| *Eriogonum dasyanthemum* | Wild buckwheat | native | |
| *Eriogonum nudum* var. *nudum* | Naked buckwheat | native | |
| *Polygonum arenastrum* | Common knotweed | non | |
| *Pterostegia drymarioides* | Pterostegia | native | |
| *Rumex crispus* | Curly dock | non | |
| *Rumex salicifolius* var. *salicifolius* | Willow dock | native | |
| | | | |
| PORTULACACEAE | | | |
| *Calandrinia ciliata* | Redmaids | native | |

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|---|---|---|---|---|---|
| *Claytonia exigua* ssp. *exigua* | | Little miner's lettuce | | native | | |
| *Claytonia perfoliata* | | Common miner's lettuce | | native | | |
| *Montia fontana* | | Water chickweed | | native | | |
| | | | | | | |
| POTAMOGETONACEAE | | | | | | |
| *Potamogeton* sp. | | Pondweed | | | | |
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| PRIMULACEAE | | | | | | |
| *Anagallis arvensis* | | Scarlet pimpernel | | non | | |
| *Androsace elongata* ssp. *acuta* | | Fairy candelabra | | native | | CNPS 4 |
| *Dodecatheon hendersonii* | | Henderson's shootingstar | | native | | |
| | | | | | | |
| PTERIDACEAE | | | | | | |
| *Pellaea andromedifolia* | | Coffee fern | | native | | |
| *Pentagramma triangularis* ssp. *triangularis* | | Goldbacked fern | | native | | |
| | | | | | | |
| RANUNCULACEAE | | | | | | |
| *Delphinium hesperium* ssp. *hesperium* | | Pale larkspur | | native | | |
| *Delphinium hesperium* ssp. *pallescens* | | Pale larkspur | | native | | |
| *Delphinium variegatum* ssp. *variegatum* | | Royal larkspur | | native | | |
| *Myosurus minimus* | | Common mousetail | | native | | |
| *Ranunculus aquatilus* | | Water buttercup | | native | | |
| *Ranunculus californicus* | | California buttercup | | native | | |
| *Ranunculus hebecarpus* | | Pubescent-fruited buttercup | | native | | |
| *Ranunculus muricatus* | | Prickle-seeded buttercup | | non | | |
| | | | | | | |
| RHAMNACEAE | | | | | | |
| *Ceanothus cuneatus* var. *cuneatus* | | Buckbrush | | native | | |
| *Rhamnus ilicifolia* | | Holly-leaved redberry | | native | | |
| | | | | | | |
| ROSACEAE | | | | | | |
| *Adenostoma fasciculatum* | | Chamise | | native | | |
| *Aphanes occidentalis* | | Western lady's-mantle | | native | | |
| *Cercocarpus betuloides* | | Mountain-mahogany | | native | | |
| *Heteromeles arbutifolia* | | Toyon | | native | | |
| *Rosa californica* | | California rose | | native | | |
| *Rubus* sp. | | Blackberry | | | | |
| | | | | | | |
| RUBIACEAE | | | | | | |
| *Crucianella angustifolia* | | Crosswort | | non | | |
| *Galium aparine* | | Cleavers | | native | | |
| *Galium parisiense* | | Wall bedstraw | | non | | |
| *Galium porrigens* var. *tenue* | | Narrow-lvd climbing bedstraw | | native | | |
| *Sherardia arvensis* | | Field-madder | | non | | |
| | | | | | | |
| SALICACEAE | | | | | | |
| *Populus fremontii* ssp. *fremontii* | | Fremont cottonwood | | native | | |
| *Salix exigua* | | Sandbar willow | | native | | |
| *Salix goodingii* | | Black willow | | native | | |

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|---|---|---|
| *Salix laevigata* | Red willow | native |
| | | |
| SAXIFRAGACEAE | | |
| *Lithophragma affine* | San Francisco woodlandstar | native |
| *Saxifraga californica* | California saxifrage | native |
| | | |
| SCROPHULARIACEAE | | |
| *Bellardia trixago* | | non |
| *Castilleja affinis* ssp. *affinis* | Lay-and-Collie's Indian paintbrush | native |
| *Castilleja attenuata* | Valley-tassels | native |
| *Castilleja exserta* | Purple owl clover | native |
| *Collinsia sparsiflora* var. *bruceae* | Bruce's few-flowered collinsia | native |
| *Collinsia sparsiflora* var. *collina* | Few-flowered collinsia | native |
| *Collinsia sparsiflora* var. *sparsiflora* | Few-flowered collinsia | native |
| *Kickxia elatine* | Sharp-leaved fluellin | non |
| *Mimulus guttatus* | Seep monkeyflower | native |
| *Mimulus latidens* | Broad-toothed monkeyflower | native |
| *Penstemon heterophyllus* var. *heterophyllus* | Foothill beardtongue | |
| *Triphysaria eriantha* ssp. *eriantha* | Butter-and-eggs | native |
| *Verbascum blattaria* | Moth mullein | non |
| *Verbascum thapsus* | Woolly mullein | non |
| *Veronica americana* | American brookline | native |
| *Veronica anagallis-aquatica* | Water speedwell | non |
| *Veronica peregrina* ssp. *xalapensis* | Purslane speedwell | native |
| *Veronica persica* | Persian speedwell | non |
| | | |
| SIMAROUBACEAE | | |
| *Ailanthus altissima* | Tree-of-heaven | non |
| | | |
| SOLANACEAE | | |
| *Nicotiana glauca* | Tree tobacco | non |
| *Lycopersicon esculentum* | Garden tomato | non |
| *Physalis lancifolia* | Lance-leaved ground-cherry | non |
| *Solanum parishii* | | |
| | | |
| TYPHACEAE | | |
| *Typha angustifolia* | Narrow-leaved cattail | native |
| | | |
| URTICACEAE | | |
| *Urtica urens* | Dwarf nettle | non |
| | | |
| VALERIANACEAE | | |
| *Plectritis ciliosa* ssp. *ciliosa* | Long-spurred pink plectritis | native |
| *Plectritis macrocera* | White plectritis | native |
| | | |
| VERBENACEAE | | |
| *Phyla nodiflora* var. *nodiflora* | Creeping lippia | native |
| *Verbena* sp. | | |

| **FAMILY *Genus species*** | **Common Name** | **Origin** | **Listing** | |
|---|---|---|---|---|
| Colusa | | | | |
| | | | | |
| ALISMATACEAE | | | | |
| Alisma plantago-aquatica | Water plantain | native | | |
| | | | | |
| APIACEAE | | | | |
| *Anthriscus caucalis* | Bur-chervil | non | | |
| *Daucus carota* | Queen Anne's lace | non | | |
| *Daucus pusillus* | Rattlesnake-weed | native | | |
| *Eryngium castrense* | Coyote thistle | native | | |
| *Lomatium dasycarpum* ssp. *tomentosum* | Woolly-fruited lomatium | native | | |
| *Lomatium marginatum* var. *purpureum* | Margined lomatium | native | | |
| *Lomatium utriculatum* | Bladder lomatium | native | | |
| *Sanicula bipinnata* | Poison sanicle | native | | |
| *Sanicula bipinnatifida* | Purple sanicle | native | | |
| *Torilis nodosa* | Knotted hedge-parsley | non | | |
| | | | | |
| ASTERACEAE | | | | |
| *Achillea millifolium* | Yarrow | native | | |
| *Achyrachaena mollis* | Blow-wives | native | | |
| *Ancistrocarphus filagineus* | Woolly fish-hooks | native | | |
| *Anthemis cotula* | Mayweed | non | | |
| *Baccharis salicifolia* | Mule fat | native | | |
| *Blennosperma nanum* | Yellow carpet | native | | |
| *Calycadenia multiglandulosa* | Sticky calycadenia | native | | |
| *Calycadenia pauciflora* | Few-flowered calycadenia | native | | |
| *Carduus pycnocephalus* | Italian plumeless-thistle | non | | |
| *Centaurea melitensis* | Tocalote | native | | |
| *Centaurea solstitialis* | Yellow star-thistle | non | | |
| *Chamomilla suaveolens* | Pineapple-weed | non | | |
| *Cirsium occidentale* var. *venustum* | Venus thistle | native | | |
| *Erigeron philadelphicus* | Philadelphia daisy | native | | |
| *Eriophyllum lanatum* | Woolly sunflower | native | | |
| *Filago gallica* | Narrow-leaved filago | non | | |
| *Gnaphalium* sp. | Cudweed | | | |
| *Grindelia camporum* var. *camporum* | Valley gumplant | native | | |
| *Helianthus annuus* | Common sunflower | non | | |
| *Hemizonia pungens* ssp. *pungens* | Common spikeweed | native | | |
| *Hesperevax acaulis* var. *robustior* | Robust evax | native | | |
| *Hesperevax caulescens* | Hogwallow starfish | native | CNPS 4 | |
| *Holocarpha virgata* ssp. *virgata* | Wand tarweed | native | | |
| *Hypochaeris glabra* | Smooth cat's ear | non | | |
| *Hypochaeris radicata* | Rough cat's-ear | non | | |
| *Lactuca serriola* | Prickly lettuce | non | | |
| *Lagophylla glandulosa* | Glandular hareleaf | native | | |
| *Lasthenia glaberrima* | Smooth goldfields | native | | |
| *Layia fremontii* | Tidytips | native | | |
| *Lessingia nemaclada* | Slender-stemmed lessingia | native | | |

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|---|---|---|---|---|
| *Madia elegans* ssp. *densifolia* | Common madia | native | | |
| *Madia glomerata* | Mountain tarweed | native | | |
| *Madia gracilis* | Slender tarweed | native | | |
| *Malacothrix floccifera* | Woolly malacothrix | native | | |
| *Micropus californicus* var. *californicus* | Slender cottonweed | native | | |
| *Microseris douglasii* ssp. *douglasii* | Douglas' microseris | native | | |
| *Psilocarphus brevissimus* ssp. *brevissimu* | Dwarf woolly-marbles | native | | |
| *Psilocarphus tenellus* var. *tenellus* | Slender woolly-marbles | native | | |
| *Psilocarphus oregonus* | Oregon woolly-marbles | native | | |
| *Rigiopappus leptocladus* | Rigiopappus | native | | |
| *Senecio vulgaris* | Old-man-in-the-spring | non | | |
| *Silybum marianum* | Milk thistle | non | | |
| *Sonchus* sp. | Sow-thistle | | | |
| *Uropappus lindleyi* | Silver puffs | native | | |
| *Wyethia glabra* | Mule's ears | native | | |
| *Xanthium strumarium* | Cocklebur | native | | |
| | | | | |
| BORAGINACEAE | | | | |
| *Amsinckia lycopsoides* | Bugloss fiddleneck | native | | |
| *Amsinckia menziesii* var. *menziesii* | Menzies' fiddleneck | native | | |
| *Cryptantha flaccida* | Weak-stemmed cryptantha | native | | |
| *Cryptantha intermedia* | Common cryptantha | native | | |
| *Pectocarya penicillata* | Winged pectocarya | native | | |
| *Plagiobothrys bracteatus* | Bracted popcornflower | native | | |
| *Plagiobothrys canescens* | Valley popcornflower | native | | |
| *Plagiobothrys fulvus* | Fulvous popcornflower | native | | |
| *Plagiobothrys greenei* | Greene's popcornflower | native | | |
| *Plagiobothrys nothofulvus* | Common popcornflower | native | | |
| *Plagiobothrys scriptus* | Scribe's popcornflower | native | | |
| *Plagiobothrys stipitatus* var. *micranthus* | Lg-flwd stalked popcornflower | native | | |
| *Plagiobothrys stipitatus* var. *stipitatus* | Sm-flwd stalked popcornflower | native | | |
| | | | | |
| BRASSICACEAE | | | | |
| *Athysanus pusillus* | Petty athysanus | native | | |
| *Brassica nigra* | Black mustard | non | | |
| *Brassica rapa* | Field mustard | non | | |
| *Capsella bursa-pastoris* | Shepherd's purse | non | | |
| *Draba verna* | Spring whitlow-grass | native | | |
| *Erysimum capitatum* | Western wallflower | native | | |
| *Guillenia lasiophylla* | Hairy-leaved guillenia | native | | |
| *Lepidium dictyotum* var. *acutidens* | Sharp-toothed peppergrass | native | | |
| *Lepidium latipes* var. *latipes* | Dwarf peppergrass | native | | |
| *Lepidium nitidum* var. *nitidum* | Shining peppergrass | native | | |
| *Lepidium strictum* | Upright peppergrass | native | | |
| *Rorippa nasturtium-aquaticum* | Watercress | native | | |
| *Thysanocarpus curvipes* | Fringepod | native | | |
| *Tropidocarpum gracile* | Slender tropidocarpum | native | | |
| *Sisymbrium officinale* | Hedge-mustard | non | | |
| *Streptanthus glandulosus* ssp. *g.* | Glandular jewelflower | native | | |

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|---|---|---|---|---|
| *Tropidocarpum gracile* | Slender tropidocarpum | native | | |
| | | | | |
| CALLITRICHACEAE | | | | |
| *Callitriche marginata* | Water starwort | native | | |
| | | | | |
| CAMPANULACEAE | | | | |
| *Downingia insignis* | Harlequin downingia | native | | |
| *Triodanus perfoliata* | Venus'-looking-glass | native | | |
| | | | | |
| CAPRIFOLIACEAE | | | | |
| *Sambucus mexicana* | Blue elderberry | native | | |
| *Symphoricarpos* sp. | Snowberry | native | | |
| | | | | |
| CARYOPHYLLACEAE | | | | |
| *Cerastium glomeratum* | Sticky mouse-eared chickweed | non | | |
| *Minuartia californica* | California sandwort | native | | |
| *Petrorhagia dubia* | Grass-pink | non | | |
| *Sagina apetala* | Dwarf pearlwort | native | | |
| *Silene gallica* | Windmill pink | non | | |
| *Stellaria media* | Common chickweed | non | | |
| *Stellaria nitens* | Shiny starwort | native | | |
| *Stellaria pallida* | Pale chickweed | non | | |
| *Velezia rigida* | Velezia | non | | |
| | | | | |
| CHENOPODIACEAE | | | | |
| *Chenopodium californicum* | California goosefoot | native | | |
| | | | | |
| CONVOLVULACEAE | | | | |
| *Convolvulus arvensis* | Bindweed | non | | |
| *Cressa truxillensis* | Alkali-weed | native | | |
| | | | | |
| CRASSULACEAE | | | | |
| *Crassula connata* | Pygmy weed | native | | |
| | | | | |
| CUCURBITACEAE | | | | |
| *Marah fabaceus* | California manroot | native | | |
| | | | | |
| CUPRESSACEAE | | | | |
| *Juniperus occidentalis* var. *australis* | Western juniper | native | | |
| | | | | |
| CYPERACEAE | | | | |
| *Cyperus eragrostis* | Tall cyperus | native | | |
| *Eleocharis acicularis* | Spike-rush | native | | |
| *Eleocharis macrostachya* | Pale spike-rush | native | | |
| *Scirpus acutus* var. *occidentalis* | Hard-stemmed tule | native | | |
| *Scirpus maritimus* | Saltmarsh bulrush | native | | |
| | | | | |
| ERICACEAE | | | | |
| *Arctostaphlos manzanita* ssp. *manzanita* | Big manzanita | native | | |

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| EUPHORBIACEAE | | | | |
| *Eremocarpus setigerus* | Turkey mullein | native | | |
| *Euphorbia spathulata* | Warty spurge | native | | |
| | | | | |
| FABACEAE | | | | |
| *Astragalus gambelianus* | Gambel's milkvetch | native | | |
| *Cercis occidentalis* | Western redbud | native | | |
| *Lotus humistratus* | Foothill lotus | native | | |
| *Lotus purshianus* var. *purshianus* | Spanish lotus | native | | |
| *Lupinus albifrons* var. *albifrons* | Silver bush lupine | native | | |
| *Lupinus bicolor* | Bicolored lupine | native | | |
| *Lupinus latifolius* var. *latifolius* | Broad-leaved lupine | native | | |
| *Lupinus microcarpus* var. *densiflorus* | White-whorled lupine | native | | |
| *Medicago polymorpha* var. *brevispina* | California burclover | non | | |
| *Melilotus officinalis* | Yellow sweetclover | non | | |
| *Trifolium bifidum* var. *bifidum* | Notch-leaved clover | native | | |
| *Trifolium fragiferum* | Strawberry clover | non | | |
| *Trifolium fucatum* | Sour clover | native | | |
| *Trifolium hirtum* | Rose clover | non | | |
| *Trifolium depauperatum* var. *d.* | Dwarf cowbag clover | native | | |
| *Trifolium depauperatum var. amplectans* | Involucrate cowbag clover | native | | |
| *Trifolium willdenovii* | Tomcat clover | native | | |
| *Vicia benghalensis* | Red-flowered vetch | non | | |
| | | | | |
| FAGACEAE | | | | |
| *Quercus* sp. (evergreen) | Live oak | | | |
| *Quercus douglasii* | Blue oak | native | | |
| *Quercus lobata* | Valley oak | native | | |
| | | | | |
| FRANKENIACEAE | | | | |
| *Frankenia salina* | Alkali heath | native | | |
| | | | | |
| GERANIACEAE | | | | |
| *Erodium botrys* | Long-beaked stork's bill | | | |
| *Erodium cicutarium* | Red-stemmed filaree | non | | |
| *Erodium moschatum* | White-stemmed filaree | | | |
| *Geranium dissectum* | Cut-leaved geranium | non | | |
| *Geranium molle* | Dove's foot geranium | non | | |
| | | | | |
| HIPPOCASTANACEAE | | | | |
| *Aesculus californicus* | California buckeye | native | | |
| | | | | |
| HYDROPHYLLACEAE | | | | |
| *Eriodictyon californicum* | California yerba santa | native | | |
| *Nemophylla heterophylla* | Variable-leaved nemophylla | native | | |
| *Phacelia* sp. | | | | |
| | | | | |
| IRIDACEAE | | | | |
| *Iris* sp. | Iris | | | |

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| JUGLANDACEAE | | | | |
| *Juglans californica* var. *hindsii* | Northern California black walnut | native | CNPS 1B | |
| | | | | |
| JUNCACEAE | | | | |
| *Juncus balticus* | Baltic rush | native | | |
| *Juncus bufonius* var. *bufonius* | Common toadrush | native | | |
| *Juncus mexicanus* | Mexican juncus | native | | |
| *Juncus xiphioides* | Iris-leaved rush | native | | |
| | | | | |
| LAMIACEAE | | | | |
| *Marrubium vulgare* | Horehound | non | | |
| *Monardella* sp. | Mint | native | | |
| *Salvia columbariae* | Chia | native | | |
| *Stachys stricta* | Sonoma hedge-nettle | native | | |
| | | | | |
| LILIACEAE | | | | |
| *Allium amplectans* | Clasping onion | native | | |
| *Allium serra* | Serrate onion | native | | |
| *Brodiaea elegans* ssp. *elegans* | Elegant brodiaea | native | | |
| *Calochortus luteus* | Yellow mariposa lilly | native | | |
| *Chlorogalum* sp. | Soaproot | native | | |
| *Dichelostemma capitatum* ssp. *capitatum* | Bluedicks | native | | |
| *Dichelostemma volubile* | Twining ookow | native | | |
| *Muilla maritima* | Common muilla | native | | |
| *Odontostomum hartwegii* | Hartweg's odontostomum | native | | |
| *Triteleia laxa* | Ithuriel's spear | native | | |
| | | | | |
| LINACEAE | | | | |
| *Hesperolinon spergulinum* | Dwarf flax | native | | |
| | | | | |
| LOASACEAE | | | | |
| *Mentzelia albicaulis* | White-stemmed blazingstar | native | | |
| *Mentzelia laevicaulis* | Giant blazing star | native | | |
| | | | | |
| LYTHRACEAE | | | | |
| *Lythrum californicum* | California loosestrife | native | | |
| *Lythrum hyssopifolium* | Hyssop loosestrife | non | | |
| *Lythrum tribracteatum* | Slender-fruited loosestrife | non | | |
| | | | | |
| MALVACEAE | | | | |
| *Malva parviflora* | Little mallow | non | | |
| *Malvella leprosa* | Alkali mallow | native | | |
| *Sidalcea diploscypha* | Fringed sidalcea | native | | |
| | | | | |
| MARTYNIACEAE | | | | |
| *Proboscidea louisianica* ssp. *louisianica* | Common unicorn plant | non | | |
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|---|---|---|---|---|
| MORACEAE | | | | |
| *Ficus carica* | Edible fig | non | | |
| | | | | |
| OLEACEAE | | | | |
| *Olea europaea* | Olive | non | | |
| | | | | |
| ONAGRACEAE | | | | |
| *Camissonia graciliflora* | Hill suncup | native | | |
| *Clarkia affinis* | | native | | |
| *Clarkia concinna* ssp. *concinna* | Red ribbons | native | | |
| *Clarkia gracilis ssp. gracilis* | Slender clarkia | native | | |
| *Epilobium cleistogamum* | Cleistogamous spike-primrose | native | | |
| *Epilobium densiflorum* | Dense-flowered spike-primrose | native | | |
| | | | | |
| OROBANCHACEAE | | | | |
| *Orobanche fasciculata* | Clustered broom-rape | native | | |
| | | | | |
| PAPAVERACEAE | | | | |
| *Eschscholzia caespitosa* | Foothill poppy | native | | |
| *Eschscholzia californica* | California poppy | native | | |
| *Eschscholzia lobbii* | Fryingpans | native | | |
| | | | | |
| PINACEAE | | | | |
| *Pinus sabiniana* | Foothill pine | native | | |
| | | | | |
| PLANTAGINACEAE | | | | |
| *Plantago coronopus* | Cut-leaved plantain | non | | |
| *Plantago elongata* | Elongate plantain | native | | |
| *Plantago erecta* | Erect plantain | native | | |
| *Plantago ovata* | Ovate plantain | native | | |
| | | | | |
| POACEAE | | | | |
| *Aegilops cylindrica* | Jointed goatgrass | non | | |
| *Aegilops triuncialis* | Barbed goatgrass | non | | |
| *Avena barbata* | Slender wild oat | non | | |
| *Avena fatua* | Wild oat | non | | |
| *Aristida ternipes* var. *hamulosa* | Hook three-awn | native | | |
| *Briza minor* | Lesser quaking grass | non | | |
| *Bromus diandrus* | Ripgut grass | non | | |
| *Bromus hordeaceus* | Softchess | non | | |
| *Bromus japonicus* | Japanese chess | non | | |
| *Bromus madritensis* ssp. *rubens* | Foxtail chess | non | | |
| *Cynosurus echinatus* | Hedgehog dogtail | non | | |
| *Deschampsia danthonioides* | Annual hairgrass | native | | |
| *Distichlis spicata* | Saltgrass | native | | |
| *Gastridium ventricosum* | Nitgrass | non | | |
| *Hordeum brachyantherum* ssp. *b.* | Meadow barley | native | | |
| *Hordeum brachyantherum* ssp. *californicu* | California meadow barley | native | | |
| *Hordeum marinum* ssp. *gussoneanum* | Mediterranean barley | non | | |

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|---|---|---|---|---|
| *Hordeum murinum* ssp. *leporinum* | Hare wall barley | non | | |
| *Hordeum murinum* ssp. *murinum* | Wall barley | non | | |
| *Koeleria macrantha* | June grass | native | | |
| *Koeleria phleoides* | Bristly Koeler's-grass | non | | |
| *Lolium multiflorum* | Italian ryegrass | non | | |
| *Melica californica* | California melic | native | | |
| *Muhlenbergia rigens* | Muhly | native | | |
| *Nassella cernua* | Nodding needlegrass | native | | |
| *Nassella pulchra* | Purple needlegrass | native | | |
| *Parapholis incurva* | Sickle grass | non | | |
| *Phalaris paradoxica* | Paradox canary grass | non | | |
| *Poa annua* | Annual bluegrass | non | | |
| *Poa bulbosa* | Bulbous bluegrass | non | | |
| *Polypogon* sp. | | | | |
| *Taeniatherum caput-medusae* | Medusa-head | non | | |
| *Triticum aestivum* | Bread wheat | non | | |
| *Vulpia bromoides* | Six-weeks fescue | non | | |
| *Vulpia microstachys* var. *ciliata* | Fringed fescue | native | | |
| *Vulpia microstachys* var. *confusa* | Hairy-leaved fescue | native | | |
| *Vulpia myuros* var. *hirsuta* | Foxtail fescue | non | | |
| *Vulpia myuros* var. *myuros* | Rattail fescue | non | | |
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| POLEMONIACEAE | | | | |
| *Gilia tricolor* | Bird's eye gilia | native | | |
| *Linanthus bicolor* | Bicolored linanthus | native | | |
| *Linanthus ciliatus* | Whiskerbrush | native | | |
| *Linanthus dichotomus* | Evening snow | native | | |
| *Linanthus parviflorus* | Cherokee linanthus | native | | |
| *Navarretia eriocephala* | Hoary navarretia | native | CNPS 4 | |
| *Navarretia heterandra* | Tehama navarretia | native | CNPS 4 | |
| *Navarretia nigelliformis* ssp. *nigelliformis* | Adobe navarretia | native | | |
| *Navarretia pubescens* | Downy navarretia | native | | |
| *Phlox gracilis* | Slender phlox | native | | |
| | | | | |
| POLYGONACEAE | | | | |
| *Chorizanthe membranaceae* | Pink spineflower | native | | |
| *Eriogonum dasyanthemum* | Wild buckwheat | native | | |
| *Polygonum arenastrum* | Common knotweed | non | | |
| *Pterostegia drymarioides* | Pterostegia | native | | |
| *Rumex crispus* | Curly dock | non | | |
| | | | | |
| PORTULACACEAE | | | | |
| *Calandrinia ciliata* | Redmaids | native | | |
| *Claytonia exigua* | Little miner's lettuce | native | | |
| *Claytonia parviflora* ssp. *parviflora* | Miner's lettice | native | | |
| *Claytonia perfoliata* | Common miner's lettuce | native | | |
| *Montia fontana* | Water chickweed | native | | |
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| PRIMULACEAE | | | | |

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|---|---|---|---|---|
| *Anagallis arvensis* | Scarlet pimpernel | non | | |
| *Androsace elongata* ssp. *acuta* | Fairy candelabra | native | CNPS 4 | |
| | | | | |
| PTERIDACEAE | | | | |
| *Pentagramma triangularis* ssp. *t.* | Gold-backed fern | native | | |
| | | | | |
| RANUNCULACEAE | | | | |
| *Delphinium hesperium* ssp. *hesperium* | Pale larkspur | native | | |
| *Delphinium hesperium* ssp. *pallescens* | Pale larkspur | native | | |
| *Myosurus minimus* | Common mousetail | native | | |
| *Ranunculus aquatilus* | Water buttercup | native | | |
| *Ranunculus californicus* | California buttercup | native | | |
| *Ranunculus hebecarpus* | Pubescent-fruited buttercup | native | | |
| *Ranunculus muricatus* | Prickle-seeded buttercup | non | | |
| *Ranunculus occidentalis* | Western buttercup | native | | |
| | | | | |
| RHAMNACEAE | | | | |
| *Ceanothus cuneatus* var. *cuneatus* | Buckbrush | native | | |
| | | | | |
| ROSACEAE | | | | |
| *Aphanes occidentalis* | Western lady's mantle | native | | |
| *Holodiscus discolor* | Oceanspray | native | | |
| *Rosa californica* | California rose | native | | |
| | | | | |
| RUBIACEAE | | | | |
| *Crucianella angustifolia* | Crosswort | non | | |
| *Galium aparine* | Cleavers | native | | |
| *Galium parisiense* | Wall bedstraw | non | | |
| | | | | |
| SALICACEAE | | | | |
| *Populus fremontii* ssp. *fremontii* | Fremont cottonwood | native | | |
| *Salix sitchensis* | Sitka willow | native | | |
| | | | | |
| SAXIFRAGACEAE | | | | |
| *Saxifraga californica* | California saxifrage | native | | |
| | | | | |
| SCROPHULARIACEAE | | | | |
| *Bellardia trixago* | | non | | |
| *Castilleja attenuata* | Valley-tassels | native | | |
| *Castilleja exserta* | Purple owl clover | native | | |
| *Collinsia sparsifolia* var. *collina* | Few-flowered collinsia | native | | |
| *Mimulus guttatus* | Seep monkey flower | native | | |
| *Penstemon heterophyllus* var. *heterophyl* | Foothill beardtongue | native | | |
| *Triphysaria eriantha* ssp. *eriantha* | Butter and eggs | native | | |
| *Verbascum thapsus* | Woolly mullein | non | | |
| *Veronica peregrina* ssp. *xalapensis* | Purslane speedwell | native | | |
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| SIMARUBACEAE | | | | |
| *Ailanthus altissima* | Tree-of-heaven | non | | |

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| SOLANACEAE | | | | |
| *Nicotiana glauca* | Tree tobacco | non | | |
| | | | | |
| TYPHACEAE | | | | |
| *Typha* sp. | Cattail | native | | |
| | | | | |
| VALERIANACEAE | | | | |
| *Plectritis ciliosa* ssp. *ciliosa* | Ciliate plectritis | native | | |
| *Plectritis macrocera* | White plectritis | native | | |
| | | | | |
| VERBENACEAE | | | | |
| *Phyla nodiflora* | Creeping lippia | native | | |

| V | FAMILY *Genus species* | | Common Name | Origin | Listing |
|---|---|---|---|---|---|
| | **Newville** | | | | |
| | | | | | |
| | ACERACEAE | | | | |
| | *Acer macrophyllum* | | Big-leaved maple | native | |
| | | | | | |
| | ALISMATACEAE | | | | |
| | *Alisma plantago-aquatica* ssp. *brevipes* | | Water-plantain | native | |
| * | *Damasonium californicum* | | Fringed water-plantain | native | |
| | *Echinodorus berteroi* | | Burhead | native | |
| | *Sagittaria montevidensis* ssp. *calycina* | | Montevideo arrowhead | native | |
| | | | | | |
| | AMARANTHACEAE | | | | |
| * | *Amaranthus albus* | | Tumbleweed | non | |
| | *Amaranthus blitoides* | | Mat amaranth | native | |
| | | | | | |
| | ANACARDIACEAE | | | | |
| | *Rhus trilobata* | | Skunkbrush | native | |
| | *Toxicodendron diversilobum* | | Western poison oak | native | |
| | | | | | |
| | APIACEAE | | | | |
| * | *Anthriscus caucalis* | | Bur-chervil | non | |
| | *Daucus carota* | | Queen Anne's lace | non | |
| * | *Daucus pusillus* | | Rattlesnake-weed | native | |
| * | *Eryngium castrense* | | Coyote thistle | native | |
| | *Foeniculum vulgare* | | Fennel | non | |
| * | *Lomatium dasycarpum* ssp. *dasycarpum* | | Hairy-fruited lomatium | native | |
| * | *Lomatium dasycarpum* ssp. *tomentosum* | | Woolly-fruited lomatium | native | |
| * | *Lomatium marginatum* var. *marginatum* | | Margined lomatium | native | |
| * | *Lomatium marginatum* var. *purpureum* | | Margined lomatium | native | |
| * | *Lomatium utriculatum* | | Bladder lomatium | native | |
| * | *Perideridia kelloggii* | | Kellogg's yampah | native | |
| | *Sanicula bipinnata* | | Poison sanicle | native | |
| | *Sanicula bipinnatifida* | | Purple sanicle | native | |
| | *Sanicula crassicaulis* | | Pacific sanicle | native | |
| * | *Torilis arvensis* ssp. *arvensis* | | Common hedge-parsley | non | |
| * | *Torilis nodosa* | | Knotted hedge-parsley | non | |
| | *Yabea microcarpa* | | California hedge-parsley | native | |
| | | | | | |
| | APOCYNACEAE | | | | |
| | *Apocynum cannabinum* | | Indian-hemp | native | |
| | | | | | |
| | ARISTOLOCHIACEAE | | | | |
| | *Aristolochia californica* | | California pipevine | non | |
| | | | | | |
| | ASCLEPIADACEAE | | | | |
| | *Asclepias eriocarpa* | | Indian milkweed | native | |
| | *Asclepias fascicularis* | | Narrow-leaved milkweed | native | |

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| | ASTERACEAE | | | |
| | *Achillea millifolium* | Yarrow | native | |
| | *Achyrachaena mollis* | Blow-wives | native | |
| * | *Agoseris heterophylla* | Annual agoseris | native | |
| * | *Ancistrocarphus filagineus* | Woolly fishhooks | native | |
| | *Anthemis cotula* | Mayweed | non | |
| | *Artemisia douglasiana* | Mugwort | native | |
| | *Baccharis salicifolia* | Mule fat | native | |
| | *Bellis perennis* | English daisy | non | |
| | *Blepharipappus scaber* | Rough eyelash | native | |
| | *Brickellia californica* | California brickellbush | native | |
| * | *Calycadenia multiglandulosa* | Sticky calycadenia | native | |
| * | *Centaurea melitensis* | Tocalote | native | |
| | *Centaurea solstitialis* | Yellow star-thistle | non | |
| | *Chaenactis glabriscula* var. *glabriscula* | Yellow pincushion | native | |
| * | *Chaenactis glabriuscula* var. *heterocarpha* | Yellow pincushion | native | |
| * | *Chaenactis glabriuscula* var. *megacephala* | Yellow pincushion | native | |
| | *Chamomilla suaveolens* | Pineapple weed | non | |
| | *Cichorium intybus* | Chicory | non | |
| * | *Cirsium occidentale* var. *venustum* | Venus thistle | native | |
| | *Cirsium vulgare* | Bull thistle | non | |
| * | *Crocidium multicaule* | Spring gold | native | |
| * | *Ericameria linearifolia* | Interior goldenbush | native | |
| * | *Eriophyllum lanatum* var. *achillaeoides* | Yarrow woolly sunflower | native | |
| * | *Eriophyllum lanatum* var. *aphanactis* | Rayless woolly sunflower | native | |
| * | *Eriophyllum lanatum* var. *grandiflorum* | Large-flowered woolly sunflower | native | |
| * | *Filago gallica* | Narrow-leaved filago | non | |
| | *Gnaphalium palustre* | Everlasting | native | |
| * | *Gnaphalium luteo-album* | Weedy cudweed | non | |
| | *Grindelia camporum* var. *camporum* | Valley gumplant | native | |
| | *Helianthus annuus* | Common sunflower | native | |
| | *Helianthus bolanderi* | Bolander's sunflower | native | |
| | *Hemizonia congesta* ssp. *luzulifolia* | Hayfield tarweed | native | |
| * | *Hemizonia fitchii* | Fitch's spikeweed | native | |
| | *Hemizonia pungens* ssp. *pungens* | Common spikeweed | native | |
| * | *Hesperevax caulescens* | Hogwallow starfish | native | CNPS 4 |
| * | *Holocarpha obconica* | Tar plant | native | |
| * | *Holocarpha virgata* ssp. *virgata* | Wand tarweed | native | |
| * | *Hypochaeris glabra* | Smooth cat's-ear | non | |
| * | *Hypochaeris radicata* | Rough cat's ear | non | |
| | *Lactuca serriola* | Prickly lettuce | non | |
| * | *Lagophylla glandulosa* | Glandular hareleaf | native | |
| * | *Lagophylla minor* | Lesser hareleaf | native | |
| * | *Lagophylla ramosissima* ssp. *ramosissima* | Slender hareleaf | native | |
| * | *Lasthenia californica* | California goldfields | native | |
| | *Lasthenia glaberrima* | Smooth goldfields | native | |
| * | *Layia fremontii* | Fremont's tidytips | native | |
| | *Leontodon taraxacoides* | Hawkbit | non | |
| | *Lessingia filaginifolia* var. *californica* | California aster | native | |
| * | *Lessingia nana* | Dwarf lessingia | native | |
| * | *Lessingia nemaclada* | Slender-stemmed lessingia | native | |

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|---|---|---|---|---|---|
| | *Machaeranthera gracilis* | | Slender macheranthera | native | |
| * | *Madia elegans* ssp. *densifolia* | | Dense-leaved madia | native | |
| * | *Madia exigua* | | Thread-stemmed madia | native | |
| | *Madia glomerata* | | Mountain tarweed | native | |
| * | *Madia gracilis* | | Slender tarweed | native | |
| * | *Malacothrix floccifera* | | Woolly malacothrix | native | |
| * | *Micropus californicus* var. *californicus* | | Slender cottonweed | native | |
| * | *Microseris acuminata* | | Sierra foothill microseris | native | |
| * | *Microseris douglasii* ssp. *douglasii* | | Douglas' microseris | native | |
| * | *Monolopia gracilens* | | Slender monolopia | native | |
| | *Picris echioides* | | Bristly ox-tongue | non | |
| * | *Psilocarphus brevissimus* var. *brevissimus* | | Dwarf woolly-heads | native | |
| * | *Psilocarphus oregonus* | | Oregon woolly-heads | native | |
| * | *Psilocarphus tenellus* var. *tenellus* | | Slender woolly-marbles | native | |
| * | *Rafinesquia californica* | | California chicory | native | |
| * | *Rigiopappus leptocladus* | | Rigiopappus | native | |
| | *Senecio vulgaris* | | Groundsel | non | |
| | *Silybum marianum* | | Milk-thistle | non | |
| * | *Sonchus asper* ssp. *asper* | | Spiny-leaved sow-thistle | non | |
| * | *Stephanomeria* sp. | | | native | |
| | *Taraxacum officinale* | | Dandelion | non | |
| * | *Uropappus lindleyi* | | Silver puffs | native | |
| * | *Wyethia angustifolia* | | Narrow-leaved mule's ears | native | |
| * | *Wyethia helenioides/glabra* | | Gray-green mule's ears | native | |
| | *Wyethia mollis* | | Woolly mule's-ears | native | |
| | *Xanthium strumarium* | | Cocklebur | native | |
| | | | | | |
| | BETULACEAE | | | | |
| | *Alnus rhombifolia* | | White alder | native | |
| | | | | | |
| | BLECHNACEAE | | | | |
| | *Blechnum spicant* | | Deer fern | native | |
| | | | | | |
| | BORAGINACEAE | | | | |
| | *Amsinckia eastwoodiae* | | Eastwood's fiddleneck | native | |
| | *Amsinckia lycopsoides* | | Bugloss fiddleneck | native | |
| | *Amsinckia menziesii* var. *intermedia* | | Common fiddleneck | native | |
| * | *Amsinckia menziesii* var. *menziesii* | | Menzie's fiddleneck | native | |
| * | *Cryptantha flaccida* | | Weak-stemmed cryptantha | native | |
| * | *Cryptantha intermedia* | | Common cryptantha | native | |
| | *Cryptantha muricata* | | Prickle-seeded cryptantha | native | |
| | *Heliotropium curassavicum* | | Wild heliotrope | native | |
| | *Heliotropium europaeum* | | European heliotrope | non | |
| | *Pectocarya penicillata* | | Winged pectocarya | native | |
| | *Pectocarya pusilla* | | Little pectocarya | native | |
| | *Plagiobothrys bracteatus* | | Bracted popcornflower | native | |
| * | *Plagiobothrys fulvus* | | Fulvous popcornflower | native | |
| * | *Plagiobothrys greenei* | | Greene's popcornflower | native | |
| * | *Plagiobothrys nothofulvus* | | Perennial popcornflower | native | |
| * | *Plagiobothrys stipitatus* var. *micranthus* | | Small-flwd stalked popcornflower | native | |
| | *Plagiobothrys stipitatus* var. *stipitatus* | | Large-flwd stalked popcornflower | native | |
| * | *Plagiobothrys tenellus* | | Slender popcornflower | native | |

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|---|---|---|---|---|---|---|
| * | *Plagiobothrys undulatus* | | Coast popcornflower | native | | |
| | | | | | | |
| | BRASSICACEAE | | | | | |
| | *Athysanus pusillus* | | Petty athysanus | native | | |
| | *Brassica* sp. | | Mustard | non | | |
| | *Capsella bursa-pastoris* | | Shepherd's purse | non | | |
| * | *Cardamine oligosperma* | | Bitter-cress | native | | |
| * | *Cardaria chalapensis* | | Lens-podded hoarycress | non | | |
| | *Draba verna* | | Spring whitlow-grass | native | | |
| | *Lepidium latifolium* | | White-top | non | | |
| * | *Lepidium latipes* var. *latipes* | | Dwarf peppergrass | native | | |
| * | *Lepidium nitidum* var. *nitidum* | | Shining peppergrass | native | | |
| | *Lepidium nitidum* var. *oreganum* | | Oregon shining peppergrass | native | | |
| | *Lepidium oblongum* var. *oblongum* | | | native | | |
| * | *Lepidium strictum* | | Upright peppergrass | native | | |
| | *Raphanus* sp. | | Wild radish | non | | |
| * | *Rorippa nasturtium-aquaticum* | | Watercress | native | | |
| * | *Sisymbrium officinale* | | Hedge-mustard | non | | |
| * | *Streptanthus glandulosus* ssp. *glandulosus* | | Jewelflower | native | | |
| * | *Thysanocarpus curvipes* | | Lacepod | native | | |
| | *Thysanocarpus laciniatus* | | Fringepod | native | | |
| * | *Tropidocarpum gracile* | | Slender tropidocarpum | native | | |
| | | | | | | |
| | CALLITRICHACEAE | | | | | |
| | *Callitriche marginata* | | Water starwort | native | | |
| | | | | | | |
| | CALYCANTHACEAE | | | | | |
| | *Calycanthus occidentalis* | | Western spicebush | native | | |
| | | | | | | |
| | CAMPANULACEAE | | | | | |
| | *Downingia insignis* | | Harlequin downingia | native | | |
| * | *Githopsis specularioides* | | Bluecup | native | | |
| | *Heterocodon rariflorum* | | Heterocodon | native | | |
| * | *Nemocladus montanus* | | Mountain nemocladus | native | | |
| | *Triodanis biflora* | | Small Venus'-looking-glass | native | | |
| | | | | | | |
| | CAPRIFOLIACEAE | | | | | |
| * | *Lonicera hispidula* var. *vacillans* | | Hairy honeysuckle | native | | |
| * | *Lonicera interrupta* | | Chaparral honeysuckle | native | | |
| | *Sambucus mexicana* | | Blue elderberry | native | | |
| | *Symphoricarpos albus* var. *laevigatus* | | Common snowberry | native | | |
| | | | | | | |
| | CARYOPHYLLACEAE | | | | | |
| | *Cerastium glomeratum* | | Mouse-ear chickweed | non | | |
| | *Minuartia californica* | | California sandwort | native | | |
| * | *Minuartia douglasii* | | Douglas' sandwort | native | | |
| | *Moenchia erecta* ssp. *erecta* | | Upright chickweed | non | | |
| | *Petrorhagia dubia* | | Grass-pink | non | | |
| * | *Sagina apetala* | | Dwarf pearlwort | native | | |
| | *Sagina decumbens* ssp. *occidentalis* | | Western pearlwort | native | | |
| * | *Scleranthus annuus* ssp. *annuus* | | Knawel weed | non | | |
| * | *Silene gallica* | | Catch-fly | non | | |

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|---|---|---|---|---|---|---|
| | *Spergularia bocconii* | | Boccone's sandspurry | non | | |
| * | *Spergularia marina* | | Sandspurry | native | | |
| | *Stellaria media* | | Common chickweed | non | | |
| | *Stellaria nitens* | | Shining chickweed | native | | |
| * | *Velezia rigida* | | Velezia | non | | |
| | | | | | | |
| | CHENOPODIACEAE | | | | | |
| | *Chenopodium foliosum* | | Leafy goosefoot | non | | |
| | | | | | | |
| | CONVOLVULACEAE | | | | | |
| | *Calystegia occidentalis* ssp. *occidentalis* | | Western morning-glory | native | | |
| | *Convolvulus arvensis* | | Field bindweed | non | | |
| | | | | | | |
| | CRASSULACEAE | | | | | |
| * | *Crassula aquatica* | | Water pygmyweed | native | | |
| | *Crassula connata* | | Pygmy-weed | native | | |
| * | *Crassula tillaea* | | Mossy pygmyweed | native | | |
| | | | | | | |
| | CUCURBITACEAE | | | | | |
| | *Marah fabaceus* | | California man-root | native | | |
| | | | | | | |
| | CUPRESSACEAE | | | | | |
| * | *Juniperus californicus* | | California juniper | native | | |
| | | | | | | |
| | CYPERACEAE | | | | | |
| * | *Carex nudata* | | Torrent sedge | native | | |
| * | *Carex praegracilis* | | Clustered field sedge | native | | |
| * | *Carex serratodens* | | Saw-toothed sedge | native | | |
| * | *Carex nebrascensis* | | Nebraska sedge | native | | |
| | *Cyperus eragrostis* | | Tall cyperus | native | | |
| * | *Cyperus squarrosus* | | Awned cyperus | native | | |
| * | *Eleocharis obtusa* var. *englemannii* | | Englemann's spikerush | native | | |
| | *Eleocharis macrostachya* | | Pale spike-rush | native | | |
| * | *Scirpus acutus* var. *occidentalis* | | Hard-stemmed tule | native | | |
| * | *Scirpus pungens* | | Common threesquare | native | | |
| | | | | | | |
| | DATISCACEAE | | | | | |
| | *Datisca glomerata* | | Durango root | native | | |
| | | | | | | |
| | DENNSTAEDTIACEAE | | | | | |
| | *Pteridium aquilinum* var. *pubescens* | | Bracken fern | native | | |
| | | | | | | |
| | ELATINACEAE | | | | | |
| * | *Elatine californica* | | California waterwort | native | | |
| | | | | | | |
| | ERICACEAE | | | | | |
| * | *Arctostaphylos manzanita* ssp. *manzanita* | | Big manzanita | native | | |
| | *Arctostaphylos viscida* ssp. *viscida* | | White-leaved manzanita | native | | |
| | | | | | | |
| | EQUISETACEAE | | | | | |
| * | *Equisetum hyemale* ssp. *affine* | | Common scouring-rush | native | | |
| | *Equisetum laevigatum* | | Smooth scouring-rush | native | | |

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|---|---|---|---|---|---|
| | *Equisetum telmateia* ssp. *braunii* | | Giant horsetail | | |
| | | | | | |
| | EUPHORBIACEAE | | | | |
| | *Chamaesyce glyptosperma* | | Rib-seeded spurge | native | |
| * | *Chamaesyce ocellata* ssp. *ocellata* | | Valley spurge | native | |
| | *Chamaesyce ocellata* ssp. *ocellata* x *C. ocellata* ssp. *rattanii* | | | native | |
| | *Chamaesyce ocellata* ssp. *rattanii* | | Stony Creek spurge | native | CNPS 4 |
| | *Eremocarpus setigerus* | | Turkey mullein | native | |
| * | *Euphorbia spathulata* | | Warty spurge | native | |
| | | | | | |
| | FABACEAE | | | | |
| * | *Astragalus gambelianus* | | Gambel's milkvetch | native | |
| * | *Astragalus rattanii* var. *jepsonianus* | | Jepson's milkvetch | native | SC/1B |
| | *Cercis occidentalis* | | Western redbud | native | |
| | *Glycyrrhiza lepidota* | | American licorice | native | |
| | *Lotus corniculatus* | | Bird-foot trefoil | non | |
| * | *Lotus humistratus* | | Foothill lotus | native | |
| | *Lotus purshianus* var. *purshianus* | | Spanish lotus | native | |
| * | *Lotus wrangelianus* | | Wrangel lotus | native | |
| * | *Lupinus affinis* | | Fleshy lupine | native | |
| * | *Lupinus albifrons* var. *albifrons* | | Silver bush lupine | native | |
| * | *Lupinus bicolor* | | Miniature lupine | native | |
| | *Lupinus latifolius* var. *latifolius* | | Broad-leaved lupine | native | |
| | *Lupinus luteolus* | | Butter lupine | native | |
| * | *Lupinus densiflorus* | | White-whorled lupine | native | |
| | *Lupinus microcarpus* var. *microcarpus* | | Chick lupine | native | |
| | *Lupinus nanus* | | Sky lupine | native | |
| * | *Lupinus succulentus* | | Succulent lupine | native | |
| | *Medicago polymorpha* | | California bur-clover | non | |
| * | *Melilotus indicus* | | Sourclover | non | |
| | *Melilotus officinalis* | | Yellow sweetclover | non | |
| | *Trifolium albopurpureum* var. *albopurpureum* | | Indian clover | native | |
| * | *Trifolium bifidum* var. *bifidum* | | Notch-leaved clover | native | |
| * | *Trifolium bifidum* var. *decipiens* | | Deceptive clover | native | |
| | *Trifolium campestre* | | Hop clover | non | |
| * | *Trifolium ciliolatum* | | Foothill clover | native | |
| * | *Trifolium depauperatum* var. *amplectans* | | Involucrate cowbag clover | native | |
| * | *Trifolium depauperatum* var. *depauperatum* | | Dwarf cowbag clover | native | |
| * | *Trifolium dubium* | | Little hop clover | non | |
| | *Trifolium fragiferum* | | Strawberry clover | non | |
| * | *Trifolium fucatum* | | Sour clover | native | |
| * | *Trifolium gracilentum* var. *gracilentum* | | Slender clover | native | |
| * | *Trifolium hirtum* | | Rose clover | non | |
| * | *Trifolium microcephalum* | | Small-headed clover | native | |
| | *Trifolium monanthum* var. *monanthum* | | Carpet clover | native | |
| | *Trifolium oliganthum* | | Lanky clover | native | |
| * | *Trifolium subterraneum* | | Subterranean clover | non | |
| * | *Trifolium variegatum* | | White-tipped clover | native | |
| * | *Trifolium willdenovii* | | Tomcat clover | native | |
| * | *Trifolium wormskioldii* | | Springbank clover | native | |
| | *Vicia sativa* ssp. *sativa* | | Spring vetch | non | |
| | *Vicia villosa* ssp. *varia* | | Hairy vetch | non | |

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| | *Vicia villosa* ssp. *villosa* | | Hairy winter vetch | non | |
| | | | | | |
| | FAGACEAE | | | | |
| | *Quercus berberidifolia* | | Scrub oak | native | |
| | *Quercus chrysolepis* | | Canyon live oak | native | |
| | *Quercus douglasii* | | Blue oak | native | |
| | *Quercus lobata* | | Valley oak | native | |
| | | | | | |
| | GENTIANACEAE | | | | |
| * | Centaurium tricanthum | | Alkali centaury | native | |
| | *Centaurium venustum* | | Canchalagua | native | |
| * | *Cicendia quadrangularis* | | Timwort | native | |
| | | | | | |
| | GERANIACEAE | | | | |
| | *Erodium botrys* | | Long-beaked stork's bill | non | |
| * | *Erodium cicutarium* | | Red-stemmed filaree | non | |
| | *Erodium moschatum* | | White-stemmed filaree | non | |
| | *Geranium dissectum* | | Cut-leaved geranium | non | |
| | *Geranium molle* | | Dove's foot geranium | non | |
| | | | | | |
| | HIPPOCASTANACEAE | | | | |
| | *Aesculus californicus* | | California buckeye | native | |
| | | | | | |
| | HYDROPHYLLACEAE | | | | |
| | *Eriodictyon californicum* | | California yerba santa | native | |
| * | *Nemophila heterophylla* | | Variable-leaved nemophila | native | |
| | *Nemophila menziesii* ssp. *menziesii* | | Baby blue eyes | native | |
| | *Nemophila pedunculata* | | Meadow nemophila | native | |
| * | *Phacelia distans* | | Common phacelia | native | |
| * | *Phacelia egena* | | Rock phacelia | native | |
| | *Phacelia imbricata* ssp. *imbricata* | | Imbricate phacelia | native | |
| | *Phacelia ramosissima* var. *latifolia* | | | native | |
| * | *Phacelia ramosissima* var. *ramosissima* | | Branched phacelia | native | |
| | | | | | |
| | HYPERICACEAE | | | | |
| | *Hypericum anagalloides* | | Tinker's penny | native | |
| | | | | | |
| | ISOETACEAE | | | | |
| | *Isoetes* sp. | | Quillwort | native | |
| | | | | | |
| | JUGLANDACEAE | | | | |
| | *Juglans californica* var. *hindsii* | | Northern California black walnut | native | CNPS 1B |
| | | | | | |
| | JUNCACEAE | | | | |
| * | *Juncus balticus* | | Baltic rush | native | |
| * | *Juncus bufonius* var. *bufonius* | | Common toadrush | native | |
| * | *Juncus bufonius* var. *congestus* | | Congested toadrush | native | |
| | *Juncus capitatus* | | Leafy-bracted dwarf rush | non | |
| * | *Juncus mexicanus* | | Mexican rush | native | |
| * | *Juncus xiphioides* | | Iris-leaved rush | native | |
| | | | | | |
| | LAMIACEAE | | | | |

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|---|---|---|---|---|
| | *Agastache urticifolia* | Horsemint | native | |
| | *Marrubium vulgare* | Horehound | non | |
| * | *Monardella sheltonii* | Shelton's coyote-mint | native | |
| | *Pogogyne douglasii* | Douglas' pogogyne | native | |
| * | *Pogogyne zizyphoroides* | Sacramento Valley pogogyne | native | |
| * | *Salvia columbariae* | Chia | native | |
| | *Scutellaria californica* | California skullcap | native | |
| | *Scutellaria siphocampyloides* | Gray-leaved skullcap | | |
| | *Stachys ajugoides* | Hedge-nettle | native | |
| | *Stachys stricta* | Sonoma hedge-nettle | native | |
| | | | | |
| | LILIACEAE | | | |
| | *Allium amplectens* | Clasping onion | native | |
| * | *Allium falcifolium* | | native | |
| * | *Allium serra* | Serrate onion | native | |
| | *Brodiaea elegans* ssp. *elegans* | Elegant brodiaea | native | |
| * | *Calochortus luteus* | Yellow mariposa-lily | native | |
| | *Chlorogalum angustifolium* | Narrow-leaved soap plant | native | |
| | *Chlorogalum pomeridianum* var. *pomeridianum* | Wavy-leaved soap plant | native | |
| | *Dichelostemma capitatum* ssp. *capitatum* | Bluedicks | native | |
| * | *Dichelostemma congestum* | Fork-toothed ookow | native | |
| * | *Dichelostemma multiflorum* | Round-toothed ookow | native | |
| | *Dichelostemma volubile* | Twining ookow | native | |
| | *Fritillaria pluriflora* | Adobe lily | native | SC/1B |
| | *Odontostomum hartwegii* | Hartweg's ookow | native | |
| * | *Triteleia hyacinthina* | Wild hyacinth | native | |
| * | *Triteleia laxa* | Ithuriel's spear | native | |
| | *Triteleia peduncularis* | Long-rayed brodiaea | native | |
| | *Zigadenus fremontii* | Fremont's zigadene | native | |
| | | | | |
| | LIMNANTHACEAE | | | |
| | *Limnanthes douglasii* ssp. *nivea* | Coast Range meadowfoam | native | |
| | | | | |
| | LINACEAE | Dwarf flax | | |
| * | *Hesperolinon spergulinum* | | native | |
| | *Hesperolinon tehamense* | Tehama dwarf-flax | native | SC/1B |
| | | | | |
| | LOASACEAE | | | |
| | *Mentzelia laevicaulis* | Giant blazingstar | native | |
| | | | | |
| | LYTHRACEAE | | | |
| * | *Ammannia coccinea* | Valley redstem | native | |
| | *Ammannia robusta* | Robust redstem | native | |
| * | *Lythrum hyssopifolium* | Hyssop loosestrife | non | |
| | *Lythrum portula* | Water purslane | non | |
| | *Lythrum tribracteatum* | Slender-fruited loosestrife | non | |
| * | *Rotala ramosior* | Lowland toothcup | native | |
| | | | | |
| | MALVACEAE | | | |
| | *Malva parviflora* | Cheeseweed | non | |
| * | *Sidalcea calycosa* ssp. *calycosa* | Annual sidalcea | native | |
| | *Sidalcea hartwegii* | Hartweg's sidalcea | native | |

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|---|---|---|---|---|---|
| * | *Sidalcea hirsuta* | | Hairy sidalcea | native | |
| | | | | | |
| | MARSILEACEAE | | | | |
| * | *Marsilea vestita* ssp. *vestita* | | Hairy pepperwort | native | |
| | | | | | |
| | MARTYNIACEAE | | | | |
| | *Proboscidea louisianica* ssp. *louisianica* | | Common unicorn plant | non | |
| | | | | | |
| | MOLLUGINACEAE | | | | |
| * | *Mollugo verticillata* | | Indian chickweed | non | |
| | | | | | |
| | MORACEAE | | | | |
| | *Ficus carica* | | Edible fig | non | |
| | | | | | |
| | MYRTACEAE | | | | |
| | *Eucalyptus* sp. | | Gum tree | non | |
| | | | | | |
| | ORCHIDACEAE | | | | |
| | *Epipactis gigantea* | | Stream orchid | native | |
| | | | | | |
| | OLEACEAE | | | | |
| | *Olea europea* | | Olive | non | |
| | | | | | |
| | ONAGRACEAE | | | | |
| * | *Camissonia graciliflora* | | Hill suncup | native | |
| * | *Camissonia hirtella* | | Hairy evening-primrose | native | |
| | *Camissonia intermedia* | | | native | |
| * | *Clarkia affinis* | | | native | |
| * | *Clarkia concinna* ssp. *concinna* | | Redribbons | native | |
| * | *Clarkia gracilis* ssp. *gracilis* | | Slender clarkia | native | |
| * | *Clarkia lassenensis/gracilis* | | Lassen/slender clarkia | native | |
| * | *Clarkia modesta* | | | native | |
| * | *Clarkia purpurea* ssp. *quadrivulnera* | | Purple clarkia | native | |
| | *Clarkia rhomboidea* | | Diamond clarkia | native | |
| | *Epilobium brachycarpum* | | Tall annual willowherb | native | |
| | *Epilobium cleistogamum* | | Cleistogamous spike-primrose | native | |
| * | *Epilobium densiflorum* | | Dense-flowered spike-primrose | native | |
| * | *Epilobium minutum* | | Chaparral willowherb | native | |
| * | *Epilobium pygmaeum* | | Smooth spike-primrose | native | |
| * | *Epilobium torreyi* | | Torrey's spike-primrose | native | |
| | *Ludwigia* sp. | | False loosestrife | | |
| | | | | | |
| | ORCHIDACEAE | | | | |
| | *Epipactis gigantea* | | Stream orchid | native | |
| | | | | | |
| | OROBANCHACEAE | | | | |
| * | *Orobanche fasciculata* | | Clustered broom-rape | native | |
| | *Orobanche uniflora* | | Naked broom-rape | native | |
| | | | | | |
| | PAPAVERACEAE | | | | |
| * | *Eschscholzia caespitosa* | | Foothill poppy | native | |
| * | *Eschscholzia californica* | | California poppy | native | |

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|---|---|---|---|---|---|
| | *Eschscholzia lobbii* | | Fryingpans | native | |
| | *Platystemon californicus* | | Cream cups | native | |
| | | | | | |
| | PINACEAE | | | | |
| | *Pinus sabiniana* | | Gray pine | native | |
| | | | | | |
| | PLANTAGINACEAE | | | | |
| | *Plantago coronopus* | | Cut-leaved plantain | non | |
| | *Plantago elongata* | | Elongate plantain | native | |
| * | *Plantago erecta* | | Erect plantain | native | |
| | *Plantago lanceolata* | | English plantain | non | |
| | *Plantago ovata* | | Ovate plantain | native | |
| | | | | | |
| | POACEAE | | | | |
| | *Aira caryophyllea* | | Silver European hairgrass | non | |
| * | *Alopecurus aequalis* | | Short-awned foxtail | native | |
| | *Alopecurus saccatus* | | Vernal pool foxtail | native | |
| * | *Aristida ternipes* var. *hamulosa* | | Hook three-awn | native | |
| * | *Avena barbata* | | Slender wild oat | non | |
| | *Avena fatua* | | Wild oat | non | |
| | *Briza minor* | | Lesser quaking grass | non | |
| | *Bromus diandrus* | | Ripgut grass | non | |
| | *Bromus hordeaceus* | | Softchess | non | |
| | *Bromus japonicus* | | Japanese brome | non | |
| * | *Bromus madritensis* ssp. *rubens* | | Foxtail chess | non | |
| * | *Crypsis schoenoides* | | Swamp pricklegrass | non | |
| | *Cynodon dactylon* | | Bermuda grass | non | |
| | *Cynosurus echinatus* | | Hedgehog dogtail | non | |
| | *Deschampsia danthonioides* | | Annual hairgrass | native | |
| | *Digitaria ischaemum* | | Smooth crabgrass | non | |
| | *Digitaria sanguinalis* | | Hairy crabgrass | non | |
| | *Distichlis spicata* | | Saltgrass | native | |
| | *Echinochloa crus-galli* | | Barnyard grass | non | |
| | *Elymus elymoides* | | Squirreltail | native | |
| | *Elymus glaucus* | | Wild-rye | native | |
| | *Festuca idahoensis* | | Idaho fescue | native | |
| * | *Gastridium ventricosum* | | Nitgrass | non | |
| * | *Hordeum brachyantherum* ssp. *brachyantherum* | | Meadow barley | native | |
| * | *Hordeum marinum* ssp. *gussoneanum* | | Mediterranean barley | non | |
| | *Hordeum murinum* ssp. *leporinum* | | Hare wall barley | non | |
| | *Koeleria macrantha* | | Junegrass | native | |
| | *Koeleria phleoides* | | Bristly Koeler's grass | non | |
| * | *Leymus triticoides* | | Alkali ryegrass | native | |
| | *Lolium multiflorum* | | Italian ryegrass | non | |
| * | *Melica californica* | | California melic | native | |
| * | *Melica harfordii* | | Harford's melica | native | |
| | *Muhlenbergia rigens* | | Muhly | native | |
| * | *Nassella cernua* | | Nodding needlegrass | native | |
| * | *Nassella pulchra* | | Purple needlegrass | native | |
| | *Paspalum dilatum* | | Dallisgrass | non | |
| | *Phalaris arundinacea* | | Reed canarygrass | native | |
| * | *Phalaris minor* | | Lesser canarygrass | non | |

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|---|---|---|---|---|---|
| * | *Phalaris paradoxa* | | Paradox canarygrass | non | |
| * | *Piptatherum miliaceum* | | Smilo grass | non | |
| | *Poa annua* | | Annual bluegrass | non | |
| | *Poa bulbosa* | | Bulbous bluegrass | non | |
| * | *Poa secunda* ssp. *secunda* | | One-sided bluegrass | native | |
| | *Polypogon interruptus* | | Ditch beardgrass | non | |
| | *Polypogon maritimus* | | Mediterranean beardgrass | non | |
| * | *Polypogon monspeliensis* | | Annual beardgrass | non | |
| | *Sorghum halepense* | | Johnsongrass | non | |
| * | *Taeniatherum caput-medusae* | | Medusa-head | non | |
| * | *Vulpia bromoides* | | Six-weeks fescue | non | |
| * | *Vulpia microstachys* var. *ciliata* | | Fringed fescue | native | |
| * | *Vulpia microstachys* var. *pauciflora* | | Few-flowered fescue | native | |
| * | *Vulpia myuros* var. *hirsuta* | | Foxtail fescue | non | |
| * | *Vulpia myuros* var. *myuros* | | Rattail fescue | non | |
| | | | | | |
| | POLEMONIACEAE | | | | |
| * | *Allophyllum gilioides* ssp. *gilioides* | | | native | |
| | *Collomia tinctoria* | | Yellow-staining collomia | native | |
| * | *Gilia capitata* ssp. *capitata* | | Globe gilia | native | |
| | *Gilia capitata* ssp. *staminea/pedemontana* | | Foothill globe gilia | native | |
| * | *Gilia tricolor* ssp. *tricolor* | | Bird's-eye gilia | native | |
| * | *Linanthus acicularis* | | Bristly linanthus | native | |
| * | *Linanthus bicolor* | | Bicolored linanthus | native | |
| * | *Linanthus bolanderi* | | Bolander's linanthus | native | |
| * | *Linanthus ciliatus* | | Whiskerbrush | native | |
| * | *Linanthus dichotomus* | | Evening-snow | native | |
| * | *Linanthus parviflorus* | | Cherokee linanthus | native | |
| * | *Linanthus pygmaeus* ssp. *continentalis* | | Pygmy linanthus | native | |
| * | *Navarretia heterandra* | | Tehama navarretia | native | CNPS 4 |
| | *Navarretia intertexta* ssp. *intertexta* | | Needle-leaved navarretia | native | |
| * | *Navarretia leucocephala* var. *leucocephala* | | White-flowered navarretia | native | |
| | *Navarretia nigelliformis* ssp. *nigelliformis* | | Adobe navarretia | native | |
| * | *Navarretia pubescens* | | Downy navarretia | native | |
| * | *Navarretia tagetina* | | Marigold navarretia | native | |
| * | *Phlox gracilis* | | Slender phlox | native | |
| | | | | | |
| | POLYGONACEAE | | | | |
| * | *Chorizanthe membranacea* | | Pink spineflower | native | |
| * | *Eriogonum dasyanthemum* | | Wild buckwheat | native | |
| | *Eriogonum nudum* | | Buckwheat | native | |
| * | *Eriogonum wrightii* var. *trachygonum* | | Wright's buckwheat | native | |
| | *Polygonum arenastrum* | | Common knotweed | native | |
| * | *Polygonum californicum* | | California knotweed | native | |
| | *Polygonum douglasii* | | Douglas' knotweed | native | |
| * | *Pterostegia drymarioides* | | Pterostegia | native | |
| | *Rumex crispus* | | Curly dock | non | |
| * | *Rumex pulcher* | | Fiddle dock | non | |
| | | | | | |
| | PORTULACACEAE | | | | |
| | *Calandrinia ciliata* | | Redmaids | non | |
| | *Claytonia exigua* ssp. *exigua* | | Little miner's lettuce | native | |

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|---|---|---|---|---|---|
| | *Claytonia parviflora* | | Small-flowered miner's lettuce | native | |
| | *Claytonia perfoliata* | | Common miner's lettuce | native | |
| | *Lewisia rediviva* | | Bitter-root | native | |
| | *Montia fontana* | | Water chickweed | native | |
| | | | | | |
| | POTAMOGETONACEAE | | | | |
| | *Potamogeton pectinatus* | | Fennel-leaved pondweed | native | |
| | | | | | |
| | PRIMULACEAE | | | | |
| | *Anagallis arvensis* | | Poor man's weatherglass | non | |
| | *Androsace elongata* ssp. *acuta* | | Fairy candelabra | native | CNPS 4 |
| | *Dodecatheon clevelandii* ssp. *patulum* | | Lowland shootingstar | native | |
| | | | | | |
| | PTERIDACEAE | | | | |
| * | *Pellaea andromedifolia* | | Coffee fern | native | |
| * | *Pellaea mucronata* var. *mucronata* | | Bird's-foot fern | native | |
| | *Pentagramma triangularis* ssp. *triangularis* | | Gold-backed fern | native | |
| | | | | | |
| | RANUNCULACEAE | | | | |
| | *Clematis* sp. | | | native | |
| * | *Delphinium hesperium* var. *pallescens* | | Pale larkspur | native | |
| * | *Delphinium patens* ssp. *patens* | | Spreading larkspur | native | |
| * | *Delphinium variegatum* ssp. *variegatum* | | Royal larkspur | native | |
| * | *Myosurus minimus* | | Common mousetail | native | |
| * | *Ranunculus aquatilis* var. *hispidulus* | | Water buttercup | native | |
| * | *Ranunculus californicus* | | California buttercup | native | |
| | *Ranunculus canus* | | Sacramento Valley buttercup | native | |
| * | *Ranunculus hebecarpus* | | Pubescent-fruited buttercup | native | |
| * | *Ranunculus muricatus* | | Prickle-seeded buttercup | non | |
| | | | | | |
| | RHAMNACEAE | | | | |
| | *Ceanothus cuneatus* var. *cuneatus* | | Buck brush | native | |
| * | *Rhamnus ilicifolia* | | Holly-leaf redberry | native | |
| | *Rhamnus tomentella* ssp. *crassifolia* | | Hoary coffeeberry | native | |
| | | | | | |
| | ROSACEAE | | | | |
| * | *Aphanes occidentalis* | | Western lady's mantle | native | |
| | *Cercocarpus betuloides* | | Mountain mahogany | native | |
| | *Heteromeles arbutifolia* | | Toyon | native | |
| | *Malus sylvestris* | | Apple | non | |
| | *Prunus communis* | | Almond | non | |
| * | *Rubus discolor* | | Hymalayan blackberry | non | |
| | | | | | |
| | RUBIACEAE | | | | |
| * | *Galium aparine* | | Goosegrass | native | |
| * | *Galium parisiense* | | Wall bedstraw | non | |
| | *Galium porrigens* var. *tenue* | | Narrow-leaved climbing bedstraw | native | |
| | *Sherardia arvensis* | | Field madder | non | |
| | | | | | |
| | SALICACEAE | | | | |
| | *Populus fremontii* ssp. *fremontii* | | Fremont cottonwood | native | |
| | *Salix breweri* | | Brewer's willow | native | |

| | | | | |
|---|---|---|---|---|
| | *Salix exigua* | Sandbar willow | native | |
| | *Salix laevigata* | Red Willow | native | |
| | *Salix sitchensis* | Sitka willow | native | |
| | | | | |
| | SAURURACEAE | | | |
| | *Anemopsis californica* | California anemopsis | native | |
| | | | | |
| | SAXIFRAGACEAE | | | |
| * | *Lithophragma affine* | Woodland star | native | |
| | *Lithophragma campanulatum* | Bell-shaped woodland star | native | |
| * | *Lithophragma parviflorum* var. *parviflorum* | Small-flowered woodland star | native | |
| | *Saxifraga californica* | California saxifrage | native | |
| | | | | |
| | SCROPHULARIACEAE | | | |
| | *Antirrhinum subcordatum* | Dimorphic snapdragon | native | CNPS 1B |
| | *Bacopa rotundifolia* | Water-hyssop | non | |
| * | *Castilleja affinis* ssp. *affinis* | Lay and Collie's Indian paintbrush | native | |
| * | *Castilleja attenuata* | Valley-tassels | native | |
| * | *Castilleja exserta* ssp. *exserta* | Purple owl-clover | native | |
| | *Castilleja foliolosa* | Woolly Indian paintbrush | native | |
| * | *Collinsia sparsiflora* var. *bruceae* | Bruce's few-flowered collinsia | native | |
| * | *Collinsia sparsiflora* var. *collina* | Collinsia | native | |
| * | *Collinsia sparsiflora* var. *sparsiflora* | Few-flowered collinsia | native | |
| | *Gratiola ebracteata* | Bractless hedge-hyssop | native | |
| | *Kickxia elatine* | Sharp-leaved fluellin | non | |
| | *Mimulus androsaceus* | | native | |
| | *Mimulus cardinalis* | Scarlet monkeyflower | native | |
| | *Mimulus douglasii* | Purple mouse-ears | native | |
| | *Mimulus guttatus* | Seep monkeyflower | native | |
| * | *Mimulus kelloggii* | Kellogg's monkeyflower | native | |
| * | *Penstemon heterophyllus var. purdyi* | Purdy's beardtongue | native | |
| * | *Tonella tenella* | Small-flowered tonella | native | |
| | *Triphysaria eriantha* ssp. *eriantha* | Butter-and-eggs | native | |
| | *Verbascum thapsus* | Woolly mullein | non | |
| | *Veronica catenata* | Chain speedwell | non | |
| * | *Veronica anagallis-aquatica* | Great water speedwell | non | |
| | *Veronica peregrina* ssp. *xalapensis* | Purslane speedwell | native | |
| | | | | |
| | SELAGINELLACEAE | | | |
| | *Selaginella* sp. | Spikemoss | native | |
| | | | | |
| | SIMARUBACEAE | | | |
| | *Ailanthus altissima* | Tree-of-heaven | non | |
| | | | | |
| | SOLANACEAE | | | |
| | *Physalis lancifolia* | Lance-leaved ground-cherry | non | |
| | *Solanum rostratum* | Buffalo-berry | non | |
| | | | | |
| | TAMARICACEAE | | | |
| | *Tamarix* sp. | Tamarisk | non | |
| | | | | |
| | TYPHACEAE | | | |

