Volume 1

EXHIBIT WDCWA-209

DAVIS-WOODLAND WATER SUPPLY PROJECT

Draft Environmental Impact Report

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Lead Agency:
City of Davis, Public Works Department
In Association with:
UC Davis and City of Woodland

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Bank swallow is a migrant that nests in vertical banks and cliffs near water, and forages for insects over water. The nearest nesting colonies are along Cache Creek in Yolo County and along the Sacramento River at the border of Yolo and Sutter Counties. A few individuals from these colonies are known to forage over the Yolo Bypass Wildlife Area's wetlands after cessation of breeding in late summer. There are no known occurrences for bank swallows in the vicinity of the proposed Project area.

American badger is an uncommon permanent resident that occurs throughout California in dry scrub habitats and open, herbaceous habitats. Badgers need friable soils for digging burrows, often digging a new den each night during the summer. Badgers mainly prey on mice, rats, ground squirrels, and gophers, but may also eat small reptiles, insects, birds, eggs, or carrion. There are 3 known locations for American badger within the vicinity of the proposed Project area. The closest occurrence is approximately 2.5 miles from diversion/intake siting Option 1.

Fish and Aquatic Species

The Sacramento River, in the vicinity of the water diversion options, provides habitat for a variety of resident and migratory fish species. The river serves as a spawning and juvenile nursery area for many of these species, as well as habitat for juvenile, sub-adult, and adult fish. However, many other Sacramento River species do not occur in the vicinity of the diversion/intake options. For example, several Sacramento River species, including Delta smelt and longfin smelt primarily occur only downstream of the potential diversion/intake locations.

The following sections describe the fishery community inhabiting the Sacramento River in the general vicinity of the water diversion/intake siting options.

Fish Species Composition in the Sacramento River

Numerous fish monitoring studies have documented that a variety of resident and migratory fish and microinvertebrates are present in the Sacramento River in the vicinity of the proposed project. Relevant studies include: (1) investigations of fish eggs and larvae near Hood, (2) fisheries surveys characterizing species composition, abundance, and seasonal distribution of downstream migrating juvenile Chinook salmon and steelhead near Knights Landing, and (3) seasonal and geographic distribution of various fish species including Chinook salmon, sturgeon, and striped bass. These studies help define the environmental baseline conditions for the proposed Project area.

The Sacramento River in the vicinity of the proposed intake locations serves as a migratory corridor for the upstream migration of adult sturgeon, American shad, striped bass, salmon and steelhead, and for the downstream migration of juveniles of these species. Other fish species common in the Sacramento River near the proposed intake locations include river and Pacific lamprey, California roach, hardhead, threadfin shad, catfish, Sacramento pikeminnow, tule perch, sculpin, bullhead, and a variety of other resident fish species. The Sacramento River also provides habitat for a variety of invertebrates, including planktonic species such as copepods, and epibenthic species such as crawfish and amphipods.

The species composition and relative abundance of both fish and macroinvertebrates within the Sacramento River in the proposed Project area vary within and among years in response to environmental factors such as changes in hydrologic conditions, seasonal migration patterns, and microhabitat conditions. Several of the fish species inhabiting the proposed project area, most notably striped bass, white sturgeon, American shad, and catfish, support recreational fisheries, but are not listed under the state or federal ESA. Many other fish and macroinvertebrates are considered to be important prey and forage species. Additional surveys beyond those historically available were not conducted. Historical survey information was deemed sufficient to establish information about composition and abundance of species in the Project area.

Special-Status Fish Species

Fish species that have been identified for protection under the State and/or federal Endangered Species Acts that inhabit the Sacramento River in the vicinity of the proposed project include winter-run and spring-run Chinook salmon and Central Valley steelhead. Other special-status species including Delta smelt and longfin smelt, green sturgeon, lamprey, hardhead, and California roach are also discussed in this chapter. Based on information regarding these species' habitat distributions and known or presumed occurrences in the proposed Project area, an assessment has been made of the potential impacts associated with construction, operation, and maintenance of the proposed diversion/intake facility and positive barrier fish screen on each of the identified fish species.

