7.3 Aquatic Resources

7.3.1 Overview

This section discusses aquatic resources in the vicinity[1] of Yuba County Water Agency's (YCWA's or Licensee's) Yuba River Development Project (Project) and is divided into four topics. Section 7.3.2 describes the history of fishes in the Yuba River Basin. Section 7.3.3 identifies specific special-status aquatic species that have the potential to be affected by continued Project operation and maintenance (O&M), provides a brief life history description for each of the special-status aquatic species, and describes the known occurrence of the special-status aquatic species in relation to Project facilities and features. Section 7.3.4 describes relevant and reasonably available information regarding aquatic resources in areas upstream of the Project, within the Project Area,[2] and downstream of the Project. Areas upstream of the Project include the Middle Yuba River upstream of Our House Diversion Dam, Oregon Creek upstream of Log Cabin Diversion Dam, South Yuba River upstream of the mouth of the river at the United States Army Corps of Engineers' (USACE's) Englebright Reservoir, and on the North Yuba River upstream of New Bullards Bar Reservoir. The area downstream of the Project includes the lower Yuba River downstream of USACE's Daguerre Point Dam to the confluence with the Feather River.

7.3.2 Historic Distribution of Fish and Influences Affecting Yuba River Fisheries

7.3.2.1 Historic Distribution

Climatic and geologic forces are the dominant architects of Sierra Nevada ecosystems (SNEP 1997). The natural lakes and streams in the Project Vicinity were most recently formed during the Pleistocene Age from 2 million to 10 thousand years ago. During this time, glaciers periodically covered the high country of the Yuba River watershed, carving out numerous cirque valleys and shallow lake basins. Glacial scouring, working on the uplifted granitic batholithic which created the Sierra Nevada, also created the hanging valleys, steep stream gradients, and numerous barrier falls common in the watersheds. These features created upstream passage barriers and prevented fish from colonizing most high-elevation lakes and streams after the glaciers receded. This glacial scouring and harsh climate left most soils in the high Sierra thin and nutrient poor, resulting in nutrient poor conditions in most high lakes and streams (CDFG 2007a).

Ten thousand years ago, glaciers receded and created the mid- and high-elevation lakes of the Sierra Nevada, most of which were isolated from colonization by downstream fish populations

[1] For the purposes of this document, the Project Vicinity is defined as the area surrounding the Project on the order of a United States Geological Survey (USGS) 1:24,000 topographic quadrangle.

[2] For the purposes of this document, the Project Area is defined as the area within the Federal Energy Regulatory Commission (FERC) Project Boundary and the land immediately surrounding the FERC Project Boundary (i.e., within about 0.25 mile of the FERC Project Boundary) and includes Project-affected reaches between facilities and downstream to the next major water controlling feature or structure.

by barrier falls on outflowing rivers and streams. The estimated elevation above which most Sierra Nevada lakes and streams were fishless ranges between 4,900 and 6,000 feet[3], depending on the drainage (CDFG 2007a; Moyle et al. 1997). In the western Sierra Nevada, trout were the fish generally reaching the highest elevations. Streams at elevations above the upper limits of fish species were dominated instead by amphibians, insects, and other aquatic invertebrates (CDFG 2007a). While some lakes and streams in the high Sierra were accessible to some fish (e.g., golden or Lahontan trout), accessible waterbodies were few in number (Moyle et al. 1997). Accessible, historically fishless high Sierra lakes and streams identified by Moyle et al. (1997) are not located in the Project Vicinity.

Since the massive influx of Euro-Americans began in 1850, the fish fauna and fisheries of the Sierra Nevada have changed dramatically (Moyle et al. 1995). Historically, the Sacramento–San Joaquin Drainage, which includes most of the watersheds on the west side of the Sierra Nevada, contained the richest native fish fauna with 22 taxa, including three anadromous fish – Chinook salmon, steelhead, and Pacific lamprey – that were an important source of food for Native Americans of the region (Moyle 1976; Lindstrom 1993; Moyle et al. 1997). The only native non-trout species found at high elevations on the west side of the Sierra is the Sacramento sucker, which occurred naturally at elevations as high as 8,200 feet in the Kern River (Moyle et al. 1997). Native foothill fish included both anadromous and resident salmonid species, lamprey, hitch, roach, hardhead, pikeminnow, dace, sucker, perch, and sculpin (Moyle et al. 1997). Anadromous sturgeon may also have occurred. Based on the biological data available, streams in the Project Vicinity may serve as a transition zone that provides habitat suitable for both cold- and warm-water fish species (Table 7.3.2-1).

Table 7.3.2-1. Fish native to the upper Yuba River watershed.

Family/Species	Presence/Trend[1]	Habitat[2]
CHINOOK SALMON (SALMONIDAE)		
Spring-run (*Oncorhynchus tshawytscha*)	Extirpated/Unknown[3]	Anadromous, mid-elevation, lowlands
Fall-run (*Oncorhynchus tshawytscha*)	Extirpated/Unknown[4]	Anadromous, foothills, lowlands
LAMPREYS (PETROMYZONTIDE)		
Pacific Lamprey (*Lampetra tridentata*)	Extirpated/Unknown[4]	Anadromous, foothills, lowlands
TROUT (SALMONIDAE)		
Resident rainbow trout (*Oncorhynchus mykiss*)	Present/abundant	Resident, foothills, high elevation
Winter steelhead (*Oncorhynchus mykiss*)	Extirpated/Unknown[4]	Anadromous, lowlands, foothills
MINNOWS (CYPRINIDAE)		
Sacramento hitch (*Lavinia exilicauda*)	Rare/declining	Lowlands, foothills
Sacramento roach (*Lavinia s. symmetricus*)	Uncommon/stable	Lowlands, foothills
Hardhead (*Mylopharodon conocephalus*)	Unknown/unknown	Lowlands, foothills
Sacramento pikeminnow (*Ptychocheilus grandis*)	Common/stable expanding	Lowlands, foothills
Sacramento speckled dace (*Rhinichthys osculus ssp*)	Common/stable	Lowlands, foothills
SUCKERS (CATASTOMIDAE)		
Western sucker (*Catostomus o. occidentalis*)	Common/stable expanding	Lowlands, foothills

[3] All elevation data are in United States Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) National Geodetic Survey Datum of 1988 (NGVD 88).

Table 7.3.2-1. (continued)

Family/Species	Presence/Trend[1]	Habitat[2]
SCULPINS (COTTIDAE)		
Riffle sculpin (*Cottus gulosus)*	Uncommon/stable	Lowlands, foothills
Prickly sculpin (*Cottus asper)*	Uncommon/stable	Lowlands, foothills

Source: Modified from NID 2008.
1 Tahoe National Forest Fish Species Past/Present. Updated January 1, 2001 (applies only to FS lands)
2 Moyle et al. 1996
3 Extirpated in all sub-basins of the Project Vicinity. Historically, inhabited mid-elevation portions of Project Vicinity sub-basins. Lowland portions of sub-basins were mainly used as migratory corridors.
4 Extirpated from the upper Yuba River watershed by blockage at USACE's Englebright Dam on the lower Yuba River.

7.3.2.2 Anadromous Fish

7.3.2.2.1 Historic Range

Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (16 U.S.C. §§ 1801-1891d) requires the identification of Essential Fish Habitat (EFH) for federally managed fishery species and the implementation of measures to conserve and enhance this habitat (16 U.S.C. § 1855(b)(2)). In the Mid-Pacific Region, the Pacific Fisheries Management Council designates EFH and NMFS approves the designation. EFH includes specifically identified waters and substrate necessary for fish spawning, breeding, feeding, or growth to maturity, and therefore covers a species' full life cycle (16 U.S.C. § 1802(10)). EFH only applies to commercial fisheries, including all runs (spring-run and fall/late fall-run) of Chinook salmon. Chinook salmon habitat in the Yuba River (USGS Hydrologic Unit 18020107) has been identified as part of the Pacific salmon freshwater EFH. EFH on the Yuba River includes all water bodies NMFS believes were occupied or historically accessible to Chinook salmon within the United States Geological Survey's Hydrologic Unit Code (HUC) 18020125 (USGS 2009).

In the North Yuba River, NMFS has designated Chinook salmon EFH "*To Salmon Creek, near Sierra City*." There are no known natural obstructions from Downieville upstream to Sierra City, where Salmon Creek enters the North Yuba River (Yoshiyama et al. 2001). Deep pools are present throughout the North Yuba River from its mouth up to Sierra City (E.R. Gerstung, personal observation in Yoshiyama et al. 2001), and could have provided holding habitat for spring-run Chinook salmon (Yoshiyama et al. 2001).

In the Middle Yuba River, NMFS' EFH includes; *"The lower river, near where the North Fork joins"*. This assessment is presumably based on Yoshiyama et al. (2001) who considered a 10-foot-high falls on the lower Middle Yuba River located about 1.5 miles above the mouth as the effective upstream limit of salmon movement, and who cited 1938 unpublished California Department of Fish and Game (CDFG) data supposedly documenting both salmon and steelhead in this lower part of the Middle Yuba River. In the South Yuba River, NMFS' EFH includes *"1-2 miles upstream, perhaps spring run accessed to the present town of Washington."* There are records of salmon occurring within 1 to 2 miles upstream of the mouth of the South Yuba River (CDFG unpublished data as cited in Yoshiyama et al. 2001). Yoshiyama et al. (2001) consider the cascade, with at least a 12-foot drop, located 0.5 mile below the juncture of Humbug Creek as essentially the historical upstream limit of salmon during most years of natural streamflows.

NMFS has not established EFH for steelhead in the Yuba River because EFH only applies to commercial fisheries, which do not include steelhead. In the North Yuba River according to Yoshiyama et al. (2001) there is photographic evidence of steelhead occurring as far upstream as Downieville at the mouth of the Downie River (CDFG file records). Because there are no natural obstructions from Downieville upstream to Sierra City, steelhead probably ascended the higher-gradient reaches up to about two miles above the juncture of Salmon Creek and their absolute upstream limit on the North Fork would have been Loves Falls. In the Middle Yuba River, it is likely that the barrier falls located 1.5 miles above the mouth restricted steelhead upstream movement as well as Chinook salmon. However, based on unpublished CDFG data in Yoshiyama et al. (2001), it is possible that steelhead were found as far upstream as the mouth of Bloody Run Creek. In the South Yuba River, based on unpublished CDFG data in Yoshiyama et al. (2001) steelhead ascended as far as the confluence of Poorman Creek near the present town of Washington.

7.3.2.2.2 Influences Affecting Anadromous Fish Abundance

Historically, the Yuba River watershed reportedly was one of the most productive habitats for runs of Chinook salmon and steelhead (Yoshiyama et al. 1996). Although it is not possible to estimate from historical data the numbers of spawning fish, an assessment by CDFG (1993) suggests that the Yuba River "*historically supported up to 15% of the annual run of fall-run Chinook salmon in the Sacramento River system*" (Yoshiyama et al. 1996).

However, by the late 1800s, anadromous fish populations were experiencing significant declines, primarily because of mining activities and extreme sedimentation following flood events (McEwan 2001; Yoshiyama et al. 2001). In the process of disturbing streambeds and banks, mining operations also destroyed large salmon runs in Sierra Nevada streams and turned shady, pool-and-riffle trout streams into long, shallow, exposed runs (Moyle 2002).

To control flooding and the downstream movement of sediment, construction of several man-made instream structures on the Yuba River occurred during the early 1900s. A structure referred to as Barrier No. 1, built in 1904–1905, was located 4.5 miles above the later site of Daguerre Point Dam and probably hindered salmon upstream movement until floods destroyed it in 1907 (Sumner and Smith 1940). In 1906, the California Debris Commission, a partnership between the Federal Government and the State of California, constructed Daguerre Point Dam specifically to stabilize the mining debris and reduce flood risks. This 28-foot high dam served to retain the debris and made it difficult for spawning fish to migrate upstream, although salmon reportedly did surmount that dam in occasional years because they were observed in large numbers in the North Yuba River at Bullards Bar during the early 1920s (Yoshiyama et al. 2001). In 1924, the USACE installed fish ladders at Daguerre Point Dam, but these ladders were washed out during winter storms in 1927-28. Although USACE rebuilt the ladders, passage at the dam was considered to remain impeded.

USACE's 260-foot-high Englebright Dam, constructed in 1941, upstream of USACE's Daguerre Point Dam, has no fish ladders and blocks anadromous fish access to all areas upstream of the dam (Eilers 2008; PG&E 2008; CDWR 2009). The dam effectively restricts anadromous fish to the lower 24 miles of the Yuba River. The lower Yuba River is among the last of the Central

Valley floor tributaries supporting populations of naturally-spawning spring-run Chinook salmon and steelhead. There is no fish hatchery located on the lower Yuba River.

The lower Yuba River historically served primarily as a migration corridor for anadromous salmonids to upstream habitats. Since completion of New Bullards Bar Reservoir by Licensee in 1970, higher, colder flows in the lower Yuba River have improved conditions for adult over-summer holding, spawning, and juvenile rearing of anadromous salmonids in the lower Yuba River. Compared to pre-Project hydrology, present Project operations provide flows that are generally lower during the winter and spring and higher during the summer and fall. These Project flows provide generally suitable conditions throughout the year for anadromous salmonids. Also, the recent implementation of the Lower Yuba River Accord (Yuba Accord) will provide additional improvements to conditions through the revised minimum flow requirements. The new flow schedules were developed based on indices of water availability, identified flow-related major stressors including flow-dependent habitat availability, flow-related habitat complexity and diversity, and water temperatures. Presently, the lower Yuba River is one of the few Central Valley floor tributaries that consistently provide suitable water temperatures for salmonids throughout the year.

7.3.3 Special-status Aquatic Species

For the purpose of this Pre-Application Document, a species is considered to be a special-status aquatic species (i.e., fish, amphibian, aquatic reptile, turtle, mollusk, or invertebrate) if it has a reasonable probability of occurring in the Project Area and meets one or more of the following criteria:

- Found on public land administered by the United States Department of Interior (USDOI) Bureau of Land Management (BLM), and formally listed as Sensitive (BLM-S) on BLM's *Animal Sensitive Species List* (BLM 2006).
- Found on USDOC, NOAA, NMFS *List of Species of Concern* (NMFS 2009b), and listed as a Species of Concern (NMFS-S).
- Found on National Forest System (NFS) land managed by the United States Department of Agriculture (USDA) Forest Service (Forest Service) and listed on the Forest Service's list of *Forest Sensitive Species* (FSS), updated as of June 8, 1998, Appended March 6, 2001; May 7, 2003; April 21, 2004; March 3, 2005; and October 15, 2007.
- Found on NFS land managed by the Forest Service as either the Tahoe National Forest (TNF) or the Plumas National Forest (PNF), and formally listed by that forest as a Management Indicator Species (MIS) (USFS 2007, 2008).
- Found on the CDFG Commission's list of *State and Federally Listed Endangered and Threatened Animals of California* (CDFG 2009a). Species on the list that are considered special-status for the purpose of this Relicensing are those that are candidates for listing under the California Endangered Species Act (CESA) as endangered (SCE), threatened

(SCT), or a candidate for delisting (SCD). Also considered special-status are those wildlife species CDFG has designated Species of Special Concern (CSC).[4]

- Found on the list of species afforded protection under the federal Endangered Species Act (ESA) that occur in the Project Area, which includes the United States Geological Survey (USGS) 1:24,000 topographic quadrangles Strawberry Valley (574D, 1994), Clipper Mills (574C, 1994), Challenge (558B, 1995), Camptonville (558A, 1995), Pike (557B, 1975), French Corral (558C, 1995), Oregon House (559D, 1995), and Smartville[5] (543A, 1995) (USFWS 2009a). Species on the list that are considered special-status species for the purpose of the relicensing are those species that are proposed for listing as endangered or threatened under the ESA (FPE and FPT, respectively), a candidate for listing under the ESA (FC), or proposed for delisting from the ESA (FPD).[6]

Based on Licensee's review, six special-status aquatic species may occur in the Project Area or otherwise be affected by continued Project O&M. These species are:

- Fishes
  - ➢Central Valley fall- and late-fall-run Chinook salmon (*Oncorhynchus tshawytscha)* Evolutionarily Significant Unit (ESU) (NMFS-S, CSC, FSS)
  - ➢Hardhead minnow (*Mylopharodon conocephalus*) (CSC, FSS)
  - ➢Sacramento splittail (*Pogonichthys macrolepidotus*) (CSC)
  - ➢Sacramento-San Joaquin roach (*Lavinius symmetricus symmetricus*) (CSC)

- Amphibians
  - ➢Foothill yellow-legged frog *(Rana boylii)* (CSC, FSS, BLM-S)

- Aquatic Reptiles and Turtles
  - ➢Western (or Pacific) pond turtle *(Emys* [*Actinemys*] [formerly *Clemmys*] *marmorata)* (CSC, FSS)

Not included in this list is the Sierra Nevada yellow-legged frog (SNYLF)[7] (CSC), which has been documented within the USGS topographic quadrangles queried in the California Natural Diversity Database (CNDDB), but does not occur at the elevations associated with the Project. Historically, SNYLF occurred at sites primarily at elevations above 5,900 feet at lake, pond, and stream complexes in montane or sub-alpine forests and meadows (Knapp and Matthews 2000;

[4] Species listed as threatened (ST) or endangered (SE) under the CESA, and species that are considered Fully Protected (SFP) are not considered special-status for the purpose of the relicensing proceeding. These species are discussed separately in the Threatened, Endangered and Fully Protected Species Section of this Pre-Application Document (Section 7.7).

[5] In 2008, the people of this community petitioned to have the name changed to Smartsville, with an 's' in the middle of the name. However, the USGS gage refers to the former spelling of the community name. Therefore in this document, the community is referred to as such.

[6] Species listed as threatened (FT) or endangered (FE) under the ESA are not considered special-status for the purpose of the relicensing proceeding. These species are discussed separately in the Threatened, Endangered, and Fully Protected Species Section of this Pre-Application Document (Section 7.7).

[7] Sierra Nevada yellow-legged frog (SNYLF) (*Rana sierrae*) was previously described as the Sierra Nevada Distinct Population Segment of the mountain yellow-legged frog (*Rana muscosa*). The southern population segment found in the San Gabriel, San Bernardino, and San Jacinto mountains of southern California retains the name *R. muscosa* and is listed as a federally endangered species (USFWS 2003a; Vredenburg et al. 2007).

Pope and Matthews 2001; USFWS 2003b). This species occurs infrequently at elevations as low as 4,400 feet in streams located in forested settings, including two sites on the Plumas National Forest (Matthews et al. 2005). CDFG (2009c) reports one occurrence of SNYLF in the Project Vicinity at Pinkard Creek, north of Lost Creek Reservoir.