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|---|---|---|---|---|---|---|
| | *Typha angustifolia* | | Narrow-leaved cattail | native | | |
| | *Typha latifolia* | | Broad-leaved cattail | native | | |
| | | | | | | |
| | VALERIANACEAE | | | | | |
| * | *Plectritis ciliosa* ssp. *ciliosa* | | Long-spurred pink plectritis | native | | |
| * | *Plectritis macrocera* | | White plectritis | native | | |
| | | | | | | |
| | VERBENACEAE | | | | | |
| * | *Phyla nodiflora* var. *nodiflora* | | Creeping lippia | native | | |
| | | | | | | |
| | VIOLACEAE | | | | | |
| | *Viola douglasii* | | Douglas' violet | native | | |
| | | | | | | |
| | VISCACEAE | | | | | |
| | *Arceuthobium occidentale* | | Gray pine dwarf mistletoe | native | | |
| * | *Phoradendron densum* | | Dense mistletoe | native | | |
| | *Phoradendron juniperinum* | | Juniper mistletoe | native | | |
| | *Phorodendron macrophyllum* | | Big-leaved mistletoe | native | | |
| | *Phoradendron villosum* | | Hairy mistletoe | native | | |
| | | | | | | |
| | VITACEAE | | | | | |
| | *Vitis californica* | | California wild grape | native | | |

| **FAMILY** ***Genus species*** | **Common Name** | **Origin** | **Listing** |
|---|---|---|---|
| **Red Bank** | | | |
| | | | |
| ACERACEAE | | | |
| *Acer macrophyllum* | Big-leaved maple | native | |
| | | | |
| ALISMATACEAE | | | |
| *Echinodorus berteroi* | Burhead | native | |
| | | | |
| AMARANTHACEAE | | | |
| *Amaranthus albus* | Tumbleweed | non | |
| *Amaranthus retroflexus* | Red-rooted amaranth | non | |
| | | | |
| ANACARDIACEAE | | | |
| *Rhus trilobata* | Skunkbrush | native | |
| *Toxicodendron diversilobum* | Poison oak | native | |
| | | | |
| APIACEAE | | | |
| *Anthriscus caucalis* | Bur-chervil | non | |
| *Daucus pusillis* | Rattlesnake weed | native | |
| *Levisticum officinale* | Lovage | non | |
| *Lomatium caruifolium* var. *denticulatum* | Foothill lomatium | native | |
| *Lomatium dasycarpum* ssp. *tomentosum* | Woolly-fruited lomatium | native | |
| *Lomatium macrocarpum* | Large-fruited lomatium | native | |
| *Lomatium marginatum* var. *purpureum* | Margined lomatium | native | |
| *Lomatium utriculatum* | Bladder lomatium | native | |
| *Perideridia bolanderi* ssp. *bolanderi* | Bolander's yampah | native | |
| *Perideridia kelloggii* | Kellogg's yampah | native | |
| *Sanicula bipinnata* | Poison sanicle | native | |
| *Sanicula bipinnatifida* | Purple sanicle | native | |
| *Sanicula crassicaulis* | Pacific sanicle | native | |
| *Sanicula tuberosa* | Turkey-pea | native | |
| *Torilis arvensis* | Common hedge-parsley | non | |
| *Yabea microcarpa* | False hedge-parsley | native | |
| | | | |
| APOCYNACEAE | | | |
| *Apocynum cannabinum* | Indian-hemp | native | |
| | | | |
| ASCLEPIADACEAE | | | |
| *Asclepias californica* | California milkweed | native | |
| *Asclepias eriocarpa* | Indian milkweed | native | |
| *Asclepias fascicularis* | Narrow-leaf milkweed | native | |
| *Asclepius speciosa* | Showy milkweed | native | |
| | | | |
| ASTERACEAE | | | |
| *Achillea millefolium* | Yarrow | native | |
| *Achyrachaena mollis* | Blow-wives | native | |
| *Agoseris heterophylla* | Annual agoseris | native | |
| *Ambrosia* sp. | Ragweed | | |

| | | | |
|---|---|---|---|
| *Ancistrocarphus filagineus* | Woolly fishooks | native | |
| *Antennaria* sp. | Pussy-toes | native | |
| *Anthemis cotula* | Mayweed | non | |
| *Artemisia douglasiana* | Mugwort | native | |
| *Baccharis salicifolia* | Mule's fat | native | |
| *Balsamorhiza* sp. | Balsam-root | native | |
| *Blepharipappus scaber* | Rough eyelash | native | |
| *Brickellia californica* | California brickellbush | native | |
| *Calycadenia fremontii* | Fremont's calycadenia | native | |
| *Calycadenia multiglandulosa* | Sticky calycadenia | native | |
| *Calycadenia pauciflora* | Few-flowered calycadenia | native | |
| *Calycadenia truncata* ssp. *scabrella* | Rosinweed | native | |
| *Centaurea cyanus* | Bachelor buttons | native | |
| *Centaurea melitensis* | Tocalote | non | |
| *Centaurea solstitialis* | Yellow star-thistle | non | |
| *Chaenactis glabriuscula* var. *heterocarpha* | Yellow pincushion | native | |
| *Chamomilla suaveolens* | Common pineapple-weed | non | |
| *Cirsium occidentale* var. *venustum* | Venus thistle | native | |
| *Conyza canadensis* | Horseweed | native | |
| *Erigeron divergens* | Spreading daisy | notive | |
| *Erigeron philadelphicus* | Philadelphia daisy | native | |
| *Eriophyllum lanatum* var. *achillaeoides* | Woolly sunflower | native | |
| *Eriophyllum lanatum* var. *grandiflorum* | Woolly sunflower | native | |
| *Euthamia occidentalis* | Western goldenrod | native | |
| *Filago* sp. | Herba impia | | |
| *Gnaphalium luteo-album* | Weedy cudweed | native | |
| *Gnaphalium palustre* | Western marsh cudweed | native | |
| *Gnaphalium stramineum* | Cotton-batting cudweed | native | |
| *Helenium bigelovii* | Sneezeweed | native | |
| *Helenium puberulum* | Rosilla | native | |
| *Helianthella californica* var. *nevadensis* | California helianthella | native | |
| *Helianthus annuus* | Common sunflower | native | |
| *Helianthus bolanderi* | Bolander's sunflower | native | |
| *Hemizonia congesta* ssp. *clevelandii* | Cleveland's tarweed | native | |
| *Hesperevax acaulis* var. *robustior* | Robust evax | native | |
| *Heterotheca oregona* var. *compacta* | Compact oregon golden-aster | native | |
| *Heterotheca oregona* var. *rudis* | Oregon golden-aster | native | |
| *Hypochaeris glabra* | Smooth cat's ear | non | |
| *Hypochaeris radicata* | Rough cat's ear | non | |
| *Lagophylla glandulosa* | Glandular hareleaf | native | |
| *Lagophylla minor* | Lesser hareleaf | native | |
| *Lagophylla ramosissima* ssp. *ramosissima* | Slender hareleaf | native | |
| *Lessingia nemoclada* | Slender-stemmed lessingia | native | |
| *Madia citriodora* | Lemon-scented tarweed | native | |
| *Madia elegans* ssp. *vernalis* | Spring madia | native | |
| *Madia exigua* | Thread-stemmed madia | native | |
| *Madia gracilis* | Slender tarweed | native | |
| *Madia minima* | Dwarf madia | native | |
| *Malacothrix floccifera* | Woolly malacothrix | native | |

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|---|---|---|---|
| *Micropus californicus* var. *californicus* | Slender cottonweed | native | |
| *Microseris douglasii* ssp. *douglasii* | Douglas' microseris | native | |
| *Psilocarphus oregonus* | Oregon woolly marbles | native | |
| *Psilocarphus tenellus* var. *tenellus* | Slender woolly marbles | native | |
| *Rafinesquia californica* | California chicory | native | |
| *Rigiopappus leptocladus* | Riggiopappus | native | |
| *Senecio vulgaris* | Old-man-of-spring | non | |
| *Solidago californica* | California goldenrod | native | |
| *Sonchus asper* ssp. *asper* | Spiny-leaved sow-thistle | non | |
| *Stephanomeria elata* | Santa Barbara stephanomeria | native | |
| *Stephanomeria virgata* ssp. *pleurocarpa* | Wand stephanomeria | native | |
| *Wyethia angustifolia* | Narrow-leaved mule's ears | native | |
| *Wyethia glabra* | Smooth mule's ears | native | |
| *Wyethia helenioides* | Gray mule's ears | native | |
| *Xanthium strumarium* | Cocklebur | native | |
| | | | |
| BETULACEAE | | | |
| *Alnus rhombifolia* | White alder | native | |
| | | | |
| BORAGINACEAE | | | |
| *Amsinckia lycopsoides* | Bugloss fiddleneck | native | |
| *Amsinckia menziesii* var. *intermedia* | Common fiddleneck | native | |
| *Amsinkia menziesii* var. *menziesii* | Common fiddleneck | native | |
| *Cryptantha flaccida* | Weak-stemmed cryptantha | native | |
| *Cryptantha intermedia* | Common cryptantha | native | |
| *Cynoglossum grande* | Hound's tongue | | |
| *Heliotropium curassavicum* | Wild heliotrope | native | |
| *Heliotropium europaeum* | European heliotrope | non | |
| *Pectocarya pusilla* | Little pectocarya | native | |
| *Plagiobothrys glyptocarpus* var. *glyptocarpus* | Sculptured popcornflower | native | |
| *Plagiobothrys fulvus* | Fulvous popcornflower | | |
| *Plagiobothrys nothofulvous* | Common popcornflower | native | |
| *Plagiobothrys scriptus* | Scribe's popcornflower | native | |
| *Plagiobothrys tenellus* | Slender popcornflower | native | |
| | | | |
| BRASSICACEAE | | | |
| *Arabis breweri* var. *breweri* | Brewer's rockcress | native | |
| *Athysanus pusillus* | Petty athysanus | native | |
| *Brassica nigra* | Black mustard | non | |
| *Capsella bursa-pastoris* | Shepherd's purse | non | |
| *Cardamine oligosperma* | Western bittercress | native | |
| *Draba verna* | Spring whitlow-grass | non | |
| *Erysimum capitatum* ssp. *capitatum* | Western wallflower | native | |
| *Lepidium latifolium* | Tall white-top | non | |
| *Lepidium latipes* var. *latipes* | Dwarf peppergrass | native | |
| *Lepidium nitidum* var. *nitidum* | Shining peppergrass | native | |
| *Lepidium strictum* | Upright peppergrass | native | |
| *Rorippa nasturtium-aquaticum* | Watercress | native | |
| *Sisymbrium officianale* | Hedge-mustard | non | |

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|---|---|---|---|
| *Streptanthus drepanoides* | Jewelflower | native | CNPS 4 |
| *Thysanocarpus curvipes* | Fringepod | native | |
| *Tropidocarpum gracile* | Slender tropidocarpum | native | |
| | | | |
| CALLITRICHACEAE | | | |
| *Callitriche marginata* | Winged water-starwort | native | |
| | | | |
| CAMPANULACEAE | | | |
| *Githopsis specularioides* | Common bluecup | native | |
| *Heterocodon rariflorum* | Heterocodon | native | |
| *Nemacladus montanum* | | native | |
| *Triodanis biflora* | Small Venus'-looking-glass | native | |
| | | | |
| CAPRIFOLIACEAE | | | |
| *Lonicera interrupta* | Chaparral honeysuckle | native | |
| *Sambucus mexicana* | Blue elderberry | native | |
| *Symphoricarpus albus* var. *laevigatus* | Common snowberry | native | |
| | | | |
| CARYOPHYLLACEAE | | | |
| *Cerastium glomeratum* | Sticky mouse-eared chickweed | non | |
| *Herniaria hirsuta* ssp. *hirsuta* | Gray herniaria | non | |
| *Herniaria hirsuta* ssp. *cinerea* | | non | |
| *Minuartia californica* | California sandwort | native | |
| *Minuartia douglasii* | Douglas' sandwort | native | |
| *Petrorhagia dubia* | Grass pink | non | |
| *Scleranthus annuus* ssp. *annuus* | Knawel weed | non | |
| *Silene californica* | Indian pink | native | |
| *Spergularia marina* | Salt-marsh sandspurry | native | |
| *Spergularia rubra* | Ruby sandspurry | non | |
| *Stellaria media* | Common chickweed | non | |
| *Stellaria nitens* | Shiny starwort | native | |
| | | | |
| CHENOPODIACEAE | | | |
| *Chenopodium botrys* | Jerusalem-oak | non | |
| *Chenopodium californicum* | California goosefoot | native | |
| *Chenopodium foliosum* | Leafy goosefoot | non | |
| | | | |
| CONVOLVULACEAE | | | |
| *Calystegia occidentalis* ssp. *occidentalis* | Western morning-glory | native | |
| *Convolvulus arvensis* | Field bindweed | non | |
| | | | |
| CORNACEAE | | | |
| *Cornus glabrata* | Brown dogwood | native | |
| | | | |
| CRASSULACEAE | | | |
| *Crassula connata* | Pygmy weed | native | |
| | | | |
| CUCURBITACEAE | | | |
| *Marah fabaceus* | California manroot | native | |

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|---|---|---|---|
| CUPRESSACEAE | | | |
| *Calocedrus decurrens* | Incense cedar | native | |
| *Juniperus californica* | California juniper | native | |
| | | | |
| CYPERACEAE | | | |
| *Carex nudata* | Torrent sedge | native | |
| *Cyperus eragrostis* | Tall cyperus | native | |
| *Eleocharis macrostachya* | Pale spikerush | native | |
| *Scirpus pungens* | Common threesquare | native | |
| | | | |
| DATISCACEAE | | | |
| *Datisca glomerata* | Durango root | native | |
| | | | |
| DIPSACEAE | | | |
| *Dipsacus fullonum* | Wild teasel | non | |
| | | | |
| EQUISETACEAE | | | |
| *Equisetum arvense* | Common horsetail | native | |
| *Equisetum laevigatum* | Smooth scouring-rush | native | |
| | | | |
| ERICACEAE | | | |
| *Arctostaphylos manzanita* ssp. *manzanita* | Manzanita | native | |
| *Arctostaphylos manzanita* ssp. *wieslanderi* | Manzanita | native | |
| | | | |
| EUPHORBIACEAE | | | |
| *Chamaesyce glyptosperma* | Rib-seeded spurge | | |
| *Chamaesyce maculata* | Spotted spurge | non | |
| *Chamaesyce ocellata* ssp. *rattanii* | Stony Creek spurge | native | CNPS 4 |
| *Chamaesyce serpyllifolia* ssp. *serpyllifolia* | Thyme-leaved spurge | native | |
| *Eremocarpus setigerus* | Turkey mullein | native | |
| *Euphorbia crenulata* | Chinese caps | native | |
| *Euphorbia spathulata* | Warty spurge | native | |
| | | | |
| FABACEAE | | | |
| *Astragalus gambelianus* | Gambel's milkvetch | native | |
| *Astragalus rattanii* var. *jepsonianus* | Jepson's milkvetch | native | CNPS 1B |
| *Cercis occidentalis* | Western redbud | native | |
| *Lathyrus cicera* | Chick pea | non | |
| *Lotus humistratus* | Foothill lotus | native | |
| *Lotus purshianus* var. *purshianus* | Spanish lotus | native | |
| *Lupinus bicolor* | Bicolored lupine | native | |
| *Lupinus microcarpus* var. *densiflorus* | White-whorled lupine | native | |
| *Lupinus nanus* | Sky lupine | native | |
| *Medicago lupulina* | Black medic | non | |
| *Medicago polymorpha* | Common bur-clover | non | |
| *Melilotus alba* | White sweetclover | non | |
| *Melilotus indica* | Sourclover | non | |
| *Melilotus officinalis* | Yellow sweetclover | non | |

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|---|---|---|---|---|
| *Trifolium albopurpurpeum* var. *albopurpureum* | Indian clover | native | | |
| *Trifolium bifidum* var. *bifidum* | Notch-leaved clover | native | | |
| *Trifolium bifidum* var. *decipiens* | Deceptive clover | native | | |
| *Trifolium campestre* | Hop clover | non | | |
| *Trifolium ciliolatum* | Foothill clover | native | | |
| *Trifolium depauperatum* ssp. *depauperatum* | Dwarf cowbag clover | native | | |
| *Trifolium fucatum* | Sour clover | native | | |
| *Trifolium hirtum* | Rose clover | non | | |
| *Trifolium monanthum* var. *monanthum* | Carpet clover | native | | |
| *Trifolium obtusiflorum* | Clammy clover | native | | |
| *Trifolium variegatum* | White-tipped clover | native | | |
| *Trifolium willdenovii* | Tomcat clover | native | | |
| *Trifolium wormskioldii* | Springbank clover | native | | |
| *Vicia sativa* ssp. *sativa* | Spring vetch | non | | |
| | | | | |
| FAGACEAE | | | | |
| *Quercus agrifolia* var. *agrifolia* | Coast live oak | native | | |
| *Quercus berberidifolia* | Scrub oak | native | | |
| *Quercus chrysolepis* | Canyon live oak | native | | |
| *Quercus douglasii* | Blue oak | native | | |
| *Quercus lobata* | Valley oak | native | | |
| *Quercus wislizenii* var. *wislizenii* | Interior live oak | native | | |
| | | | | |
| GARRYACEAE | | | | |
| *Garrya congdonii* | Congdon's silk tassel | native | | |
| *Garrya elliptica* | Elliptic silk tassel | native | | |
| | | | | |
| GENTIANACEAE | | | | |
| *Centaurium muhlenbergii* | June centaury | native | | |
| *Centaurium trichanthum* | Alkali centaury | native | | |
| *Centaurium venustum* | Canchalagua | native | | |
| | | | | |
| GERANIACEAE | | | | |
| *Erodium botrys* | Long-beaked stork's bill | non | | |
| *Erodium cicutarium* | Red-stemmed filaree | non | | |
| *Erodium moschatum* | White-stemmed filaree | non | | |
| *Geranium dissectum* | Cut-leaved geranium | non | | |
| *Geranium molle* | Dove's-foot geranium | non | | |
| | | | | |
| HIPPOCASTANACEAE | | | | |
| *Aesculus californica* | California buckeye | native | | |
| | | | | |
| HYDROCHARITACEAE | | | | |
| *Najas guadalupensis* | Common water-nymph | native | | |
| | | | | |
| HYDROPHYLLACEAE | | | | |
| *Eriodictyon californicum* | California yerba santa | native | | |
| *Nemophila heterophylla* | Variable-leaved nemophila | native | | |
| *Nemophila pedunculata* | Meadow nemophila | native | | |

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|---|---|---|---|
| *Phacelia ramosissima* var. *ramosissima* | Branched phacelia | native | |
| | | | |
| HYPERICACEAE | | | |
| *Hypericum formosum* var. *scouleri* | Scouler's St. John's wort | native | |
| *Hypericum perforatum* | Klamath weed | non | |
| | | | |
| IRIDACEAE | | | |
| *Iris* sp. | Iris | native | |
| *Sisyrinchium bellum* | Blue-eyed grass | native | |
| *Sisyrinchium douglasii* var. *douglasii* | Purple-eyed grass | native | |
| | | | |
| JUGLANDACEAE | | | |
| *Juglans californica* var. *hindsii* | California walnut | native | CNPS 1B |
| | | | |
| JUNCACEAE | | | |
| *Juncus bufonius* var. *bufonius* | Common toadrush | native | |
| *Juncus xiphioides* | Iris-leaved rush | native | |
| | | | |
| LAMIACEAE | | | |
| *Lamium amplexicaule* | Giraffehead | non | |
| *Marrubium vulgare* | Horehound | non | |
| *Mentha arvensis* var. *canadensis* | American wild mint | native | |
| *Mentha pulegium* | Pennyroyal | non | |
| *Mentha spicata* var. *spicata* | Spearmint | non | |
| *Monardella sheltonii* | Shelton's coyote-mint | native | |
| *Salvia columbariae* | Chia | native | |
| *Scutellaria antirrhinoides* | Skullcap | native | |
| *Scutellaria siphocampyloides* | Gray-leaved skullcap | native | |
| *Stachys ajugoides* var. *rigida* | Rigid hedge-nettle | native | |
| *Stachys stricta* | Sonoma hedge-nettle | native | |
| *Trichostema laxum* | Turpentine weed | native | |
| | | | |
| LAURACEAE | | | |
| *Unbellaria californica* | California bay | native | |
| | | | |
| LILIACEAE | | | |
| *Allium peninsulare* var. *peninsulare* | Mexican onion | native | |
| *Brodiaea elegans* ssp. *elegans* | Elegant brodiaea | native | |
| *Brodiaea californica* var. *californica* | California brodiaea | native | |
| *Calochortus albus* | Fairy lantern | native | |
| *Calochortus amabilis* | Diogene's lantern | native | |
| *Calochortus luteus* | Yellow mariposa lily | native | |
| *Chlorogalum pomeridianum* | Soap plant | native | |
| *Dichelostemma capitatum* ssp. *capitatum* | Bluedicks | native | |
| *Dichelostemma multiflorum* | Round-toothed ookow | native | |
| *Dichelostemma volubile* | Climbing brodiaea | native | |
| *Erythronium californicum* | Trout lily | native | |
| *Fritillaria affinis* var. *affinis* | Checkered fritillary | native | |
| *Fritillaria pluriflora* | Adobe lily | native | SC/1B |

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|---|---|---|---|
| *Odontostomum hartwegii* | Hartweg's odontostomum | native | |
| *Triteleia ixioides* ssp. *scabra* | Golden brodiaea | native | |
| *Triteleia laxa* | Ithuriel's spear | native | |
| *Triteleia hyacinthina* | Wild hyacinth | native | |
| *Zigadenus fremontii* | Fremont's zigadene | native | |
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| LIMNANTHACEAE | | | |
| *Limnanthes douglasii* ssp. *nivea* | Table mountain meadowfoam | native | |
| *Limnanthes floccosa* ssp. *floccosa* | Woolly meadowfoam | native | CNPS 4 |
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| LINACEAE | | | |
| *Hesperolinon californicum* | California western flax | native | |
| *Hesperolinon disjunctum* | | native | |
| *Hesperolinon micranthum* | Small-flowered dwarf flax | native | |
| *Hesperolinon spergulinum* | Dwarf flax | native | |
| | | | |
| LOASACEAE | | | |
| *Mentzelia laevicaulis* | Giant blazingstar | native | |
| | | | |
| LYTHRACEAE | | | |
| *Lythrum hyssopifolium* | Hyssop loosestrife | non | |
| | | | |
| MALVACEAE | | | |
| *Malacothamnus fremontii* | Bush mallow | native | |
| *Sidalcea hartwegii* | Hartweg's sidalcea | native | |
| *Sidalcea hirsuta* | Hairy sidalcea | native | |
| | | | |
| OLEACEAE | | | |
| *Fraxinus dipetala* | California ash | native | |
| | | | |
| ONAGRACEAE | | | |
| *Camissonia graciliflora* | Hill sun cup | native | |
| *Clarkia concinna* ssp. *concinna* | Red ribbons | native | |
| *Clarkia gracilis* ssp. *gracilis* | Slender clarkia | native | |
| *Clarkia lassenensis* | Mt. Lassen clarkia | native | |
| *Clarkia modesta* | | native | |
| *Clarkia purpurea* ssp. *purpurea* | Purple clarkia | native | |
| *Clarkia purpurea* ssp.*quadrivulnera* | Purple clarkia | native | |
| *Clarkia rhomboidea* | Diamond clarkia | native | |
| *Epilobium brachycarpum* | Tall annual willowherb | native | |
| *Epilobium ciliatum* ssp. *ciliatum* | Fringed willowherb | native | |
| *Epilobium cleistogamum* | Cleistogamous spike-primrose | native | |
| *Epilobium foliosum* | Small-flowered willowherb | native | |
| *Epilobium minutum* | Chaparral willowherb | native | |
| | | | |
| ORCHIDACEAE | | | |
| *Piperia* sp. | Piperia | native | |
| *Spiranthes porrifolia* | Western ladies-tresses | native | |
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|---|---|---|---|
| OROBANCHACEAE | | | |
| *Orobanche fasciculata* | Clustered broomrape | native | |
| *Orobanche uniflora* | Naked broom-rape | native | |
| | | | |
| PAPAVERACEAE | | | |
| *Eschscholzia caespitosa* | Foothill poppy | native | |
| *Eschscholzia californica* | California poppy | native | |
| *Eschscholzia lobbii* | Fryingpans | native | |
| *Platystemon californicus* | California creamcups | native | |
| | | | |
| PHILADELPHACEAE | | | |
| *Philadelphus lewisii* | Mock orange | native | |
| | | | |
| PINACEAE | | | |
| *Pinus sabiniana* | Foothills pine | native | |
| | | | |
| PLANTAGINACEAE | | | |
| *Plantago erecta* | Erect plantain | native | |
| *Plantago lanceolata* | English plantain | non | |
| | | | |
| POACEAE | | | |
| *Achnatherum lemmonii* | Lemmon's needlgrass | native | |
| *Aegilops cylindrica* | Jointed goatgrass | non | |
| *Agrostis exarata* | Spiked bentgrass | native | |
| *Aira caryophyllea* | Silver European hairgrass | non | |
| *Avena fatua* | Wild oat | non | |
| *Briza minor* | Lesser quaking-grass | non | |
| *Bromus diandrus* | Ripgut brome | non | |
| *Bromus hordeaceus* | Softchess | non | |
| *Bromus japonicus* | Japanese brome | non | |
| *Bromus laevipes* | Woodland brome | native | |
| *Bromus madritensis* ssp. *madritensis* | Foxtail chess | non | |
| *Bromus madritensis* ssp. *rubens* | Red brome | non | |
| *Bromus tectorum* | Cheatgrass | non | |
| *Crypsis schoenoides* | Swamp pricklegrass | non | |
| *Cynodon dactylon* | Bermuda grass | non | |
| *Cynosurus echinatus* | Hedgehog dogtail | non | |
| *Deschampsia danthonioides* | Annual hairgrass | native | |
| *Echinochloa crus-galli* | Barnyard grass | non | |
| *Elymus glaucus* ssp. *glaucus* | Blue wild-rye | native | |
| *Elymus multisetus* | Big squirreltail | native | |
| *Elymus trachycaulis* ssp. *subsecundus* | Wheatgrass | native | |
| *Elytrigia elongata* | Elongate wheatgrass | non | |
| *Elytrigia pontica* ssp. *pontica* | Tall wheatgrass | non | |
| *Gastridium ventricosum* | Nitgrass | non | |
| *Hordeum marinum* ssp. *gussoneanum* | Mediterranean barley | non | |
| *Hordeum murinum* ssp. *leporinum* | Hare wall barley | non | |
| *Leymus* sp. | Ryegrass | native | |
| *Lolium multiflorum* | Italian ryegrass | non | |

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|---|---|---|---|
| *Melica californica* | California melic | native | |
| *Melica torreyana* | Torrey's melica | native | |
| *Muhlenbergia rigens* | Muhly | native | |
| *Nassella cernua* | Nodding needlegrass | native | |
| *Nassella lepida* | Small-flowered needlegrass | native | |
| *Nassella pulchra* | Purple needlegrass | native | |
| *Panicum capillare* | Witchgrass | native | |
| *Phalaris aquatica* | Harding-grass | non | |
| *Phalaris minor* | Lesser canary grass | non | |
| *Piptatherum miliaceum* | Smilograss | non | |
| *Poa annua* | Annual bluegrass | non | |
| *Poa bulbosa* | Bulbous bluegrass | non | |
| *Poa secunda* ssp. *secunda* | One-sided bluegrass | native | |
| *Polypogon maritimus* | Mediterranean beardgrass | non | |
| *Taeniatherum caput-medusae* | Medusa-head | non | |
| *Vulpia microstachys* var. *ciliata* | Fringed fescue | native | |
| *Vulpia microstachys* var. *pauciflora* | Few-flowered fescue | native | |
| *Vulpia myuros* var. *hirsuta* | Foxtail fescue | non | |
| | | | |
| POLEMONIACEAE | | | |
| *Eriastrum abramsii* | Abram's eriastrum | native | |
| *Eriastrum brandegeae* | Brandegee's eriastrum | native | SC/1B |
| *Gilia capitata* ssp. *capitata* | Globe gilia | native | |
| *Gilia tricolor* | Bird's-eye gilia | native | |
| *Linanthus bicolor* | Bicolored linanthus | native | |
| *Linanthus bolanderi* | Bolander's linanthus | native | |
| *Linanthus ciliatus* | Whiskerbrush | native | |
| *Linanthus dichotomus* | Evening snow | native | |
| *Linanthus parviflorus* | Cherokee linanthus | native | |
| *Navarretia heterandra* | Tehama navarretia | native | CNPS 4 |
| *Navarretia intertexta* ssp. *intertexta* | Needle-leaved navarretia | native | |
| *Navarretia jepsonii* | Jepson's navarretia | native | CNPS 4 |
| *Navarretia pubescens* | Downy navarretia | native | |
| *Navarretia tagetina* | Marigold navarretia | native | |
| *Navarretia viscidula* | Sticky navarretia | native | |
| *Phlox gracilis* | Slender phlox | native | |
| | | | |
| POLYGONACEAE | | | |
| *Chorizanthe membranacea* | Pink spineflower | native | |
| *Eriogonum compositum* var. *compositum* | Arrow-leaved buckwheat | native | |
| *Eriogonum dasyanthemum* | Wild buckwheat | native | |
| *Eriogonum nudum* var. *nudum* | Naked buckwheat | native | |
| *Eriogonum nudum* var. *oblongifolium* | Hairy-stemmed buckwheat | native | |
| *Polygonum arenastrum* | Common knotweed | non | |
| *Rumex crispus* | Curly dock | native | |
| *Rumex salicifolius* var. *denticulatus* | Smooth-valved willow dock | native | |
| | | | |
| PORTULACACEAE | | | |
| *Calandrinia ciliata* | Redmaids | native | |

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|---|---|---|---|---|
| *Claytonia exigua* ssp. *exigua* | Little miner's lettuce | native | | |
| *Claytonia parviflora* ssp. *parviflora* | Miner's lettuce | native | | |
| *Claytonia perfoliata* | Common miner's lettuce | native | | |
| *Montia fontana* | Water montia | native | | |
| *Portulaca oleracea* | Common purslane | non | | |
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| POTAMOGETONACEAE | | | | |
| *Potamogeton pectinatus* | Fennel-leaf pondweed | native | | |
| | | | | |
| PRIMULACEAE | | | | |
| *Anagallis arvensis* | Scarlet pimpernel | non | | |
| *Androsace elongata* ssp. *acuta* | Fairy candelabra | native | | CNPS 4 |
| *Dodecatheon hendersonii* | Henderson's shootingstar | native | | |
| | | | | |
| PTERIDACEAE | | | | |
| *Adiantum jordanii* | California maidenhair | native | | |
| *Pellaea andromedifolia* | Coffee fern | native | | |
| *Pentagramma triangularis* ssp. *triangularis* | Gold-backed fern | native | | |
| | | | | |
| RANUNCULACEAE | | | | |
| *Clematis lasiantha* | Chaparral clematis | native | | |
| *Clematis ligusticifolia* | Virgin's-bower | native | | |
| *Delphinium hansenii* ssp. *hansenii* | Hansen's larkspur | native | | |
| *Delphinium hesperium* ssp. *pallescens* | Pale larkspur | native | | |
| *Delphinium patens* ssp. *patens* | Spreading larkspur | native | | |
| *Ranunculus californicus* | California buttercup | native | | |
| *Ranunculus hebecarpus* | Pubescent-fruited buttercup | native | | |
| *Ranunculus muricatus* | Prickle-seeded buttercup | non | | |
| *Ranunculus occidentalis* | Western buttercup | native | | |
| *Thalictrum fendleri* var. *polycarpum* | Many-fruited meadow-rue | native | | |
| | | | | |
| RHAMNACEAE | | | | |
| *Ceanothus cuneatus* var. *cuneatus* | Buckbrush | native | | |
| *Ceanothus integerrimus* | Deerbrush | native | | |
| *Rhamnus californica* | California coffeeberry | native | | |
| *Rhamnus ilicifolia* | Holly-leaved redberry | native | | |
| *Rhamnus tomentella* ssp. *tomentella* | Hoary coffeeberry | native | | |
| | | | | |
| ROSACEAE | | | | |
| *Adenostoma fasciculatum* | Chamise | native | | |
| *Aphanes occidentalis* | Western lady's-mantle | non | | |
| *Cercocarpus betuloides* var. *betuloides* | Birch-leaved mountain mahogany | native | | |
| *Heteromeles arbutifolia* | Toyon | native | | |
| *Prunus* sp. | Cherry | | | |
| *Rosa californica* | California rose | native | | |
| *Rosa woodsii* var. *ultramontanus* | Interior rose | native | | |
| *Rubus discolor* | Blackberry | non | | |
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| RUBIACEAE | | | | |

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|---|---|---|---|
| *Crucianella angustifolia* | Crosswort | non | |
| *Galium aparine* | Cleavers | native | |
| *Galium parisiense* | Wall bedstraw | non | |
| *Galium porrigens* var. *tenue* | Narrow-leaved climbing bedstraw | native | |
| *Sherardia arvensis* | Field-madder | non | |
| | | | |
| SALICACEAE | | | |
| *Populus fremontii* ssp. *fremontii* | Fremont's cottonwood | native | |
| *Salix exigua* | Sandbar willow | native | |
| *Salix laevigata* | Red willow | native | |
| *Salix lasiolepis* | Arroyo willow | native | |
| *Salix lucida* ssp. *lasiandra* | Shining willow | native | |
| | | | |
| SAXIFRAGACEAE | | | |
| *Lithophragma parviflorum* var. *parviflorum* | Small-flowered woodland star | native | |
| *Saxifraga californica* | California saxifrage | native | |
| | | | |
| SCROPHULARIACEAE | | | |
| *Antirrhinum cornutum* | Spurred snapdragon | native | |
| *Antirrhinum subcordatum* | Dimorphic snapdragon | native | CNPS 1B |
| *Castilleja affinis* ssp. *affinis* | Lay-and-Collie's Indian paintbrush | native | |
| *Castilleja attenuata* | Valley tassels | native | |
| *Castilleja campestris* ssp. *campestris* | Field owl-clover | native | |
| *Castillja foliolosa* | Woolly Indian paintbrush | native | |
| *Castilleja rubicundula* ssp. *lithospermoides* | Cream sacs | native | |
| *Collinsia sparsiflora* var. *collina* | Collinsia | native | |
| *Collinsia sparsiflora* var. *sparsiflora* | Few-flowered collinsia | native | |
| *Keckiella corymbosa* | Redwood keckiella | native | |
| *Keckiella lemmonii* | Lemmon's keckiella | native | |
| *Mimulus cardinalis* | Scarlet monkeyflower | native | |
| *Mimulus floribundus* | Floriferous monkeyflower | native | |
| *Mimulus guttatus* | Seep monkeyflower | native | |
| *Mimulus kelloggii* | Kellogg's monkeyflower | native | |
| *Mimulus moschatus* | Musk monkeyflower | native | |
| *Mimulus pilosus* | Downy mimetanthe | native | |
| *Penstemon heterophyllus* var. *heterophyllus* | Foothill beardtongue | native | |
| *Penstemon heterophyllus* var. *purdyi* | Foothill beardtongue | native | |
| *Scrophularia californica* | California figwort | native | |
| *Tonella tenella* | Small-flowered tenella | native | |
| *Triphysaria eriantha* ssp. *eriantha* | Johnnytuck | native | |
| *Triphysaria pusilla* | Dwarf owl-clover | native | |
| *Verbascum blattaria* | Moth mullein | non | |
| *Verbascum thapsus* | Woolly mullein | non | |
| *Veronica anagallis-aquatica* | Great water speedwell | non | |
| *Veronica catenata* | Chain speedwell | non | |
| *Veronica peregrina* ssp. *xalapensis* | Purslane speedwell | native | |
| | | | |
| SOLANACEAE | | | |
| *Nicotiana quadrivalvis* | Indian tobacco | native | |

| | | | | |
|---|---|---|---|---|
| *Solanum nigrum* | Black nightshade | non | | |
| *Solanum parishii* | Parish's nightshade | native | | |
| | | | | |
| STYRACACEAE | | | | |
| *Styrax officinalis* var. *redivivus* | Snowdrop bush | native | | |
| | | | | |
| TAMARICACEAE | | | | |
| *Tamarix gallica* | French tamarisk | non | | |
| *Tamarix ramosissima* | Branched tamarisk | non | | |
| | | | | |
| VALERIANACEAE | | | | |
| *Plectritis ciliosa* ssp. *ciliosa* | Long-spurred pink plectritis | native | | |
| *Plectritis macrocera* | White plectritis | native | | |
| | | | | |
| VERBENACEAE | | | | |
| *Verbena hastata* | Halberd-leaved vervain | native | | |
| *Verbena lasiostachys* var. *scabrida* | Western vervain | native | | |
| *Verbena lasiostachys* var. *lasiostachys* | Western vervain | native | | |
| | | | | |
| VISCACEAE | | | | |
| *Arceuthobium occidentale* | Gray pine dwarf-mistletoe | native | | |
| *Phoradendron villosum* | Oak mistletoe | native | | |
| | | | | |
| VITACEAE | | | | |
| *Vitis californica* | California wild grape | native | | |

January 4, 2000

# ATTACHMENT 6.

## OFFSTREAM STORAGE RESERVOIR ALTERNATIVES:

## 1998-1999 plant voucher collection

| Plant Voucher -- plant specimen collected and preserved as proof for species named on this list. | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
| | | | | | |
| ACERACEAE | | | | | |
| *Acer macrophyllum* | Red Bank | 99-134 | 14-Jun | B. Castro | |
| | | | | | |
| ALISMATACEAE | | | | | |
| *Damasonium californicum* | Sites | 98-1 | 1-Jul | J. Marr | |
| *Damasonium californicum* | Newville | 98-708 | 1-Jul | C. Warren | |
| *Echinodorus berteroi* | Red Bank | 98-852 | 7-Jul | J. Cunningham | |
| *Echinodorus berteroi* | Newville | 99-135 | 1-Jun | B. Castro | |
| | | | | | |
| AMARANTHACEAE | | | | | |
| *Amarathus albus* | Newville | 98-2 | 15-Jul | J. Marr | |
| *Amarathus albus* | Red Bank | 98-853 | 7-Jul | J. Cunningham | |
| | | | | | |
| ANACARDIACEAE | | | | | |
| *Rhus trilobata* | Newville | 99-40 | 9-Jun | J. Witzman | |
| | | | | | |
| APIACEAE | | | | | |
| Undetermined | Newville | 98-709 | 30-Mar | C. Warren | |
| Undetermined | Newville | 98-710 | 11-May | C. Warren | |
| *Anthriscus caucalis* | Newville | 98-854 | 27-Apr | J. Cunningham | |
| *Daucus pusillus* | Newville | 98-855 | 28-Apr | J. Cunningham | |
| *Daucus pusillus* | Newville | 98-856 | 14-May | J. Cunningham | |
| *Daucus pusillus* | Newville | 98-857 | 14-May | J. Cunningham | |
| *Daucus pusillus* | Sites | 98-3 | 4-May | J. Marr | |
| *Daucus pusillus* | Newville | 98-4 | 30-Apr | J. Marr | |
| *Eryngium castrense* | Sites | 99-301 | 1-Jul | J. Marr | |
| *Eryngium castrense* | Newville | 98-5 | 14-Jul | J. Marr | |
| *Levisticum officinale* | Red Bank | 98-6 | 9-Jun | J. Marr | |
| *Lomatium* sp. | Sites | 99-302 | 18-Feb | J. Marr | |
| *Lomatium carvifolium* | Sites | 99-39 | 23-Mar | B. Hendrickson | |
| *Lomatium carvifolium* var. *denticulatum* | Red Bank | 99-136 | 18-May | B. Castro | |
| *Lomatium dasycarpum* ssp. *dasycarpum* | Newville | 98-7 | 29-Apr | J. Marr | |
| *Lomatium dasycarpum* ssp. *tomentosum* | Newville | 98-8 | 20-Mar | J. Marr | |
| *Lomatium dasycarpum* ssp. *tomentosum* | Newville | 98-9 | 20-Mar | J. Marr | |
| *Lomatium macrocarpum* | Red Bank | 98-10 | 2-Apr | J. Marr | |
| *Lomatium marginatum* var. *marginatum* | Newville | 98-11 | 19-Mar | J. Marr | |
| *Lomatium marginatum* var. *marginatum* | Newville | 98-12 | 29-Apr | J. Marr | |
| *Lomatium marginatum* var. *purpureum* | Newville | 98-13 | 20-Mar | J. Marr | |
| *Lomatium marginatum* var. *purpureum* | Newville | 99-137 | 9-Apr | B. Castro | |
| *Lomatium marginatum* var. *purpureum* | Sites | 99-138 | 12-Apr | B. Castro | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Lomatium utriculatum* | Newville | 98-14 | 20-Apr | J. Marr | |
| *Lomatium utriculatum* | Newville | 98-15 | 28-Mar | J. Marr | |
| *Lomatium utriculatum* | Newville | 99-280 | 5-May | B. Castro | |
| *Lomatium utriculatum* | Newville | 99-139 | 4-May | B. Castro | |
| *Perideridia bolanderi* ssp. *bolanderi* | Red Bank | 98-711 | 27-Aug | C. Warren | |
| *Perideridia kelloggii* | Red Bank | 98-16 | 3-Jul | J. Marr | |
| *Perideridia kelloggii* | Red Bank | 98-17 | 15-Jun | J. Marr | |
| *Perideridia kelloggii* | Red Bank | 98-18 | 27-Aug | J. Marr | |
| *Perideridia kelloggii* | Red Bank | 98-645 | 27-Aug | H. West | |
| *Perideridia kelloggii* | Red Bank | 99-140 | 21-Jun | B. Castro | |
| *Sanicula crassicaulis* | Red Bank | 99-303 | 28-Apr | J. Marr | |
| *Sanicula tuberosa* | Red Bank | 99-141 | 23-Mar | B. Castro | |
| *Sanicula tuberosa* | Red Bank | 99-304 | 28-Apr | J. Marr | |
| *Torilis arvensis* | Newville | 98-19 | 29-Apr | J. Marr | |
| *Torilis arvensis* | Newville | 98-20 | 17-Apr | J. Marr | |
| *Torilis nodosa* | Sites | 98-21 | 27-May | J. Marr | |
| *Torilis nodosa* | Newville | 98-22 | 11-May | J. Marr | |
| *Torilis nodosa* | Newville | 98-859 | 4-May | J. Cunningham | |
| *Torilis nodosa* | Newville | 98-860 | 18-May | J. Cunningham | |
| *Yabea microcarpa* | Red Bank | 98-23 | 20-May | J. Marr | |
| *Yabea microcarpa* | Sites | 99-1 | 21-Apr | B. Hendrickson | |
| *Yabea microcarpa* | Newville | 99-142 | 14-Apr | B. Castro | |
| | | | | | |
| APOCYANACEAE | | | | | |
| *Apocyanum cannabinum* | Red Bank | 99-2 | | B. Hendrickson | |
| *Apocyanum cannabinum* | Newville | 99-41 | 9-Jun | J. Witzman | |
| *Apocyanum cannabinum* | Red Bank | 99-306 | 27-May | J. Marr | |
| | | | | | |
| ASCLEPIADACEAE | | | | | |
| *Asclepias eriocarpa* | Red Bank | 99-69 | 10-Apr | L. Janeway | |
| *Asclepias eriocarpa* | Newville | 99-143 | 1-Jun | B. Castro | |
| *Asclepias fascicularis* | Red Bank | 98-24 | 2-Jul | J. Marr | |
| *Asclepias fascicularis* | Red Bank | 98-25 | 8-Jul | J. Marr | |
| *Asclepias fascicularis* | Red Bank | 98-861 | 25-Jun | J. Cunningham | |
| *Asclepias speciosa* | Red Bank | 99-70 | 14-Apr | L. Janeway | |
| | | | | | |
| ASTERACEAE | | | | | |
| Undetermined | Red Bank | 98-26 | 13-Oct | J. Marr | |
| Undetermined | Red Bank | 98-651 | 27-Apr | H. West | |
| Undetermined | Red Bank | 98-34 | 9-Jun | J. Marr | |
| Undetermined | Red Bank | 98-712 | 27-Apr | C. Warren | |
| Undetermined | Newville | 98-862 | 14-May | J. Cunningham | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| Undetermined | Colusa | 99-307 | 1-Apr | J. Marr | |
| Undetermined | Newville | 99-308 | 20-Apr | J. Marr | |
| *Agoseris heterophylla* | Red Bank | 99-309 | 27-May | J. Marr | |
| *Agoseris heterophylla* | Red Bank | 98-863 | 27-Apr | J. Cunningham | |
| *Agoseris heterophylla* | Newville | 98-864 | 29-Apr | J. Cunningham | |
| *Agoseris heterophylla* | Newville | 98-27 | 30-Apr | J. Marr | |
| *Agoseris heterophylla* | Red Bank | 98-28 | 1-Apr | J. Marr | |
| *Agoseris heterophylla* | Newville | 98-29 | 20-Mar | J. Marr | |
| *Agoseris heterophylla* | Sites | 98-30 | 8-May | J. Marr | |
| *Agoseris heterophylla* | Sites | 98-31 | 14-Apr | J. Marr | |
| *Agoseris heterophylla* | Sites | 98-32 | 14-Apr | J. Marr | |
| *Agoseris heterophylla* | Newville | 98-33 | 19-May | J. Marr | |
| *Agoseris heterophylla* | Newville | 99-71 | 21-Apr | L. Janeway | |
| *Ancistrocarphus filagineus* | Newville | 99-72 | 6-Apr | L. Janeway | |
| *Ancistrocarphus filagineus* | Newville | 98-35 | 17-Apr | J. Marr | |
| *Ancistrocarphus filagineus* | Sites | 98-36 | 14-Apr | J. Marr | |
| *Ancistrocarphus filagineus* | Red Bank | 99-144 | 7-Apr | B. Castro | |
| *Anthemis cotula* | Red Bank | 98-866 | 7-Jul | J. Cunningham | |
| *Artemisia douglasiana* | Red Bank | 98-655 | 21-Aug | H. West | |
| *Artemisia douglasiana* | Red Bank | 98-670 | 27-Aug | H. West | |
| *Artemisia douglasiana* | Red Bank | 98-37 | 27-Aug | J. Marr | |
| *Baccharis* sp. | Red Bank | 98-713 | 24-Sep | C. Warren | |
| *Baccharis salicifolia* | Red Bank | 98-38 | 9-Jun | J. Marr | |
| *Baccharis salicifolia* | Red Bank | 98-39 | 13-Oct | J. Marr | |
| *Blennosperma nanum* var. *nanum* | Colusa | 98-40 | 6-Apr | J. Marr | |
| *Brickellia californica* | Red Bank | 98-41 | 27-Aug | J. Marr | |
| *Brickellia californica* | Red Bank | 99-310 | 9-Jul | J. Marr | |
| *Calycadenia* sp. | Red Bank | 98-42 | 9-Jun | J. Marr | |
| *Calycadenia* sp. | Newville | 98-43 | 2-Jun | J. Marr | |
| *Calycadenia* sp. | Red Bank | 98-44 | 9-Jul | J. Marr | |
| *Calycadenia fremontii* | Red Bank | 98-45 | 8-Jul | J. Marr | |
| *Calycadenia fremontii* | Red Bank | 98-672 | 13-Oct | H. West | |
| *Calycadenia fremontii* | Red Bank | 98-867 | 25-Jun | J. Cunningham | |
| *Calycadenia fremontii* | Red Bank | 99-145 | 8-Jun | B. Castro | |
| *Calycadenia fremontii* | Red Bank | 99-285 | 11-Aug | B. Castro | |
| *Calycadenia fremontii* | Red Bank | 99-311 | 27-May | J. Marr | |
| *Calycadenia multiglandulosa* | Newville | 98-46 | 16-Jun | J. Marr | |
| *Calycadenia multiglandulosa* | Red Bank | 98-47 | 27-Aug | J. Marr | |
| *Calycadenia multiglandulosa* | Red Bank | 98-48 | 9-Jun | J. Marr | |
| *Calycadenia pauciflora* | Red Bank | 98-868 | 25-Jun | J. Cunningham | |
| *Calycadenia pauciflora* | Red Bank | 98-49 | 2-Jul | J. Marr | |
| *Calycadenia pauciflora* | Sites | 98-50 | 27-May | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Calycadenia pauciflora* | Colusa | 98-51 | 17-Jun | J. Marr | |
| *Calycadenia pauciflora* | Red Bank | 98-52 | 8-Jul | J. Marr | |
| *Calycadenia pauciflora* | Red Bank | 98-53 | 8-Jul | J. Marr | |
| *Calycadenia pauciflora* | Red Bank | 99-73 | 4-Apr | L. Janeway | |
| *Calycadenia pauciflora* | Red Bank | 99-146 | 14-Jun | B. Castro | |
| *Calycadenia truncata* | Red Bank | 99-147 | 9-Jun | B. Castro | |
| *Calycadenia truncata* | Red Bank | 98-54 | 2-Jul | J. Marr | |
| *Calycadenia truncata* | Red Bank | 98-55 | 3-Jul | J. Marr | |
| *Calycadenia truncata* | Red Bank | 98-714 | 6-Jul | C. Warren | |
| *Calycadenia truncata* | Red Bank | 98-715 | 3-Jul | C. Warren | |
| *Calycadenia truncata* | Red Bank | 98-56 | 8-Jul | J. Marr | |
| *Calycadenia truncata* ssp. *scabrella* | Red Bank | 98-57 | 8-Jul | J. Marr | |
| *Calycadenia truncata* ssp. *scabrella* | Red Bank | 99-74 | 9-Jun | L. Janeway | |
| *Carduus pycnocephalus* | Sites | 98-58 | 4-May | J. Marr | |
| *Centaurea melitensis* | Colusa | 98-59 | 17-Jun | J. Marr | |
| *Centaurea melitensis* | Newville | 98-60 | 16-Jun | J. Marr | |
| *Centaurea melitensis* | Sites | 98-61 | 4-May | J. Marr | |
| *Chaenactis glabriuscula* var. *heterocarpha* | Red Bank | 98-62 | 15-Jun | J. Marr | |
| *Chaenactis glabriuscula* var. *heterocarpha* | Red Bank | 98-63 | 3-Jul | J. Marr | |
| *Chaenactis glabriuscula* var. *heterocarpha* | Newville | 98-871 | 14-May | J. Cunningham | |
| *Chaenactis glabriuscula* var. *heterocarpha* | Red Bank | 99-312 | 29-Apr | J. Marr | |
| *Chaenactis glabriuscula* var. *megacephala* | Newville | 98-870 | 19-May | J. Cunningham | |
| *Cirsium occidentale* var. *venustum* | Newville | 98-64 | 29-Apr | J. Marr | |
| *Conyza canadensis* | Red Bank | 98-65 | 27-Aug | J. Marr | |
| *Conyza canadensis* | Red Bank | 99-284 | 11-Aug | B. Castro | |
| *Cotula coronopifolia* | Sites | 98-66 | 11-Jun | J. Marr | |
| *Cotula coronopifolia* | Sites | 98-716 | 11-Jun | C. Warren | |
| *Crocidium multicaule* | Newville | 98-67 | 19-Mar | J. Marr | |
| *Crocidium multicaule* | Newville | 99-313 | 23-Mar | J. Marr | |
| *Erigeron divergens* | Red Bank | 99-300 | 11-Aug | L. Janeway | |
| *Erigeron philadelphicus* | Colusa | 98-69 | 22-Apr | J. Marr | |
| *Erigeron philadelphicus* | Red Bank | 99-148 | 24-Jun | B. Castro | |
| *Ericameria linearifolia* | Newville | 98-70 | 28-Apr | J. Marr | |
| *Ericameria linearifolia* | Newville | 98-717 | 11-May | C. Warren | |
| *Ericameria linearifolia* | Newville | 98-872 | 19-May | J. Cunningham | |
| *Ericameria linearifolia* | Newville | 98-873 | 28-Apr | J. Cunningham | |
| *Eriophyllum lanatum* | Newville | 98-718 | 14-May | C. Warren | |
| *Eriophyllum lanatum* var. *achillaeoides* | Newville | 98-71 | 18-Jun | J. Marr | |
| *Eriophyllum lanatum* var. *achillaeoides* | Newville | 98-72 | 16-Jun | J. Marr | |
| *Eriophyllum lanatum* var. *achillaeoides* | Newville | 98-874 | 19-May | J. Cunningham | |
| *Eriophyllum lanatum* var. *achillaeoides* | Red Bank | 98-875 | 25-Jun | J. Cunningham | |
| *Eriophyllum lanatum* var. *achillaeoides* | Red Bank | 99-314 | 28-May | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Eriophyllum lanatum* var. *aphanactis* | Newville | 99-149 | 12-May | B. Castro | |
| *Euthamia occidentalis* | Red Bank | 98-68 | 24-Sep | J. Marr | |
| *Euthamia occidentalis* | Red Bank | 98-706 | 13-Oct | H. West | |
| *Filago gallica* | Newville | 98-73 | 20-Apr | J. Marr | |
| *Filago gallica* | Sites | 98-74 | 7-Apr | J. Marr | |
| *Filago gallica* | Colusa | 98-75 | 8-Apr | J. Marr | |
| *Filago gallica* | Newville | 98-719 | 28-Apr | C. Warren | |
| *Gnaphalium luteo-album* | Red Bank | 98-76 | 20-May | J. Marr | |
| *Gnaphalium luteo-album* | Newville | 98-77 | 14-Jul | J. Marr | |
| *Gnaphalium luteo-album* | Red Bank | 98-78 | 9-Jul | J. Marr | |
| *Gnaphalium luteo-album* | Newville | 98-79 | 16-Jun | J. Marr | |
| *Gnaphalium luteo-album* | Red Bank | 98-80 | 2-Jul | J. Marr | |
| *Gnaphalium luteo-album* | Newville | 99-75 | 5-May | L. Janeway | |
| *Gnaphalium stramineum* | Red Bank | 99-76 | 24-Jun | L. Janeway | |
| *Grindelia* sp. | Newville | 99-150 | 21-Apr | B. Castro | |
| *Helenium puberulum* | Red Bank | 98-81 | 27-Aug | J. Marr | |
| *Helenium puberulum* | Red Bank | 98-661 | 27-Aug | H. West | |
| *Helenium puberulum* | Red Bank | 98-666 | 21-Aug | H. West | |
| *Helianthella californica* var. *nevadensis* | Red Bank | 99-151 | 3-Jun | B. Castro | |
| *Hemizonia* sp. | Red Bank | 98-82 | 23-Sep | J. Marr | |
| *Hemizonia congesta* | Red Bank | 98-652 | 25-Jun | H. West | |
| *Hemizonia congesta* ssp. *clevelandii* | Red Bank | 99-77 | 4-Jun | L. Janeway | |
| *Hemizonia congesta* ssp. *clevelandii* | Red Bank | 99-152 | 3-Jun | B. Castro | |
| *Hemizonia congesta* ssp. *clevelandii* | Red Bank | 99-153 | 24-Jun | B. Castro | |
| *Hemizonia congesta* ssp. *luzulifolia* | Sites | 98-83 | 22-Jul | J. Marr | |
| *Hemizonia fitchii* | Newville | 98-84 | 18-Jun | J. Marr | |
| *Hesperevax acaulis* var. *robustior* | Colusa | 98-85 | 18-Apr | J. Marr | |
| *Hesperevax acaulis* var. *robustior* | Red Bank | 98-707 | 27-Apr | H. West | |
| *Hesperevax acaulis* var. *robustior* | Red Bank | 99-315 | 29-Apr | J. Marr | |
| *Hesperevax caulescens* | Colusa | 99-316 | 30-Mar | J. Marr | |
| *Hesperevax caulescens* | Newville | 99-317 | 21-Apr | J. Marr | |
| *Hesperevax caulescens* | Sites | 98-86 | 14-Apr | J. Marr | |
| *Hesperevax caulescens* | Newville | 98-87 | 29-Apr | J. Marr | |
| *Hesperevax caulescens* | Colusa | 99-154 | 1-Apr | B. Castro | |
| *Hesperevax sparsiflora* | Sites | 98-88 | 8-May | J. Marr | |
| *Heterotheca oregona* var. *compacta* | Red Bank | 98-704 | 21-Aug | H. West | |
| *Heterotheca oregona* var. *compacta* | Red Bank | 99-287 | 11-Aug | B. Castro | |
| *Heterotheca oregona* var. *rudis* | Red Bank | 98-701 | 13-Oct | H. West | |
| *Heterotheca oregona* var. *rudis* | Red Bank | 98-89 | 13-Oct | J. Marr | |
| *Holocarpha obconica* | Newville | 98-720 | 18-Jun | C. Warren | |
| *Holocarpha virgata* ssp. *virgata* | Colusa | 98-90 | 17-Jun | J. Marr | |
| *Holocarpha virgata* ssp. *virgata* | Newville | 98-91 | 18-Jun | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Hypochaeris glabra* | Colusa | 98-92 | 17-Jun | J. Marr | |
| *Hypochaeris glabra* | Newville | 98-93 | 29-Apr | J. Marr | |
| *Hypochaeris glabra* | Red Bank | 98-721 | 27-Apr | C. Warren | |
| *Hypochaeris glabra* | Red Bank | 98-876 | 27-Apr | J. Cunningham | |
| *Hypochaeris glabra* | Newville | 98-877 | 28-Apr | J. Cunningham | |
| *Hypochaeris glabra* | Newville | 98-878 | 11-May | J. Cunningham | |
| *Hypochaeris glabra* | Colusa | 99-318 | 30-Mar | J. Marr | |
| *Hypochaeris radicata* | Newville | 99-319 | 20-Apr | J. Marr | |
| *Hypochaeris radicata* | Newville | 98-94 | 7-Apr | J. Marr | |
| *Hypochaeris radicata* | Red Bank | 98-95 | 9-Jun | J. Marr | |
| *Lactuca saligna* | Sites | 98-96 | 22-Jul | J. Marr | |
| *Lactuca saligna* | Sites | 98-671 | 29-Oct | H. West | |
| *Lagophylla* sp. | Newville | 98-97 | 28-Apr | J. Marr | |
| *Lagophylla glandulosa* | Newville | 98-98 | 30-Apr | J. Marr | |
| *Lagophylla glandulosa* | Newville | 98-99 | 30-Apr | J. Marr | |
| *Lagophylla glandulosa* | Newville | 98-120 | 2-Jun | J. Marr | |
| *Lagophylla glandulosa* | Newville | 99-155 | 4-May | B. Castro | |
| *Lagophylla minor* | Red Bank | 98-100 | 15-Jun | J. Marr | |
| *Lagophylla minor* | Newville | 98-101 | 29-Apr | J. Marr | |
| *Lagophylla minor* | Red Bank | 98-879 | 7-Jul | J. Cunningham | |
| *Lagophylla minor* | Newville | 98-880 | 11-May | J. Cunningham | |
| *Lagophylla ramosissima* ssp. *ramosissima* | Newville | 98-881 | 11-May | J. Cunningham | |
| *Lagophylla ramosissima* ssp. *ramosissima* | Red Bank | 98-882 | 27-Apr | J. Cunningham | |
| *Lagophylla ramosissima* ssp. *ramosissima* | Newville | 98-883 | 14-May | J. Cunningham | |
| *Lagophylla ramosissima* ssp. *ramosissima* | Red Bank | 98-884 | 25-Jun | J. Cunningham | |
| *Lagophylla ramosissima* ssp. *ramosissima* | Red Bank | 98-102 | 15-Jun | J. Marr | |
| *Lagophylla ramosissima* ssp. *ramosissima* | Red Bank | 99-156 | 3-Jun | B. Castro | |
| *Lasthenia californica* | Newville | 99-157 | 12-Apr | B. Castro | |
| *Lasthenia californica* | Newville | 98-103 | 20-Apr | J. Marr | |
| *Lasthenia californica* | Newville | 98-104 | 29-Apr | J. Marr | |
| *Lasthenia californica* | Newville | 98-105 | 26-Mar | J. Marr | |
| *Lasthenia californica* | Newville | 98-106 | 17-Apr | J. Marr | |
| *Lasthenia californica* | Newville | 98-700 | 6-Apr | H. West | |
| *Lasthenia californica* | Newville | 98-722 | 30-Mar | C. Warren | |
| *Lasthenia californica* | Newville | 98-885 | 11-May | J. Cunningham | |
| *Lasthenia californica* | Sites | 99-3 | 7-Apr | B. Hendrickson | |
| *Lasthenia californica* | Newville | 99-320 | 23-Mar | J. Marr | |
| *Lasthenia glaberrima* | Newville | 98-107 | 28-Apr | J. Marr | |
| *Lasthenia glaberrima* | Newville | 99-158 | 1-Jun | B. Castro | |
| *Layia chrysanthemoides* | Sites | 98-108 | 8-May | J. Marr | |
| *Layia chrysanthemoides* | Sites | 98-109 | 8-May | J. Marr | |
| *Layia fremontii* | Newville | 98-110 | 28-Apr | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Layia fremontii* | Newville | 98-111 | 29-Apr | J. Marr | |
| *Layia fremontii* | Newville | 99-321 | 14-Apr | J. Marr | |
| *Lessingia* sp. | Newville | 98-112 | 19-May | J. Marr | |
| *Lessingia* sp. | Colusa | 98-114 | 17-Jun | J. Marr | |
| *Lessingia* sp. | Newville | 98-115 | 11-May | J. Marr | |
| *Lessingia nana* | Newville | 98-702 | 15-Jul | H. West | |
| *Lessingia nana* | Newville | 98-121 | 15-Jul | J. Marr | |
| *Lessingia nemoclada* | Red Bank | 98-113 | 27-Aug | J. Marr | |
| *Lessingia nemoclada* | Red Bank | 98-116 | 2-Jul | J. Marr | |
| *Lessingia nemoclada* | Red Bank | 98-117 | 2-Jul | J. Marr | |
| *Lessingia nemoclada* | Red Bank | 98-118 | 9-Jul | J. Marr | |
| *Lessingia nemoclada* | Red Bank | 98-119 | 9-Jul | J. Marr | |
| *Lessingia nemoclada* | Red Bank | 98-886 | 7-Jul | J. Cunningham | |
| *Lessingia nemoclada* | Newville | 99-159 | 10-May | B. Castro | |
| *Madia elegans* ssp. *densifolia* | Newville | 98-122 | 14-Jul | J. Marr | |
| *Madia elegans* ssp. *densifolia* | Newville | 98-123 | 15-Jul | J. Marr | |
| *Madia elegans* ssp. *densifolia* | Newville | 98-887 | 14-May | J. Cunningham | |
| *Madia elegans* ssp. *vernalis* | Red Bank | 98-124 | 9-Jun | J. Marr | |
| *Madia exigua* | Red Bank | 99-161 | 18-May | B. Castro | |
| *Madia exigua* | Newville | 99-160 | 4-May | B. Castro | |
| *Madia exigua* | Red Bank | 98-125 | 8-Jul | J. Marr | |
| *Madia exigua* | Red Bank | 98-126 | 8-Jul | J. Marr | |
| *Madia exigua* | Newville | 98-723 | 14-May | C. Warren | |
| *Madia exigua* | Red Bank | 98-888 | 26-May | J. Cunningham | |
| *Madia exigua* | Newville | 98-889 | 11-May | J. Cunningham | |
| *Madia exigua* | Newville | 98-890 | 11-May | J. Cunningham | |
| *Madia gracilis* | Red Bank | 98-891 | 27-Apr | J. Cunningham | |
| *Madia gracilis* | Red Bank | 98-892 | 27-Apr | J. Cunningham | |
| *Madia gracilis* | Newville | 98-127 | 19-May | J. Marr | |
| *Madia gracilis* | Sites | 98-128 | 27-May | J. Marr | |
| *Madia gracilis* | Newville | 98-129 | 30-Apr | J. Marr | |
| *Madia gracilis* | Red Bank | 99-162 | 18-May | B. Castro | |
| *Malacothrix floccifera* | Newville | 98-130 | 17-Apr | J. Marr | |
| *Malacothrix floccifera* | Newville | 98-131 | 19-Mar | J. Marr | |
| *Micropus californicus* var. *californicus* | Sites | 98-132 | 7-Apr | J. Marr | |
| *Micropus californicus* var. *californicus* | Colusa | 98-133 | 8-Apr | J. Marr | |
| *Micropus californicus* var. *californicus* | Colusa | 98-134 | 21-Apr | J. Marr | |
| *Micropus californicus* var. *californicus* | Newville | 98-135 | 20-Apr | J. Marr | |
| *Micropus californicus* var. *californicus* | Colusa | 98-136 | 6-Apr | J. Marr | |
| *Micropus californicus* var. *californicus* | Sites | 98-137 | 14-Apr | J. Marr | |
| *Micropus californicus* var. *californicus* | Colusa | 98-138 | 7-Apr | J. Marr | |
| *Micropus californicus* var. *californicus* | Colusa | 98-139 | 7-Apr | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Micropus californicus* var. *californicus* | Newville | 98-140 | 28-Apr | J. Marr | |
| *Micropus californicus* var. *californicus* | Newville | 98-724 | 14-May | C. Warren | |
| *Microseris acuminata* | Newville | 98-893 | 29-Apr | J. Cunningham | |
| *Microseris douglasii* ssp. *douglasii* | Newville | 98-894 | 11-May | J. Cunningham | |
| *Microseris douglasii* ssp. *douglasii* | Red Bank | 98-895 | 27-Apr | J. Cunningham | |
| *Microseris douglasii* ssp. *douglasii* | Newville | 98-141 | 20-Apr | J. Marr | |
| *Microseris douglasii* ssp. *douglasii* | Newville | 98-142 | 30-Apr | J. Marr | |
| *Microseris douglasii* ssp. *douglasii* | Colusa | 98-667 | 22-Apr | H. West | |
| *Microseris douglasii* ssp. *douglasii* | Newville | 99-322 | 7-Apr | J. Marr | |
| *Microseris douglasii* ssp. *tenella* | Sites | 98-143 | 8-May | J. Marr | |
| *Monolopia gracilens* | Newville | 98-726 | 14-May | C. Warren | |
| *Monolopia major* | Sites | 98-144 | 8-May | J. Marr | |
| *Psilocarphus brevissimus* var. *brevissimus* | Newville | 99-163 | 1-Jun | B. Castro | |
| *Psilocarphus oregonus* | Colusa | 98-145 | 21-Apr | J. Marr | |
| *Psilocarphus oregonus* | Newville | 98-146 | 29-Apr | J. Marr | |
| *Psilocarphus oregonus* | Newville | 98-147 | 28-Apr | J. Marr | |
| *Psilocarphus oregonus* | Newville | 98-727 | 28-Apr | C. Warren | |
| *Psilocarphus tenellus* | Sites | 98-728 | 8-May | C. Warren | |
| *Psilocarphus tenellus* var. *tenellus* | Sites | 98-148 | 14-Apr | J. Marr | |
| *Psilocarphus tenellus* var. *tenellus* | Newville | 98-149 | 17-Apr | J. Marr | |
| *Psilocarphus tenellus* var. *tenellus* | Newville | 98-150 | 20-Apr | J. Marr | |
| *Psilocarphus tenellus* var. *tenellus* | Newville | 98-896 | 11-May | J. Cunningham | |
| *Psilocarphus tenellus* var. *tenellus* | Red Bank | 99-78 | 20-Apr | L. Janeway | |
| *Rafinesquia californica* | Newville | 98-897 | 19-May | J. Cunningham | |
| *Rafinesquia californica* | Red Bank | 98-151 | 20-May | J. Marr | |
| *Rafinesquia californica* | Newville | 99-164 | 10-May | B. Castro | |
| *Rigiopappus leptocladus* | Newville | 98-152 | 28-Apr | J. Marr | |
| *Rigiopappus leptocladus* | Newville | 98-153 | 20-Apr | J. Marr | |
| *Rigiopappus leptocladus* | Sites | 98-154 | 8-May | J. Marr | |
| *Rigiopappus leptocladus* | Newville | 98-155 | 30-Apr | J. Marr | |
| *Rigiopappus leptocladus* | Red Bank | 98-156 | 6-Jul | J. Marr | |
| *Rigiopappus leptocladus* | Newville | 98-703 | 19-May | H. West | |
| *Rigiopappus leptocladus* | Newville | 98-898 | 11-May | J. Cunningham | |
| *Rigiopappus leptocladus* | Newville | 98-899 | 11-May | J. Cunningham | |
| *Rigiopappus leptocladus* | Newville | 99-165 | 22-Apr | B. Castro | |
| *Rigiopappus leptocladus* | Newville | 99-323 | 20-Apr | J. Marr | |
| *Rigiopappus leptocladus* | Newville | 99-324 | 20-Apr | J. Marr | |
| *Solidago californica* | Red Bank | 98-705 | 13-Oct | H. West | |
| *Solidago californica* | Red Bank | 98-157 | 13-Oct | J. Marr | |
| *Sonchus asper* ssp. *asper* | Newville | 98-158 | 14-Jul | J. Marr | |
| *Sonchus asper* ssp. *asper* | Red Bank | 99-326 | 28-May | J. Marr | |
| *Stephanomeria* sp. | Newville | 98-159 | 18-Jun | J. Marr | |

| FAMILY ***Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Stephanomeria* sp. | Red Bank | 98-160 | 3-Jul | J. Marr | |
| *Stephanomeria elata* | Red Bank | 98-161 | 9-Jul | J. Marr | |
| *Stephanomeria virgata* ssp. *pleurocarpa* | Red Bank | 98-162 | 13-Oct | J. Marr | |
| *Stephanomeria virgata* ssp. *pleurocarpa* | Red Bank | 99-286 | 11-Aug | B. Castro | |
| *Uropappus lindleyi* | Newville | 99-166 | 15-Apr | B. Castro | |
| *Uropappus lindleyi* | Newville | 98-163 | 29-Apr | J. Marr | |
| *Uropappus lindleyi* | Newville | 98-164 | 17-Apr | J. Marr | |
| *Uropappus lindleyi* | Colusa | 98-165 | 6-Apr | J. Marr | |
| *Uropappus lindleyi* | Newville | 98-166 | 26-Mar | J. Marr | |
| *Wyethia angustifolia* | Newville | 98-167 | 28-Apr | J. Marr | |
| *Wyethia angustifolia* | Newville | 98-730 | 14-May | C. Warren | |
| *Wyethia angustifolia* | Red Bank | 98-900 | 25-Jun | J. Cunningham | |
| *Wyethia angustifolia* | Newville | 98-901 | 14-May | J. Cunningham | |
| *Wyethia angustifolia* | Sites | 99-42 | 6-May | J. Witzman | |
| *Wyethia angustifolia* | Newville | 99-167 | 12-May | B. Castro | |
| *Wyethia glabra* | Colusa | 99-4 | 1-Apr | B. Hendrickson | |
| *Wyethia helenioides* | Newville | 99-168 | 12-May | B. Castro | |
| *Wyethia helenioides* | Red Bank | 99-326 | 28-Apr | J. Marr | |
| *Xanthium spinosum* | Sites | 98-731 | 11-Jun | C. Warren | |
| | | | | | |
| BETULACEAE | | | | | |
| *Alnus rhombifolia* | Red Bank | 98-168 | 21-May | J. Marr | |
| *Alnus rhombifolia* | Red Bank | 99-327 | 28-May | J. Marr | |
| | | | | | |
| BORAGINACEAE | | | | | |
| Undetermined | Newville | 99-328 | 23-Mar | J. Marr | |
| *Amsinckia* sp. | Colusa | 98-169 | 6-Apr | J. Marr | |
| *Amsinckia lycopsoides* | Colusa | 99-169 | 31-Mar | B. Castro | |
| *Amsinckia lycopsoides* | Colusa | 99-329 | 31-Mar | J. Marr | |
| *Amsinckia menziesii* | Newville | 98-171 | 20-Apr | J. Marr | |
| *Amsinckia menziesii* var. *menziesii* | Colusa | 98-170 | 7-Apr | J. Marr | |
| *Amsinckia menziesii* var. *menziesii* | Newville | 98-902 | 11-May | J. Cunningham | |
| *Amsinckia menziesii* var. *menziesii* | Newville | 98-903 | 11-May | J. Cunningham | |
| *Cryptantha* sp. | Red Bank | 98-904 | 27-Apr | J. Cunningham | |
| *Cryptantha* sp. | Red Bank | 99-332 | 28-Apr | J. Marr | |
| *Cryptantha flaccida* | Newville | 98-172 | 28-Apr | J. Marr | |
| *Cryptantha flaccida* | Newville | 98-173 | 20-Apr | J. Marr | |
| *Cryptantha flaccida* | Colusa | 98-174 | 21-Apr | J. Marr | |
| *Cryptantha flaccida* | Newville | 98-175 | 30-Apr | J. Marr | |
| *Cryptantha flaccida* | Newville | 98-732 | 14-May | C. Warren | |
| *Cryptantha flaccida* | Newville | 98-905 | 28-Apr | J. Cunningham | |
| *Cryptantha flaccida* | Newville | 98-906 | 28-Apr | J. Cunningham | |