Several endangered or threatened fish species have been collected in the vicinity of the proposed Project intake. These include: (1) winter-run Chinook salmon (listed as an endangered species under the CESA and FESA, (2) spring-run Chinook salmon and steelhead (listed as threatened species under the California and/or federal ESA), (3) Green sturgeon juveniles and adults, (recently listed as a threatened species under the federal ESA), and (4) Delta smelt (listed as a threatened species under the CESA and FESA). Although Delta smelt have been occasionally collected in the Sacramento River near the potential Project diversion/intake sites, they primarily occur downstream of the proposed diversion/intake sites (that is, within the lower Sacramento River downstream of Sacramento, the Delta, and Suisun Bay).

Salmonid Fish Species

Chinook Salmon is an anadromous species, spawning in freshwater and spending a portion of their life cycle within the Pacific Ocean. The species is divided into the following four runs according to spawning season: winter-run, spring-run, fall-run, and late fall-run. These runs inhabit the upper Sacramento River (Vogel and Marine 1991), and occur seasonally in the vicinity of the proposed Project area. Chinook salmon do not spawn within the Sacramento River in the vicinity of the proposed Project area. Instead, they utilize this portion of the river as their primary upstream and downstream migration route. In general, Chinook salmon require relatively cool water throughout their juvenile residence, good water quality, and foraging/cover areas. The Sacramento River, including the proposed project area, has been designated as critical habitat for Chinook salmon by the National Marine Fisheries Service (NMFS) and as Essential Fish Habitat (EFH) for Pacific salmon.

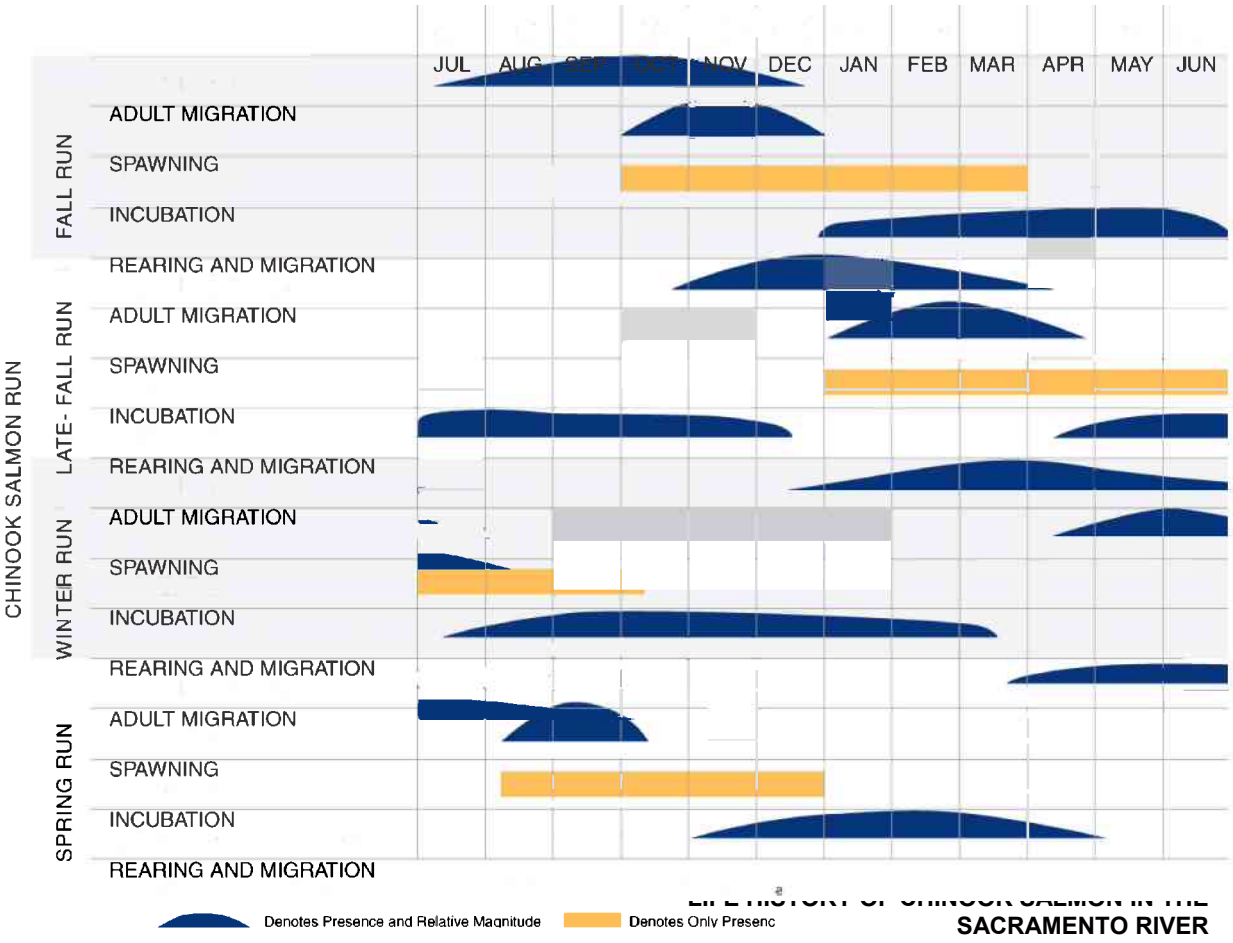
Fishery sampling at the RD 108 Wilkins Slough diversion over the period from 1993 through 1996 provides useful information on the seasonal distribution and length frequencies of juvenile Chinook salmon in the vicinity of the proposed Project area. Results of these surveys indicate that juvenile Chinook salmon are present in greatest abundance during the spring (April - June) and winter (November - January). Juvenile Chinook salmon also migrate downstream in the Sacramento River during the late winter (February-March). Results of monitoring at the Wilkins Slough diversion show a seasonal distribution pattern for juvenile Chinook salmon that is consistent with the patterns observed at Knights Landing (Snider and Titus 1998, 2001) and at Sacramento (USFWS unpublished data).