Central Valley steelhead and spring-run Chinook salmon also were not included in this list of special-status species because the Yuba River populations of these species, which are listed as federal threatened species, occur below USACE's Englebright Dam. These species are addressed in the descriptions of threatened and endangered species, in Section 7.7 of this Pre-Application Document.

A description of each of the seven special-status aquatic species, including its nearest known occurrence to Project facilities and features, is provided below.

7.3.3.1 Fishes

7.3.3.1.1 Central Valley fall and late fall-run Chinook salmon ESU (NMFS-S, CSC, FSS)[8]

Four principal life history variants of Chinook salmon are recognized in the Central Valley and are named for the timing of their spawning runs: fall-run, late fall-run, winter-run, and spring-run.

Seventeen distinct groups, or ESUs, of naturally-spawned Chinook salmon occur from southern California to the Canadian border and east to the Rocky Mountains; five of these groups occur in California (Myers et al. 1998). All variants (i.e., fall-, late fall-, winter-, and spring-runs) occur in the Project Vicinity (NMFS 2008a) and the spring-, fall-, and late fall-runs have been documented in the lower Yuba River (Massa and McKibbin 2005).

Of these variants, the Central Valley fall-/late fall-run Chinook salmon ESU (a combination of the fall- and late fall-runs as characterized by NMFS) was included on the Species of Concern List under the ESA in 2004 due to concerns about population size and hatchery influence (NMFS 2009a).

Although it is an important commercial and recreational fish species, recent declines in populations of this species have resulted in harvest management restrictions. In April 2009, the Pacific Fishery Management Council and NMFS adopted a closure of all commercial ocean salmon fishing through April 30, 2010, and placed restrictions on inland salmon fisheries (CDFG 2009a).[9]

[8] Photo source: http://www.usgs.gov/features/lewisandclark/images/Chinook_Salmon.jpg

[9] Chinook salmon listed as threatened (ST) or endangered (SE) under the CESA, and species that are considered Fully Protected (SFP), or listed as threatened (FT) or endangered (FE) under the ESA, are not considered special-status for the purpose of the relicensing proceeding. These species are discussed separately in the Threatened, Endangered, and Fully Protected Species Section of this Pre-Application Document (Section 7.7).

Chinook salmon are the largest salmonids, with adults often exceeding 40 pounds, and individuals over 120 pounds reported (NMFS 2008a). The generalized life history of Pacific salmon involves spawning, incubation, hatching, emergence, and rearing in freshwater, migration to the ocean, and subsequent initiation of maturation and return to freshwater for completion of the life-cycle (Myers et al. 1998).

Adult Chinook salmon migrate from the ocean into the freshwater streams and rivers of their birth to mate (i.e., anadromy) and, following a single spawning event, they die (i.e., semelparity). Adult fall-run Central Valley Chinook salmon generally begin migrating upstream annually in June, with immigration continuing through December (Moyle 2002; NMFS 2008a). Immigration generally peaks in November and, typically, greater than 90 percent of the run has entered their natal river by the end of November (Moyle et al. 2008).

The timing of adult Chinook salmon spawning activity is influenced by water temperatures. In general, when daily average water temperatures decrease to approximately 60 degrees Fahrenheit (°F), female Chinook salmon begin to construct nests (i.e., redds) into which their eggs are eventually released and simultaneously fertilized by males. Fall-run Chinook salmon require gravel and cobble areas, primarily at the heads of riffles, with water flow through the substrate for spawning. Gravel and cobble sizes can range from 0.1 to 6 inches. The fall-run Chinook salmon spawning and embryo incubation period generally extends from October through March, but may occur earlier if temperature conditions fall below 60°F (Moyle 2002; NMFS 2008a). Within the Project Vicinity, fall-run Chinook salmon fry emergence typically occurs from late December through March (Moyle 2002). Growth rates are largely influenced by water temperature, and the optimal range of juvenile rearing temperatures is 55°F-65°F. Young Chinook salmon will survive and grow within the range of 41°F-66°F, but steady temperatures above 75°F are lethal (UC Davis 2009).

In the Central Valley, fall-run Chinook salmon are the most numerous of the four salmon runs and are the principal run raised in hatcheries (Moyle 2002). Historical accounts indicate that prior to construction of the original Bullards Bar Dam in the early 1920s, large numbers of Chinook salmon were present as far upstream as Downieville on the North Yuba River, but these runs were believed to be spring-run Chinook salmon (Yoshiyama et al. 2001). Although actual numbers are not known, historical annual escapements of Chinook salmon into the Sacramento River are estimated to have reached 600,000 spawners (Massa and McKibbin 2005; Massa 2008). Within Yuba County, the Bear, Feather, and Yuba (downstream of USACE's Englebright Dam) river watersheds support runs of Chinook salmon (CDWR 2008, 2009; UC Davis 2009).

Fall-run Chinook salmon are raised at five major Central Valley hatcheries that release more than 32 million smolts each year into California water bodies (CDFG 2007b). While hatchery programs can increase overall returns to the fishery, Lindley et al. (2007) concluded that hatchery programs have negative effects on wild populations of Chinook salmon due to competition by hatchery fish with wild juveniles, and straying of hatchery fish both within and between basins and resultant introgression of hatchery stocks with native populations.

Recent habitat assessments for portions of the upper Yuba River within the Project Area indicate that the analyzed habitat and temperature conditions in the upper Yuba River watershed are capable of supporting anadromous salmonids (CDWR 2008). However, the habitat assessment study was unable to conclude that the introduction of Chinook salmon or steelhead would be feasible over the long term, due to the need for additional data relating to biological and habitat issues, water supply and hydropower impacts, flood risk, water quality, sediment transport, and socio-economics (CDWR 2008).

Escapement surveys within the Project Area for Chinook salmon occur from the Narrows Pool to USACE's Daguerre Point Dam. Surveys below the Project Area extend from USACE's Daguerre Point Dam to the Simpson Lane Bridge. Escapement surveys suggest that the majority (on average approximately two-thirds) of Chinook salmon spawning in the Yuba River occurs above USACE's Daguerre Point Dam (Jones & Stokes 2006; Massa 2006, 2007). During the escapement surveys, recoveries of Chinook salmon with coded wire tags (CWT) indicate that straying of spring-run and fall-run Chinook salmon from the Feather River hatchery occurs in the lower Yuba River. Additionally, during 2008, six Chinook salmon adults were recovered during the late-winter and early-spring portion of the escapement surveys with CWTs demonstrating that these were late fall-run fish from the Coleman National Fish Hatchery located on Battle Creek.

Throughout the Central Valley, the number of Chinook salmon returning in the fall to spawn has exhibited a declining trend in recent years based on data reported in GrandTab[10]. In the lower Yuba River, fall-run Chinook salmon[11] spawning escapement estimates have been lower in recent years than the preceding 30-year average of about 15,000 fish. Nonetheless, by contrast to the overall Central Valley, fall-run Chinook salmon annual spawning estimates have exhibited an increasing trend in recent years, with approximately 2,600 fish during 2007, 3,600 during 2008, and 4,635 during 2009.

Unlike spring-run Chinook salmon, adult fall-run Chinook salmon do not exhibit an extended over-summer holding period. Rather, they stage for a relatively short period of time prior to spawning. Adult fall-run Chinook salmon immigration and staging has been reported to generally occur in the lower Yuba River from August through November (CALFED and YCWA 2005).

Examination of preliminary data obtained from the carcass surveys does not indicate a distinct bimodal distribution of spawning activities (i.e., a distinct spring-run spawning period followed by a distinct fall-run Chinook salmon spawning period) but instead demonstrates a slow build-up of spawning activities starting in early September and transitioning into the main fall-run spawning period. The lower Yuba River fall-run Chinook salmon spawning period has been reported to extend from October through December (CALFED and YCWA 2005). Preliminary data from the recently conducted redd surveys, and back-calculations from previous and recent carcass surveys, generally confirm this temporal distribution. During the pilot redd survey conducted from the fall of 2008 through spring of 2009, the Yuba Accord RMT (2010) report

[10] GrandTab is a compilation of annual population estimates for Chinook salmon, Oncorhynchus *tshawytscha*, in the Sacramento and San Joaquin River systems. GrandTab is available for download at: http://www.calfish.org/IndependentDatasets/CDFGFisheriesBranch/tabid/157/Default.aspx

[11] For the lower Yuba River, GrandTab does not distinguish between fall-run and spring-run Chinook salmon, and report all annual spawning stock escapement estimates as fall-run Chinook salmon.

that the majority (about 63%) of fresh Chinook salmon redds constructed during November and December of 2008, potentially representing fall-run Chinook salmon, were observed upstream of Daguerre Point Dam.

Fall-run Chinook salmon embryo incubation in the lower Yuba River extends from the time of egg deposition through alevin emergence from the gravel. The fall-run Chinook salmon embryo incubation period has been reported to extend from October through March (YCWA *et al.* 2007). Based upon consideration of accumulated thermal units from the time of egg deposition through hatching and alevin incubation, the fall-run incubation period is considered to extend from October through March. This time period is consistent with observed trends in Chinook salmon fry captures in the rotary screw traps (RSTs) in the lower Yuba River.

Fall-run Chinook salmon fry emergence generally occurs from late-December through March (Moyle 2002). Fall-run Chinook salmon juvenile rearing and outmigration in the lower Yuba River has been reported to primarily occur from December through June (CALFED and YCWA 2005; SWRI 2002). In the lower Yuba River, most fall-run Chinook salmon exhibit downstream movement as fry shortly after emergence from gravels, although some individuals rear in the river for a period up to several months and move downstream as juveniles. Thus, the fry rearing lifestage is considered to extend from December through April, and the juvenile rearing lifestage from March through June.

Juvenile salmonid outmigration (RST) monitoring has been conducted in the lower Yuba River near Hallwood Boulevard, located approximately 6 river miles (RM) upstream from the city of Marysville, by CDFG annually from 1999 to 2006, and by the Yuba Accord RMT from 2006 to 2009. Data from CDFG RST monitoring are available from 1999 to 2005, and a Yuba Accord RMT report (Campos and Massa 2010) has been prepared for the sampling period extending from October 1, 2007 to September 30, 2008. Analyses of CDFG RST data indicate that about 98 to 99% of the total numbers of juvenile Chinook salmon were captured by May 1 of each year, followed by up to about 1 percent during May and June (YCWA *et al.* 2007). During the 2007 to 2008 sampling period, 95 percent of all juvenile Chinook salmon were captured by June 2, 2008 (Campos and Massa 2010).

For the sampling periods extending from 2001 to 2005, CDFG identified specific runs based on sub-samples of lengths of all juvenile Chinook salmon captured in the RSTs by using the length-at-time tables developed by Fisher (1992), as modified by S. Green (CDWR). Although the veracity of utilization of the length-at-time tables in the Yuba River has not been ascertained, the examination of run-specific determinations indicate that, in the lower Yuba River, the majority (81.1%) of fall-run Chinook salmon move past the Hallwood Boulevard RST from December through March, with decreasing numbers captured during April (8.9%), May (6.6%), June (3.2%), and July (0.2%). Most of the fish captured from December through March were post-emergent fry (< 50 mm FL), while nearly all juvenile fall-run Chinook salmon captured from May through July were larger (≥ 50 mm FL) (YCWA *et al.* 2007). Juvenile fall-run Chinook salmon downstream movement (fry and larger juveniles) extends from late December to mid-July.

7.3.3.1.2 Hardhead Minnow (FSS, CSC)[12]

The hardhead minnow is a large cyprinid species that can reach lengths of over 23 inches, and generally occurs in large, undisturbed, low- to mid-elevation, cool- to warm-water rivers and streams (Moyle 2002). Hardhead was designated CSC by CDFG in 1995, and is listed as a Class 3 Watch List species, meaning that it occupies much of its native range but was formerly more widespread or abundant within that range (CDFG 2009a, b). Historically, hardhead were considered a widespread and locally abundant species in California, but their specialized habitat requirements, widespread alteration of downstream habitats, and predation by smallmouth bass have resulted in population declines and isolation of populations (Moyle 2002).

Hardhead also have been abundant in reservoirs. However, most of these reservoir populations have proved to be temporary, presumably the result of colonization of the reservoir by juvenile hardhead before introduced predators became established. Brown and Moyle (1993) observed that hardhead disappeared from the upper Kings River when the reach was invaded by bass. A similar situation has been documented in the South Yuba River (Gard et. al. 1994, as cited in Moyle et al. 1995).

Hardhead mature following their second year. Spawning migrations, which occur in the spring into smaller tributary streams, are common. The spawning season may extend into August in the foothill streams of the Sacramento and San Joaquin River basins. Spawning behavior has not been documented, but hardhead are believed to elicit mass spawning in gravel riffles (Moyle 2002). Little is known about life stage specific temperature requirements of hardhead; however, temperatures ranging from approximately 65°F to 75°F are believed to be suitable (Moyle 2002).

Within Yuba County, hardhead have been reported to occur in the upper Yuba River, the lower Bear, Feather, and Yuba rivers, and the Honcut Creek headwaters (UC Davis 2009). Hardhead have been documented during the 2003-2004 and 2004-2005 juvenile salmon emigration studies on the Yuba River (Massa 2006). Adult hardhead were observed in the South Yuba River at RM 3.9, approximately 0.3 mile downstream of the confluence of Owl Creek (Gast et al. 2005).

7.3.3.1.3 Sacramento Splittail (CSC)[13]

The Sacramento splittail, a minnow, was listed as a federal threatened species on February 8, 1999, and delisted on September 22, 2003 (USFWS 2003b, c). Sacramento splittail are designated as a CSC (CDFG 2009a, b). Splittail are large cyprinids, growing in excess of 12 inches, and are adapted to living in freshwater and estuarine habitats as well as alkaline lakes and sloughs (Moyle 2002).

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[12] Photo source - http://calfish.ucdavis.edu/calfish/Hardhead.html
[13] Photo source http://swr.nmfs.noaa.gov/overview/sroffice/2Dredge_species_list.html

Historically, splittail inhabited sloughs, lakes, and rivers of the Central Valley with populations extending upstream to Redding in the Sacramento River, to the vicinity of Colusa-Sacramento River State Recreation Area, in Butte Creek/Sutter Bypass, to Oroville in the Feather River, to Folsom in the American River, and to Friant in the San Joaquin River (Moyle et al. 2004, USFWS 2003c). The current distribution is limited by dams and other barriers. Currently, the species is known to migrate up the Sacramento River to Red Bluff Diversion Dam and up the San Joaquin River to Salt Slough in wet years as well as into the lower reaches of the Feather and American rivers (USFWS 2003c).

Within Yuba County, splittail have been documented only in the lower Feather River (UC Davis 2009), and, according to Moyle, evidence of self-sustaining populations of splittail occurring outside of these areas is weak (Moyle et al. 2004). During the preparation of this Pre-Document, no documentation of splittail in the Yuba River (either historical or current distribution) was found.

7.3.3.1.4 Sacramento-San Joaquin Roach (CSC)[14]

The Sacramento-San Joaquin roach, a CSC, is part of the California roach complex, which is composed of various subspecies. The Sacramento-San Joaquin roach is found in the Sacramento and San Joaquin River drainages, except the Pit River, and in other tributaries to San Francisco Bay. Sacramento-San Joaquin roach are generally found in small, warm intermittent streams, and are most abundant in mid-elevation streams in the Sierra foothills and in the lower reaches of some coastal streams (Moyle 2002; Moyle et al. 1982). Assuming that the Sacramento-San Joaquin roach is indeed a single taxon (which is unlikely), it is abundant in a large number of streams although it is now extirpated from a number of streams and stream reaches where it once occurred (Moyle 2002). Roach are tolerant of relatively high temperatures (86°F to 95°F) and low oxygen levels (1 to 2 parts per million) (Taylor et al. 1982). However, they are habitat generalists, also being found in cold, well-aerated clear "trout" streams (Taylor et al. 1982), in human-modified habitats (Moyle 2002; Moyle and Daniels 1982) and in the main channels of rivers.

Reproduction occurs from March through early July, depending on water temperature (Moyle 2002). Murphy (1943) in CDFG 2008a states that spawning is determined by water temperature, which must be approximately 60°F for spawning to be initiated. During the spawning season, schools of fish move into shallow areas with moderate flow and gravel/rubble substrate (Moyle 2002). Females deposit adhesive eggs in the substrate interstices and the eggs are fertilized by attendant males. Typically, 250-900 eggs are produced by a female and the eggs hatch within two to three days. Fry remain in the substrate interstices until they are free-swimming.

Within Yuba County, Sacramento-San Joaquin roach have been reported to occur in the upper Yuba River, the lower Bear and Feather rivers, the Middle Fork of the Feather River, and the Honcut Creek headwaters (UC Davis 2009). In addition, Sacramento-San Joaquin roach have

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[14] Photo source - http://calfish.ucdavis.edu/calfish/CaliforniaRoach.htm

been documented during the rotary screw trapping monitoring on the lower Yuba River (Casey Campos, PSMFC, 2009 pers. comm.).

7.3.3.2 Amphibians

7.3.3.2.1 Foothill yellow-legged frog (CSC, FSS, BLM-S)[15]

The foothill yellow-legged frog is a stream-adapted species, usually associated with shallow, flowing streams with backwater habitats and coarse cobble-sized substrates (Jennings and Hayes 1994) between about 600 to 5,000 feet elevation (Moyle 1973; Seltenrich and Pool 2002; ECORP 2005). The status of foothill yellow-legged frog in the Sierra Nevada is in poor condition and this is reflected in its listing as a CSC, FSS, and BLM-S. However, populations persist on some portions of previously occupied drainages (NatureServe© 2009). Foothill yellow-legged frog populations may require both mainstem and tributary habitats for long-term persistence. Streams too small to provide breeding habitat for this species may be critical as seasonal habitats (e.g., in winter and during the hottest part of the summer) (VanWagner 1996; Seltenrich and Pool 2002), and there is evidence that habitat use by young-of-the-year, sub-adult, and adult frogs differs by age-class and changes seasonally (Randall 1997). Breeding tends to occur in spring or early summer and eggs are laid in areas of shallow, slow-moving waters near the shore. Foothill yellow-legged frogs are infrequent in habitats where introduced fish and bullfrogs are present (Jennings and Hayes 1994).