| FAMILY *Genus species* | Reservoir | Voucher | Date | Collector | |
|---|---|---|---|---|---|
| | | | | | |
| *Cryptantha flaccida* | Newville | 98-907 | 19-May | J. Cunningham | |
| *Cryptantha flaccida* | Newville | 98-908 | 14-May | J. Cunningham | |
| *Cryptantha flaccida* | Newville | 98-909 | 11-May | J. Cunningham | |
| *Cryptantha flaccida* | Newville | 98-910 | 19-May | J. Cunningham | |
| *Cryptantha flaccida* | Red Bank | 98-911 | 25-Jun | J. Cunningham | |
| *Cryptantha intermedia* | Red Bank | 98-912 | 25-Jun | J. Cunningham | |
| *Cryptantha intermedia* | Newville | 98-913 | 11-May | J. Cunningham | |
| *Cryptantha intermedia* | Newville | 98-914 | 19-May | J. Cunningham | |
| *Cryptantha intermedia* | Red Bank | 98-915 | 6-Jul | J. Cunningham | |
| *Cryptantha intermedia* | Newville | 98-176 | 16-Jun | J. Marr | |
| *Cryptantha intermedia* | Newville | 98-177 | 28-Apr | J. Marr | |
| *Cryptantha intermedia* | Red Bank | 98-178 | 2-Jul | J. Marr | |
| *Cryptantha intermedia* | Newville | 98-179 | 17-Apr | J. Marr | |
| *Cryptantha intermedia* | Newville | 98-180 | 20-Apr | J. Marr | |
| *Cryptantha intermedia* | Red Bank | 98-657 | 21-Aug | H. West | |
| *Cryptantha intermedia* | Newville | 98-699 | 5-Jun | H. West | |
| *Cryptantha intermedia* | Newville | 98-733 | 11-May | C. Warren | |
| *Cryptantha intermedia* | Red Bank | 98-734 | 15-Jun | C. Warren | |
| *Cryptantha intermedia* | Newville | 98-735 | 11-May | C. Warren | |
| *Cryptantha intermedia* | Newville | 98-736 | 14-May | C. Warren | |
| *Cryptantha intermedia* | Newville | 99-79 | 5-May | L. Janeway | |
| *Cryptantha intermedia* | Red Bank | 99-292 | 18-May | B. Castro | |
| *Cryptantha intermedia* | Colusa | 99-333 | 31-Mar | J. Marr | |
| *Cryptantha muricata* | Newville | 99-170 | 15-Apr | B. Castro | |
| *Heliotropium europaeum* | Red Bank | 98-916 | 7-Jul | J. Cunningham | |
| *Heliotropium europaeum* | Newville | 99-171 | 1-Jun | B. Castro | |
| *Pectocarya penicillata* | Colusa | 99-80 | 31-Mar | L. Janeway | |
| *Pectocarya pusilla* | Sites | 99-5 | 21-Apr | B. Hendrickson | |
| *Pectocarya pusilla* | Sites | 99-6 | 7-Apr | B. Hendrickson | |
| *Pectocarya pusilla* | Red Bank | 99-172 | 7-Apr | B. Castro | |
| *Pectocarya pusilla* | Red Bank | 99-334 | 28-Apr | J. Marr | |
| *Plagiobothrys* sp. | Newville | 98-213 | 26-Mar | J. Marr | |
| *Plagiobothrys* sp. | Red Bank | 99-330 | 28-Apr | J. Marr | |
| *Plagiobothrys* sp. | Colusa | 99-331 | 30-Mar | J. Marr | |
| *Plagiobothrys* sp. | Colusa | 99-335 | 1-Apr | J. Marr | |
| *Plagiobothrys bracteatus* | Colusa | 99-173 | 31-Mar | B. Castro | |
| *Plagiobothrys canescens* | Sites | 99-7 | 21-Apr | B. Hendrickson | |
| *Plagiobothrys canescens* | Colusa | 99-8 | 30-Mar | B. Hendrickson | |
| *Plagiobothrys fulvus* | Red Bank | 98-917 | 27-Apr | J. Cunningham | |
| *Plagiobothrys fulvus* | Newville | 98-181 | 26-Mar | J. Marr | |
| *Plagiobothrys fulvus* | Sites | 98-182 | 27-May | J. Marr | |
| *Plagiobothrys fulvus* | Colusa | 98-183 | 7-Apr | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Plagiobothrys fulvus* | Newville | 98-184 | 26-Mar | J. Marr | |
| *Plagiobothrys fulvus* | Sites | 98-185 | 8-May | J. Marr | |
| *Plagiobothrys fulvus* | Newville | 98-186 | 26-Mar | J. Marr | |
| *Plagiobothrys greenii* | Newville | 98-187 | 29-Apr | J. Marr | |
| *Plagiobothrys greenii* | Colusa | 98-188 | 6-Apr | J. Marr | |
| *Plagiobothrys greenii* | Newville | 98-189 | 29-Apr | J. Marr | |
| *Plagiobothrys greenii* | Sites | 98-190 | 14-Apr | J. Marr | |
| *Plagiobothrys greenii* | Colusa | 98-191 | 7-Apr | J. Marr | |
| *Plagiobothrys greenii* | Newville | 98-192 | 29-Apr | J. Marr | |
| *Plagiobothrys greenii* | Sites | 98-193 | 8-May | J. Marr | |
| *Plagiobothrys greenii* | Newville | 98-194 | 20-Apr | J. Marr | |
| *Plagiobothrys greenii* | Colusa | 98-195 | 7-Apr | J. Marr | |
| *Plagiobothrys greenii* | Sites | 98-196 | 16-Apr | J. Marr | |
| *Plagiobothrys nothofulvus* | Colusa | 98-197 | 7-Apr | J. Marr | |
| *Plagiobothrys nothofulvus* | Newville | 98-198 | 29-Apr | J. Marr | |
| *Plagiobothrys nothofulvus* | Newville | 98-199 | 17-Apr | J. Marr | |
| *Plagiobothrys nothofulvus* | Newville | 98-200 | 30-Apr | J. Marr | |
| *Plagiobothrys nothofulvus* | Newville | 98-201 | 30-Apr | J. Marr | |
| *Plagiobothrys nothofulvus* | Colusa | 98-202 | 7-Apr | J. Marr | |
| *Plagiobothrys nothofulvus* | Newville | 98-737 | 28-Apr | C. Warren | |
| *Plagiobothrys nothofulvus* | Newville | 98-738 | 30-Mar | C. Warren | |
| *Plagiobothrys nothofulvus* | Newville | 98-918 | 11-May | J. Cunningham | |
| *Plagiobothrys nothofulvus* | Newville | 98-919 | 28-Apr | J. Cunningham | |
| *Plagiobothrys nothofulvus* | Newville | 98-920 | 28-Apr | J. Cunningham | |
| *Plagiobothrys nothofulvus* | Red Bank | 98-921 | 27-Apr | J. Cunningham | |
| *Plagiobothrys nothofulvus* | Newville | 98-922 | 19-May | J. Cunningham | |
| *Plagiobothrys nothofulvus* | Newville | 98-923 | 14-May | J. Cunningham | |
| *Plagiobothrys nothofulvus* | Newville | 99-336 | 28-Apr | J. Marr | |
| *Plagiobothrys stipitatus* | Newville | 99-290 | 21-Apr | B. Castro | |
| *Plagiobothrys stipitatus* var. *micranthus* | Newville | 98-924 | 11-May | J. Cunningham | |
| *Plagiobothrys stipitatus* var. *micranthus* | Newville | 98-925 | 19-May | J. Cunningham | |
| *Plagiobothrys stipitatus* var. *micranthus* | Colusa | 98-203 | 6-Apr | J. Marr | |
| *Plagiobothrys stipitatus* var. *micranthus* | Sites | 98-204 | 8-May | J. Marr | |
| *Plagiobothrys stipitatus* var. *micranthus* | Newville | 98-205 | 14-Jul | J. Marr | |
| *Plagiobothrys stipitatus* var. *micranthus* | Sites | 98-206 | 1-Jul | J. Marr | |
| *Plagiobothrys stipitatus* var. *micranthus* | Sites | 98-207 | 11-Jun | J. Marr | |
| *Plagiobothrys stipitatus* var. *micranthus* | Sites | 98-208 | 16-Apr | J. Marr | |
| *Plagiobothrys stipitatus* var. *micranthus* | Newville | 98-698 | 6-Apr | H. West | |
| *Plagiobothrys stipitatus* var. *micranthus* | Sites | 99-9 | 25-Mar | B. Hendrickson | |
| *Plagiobothrys stipitatus* var. *micranthus* | Newville | 99-290 | 21-Apr | B. Castro | |
| *Plagiobothrys stipitatus* var. *micranthus* | Newville | 99-337 | 28-Apr | J. Marr | |
| *Plagiobothrys stipitatus* var. *micranthus* | Newville | 99-338 | 1-Jun | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Plagiobothrys stipitatus* var. *stipitatus* | Colusa | 99-10 | 1-Apr | B. Hendrickson | |
| *Plagiobothrys stipitatus* var. *stipitatus* | Sites | 98-209 | 14-Apr | J. Marr | |
| *Plagiobothrys stipitatus* var. *stipitatus* | Sites | 98-210 | 16-Apr | J. Marr | |
| *Plagiobothrys tenellus* | Newville | 98-211 | 20-Mar | J. Marr | |
| *Plagiobothrys tenellus* | Newville | 98-212 | 30-Apr | J. Marr | |
| *Plagiobothrys tenellus* | Red Bank | 98-739 | 27-Apr | C. Warren | |
| *Plagiobothrys tenellus* | Red Bank | 98-740 | 27-Apr | C. Warren | |
| *Plagiobothrys undulatus* | Newville | 99-174 | 1-Jun | B. Castro | |
| | | | | | |
| BRASSICACEAE | | | | | |
| Undetermined | Colusa | 98-214 | 7-Apr | J. Marr | |
| Undetermined | Newville | 98-230 | 17-Mar | J. Marr | |
| *Arabis breweri* var. *breweri* | Red Bank | 99-175 | 24-Jun | B. Castro | |
| *Athysanus pusillus* | Sites | 99-339 | 25-Feb | J. Marr | |
| *Cardamine oligosperma* | Newville | 98-215 | 26-Mar | J. Marr | |
| *Cardamine oligosperma* | Sites | 99-340 | 25-Feb | J. Marr | |
| *Cardaria chalepensis* | Newville | 99-81 | 12-May | L. Janeway | |
| *Cardaria chalepensis* | Newville | 99-291 | 12-May | B. Castro | |
| *Draba verna* | Newville | 99-341 | 14-Apr | J. Marr | |
| *Lepidium dictyotum* var. *acutidens* | Colusa | 99-82 | 13-Apr | L. Janeway | |
| *Lepidium latifolium* | Red Bank | 99-176 | 14-Jun | B. Castro | |
| *Lepidium latipes* var. *latipes* | Newville | 99-297 | 5-May | B. Castro | |
| *Lepidium latipes* var. *latipes* | Newville | 98-216 | 17-Apr | J. Marr | |
| *Lepidium latipes* var. *latipes* | Sites | 98-217 | 14-Apr | J. Marr | |
| *Lepidium latipes* var. *latipes* | Newville | 98-218 | 26-Mar | J. Marr | |
| *Lepidium latipes* var. *latipes* | Newville | 98-741 | 26-Mar | C. Warren | |
| *Lepidium nitidum* var. *nitidum* | Newville | 98-219 | 29-Apr | J. Marr | |
| *Lepidium strictum* | Colusa | 98-220 | 6-Apr | J. Marr | |
| *Lepidium strictum* | Sites | 98-221 | 11-Jun | J. Marr | |
| *Lepidium strictum* | Colusa | 98-222 | 21-Apr | J. Marr | |
| *Lepidium strictum* | Sites | 98-742 | 11-Jun | C. Warren | |
| *Lepidium strictum* | Newville | 99-83 | 6-May | L. Janeway | |
| *Lepidium strictum* | Red Bank | 99-342 | 29-Apr | J. Marr | |
| *Rorippa nasturtium-aquaticum* | Newville | 98-223 | 19-Mar | J. Marr | |
| *Sisymbrium officianale* | Newville | 98-743 | 14-May | C. Warren | |
| *Sisymbrium officianale* | Newville | 98-926 | 14-May | J. Cunningham | |
| *Strepthanthus* sp. | Newville | 98-927 | 19-May | J. Cunningham | |
| *Strepthanthus drepanoides* | Red Bank | 98-224 | 3-Jul | J. Marr | |
| *Strepthanthus drepanoides* | Red Bank | 99-84 | 27-Apr | L. Janeway | |
| *Strepthanthus glandulosus* | Newville | 98-225 | 26-Feb | J. Marr | |
| *Strepthanthus glandulosus* ssp. *glandulosus* | Newville | 98-226 | 19-Mar | J. Marr | |
| *Strepthanthus glandulosus* ssp. *glandulosus* | Newville | 98-227 | 17-Apr | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Strepthanthus glandulosus* ssp. *glandulosus* | Sites | 99-36 | 14-Apr | B. Hendrickson | |
| *Strepthanthus glandulosus* ssp. *glandulosus* | Newville | 99-177 | 14-Apr | B. Castro | |
| *Thysanocarpus curvipes* | Newville | 98-744 | 20-Mar | C. Warren | |
| *Tropidocarpum gracile* | Newville | 98-228 | 19-Mar | J. Marr | |
| *Tropidocarpum gracile* | Newville | 98-229 | 18-Mar | J. Marr | |
| *Tropidocarpum gracile* | Newville | 98-928 | 28-Apr | J. Cunningham | |
| *Tropidocarpum gracile* | Newville | 99-85 | 22-Apr | L. Janeway | |
| *Tropidocarpum gracile* | Colusa | 99-178 | 31-Mar | B. Castro | |
| *Tropidocarpum gracile* | Red Bank | 99-179 | 7-Apr | B. Castro | |
| *Tropidocarpum gracile* | Newville | 99-343 | 14-Apr | J. Marr | |
| | | | | | |
| CALLITRICHACEAE | | | | | |
| *Callitriche longipedunculata* | Newville | 98-929 | 11-May | J. Cunningham | |
| *Callitriche marginata* | Red Bank | 99-344 | 28-Apr | J. Marr | |
| | | | | | |
| CALYCANTHACEAE | | | | | |
| *Calycanthus occidentalis* | Newville | 99-43 | 9-Jun | J. Witzman | |
| | | | | | |
| CAMPANULACEAE | | | | | |
| *Downingia insignis* | Sites | 98-753 | 8-May | C. Warren | |
| *Githopsis specularioides* | Newville | 98-231 | 30-Apr | J. Marr | |
| *Githopsis specularioides* | Newville | 98-697 | 29-Apr | H. West | |
| *Heterocodon rariflorum* | Red Bank | 98-754 | 2-Jul | C. Warren | |
| *Heterocodon rariflorum* | Red Bank | 99-180 | 3-Jun | B. Castro | |
| *Nemocladus* sp. | Newville | 98-930 | 19-May | J. Cunningham | |
| *Nemocladus* sp. | Red Bank | 99-345 | 2-Apr | J. Marr | |
| *Nemocladus montanus* | Red Bank | 99-86 | 9-Jun | L. Janeway | |
| *Triodanis biflora* | Red Bank | 98-233 | 8-Jul | J. Marr | |
| | | | | | |
| CAPRIFOLIACEAE | | | | | |
| *Lonicera hispidula* | Newville | 99-295 | 4-May | B. Castro | |
| *Lonicera interrupta* | Newville | 98-234 | 16-Jun | J. Marr | |
| *Lonicera interrupta* | Red Bank | 99-181 | 19-May | B. Castro | |
| *Sambucus mexicana* | Newville | 99-182 | 28-Apr | B. Castro | |
| | | | | | |
| CARYOPHYLLACEAE | | | | | |
| Undetermined | Newville | 98-239 | 16-Mar | J. Marr | |
| *Hernaria hirsuta* ssp. *cinerea* | Red Bank | 98-639 | 21-Aug | H. West | |
| *Minuartia sp.* | Colusa | 99-44 | 30-Mar | J. Witzman | |
| *Minuartia californica* | Newville | 99-346 | 13-Apr | J. Marr | |
| *Minuartia californica* | Newville | 99-347 | 7-Apr | J. Marr | |
| *Minuartia douglasii* | Red Bank | 98-240 | 15-Jun | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Minuartia douglasii* | Newville | 98-241 | 28-Apr | J. Marr | |
| *Minuartia douglasii* | Newville | 98-540 | 29-Apr | J. Marr | |
| *Minuartia douglasii* | Sites | 99-11 | 7-Apr | B. Hendrickson | |
| *Minuartia douglasii* | Newville | 99-348 | 20-Apr | J. Marr | |
| *Sagina apetala* | Colusa | 99-349 | 1-Apr | J. Marr | |
| *Sagina apetala* | Newville | 98-242 | 11-May | J. Marr | |
| *Sagina apetala* | Colusa | 98-243 | 14-Apr | J. Marr | |
| *Sagina apetala* | Colusa | 99-87 | 1-Apr | L. Janeway | |
| *Sagina apetala* | Newville | 99-293 | 21-Apr | B. Castro | |
| *Sagina decumbens* ssp. *occidentalis* | Sites | 99-12 | 22-Apr | B. Hendrickson | |
| *Scleranthus annuus* | Newville | 98-244 | 17-Apr | J. Marr | |
| *Scleranthus annuus* | Newville | 98-748 | 26-Mar | C. Warren | |
| *Scleranthus annuus* | Red Bank | 98-749 | 27-Apr | C. Warren | |
| *Scleranthus annuus* | Red Bank | 99-350 | 28-Apr | J. Marr | |
| *Silene gallica* | Newville | 98-245 | 20-Apr | J. Marr | |
| *Silene gallica* | Newville | 98-232 | 29-Apr | J. Marr | |
| *Silene gallica* | Colusa | 98-246 | 22-Apr | J. Marr | |
| *Silene gallica* | Newville | 98-750 | 11-May | C. Warren | |
| *Silene gallica* | | 98-751 | | C. Warren | |
| *Spergularia marina* | Newville | 98-247 | 2-Jun | J. Marr | |
| *Spergularia marina* | Colusa | 98-248 | 7-Apr | J. Marr | |
| *Spergularia marina* | Sites | 98-752 | 8-May | C. Warren | |
| *Spergularia marina* | Red Bank | 98-931 | 7-Jul | J. Cunningham | |
| *Stellaria nitens* | Colusa | 99-88 | 1-Apr | L. Janeway | |
| *Stellaria nitens* | Colusa | 99-13 | 30-Mar | B. Hendrickson | |
| *Stellaria pallida* | Colusa | 99-183 | 3-Mar | B. Castro | |
| *Velezia rigida* | Newville | 98-932 | 11-May | J. Cunningham | |
| *Velezia rigida* | Newville | 98-933 | 28-Apr | J. Cunningham | |
| *Velezia rigida* | Newville | 98-249 | 28-Apr | J. Marr | |
| *Velezia rigida* | Newville | 98-755 | 11-May | C. Warren | |
| *Velezia rigida* | Newville | 98-653 | 14-May | H. West | |
| | | | | | |
| CHENOPODIACEAE | | | | | |
| *Chenopodium* sp. | Newville | 98-756 | 29-Jul | C. Warren | |
| *Chenopodium album* | Sites | 98-757 | 11-Jun | C. Warren | |
| *Chenopodium album* | Sites | 98-677 | 11-Jun | H. West | |
| *Chenopodium botrys* | Red Bank | 98-235 | 13-Oct | J. Marr | |
| *Chenopodium botrys* | Red Bank | 98-665 | 13-Oct | H. West | |
| *Chenopodium botrys* | Red Bank | 99-89 | 14-Jun | L. Janeway | |
| *Chenopodium californicum* | Red Bank | 98-236 | 1-Apr | J. Marr | |
| *Hernaria hirsuta* ssp. *hirsuta* | Red Bank | 98-758 | 21-Aug | C. Warren | |
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| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
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| | | | | | |
| CONVOLVULACEAE | | | | | |
| *Cressa truxillensis* | Sites | 98-237 | 11-Jun | J. Marr | |
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| CORNACEAE | | | | | |
| *Cornus glabrata* | Red Bank | 99-184 | 14-Jun | B. Castro | |
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| CRASSULACEAE | | | | | |
| *Crassula aquatica* | Newville | 99-298 | 5-May | B. Castro | |
| *Crassula connata* | Newville | 99-351 | 28-Apr | J. Marr | |
| *Crassula tillaea* | Newville | 98-238 | 17-Mar | J. Marr | |
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| CUPRESSACEAE | | | | | |
| *Juniperus californica* | Colusa | 99-294 | 18-Mar | B. Castro | |
| *Juniperus californica* | Newville | 99-296 | 4-May | B. Castro | |
| *Juniperus occidentalis* | Colusa | 99-14 | 30-Mar | B. Hendrickson | |
| | | | | | |
| CUSCUTACEAE | | | | | |
| *Cuscuta sp.* | Colusa | 99-352 | 17-Jun | J. Marr | |
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| CYPERACEAE | | | | | |
| *Carex* sp. | Newville | 98-250 | 17-Mar | J. Marr | |
| *Carex* sp. | Newville | 98-251 | 20-Mar | J. Marr | |
| *Carex nebrascensis* | Newville | 98-252 | 17-Mar | J. Marr | |
| *Carex nudata* | Newville | 98-759 | 30-Mar | C. Warren | |
| *Carex praegracilis* | Newville | 98-760 | 30-Mar | C. Warren | |
| *Carex serratodens* | Newville | 98-253 | 16-Jun | J. Marr | |
| *Carex serratodens* | Newville | 98-254 | 26-Mar | J. Marr | |
| *Carex serratodens* | Newville | 98-761 | 20-Mar | C. Warren | |
| *Carex serratodens* | Newville | 99-45 | 9-Jun | J. Witzman | |
| *Cyperus eragrostis* | Colusa | 98-255 | 21-Jul | J. Marr | |
| *Cyperus eragrostis* | Red Bank | 98-640 | 21-Aug | H. West | |
| *Cyperus squarrosus* | Newville | 98-934 | 14-Jul | J. Cunningham | |
| *Eleocharis* sp. | Newville | 98-935 | 8-Apr | J. Cunningham | |
| *Eleocharis* sp. | Newville | 98-936 | 11-May | J. Cunningham | |
| *Eleocharis* sp. | Newville | 98-256 | 14-Jul | J. Marr | |
| *Eleocharis* sp. | Colusa | 98-257 | 6-Apr | J. Marr | |
| *Eleocharis macrostachya* | Sites | 98-258 | 1-Jul | J. Marr | |
| *Eleocharis macrostachya* | Red Bank | 98-259 | 27-Aug | J. Marr | |
| *Eleocharis macrostachya* | Red Bank | 99-90 | 24-Jun | L. Janeway | |
| *Eleocharis macrostachya* | Colusa | 99-91 | 13-Apr | L. Janeway | |
| *Eleocharis macrostachya* | Colusa | 99-15 | 1-Apr | B. Hendrickson | |
| *Eleocharis obtusa* var. *engelmannii* | Newville | 98-937 | 14-Jul | J. Cunningham | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Eleocharis obtusa* var. *engelmannii* | Newville | 98-696 | 14-Jul | H. West | |
| *Scirpus acutus* var. *occidentalis* | Newville | 98-260 | 2-Jun | J. Marr | |
| *Scirpus acutus* var. *occidentalis* | Colusa | 98-261 | 22-Jul | J. Marr | |
| *Scirpus maritimus* | Sites | 98-668 | 22-Jul | H. West | |
| *Scirpus maritimus* | Sites | 98-262 | 11-Jun | J. Marr | |
| *Scirpus maritimus* | Colusa | 98-263 | 22-Jul | J. Marr | |
| *Scirpus maritimus* | Sites | 98-762 | 11-Jun | C. Warren | |
| *Scirpus pungens* | Red Bank | 99-92 | 14-Jun | L. Janeway | |
| *Scirpus pungens* | Newville | 99-46 | 9-Jun | J. Witzman | |
| *Scirpus pungens* | Newville | 99-185 | 1-Jun | B. Castro | |
| *Scirpus pungens* | Red Bank | 99-353 | 13-Oct | J. Marr | |
| | | | | | |
| DATISCACEAE | | | | | |
| *Datisca glomerata* | Red Bank | 98-264 | 9-Jul | J. Marr | |
| *Datisca glomerata* | Red Bank | 99-186 | 3-Jun | B. Castro | |
| | | | | | |
| ELATINACEAE | | | | | |
| *Elatine californica* | Newville | 98-938 | 14-Jul | J. Cunningham | |
| | | | | | |
| EQUISETACEAE | | | | | |
| *Equisetum arvense* | Red Bank | 98-269 | 27-Aug | J. Marr | |
| *Equisetum arvense* | Red Bank | 98-656 | 27-Aug | H. West | |
| *Equisetum hyemale* ssp. *affine* | Newville | 98-270 | 20-Mar | J. Marr | |
| *Equisetum telmateia* ssp. *braunii* | Newville | 99-47 | 9-Jun | J. Witzman | |
| | | | | | |
| ERICACEAE | | | | | |
| *Arctostaphylos* sp. | Colusa | 98-265 | 8-Apr | J. Marr | |
| *Arctostaphylos* sp. | Red Bank | 98-266 | 3-Jul | J. Marr | |
| *Arctostaphylos manzanita* | Colusa | 98-267 | 17-Jun | J. Marr | |
| *Arctostaphylos manzanita* ssp. *manzanita* | Red Bank | 98-684 | 20-May | H. West | |
| *Arctostaphylos manzanita* ssp. *manzanita* | Newville | 99-187 | 4-May | B. Castro | |
| *Arctostaphylos viscida* | Newville | 98-268 | 19-May | J. Marr | |
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| EUPHORBIACEAE | | | | | |
| *Chamaesyce* sp. | Red Bank | 98-271 | 21-May | J. Marr | |
| *Chamaesyce* sp. | Red Bank | 98-939 | 25-Jun | J. Cunningham | |
| *Chamaesyce glyptosperma* | Red Bank | 98-272 | 27-Aug | J. Marr | |
| *Chamaesyce glyptosperma* | Sites | 98-644 | 29-Oct | H. West | |
| *Chamaesyce glyptosperma* | Red Bank | 98-654 | 21-Aug | H. West | |
| *Chamaesyce maculata* | Red Bank | 98-273 | 27-Aug | J. Marr | |
| *Chamaesyce maculata* | Red Bank | 99-93 | 21-Jun | L. Janeway | |
| *Chamaesyce ocellata* | Newville | 98-274 | 15-Jul | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Chamaesyce ocellata* | Sites | 98-763 | 21-Aug | C. Warren | |
| *Chamaesyce ocellata* | Newville | 98-765 | 1-Sep | C. Warren | |
| *Chamaesyce ocellata* ssp. *rattanii* | Red Bank | 98-275 | 3-Jul | J. Marr | |
| *Chamaesyce ocellata* ssp. *rattanii* | Red Bank | 98-276 | 27-Aug | J. Marr | |
| *Chamaesyce ocellata* ssp. *rattanii* | Red Bank | 99-94 | 9-Jun | L. Janeway | |
| *Chamaesyce ocellata* ssp. *rattanii* | Red Bank | 99-188 | 21-Jun | B. Castro | |
| *Chamaesyce serpyllifolia* | Red Bank | 99-95 | 21-Jun | L. Janeway | |
| *Chamaesyce serpyllifolia* ssp. *serpyllifolia* | Red Bank | 98-277 | 13-Oct | J. Marr | |
| *Euphorbia crenulata* | Red Bank | 99-189 | 21-Jun | B. Castro | |
| *Euphorbia spathulata* | Colusa | 98-278 | 17-Jun | J. Marr | |
| *Euphorbia spathulata* | Newville | 98-279 | 19-May | J. Marr | |
| *Euphorbia spathulata* | Red Bank | 98-940 | 27-Apr | J. Cunningham | |
| | | | | | |
| FABACEAE | | | | | |
| *Astragalus gambelianus* | Colusa | 98-280 | 7-Apr | J. Marr | |
| *Astragalus gambelianus* | Newville | 98-281 | 19-Mar | J. Marr | |
| *Astragalus rattanii* var. *jepsonianus* | Newville | 98-282 | 19-May | J. Marr | |
| *Astragalus rattanii* var. *jepsonianus* | Newville | 98-283 | 17-Apr | J. Marr | |
| *Astragalus rattanii* var. *jepsonianus* | Red Bank | 99-96 | 18-May | L. Janeway | |
| *Glycyrrhiza lepidota* | Newville | 99-190 | 1-Jun | B. Castro | |
| *Lotus corniculatus* | Sites | 98-284 | 11-Jun | J. Marr | |
| *Lotus corniculatus* | Sites | 98-766 | 11-Jun | C. Warren | |
| *Lotus humistratus* | Newville | 98-285 | 26-Mar | J. Marr | |
| *Lotus humistratus* | Red Bank | 98-828 | 6-Jul | C. Warren | |
| *Lotus humistratus* | Red Bank | 98-941 | 6-Jul | J. Cunningham | |
| *Lotus purshianus* var. *purshianus* | Red Bank | 98-286 | 2-Jul | J. Marr | |
| *Lotus purshianus* var. *purshianus* | Red Bank | 98-287 | 9-Jul | J. Marr | |
| *Lotus wrangelianus* | Newville | 98-288 | 2-Jun | J. Marr | |
| *Lotus wrangelianus* | Newville | 98-289 | 19-Mar | J. Marr | |
| *Lupinus affinis* | Newville | 98-767 | 14-May | C. Warren | |
| *Lupinus albifrons* var. *albifrons* | Newville | 98-694 | 30-Apr | H. West | |
| *Lupinus albifrons* var. *albifrons* | Newville | 98-942 | 19-May | J. Cunningham | |
| *Lupinus bicolor* | Newville | 98-290 | 19-Mar | J. Marr | |
| *Lupinus bicolor* | Newville | 98-292 | 26-Mar | J. Marr | |
| *Lupinus bicolor* | Newville | 98-695 | 30-Mar | H. West | |
| *Lupinus bicolor* | Red Bank | 98-768 | 1-Apr | C. Warren | |
| *Lupinus bicolor* | Newville | 98-769 | 26-Mar | C. Warren | |
| *Lupinus latifolius* | Colusa | 98-291 | 8-Apr | J. Marr | |
| *Lupinus luteolus* | Newville | 99-191 | 14-Apr | B. Castro | |
| *Lupinus luteolus* | Newville | 99-192 | 28-Apr | B. Castro | |
| *Lupinus microcarpus* | Newville | 98-770 | 28-Apr | C. Warren | |
| *Lupinus microcarpus* | Newville | 98-771 | 14-May | C. Warren | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Lupinus microcarpus* | Newville | 98-943 | 11-May | J. Cunningham | |
| *Lupinus microcarpus* | Newville | 98-944 | 19-May | J. Cunningham | |
| *Lupinus microcarpus* var. *densiflorus* | Red Bank | 99-193 | 18-May | B. Castro | |
| *Lupinus microcarpus* var. *densiflorus* | Red Bank | 99-194 | 18-May | B. Castro | |
| *Lupinus microcarpus* var. *microcarpus* | Newville | 98-293 | 28-Apr | J. Marr | |
| *Lupinus microcarpus* var. *microcarpus* | Newville | 98-294 | 29-Apr | J. Marr | |
| *Lupinus microcarpus* var. *microcarpus* | Newville | 98-295 | 19-May | J. Marr | |
| *Lupinus nanus* | Newville | 98-296 | 26-Mar | J. Marr | |
| *Lupinus succulentus* | Sites | 99-48 | 19-Apr | J. Witzman | |
| *Lupinus succulentus* | Newville | 99-195 | 4-May | B. Castro | |
| *Medicago lupulina* | Red Bank | 98-647 | 21-Aug | H. West | |
| *Medicago lupulina* | Red Bank | 99-97 | 14-Jun | L. Janeway | |
| *Medicago polymorpha* | Newville | 98-772 | 26-Mar | C. Warren | |
| *Trifolium* sp. | Red Bank | 98-297 | 2-Jul | J. Marr | |
| *Trifolium albopurpureum* var. *albopurpureum* | Red Bank | 98-773 | 27-Apr | C. Warren | |
| *Trifolium albopurpureum* var. *albopurpureum* | Red Bank | 98-774 | 1-Apr | C. Warren | |
| *Trifolium albopurpureum* var. *albopurpureum* | Newville | 99-196 | 14-Apr | B. Castro | |
| *Trifolium bifidum* | Newville | 98-775 | 28-Apr | C. Warren | |
| *Trifolium bifidum* var. *bifidum* | Colusa | 99-197 | 18-Mar | B. Castro | |
| *Trifolium bifidum* var. *bifidum* | Newville | 98-298 | 28-Apr | J. Marr | |
| *Trifolium bifidum* var. *bifidum* | Newville | 98-299 | 20-Apr | J. Marr | |
| *Trifolium bifidum* var. *bifidum* | Red Bank | 98-945 | 27-Apr | J. Cunningham | |
| *Trifolium bifidum* var. *decipiens* | Newville | 98-946 | 11-May | J. Cunningham | |
| *Trifolium bifidum* var. *decipiens* | Sites | 98-300 | 14-Apr | J. Marr | |
| *Trifolium campestre* | Red Bank | 98-301 | 9-Jun | J. Marr | |
| *Trifolium campestre* | Newville | 98-947 | 11-May | J. Cunningham | |
| *Trifolium ciliolatum* | Red Bank | 98-948 | 27-Apr | J. Cunningham | |
| *Trifolium ciliolatum* | Newville | 98-949 | 28-Apr | J. Cunningham | |
| *Trifolium ciliolatum* | Newville | 98-302 | 28-Apr | C. Warren | |
| *Trifolium depauperatum* | Newville | 98-310 | 17-Mar | J. Marr | |
| *Trifolium depauperatum* var. *amplectans* | Newville | 98-303 | 19-Mar | J. Marr | |
| *Trifolium depauperatum* var. *amplectans* | Newville | 98-776 | 30-Mar | C. Warren | |
| *Trifolium depauperatum* var. *depauperatum* | Newville | 98-304 | 19-Mar | J. Marr | |
| *Trifolium dubium* | Newville | 98-305 | 28-Apr | J. Marr | |
| *Trifolium fragiferum* | Sites | 98-306 | 11-Jun | J. Marr | |
| *Trifolium fragiferum* | Colusa | 98-307 | 22-Jul | J. Marr | |
| *Trifolium fucatum* | Newville | 98-308 | 28-Apr | J. Marr | |
| *Trifolium fucatum* | Newville | 98-777 | 30-Mar | C. Warren | |
| *Trifolium fucatum* | Newville | 98-778 | 28-Apr | C. Warren | |
| *Trifolium gracilentum* var. *gracilentum* | Newville | 98-309 | 28-Apr | J. Marr | |
| *Trifolium hirtum* | Newville | 98-779 | 30-Mar | C. Warren | |
| *Trifolium hirtum* | Newville | 98-311 | 19-Mar | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
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| *Trifolium hirtum* | Newville | 98-950 | 11-May | J. Cunningham | |
| *Trifolium microcephalum* | Newville | 98-312 | 2-Jun | J. Marr | |
| *Trifolium monanthum* var. *monanthum* | Red Bank | 98-780 | 6-Jul | C. Warren | |
| *Trifolium obtusiflorum* | Red Bank | 98-313 | 2-Jul | J. Marr | |
| *Trifolium obtusiflorum* | Red Bank | 98-314 | 9-Jun | J. Marr | |
| *Trifolium obtusiflorum* | Red Bank | 98-315 | 27-Aug | J. Marr | |
| *Trifolium obtusiflorum* | Sites | 99-49 | 6-May | J. Witzman | |
| *Trifolium obtusiflorum* | Red Bank | 99-198 | 3-Jun | B. Castro | |
| *Trifolium subterraneanum* | Newville | 98-316 | 29-Apr | J. Marr | |
| *Trifolium subterraneanum* | Newville | 98-317 | 19-Mar | J. Marr | |
| *Trifolium variegatum* | Newville | 98-318 | 8-May | J. Marr | |
| *Trifolium variegatum* | Newville | 98-951 | 14-May | J. Cunningham | |
| *Trifolium variegatum* | Newville | 98-952 | 14-May | J. Cunningham | |
| *Trifolium variegatum* | Newville | 98-953 | 11-May | J. Cunningham | |
| *Trifolium willdenovii* | Newville | 98-319 | 28-Apr | C. Warren | |
| *Trifolium willdenovii* | Newville | 98-320 | 8-May | J. Marr | |
| *Trifolium willdenovii* | Newville | 98-321 | 29-Apr | J. Marr | |
| *Trifolium willdenovii* | Newville | 98-322 | 20-Apr | J. Marr | |
| *Trifolium wormskioldii* | Newville | 98-781 | 11-May | C. Warren | |
| *Trifolium wormskioldii* | Newville | 98-954 | 11-May | J. Cunningham | |
| *Trifolium wormskioldii* | Newville | 98-955 | 28-Apr | J. Cunningham | |
| *Trifolium wormskioldii* | Newville | 98-956 | 28-Apr | J. Cunningham | |
| *Vicia benghalensis* | Sites | 98-782 | 11-Jun | C. Warren | |
| *Vicia villosa* ssp. *villosa* | Sites | 98-323 | 14-Apr | J. Marr | |
| | | | | | |
| FAGACEAE | | | | | |
| *Quercus* sp. | Red Bank | 98-957 | 25-Jun | J. Cunningham | |
| *Quercus* sp. | Red Bank | 98-328 | 9-Jul | J. Marr | |
| *Quercus agrifolia* var. *agrifolia* | Red Bank | 98-324 | 20-May | J. Marr | |
| *Quercus agrifolia* var. *agrifolia* | Red Bank | 98-325 | 9-Jul | J. Marr | |
| *Quercus agrifolia* var. *agrifolia* | Red Bank | 98-326 | 3-Jul | J. Marr | |
| *Quercus berberidifolia* | Red Bank | 98-327 | 15-Jun | J. Marr | |
| *Quercus berberidifolia* | Red Bank | 98-329 | 2-Jul | J. Marr | |
| *Quercus berberidifolia* | Red Bank | 98-330 | 2-Jul | J. Marr | |
| *Quercus berberidifolia* | Newville | 99-98 | 4-May | L. Janeway | |
| *Quercus berberidifolia* | Newville | 99-199 | 5-May | B. Castro | |
| *Quercus chrysolepis* | Red Bank | 98-331 | 9-Jul | J. Marr | |
| *Quercus chrysolepis* | Red Bank | 98-332 | 9-Jul | J. Marr | |
| *Quercus chrysolepis* | Newville | 99-50 | 9-Jun | J. Witzman | |
| *Quercus chrysolepis* | Newville | 99-51 | 9-Jun | J. Witzman | |
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| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| FRANKENIACEAE | | | | | |
| *Frankenia salina* | Sites | 98-783 | 11-Jun | C. Warren | |
| *Frankenia salina* | Sites | 98-784 | 21-Jun | C. Warren | |
| *Frankenia salina* | Colusa | 99-99 | 13-Apr | L. Janeway | |
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| GARRYACEAE | | | | | |
| *Garrya* sp. | Red Bank | 98-958 | 25-Jun | J. Cunningham | |
| *Garrya congdonii* | Red Bank | 99-100 | 19-May | L. Janeway | |
| *Garrya congdonii* | Red Bank | 99-200 | 19-May | B. Castro | |
| *Garrya elliptica* | Red Bank | 98-333 | 20-May | J. Marr | |
| *Garrya elliptica* | Red Bank | 98-334 | 20-May | J. Marr | |
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| GENTIANACEAE | | | | | |
| *Centaurium muehlenbergii* | Colusa | 98-785 | 24-Jun | C. Warren | |
| *Centaurium trichantum* | Red Bank | 98-786 | 7-Jul | C. Warren | |
| *Centaurium trichantum* | Red Bank | 98-335 | 3-Jul | J. Marr | |
| *Centaurium trichantum* | Red Bank | 98-648 | 21-Aug | H. West | |
| *Centaurium trichantum* | Red Bank | 99-201 | 3-Jun | B. Castro | |
| *Centaurium venustum* | Red Bank | 98-336 | 2-Jul | J. Marr | |
| *Centaurium venustum* | Red Bank | 98-959 | 6-Jul | J. Cunningham | |
| *Cicendia quadrangularis* | Newville | 98-337 | 1-Jun | J. Marr | |
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| GERANIACEAE | | | | | |
| *Erodium* sp. | Red Bank | 98-339 | 15-Jun | J. Marr | |
| *Erodium cicutarium* | Newville | 98-338 | 17-Mar | J. Marr | |
| *Geranium carolinianum* | Sites | 99-16 | 22-Apr | B. Hendrickson | |
| | | | | | |
| HYDROCHARITACEAE | | | | | |
| *Najas guadalupensis* | Red Bank | 98-960 | 7-Apr | J. Cunningham | |
| | | | | | |
| HYDROPHYLLACEAE | | | | | |
| *Nemophila sp.* | Sites | 99-18 | 21-Apr | B. Hendrickson | |
| *Nemophila heterophylla* | Newville | 98-340 | 19-May | J. Marr | |
| *Nemophila heterophylla* | Colusa | 99-101 | 1-Apr | L Janeway | |
| *Nemophila menziesii* ssp. *menziesii* | Newville | 99-202 | 28-Apr | B. Castro | |
| *Nemophila pedunculata* | Red Bank | 98-787 | 1-Apr | C. Warren | |
| *Nemophila pedunculata* | Newville | 99-17 | 29-Apr | B. Hendrickson | |
| *Nemophila pedunculata* | Newville | 99-203 | 10-Mar | B. Castro | |
| *Nemophila pulchella* var. *fremontii* | Sites | 99-38 | 23-Mar | B. Hendrickson | |
| *Phacelia distans* | Newville | 98-788 | 11-May | C. Warren | |
| *Phacelia egena* | Newville | 98-341 | 28-Apr | J. Marr | |
| *Phacelia egena* | Sites | 99-19 | 12-Apr | B. Hendrickson | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Phacelia imbricata* ssp. *imbricata* | Newville | 99-102 | 12-May | L Janeway | |
| *Phacelia ramosissima* var. *ramosissima* | Newville | 98-342 | 29-Apr | J. Marr | |
| *Phacelia ramosissima* var. *ramosissima* | Newville | 98-804 | 14-May | C. Warren | |
| *Phacelia ramosissima* var. *ramosissima* | Newville | 98-961 | 14-May | J. Cunningham | |
| *Phacelia ramosissima* var. *ramosissima* | Newville | 99-204 | 12-May | B. Castro | |
| *Phacelia ramosissima* var. *ramosissima* | Newville | 99-205 | 14-Apr | B. Castro | |
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| HYPERICACEAE | | | | | |
| *Hypericum* sp. | Red Bank | 98-346 | 20-May | J. Marr | |
| *Hypericum formosum* var. *scouleri* | Red Bank | 98-343 | 27-Aug | J. Marr | |
| *Hypericum formosum* var. *scouleri* | Red Bank | 98-344 | 2-Apr | J. Marr | |
| *Hypericum formosum* var. *scouleri* | Red Bank | 98-345 | 2-Jul | J. Marr | |
| *Hypericum formosum* var. *scouleri* | Red Bank | 99-282 | 11-Aug | B. Castro | |
| *Hypericum perforatum* | Red Bank | 98-662 | 27-Aug | H. West | |
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| JUGLANDACEAE | | | | | |
| *Juglans californica* var. *hindsii* | Newville | 99-206 | 28-Apr | B. Castro | |
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| JUNCACEAE | | | | | |
| *Juncus* sp. | Colusa | 98-350 | 7-Apr | J. Marr | |
| *Juncus balticus* | Newville | 98-962 | 29-Apr | J. Cunningham | |
| *Juncus balticus* | Sites | 98-347 | 4-May | J. Marr | |
| *Juncus balticus* | Newville | 98-348 | 16-Jun | J. Marr | |
| *Juncus balticus* | Sites | 98-349 | 11-Jun | J. Marr | |
| *Juncus bufonius* | Sites | 98-789 | 14-Apr | C. Warren | |
| *Juncus bufonius* var. *bufonius* | Sites | 98-351 | 11-Jun | J. Marr | |
| *Juncus bufonius* var. *bufonius* | Red Bank | 98-352 | 2-Jul | J. Marr | |
| *Juncus bufonius* var. *bufonius* | Newville | 98-353 | 2-Jun | J. Marr | |
| *Juncus bufonius* var. *bufonius* | Colusa | 98-354 | | J. Marr | |
| *Juncus bufonius* var. *bufonius* | Sites | 98-355 | 14-Apr | J. Marr | |
| *Juncus bufonius* var. *congestus* | Newville | 98-356 | | J. Marr | |
| *Juncus xiphioides* | Red Bank | 98-357 | 9-Jun | J. Marr | |
| *Juncus xiphioides* | Colusa | 98-358 | 22-Jul | J. Marr | |
| *Juncus xiphioides* | Red Bank | 98-359 | 27-Aug | J. Marr | |
| *Juncus xiphioides* | Newville | 98-790 | 14-May | C. Warren | |
| *Juncus xiphioides* | Newville | 99-207 | 1-Jun | B. Castro | |
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| LAMIACEAE | | | | | |
| Undetermined | Red Bank | 98-360 | 9-Jun | J. Marr | |
| *Menthe pulegium* | Red Bank | 98-361 | 21-Oct | J. Marr | |
| *Menthe spicata* var. *spicata* | Red Bank | 98-362 | 24-Sep | J. Marr | |
| *Monardella sheltonii* | Newville | 98-692 | 5-Jun | H. West | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Monardella sheltonii* | Red Bank | 98-363 | 27-Aug | J. Marr | |
| *Monardella sheltonii* | Red Bank | 98-963 | 25-Jun | J. Cunningham | |
| *Monardella sheltonii* | Red Bank | 99-210 | 24-Jun | B. Castro | |
| *Pogogyne zizyphoroides* | Newville | 98-364 | 1-Jun | J. Marr | |
| *Pogogyne zizyphoroides* | Newville | 98-365 | 29-Apr | J. Marr | |
| *Salvia columbariae* | Newville | 98-366 | 17-Apr | J. Marr | |
| *Salvia columbariae* | Red Bank | 98-367 | 3-Jul | J. Marr | |
| *Salvia columbariae* | Newville | 98-368 | 19-Mar | J. Marr | |
| *Salvia columbariae* | Colusa | 99-208 | 1-Apr | B. Castro | |
| *Scuttelaria antirrhinoides* | Red Bank | 98-369 | 21-May | J. Marr | |
| *Scuttelaria californica* | Newville | 99-52 | 9-Jun | J. Witzman | |
| *Scuttelaria siphocampyloides* | Newville | 99-53 | 9-Jun | J. Witzman | |
| *Scuttelaria siphocampyloides* | Red Bank | 98-370 | 3-Jul | J. Marr | |
| *Scuttelaria siphocampyloides* | Red Bank | 98-371 | 2-Jul | J. Marr | |
| *Scuttelaria siphocampyloides* | Red Bank | 98-964 | 7-Jul | J. Cunningham | |
| *Scuttelaria siphocampyloides* | Red Bank | 99-211 | 3-Jun | B. Castro | |
| *Stachys ajugoides* | Newville | 99-64 | 10-Jun | J. Witzman | |
| *Stachys ajugoides* var. *ajugoides* | Sites | 98-791 | 11-Jun | C. Warren | |
| *Stachys ajugoides* var. *rigida* | Red Bank | 98-649 | 9-Jul | H. West | |
| *Stachys pycnantha* | Colusa | 98-372 | 22-Jul | J. Marr | |
| *Stachys stricta* | Newville | 99-103 | 17-Jun | L. Janeway | |
| *Stachys stricta* | Newville | 99-212 | 6-May | B. Castro | |
| *Trichostemma lanceolatum* | Sites | 98-650 | 29-Oct | H. West | |
| *Trichostemma laxum* | Red Bank | 98-643 | 21-Aug | H. West | |
| *Trichostemma laxum* | Red Bank | 99-213 | 9-Jun | B. Castro | |
| *Trichostemma laxum* | Red Bank | 99-214 | 24-Jun | B. Castro | |
| *Trichostemma laxum* | Red Bank | 99-215 | 10-Jun | B. Castro | |
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| LILIACEAE | | | | | |
| *Allium* sp. | Colusa | 98-376 | 6-Apr | J. Marr | |
| *Allium amplectans* | Sites | 98-673 | 15-Apr | H. West | |
| *Allium amplectans* | Newville | 98-690 | 6-Apr | H. West | |
| *Allium amplectans* | Newville | 98-792 | 26-Mar | C. Warren | |
| *Allium falcifolium* | Newville | 98-373 | 26-Mar | J. Marr | |
| *Allium falcifolium* | Newville | 98-374 | 26-Mar | J. Marr | |
| *Allium peninsulare* var. *peninsulare* | Red Bank | 98-375 | 20-May | J. Marr | |
| *Allium peninsulare* var. *peninsulare* | Red Bank | 98-965 | 25-Jun | J. Cunningham | |
| *Allium serra* | Colusa | 98-377 | 21-Apr | J. Marr | |
| *Allium serra* | Sites | 98-378 | 4-May | J. Marr | |
| *Allium serra* | Newville | 99-104 | 22-Apr | L. Janeway | |
| *Allium serra* | Newville | 99-216 | 4-May | B. Castro | |
| *Calochortus amabilis* | Red Bank | 99-217 | 18-May | B. Castro | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
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| | | | | | |
| *Calochortus luteus* | Newville | 98-379 | 30-Apr | J. Marr | |
| *Calochortus luteus* | Sites | 98-380 | 8-May | J. Marr | |
| *Calochortus luteus* | Newville | 99-218 | 4-May | B. Castro | |
| *Chloragalum angustifolium* | Newville | 99-219 | 29-Apr | B. Castro | |
| *Chloragalum angustifolium* | Newville | 99-20 | 29-Apr | B. Hendrickson | |
| *Dichelostemma congestum* | Newville | 98-381 | 19-May | J. Marr | |
| *Dichelostemma multiflorum* | Newville | 98-382 | 19-May | J. Marr | |
| *Dichelostemma multiflorum* | Newville | 98-383 | 29-Apr | J. Marr | |
| *Triteleia hyacinthina* | Newville | 98-384 | 2-Jun | J. Marr | |
| *Triteleia hyacinthina* | Sites | 98-385 | 8-May | J. Marr | |
| *Triteleia laxa* | Newville | 98-691 | 30-Mar | H. West | |
| *Triteleia laxa* | Newville | 98-693 | 6-Apr | H. West | |
| *Triteleia peduncularis* | Newville | 99-55 | 10-Jun | J. Witzman | |
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| LIMNANTHACEAE | | | | | |
| *Limnanthes douglasii* ssp. *nivea* | Newville | 99-105 | 6-Apr | L. Janeway | |
| *Limnanthes douglasii* ssp. *nivea* | Red Bank | 99-21 | | B. Hendrickson | |
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| LINACEAE | | | | | |
| *Hesperolinon californicum* | Red Bank | 99-106 | 8-Jun | L. Janeway | |
| *Hesperolinon disjunctum* | Red Bank | 98-386 | 6-Jul | J. Marr | |
| *Hesperolinon disjunctum* | Red Bank | 98-966 | 25-Jun | J. Cunningham | |
| *Hesperolinon disjunctum* | Red Bank | 98-967 | 7-Jul | J. Cunningham | |
| *Hesperolinon micranthum* | Red Bank | 98-793 | 2-Jul | C. Warren | |
| *Hesperolinon spurgulinum* | Newville | 98-794 | 11-May | C. Warren | |
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| LOASACEAE | | | | | |
| *Mentzelia laevicaulis* | Red Bank | 98-388 | 13-Oct | J. Marr | |
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| LYTHRACEAE | | | | | |
| *Ammania coccinea* | Newville | 98-795 | 15-Jul | C.Warren | |
| *Ammania coccinea* | Newville | 98-968 | 14-Jul | J. Cunningham | |
| *Lythrum californicum* | Colusa | 98-389 | 22-Jul | J. Marr | |
| *Lythrum hyssopifolium* | Red Bank | 98-390 | 3-Jul | J. Marr | |
| *Lythrum hyssopifolium* | Sites | 98-391 | 1-Jul | J. Marr | |
| *Lythrum hyssopifolium* | Newville | 98-392 | 14-Jul | J. Marr | |
| *Lythrum hyssopifolium* | Red Bank | 98-393 | 2-Jul | J. Marr | |
| *Lythrum hyssopifolium* | Sites | 98-394 | 11-Jun | J. Marr | |
| *Lythrum hyssopifolium* | Sites | 98-395 | 11-Jun | J. Marr | |
| *Lythrum hyssopifolium* | Red Bank | 99-220 | 3-Jun | B. Castro | |
| *Lythrum tribracteatum* | Sites | 98-796 | 22-Jun | C.Warren | |
| *Lythrum tribracteatum* | Sites | 98-396 | 1-Jul | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
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| | | | | | |
| *Lythrum tribracteatum* | Newville | 99-221 | 1-Jun | B. Castro | |
| *Rotala ramosior* | Newville | 98-797 | 15-Jul | C.Warren | |
| *Rotala ramosior* | Newville | 98-798 | 14-Jul | C.Warren | |
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| MALVACEAE | | | | | |
| *Malacothamnus fremontii* | Red Bank | 99-222 | 9-Jun | B. Castro | |
| *Malvella leprosa* | Colusa | 98-397 | 21-Jul | J. Marr | |
| *Malvella leprosa* | Sites | 98-398 | 1-Jul | J. Marr | |
| *Sidalcea calycosa* ssp. *calycosa* | Newville | 98-399 | 2-Jun | J. Marr | |
| *Sidalcea hirsuta* | Red Bank | 98-400 | 9-Jun | J. Marr | |
| *Sidalcea hirsuta* | Newville | 98-401 | 2-Jun | J. Marr | |
| *Sidalcea hirsuta* | Red Bank | 98-402 | 2-Jul | J. Marr | |
| *Sidalcea hirsuta* | Newville | 98-403 | 19-May | J. Marr | |
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| MARSILEACEAE | | | | | |
| *Marsilea vestita* ssp. *vestita.* | Newville | 98-404 | 30-Apr | J. Marr | |
| *Marsilea vestita* ssp. *vestita.* | Newville | 98-405 | 16-Mar | J. Marr | |
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| MOLLUGONACEAE | | | | | |
| *Mollugo verticillata* | Newville | 98-406 | 15-Jul | J. Marr | |
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| OLEACEAE | | | | | |
| *Fraxinus dipetala* | Red Bank | 99-223 | 10-Jun | B. Castro | |
| *Fraxinus dipetala* | Red Bank | 99-224 | 10-Jun | B. Castro | |
| *Fraxinus dipetala* | Red Bank | 99-225 | 9-Jun | B. Castro | |
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| ONAGRACEAE | | | | | |
| *Camissonia graciliflora* | Newville | 98-407 | 28-Apr | J. Marr | |
| *Camissonia graciliflora* | Newville | 98-408 | 29-Apr | J. Marr | |
| *Camissonia graciliflora* | Sites | 99-107 | 12-Apr | L. Janeway | |
| *Camissonia graciliflora* | Colusa | 99-108 | 1-Apr | L. Janeway | |
| *Camissonia graciliflora* | Red Bank | 99-109 | 20-Apr | L. Janeway | |
| *Camissonia graciliflora* | Colusa | 99-22 | 30-Mar | B. Hendrickson | |
| *Camissonia graciliflora* | Sites | 99-23 | 13-Apr | B. Hendrickson | |
| *Camissonia hirtella* | Newville | 98-849 | 18-Jun | C. Warren | |
| *Clarkia* sp. | Newville | 98-969 | 14-May | J. Cunningham | |
| *Clarkia affinis* | Newville | 98-409 | 29-Apr | J. Marr | |
| *Clarkia affinis* | Newville | 98-410 | 28-Apr | J. Marr | |
| *Clarkia affinis* | Sites | 98-411 | 4-May | J. Marr | |
| *Clarkia affinis* | Sites | 98-412 | 8-May | J. Marr | |
| *Clarkia affinis* | Newville | 98-799 | 14-May | C. Warren | |
| *Clarkia affinis* | Newville | 98-970 | 19-May | J. Cunningham | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
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| | | | | | |
| *Clarkia affinis* | Newville | 98-972 | 28-Apr | J. Cunningham | |
| *Clarkia concinna* ssp. *concinna* | Newville | 98-973 | 18-May | J. Cunningham | |
| *Clarkia concinna* ssp. *concinna* | Red Bank | 98-413 | 20-May | J. Marr | |
| *Clarkia gracilis* ssp. *gracilis* | Newville | 98-414 | 30-Apr | J. Marr | |
| *Clarkia gracilis* ssp. *gracilis* | Colusa | 98-415 | 17-Jun | J. Marr | |
| *Clarkia gracilis* ssp. *gracilis* | Newville | 98-416 | 29-Apr | J. Marr | |
| *Clarkia gracilis* ssp. *gracilis* | Newville | 98-974 | 14-May | J. Cunningham | |
| *Clarkia gracilis* ssp. *gracilis* | Newville | 99-226 | 4-May | B. Castro | |
| *Clarkia gracilis* ssp. *gracilis* | Newville | 99-228 | 28-Apr | B. Castro | |
| *Clarkia lassenensis* | Newville | 99-227 | 14-Apr | B. Castro | |
| *Clarkia modesta* | Newville | 98-975 | 14-May | J. Cunningham | |
| *Clarkia modesta* | Newville | 98-800 | 14-May | C. Warren | |
| *Clarkia purpurea* ssp. *quadrivulnera* | Newville | 98-801 | 4-May | C. Warren | |
| *Clarkia purpurea* ssp. *quadrivulnera* | Newville | 98-417 | 18-May | J. Marr | |
| *Clarkia purpurea* ssp. *quadrivulnera* | Red Bank | 98-418 | 9-Jun | J. Marr | |
| *Clarkia purpurea* ssp. *quadrivulnera* | Sites | 98-419 | 8-May | J. Marr | |
| *Clarkia purpurea* ssp. *quadrivulnera* | Newville | 98-971 | 11-May | J. Cunningham | |
| *Clarkia purpurea* ssp. *quadrivulnera* | Newville | 98-976 | 19-May | J. Cunningham | |
| *Clarkia purpurea* ssp. *quadrivulnera* | Newville | 98-977 | 28-Apr | J. Cunningham | |
| *Clarkia rhomboidea* | Red Bank | 98-420 | 2-Jul | J. Marr | |
| *Clarkia rhomboidea* | Red Bank | 98-421 | 9-Jun | J. Marr | |
| *Epilobium brachycarpum* | Red Bank | 98-422 | 23-Sep | J. Marr | |
| *Epilobium brachycarpum* | Red Bank | 98-423 | 23-Sep | J. Marr | |
| *Epilobium ciliatum* ssp. *ciliatum* | Red Bank | 98-424 | 27-Aug | J. Marr | |
| *Epilobium ciliatum* ssp. *ciliatum* | Red Bank | 98-641 | 21-Aug | H. West | |
| *Epilobium cleistogamum* | Red Bank | 98-425 | 2-Jul | J. Marr | |
| *Epilobium cleistogamum* | Sites | 98-426 | 1-Jul | J. Marr | |
| *Epilobium cleistogamum* | Colusa | 98-427 | 22-Jul | J. Marr | |
| *Epilobium cleistogamum* | Red Bank | 98-802 | 7-Jul | C. Warren | |
| *Epilobium densiflorum* | Colusa | 98-428 | 21-Jul | J. Marr | |
| *Epilobium densiflorum* | Newville | 98-851 | 5-Jun | C. Warren | |
| *Epilobium foliosum* | Red Bank | 98-683 | 20-May | H. West | |
| *Epilobium minutum* | Red Bank | 98-429 | 15-Jun | J. Marr | |
| *Epilobium minutum* | Newville | 98-430 | 16-Jun | J. Marr | |
| *Epilobium minutum* | Red Bank | 98-431 | 9-Jun | J. Marr | |
| *Epilobium minutum* | Red Bank | 98-432 | 8-Jul | J. Marr | |
| *Epilobium minutum* | Newville | 98-433 | 19-May | J. Marr | |
| *Epilobium pygmaeum* | Newville | 98-434 | 2-Jun | J. Marr | |
| *Epilobium torreyi* | Newville | 98-803 | 5-Jun | C. Warren | |
| | | | | | |
| ORCHIDACEAE | | | | | |
| *Epipactis gigantea* | Newville | 99-56 | 9-Jun | J. Witzman | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Spiranthes porrifolia* | Red Bank | 99-110 | 24-Jun | L. Janeway | |
| | | | | | |
| OROBANCHEACEAE | | | | | |
| *Orobanche fasciculata* | Newville | 98-435 | 29-Apr | J. Marr | |
| *Orobanche fasciculata* | Red Bank | 98-978 | 25-Jun | J. Cunningham | |
| | | | | | |
| PAPAVERACEAE | | | | | |
| *Eschscholzia* sp. | Newville | 98-979 | 28-Apr | J. Cunningham | |
| *Eschscholzia caespitosa* | Sites | 98-436 | 4-May | J. Marr | |
| *Eschscholzia caespitosa* | Newville | 98-437 | 19-Mar | J. Marr | |
| *Eschscholzia californica* | Newville | 98-438 | 28-Apr | J. Marr | |
| *Eschscholzia californica* | Red Bank | 98-980 | 27-Apr | J. Cunningham | |
| *Platystemon californicis* | Red Bank | 98-981 | 27-Apr | J. Cunningham | |
| | | | | | |
| PHILADELPHACEAE | | | | | |
| *Philadelphus lewisii* | Red Bank | 99-258 | 21-Jun | B. Castro | |
| | | | | | |
| PLANTAGINACEAE | | | | | |
| *Plantago coronopus* | Colusa | 98-439 | 6-Apr | J. Marr | |
| *Plantago coronopus* | Sites | 98-440 | 11-Jun | J. Marr | |
| *Plantago elongata* | Colusa | 98-441 | 21-Apr | J. Marr | |
| *Plantago elongata* | Sites | 98-442 | 16-Apr | J. Marr | |
| *Plantago elongata* | Colusa | 98-443 | 7-Apr | J. Marr | |
| *Plantago erecta* | Sites | 98-444 | 14-Apr | J. Marr | |
| *Plantago erecta* | Colusa | 98-445 | 6-Apr | J. Marr | |
| *Plantago erecta* | Colusa | 98-446 | 14-Apr | J. Marr | |
| *Plantago erecta* | Newville | 98-447 | 20-Apr | J. Marr | |
| *Plantago erecta* | Sites | 98-448 | 8-May | J. Marr | |
| *Plantago erecta* | Sites | 98-449 | 4-May | J. Marr | |
| | | | | | |
| POACEAE | | | | | |
| Undetermined | Red Bank | 98-805 | 2-Jul | C. Warren | |
| *Achnatherum lemmonii* | Red Bank | 98-450 | 23-Sep | J. Marr | |
| *Achnatherum lemmonii* | Red Bank | 98-986 | 25-Jun | J. Cunningham | |
| *Achnatherum lemmonii* | Red Bank | 99-229 | 10-Jun | B. Castro | |
| *Aegilops cylindrica* | Sites | 98-806 | 8-May | C. Warren | |
| *Agrostis exarata* | Red Bank | 98-865 | 25-Jun | J. Cunningham | |
| *Aira caryophyllea* | Red Bank | 98-451 | 1-Apr | J. Marr | |
| *Alopecurus aequalis* | Newville | 98-452 | 1-Jun | J. Marr | |
| *Alopecurus saccatus* | Sites | 98-453 | 16-Apr | J. Marr | |
| *Alopecurus saccatus* | Newville | 99-230 | 5-May | B. Castro | |
| *Aristida ternipes* var. *hamulosa* | Sites | 98-454 | 27-May | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Aristida ternipes* var. *hamulosa* | Newville | 98-987 | 14-May | J. Cunningham | |
| *Avena barbata* | Colusa | 98-455 | 17-Jun | J. Marr | |
| *Avena barbata* | Newville | 98-456 | 28-Apr | J. Marr | |
| *Avena barbata* | Colusa | 98-457 | 7-Apr | J. Marr | |
| *Avena fatua* | Sites | 98-458 | 14-Apr | J. Marr | |
| *Bromus diandrus* | Red Bank | 98-459 | 2-Jul | J. Marr | |
| *Bromus japonicus* | Red Bank | 98-460 | 21-May | J. Marr | |
| *Bromus japonicus* | Colusa | 98-461 | 6-Apr | J. Marr | |
| *Bromus laevipes* | Red Bank | 98-462 | 9-Jul | J. Marr | |
| *Bromus madritensis* ssp. *rubens* | Newville | 98-463 | 16-Jun | J. Marr | |
| *Bromus madritensis* ssp. *rubens* | Newville | 98-464 | 19-Mar | J. Marr | |
| *Bromus madritensis* ssp. *rubens* | Sites | 98-465 | 14-Apr | J. Marr | |
| *Crypsis schoenoides* | Newville | 98-466 | 15-Apr | J. Marr | |
| *Crypsis schoenoides* | Red Bank | 98-467 | 21-Jul | J. Marr | |
| *Crypsis schoenoides* | Sites | 98-660 | 29-Oct | H. West | |
| *Cynodon dactylon* | Red Bank | 99-111 | 24-Jun | L. Janeway | |
| *Cynosurus echinatus* | Red Bank | 98-988 | 25-Jun | J. Cunningham | |
| *Deschampsia danthonioides* | Sites | 98-468 | 8-May | J. Marr | |
| *Deschampsia danthonioides* | Sites | 98-469 | 8-May | J. Marr | |
| *Deschampsia danthonioides* | Newville | 99-231 | 5-May | B. Castro | |
| *Elymus glaucus* | Newville | 99-57 | 9-Jun | J. Witzman | |
| *Elymus multisetus* | Red Bank | 99-232 | 14-Jun | B. Castro | |
| *Elymus trachycaulis* ssp. *subsecundus* | Red Bank | 98-807 | 9-Jul | C. Warren | |
| *Elytrigia pontica* ssp. *pontica* | Red Bank | 98-470 | 24-Sep | J. Marr | |
| *Elytrigia pontica* ssp. *pontica* | Red Bank | 98-471 | 24-Sep | J. Marr | |
| *Gastridium ventricosum* | Colusa | 98-472 | 17-Jun | J. Marr | |
| *Gastridium ventricosum* | Newville | 98-473 | 16-Jun | J. Marr | |
| *Gastridium ventricosum* | Red Bank | 98-474 | 9-Jun | J. Marr | |
| *Gastridium ventricosum* | Newville | 98-475 | 15-Jul | J. Marr | |
| *Gastridium ventricosum* | Sites | 98-476 | 8-May | J. Marr | |
| *Gastridium ventricosum* | Newville | 98-989 | 11-May | J. Cunningham | |
| *Hordeum brachyantherum* ssp. *brachyantherum* | Newville | 98-477 | 14-Jun | J. Marr | |
| *Hordeum brachyantherum* ssp. *californicum* | Colusa | 98-478 | 21-Apr | J. Marr | |
| *Hordeum marinum* ssp. *gussoneanum* | Sites | 98-808 | 8-May | C. Warren | |
| *Hordeum marinum* ssp. *gussoneanum* | Newville | 98-990 | 11-May | J. Cunningham | |
| *Hordeum murinum* ssp. *leporinum* | Colusa | 98-479 | 8-Apr | J. Marr | |
| *Hordeum murinum* ssp. *murinum* | Sites | 98-480 | 16-Apr | J. Marr | |
| *Hordeum murinum* ssp. *murinum* | Colusa | 99-233 | 18-Mar | B. Castro | |
| *Koeleria macrantha* | Colusa | 98-481 | 7-Apr | J. Marr | |
| *Koeleria phleoides* | Colusa | 98-482 | 7-Apr | J. Marr | |
| *Leymus triticoides* | Newville | 98-483 | 16-Jun | J. Marr | |
| *Lolium multiflorum* | Colusa | 98-484 | 8-Apr | J. Marr | |