Juvenile Chinook salmon emigrating downstream past the proposed Project area typically range in length from approximately 27 to 150 mm. Length frequencies typically reflect three juvenile lifestages: fry (approximately 30 - 50 mm), smolts (approximately 60 - 90 mm), and yearlings (up to 150 mm).

Life Histories of Winter, Spring, Fall, and Late Fall-Run Chinook Salmon. The general seasonal timing of migration and spawning by each of the runs is detailed in Figure 3.6-1. These trends are based on observations of fish passage upstream at the Red Bluff Diversion Dam and other fishery monitoring within the Sacramento River (Vogel and Marine 1991).

Winter-Run salmon migrate upstream from December through June. Juveniles rear within the Sacramento River throughout the year, feeding primarily on aquatic insects. Smolts then migrate downstream from December through May to the Pacific Ocean. During the mid-1960s adult winter-run Chinook salmon returns to the Sacramento River were relatively high (approximately 80,000 returning adults). However, because of commercial ocean fishing, operation of dams, unscreened water diversions, and other causes, the population declined substantially during the 1970s and 1980s. The population decline continued until 1991 when the adult winter-run Chinook salmon population was estimated to be less than 200 fish. As a result of the substantial decline in abundance the species was listed as an endangered species under both the California and Federal ESAs.

During the mid- and late 1990s the numbers of adult winter-run salmon returning to Sacramento River gradually increased and the trend of increasing abundance continues today. Approximately 8224 adult winter-run salmon returned to the river to spawn in 2001, 7441 in 2002, 8218 in 2003, and 8896 in 2004. As with other Chinook salmon stocks, NMFS is continuing to evaluate the status of the winter-run Chinook salmon population and the effectiveness of various management actions implemented within the Sacramento River, Delta, and ocean to provide improved protection and reduced mortality for winter-run salmon.



Spring-Run salmon migrate upstream from March through October. Adults hold in deep cold pools within the rivers and tributaries over the summer months prior to spawning from August to October. Fry emerge from spawning areas during the late fall and winter. A portion of the fry appear to migrate downstream soon after emerging, and they then rear in downstream river channels, and potentially in the Delta estuary, during winter and spring months. The remainder of the fry reside in creeks and rear for approximately one year. The juvenile spring-run Chinook salmon that remain in the creeks migrate downstream as yearlings primarily during the late fall, winter and early spring with peak migration occurring in November (Hill and Weber 1999). The downstream migration of both spring-run Chinook salmon fry and yearlings during the late fall and winter typically coincides with increased flow and water turbidity associated with winter stormwater runoff.