CDFG (2009b) reports twenty-one occurrences of foothill yellow-legged frog from the following locations in the Project Vicinity: Oregon Creek (TNF) (three occurrences); Grizzly Gulch Creek (three occurrences), a tributary of Oregon Creek (TNF); three occurrences in Kanaka Creek and an unnamed tributary (three occurrences); Slate Creek and an unnamed tributary (PNF) (three occurrences); South Fork Feather River (PNF); Middle Yuba River (TNF); Grouse Creek; Oroleve Creek (PNF); Youngs Ravine (TNF); Oak Valley (TNF); Mosquito Creek (TNF); confluence of Willow Creek and Horse Creek (TNF); and along Forest Rd 180-8. There are additional TNF records from the North Yuba River and these tributaries (TNF 2009): Willow Creek, Brandy Creek (a tributary of Willow Creek) Indian Creek, Bridger Creek, Humbug Creek, and Fiddle Creek. In the Middle Yuba River system, there are also TNF records for the Middle Yuba and these tributaries: Oregon Creek and Grizzly Creek (a tributary of Oregon Creek).

[15] Photo source: Stephen Nyman, PhD

7.3.3.3 Aquatic Reptiles and Turtles

7.3.3.3.1 Western pond turtle (CSC, FSS)[16]

The western, or Pacific, pond turtle occurs in a wide variety of aquatic habitats up to 6,000 feet elevation, particularly permanent ponds, lakes, side channels, backwaters, and pools of streams, but is uncommon in high-gradient streams (Jennings and Hayes 1994). Western pond turtle has declined due to loss of habitat, introduced species, and historical over-collection (Jennings and Hayes 1994), and has been designated as CSC and FSS. Isolated occurrences of western pond turtle in lakes and reservoirs sometimes occur from deliberate releases of pets. Although highly aquatic, western pond turtle often overwinters in forested habitats and eggs are laid in shallow nests in sandy or loamy soil in summer at upland sites as much as 1,200 feet from aquatic habitats (Jennings and Hayes 1994). Hatchlings do not typically emerge from the covered nests until the following spring. Reese and Welsh (1997) documented western pond turtle away from aquatic habitats for as much as seven months a year and suggested that terrestrial habitat use was at least in part a response to seasonal high flows. Basking sites are an important habitat element (Jennings and Hayes 1994) and substrates include rocks, logs, banks, emergent vegetation, root masses, and tree limbs (Reese undated). Terrestrial activities include basking, overwintering, nesting, and moving between ephemeral sources of water (Holland 1991). Breeding activity may occur year-round in California, but egg-laying tends to peak in June and July in colder climates, when females begin to search for suitable nesting sites upslope from water. Adult western pond turtles have been documented traveling long distances from perennial watercourses for both aestivation and nesting, with long-range movements to aestivation sites averaging about 820 feet, and nesting movements averaging about 295 feet (Rathbun et al. 2002). During the terrestrial period, Reese and Welsh (1997) found that radio-tracked western pond turtles were burrowed in leaf litter. Introduced species of turtles (e.g., red-eared sliders) may out-compete western pond turtle for basking sites, and bullfrogs are known to consume hatchling western pond turtles.

CDFG (2009b) reports three occurrences of WPT in the Project Vicinity: Dry Creek (south-southwest of Collins Lake); a tributary to French Creek (south of South Yuba River State Park); and Sicard Flat Ditch (west of USACE's Englebright Dam). There are also TNF or museum records for WPT from three locations on New Bullards Bar Reservoir; in the Middle Yuba River system from Little Willow Creek, a tributary of Indian Creek, north of Grizzly Gulch Creek, and the North San Juan area (TNF 2009).

7.3.4 Aquatic Resources of the Yuba River Area

Further information regarding aquatic resources of the Yuba River area found by Licensee is provided in the sections below for areas upstream, within, and downstream of the Project Area.

[16] Photo source: Joel Passavoy.

7.3.4.1 Upstream of the Project Area

This section presents relevant and reasonably available information regarding aquatic resources located upstream of the Project (i.e., on the Middle Yuba River upstream of Our House Diversion Dam, on Oregon Creek upstream of Log Cabin Diversion Dam, on the North Yuba River upstream of New Bullards Bar Reservoir, and on the South Yuba River upstream of its mouth at USACE's Englebright Reservoir).

7.3.4.1.1 Fishes

Licensee found six source documents[17] of relevant information regarding existing fish populations in the Yuba River upstream of the Project. The contents of these source documents, as well as anecdotal information, are described here.

Source Documents

Upper Yuba River Studies Program

The Upper Yuba River Studies Program (UYRSP) (CDWR 2006a) included an extensive study of trout fisheries and habitat in the Yuba River watershed upstream of the Project. The UYRSP was a multi-disciplinary investigation into the feasibility of introducing anadromous salmonids to the upper Yuba River system and involved numerous fish studies (CDWR 2006a) as well as bathymetric, geophysical, and geological studies of USACE's Englebright Reservoir conducted by the USGS (Childs et al. 2003). While the program focused on habitat assessments to evaluate the feasibility of reintroduction of salmon and steelhead into the Middle and South Yuba rivers upstream of USACE's Englebright Dam, portions of the report are informative on resident fish populations and their habitats in the Middle Yuba River. UYRSP fisheries studies included the South Yuba River from its confluence at USACE's Englebright Reservoir to Jordan Creek, and the Middle Yuba River from the confluence with the North Yuba River to Milton Diversion Dam. The North Yuba River from USACE's Englebright Reservoir to New Bullards Bar Dam was not included in the study.

Of particular value for the Middle and South Yuba rivers is the 2004 dive count survey for rainbow trout by Gast et al. (2005) included as Appendix G of the California Department of Water Resources (CDWR) (2006a) report. The survey area covered the section of the Middle Yuba River extending from USACE's Englebright Reservoir to the Milton Diversion Dam Impoundment, and the South Yuba River extending from USACE's Englebright Reservoir to Spaulding Dam (refer to CDWR 2006a for study details).

Middle Yuba River

The UYRSP survey section and related findings (Gast et al. 2005) for the Middle Yuba River above Our House Diversion Dam are considered "upstream" of the Project. However, because the original study findings were reported for the Middle Yuba River as a longitudinal continuum

[17] A "source document" contains original data collected by the author's and associated conclusions, interpretations, and other information developed *de novo* by the authors.

from its mouth to the Milton Diversion Dam, the separation between "upstream" and "within" the Project is difficult to create without losing the value of the findings. For this reason, many of the findings have been left intact to show the longitudinal trends in fish distribution between the lower and upper Middle Yuba River.

Gast et al. (2005) assessed the potential distribution of available rearing habitat for anadromous salmonids in the Middle Yuba River using the distribution and abundance of endemic rainbow trout as a surrogate. The relative distribution and abundance of rainbow trout were assessed in the Middle Yuba River during August and early September 2004 using direct observation (snorkeling) methodologies. Potential migration barriers and thermal refugia for trout were also investigated.

In addition to mainstem surveys, qualitative assessments of all accessible significant tributaries were conducted by visually estimating the stream flow, measuring water temperature, photographing the stream sections, and visually assessing the rearing potential of the lower reaches (Gast et al. 2005). Surveys were conducted in tributaries up to 1,000 to 2,000 feet upstream of their confluences with the Middle Yuba River, or to the first impassable fish barrier, whichever was encountered first. All potential barriers to fish migration encountered during the surveys were photographed and qualitatively described, with estimated vertical heights and Global Positioning System (GPS) positions recorded for each barrier.

The following description of results from 2004 snorkel surveys in the Middle Yuba River from just upstream of Our House Diversion Impoundment to the Milton Diversion Dam is based on Gast et al. (2005). Referenced river miles are based on RM 0.0 at the confluence of the Middle and North Yuba rivers. Throughout the surveyed reach estimated index densities of rainbow trout in specific habitats varied between 0 and 1,506 rainbow trout per mile.

Generally, trout densities were higher in the cooler, upstream reaches above Our House Diversion Dam (see Table 7.3.4-1 for a list of survey locations and water temperatures). Adult trout densities progressively increased upstream to RM 17.1. Densities upstream of this point showed no apparent trend and averaged 204 trout per mile. Adult rainbow trout observations were more frequent in pools than riffles. However, most riffles contained abundant whitewater, fast chutes, and other obstructions, making dive counts difficult and, thus, observation probabilities were lower in riffles than in pools. Rainbow trout densities in run habitats were between the lower densities in riffles and the higher densities in pools. In the lower reaches, most of the rainbow trout in pools were concentrated at the heads of the pools. Rainbow trout larger than 14 inches were observed only in runs and pools during the dive counts, and only downstream of RM 31.0. The index density of rainbow trout fry was variable, but generally increased upstream to RM 27.5, where they averaged 343 rainbow trout per mile. A spike (1,218 per mile) in the density of rainbow trout fry was observed at RM 39. Excluding the high-density observation, the average fry density in the upper section of the river was 213 rainbow trout per mile. The furthest downstream observation of rainbow trout fry in dive counts was at RM 12.68 (just upstream of Our House Diversion Dam. However, rainbow trout fry were observed at non-sampling locations near Oregon Creek (RM 4.8). Fry densities were generally highest in riffles as opposed to pools, with runs exhibiting intermediate densities. Fry densities among pools were highest in the cooler upstream reaches.

Besides rainbow trout, observed fish species included brown trout, Sacramento sucker, Sacramento pikeminnow, hardhead, smallmouth bass, and various sunfish. No smallmouth bass, adult pikeminnow, or hardhead were observed upstream of Our House Diversion Dam (RM 12.8), although a few minnow fry were observed a short distance upstream of the dam.

According to Gast et al. (2005), tributaries to the mainstem of the Middle Yuba River, having cooler summertime water temperatures, may provide refuge for salmonids from higher than optimum mainstem water temperatures. Kanaka Creek and Wolf Creek were cooler than the mainstem, appeared to provide good habitat, and were inhabited by juvenile and adult rainbow trout.

Table 7.3.4-1. Distribution of fish species relative to river mile and stream temperature observed during 2004 Middle Yuba River snorkel surveys upstream of Our House Diversion Dam.

River Mile[1]	Tributary Inflow	Middle Yuba Water Temperature (°C)	Rainbow Trout	Brown Trout	Pikeminnow Hardhead[2]	Pikeminnow	Hardhead	Suckers	Smallmouth Bass	Rainbow (Fry Lane)	Non-game (Fry Lane)
13.0	--	21.8	●	--	●	--	--	--	--	--	--
16.5	Kanaka Creek		--	--	--	--	--	--	--	--	--
17.1	--	20.8	●	--	--	--	--	--	--	--	--
26.1	--	17.6	●	--	--	--	--	--	--	●	--
26.9	Wolf Creek		--	--	--	--	--	--	--	--	--
27.5	--	19.8	●	--	--	--	--	●	--	●	●
30.5	--	16.8	●	--	--	--	--	●	--	--	--
31.0	--	17.6	●	--	--	--	--	●	--	--	--
37.5	--	11.5	●	●	--	--	--	--	--	●	--
37.6	--	12.4	●	●	--	--	--	--	--	●	--
39.1	--	16.1	●	●	--	--	--	--	--	●	--
39.6	--	14.3	●	--	--	--	--	--	--	●	--

Source: Gast et al. 2005
1 Beginning at the confluence of the Middle Yuba and the North Yuba rivers
2 Pikeminnow and hardhead less than 4” in length not discernible.

Gast et al. (2005) identified Our House Diversion Dam, at RM 12.8, as the only man-made barrier in the survey area that currently blocks upstream fish migration. Vogel (2006) identified six natural barriers that potentially block upstream migration between Our House Diversion Dam and Wilson Creek.

Lahontan cutthroat trout occur in two tributaries to the mainstem of the Middle Yuba River. Small, introduced populations exist in Macklin and East Fork creeks and were probably derived from the now extinct Lake Tahoe population (Coffin and Cowan 1995, as cited by Beedy et al. 2002 a and b). CDFG successfully transplanted Lahontan cutthroat trout into East Fork Creek. The Macklin Creek population is believed to have originated via a transfer of fish from Lake Tahoe in the early 1900s (E. Gerstung, CDFG, pers. comm. as cited by USFWS 2003e). According to the USDOI United States Fish and Wildlife Service (USFWS), these are both strong, viable populations (USFWS 1975).

Macklin Creek enters the Middle Yuba River on the south bank at approximately RM 41.9. The stream rises steeply at a 23 percent gradient for the first 0.5 mile. For the remaining 1.6 miles, the stream gradient averages 4.5 percent. The steep gradient in the lower reach of Macklin Creek restricts fish movement from the Middle Yuba River into Macklin Creek. Licensee found no citing in the literature of Lahontan trout in the Middle Yuba River.

East Fork Creek enters the Middle Yuba River on the south bank, approximately 7 miles downstream of Macklin Creek. Licensee was unable to find any information on the Lahontan trout population in East Fork Creek.

South Yuba River

The UYRSP also included work in the South Yuba River from Lake Spaulding to the confluence with USACE's Englebright Reservoir. The 2004 dive count survey for rainbow trout by Gast et al. (2005) is included as Appendix G of the CDWR (2006a) report. The survey area covered the South Yuba River from USACE's Englebright Reservoir upstream to the confluence with Jordan Creek (refer to CDWR 2006a for study details).

Gast et al. (2005) assessed the potential distribution of available rearing habitat for anadromous salmonids in the South Yuba River using the distribution and abundance of endemic rainbow trout as a surrogate. The relative distribution and abundance of rainbow trout were assessed in the South Yuba River during August and early September 2004 using direct observation (snorkeling) methodologies. Potential migration barriers and thermal refugia for trout also were investigated.

In addition to mainstem surveys, qualitative assessments of all accessible significant tributaries were conducted by visually estimating the stream flow, measuring water temperature, photographing stream sections, and visually assessing the rearing potential of the lower reaches (Gast et al. 2005). Tributary surveys were conducted upstream 1,000 to 2,000 feet or to the first impassable barrier, whichever was encountered first. All potential barriers to fish migration encountered were photographed and qualitatively described, with estimated vertical heights and GPS positions recorded for each barrier. While the focus was on rainbow trout, other species were also observed and recorded.

The following description of results from 2004 snorkel surveys of the upper South Yuba River is based on Gast et al. (2005). Estimated index densities of rainbow trout in all size classes in specific habitats varied between 0 and 1,402 rainbow trout per mile. Generally, these trout index densities were lower in the warmer, lower reaches and higher in the cooler, upper reaches (Table 7.3.4-2). Densities of adult trout (i.e., 8 in. and larger) progressively increased upstream to RM 18.1, approximately 1.7 miles upstream of Edwards Crossing. Densities of such larger trout upstream of this point were relatively consistent and showed no apparent trend, averaging 273 trout per mile. Adult rainbow trout observations were more frequent in pools than riffles. However, most riffles contained abundant whitewater, fast chutes, and other obstructions, making dive counts difficult and thus observation probabilities were likely lower than in pools. Trout densities in run habitats were intermediate to the lower densities found in riffles and higher densities in pools. In the lower reaches, most of the trout in pools were concentrated at the heads of the pools. Trout larger than 14 inches were observed only in runs and pools during the dive counts and only downstream of RM 28.3, approximately 1.6 miles downstream of Washington Bridge.

The index density of rainbow trout fry (i.e., 4 inches and less) was variable, but generally increased upstream to RM 27.5, approximately 2.7 miles downstream of Washington Bridge, where they averaged 455 fish per mile. When compared to surveys done with an identical methodology on the Middle Yuba River by Gast et al. (2005), the average fry density in the South Yuba River was approximately twice the Middle Yuba River fry density. The observation of trout fry furthest downstream in the South Yuba River dive counts were at RM 15.2, approximately 1.2 miles downstream of Edwards Crossing. Trout fry were, however, visually observed from the stream bank in the vicinity of Owl Creek (RM 4.2) in the South Yuba River. Fry densities were generally highest in riffles as opposed to pools, with runs exhibiting intermediate densities. Fry densities among pools were highest in the cooler upstream reaches.

Adult hardhead were observed (not collected) at RM 3.9, approximately 0.3 mile downstream of the confluence with Owl Creek, whereas adult pikeminnow were observed at several locations downstream of RM 10.4, approximately 2.3 miles upstream of the Highway 49 crossing. Fry and juvenile minnows and Sacramento sucker were observed upstream to RM 28.3, approximately 1.6 miles downstream of Washington Bridge. No smallmouth bass or brown trout were observed, but a few sunfish were observed in a shallow backwater pool at RM 5.7, approximately 2.4 miles downstream of the Highway 49 crossing (Gast et al. 2005). Table 7.3.3-2 below shows the distribution of observed fish in the South Yuba River relative to stream mile and stream temperature.

According to Gast et al. (2005), tributaries to the mainstem, having cooler summertime water temperatures, may provide refuge for salmonids from higher than optimum mainstem water temperatures. Poorman Creek, a tributary to the South Yuba River at RM 28.8, was cooler than the mainstem, appeared to provide good habitat, and was inhabited by juvenile and adult rainbow trout.

Table 7.3.4-2. Distribution of fish relative to river mile and stream temperature observed during 2004 South Yuba River snorkel surveys.

River Mile [1]	Tributary Inflow	South Yuba Water Temperature (°C)	Rainbow Trout	Pikeminnow Hardhead[2]	Pikeminnow	Hardhead	Suckers	Rainbow (Fry Lane)	Non-game (Fry Lane)
0.0	--	--	--	--	--	--	--	--	--
3.5	--	25.1	--	●*	--	--	--	--	●
3.9	--	23.3	●	●*	--	●	--	--	●
4.2	Owl Creek	--	--	--	--	--	--	--	--
5.7	--	25.1	--	●*	--	--	●	--	●
6.7	--	23.1	--	--	●	--	●	--	--
10.4	--	24.0	●	●*	●	--	--	--	--
12.0	--	20.7	●	●*	--	--	--	--	●
15.2	--	22.9	●	●*	--	--	●	--	●
16.0	Spring Creek	21.9	●*	●	--	--	●	●	●

18.1	--	24.5	●*	●	--	--	●	●	●
19.7	--	24.3	●*	●	--	--	--	--	●

Table 7.3.4-2. (continued)

River Mile [1]	Tributary Inflow	South Yuba Water Temperature (°C)	Rainbow Trout	Pikeminnow Hardhead[2]	Pikeminnow	Hardhead	Suckers	Rainbow (Fry Lane)	Non-game (Fry Lane)
20.6	Humbug Creek	22.8	●*	--	--	--	●	●	--
23.3	--	22.6	●*	●	--	--	●	●	--
24.5	--	21.4	●*	●	--	--	--	●	●
28.1	McKilligan Creek	--	--	--	--	--	--	--	--
28.3	--	20.3	●*	●*	--	--	●	--	●
28.8	Poorman Creek		--	--	--	--	--	--	--
35.8	--	18.1	●*	--	--	--	--	●	--
36.0	--	17.3	●*	--	--	--	--	●	--
40.6	--	17.3	●*	--	--	--	--	--	--

Source: Gast et al. 2005
[1] Beginning at the confluence of the South Yuba River with USACE's Englebright Reservoir. RM from Gast et al. (2005) is slightly different than Licensee's RM measurement.
[2] Pikeminnow and hardhead less than 4" in length not discernible.
* Higher population levels (Rainbow trout and Pikeminnow/Hardhead only)

Table 7.3.4-3 summarizes the occurrence of fish species upstream of the Project in the North, Middle and South Yuba rivers.