| FAMILY *Genus species* | Reservoir | Voucher | Date | Collector | |
|---|---|---|---|---|---|
| | | | | | |
| *Melica californica* | Red Bank | 98-485 | 15-Jun | J. Marr | |
| *Melica californica* | Newville | 98-486 | 1-May | J. Marr | |
| *Melica californica* | Newville | 98-487 | 29-Apr | J. Marr | |
| *Melica californica* | Colusa | 98-488 | 17-Jun | J. Marr | |
| *Melica californica* | Sites | 98-489 | 27-May | J. Marr | |
| *Melica californica* | Newville | 98-490 | 30-Apr | J. Marr | |
| *Melica harfordii* | Newville | 98-991 | 14-May | J. Cunningham | |
| *Melica harfordii* | Newville | 98-995 | 28-Apr | J. Cunningham | |
| *Melica torreyana* | Red Bank | 98-491 | 9-Jul | J. Marr | |
| *Muhlenbergia rigens* | Sites | 99-24 | 25-Mar | B. Hendrickson | |
| *Nasella cernua* | Sites | 98-492 | 27-May | J. Marr | |
| *Nasella cernua* | Colusa | 98-493 | 17-Jun | J. Marr | |
| *Nasella cernua* | Sites | 98-494 | 8-May | J. Marr | |
| *Nasella cernua* | Newville | 98-809 | 11-May | C. Warren | |
| *Nasella cernua* | Newville | 99-234 | 4-May | B. Castro | |
| *Nasella cernua* | Newville | 99-235 | 11-May | B. Castro | |
| *Nasella lepida* | Red Bank | 98-993 | 27-Apr | J. Cunningham | |
| *Nasella pulchra* | Newville | 98-994 | 11-May | J. Cunningham | |
| *Nasella pulchra* | Newville | 98-810 | 14-May | C. Warren | |
| *Nasella pulchra* | Sites | 98-495 | 4-May | J. Marr | |
| *Nasella pulchra* | Newville | 98-496 | 16-Jun | J. Marr | |
| *Nasella pulchra* | Newville | 98-497 | 16-Jun | J. Marr | |
| *Nasella pulchra* | Sites | 98-498 | 16-Apr | J. Marr | |
| *Nasella pulchra* | Red Bank | 98-499 | 15-Jun | J. Marr | |
| *Nasella pulchra* | Newville | 98-500 | 30-Apr | J. Marr | |
| *Panicum capillare* | Red Bank | 98-501 | 24-Sep | J. Marr | |
| *Panicum capillare* | Red Bank | 98-658 | 21-Aug | H. West | |
| *Panicum capillare* | Red Bank | 98-659 | 27-Aug | H. West | |
| *Parapholis incurva* | Sites | 98-502 | 1-Jun | J. Marr | |
| *Paspalum dilatatum* | Newville | 99-112 | 17-Jun | L. Janeway | |
| *Phalaris aquatica* | Red Bank | 98-503 | 9-Jun | J. Marr | |
| *Phalaris minor* | Newville | 98-504 | 14-Jul | J. Marr | |
| *Phalaris minor* | Red Bank | 98-505 | 9-Jul | J. Marr | |
| *Phalaris paradoxa* | Colusa | 98-506 | 17-Jun | J. Marr | |
| *Phalaris paradoxa* | Sites | 98-507 | 11-Jun | J. Marr | |
| *Phalaris paradoxa* | Newville | 98-508 | 2-Jun | J. Marr | |
| *Phalaris paradoxa* | Sites | 98-509 | 11-Jun | J. Marr | |
| *Phalaris paradoxa* | Sites | 98-510 | 8-May | J. Marr | |
| *Phalaris paradoxa* | Sites | 98-811 | 8-May | C. Warren | |
| *Piptatherum miliaceum* | Red Bank | 98-812 | 21-Aug | C. Warren | |
| *Piptatherum miliaceum* | Red Bank | 99-113 | 24-Jun | L. Janeway | |
| *Poa* sp. | Newville | 99-58 | 9-Jun | J. Witzman | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Poa secunda* ssp. *secunda* | Red Bank | 98-813 | 27-Apr | C. Warren | |
| *Poa secunda* ssp. *secunda* | Newville | 98-814 | 20-Mar | C. Warren | |
| *Poa secunda* ssp. *secunda* | Newville | 98-511 | 30-Apr | J. Marr | |
| *Poa secunda* ssp. *secunda* | Red Bank | 98-512 | 1-Apr | J. Marr | |
| *Poa secunda* ssp. *secunda* | Red Bank | 98-994 | 27-Apr | J. Cunningham | |
| *Poa secunda* ssp. *secunda* | Newville | 98-996 | 29-Apr | J. Cunningham | |
| *Polypogon interruptus* | Newville | 99-59 | 9-Jun | J. Witzman | |
| *Polypogon maritimus* | Red Bank | 98-513 | 2-Jul | J. Marr | |
| *Polypogon maritimus* | Red Bank | 98-815 | 7-Jul | C. Warren | |
| *Polypogon maritimus* | Sites | 98-816 | 8-May | C. Warren | |
| *Polypogon monspeliensis* | Sites | 98-514 | 1-Jul | J. Marr | |
| *Polypogon monspeliensis* | Sites | 98-515 | 11-Jun | J. Marr | |
| *Polypogon monspeliensis* | Sites | 98-669 | 27-May | H. West | |
| *Polypogon monspeliensis* | Sites | 98-674 | 29-Oct | H. West | |
| *Polypogon monspeliensis* | Newville | 98-687 | 2-Jun | H. West | |
| *Scribneria bolanderi* | Sites | 98-729 | 11-Jun | C. Warren | |
| *Taeniatherum caput-medusae* | Newville | 98-997 | 29-Apr | J. Cunningham | |
| *Taeniatherum caput-medusae* | Newville | 98-998 | 11-May | J. Cunningham | |
| *Vulpia bromoides* | Newville | 98-999 | 29-Apr | J. Cunningham | |
| *Vulpia bromoides* | Newville | 98-1000 | 11-May | J. Cunningham | |
| *Vulpia bromoides* | Colusa | 98-516 | 6-Apr | J. Marr | |
| *Vulpia bromoides* | Colusa | 98-517 | 7-Apr | J. Marr | |
| *Vulpia microstachys* var. *ciliata* | Newville | 98-518 | 20-Apr | J. Marr | |
| *Vulpia microstachys* var. *ciliata* | Sites | 98-519 | 8-May | J. Marr | |
| *Vulpia microstachys* var. *ciliata* | Newville | 98-520 | 28-Apr | J. Marr | |
| *Vulpia microstachys* var. *ciliata* | Newville | 98-521 | 29-Apr | J. Marr | |
| *Vulpia microstachys* var. *ciliata* | Newville | 98-522 | 20-Apr | J. Marr | |
| *Vulpia microstachys* var. *ciliata* | Newville | 98-1001 | 29-Apr | J. Cunningham | |
| *Vulpia microstachys* var. *confusa* | Colusa | 98-523 | 7-Apr | J. Marr | |
| *Vulpia microstachys* var. *pauciflora* | Newville | 98-524 | 28-Apr | J. Marr | |
| *Vulpia microstachys* var. *pauciflora* | Newville | 98-525 | 20-Apr | J. Marr | |
| *Vulpia microstachys* var. *pauciflora* | Newville | 98-526 | 17-Apr | J. Marr | |
| *Vulpia microstachys* var. *pauciflora* | Newville | 98-817 | 26-Mar | C. Warren | |
| *Vulpia microstachys* var. *pauciflora* | Red Bank | 98-818 | 27-Apr | C. Warren | |
| *Vulpia myuros* var. *hirsuta* | Newville | 98-527 | 26-Mar | J. Marr | |
| *Vulpia myuros* var. *hirsuta* | Newville | 98-528 | 19-Mar | J. Marr | |
| *Vulpia myuros* var. *hirsuta* | Colusa | 98-529 | 7-Apr | J. Marr | |
| *Vulpia myuros* var. *hirsuta* | Red Bank | 98-530 | 1-Apr | J. Marr | |
| *Vulpia myuros* var. *myuros* | Colusa | 98-531 | 6-Apr | J. Marr | |
| *Vulpia myuros* var. *myuros* | Newville | 98-1002 | 11-May | J. Cunningham | |
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| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| POLEMONIACEAE | | | | | |
| *Allophyllum gilioides* | Newville | 98-1003 | 28-Apr | J. Cunningham | |
| *Eriastrum abramsii* | Red Bank | 98-541 | 6-Jul | J. Marr | |
| *Eriastrum brandegeae* | Red Bank | 99-114 | 4-Jun | L. Janeway | |
| *Gilia capitata* ssp. *capitata* | Newville | 98-819 | 28-Apr | C. Warren | |
| *Gilia capitata* ssp. *capitata* | Newville | 98-688 | 30-Mar | H.West | |
| *Gilia capitata* ssp. *capitata* | Newville | 98-1004 | 14-May | J. Cunningham | |
| *Gilia capitata* ssp. *staminea* | Newville | 99-236 | 14-Apr | B. Castro | |
| *Gilia tricolor* ssp. *tricolor* | Newville | 98-827 | 26-Mar | C. Warren | |
| *Linanthus acicularis* | Newville | 98-820 | 26-Mar | C. Warren | |
| *Linanthus bicolor* | Newville | 98-821 | 26-Mar | C. Warren | |
| *Linanthus bolanderi* | Red Bank | 98-533 | 15-Jun | J. Marr | |
| *Linanthus bolanderi* | Newville | 98-1005 | 11-May | J. Cunningham | |
| *Linanthus bolanderi* | Newville | 98-1006 | 28-Apr | J. Cunningham | |
| *Linanthus ciliatus* | Newville | 98-1007 | 28-Apr | J. Cunningham | |
| *Linanthus ciliatus* | Newville | 98-1008 | 11-May | J. Cunningham | |
| *Linanthus ciliatus* | Colusa | 98-534 | 7-Apr | J. Marr | |
| *Linanthus ciliatus* | Newville | 98-535 | 20-Apr | J. Marr | |
| *Linanthus ciliatus* | Sites | 98-536 | 14-Apr | J. Marr | |
| *Linanthus ciliatus* | Newville | 98-537 | 28-Apr | J. Marr | |
| *Linanthus dichotomous* | Newville | 98-538 | 29-Apr | J. Marr | |
| *Linanthus dichotomous* | Red Bank | 99-237 | 25-Mar | B. Castro | |
| *Linanthus dichotomous* | Newville | 99-238 | 14-Apr | B. Castro | |
| *Linanthus parviflorus* | Newville | 98-822 | 15-Apr | C. Warren | |
| *Linanthus parviflorus* | Red Bank | 98-1009 | 27-Apr | J. Cunningham | |
| *Linanthus parviflorus* | Newville | 98-387 | 20-Mar | J. Marr | |
| *Linanthus pygmaeus* ssp. *continentalis* | Newville | 98-539 | 11-Apr | J. Marr | |
| *Navarretia eriocephala* | Colusa | 98-542 | 17-Jun | J. Marr | |
| *Navarretia eriocephala* | Sites | 98-543 | 8-May | J. Marr | |
| *Navarretia heterandra* | Newville | 98-544 | 2-Jun | J. Marr | |
| *Navarretia heterandra* | Sites | 98-545 | 8-May | J. Marr | |
| *Navarretia heterandra* | Newville | 98-823 | 11-May | C. Warren | |
| *Navarretia heterandra* | Newville | 99-239 | 4-May | B. Castro | |
| *Navarretia intertexta* ssp. *intertexta* | Red Bank | 98-824 | 7-Jul | C. Warren | |
| *Navarretia intertexta* ssp. *intertexta* | Red Bank | 98-1010 | 7-Jul | J. Cunningham | |
| *Navarretia jepsonii* | Red Bank | 98-681 | 6-Jul | H.West | |
| *Navarretia jepsonii* | Red Bank | 99-115 | 21-Jun | L. Janeway | |
| *Navarretia jepsonii* | Red Bank | 99-240 | 3-Jun | B. Castro | |
| *Navarretia jepsonii* | Red Bank | 99-241 | 9-Jun | B. Castro | |
| *Navarretia jepsonii* | Red Bank | 99-242 | 14-Jun | B. Castro | |
| *Navarretia leucocephala* | Sites | 98-825 | 1-Jul | C. Warren | |
| *Navarretia leucocephala* ssp. *leucocephala* | Newville | 98-546 | 1-Jun | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
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| | | | | | |
| *Navarretia leucocephala* ssp. *leucocephala* | Newville | 98-547 | 14-Jul | J. Marr | |
| *Navarretia leucocephala* ssp. *leucocephala* | Sites | 98-548 | 1-Jul | J. Marr | |
| *Navarretia leucocephala* ssp. *leucocephala* | Newville | 98-549 | 30-Apr | J. Marr | |
| *Navarretia leucocephala* ssp. *leucocephala* | Newville | 98-1011 | 14-Jul | J. Cunningham | |
| *N. nigelliformis* ssp. *nigelliformis* | Colusa | 98-550 | 17-Jun | J. Marr | |
| *N. nigelliformis* ssp. *nigelliformis* | Sites | 98-551 | 8-May | J. Marr | |
| *Navarretia prolifera* ssp. *prolifera* | Red Bank | 98-552 | 6-Jul | J. Marr | |
| *Navarretia pubescens* | Red Bank | 98-553 | 15-Jun | J. Marr | |
| *Navarretia pubescens* | Sites | 98-554 | 8-May | J. Marr | |
| *Navarretia pubescens* | Newville | 98-685 | 1-Jun | H.West | |
| *Navarretia pubescens* | Newville | 98-826 | 11-May | C. Warren | |
| *Navarretia pubescens* | Red Bank | 99-243 | 9-Jun | B. Castro | |
| *Navarretia pubescens* | Red Bank | 99-244 | 10-Jun | B. Castro | |
| *Navarretia tagetina* | Red Bank | 98-555 | 2-Jul | J. Marr | |
| *Navarretia tagetina* | Red Bank | 98-556 | 8-Jul | J. Marr | |
| *Navarretia tagetina* | Newville | 98-557 | 1-Jun | J. Marr | |
| *Navarretia viscidula* | Red Bank | 98-558 | 8-Jul | J. Marr | |
| *Navarretia viscidula* | Red Bank | 98-682 | 6-Jul | H.West | |
| *Navarretia viscidula* | Red Bank | 98-680 | 25-Jun | H.West | |
| *Navarretia viscidula* | Red Bank | 98-829 | 6-Jul | C. Warren | |
| *Navarretia viscidula* | Red Bank | 98-1012 | 25-Jun | J. Cunningham | |
| *Navarretia viscidula* | Red Bank | 98-1013 | 6-Jul | J. Cunningham | |
| *Navarretia viscidula* | Red Bank | 99-116 | 15-Jun | L. Janeway | |
| *Phlox gracilis* | Colusa | 99-25 | 30-Mar | B. Hendrickson | |
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| POLYGONACEAE | | | | | |
| *Chorizanthe membranacea* | Newville | 98-560 | 28-Apr | J. Marr | |
| *Chorizanthe membranacea* | Sites | 98-676 | 26-May | H. West | |
| *Chorizanthe membranacea* | Newville | 98-982 | 14-May | J. Cunningham | |
| *Chorizanthe membranacea* | Newville | 98-983 | 19-May | J. Cunningham | |
| *Chorizanthe membranacea* | Newville | 99-245 | 12-May | B. Castro | |
| *Eriogonum dasyanthemum* | Red Bank | 99-246 | 9-Jun | B. Castro | |
| *Eriogonum dasyanthemum* | Newville | 98-984 | 14-May | J. Cunningham | |
| *Eriogonum dasyanthemum* | Sites | 98-675 | 26-May | H. West | |
| *Eriogonum dasyanthemum* | Colusa | 98-561 | 17-Jun | J. Marr | |
| *Eriogonum dasyanthemum* | Red Bank | 98-562 | 15-Jun | J. Marr | |
| *Eriogonum dasyanthemum* | Newville | 98-563 | 16-Jun | J. Marr | |
| *Eriogonum dasyanthemum* | Red Bank | 98-564 | 3-Jul | J. Marr | |
| *Eriogonum dasyanthemum* | Red Bank | 98-565 | 3-Jul | J. Marr | |
| *Eriogonum dasyanthemum* | Red Bank | 98-566 | 21-May | J. Marr | |
| *Eriogonum dasyanthemum* | Red Bank | 98-646 | 21-Aug | H. West | |
| *Eriogonum dasyanthemum* | Red Bank | 98-830 | 6-Jul | C. Warren | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Eriogonum dasyanthemum* | Red Bank | 99-247 | 24-Jun | B. Castro | |
| *Eriogonum nudum* var. *nudum* | Red Bank | 98-567 | 13-Oct | J. Marr | |
| *Eriogonum nudum* var. *oblongifolium* | Red Bank | 98-568 | 3-Jul | J. Marr | |
| *Eriogonum nudum* var. *oblongifolium* | Red Bank | 98-569 | 9-Jul | J. Marr | |
| *Eriogonum wrightii* var. *trachygonum* | Red Bank | 99-248 | 3-Jun | B. Castro | |
| *Eriogonum wrightii* var. *trachygonum* | Red Bank | 99-249 | 9-Jun | B. Castro | |
| *Eriogonum wrightii* var. *trachygonum* | Red Bank | 99-250 | 21-Jun | B. Castro | |
| *Eriogonum wrightii* var. *trachygonum* | Red Bank | 99-289 | 11-Aug | B. Castro | |
| *Polygonum* sp. | Red Bank | 98-573 | 3-Jul | J. Marr | |
| *Polygonum arenastrum* | Sites | 98-559 | 4-May | J. Marr | |
| *Polygonum arenastrum* | Sites | 98-570 | 11-Jun | J. Marr | |
| *Polygonum arenastrum* | Red Bank | 99-299 | 11-Aug | L. Janeway | |
| *Polygonum californicum* | Newville | 98-571 | 15-Jul | J. Marr | |
| *Polygonum californicum* | Newville | 98-572 | 2-Jun | J. Marr | |
| *Pterostegia drymarioides* | Newville | 98-574 | 29-Apr | J. Marr | |
| *Pterostegia drymarioides* | Newville | 98-575 | 18-Jun | J. Marr | |
| *Pterostegia drymarioides* | Sites | 98-831 | 4-May | C. Warren | |
| *Pterostegia drymarioides* | Newville | 98-985 | 14-May | J. Cunningham | |
| *Pterostegia drymarioides* | Newville | 99-251 | 12-May | B. Castro | |
| *Rumex pulcher* | Newville | 98-576 | 18-May | J. Marr | |
| *Rumex salicifolius* var. *denticulatus* | Red Bank | 98-832 | 21-Oct | C. Warren | |
| *Rumex salicifolius* var. *denticulatus* | Red Bank | 98-577 | 21-Oct | J. Marr | |
| *Rumex salicifolius* var. *denticulatus* | Red Bank | 99-252 | 1-Jun | B. Castro | |
| | | | | | |
| PORTULACACEAE | | | | | |
| *Claytonia exigua* ssp. *exigua* | Newville | 99-117 | 22-Apr | L. Janeway | |
| *Lewisia rediviva* | Newville | 99-118 | 6-Apr | L. Janeway | |
| *Montia fontana* | Newville | 98-532 | 16-Mar | J. Marr | |
| *Portulaca oleraceae* | Red Bank | 98-642 | 21-Aug | H. West | |
| | | | | | |
| PRIMULACEAE | | | | | |
| *Androsace elongata* ssp. *acuta* | Newville | 99-119 | 22-Apr | L. Janeway | |
| *Androsace elongata* ssp. *acuta* | Colusa | 99-120 | 13-Apr | L. Janeway | |
| *Androsace elongata* ssp. *acuta* | Newville | 99-253 | 4-May | B. Castro | |
| *Androsace elongata* ssp. *acuta* | Newville | 99-254 | 16-Apr | B. Castro | |
| | | | | | |
| PTERIDACEAE | | | | | |
| *Adiantum jordanii* | Red Bank | 99-255 | 21-Jun | B. Castro | |
| *Pellaea andromedifolia* | Red Bank | 98-578 | 9-Jun | J. Marr | |
| *Pellaea andromedifolia* | Newville | 98-1014 | 19-May | J. Cunningham | |
| *Pellaea andromedifolia* | Newville | 99-26 | 14-Apr | B. Hendrickson | |
| *Pellaea andromedifolia* | Sites | 99-27 | 16-Mar | B. Hendrickson | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Pellaea andromedifolia* | Newville | 99-60 | 9-Jun | J. Witzman | |
| *Pellaea andromedifolia* | Newville | 99-256 | 10-May | B. Castro | |
| *Pellaea mucronata var. mucronata* | Newville | 98-1015 | 14-May | J. Cunningham | |
| *Pentagramma triangularis* ssp. *triangularis* | Newville | 99-61 | 9-Jun | J. Witzman | |
| | | | | | |
| RANUNCULACEAE | | | | | |
| Undetermined | Newville | 98-593 | 19-Mar | J. Marr | |
| *Clematis* sp. | Red Bank | 98-580 | 9-Jul | J. Marr | |
| *Clematis ligusticifolia* | Red Bank | 98-579 | 27-Aug | J. Marr | |
| *Delphinium patens* ssp. *patens* | Newville | 98-581 | 26-Mar | J. Marr | |
| *Delphinium hesperian* ssp. *pallescens* | Colusa | 98-582 | 21-Apr | J. Marr | |
| *Delphinium variegatum* ssp. *variegatum* | Sites | 98-583 | 14-Apr | J. Marr | |
| *Delphinium variegatum* ssp. *variegatum* | Sites | 98-584 | 14-Apr | J. Marr | |
| *Delphinium variegatum* ssp. *variegatum* | Newville | 98-689 | 29-Apr | H. West | |
| *Delphinium variegatum* ssp. *variegatum* | Newville | 98-1016 | 11-May | J. Cunningham | |
| *Myosaurus minimus* | Newville | 98-833 | 26-Mar | C. Warren | |
| *Myosaurus minimus* | Newville | 99-259 | 21-Apr | B. Castro | |
| *Ranunculus aquatilis* | Newville | 98-585 | 18-Mar | J. Marr | |
| *Ranunculus californicus* | Newville | 98-586 | 17-Mar | J. Marr | |
| *Ranunculus californicus* | Newville | 98-834 | 16-Mar | C. Warren | |
| *Ranunculus canus* | Newville | 99-121 | 6-Apr | L. Janeway | |
| *Ranunculus hebecarpus* | Newville | 98-587 | 20-Mar | J. Marr | |
| *Ranunculus hebecarpus* | Newville | 98-588 | 17-Mar | J. Marr | |
| *Ranunculus muricatus* | Newville | 98-589 | 26-Mar | J. Marr | |
| *Ranunculus muricatus* | Colusa | 98-590 | 8-Apr | J. Marr | |
| *Ranunculus occidentalis* | Colusa | 98-591 | 6-Apr | J. Marr | |
| *Thalictrum fendleri* | Red Bank | 98-592 | 3-Jul | J. Marr | |
| *Thalictrum fendleri* var. *polycarpum* | Red Bank | 99-260 | 9-Jun | B. Castro | |
| *Thalictrum fendleri* var. *polycarpum* | Red Bank | 99-305 | 28-Apr | J. Marr | |
| | | | | | |
| RHAMNACEAE | | | | | |
| *Rhamnus ilicifolia* | Newville | 99-122 | 11-May | L. Janeway | |
| *Rhamnus tomentella* ssp. *crassifolia* | Newville | 99-62 | 9-Jun | J. Witzman | |
| *Rhamnus tomentella* ssp. *tomentella* | Red Bank | 98-594 | 2-Jul | J. Marr | |
| *Rhamnus tomentella* ssp. *tomentella* | Red Bank | 99-288 | 11-Aug | B. Castro | |
| | | | | | |
| ROSACEAE | | | | | |
| *Aphanes occidentalis* | Newville | 98-595 | 26-Feb | J. Marr | |
| *Cercocarpus betuloides* | Red Bank | 98-835 | 27-Apr | C. Warren | |
| *Cercocarpus betuloides* var. *betuloides* | Red Bank | 98-596 | 2-Jul | J. Marr | |
| *Cercocarpus betuloides* var. *betuloides* | Newville | 99-261 | 5-May | B. Castro | |
| *Heteromeles arbutifolia* | Red Bank | 98-597 | 9-Jul | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Heteromeles arbutifolia* | Red Bank | 98-598 | 2-Jul | J. Marr | |
| *Heteromeles arbutifolia* | Red Bank | 98-1017 | 25-Jun | J. Cunningham | |
| *Rosa californica* | Sites | 98-599 | 4-May | J. Marr | |
| *Rosa californica* | Red Bank | 99-262 | 14-Jun | B. Castro | |
| | | | | | |
| RUBIACEAE | | | | | |
| *Crucianella angustifolia* | Red Bank | 98-600 | 21-May | J. Marr | |
| *Galium* sp. | Newville | 99-63 | 9-Jun | J. Witzman | |
| *Galium aparine* | Newville | 98-836 | 30-Mar | C. Warren | |
| *Galium aparine* | Colusa | 98-601 | 8-Apr | J. Marr | |
| *Galium parisiense* | Newville | 98-602 | 11-May | J. Marr | |
| *Galium parisiense* | Sites | 98-603 | 27-May | J. Marr | |
| *Galium parisiense* | Newville | 98-837 | 26-Mar | C. Warren | |
| *Galium parisiense* | Newville | 98-838 | 11-May | C. Warren | |
| *Galium parisiense* | Newville | 98-1018 | 28-Apr | J. Cunningham | |
| *Galium parisiense* | Red Bank | 99-263 | 21-Jun | B. Castro | |
| *Galium porrigens* var. *tenue* | Newville | 99-264 | 10-May | B. Castro | |
| | | | | | |
| SALICACEAE | | | | | |
| *Salix* sp. | Newville | 99-64 | 9-Jun | J. Witzman | |
| *Salix exigua* | Red Bank | 98-604 | 9-Jul | J. Marr | |
| *Salix exigua* | Red Bank | 98-605 | 3-Jul | J. Marr | |
| *Salix laevigata* | Red Bank | 98-606 | 13-Oct | J. Marr | |
| *Salix laevigata* | Red Bank | 98-607 | 27-Aug | J. Marr | |
| *Salix laevigata* | Red Bank | 98-608 | 21-Oct | J. Marr | |
| *Salix laevigata* | Red Bank | 98-839 | 24-Sep | C. Warren | |
| *Salix laevigata* | Newville | 99-123 | 6-Apr | L. Janeway | |
| *Salix laevigata* | Sites | 99-28 | 12-Apr | B. Hendrickson | |
| *Salix laevigata* | Newville | 99-65 | 10-Jun | J. Witzman | |
| *Salix laevigata* | Red Bank | 99-265 | 10-Jun | B. Castro | |
| *Salix lasiolepis* | Red Bank | 98-609 | 13-Oct | J. Marr | |
| *Salix lasiolepis* | Red Bank | 98-663 | 29-Oct | H. West | |
| *Salix lucida* ssp. *lasiandra* | Red Bank | 98-610 | 9-Jul | J. Marr | |
| *Salix lucida* ssp. *lasiandra* | Red Bank | 98-611 | 13-Oct | J. Marr | |
| | | | | | |
| SAXIFRAGACEAE | | | | | |
| *Lithofragma affine* | Newville | 98-612 | 30-Apr | J. Marr | |
| *Lithofragma heterophylla* | Sites | 99-37 | 23-Mar | B. Hendrickson | |
| *Saxifraga californica* | Colusa | 99-124 | 1-Apr | L. Janeway | |
| | | | | | |
| SCROPHULARIACEAE | | | | | |
| *Antirrhinum subcordatum* | Red Bank | 99-125 | 15-Jun | L. Janeway | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Bellarida trixago* | Sites | 98-613 | 8-May | J. Marr | |
| *Castilleja affinis* | Sites | 99-30 | 17-Mar | B. Hendrickson | |
| *Castilleja affinis* ssp. *affinis* | Newville | 99-126 | 10-Mar | L. Janeway | |
| *Castilleja affinis* ssp. *affinis* | Newville | 99-266 | 4-May | B. Castro | |
| *Castilleja affinis* ssp. *affinis* | Newville | 99-267 | 14-Apr | B. Castro | |
| *Castilleja attenuata* | Sites | 98-614 | 14-Apr | J. Marr | |
| *Castilleja attenuata* | Newville | 98-615 | 26-Mar | J. Marr | |
| *Castilleja attenuata* | Newville | 98-840 | 26-Mar | C. Warren | |
| *Castilleja exerta* ssp. *exerta* | Newville | 98-616 | 19-Mar | J. Marr | |
| *Castilleja foliolosa* | Red Bank | 98-618 | 9-Jul | J. Marr | |
| *Castilleja foliolosa* | Newville | 98-686 | 19-May | H. West | |
| *Castilleja foliolosa* | Red Bank | 99-127 | 10-Jun | L. Janeway | |
| *Castilleja rubicundula* ssp. *lithospermoides* | Red Bank | 98-619 | 8-Jul | J. Marr | |
| *Castilleja rubicundula* ssp. *lithospermoides* | Red Bank | 98-1019 | 25-Jun | J. Cunningham | |
| *Collinsia sparsiflora* var. *bruceae* | Newville | 99-268 | 10-Mar | B. Castro | |
| *Collinsia sparsiflora* var. *collina* | Newville | 98-841 | 26-Mar | C. Warren | |
| *Collinsia sparsiflora* var. *collina* | Newville | 98-842 | 26-Mar | C. Warren | |
| *Collinsia sparsiflora* var. *collina* | Newville | 99-128 | 10-Mar | L. Janeway | |
| *Collinsia sparsiflora* var. *collina* | Colusa | 99-29 | 2-Apr | B. Hendrickson | |
| *Collinsia sparsiflora* var. *sparsiflora* | Newville | 98-620 | 20-Mar | J. Marr | |
| *Collinsia sparsiflora* var. *sparsiflora* | Colusa | 99-31 | 30-Mar | B. Hendrickson | |
| *Keckiella corymbosa* | Red Bank | 99-269 | 21-Jun | B. Castro | |
| *Keckiella corymbosa* | Red Bank | 99-283 | 11-Aug | B. Castro | |
| *Keckiella lemmonii* | Red Bank | 98-621 | 3-Jul | J. Marr | |
| *Keckiella lemmonii* | Red Bank | 99-270 | 10-Jun | B. Castro | |
| *Mimulus androsace* | Newville | 98-1020 | 28-Apr | J. Cunningham | |
| *Mimulus douglasii* | Newville | 99-271 | 15-Apr | B. Castro | |
| *Mimulus floribundus* | Red Bank | 98-617 | 27-Aug | J. Marr | |
| *Mimulus latidens* | Sites | 98-843 | 4-May | C. Warren | |
| *Mimulus moschatus* | Red Bank | 99-281 | 11-Aug | B. Castro | |
| *Mimulus pilosus* | Red Bank | 99-273 | 21-Jun | B. Castro | |
| *Mimulus kelloggii* | Red Bank | 98-622 | 1-Apr | J. Marr | |
| *Mimulus kelloggii* | Newville | 98-623 | 29-Apr | J. Marr | |
| *Penstemon* sp. | Newville | 98-624 | 29-Apr | J. Marr | |
| *Penstemon heterophyllus* var *heterophyllus* | Red Bank | 98-625 | 9-Jul | J. Marr | |
| *Penstemon heterophyllus* var *heterophyllus* | Sites | 98-626 | 4-May | J. Marr | |
| *Penstemon heterophyllus* var. *purdyi* | Red Bank | 98-627 | 3-Jul | J. Marr | |
| *Penstemon heterophyllus* var. *purdyi* | Newville | 99-129 | 13-May | L. Janeway | |
| *Penstemon heterophyllus* var. *purdyi* | Red Bank | 99-274 | 9-Jun | B. Castro | |
| *Penstemon heterophyllus* var. *purdyi* | Red Bank | 99-275 | 3-Jun | B. Castro | |
| *Tonella tenella* | Red Bank | 99-276 | 23-Mar | B. Castro | |
| *Tonella tenella* | Newville | 98-628 | 17-Apr | J. Marr | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Triphysaria eriantha* | Red Bank | 98-844 | 27-Apr | C. Warren | |
| *Triphysaria pusilla* | Red Bank | 99-130 | 27-Apr | L. Janeway | |
| *Verbascum thapsus* | Red Bank | 98-664 | 27-Aug | H. West | |
| *Veronica anagallis-aquatica* | Red Bank | 98-845 | 9-Jul | C. Warren | |
| *Veronica anagallis-aquatica* | Newville | 98-846 | 5-Jun | C. Warren | |
| *Veronica anagallis-aquatica* | Red Bank | 98-1021 | 7-Jul | J. Cunningham | |
| *Veronica anagallis-aquatica* | Newville | 99-131 | 5-May | L. Janeway | |
| *Veronica anagallis-aquatica* | Newville | 99-277 | 1-Jun | B. Castro | |
| *Veronica catenata* | Red Bank | 98-679 | 9-Jul | H. West | |
| *Veronica persica* | Sites | 99-32 | 25-Mar | B. Hendrickson | |
| | | | | | |
| SOLANACEAE | | | | | |
| *Nicotiana guadrivalvis* | Red Bank | 98-629 | 13-Oct | J. Marr | |
| *Physalis lancifolia* | Sites | 98-847 | 1-Jul | C. Warren | |
| *Solanum* sp. | Sites | 99-33 | 17-Mar | B. Hendrickson | |
| *Solanum nigrum* | Red Bank | 98-630 | 13-Oct | J. Marr | |
| *Solanum parishii* | Red Bank | 98-631 | 20-May | J. Marr | |
| *Solanum rostratum* | Newville | 99-66 | 10-Jun | J. Witzman | |
| | | | | | |
| URTICACEAE | | | | | |
| *Urtica urens* | Sites | 98-635 | 14-Apr | J. Marr | |
| | | | | | |
| VALERIANACEAE | | | | | |
| *Plectritis* sp. | Colusa | 98-632 | 21-Apr | J. Marr | |
| *Plectritis ciliosa* | Newville | 98-633 | 20-Mar | J. Marr | |
| *Plectritis ciliosa* ssp. *ciliosa* | Newville | 98-634 | 26-Mar | J. Marr | |
| *Plectritis macrocera* | Newville | 98-1022 | 7-Apr | J. Cunningham | |
| *Plectritis macrocera* | Colusa | 99-34 | 30-Mar | B. Hendrickson | |
| *Plectritis macrocera* | Colusa | 99-35 | 1-Apr | B. Hendrickson | |
| *Plectritis macrocera* | Newville | 99-278 | 22-Apr | B. Castro | |
| | | | | | |
| VERBENACEAE | | | | | |
| *Phyla nodiflora* var. *nodiflora* | Newville | 98-848 | 18-Jun | C. Warren | |
| *Phyla nodiflora* var. *nodiflora* | Sites | 98-638 | 4-May | J. Marr | |
| *Verbena lasiostachys* var. *lasiostachys* | Red Bank | 98-636 | 9-Jul | J. Marr | |
| *Verbena lasiostachys* var. *lasiostachys* | Red Bank | 98-678 | 21-Aug | H. West | |
| *Verbena lasiostachys* var. *scabrida* | Red Bank | 98-850 | 21-Aug | C. Warren | |
| *Verbena lasiostachys* var. *scabrida* | Red Bank | 98-637 | 13-Oct | J. Marr | |
| *Verbena lasiostachys* var. *scabrida* | Red Bank | 99-279 | 3-Jun | B. Castro | |
| | | | | | |
| VISCACEAE | | | | | |
| *Arceuthobium occidentale* | Red Bank | 99-132 | 18-Mar | L. Janeway | |

| **FAMILY *Genus species*** | **Reservoir** | **Voucher** | **Date** | **Collector** | |
|---|---|---|---|---|---|
| | | | | | |
| *Arceuthobium occidentale* | Newville | 99-67 | 9-Jun | J. Witzman | |
| *Phoradendron densum* | Newville | 98-1023 | 28-Apr | J. Cunningham | |
| *Phoradendron villosum* | Newville | 99-133 | 10-Mar | L. Janeway | |

January 4, 2000

ATTACHMENT 7.

OFFSTREAM STORAGE RESERVOIR INVESTIGATION:

a. Explanation of prioritized plant species name and spreadsheet column acronyms

b. 1998-1999 prioritized plant species population occurrence records

ATTACHMENT 7A. Explanation of Acronyms for Prioritized Plant Species Names and Attachment B Column Headings



Acronyms found in Attachment B, 1998-1999 Prioritized Plant Species Population Occurrence Records, are spelled out below.

## 1) Prioritized Plant Species Names

| **Acronym** | **Species name** |
|---|---|
| ANELA | *Androsace elongata* ssp. *acuta* |
| ANSU | *Antirrhinum subcordatum* |
| ASRAJ | *Astragalus rattanii* var. *jepsonianus* |
| CHOCR | *Chamaesyce ocellata* ssp. *rattanii* |
| ERBR | *Eriastrum brandegeae* |
| FRPL | *Fritillaria pluriflora* |
| HECA | *Hesperevax caulescens* |
| HETE | *Hesperolinon tehamense* |
| JUCAH | *Juglans californica* var. *hindsii* |
| LIFLF | *Limnanthes floccosa* ssp. *floccosa* |
| NAER | *Navarretia eriocephala* |
| NAHE | *Navarretia heterandra* |
| NAJE | *Navarretia jepsonii* |
| STDR | *Streptanthus drepanoides* |

## 2) Attachment B Column Headings

| **Column Heading** | **Explanation** |
|---|---|
| 1. Site | Proposed reservoir sites; C=Colusa, N=Newville, RB=Red Bank, S=Sites |
| 2. Sp | Species |
| 3. Date | Date of discovery |
| 4. Other Dates | Revisit or other discovery dates |
| 5. Co. | County |
| 6. Quad | USGS &.5' quadrangle map |
| 7. T | Township |
| 8. R | Range |
| 9. Elev | Elevation (ft.) |
| 10. Veg | # of plants in Vegetative state |
| 11. Fl | # of plants in Flower |
| 12. Fr | # of plants in Fruit |
| 13. Tot | Total # of plants in occurrence |
| 14. Rep | Reporter |
| 15. Habitat | Plant community |
| 16. Soil | General soil type |
| 17. Slope | Angle of hillside in degrees |
| 18. Aspect | Direction of exposure |
| 19. Dom | Dominant plant species within occurrence |
| 20. Assoc | Associated plant species within occurrence |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE ( $^o$ ) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | ANELA | 03/30/99 | | GLENN | RAIL CYN | 19N | 5W | 500 | unk | unk | unk | unk | BH JM | annual grassland | shale | 60 | N | none | DRVE, HECA, PHGR,Plagiobo-thrys sp., STNI, Vulpia sp. |
| C | ANELA | 04/13/99 | | GLENN | LOGAN RIDGE | 18N | 4W | 650 | 0 | 0 | 50 | 50 | MAG LJ CW | annual grassland | shale | steep | NW | none | ANFI, Eriogonum spp., LIBI, PHGR, TRWI, Vulpia sp. |
| C | HECA | 03/30/99 | | GLENN | RAIL CYN | 19N | 5W | 580 | 0 | 50 | 0 | 50 | BH JM | annual grassland | clay | 65 | N | TACAM | ANELA, Bromus sp., COSP |
| C | HECA | 04/01/99 | | GLENN | RAIL CYN | 19N | 5W | 540 | 200 | 800 | 0 | 1000 | BC LJ | blue oak woodland | clay | 45-60 | ESE/ENE | QUDO | Erodium spp., CAGR, CESO, CLGR, LIBI |
| C | NAER | 06/17/98 | | GLENN | RAIL CYN | 19N | 5W | 520 | unk | unk | unk | 100 | JM HW | annual grassland | clay | 15 | E, NE | CESO, Avena sp. | LOMU, Bromus spp., Erodium spp., NANI, KOMI |
| C | NAHE | 06/17/98 | | GLENN | RAIL CYN | 19N | 5W | 550 | unk | unk | unk | 250 | JM HW | blue oak woodland | clay | 20 | NE | Avena sp., Erodium spp. | CESO, Clarkia affinis, NAPU |
| N | ANELA | 03/18/99 | | GLENN | NEWVILLE | 22N | 6W | 770 | 0 | 100 | 0 | 100 | JM NW | annual grassland | clay-shale | 70 | N | none | COSPS, DRVE, Plagiobothrys sp., STNI, Vulpia sp. |
| N | ANELA | 03/23/99 | | GLENN | NEWVILLE | 22N | 6W | 720-800 | 0 | 400-500 | 0 | 400-500 | JM MAG CW | annual grassland/ blue oak savanna | shale | 65-70 | N | none | COSP, DRVE, Plagiobothrys sp., Vulpia sp |
| N | ANELA | 04/13/99 | 04/14/99 | TEH | NEWVILLE | 23N | 7W; 6W | 800-1000 | 0 | 50 | 950 | 1000 [19 colo-nies] | JM HW | annual grassland/ blue oak savanna | shale | 60-80 | N | none | BRMAR, GITR, LUNA, DRVE, TRER, MICA, PLER, VERI, LICI, CECU, Arctostaphylos sp., Cerco-carpus sp. |
| N | ANELA | 04/14/99 | | GLENN | CHROME | 22N | 6W | 1040 | 0 | 0 | 3 | 3 | LJ MAG CW | annual grassland | pebbly conglom-erate | steep | NW | QUDO, annual grasses | ATPU, CENI, Erodium sp., Galium sp., LUBI, PHGR, MICA, SEVU |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE (°) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | **ANELA** | 04/14/99 | | TEH | NEWVILLE | 23N | 6W | 760 | 0 | 0 | 150 | 150 | JM HW | grassland/ chaparral/ foothill pine woodland | crumbly shale | 80 | N | none | LUNA, GITR, TRER, LENI, Plagiobothrys sp. |
| N | **ANELA** | 04/15/99 | | GLENN | CHROME | 22N | 6W | 1040 | 0 | 0 | 1000 | 1000 | MAG | annual grassland | shale | 50 | N | none | CLEX, GITR, LAFR,PHGR, Plantago sp. |
| N | **ANELA** | 04/16/99 | | GLENN | NEWVILLE | 22N | 6W | 840 | 0 | 0 | 250 | 250 | BH BC | annual grassland | shale | steep slope | N | none | LOMA,TRER, PHGR, DRVE, ANFI, MICA, SNI, CLEX, ATPU,CAGR, LIBI, PEPU |
| N | **ANELA** | 04/20/99 | | GLENN | NEWVILLE | 22N | 6W | 960 | 0 | 0 | 50 | 50 | JM CW | annual grassland | clay | slope | N | none | CHMO, Avena sp., COSPC, MICA, Plectritis sp., TRER |
| N | **ANELA** | 04/21/99 | | GLENN | CHROME | 22N | 6W | 915 | 5 | 0 | 270 | 275 [9 colo-nies] | JM HW | annual grassland | shale | 45 | N, NE, NW | Clarkia sp., Vulpia sp. | ANFI, BRMA, DRVE, Erodium spp., HECA, LICI |
| N | **ANELA** | 04/21/99 | | GLENN | NEWVILLE | 22N | 6W | 740; 840-880 | 0; 0; 0 | 0; 0; 0 | >1000; 100; >100 | >1000; 100; >100 | BC LJ | blue oak woodland | shale | steep | N | QUDO | ANFI, CAGR, Clarkia sp.,CLEX, COSP, Erodium sp., LUAL, MICA, Phacelia sp., TRLA |
| N | **ANELA** | 04/22/99 | | GLENN | NEWVILLE | 22N | 6W | 800-850; 920-980 | 0 | 0 | 1000's | 1000's | LJ BC | annual grassland/ blue oak savanna | shale | steep | N, NE | none | APOC, CAGR, COSPB, GITR, LIBI, MICA, RILE, TRER |
| N | **ANELA** | 05/04/99 | | TEH | NEWVILLE | 23N | 6W | 920-1020 | 0 | 0 | 300-400 | 300-400 | BC LJ | annual grassland/shrubby blue oak savanna | shale | 60 | N | QUDO | MIDO, DRVE, COSP, RILE, CAGR |
| N | **ANELA** | 05/12/99 | | TEH | NEWVILLE | 23N | 6W | 820-880 | 0 | 0 | <600 | <600 | HW, JW | annual grassland | shale | 40 | N, NE | Avena sp., ERNU | ANFI, Clarkia sp., Erodium sp., PLER, Vulpia sp. |
| N | **ANSU** | 05/19/98 | 05/13/99 | TEH | NEWVILLE | 23N | 6W | 920-960 | 18 | 30 | 0 | 48; 0 in 1999 revisit | JL-R HW | blue oak woodland | shale/ other soil | 45-55 | SW | Avena sp. | ERLA, ESCA, BRMA, MAFL, LOHU, LUMI |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE ( ° ) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | ANSU | 05/19/98 | | TEH | NEWVILLE | 23N | 6W | 950 | unk | unk | unk | 160 | JC NW | chaparral | shale | 35-40 | SSE | Quercus sp. | ACMO, Avena sp., DACA, Chia, fern |
| N | ANSU | 06/16/98 | | GLENN | CHROME | 22N | 6W | 1060 | >1000 | >1000 | 0 | >2000 [in 4 colonies] | JM NW | foothill pine/ chaparral ecotone, annual grassland | shale | slopes | E, S | PISA, CECU, Quercus sp. | CAOCOC, CLGRGR, Eriogonum sp., ESCA,VERI, MAFL, LOHU, SACO, GICA |
| N | ANSU | 06/18/98 | | TEH | NEWVILLE | 23N | 6W | 1000 | 0 | 3 | 0 | 3 | JC NW | open blue oak woodland | gravelly clay | 40 | W, NW | QUDO, CECU | Avena sp., VERI, TACAM, ACMI, Galium sp. |
| N | ANSU | 06/18/98 | | GLENN | NEWVILLE | 22N | 6W | 880-950 | 0; 2 | 1; 10 | 0; 0 | 1; 12 | JM CW | open blue oak woodland | shale | 45 | W | QUDO | CECU, Linanthus sp., SACO, VERI, VUMY, PHRA |
| N | ANSU | 06/19/98 | | GLENN | CHROME | 22N | 6W | 1200-1240 | 230-295 | 115- 150 | 0 | 345- 445 | JC HW NW | foothill pine/ chaparral ecotone, annual grassland | reddish gravelly clay | 30- 45 | S, SE | PISA, scrub oak | ERLA, Arctostaphylos sp., Avena sp., CESO, Melica sp., PISA |
| N | ANSU | 05/10/99 | 05/11/99 | TEH | NEWVILLE | 23N | 6W | 880-1000 | 140 | 69 | 0 | 209 (partial revisit, Sec. 21) | BC LJ BH | chaparral | crumbly clay/ shale | 50 | SE - SW | QUBE | PHEG, GAPO, PEAN, SACO, CEME, MECA, Marah |
| N | ASRAJ | 04/15/98 | 05/19/98 | TEH | NEWVILLE | 23N | 7W | 1000 | 0 | 500 | 0 | 500 | JM CW | chaparral/ foothill pine woodland | shale | slope | S | ASRAJ | MAFL,LOHU, ASGA, VERI |
| N | CHOCR | 07/15/98 | | GLENN | NEWVILLE | 22N | 6W | 800 | 0 | 15 | 15 | 30 | JM | annual grassland | clay | 0 | 0 | grasses | Lessingia nana |
| N | CHOCR | 08/11/98 | | GLENN | NEWVILLE | 22N | 6W | 760 | unk | unk | unk | unk | CW HW NW | dried VP in annual grassland | gravelly bare soil | 0 | 0 | none | Lythrum, Trifolium, grass spp. |
| N | CHOCR | 06/01/99 | | TEH | NEWVILLE | 23N | 6W | 665 | unk | unk | unk | unk | HW | creek bank in annual grassland | lodo shale | steep | S | unk | unk |
| N | CHOCR | 06/02/99 | 06/03/99 | GLENN; TEH | NEWVILLE | 22N; 23N | 6W; 7W | 800-920 | 250-300 | 600 | 0 | 850-900 | HW BH | annual grassland/ foothill pine woodland | shale | 50 | S, SE | grasses and QULO; PISA | Avena sp. |
| N | CHOCR | 06/09/99 | | GLENN | NEWVILLE | 22N | 7W | 950 | 60 | 540 | 0 | 600 | JW BH | annual grassland | shale | 45-70 | S,SSW | none | AVFA, BRMAR, CESO, Cryptantha sp. |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE (°) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | CHOCR | 06/10/99 | | GLENN | NEWVILLE | 22N | 6W | 880 | 0 | 0 | 8 | 8 | BH JW | unk | shale | very steep | SW | none | Avena sp. |
| N | CHOCR | 06/16/99 | | TEH | NEWVILLE | 23N | 7W | 920 | 0 | 202 | 202 | 4; 400 | BH CW | creek banks | shale | slope | S | none | none (very low veg cover) |
| N | FRPL | 02/27/98 | 02/26/98 03/10/99 | GLENN | NEWVILLE | 22N | 6W | 640; 755 | 1;500 | 5; 500 | 0; 0 | 6; 1000-2000 | JM CW HW | annual grassland | clay | slope | N | ZIFR | graminoid spp. |
| N | FRPL | 03/04/98 | | GLENN | CHROME | 22N | 6W | 880-1000 | 115 | 115 | 0 | 230 | JC JM CW HW | annual grassland | clay | 0 | 0 | grasses, Erodium spp. | ZIFR, LENI, Lupinus sp., Plagiobothrys sp. |
| N | FRPL | 03/17/98 | 04/14/99 | GLENN | CHROME | 22N | 6W | 850 | 61; 15 in 1999 | 2; 6 in 1999 | 0 | 63; 21 in 1999 | CW HW; LJ MAG CW | annual grassland | clay | 10 | E, SW | grasses CESO | TRER |
| N | FRPL | 03/30/98 | | GLENN | NEWVILLE | 22N | 6W | 680 | unk | unk | unk | 125-150; 250-500; 10 | JC CW HW | annual grassland | clay | 30-40 | NE, NW | none | graminoid spp., ZIFR |
| N | FRPL | 04/06/98 | | GLENN | NEWVILLE | 22N | 6W | 840 | 3 | 1 | 1 | 5 | HW JC | annual grassland | clay | 25 | N, NE | ZIFR | graminoid spp., TRER, TRLA |
| N | FRPL | 04/07/98 | | GLENN | NEWVILLE | 22N | 6W | 720 | unk | unk | unk | 21 | JC HW | annual grassland | unk | 30 | N | unk | BRELEL, graminoids, ZIFR |
| N | FRPL | 04/30/98 | 03/26/99 | TEH | NEWVILLE | 23N | 6W | 680 | 166; 300 in 1999 | 0; 100 in 1999 | 2; 0 in 1999 | 168; 400 in 1999 | JM HW GP | annual grassland | Meyers clay | 25-35 | N | CESO, TACAME | Avena sp., Bromus sp., GEMO, PHGR, Lupinus sp. |
| N | FRPL | 03/10/99 | | TEH | NEWVILLE | 23N | 6W | 1000 | 2 | 2 | 0 | 4 | BC LJ JM MAG | blue oak woodland | clay | 50 | N | Arcto-staphylos sp., JUCA, QUDO | Chlorogalum sp., ZIFR |
| N | FRPL | 04/07/99 | | TEH | NEWVILLE | 23N | 6W | 680-720 | 217 | 4 | 0 | 221 (range ext) | LJ JM | annual grassland | clay | 35- 45 | N | grasses | CESO, TACA,TRLA, Bromus sp. |
| N | FRPL | 04/14/99 | | GLENN | CHROME | 22N | 6W | 890 | 475 | 0 | 25 | 500 | MAG LJ | annual grassland | clay | gentle | N | unk | CESO |
| N | FRPL | 04/22/99 | | GLENN | NEWVILLE | 22N | 6W | 970 | 85 | 0 | 0 | 85 | BC LJ | annual grassland | clay | 0-5 | N | grasses | CEGL, CHPO, GAVE,TACAM, ZIFR |
| N | FRPL | 05/04/99 | | TEH | NEWVILLE | 23N | 6W | 940 | 3 | 0 | 0 | 3 | BC CW LJ | blue oak woodland | clay | 0-5 | NNW | QUDO | Madia, Vulpia, Micropus spp., AVBA, CLPU |
| N | HECA | 02/27/98 | | GLENN | NEWVILLE | 22N | 6W | 650-750 | unk | unk | unk | unk | CW JM JC | annual grassland | shale | slope | N | none | NEME, Phacelia sp., PLCA, STNI, CLEX |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **N** | **HECA** | 03/17/98 | 03/16/98 | GLENN | NEWVILLE | 22N | 6W | 840-880 | all | 0 | 0 | unk | HW CW | annual grassland | unk | 0-20 | W | unk | grasses, occ. QUDO |
| **N** | **HECA** | 04/29/98 | | GLENN | NEWVILLE | 22N | 6W | 760 | 50 | 50 | 0 | 100 | JM | annual grassland | crumbly clay/ shale | 45 | W | none | BRMAR, Clarkia sp., Plagiobothrys sp. |
| **N** | **HECA** | 04/21/99 | | GLENN | CHROME | 22N | 6W | 950 | 0 | 50 | 0 | 50 | JM | annual grassland | clay | 60 | N | none | ANELA, ANFI, Bromus sp., MICA, MIDOD, TRER |
| **N** | **HETE** | 06/16/98 | 06/19/98 | GLENN | CHROME | 22N | 6W | 1060; 1280 | 135; unk | 15; 1333 | 0; unk | 150; 4000 | JM NW; JC HW NW | foothill pine woodland/ chaparral with annual grassland | heneke shale; reddish rocky clay and shale | 50-60 | E; ENE | PISA, QUDO, Arctosta-phylos sp. | LEFI, ERCA, HEAR, Monardella sp., grasses, Cryptantha sp. |
| **N** | **HETE** | 06/19/98 | | GLENN | CHROME | 22N | 6W | 1280 | 900 | 450 | 0 | 1350 | JC HW NW | foothill pine woodland | rocky clay | 45-55 | E, NE | ERCA, PISA, TODI | Avena sp., Clarkia sp., Eriogonum sp., Lessingia sp. |
| **N** | **JUCAH** | 04/28/99 | | GLENN | NEWVILLE | 22N | 6W | 780 | 0 | 4 | 0 | 4 | BC BH | riparian floodplain within annual grassland | clay/silt | 0 | 0 | JUCAH, QULO, cotton-wood | graminoids |
| **N** | **NAHE** | 05/11/98 | | TEH | NEWVILLE | 23N | 6W | 850-950 | unk | unk | unk | unk | CW JM JC | annual grassland | unk | unk | unk | unk | Cirsium sp., Hesperolinon sp., NAPU |
| **N** | **NAHE** | 06/01/98 | | GLENN | NEWVILLE | 22N | 6W | 740 | 0 | 300 | 0 | 300 | JM CW HW | annual grassland | gravelly clay | 30 | NE to NW | Avena sp., BRHO | Clarkia sp., TACAME, Vulpia sp.,CALU, NAPU, HOMU |
| **N** | **NAHE** | 06/16/98 | | TEH | NEWVILLE | 23N | 6W | 920 | 0 | 500-1000 | 0 | 500- 1000 | CW HW | blue oak woodland | gravelly clay with shale | 15 | S | Avena sp., QUDO | GAVE, Lessingia sp., NATA, TACAME, VERI |
| **N** | **NAHE** | 06/19/98 | | GLENN | CHROME | 22N | 6W | 1200 | 0 | 500-1000 | 0 | 500- 1000 | JC HW NW | annual grassland | clay | 45 | NE | BRHO, LOMU | Avena sp., CULU, Lessingia sp. |
| **N** | **NAHE** | 05/04/99 | | TEH | NEWVILLE | 23N | 6W | 920 | 0 | 100 | 0 | 100 | BC | blue oak woodland | clay | 40-50 | NNW | QUDO | shrubs, grasses, FRPL |
| **N** | **NAHE** | 05/06/99 | | TEH | NEWVILLE | 23N | 6W | 970 | 0 | 500-1000 | 0 | 500-1000 | BC | annual grassland | clay | 0-20 | NNW | low grasses | Castilleja exserta |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **N** | **NAHE** | 05/12/99 | 05/06/99 | TEH | NEWVILLE | 23N | 6W | 720-760 | 98;10 | 2;10 | 0;0 | 100; 20 [2 colonies] | HW NW ; HW JW | annual grassland | lodo shale and clay | 0-10 | 0 to E | TACAM | Amsinckia sp., ANFI, Avena sp., BRHO, HYGL, NAPU |
| **RB** | **ANELA** | 04/29/99 | | TEH | LOWREY | 26N | 6W | 920 | 0 | 0 | 4 | 4 | JM | blue/valley oak woodland | shale | 70 | N | QUDO QULO | COSP, RAHE, Vulpia sp. |
| **RB** | **ANSU** | 05/20/98 | | TEH | COLD FORK | 27N | 7W | 1300; 1120 | unk | unk | unk | 112 | JM CW HW | blue oak woodland | shale | 40-50 | SW | QUDO | Avena sp., Bromus spp., CESO, ERLA, LOHU, Lupinus sp., Madia sp., MECA |
| **RB** | **ANSU** | 05/21/98 | | TEH | OXBOW BRIDGE, COLD FORK | 27N | 7W | 1300, 1160 | 200; unk | 0; unk | 0; unk | 200; 40 | JL JM HW | blue oak woodland | shale | 40-50 | SW | QUDO | Avena sp., Bromus spp., CESO, ERLA, LOHU, Lupinus sp., Madia sp., MECA |
| **RB** | **ANSU** | 06/09/98 | | TEH | LOWREY | 26N | 6W | 975 | unk | unk | unk | 1173 | CW HW | foothill pine woodland | gravelly clay, shale | 25-35 | NE | PISA, TODI, Avena sp. | Arctostaphylos sp., CESO, Ceanothus sp., PEDU, QUDO |
| **RB** | **ANSU** | 06/15/98 | | TEH | LOWREY | 26N | 6W | 1000 | 0 | 1000 | 0 | 1000 | CW HW | foothill pine woodland/ chaparral interface | shale | 30-45 | SW | Avena sp., Nasella sp., PEDU | Bromus spp., ESLO, LOHU, MECA, MEFL |
| **RB** | **ANSU** | 06/15/98 | | TEH | LOWREY | 26N | 6W; 7W | 1000 | 0 | 0 | 100 | 100 | JM CW HW | chaparral/ foothill pine woodland | crumbly shale | steep | SW | none | unk |
| **RB** | **ANSU** | 06/25/98 | | TEH | OXBOW BRIDGE | 27N | 7W | 1100 - 1200 | 1290 | 3010 | 0 | 4300 | JC HW NW | blue oak/ foothill pine woodland/ chaparral | loamy shale | 45-55 | W/SW | QUDO, Avena sp., CECU, TODI | CEOC, CESO, HESP, PISA |
| **RB** | **ANSU** | 07/02/98 | | TEH | LOWREY | 26N | 6W | 940 | 650 | 1850 | 0 | 2500 | CW NW | blue oak woodland | shale | 55-60 | S | PISA | CECU, QUBE, HEAR, ERLA, MOSH |
| **RB** | **ANSU** | 07/02/98 | 07/03/98 | TEH | LOWREY | 26N | 6W | 850-1200 | 220; unk | 1080; unk | 0; unk | 1300; 22250 | JM HW CW NW | foothill pine woodland/ chaparral interface | shale | 40-60 | S/SE/SW | Scrub oak, Arcto-staphylos sp., CESO, PISA | Avena sp., Cryptantha sp., Eriogonum sp., MAFL, PEDU, TODI, ERLA, BRHO, Ceanothus sp. |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE ( $^{o}$ ) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RB** | **ANSU** | 07/06/98 | | TEH | COLD FORK | 27N | 7W | 1280 | unk | unk | unk | 50 | JM JC CW HW | chaparral | shale | slope | S | CECU, CEOC, TODI | Scrub oak, ERAB, HEDI, ERCA |
| **RB** | **ANSU** | 07/08/98 | | TEH | LOWREY | 26N | 6W | 950-1000 | unk | unk | unk | 624 | JM CW | chaparral | shale | slope | S | Cercocar-pus sp., Quercus sp. (scrub) | Calycadenia sp., Hemizonia sp., PISA, Salvia sp. |
| **RB** | **ANSU** | 07/09/98 | | TEH | LOWREY | 26N | 6W | 1060; 960 | unk | unk | unk | 150- 200 | JM CW | chaparral/ foothill pine woodland | crumbly tan shale | slope | S | PISA, Scrub oak, Arcto-staphylos sp. | CESO, ADFA |
| **RB** | **ANSU** | 05/12/99 | | TEH | LOWREY | 26N | 6W | 1000 | 1 | 0 | 0 | 1 | JM CW | chaparral/ foothill pine woodland | tan crumbly shale | 45 | NW | CECU, PISA | unk |
| **RB** | **ANSU** | 05/13/99 | | TEH | LOWREY | 26N | 7W | 1000 | 11 | 0 | 0 | 11 | BC NW | chaparral/ blue oak woodland | crumbly clay/ shale | steep | S | PISA QUDO, CECU, ARMA | QUBE, GAPO, PEAN, CLRH, YAMI, ERLA, Marah |
| **RB** | **ANSU** | 05/20/99 | | TEH | COLD FORK | 27N | 7W | 1100 | 360 | 40 | 0 | 400 | JW BH | chaparral | shaley soil | steep | S,SW, SE, W | QUBE | CEBE, GACO,QUDO, STDR, CHOCR, ASRAJ, Eriophyllum sp. |
| **RB** | **ANSU** | 05/21/99 | | TEH | COLD FORK | 27N | 7W | 1150 | 200 | 200 | 0 | 400 | JW BH | chaparral | shaley clay | slope | S | CECU, Arcto-staphylos sp. | BRMAR, VUMY, SACO, ERCA, QUBE |
| **RB** | **ANSU** | 05/24/99 | 06/01/99 06/08/99 | TEH | OXBOW BRIDGE | 27N | 7W | 1150-1200 | 40+ | 60+ | 0 | 100+ | BC LJ CW | chaparral | loose shale | steep | S-SW | QUBE, CECU, RHIL, GACO | DIVO,GAPO, TODI, Phacelia sp., Nasella sp., ERNU, annual grasses |
| **RB** | **ANSU** | 05/27/99 | | TEH | LOWREY | 26N | 7W | 1040 | 150 | 150 | 0 | 300+ ["100's"] | JM BH | chaparral/ riparian | tan crumbly shale | very steep | S | Chamise, willow | ERBR |
| **RB** | **ANSU** | 06/03/99 | | TEH | COLD FORK | 27N | 7W | 1200 | 18 | 4 | 2 | 24 | BC LJ | chaparral/ blue oak woodland | crumbly clay/ shale | steep | S-SW | QUBE | QUBE, TODI, AVBA, CRAN, FICA, Daucus sp. |
| **RB** | **ANSU** | 06/09/99 | | TEH | LOWREY | 26N | 7W | 1040 | unk | unk | unk | unk | LJ BC | chaparral | loose shale | steep | SW | QUDO, PISA | QUBE, GACO, near CHOCR |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE ( $^o$ ) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RB | ANSU | 06/10/99 | | TEH | LOWREY | 26N | 7W | 1040 | 0 | 15 | 135 | 150 | HW, CW | foothill pine woodland/chaparral | shale | 40 | S | PISA, ADFA | Interior live oak, Arctostaphylos sp., Avena sp., ERLA |
| RB | ANSU | 06/14/99 | 06/15/99 | TEH | COLD FORK | 27N | 7W | 1120-1200 | 0 | 1000+ | 0 | 1000+ | LJ BC CW | open chaparral | crum-bly clay/ shale | steep | S | QUBE | CECU, ARMA |
| RB | ANSU | 06/21/99 | 06/24/99 | TEH | COLD FORK | 27N; 26N | 7W | 1150-1200 | 0 | 100+ | 0 | 100+ | LJ BC | open chaparral | crum-bly clay/ shale | steep | S | QUBE | JUCA, GACO, CEBE, CECU, CHOCR |
| RB | ANSU | 06/24/99 | | TEH | COLD FORK | 27N | 7W | 1160 | 0 | 15 | 60 | 75 | JW BH | chaparral | shale | steep | S | QUBE | CESO, BRMAR,AVFA |
| RB | ASRAJ | 04/27/98 | | TEH | LOWREY | 26N | 6W | 815 | unk | unk | unk | 25 | JC HW CW | foothill pine wood-land | shale | 5 | S | PISA | Arctostaphylos sp., graminoids, PEDU, QUDO |
| RB | ASRAJ | 05/21/98 | | TEH | COLD FORK/OX-BOW BRIDGE | 27N | 7W | 960 | unk | unk | unk | 2 | JL JM HW | blue oak woodland | shale | 20 | S | none | ASGA, LOHU, CESO,PEDU |
| RB | ASRAJ | 06/09/98 | | TEH | LOWREY | 26N | 6W | 940 | 1 | 33 | 0 | 34 | CW HW | foothill pine woodland | shale | 0 | 0 | PISA, TODI | Arctostaphylos sp., Avena sp., CESO, PEDU, QUDO |
| RB | ASRAJ | 07/02/98 | | TEH | LOWREY | 26N | 6W | 880 | 0 | 1 | 0 | 1 | JM HW | floodplain | sand/ gravel | 0 | 0 | CESO, LUMI | BRDI, LOHU, PEDU |
| RB | ASRAJ | 04/27/99 | 05/18/99 | TEH | LOWREY | 26N | 6W | 1040 | 0 | 17 | 17 | 34 | CW LJ BC | blue oak/ foothill pine woodland | shale | mod. steep | SW | PISA | MAFL, STGL, ESCA, LUMID, BRHO |
| RB | ASRAJ | 04/28/99 | | TEH | LOWREY | 26N | 6W | 940 | 5 | 5 | 0 | 10 | LJ JM CW | creek, gravel bed | shale | 0-5 | 0 | none | Cryptantha sp., SAEX, SALA, SIBE, WYHE, ERCA |
| RB | ASRAJ | 05/12/99 | | TEH | LOWREY | 26N | 6W | 1000 | 0 | 1 | 1 | 1 | JM CW | riparian | stony cobbles/gravel | 0 | 0 | PofR, SALA | BRDI |
| RB | ASRAJ | 05/20/99 | | TEH | COLD FORK | 27N | 7W | 1050 | 2 | 10 | 3 | 15 | JW BH | grassy creekside | unk | flat | NE | CECU | BRHO, POBU, CESO, PLER, Lupinus sp. |
| RB | CHOCR | 05/21/98 | | TEH | COLD FORK | 27N | 7W | 1020 | 30 | 24 | 6 | 60 | JM HW CW | chaparral/ foothill pine woodland | shale | steep | S | none | ANSU |
| RB | CHOCR | 07/03/98 | | TEH | LOWREY | 26N | 7W | 1020 | <25 | <20 | 5 | <50 | JM CW HW | chaparral/ foothill pine woodland | crumbly pale shale | 70 | S | none | none (very low veg cover) |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE (°) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RB** | **CHOCR** | 08/27/98 | | TEH | LOWREY | 26N | 7W | 1000 | <35 | 13 | 2 | <50 | JM HW CW | shale slope in grassy area | shale | 80 | S | none | ERDA, MAFL, BRMAR |
| **RB** | **CHOCR** | 05/20/99 | | TEH | COLD FORK | 27N | 7W | 1180 | 6 | 1 | 0 | 7 | JW BH | chaparral | shale | slope | SW | none | Crucianella angustifolia, Avena barbata |
| **RB** | **CHOCR** | 06/09/99 | | TEH | LOWREY | 26N | 6W | 1150 | unk | unk | unk | unk | HW | unk | shale | 45 | S | unk | unk |
| **RB** | **CHOCR** | 06/09/99 | 06/10/99 | TEH | LOWREY | 26N | 6W | 960-1040 | 50 | 200 | 0 | 250 | HW LJ BC CW | foothill pine woodland nr creek | shale | 45-60 | S-SW | PISA, ARMA, QUDO, GACO | graminoids, ERLA,ERNU, MAFL, SACO |
| **RB** | **CHOCR** | 06/21/99 | | TEH | COLD FORK | 27N | 7W | 1150-1200 | 0 | 32 | 0 | 32 | LJ BC | chaparral/ foothill pine woodland | shale | 35-50 | S | PISA, QUBE | ERNU, ERLA, ERDA, CLEX, ERCA, grasses |
| **RB** | **CHOCR** | 06/24/99 | | TEH | COLD FORK | 27N | 7W | 1080 | 0 | 4 | 0 | 4 | BH JM CW | creek bank | shale | slope | S | unk | unk |
| **RB** | **CHOCR** | 08/11/99 | | TEH | COLD FORK | 27N | 7W | 1100 | 0 | 16 | 16 | 16 | LJ BC CW JM | high creek bank | crumbly shale | very steep | S | none | MELA, CHBO, ERNU, ERDA, STVI |
| **RB** | **ERBR** | 05/27/99 | | TEH | LOWREY | 26N | 7W | 1040 | 150+ | 150+ | 0 | 300+ | JM BH | disturbed area in chaparral/ riparian | shale | 0-5 | S | Chamise, willow | ANSU |
| **RB** | **ERBR** | 06/03/99 | | TEH | COLD FORK | 27N | 7W | 1200 | 0 | 12 | 8 | 20 | LJ BC | grassy opening in chaparral/ foothill pine woodland | hard shaley soil | gentle | SW | QUDO, PISA, CECU, ARMA | short annual grasses, PLER, Lessingia sp. |
| **RB** | **ERBR** | 06/24/99 | | TEH | COLD FORK | 27N | 6W | 1160-1200 | 0 | 1 | 14 | 15 | LJ BC | grassy opening in chaparral/ foothill pine woodland | hard clay/ shale soil | 0-20 | E | PISA, QUBE, CEBE, GACO, ADFA | AICA, BRMA, PLER, Filago sp. |
| **RB** | **FRPL** | 04/01/98 | | TEH | LOWREY | 26N | 6W | 960 | unk | unk (grazed) | unk (grazed) | 17 | JL-R CW | opening nr blue oak woodland | clay | slope | N | CECU | ZIFR, MICA |
| **RB** | **FRPL** | 03/05/99 | | TEH | LOWREY | 26N | 6W | 940 | 29 | 1 | 0 | 30 | MAG CW | open blue oak woodland | unk | slope | W | Arcto-staphylos sp., QUDO | Quercus sp. (live), graminoids |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE ( o ) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RB** | **FRPL** | 03/05/99 | 04/27/99 revisit | TEH | LOWREY | 26N | 6W | 1010-1040 | 1000+ | unk | unk | 1075 | CW MAG LJ | meadow in blue oak woodland | clay | 0 | 0 | QUDO, PISA | CESO, Perlagrass, Nasella sp., Sisyrhynchium |
| **RB** | **FRPL** | 03/29/99 | | TEH | LOWREY | 26N | 6W | 820 | 35 | 2 | 0 | 37 (revisit/ exten-sion of 040198 site) | MAG BC LJ | grassy opening nr blue oak savanna | clay | 20-40 | SE to NE | QUDO | ZIFR, CESO, TACA,RAOC, SIBE, CLEX, Lupinus sp., Nasella sp. |
| **RB** | **FRPL** | 04/27/99 | | TEH | LOWREY | 26N | 6W | 1100 | 17 | 0 | 3 | 20 | CW LJ | grass by blue oak woodland | unk | slope | N | ZIFR | CESO,RAOC, TRLA, grasses |
| **RB** | **LIFLF** | 04/29/99 | | TEH | LOWREY | 26N | 6W | 890-910 | 0 | 10 | 990 | 1000 | JM HW NW | valley oak woodland | shale | 5 | W | QULO, Arctosta-phylos sp. | PISA, TACAME, Vulpia sp. |
| **RB** | **NAHE** | 05/21/98 | | TEH | COLD FORK | 27N | 7W | 1120 | unk | unk | unk | 1000 | HW | open grass in blue oak woodland | clay | 15 | SE | none | unk |
| **RB** | **NAHE** | 06/09/98 | | TEH | LOWREY | 26N | 6W | 950 | unk | unk | unk | 100 | CW HW | blue oak woodland | clay | 0 | 0 | QUDO, BRHO | CESO, MICA, PEDU |
| **RB** | **NAHE** | 06/15/98 | | TEH | LOWREY | 26N | 6W | 950 | unk | unk | unk | 500 | HW | annual grassland | clay | 0 | 0 | Avena sp., Bromus spp. | ANAR, CLAF, NAPU |
| **RB** | **NAHE** | 07/03/98 | | TEH | LOWREY | 26N | 6W | 850-900 | unk | unk | unk | 200 | HW | foothill pine woodland | unk | 0 | 0 | PISA, Arcto-staphylos sp., CESO | Avena sp., Bromus spp., PEDU |
| **RB** | **NAHE** | 07/06/98 | | TEH | COLD FORK | 27N | 7W | 1100-1200 | unk | unk | unk | 1400 | JC JM CW HW | chaparral, blue oak woodland | gravelly clay | 0 | 0 | QUDO, CECU, PISA | BLSC,NAPU, PEDU, NAJE, Clarkia sp. |
| **RB** | **NAHE** | 07/07/98 | | TEH | OXBOW BRIDGE | 27N | 7W | 1020-1040 | unk | unk | unk | 400; 700 | JC CW HW | blue oak woodland | clay | 0-25 | S/SE | QUDO, CESO, TECA | Bromus spp., LYHY, MICA, NAPU |
| **RB** | **NAHE** | 07/09/98 | | TEH | LOWREY | 26N | 7W | 1000 | unk | unk | unk | 100 | HW | foothill pine woodland | shale | 15 | E | Arcto-staphylos sp., CESO, PISA | Avena sp., BRHO, CECU,PEDU, QUDO |
| **RB** | **NAHE** | 05/24/99 | | TEH | COLD FORK | 26N; 27N | 7W | 1160-1370 | 0 | 500 | 0 | 500 | BC LJ | old roadbed, blue oak savanna | clay | 0-5 | SE | QUDO | Erodium sp., Hordeum sp., other grasses |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE (°) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RB** | **NAHE** | 06/08/99 | | TEH | OXBOW BRIDGE | 27N | 7W | 1070 | 20 | 60 | 20 | 100 | BC | grassy edge, blue oak woodland | clay | 0-5 | SW | QUDO | Vulpia spp. |
| **RB** | **NAHE** | 06/09/99 | | TEH | LOWREY | 26N | 6W | 920 | 0 | 30-60 | 20-40 | 50-100 | BC LJ | open foothill pine woodland | clay | 0 | 0 | PISA | CECU, NAPU, Eriogonum wrightii var. trachygonum |
| **RB** | **NAHE** | 06/09/99 | | TEH | LOWREY | 26N | 6W | 1100 | 63 | 116 | 0 | 179 [3 colo- nies] | HW CW | grassy opening in foothill pine woodland | gravelly clay | 0 | 0 to W | PISA | Bromus sp, Avena sp. |
| **RB** | **NAJE** | 07/06/98 | | TEH | COLD FORK | 27N | 7W | 1100-1250 | unk | unk | unk | 500- 1000 | HW | chaparral edges | gravelly clay | 0 | 0 | CECU, PISA | NAHE, NAPU, Clarkia sp. |
| **RB** | **NAJE** | 05/20/99 | | TEH | COLD FORK | 27N | 7W | 1160 | 0 | 15 | 0 | 15 | JW BH | grassland | clay | gentle | S | none | BRHO, TACAM, CLPU, BRMAR |
| **RB** | **NAJE** | 06/03/99 | | TEH | COLD FORK | 27N | 7W | 1000-1050 | 240-300 | 320-400 | 240-300 | 800-1000 | BC LJ | grassy opening in chaparral/ blue oak woodland | shaley clay | 0-10 | 0 | PISA, QUDO, GACO, QUBE, CEBE | HEAR, CAPA, LENE, BRHO |
| **RB** | **NAJE** | 06/09/99 | | TEH | LOWREY | 26N | 6W | 880 | 0 | 50-60 | 0 | 50-60 | BC LJ | old roadbed, riparian/ foothill pine savanna | hard stony clay | 0 | 0 | PISA, PofR | AICA |
| **RB** | **NAJE** | 06/10/99 | | TEH | LOWREY | 26N | 7W | 1000 | unk | unk | unk | 120 | BC LJ | grassy terrace, chaparral/ foothill pine woodland | clay | 0-5 | S | PISA, ADFA | BRHO, PLER, Calycadenia sp. |
| **RB** | **NAJE** | 06/14/99 | | TEH | COLD FORK | 27N | 7W | 1140 | 0 | 100 | 100 | 200 | BC LJ | grassy flat, chaparral/ foothill pine woodland | clay | 0-5 | S/0 | PISA, JUCA, QUBE | short annual grasses, SABI, CAPA, Lessingia sp. |
| **RB** | **NAJE** | 06/21/99 | | TEH | COLD FORK | 27N | 7W | 1160 | 0 | 200 | 0 | 200 | LJ BC | grassy ridge, chaparral/ foothill pine woodland | clay/ shale | gentle | N | QUDO, PISA | short grasses, scattered shrubs |
| **RB** | **NAJE** | 06/24/99 | | TEH | COLD FORK | 27W | 7W | 1180 | 0 | 135 | 15 | 150 | JW CW BH | opening in chaparral/ foothill pine woodland | unk | gentle | E | none | dried grasses, CAPA,CESO, Sanicula sp. |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE (°) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RB** | **STDR** | 07/03/98 | | TEH | LOWREY | 26N | 6W | 880 | unk | unk | unk | <50 | JM HW CW | chaparral/ foothill pine woodland | shale | very steep | N | none | ANSU |
| **RB** | **STDR** | 04/27/99 | 05/18/99 | TEH | LOWREY | 26W | 6W | 1020-1040 | 21; 0 | 9; 30+ | 0; 30+ | 30; 60+ | LJ CW BC | foothill pine woodland | shale | very steep | S/SW | PISA, QUDO | ESCA, MAFL, Cryptantha sp. |
| **RB** | **STDR** | 05/20/99 | 05/20/98 | TEH | COLD FORK | 27N | 7W | 1000 | 8 | 72 | 0 | 80 | HW (in 1998); JW BH | unk | shale | steep | S | none | ERNU,BRMAR, SACO, ERLA, MAFL |
| **RB** | **STDR** | 06/10/99 | | TEH | LOWREY | 26N | 6W | 880 | 3 | 0 | 0 | 3 | LJ BC HW CW | creek bank in open foothill pine savanna | shale | very steep | S | none | CHOCR |
| **S** | **ANELA** | 04/19/99 | | COL | SITES | 18N | 4W | 500 | 0 | 0 | 200- 300 | 200- 300 | JW BH | annual grassland | crumbly shale | slope | N | none | STNI, CLEX, LIBI, PLER, COSP, Clarkia sp., Galium sp. |
| **S** | **ANELA** | 04/23/99 | | COL | LODOGA | 17N | 5W | 440; 480 | 0 | 0 | 17; 150 | 17; 150 [2 colonies] | JW BH | creek bank in annual grassland/ oak savanna | crumbly clay/ rocky shale | steep | N | none | ANFI, LUBI, CLPE, DRVE, ATPU, PLER, LIBI, STNI, Pectocarya sp. |
| **S** | **ANELA** | 05/05/99 | | COL | SITES | 17N | 4W | 500 | 0 | 0 | 6 | 6 | JW BH | annual grassland | crumbly clay/ shale | slope | N | none | STNI, PLER, MICA, ANFI |
| **S** | **HECA** | 03/06/98 | | COL | SITES | 16N | 5W | 400 | 25 | 25 | 0 | 50 | JC JM CW | annual grassland | clay | 20 | E | Bromus sp. | DRVE, HOBR, PLST, NAER, NAHE |
| **S** | **HECA** | 04/14/98 | | COL | LODOGA | 18N | 5W | 520 | 0 | <50 | 0 | <50 | JM | annual grassland | clay | 0 | 0 | grasses | ERBO, LENI, LOMU, AVFA, Lupinus sp., Psilocarphus sp. |
| **S** | **HECA** | 05/08/98 | | COL | SITES | 17N | 5W | 400 | 25 | 25 | 0 | 50 | JM CW HW | annual grassland | clay | 20 | E | Bromus sp. | DRVE, HOBR, PLST, NAER, NAHE |
| **S** | **NAER** | 05/08/98 | | COL | SITES | 17N | 5W | 375-420 | unk | unk | unk | unk | JM HW | annual grassland | unk | gentle | NE | none | NAPU, NANI, NAHE, CLAF |
| **S** | **NAHE** | 05/08/98 | | COL | SITES | 17N | 5W; 4W | 375 | unk | unk | unk | unk | JM HW | annual grassland | unk | gentle | NE | none | NAPU, NANI, NAER, CLAF |
| **S** | **NAHE** | 05/26/98 | 05/27/98 | COL | SITES | 17N; 16N | 4W | 400-480 | unk | unk | unk | >1000 | CW HW | annual grassland | clay | 5-35 | W, N, NW | grasses | BRMAR, Avena sp., CALU, MICA, ACMO, BRHO, NANI |

| SITE | SP | DATE | OTHER DATES | CO. | QUAD | T | R | ELEV (ft) | VEG | FL | FR | TOT | REP | HABITAT | SOIL | SLOPE ( º ) | ASPECT | DOM | ASSOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **S** | **NAHE** | 05/27/98 | | COL | SITES | 17N | 5W | 400 | unk | unk | unk | "large pop" | HW JM JC CW | annual grassland | clay | 10-15 | E | grasses | QUDO, TECAM, CESO, BRRU, Micropus sp. |

January 4, 2000

ATTACHMENT 7

OFFSTREAM STORAGE RESERVOIR INVESTIGATION:

c. Explanation of prioritized plant species name and spreadsheet column acronyms

d. 1998-1999 prioritized plant species population occurrence records

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# FILE CONTENTS CONFIDENTIAL

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January 4, 2000

ATTACHMENT 8.