Fall-Run salmon migrate upstream from July through December. Fall-run Chinook salmon spawning is similar to that described for other Chinook salmon. Fall-run Chinook salmon spawning occurs between October and December with the greatest spawning activity occurring typically in November and early December. The success of fall-run Chinook salmon spawning is dependent, in part, on seasonal water temperatures. After incubating and hatching, the young salmon emerge from the spawning areas as fry. A portion of the fry population migrate

downstream soon after emergence, where they rear in the downstream river channels and the Delta estuary during the spring months. The remaining portion of juvenile salmon continue to rear in the upstream stream systems through the spring months, until they are adapted to migration into saltwater (smolting), which typically takes place between April and early June. A small proportion of the fall-run Chinook salmon juveniles may, in some streams, rear through the summer and fall months migrating downstream during the fall, winter, or early spring as yearlings.

Late Fall-Run salmon migrate upstream from October through April, and spawn from January through April. Adult and juvenile fall-run and late fall-run Chinook salmon migrate downstream from the Sacramento River through the Delta and San Francisco Bay during the late winter and spring migration period. The life history and factors affecting abundance of late fall-run Chinook salmon are otherwise similar to those described for fall-run Chinook salmon.

Factors Affecting Chinook Salmon Populations. The following environmental and biological factors affect the abundance, mortality, and population dynamics of Chinook salmon:

- Loss of access to historic spawning and juvenile rearing habitat within the upper reaches of the Sacramento River and its tributaries as a result of the migration barriers caused by major dams and reservoirs;
- River and creek water temperatures affect incubating eggs, holding adults, and growth and survival of juvenile salmon;
- Juveniles are vulnerable to entrainment, or the pulling of fish along with current into water diversion facilities, at a large number of unscreened water diversions located along the Sacramento River and in the Delta, including State Water Project (SWP) and Central Valley Project (CVP) export facilities;
- Salvage mortality, defined as the fraction of fish that do not survive fish salvage, at the SWP and CVP pumping facilities;
- Changes in habitat quality including availability for spawning and juvenile rearing;
- Exposure to contaminants;
- Predation mortality by Sacramento pikeminnow, striped bass, and other predators;
- Competition and interactions with hatchery-produced Chinook salmon;
- Recreational and commercial fishing of subadult and adult Chinook salmon.

In recent years, however, a number of changes have been made to improve the survival and habitat conditions for Chinook salmon. Several large, previously unscreened water diversions have been equipped with positive barrier fish screens. These screens include perforated metal plates, meshes, or other physical devices that are designed to prevent fish from passing into pumping intake facilities (entrainment) while minimizing the stress and injury that may occur when fish impact the screen or are subjected to changes in water velocity caused by the diversion.

Changes to ocean salmon fishing regulations, and modifications to SWP and CVP Delta export operations, have also been made to improve the survival of both adult and juvenile Chinook salmon. Improvements in fish passage facilities have been made to improve migration and

upstream access. These and other changes in management actions, in combination with favorable hydrologic and oceanographic conditions in recent years, are thought to have contributed to the increasing abundance of adults returning to the upper Sacramento River since the mid-1990s.

Regulatory Listing Status. Listing status of Chinook Salmon varies according to run. Winter-run are listed as an endangered species under both the California and Federal Endangered Species Acts, spring-run are listed as a threatened species under both ESAs, and fall-run and late fall-run are not listed, although late fall-run remain a candidate species for further analysis and evaluation. Fall-run and late fall-run are included in this environmental analysis because the proposed Project would be located within the area identified as EFH for Pacific Salmon. NMFS has prepared a draft recovery plan for winter-run, and is in the process of developing a recovery plan for spring-run Chinook Salmon.

Steelhead (*Oncorhynchus mykiss*). Central Valley steelhead are an anadromous species with adult steelhead spawning in freshwater and the juveniles migrating to the Pacific Ocean where they reside for several years before returning to the river system. Steelhead that do not migrate to the ocean, but spend their entire life in freshwater, are known as resident rainbow trout. Steelhead inhabit the upper Sacramento River and occur seasonally in the vicinity of the proposed Project area, which serves as a migration corridor. Adult steelhead typically migrate upstream within the Sacramento River during the winter (November - March) to spawning areas upstream of the proposed Project area. A portion of the adult steelhead survive spawning and migrate back downstream to migrate and spawn in subsequent years.