Table 7.3.4-3. Fish species known or likely to occur in stream reaches upstream of the Project.

Family	Common Name	Middle Yuba	South Yuba	North Yuba
Salmonidae	Rainbow Trout	X	X	X
	Brown Trout	X	X	X
Centrarchidae	Smallmouth Bass	--	X	X
Cyprinidae	Hardhead	X	X	X
	Pikeminnow	X	X	X
Catostomidae	Suckers	X	X	X
Cottidae	Sculpin	X	X	X

Gast et al. (2005) also identified three potential barriers to upstream anadromous salmonid migration in the South Yuba River. Two are natural falls or cascades located at RM 6.2 and RM 20.0, and one is an abandoned diversion dam located at RM 10.4 (Table 7.3.4-4).

Table 7.3.4-4. Location and height of migration barriers found on the South Yuba River between USACE's Englebright Reservoir and Spaulding Dam.

River Mile	Barrier Height (feet)
6.2	6
10.4	< 6 (remnant breached dam)
20	6 to 7

Source: Gast et al. 2005

For information on fisheries resources in the South Yuba watershed upstream of Spaulding Dam please refer to the Pacific Gas and Electric Company's (PG&E) Drum-Spaulding Project (FERC Project No. 2310) Pre-Application Document (PG&E 2008).

South Feather Power Project Relicensing

Slate Creek Diversion Tunnel conveys water from the Slate Creek Diversion Dam in the North Yuba River Basin to Sly Creek Reservoir in the Feather River Basin (South Feather Power Project, FERC 2088-068). A Final Environmental Impact Statement (FEIS) was completed for relicensing of this project in 2009 (FERC 2009).

The FEIS describes the results of recent fisheries studies. During 2004-2006 stream surveys, South Feather Water and Power Agency (SFWPA) sampled all project reaches and reference reaches with similar habitat characteristics selected for comparison of fish populations. The fish species composition in Slate Creek consisted of rainbow trout and speckled dace in the upper watershed, changing to a transitional zone (e.g., Sacramento pikeminnow) and warmwater species (e.g., smallmouth bass) in the lowest section of the stream near the North Yuba River confluence. Average trout biomass at trout-dominated sites from 1993 to 2005 ranged from 24 to 28 pounds per acre, and the average number of catchable trout ranged from 248 to 304 trout per mile.

Nevada Irrigation District's (NID) Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Project Relicensing Studies

The remaining source documents consist of technical memoranda that describe the results of NID's and PG&E's fish-related studies that were conducted in support of the coordinated relicensing of NID's Yuba-Bear Hydroelectric Project (FERC Project No. 2266) and PG&E's Drum-Spaulding Project.

- One-dimensional instream flow studies on the Middle Yuba River between Our House Diversion Dam and Jackson Meadows Reservoir Dam, and on the South Yuba River between the North Yuba River confluence and Spaulding Dam.
- Stream fish population studies on the Middle Yuba River between Our House Diversion Dam and Jackson Meadows Reservoir Dam, on the South Yuba River between the North Yuba River confluence and Spaulding Dam, and on the North Yuba River at three locations including near the towns of Bassetts and Sierra City, and near the confluence of Indian Creek.
- Fish passage studies in selected tributaries to the Middle and South Yuba rivers and Jackson Meadows and Spaulding reservoirs.
- Reservoir fish population studies in Jackson Meadows Reservoir on the Middle Yuba River and in Spaulding Reservoir on the South Yuba River.
- Benthic macroinvertebrate (BMI) studies on the Middle Yuba River between Our House Diversion Dam and Jackson Meadows Reservoir Dam, and on the South Yuba River between the North Yuba River confluence and Spaulding Dam.

The results for these studies (NID and PG&E 2010a, f, g, h, and i) are available on the NID/PG&E Relicensing Website at www.nid-relicensing.com.

CDFG 1970

Between 1929 and 1950, CDFG established an experimental fish hatchery on Fiddle Creek, a tributary to the North Yuba River located about 34 miles from Nevada City. This site was selected by CDFG because the water was very suitable (CDFG 1970). Floods during the severe winter of 1937–38 caused some damage, but CDFG made repairs and hatchery operations continued. During January 1950, heavy snows caused the CDFG Yuba River Hatchery to be closed temporarily, and CDFG began hatchery operations again in April 1950. Eggs were hatched and the water supplies were adequate due to the large snowpack. However, by July 1950, increased water temperatures and decreases in the amount of water available made it necessary for CDFG to plant fish rapidly. By August 1950, CDFG's fish planting was completed. Storms during November 1950 caused such extensive damage to the hatchery that repairs could not be made. Since the hatchery was outmoded and suitable for rearing fingerlings only, CDFG permanently closed its hatchery and all reclaimable material was salvaged (CDFG 1970).

Anecdotal Information

Licensee found three sources of anecdotal information that may be relevant to fish populations upstream of the Project. The content of these anecdotal sources is described below.

NID's Yuba-Bear Hydroelectric Project PAD

As discussed in the PAD prepared by NID for the Yuba-Bear Hydroelectric Project relicensing, located on the Middle and South Yuba rivers (NID 2008), there are two NID reservoirs or impoundments upstream of the Project on the Middle Yuba River: Jackson Meadows Reservoir and the Milton Diversion Impoundment.

CDFG manages Jackson Meadows Reservoir as a Trout Put-and-Grow and Catchable fishery with rainbow and brown trout (Hiscox, personal communication, 2007). Large spawning migration of wild rainbow trout, averaging 11 inches in length, was observed in Middle Yuba River in May 1967. The reservoir contains both Lahontan redside and speckled dace. Hiscox indicates that Arctic Grayling have been seen in the past but not for many years (Hiscox, personal communication, 2007). Bacher (2002) reports there are populations of brook trout, brown bullheads, and Lahontan redsides in the reservoir.

Licensee found little definitive information regarding fish in the reach of the Middle Yuba River between Jackson Meadows Reservoir and the Milton Diversion Impoundment. However, given the high elevation and cool water, Licensee expects that the reach supports populations of rainbow, brown, and brook trout. Other species, such as brown bullhead, Lahontan redside, and golden shiner may occur in Jackson Meadows Reservoir or in the Milton Diversion Dam Impoundment, but Licensee believes that it is unlikely that these species have become established in the reach.

CDFG manages the Milton Diversion Dam Impoundment as a self-sustaining fishery for rainbow and brown trout, and has designated the impoundment as wild trout water with a size bag limit (Hiscox, personal communication, 2007). According to Schaffer (2005), the Milton Diversion Dam Impoundment is a quality brown trout fishery and has excellent fly-fishing. Both brown and rainbow trout reproduce in the Middle Yuba River inlet to the Milton Diversion Dam Impoundment. Wiza (2000) states that large (i.e., 18 to 22 inches) brown trout are common in the impoundment. Hiscox (1986-1993) reports a fish rescue from 1993 recovered rainbow trout, brown trout, cutthroat trout, brown bullhead, Lahontan redside, and golden shiner. Hiscox further states that the lake has “flow-down” recruitment from Jackson Meadows Reservoir (Hiscox, personal communication, 2007).

<u>PG&E’s Drum-Spaulding Project PAD (2008)</u>
A PAD was prepared for PG&E’s Drum-Spaulding Project relicensing which includes the South Yuba River from near the town of Soda Springs downstream to its confluence with the North Yuba River (PG&E 2008). Included in the Drum-Spaulding Project Area is the South Yuba Spaulding Dam Reach extending 41.1 miles from the base of Lake Spaulding Dam (RM 41.1) downstream to the confluence with USACE’s Englebright Reservoir (RM 0).

Fish species identified in the PAD as likely to occur in the South Yuba River below Spaulding Dam include rainbow trout, hardhead, pikeminnow, suckers, and other small non-game fishes.

The first documented CDFG capture of trout was reported in 1970, and the summary memorandum associated with the event provides anecdotal information indicating that anglers fishing the nearby Willow Creek and the North Yuba River landed 35 rainbow trout (CDFG 1970). It is unknown whether the species were planted or resident fish.

The University of California, Davis (UC Davis) reported native species in the upper Yuba River on their fish website. These reported native species include California roach, hardhead, hitch, Lahontan redside, Paiute sculpin, rainbow/steelhead trout, riffle sculpin, Sacramento blackfish, Sacramento pikeminnow, Sacramento sucker, speckled dace, Tui chub, and western brook lamprey (UC Davis 2009).

A nine-quadrangle query of the CNDDB within quadrangles located immediately upstream of the Project (i.e., Clio, Calpine, Antelope Valley, Loyalton, Beckwourth Pass, Constantina, Evans Canyon, Frenchman Lake, and McKesick Peak) did not reveal any occurrences of special-status fish species upstream of the Project Area (CDFG 2009c).

<u>CDFG’s Fish Stocking Program</u>
CDFG’s fish stocking records through 2007 for New Bullards Bar Reservoir, USACE’s Englebright Reservoir, and several river reaches in the watershed are provided in Attachment 7.3A. Fish populations in the Sierra Nevada have been dramatically altered by numerous factors, one of which is the introduction of both native and non-native fish species, many of which have occurred in areas previously devoid of fish. Fish have been introduced into the lakes and streams on the Sierra Nevada since the 1800s, and by the 1860s, stocking of salmonids and other recreational fish was being conducted by various fishing groups (Pister 2001). Although

involved in sporadic planting activities pre-1900s, the California Fish and Game Commission did not begin stocking activities on a regular basis until the 1920s (Pister 2001).

Fish stocking has taken place upstream of the Project Area in the North Yuba River, and three locations in the South Yuba River (i.e., Washington Area, Highway 80, and Bridgeport) (CDFG 1989, 2007b). Stocked species were raised primarily at the Bear Valley, Mt. Shasta, and Mobile hatcheries. Stocking in the Washington area has taken place from 1951 through 2003; during this time some 354,000 rainbow trout, 10,300 brown trout and 1,620 rainbow trout (Kamloops and Coleman strains) were planted (CDFG 2007b). At the Highway 80 location, nearly 903,000 rainbow trout were released between 1950 and 1978, the last recorded planting at this location (CDFG 2007b). About 990 eastern brook trout and 4,000 brown trout also were stocked at this location. Only three stocking events are documented at the Bridgeport site. Stocking was conducted from 1998 through 2000, and 2,350 rainbow trout were released during this period (CDFG 2007b). No records of Chinook salmon plantings in the North, Middle, and South Yuba rivers were found during the preparation of this Pre-Application Document.

In 2006, a lawsuit was filed against CDFG contending that no Environmental Impact Report (EIR) had been completed for CDFG's stocking programs. As a result, an order was issued that placed a restriction against stocking non-native fish in California fresh waterbodies where surveys have demonstrated the presence of any of the 25 specified amphibian or fish species of special concern or where a survey for those species has not yet been done (CDFG 2008b). To comply with the order, in 2008 CDFG halted stocking in nearly 200 lakes and streams pending completion of the EIR, which is anticipated in 2010 (CDFG 2008b). However, stocking is allowable and continues in waterbodies that meet certain requirements, some of which include: 1) human-made waterbodies >1,000 acres; 2) human-made waterbodies <1,000 acres and not connected to a river or stream; and 3) waterbodies that are not within California red-legged frog habitat (CDFG 2008b). Stocking in waters located upstream of the Project Area in 2009-2010 will take place in 11 waterbodies in Plumas County, 18 waterbodies in Sierra County, and 23 waterbodies in Nevada County (CDFG 2008c). Several "allowable" lakes are located in the headwaters of the Middle and South Yuba watersheds, upstream of the Project. These include Carr Lake, Culbertson Lake, Faucherie Lake, Feeley Lake, Fuller Lake, Jackson Meadows Reservoir, Lower Lindsey Lake, Upper Lindsey Lake, Milk Lake, Penner Lake, Lower Rock Lake, Upper Rock Lake and Sawmill Lake.

7.3.4.1.2 Amphibians

Licensee found four source documents of relevant information regarding amphibians in the Yuba River Basin of the Project. The contents of these source documents, as well as anecdotal information, are described below.

Source Documents

Nevada Irrigation District's (NID) Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Project Relicensing Studies

Amphibians upstream of the Project are addressed by two studies being conducted in support of the coordinated relicensing of NID's Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Project:

- Foothill yellow-legged frog surveys on the Middle Yuba River beginning approximately 1 mile upstream of Our House Diversion Dam and on the South Yuba River beginning 11 miles upstream of USACE's Englebright Dam. Study results have documented breeding occurrences of foothill yellow-legged frog at four sites on the Middle Yuba and at nine sites on the South Yuba River. This report also includes descriptions of habitats and photographs of each site, and incidental observations of other amphibians, aquatic reptiles, and turtles.
- Foothill yellow-legged frog habitat modeling is being conducted at one site on the Middle Yuba River and one site on the South Yuba River.

The results for these studies (NID and PG&E 2010j, k) are available on the NID/PG&E Relicensing Website at www.nid-relicensing.com.

South Feather Water and Power Relicensing (2006)

Multi-year, weekly visual encounter surveys (7 sites in the Slate Creek Diversion Dam Reach) were conducted for amphibians from April to June during 2004 and 2005. The Slate Creek Diversion Dam Reach has a known breeding foothill yellow-legged frog population. Tadpoles were observed both survey years. One account from 2004 described a large aggregation (of approximately 450 individuals) in a gravel and sand shallow-water area immediately adjacent to an egg mass on the right bank. Tadpoles of approximately the same size and aggregation size were directly across the stream on the left bank in a backwater, boulder-dominated habitat area.

Also documented were two historical foothill yellow-legged frog observations. The first occurrence was an observation of 13 adults and 18 juveniles at Slate Creek upstream and downstream of Slate Creek Diversion Dam (Stillwater Sciences 2001). The second documented observation consisted of three adults and 5 juveniles at Slate Creek north of the forest road 512, southeast of Little Grass Valley Reservoir (CDFG 2009a). Mountain yellow-legged frog (i.e., Sierra Nevada yellow-legged frog) and California red-legged frog were not found during any of the surveys.

Masters Thesis – Van Wagner (1996)

Habitat associations and life history characteristics of a population of foothill yellow-legged frog on Clear Creek, a tributary of the Middle Yuba River below the confluence of Oregon Creek, were the topics of a Masters thesis (Van Wagner 1996), which included reference to the presence of bullfrogs in the study area.

Licensee found six sources of anecdotal information that may be relevant to existing amphibian populations upstream of the Project. The contents of these anecdotal sources are described here.

Anecdotal Information

NID's Yuba-Bear Hydroelectric Project PAD (2008) and PG&E's Drum-Spaulding Project PAD (2008)

A PAD was prepared by NID for the Yuba-Bear Hydroelectric Project relicensing, located on the Middle and South Yuba rivers (NID 2008), and similarly, a PAD was prepared for PG&E's Drum-Spaulding Project relicensing, which includes the South Yuba River from near the town of Soda Springs downstream to its confluence with the North Yuba River (PG&E 2008). Ten species of amphibians are known to occur in the vicinity of the NID and PG&E projects. Most of these species could potentially occur across a wide range of elevations (Table 7.3.4-5). Three other species were considered, but were not included in this list based on known and expected patterns of occurrence (Table 7.3.4-6) (Jennings and Hayes 1994; Zeiner 1988-1990; Vindum and Koo 1999a, b).

With the exception of two completely terrestrial species without free-living larval stages (ensatina and California slender salamander), all of these documented species require still or slow-flowing water in which to breed. The species most likely to occur in aquatic habitats at lower elevations of these Projects are probably California newt, Sierra treefrog, foothill yellow-legged frog, and bullfrog. At elevations above 5,000 feet, long toed salamander, Sierra treefrog, western toad, and Sierra Nevada yellow-legged frog are the characteristic species, but because of introduced fish and other recent changes to high elevation ecosystems, these species cannot be assumed to occur.

Table 7.3.4-5. General distribution of amphibian species that have been reported in the vicinity of the Yuba-Bear Hydroelectric Project and the Drum-Spaulding Project (NID 2008; PG&E 2008).

Species/Status[1]	General Distribution[2]
Long-toed salamander *Ambystoma macrodactylum*	Widespread species, primarily restricted to high elevations in the Sierra Nevada, but there are few known populations. Breeds in ponds and high elevation lakes, where the introduction of fish has adversely affected some populations.
California (Sierra) newt *Taricha torosa sierra*	Widespread and common species. Breeds in ponds, lakes, reservoirs, and streams mostly at low to middle elevations in forested areas.
Ensatina *Ensatina eschscholtzii*	Widespread and common species; completely terrestrial, associated with forested areas over a broad range of elevations (known from 1,300-5,300 ft).
California slender salamander *Batrachoseps attenuatus*	Widespread and common species; completely terrestrial. Occurs mostly in the forested foothills and chaparral (occasionally to 3,000 ft elevation).
Sierra treefrog (chorus frog) *Pseudacris sierra*[3]	Widespread and common species over a wide range of elevations, and breeding in ponds, lake and reservoir edges, ditches, and slow-moving or still sections of streams. Possibly reduced in abundance at high elevations.
Western (California) toad *Anaxyrus boreas halophilus*[4]	Widespread species, breeding in ponds, lake, and reservoir edges, and slow-moving or still sections of streams across a wide range of elevations. In the Sierra Nevada more likely to occur at higher elevations (may have declined in the foothills). May be reduced in numbers but most known populations appear to be extant.
California red-legged frog[FT, CT, FSS] *Rana draytonii*[5]	Nearly extirpated in the Sierra Nevada. Formerly occurred on at least 30 drainages in the foothills (mostly below 3,500 ft elevation). Breeds in slow-moving or still sections of streams and ponds, usually where there is emergent and aquatic vegetation.
Foothill yellow-legged frog [CSC, FSS] *Rana boylii*	Estimated to no longer occur in at least 50 percent of former range in the Sierra Nevada. Occurs on small to large streams and rivers with pools and low-gradient riffles (small streams are probably non-breeding habitat). Most known occurrences are below 5,000 ft elevation.