OFFSTREAM STORAGE RESERVOIR INVESTIGATION:

1998-1999 Photographs of prioritized plants and vegetation communities

**Antirrhinum subcordatum**

**Antirrhinum subcordatum habitat under scrub oak**

**Astragalus rattanii var. jepsonianus**

**Astragalus rattanii var. jepsonianus habitat**


**Chamaesyce occellata spp. rattanii**

**CHOCR habitat on south-facing, bare shale slopes**

**Eriastrum brandegeae**

**ERBR habitat on bare, rocky open slope**

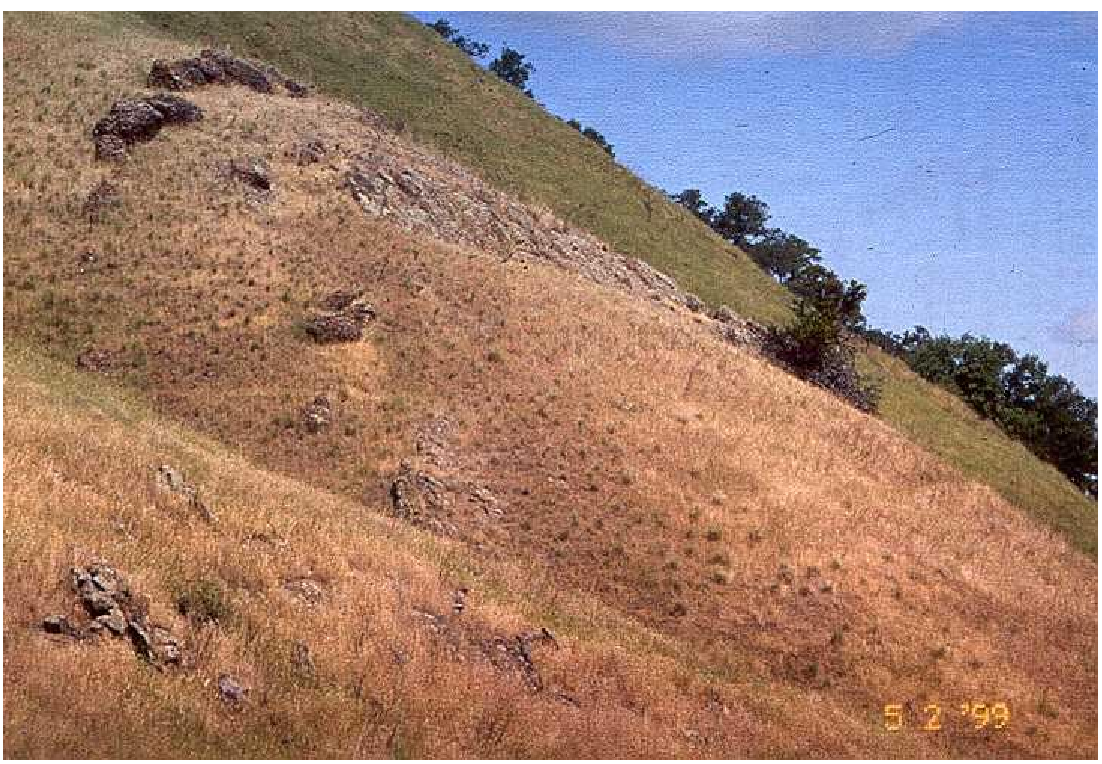
**Valley oak (*Quercus lobata*) at Thomes-Newville Reservoir**

**Salt Creek and associated wetland vegetation at Thomes-Newville Reservoir**

**Grasslands and grazing cattle at Thomes-Newville Reservoir**

**Riparian willow scrub vegetation at Thomes-Newville Reservoir**

**Blue oak woodland and north-facing shale slope at Thomes-Newville Reservoir**



**Native bunchgrasses at Thomes-Newville Reservoir**


**Grassland opening on valley floor at Red Bank Reservoir**

**Blue oak woodlands at Red Bank Reservoir**


**Chamise chaparral vegetation at Red Bank Reservoir**

**Blue oak and grey pine woodland at Red Bank Reservoir**

**Steep Lodo Shale slope at Red Bank Reservoir**

**Red Bank Creek with associated riparian vegetation**

**State of California**, Gray Davis, Governor
**The Resources Agency**, Mary D. Nichols, Secretary for Resources
**Department of Water Resources**, Thomas M. Hannigan, Director

Steve Macaulay, Chief Deputy Director
Raymond D. Hart, Deputy Director
L. Lucinda Chipponeri, Assistant Director for Legislation
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William J. Bennett, Chief, Division of Planning and Local Assistance

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North of the Delta
Offstream Storage Investigation

# Progress Report Appendix E:

## Amphibian and Reptile Survey Summary

**April 2000**

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# Progress Report Appendix E:

## Amphibian and Reptile Survey Summary

**Report prepared by:**
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**Division of Planning and Local Assistance**

**April 2000**

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## Tables



## Figures

# Amphibian and Reptile Survey Summary

## Introduction

In late 1997, the Department of Water Resources began a two-year reconnaissance level study of North of the Delta Offstream Storage, authorized by Proposition 204—the Safe, Clean, Reliable Water Supply Act approved by voters in 1996. In early 1999, CALFED consolidated all storage investigations under a comprehensive program called Integrated Storage Investigations. The North of the Delta Offstream Storage Investigation was incorporated into one of seven ISI program elements.

The North of the Delta Offstream Storage Investigation analyzes engineering, economic, and environmental impact to determine the feasibility of four north-of-the-Delta storage projects. The four potential alternatives are Sites Reservoir, Colusa Project, Thomes-Newville Project, and Red Bank Project (Figure 1). Phase I, currently underway, includes preliminary field surveys of environmental resources and extensive field surveys of cultural resources, geological, seismic, and foundation studies, and engineering feasibility evaluation. Phase II will start when CALFED's Record of Decision and Certification for the Programmatic EIR/EIS is completed and if North of Delta Offstream Storage is consistent with CALFED's preferred program alternative. Phase II will include completion of necessary fish and wildlife surveys, evaluations of potential mitigation sites, preparation of project-specific environmental documentation, final project feasibility reports, and the acquisition of permits necessary to implement the project.

Under Phase I, the Department of Fish and Game conducted studies of fish and wildlife resources in each project area. This appendix summarizes surveys of amphibians and reptiles in the four proposed project areas. The information gathered will be used to describe impacts on fish and wildlife resources during the planning process.

### Contract with DFG

Amphibian and reptile studies were initiated in 1997 for Red Bank, Sites, and Colusa Projects. DFG collected data on occurrence, distribution, and relative abundance of amphibians and reptiles at the proposed reservoir inundation areas for these projects. DFG also reviewed past amphibian and reptile studies for Red Bank and Thomes-Newville Projects.

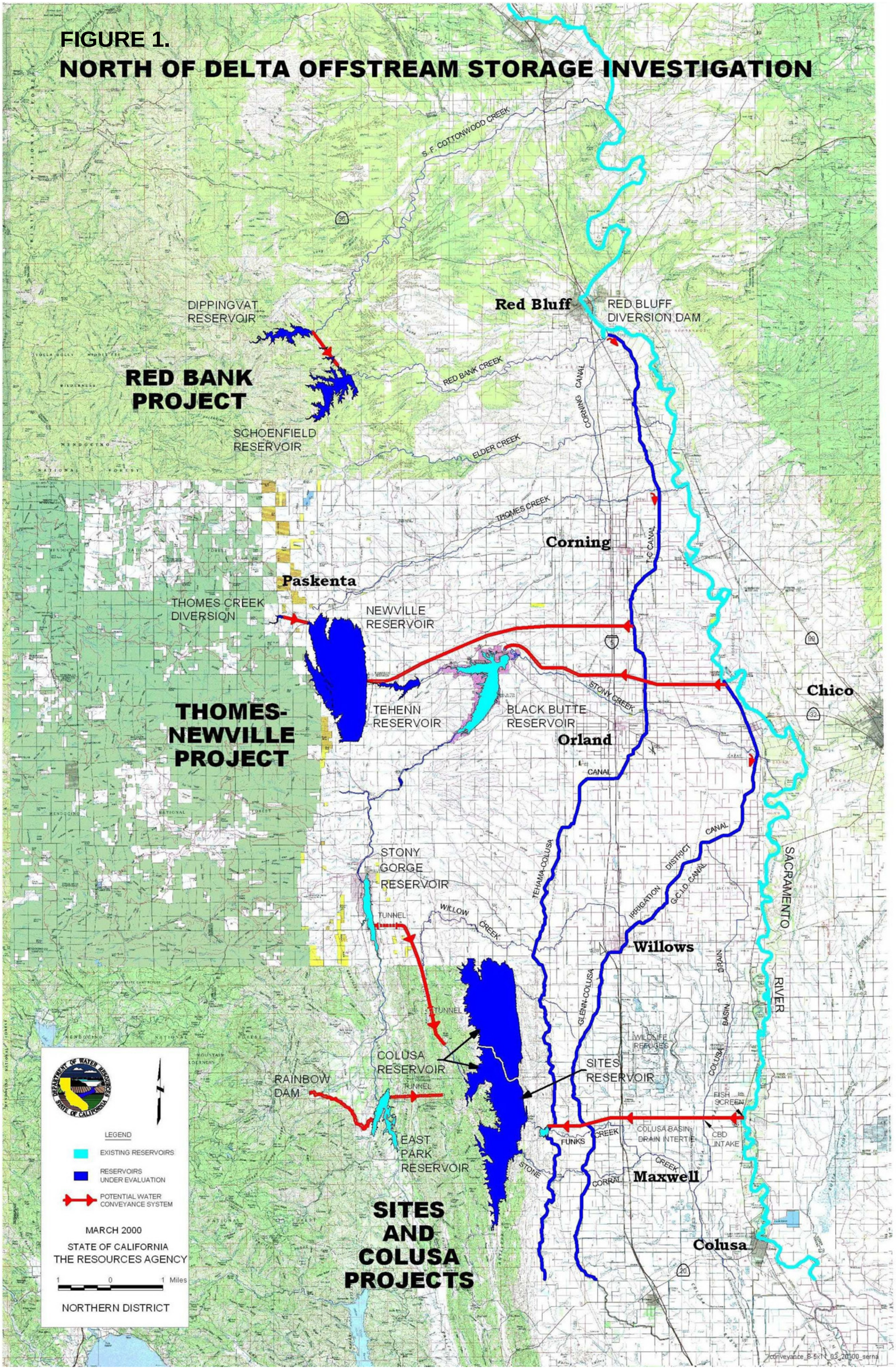


FIGURE 1.
NORTH OF DELTA OFFSTREAM STORAGE INVESTIGATION

### Report Organization and Content

Results and findings of past studies and recently conducted surveys of amphibians and reptiles in the proposed project areas are discussed in this appendix. The general survey procedures used in the recent surveys at Sites, Colusa, and Red Bank Project areas are discussed below. The specific sampling data and results of these surveys and past studies are discussed in respective sections for each proposed project area. Findings of species with special status are summarized at the end of this appendix.

## Methodology

DFG staff conducted surveys for amphibians and reptiles from August 1997 through spring 1999 in Sites, Colusa, and Red Bank Project areas. The surveys included threatened or endangered species, Species of Concern, and common species of amphibians and reptiles.

The Stebbins field guide (1985) was used to determine historic ranges of the species. DFG staff also used physical observation of the present habitat, historic records, and DFG's Natural Diversity Data Base to establish the list of potential species that could occur in the project areas (Table 1). The major focus of field surveys was to locate the special species listed in Table 1 that could potentially occur in the project area. Survey techniques used included night driving, dip netting, seining, and day and night ground searches in all weather conditions and seasons to find species of common amphibians and reptiles.

**Table 1. Special Species of Amphibians and Reptiles in Project Areas**

| | | Project Area | | |
|---|---|---|---|---|
| **Species** | **Status** | **Sites and Colusa** | **Red Bank** | **Thomes-Newville**[1] |
| **Amphibians** | | | | |
| California red-legged frog | Federally threatened | X | X | X |
| California tiger salamander | Candidate for federal listing; State Species of Concern | X | | X |
| Foothill yellow-legged frog | Federal and State Species of Concern | X | X | X |
| Western spadefoot toads | Federal and State Species of Concern | X | X | X |
| Reptiles | | | | |
| California horned lizard | Federal and State Species of Concern | X | | |
| Western pond turtle | Federal and State Species of Concern | X | X | X |

[1] Results from surveys of Thomes-Newville Project area conducted in 1981-82

All habitats at the selected survey sections were identified and categorized as to type of water body (e.g., pond, farm impoundment, vernal pool, or creeks). All ponds were measured for length, width, and depth during the initial assessment in fall 1997. Aquatic vegetation, root-wads, water turbidity, and characterization of the surrounding terrain (e.g., degree of degradation, canopy, embankment, and soil type) were recorded during the initial assessment period and on all subsequent surveys. Staff visually inspected ponds at the time of the preliminary assessment to determine the presence of, and the ability to support, amphibians, reptiles, and fish. Once the ponds were located and assessed, they were assigned an identification code. Vernal pools were surveyed during spring 1998 and assigned an identification code. All ponds and vernal pools were marked on a topographical quad map by their appropriate code.

Creeks were divided into a maximum of three regions, depending on the length of each habitat type contained in the reservoir footprint. A total of eight transects were established to encompass vernal pools and support California tiger salamander surveys at the Sites and Colusa Project areas. California tiger salamander transects were assigned an identification code and marked on a topographic map. Other transects were established throughout the potential Sites, Colusa, and Red Bank Reservoir areas to encompass a variety of habitat types for general herpetology surveys. Photocopies of topographical maps were made of the specific areas to be surveyed for workers to take out into the field. Staff obtained permission to survey on private property from the property owners at least a week in advance of all surveys.

Survey data were collected in a standard 5 to 7 inch "write in the rain" notebook. At the end of the day, data for the California red-legged frog, California tiger salamander, and general herpetology surveys were transferred to a standardized data sheet from *A Standardized Protocol for Surveying Aquatic Amphibians, Technical Report NPS/WRUC/NRTRP-95-01*. All other data was photocopied and inserted into the appropriate binder. For general herpetology surveys, data was also transferred onto a CALFED Herpetology Investigation Field Observation Report. All data was transferred to a computer spreadsheet program. A photocopy of the topographical map with the area surveyed was highlighted and the location of any Species of Concern found marked on it was stapled to the data sheet. The surveyors present, the time of survey, environmental, and weather conditions were all recorded. The condition and type of the habitat were noted, including emergent and aquatic vegetation, turbidity of water, condition and predominant type of surrounding vegetation, and substrate. Land use or alteration was noted as well.

## California Red-legged Frog

Surveys for the California red-legged frog (*Rana aurora draytonii*), a federally threatened species, were conducted from August 1997 to January 1998 and from May through October 1998 in Sites, Colusa, and Red Bank Project areas. Surveys were not conducted during the breeding or rearing period of red-legged frogs to avoid disturbing breeding frogs, eggs, or larvae. All ponds and creeks in the study area were surveyed a minimum of four times during the five-month period in 1998. Day surveys were performed on clear, sunny days with minimal wind. Night surveys were conducted on warm, still nights from an hour past sunset until midnight (U.S. Fish and Wildlife 1997).

Crews of two to nine people conducted surveys. The surveyors would often break up into teams or work as individuals to either walk the perimeter of the ponds or the length of the stream for both day and night surveys. Taking care not to disturb habitat, the shoreline of each pond or creek section was thoroughly inspected, with particular care to examine overhangs, root-wads, emergent vegetation, or other structures that are used as shelter by red-legged frogs. Two surveyors would walk in opposite directions at the water's edge, while two other surveyors would walk opposite directions at a distance of 17 to 33 feet from the water's edge. During night surveys, 6-volt battery lamps were used to scan the water surface for eye-shine (U.S. Fish and Wildlife 1997). Day surveyors used binoculars to scan ahead up to 50 feet to spot frogs before they jumped into the water. The survey team also used auditory identification of frog calls during day and night surveys. A single lens reflex camera was used to photograph any species of interest for future identification verification. Photographs were also taken of the environment in which animals were found, to confirm field notes and to document the state of the habitat when it was surveyed (Bury and Corn 1991).

## California Tiger Salamander

California tiger salamanders (*Ambystoma californiense*) are candidate species for federal listing, currently DFG Species of Concern, and are fully protected. The historic range of California tiger salamanders in the Sites and Colusa Project areas was determined using Stebbins field guide (1985). As in the California red-legged frog survey, a preliminary survey of the study area was done to assess the potential of California tiger salamander habitat. Grasslands, vernal pools, and farm pond impoundments that contained water for only part of the year were all examined as potential California tiger salamander habitat sites. All ponds, vernal pools, and the surrounding territory were examined for burrows, log debris, and type of terrestrial vegetation. Each pond was then seined. Transects were laid out within potential breeding habitat and grassland terrain (Brode 1993). Eight transects averaging about 0.62 by 0.31 miles were established.

Transect and visual pond inspections were conducted at night, during storms that continued from the day into the night, or when the air temperature was between 45-50° F or warmer between the months of November and March for both the 1997-98 and 1998-99 seasons.

For transects, the team members formed a line, keeping a distance of at least 17 feet between them. Six-volt flashlights were used to scan the terrain. All mammal burrows, cracks, logs, and debris in the transect were inspected for California tiger salamanders. A camera was brought to photograph adult specimens for future identification verification and to photograph the area in which they were found.

Visual pond surveys were performed by biologists who walked concentric circles around the pond starting with an inner circle at the water's edge, with walkers spanning out about 33 feet. Surveyors would walk in opposite directions around the pond, utilizing 6-volt flashlights to scan back and forth for animals. Any surrounding burrows or logs were inspected.

Dip netting and seining aquatic surveys were done twice a year for each vernal pool and intermittent pond, at least 15 days apart. The first survey was done between March 15 and April 15, and the second between April 15 and May 15. Only ponds that would hold water for at least 10 weeks during the survey time interval were inspected.

Initial samples were made using a 12-inch dip net with a 1/8-inch mesh. Each pond was divided so that the dip net sweeps would sample 50 percent of the surface area. Seining was done using one of three seines depending on the size of the pond, the largest seine being 60 feet long, 5 feet high, with a 1/4-inch mesh, and a 7 foot by 7 foot pocket. A medium sized seine was 29 feet long, 6 feet high, with a 1/4-inch mesh, and a pocket size of 7 feet by 5 feet. The third seine, used only for small ponds, was 12 feet long, 4 feet high, with a 1/4-inch mesh, and a 7 feet by 5 feet pocket. When possible, the seine would be pulled through the pond, arcing from one point around and back again, sweeping the whole pond at once. Large ponds had to be seined in sections.

## Western Pond Turtle

DFG biologists looked for western pond turtles (*Clemmys marmorata*), a federal and State Species of Concern, when seining or during daytime visual surveys in the project areas. Carapaces (shells) of dead turtles were also noted and measured. During periods of warm weather, biologists watched the creek when possible while traveling to and from work stations, which yielded positive results in locating western pond turtles. A general lookout for western pond turtles was established while driving or walking near creeks.

## General Amphibian and Reptile

General herpetology surveys were done by ground, searching ponds and transects, by seining, or by night driving studies in the Sites, Colusa, and Red Bank Project areas. Ground searches were done both day and night. Seining was done during the day. Driving surveys were only done at night. General amphibian and reptile surveys were conducted year-round throughout these project areas, when the weather was appropriate for amphibian and reptile activity.

Transects were walked by team members in a line, 17 feet apart. All logs, trees, burrows, rocks, and crevices were inspected for animals. Transect areas included riparian, grasslands, and oak woodlands. Binoculars were used to scan ahead for animals such as turtles and frogs (Bury and Corn 1991). Night transects were walked in the same manner, using 6-volt flashlights for illumination. During the warmer seasons, biologist going to and from transects kept a general watch for reptiles and amphibians.

Ponds were inspected by both ground searches and seining. Teams of two to nine members spread out from the pond's edge to 33 feet away to conduct ground searches. Frog calls were noted as an auditory identification of species. A fine mesh minnow seine was pulled from one bank to the other to seine ponds. Trapped animals were identified by species and tallied. Hand-held dip nets were used to capture animals near the shore.

Night-driving surveys were conducted from a motor vehicle traveling at speeds between 15-25 mph (Brown et al 1987). Specimens found on the shoulder were identified and counted. Night drive routes included roads both within and surrounding the project area. These roads were traveled in both directions. During the warmer seasons, a general watch was made on the roadsides whenever surveyors were driving in the study area. A camera was used to photograph specimens for species verification and to maintain a general record of the find. Roads interior to the reservoir sites and immediately surrounding the project areas were driven a total of eight times in 1997 in the Sites and Colusa Project areas.

## Sites and Colusa Projects

Surveys for reptiles and amphibians were conducted by DFG employees from August 1997 through spring 1999 in the Sites and Colusa Project areas. The major objectives of these surveys were to search for California red-legged frogs, federally threatened; California tiger salamanders, candidate for federal listing and State Species of Concern; and to conduct general herpetology surveys. Four species listed as federal and California State Species of Concern that could potentially occur in the Sites and Colusa Project areas—foothill yellow-legged frogs, western pond turtles, western spadefoot toads, and California horned lizard—were also looked for during the course of this survey (DFG 1998).

### Results

A total of 2,400 hours were spent in the Sites and Colusa Project areas looking for reptiles and amphibians. A total of 19 species, 5 amphibians and 14 reptiles, were found during this survey (Table 2). Only one special species listed in Table 1 was found, the western pond turtle. These turtles are listed by the Natural Diversity Data Base as occurring in Colusa County. California red-legged frogs and California tiger salamanders were not found.

The most prevalent species found was the bullfrog. Bullfrogs, Pacific tree frogs, and western toads were the most commonly observed amphibians (Table 4). Western fence lizards were the most prevalent reptiles, with a catch per hour effort ratio of 0.17 (Table 4).

## Table 2. Amphibian and Reptile Species Observed in the Sites and Colusa Project Areas

| Common Name | Scientific Name |
|---|---|
| **Amphibians** | |
| Bullfrog | *Rana catasbieana* |
| California newt | *Taricha torosa* |
| California slender salamander | *Batrachoseps attenuatus* |
| Pacific treefrog | *Hylla regilla* |
| Western toad | *Bufo boreas* |
| **Reptiles** | |
| Aquatic garter snake | *Thamnophis couchii* |
| Common garter snake | *Thamnophis sirtalis* |
| Common king snake | *Lampropeltus getula* |
| Gopher snake | *Pituohpis catenifer* |
| Ring neck snake | *Diadophis punctatus* |
| Sharp tailed snake | *Contia tenuis* |
| Southern alligator lizard | *Elgaria mulitcoranata* |
| Western fence lizard | *Sceloporus occidentalis* |
| Western pond turtle[1] | *Clemmys marmorata* |
| Western racer | *Coluber constrictor* |
| Western rattlesnake | *Crotalus viridus* |
| Western sagebrush lizard | *Sceloporus graciosus gracilis* |
| Western skink | *Eumeces skiltonianus* |
| Western terrestrial garter snake | *Thamnophis elegans* |

Seven-hundred-and-fifty hours were spent searching riparian habitat, which yielded the greatest diversity of species. Fourteen of the nineteen total species of reptiles and amphibians, all three frog species, and all but three reptile species were found in this type of habitat (Table 3). Bullfrogs and western toad larvae were also found in pools of the riparian zone.

Fourteen species of reptiles and amphibians were also found in the oak woodland habitat. Adults of all five species of amphibians and all but five species of reptiles were found in the oak woodlands.

A total of 2,060 hours was spent in ground searches. Ground searching was the most productive method of locating a variety of reptiles and amphibians, with an overall catch per hour effort ratio of 8.1 (Table 4). Representatives of all species found during the study were located via ground searches. Dip netting and seining were particularly effective in capturing semi-aquatic reptiles and amphibians, especially larval amphibians (Table 4).

[1] State and federal Species of Concern

During the winter and early spring of 1999, the vernal pools of the Sites and Colusa Project areas either remained dry or only held water for a week's time. The protocol for dip netting vernal pools for California tiger salamanders could not be met as a result.

## Table 3. Species Found in Each Habitat Type

| Common Name | Riparian | Oak Woodland | Grassland | Farm Pond | Vernal Pool | Roads |
|---|---|---|---|---|---|---|
| **Amphibians** | | | | | | |
| Bullfrog | X | X | X | X | | |
| Bullfrog larvae | X | X | | X | | |
| California newt | | X | | X | | |
| California slender salamander | | X | | X | | |
| Pacific treefrog | X | X | X | X | X | |
| Pacific treefrog larvae | | | | X | X | |
| Western toad | X | X | X | X | | |
| Western toad larvae | X | | | X | X | |
| **Reptiles** | | | | | | |
| Aquatic garter snake | X | | | | X | |
| Common garter snake | X | X | X | X | X | |
| Common king snake | X | | X | X | | |
| Gopher snake | X | X | X | X | X | |
| Ring neck snake | | | | | X | |
| Sharp tailed snake | X | | | | | |
| Southern alligator lizard | X | X | X | X | | |
| Western fence lizard | X | X | X | X | X | |
| Western pond turtle[1] | X | | | | | |
| Western racer | X | X | | | | |
| Western rattlesnake | X | X | X | X | | X |
| Western sagebrush lizard | | X | | | | |
| Western skink | | X | | | | |
| Western terrestrial garter snake | X | X | | X | | |

[1] State and federal Species of Concern

## Table 4. Catch Per Hour Effort for Each Survey Method

| Common Name | Ground Searching | Dip Netting | Seining | Night Driving |
|---|---|---|---|---|
| **Amphibians** | | | | |
| Bullfrog | 4.8 | 0.7 | 1 | 0 |
| Bullfrog larvae | 1.1 | 0 | 2.9 | 0 |
| California newt | 0.003 | 0 | 0 | 0 |
| California slender salamander | 0.009 | 0 | 0.3 | 0 |
| Pacific tree frog | 1.2 | 3.8 | 0.6 | 0 |
| Pacific tree frog larvae | 0 | 27.6 | 0 | 0 |
| Western toad | 0.5 | 0.02 | 0.04 | 0 |
| Western toad larvae | 0.2 | 13.4 | 7.1 | 0 |
| **Reptile** | | | | |
| Aquatic garter snake | 0.0005 | 0.009 | 0 | 0 |
| Common garter snake | 0.02 | 0.04 | 0.02 | 0 |
| Common king snake | 0.003 | 0 | 0 | 0 |
| Common racer | 0.0002 | 0 | 0 | 0 |
| Gopher snake | 0.007 | 0.009 | 0 | 0 |
| Ring neck snake | 0.0005 | 0 | 0 | 0 |
| Sharp tailed snake | 0.0005 | 0 | 0 | 0 |
| Southern alligator lizard | 0.005 | 0 | 0 | 0 |
| Western fence lizard | 0.17 | 0 | 0 | 0 |
| Western pond turtle[1] | 0.0009 | 0 | 0 | 0 |
| Western rattlesnake | 0.02 | 0.009 | 0.06 | 0.2 |
| Western sagebrush lizard | 0.0005 | 0 | 0 | 0 |
| Western skink | 0.006 | 0 | 0 | 0 |
| Western terrestrial garter snake | 0.05 | 0 | 0.02 | 0 |
| **Totals** | **8.1** | **45.6** | **12.1** | **0.2** |

## Discussion

The foothill yellow-legged frog, which occurs in both Glenn and Colusa counties and is listed by the DFG as a Species of Concern, was not observed in the project area. These frogs prefer the running waters of mid-sized streams.

Several reptile and amphibian species whose historic range may include the Sites and Colusa Project areas that were not observed include the Oregon salamander (*Ensatina escholtzii oregonense)*, the black salamander (*Aneides flavipunctatus)*, and the mountain king snake (*Lampropeltis zonata)*. These species tend to prefer shaded oak woodlands of the arroyos to the west side of the project area.

Western spadefoot toad, rubber boas (*Charina bottea bottae)*, and the California night snake (*Hypsiglena torquata nuchalata)* were expected to be found in the grasslands of the Antelope Valley, but were not.

Western pond turtles were found in the project area, as well as outside the reservoir footprint, both upstream and downstream. California red-legged frogs, which generally have a similar habitat preference as western pond turtles and are frequently found occupying the same areas (Jennings, Hayes, and Holland 1985), were not, however, found during these surveys. Further surveys of the streams and pools surrounding the reservoir inundation area will be conducted.

### Red Bank Project

DFG initiated studies of amphibians and reptiles in the Red Bank Project area in 1997. DFG also reviewed past studies as part of the Red Bank Investigations (Bill et al 1975, Smith 1987, Brown et al 1987). This summary briefly describes the results of current and past studies of amphibians and reptiles conducted on Cottonwood Creek and Red Bank Creek.

DFG staff conducted surveys for reptiles and amphibians from August 1997 through spring 1999 in the Red Bank Project area. The major objectives of these surveys were to search for California red-legged frogs (federally listed as threatened) and to conduct general herpetology surveys. Three species listed as federal and State Species of Concern that could potentially occur in the Red Bank Project area—foothill yellow legged frogs, western pond turtles, and western spadefoot toads)—were also looked for during the course of these surveys (DFG 1998).

## Results

### *Cottonwood Creek*

DFG conducted one-year reconnaissance-level studies of the Red Bank Project in 1986 (Brown et al 1987). Biologists spent about 25 hours searching the banks of Cottonwood Creek in the study area in 1986 and 125 hours searching in 1998. Two species listed as Species of Concern were found, foothill yellow-legged frogs and western pond turtles (Table 5). These two species were distributed throughout the study area.

During these studies, fourteen species of amphibians and reptiles were found. The most common species of amphibians observed in the Cottonwood Creek study area were foothill yellow-legged frogs (14.80/hr) and western toads (13.10/hr) (Table 6). The most common species of reptiles observed were common garter snakes (0.39/hr) and western pond turtles (0.17/hr) (Table 6).

### Table 5. Amphibians and Reptiles Observed in the Red Bank Project Area

| Common Name | Scientific Name | Cottonwood Creek | Red Bank Creek |
|---|---|---|---|
| **Amphibians** | | | |
| Bullfrog | *Rana catesbeiana* | X | X |
| California red-legged frog[1] | *Rana aurora draytonni* | | X |
| Foothill yellow-legged frog[2] | *Rana bolei* | X | X |
| Pacific tree frog | *Hyla regilla* | X | X |
| Western toad | *Bufo boreas* | X | X |
| **Reptiles** | | | |
| Common garter snake | *Thamnophis sirtalis* | X | X |
| Common kingsnake | *Lampropeltis getulus* | X | X |
| Gopher snake | *Pituophis malanoleucus* | X | |
| Southern alligator lizard | *Elgaria multicarinata* | X | X |
| Western fence lizard | *Sceloperus occidentalis* | X | X |
| Western pond turtle[2] | *Clemmys marmorata* | X | X |
| Western racer | *Coluber constrictor* | | X |
| Western rattlesnake | *Crotalus viridis* | X | X |
| Western sagebrush lizard | *Sceloperus graciousus gracilis* | X | X |
| Western skink | *Eumeces skiltonianus* | X | X |
| Western terrestrial garter snake | *Thamnophis elegans* | X | X |

### *Red Bank Creek*

Biologists spent 75 hours searching Red Bank Creek and surrounding areas in 1986 and 300 hours in 1998. Biologists found two species listed as Species of Concern, the foothill yellow-legged frog and the western pond turtle (Table 5). These two species were distributed throughout the Red Bank Project study area. Biologists also observed a threatened species, the California red-legged frog, in 1986 and 1998 at Sunflower Gulch, a tributary to Red Bank Creek. Biologists found sixteen species of amphibians and reptiles (Table 5).

## Discussion

The most common species of amphibians observed in the Red Bank study area were western toads (5.65/hr.) and foothill yellow-legged frogs (3.91/hr.) (Table 6). The most common species of reptiles observed were western terrestrial garter snakes (0.13/hr.) and western pond turtles (0.09/hr.) (Table 6).

[1] Listed as federally threatened species
[2] State and federal Species of Concern

### Table 6. Relative Abundance of Amphibians and Reptiles Observed in the Red Bank Project Area

| Species | Catch per hour: Cottonwood Creek | Catch per hour: Red Bank Creek |
|---|---|---|
| Amphibians | | |
| Bullfrog | 0.02 | 1.06 |
| California red-legged frog[1] | | <0.01 |
| Foothill yellow-legged frog[2] | 14.8 | 3.91 |
| Pacific tree frog | 0.01 | 1.58 |
| Western toad | 13.1 | 5.65 |
| Reptiles | | |
| Common garter snake | 0.39 | 0.03 |
| Common king snake | 0.01 | 0.01 |
| Gopher snake | 0.05 | 0.01 |
| Southern alligator lizard | 0.02 | 0.01 |
| Western fence lizard | 0.14 | 0.08 |
| Western pond turtle[2] | 0.17 | 0.09 |
| Western racer | | 0.01 |
| Western rattlesnake | 0.12 | 0.01 |
| Western sagebrush lizard | 0.02 | 0.01 |
| Western terrestrial garter snake | 0.15 | 0.13 |

The most significant finding in the current investigation is the confirmation of the presence of a California red-legged frog in Sunflower Gulch. One was observed in the same location in 1986 (Brown et al 1987). Extensive searches failed to find other red-legged frogs in the study area. It is probable that the population of red-legged frogs is very small at the site of the proposed Red Bank Project.

Two Species of Concern are plentiful throughout the Red Bank Project study area: the foothill yellow-legged frog and the western pond turtle. They were found in both Red Bank Creek and the South Fork of Cottonwood Creek.

## Thomes-Newville Project

DFG initiated studies of the impacts on fish and wildlife of a Thomes-Newville Project in 1979 as part of DWR's Thomes-Newville Reservoir planning studies. However, the planning studies were halted in 1982. DFG completed a report of its abbreviated studies in 1983 (Brown et al 1983). This section recapitulates the effort and results of DFG's 1981-82 field studies. No new studies of amphibians or reptiles at the Thomes-Newville Project area were undertaken during the recent investigations of offstream storage.

[1] Listed as federally threatened species
[2] State and federal Species of Concern

## Methods

Surveys for amphibians and reptiles in the Thomes-Newville Project area were conducted from April 1981 through May 1982. Before surveying began, it was necessary to determine the historic range and available suitable habitat of the threatened California red-legged frog and Species of Concern that might be present in the project area, such as the California tiger salamander, western pond turtle, foothill yellow-legged frog, and western spadefoot toad. This evaluation was made by physically observing the present habitat in conjunction with historic records, reviewing previous field data, and consulting professional and amateur organizations such as the Natural Diversity Database, the DFG Natural Heritage Division, and others involved in consulting or amateur herpetology in the study area. Biologists and herpetologists from State and federal agencies and environmental groups, as well as university and museum personnel, were also consulted on possible indigenous reptiles and amphibians in the study area.

Pitfall trapping was done in the Thomes-Newville Project area surveys. Square plywood roofs supported by wooden legs approximately 4.3 inches above the soil surface covered plastic 5.0 gallon buckets or 3 pound coffee cans that were buried so their open top was level with the soil surface. Animals seeking shelter would run under the roofs, fall into the can or bucket, and be trapped. The roofs prevented livestock and people from stepping into the traps.

Buckets measured 10.8 inches on the inside diameter and varied from 12.0 inches to 14.0 inches in depth. Their plywood roofs had 16.0-inch sides. Coffee cans measured 6.1 inches on the inside diameter and were 6.9-inches deep. Coffee can traps were constructed by burying one can with both lids removed above another with its bottom lid intact. This resulted in doubling the trap depth to 13.8 inches. The plywood roofs for these traps had 12.0-inch sides.

Two-hundred-and-nine traps were installed during the course of the survey, including 79 bucket traps and 130 can traps. The trapping effort included placing traps within each of the major habitat types found within the project site and surrounding areas. Grassland, oak savannah, pine-oak woodland, chaparral, and riparian areas comprised the major habitat types selected for pitfall trap installation.

Pitfall traps were checked four times per week from spring through early fall. During late fall and winter, traps were checked at least once per week. The increased frequency of trap checking during the warmer seasons coincided with increased terrestrial activity of many amphibian and reptile species. Captured amphibians and lizards were marked by clipping their toes in a predetermined sequence to obtain population estimates based on recaptures of marked individuals. These species regenerate their lost limbs.

Team members walked 16 feet apart in a line to search for amphibians and reptiles. All logs, trees, burrows, rocks, and crevices were inspected for animals. Areas searched included riparian, grasslands, and oak woodlands. Binoculars were used to scan ahead for animals such as turtles and frogs. This method was most effective for snakes, lizards, toads, slender salamanders, and tree frogs. Night searches were walked in the same manner, using 6-volt flashlights for illumination. During the warmer seasons, a general watch for reptiles and amphibians was made by staff going to and from transects.

Searches of aquatic habitat in the Thomes-Newville area included visual observations of animals on shore or in shallow water. Hand-held dip nets were used to capture animals near the shore. The study also included seining stock ponds and ephemeral pools in the project area, using a 50-foot beach seine.

Night drives occurred an average of six times per month in the Thomes-Newville area. Night drives followed roads both within and surrounding the project boundaries. These roads were traveled in both directions. Night surveys were very successful in locating snakes, lizards, and toads. During the warmer seasons, a general watch was made on the roadsides whenever surveyors were driving in the study area. A camera was used to photograph specimens for species verification and to maintain a general record of the find.

## Results

This 1981-82 survey produced observations of 22 amphibian and reptile species that occur within the habitats in the project area and surrounding areas (Table 7). No estimate of population sizes was possible because of the small number of recaptures that occurred during the pitfall trapping.

## Table 7. Amphibians and Reptiles Observed in the Thomes-Newville Project Area in 1982[1]

| Common Name | Scientific Name |
|---|---|
| **Amphibians** | |
| Black salamander | *Aneides flavipunctatus* |
| Bullfrog | *Rana catesbeiana* |
| California slender salamander | *Batrachoseps attenuatus* |
| Foothill yellow-legged frog[2] | *Rana boylei* |
| Pacific tree frog | *Hyla regilla* |
| Western spadefoot toad[2] | *Spea hammondi* |
| Western toad | *Bufo boreas* |
| **Reptiles** | |
| Common garter snake | *Thamnophis sirtalis* |
| Common king snake | *Lampropeltis getulus* |
| Gopher snake | *Pituophis malanoleucus* |
| Sagebrush lizard | *Sceloperus graciosus* |
| Sharp-tailed snake | *Contia tenuis* |
| Southern alligator lizard | *Elgaria multicarinata* |
| Striped racer | *Masticophis lateralis* |
| Western aquatic garter snake | *Thamnophis couchi* |
| Western fence lizard | *Sceloperus occidentalis* |
| Western pond turtle[2] | *Clemmys marmorata* |
| Western racer | *Coluber constrictor* |
| Western rattlesnake | *Crotalus viridis* |
| Western skink | *Eumeces skiltonianus* |
| Western terrestrial garter snake | *Thamnophis elegans* |
| Western whiptail | *Cnemidophorus tigris* |

Western toads, Pacific tree frogs, and western fence lizards were found in all habitat types. Gopher snakes and western rattlesnakes were also found in most habitat types. Some species such as black salamanders and western sagebrush lizards were much more limited in their distribution (Table 8).

[1] Scientific names are taken from Collins 1997
[2] State and federal Species of Concern

## Table 8. Amphibian and Reptile Species Found in the Thomes-Newville Project Area in 1982

| Species | Grassland | Chaparral | Oak Savannah | Oak Woodland | Riparian | Stream | Standing Water |
|---|---|---|---|---|---|---|---|
| **Amphibians** | | | | | | | |
| Black salamander | | | | X | | | |
| Bullfrog | | | | | X | X | X |
| California slender salamander | X | X | X | X | | | |
| Foothill yellow-legged frog[1] | | | | | X | X | X |
| Pacific tree frog | X | X | X | X | X | X | X |
| Western spadefoot toad[1] | X | | X | | | | |
| Western toad | X | X | X | X | X | X | X |
| **Reptiles** | | | | | | | |
| Common garter snake | X | | | | X | X | X |
| Common king snake | X | X | X | X | | | |
| Gopher snake | X | X | X | X | X | | |
| Sagebrush lizard | | X | | | | | |
| Sharp-tailed snake | X | X | | | | | |
| Southern alligator lizard | X | X | X | X | X | | |
| Striped racer | X | X | | | | | |
| Western aquatic garter snake | | | | | X | X | |
| Western fence lizard | X | X | X | X | X | X | X |
| Western pond turtle[1] | | | | | X | X | X |
| Western racer | X | X | X | | X | | |
| Western rattlesnake | X | X | X | X | X | | |
| Western skink | X | X | X | | | | |
| Western terrestrial garter snake | X | | X | | X | X | X |
| Western whiptail | | X | X | X | | | |
| **Total number of species observed** | **15** | **14** | **13** | **10** | **13** | **8** | **8** |

Ground searching proved to be the most successful method of observation in terms of the number of species it produced. This method accounted for 90.9 percent of all species found. Night driving yielded 63.6 percent, followed by pitfall trapping and searches of aquatic habitats, each of which produced 40.9 percent of all species found.

Pitfall traps tended to trap amphibians, lizards, and smaller snakes, such as the sharp-tailed snake (*Contia tenuis*). Larger snakes, because of their length, could easily avoid falling into the traps. This trapping method failed to provide any amphibian or reptile species not found by at least one other collection method.

[1] State and federal Species of Concern

Time limitations and lack of access prevented use of the beach seine except on one occasion in April 1982. A stock pond with a surface area of approximately 0.1 acre, located adjacent to Newville Road and about 0.25 mile south of the bridge near the Tehama-Glenn County line, was seined in April 1982. One seine haul yielded 13,761 Pacific tree frog tadpoles and two western spadefoot toad tadpoles. Several adult bullfrogs (*Rana catesbeiana*) were observed, but no adult or larval salamanders were found (Table 9).

### Table 9. Observation and Capture Methods for Amphibian and Reptile Species in the Thomes-Newville Project Area in 1982

| | Observation or Capture Method | | | |
|---|---|---|---|---|
| **Species** | **Pitfall Trapping** | **Night Driving** | **Ground Searching** | **Aquatic Surveys** |
| **Amphibians** | | | | |
| Black salamander | | | X | |
| Bullfrog | | X | | X |
| California slender salamander | X | | X | |
| Foothill yellow-legged frog[1] | | X | X | X |
| Pacific tree frog | X | X | X | X |
| Western spadefoot toad[1] | X | X | X | X |
| Western toad | | X | | X |
| **Reptiles** | | | | |
| Common garter snake | | X | X | X |
| Common king snake | | X | X | |
| Gopher snake | | X | X | |
| Sagebrush lizard | | | X | |
| Sharp-tailed snake | X | | X | |
| Southern alligator lizard | X | X | X | |
| Striped racer | | X | X | |
| Western aquatic garter snake | | | X | X |
| Western fence lizard | X | X | X | |
| Western pond turtle[1] | | | X | X |
| Western racer | | X | X | |
| Western rattlesnake | | X | X | |
| Western skink | X | | X | |
| Western terrestrial garter snake | X | X | X | X |
| Western whiptail | X | | X | |
| **Total number of species observed** | **9** | **14** | **20** | **9** |

Although no amphibian or reptile species listed as rare or endangered occurred in the project area, three species considered of special concern to the State of California because of habitat losses complete their reproductive cycle in

[1] State and federal Species of Concern

both temporary and permanent ponds found throughout the inundation area. western spadefoot toads, foothill yellow-legged frogs, and western pond turtles occur in the streams coursing through the reservoir site.

### Discussion

DFG believe this survey found most, if not all, of the different amphibian and reptile species occurring within the reservoir site and surrounding areas. Two notable exceptions, the ringneck snake (*Diadophis punctatus)* and the night snake (*Hypsiglena torquata)*, may occur here, based on habitat descriptions and range maps presented in Stebbins (1966). The survey failed to find either of these species.

The combination of survey methods proved adequate for their purpose. These methods seem well suited for a short-term survey such as this, since they allow a great deal of territory to be covered in a brief period of time. Although accurate estimates of amphibian and reptile species are difficult or impossible to make using these methods, they do appear to provide reliable qualitative inventory of which species are present.

The pitfall trapping method required a relatively large amount of preparation time compared to the results it produced. Approximately three person-months were spent obtaining materials and installing traps. Had the survey continued through summer 1982 and spring 1983, enough recaptures of marked individuals may have occurred to allow population estimates to be made. In general, it appears that studies of this sort, faced with uncertain funding, should concentrate on finding species present using methods that require less preparation time.

## Summary of Special Species Findings

Table 10 summarizes the observations of species with special status in each project area. The findings for Sites, Colusa, and Red Bank Project areas are a result of recent surveys, while those of Thomes-Newville Project area are the result of past surveys.

Western pond turtles, a federal and State Species of Concern, was found in the Sites and Colusa Project area. No other Species of Concern were found in the potential project area during these surveys. However, California red-legged frogs, a federally threatened species, generally have a similar habitat preference as western pond turtles and are frequently found occupying the same areas. Further surveys of the area surrounding the proposed inundation area will be conducted.

In comparison, a California red-legged frog and several Species of Concern were found at the proposed Red Bank Project area. Foothill yellow-legged frogs and western pond turtles were found in both Red Bank and Cottonwood Creeks.

A number of Species of Concern were also found at the Thomes-Newville project area in earlier surveys. Foothill yellow-legged frogs, western spadefoot toads, and western pond turtles were all found in 1981-82 field studies.

## Table 10. Special Species of Amphibians and Reptiles Observed in Project Areas

| Species | Status | Project Area: Sites and Colusa | Project Area: Red Bank | Project Area: Thomes-Newville[1] |
|---|---|---|---|---|
| **Amphibians** | | | | |
| California red-legged frog | Federally threatened | | X | |
| California tiger salamander | Candidate for federal listing; State Species of Concern | | | |
| Foothill yellow-legged frog | Federal and State Species of Concern | | X | X |
| Western spadefoot toads | Federal and State Species of Concern | | | X |
| **Reptiles** | | | | |
| California horned lizard | Federal and State Species of Concern | | | |
| Western pond turtle | Federal and State Species of Concern | X | X | X |

[1] Results from surveys of Thomes-Newville Project area conducted in 1981-82

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North of the Delta
Offstream Storage Investigation

# Progress Report Appendix B:

## Wetland Delineation Field Studies Report

**April 2000**

Integrated
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Investigations

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North of the Delta
Offstream Storage Investigation

# Progress Report Appendix B:

## Wetland Delineation Field Studies Report

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**April 2000**

Integrated
Storage
Investigations

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# Wetland Delineation Field Studies Report

## Introduction

Section 404 of the Clean Water Act requires the U.S. Army Corps of Engineers' authorization for projects involving the placement of "fill" material into any "waters of the United States." The decision to grant such a permit is based on a review of the project's impacts to a number of economic and environmental factors, including the quantity and types of wetlands. The Corps defines wetlands as "areas that are periodically or permanently inundated by surface or groundwater and support vegetation adapted for life in saturated soil."

This report summarizes the two-year survey of wetlands and other waters of the U.S. within the footprint of the four potential offstream storage reservoir locations: Sites Reservoir, Colusa Cell, Thomes-Newville Reservoir, and the Red Bank Project (Figure 1).

## Methods

Stereo pairs of 1:12,000 and 1:6,000 scale color aerial photos were reviewed for wetland types prior to field studies. All aerial photography used in the wetland identifications were taken in late spring to differentiate seasonal wetlands from annual grassland cover. Wetland types were identified on the photographs, and representative types were selected throughout each reservoir for field verification. Selection of representative types was based on soil types and aerial photo wetland vegetation "signatures." Field visits were conducted during and after rainfall events in order to observe hydrology conditions. These representative sites and additional sites were revisited later in the season when wetland vegetation was identifiable to the species level. Wetland delineations were made using the "routine method," as described in the 1987 *Corps of Engineers Wetland Delineation Manual*. This method involves a field review of the hydrology conditions, plant species' composition, and hydric soil indicators. The Corps' regulatory specialists were also consulted for guidance on field sampling and data presentation.

Results of the wetland delineations and field verifications were used to produce a draft map of jurisdictional wetlands. Stereo pairs of aerial photos for the inundation areas of each reservoir were studied, and all areas that matched signatures of field-verified wetland types were mapped as jurisdictional wetlands. Questionable areas were also identified as wetlands and marked for future field verification. All wetland polygons were mapped and acreage was calculated.

Other waters of the U.S. were also identified on the aerial photos. These included stock ponds, small reservoirs, and tributaries. All drainages were identified as either main tributaries (i.e., width of streambed equal to or wider than 15 feet and generally perennial) or tributaries (i.e., width of streambed less than 15 feet and drainages usually ephemeral, possibly perennial). Stream width measurements were made throughout the project sites. Drainages with wetlands or jurisdictional riparian areas were classified as wetlands.

All waters of the U.S. were mapped using the procedure outlined above. The acreages for all waters of the U.S. and linear distances (miles) of all drainages were then calculated. Attachment A shows the stream width measurement data for drainages within the proposed reservoir sites.

The Corps' regulatory specialists have not verified these maps. Field verification of these maps will involve site visits to each wetland delineation site by the Corps' regulatory specialist.

# Results

Areas identified as jurisdictional wetlands represent approximately 2 percent of the surface area of each reservoir footprint. The acreage and wetland types within each reservoir area are presented in Tables 1 through 4. Information on other waters of the U.S. is also included in these tables. The waters of the U.S. acreage for all reservoir locations are summarized in Table 5. Throughout this report, all data are presented with the most southern reservoir location first (i.e., Sites Reservoir) and the northern reservoir last (i.e., Red Bank Project).

## Discussion

The wetland type, quality, and quantity within a given location are dependent on a number of factors, including soil types, site geology (evidence of faulting and springs), and land management. The three southern reservoir locations were similar in dominant wetland types and distribution patterns. The Red Bank Project is dominated by steep, well-drained slopes, which supported few seasonal or emergent wetland areas. Wetland types will be addressed in general terms and site-specific information given for each reservoir area.

## Sites Reservoir and Colusa Cell

Seasonal wetlands account for over 75 percent of the jurisdictional wetlands identified within the Sites Reservoir footprint and 84 percent of the Colusa Cell jurisdictional wetlands (Tables 1 and 2). This very common wetland type is inundated by surface water or saturated by groundwater during the winter and spring months. Most of these seasonal wetlands were dry by early summer and are strongly associated with low-lying areas of clay or clay loam soils (Tables 6 and 7). Many of the plants found in these wetlands are dry and brown during the summer months, making the wetlands almost indistinguishable from the surrounding annual grasslands. Dominant plant species include *Eleocharis* *macrostachya* (spike rush), *Hordeum marinum* ssp, *Gussoneanum* (Mediterranean baryle), and *Rumes* spp (dock).

### Table 1. Sites Reservoir Waters of the U.S.

| Wetlands and Other Waters | Acres | Linear Distance (Miles) |
|---|---|---|
| Wetlands | 201 | |
| Other Waters | 175 | |
| **Total Waters of the U.S.** | **376** | |
| **Total Reservoir Area** | **14,162** | |
| **Wetland Types** | | |
| Alkaline | 19 | |
| Emergent | 2 | |
| Riparian | 22 | |
| Seasonal | 153 | |
| Vernal Pools | 5 | |
| **Total** | **201** | |
| **Other Waters** | | |
| Major Tributaries | 82 | 25 |
| Tributaries | 77 | 123 |
| Ponds/Small Reservoirs | 16 | |
| **Total** | **175** | **148** |

## Table 2. Colusa Cell Waters of the U.S.

| Wetlands and Other Waters | Acres | Linear Distance (Miles) |
|---|---|---|
| Wetlands | 312 | |
| Other Waters | 135 | |
| | | |
| **Total Waters of the U.S.** | **447** | |
| **Total Reservoir Area** | **13,664** | |
| | | |
| **Wetland Types** | | |
| Alkaline | 35 | |
| Emergent | 0 | |
| Riparian | 11 | |
| Seasonal | 263 | |
| Vernal Pools | 3 | |
| **Total** | **312** | |
| | | |
| **Other Waters** | | |
| Major Tributaries | 30 | 15 |
| Tributaries | 81 | 143 |
| Ponds/Small Reservoirs | 24 | |
| **Total** | **135** | **158** |

**Table 3. Newville Reservoir Waters of the U.S.**

| Wetlands and Other Waters | Acres | Linear Distance (Miles) |
|---|---|---|
| Wetlands | 413 | |
| Other Waters | 231 | |
| | | |
| **Total Waters of the U.S.** | **644** | |
| **Total Reservoir Area** | **17,073** | |
| | | |
| **Wetland Types** | | |
| Alkaline | 3 | |
| Emergent | 6 | |
| Riparian | 77 | |
| Seasonal | 304 | |
| Vernal Pools | 23 | |
| **Total** | **413** | |
| | | |
| **Other Waters** | | |
| Major Tributaries | 59 | 17 |
| Tributaries | 106 | 223 |
| Ponds/Small Reservoirs | 66 | |
| **Total** | **231** | **148** |

### Table 4. Red Bank Project Waters of the U.S.

| Wetlands and Other Waters | Acres | Linear Distance (Miles) |
|---|---|---|
| Wetlands | 83 | |
| Other Waters | 152 | |
| | | |
| **Total Waters of the U.S.** | **235** | |
| **Total Reservoir Area** | **4,905** | |
| | | |
| **Wetland Types** | | |
| Emergent/Seasonal | 7 | |
| Riparian | 76 | |
| **Total** | **83** | |
| | | |
| **Other Waters** | | |
| Major Tributaries | 71 | 17 |
| Tributaries | 47 | 110 |
| Ponds/Small Reservoirs | 34 | |
| **Total** | **152** | **127** |

### Table 5. Offstream Storage Waters of the U.S.

| Reservoir Site | Reservoir Size (Acres) | Waters of the U.S. (Acres) | Wetlands (Acres) |
|---|---|---|---|
| Sites | 14,162 | 376 | 201 |
| Colusa Cell | 13,664 | 447 | 312 |
| Newville | 17,073 | 644 | 413 |
| Red Bank Project | 4,905 | 235 | 83 |

## Table 6. Sites Reservoir Seasonal Wetlands Soil Type

| Pool Number | Date Pool Visited | Soil Name | Soil Sample Color |
|---|---|---|---|
| S-1 | 4/14/98 | Altamont-Contra Costa clay loam | |
| S-2 | 5/8/98 | Altamont-Contra Costa clay loam, slightly eroded, hilly, 16-30% slopes | 5Y 3/1 |
| S-3 | 5/8/98 | Altamont clay loam, slightly eroded; hilly | 5Y 4/1 |
| S-3 | 5/8/98 | Altamont clay loam, slightly eroded; hilly | 5Y 3/1 |
| S-4 | 5/26/98 | Contra Costa clay loam, slightly eroded, very steep | |
| S-5 | 5/26/98 | Forgeus clay, undulating | 5Y 3/1 |
| S-5 | 5/26/98 | Forgeus clay, undulating | 5Y 4/1 |
| S-6 | 6/5/98 | Myers clay, 0-3% slopes | 5Y 4/1 |
| S-6 | 6/5/98 | Myers clay, 0-3% slopes | 10YR 3/3 |
| S-6 | 6/5/98 | Myers clay, 0-3% slopes | 10YR 6/6 |
| S-6 | 6/5/98 | Myers clay, 0-3% slopes | 5Y 4/1 |
| S-6 | 6/5/98 | Myers clay, 0-3% slopes | 5Y 4/1 |
| S-7 | 6/5/98 | Antone clay loam, strong alkali | 2.5Y 4/0 |
| S-7 | 6/5/98 | Antone clay loam, strong alkali | 5Y 4/1 |
| S-7 | 6/5/98 | Antone clay loam, strong alkali | 10YR 5/8 |
| S-8 | 6/5/98 | Antone clay loam, strong alkali | 10YR 5/8 |
| S-8 | 6/5/98 | Antone clay loam, strong alkali | 10YR 4/1 |
| S-8 | 6/5/98 | Antone clay loam, strong alkali | 10YR 3/3 |
| S-9 | 6/9/98 | Myers clay loam, 0-3% slopes | |
| S-10 | 6/9/98 | Altamont-Contra Costa clays, 15-30% slopes | |
| S-11 | 6/9/98 | Zamora silty clay loam, 0-2% slopes | 10 YR 4/2 |
| S-11 | 6/9/98 | Zamora silty clay loam, 0-2% slopes | 10 YR 3/2 |
| S-11 | 6/9/98 | Zamora silty clay loam, 0-2% slopes | 10 YR 5/6 |
| S-12 | 10/15/98 | Altamont clay loam, slightly eroded; undulating to rolling | 10 YR 3/2+3 |
| S-13 | 10/15/98 | Altamont clay loam, slightly eroded; undulating to rolling | 10 YR 3/2 |
| S-13 | 10/15/98 | Altamont clay loam, slightly eroded; undulating to rolling | 10 YR 2/2 |
| S-13 | 10/15/98 | Altamont clay loam, slightly eroded; undulating to rolling | 5 YR 5/8 |
| S-14 | 10/15/98 | Altamont-Contra Costa clay loam, slightly eroded, hilly, 16-30% slopes | 5 Y 4/2 |
| S-14 | 10/15/98 | Altamont-Contra Costa clay loam, slightly eroded, hilly, 16-30% slopes | 5 YR 5/8 |
| S-15 | 10/15/98 | Myers clay loam, gently undulating, 0-2% slopes | 10 YR 3/2 |
| S-15 | 10/15/98 | Myers clay loam, gently undulating, 0-2% slopes | 10 Y 5/8 |
| S-16 | 3/4/99 | Altamont clay loam, slightly eroded; undulating to rolling | 2.5 Y 4/2 |
| S-17 | 3/4/99 | Contra Costa clay loam, slightly eroded, steep | 2.5 YR 4/2 |
| S-18 | 3/5/99 | Altamont clay loam, slightly eroded; hilly | 10 YR 3/2 |
| S-18 | 3/5/99 | Altamont clay loam, slightly eroded; hilly | 10 YR 6/8 |
| S-18 | 3/5/99 | Altamont clay loam, slightly eroded; hilly | 10 YR 4/2 |
| S-18 | 3/5/99 | Altamont clay loam, slightly eroded; hilly | 5 YR 5/8 |
| S-18 | 3/5/99 | Altamont clay loam, slightly eroded; hilly | 10 YR 3/2 |
| S-19 | 3/5/99 | Contra Costa clay loam, slightly eroded, steep | 10 YR 3/1 |
| S-20 | 3/25/99 | Myers clay, gently undulating, 0-2% slopes | 10 YR 4/1 |
| S-20 | 3/25/99 | Myers clay, gently undulating, 0-2% slopes | 10 YR 4/2 |
| S-20 | 3/25/99 | Myers clay, gently undulating, 0-2% slopes | 10 YR 7/6 |

**Table 7. Colusa Reservoir Seasonal Wetlands Soil Type**

| Pool Number | Date Pool Visited | Soil Name | Soil Sample Color |
|---|---|---|---|
| C-1 | 4/22/98 | Myers clay, 0-3% slopes | |
| C-2 | 4/22/98 | Kimball gravelly loam, 2-10% slopes | 10YR 5/2 |
| C-2 | 4/22/98 | Kimball gravelly loam, 2-10% slopes | 10YR 4/1 |
| C-3 | 6/9/98 | Altamont soils, 30-65% slopes | |
| C-4 | 6/9/98 | Capay clay, 0-2% slopes | 2.5 Y 4/2 |
| C-4 | 6/9/98 | Capay clay, 0-2% slopes | 2.5Y 6/4 |
| C-4 | 6/9/98 | Capay clay, 0-2% slopes | 5Y 4/1 |
| C-4 | 6/9/98 | Capay clay, 0-2% slopes | 2.5 Y 3/2 |
| C-4 | 6/9/98 | Capay clay, 0-2% slopes | 5Y 4/1 |
| C-5 | 6/15/98 | Yolo clay loam, shallow over clay | 5 YR 2.5/1 |
| C-5 | 6/15/98 | Yolo clay loam, shallow over clay | 10 YR 6/8 |
| C-5 | 6/15/98 | Yolo clay loam, shallow over clay | 10 YR 3/2 |
| C-5 | 6/15/98 | Yolo clay loam, shallow over clay | 10 YR 6/8 |
| C-6 | 6/15/98 | Zamora silty clay loam, 2-8% slopes | 10 YR 3/3 |
| C-6 | 6/15/98 | Zamora silty clay loam, 2-8% slopes | 10 YR 3/1 |
| C-6 | 6/15/98 | Zamora silty clay loam, 2-8% slopes | 10 YR 3/1 |
| C-6 | 6/15/98 | Zamora silty clay loam, 2-8% slopes | 10 YR 3/3 |
| C-7 | 6/23/98 | Myers clay, 0-3% slopes | 5Y 4/1 |
| C-7 | 6/23/98 | Myers clay, 0-3% slopes | 5Y 4/2 |
| C-8 | 4/1/99 | Nacimiento soils, 30-50% slopes | |
| C-9 | 4/1/99 | Nacimiento soils, 30-50% slopes | |
| C-10 | 4/1/99 | Nacimiento-Contra Costa association, 15-30% slopes | |

Most of the alkaline wetlands are also seasonal but are vastly different in plant species composition. The annual and perennial species in these areas are tolerant of alkali conditions. The majority of these wetlands are dominated by *Distichlis spicata* (salt grass), with a varity of other species including *Parapholis incurva* (sickle grass), *Frankenia salina* (alkali heath), *Cressa truxillensis* (alkali weed), and *Scirpus martimus* (slat marsh bulrush). The alkaline wetlands within the Sites Reservoir and Colusa Cell are along a linear zone of deformation potentially associated with the Salt Lake fault.

Impacts to the alkaline wetlands may be considered significant by regulatory agencies during the environmental review of these projects. These alkaline areas could provide habitat for a number of sensitive plant and animal species, although no sensitive species were identified during the current field studies. The Colusa Cell alkaline wetlands could serve as potential mitigation for the alkaline wetlands inundated by the Sites Reservoir. These wetlands could be enhanced using various land management methods.

A very small quantity (2 acres) of emergent wetlands was identified within the Sites Reservoir; this wetland type was present within the Colusa Cell in several small areas, but these were not measurable using aerial photo interpretation. Emergent wetlands have typical wetland species, such as *Scirpus acutus* (hard-stemmed tule), *Scirpus californicus* (California bulrush) and *Typha angustifolia* (cattails), and are associated with existing reservoir shorelines and drainages. Drainages with emergent wetlands were often protected from grazing animals by fences.

The riparian areas found within these two reservoir alternatives are rarely well developed or large in size. Many of the drainages are downcut and do not support wetland species along the banks. Small strands of *Populus fremintii* (cottonwood), *Quercus lobata* (valley oak), and *Salix* spp (willows) occur as isolated units throughout the area. The largest concentration of riparian habitat is within the southern portion of the Sites Reservoir. Potential riparian creation sites occur throughout the surrounding area.

Many of the vernal pools found within these reservoir alternatives are "manmade" (e.g., drainages blocked by roads or disturbed areas within heavy clay soils) and have very low plant species diversities. Pools occurring along the northeastern edge of the Sites Reservoir tended to be larger in size and higher in plant species diversity. One similar area also occurs within the Colusa Cell. Typical species include *Eryngium castrense* (coyote thistle), *Plagiobothrys* ssp (popcorn flower), and *Lythrum hussopifolium* (loosestrife).

### Newville Reservoir

Seasonal wetlands also dominate the wetlands of the Newville Reservoir inundation area (Table 3). Some of the wetland areas are very large in size and may form complexes with other types of wetlands, including riparian. This area also has significant quantities of other wetland types. The seasonal wetlands are closely associated with clay soils (Table 8). The seasonal wetlands within this area tended to be more diverse in both subtypes and plant species composition. Common species included those listed under the Sites/Colusa discussion, as well as *Trifolium* ssp (clovers), *Juncus* ssp (rushes), *Mimulus guttatus* (monkeyflower), and *Rorippa nasturium-aquaticum* (watercress).

Riparian areas account for over 18 percent of the reservoir area's wetlands. Well-developed riparian habitat occurs along a number of the main tributaries, although patches of the invasive non-native *Ailanthus altissima* (tree of heaven) occur within some of these strands. Riparian wetlands in this reservoir area cover about 77 acres, which may be considered significant by regulatory agencies.

One small area of alkaline wetland was identified within the Salt Creek drainage. Other areas adjacent to Salt Creek and some of its tributaries supported alkaline species, but were too narrow to map. The areas identified as alkaline are within a zone, which was identified as an inferred fault area during a 1980 geological study of the area *(Seismic and Fault Activity Study, Proposed Glenn Reservoir Complex*. Prepared for DWR by Earth Sciences Associates). The alkaline wetlands of this area have not been site checked.

## Table 8. Newville Reservoir Seasonal Wetlands Soil Type

| Pool Number | Date Pool Visited | Soil Name | Soil Sample Color |
|---|---|---|---|
| N-1 | 3/4/98 | Altamont clay, 3-15% slopes | |
| N-2 | 3/17/98 | Altamont clay, 3-15% slopes | |
| N-3 | 3/19/98 | Lodo-Millsholm complex, 30-50% slopes | |
| N-4 | 3/19/98 | Zamora loam, 0-3% slopes | |
| N-5 | 3/19/98 | Lodo-Millsholm complex, 10-30% slopes | |
| N-6 | 3/20/98 | Lodo-Gullied land complex, 10-30% slopes | |
| N-7 | 3/20/98 | Tehama clay loam, 2-10% slopes | |
| N-8 | 3/26/98 | Terrace escarpments | |
| N-9 | 4/7/99 | Zamora loam, 0-3% slopes | |
| N-10 | 4/7/99 | Hillgate loam, 0-3% slopes | |
| N-11 | 4/7/99 | Hillgate loam, 0-3% slopes | |
| N-12 | 4/7/99 | Lodo-Millsholm complex, 10-30% slopes | |
| N-13 | 4/20/98 | Zamora loam, 0-3% slopes | 5Y 4/1 |
| N-14 | 4/20/98 | Zamora loam, 0-3% slopes | 5Y 4/1 |
| N-15 | 4/20/98 | Lodo-Millsholm complex, 10-30% slopes | |
| N-16 | 4/20/98 | Lodo-Millsholm complex, 10-30% slopes | |
| N-17 | 4/20/98 | Hillgate loam, 0-3% slopes | 5Y 4/1, 5Y 3/2 |
| N-18 | 4/20/98 | Lodo-Millsholm complex, 10-30% slopes | 5Y 4/1 |
| N-19 | 4/20/98 | Pleasanton gravelly loam, 1-10% slopes | 5Y 4/1 |
| N-20 | 4/20/98 | Tehama loam, 3-8% slopes | |
| N-21 | 4/20/98 | Pleasanton gravelly loam, 1-10% slopes | |
| N-22 | 4/28/98 | Hillgate-Millsholm complex, 3-30% slopes | 5Y 4/1 |
| N-23 | 4/28/98 | Lodo-Milsholm complex, 30-50% slopes | 5Y 4/1 |
| N-24 | 4/28/98 | Clear Lake clay | N4/ |
| N-25 | 4/28/98 | Clear Lake clay | 5Y 4/1 |
| N-26 | 4/29/98 | Hillgate-Gullied land complex, 2-10% slopes | |
| N-27 | 4/29/98 | Corning gravelly loam, 0-2% slopes | |
| N-28 | 4/29/98 | Clear Lake clay | 5Y 4/1 |
| N-29 | 4/29/98 | Millsholm clay loam-Gullied land complex, 10-30% slopes | 5Y 4/1 |
| N-30 | 5/19/98 | Hillgate-Millsholm complex, 3-30% slopes | |
| N-31 | 5/19/98 | Hillgate-Millsholm complex, 3-30% slopes | |
| N-32 | 6/1/98 | Zamora loam, 0-3% slopes | 5Y 3/2 |
| N-33 | 6/2/98 | Zamora loam, 0-3% slopes | 5Y 4/1 |
| N-34 | 6/2/98 | Zamora loam, 0-3% slopes | 5Y 2.5/1-2 |
| N-35 | 6/2/98 | Zamora loam, 0-3% slopes | 10YR 3/2 |
| N-36 | 6/2/98 | Zamora loam, 0-3% slopes | 5Y 3/2 |
| N-36 | 6/2/98 | Zamora loam, 0-3% slopes | 5Y 3/1 |
| N-36 | 6/2/98 | Zamora loam, 0-3% slopes | 5Y 6/2-3 |
| N-37 | 6/11/98 | Lodo-Tehama-Gullied land complex, 10-30% slopes | 5Y 4/1 |
| N-38 | 6/12/98 | Terrace escarpments | |
| N-39 | 6/12/98 | Lodo-Tehama-Gullied land complex, 10-30% slopes | 5Y 4/1 |
| N-40 | 6/12/98 | Lodo-Tehama-Gullied land complex, 30-50% slopes | 5Y 4/1 |
| N-40 | 6/12/98 | Lodo-Tehama-Gullied land complex, 30-50% slopes | 10YR 5/8 |

Vernal pool complexes, areas of concentrated pools and connecting swales, were found in several locations within the reservoir area. They were usually associated with terrace deposits occurring between streambeds. The pools of this reservoir alternative were of an overall higher quality than those of the Sites/ Colusa Cell location.

### Red Bank Project

Seasonal and emergent wetlands make up less than 9 percent of the wetland total for the Red Bank Project (Table 4). Many of these wetlands are located within or adjacent to small stockponds or are associated with saturated spring-fed areas. Clay soils are relatively rare within the steep terrain that dominates both the Schoenfield and Dippingvat Reservoirs (Table 9).

**Table 9. Red Bank Project Seasonal Wetlands Soil Type**

| Pool Number | Date Pool Visited | Soil Name | Soil Sample Color |
|---|---|---|---|
| R-1 | 4/1/98 | Hillgate loam, shaly substrate, 0-8% slopes | Soil saturated |
| R-2 | 4/1/98 | Hillgate loam, shaly substrate, 0-8% slopes | |
| R-3 | 5/21/98 | Zamora clay loam, 0-3% slopes | |
| R-4 | 5/21/98 | Riverwash | |
| R-5 | 5/21/98 | Zamora clay loam, 0-3% slopes | |
| R-6 | 7/2/98 | Lodo and Maymen shaly loams, 10-30% slopes, eroded | 10 YR 3/2 |
| R-7 | 7/2/98 | Lodo and Maymen shaly loams, 10-30% slopes, eroded | |
| R-8 | 7/3/98 | Cortina gravelly fine sandy loam | |
| R-9 | 7/3/98 | Cortina gravelly fine sandy loam | |

Riparian areas dominate the wetlands of this area. Riparian areas can be found throughout the larger reservoirs of the project but are best developed along the South Fork of Cottonwood and Red Bank Creeks. The typical species are similar to the species outlined in the Sites/Colusa discussion, except many of the riparian stands are dominated by *Alnus rhombifolia* (white alder).