Steelhead spawn in areas characterized by clean spawning gravels, cold-water temperatures, and moderately high water velocities. Spawning typically occurs during the winter and spring (December through April) with the majority of spawning activity occurring between January and March. Spawning by adult steelhead has not been observed or documented in the area of the proposed Project.

Young steelhead typically rear in areas upstream of the proposed Project area for 1 to 2 or more years before migrating to the ocean. Downstream migration of steelhead smolts typically occurs during the late winter and early spring (January through May). The seasonal timing of downstream migration of steelhead smolts may vary in response to a variety of environmental and physiological factors including changes in water temperature, and changes in stream flow and increased water turbidity, resulting from stormwater runoff.

Historically, Central Valley steelhead migrated upstream into the upper reaches of streams and rivers for spawning and juvenile rearing. Construction of dams and barriers on Central Valley rivers has created impassable barriers to upstream migration and substantially reduced the geographic distribution of steelhead, reducing access to historic spawning grounds. Changes in habitat quality for juvenile rearing, exposure to contaminants, predation mortality, passage barriers and impediments to migration, changes in land use practices, changes in water temperatures during summer and early fall, and competition and interactions with hatchery-produced steelhead have all been identified as factors affecting steelhead abundance.

In recent years a number of changes have been made to improve the survival and habitat conditions for steelhead. Several large previously unscreened water diversions close to the proposed Project area, including the RD 108 Wilkins Slough Pumping Plant and the Sutter Mutual Water Company Tisdale Pumping Plant, have been equipped with positive barrier fish screens. Improvements to fish passage facilities have also been made to improve migration and access to spawning and juvenile rearing habitat.

Although quantitative estimates of the number of adult steelhead returning to Central Valley streams are not available, anecdotal information and observations indicate that population abundance is low. Steelhead distribution is currently restricted to the mainstem Sacramento River downstream of Shasta Dam, the Feather River downstream of Oroville Dam, the American River downstream of Nimbus Dam, the Mokelumne River downstream of Comanche Dam, and a number of smaller tributaries to the Sacramento River system, Delta, and San Francisco Bay. The Central Valley steelhead population is composed of both naturally spawning steelhead and steelhead produced in hatcheries. The NMFS is continuing to evaluate the status of steelhead and developing a recovery plan for the species.

Central Valley steelhead have been listed as a threatened species under the Federal ESA and the Sacramento River has been designated as critical habitat. Steelhead are not listed for protection under the CESA but are identified as a species of concern.

Non-Salmonid Fish Species

The species composition and relative abundance of both fish and macroinvertebrates within the Sacramento River in the proposed project area varies in response to environmental factors such as changes in hydrologic conditions (e.g., Sacramento River flow), seasonal migration patterns, and microhabitat conditions. Non-salmonid special-status fish species that may also be found in the Sacramento River in the area of the proposed Project include Delta smelt, sturgeon**,** and Sacramento splittail.

Delta Smelt (*Hypomesus transpacificus).* Delta smelt are a relatively small (2-3 inches long) species with an annual lifecycle, although some individuals may live two years. Prior to spawning, adult Delta smelt may migrate upstream into the lower reaches of the Sacramento and San Joaquin River systems, where spawning occurs from approximately February through June, with the greatest spawning activity occurring in April and May. Females deposit adhesive eggs on substrates such as gravel, rock, and submerged vegetation. Eggs hatch, releasing planktonic larvae which are passively dispersed downstream by river flow. Larval and juvenile Delta smelt rear within the estuarine portions of the Delta for a period of approximately 6-9 months before beginning their upstream spawning movement into freshwater areas of the lower Sacramento and San Joaquin Rivers.

Delta smelt generally inhabit the lower reaches of the Sacramento River downstream of Isleton, the San Joaquin River downstream of Mossdale, and the Delta including Suisun Bay. However, individuals have been collected infrequently in the Sacramento River near Sacramento. USFWS collection data for sampling show that the upstream distribution limit of Delta smelt within the Sacramento River is in the general vicinity of Sacramento.