Table 7.3.4-5. (continued)

Species/Status[1]	General Distribution[2]
Sierra Nevada yellow-legged frog[FC, CSC, FSS] *Rana sierrae*[6]	May be absent from more than 80 percent of former range in the Sierra Nevada. Extant populations are often small. Inhabits ponds, lakes, and streams, mostly above 5,000 ft elevation. Introduction of fish to high elevation areas may have eliminated many populations.
Bullfrog *Lithobates catesbeianus*[7]	Introduced and well established in slow-moving streams, stock ponds, lakes, and reservoirs to at least 5,000 ft elevation. The presence of bullfrogs may be associated with declines of other native ranid frogs.

[1]Status: FT = federal threatened, FC = federal candidate, CT = California threatened, CSC = CDFG California species of special concern, FSS = Forest Service sensitive.
[2]Sources include Jennings and Hayes 1994, Jennings 1996, Vindum and Koo 1999a, 1999b
[3]Previously classified as *Hyla regilla* (Pacific treefrog) (see Recuero et al. 2006a, 2006b). Retention of the common name "treefrog" reflects longstanding, popular usage.
[4]Previously classified as *Bufo boreas* (see Frost et al. 2006)
[5]Previously classified as *Rana aurora draytonii* (see Frost et al. 2006)
[6]Previously classified as *Rana muscosa* (mountain yellow-legged frog) (see Vredenburg et al. 2007).
[7]Previously classified as *Rana catesbeiana* (see Frost et al. 2006)

Table 7.3.4-6. General distribution of amphibian species considered for inclusion, but determined not to occur in the Project Vicinity.

Species/Status[1]	General Distribution
Mount Lyell salamander [CSC] *Hydromantes platycephalus*	A terrestrial species associated with granite outcrops and only known to occur in disjunct alpine and sub-alpine areas well north and southeast of the Project Vicinity.
Western spadefoot [CSC] *Spea hammondii*	Primarily found west of the Sierra Nevada foothills and has never been recorded in any of the counties associated with the Project Vicinity.
Northern leopard frog [CSC] *Lithobates pipiens*	Occurs in only a few scattered sites in the Sierra Nevada, the nearest of which are in northeast Sierra County and south of Lake Tahoe (populations possibly extirpated).

[1] Status : CSC = CDFG California species of special concern, FSS = Forest Service sensitive.
[2] Previously classified as *Rana pipiens* (see Frost et al. 2006)

In addition to the two PADs described above, searchable museum collection records reviewed from the California Academy of Sciences (CAS) (2009) and the Museum of Vertebrate Zoology (MVZ) (2009), sight records provided by TNF, and range maps and descriptions (California Herps 2009) indicate that a total of ten species of amphibians (the same species listed in Table 7.3.4-5) may occur in or near the North and Middle Yuba rivers upstream of the Project. This total includes two completely terrestrial species: California slender salamander, which has rarely been documented in the Project Vicinity; and ensatina, for which there are numerous records. TNF data include sight records for rough-skinned newt (*Taricha granulosa*) on Grizzly Creek (Middle Yuba Watershed) and at the confluence of Brandy and Horse Valley creeks (North Yuba Watershed). However, these are likely misidentifications as there are museum records for Sierra newt from the same locations and no other sources suggest that the distribution of rough-skinned newt extends south of central Butte County.

Records for foothill yellow-legged frog upstream of the Project include the North Yuba River and many of the tributaries, including Cherokee Creek, Indian Creek, Fiddle Creek, Humbug Creek, Goodyears Creek, Downie River, and Slate Creek. There are records for the Middle Yuba River from Our House Diversion Dam to Kanaka Creek, and on the following tributaries: Grizzly Creek, Hornswoggle Creek, Indian Creek, and Oregon Creek. In addition, foothill yellow-legged frog has been found on Willow Creek, Bridger Creek, and Grizzly Gulch Creek, which flow into New Bullards Bar Reservoir.

The data suggest that the other widespread species associated with aquatic habitats upstream of the Project Area are Sierra newt and Sierra treefrog. Sierra newt occurrences are mostly associated with creeks, although this species has also been documented on land, whereas Sierra treefrog records are from creeks, ponds, and small wetlands. Bullfrogs are documented on Willow Creek, which flows into New Bullards Bar Reservoir, and in the Middle Yuba Watershed on Clear Creek, Hornswoggle Creek, Oregon Creek, Moonshine Creek, Willow Creek, and a tributary to Grizzly Creek. There was one documented locality for long-toed salamander (i.e., larvae and juveniles in a pond on a tributary to Slate Creek more than 20 miles upstream of New Bullards Bar Reservoir). There were no records found for western (California) toad in the upstream Project Vicinity.

7.3.4.1.3 Aquatic Reptiles and Turtles

Licensee found two source documents of relevant information regarding turtles (Class Chelonia) associated with aquatic environments upstream of the Project Area, and found no source documents with relevant information regarding reptiles (Class Reptilia, snakes and lizards) upstream of the Project. The contents of these source documents, as well as anecdotal information, are described here.

Source Documents

Nevada Irrigation District's (NID) Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Project Relicensing Studies (2008-2009)
Western pond turtle was addressed by a study performed for the coordinated relicensing of NID's Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Project.

Results for these studies (NID and PG&E 2010l) are available on the NID/PG&E Relicensing Website at www.nid-relicensing.com.

South Feather Water and Power Relicensing (2006)
Visual encounter surveys were conducted for Western pond turtle in the Slate Creek Diversion Dam Reach, and none were found.

Anecdotal Information

Licensee also found two sources of anecdotal information regarding reptiles or turtles associated with aquatic environments upstream of the Project, which are described below.

There are museum records from CAS and MVZ for four species (Table 7.3.4-7). These include one special-status aquatic turtle, western pond turtle, which is discussed in Section 7.3.2. Garter snakes also are often associated with aquatic habitats to varying extents.

There are records for Sierra garter snake on the North Yuba River and tributaries (i.e., Cherokee Creek and Deadwood Creek) upstream of the Project. The western terrestrial garter snake has been recorded on the North Yuba River, Deadwood Creek, Indian Creek, Cherokee Creek, and tributaries to New Bullards Bar Reservoir (i.e., Willow Creek and Mill Creek), and the common garter snake is documented on Willow Creek.

Western pond turtle occurrences upstream of the Project are associated with ponds and streams in the North Yuba (pond near Grizzly Gulch Creek), Middle Yuba (pond near Grizzly Creek, tributary to Indian Creek, and in Little Willow Creek), and South Yuba (pond near Shady Creek) watersheds.

Table 7.3.4-7. Aquatic reptile and turtle species that have been reported from the Project Vicinity.

Species	General Distribution
Western pond turtle *Actinemys* [*Emys*] *marmorata*[1]	Occurs in a wide variety of aquatic habitats across a broad range of elevations, particularly permanent ponds, lakes, side channels, backwaters, and pools of streams, but is uncommon in high-gradient streams. Often overwinters in forested habitats and oviposits in summer at upland sites as much as 1,200 feet from aquatic habitats. See Section 7.3.2.
Sierra garter snake *Thamnophis couchii*	Highly aquatic snake occurring in the Sierra Nevada at elevations of 300-8,000 ft.
Western terrestrial garter snake *Thamnophis elegans*	Occurs throughout the Sierra Nevada up to 13,100 ft elevation. Often forages in or near aquatic habitats.
Common garter snake *Thamnophis sirtalis*	Widespread throughout northern California, occurs east and west of the high Sierras and south to San Joaquin Valley. Often forages in or near aquatic habitats.

Source(s): Storer 1930; Jennings and Hayes 1994; Jennings 1996
[1] Formerly called *Clemmys marmorata* or *Emys marmorata.*

The discussion above regarding aquatic reptiles and turtles includes compilation of information from the NID's Yuba-Bear Hydroelectric Project PAD (2008) and PG&E's Drum-Spaulding Project PAD (2008).

7.3.4.1.4 Aquatic Mollusks and Snails

Licensee found one source document of relevant information regarding existing aquatic mollusks (bivalves and aquatic snails) in the Yuba River upstream of the Project. The contents of this document, as well as anecdotal information, are described here.

Source Document

<u>Nevada Irrigation District's (NID) Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Project Relicensing Studies (2008-2009)</u>
Mollusk populations upstream of the Project are addressed by one ongoing study conducted in support of the coordinated relicensing of NID's Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Project:

Mollusk studies on the Middle Yuba River between Our House Diversion Dam and Jackson Meadows Reservoir Dam and on the South Yuba River between the North Yuba confluence and Spaulding Dam.

Results for these studies (NID and PG&E 2010m) are available on the NID/PG&E Relicensing Website at www.nid-relicensing.com.

Anecdotal Information

NID's Yuba-Bear Hydroelectric Project PAD (2008)
The Yuba-Bear Hydroelectric Project PAD did not identify any mollusks of special concern in the Yuba-Bear Hydroelectric Project vicinity (NID 2008). Two snails are documented as occurring in PG&E's Drum-Spaulding project vicinity, but neither are species of special concern (PG&E 2008).

A query of the CNDDB was conducted within quadrangles located immediately upstream of the Project. One mollusk, the Long Valley Pyrg, was reported in a stream in Long Valley, located about 60 miles upstream (to the northeast) of the Project Area (CDFG 2009a).

7.3.4.1.5 Benthic Macroinvertebrates

In virtually all ecosystems, invertebrates comprise the vast bulk of faunal taxa and biomass. Their significance as indicators of ecosystem health is indicative of their proximal relationship to environmental parameters and the reliance of higher animals upon them as prey. In freshwater environments, the larger bottom-dwelling invertebrate species, or benthic macroinvertebrates (BMI) provide an essential trophic base for many vertebrate species. Yet, these organisms are a subject and resource that are seldom studied, and available information concerning BMI is primarily general in nature.

Source Documents

Licensee found six source documents of relevant information regarding BMI upstream of the Project. The contents of these source documents, as well as anecdotal information, are described below.

Rose et al. (1995) and Garcia and Associates (GANDA) (2001)
In 1995 and 2001, two studies were conducted in the upper Yuba River Basin. One of the studies was conducted on Fordyce Creek (GANDA 2001) and the other was conducted on Clear, Fall, Trap, and Rucker creeks. Rose et al. (1995) not only documented the occurrence of numerous aquatic insects (Table 7.3.4-8), but also found that the consistency of trends in BMI taxa richness, Shannon diversity, and abundance was greatest between sections of streams with similar flow rather than between upstream and downstream reaches with differing flow. This suggests that habitat similarity, as characterized by flow regime and elevation, can be a reliable means for inferring BMI community composition and structure.

Table 7.3.4-8. Orders and families of aquatic macroinvertebrates (all insects) that were found in three studies of high elevation Sierra Nevada streams upstream of the Project Area.

Coleoptera	Diptera	Ephemeroptera	Hemiptera	Megaloptera	Plecoptera	Trichoptera
Elmidae	Chironomidae	Baetidae	Corixidae	Sialidae	Nemouridae	Brachycentridae
Dytiscidae	Empididae	Heptageniidae	--	Corydalidae	Capniidae	Ryacophilidae
Staphylinidae	Ceretopogonidae	Leptophlebiidae	--	--	Chloroperlidae	Hydroptilidae
Tenebrionidae	Tabanidae	Ephemerellidae	--	--	Perlodidae	Limnephilidae
Psephenidae	Simuliidae	Ameletidae	--	--	Leuctridae	Hydropsychidae

Table 7.3.4-8. (continued)

Coleoptera	Diptera	Ephemeroptera	Hemiptera	Megaloptera	Plecoptera	Trichoptera
--	Tipulidae	Siphlonuridae	--	--	Perlidae	Lepidostomatidae
--	Hesperoconopa	--	--	--	Peltoperlidae	Phryganaeidae
--	Dixidae	--	--	--	--	Polycentropodidae
--	Nymphomyiidae	--	--	--	--	Philopotamidae
--	Stratiomyidae	--	--	--	--	Sericostomatidae
--	--	--	--	--	--	Glossosomatidae
--	--	--	--	--	--	Uenoidae
--	--	--	--	--	--	Calamoceratidae

Source(s): Herbst 2003; GANDA 2001; & Rose et al. 1995.

The area upstream of the Project contains both flowing (lotic) and still water (lentic) habitats, and likely occurring taxa can be broken into these two habitat categories. Lotic habitats upstream of the Project would likely contain the invertebrate groups Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies), Diptera (midges), Coleoptera (beetles), Megaloptera (alderflies), Hemiptera (true bugs), Hirudinea (leeches), Oligocheata (segmented worms), Turbellaria (flatworms), Nematoda (roundworms), Crustacea (scuds, crayfish), Mollusca (clams, snails), Acari (water mites), and Lepidoptera (aquatic moths). Lentic habitats upstream of the Project likely contains the same higher order groups, with the exception of Plecoptera and Megaloptera, but would share few species with lotic habitats, and also probably include Odonata (dragonflies and damselflies) (Rose et al. 1995).

Licensee found three sources of anecdotal information that may be relevant to BMI upstream of the Project, as described below.

Erman (1997)

Erman noted that the inadequacy of current studies is compounded by a lack of historical data, and therefore also by unknown and undocumented rates of change within the aquatic invertebrate assemblages of the Sierra Nevada as a result of watershed perturbations that have occurred over the last 150 years. As a result, only a surprisingly small amount of survey information exists for the Sierra Nevada at the species level. A review of anecdotal information suggests that a general description of the aquatic invertebrate taxa likely to occur in the Project Vicinity is possible. Insects undoubtedly comprise the majority of BMI species in Sierra Nevada waters; other groups include flatworms, nematodes, segmented worms, snails, clams, and crustaceans (e.g., fairy shrimp, crayfish, and isopods). Moreover, many aquatic invertebrate species are endemic to the Sierra Nevada. In an attempt to characterize the diversity and degree of endemism present in certain communities, a few areas in the Sierra Nevada have been subjected to extensive invertebrate surveys, but as with other recent endeavors, these surveys are incomplete and there is a good possibility that numerous taxa are unrepresented. Results of one such study by Erman (1997) are summarized in Table 7.3.4-9.

Table 7.3.4-9. Summary of aquatic invertebrate species collections in the Sierra Nevada.

Taxon	Total Species in Sierra Nevada Range	Number of Species Endemic to Sierra Nevada Range	Percent Species Endemic to Sierra Nevada Range
Stoneflies (Plecoptera)	122	31	25
Alderflies (Megaloptera)	4	0	0
Dobsonflies (Megaloptera)	7	?	?
Caddisflies (Trichoptera)	199	37	19
Net-winged midges (Diptera, Blephariceridae)	11	1	9
Mountain midges (Diptera, Deuterophlebiidae)	4	1	25
Snails, clams (Mollusca, Bivalvia)	40	8	20
Fairy shrimp (Crustacea, Anostraca, Branchiopoda)	10	1	10

Source: Erman 1997

Regardless of whether a species is endemic or introduced, the presence and location of any given species within the Project Vicinity is largely dependent on its preference for either still or flowing water. The major taxa of many invertebrate groups are found in both general habitat types, and in gradations between them, but the species that live in these two habitats are usually different, and there is essentially no similarity between the inhabiting assemblages (Erman 1997).

<u>Herbst et al. (2003)</u>

Herbst et al. reported that in the Sierra Nevada, BMI, especially those that inhabit streams, are among the most poorly known of all faunal groups. Data pertaining to these organisms is limited, with most collection records having been derived from intensively studied locales or taxonomic units rather than from broad, basin-wide, multi-taxon efforts.

<u>Brown and May (2000)</u>

In 2000, Brown and May reported BMI data collected during 1994 to 1996 from various locations throughout the western Sierra Nevada and California Central Valley. The authors reported that BMI assemblages in riffles (as well as species associated with snags) might be useful in family level bioassessments of environmental conditions in valley floor habitats. For the riffle samples, elevation was the most important factor determining BMI assemblage structure.

<u>South Feather Water and Power Relicensing (2006)</u>

BMI sampling was conducted in November 1999 by SFWPA in support of permits to conduct sediment pass-through operations at Slate Creek Diversion Dam. Table 7.3.4-10 contains the BMI metric results for the Slate Creek sampling.

Table 7.3.4-10. Invertebrate biological metrics from November 1999 CSBP sampling of Slate Creek.[1]

	Above Diversion Dam					Below Diversion Dam				
	1	2	3	Mean	Coefficient Of Variation	1	2	3	Mean	Coefficient Of Variation
RICHNESS MEASURES (TOTAL NUMBER OF TAXA)										
Taxa Richness	11.00	20.00	25.00	18.67	38.01	27.00	26.00	26.00	26.33	2.19
Ephemeropteran, Plecopteran, And Trichopteran Taxa	7.00	13.00	15.00	11.67	35.69	21.00	18.00	19.00	19.33	7.90
Ephemeropteran Taxa	3.00	5.00	8.00	5.33	47.19	9.00	9.00	7.00	8.33	13.86
Plecopteran Taxa	0.00	4.00	4.00	2.67	86.60	6.00	5.00	5.00	5.33	10.83
Trichopteran Taxa	4.00	4.00	3.00	3.67	15.75	5.00	4.00	6.00	5.00	20.00
COMPOSITION MEASURES (PERCENT COMPOSITION)										
Ephemeropteran, Plecopteran, And Trichopteran Index	82.14	84.78	89.00	85.31	4.06	83.28	88.42	84.82	85.51	3.09
Sensitive Ephemeropteran, Plecopteran, And Trichopteran Index[2]	71.43	60.14	77.66	69.75	12.73	55.84	46.95	56.11	52.96	9.84
Shannon Diversity[3]	1.65	2.34	2.05	2.01	17.27	2.80	2.63	2.64	2.69	3.46
TOLERANCE/INTOLERANCE MEASURES										
Tolerance Value[4]	1.43	2.05	1.33	1.60	24.29	2.17	2.58	2.33	2.36	8.66
Percent Intolerant (0-2)	67.86	62.32	84.19	71.46	15.92	59.94	48.87	57.76	55.52	10.55
Percent Tolerant (8-10)	0.00	0.00	0.34	0.11	173.21	0.00	0.00	0.00	0.00	--
Percent Hydropsychidae	7.14	21.01	6.87	11.68	69.26	16.09	26.37	13.37	18.61	36.82
Percent Baetidae	0.00	1.45	0.69	0.71	101.79	5.36	10.29	4.77	6.81	44.46
Percent Dominant Taxon	57.14	21.01	39.18	39.11	46.19	16.09	26.37	13.86	18.77	35.53
FUNCTIONAL FEEDING GROUPS										
Percent Collectors[5]	7.14	15.94	29.21	17.43	63.73	23.34	31.83	37.95	31.04	23.63
Percent Filterers[6]	7.14	21.01	6.87	11.68	69.26	17.67	28.62	12.87	19.72	40.93
Percent Grazers[7]	78.57	31.88	45.02	51.82	46.46	23.66	19.61	21.78	21.69	9.34
Percent Predators[8]	3.57	10.14	12.37	8.70	52.62	21.77	14.47	13.20	16.48	28.05
Percent Shredders[9]	3.57	21.01	6.53	10.37	90.00	13.56	5.47	14.19	11.07	43.95

[1] EA 2000
[2] Percent composition with Tolerance values of 0 to 3.
[3] General measure of sample diversity that incorporates richness and evenness (Shannon and Weiner 1963).
[4] Value (0-10) weighted for abundance of individual designated as pollution tolerant (10) and intolerant (0).
[5] Macrobenthos that collect /gather fine particulate matter.
[6] Macrobenthos that filter fine particulate matter.
[7] Macrobenthos that graze upon periphyton.
[8] Macrobenthos that feed on other organisms.
[9] Macrobenthos that shred coarse particulate matter.