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The Resources Agency
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Division of Planning and Local Assistance

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North of the Delta
Offstream Storage Investigation

# Progress Report

## Appendix C:
## Survey for the Valley Elderberry Longhorn Beetle at Four Proposed Offstream Storage Reservoir Locations

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Offstream Storage Investigation

# Progress Report

## Appendix C: Survey for the Valley Elderberry Longhorn Beetle at Four Proposed Offstream Storage Reservoir Locations

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**June 2000**

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# Summary

This report summarizes an assessment of the valley elderberry longhorn beetle within the Sites, Colusa Cell, Newville, and Red Bank reservoir sites in 1998 and 1999.

The valley elderberry longhorn beetle is listed by the U.S. Fish and Wildlife Service as "threatened, with Critical Habitat". Although there were no known populations within the proposed reservoir sites, habitat exists and known populations occur nearby.

Surveys focused on identifying potential habitat for VELB, the number of elderberry stems found measuring 1 inch or more, and the presence of exit holes. Aerial photos were used to determine which drainages should be field checked within the grassland habitats of the Sites, Colusa Cell, and Newville reservoir areas. All drainages were field checked within the Red Bank Reservoir site.

Habitat for VELB occurs at each of the four proposed reservoir sites. VELB emergence holes were found within the proposed Sites and Newville reservoir areas. No emergence holes were found within the proposed Colusa and Red Bank project areas. No adult beetles were observed at any of the proposed reservoir sites.

Surveys are valid for a two-year period according to U.S. Fish and Wildlife guidelines. Potential reservoir sites will need to be resurveyed before a final report is produced. Areas not surveyed prior to this report, such as areas with restricted access, conveyance routes, road relocations, recreational areas etc., will need to be surveyed. Analyses will also be needed to predict how possible changes in flow regimes within the channels and associated savannas downstream will affect elderberry survival and distribution.

# Contents



## Tables



## Figures

# Introduction

The Department of Water Resources is currently evaluating the feasibility of constructing an offstream water supply reservoir at one of four locations on the west side of the Sacramento Valley in cooperation with CALFED. These locations include Sites Reservoir in western Colusa County, Colusa Reservoir in western Glenn and Colusa Counties, Thomes-Newville Project in western Tehama and Glenn Counties, and the Red Bank Project in western Tehama County (Figure 1).

The valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* Fisher, was listed by the U.S. Fish and Wildlife Service as "threatened, with Critical Habitat" on August 10, 1980 (Federal Register 45:52803-52807) (Figure 2). The beetle is endemic to riparian systems along the margins of rivers and streams, occasional seeps, and in adjacent grassy savannas in the Sacramento and San Joaquin Valleys. VELB feeds on two species of elderberry (*Sambucus mexicana* Presl. - Figure 3 and 4, and *S. racemosa* L. var. *microbotrys* Rydb.). The adult female beetle deposits eggs in the crevices of the bark of living plants. The larvae bore into the pith of the larger elderberry stems where the majority of the animal's life span is spent. Following pupation in the spring, the adult beetle opens an emergence hole in the bark through which it exits (Figure 5). Adults feed on foliage and are present from March through early June. Because the adult stage is short lived, surveys techniques focus on the presence of emergence holes for evidence of VELB. VELB emergence holes have been observed in shoots or branches with diameters as small as 0.5 inches (13mm) but are more common in older branches (Barr 1991, USFWS 1984). Barr (1991) found exit holes most often in older mature healthy plants and rarely in young or stressed individuals. Exit holes are circular or slightly oval and are usually 7-10 mm in diameter. VELB is the only insect species known to inhabit live elderberry wood and/or make exit holes of a similar size and shape in the Central Valley (Barr 1991).

The VELB is known to occur throughout the California Central Valley and it is associated foothills from the valley floor up to 3,000-foot elevation. Although there were no known VELB populations within the proposed reservoirs, habitat was known to exist within the project area and known VELB locations were recorded nearby. According to Jones and Stokes (1986) "potential VELB habitat is defined by the presence of mature and immature elderberry shrubs (*Sambucus* spp.)."

The State and federal Endangered Species Acts require that any analysis of a project that could result in a "take " of a State or federally "listed" species include an evaluation of alternatives, consultation with the respective regulatory agencies, and the development of mitigation and avoidance measures. This not only includes the individual species but their habitats as well. Surveys for VELB are valid for a period of two years. All beetle habitat that cannot be avoided will be considered impacted and appropriate mitigation, as set forth in the Mitigation Guidelines for the Valley Elderberry Longhorn Beetle (USFWS 1996) and in consultation with the USFWS, must be implemented.

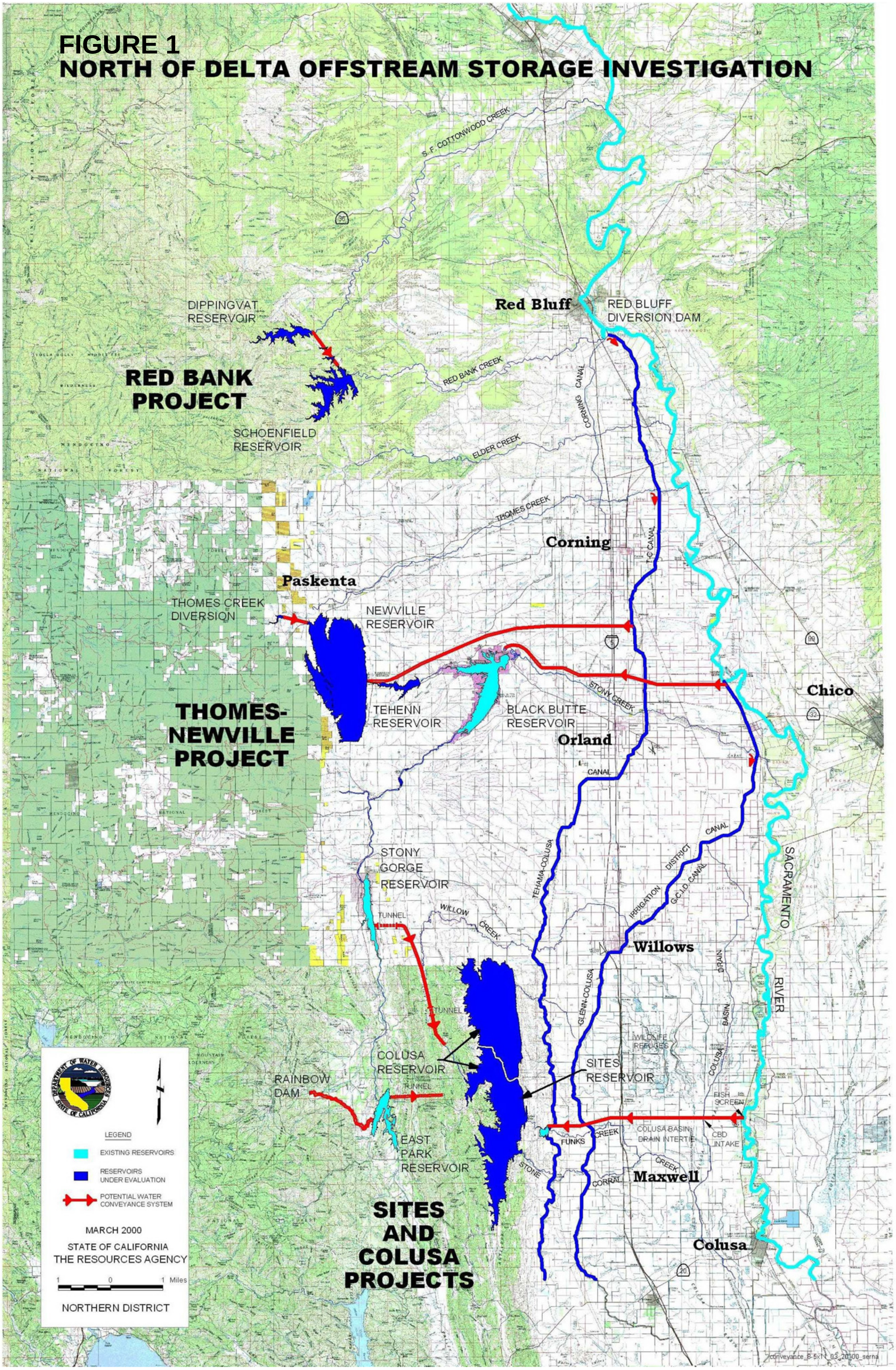
FIGURE 1
NORTH OF DELTA OFFSTREAM STORAGE INVESTIGATION
S.F. COTTONWOOD CREEK
Red Bluff
RED BLUFF DIVERSION DAM
DIPPINGVAT RESERVOIR
RED BANK PROJECT
RED BANK CREEK
SCHOENFIELD RESERVOIR
ELDER CREEK
CORNING CANAL
THOMES CREEK
Corning
T-C CANAL
Paskenta
THOMES CREEK DIVERSION
NEWVILLE RESERVOIR
TEHENN RESERVOIR
BLACK BUTTE RESERVOIR
STONY CREEK
Chico
THOMES-NEWVILLE PROJECT
Orland
CANAL
STONY GORGE RESERVOIR
TUNNEL
WILLOW CREEK
TEHAMA-COLUSA
IRRIGATION DISTRICT CANAL
G.C.I.D. CANAL
SACRAMENTO RIVER
Willows
GLENN-COLUSA
DRAIN
BASIN
COLUSA
WILDLIFE REFUGES
TUNNEL
COLUSA RESERVOIR
SITES RESERVOIR
RAINBOW DAM
TUNNEL
FISH SCREEN
EAST PARK RESERVOIR
FUNKS CREEK
COLUSA BASIN DRAIN INTERTIE
CBD INTAKE
STONE CORRAL CREEK
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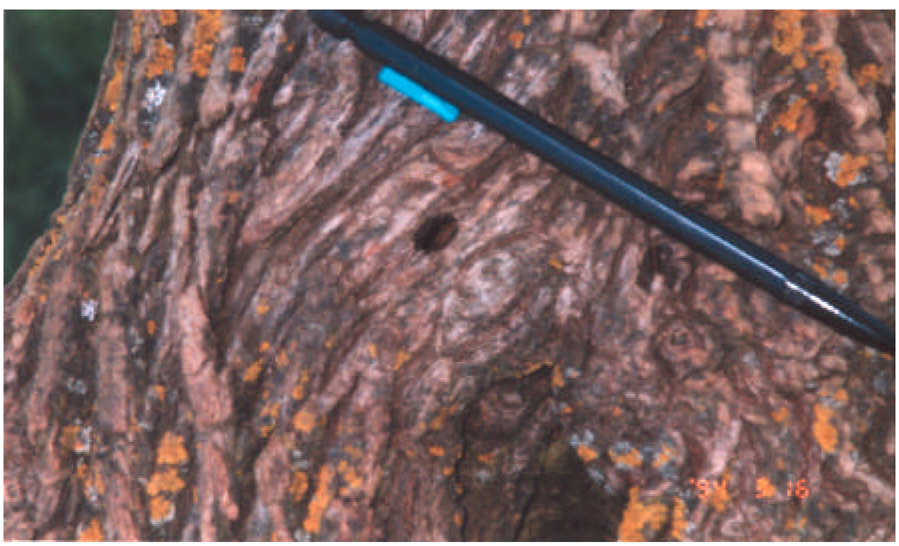
EXISTING RESERVOIRS
RESERVOIRS UNDER EVALUATION
POTENTIAL WATER CONVEYANCE SYSTEM
MARCH 2000
STATE OF CALIFORNIA
THE RESOURCES AGENCY
Miles
NORTHERN DISTRICT

**Figure 2. Valley Elderberry Longhorn Beetle**


**Figure 3. Elderberry Plant With a Single Trunk**

**Figure 4. Elderberry Stand**

**Figure 5. Valley Elderberry Longhorn Beetle Emergence Hole**



## Methods

A survey of all potential reservoir sites for the VELB and its habitat was conducted during the periods January through July 1998 and April through June 1999. Surveys focused on identifying potential habitat for VELB, the number of elderberry stems found measuring more than one inch, and the presence of exit holes. A total of 45 days was spent field surveying the drainages.

Sites, Colusa, and Newville proposed reservoir areas are comprised mainly of non-native grassland with scattered oak woodland on the upland areas. Riparian vegetation along stream channels is sparse, especially within the Colusa

Reservoir. The larger streams at Sites and Newville reservoir areas are bordered by scattered stands of mature cottonwood, oak, willow, and elderberry. However, the majority of stream channels lacks any riparian vegetation and consists mainly of grassland vegetation with an occasional cottonwood or willow. Aerial photographs were used to identify the drainages, or portions thereof, in the proposed project areas with potential VELB habitat. All drainage areas and the adjacent savannas were walked and checked for the presence of VELB habitat, with the exception of those drainages bordered solely by grasslands and those areas restricted by landowners.

Within the proposed Red Bank Project area, foothill woodland habitat, with moderate to dense canopy cover, comprises 81 percent of the area. Riparian habitat along the major stream channels is more continuous than that at the proposed Sites, Colusa, and Newville reservoir areas. Vegetation along the lesser channels consists of scattered oaks, cottonwoods, willows, or elderberries. All the stream channels and adjacent savannas within the Red Bank Project area were walked and checked for the presence of VELB habitat except for portions where access was restricted by landowners.

According to VELB survey procedures outlined in the USFWS 1996 report on mitigation guidelines, all stems measuring 1 inch or more at ground level were recorded and checked for emergence holes. The elderberry plants were examined by scanning the foliage and branches for adult beetles and the trunks and branches for exit holes. Growth forms of elderberry plants throughout the project area are varied. A stand may consist of a single individual with multiple trunks, several individuals growing in close proximity, or a tree-like individual with a single large trunk. Multiple trunks were counted as individual stems if it was apparent that the branching was off the root mass and exposed due to recent erosion.

## Results

Habitat for VELB occurs at each of the four proposed reservoir sites. VELB emergence holes were found within the proposed Sites and Newville reservoir areas. No emergence holes were found within the proposed Colusa and Red Bank project areas. No adult beetles were observed, although the majority of surveys were conducted during the time the adult beetles would be present. The physical condition of the elderberry plants varied from poor to good. Table 1 lists the number of stems counted at each reservoir site, and the number and percentage of stems with emergence holes.

### Sites Project Area

Six hundred seventy-two stems were counted within the proposed Sites Project area. Emergence holes were found on 18 individual stems. The plants within this area tend to be individuals with multiple trunks and range from unhealthy stressed plants to occasional large healthy individuals. The majority of plants at this site and the riparian vegetation in general tend to be in poor condition.

## Colusa Project Area

Only one stand of elderberry was found within the proposed Colusa Cell. This stand consisted of 38 stems and was found near a seep on a steep slope at the reservoir's eastern edge. Drainages where elderberry plants would typically be found were too dry and degraded due to natural causes or downcutting to support elderberry plants. Very few associated riparian species (cottonwood and willow) were found along the drainages.

## Newville Project Area

Five hundred fifty-two stems have been counted in the proposed Newville project area. Emergence holes have been found in 42 stems. The plants at this site tend to be large healthy individuals with single or multiple trunks. Most occurred along the major drainages, but some individuals were found at the edges of associated grassy savannas and even upslope along the dryer margins.

**Table 1. Number of Elderberry Stems and Emergence Holes Found Within Each Proposed Reservoir Site**

| Reservoir Site | Number of elderberry stems | Number of stems with emergence holes | Percentage of stems with emergence holes |
|---|---|---|---|
| Sites | 672 | 18 | 2.7 |
| Colusa | 38 | 0 | 0 |
| Newville | 552 | 42 | 7.6 |
| Red Bank | 1,001 | 0 | 0 |
| Schoenfield | 791 | 0 | 0 |
| Lanyan | 0 | 0 | 0 |
| Bluedoor | 0 | 0 | 0 |
| Dippingvat | 210 | 0 | 0 |

## Red Bank Project Area

**Dippingvat**. Two hundred ten individuals were found at the proposed Dippingvat reservoir area. No emergence holes were found. Individuals at this site tend to be older with a single trunk and in good condition.

**Bluedoor and Lanyan**. No elderberry plants were found at either of these proposed reservoir sites; however, potential elderberry habitat does exist at both areas.

**Schoenfield**. Seven hundred ninety-one individual stems were counted at the proposed Schoenfield Reservoir site. No emergence holes were found. The majority of plants are healthy and consist of both single individuals with multiple trunks and tree-like individuals. They tend to occur along the savannas and edges of Red Bank Creek but some were found upslope on the dryer hillsides and drainages.

## Mitigation Guidelines

Guidelines have been issued by USFWS to assist in developing measures to mitigate adverse effects on VELB if complete avoidance is not possible. Surveys are valid for a period of two years. Elderberry plants are to be transplanted if they cannot be avoided. However, at the discretion of the USFWS, a plant that would be extremely difficult to move because of access problems may be exempted from transplantation (USFWS 1996). Planting of additional seedling or cuttings may be required under the mitigation guidelines, depending upon the absence or percentage of elderberry plants with emergence holes found in the project area. Elderberry plants with no beetle exit holes are planted at a ratio of 2:1. Elderberry plants with beetle holes in 50 percent or fewer of the plants are planted at a ratio of 3:1. And elderberry plants with beetle holes in more than 50 percent of the plants are planted in the ratio of 5:1. In addition, a mix of native plants (cottonwood, willow, etc.) associated with the elderberry shrubs at the project site are to be planted at a ratio of at least one specimen of native tree and shrub species for every elderberry plant (seedling or cutting).

## Discussion

Off-site mitigation for elderberry plant impacts will be required for any of the proposed reservoirs. This mitigation will include acquisition of suitable land, transplantation of existing elderberry bushes, and planting of cuttings of both elderberries and associated native plants. The USFWS requires the mitigation area provide at least 1,800 square feet for each transplanted elderberry shrub, with as many as five elderberry cuttings or seedlings and up to five associated natives. This planting density is primarily for riparian forest habitats. If the mitigation site is an open habitat, as is the case for the proposed Sites, Colusa, and Newville Reservoirs, more area may be needed. Watering basins will also be needed at each site. The mitigation area should be protected in perpetuity as habitat for the valley elderberry longhorn beetle, which would require continuing funding, management, protection, and monitoring.

The proposed Colusa Project area had the least number of individual elderberry plants and less suitable elderberry habitat, thus mitigation would be minimal for this site. Sites, Newville, and Red Bank reservoir sites would require extensive replanting of elderberry plants as well as planting of seedlings and cuttings of both elderberries and associated species such as cottonwood and willow. Many of the plants within the Sites and Newville reservoir areas are accessible and could be transplanted. However, because of the steepness of the terrain within the Red Bank project area, transplantation of the elderberry shrubs would be more difficult.

The elderberry plants within the proposed Newville and Red Bank project areas tend to be healthier and less stressed than the plants at the Sites Reservoir area. The associated riparian forest is also best developed within the proposed Red Bank Reservoir area. The condition of the riparian vegetation and elderberry plants within the proposed Sites Reservoir was generally worse than that at Newville Reservoir.

The numbers of elderberry plants within the proposed Sites and Newville project areas is similar, thus the mitigation area required would be approximately the same. However, although the Red Bank Project area is much smaller than the Sites or Newville areas, there were almost twice as many elderberry stems. This in turn would double the off-site mitigation area required for the Red Bank Project.

Surveys are valid for a two-year period according to USFWS guidelines because of the potential for the adult female beetles to lay their eggs in different elderberry plants from which they emerged. Field surveys will need to be conducted again before a final report is produced. In addition, areas not surveyed prior to this report, such as areas with restricted access, conveyance routes, road relocations, recreation, etc. will need to be surveyed. Analyses will also be needed to predict how possible changes in water regimes within the channels and associated savannas downstream of potential reservoir areas will affect elderberry survival and distribution.

Mitigation requirements for each of the proposed reservoir sites will need to be discussed with the USFWS. Contact with appropriate USFWS personnel has already been initiated by telephone. Survey methodologies have been discussed and approved.

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State of California
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Department of Water Resources
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North of the Delta
Offstream Storage Investigation

# Progress Report

## Appendix D: Fish Survey Summary

**September 2000**

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Offstream Storage Investigation

# Progress Report

## Appendix D: Fish Survey Summary

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**September 2000**

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# Contents



## Tables

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# Figures

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# Fish Survey Summary

## Introduction

In late 1997, the Department of Water Resources began a two-year reconnaissance level study of North of the Delta Offstream Storage authorized by Proposition 204—the Safe, Clean, Reliable Water Supply Act approved by voters in 1996. In early 1999, CALFED consolidated all storage investigations under a comprehensive program called Integrated Storage Investigations. The North of the Delta Offstream Storage Investigation was incorporated into one of seven ISI program elements.

The North of the Delta Offstream Storage Investigation continues engineering, economic, and environmental impact analyses to determine the feasibility of four north of the Delta storage projects. The four potential alternatives are Sites Reservoir, Colusa Project, Thomes-Newville Project, and Red Bank Project (Figure 1). Phase I, currently underway, includes preliminary field surveys of environmental resources and extensive field surveys of cultural resources, geological, seismic and foundation studies, and an engineering feasibility evaluation. Phase II will start when CALFED's Record of Decision and Certification for the Programmatic EIR/EIS is completed and if north of Delta offstream storage is consistent with CALFED's preferred program alternative. Phase II will include completion of necessary fish and wildlife surveys, evaluations of potential mitigation sites, preparation of project-specific environmental documentation, final project feasibility reports, and the acquisition of permits necessary for implementation.

Under Phase I, the Department of Fish and Game conducted studies of fish and wildlife resources in each project area. This appendix summarizes studies of fish in the tributaries that flow through each of the four proposed project areas. The information gathered will be used to describe impacts on fish resources during the planning process. Fishery studies conducted for the Sacramento River will be summarized in a separate report.

### Contract with DFG

DFG initiated fish studies in 1997. Studies were conducted to develop data adequate to meet the needs of the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and DFG consultations as required by endangered species legislation. Past studies were also reviewed and evaluated as part of this effort.

### Report Organization and Content

Results and discussions of findings in past fishery studies and recently conducted surveys of fishery resources in the four proposed project areas are included in this appendix. The general procedure for commonly used fish surveys are outlined, with specific sampling data and results discussed in respective sections for each proposed project area.

## Methodology

At the proposed project sites, fish surveys were conducted by diving, seining, fyke netting, and/or electrofishing. These methods were used to collect data on occurrence and relative abundance of species of fish. This section discusses general procedures for these methods. Details of surveys and results for each site are discussed in the respective sections.

### Diving

Fish were observed in deep pools by divers wearing faceplates. Fish species were identified and numbers of each species observed were recorded. Diving was used as a sampling technique when pools were too big or deep for other sampling methods.

### Seining

A seine is used to collect fish for sampling data. Three different seines varying in size were used depending on the size of the pool. The largest seine was 60 feet long, 5 feet high, with a mesh size of one-quarter inch and a 7-foot-by -7-foot pocket. A medium sized seine was 29 feet long, 6 feet high, with a mesh size of one-quarter inch and a pocket size of 7 feet by 5 feet. The third seine, used only for small pools and ponds, was 12 feet long, 4 feet high, with a mesh size of one-quarter inch and a 7-foot-by-5-foot pocket. A seine was brought around from one edge of the pool to the other. To prevent fish from escaping, a barrier net was stretched across the creek upstream and downstream from the pool to be seined. Captured specimens were stored in a bucket of water until they could be examined. Specimens were identified and the first 20 of each species were measured for fork length to the nearest millimeter and then released downstream. The seine was pulled a total of three times at each site. Representative specimens were either preserved or photographed for positive identification.

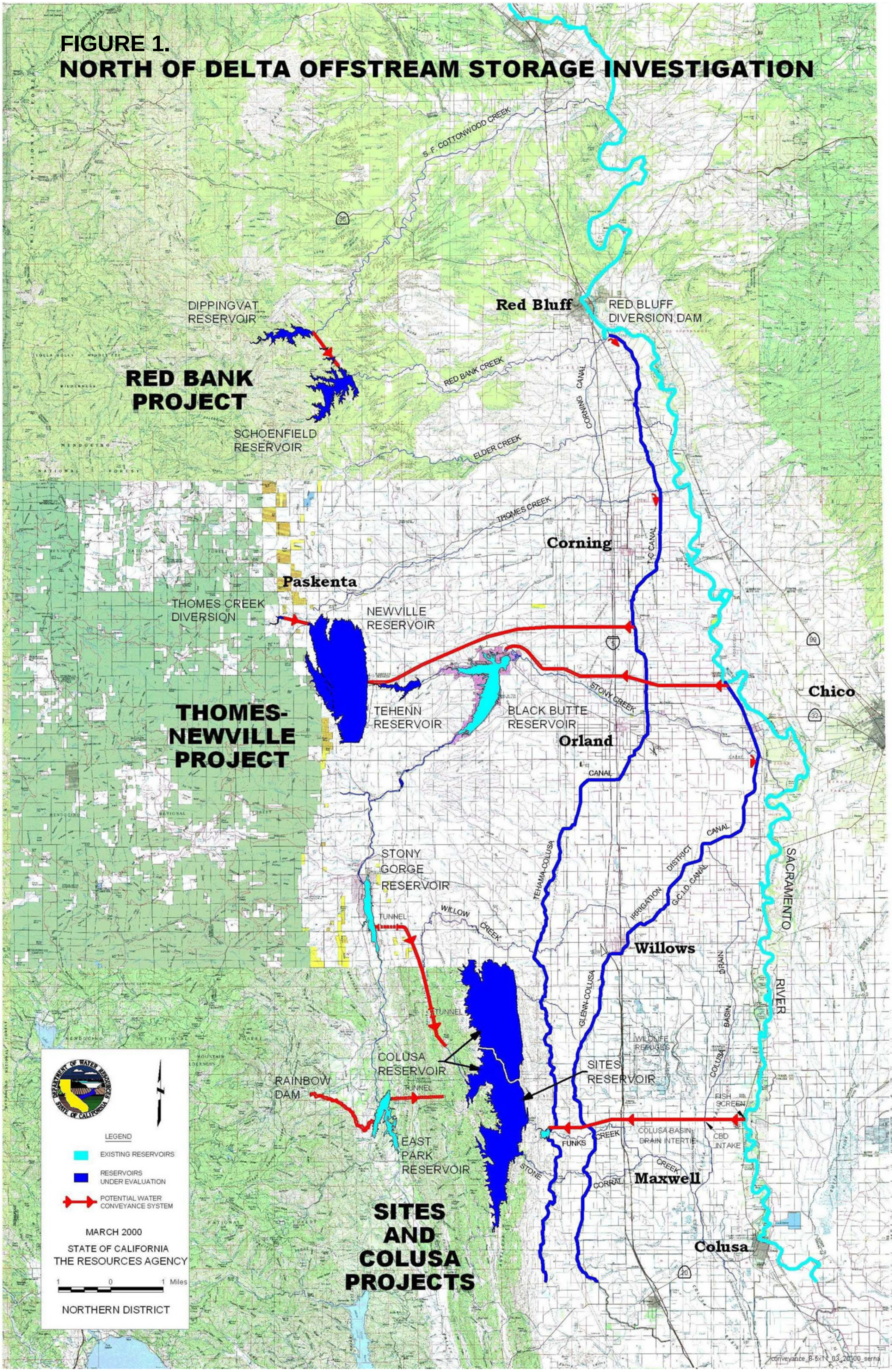
FIGURE 1.
NORTH OF DELTA OFFSTREAM STORAGE INVESTIGATION
S.F. COTTONWOOD CREEK
DIPPINGVAT RESERVOIR
Red Bluff
RED BLUFF DIVERSION DAM
RED BANK CREEK
RED BANK PROJECT
CORNING CANAL
SCHOENFIELD RESERVOIR
ELDER CREEK
THOMES CREEK
Corning
T-C CANAL
Paskenta
THOMES CREEK DIVERSION
NEWVILLE RESERVOIR
STONY CREEK
Chico
THOMES-NEWVILLE PROJECT
TEHENN RESERVOIR
BLACK BUTTE RESERVOIR
Orland
CANAL
STONY GORGE RESERVOIR
TEHAMA-COLUSA
DISTRICT
CANAL
IRRIGATION
G-C.I.D. CANAL
SACRAMENTO
TUNNEL
WILLOW CREEK
Willows
DRAIN
RIVER
GLENN-COLUSA
BASIN
TUNNEL
WILDLIFE REFUGES
COLUSA
COLUSA RESERVOIR
SITES RESERVOIR
RAINBOW DAM
TUNNEL
FISH SCREEN
COLUSA BASIN DRAIN INTERTIE
CBD INTAKE
FUNKS CREEK
EAST PARK RESERVOIR
STONE
CORRAL
CREEK
Maxwell
LEGEND
EXISTING RESERVOIRS
RESERVOIRS UNDER EVALUATION
POTENTIAL WATER CONVEYANCE SYSTEM
MARCH 2000
STATE OF CALIFORNIA
THE RESOURCES AGENCY
Miles
NORTHERN DISTRICT
SITES AND COLUSA PROJECTS
Colusa

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### Fyke Nets

Fish captured in fyke nets were measured for fork length to the nearest millimeter and weighed by water displacement to the nearest gram. No estimates of abundance were done for fish caught in fyke nets. Therefore, these fish were not included in the relative abundance tables.

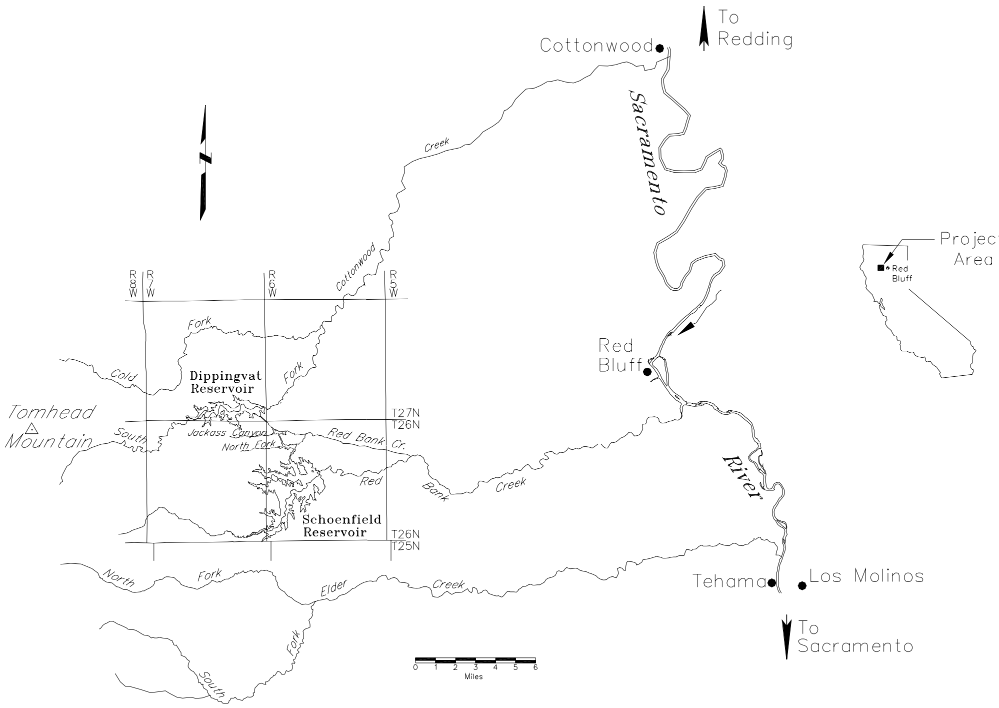
### Electrofishing

Electrofishing was done with a Smith-Root Type VII electroshocker. Sections of creek varying from 33 to 138 feet were netted off, upstream and downstream. With a backpack electroshocker, DFG biologists waded into the stream starting from the upstream net and moved downstream. The anode of the electrofisher was inserted into likely fish habitat. The stunned fish were then collected into buckets, measured for fork length to the nearest millimeter for the first 20 of each species, and then a plus count was taken. Fish were weighed using water displacement to the nearest gram. The surface area of each station was calculated in square feet and then converted to square millimeters for fish density analysis. The resulting relative abundance was converted to and reported in fish per square yard.

## Red Bank Project Fish Studies

This section describes the results of current and past fish studies conducted on Red Bank, South Fork Cottonwood, and Cottonwood Creeks, the major tributaries of the Red Bank Project area (Figure 2). Past studies date to 1969 and contain the reconnaissance-level fish and wildlife evaluation of Sacramento Valley alternative west side conveyance routes prepared by DFG (Smith and Van Woert 1969). Other studies reviewed include reports prepared by DFG and DWR in 1972, 1975, 1985, and 1987 (Haley and Van Woert 1972, Bill et al. 1975, Brown et al. 1985, Smith 1987).

**Figure 2. Cottonwood Creek System and the Red Bank Project**




### Red Bank Creek Fish Resources

DFG Biologists sampled fish in Red Bank Creek within the footprint of the Schoenfield Reservoir in 1998. Data were collected at 28 stations. In summer 1998, seining was done at 16 stations dispersed on Red Bank Creek and its tributaries, Dry and Grizzly Creeks. Twelve stations were sampled on Red Bank Creek by electrofishing in October and November 1998.

#### *Nongame Fish*

Four species of nongame fish were observed (Table 1). The most common species of nongame fish found were California roach (0.588 fish/yd$^2$) and Sacramento pike minnow (0.158 fish/yd$^2$) (Table 2).

#### *Resident Game Fish*

In 1998, DFG biologists observed four species of resident game fish in Red Bank Creek (Table 3). The most common resident game fish were largemouth bass (0.009 fish/yd$^2$) and bluegill (0.001 fish/yd$^2$) (Table 4).

#### *Steelhead*

Also in 1998, DFG biologists found juvenile steelhead in the footprint of the proposed Schoenfield Reservoir in Red Bank by electrofishing and estimated density to be 0.002 fish/yd$^2$. Steelhead were found in two of 28 stations sampled.

**Table 1. Nongame Fish Observed in the Red Bank and Cottonwood Creeks**

| Common Name | Scientific Name | Cottonwood Creek (1976) | Red Bank Creek (1998) |
|---|---|---|---|
| California roach | *Hesperoleucus symmetricus* | X | X |
| Carp | *Cyprinus carpio* | X | |
| Golden shiner | *Notemigonus crysoleucas* | X | |
| Hardhead | *Mylopharodon conocephalus* | X | |
| Hitch | *Lavinia exilicauda* | X | |
| Mosquitofish | *Gambusia affinis* | X | |
| Pacific lamprey | *Lampetra tridentata* | X | X |
| Prickly sculpin | *Cottus asper* | X | |
| Sacramento pike minnow | *Ptychocheilus grandis* | X | X |
| Sacramento sucker | *Catostomus occidentalis* | X | X |
| Speckled dace | *Rhinichthys osculus* | X | |
| Threespine stickleback | *Gasterosteus aculeatus* | X | |
| Tule perch | *Hysterocarpus traski* | X | |

**Table 2. Relative Abundance of Nongame Fish (Fish/Yd$^2$) Caught in Lower Cottonwood Creek, 1976, and in Red Bank Creek, 1998**

| Species | Cottonwood Creek (1976) | Red Bank Creek (1998) |
|---|---|---|
| California roach | 0.003 | 0.588 |
| Carp | 0.003 | |
| Hardhead | 0.022 | |
| Sacramento pike minnow | 0.015 | 0.158 |
| Sacramento sucker | 0.006 | 0.091 |

**Table 3. Game Fish Observed in Cottonwood Creek, 1976, and in Red Bank Creek, 1998**

| Common Name | Scientific Name | Cottonwood Creek (1976) | Red Bank Creek (1998) |
|---|---|---|---|
| Black bullhead | *Ictalurus melas* | X | |
| Bluegill | *Lepomis macrochirus* | X | X |
| Brown bullhead | *Ictalurus nebulosus* | X | |
| Brown trout | *Salmo trutta* | X | |
| Chinook salmon | *Onchorhynchus tshawytscha* | X | |
| Green sunfish | *Lepomis cyanellus* | X | X |
| Largemouth bass | *Micropterus salmoides* | X | X |
| Smallmouth bass | *Micropterus dolomieui* | X | |
| Steelhead | *Onchorhynchys mykiss* | X | X |
| White catfish | *Ictalurus catus* | X | |

**Table 4. Relative Abundance of Resident Game Fish (Fish/ $Yd^2$) Caught in Lower Cottonwood Creek and in Red Bank Creek**

| Species | Cottonwood Creek (1976) | Red Bank Creek (1998) |
|---|---|---|
| Bluegill | 0.022 | 0.001 |
| Brown bullhead | 0.006 | |
| Green sunfish | 0.015 | 0.001 |
| Largemouth bass | 0.003 | 0.009 |
| Smallmouth bass | 0.003 | |

## Cottonwood Creek Fish Resources

DFG biologists surveyed Cottonwood Creek from the confluence of the north fork to the mouth of Cottonwood Creek in 1976 (Richardson et al. 1978). Observations were made by diving, seining, fyke netting, and electrofishing. Abundance estimates were made for fish caught by electrofishing. Fish caught in fyke nets or observed by divers were not included in the relative abundance tables, because no estimates of abundance were done for these fish.

### *Nongame Fish*

Thirteen species of nongame fish were observed (Table 1). The most common species of resident nongame fish found were hardhead (0.022 fish/$yd^2$) and Sacramento pike minnows (0.015 fish/$yd^2$) (Table 2). Some Sacramento pike minnows and Sacramento suckers also migrate to the Sacramento-San Joaquin estuary to rear and return to Cottonwood Creek as adults to spawn (Richardson et al. 1978). Life history information is valuable in planning instream flow studies, HEP evaluations, and determining project impacts.

### *Resident Game Fish*

Ten species of resident game fish were observed in the Cottonwood Creek system in 1976 (Richardson et al. 1978) (Table 3). The most common resident game fish were bluegill (0.022 fish/$yd^2$) and green sunfish (0.015 fish/$yd^2$) (Table 4). Green sunfish and bluegill were common in the lower reaches surveyed (Richardson et al. 1978).

### *Steelhead*

DFG biologists found juvenile steelhead in South Fork Cottonwood Creek in the Yolla Bolly Wilderness in the summer of 1976. No estimates of numbers of juvenile steelhead were made. The Yolla Bolly Wilderness is well above the site of the proposed Dippingvat Dam. Adult steelhead were seined from the mouth of Cottonwood Creek in November 1976 (Brown, et al., 1985). DFG estimates that Cottonwood Creek supports an average annual migration of 1,000 steelhead based on the best estimates of biologists who were most familiar with Cottonwood Creek (DFG 1966).

### *Chinook Salmon*

**Fall Run.** Fall-run chinook salmon ascend Cottonwood Creek and spawn in late October through November (Richardson et al. 1978). They spawn in

Cottonwood Creek from the mouth to the confluence of North Fork Cottonwood Creek. About 53 percent of fall-run chinook salmon spawn from the mouth of Cottonwood Creek to the Interstate-5 highway bridge, 23 percent spawn from the Interstate-5 highway bridge to the confluence of Cottonwood Creek and South Fork Cottonwood Creek, and 24 percent spawn in Cottonwood Creek between the confluence of the south and north forks. Their young begin migrating after they incubate in January (Richardson 1978). They migrate downstream from January through May. DFG estimates that an average of 3,600 fall-run chinook salmon spawn in Cottonwood Creek (Table 5) (Elwell 1962; Fry 1961; Fry and Petrovich 1970; Hoopaugh 1978; Hoopaugh and Knudson 1979; Kano et al. 1996; Kano 1998a, 1998b; Knutson 1980; Mahoney 1962; Menchen 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970; Puckett et al. 1979; Reavis 1983, 1984, 1986).

## Table 5. Estimates of Chinook Salmon Spawning in the Cottonwood Creek System, 1952-98 (DFG Spawning Stock Reports)

| Year | Fall Run | Spring Run | | |
|---|---|---|---|---|
| | | Beegum Gulch | North Fork | South Fork |
| 1952 | - | - | - | - |
| 1953 | 3,000 | - | - | - |
| 1954 | 1,000 | - | - | - |
| 1955 | 800 | - | - | - |
| 1956 | 660 | - | - | - |
| 1957 | 358 | - | - | - |
| 1958 | 600 | - | - | - |
| 1959 | 3,300 | - | - | - |
| 1960 | 350 | - | - | - |
| 1961 | 1,500 | - | - | - |
| 1962 | 6,000 | - | - | 0 |
| 1963 | 3,500 | - | - | - |
| 1964 | 3,450 | - | - | - |
| 1965 | 900 | - | - | - |
| 1966 | 2,900 | - | - | - |
| 1967 | 600 | - | - | - |
| 1968 | 8,540 | - | - | - |
| 1969 | 4,967 | - | - | - |
| 1970 | - | - | - | - |
| 1971 | - | - | - | - |
| 1972 | - | - | - | 0 |
| 1973 | - | 0 | - | - |
| 1974 | - | 3 | - | - |
| 1975 | - | 3 | - | 1 |
| 1976 | 2,427 | - | - | - |
| 1977 | 1,512 | - | - | - |
| 1978 | 1,120 | - | - | 0 |
| 1979 | - | - | - | - |
| 1980 | - | - | - | - |
| 1981 | 3,356 | - | - | - |
| 1982 | 700 | 0 | - | - |
| 1983 | 1,000 | - | - | - |
| 1984 | 500 | - | - | - |
| 1985 | - | - | - | - |
| 1986 | - | - | - | - |
| 1987 | - | - | - | - |
| 1988 | - | - | - | - |
| 1989 | - | 0 | - | - |
| 1990 | - | - | - | - |

## Table 5. Estimates of Chinook Salmon Spawning in the Cottonwood Creek System, 1952-98 (DFG Spawning Stock Reports) continued

| Year | Fall Run | Spring Run | | |
|---|---|---|---|---|
| | | Beegum Gulch | North Fork | South Fork |
| 1991 | 676 | - | - | - |
| 1992 | 1,585 | - | - | - |
| 1993 | - | 1 | - | - |
| 1994 | - | - | - | - |
| 1995 | - | 8 | - | - |
| 1996 | - | 6 | - | - |
| 1997 | - | - | - | - |
| 1998 | - | 477 | - | 0 |

**Late Fall-Run.** Late fall-run chinook salmon migrate up Cottonwood Creek and spawn in January. DFG Biologists observed them spawning at the mouth of North Fork Cottonwood Creek in January 1976 (Richardson et al. 1978). Their young migrate downstream in May and June as much smaller fry than fall-run at that time of year. Young late fall-run chinook salmon were caught in fyke nets near the mouth of Cottonwood Creek in May and June 1976 (Richardson 1978). DFG estimates that an average of 300 late fall-run chinook salmon migrate up Cottonwood Creek (Smith and Van Woert 1969). DFG biologists surveying Cottonwood Creek in 1977 observed late fall-run chinook salmon spawning, but no estimates of run size were made.

**Spring-Run.** Spring-run chinook salmon migrate up Cottonwood Creek in April and spend the summer in deep pools in South Fork Cottonwood Creek, Beegum Gulch, and North Fork Cottonwood Creek. Most are found in Beegum Gulch. Young spring-run chinook salmon migrate downstream from January through May. DFG estimates that an average of 500 spring-run chinook salmon migrate up Cottonwood Creek (DFG 1966). DFG biologists surveyed Beegum Gulch in 1998 and found about 500 spring-run chinook salmon. Some young spring-run salmon from the Sacramento River use the lower reach of Cottonwood Creek from Interstate-5 to the mouth for rearing during the summer and fall (Richardson et al. 1978).

**Spawning Habitat.** DFG biologists took gravel samples in summer 1977 to measure quantity and quality of salmon spawning habitat in Cottonwood Creek. Approximately 392,000 square feet of gravel suitable for chinook salmon spawning was identified in the Cottonwood Creek system (Richardson and Brown 1978). About 40,000 square feet of that total was in south fork. Other investigations have produced estimates ranging from 285,000 square feet (Hansen et al. 1940) to 2,000,000 square feet (Leach and Van Woert 1968) of gravel in the system. A female chinook salmon requires about 100 square feet of gravel for spawning (Leach and Van Woert 1968). Most of the gravel was found in Cottonwood Creek below its confluence with North Fork Cottonwood Creek. Little suitable gravel was found in North Fork Cottonwood Creek.

**Instream Flow.** An instream flow study was conducted in 1976 and 1977 to measure the amount of chinook salmon spawning and rearing habitat in Cottonwood Creek and South Fork Cottonwood Creek. Optimum spawning flow was about 180 cfs and optimum rearing flow was 200 cfs from the mouth of Cottonwood Creek to the confluence of Cottonwood Creek and South Fork Cottonwood Creek. Optimum spawning flow was about 80 cfs and optimum rearing flow was 100 cfs in the lower seven miles of South Fork (Brown 1979). Natural monthly stream flow averages 295 cfs during fall-run chinook spawning in November near the mouth of Cottonwood Creek (Table 6). Average monthly flows range from 604 to 2,174 cfs when salmon rear from January through May.

**Table 6. Average Monthly Stream Flow in Cottonwood Creek at the Cottonwood Gage**

| Month | Average Monthly Flow (cfs) |
|---|---|
| January | 1,744 |
| February | 2,174 |
| March | 1,590 |
| April | 1,205 |
| May | 604 |
| June | 283 |
| July | 112 |
| August | 66 |
| September | 66 |
| October | 108 |
| November | 295 |
| December | 955 |

## Thomes-Newville Project Fish Studies

DFG initiated studies of the impacts on fish and wildlife of a Thomes-Newville Project in 1979 as part of DWR's Thomes-Newville Reservoir planning studies. However, the planning studies were halted in 1982. DFG completed a report of its abbreviated studies in 1983 (Brown et al. 1983). In 1998, DFG initiated studies of fish and wildlife resources of a Thomes-Newville Project as part of the North of Delta Offstream Storage Program. A brief survey of spring-run chinook salmon was conducted during the recent investigations. This section discusses recent findings and recapitulates the effort and results of the 1982 study (Brown et al. 1983).

## Methodology

### *Juvenile Salmon*

Seining for juvenile chinook salmon in Stony and Thomes Creeks was done over a period of three years, 1980 to 1982. Ten sample stations were selected on Thomes and Stony Creeks. Each station was seined weekly from February to June, with 50-foot delta mesh seines (Brown et al. 1983).

Fyke nets were used to sample for juvenile salmonids during the 1981 and 1982 seasons on Thomes Creek only. Irregular and frequent floodflow releases from Black Butte Reservoir made it impractical to fyke net in Stony Creek. Two fyke nets were used in Thomes Creek. One was placed in the mainstem and another near the confluence to the discharge channel from the Tehama-Colusa Canal. The nets were fished continuously from Monday to Friday and were removed during weekends or during high water. Each net in the mainstem was fished from February through March. Captured fish were measured for fork length to the nearest millimeter and weighed by water displacement to the nearest gram (Brown et al. 1983).

### *Adult Salmon and Steelhead*

Adult chinook salmon carcasses were counted to estimate the number of salmon in Stony and Thomes Creeks. Stony Creek was surveyed for carcasses between the Sacramento River confluence and the North Diversion Dam. Thomes Creek was surveyed between the Sacramento River confluence and Paskenta and in a channel from the discharge point of the Tehama-Colusa Canal to its confluence with Thomes Creek. Counts were taken once per week from November through January in 1980-81 and 1981-82 on Thomes Creek and from December through February in 1981-82 on Stony Creek. Each carcass was tagged by fastening a number 3 hog ring to its mandible. Tick marks were notched into the hog rings with wire cutters to identify the appropriate week of tagging. The sex and fork length of each carcass was noted. The date and location of where each carcass was found was recorded; each carcass was then returned to the same area where it was tagged. On successive surveys, tagged fish that were recovered were cut in half to avoid recounting in subsequent surveys. The 1980-81 spawning escapement estimate for Thomes Creek was calculated with the Schaefer method (Ricker 1975), while the 1981-82 estimates for both Stony and Thomes Creeks were estimated with the Peterson method (Ricker 1975) (Brown et al. 1983).

On June 13, 1979; August 18, 1980; and August 12, 1998, Thomes Creek was surveyed to enumerate adult spring-run chinook salmon and summer-steelhead. The area surveyed was from the gorge to the fjord at Hatch Flat near Paskenta. Each pool was examined by snorkel diving. All fish were identified and their size range and relative abundance estimated. No habitat suitable for spring-run salmon and summer steelhead exists in Stony Creek; therefore, no survey was conducted (Brown et al. 1983). Historical estimates for fall-run chinook salmon for both Stony and Thomes Creeks were compiled from DFG salmon-spawning stock reports.

### Resident Fish and Migratory Nongame Fish

A fyke net consisting of 0.03 inch oval mesh netting mounted on a 0.01 inch x 0.02 inch metal tubing frame was placed in the creek near the mouth of Thomes Creek. The purpose of the net was to capture juveniles, larval Sacramento suckers, and Sacramento pike minnows migrating to the Sacramento River. A perforated aluminum box—1.6 feet x 1.6 feet x 3.3 feet—was attached to the cod end of the net to receive captured fish. The net was fished 24 hours per day during weekdays from January to June 1981 (Brown et al. 1983).

To estimate the population of spawning Sacramento suckers and Sacramento pike minnows, adult fish were captured in Thomes Creek and its tributary, Mill Creek. From December 1980 through June 1981, 17 samples were taken at 10-day intervals via electrofishing. A 12-foot Avon rubber raft was retrofitted with a Smith-Root Type VII electroshocker. The battery and electroshocking unit were placed inside an ice chest and secured to the raft's rowing frame. Prove arrays were constructed of 0.08-inch stainless steel cable, attached to the bow of the raft, and fished at a depth of 4.9 feet. (Brown et al. 1983).

Captured fish were weighed to the nearest 0.3 ounce and fork lengths were measured to the nearest millimeter. Each fish was marked with a floy spaghetti tag and released. The tag was inserted under the dorsal fin and tied in a loop. The Jolly-Seber method was used to determine the population estimate for Sacramento suckers while the Schaefer method (Ricker 1975) was used to estimate the population of Sacramento pike minnows (Brown et al. 1983).

Electrofishing was done in streams in the footprint of proposed Newville Reservoir in 1981 and 1982. Seven sections were sampled in streams within the project area. These include North Fork Stony, Salt, and Heifer Camp Creeks. Ten sections in Stony Creek and 15 in Thomes Creek were sampled. Fish were captured by backpack electrofishing. Population number and biomass estimates for each species for the Thomes-Newville data were developed using the two-pass method of Seber and LeCren (1967) (Brown et al. 1983).

## Thomes Creek Fish Resources

### Juvenile Chinook Salmon

**1980 Emigration.** Thirteen juvenile chinook salmon were captured by seining during the 1980 sample period (Table 7). These fish were caught in the lowermost stations of Thomes Creek from March 20 to May 24, 1980.

**1981 Emigration**. Six juvenile chinook salmon were captured by seining during the 1981 sample period (Table 7). One of these fish was from Coleman National Fish Hatchery.

In 1981, 206 juvenile chinook salmon were captured by fyke netting in Thomes Creek, 20 from the mainstem and 186 from the discharge canal (Tables 8 and 9).

**Table 7. Juvenile Chinook Salmon Seined from Thomes Creek in 1980 and 1981 [1]**

| Sample Period | Number of Weekly Seinings | Number of Fish | Average Length of Fish (inches) |
|---|---|---|---|
| 1980 | | | |
| March | 4 | 5 | 2.8 |
| April | 5 | 8 | 2.8 |
| **Total** | **9** | **13** | |
| 1981 | | | |
| March | 2 | 5 | 4.1 |
| April | 1 | 1 | 2.3 |
| **Total** | **3** | **6** | |

[1] Brown et al. 1983

**Table 8. Fyke Net Catches of Juvenile Chinook Salmon from Mainstem of Thomes Creek in 1981[1]**

| Sample Period | Hours Fished | Number of Salmon | Average Length of Fish (inches) |
|---|---|---|---|
| February | 672 | 0 | 0 |
| March | 744 | 9 | 2.7 |
| April | 648 | 10 | 3.1 |
| May | 336 | 1 | 2.7 |
| **Total** | **2,400** | **20** | |

[1] Brown et al. 1983

**Table 9. Fyke Net Catches of Juvenile Chinook Salmon from the Tehama-Colusa Canal Discharge Channel in Thomes Creek in 1981 and 1982[1]**

| Sample Period | Number of Fish | Average Length of Fish (inches) |
|---|---|---|
| 1981 | | |
| January | 1 | 1.4 |
| February | 126 | 1.3 |
| March | 59 | 1.3 |
| **Total** | **186** | |
| 1982 | | |
| January | 2 | 1.4 |
| February | 45 | 1.4 |
| March | 337 | 1.5 |
| **Total** | **384** | |

[1] Brown et al. 1983

The catches from the mainstem occurred over a nine-week period beginnning the first week of March and ending the first week of May. Salmon from these catches ranged in size from 2.7 to 3.1 inches fork length (Table 8). Except for the time when the migration occurred, no real descriptive trends can be derived from these data. These fish, however, appear to be much larger than expected for fall-run fish spawned in Thomes Creek. Some fish may have spawned earlier in the mainstem Sacramento River and moved upstream into Thomes Creek. It is common for juvenile salmonids from the Sacramento River to swim upstream into tributaries (Richard Hallock, DFG, personal communication).

Juveniles captured in the discharge channel spawned there. The presence of live adults, carcasses, and redds in the channel together with the presence of juveniles is strong evidence that successful spawning occurred in the channel.

The migration of juvenile chinook salmon from the discharge channel occurred from late February through the third week of March. At this time the discharge was terminated by the U.S. Bureau of Reclamation and no water flowed to indicate newly hatched fish. These fish were of the fall-run spawn. Although the migration was halted by lack of flow, it could have continued if discharge had been extended. In response to the lack of flow, DFG regional personnel rescued in excess of 3,000 juvenile salmon.

**1982 Emigration** – No juvenile chinook salmon were captured by seining or fyke netting in the mainstem of Thomes Creek during the 1982 sample period. High flows and other duties limited efforts.

As indicated in Table 9, 384 juvenile chinook salmon were captured by fyke netting in the discharge channel from the Tehama-Colusa Canal. The first fish was captured during the first week of January, but the bulk of the migration did not occur until the third week of February. The migration continued until March 30, 1982, when the discharge was terminated by USBR.

### Juvenile Steelhead

Seven juvenile steelhead were captured by seining in Thomes Creek in 1981. Four of these fish were probably from Coleman National Fish Hatchery. They had rounded fins and deformed dorsal fins, which are a characteristic of hatchery-grown fish. Juvenile salmonids from the Sacramento River commonly ascend tributaries (Richard Hallock, DFG, personal communication).

### Adult Chinook Salmon

Review of past reports show little information on historic salmon runs in Thomes Creek. Only seven surveys were documented between 1955 and 1979. In 1957, the fall-run escapement estimate was 25, and in 1975 the estimate was 170 fish (Mahoney 1958, Hoopaugh 1978a). Estimates of fall-run salmon for survey years 1959, 1960, 1964, 1965, and 1976 were zero (Mahoney 1960, 1962; Menchen 1965, 1966; Hoopaugh 1978b).

**1980-81 Fall-Run Estimate**. Fifty-nine chinook salmon carcasses were tagged during 12 surveys of Thomes Creek. Of these 59, 17 fish (29 percent) were males while 42 fish (71 percent) were females. This represented a male-female ratio of 1:2.5. Twenty-three carcasses were recovered in fall 1980. From these data an estimated 155 salmon spawned in Thomes Creek during the sample period.

Live fish were first observed in the creek November 11, 1980, but no carcass was tagged until nine days later. The last carcass was tagged on January 12, 1981. Fifty-seven (97 percent) of the fish tagged were located in the Tehama-Colusa Canal outlet channel. Only two fish (3 percent) were tagged in the mainstem. Observation of six redds and four live fish indicates there was some spawning activity in areas below Henleyville.

**1981-82 Fall-Run Estimates**. Thirty-eight chinook salmon carcasses were tagged during 10 surveys of Thomes Creek. Of these 38, 16 fish (42 percent) were males while 22 fish (58 percent) were females. This represents a male-female ratio of 1:1.4. All of the fish tagged were located in the Tehama-Colusa Canal outlet channel. Twenty tagged carcasses were recovered. From these data an estimated 167 salmon spawned in Thomes Creek during the sample period. No live fish or redd was seen in the mainstem.

**1979-1980 Spring-Run Estimates**. No adult anadromous salmonid was seen during the June 1979 or August 1980 spring-run chinook salmon surveys in Thomes Creek. Numerous juvenile steelhead and brown trout were seen in the area of the survey which may indicate that habitat for spring-run chinook salmon or summer steelhead may exist. Although surface water temperatures generally approach 77°F in these areas, cooler water (59-68°F) can be found near the bottom of larger pools that could support salmonids.

**1999 Spring-Run Estimates**. One adult spring-run chinook salmon was seen during August 1999 diving surveys in Thomes Creek. As in 1980, numerous juvenile steelhead and brown trout were seen in the area of the survey.

**1980 Late Fall-Run**. The late spawning characteristics of a few chinook salmon indicate that they were of the late fall-run. Those that spawned in late December and January were salmon of this race.

### *Resident Fish and Migratory Nongame Fish*

Twenty-two species of fish were observed in Thomes Creek (Table 10). DFG staff developed population and biomass estimates for 13 of these species (Table 11). Three species were game fish and 10 were nongame fish. Steelhead were the most abundant fish above the gorge, while Sacramento pike minnow, Sacramento suckers, hardhead, California roach, and speckled dace were the more common fish below the gorge.

Most of the nongame fish caught in the reach below the gorge were juveniles, indicating that this reach serves mainly as a spawning and rearing area. Adult Sacramento suckers, Sacramento pike minnow, California roach, and hardhead annually migrate from the Sacramento River into Thomes Creek and its tributaries to spawn. Juveniles that do not migrate immediately after hatching remain to rear until the following rainy season when water flows to the mouth.

Thomes Creek below Paskenta usually dries up except for a few residual pools scattered along the streambed during the late summer, making it impossible for resident adult fish to live throughout the summer months. Some adult game fish such as largemouth and smallmouth bass, bluegill, and green sunfish ascend the creek from the Sacramento River during late spring and early summer to use these pools as spawning areas.

### Table 10. Fish Species Found in Thomes Creek in 1982[1]

| Common Name | Scientific name |
|---|---|
| Bluegill | *Lepomis machrochirus* |
| Brown bullhead | *Ictalurus nebulosus* |
| California roach | *Lavinia symmetricus* |
| Carp | *Cyprinus carpio* |
| Channel catfish | *Ictalurus punctatus* |
| Golden shiner | *Notemigomus crysoleucus* |
| Goldfish | *Carassius auratus* |
| Green sunfish | *Lepomis cyanellus* |
| Hardhead | *Mylopharodon conocephalus* |
| Hitch | *Lavinia exilicauda* |
| Largemouth bass | *Micropterus salmoides* |
| Mosquitofish | *Gambusia affinis* |
| Pacific lamprey | *Lampetra tredentata* |
| Prickly sculpin | *Cottus asper* |
| Sacramento pike minnow | *Ptychocheilus grandis* |
| Sacramento sucker | *Catostomus occidentatlis* |
| Smallmouth bass | *Micropterus dolomeiu* |
| Speckled dace | *Rhinicthys osculus* |
| Steelhead | *Onchorynchus mykiss* |
| Threespine stickleback | *Gasterosteus aculeatus* |
| Tule perch | *Hysterocarpus traski* |
| White catfish | *Ictalurus catus* |

[1] Brown et al. 1983

### Table 11. Average Population Estimates and Biomass Estimates for Fish Caught in Sections of Thomes Creek in 1982[1]

| Species | Average Population Estimate | Average Biomass (lb/acre) |
|---|---|---|
| Bluegill | 3 | 4.5 |
| California roach | 41 | 10.7 |
| Carp | 90 | 64.2 |
| Goldfish | 1 | 19.2 |
| Green sunfish | 14 | 15.2 |
| Hardhead | 47 | 47.3 |
| Hitch | 1 | 0.4 |
| Largemouth bass | 5 | 8 |
| Prickly sculpin | 1 | 1.8 |
| Sacramento pike minnow | 337 | 89.2 |
| Sacramento sucker | 143 | 16.1 |
| Speckled dace | 229 | 16.1 |
| Tule perch | 1 | 0.2 |

[1] Brown et al. 1983

## Stony Creek Fish Resources

### *Juvenile Chinook Salmon*

**1980 Emigration**. During the 1980 sample period, 181 juvenile chinook salmon were caught by seining (Table 12). Salmon were first caught during the second week of February and the last salmon was caught during the first week of May.

**1981 Emigration**. During the 1981 sample period, 73 juvenile chinook salmon were captured by seining (Table 12). Fish were first captured during the third week of February and the last fish were captured during the second week of April.

**1982 Emigration**. During the 1982 sample period, only four juvenile chinook salmon were captured by seining (Table 12). Two fish were captured during January and two were captured during the first week of March.

### *Adult Salmon Studies*

**1981-82 Fall-Run Estimates**. Thirty-six chinook salmon carcasses were tagged during five surveys. Two of these salmon were recovered. From these data DFG estimates that 393 salmon spawned in Stony Creek during the sample period. Of the 36 tagged, 11 fish (31 percent) were males while 25 fish (69 percent) were females. This represents a male-female ratio of 1:2.3.

Most of the spawning activity was located in lower Stony Creek in the reach between the Interstate-5 bridge and the mouth. At least 35 redds and 29 carcasses were counted in this area.

**Table 12. Juvenile Chinook Salmon Seined from Stony Creek in 1980, 1981, and 1982[1]**

| Sample Period | Number of Fish | Average Length of Fish (in) |
|---|---|---|
| **1980** | | |
| February | 64 | **1.7** |
| March | 51 | 1.8 |
| April | 60 | 2.0 |
| May | 6 | 3.0 |
| **Total** | **181** | |
| **1981** | | |
| February | 5 | 1.5 |
| March | 64 | 2.1 |
| April | 4 | 3.0 |
| **Total** | **73** | |
| **1982** | | |
| January | 2 | 3.3 |
| March | 2 | 1.7 |
| **Total** | **4** | |

[1] Brown et al. 1983

### *Resident Fish Surveys*

Six species of fish, two game and four nongame, were captured in streams potentially inundated by the Newville Reservoir (Tables 13 and 14). These streams include North Fork Stony Creek, Salt Creek, and Heifer Camp Creek. Rainbow trout were captured in sections of streams above the inundation line where the water is cool and cover is abundant. California roach, Sacramento pike minnow, Sacramento sucker, carp, and green sunfish were captured in sections of streams below the inundation line. California roach, Sacramento pike minnows, and Sacramento suckers were more abundant species, while carp and green sunfish are relatively uncommon (Brown et al. 1983).

**Table 13. Population Estimates for Fish Caught in Selected Sections of Streams within the Newville Reservoir Site in 1983[1]**

| Species | North Fork Stony Creek | Salt Creek | Heifer Camp Creek |
|---|---|---|---|
| California roach | 4 | 546 | 120 |
| Carp | 1 | | |
| Green sunfish | - | 13 | |
| Rainbow trout | - | 24 | 8 |
| Sacramento pike minnow | 12 | 24 | 85 |
| Sacramento sucker | > 2 | 45 | 6 |

[1] Brown et al. 1983

**Table 14. Average Biomass Estimates (lb/acre) for Fish Caught in Selected Sections of Streams within the Newville Reservoir Site in 1983[1]**

| Species | North Fork Stony Creek | Salt Creek | Heifer Camp Creek |
|---|---|---|---|
| California roach | 0.9 | 427.3 | 72.3 |
| Carp | 145.4 | - | |
| Green sunfish | - | 33.9 | |
| Rainbow trout | - | 74.9 | 18.7 |
| Sacramento pike minnow | 8 | 339.9 | 775.1 |
| Sacramento sucker | 0.09 | 88.3 | |

[1] Brown et al. 1983

The sections of stream within the inundation area are used primarily for spawning and rearing by nongame species (mainly the minnow family), although some green sunfish were observed spawning during the late spring in nonflowing areas of the stream. It is likely that, during high water, adult cyprinids ascend these tributaries from Black Butte Reservoir to spawn (Brown et al. 1983).

Upper Salt Creek supports a population of rainbow trout. Nongame fish were not found in this area nor were migratory cyprinids because they cannot ascend the creek due to a waterfall. This waterfall is not in the inundation area.

However, if Newville Reservoir is built, the waterfall could be flooded, which would allow nongame fish to swim upstream. This may reduce the rainbow trout populations because of competiton with nongame fish (Brown et al. 1983).

Twenty-eight species of fish were observed in Stony Creek (Table 15). DFG developed population and biomass estimates for 21 of these species (Table 16). Eight species were game fish and 13 were nongame fish. Largemouth bass and bluegill were the most abundant gamefish below Black Butte Reservoir; channel catfish and white catfish were the most abundant game fish above the Sacramento River. Sacramento pike minnows and suckers were found in all stations throughout Stony Creek, were the most abundant, and had the highest biomass for all species of fish. Prickly sculpin were found in all sections, but made up a very small portion of the total biomass.

Most nongame fish caught in the reach below Black Butte Reservoir were juveniles, indicating that this reach serves mainly as a spawning and rearing area. Adult Sacramento suckers, Sacramento pike minnow, California roach, and hardhead annually migrate from the Sacramento River into Stony Creek to spawn. Juveniles that do not migrate immediately after hatching remain to rear until the following season when water flows to the mouth. Other game fish such as largemouth bass, smallmouth bass, bluegill, and green sunfish were also observed spawning in backwater areas of Stony Creek. These adult fish may have migrated upstream from the Sacramento River, may have washed downstream from Black Butte Reservoir, or may reside throughout the year in the creek.

## Table 15. Fish of the Stony Creek Drainage (Excludes Fish within Newville Reservoir Site)[1]

| Common Name | Scientific Name |
|---|---|
| Black bullhead | *Ictalurus melas* |
| Black crappie | *Pomoxis melas* |
| Bluegill | *Lepomis machrochirus* |
| Brown bullhead | *Ictalurus nebulosus* |
| California roach | *Lavinia symmetricus* |
| Carp | *Cyprinus carpio* |
| Channel catfish | *Ictalurus punctatus* |
| Golden shiner | *Notemigomus crysoleucus* |
| Goldfish | *Carassius auratus* |
| Green sunfish | *Lepomis cyanellus* |
| Hardhead | *Mylopharodon conocephalus* |
| Hitch | *Lavinia exilicauda* |
| Largemouth bass | *Micropterus salmoides* |
| Mosquitofish | *Gambusia affinis* |
| Pacific lamprey | *Lampetra tridentata* |
| Prickly sculpin | *Cottus asper* |
| Rainbow trout | *Onchorynchus mykiss* |
| Redear sunfish | *Lepomis microlophus* |
| Sacramento blackfish | *Orthodon microlepidotus* |
| Sacramento pike minnow | *Ptychocheilus grandis* |
| Sacramento sucker | *Catostomus occidentatlis* |
| Smallmouth bass | *Micropterus dolomeiu* |
| Speckled dace | *Rhinicthys osculus* |
| Threadfin shad | *Dorosoma petenense* |
| Threespine stickleback | *Gasterosteus aculeatus* |
| Tule perch | *Hysterocarpus traski* |
| White catfish | *Ictalurus catus* |
| White crappie | *Pomoxis annularis* |

[1] Brown et al. 1983

**Table 16. Average Population Estimates and Biomass Estimates for Fish Caught in Selected Sections of Stony Creek in 1982 [1]**

| Species | Average Population Estimate | Average Biomass (lb/acre) |
|---|---|---|
| Black crappie | 8 | 87.4 |
| Bluegill | 19 | 8 |
| California roach | 200 | 54.4 |
| Carp | 5 | 64.2 |
| Channel catfish | 57 | 47.3 |
| Goldfish | 8 | 33.9 |
| Green sunfish | 7 | 2.7 |
| Hardhead | 9 | 24.1 |
| Hitch | 32 | 20.5 |
| Largemouth bass | 13 | 11.6 |
| Mosquitofish | 3 | 0.09 |
| Prickly sculpin | 57 | 11.6 |
| Sacramento pike minnow | 146 | 91 |
| Sacramento sucker | 96 | 256.9 |
| Smallmouth bass | 5 | 16.1 |
| Speckled dace | 318 | 41.9 |
| Threadfin shad | 2 | 0.9 |
| Threespine stickleback | 3 | 0.05 |
| Tule perch | 6 | 5.4 |
| White catfish | 30 | 34.8 |
| White crappie | 5 | 17.8 |

[1] Brown et al. 1983

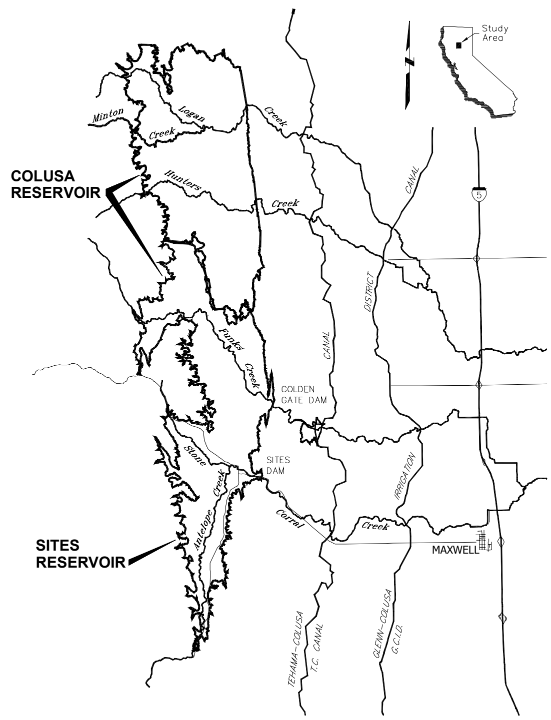
## Sites and Colusa Project Fish Studies

Fish studies for the Sites and Colusa Projects included three basic areas of study: fish resources in streams within the proposed reservoirs and in the Colusa Basin Drain, and habitat typing of the dominant streams in the proposed reservoirs.

### Sites and Colusa Project Stream Fish Resources

This section summarizes studies of fish in streams that flow through the proposed Sites and Colusa Projects. Studies were conducted in 1998 and 1999. Information gathered in these streams will be used to describe impacts on fish resources during the planning process.

**Figure 3. Streams in the Sites-Colusa Project**




### *Methodology*

Stone Corral Creek, Funks Creek, Logan Creek, and Hunters Creek and their tributaries originate in oak woodland habitat in western Colusa and Glenn Counties (Figure 3). The creeks flow downstream through annual grassland and cultivated rice fields before flowing into the Colusa Basin Drain. Deeply incised channels characterize these streams with little vegetation on the banks and little cover in streambeds. Streamflow is seasonal with periods of high flow during winter storms, declining flows through spring and early summer, and intermittent flow in late summer. Water quality is poor and high in dissolved minerals. The total dissolved solids in the water are so high that electrofishing as a means of sampling is not possible in the streams.

Pools were seined at specific stations on all creeks surveyed to determine species composition. All sample stations were within the footprint of the Sites-Colusa Project. Thirty-six stations were spread out among Hunter, Minton, Logan, Antelope, and particularly Stone Corral and Funks Creeks. Seven stock ponds in the Sites and Colusa area were also seined for fish.

Twelve species of fish were caught in the Sites and Colusa study area in 1998 and 1999. Five species were game fish and seven species were nongame fish (Table 17). A single spring-run chinook salmon was observed in Antelope Creek, a tributary to Stone Corral Creek in spring 1998. It died a few weeks later and was identified by its carcass.

**Table 17. Fish Caught in the Sites Study Area in 1998 and 1999**

| Common Name | Scientific Name |
|---|---|
| Bluegill | *Lepomis macrochirus* |
| California roach | *Hesperoleucus symmetricus* |
| Chinook salmon | *Oncorhynchus tschawtscha* |
| Green sunfish | *Lepomis cyanellus* |
| Hitch | *Lavinia exilicauda* |
| Largemouth bass | *Micropterus salmoides* |
| Mosquitofish | *Gambusia affinis* |
| Redear sunfish | *Lepomis microlophus* |
| Sacramento blackfish | *Orthodon microlepidotus* |
| Sacramento pike minnow | *Ptychocheilus grandis* |
| Sacramento sucker | *Catostomus occidentalis* |
| Sculpin sp. | *Cottus sp.* |

**Funks Creek.** Fifteen stations were sampled on Funks Creek between July 22, 1998, and January 8, 1999. Stations were evenly spaced between the Golden Gate damsite and the upper limit of flow in Funks Creek. Streamflow was intermittent. Five species of fish were found in Funks Creek, including one type of game fish, largemouth bass (Table 18). The most common fish in Funks Creek was the hitch, with an average density of 3.1 fish/yd$^2$ (Table 18). Hitch were caught in 11 out of 15 stations seined (Table 18).

**Table 18. Species Caught at Each Sample Station and Relative Abundance on Funks Creek**

| Species | Station Sampled | | | | | | | | | | | | | | | Fish/yd$^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| Hitch | | | X | X | X | X | X | X | X | X | X | X | X | | | 3.1 |
| Largemouth bass | | | | | | | | | X | | | X | | | | 0.001 |
| Sacramento pike minnow | | | | | X | X | | | X | | | | X | | | 0.06 |
| Sacramento Sucker | | | | | X | X | | | X | X | | | X | | | 0.02 |
| Sculpin | | | | | | | | | | | | | | X | | --- |

The most diverse sampled sections of Funks Creek were in the lower reaches, stations 5, 6, 9, 10, 12, and 13. The upper reaches of Funks Creek either lacked fish or only one species was found. Hitch densities varied widely throughout the creek, and no one area seemed to maintain a higher population.

**Hunters Creek.** Three stations on lower Hunters Creek were seined between July 22, 1998, and August 3, 1998. No water was present above these sites. Only two species of fish were found on Hunters Creek, green sunfish and mosquitofish. Both species were found in two of the three stations (Table 19).

Mosquitofish were found in a relative abundance of 3.8 fish/yd$^2$, but they only occurred in abundance at one station. Green sunfish were found to have an average density of 2.3 fish/yd$^2$.

### Table 19. Relative Abundance of Fish Caught at Hunters Creek

| Species | Fish/yd$^2$ |
|---|---|
| Green sunfish | 2.3 |
| Mosquitofish | 3.8 |

**Minton Creek.** Minton Creek was sampled in two places on August 12, 1998. Samples were taken in lower reaches of the creek because areas of the creek above the sample sites were dry. Hitch were found in only one of those stations, at a density of 0.5 fish/yd$^2$ .

**Stone Corral Creek.** Eleven stations were sampled on Stone Corral Creek between July 15, 1998, and January 6, 1999. Stations were located from the damsite to about 1 mile above. Flows were less than 1 cfs. Eight species of fish were found in Stone Corral Creek, including two species of game fish, green sunfish and bluegill (Table 20).

The fish most common fish among the stations was the Sacramento pike minnow followed by the hitch (Table 20). Fish density on Stone Corral was relatively low for all species at all stations. Hitch were the dominant species in terms of density 0.8 fish/yd$^2$.

### Table 20. Species Caught at Each Station and Relative Abundance on Stone Corral Creek

| Species | Station Sampled | | | | | | | | | | | Fish/yd2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | |
| Bluegill | | | | X | | | | | | | | 0.002 |
| California roach | | X | | X | | | | | | | | 0.02 |
| Green sunfish | | | X | | | | | X | X | X | X | 0.03 |
| Hitch | | X | X | | | | | X | X | X | X | 0.8 |
| Mosquitofish | | | | X | | | | | | | | 0.002 |
| Sacramento blackfish | | | | | | | | | | | X | 0.2 |
| Sacramento pike minnow | | | X | X | X | X | | X | X | | X | 0.2 |
| Sacramento sucker | | | X | X | | X | | | | | X | 0.02 |

Most seining stations on Stone Corral Creek were clustered around the same region. Station 1 was far upstream from the others and yielded no fish. The diversity of species caught was highest at stations 4 and 11.

**Antelope Creek.** Five seining stations were sampled on Antelope Creek between July 14, 1998, and November 25, 1998. Stations were evenly spaced between the mouth of Antelope Creek and the boundary of Sites Reservoir.

Streamflow was less than 5 cfs. Three species of fish were captured on Antelope Creek: green sunfish, hitch, and Sacramento pike minnow (Table 21). Hitch were the most abundant fish with an average density of 3.8 fish/yd$^2$. The Sacramento pike minnow and the green sunfish both had a relative abundance of 0.2 fish/yd$^2$.

### Table 21. Species Caught at Each Station and Relative Abundance on Antelope Creek

| Species | Station Sampled | | | | | Fish/yd2 |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| Green sunfish | | X | | X | X | 0.2 |
| Hitch | X | X | X | X | X | 3.8 |
| Sacramento pike minnow | | | | X | X | 0.2 |

**Logan Creek.** Four stations were sampled on Logan Creek over two days in August 1998. Stations were located in and near the footprint of the proposed Colusa Reservoir. Streamflow was less than 1 cfs. Hitch were caught in stations 1 and 2. The average density of hitch on Logan Creek was 0.4 fish/yd$^2$.

**Ponds.** DFG biologist seined seven stock-watering ponds in the study area. The ponds seined do not dry up during the summer. Three game fish were found in the ponds, red-eared sunfish, bluegill, and largemouth bass. Redear sunfish were found in one pond, bluegill were found in abundance in two ponds, and largemouth bass were found in three ponds. No other fish were found in these ponds.

#### *Discussion*

Hitch were found in all the creeks in the Sites and Colusa Project area. Hitch were also present in the greatest numbers. Stone Corral Creek had the greatest diversity of fish throughout the year—eight species—including two species of introduced game fish, bluegill and green sunfish. However fish densities were lower, particularly for hitch in Stone Corral than in other creeks. Funks Creek, the next most diverse creek, had only five species of fish, including one introduced game fish, largemouth bass.

Most fish captured during seining were minnows, members of the Cyprinid family. California roach are the only fish present that are adapted to spending summers in the remaining pools of intermittent streams (Moyle 1976). Very few fish found while seining, including game fish, were above 5.9 inches in lengths, suggesting that juvenile fish only rear in these areas. Adult fish typically ascend seasonal creeks in the study area in winter and spawn there in early spring. Most adults migrate downstream after spawning.

No species of concern or threatened or endangered species were found in this study. The species caught during the study are common in California.

### Colusa Basin Drain Fish Studies

This section describes the fish resources of the Colusa Basin Drain. Colusa Basin Drain is a natural channel that historically transported water from west side tributaries such as Willow, Funks, Stone Corral, and Freshwater Creeks to the Sacramento River. It also carried overflowing floodwater from the Sacramento River. With the advent of agriculture in the Sacramento Valley, the Colusa Basin Drain was channelized and dredged to carry agricultural runoff in addition to natural flows.

Streamflow in the CBD peaks in winter months when storms swell the small streams that feed the CBD. Flow also reaches high levels in late summer when rice fields are drained into the CBD. Table 22 shows average monthly streamflow in CBD from 1976 to 1997. Daily and instantaneous flows in the CBD may be much higher.

The CBD provides little bank cover for fish; however, some instream cover is provided by large and small woody debris. Its banks are scoured by periodic high flows and roads often run along the dikes that contain the waters of the CBD. The bottom of the CBD is largely mud. Water in the CBD is turbid and warm in the summer, and turbid and cool during the winter. The proposed diversion from the CBD for Sites and Colusa Reservoirs will be east of the town of Maxwell along the CBD.

**Table 22. Average Monthly Streamflow (cfs) in the Colusa Basin Drain at the Highway 20 Crossing**

| Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | 237 | 249 | 160 | 185 | 177 | 371 | 312 | 879 | 239 | 434 | 926 | 904 |
| 1977 | 169 | 255 | 138 | 312 | 181 | 256 | 90 | 642 | 121 | 121 | 424 | 388 |
| 1978 | 116 | 272 | 254 | 3121 | 2133 | 1429 | 365 | 684 | 469 | 711 | 1056 | 1028 |
| 1979 | 201 | 312 | 113 | 689 | 940 | 407 | 328 | 802 | 424 | 803 | 1211 | 1029 |
| 1980 | 200 | 563 | 837 | 1874 | 2888 | 1305 | 326 | 1048 | 603 | 805 | 1307 | 1160 |
| 1981 | 275 | 328 | 359 | 1017 | 840 | 433 | 342 | 1039 | 446 | 1057 | 1464 | 1182 |
| 1982 | 284 | 877 | 1115 | 1939 | 472 | 383 | 682 | 743 | 908 | n.r. | 1393 | 1356 |
| 1983 | 467 | 778 | 1225 | 2331 | 3028 | 5304 | 990 | n.r. | n.r. | 907 | 1168 | 1198 |
| 1984 | 315 | 1302 | 3623 | 1523 | 493 | 265 | 547 | 1190 | 851 | 1310 | 1580 | 1041 |
| 1985 | 376 | 1160 | 683 | 285 | 170 | 196 | 409 | 1048 | 768 | 1237 | 1442 | 1442 |
| 1986 | 316 | 663 | 700 | 754 | 4214 | 1833 | 449 | 921 | 834 | 1052 | 1338 | 1338 |
| 1987 | 318 | 459 | 235 | 249 | 319 | 508 | 495 | 913 | 707 | 907 | 1175 | 1175 |
| 1988 | 341 | 668 | 462 | 1365 | 287 | 431 | 666 | 849 | 515 | 586 | 972 | 972 |
| 1989 | 345 | 617 | 354 | 342 | 212 | 404 | 438 | 572 | 587 | 800 | 995 | 995 |
| 1990 | 303 | 411 | 181 | 346 | 203 | n.r. | n.r. | 583 | 439 | 533 | 913 | 913 |
| 1991 | 247 | n.r. | n.r. | 153 | 217 | 916 | 423 | 477 | 353 | 371 | 535 | 535 |
| 1992 | 159 | 319 | 291 | 261 | 932 | 670 | 256 | 167 | 250 | 149 | 186 | 186 |
| 1993 | 116 | 267 | 347 | 2900 | 3049 | 762 | 322 | 279 | 290 | 201 | 489 | 489 |
| 1994 | 203 | 419 | 466 | 315 | 740 | 331 | 300 | 191 | 147 | 61 | 418 | 418 |
| 1995 | 155 | 565 | 549 | 6612 | 2020 | 3823 | 591 | 551 | 364 | 297 | 416 | 416 |
| 1996 | 255 | 368 | 749 | 972 | 2668 | 1092 | 493 | 771 | 472 | 249 | 660 | 660 |
| 1997 | 229 | 643 | 643 | 3698 | 1464 | 357 | 321 | 286 | 152 | 368 | 953 | 953 |
| **AVG** | **256** | **547** | **642** | **1420** | **1257** | **1023** | **435** | **697** | **473** | **617** | **956** | **956** |

### *Methodology*

Two fyke nets were placed in the CBD, one upstream of the proposed diversion point and one downstream. The first net was put in at the confluence of Willow Creek and the CBD. The second was placed just south of Hwy 20 on the CBD. The fyke nets have a 3 foot-by-5 foot opening, and a 12-foot funnel. Galvanized pipe frames support the net opening. Nets of variable size stretched mesh were used: 1 inch, 0.25 inch, and 0.125 inch. The largest sized mesh was at the front of the funnel, and smallest size mesh was at the back. The narrow end of each net is connected to a wooden live box, 2.5 feet by 1.5 feet by 1.6 feet. Holes in the side and back of the box were covered by screening with a mesh size of 0.19 inch. The fyke nets were held in fishing position by rope bridles attached to ropes secured to metal fencing posts and/or a tree or utility pole on the bank. The nets were installed on January 19, 1999, and checked daily Monday through Friday. The nets were removed from the canal during periods of high water. Captured specimens were identified and measured for fork length to the nearest millimeter for the first 20 of each species, after which species were only tallied. Representatives of each species were either photographed or preserved for future positive identification.

Periodic seining using the medium sized—29-feet long, 6-feet high, one-quarter inch mesh; seine, and hook and line sampling were also used to sample the fish of the Colusa Basin Drain at the upper net location. Two hoop nets and a gill net were also placed at the upper fyke net location February 1, 1999. The hoop nets were installed upstream of the fyke net. The hoop nets were 7 feet long with six hoops 2 feet in diameter set 1 foot apart, with a net mesh size of 1 inch. They had two finger funnels each. These nets were secured to a wooden bridge and placed on either side of the channel. The hoop nets were baited with fish carcasses. The gill net spanned the entire distance of the drain downstream of the fyke net. These nets were removed March 10, 1999. One hoop was replaced at the bridge on March 19, 1999.

### Results

A total of 9 game fish and 17 nongame fish were caught in the CBD (Tables 23 and 24). The warmouth (*Lepomis gulosus*) and the largemouth bass (*Micropterus salmoides)*, which were caught by U.S. Geological Survey in 1996, were not observed in this recent survey.

**Table 23. Resident Game Fish of the Colusa Basin Drain**

| Common Name | Scientific Name |
|---|---|
| Black bullhead | *Ictalurus melas* |
| Black crappie | *Pomoxis nigromaculatus* |
| Bluegill | *Lepomis macrochirus* |
| Brown bullhead | *Ictalurus nebulosus* |
| Channel catfish | *Ictalurus punctatus* |
| Chinook salmon | *Oncorhynchus tschawtscha* |
| Green sunfish | *Lepomis cyanellus* |
| White catfish | *Ictalurus catus* |
| White crappie | *Pomoxis annularis* |

**Table 24. Resident Nongame Fish of the Colusa Basin Drain**

| Common Name | Scientific Name |
|---|---|
| Big scale logperch | *Percina macrolepida* |
| California roach | *Hesperoleucus symmetricus* |
| Carp | *Cyprinus carpio* |
| Flathead minnow | *Pimephales promelas* |
| Goldfish | *Carassius auratus* |
| Hitch | *Lavinia exilicauda* |
| Inland silversides | *Menidia beryllina* |
| Mosquitofish | *Gambusia affinis* |
| Pacific lamprey | *Lampetra tridentata* |
| Sacramento blackfish | *Orthodon microlepidotus* |
| Sacramento pike minnow | *Ptycholcheilus grandis* |
| Sacramento splittail | *Pogonichthys macrolepidotus* |
| Sacramento sucker | *Catostomus occidentalis* |
| Sculpin sp. | *Cottus sp.* |
| Threadfin shad | *Dorosoma pretenense* |
| Tui chub | *Gila bicolor* |
| Tule perch | *Hysterocarpus traski* |

One late fall-run chinook salmon carcass was found in the upper fyke net. In October 1998, fall-run chinook salmon were observed migrating up the CBD at the Delevan Wildlife Area. DWR biologists saw spring-run chinook salmon in Walker Creek, a tributary to Willow Creek, in spring 1998. Four splittail were caught in the fyke net located just below Highway 20 in July and August, 1999. All four were young-of-the-year splittail. They averaged 1.4 inches, and ranged from 0.9 to 2.0 inches fork length.

The greatest diversity of fish was caught in the upper fyke net, at the confluence of Willow Creek and the CBD. The gill net and the hoop net caught only a few different species of fish (Table 25). Various tadpoles, mostly bullfrog, (*Rana catesbieana)*, were by far the most numerous animal caught by any method, but particularly the fyke nets. Channel catfish were the most frequently caught fish, the majority of which were juveniles. Mostly juvenile fish were caught in the nets. Rarely did fish exceed 5.9 inches, with the exception of the goldfish. Adult channel catfish, up to 17.7 inches, were caught by hook and line. Carp, up to 20 inches, were also caught with hook and line.

Seining was the most efficient form of sampling in the Colusa Basin Drain, with a catch per hour effort ratio of 21.8. The hoop net was the least efficient method of capture, with a catch per hour effort ratio of 0.01 (Table 26).

**Table 25. Number of Species Captured at Each Trapping Station**

| Species | Gill net | Hoop net | Seine | Hook & line | Fyke nets | Total |
|---|---|---|---|---|---|---|
| Big scale logperch | | | 2 | | 3 | 5 |
| Black bullhead | | | | 1 | 7 | 8 |
| Black crappie | | | 1 | | 2 | 3 |
| Bluegill | 1 | 1 | 10 | 1 | 23 | 36 |
| Brown bullhead | | | | 20 | 18 | 38 |
| California roach | | | 15 | | 1 | 16 |
| Carp | | | | 69 | 2 | 71 |
| Channel catfish | 2 | 1 | | 28 | 195 | 226 |
| Chinook salmon | | | | | 1 | 1 |
| Flathead minnow | | | | | 1 | 1 |
| Goldfish | | | | 16 | 15 | 31 |
| Green sunfish | | | 8 | | 48 | 56 |
| Hitch | | | 40 | 1 | 52 | 93 |
| Inland silversides | | | 1 | | 4 | 5 |
| Mosquitofish | | | 3 | | 6 | 9 |
| Pacific lamprey | | | | | 7 | 7 |
| Sacramento blackfish | | | 96 | | 23 | 119 |
| Sacramento pike minnow | 1 | | | | 2 | 3 |
| Sacramento splittail | | | | | 4 | 4 |
| Sacramento sucker | 1 | 1 | 1 | | 3 | 6 |
| Sculpin sp. | | | 1 | | 1 | 2 |
| Threadfin shad | | | | | 6 | 6 |
| Tui chub | | | | | | 1 |
| Tule perch | | 1 | | | 4 | 5 |
| White catfish | | | | 7 | 18 | 25 |
| White crappie | | | | | 3 | 3 |

**Table 26. Catch Per Hour Effort for Each Trapping Method**

| Trapping Method | Total Effort Hours | Catch per Hour Effort |
|---|---|---|
| Gill net | 336 | 0.02 |
| Hoop net | 576 | 0.01 |
| Seine | 8 | 21.8 |
| Hook and line | 41 | 3.5 |
| Fyke net | 2500 | 0.25 |

### *Discussion*

Four Sacramento splittail were caught. This species were federally listed as threatened in March 1999. Numerous fall-run chinook salmon were observed in the CBD and the carcass of one late fall-run chinook salmon was found. Fall-run chinook salmon and late fall-run chinook salmon are federally proposed for listing as threatened. Spring-run chinook salmon were observed in Walker Creek, a tributary to the CBD. They were listed as a State of California Threatened Species in February 1999. They are also proposed for listing as a federally endangered species.

Willow and Freshwater Creeks are tributaries to the CBD. They flow all year in their upper reaches and have deep pools suitable for steelhead juveniles. Steelhead smolts migrate during high stream flows in the winter. The nets set up in the CBD might not have caught them because larger fish and migrating yearling steelhead avoid fixed fyke nets. Willow and Freshwater Creeks should be sampled during summer to detect rearing steelhead fry.

## Sites and Colusa Project Habitat Types

This section summarizes studies of habitat types along the streams in the proposed Sites and Colusa Project areas conducted in 1998 and 1999.

### *Methodology*

An initial channel type survey, including an evaluation of the overall channel morphology, was made at the beginning of the study of each creek. Channel type was subsequently determined when the overall character of the channel changed for over 20 bankfull widths.

Channel type surveys began by first noting if the stream is a threaded or single channel. Then the bankfull width was measured at the prominent scour marks and sedimentation on the bank substrate with a 100-foot vinyl tape. Ten depths were taken at the study section to obtain the average bankfull depth. The substrate type was noted (Table 27).

**Table 27. Substrate Type and Size Used[1]**

| Substrate Type | Size in inches |
|---|---|
| Boulder | > 10 |
| Large Cobble | 5-10 |
| Small Cobble | 2.5-5 |
| Gravel | 0.08-2.5 |
| Sand | <0.08 |

[1] Flosi et al. 1998

Habitat type evaluation on Funks Creek began at Golden Gate damsite on January 12, 1999, and proceeded upstream to a point just above the mouth of Grapevine Creek on February 25, 1999. After this point, Funks Creek no longer contained water. Habitat typing continued on Grapevine Creek from the confluence with Funks Creek on February 26, 1999, and concluded at the reservoir inundation line on April 28, 1999. Stone Corral Creek habitat typing began on February 10, 1999, and continued until the channel no longer contained water, just past the confluence of Antelope Creek. Habitat typing concluded for Stone Corral and began on Antelope Creek on February 23, 1999. Habitat typing concluded on Antelope Creek on April 22, 1999, at the reservoir inundation line.

Each habitat unit was described as a pool, flat water, or riffle. All data was recorded on a standardized habitat typing data sheet (Flosi et al. 1998). Side channels were evaluated separately only when they demonstrated a different habitat type due to the small nature of the creek bed and intermittent water flow. Once the habitat unit type was identified it was assigned a unit number. For each unit, a mean length (measured as the thalweg length), width, and depth were taken, as well a maximum depth. All measurements were made and recorded in feet and tenths of feet using standard engineering measuring tapes and stadia rods. For pools, the tail-crest depth, type of pool-tail substrate, and the percent the substrate is embedded were also evaluated.

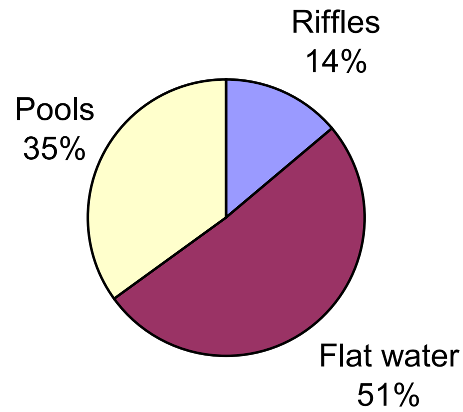
In addition to unit type data, the time surveying began, air and water temperature, date, and surveyors present were all recorded daily. Yellow flags were left at the end of the last habitat unit surveyed each day. The substrate type and percent exposed substrate was recorded. A shelter value for the unit was given based on the quantity and composition of the cover. The total percent cover for the habitat unit was recorded, then broken down into the percentages of the total that each cover element represented.

The bank composition was evaluated and dominant vegetation for right and left banks was recorded. Plant species and bank substrates were entered. The percent of the bank vegetated was evaluated up to bankfull width plus 20 feet. The percent and type, (deciduous or coniferous), of cover by tree canopy at midday was also evaluated. This was done for the entire part of each stream studied.

### *Results*

**Funks Creek.** Flat water constituted 51 percent of the total creek measured. The average flat water length on Funks Creek was 212 feet. Pools at 35 percent of the total length with an average length of 146 feet, were the second most dominant habitat type. Riffles constituted 14 percent of the creek, with an average unit length of 57 feet (Figure 4).

**Figure 4. Relative Occurrence of Habitat Types in Funks Creek**




Gravel was the most common substrate (Table 28). Small cobble substrate was the second most common substrate type, occurring at 28 percent of the units surveyed. Silt/clay type substrate was most commonly associated with the gravel substrate, either as the primary or secondary substrate. It also frequently occurred as a layer over bedrock or boulder substrates. Silt/clay was the dominant substrate in the lower reaches of Funks Creek, giving way to gravel as the dominant substrate in the upper reaches of the stream.

**Table 28. Summary of Substrates (%) by Habitat Type on Funks Creek**

| Habitat type | Silt/Clay | Sand | Gravel | Small cobble | Large cobble | Boulder | Bedrock |
|---|---|---|---|---|---|---|---|
| Riffle | 19 | 0 | 26 | 21 | 10 | 1 | 24 |
| Flat water | 11 | 1 | 33 | 21 | 5 | 8 | 21 |
| Pool | 6 | 1 | 41 | 43 | 5 | 2 | 2 |
| Average | 12 | 1 | 33 | 28 | 7 | 4 | 15 |

The bank composition was overwhelmingly silt/clay. Occasional areas of bedrock bank or cobble bank occurred; where roads passed through or near the creek, boulders dominated the bank. Greater variability of bank composition occurred in the lower reaches of the creek. Most bedrock banks occurred in major blocks where bedrock ridges rose through the valley floor.

Star thistle and grasses dominated both banks. The average percent bank covered by vegetation was 52 percent for the right bank and 53 percent for the left bank. Occasional cottonwoods, willows, oaks, and walnut trees punctuate the bank. Only 18 percent of the habitat units had some degree of canopy. The average canopy cover was 5 percent, or 26 percent when considering only those units that had any canopy cover at all. Trees were concentrated at Golden Gate, where habitat typing began on Funks Creek, and in the upper reaches of the creek.

The average of the total units covered by all cover combined was 27 percent. Aquatic vegetation was the prevalent type of cover, boulders were the most common large cover item. Aquatic vegetation and boulders each comprised an average of 25 percent of the total cover (Table 29). Large woody debris and root masses occurred relatively infrequently. Undercut banks occurred in 17 percent of the habitat units. Pools overall had a large degree and variety of cover, while flat water and riffles had less cover.

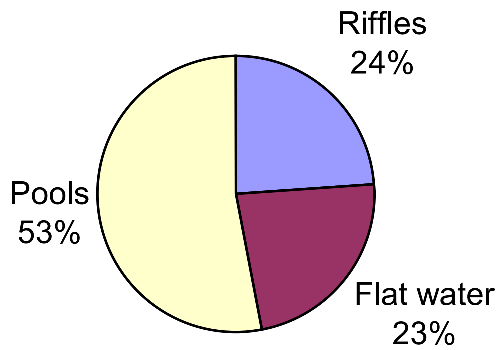
**Table 29. Summary of Habitat Cover in Funks Creek**

| | Percent of each habitat having cover | Percent of Cover Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Undercut banks | Small woody debris | Large woody debris | Root masses | Terrestrial vegetation | Aquatic vegetation | Bubble curtain | Boulders | Bedrock ledges |
| Riffles | 20 | - | - | 1 | - | 20 | 15 | 30 | 28 | 6 |
| Flat water | 38 | 34 | 1 | 1 | - | 1 | 27 | 10 | 25 | 1 |
| Pools | 24 | 18 | 3 | 1 | 1 | 1 | 34 | 2 | 21 | 19 |
| Average | 27 | 17 | 1 | 1 | - | 7 | 25 | 14 | 25 | 9 |

**Grapevine Creek.** Riffles made up 24 percent of the total creek measured (Figure 5). The average riffle length on Grapevine Creek was 72 feet. Flat water made up 23 percent of the total length with an average length of 143 feet, and was the least dominant habitat type. Pools made up just over half, 53 percent, of the total length of Grapevine Creek within the reservoir footprint.

Small cobble was the most common substrate in Grapevine Creek. Gravel was also common, occurring as the substrate in 30 percent of the habitat units. Large cobble was the dominant substrate in 13 percent of the units surveyed. Small cobble substrate was spread throughout the creek system; however, there were no distinct pockets of this or any other substrate.

**Figure 5. Relative Occurrence of Habitat Types in Grapevine Creek**




Thirty-two percent of the pools on Grapevine Creek were dominated by small cobble substrate. Gravel was dominant in 22 percent of these. Flat water was dominated by gravel and small cobbles (Table 30).

**Table 30. Summary of Substrates on Grapevine Creek**

| | Silt/Clay | Sand | Gravel | Small cobble | Large cobble | Boulder | Bedrock |
|---|---|---|---|---|---|---|---|
| Riffle | 5 | | 32 | 24 | 11 | 1 | 27 |
| Flat water | 12 | 1 | 35 | 41 | 7 | 2 | 2 |
| Pool | 6 | | 22 | 32 | 21 | 5 | 14 |
| Average | 8 | | 30 | 32 | 13 | 3 | 14 |

Bank composition was overwhelmingly silt/clay. Frequent patches of gravel/cobble banks occurred throughout the creek channel surveyed. Most bedrock banks occurred in major blocks where bedrock ridges rise through the valley floor.

Grasses and star thistle dominated both banks. The average percent bank covered by vegetation was 56 percent for the right bank and 54 percent for the left bank. Occasional oaks, willows, cottonwoods, walnuts, and gray pines punctuate the bank. Thirty-nine percent of the habitat units examined on Grapevine Creek had some degree of canopy—38 percent from deciduous trees and shrubs, and 1 percent from pines. The average canopy cover was 12 percent. Trees were more concentrated at the upstream end where Grapevine Creek starts to climb in elevation toward the edge of the reservoir footprint.

The average of the total unit covered by all cover combined was 29 percent. Aquatic vegetation was the most prevalent type of cover, occurring in 72 percent of the flat water units surveyed. Aquatic vegetation comprised an average 53 percent of the total unit cover (Table 31).

Pools had the largest mean total coverage at 32 percent. Aquatic vegetation comprised 46 percent of the cover in pools. Riffles had a mean total cover 28 percent, 40 percent of which was aquatic vegetation. Terrestrial vegetation, boulders, and bubble curtains also provided cover in riffles—14 percent, 17 percent, and 7 percent, respectively. Flat water averaged 26 percent total coverage, of this 72 percent of the cover was aquatic vegetation.

Aquatic vegetation was the most common large cover item, occurring in 53 percent of the units surveyed. Root masses were another large cover item that occurred with some frequency at 7 percent. Terrestrial vegetation occurred in 9 percent of the habitat units, and bedrock ledges in 4 percent of the units. Riffles and pools contained all of the major types of cover (Table 31).

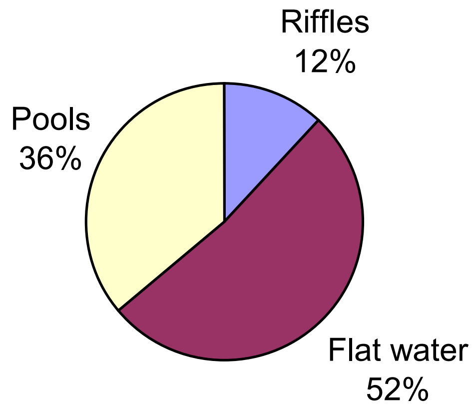
**Table 31. Summary of Habitat Cover in Grapevine Creek**

| | Percent of each habitat having cover | Percent of Cover Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Undercut banks | Small woody debris | Large woody debris | Root masses | Terrestrial vegetation | Aquatic vegetation | Bubble curtain | Boulders | Bedrock ledges |
| Riffles | 28 | 1 | 3 | 3 | 13 | 14 | 40 | 7 | 17 | 2 |
| Flat water | 26 | 5 | 3 | - | 4 | 8 | 72 | 4 | 4 | - |
| Pools | 32 | 7 | 3 | 12 | 4 | 4 | 46 | 4 | 9 | 11 |
| Average | 29 | 4 | 3 | 5 | 7 | 9 | 53 | 5 | 10 | 4 |

**Stone Corral Creek.** Flat water made up the majority of habitat type measured, comprising 52 percent of the total creek. The average flat water length on Stone Corral Creek was 213 feet. Pools, making up 36 percent of the total length and with an average length of 145 feet, were the second most dominant habitat type in terms of total footage. Riffles made up 12 percent of the creek's total length, with an average unit length of 48 feet (Figure 6).

Bedrock was the most common substrate, occurring as the primary substrate in 31 percent of the total units surveyed on Stone Corral Creek. Gravel substrate was the second most common substrate type, occurring in 24 percent of units surveyed. Silt/clay type substrate was commonly associated with bedrock or gravel, occurring as a layer over the other substrates. The lower reach of Stone Corral Creek was heavily dominated by bedrock, giving way to a more gravel base near the confluence with Antelope Creek. Silt/clay substrate is spread consistently throughout the creek system.

**Figure 6. Relative Occurrence of Habitat Types in Stone Corral Creek**




Thirty-three percent of pools had silt/clay as the dominant substrate (Table 32). Fifty-two percent of flat water had gravel as the dominant substrate. Riffles had 56 percent bedrock dominant and 17 percent silt/clay dominant substrate. The most common occurring pool tail substrate was bedrock.

**Table 32. Summary of Substrates on Stone Corral Creek**

| | Silt/Clay | Sand | Gravel | Small cobble | Large cobble | Boulder | Bedrock |
|---|---|---|---|---|---|---|---|
| Riffle | 17 | | 9 | 1 | | 17 | 56 |
| Flat water | 20 | | 52 | | 14 | 14 | |
| Pool | 33 | 5 | 12 | 2 | | 12 | 36 |
| Average | 23 | 2 | 24 | 1 | 5 | 14 | 31 |

The bank composition was overwhelmingly silt/clay. Occasional areas of bedrock bank or cobble bank occurred; where roads passed through or near the creek, boulders dominated the bank. Greater variability of bank composition then occurred in the lower reaches of the creek, where cobbled banks frequently occurred. Most bedrock banks occurred in major blocks where bedrock ridges rise through the valley floor.

Bank vegetation included grasses and star thistle, which dominated both banks. The average percent bank covered by vegetation was 62 percent for the right bank and 63 percent for the left bank. Occasional oaks, willows, cottonwoods, and walnut trees punctuate the bank. Only 11 percent of the habitat units surveyed had some degree of canopy. The average canopy cover was 4 percent, all deciduous trees and shrubs. Trees were more concentrated at the lower end where habitat typing began on Stone Corral Creek.

The average of the total unit covered by all cover types combined was 33 percent. Aquatic vegetation was the most prevalent type of cover, comprising an average of 56 percent of the total unit coverage.

Riffles had a mean total cover of 39 percent, 49 percent of which was aquatic vegetation. An average of 7 percent of the cover in riffles was comprised of boulders. Flat water averaged 34 percent total coverage, of this 61 percent of the cover was aquatic vegetation. Pools had a mean percent total coverage of 26 percent.

Aquatic vegetation was the most common large cover item, occurring in 56 percent of the units surveyed. Boulders and terrestrial vegetation were the next most common cover items at 16 percent and 12 percent, respectively. Undercut banks occurred in 6 percent of the habitat units, and bedrock ledges in 4 percent of the units. No habitat unit types contained all major types of cover (Table 33).

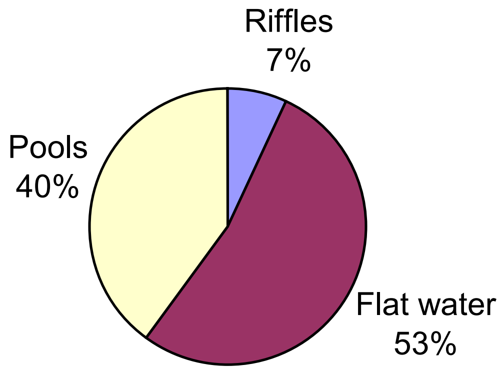
**Table 33. Summary of Habitat Cover in Stone Corral Creek**

| | Percent of each habitat having cover | Percent of Cover Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Undercut banks | Small woody debris | Large woody debris | Root masses | Terrestrial vegetation | Aquatic vegetation | Bubble curtain | Boulders | Bedrock ledges |
| Riffles | 39 | - | - | - | - | 25 | 49 | 18 | 7 | 2 |
| Flat water | 34 | 5 | 5 | - | - | 6 | 61 | - | 21 | 3 |
| Pools | 26 | 12 | - | - | 1 | 4 | 57 | - | 19 | 7 |
| Average | 33 | 6 | 2 | - | - | 12 | 56 | 6 | 16 | 4 |

**Antelope Creek.** Flat water made up the majority of the total footage measured, comprising 53 percent of the total creek measured. The average flat water length on Antelope Creek was 135 feet. Riffles made up 7 percent of the creek's total length, with an average unit length of 18 feet. Pools comprised 40 percent of the total length measured with an average length of 103 feet (Figure 7).

Silt/clay was the most common substrate, occurring as the primary substrate in 24 percent of Antelope Creek. Gravel and small cobble were also common substrates at 22 percent each. Silt/clay type substrate was commonly associated with gravel. Small cobble increased in frequency of occurrence in the upper reaches of Antelope Creek. Gravel substrate occurred uniformly throughout Antelope Creek (Table 34).

**Figure 7. Relative Occurrence of Habitat Types in Antelope Creek**




Silt/clay dominated the majority of pools. Twenty-nine percent of flat water units had silt/clay as the dominant substrate. Gravel and small cobbles at 23 percent and 22 percent respectively (Table 34) dominated riffles.

**Table 34. Summary of Substrates on Antelope Creek**

| | Silt/Clay | Sand | Gravel | Small cobble | Large cobble | Boulder | Bedrock |
|---|---|---|---|---|---|---|---|
| Riffle | 7 | 2 | 23 | 22 | 7 | 9 | 30 |
| Flat water | 29 | 3 | 25 | 27 | 7 | 2 | 7 |
| Pool | 35 | 3 | 18 | 16 | 10 | 14 | 4 |
| Average | 24 | 3 | 22 | 22 | 8 | 8 | 14 |

Bank composition was largely silt/clay. Occasional areas of bedrock bank or cobble bank occurred; where roads passed through or near the creek, boulders dominated the bank. The diversity of bank substrate increased, particularly gravel and cobble, in the upper reaches of Antelope Creek.

Grasses and star thistle dominated both banks. The average percent bank covered by vegetation was 80 percent for the right bank and 80 percent for the left bank. Oaks, willows, cottonwoods, walnut trees, and gray pines punctuate and occasionally line the bank. Forty-seven percent of the habitat units surveyed had some degree of canopy. The average canopy cover was 20 percent. Trees were more concentrated at the middle to upper reaches.

The average of the total stream habitat covered was 31 percent (Table 35). Aquatic vegetation was the most prevalent type of cover, occurring in 65 percent of the units surveyed. Aquatic vegetation comprised an average of 46 percent of the total unit cover.

Riffles had an average total cover of 34 percent, with 43 percent aquatic vegetation. Flat water averaged 30 percent total coverage—58 percent aquatic vegetation. The primary cover for all units was aquatic vegetation. Some units indicated a higher percentage of cover, but these occur on an infrequent basis in this creek.

Aquatic vegetation and terrestrial vegetation were the most common large cover items, occurring in 46 percent and 17 percent respectively of the units surveyed. Most units surveyed had small amounts of a variety of cover types.

**Table 35. Summary of Cover in Antelope Creek**

| Habitat type | Percent of each habitat having cover | Percent of each habitat type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Undercut banks | Small woody debris | Large woody debris | Root masses | Terrestrial vegetation | Aquatic vegetation | Bubble curtain | Boulders | Bedrock ledges |
| Riffles | 34 | 4 | 5 | 4 | 15 | 16 | 43 | 1 | 12 | - |
| Flat water | 30 | 4 | 3 | 1 | 8 | 19 | 58 | 1 | 5 | 1 |
| Pools | 29 | 18 | 7 | 1 | 7 | 15 | 37 | 1 | 13 | 1 |
| Average | 31 | 9 | 5 | 2 | 10 | 17 | 46 | 1 | 10 | 1 |

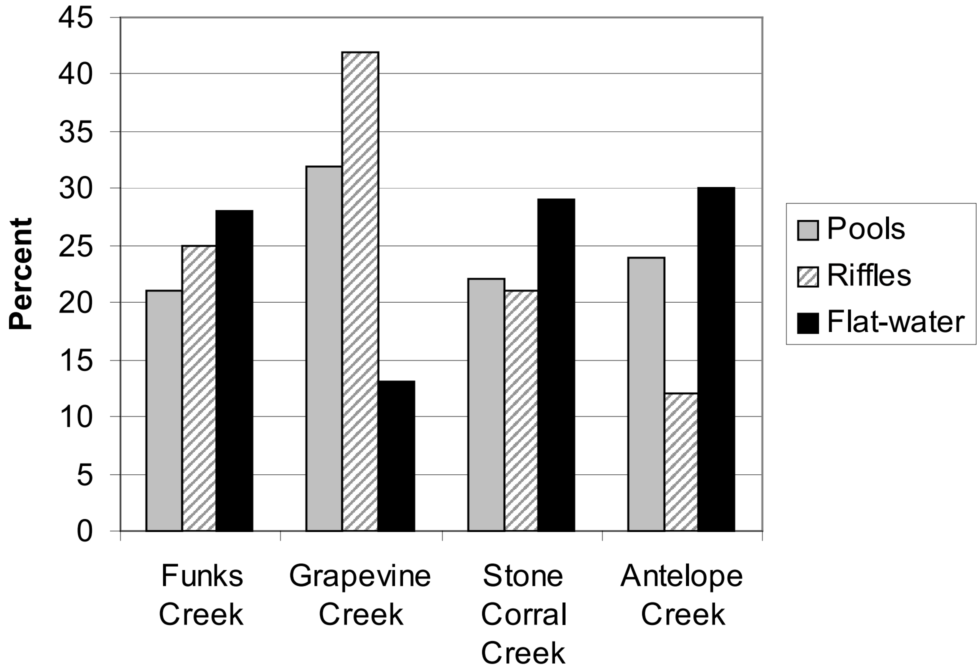
### *Discussion*

Habitat typing was done to quantify physical aquatic habitat to provide information for the NEPA and CEQA process. This quantification will determine habitat lost by inundation and will form the basis for mitigation. Grapevine Creek had more pools and riffles. Grapevine Creek also had the least amount of flat water. Funks Creek and Stone Corral Creek had similar amounts of pools, flat water, and riffles. Antelope Creek was more like Stone Corral and Funks Creeks than Grapevine Creek. Grapevine Creek flows from springs in hills to the west of Sites-Colusa and is steeper than the other creeks. That causes Grapevine Creek to have less flat water than the other creeks (Table 36 and Figure 8).

**Table 36. Comparison of Relative Occurrence of Pools, Flat Water, and Riffles in Creeks in the Sites-Colusa Project Area**

| | Funks | Grapevine | Stone Corral | Antelope |
|---|---|---|---|---|
| Pools | 21 | 32 | 22 | 24 |
| Riffles | 25 | 42 | 21 | 12 |
| Flat water | 28 | 13 | 29 | 30 |

**Figure 8. Relative Occurrence of Habitat Types in Sites-Colusa**




Stone Corral Creek had a high abundance of larger substrates. Grapevine Creek had the lowest percentage of silt. Grapevine Creek also had the most gravel, small cobble, and large cobble substrate. Fine materials are abundant in Stone Corral and Antelope Creeks. The relatively steep nature of Grapevine Creek washes fine materials away and leaves coarser materials behind (Table 37).

**Table 37. Summary of Substrates (%) by Habitat Type on Creeks in the Sites-Colusa Study Area**

| Creek | Habitat type | | | | | | |
|---|---|---|---|---|---|---|---|
| | Silt/Clay | Sand | Gravel | Small cobble | Large cobble | Boulder | Bedrock |
| Funks | 12 | 3 | 32 | 28 | 7 | 3 | 15 |
| Grapevine | 8 | 1 | 30 | 32 | 13 | 3 | 13 |
| Stone Corral | 23 | 2 | 24 | 1 | 5 | 14 | 31 |
| Antelope | 24 | 3 | 22 | 22 | 8 | 8 | 13 |

The occurrence of cover types followed the same trends for all four creeks surveyed. Aquatic vegetation was the dominant cover type in each creek. Stone Corral Creek showed a higher percent occurrence of boulders—nearly twice as many as Antelope Creek and nearly five times as many as Funks and Grapevine Creeks.

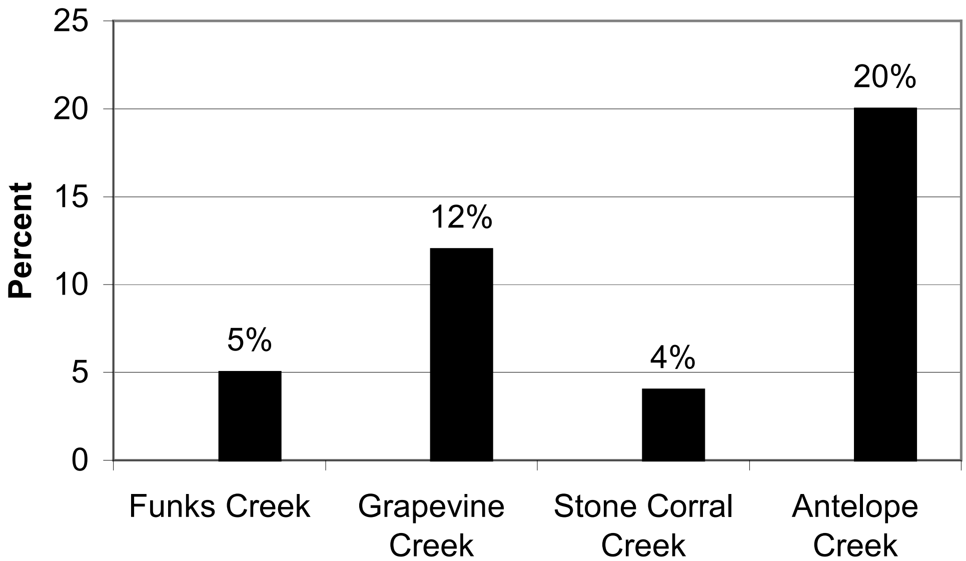
Bubble curtains were more common in Funks Creek. Antelope Creek had more cover provided by root masses than the other creeks (Table 38).

**Table 38. Summary of Cover (percent of each habitat type) on Creeks in the Sites-Colusa Study Area**

| Creek | Percent of each habitat having cover | Percent of Habitat Cover | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Undercut banks | Small woody debris | Large woody debris | Root masses | Terrestrial vegetation | Aquatic vegetation | Bubble curtain | Boulders | Bedrock ledges |
| Funks | 27 | 17 | 1 | 1 | 1 | 7 | 25 | 14 | 25 | 9 |
| Grapevine | 29 | 4 | 3 | 4 | 7 | 10 | 53 | 6 | 10 | 4 |
| Stone Corral | 33 | 6 | 1 | - | 1 | 10 | 54 | 6 | 16 | 4 |
| Antelope | 31 | 9 | 5 | 2 | 10 | 17 | 46 | 1 | 9 | 1 |

The pools of all four creeks had similar degrees of cover for all habitats, which were spread very closely to 30 percent coverage. Notable spikes in percent unit covered occurred in unit types that have a very low frequency of occurrence. Grapevine and Antelope Creeks show an increase in the occurrence of canopy (Figure 9).

**Figure 9. Percent of Canopy Over Creeks Measured at Sites-Colusa Project Area**




Creek flows varied widely with lack of rainfall, forcing activity to be suspended on some areas of Funks, Stone Corral, and Antelope Creeks until further rain revived the stream flow. This suggests that streams on the floor of the Antelope Valley are intermittent and only flow during the summers of particularly wet years. Antelope Creek, and particularly Grapevine Creek, could flow year round. The majority of the fish found in this area were juvenile fish that would probably use the creeks only as rearing areas. The high concentration of sediments and aquatic vegetation would also raise the biological oxygen demand in the creeks during the summer months in any remaining deeper pools, making them uninhabitable to most fish, with the exception of the California roach, *Lavinia exilicauda* (Moyle 1976).

Both Grapevine and Antelope Creeks are the continuations of the main creek channels of those systems. Both creeks also show an increase in canopy and larger substrates. When viewed as just two creek systems, Funks-Grapevine and Stone Corral-Antelope both show a trend toward more canopy and larger substrates. The increased canopy and decreased sedimentation in the upper reaches of Antelope Creek and Grapevine Creek may provide sufficient cooling factors for year-long fish inhabitants. Eight-to-10 inch largemouth bass, *Micropterus salmoides*, were seen in the upper reaches of Grapevine Creek, which suggests a year-round flow capable of supporting larger fish. The larger substrate size also provides cover for the minnow fry that occupy the creeks in the spring.

Very little riparian vegetation, such as rushes, essential cover for aquatic amphibians and reptiles, exists on the banks of any of the creeks in the Sites-Colusa Project area, with the exceptions of the upper reaches of Antelope and Grapevine Creeks.

## Summary of Fish Studies for Proposed Projects

Thomes Creek has runs of fall-run, late fall-run, and limited numbers of spring-run chinook salmon. Steelhead also spawn in Thomes Creek. Large runs of Sacramento suckers and Sacramento pike minnows migrate up Thomes Creek. Fall-run salmon, Sacramento suckers, and Sacramento pike minnow also migrate up Stony Creek. Cottonwood Creek has larger runs of fall-run, late fall-run, and spring-run chinook salmon. Cottonwood Creek has a run of steelhead, as well as annual migrations of Sacramento suckers and Sacramento pike minnows. Stone Corral Creek and Funks Creek have no established runs of chinook salmon but have small runs of Sacramento suckers and Sacramento pike minnows.

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who drafted many chapters of this progress report and conducted many of the studies that form its core.

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North of the Delta
Offstream Storage Investigation

# Progress Report

## Appendix D: Fish Survey Summary

September 2000

Integrated
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North of the Delta
Offstream Storage Investigation

# Progress Report

## Appendix D: Fish Survey Summary

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**September 2000**

Integrated
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CALFED
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## Tables

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# Fish Survey Summary

## Introduction

In late 1997, the Department of Water Resources began a two-year reconnaissance level study of North of the Delta Offstream Storage authorized by Proposition 204—the Safe, Clean, Reliable Water Supply Act approved by voters in 1996. In early 1999, CALFED consolidated all storage investigations under a comprehensive program called Integrated Storage Investigations. The North of the Delta Offstream Storage Investigation was incorporated into one of seven ISI program elements.

The North of the Delta Offstream Storage Investigation continues engineering, economic, and environmental impact analyses to determine the feasibility of four north of the Delta storage projects. The four potential alternatives are Sites Reservoir, Colusa Project, Thomes-Newville Project, and Red Bank Project (Figure 1). Phase I, currently underway, includes preliminary field surveys of environmental resources and extensive field surveys of cultural resources, geological, seismic and foundation studies, and an engineering feasibility evaluation. Phase II will start when CALFED's Record of Decision and Certification for the Programmatic EIR/EIS is completed and if north of Delta offstream storage is consistent with CALFED's preferred program alternative. Phase II will include completion of necessary fish and wildlife surveys, evaluations of potential mitigation sites, preparation of project-specific environmental documentation, final project feasibility reports, and the acquisition of permits necessary for implementation.

Under Phase I, the Department of Fish and Game conducted studies of fish and wildlife resources in each project area. This appendix summarizes studies of fish in the tributaries that flow through each of the four proposed project areas. The information gathered will be used to describe impacts on fish resources during the planning process. Fishery studies conducted for the Sacramento River will be summarized in a separate report.

### Contract with DFG

DFG initiated fish studies in 1997. Studies were conducted to develop data adequate to meet the needs of the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and DFG consultations as required by endangered species legislation. Past studies were also reviewed and evaluated as part of this effort.

### Report Organization and Content

Results and discussions of findings in past fishery studies and recently conducted surveys of fishery resources in the four proposed project areas are included in this appendix. The general procedure for commonly used fish surveys are outlined, with specific sampling data and results discussed in respective sections for each proposed project area.

## Methodology

At the proposed project sites, fish surveys were conducted by diving, seining, fyke netting, and/or electrofishing. These methods were used to collect data on occurrence and relative abundance of species of fish. This section discusses general procedures for these methods. Details of surveys and results for each site are discussed in the respective sections.

### Diving

Fish were observed in deep pools by divers wearing faceplates. Fish species were identified and numbers of each species observed were recorded. Diving was used as a sampling technique when pools were too big or deep for other sampling methods.

### Seining

A seine is used to collect fish for sampling data. Three different seines varying in size were used depending on the size of the pool. The largest seine was 60 feet long, 5 feet high, with a mesh size of one-quarter inch and a 7-foot-by -7-foot pocket. A medium sized seine was 29 feet long, 6 feet high, with a mesh size of one-quarter inch and a pocket size of 7 feet by 5 feet. The third seine, used only for small pools and ponds, was 12 feet long, 4 feet high, with a mesh size of one-quarter inch and a 7-foot-by-5-foot pocket. A seine was brought around from one edge of the pool to the other. To prevent fish from escaping, a barrier net was stretched across the creek upstream and downstream from the pool to be seined. Captured specimens were stored in a bucket of water until they could be examined. Specimens were identified and the first 20 of each species were measured for fork length to the nearest millimeter and then released downstream. The seine was pulled a total of three times at each site. Representative specimens were either preserved or photographed for positive identification.

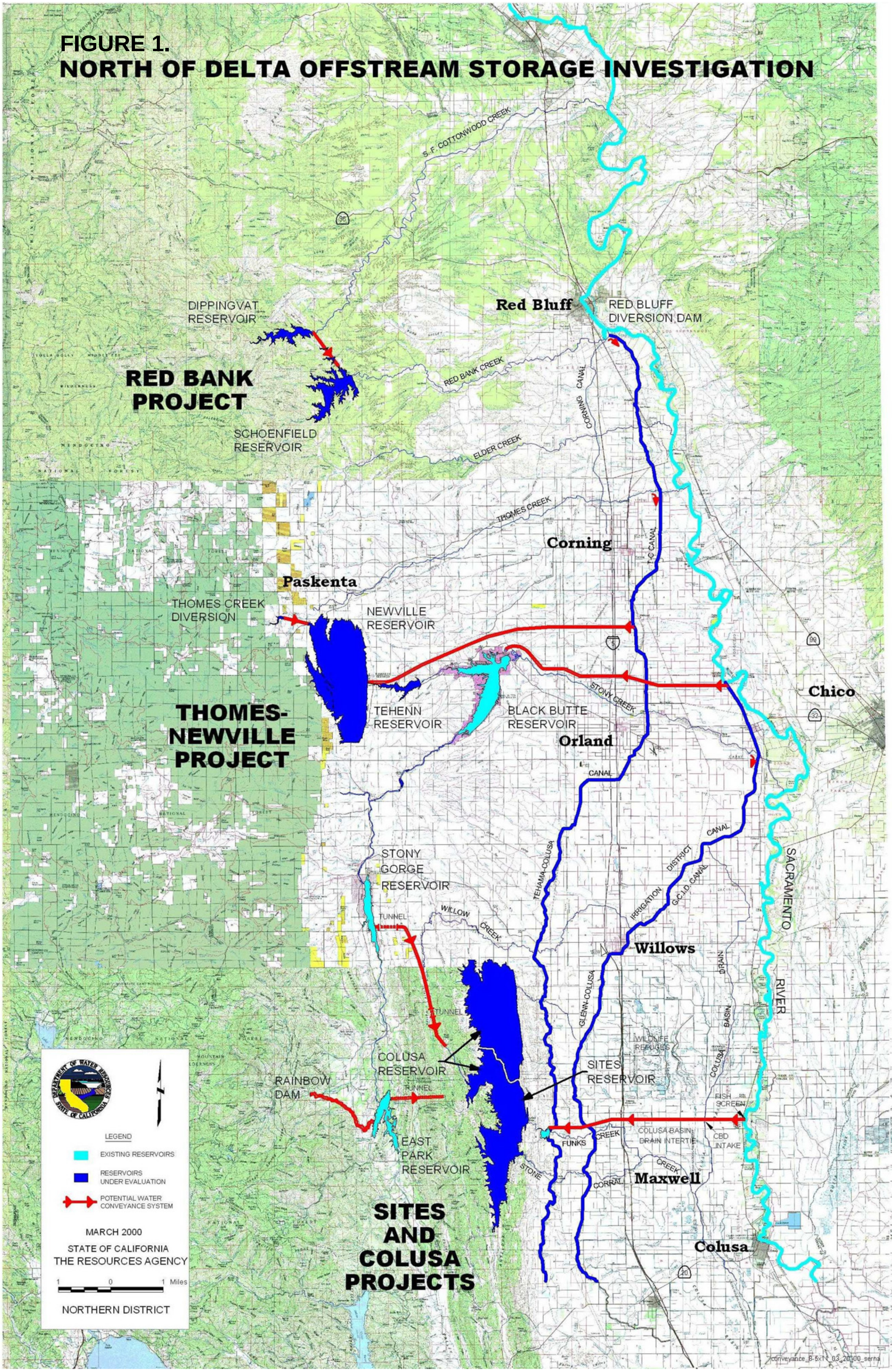
FIGURE 1.
NORTH OF DELTA OFFSTREAM STORAGE INVESTIGATION
S.F. COTTONWOOD CREEK
DIPPINGVAT RESERVOIR
RED BANK PROJECT
SCHOENFIELD RESERVOIR
RED BANK CREEK
ELDER CREEK
Red Bluff
RED BLUFF DIVERSION DAM
CORNING CANAL
THOMES CREEK
Corning
T-C CANAL
Paskenta
THOMES CREEK DIVERSION
NEWVILLE RESERVOIR
THOMES-NEWVILLE PROJECT
TEHENN RESERVOIR
BLACK BUTTE RESERVOIR
STONY CREEK
Orland
Chico
CANAL
STONY GORGE RESERVOIR
TUNNEL
WILLOW CREEK
TEHAMA-COLUSA
IRRIGATION DISTRICT CANAL
G-C.I.D. CANAL
SACRAMENTO RIVER
Willows
GLENN-COLUSA
DRAIN
COLUSA BASIN
WILDLIFE REFUGES
COLUSA RESERVOIR
RAINBOW DAM
SITES RESERVOIR
FISH SCREEN
EAST PARK RESERVOIR
FUNKS CREEK
COLUSA BASIN DRAIN INTERTIE
CBD INTAKE
STONE
CORRAL CREEK
Maxwell
Colusa
SITES AND COLUSA PROJECTS
LEGEND
EXISTING RESERVOIRS
RESERVOIRS UNDER EVALUATION
POTENTIAL WATER CONVEYANCE SYSTEM
MARCH 2000
STATE OF CALIFORNIA
THE RESOURCES AGENCY
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### Fyke Nets

Fish captured in fyke nets were measured for fork length to the nearest millimeter and weighed by water displacement to the nearest gram. No estimates of abundance were done for fish caught in fyke nets. Therefore, these fish were not included in the relative abundance tables.

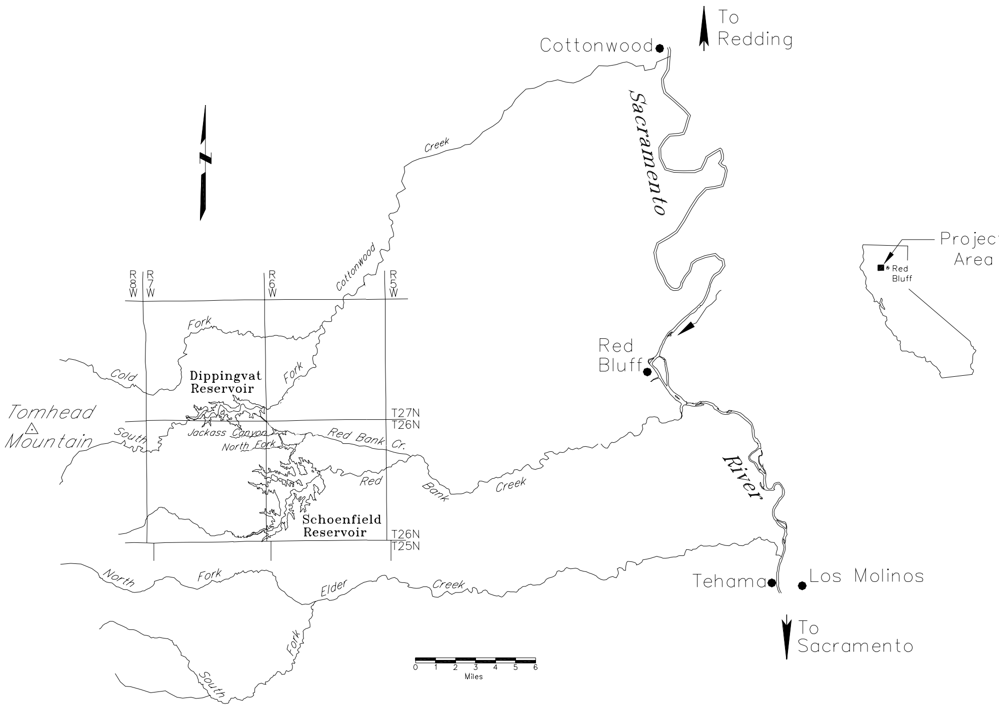
### Electrofishing

Electrofishing was done with a Smith-Root Type VII electroshocker. Sections of creek varying from 33 to 138 feet were netted off, upstream and downstream. With a backpack electroshocker, DFG biologists waded into the stream starting from the upstream net and moved downstream. The anode of the electrofisher was inserted into likely fish habitat. The stunned fish were then collected into buckets, measured for fork length to the nearest millimeter for the first 20 of each species, and then a plus count was taken. Fish were weighed using water displacement to the nearest gram. The surface area of each station was calculated in square feet and then converted to square millimeters for fish density analysis. The resulting relative abundance was converted to and reported in fish per square yard.

## Red Bank Project Fish Studies

This section describes the results of current and past fish studies conducted on Red Bank, South Fork Cottonwood, and Cottonwood Creeks, the major tributaries of the Red Bank Project area (Figure 2). Past studies date to 1969 and contain the reconnaissance-level fish and wildlife evaluation of Sacramento Valley alternative west side conveyance routes prepared by DFG (Smith and Van Woert 1969). Other studies reviewed include reports prepared by DFG and DWR in 1972, 1975, 1985, and 1987 (Haley and Van Woert 1972, Bill et al. 1975, Brown et al. 1985, Smith 1987).

## Figure 2. Cottonwood Creek System and the Red Bank Project




### Red Bank Creek Fish Resources

DFG Biologists sampled fish in Red Bank Creek within the footprint of the Schoenfield Reservoir in 1998. Data were collected at 28 stations. In summer 1998, seining was done at 16 stations dispersed on Red Bank Creek and its tributaries, Dry and Grizzly Creeks. Twelve stations were sampled on Red Bank Creek by electrofishing in October and November 1998.

#### *Nongame Fish*

Four species of nongame fish were observed (Table 1). The most common species of nongame fish found were California roach (0.588 fish/$yd^2$) and Sacramento pike minnow (0.158 fish/$yd^2$) (Table 2).

#### *Resident Game Fish*

In 1998, DFG biologists observed four species of resident game fish in Red Bank Creek (Table 3). The most common resident game fish were largemouth bass (0.009 fish/$yd^2$) and bluegill (0.001 fish/$yd^2$) (Table 4).

#### *Steelhead*

Also in 1998, DFG biologists found juvenile steelhead in the footprint of the proposed Schoenfield Reservoir in Red Bank by electrofishing and estimated density to be 0.002 fish/$yd^2$. Steelhead were found in two of 28 stations sampled.

## Table 1. Nongame Fish Observed in the Red Bank and Cottonwood Creeks

| Common Name | Scientific Name | Cottonwood Creek (1976) | Red Bank Creek (1998) |
|---|---|---|---|
| California roach | *Hesperoleucus symmetricus* | X | X |
| Carp | *Cyprinus carpio* | X | |
| Golden shiner | *Notemigonus crysoleucas* | X | |
| Hardhead | *Mylopharodon conocephalus* | X | |
| Hitch | *Lavinia exilicauda* | X | |
| Mosquitofish | *Gambusia affinis* | X | |
| Pacific lamprey | *Lampetra tridentata* | X | X |
| Prickly sculpin | *Cottus asper* | X | |
| Sacramento pike minnow | *Ptychocheilus grandis* | X | X |
| Sacramento sucker | *Catostomus occidentalis* | X | X |
| Speckled dace | *Rhinichthys osculus* | X | |
| Threespine stickleback | *Gasterosteus aculeatus* | X | |
| Tule perch | *Hysterocarpus traski* | X | |

## Table 2. Relative Abundance of Nongame Fish (Fish/Yd$^2$) Caught in Lower Cottonwood Creek, 1976, and in Red Bank Creek, 1998

| Species | Cottonwood Creek (1976) | Red Bank Creek (1998) |
|---|---|---|
| California roach | 0.003 | 0.588 |
| Carp | 0.003 | |
| Hardhead | 0.022 | |
| Sacramento pike minnow | 0.015 | 0.158 |
| Sacramento sucker | 0.006 | 0.091 |

## Table 3. Game Fish Observed in Cottonwood Creek, 1976, and in Red Bank Creek, 1998

| Common Name | Scientific Name | Cottonwood Creek (1976) | Red Bank Creek (1998) |
|---|---|---|---|
| Black bullhead | *Ictalurus melas* | X | |
| Bluegill | *Lepomis macrochirus* | X | X |
| Brown bullhead | *Ictalurus nebulosus* | X | |
| Brown trout | *Salmo trutta* | X | |
| Chinook salmon | *Onchorhynchus tshawytscha* | X | |
| Green sunfish | *Lepomis cyanellus* | X | X |
| Largemouth bass | *Micropterus salmoides* | X | X |
| Smallmouth bass | *Micropterus dolomieui* | X | |
| Steelhead | *Onchorhynchys mykiss* | X | X |
| White catfish | *Ictalurus catus* | X | |

**Table 4. Relative Abundance of Resident Game Fish (Fish/ Yd$^2$) Caught in Lower Cottonwood Creek and in Red Bank Creek**

| Species | Cottonwood Creek (1976) | Red Bank Creek (1998) |
|---|---|---|
| Bluegill | 0.022 | 0.001 |
| Brown bullhead | 0.006 | |
| Green sunfish | 0.015 | 0.001 |
| Largemouth bass | 0.003 | 0.009 |
| Smallmouth bass | 0.003 | |

### Cottonwood Creek Fish Resources

DFG biologists surveyed Cottonwood Creek from the confluence of the north fork to the mouth of Cottonwood Creek in 1976 (Richardson et al. 1978). Observations were made by diving, seining, fyke netting, and electrofishing. Abundance estimates were made for fish caught by electrofishing. Fish caught in fyke nets or observed by divers were not included in the relative abundance tables, because no estimates of abundance were done for these fish.

#### *Nongame Fish*

Thirteen species of nongame fish were observed (Table 1). The most common species of resident nongame fish found were hardhead (0.022 fish/yd$^2$) and Sacramento pike minnows (0.015 fish/yd$^2$) (Table 2). Some Sacramento pike minnows and Sacramento suckers also migrate to the Sacramento-San Joaquin estuary to rear and return to Cottonwood Creek as adults to spawn (Richardson et al. 1978). Life history information is valuable in planning instream flow studies, HEP evaluations, and determining project impacts.

#### *Resident Game Fish*

Ten species of resident game fish were observed in the Cottonwood Creek system in 1976 (Richardson et al. 1978) (Table 3). The most common resident game fish were bluegill (0.022 fish/yd$^2$) and green sunfish (0.015 fish/yd$^2$) (Table 4). Green sunfish and bluegill were common in the lower reaches surveyed (Richardson et al. 1978).

#### *Steelhead*

DFG biologists found juvenile steelhead in South Fork Cottonwood Creek in the Yolla Bolly Wilderness in the summer of 1976. No estimates of numbers of juvenile steelhead were made. The Yolla Bolly Wilderness is well above the site of the proposed Dippingvat Dam. Adult steelhead were seined from the mouth of Cottonwood Creek in November 1976 (Brown, et al., 1985). DFG estimates that Cottonwood Creek supports an average annual migration of 1,000 steelhead based on the best estimates of biologists who were most familiar with Cottonwood Creek (DFG 1966).

#### *Chinook Salmon*

**Fall Run.** Fall-run chinook salmon ascend Cottonwood Creek and spawn in late October through November (Richardson et al. 1978). They spawn in

Cottonwood Creek from the mouth to the confluence of North Fork Cottonwood Creek. About 53 percent of fall-run chinook salmon spawn from the mouth of Cottonwood Creek to the Interstate-5 highway bridge, 23 percent spawn from the Interstate-5 highway bridge to the confluence of Cottonwood Creek and South Fork Cottonwood Creek, and 24 percent spawn in Cottonwood Creek between the confluence of the south and north forks. Their young begin migrating after they incubate in January (Richardson 1978). They migrate downstream from January through May. DFG estimates that an average of 3,600 fall-run chinook salmon spawn in Cottonwood Creek (Table 5) (Elwell 1962; Fry 1961; Fry and Petrovich 1970; Hoopaugh 1978; Hoopaugh and Knudson 1979; Kano et al. 1996; Kano 1998a, 1998b; Knutson 1980; Mahoney 1962; Menchen 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970; Puckett et al. 1979; Reavis 1983, 1984, 1986).

**Table 5. Estimates of Chinook Salmon Spawning in the Cottonwood Creek System, 1952-98 (DFG Spawning Stock Reports)**

| Year | Fall Run | Spring Run | | |
|---|---|---|---|---|
| | | Beegum Gulch | North Fork | South Fork |
| 1952 | - | - | - | - |
| 1953 | 3,000 | - | - | - |
| 1954 | 1,000 | - | - | - |
| 1955 | 800 | - | - | - |
| 1956 | 660 | - | - | - |
| 1957 | 358 | - | - | - |
| 1958 | 600 | - | - | - |
| 1959 | 3,300 | - | - | - |
| 1960 | 350 | - | - | - |
| 1961 | 1,500 | - | - | - |
| 1962 | 6,000 | - | - | 0 |
| 1963 | 3,500 | - | - | - |
| 1964 | 3,450 | - | - | - |
| 1965 | 900 | - | - | - |
| 1966 | 2,900 | - | - | - |
| 1967 | 600 | - | - | - |
| 1968 | 8,540 | - | - | - |
| 1969 | 4,967 | - | - | - |
| 1970 | - | - | - | - |
| 1971 | - | - | - | - |
| 1972 | - | - | - | 0 |
| 1973 | - | 0 | - | - |
| 1974 | - | 3 | - | - |
| 1975 | - | 3 | - | 1 |
| 1976 | 2,427 | - | - | - |
| 1977 | 1,512 | - | - | - |
| 1978 | 1,120 | - | - | 0 |
| 1979 | - | - | - | - |
| 1980 | - | - | - | - |
| 1981 | 3,356 | - | - | - |
| 1982 | 700 | 0 | - | - |
| 1983 | 1,000 | - | - | - |
| 1984 | 500 | - | - | - |
| 1985 | - | - | - | - |
| 1986 | - | - | - | - |
| 1987 | - | - | - | - |
| 1988 | - | - | - | - |
| 1989 | - | 0 | - | - |
| 1990 | - | - | - | - |

**Table 5. Estimates of Chinook Salmon Spawning in the Cottonwood Creek System, 1952-98 (DFG Spawning Stock Reports) continued**

| Year | Fall Run | Spring Run | | |
|---|---|---|---|---|
| | | Beegum Gulch | North Fork | South Fork |
| 1991 | 676 | - | - | - |
| 1992 | 1,585 | - | - | - |
| 1993 | - | 1 | - | - |
| 1994 | - | - | - | - |
| 1995 | - | 8 | - | - |
| 1996 | - | 6 | - | - |
| 1997 | - | - | - | - |
| 1998 | - | 477 | - | 0 |

**Late Fall-Run.** Late fall-run chinook salmon migrate up Cottonwood Creek and spawn in January. DFG Biologists observed them spawning at the mouth of North Fork Cottonwood Creek in January 1976 (Richardson et al. 1978). Their young migrate downstream in May and June as much smaller fry than fall-run at that time of year. Young late fall-run chinook salmon were caught in fyke nets near the mouth of Cottonwood Creek in May and June 1976 (Richardson 1978). DFG estimates that an average of 300 late fall-run chinook salmon migrate up Cottonwood Creek (Smith and Van Woert 1969). DFG biologists surveying Cottonwood Creek in 1977 observed late fall-run chinook salmon spawning, but no estimates of run size were made.

**Spring-Run.** Spring-run chinook salmon migrate up Cottonwood Creek in April and spend the summer in deep pools in South Fork Cottonwood Creek, Beegum Gulch, and North Fork Cottonwood Creek. Most are found in Beegum Gulch. Young spring-run chinook salmon migrate downstream from January through May. DFG estimates that an average of 500 spring-run chinook salmon migrate up Cottonwood Creek (DFG 1966). DFG biologists surveyed Beegum Gulch in 1998 and found about 500 spring-run chinook salmon. Some young spring-run salmon from the Sacramento River use the lower reach of Cottonwood Creek from Interstate-5 to the mouth for rearing during the summer and fall (Richardson et al. 1978).

**Spawning Habitat.** DFG biologists took gravel samples in summer 1977 to measure quantity and quality of salmon spawning habitat in Cottonwood Creek. Approximately 392,000 square feet of gravel suitable for chinook salmon spawning was identified in the Cottonwood Creek system (Richardson and Brown 1978). About 40,000 square feet of that total was in south fork. Other investigations have produced estimates ranging from 285,000 square feet (Hansen et al. 1940) to 2,000,000 square feet (Leach and Van Woert 1968) of gravel in the system. A female chinook salmon requires about 100 square feet of gravel for spawning (Leach and Van Woert 1968). Most of the gravel was found in Cottonwood Creek below its confluence with North Fork Cottonwood Creek. Little suitable gravel was found in North Fork Cottonwood Creek.

**Instream Flow.** An instream flow study was conducted in 1976 and 1977 to measure the amount of chinook salmon spawning and rearing habitat in Cottonwood Creek and South Fork Cottonwood Creek. Optimum spawning flow was about 180 cfs and optimum rearing flow was 200 cfs from the mouth of Cottonwood Creek to the confluence of Cottonwood Creek and South Fork Cottonwood Creek. Optimum spawning flow was about 80 cfs and optimum rearing flow was 100 cfs in the lower seven miles of South Fork (Brown 1979). Natural monthly stream flow averages 295 cfs during fall-run chinook spawning in November near the mouth of Cottonwood Creek (Table 6). Average monthly flows range from 604 to 2,174 cfs when salmon rear from January through May.

**Table 6. Average Monthly Stream Flow in Cottonwood Creek at the Cottonwood Gage**

| Month | Average Monthly Flow (cfs) |
|---|---|
| January | 1,744 |
| February | 2,174 |
| March | 1,590 |
| April | 1,205 |
| May | 604 |
| June | 283 |
| July | 112 |
| August | 66 |
| September | 66 |
| October | 108 |
| November | 295 |
| December | 955 |

## Thomes-Newville Project Fish Studies

DFG initiated studies of the impacts on fish and wildlife of a Thomes-Newville Project in 1979 as part of DWR's Thomes-Newville Reservoir planning studies. However, the planning studies were halted in 1982. DFG completed a report of its abbreviated studies in 1983 (Brown et al. 1983). In 1998, DFG initiated studies of fish and wildlife resources of a Thomes-Newville Project as part of the North of Delta Offstream Storage Program. A brief survey of spring-run chinook salmon was conducted during the recent investigations. This section discusses recent findings and recapitulates the effort and results of the 1982 study (Brown et al. 1983).

## Methodology

### *Juvenile Salmon*

Seining for juvenile chinook salmon in Stony and Thomes Creeks was done over a period of three years, 1980 to 1982. Ten sample stations were selected on Thomes and Stony Creeks. Each station was seined weekly from February to June, with 50-foot delta mesh seines (Brown et al. 1983).

Fyke nets were used to sample for juvenile salmonids during the 1981 and 1982 seasons on Thomes Creek only. Irregular and frequent floodflow releases from Black Butte Reservoir made it impractical to fyke net in Stony Creek. Two fyke nets were used in Thomes Creek. One was placed in the mainstem and another near the confluence to the discharge channel from the Tehama-Colusa Canal. The nets were fished continuously from Monday to Friday and were removed during weekends or during high water. Each net in the mainstem was fished from February through March. Captured fish were measured for fork length to the nearest millimeter and weighed by water displacement to the nearest gram (Brown et al. 1983).