Nevada Irrigation District's (NID) Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Project Relicensing Studies (2008-2009)
BMI upstream of the Project were addressed by a study conducted in support of the coordinated relicensing of NID's Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Project:

- Benthic macroinvertebrate studies on the Middle Yuba River between Our House Diversion Dam and Jackson Meadows Reservoir Dam, and on the South Yuba River between the North Yuba River confluence and Spaulding Dam.

Results for these studies (NID and PG&E 2010i) are available on the NID/PG&E Relicensing Website at www.nid-relicensing.com.

The discussion above regarding BMI was developed using the same sources of information used to develop the BMI sections of NID's Yuba-Bear Hydroelectric Project PAD (2008) and PG&E's Drum-Spaulding Project PAD (2008).

7.3.4.1.6 Algae

Filamentous alga develops as single cells, which form long, visible chains, threads, or filaments (www.aquaplant.tamu.edu). When the algae grow in excess they can form dense mats, which rapidly remove nutrients from the water and may kill off other organisms. Large algae blooms can be associated with human disturbance, particularly downstream of dams and other flow-regulated water. During the summer months, heavy blooms of the green alga genus *Cladophora* can occur in unspecified sections of the South Yuba River (Cohen et al. 2001, Shilling pers. comm. 2003).

Anecdotal Information

NID's Yuba-Bear Hydroelectric Project PAD (2008)
The Yuba-Bear Hydroelectric Project identified that during the summer months, heavy blooms of the green alga genus *Cladophora* can occur in unspecified sections of the South Yuba River and its tributary, Deer Creek. The PAD also found that the Dry Creek Conservancy has observed heavy algae growth in several areas of Coon Creek, probably associated with high nutrient loads during the summer.

7.3.4.2 Within the Project Area

This section presents relevant and reasonably available information regarding aquatic resources located within the Project area (i.e., on the Middle Yuba River downstream of Our House Diversion Dam, on Oregon Creek downstream of Log Cabin Diversion Dam, on the North Yuba River downstream of the normal high water line of New Bullards Bar Reservoir, through USACE's Englebright Reservoir and downstream on the mainstem Yuba River to the USACE's Daguerre Point Dam).

7.3.4.2.1 Fishes

Upstream of USACE's Englebright Dam

Licensee found nine source documents of relevant information regarding fish resources within the Project Area. The contents of these documents, as well as anecdotal information, are described here. Licensee found little definitive information regarding fish in the North Yuba River between its confluence with USACE's Englebright Reservoir and New Bullards Bar Dam. Licensee believes fish populations from the North Yuba River between its confluence with USACE's Englebright Reservoir and New Bullards Bar Dam would be similar to those in the lower Middle (described below) and lower South Yuba rivers.

Source Documents

Upper Yuba River Studies Program (CDWR 2006a)
The following description of results from 2004 snorkel surveys in the Middle Yuba River from its confluence with the North Yuba River to Milton Diversion Dam is based on Gast et al. (2005). Referenced river miles are based on RM 0.0 at the confluence of the Middle and North Yuba rivers. Generally, trout densities were lower in the warmer, lower section of the river (Table 7.3.4-11). The furthest downstream observations of rainbow trout fry in dive counts was at RM 12.6 (i.e., upstream of the Project, approximately 0.5 mile above Our House Diversion Dam). However, rainbow trout fry were observed at non-sampling locations near Oregon Creek (RM 4.8).

Other than rainbow trout, fish observed included brown trout, Sacramento sucker, Sacramento pikeminnow, hardhead, smallmouth bass, and various sunfish. Sacramento suckers were observed below Our House Diversion Dam.

According to Gast et al. (2005), tributaries to the mainstem, having cooler summertime water temperatures, may provide refuge for salmonids from higher than optimum mainstem water temperatures. Oregon Creek was cooler than the mainstem, appeared to provide good habitat, and was inhabited by rainbow trout. The North Yuba River, at the confluence with the Middle Yuba River, also provides ample cool-water trout habitat. At the time of observation, water temperature in the North Yuba River at the confluence with the Middle Yuba River was 18.6°C, which is 4.5°C cooler than the Middle Yuba River water temperature (23.1°C).

Table 7.3.4-11. Distribution of fish species relative to river mile and stream temperature observed during 2004 Middle Yuba River snorkel surveys downstream of Our House Diversion Dam.

RM[1]	Tributary Inflow	Middle Yuba Water Temperature (°C)	Rainbow Trout	Brown Trout	Pikeminnow Hardhead[2]	Pikeminnow	Hardhead	Suckers	Smallmouth Bass	Rainbow (Fry Lane)	Non-game (Fry Lane)
0.0			--	--	--	--	--	--	--	--	--
0.1		23.1	●	--	--	●	--	--	●	--	--
1.8	Yellowjacket Creek		--	--	--	--	--	--	--	--	--

Table 7.3.4-11. (continued)

RM[1]	Tributary Inflow	Middle Yuba Water Temperature (°C)	Rainbow Trout	Brown Trout	Pikeminnow Hardhead[2]	Pikeminnow	Hardhead	Suckers	Smallmouth Bass	Rainbow (Fry Lane)	Non-game (Fry Lane)
2.6		20.4	●	--	--	●	--	●	●	--	--
4.8	Oregon Creek	21.4	--	--	--	--	--	--	●	--	--
12.6		23.7	●	--	●	●	●	●	●	--	●

Source: Gast et al. 2005
[1] Beginning at the confluence of the Middle Yuba River and North Yuba rivers.
[2] Pikeminnow and hardhead less than 4" in length not discernible.

Gast et al. (2005) identified four barriers to upstream fish migration, listed in Table 7.3.4-12. Our House Diversion Dam, at RM 12.8, is the only man-made barrier (in the survey area) that currently blocks upstream fish migration. There are natural barriers at RM 0.2 and 3.2 that would only be low flow barriers to upstream migration of small fish. At RM 0.4, there is an estimated 13 foot high cascade that would be a major obstacle to upstream migration. Several very large boulders blocking the narrow bedrock channel created this barrier, and sediment has filled in upstream of the boulders forming a dam. Although large fish may be able to pass at certain flows, the height of the cascade and narrowness of the canyon is expected to at least impede passage at all flows.

Table 7.3.4-12. Location and height of migration barriers found on the Middle Yuba River from the confluence with the North Yuba River to Our House Diversion Dam.

River Mile	Barrier Height in Feet
0.2	5
0.4	13
3.2	2
12.7	Licensee's Our House Diversion Dam

Source : Gast et al. 2005

Recreational angling also has provided some information on fish species in New Bullards Bar and USACE's Englebright Reservoir; a list of known game species that occur within these reservoirs is presented in Table 7.3.3-13 below.

Table 7.3.4-13. Game fish species known to occur in New Bullards Bar Reservoir and USACE's Englebright Reservoir.

Family	Common Name	New Bullards Bar Reservoir	USACE's Englebright Reservoir
Salmonid	Rainbow Trout	X	X
	Brown Trout	X	X
	Kokanee	X	X
Sunfishes	Largemouth Bass	X	X
	Smallmouth Bass	X	X
	Spotted Bass	X	X

Table 7.3.4-13. (continued)

Family	Common Name	New Bullards Bar Reservoir	USACE's Englebright Reservoir
Sunfishes (continued)	Red Ear Sunfish	X	X
	Crappie	X	X
	Bluegill	X	X
Catfishes	Channel Catfish	X	X

Source: Fishsniffer.com 2009; CDWR 2006b

CDFG New Bullards Bar Reservoir Fish Surveys.

CDFG has been conducting surveys of fish in old and New Bullards Bar Reservoirs since the 1950s. A 1959 survey of fish species in the old Bullards Bar reservoir found 12 species of fish including bass, crappie, sunfish, bluegill, bullhead, shiners, squawfish, sucker, and carp species. No trout species were found (Central Valley Fish Hatchery 1959). A subsequent summary report for CDFG fish survey activities in the reservoirs from 1959 through 1974 identified 16 species of fish as relatively common in the reservoirs, including smallmouth and largemouth bass, black and white crappie, warmouth, green and red-ear sunfish, bluegill, brown bullhead, squawfish, sucker, carp, rainbow trout, and kokanee salmon (CDFG 1974). Brown trout and white catfish are noted as rare occurrences. Channel catfish, threadfin shad, and fathead minnow were reportedly planted in the reservoir prior to 1960, but were not captured during any surveys. Golden shiners were observed only in 1959 (Central Valley Fish Hatchery 1959; CDFG 1974). The first documented CDFG capture of trout was reported in 1970 (CDFG 1963, 1970). Kokanee salmon were first documented during CDFG survey efforts in 1972 (CDFG 1963, 1970, 1972).

A letter to CDFG from a concerned angler indicates that the New Bullards Bar Reservoir fisheries experienced declines in smallmouth bass, trout, and kokanee salmon in the mid-1970s (French 1974). Rhodes (1983) notes that kokanee salmon numbers were low in 1978, but were improving through the early 1980s. Low stocking numbers, poor habitat conditions in the reservoir, and competition/predation from other fish species were noted as possible sources for the declines.

Recent blogs on an angling web site indicate that after several years of high quality kokanee fishing in New Bullards Bar Reservoir, the kokanee population has again declined for unknown reasons (Fish Sniffer 2009).

CDFG USACE's Englebright Reservoir Creel Surveys (CDWR 2006b)

Creel surveys conducted from July 2003 through May 2004 documented 12 sport fish species in USACE's Englebright Reservoir, including spotted bass, smallmouth bass, largemouth bass, bluegill, brown trout, rainbow trout, carp, channel catfish, crappie, kokanee, sucker, yellow perch, and Sacramento pikeminnow (CDWR 2006b). In addition to the sport fish species documented in the creel surveys, it is known that since 1965 USACE's Englebright Reservoir has been stocked by CDFG with rainbow trout, kokanee salmon, lake trout, brown trout, Eagle Lake rainbow trout, brook trout, white crappie, and black crappie (CDFG 2007b).

<u>CDFG's Fish Stocking Program</u>
New Bullards Bar Reservoir has a long history of annual fish stocking activities dating back to 1959 (Central Valley Fish Hatchery 1959; CDFG 1974). Based on actual CDFG stocking records, between 1969 and 2007 over 4.9 million kokanee salmon, nearly 1.6 million rainbow trout, over 310,000 Eagle Lake rainbow trout, 40,000 brook trout, 200 eastern brook trout, 200 cutthroat trout, and 185 spotted bass were planted in New Bullards Bar Reservoir (CDFG 1989, 2007b; Attachment 7.3A).

Although not part of the Project, USACE's Englebright Dam is located on the Yuba River between Project facilities. Similar to records for stocking in New Bullards Bar Reservoir, CDFG stocking records indicate that fish plantings in USACE's Englebright Reservoir have taken place from 1965 through 2007 (Attachment 7.3A). During this period just over 756,000 rainbow trout, 228,320 kokanee salmon, 6,973 lake trout, nearly 28,000 brown trout, 4,000 Eagle Lake rainbow trout, 2,640 brook trout, 45 white crappie, and 80 black crappie were planted (CDFG 2007b). Stocked species were primarily from the Shasta and San Joaquin hatcheries.

In accordance with new fish planting regulations, stocking of salmon and steelhead is scheduled to take place in one water body located within the Project Area - New Bullards Bar Reservoir (CDFG 2008c). Other common sport fisheries species in the reservoir include stocked rainbow and brown trout and kokanee salmon, as well as spotted, largemouth and smallmouth bass, crappie, sunfish, and catfish (CDFG 2002). USACE's Englebright Reservoir is not scheduled for stocking in 2008 to 2010 (CDFG 2008b, c).

Downstream of USACE's Englebright Dam

Many of the documents and ongoing monitoring and evaluation activities for fish in the lower Yuba River address both area within the Project (Englebright Dam to Daguerre Point Dam) and downstream of the Project (Daguerre Point Dam to the confluence with the lower Feather River). As one example, Chinook salmon (and steelhead) redd surveys are conducted concurrently both within and below the Project. As another (of many) example(s), although RST sampling has been conducted at a site located below the Project, about 6 RM upstream from the lower Yuba and Feather rivers confluence, the RST collects fish originating from both within and downstream of the Project. Documents that address fishes specifically between Englebright and Daguerre Point dams, as well as those documents that address fishes both between Englebright and Daguerre Point dams ("within the Project") and Daguerre Point Dam to the mouth of the lower Yuba River ("downstream of the Project") are presented in this section addressing "within the Project".

Also, many of the documents and ongoing monitoring and evaluation activities either do not specifically distinguish between spring-run and fall-run Chinook salmon, particularly regarding the juvenile rearing and emigration lifestages, or have been and are being conducted to address such distinctions. Therefore, for all of these reasons and for organizational efficiency and consistency, the suite of documents addressing Chinook salmon are presented in this section (7.3.4.2.1) of the PAD. Documents pertaining specifically and only to Threatened and Endangered spring-run Chinook salmon and *O. mykiss* (steelhead) are incorporated into the life history descriptions presented in Section 7.7 of the PAD.

Licensee found 14 source documents of relevant information regarding special status fish species either within the Project, or concurrently within the Project and downstream of the Project. The contents of these documents, as well as 14 anecdotal documents, are described below.

Source Documents

Lower Yuba River Fisheries Management Plan Final Report (CDFG 1991)
Between 1986 and 1988, the CDFG and its contractor (Beak Consultants Inc. 1989) conducted a comprehensive series of detailed studies addressing fish community structure, fish populations, fish passage, flow-habitat relationships, water temperature, water quality, riparian habitat, and diversion impacts. These studies were conducted in four reaches of the lower Yuba River: (1) Narrows Reach extending approximately 2.2 miles below Englebright Dam and downstream of the Narrows 1 and Narrows 2 powerhouses; (2) Garcia Gravel Pit Reach beginning downstream of the Narrows Reach and extending to the Daguerre Point Dam located 12.5 miles downstream of Englebright Dam; the (3) Daguerre Point Dam Reach extending 7.8 miles to the downstream terminus of the Yuba Goldfield; and (4) the remaining 3.5 miles below the Simpson bridge to the confluence with the Feather River in the town of Marysville. The results of these studies led to the development of CDFG's The Lower Yuba River Fisheries Management Plan Final Report in 1991.

Assessment of the fish community structure within the lower Yuba River included the estimation of fish species composition, relative abundance, and distribution parameters using electrofishing and snorkel survey techniques. Both methods were used because of their utility in addressing different informational needs of the study. Snorkeling surveys allowed for the characterization of juvenile salmonid habitat during spring months that were otherwise inaccessible to boat electrofishing, such as shallow near-shore and riffle areas. Electrofishing was conducted primarily to assess those species that were underrepresented in snorkel surveys.

Combined results from the electrofishing and snorkeling surveys resulted in the documentation of 15 fish species in the lower Yuba River including the special status species of hardhead, roach, and Chinook salmon. Chinook salmon were observed in all river reaches downstream of the Englebright Dam. Chinook salmon were the most abundant of all fish species in the lower Yuba River representing 49 percent of total number of fish observed.

A total of 1,707 fish was collected by electrofishing with increasing species diversity in the downstream direction. Only Chinook salmon and two other fish species were captured in the Narrows Reach. Diversity was greater in the Garcia Gravel Pit Reach and included Chinook salmon, steelhead/rainbow trout, and seven other species including hardhead. Chinook salmon and hardhead also were collected in the Daguerre Point Dam Reach. Relative abundance estimates from electrofishing indicated Chinook salmon was the most abundant species, comprising 49 percent of total electrofishing efforts.

A total of 8,815 fish was observed during snorkeling surveys. Chinook salmon were present in all four reaches. Snorkel survey abundance estimates suggested that Chinook salmon were the most abundant fish species in the lower Yuba River representing 49% of all fish observed. The other special status species observed included roach and hardhead, although in relatively low abundances.

CDFG (1991) reported that adult Chinook salmon densities were greatest in riffle and deep pool habitats, whereas juvenile Chinook salmon were highest in the fast flowing riffle and run/glide habitats.

Microhabitat use criteria were developed to address habitat-flow relationships in the lower Yuba River for the Chinook salmon spawning, fry, and juvenile rearing lifestages. Substrate criteria used frequency of observation of dominant substrate particle size, whereas water depth and velocity criteria were developed by applying the non-parametric tolerance limits method to the frequency-of-use distribution measurements taken on the lower Yuba River. CDFG (1991) considered spawning gravel resources in Garcia Gravel Pit and Daguerre Point Dam reaches of the lower Yuba River to be excellent, and also recommended future habitat improvement including construction of shallow rearing areas and off-channel habitat to increase survival of fry and juveniles.

<u>Hearing Exhibit S-YCWA-19. Expert Testimony on Yuba River Fisheries Issues (SWRI, JSA, and BE. 2000)</u>

The SWRI et al. (2000) document summarized data collection in the lower Yuba River obtained from 1992 through 2000. Between 1992 and 2000, Jones and Stokes Associates (JSA) biologists conducted fish population surveys in the lower Yuba River, using snorkel surveys to determine annual and seasonal patterns of abundance and distribution of juvenile Chinook salmon (and steelhead) during the spring and summer rearing periods. The SWRI et al. (2000) report stated that in general, juvenile Chinook salmon were observed by snorkeling throughout the river but with higher abundances above Daguerre Point Dam. This report suggested that higher abundances above Daguerre Point Dam may have been due to larger numbers of spawners, greater amounts of more complex, high quality cover, and lower densities of predators such as striped bass and American shad, which reportedly were restricted to areas below the dam. The SWRI et al. (2000) report stated that, in 1992, beach seining surveys were conducted to measure lengths and weights of juvenile Chinook salmon at several locations in the lower Yuba River upstream and downstream of Daguerre Point Dam. Juvenile salmon in the lower Yuba River exhibited significant growth in 1992. The average sizes of juvenile on specific sampling dates both upstream and downstream of Daguerre Point Dam were consistent with relatively rapid growth based on generalized growth curves for Chinook salmon.