### *Adult Salmon and Steelhead*

Adult chinook salmon carcasses were counted to estimate the number of salmon in Stony and Thomes Creeks. Stony Creek was surveyed for carcasses between the Sacramento River confluence and the North Diversion Dam. Thomes Creek was surveyed between the Sacramento River confluence and Paskenta and in a channel from the discharge point of the Tehama-Colusa Canal to its confluence with Thomes Creek. Counts were taken once per week from November through January in 1980-81 and 1981-82 on Thomes Creek and from December through February in 1981-82 on Stony Creek. Each carcass was tagged by fastening a number 3 hog ring to its mandible. Tick marks were notched into the hog rings with wire cutters to identify the appropriate week of tagging. The sex and fork length of each carcass was noted. The date and location of where each carcass was found was recorded; each carcass was then returned to the same area where it was tagged. On successive surveys, tagged fish that were recovered were cut in half to avoid recounting in subsequent surveys. The 1980-81 spawning escapement estimate for Thomes Creek was calculated with the Schaefer method (Ricker 1975), while the 1981-82 estimates for both Stony and Thomes Creeks were estimated with the Peterson method (Ricker 1975) (Brown et al. 1983).

On June 13, 1979; August 18, 1980; and August 12, 1998, Thomes Creek was surveyed to enumerate adult spring-run chinook salmon and summer-steelhead. The area surveyed was from the gorge to the fjord at Hatch Flat near Paskenta. Each pool was examined by snorkel diving. All fish were identified and their size range and relative abundance estimated. No habitat suitable for spring-run salmon and summer steelhead exists in Stony Creek; therefore, no survey was conducted (Brown et al. 1983). Historical estimates for fall-run chinook salmon for both Stony and Thomes Creeks were compiled from DFG salmon-spawning stock reports.

### Resident Fish and Migratory Nongame Fish

A fyke net consisting of 0.03 inch oval mesh netting mounted on a 0.01 inch x 0.02 inch metal tubing frame was placed in the creek near the mouth of Thomes Creek. The purpose of the net was to capture juveniles, larval Sacramento suckers, and Sacramento pike minnows migrating to the Sacramento River. A perforated aluminum box—1.6 feet x 1.6 feet x 3.3 feet—was attached to the cod end of the net to receive captured fish. The net was fished 24 hours per day during weekdays from January to June 1981 (Brown et al. 1983).

To estimate the population of spawning Sacramento suckers and Sacramento pike minnows, adult fish were captured in Thomes Creek and its tributary, Mill Creek. From December 1980 through June 1981, 17 samples were taken at 10-day intervals via electrofishing. A 12-foot Avon rubber raft was retrofitted with a Smith-Root Type VII electroshocker. The battery and electroshocking unit were placed inside an ice chest and secured to the raft's rowing frame. Prove arrays were constructed of 0.08-inch stainless steel cable, attached to the bow of the raft, and fished at a depth of 4.9 feet. (Brown et al. 1983).

Captured fish were weighed to the nearest 0.3 ounce and fork lengths were measured to the nearest millimeter. Each fish was marked with a floy spaghetti tag and released. The tag was inserted under the dorsal fin and tied in a loop. The Jolly-Seber method was used to determine the population estimate for Sacramento suckers while the Schaefer method (Ricker 1975) was used to estimate the population of Sacramento pike minnows (Brown et al. 1983).

Electrofishing was done in streams in the footprint of proposed Newville Reservoir in 1981 and 1982. Seven sections were sampled in streams within the project area. These include North Fork Stony, Salt, and Heifer Camp Creeks. Ten sections in Stony Creek and 15 in Thomes Creek were sampled. Fish were captured by backpack electrofishing. Population number and biomass estimates for each species for the Thomes-Newville data were developed using the two-pass method of Seber and LeCren (1967) (Brown et al. 1983).

## Thomes Creek Fish Resources

### Juvenile Chinook Salmon

**1980 Emigration.** Thirteen juvenile chinook salmon were captured by seining during the 1980 sample period (Table 7). These fish were caught in the lowermost stations of Thomes Creek from March 20 to May 24, 1980.

**1981 Emigration**. Six juvenile chinook salmon were captured by seining during the 1981 sample period (Table 7). One of these fish was from Coleman National Fish Hatchery.

In 1981, 206 juvenile chinook salmon were captured by fyke netting in Thomes Creek, 20 from the mainstem and 186 from the discharge canal (Tables 8 and 9).

**Table 7. Juvenile Chinook Salmon Seined from Thomes Creek in 1980 and 1981 [1]**

| Sample Period | Number of Weekly Seinings | Number of Fish | Average Length of Fish (inches) |
|---|---|---|---|
| 1980 | | | |
| March | 4 | 5 | 2.8 |
| April | 5 | 8 | 2.8 |
| **Total** | **9** | **13** | |
| 1981 | | | |
| March | 2 | 5 | 4.1 |
| April | 1 | 1 | 2.3 |
| **Total** | **3** | **6** | |

[1] Brown et al. 1983

**Table 8. Fyke Net Catches of Juvenile Chinook Salmon from Mainstem of Thomes Creek in 1981[1]**

| Sample Period | Hours Fished | Number of Salmon | Average Length of Fish (inches) |
|---|---|---|---|
| February | 672 | 0 | 0 |
| March | 744 | 9 | 2.7 |
| April | 648 | 10 | 3.1 |
| May | 336 | 1 | 2.7 |
| **Total** | **2,400** | **20** | |

[1] Brown et al. 1983

**Table 9. Fyke Net Catches of Juvenile Chinook Salmon from the Tehama-Colusa Canal Discharge Channel in Thomes Creek in 1981 and 1982[1]**

| Sample Period | Number of Fish | Average Length of Fish (inches) |
|---|---|---|
| 1981 | | |
| January | 1 | 1.4 |
| February | 126 | 1.3 |
| March | 59 | 1.3 |
| **Total** | **186** | |
| 1982 | | |
| January | 2 | 1.4 |
| February | 45 | 1.4 |
| March | 337 | 1.5 |
| **Total** | **384** | |

[1] Brown et al. 1983

The catches from the mainstem occurred over a nine-week period beginnning the first week of March and ending the first week of May. Salmon from these catches ranged in size from 2.7 to 3.1 inches fork length (Table 8). Except for the time when the migration occurred, no real descriptive trends can be derived from these data. These fish, however, appear to be much larger than expected for fall-run fish spawned in Thomes Creek. Some fish may have spawned earlier in the mainstem Sacramento River and moved upstream into Thomes Creek. It is common for juvenile salmonids from the Sacramento River to swim upstream into tributaries (Richard Hallock, DFG, personal communication).

Juveniles captured in the discharge channel spawned there. The presence of live adults, carcasses, and redds in the channel together with the presence of juveniles is strong evidence that successful spawning occurred in the channel.

The migration of juvenile chinook salmon from the discharge channel occurred from late February through the third week of March. At this time the discharge was terminated by the U.S. Bureau of Reclamation and no water flowed to indicate newly hatched fish. These fish were of the fall-run spawn. Although the migration was halted by lack of flow, it could have continued if discharge had been extended. In response to the lack of flow, DFG regional personnel rescued in excess of 3,000 juvenile salmon.

**1982 Emigration** – No juvenile chinook salmon were captured by seining or fyke netting in the mainstem of Thomes Creek during the 1982 sample period. High flows and other duties limited efforts.

As indicated in Table 9, 384 juvenile chinook salmon were captured by fyke netting in the discharge channel from the Tehama-Colusa Canal. The first fish was captured during the first week of January, but the bulk of the migration did not occur until the third week of February. The migration continued until March 30, 1982, when the discharge was terminated by USBR.

### *Juvenile Steelhead*

Seven juvenile steelhead were captured by seining in Thomes Creek in 1981. Four of these fish were probably from Coleman National Fish Hatchery. They had rounded fins and deformed dorsal fins, which are a characteristic of hatchery-grown fish. Juvenile salmonids from the Sacramento River commonly ascend tributaries (Richard Hallock, DFG, personal communication).

### *Adult Chinook Salmon*

Review of past reports show little information on historic salmon runs in Thomes Creek. Only seven surveys were documented between 1955 and 1979. In 1957, the fall-run escapement estimate was 25, and in 1975 the estimate was 170 fish (Mahoney 1958, Hoopaugh 1978a). Estimates of fall-run salmon for survey years 1959, 1960, 1964, 1965, and 1976 were zero (Mahoney 1960, 1962; Menchen 1965, 1966; Hoopaugh 1978b).

**1980-81 Fall-Run Estimate**. Fifty-nine chinook salmon carcasses were tagged during 12 surveys of Thomes Creek. Of these 59, 17 fish (29 percent) were males while 42 fish (71 percent) were females. This represented a male-female ratio of 1:2.5. Twenty-three carcasses were recovered in fall 1980. From these data an estimated 155 salmon spawned in Thomes Creek during the sample period.

Live fish were first observed in the creek November 11, 1980, but no carcass was tagged until nine days later. The last carcass was tagged on January 12, 1981. Fifty-seven (97 percent) of the fish tagged were located in the Tehama-Colusa Canal outlet channel. Only two fish (3 percent) were tagged in the mainstem. Observation of six redds and four live fish indicates there was some spawning activity in areas below Henleyville.

**1981-82 Fall-Run Estimates**. Thirty-eight chinook salmon carcasses were tagged during 10 surveys of Thomes Creek. Of these 38, 16 fish (42 percent) were males while 22 fish (58 percent) were females. This represents a male-female ratio of 1:1.4. All of the fish tagged were located in the Tehama-Colusa Canal outlet channel. Twenty tagged carcasses were recovered. From these data an estimated 167 salmon spawned in Thomes Creek during the sample period. No live fish or redd was seen in the mainstem.

**1979-1980 Spring-Run Estimates**. No adult anadromous salmonid was seen during the June 1979 or August 1980 spring-run chinook salmon surveys in Thomes Creek. Numerous juvenile steelhead and brown trout were seen in the area of the survey which may indicate that habitat for spring-run chinook salmon or summer steelhead may exist. Although surface water temperatures generally approach 77ºF in these areas, cooler water (59-68ºF) can be found near the bottom of larger pools that could support salmonids.

**1999 Spring-Run Estimates**. One adult spring-run chinook salmon was seen during August 1999 diving surveys in Thomes Creek. As in 1980, numerous juvenile steelhead and brown trout were seen in the area of the survey.

**1980 Late Fall-Run**. The late spawning characteristics of a few chinook salmon indicate that they were of the late fall-run. Those that spawned in late December and January were salmon of this race.

### *Resident Fish and Migratory Nongame Fish*

Twenty-two species of fish were observed in Thomes Creek (Table 10). DFG staff developed population and biomass estimates for 13 of these species (Table 11). Three species were game fish and 10 were nongame fish. Steelhead were the most abundant fish above the gorge, while Sacramento pike minnow, Sacramento suckers, hardhead, California roach, and speckled dace were the more common fish below the gorge.

Most of the nongame fish caught in the reach below the gorge were juveniles, indicating that this reach serves mainly as a spawning and rearing area. Adult Sacramento suckers, Sacramento pike minnow, California roach, and hardhead annually migrate from the Sacramento River into Thomes Creek and its tributaries to spawn. Juveniles that do not migrate immediately after hatching remain to rear until the following rainy season when water flows to the mouth.

Thomes Creek below Paskenta usually dries up except for a few residual pools scattered along the streambed during the late summer, making it impossible for resident adult fish to live throughout the summer months. Some adult game fish such as largemouth and smallmouth bass, bluegill, and green sunfish ascend the creek from the Sacramento River during late spring and early summer to use these pools as spawning areas.

## Table 10. Fish Species Found in Thomes Creek in 1982[1]

| Common Name | Scientific name |
|---|---|
| Bluegill | *Lepomis machrochirus* |
| Brown bullhead | *Ictalurus nebulosus* |
| California roach | *Lavinia symmetricus* |
| Carp | *Cyprinus carpio* |
| Channel catfish | *Ictalurus punctatus* |
| Golden shiner | *Notemigomus crysoleucus* |
| Goldfish | *Carassius auratus* |
| Green sunfish | *Lepomis cyanellus* |
| Hardhead | *Mylopharodon conocephalus* |
| Hitch | *Lavinia exilicauda* |
| Largemouth bass | *Micropterus salmoides* |
| Mosquitofish | *Gambusia affinis* |
| Pacific lamprey | *Lampetra tredentata* |
| Prickly sculpin | *Cottus asper* |
| Sacramento pike minnow | *Ptychocheilus grandis* |
| Sacramento sucker | *Catostomus occidentatlis* |
| Smallmouth bass | *Micropterus dolomeiu* |
| Speckled dace | *Rhinicthys osculus* |
| Steelhead | *Onchorynchus mykiss* |
| Threespine stickleback | *Gasterosteus aculeatus* |
| Tule perch | *Hysterocarpus traski* |
| White catfish | *Ictalurus catus* |

[1] Brown et al. 1983

## Table 11. Average Population Estimates and Biomass Estimates for Fish Caught in Sections of Thomes Creek in 1982[1]

| Species | Average Population Estimate | Average Biomass (lb/acre) |
|---|---|---|
| Bluegill | 3 | 4.5 |
| California roach | 41 | 10.7 |
| Carp | 90 | 64.2 |
| Goldfish | 1 | 19.2 |
| Green sunfish | 14 | 15.2 |
| Hardhead | 47 | 47.3 |
| Hitch | 1 | 0.4 |
| Largemouth bass | 5 | 8 |
| Prickly sculpin | 1 | 1.8 |
| Sacramento pike minnow | 337 | 89.2 |
| Sacramento sucker | 143 | 16.1 |
| Speckled dace | 229 | 16.1 |
| Tule perch | 1 | 0.2 |

[1] Brown et al. 1983

## Stony Creek Fish Resources

### *Juvenile Chinook Salmon*

**1980 Emigration**. During the 1980 sample period, 181 juvenile chinook salmon were caught by seining (Table 12). Salmon were first caught during the second week of February and the last salmon was caught during the first week of May.

**1981 Emigration**. During the 1981 sample period, 73 juvenile chinook salmon were captured by seining (Table 12). Fish were first captured during the third week of February and the last fish were captured during the second week of April.

**1982 Emigration**. During the 1982 sample period, only four juvenile chinook salmon were captured by seining (Table 12). Two fish were captured during January and two were captured during the first week of March.

### *Adult Salmon Studies*

**1981-82 Fall-Run Estimates**. Thirty-six chinook salmon carcasses were tagged during five surveys. Two of these salmon were recovered. From these data DFG estimates that 393 salmon spawned in Stony Creek during the sample period. Of the 36 tagged, 11 fish (31 percent) were males while 25 fish (69 percent) were females. This represents a male-female ratio of 1:2.3.

Most of the spawning activity was located in lower Stony Creek in the reach between the Interstate-5 bridge and the mouth. At least 35 redds and 29 carcasses were counted in this area.

**Table 12. Juvenile Chinook Salmon Seined from Stony Creek in 1980, 1981, and 1982[1]**

| Sample Period | Number of Fish | Average Length of Fish (in) |
|---|---|---|
| **1980** | | |
| February | 64 | **1.7** |
| March | 51 | 1.8 |
| April | 60 | 2.0 |
| May | 6 | 3.0 |
| **Total** | **181** | |
| **1981** | | |
| February | 5 | 1.5 |
| March | 64 | 2.1 |
| April | 4 | 3.0 |
| **Total** | **73** | |
| **1982** | | |
| January | 2 | 3.3 |
| March | 2 | 1.7 |
| **Total** | **4** | |

[1] Brown et al. 1983

### Resident Fish Surveys

Six species of fish, two game and four nongame, were captured in streams potentially inundated by the Newville Reservoir (Tables 13 and 14). These streams include North Fork Stony Creek, Salt Creek, and Heifer Camp Creek. Rainbow trout were captured in sections of streams above the inundation line where the water is cool and cover is abundant. California roach, Sacramento pike minnow, Sacramento sucker, carp, and green sunfish were captured in sections of streams below the inundation line. California roach, Sacramento pike minnows, and Sacramento suckers were more abundant species, while carp and green sunfish are relatively uncommon (Brown et al. 1983).

**Table 13. Population Estimates for Fish Caught in Selected Sections of Streams within the Newville Reservoir Site in 1983[1]**

| Species | North Fork Stony Creek | Salt Creek | Heifer Camp Creek |
|---|---|---|---|
| California roach | 4 | 546 | 120 |
| Carp | 1 | | |
| Green sunfish | - | 13 | |
| Rainbow trout | - | 24 | 8 |
| Sacramento pike minnow | 12 | 24 | 85 |
| Sacramento sucker | > 2 | 45 | 6 |

[1] Brown et al. 1983

**Table 14. Average Biomass Estimates (lb/acre) for Fish Caught in Selected Sections of Streams within the Newville Reservoir Site in 1983[1]**

| Species | North Fork Stony Creek | Salt Creek | Heifer Camp Creek |
|---|---|---|---|
| California roach | 0.9 | 427.3 | 72.3 |
| Carp | 145.4 | - | |
| Green sunfish | - | 33.9 | |
| Rainbow trout | - | 74.9 | 18.7 |
| Sacramento pike minnow | 8 | 339.9 | 775.1 |
| Sacramento sucker | 0.09 | 88.3 | |

[1] Brown et al. 1983

The sections of stream within the inundation area are used primarily for spawning and rearing by nongame species (mainly the minnow family), although some green sunfish were observed spawning during the late spring in nonflowing areas of the stream. It is likely that, during high water, adult cyprinids ascend these tributaries from Black Butte Reservoir to spawn (Brown et al. 1983).

Upper Salt Creek supports a population of rainbow trout. Nongame fish were not found in this area nor were migratory cyprinids because they cannot ascend the creek due to a waterfall. This waterfall is not in the inundation area.

However, if Newville Reservoir is built, the waterfall could be flooded, which would allow nongame fish to swim upstream. This may reduce the rainbow trout populations because of competiton with nongame fish (Brown et al. 1983).

Twenty-eight species of fish were observed in Stony Creek (Table 15). DFG developed population and biomass estimates for 21 of these species (Table 16). Eight species were game fish and 13 were nongame fish. Largemouth bass and bluegill were the most abundant gamefish below Black Butte Reservoir; channel catfish and white catfish were the most abundant game fish above the Sacramento River. Sacramento pike minnows and suckers were found in all stations throughout Stony Creek, were the most abundant, and had the highest biomass for all species of fish. Prickly sculpin were found in all sections, but made up a very small portion of the total biomass.

Most nongame fish caught in the reach below Black Butte Reservoir were juveniles, indicating that this reach serves mainly as a spawning and rearing area. Adult Sacramento suckers, Sacramento pike minnow, California roach, and hardhead annually migrate from the Sacramento River into Stony Creek to spawn. Juveniles that do not migrate immediately after hatching remain to rear until the following season when water flows to the mouth. Other game fish such as largemouth bass, smallmouth bass, bluegill, and green sunfish were also observed spawning in backwater areas of Stony Creek. These adult fish may have migrated upstream from the Sacramento River, may have washed downstream from Black Butte Reservoir, or may reside throughout the year in the creek.

## Table 15. Fish of the Stony Creek Drainage (Excludes Fish within Newville Reservoir Site)[1]

| Common Name | Scientific Name |
|---|---|
| Black bullhead | *Ictalurus melas* |
| Black crappie | *Pomoxis melas* |
| Bluegill | *Lepomis machrochirus* |
| Brown bullhead | *Ictalurus nebulosus* |
| California roach | *Lavinia symmetricus* |
| Carp | *Cyprinus carpio* |
| Channel catfish | *Ictalurus punctatus* |
| Golden shiner | *Notemigomus crysoleucus* |
| Goldfish | *Carassius auratus* |
| Green sunfish | *Lepomis cyanellus* |
| Hardhead | *Mylopharodon conocephalus* |
| Hitch | *Lavinia exilicauda* |
| Largemouth bass | *Micropterus salmoides* |
| Mosquitofish | *Gambusia affinis* |
| Pacific lamprey | *Lampetra tridentata* |
| Prickly sculpin | *Cottus asper* |
| Rainbow trout | *Onchorynchus mykiss* |
| Redear sunfish | *Lepomis microlophus* |
| Sacramento blackfish | *Orthodon microlepidotus* |
| Sacramento pike minnow | *Ptychocheilus grandis* |
| Sacramento sucker | *Catostomus occidentatlis* |
| Smallmouth bass | *Micropterus dolomeiu* |
| Speckled dace | *Rhinicthys osculus* |
| Threadfin shad | *Dorosoma petenense* |
| Threespine stickleback | *Gasterosteus aculeatus* |
| Tule perch | *Hysterocarpus traski* |
| White catfish | *Ictalurus catus* |
| White crappie | *Pomoxis annularis* |

[1] Brown et al. 1983

**Table 16. Average Population Estimates and Biomass Estimates for Fish Caught in Selected Sections of Stony Creek in 1982 [1]**

| Species | Average Population Estimate | Average Biomass (lb/acre) |
|---|---|---|
| Black crappie | 8 | 87.4 |
| Bluegill | 19 | 8 |
| California roach | 200 | 54.4 |
| Carp | 5 | 64.2 |
| Channel catfish | 57 | 47.3 |
| Goldfish | 8 | 33.9 |
| Green sunfish | 7 | 2.7 |
| Hardhead | 9 | 24.1 |
| Hitch | 32 | 20.5 |
| Largemouth bass | 13 | 11.6 |
| Mosquitofish | 3 | 0.09 |
| Prickly sculpin | 57 | 11.6 |
| Sacramento pike minnow | 146 | 91 |
| Sacramento sucker | 96 | 256.9 |
| Smallmouth bass | 5 | 16.1 |
| Speckled dace | 318 | 41.9 |
| Threadfin shad | 2 | 0.9 |
| Threespine stickleback | 3 | 0.05 |
| Tule perch | 6 | 5.4 |
| White catfish | 30 | 34.8 |
| White crappie | 5 | 17.8 |

[1] Brown et al. 1983

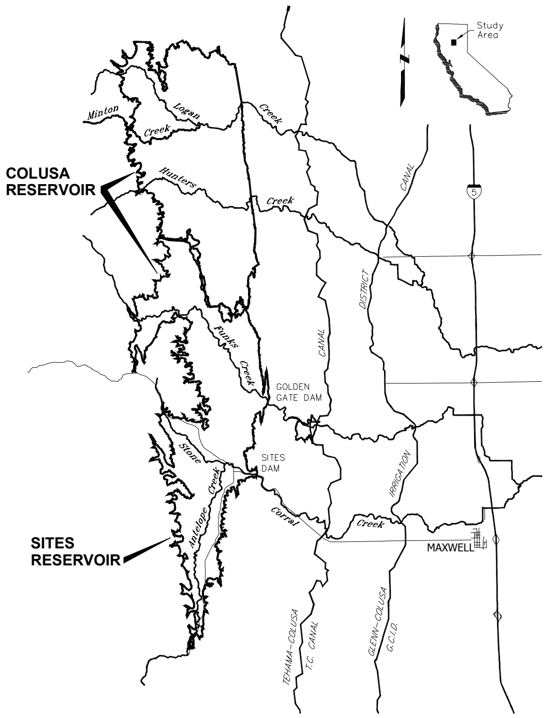
## Sites and Colusa Project Fish Studies

Fish studies for the Sites and Colusa Projects included three basic areas of study: fish resources in streams within the proposed reservoirs and in the Colusa Basin Drain, and habitat typing of the dominant streams in the proposed reservoirs.

### Sites and Colusa Project Stream Fish Resources

This section summarizes studies of fish in streams that flow through the proposed Sites and Colusa Projects. Studies were conducted in 1998 and 1999. Information gathered in these streams will be used to describe impacts on fish resources during the planning process.

**Figure 3. Streams in the Sites-Colusa Project**




### *Methodology*

Stone Corral Creek, Funks Creek, Logan Creek, and Hunters Creek and their tributaries originate in oak woodland habitat in western Colusa and Glenn Counties (Figure 3). The creeks flow downstream through annual grassland and cultivated rice fields before flowing into the Colusa Basin Drain. Deeply incised channels characterize these streams with little vegetation on the banks and little cover in streambeds. Streamflow is seasonal with periods of high flow during winter storms, declining flows through spring and early summer, and intermittent flow in late summer. Water quality is poor and high in dissolved minerals. The total dissolved solids in the water are so high that electrofishing as a means of sampling is not possible in the streams.

Pools were seined at specific stations on all creeks surveyed to determine species composition. All sample stations were within the footprint of the Sites-Colusa Project. Thirty-six stations were spread out among Hunter, Minton, Logan, Antelope, and particularly Stone Corral and Funks Creeks. Seven stock ponds in the Sites and Colusa area were also seined for fish.

Twelve species of fish were caught in the Sites and Colusa study area in 1998 and 1999. Five species were game fish and seven species were nongame fish (Table 17). A single spring-run chinook salmon was observed in Antelope Creek, a tributary to Stone Corral Creek in spring 1998. It died a few weeks later and was identified by its carcass.

**Table 17. Fish Caught in the Sites Study Area in 1998 and 1999**

| Common Name | Scientific Name |
|---|---|
| Bluegill | *Lepomis macrochirus* |
| California roach | *Hesperoleucus symmetricus* |
| Chinook salmon | *Oncorhynchus tschawtscha* |
| Green sunfish | *Lepomis cyanellus* |
| Hitch | *Lavinia exilicauda* |
| Largemouth bass | *Micropterus salmoides* |
| Mosquitofish | *Gambusia affinis* |
| Redear sunfish | *Lepomis microlophus* |
| Sacramento blackfish | *Orthodon microlepidotus* |
| Sacramento pike minnow | *Ptychocheilus grandis* |
| Sacramento sucker | *Catostomus occidentalis* |
| Sculpin sp. | *Cottus sp.* |

**Funks Creek.** Fifteen stations were sampled on Funks Creek between July 22, 1998, and January 8, 1999. Stations were evenly spaced between the Golden Gate damsite and the upper limit of flow in Funks Creek. Streamflow was intermittent. Five species of fish were found in Funks Creek, including one type of game fish, largemouth bass (Table 18). The most common fish in Funks Creek was the hitch, with an average density of 3.1 fish/yd$^2$ (Table 18). Hitch were caught in 11 out of 15 stations seined (Table 18).

**Table 18. Species Caught at Each Sample Station and Relative Abundance on Funks Creek**

| Species | Station Sampled | | | | | | | | | | | | | | | Fish/yd$^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| Hitch | | | X | X | X | X | X | X | X | X | X | X | X | | | 3.1 |
| Largemouth bass | | | | | | | | | X | | | X | | | | 0.001 |
| Sacramento pike minnow | | | | | X | X | | | X | | | | X | | | 0.06 |
| Sacramento Sucker | | | | | X | X | | | X | X | | | X | | | 0.02 |
| Sculpin | | | | | | | | | | | | | | X | | --- |

The most diverse sampled sections of Funks Creek were in the lower reaches, stations 5, 6, 9, 10, 12, and 13. The upper reaches of Funks Creek either lacked fish or only one species was found. Hitch densities varied widely throughout the creek, and no one area seemed to maintain a higher population.

**Hunters Creek.** Three stations on lower Hunters Creek were seined between July 22, 1998, and August 3, 1998. No water was present above these sites. Only two species of fish were found on Hunters Creek, green sunfish and mosquitofish. Both species were found in two of the three stations (Table 19).

Mosquitofish were found in a relative abundance of 3.8 fish/yd$^2$, but they only occurred in abundance at one station. Green sunfish were found to have an average density of 2.3 fish/yd$^2$.

### Table 19. Relative Abundance of Fish Caught at Hunters Creek

| Species | Fish/yd$^2$ |
|---|---|
| Green sunfish | 2.3 |
| Mosquitofish | 3.8 |

**Minton Creek.** Minton Creek was sampled in two places on August 12, 1998. Samples were taken in lower reaches of the creek because areas of the creek above the sample sites were dry. Hitch were found in only one of those stations, at a density of 0.5 fish/yd$^2$ .

**Stone Corral Creek.** Eleven stations were sampled on Stone Corral Creek between July 15, 1998, and January 6, 1999. Stations were located from the damsite to about 1 mile above. Flows were less than 1 cfs. Eight species of fish were found in Stone Corral Creek, including two species of game fish, green sunfish and bluegill (Table 20).

The fish most common fish among the stations was the Sacramento pike minnow followed by the hitch (Table 20). Fish density on Stone Corral was relatively low for all species at all stations. Hitch were the dominant species in terms of density 0.8 fish/yd$^2$.

### Table 20. Species Caught at Each Station and Relative Abundance on Stone Corral Creek

| Species | Station Sampled | | | | | | | | | | | Fish/yd2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | |
| Bluegill | | | | X | | | | | | | | 0.002 |
| California roach | | X | | X | | | | | | | | 0.02 |
| Green sunfish | | | X | | | | | X | X | X | X | 0.03 |
| Hitch | | X | X | | | | | X | X | X | X | 0.8 |
| Mosquitofish | | | | X | | | | | | | | 0.002 |
| Sacramento blackfish | | | | | | | | | | | X | 0.2 |
| Sacramento pike minnow | | | X | X | X | X | | X | X | | X | 0.2 |
| Sacramento sucker | | | X | X | | X | | | | | X | 0.02 |

Most seining stations on Stone Corral Creek were clustered around the same region. Station 1 was far upstream from the others and yielded no fish. The diversity of species caught was highest at stations 4 and 11.

**Antelope Creek.** Five seining stations were sampled on Antelope Creek between July 14, 1998, and November 25, 1998. Stations were evenly spaced between the mouth of Antelope Creek and the boundary of Sites Reservoir.

Streamflow was less than 5 cfs. Three species of fish were captured on Antelope Creek: green sunfish, hitch, and Sacramento pike minnow (Table 21). Hitch were the most abundant fish with an average density of 3.8 fish/yd$^2$. The Sacramento pike minnow and the green sunfish both had a relative abundance of 0.2 fish/yd$^2$.

**Table 21. Species Caught at Each Station and Relative Abundance on Antelope Creek**

| Species | Station Sampled | | | | | Fish/yd2 |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| Green sunfish | | X | | X | X | 0.2 |
| Hitch | X | X | X | X | X | 3.8 |
| Sacramento pike minnow | | | | X | X | 0.2 |

**Logan Creek.** Four stations were sampled on Logan Creek over two days in August 1998. Stations were located in and near the footprint of the proposed Colusa Reservoir. Streamflow was less than 1 cfs. Hitch were caught in stations 1 and 2. The average density of hitch on Logan Creek was 0.4 fish/yd$^2$.

**Ponds.** DFG biologist seined seven stock-watering ponds in the study area. The ponds seined do not dry up during the summer. Three game fish were found in the ponds, red-eared sunfish, bluegill, and largemouth bass. Redear sunfish were found in one pond, bluegill were found in abundance in two ponds, and largemouth bass were found in three ponds. No other fish were found in these ponds.

### *Discussion*

Hitch were found in all the creeks in the Sites and Colusa Project area. Hitch were also present in the greatest numbers. Stone Corral Creek had the greatest diversity of fish throughout the year—eight species—including two species of introduced game fish, bluegill and green sunfish. However fish densities were lower, particularly for hitch in Stone Corral than in other creeks. Funks Creek, the next most diverse creek, had only five species of fish, including one introduced game fish, largemouth bass.

Most fish captured during seining were minnows, members of the Cyprinid family. California roach are the only fish present that are adapted to spending summers in the remaining pools of intermittent streams (Moyle 1976). Very few fish found while seining, including game fish, were above 5.9 inches in lengths, suggesting that juvenile fish only rear in these areas. Adult fish typically ascend seasonal creeks in the study area in winter and spawn there in early spring. Most adults migrate downstream after spawning.

No species of concern or threatened or endangered species were found in this study. The species caught during the study are common in California.

## Colusa Basin Drain Fish Studies

This section describes the fish resources of the Colusa Basin Drain. Colusa Basin Drain is a natural channel that historically transported water from west side tributaries such as Willow, Funks, Stone Corral, and Freshwater Creeks to the Sacramento River. It also carried overflowing floodwater from the Sacramento River. With the advent of agriculture in the Sacramento Valley, the Colusa Basin Drain was channelized and dredged to carry agricultural runoff in addition to natural flows.

Streamflow in the CBD peaks in winter months when storms swell the small streams that feed the CBD. Flow also reaches high levels in late summer when rice fields are drained into the CBD. Table 22 shows average monthly streamflow in CBD from 1976 to 1997. Daily and instantaneous flows in the CBD may be much higher.

The CBD provides little bank cover for fish; however, some instream cover is provided by large and small woody debris. Its banks are scoured by periodic high flows and roads often run along the dikes that contain the waters of the CBD. The bottom of the CBD is largely mud. Water in the CBD is turbid and warm in the summer, and turbid and cool during the winter. The proposed diversion from the CBD for Sites and Colusa Reservoirs will be east of the town of Maxwell along the CBD.

**Table 22. Average Monthly Streamflow (cfs) in the Colusa Basin Drain at the Highway 20 Crossing**

| Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | 237 | 249 | 160 | 185 | 177 | 371 | 312 | 879 | 239 | 434 | 926 | 904 |
| 1977 | 169 | 255 | 138 | 312 | 181 | 256 | 90 | 642 | 121 | 121 | 424 | 388 |
| 1978 | 116 | 272 | 254 | 3121 | 2133 | 1429 | 365 | 684 | 469 | 711 | 1056 | 1028 |
| 1979 | 201 | 312 | 113 | 689 | 940 | 407 | 328 | 802 | 424 | 803 | 1211 | 1029 |
| 1980 | 200 | 563 | 837 | 1874 | 2888 | 1305 | 326 | 1048 | 603 | 805 | 1307 | 1160 |
| 1981 | 275 | 328 | 359 | 1017 | 840 | 433 | 342 | 1039 | 446 | 1057 | 1464 | 1182 |
| 1982 | 284 | 877 | 1115 | 1939 | 472 | 383 | 682 | 743 | 908 | n.r. | 1393 | 1356 |
| 1983 | 467 | 778 | 1225 | 2331 | 3028 | 5304 | 990 | n.r. | n.r. | 907 | 1168 | 1198 |
| 1984 | 315 | 1302 | 3623 | 1523 | 493 | 265 | 547 | 1190 | 851 | 1310 | 1580 | 1041 |
| 1985 | 376 | 1160 | 683 | 285 | 170 | 196 | 409 | 1048 | 768 | 1237 | 1442 | 1442 |
| 1986 | 316 | 663 | 700 | 754 | 4214 | 1833 | 449 | 921 | 834 | 1052 | 1338 | 1338 |
| 1987 | 318 | 459 | 235 | 249 | 319 | 508 | 495 | 913 | 707 | 907 | 1175 | 1175 |
| 1988 | 341 | 668 | 462 | 1365 | 287 | 431 | 666 | 849 | 515 | 586 | 972 | 972 |
| 1989 | 345 | 617 | 354 | 342 | 212 | 404 | 438 | 572 | 587 | 800 | 995 | 995 |
| 1990 | 303 | 411 | 181 | 346 | 203 | n.r. | n.r. | 583 | 439 | 533 | 913 | 913 |
| 1991 | 247 | n.r. | n.r. | 153 | 217 | 916 | 423 | 477 | 353 | 371 | 535 | 535 |
| 1992 | 159 | 319 | 291 | 261 | 932 | 670 | 256 | 167 | 250 | 149 | 186 | 186 |
| 1993 | 116 | 267 | 347 | 2900 | 3049 | 762 | 322 | 279 | 290 | 201 | 489 | 489 |
| 1994 | 203 | 419 | 466 | 315 | 740 | 331 | 300 | 191 | 147 | 61 | 418 | 418 |
| 1995 | 155 | 565 | 549 | 6612 | 2020 | 3823 | 591 | 551 | 364 | 297 | 416 | 416 |
| 1996 | 255 | 368 | 749 | 972 | 2668 | 1092 | 493 | 771 | 472 | 249 | 660 | 660 |
| 1997 | 229 | 643 | 643 | 3698 | 1464 | 357 | 321 | 286 | 152 | 368 | 953 | 953 |
| **AVG** | **256** | **547** | **642** | **1420** | **1257** | **1023** | **435** | **697** | **473** | **617** | **956** | **956** |

### *Methodology*

Two fyke nets were placed in the CBD, one upstream of the proposed diversion point and one downstream. The first net was put in at the confluence of Willow Creek and the CBD. The second was placed just south of Hwy 20 on the CBD. The fyke nets have a 3 foot-by-5 foot opening, and a 12-foot funnel. Galvanized pipe frames support the net opening. Nets of variable size stretched mesh were used: 1 inch, 0.25 inch, and 0.125 inch. The largest sized mesh was at the front of the funnel, and smallest size mesh was at the back. The narrow end of each net is connected to a wooden live box, 2.5 feet by 1.5 feet by 1.6 feet. Holes in the side and back of the box were covered by screening with a mesh size of 0.19 inch. The fyke nets were held in fishing position by rope bridles attached to ropes secured to metal fencing posts and/or a tree or utility pole on the bank. The nets were installed on January 19, 1999, and checked daily Monday through Friday. The nets were removed from the canal during periods of high water. Captured specimens were identified and measured for fork length to the nearest millimeter for the first 20 of each species, after which species were only tallied. Representatives of each species were either photographed or preserved for future positive identification.

Periodic seining using the medium sized—29-feet long, 6-feet high, one-quarter inch mesh; seine, and hook and line sampling were also used to sample the fish of the Colusa Basin Drain at the upper net location. Two hoop nets and a gill net were also placed at the upper fyke net location February 1, 1999. The hoop nets were installed upstream of the fyke net. The hoop nets were 7 feet long with six hoops 2 feet in diameter set 1 foot apart, with a net mesh size of 1 inch. They had two finger funnels each. These nets were secured to a wooden bridge and placed on either side of the channel. The hoop nets were baited with fish carcasses. The gill net spanned the entire distance of the drain downstream of the fyke net. These nets were removed March 10, 1999. One hoop was replaced at the bridge on March 19, 1999.

### Results

A total of 9 game fish and 17 nongame fish were caught in the CBD (Tables 23 and 24). The warmouth (*Lepomis gulosus*) and the largemouth bass (*Micropterus salmoides)*, which were caught by U.S. Geological Survey in 1996, were not observed in this recent survey.

### Table 23. Resident Game Fish of the Colusa Basin Drain

| Common Name | Scientific Name |
|---|---|
| Black bullhead | *Ictalurus melas* |
| Black crappie | *Pomoxis nigromaculatus* |
| Bluegill | *Lepomis macrochirus* |
| Brown bullhead | *Ictalurus nebulosus* |
| Channel catfish | *Ictalurus punctatus* |
| Chinook salmon | *Oncorhynchus tschawtscha* |
| Green sunfish | *Lepomis cyanellus* |
| White catfish | *Ictalurus catus* |
| White crappie | *Pomoxis annularis* |

### Table 24. Resident Nongame Fish of the Colusa Basin Drain

| Common Name | Scientific Name |
|---|---|
| Big scale logperch | *Percina macrolepida* |
| California roach | *Hesperoleucus symmetricus* |
| Carp | *Cyprinus carpio* |
| Flathead minnow | *Pimephales promelas* |
| Goldfish | *Carassius auratus* |
| Hitch | *Lavinia exilicauda* |
| Inland silversides | *Menidia beryllina* |
| Mosquitofish | *Gambusia affinis* |
| Pacific lamprey | *Lampetra tridentata* |
| Sacramento blackfish | *Orthodon microlepidotus* |
| Sacramento pike minnow | *Ptycholcheilus grandis* |
| Sacramento splittail | *Pogonichthys macrolepidotus* |
| Sacramento sucker | *Catostomus occidentalis* |
| Sculpin sp. | *Cottus sp.* |
| Threadfin shad | *Dorosoma pretenense* |
| Tui chub | *Gila bicolor* |
| Tule perch | *Hysterocarpus traski* |

One late fall-run chinook salmon carcass was found in the upper fyke net. In October 1998, fall-run chinook salmon were observed migrating up the CBD at the Delevan Wildlife Area. DWR biologists saw spring-run chinook salmon in Walker Creek, a tributary to Willow Creek, in spring 1998. Four splittail were caught in the fyke net located just below Highway 20 in July and August, 1999. All four were young-of-the-year splittail. They averaged 1.4 inches, and ranged from 0.9 to 2.0 inches fork length.

The greatest diversity of fish was caught in the upper fyke net, at the confluence of Willow Creek and the CBD. The gill net and the hoop net caught only a few different species of fish (Table 25). Various tadpoles, mostly bullfrog, (*Rana catesbieana)*, were by far the most numerous animal caught by any method, but particularly the fyke nets. Channel catfish were the most frequently caught fish, the majority of which were juveniles. Mostly juvenile fish were caught in the nets. Rarely did fish exceed 5.9 inches, with the exception of the goldfish. Adult channel catfish, up to 17.7 inches, were caught by hook and line. Carp, up to 20 inches, were also caught with hook and line.

Seining was the most efficient form of sampling in the Colusa Basin Drain, with a catch per hour effort ratio of 21.8. The hoop net was the least efficient method of capture, with a catch per hour effort ratio of 0.01 (Table 26).

**Table 25. Number of Species Captured at Each Trapping Station**

| Species | Gill net | Hoop net | Seine | Hook & line | Fyke nets | Total |
|---|---|---|---|---|---|---|
| Big scale logperch | | | 2 | | 3 | 5 |
| Black bullhead | | | | 1 | 7 | 8 |
| Black crappie | | | 1 | | 2 | 3 |
| Bluegill | 1 | 1 | 10 | 1 | 23 | 36 |
| Brown bullhead | | | | 20 | 18 | 38 |
| California roach | | | 15 | | 1 | 16 |
| Carp | | | | 69 | 2 | 71 |
| Channel catfish | 2 | 1 | | 28 | 195 | 226 |
| Chinook salmon | | | | | 1 | 1 |
| Flathead minnow | | | | | 1 | 1 |
| Goldfish | | | | 16 | 15 | 31 |
| Green sunfish | | | 8 | | 48 | 56 |
| Hitch | | | 40 | 1 | 52 | 93 |
| Inland silversides | | | 1 | | 4 | 5 |
| Mosquitofish | | | 3 | | 6 | 9 |
| Pacific lamprey | | | | | 7 | 7 |
| Sacramento blackfish | | | 96 | | 23 | 119 |
| Sacramento pike minnow | 1 | | | | 2 | 3 |
| Sacramento splittail | | | | | 4 | 4 |
| Sacramento sucker | 1 | 1 | 1 | | 3 | 6 |
| Sculpin sp. | | | 1 | | 1 | 2 |
| Threadfin shad | | | | | 6 | 6 |
| Tui chub | | | | | | 1 |
| Tule perch | | 1 | | | 4 | 5 |
| White catfish | | | | 7 | 18 | 25 |
| White crappie | | | | | 3 | 3 |

**Table 26. Catch Per Hour Effort for Each Trapping Method**

| Trapping Method | Total Effort Hours | Catch per Hour Effort |
|---|---|---|
| Gill net | 336 | 0.02 |
| Hoop net | 576 | 0.01 |
| Seine | 8 | 21.8 |
| Hook and line | 41 | 3.5 |
| Fyke net | 2500 | 0.25 |

#### *Discussion*

Four Sacramento splittail were caught. This species were federally listed as threatened in March 1999. Numerous fall-run chinook salmon were observed in the CBD and the carcass of one late fall-run chinook salmon was found. Fall-run chinook salmon and late fall-run chinook salmon are federally proposed for listing as threatened. Spring-run chinook salmon were observed in Walker Creek, a tributary to the CBD. They were listed as a State of California Threatened Species in February 1999. They are also proposed for listing as a federally endangered species.

Willow and Freshwater Creeks are tributaries to the CBD. They flow all year in their upper reaches and have deep pools suitable for steelhead juveniles. Steelhead smolts migrate during high stream flows in the winter. The nets set up in the CBD might not have caught them because larger fish and migrating yearling steelhead avoid fixed fyke nets. Willow and Freshwater Creeks should be sampled during summer to detect rearing steelhead fry.

### Sites and Colusa Project Habitat Types

This section summarizes studies of habitat types along the streams in the proposed Sites and Colusa Project areas conducted in 1998 and 1999.

#### *Methodology*

An initial channel type survey, including an evaluation of the overall channel morphology, was made at the beginning of the study of each creek. Channel type was subsequently determined when the overall character of the channel changed for over 20 bankfull widths.

Channel type surveys began by first noting if the stream is a threaded or single channel. Then the bankfull width was measured at the prominent scour marks and sedimentation on the bank substrate with a 100-foot vinyl tape. Ten depths were taken at the study section to obtain the average bankfull depth. The substrate type was noted (Table 27).

**Table 27. Substrate Type and Size Used[1]**

| Substrate Type | Size in inches |
|---|---|
| Boulder | > 10 |
| Large Cobble | 5-10 |
| Small Cobble | 2.5-5 |
| Gravel | 0.08-2.5 |
| Sand | <0.08 |

[1] Flosi et al. 1998

Habitat type evaluation on Funks Creek began at Golden Gate damsite on January 12, 1999, and proceeded upstream to a point just above the mouth of Grapevine Creek on February 25, 1999. After this point, Funks Creek no longer contained water. Habitat typing continued on Grapevine Creek from the confluence with Funks Creek on February 26, 1999, and concluded at the reservoir inundation line on April 28, 1999. Stone Corral Creek habitat typing began on February 10, 1999, and continued until the channel no longer contained water, just past the confluence of Antelope Creek. Habitat typing concluded for Stone Corral and began on Antelope Creek on February 23, 1999. Habitat typing concluded on Antelope Creek on April 22, 1999, at the reservoir inundation line.

Each habitat unit was described as a pool, flat water, or riffle. All data was recorded on a standardized habitat typing data sheet (Flosi et al. 1998). Side channels were evaluated separately only when they demonstrated a different habitat type due to the small nature of the creek bed and intermittent water flow. Once the habitat unit type was identified it was assigned a unit number. For each unit, a mean length (measured as the thalweg length), width, and depth were taken, as well a maximum depth. All measurements were made and recorded in feet and tenths of feet using standard engineering measuring tapes and stadia rods. For pools, the tail-crest depth, type of pool-tail substrate, and the percent the substrate is embedded were also evaluated.

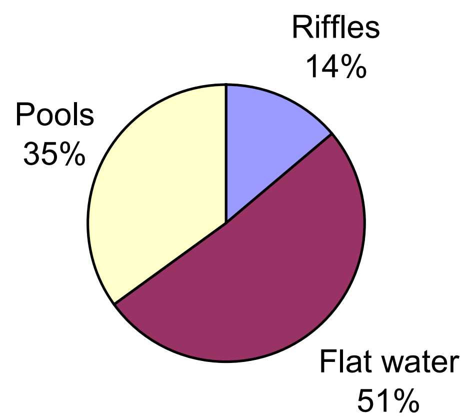
In addition to unit type data, the time surveying began, air and water temperature, date, and surveyors present were all recorded daily. Yellow flags were left at the end of the last habitat unit surveyed each day. The substrate type and percent exposed substrate was recorded. A shelter value for the unit was given based on the quantity and composition of the cover. The total percent cover for the habitat unit was recorded, then broken down into the percentages of the total that each cover element represented.

The bank composition was evaluated and dominant vegetation for right and left banks was recorded. Plant species and bank substrates were entered. The percent of the bank vegetated was evaluated up to bankfull width plus 20 feet. The percent and type, (deciduous or coniferous), of cover by tree canopy at midday was also evaluated. This was done for the entire part of each stream studied.

### *Results*

**Funks Creek.** Flat water constituted 51 percent of the total creek measured. The average flat water length on Funks Creek was 212 feet. Pools at 35 percent of the total length with an average length of 146 feet, were the second most dominant habitat type. Riffles constituted 14 percent of the creek, with an average unit length of 57 feet (Figure 4).

**Figure 4. Relative Occurrence of Habitat Types in Funks Creek**




Gravel was the most common substrate (Table 28). Small cobble substrate was the second most common substrate type, occurring at 28 percent of the units surveyed. Silt/clay type substrate was most commonly associated with the gravel substrate, either as the primary or secondary substrate. It also frequently occurred as a layer over bedrock or boulder substrates. Silt/clay was the dominant substrate in the lower reaches of Funks Creek, giving way to gravel as the dominant substrate in the upper reaches of the stream.

**Table 28. Summary of Substrates (%) by Habitat Type on Funks Creek**

| Habitat type | Silt/Clay | Sand | Gravel | Small cobble | Large cobble | Boulder | Bedrock |
|---|---|---|---|---|---|---|---|
| Riffle | 19 | 0 | 26 | 21 | 10 | 1 | 24 |
| Flat water | 11 | 1 | 33 | 21 | 5 | 8 | 21 |
| Pool | 6 | 1 | 41 | 43 | 5 | 2 | 2 |
| Average | 12 | 1 | 33 | 28 | 7 | 4 | 15 |

The bank composition was overwhelmingly silt/clay. Occasional areas of bedrock bank or cobble bank occurred; where roads passed through or near the creek, boulders dominated the bank. Greater variability of bank composition occurred in the lower reaches of the creek. Most bedrock banks occurred in major blocks where bedrock ridges rose through the valley floor.

Star thistle and grasses dominated both banks. The average percent bank covered by vegetation was 52 percent for the right bank and 53 percent for the left bank. Occasional cottonwoods, willows, oaks, and walnut trees punctuate the bank. Only 18 percent of the habitat units had some degree of canopy. The average canopy cover was 5 percent, or 26 percent when considering only those units that had any canopy cover at all. Trees were concentrated at Golden Gate, where habitat typing began on Funks Creek, and in the upper reaches of the creek.

The average of the total units covered by all cover combined was 27 percent. Aquatic vegetation was the prevalent type of cover, boulders were the most common large cover item. Aquatic vegetation and boulders each comprised an average of 25 percent of the total cover (Table 29). Large woody debris and root masses occurred relatively infrequently. Undercut banks occurred in 17 percent of the habitat units. Pools overall had a large degree and variety of cover, while flat water and riffles had less cover.

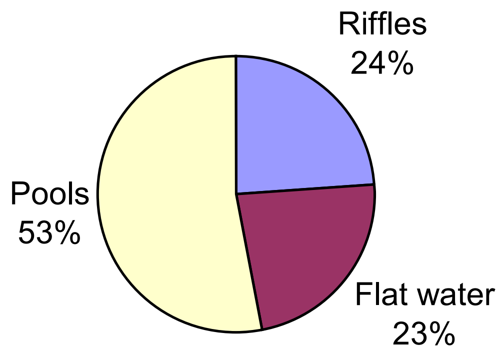
### Table 29. Summary of Habitat Cover in Funks Creek

| | Percent of each habitat having cover | Percent of Cover Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Undercut banks | Small woody debris | Large woody debris | Root masses | Terrestrial vegetation | Aquatic vegetation | Bubble curtain | Boulders | Bedrock ledges |
| Riffles | 20 | - | - | 1 | - | 20 | 15 | 30 | 28 | 6 |
| Flat water | 38 | 34 | 1 | 1 | - | 1 | 27 | 10 | 25 | 1 |
| Pools | 24 | 18 | 3 | 1 | 1 | 1 | 34 | 2 | 21 | 19 |
| Average | 27 | 17 | 1 | 1 | - | 7 | 25 | 14 | 25 | 9 |

**Grapevine Creek.** Riffles made up 24 percent of the total creek measured (Figure 5). The average riffle length on Grapevine Creek was 72 feet. Flat water made up 23 percent of the total length with an average length of 143 feet, and was the least dominant habitat type. Pools made up just over half, 53 percent, of the total length of Grapevine Creek within the reservoir footprint.

Small cobble was the most common substrate in Grapevine Creek. Gravel was also common, occurring as the substrate in 30 percent of the habitat units. Large cobble was the dominant substrate in 13 percent of the units surveyed. Small cobble substrate was spread throughout the creek system; however, there were no distinct pockets of this or any other substrate.

**Figure 5. Relative Occurrence of Habitat Types in Grapevine Creek**




Thirty-two percent of the pools on Grapevine Creek were dominated by small cobble substrate. Gravel was dominant in 22 percent of these. Flat water was dominated by gravel and small cobbles (Table 30).

**Table 30. Summary of Substrates on Grapevine Creek**

| | Silt/Clay | Sand | Gravel | Small cobble | Large cobble | Boulder | Bedrock |
|---|---|---|---|---|---|---|---|
| Riffle | 5 | | 32 | 24 | 11 | 1 | 27 |
| Flat water | 12 | 1 | 35 | 41 | 7 | 2 | 2 |
| Pool | 6 | | 22 | 32 | 21 | 5 | 14 |
| Average | 8 | | 30 | 32 | 13 | 3 | 14 |

Bank composition was overwhelmingly silt/clay. Frequent patches of gravel/cobble banks occurred throughout the creek channel surveyed. Most bedrock banks occurred in major blocks where bedrock ridges rise through the valley floor.

Grasses and star thistle dominated both banks. The average percent bank covered by vegetation was 56 percent for the right bank and 54 percent for the left bank. Occasional oaks, willows, cottonwoods, walnuts, and gray pines punctuate the bank. Thirty-nine percent of the habitat units examined on Grapevine Creek had some degree of canopy—38 percent from deciduous trees and shrubs, and 1 percent from pines. The average canopy cover was 12 percent. Trees were more concentrated at the upstream end where Grapevine Creek starts to climb in elevation toward the edge of the reservoir footprint.

The average of the total unit covered by all cover combined was 29 percent. Aquatic vegetation was the most prevalent type of cover, occurring in 72 percent of the flat water units surveyed. Aquatic vegetation comprised an average 53 percent of the total unit cover (Table 31).

Pools had the largest mean total coverage at 32 percent. Aquatic vegetation comprised 46 percent of the cover in pools. Riffles had a mean total cover 28 percent, 40 percent of which was aquatic vegetation. Terrestrial vegetation, boulders, and bubble curtains also provided cover in riffles—14 percent, 17 percent, and 7 percent, respectively. Flat water averaged 26 percent total coverage, of this 72 percent of the cover was aquatic vegetation.

Aquatic vegetation was the most common large cover item, occurring in 53 percent of the units surveyed. Root masses were another large cover item that occurred with some frequency at 7 percent. Terrestrial vegetation occurred in 9 percent of the habitat units, and bedrock ledges in 4 percent of the units. Riffles and pools contained all of the major types of cover (Table 31).

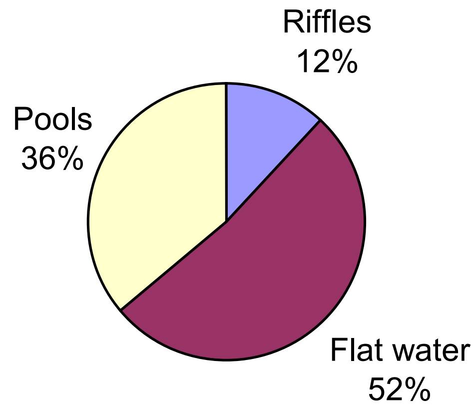
**Table 31. Summary of Habitat Cover in Grapevine Creek**

| | Percent of each habitat having cover | Percent of Cover Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Undercut banks | Small woody debris | Large woody debris | Root masses | Terrestrial vegetation | Aquatic vegetation | Bubble curtain | Boulders | Bedrock ledges |
| Riffles | 28 | 1 | 3 | 3 | 13 | 14 | 40 | 7 | 17 | 2 |
| Flat water | 26 | 5 | 3 | - | 4 | 8 | 72 | 4 | 4 | - |
| Pools | 32 | 7 | 3 | 12 | 4 | 4 | 46 | 4 | 9 | 11 |
| Average | 29 | 4 | 3 | 5 | 7 | 9 | 53 | 5 | 10 | 4 |

**Stone Corral Creek.** Flat water made up the majority of habitat type measured, comprising 52 percent of the total creek. The average flat water length on Stone Corral Creek was 213 feet. Pools, making up 36 percent of the total length and with an average length of 145 feet, were the second most dominant habitat type in terms of total footage. Riffles made up 12 percent of the creek's total length, with an average unit length of 48 feet (Figure 6).

Bedrock was the most common substrate, occurring as the primary substrate in 31 percent of the total units surveyed on Stone Corral Creek. Gravel substrate was the second most common substrate type, occurring in 24 percent of units surveyed. Silt/clay type substrate was commonly associated with bedrock or gravel, occurring as a layer over the other substrates. The lower reach of Stone Corral Creek was heavily dominated by bedrock, giving way to a more gravel base near the confluence with Antelope Creek. Silt/clay substrate is spread consistently throughout the creek system.

**Figure 6. Relative Occurrence of Habitat Types in Stone Corral Creek**




Thirty-three percent of pools had silt/clay as the dominant substrate (Table 32). Fifty-two percent of flat water had gravel as the dominant substrate. Riffles had 56 percent bedrock dominant and 17 percent silt/clay dominant substrate. The most common occurring pool tail substrate was bedrock.

**Table 32. Summary of Substrates on Stone Corral Creek**

| | Silt/Clay | Sand | Gravel | Small cobble | Large cobble | Boulder | Bedrock |
|---|---|---|---|---|---|---|---|
| Riffle | 17 | | 9 | 1 | | 17 | 56 |
| Flat water | 20 | | 52 | | 14 | 14 | |
| Pool | 33 | 5 | 12 | 2 | | 12 | 36 |
| Average | 23 | 2 | 24 | 1 | 5 | 14 | 31 |

The bank composition was overwhelmingly silt/clay. Occasional areas of bedrock bank or cobble bank occurred; where roads passed through or near the creek, boulders dominated the bank. Greater variability of bank composition then occurred in the lower reaches of the creek, where cobbled banks frequently occurred. Most bedrock banks occurred in major blocks where bedrock ridges rise through the valley floor.

Bank vegetation included grasses and star thistle, which dominated both banks. The average percent bank covered by vegetation was 62 percent for the right bank and 63 percent for the left bank. Occasional oaks, willows, cottonwoods, and walnut trees punctuate the bank. Only 11 percent of the habitat units surveyed had some degree of canopy. The average canopy cover was 4 percent, all deciduous trees and shrubs. Trees were more concentrated at the lower end where habitat typing began on Stone Corral Creek.

The average of the total unit covered by all cover types combined was 33 percent. Aquatic vegetation was the most prevalent type of cover, comprising an average of 56 percent of the total unit coverage.

Riffles had a mean total cover of 39 percent, 49 percent of which was aquatic vegetation. An average of 7 percent of the cover in riffles was comprised of boulders. Flat water averaged 34 percent total coverage, of this 61 percent of the cover was aquatic vegetation. Pools had a mean percent total coverage of 26 percent.

Aquatic vegetation was the most common large cover item, occurring in 56 percent of the units surveyed. Boulders and terrestrial vegetation were the next most common cover items at 16 percent and 12 percent, respectively. Undercut banks occurred in 6 percent of the habitat units, and bedrock ledges in 4 percent of the units. No habitat unit types contained all major types of cover (Table 33).

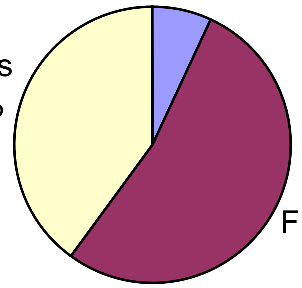
**Table 33. Summary of Habitat Cover in Stone Corral Creek**

| | Percent of each habitat having cover | Percent of Cover Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Undercut banks | Small woody debris | Large woody debris | Root masses | Terrestrial vegetation | Aquatic vegetation | Bubble curtain | Boulders | Bedrock ledges |
| Riffles | 39 | - | - | - | - | 25 | 49 | 18 | 7 | 2 |
| Flat water | 34 | 5 | 5 | - | - | 6 | 61 | - | 21 | 3 |
| Pools | 26 | 12 | - | - | 1 | 4 | 57 | - | 19 | 7 |
| Average | 33 | 6 | 2 | - | - | 12 | 56 | 6 | 16 | 4 |

**Antelope Creek.** Flat water made up the majority of the total footage measured, comprising 53 percent of the total creek measured. The average flat water length on Antelope Creek was 135 feet. Riffles made up 7 percent of the creek's total length, with an average unit length of 18 feet. Pools comprised 40 percent of the total length measured with an average length of 103 feet (Figure 7).

Silt/clay was the most common substrate, occurring as the primary substrate in 24 percent of Antelope Creek. Gravel and small cobble were also common substrates at 22 percent each. Silt/clay type substrate was commonly associated with gravel. Small cobble increased in frequency of occurrence in the upper reaches of Antelope Creek. Gravel substrate occurred uniformly throughout Antelope Creek (Table 34).

**Figure 7. Relative Occurrence of Habitat Types in Antelope Creek**




Silt/clay dominated the majority of pools. Twenty-nine percent of flat water units had silt/clay as the dominant substrate. Gravel and small cobbles at 23 percent and 22 percent respectively (Table 34) dominated riffles.

**Table 34. Summary of Substrates on Antelope Creek**

| | Silt/Clay | Sand | Gravel | Small cobble | Large cobble | Boulder | Bedrock |
|---|---|---|---|---|---|---|---|
| Riffle | 7 | 2 | 23 | 22 | 7 | 9 | 30 |
| Flat water | 29 | 3 | 25 | 27 | 7 | 2 | 7 |
| Pool | 35 | 3 | 18 | 16 | 10 | 14 | 4 |
| Average | 24 | 3 | 22 | 22 | 8 | 8 | 14 |

Bank composition was largely silt/clay. Occasional areas of bedrock bank or cobble bank occurred; where roads passed through or near the creek, boulders dominated the bank. The diversity of bank substrate increased, particularly gravel and cobble, in the upper reaches of Antelope Creek.

Grasses and star thistle dominated both banks. The average percent bank covered by vegetation was 80 percent for the right bank and 80 percent for the left bank. Oaks, willows, cottonwoods, walnut trees, and gray pines punctuate and occasionally line the bank. Forty-seven percent of the habitat units surveyed had some degree of canopy. The average canopy cover was 20 percent. Trees were more concentrated at the middle to upper reaches.

The average of the total stream habitat covered was 31 percent (Table 35). Aquatic vegetation was the most prevalent type of cover, occurring in 65 percent of the units surveyed. Aquatic vegetation comprised an average of 46 percent of the total unit cover.

Riffles had an average total cover of 34 percent, with 43 percent aquatic vegetation. Flat water averaged 30 percent total coverage—58 percent aquatic vegetation. The primary cover for all units was aquatic vegetation. Some units indicated a higher percentage of cover, but these occur on an infrequent basis in this creek.

Aquatic vegetation and terrestrial vegetation were the most common large cover items, occurring in 46 percent and 17 percent respectively of the units surveyed. Most units surveyed had small amounts of a variety of cover types.

**Table 35. Summary of Cover in Antelope Creek**

| Habitat type | Percent of each habitat having cover | Percent of each habitat type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Undercut banks | Small woody debris | Large woody debris | Root masses | Terrestrial vegetation | Aquatic vegetation | Bubble curtain | Boulders | Bedrock ledges |
| Riffles | 34 | 4 | 5 | 4 | 15 | 16 | 43 | 1 | 12 | - |
| Flat water | 30 | 4 | 3 | 1 | 8 | 19 | 58 | 1 | 5 | 1 |
| Pools | 29 | 18 | 7 | 1 | 7 | 15 | 37 | 1 | 13 | 1 |
| Average | 31 | 9 | 5 | 2 | 10 | 17 | 46 | 1 | 10 | 1 |

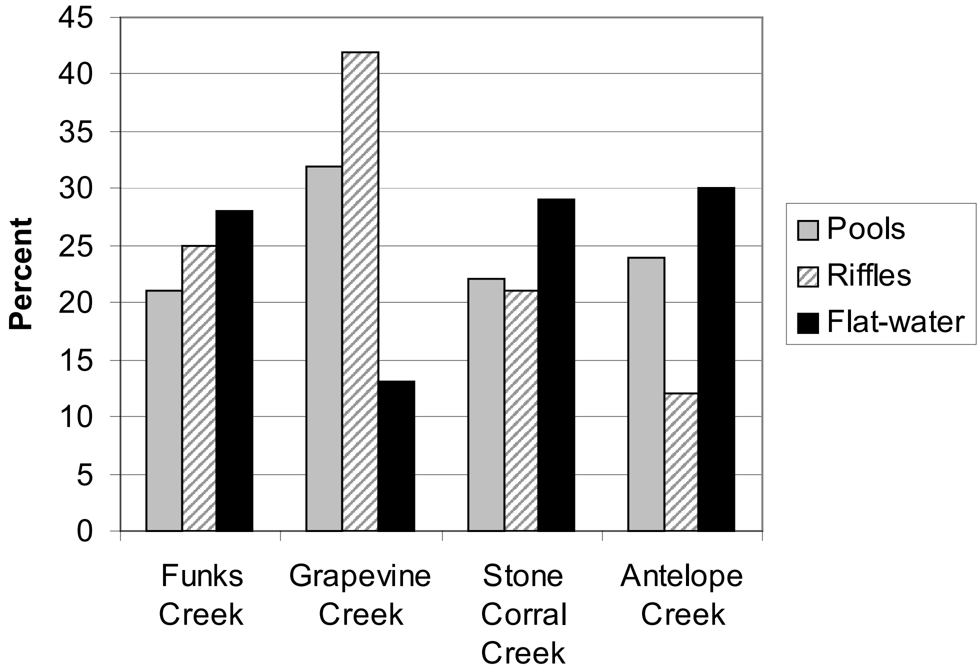
### *Discussion*

Habitat typing was done to quantify physical aquatic habitat to provide information for the NEPA and CEQA process. This quantification will determine habitat lost by inundation and will form the basis for mitigation. Grapevine Creek had more pools and riffles. Grapevine Creek also had the least amount of flat water. Funks Creek and Stone Corral Creek had similar amounts of pools, flat water, and riffles. Antelope Creek was more like Stone Corral and Funks Creeks than Grapevine Creek. Grapevine Creek flows from springs in hills to the west of Sites-Colusa and is steeper than the other creeks. That causes Grapevine Creek to have less flat water than the other creeks (Table 36 and Figure 8).

**Table 36. Comparison of Relative Occurrence of Pools, Flat Water, and Riffles in Creeks in the Sites-Colusa Project Area**

| | Funks | Grapevine | Stone Corral | Antelope |
|---|---|---|---|---|
| Pools | 21 | 32 | 22 | 24 |
| Riffles | 25 | 42 | 21 | 12 |
| Flat water | 28 | 13 | 29 | 30 |

**Figure 8. Relative Occurrence of Habitat Types in Sites-Colusa**




Stone Corral Creek had a high abundance of larger substrates. Grapevine Creek had the lowest percentage of silt. Grapevine Creek also had the most gravel, small cobble, and large cobble substrate. Fine materials are abundant in Stone Corral and Antelope Creeks. The relatively steep nature of Grapevine Creek washes fine materials away and leaves coarser materials behind (Table 37).

**Table 37. Summary of Substrates (%) by Habitat Type on Creeks in the Sites-Colusa Study Area**

| Creek | Habitat type | | | | | | |
|---|---|---|---|---|---|---|---|
| | Silt/Clay | Sand | Gravel | Small cobble | Large cobble | Boulder | Bedrock |
| Funks | 12 | 3 | 32 | 28 | 7 | 3 | 15 |
| Grapevine | 8 | 1 | 30 | 32 | 13 | 3 | 13 |
| Stone Corral | 23 | 2 | 24 | 1 | 5 | 14 | 31 |
| Antelope | 24 | 3 | 22 | 22 | 8 | 8 | 13 |

The occurrence of cover types followed the same trends for all four creeks surveyed. Aquatic vegetation was the dominant cover type in each creek. Stone Corral Creek showed a higher percent occurrence of boulders—nearly twice as many as Antelope Creek and nearly five times as many as Funks and Grapevine Creeks.

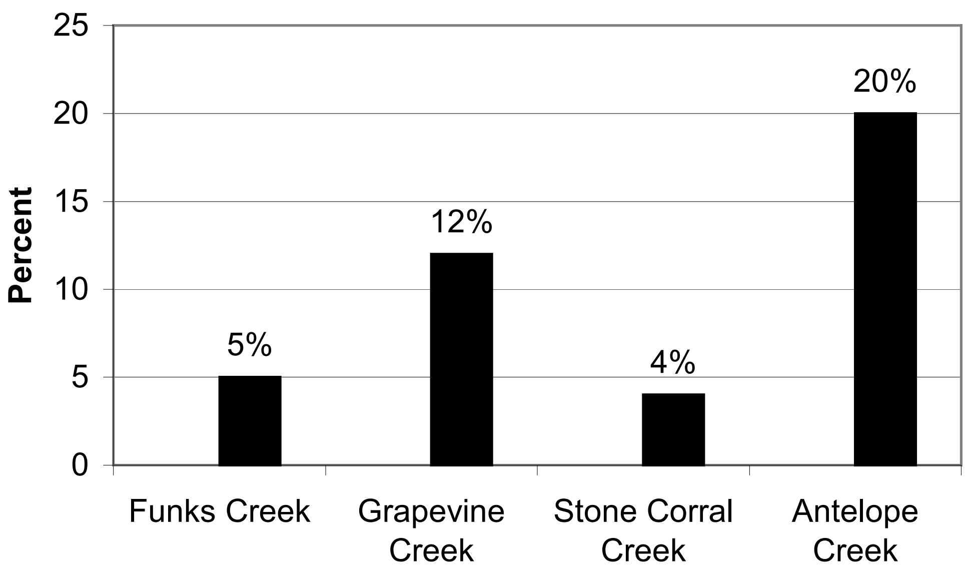
Bubble curtains were more common in Funks Creek. Antelope Creek had more cover provided by root masses than the other creeks (Table 38).

**Table 38. Summary of Cover (percent of each habitat type) on Creeks in the Sites-Colusa Study Area**

| Creek | Percent of each habitat having cover | Percent of Habitat Cover | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Undercut banks | Small woody debris | Large woody debris | Root masses | Terrestrial vegetation | Aquatic vegetation | Bubble curtain | Boulders | Bedrock ledges |
| Funks | 27 | 17 | 1 | 1 | 1 | 7 | 25 | 14 | 25 | 9 |
| Grapevine | 29 | 4 | 3 | 4 | 7 | 10 | 53 | 6 | 10 | 4 |
| Stone Corral | 33 | 6 | 1 | - | 1 | 10 | 54 | 6 | 16 | 4 |
| Antelope | 31 | 9 | 5 | 2 | 10 | 17 | 46 | 1 | 9 | 1 |

The pools of all four creeks had similar degrees of cover for all habitats, which were spread very closely to 30 percent coverage. Notable spikes in percent unit covered occurred in unit types that have a very low frequency of occurrence. Grapevine and Antelope Creeks show an increase in the occurrence of canopy (Figure 9).

**Figure 9. Percent of Canopy Over Creeks Measured at Sites-Colusa Project Area**




Creek flows varied widely with lack of rainfall, forcing activity to be suspended on some areas of Funks, Stone Corral, and Antelope Creeks until further rain revived the stream flow. This suggests that streams on the floor of the Antelope Valley are intermittent and only flow during the summers of particularly wet years. Antelope Creek, and particularly Grapevine Creek, could flow year round. The majority of the fish found in this area were juvenile fish that would probably use the creeks only as rearing areas. The high concentration of sediments and aquatic vegetation would also raise the biological oxygen demand in the creeks during the summer months in any remaining deeper pools, making them uninhabitable to most fish, with the exception of the California roach, *Lavinia exilicauda* (Moyle 1976).

Both Grapevine and Antelope Creeks are the continuations of the main creek channels of those systems. Both creeks also show an increase in canopy and larger substrates. When viewed as just two creek systems, Funks-Grapevine and Stone Corral-Antelope both show a trend toward more canopy and larger substrates. The increased canopy and decreased sedimentation in the upper reaches of Antelope Creek and Grapevine Creek may provide sufficient cooling factors for year-long fish inhabitants. Eight-to-10 inch largemouth bass, *Micropterus salmoides*, were seen in the upper reaches of Grapevine Creek, which suggests a year-round flow capable of supporting larger fish. The larger substrate size also provides cover for the minnow fry that occupy the creeks in the spring.

Very little riparian vegetation, such as rushes, essential cover for aquatic amphibians and reptiles, exists on the banks of any of the creeks in the Sites-Colusa Project area, with the exceptions of the upper reaches of Antelope and Grapevine Creeks.

## Summary of Fish Studies for Proposed Projects

Thomes Creek has runs of fall-run, late fall-run, and limited numbers of spring-run chinook salmon. Steelhead also spawn in Thomes Creek. Large runs of Sacramento suckers and Sacramento pike minnows migrate up Thomes Creek. Fall-run salmon, Sacramento suckers, and Sacramento pike minnow also migrate up Stony Creek. Cottonwood Creek has larger runs of fall-run, late fall-run, and spring-run chinook salmon. Cottonwood Creek has a run of steelhead, as well as annual migrations of Sacramento suckers and Sacramento pike minnows. Stone Corral Creek and Funks Creek have no established runs of chinook salmon but have small runs of Sacramento suckers and Sacramento pike minnows.

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