Emigrating Chinook salmon salvaged at the Hallwood-Cordua fish screen were larger on any given date and encompassed a narrower size range than Chinook salmon sampled above Daguerre Point Dam. The SWRI et al. (2000) report stated that based on daily records of the number of Chinook salmon salvaged at the Hallwood-Cordua canal fish screen, the spring emigration period of juvenile salmon can begin as early as mid-April and continue until mid-June. However, it was noted that CDFG had not initiated salvage operations early enough in the season to sufficiently address the overall outmigration period.

The SWRI et al. (2000) document also developed proposed minimum instream flow requirements which built upon additional information developed since 1992, including fish habitat utilization and detailed analyses of fish habitat-flow relationships and water availability. Development of the proposed instream flow requirements was based primarily on: (1) updated information characterizing Yuba River Basin hydrology and water year type classification; (2) water availability assessments for lower Yuba River instream flows, based on five water year types; (3) updated and additional lower Yuba River fishery information; (4) improved flow-temperature relationships for the lower Yuba River; and (5) a definition of maintaining lower Yuba River fish resources in "good condition."

Lower Yuba River Water Transfer Monitoring Reports 2001 – 2004. (YCWA and SWRCB. 2001; YCWA. 2003; YCWA. 2005)

Water transfers and related monitoring studies and evaluations were performed in the lower Yuba River during 2001, 2002, and 2004. Chinook salmon was the only special status fish species evaluated by these studies.

The 2001 water transfer was characterized by a relatively large, rapid ramp-up period. In response to these observations conducted during these water transfers resulted in development of an instream flow release schedule for the water transfers created by YCWA, NMFS, USFWS, and CDFG to avoid a rapid increase in flow when the transfers begin, and to minimize or avoid potential impacts on anadromous fish in the lower Yuba River associated with non-volitional downstream movement.

Water transfer monitoring efforts also studied the potential for the Yuba River water transfers to affect the straying of Feather River hatchery Chinook salmon into the lower Yuba River via decreased water temperatures and increased flow relative to the Feather River. The results of YCWA and CDFG monitoring efforts during the 2001, 2002, and 2004 water transfer years indicated that Chinook salmon of hatchery origin ascended the fish ladders at Daguerre Point Dam in the lower Yuba River during both the water transfer and non-transfer periods. Chinook salmon of hatchery origin also have been observed ascending the Yuba River in non-transfer years (CDFG unpublished data). Observations made during these water transfer studies led to the June 2003 installation of a VAKIRiverwatcher system, an infrared detection device, as well as a photographic recorder at Daguerre Point Dam. Multivariate time series analyses indicated that the immigration rates of non-adipose fin clipped and adipose-fin clipped Chinook salmon in 2004 were not significantly associated with attraction flows, defined as the difference between lower Yuba River and Feather River flows, or attraction water temperatures, defined as the difference between lower Yuba River and Feather River water temperatures.

Lower Yuba River Redd Dewatering and Fry Stranding (JSA. 2003, 2007, and 2008).

YCWA has been conducting Chinook salmon (and steelhead) redd dewatering and fry stranding studies since 2002. Phase I of the Plan was undertaken in 2002, and implementation of Phase II of the Plan continues.

Yuba River Juvenile Chinook Salmon and Juvenile Central Valley Steelhead Trout Life History Survey (Massa 2004).

This study was conducted to continue development of baseline information for the Central Valley Project Improvements Act's (CVPIA), Anadromous Fish Restoration Program (AFRP) for juvenile Chinook salmon (and steelhead/rainbow trout) life history strategies on the lower

Yuba River. Data were collected to determine the timing and duration of downstream emigration, abundance and/or relative abundance, and to monitor the condition and size of outmigrating juvenile Chinook salmon. Emigrating juvenile Chinook salmon were coded-wire tagged (CWT) in an effort to enumerate and determine the relative contribution to adult escapement on the lower Yuba River.

Juvenile Chinook salmon (and steelhead trout) were captured using a rotary screw trap (RST) with an eight-foot diameter cone placed in the lower Yuba River located approximately 6 miles east of the city of Marysville, adjacent to the south end of Hallwood Boulevard. Except during extraordinarily high water flows or during periods of excessive debris, the trap was operated 24 hours per day, seven days a week from October 15, 2003, through June 17, 2004, following its installation on October 1, 2003.

Twenty-one species of fish were captured in the RST including a total of 307,297 juvenile Chinook salmon. This study revealed that peak catches of juvenile Chinook salmon on the lower Yuba River occur between December and March, which is approximately one month earlier than observed during previous monitoring efforts. Over 67,000 juvenile Chinook salmon were captured during the first two weeks of December 2003, and captures remained high until mid-March 2004. A total of 21,396 captured fry for the month of March 2003 signified the conclusion of peak emigration for juvenile Chinook salmon. Massa (2004) suggested that three runs of Chinook salmon (spring-, fall-, and late-fall run) were identified by modal distributions of captures at the RST. Spring-run Chinook salmon were first observed on November 1, 2003, followed by fall-run observations in December 2003, and late-fall run during mid-April 2004. Fall-run Chinook represented the majority of juveniles captured in the lower Yuba River. Coded Wire Tagging (CWT) began November 26, 2003 and ended June 15, 2004 with the majority of tagging occurring during peak emigration between December 9, 2003 and March 18, 2004. Of the 307,397 total juvenile Chinook salmon captured in the RST, 185,305 juvenile Chinook salmon were successfully injected with a CWT and adipose-fin clipped prior to release.

<u>Summer Distribution, Abundance, and Movements of Rainbow Trout and other Fishes in the Lower Yuba River (Kozlowski 2004).</u>
Kozlowski (2004) conducted electrofishing (early-July and late-August), two mid-channel snorkel surveys (late-July and early-September), and river margin surveys (mid-August) just prior to the second electrofishing period during 2000. In addition, he reviewed 1999-2000 salvage data for the Hallwood-Cordua canal, a diversion canal located at Daguerre Point Dam, and 1999-2001 trapping data for the Hallwood rotary screw trap (RST) near Hallwood Boulevard. These surveys were conducted to assess the distribution, abundance, and movement of steelhead/rainbow trout and other species below Englebright Dam.

Backpack electrofishing and snorkel survey data collection methods were used to estimate distribution and abundance population parameters for various life stages of steelhead/rainbow trout, as well as assess the aquatic community composition in the lower Yuba River. Fish screen salvage at Daguerre Point Dam and rotary screw trapping methods were used to assess fish movements within the lower Yuba River, including above and below Daguerre Point Dam. During the study a total of at least 12 species were observed including the special status species of Chinook salmon and hardhead.

Yuba River Juvenile Chinook Salmon and Juvenile Central Valley Steelhead Trout Life History Survey (Massa and McKibbin 2005)

Massa and McKibbin (2005) is a continuation of the Life History Surveys for the annual period extending from 2004-2005. Juvenile Chinook salmon (and steelhead/rainbow trout) were captured using two rotary screw traps (RST) with an eight-foot diameter cone placed in the lower Yuba River approximately 6 miles east of the city of Marysville, adjacent to the south end of Hallwood Boulevard.

Twenty-two species of fish were captured in the RST, including the special status species of Chinook salmon, roach, and hardhead. Massa and McKibbin (2005) suggested that peak catches of juvenile Chinook salmon on the lower Yuba River were observed later in the calendar year than in the previous 2003-2004 season, but were consistent with observations from earlier monitoring efforts (1999-2002). Massa and McKibbins (2005) suggested that three runs of juvenile Chinook salmon (spring-, fall-, and late-fall run) were identified by modal distributions of captures at the RST. Fall-run Chinook represented the majority of juveniles captured in the lower Yuba River. CWT began November 29, 2004 and ended June 7, 2005 with the majority of tagging occurring during peak emigration between early January 2005 and late February 2005. Of the 285,034 total juvenile Chinook salmon captured in the RST, 242,774 juvenile Chinook salmon were successfully injected with CWTs and adipose-fin clipped prior to release.

Fall-run Chinook salmon spawning escapement (2003) in the Yuba River (JSA 2006)

JSA (2006) reported that annual surveys of Chinook salmon carcasses have been conducted on the lower Yuba River since 1953 to estimate fall-run Chinook salmon spawning escapement. They reported that CDFG has conducted annual surveys of Chinook salmon carcasses on the lower Yuba River from 1953 to 1989, but suspended its surveys because of budget cuts. In response, YCWA with the assistance of JSA in 1991 conducted subsequent escapement surveys through 2003. CDFG assisted JSA from 1992 through 1994. In 2002 and 2003, additional funding was provided by the California Department of Water Resources (CDWR) and the Pacific States Marine Fisheries Commission (PSMFC) to ensure a complete search for tagged hatchery strays. The main objective of the annual carcass surveys was to estimate annual spawning escapement of fall-run Chinook salmon in the lower Yuba River downstream of Englebright Dam.

JSA (2006) reported an estimate of 28,897 Chinook salmon spawned in the lower Yuba River based on surveys conducted during 2003. JSA (2006) reported that the average spawning escapement for 1996–2003 was estimated to be 24,563 fish, which was substantially higher than the average of 13,809 for the preceding period between 1972–1995 representing the post–New Bullards Bar Reservoir period. Overall, average spawning escapements for the pre- and post-reservoir periods (1953–1971 and 1972–2003) were 12,906 and 16,050 fish, respectively.

2006 Central Valley Chinook Age Specific Run Size Estimates (Grover and Kormos undated)

Through scale aging, this study produced age-structured hatchery and natural escapement estimates for all principal reaches and runs of Chinook salmon in the Central Valley. Digital imaging and reading techniques were used, and a modified maximum likelihood estimator based on the work of Kimura and Chikuni (1987; as cited in Grover and Kormos undated) was utilized. This method uses known-aged CWT salmon scale samples in conjunction with those of unknown-aged (non-CWT) fish to create bias-corrected age proportions from which age-specific run size estimates were made. Grover and Kormos (undated) reported that preliminary results showed that there are differences between the age structure of hatchery and natural escapement. In addition, they indicated that there are age structure differences among the Chinook life history types present in the Central Valley. Results from this study indicated that in the lower Yuba River about 4.5 percent of the 2006 total escapement was comprised of 2 year old Chinook salmon, 16 percent were age 3, and 79.5 percent were age 4.

The 2007 Central Valley Chinook Age Specific Run Size Estimates (Grover and Kormos undated)

Results from the 2007 evaluation utilized the same methods and procedures described for the 2006 evaluation (presented above). Grover and Kormos (undated) stated that there are differences between the age structure of hatchery and natural escapement, and among the Chinook life history types present in the Central Valley. Results from this study indicated that in the lower Yuba River about 3% of the 2007 total escapement was comprised of 2 year old Chinook salmon, 36 percent were age 3, 59 percent were age 4, and 1.6 percent were age 5.

Lower Yuba River Chinook Salmon Escapement Survey: October 2007 – January 2008. (Massa 2008)

This report presents results of Chinook salmon spawning escapement surveys during 2007 to 2008, as well as summary information from preceding years. Massa (2008) reported that although escapement surveys were conducted on the lower Yuba River to estimate the number of returning adult Chinook salmon since 1953, previous estimates were infrequent and unlike more recent surveys (1994, 1996-2006), because methods were not consistent from year to year. Survey duration and area of sampling varied, resulting in data that were statistically inappropriate for trend analysis.

Massa (2008) estimated 2,604 Chinook salmon (2,423 adult and 81 grilse) spawned in the lower Yuba River survey area during the period of October 2, 2007 to January 3, 2008. This estimate was the lowest observed in twelve consecutive years, and was less than a third of the escapement estimate reported for 2006 (8,231 fish). Separate estimates could not be created for each of the six survey reaches due to low sample size, although previous surveys have suggested that the majority of spawning occurs above Daguerre Point Dam (JSA 2006; Massa 2006; Massa 2007). Approximately 70% of the returning escapement in 2006 utilized the area between the Narrows pool and Daguerre Point Dam (Massa 2007). A single fall-run recovery originated from the Feather River Hatchery. No recoveries were observed from the CDFG's wild-tagging operation (*Lower Yuba River Life History Investigation*) during this survey.

Lower Yuba River Accord

The Yuba Accord is a consensus-based, comprehensive set of agreements designed, among other things, to protect and enhance 24 miles of aquatic habitat in the lower Yuba River, which extends from USACE's Englebright Dam downstream to the river's confluence with the Feather River near Marysville. The Yuba Accord includes a Fisheries Agreement, under which YCWA cooperatively manages the flows of the lower Yuba River according to specified criteria, and provides a River Management Fund for monitoring and evaluation of fish, and fish habitat. The Yuba Accord River Management Fund is administered by the River Management Team (RMT).

The RMT is comprised of representatives of YCWA, NMFS, USFWS, CDFG, PG&E, CDWR, and the non-governmental organizations (NGOs) that are parties to the Fisheries Agreement of the Yuba Accord (South Yuba River Citizens League, Trout Unlimited, Friends of the River, The Bay Institute). The RMT, in collaboration with representatives from University of California, Davis and the Pacific States Marine Fisheries Commission, has developed a Monitoring and Evaluation Program (M&E Program) to guide the efficient expenditure of approximately $6 million to evaluate the effects of implementation of the Yuba Accord on the aquatic resources of the lower Yuba River over the period extending from 2008 to 2016. The M&E Program embraces a monitoring-based adaptive management approach to increase the effectiveness of, and to address the scientific uncertainty associated with, specific monitoring and study activities, and restoration actions.

The primary purpose of the M&E Program is to provide the monitoring data necessary to evaluate whether implementation of the Yuba Accord will maintain fish resources (i.e., the fish community including native fish and non-native fish) of the lower Yuba River in good condition, and will maintain viable anadromous salmonid populations. The RMT has developed the following Protocols and Procedures in accordance with the Yuba Accord M&E Program:

- Flow and Water Temperature Monitoring
- Topographic Mapping (Digital Elevation Model)
- Substrate and Cover Mapping
- 2-D Hydrodynamic Modeling
- Mesohabitat Classification
- Riparian Vegetation Mapping
- Acoustic Tagging and Tracking
- VAKIRiverwatcher Monitoring
- Redd Surveys
- Carcass Surveys
- Snorkel Surveys
- Rotary Screw Trapping
- Genetic Sampling and Characterization
- Otolith Sampling and Characterization

Each of the Yuba Accord M&E Program Protocols and Procedures prepared by the Yuba Accord RMT are summarized in Section 7.8. Detailed descriptions of each of the Protocols and Procedures, and monitoring data from implementation of the M&E Program, as they become available are complied into annual reports (see the RMT website www.yubaaccordrmt.com).

CDFG Scale Aging Program

CDFG uses scales to estimate salmonid size at age, and obtain information on the age structure of the annual Chinook salmon runs in the Central Valley, including the lower Yuba River. Scale sampling occurs at hatcheries and on CDFG escapement surveys to reflect spatial and temporal differences in age structure among fish.

Goals of CDFG's Scale-Age Program include: (1) examining age structure and the variation in the age structure of the total (hatchery and natural origin) and of natural origin spring-run and fall-run Chinook salmon; and (2) estimating sex composition by age for the total (hatchery and natural origin) population and of natural origin adults, and determine the variability in sex composition of the adult population (by age) for spring-run and fall-run Chinook salmon.
Lower Yuba River Chinook salmon escapement surveys are conducted each year (see above). Scale samples are collected annually from October through January in the lower Yuba River. Results from the 2006-2007 and 2007-2008 are reported above (see Grover and Kormos undated).

Scale samples are collected from fresh Chinook salmon carcasses for age determination and cohort reconstruction through cooperation with the Ocean Salmon Project. The sample design was selected to achieve a non-biased estimate of age structure for the specific portion of the population where escapement estimates are made without respect to known or unknown age fish. Almost all of the adipose fin clipped fish from hatcheries are scale sampled to provide a reference collection of as many known age scales as possible. In hatcheries, samples are collected at a constant rate throughout the entire spawning period keeping track of the "random" age sample and the additional "non-random" known age samples. During carcass surveys, samples are collected at a constant rate as fish suitable for sampling are encountered. Because of the high sample rate for known age scales at hatcheries and the difficulty of sampling on spawning grounds, non-random samples are generally not taken from adipose fin clipped carcasses.

CDFG Angler Surveys

In 1998, the CDFG created the Central Valley Salmon and Steelhead Harvest Monitoring Project. The goal of this program is to estimate the number of adult Chinook salmon (and steelhead) resulting from natural production in Central Valley rivers and streams including: (1) determining annual estimates of the total in-river harvest of salmon and steelhead; and (2) provide limited harvest data on other anadromous and resident sport fish species. According to CDFG's current Freshwater Sport Fishing Regulations, the lower Yuba River is closed to salmon fishing.

Anecdotal Information

Restoring Central Valley streams: A plan for action (CDFG 1993)

The CDFG (1993) report assessed the condition of Central Valley anadromous fish habitat and associated riparian wetlands, and set priorities for taking actions to restore and protect aquatic ecosystems that support fish and wildlife and to protect threatened and endangered species. Priorities were identified to guide future efforts toward restoration. On the lower Yuba River, priority actions included installing fish screens on lower Yuba River diversions, improving spawning and rearing habitat, and protecting and managing riparian habitat. Recommendations for administrative actions to improve anadromous fish habitat in the lower Yuba River also included specific stream flow recommendations which were consistent with the CDFG (1991) report titled *The Lower Yuba River Fisheries Management Plan Final Report*. The recommendations also included target water temperatures, although no specific water temperature studies, flow-temperature relationships, or water temperature availability studies were presented.

Historical and present distribution of Chinook salmon in the Central Valley Drainage of California (Yoshiyama et al. 1996)

This report summarized historical accounts of Chinook salmon populations, including the Yuba River. Yoshiyama et al. (1996) reported that prior to the impacts associated with gold mining, dam construction, and water diversions, large numbers of Chinook salmon were taken by miners and Native Americans as far upstream as Downieville on the North Yuba River. During the construction of the original Bullards Bar Dam (1921 - 1924), numerous Chinook salmon congregated and died below the dam. Due to their presence high in the watershed, Yoshiyama et al. (1996) concluded that these fish were spring-run Chinook salmon.

A Status Review of the Spring-Run Chinook Salmon in the Sacramento River Drainage (CDFG 1998)

This status report was prepared in response to a petition to list Sacramento River spring-run Chinook salmon as an endangered species pursuant to the California Endangered Species Act (Fish and Game Code Sections 2050 *et seq*.). Regarding the lower Yuba River, this report suggested that spring-run Chinook salmon populations may be hybridized to some degree with fall-run Chinook salmon due to lack of spatial separation of spawning habitat.

Status review of Chinook salmon from Washington, Idaho, Oregon, and California (Myers et al. 1998)

This document reports results of the comprehensive ESA status review of Chinook salmon from Washington, Oregon, California, and Idaho. To provide a context for evaluating these populations of Chinook salmon, biological and ecological information for Chinook salmon in British Columbia, Alaska, and Asia were also considered. NMFS formed a team of scientists with diverse backgrounds in salmon biology to conduct this review. This Biological Review Team (BRT) for Chinook salmon included fisheries scientists, and federal and state agencies. The BRT addressed issues related to the definition of Distinct Population Segments, population abundance, and causes of decline for Chinook salmon. Ecoregions delineated in this report include those geographic areas throughout the broad distribution of Chinook salmon, including California's Central Valley. The BRT analyzed regional variations in life-history, ecology, and genetic information as part of the assessment regarding California Central Valley Chinook salmon. The report includes discussion and conclusions specific to Central Valley spring-run and fall-run ESU's found in the Sacramento, Feather, and Yuba rivers.

Historical and Present Distribution of Chinook Salmon in the Central Valley Drainage of California (Yoshiyama et al. 2001)

This report characterized historic distributions of Chinook salmon throughout the Central Valley of California, and states that both spring- and fall-run Chinook salmon historically occurred in the Yuba River watershed. Relevant information regarding the Yuba River basin is provided above in section 7.3.2.2 of this PAD.

<u>Daguerre Point Dam Fish Passage Improvement Project 2002 Fisheries Studies (CDWR and USACE 2003a)</u>

The purpose of this report was to examine available data on habitat conditions, flow, passage, and spawning above and below Daguerre Point Dam to assist in the analysis of potential benefits or impacts of improved passage at the dam prior to selection of an alternative concept(s) for consideration in the environmental review process. The report included a review of available data from CDFG, USFWS, JSA, and other sources. It also incorporated field observations of river habitat conditions made by ENTRIX, Inc. (ENTRIX) in September of 2002 (ENTRIX and J. Munroe 2003 as cited in CDWR and USACE 2003). The report described channel morphology, spawning habitat suitability, historical and potential habitat use by species, water temperature, hydrology, as well as discussions regarding conceptual benefits and impacts for different fish passage alternatives.

<u>Daguerre Point Dam Fish Passage Improvement Project 2002 Water Resources Studies (CDWR and USACE 2003b)</u>

The purpose of this report was to summarize and analyze the available hydrologic (including groundwater and flooding), hydraulic, and sediment data for the lower Yuba River. This report characterized the conditions on the river, including hydrology (groundwater and surface water), flow hydraulics, sediment transport, and flooding as part of the Daguerre Point Dam Fish Passage Improvement Project.

<u>Daguerre Point Dam Fish Passage Improvement Project (USACE 2003c)</u>

USACE (2003c) focused conceptually on improving fish passage for native anadromous fish species at Daguerre Point Dam while maintaining water interests and flood management. Project alternative feasibility was assessed with consideration given to fisheries benefits and limitations, environmental impacts, sediment/mercury containment, water supply impacts, operation and maintenance requirements, engineering and construction demands, and economics.

<u>Initial Study/Proposed Mitigated Negative Declaration for the Narrows 2 Powerplant Flow Bypass System Project (YCWA 2003)</u>

The Initial Study (YCWA 2003) addressed the environmental impacts of construction and operation of a synchronous full-flow bypass at YCWA's Narrows 2 Powerplant. Prior to implementation of the Narrows 2 Powerplant Full-flow Bypass System, the Narrows 2 Powerplant did not allow the full-flow capacity to be bypassed during non-operation. Even a brief loss of power resulted in a substantial loss of river flow. YCWA (2003) suggested that any facility shutdowns, particularly those occurring during the warm and dry summer months, could result in flow and temperature conditions in the lower Yuba River potentially detrimental to fish by increasing water temperatures in the river above physiologically suitable levels, or reducing flow magnitude to levels that could result in redd dewatering or juvenile stranding.

The primary objectives of the Narrows 2 Powerplant Full-flow Bypass System Project were to: 1) maintain more stable releases from the Narrows 2 Powerplant during emergency and maintenance shutdowns at the same flow rate as was being discharged before the shutdown occurred; and 2) make the flow fluctuation and reduction criteria stated in YCWA's FERC License No. 2246 more protective of downstream fish species than the criteria that were previously stated in that license.

Draft Implementation Plan for the Lower Yuba River Anadromous Fish Habitat Restoration (CALFED and YCWA 2005)

The purpose and goal of the CALFED and YCWA (2005) report was to facilitate the implementation of prioritized actions and studies that intended to protect, enhance, and restore: 1) the Yuba River aquatic and riparian habitats; 2) the key processes that create and maintain these habitats; and 3) the anadromous fish species that use such habitats.

The report described abiotic (geomorphology, water flow, and water temperature) and biotic (habitat, species-specific profile and population status) conditions in the lower Yuba River watershed to provide a technical basis for the development of species-specific conceptual models to assess how physical conditions may be affecting the anadromous fish species of primary management concern including the special status species of fall-run Chinook salmon. The conceptual models prioritized potential life-stage specific stressors that may negatively affect fish survival, growth or other critical lifecycle processes.

Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead (Good et al. 2005).

This report summarizes biological information updated from the 1999 status review for the 26 ESUs of listed salmon and steelhead, and one candidate ESU (lower Columbia coho salmon), and presents the team's conclusions regarding the current risk status of the these ESUs. The status of the Central Valley spring-run Chinook salmon ESU, which includes populations found on the Yuba River, was formally assessed during a coastwide status review (Myers et al. 1998). In June 1999, a BRT convened to update the status of this ESU by summarizing information and comments received since the 1997 status review.

The Feather and Yuba rivers contain populations that are thought to be significantly influenced by the Feather River Hatchery spring-run Chinook salmon stock. The Feather River Hatchery spring-run Chinook salmon program releases its production far downstream of the hatchery, causing high rates of straying. The BRT suggests there is concern that Central Valley fall-run and spring-run Chinook salmon have hybridized, and that the Feather River Central Valley spring-run Chinook salmon population is depends on Feather River Hatchery production (Good et al. 2005). Good et al. (2005) indicates that Yuba River spring-run Chinook salmon, Feather River Hatchery spring-run Chinook salmon, and putative Feather River natural spring-run Chinook salmon, were categorized into a large cluster composed mostly of natural- and hatchery-origin fall-run Chinook salmon.

Draft Report On Flow-Habitat Relationships for Spring and Fall-Run Chinook Salmon and Steelhead/Rainbow Trout Spawning in the Yuba River (Gard 2007)

This draft report presented flow-habitat relationships for spring- and fall-run Chinook salmon and steelhead/rainbow trout spawning in the lower Yuba River. This draft report used the 2-Dimensional hydraulic model River2D and habitat suitability criteria (HSC) developed for the lower Yuba River from data collected during 2000 – 2004. Representatives of YCWA, PG&E, and UC Davis submitted comments on this draft report, requesting necessary revisions to the hydraulic model, and particularly to the HSC development. Although the report was revised in March 2008, the issues raised in the comments remain unresolved.

Draft Report On Flow-Habitat Relationships for Juvenile Spring/Fall-Run Chinook Salmon and Steelhead/Rainbow Trout Rearing in the Yuba River (Gard 2008a)
This draft report presented flow-habitat relationships for spring- and fall-run Chinook salmon and steelhead/rainbow trout juvenile rearing in the lower Yuba River. This draft report used the 2-Dimensional hydraulic model River2D and habitat suitability criteria (HSC) developed for the lower Yuba River from data collected during 2003 – 2005. Representatives of YCWA, PG&E, and UC Davis submitted comments on the draft report requesting necessary revisions o the hydraulic model and HSC development. These comments have not been addressed to date.

Draft Report On Sensitivity Analysis for Flow-Habitat Relationships for Steelhead/Rainbow Trout Spawning in the Yuba River (Gard 2008b).
This draft report presented a sensitivity analysis that was conducted to examine the effects of alternative criteria on flow-habitat relationships and biological validation for steelhead/rainbow trout spawning in the lower Yuba River. This draft report did not resolve the comments made by representatives of YCWA, PG&E and UC Davis on (Gard 2007).

Draft Report On Relationships Between Flow Fluctuations and Redd Dewatering and Juvenile Stranding for Chinook Salmon and Steelhead/Rainbow Trout in the Yuba River (Gard 2008c).
This draft report presented potential relationships between lower Yuba River flow fluctuations and Chinook salmon and steelhead/rainbow trout redd dewatering and juvenile entrapment stranding. These relationships were presented as the percentages of spawning habitat dewatered and area stranded with different flow reductions. The draft report assumes that juvenile salmon would be stranded if the depth at the stranding point is less than the minimum depth at which Gard (2008a) found juvenile salmon during juvenile habitat suitability data collection, and that there would be insufficient intragravel flow through a redd if the mean water column velocity at the redd was less than the lowest velocity at which Gard (2007) found a salmonid redd in the lower Yuba River. YCWA has provided comments on this draft report.

7.3.4.2.2 Amphibians

Licensee found one source document of relevant information regarding amphibians within the Project Area. The contents of this source document, as well as anecdotal information, are described here.

Source Document

Yuba County General Plan (2007)
The presence of California red-legged frog is addressed in the Yuba County General Plan Update Background Report. California red-legged frog has been documented just outside the Project Area east of New Bullards Bar Reservoir near Little Oregon Creek. Critical habitat has been designated around this occurrence and includes land in the Project Area (USFWS 2006). Licensee modified the FERC approved project recreation plan to seasonally restrict access at the Moran Road area of New Bullards Bar Reservoir, in part to protect California red-legged frog. The modification entailed closing the Moran Road gate from October 15 to May 1, and followed consultation with the Forest Service and USFWS. USFWS concurred with the Forest Service finding that the action is not likely to adversely affect California red-legged frog as long as the

mitigation measures listed in the Forest Service Decision Memo dated August 26, 2003, are implemented.

Anecdotal Information

Licensee found two sources of anecdotal information that may be relevant to amphibian resources within the Project Area. The contents of these anecdotal sources are described here.

There are CAS and MVZ museum collection or sight records within the Project Area at New Bullards Bar Reservoir for Sierra newt (vicinity of Dark Day Campground) and bullfrog (Dark Day Cove Creek on southeast shore). In the vicinity of Log Cabin Diversion Dam on Oregon Creek, there are records for Sierra newt and foothill yellow-legged frog (adults and subadults); foothill yellow-legged frog also has been documented near (upstream and downstream of) Our House Diversion Dam on the Middle Yuba River. Finally, there is a 1942 record for western toad 1.2 miles south of the mouth of South Yuba River at USACE's Englebright Dam.

7.3.4.2.3 Aquatic Reptiles and Turtles

Licensee found no source documents of relevant information regarding reptiles or turtles associated with aquatic environments within the Project Area. However, Licensee found two sources of anecdotal information, which are described below.

There are CAS and MVZ museum collection or sight records from the Project Area for western pond turtle on the north and west sides of New Bullards Bar Reservoir, and for western terrestrial garter snake on Mill Creek near New Bullards Bar Reservoir.

7.3.4.2.4 Aquatic Mollusks and Snails

Licensee did not find any additional source documents or anecdotal information regarding mussels or aquatic snails in the Project Area.

7.3.4.2.5 Benthic Macroinvertebrates

Licensee did not find any source documents regarding BMI in the Project Area.

However, based on the source and anecdotal documents discussed in Section 7.3.3.1, a general description of the aquatic invertebrate taxa likely to occur within the Project Vicinity is possible. Again, the presence and location of a given BMI species within the Project Vicinity is largely dependent on its preference for either standing or running water. Where flowing habitats within the Project Vicinity are dominant, invertebrate groups likely to occur include Ephemeroptera, Plecoptera, Trichoptera, Diptera, Coleoptera, Megaloptera, Hemiptera, Hirudinea, Oligocheata, Turbellaria, Nematoda, Crustacea, Mollusca, Acari, and Lepidoptera. Where still water habitats within the Project Vicinity are dominant, invertebrate groups likely to occur include Ephemeroptera, Trichoptera, Diptera, Coleoptera, Hemiptera, Oligocheata, Hirudinea, Turbellaria, Nematoda, Crustacea, Mollusca, Odonata, and Acari (Rose et al. 1995).

7.3.4.2.6 Algae

As described in Section 7.3.3.1, algae blooms can be associated with human disturbance, particularly downstream of dams and other flow-regulated water.

Licensee is aware of algal blooms in New Bullards Bar Reservoir periodically during the summer months.

During the summer months, heavy blooms of the green alga genus *Cladophora* can occur in unspecified sections of Deer Creek, a non-Project-affected stream that is tributary to the lower Yuba River below USACE's Englebright Dam (Cohen 2001, Shilling, pers. comm. 2003).

7.3.4.3 Downstream of the Project Area

Downstream of the Project Area, the Yuba River flows from below USACE's Daguerre Point Dam to the Feather River at Marysville. Twenty-four miles downstream, the Feather River joins the Sacramento River. USACE's Daguerre Point Dam is located 11 miles upstream from the mouth of the lower Yuba River. Two fish ladders provide passage for upstream migrant fish. A 1989 CDFG study reports that habitat conditions for spawning salmonids below USACE's Englebright Dam are improved because of better winter and spring runoff release in the summer and fall and colder water temperatures than before construction of New Bullards Bar Reservoir (CDFG 1989). Average flows in the lower Yuba River below USACE's Englebright Dam were reported to range from 340 cubic feet per second (cfs) to 4,405 cfs between 1949 and 1967, and from 1,320 cfs to 3,544 cfs between 1970 and 1977. Extreme flow events prior to 1970 ranged from 15 cfs to 136,000 cfs (CDFG 1989).

This section presents relevant and reasonably available information regarding aquatic resources located downstream of the Project (i.e., in the lower Yuba River from USACE's Daguerre Point Dam to the confluence with the Feather River).

7.3.4.3.1 Fishes

Licensee did not find additional source documents with relevant information regarding fish resources downstream of the Project that were not included in the "within the Project" section. Licensee found four sources of anecdotal information that may be relevant to fish resources downstream of the Project. The contents of these anecdotal sources are described here.

Anecdotal Information

<u>CNDDB</u>
A query of the CNDDB for special concern species within quadrangles located immediately downstream of the Project (i.e., Browns Valley and Yuba City), did not reveal any confirmed occurrences of fish species of special concern (CDFG 2009c).

Angler Surveys

Angler surveys conducted by CDFG in the Central Valley report populations of Chinook salmon, steelhead trout, rainbow trout, striped bass, American shad, white and bullhead catfish, bluegill, green sunfish, and black bass in the Feather River (Massa and Schreyer 2003). These species, as well as Sacramento-San Joaquin roach, golden shiner, hardhead, mosquitofish, Pacific lamprey, prickly and riffle sculpin, Sacramento pikeminnow and sucker, largemouth and smallmouth bass, speckled dace, Tule perch, and white crappie were documented during 2004-2005 CDFG life history studies conducted in the lower Yuba River (Massa and McKibbin 2005). Native fish species reportedly occurring in the lower Yuba River include Chinook salmon, green sturgeon, hardhead, Pacific lamprey, rainbow trout, steelhead, riffle sculpin, Sacramento pikeminnow and sucker, speckled dace, and tule perch, some of which occur in lower portions of the river near the mouth.

River Restoration and Fish Management

Since 1996, AFRP efforts in the Yuba River, downstream of the Project Area, have included fish barrier evaluation and improvements, temperature analysis, escapement studies, life history evaluations, sediment studies and fish monitoring programs (Massa 2006, 2007, 2008; USFWS 2008a, b). Additionally, AFRP restoration efforts are ongoing in the Feather River watershed located downstream of the Project. Goals of the Feather River restoration efforts (located to the north and west of the Yuba River) include species life history evaluations, water temperature and flow evaluations, and management for Chinook and steelhead, borrow pit evaluations and implementation of a gravel replenishment program (USFWS 2008a, d). Documented studies include support for an educational program called "Kids and Creeks: Restoration Ecology in Action," which began in 2000.

CDFG's Fish Stocking Program

Salmon and steelhead from the Feather River Hatchery are artificially stocked in waterbodies within numerous counties located downstream of the Project Area including 10 waterbodies in Sacramento County and one in Yuba County (CDFG 2008c).

7.3.4.3.2 Amphibians

Licensee found no source documents concerning amphibians in or near the Yuba River downstream of the Project. A review of museum records from the CAS and MVZ revealed only three records for this area: Sierra treefrog at a location near the Yuba Gold Fields and from southeast of USACE's Englebright Dam (1942 record); and bullfrog at a pond southeast of USACE's Englebright Dam.

7.3.4.3.3 Aquatic Reptiles and Turtles

Licensee found no source documents or anecdotal information concerning aquatic reptiles and turtles downstream of the Project.

7.3.4.3.4 Aquatic Mollusks and Snails

Licensee found no source documents regarding aquatic mollusks downstream of the Project. However, Licensee found one source of anecdotal information, which is described below.

A query of the CNDDB within USGS topographic quadrangles located immediately downstream of the Project (e.g., Browns Valley and Yuba City), did not reveal any confirmed occurrences of mollusks of special concern downstream of the Project Area (CDFG 2009c).

7.3.4.3.5 Benthic Macroinvertebrates

Licensee found no source documents regarding BMI downstream of the Project. Licensee found one source of anecdotal information, which is described below.

Brown and May (2000)
In 2000, Brown and May reported BMI data collected during 1994-1996 from various locations throughout the western Sierra Nevada and California Central Valley. The authors reported that BMI assemblages in riffles (as well as species associated with snags) might be useful in family level bioassessments of environmental conditions in valley floor habitats. For the riffle samples, elevation was the most important factor determining BMI assemblage structure.

South Yuba River Citizens League (2010)
In September 2007, SYRCL collected BMI data from various streams in Nevada County, California, including Parks Bar Creek. The dominant family (37 percent contribution) at Parks Bar Creek was the Chironomidae. Other groups collected at this site included Ephemeroptera, Plecoptera, Trichoptera, and Mollusca.

7.3.4.3.6 Algae

As described in Section 7.3.3.1 algae blooms can be associated with human disturbance, particularly downstream of dams and other flow-regulated water. No additional information was identified.

7.3.5 List of Attachments

This section includes one attachment:

- Attachment 7.3A – Fish Stocking Records

Aquatics-related CNDDB query results are included in the attachments to Section 7.4, Wildlife Resources of this Pre-Application Document.

Section 7.3
Aquatic Resources Attachment

- **Attachment 7.3A: Fish Stocking Records 1965-2007**

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