Results of intensive fisheries sampling by USFWS near Sacramento and in the vicinity of the proposed Project area show that the number of Delta smelt collected each year typically ranges from approximately 0-10 fish. However, it is possible that some or all of the fish identified as Delta smelt actually were wakasagi, a very similar Japanese smelt that is abundant in Folsom Reservoir and often carried downstream.

The abundance of Delta smelt increases further downstream within the lower reaches of the Sacramento River and Delta. Sampling conducted 18 miles downstream of the proposed Project area in the vicinity of Hood showed that a total of 74 juvenile and adult Delta smelt were collected in sampling during 1993, 3 in 1994, 13 in 1995, and 11 in 1996. In comparison, fisheries sampling conducted within the Delta in the vicinity of Antioch and Pittsburg frequently collects 500-1,500 Delta smelt per year (Hanson, unpublished data). Although not directly comparable to fisheries sampling in the Sacramento River, the numbers of Delta smelt salvaged in SWP and CVP south Delta pumping operations have exceeded thousands of Delta smelt in recent years (e.g., approximately 59,000 Delta smelt in May 1999, 73,000 in June 1999, 49,000 in May 2000, 49,000 in June 2000, etc.).

Based upon these results and information available from other surveys regarding the abundance and geographic distribution of Delta smelt, it is concluded that the Sacramento River in the vicinity of the proposed Project area is at most an extremely small portion of the total available Delta smelt habitat, and that only an extremely small proportion of the total Delta smelt population occurs in this part of the river.

Delta smelt, a fish species native to the Sacramento – San Joaquin Delta, has been listed as a threatened species under both the California and Federal Endangered Species Acts.

Green sturgeon (*Acipenseridae sp.).* The green sturgeon is a large bottom dwelling anadromous fish, widely distributed along the Pacific coast of North America. They are slow growing and late maturing, spawning every 4 to 11 years during the spring and summer months. Adult fish spawn in fresh water and then return to estuarine or marine environments. Preferred spawning habitat is the lower reaches of large rivers with swift currents and large cobble. Larval and juvenile green sturgeon may rear for up to 2 years in freshwater and then migrate to an estuarine environment. Green sturgeon may spawn both upstream and downstream of the proposed Project area. Larvae may attach to rip rap, but are not likely to attach to the sandy-silty river bottom found in the proposed Project area. It is probable that green sturgeon larvae or juveniles will be in the water column throughout the year.

Sturgeon were collected infrequently in fishery sampling at the Wilkins Slough diversion facility. During sampling in 1993 and 1995, no juvenile sturgeon were observed in fishery collections (Demko *et al.* 1994; Hanson 1996). During 1996, a total of two juvenile sturgeon were collected in fyke net samples at the RD 108 Wilkins Slough diversion. Although juvenile sturgeon were infrequently collected in samples from the area, they are expected to be present in the vicinity of the proposed Project area. However, the low number of juvenile sturgeon collected suggests that the Sacramento River in the general vicinity of the proposed Project area does not serve as a major juvenile sturgeon rearing area.

Adult sturgeon have been harvested by recreational anglers in the proposed Project area. Sturgeon typically inhabit relatively high velocity riverine habitat which, under natural conditions, is characterized by seasonally high turbidity. Green sturgeon is federally listed as a threatened species (AP, 2006).

Sacramento Splittail (*Pogonichthys macrolepidotus)*. Sacramento splittail is unique to the Sacramento/San Joaquin basin. The species is relatively long-lived (5-7 years), and matures at the end of the first year (males) or third year (females). As is typical of a fish species evolved in a highly variable riverine system, populations fluctuate annually, depending on spawning success. The fish are found mostly in slow moving sections of mainstem rivers and sloughs, and have been abundant in Suisun Bay and Marsh. Adults migrate upstream to spawn in conjunction with high flows that inundate side-channel and off-channel spawning habitat consisting of vegetation temporarily submerged by flooding of riparian and upland habitats. In the reach of the river near the proposed Project area, there is virtually no suitable spawning or rearing habitat, although spawning is likely to occur upstream and downstream. However, splittail inhabit the Sacramento River within the area of the proposed diversion locations, both as adults and juveniles. The habitat in the area is typically characterized by riprap-stabilized levees and natural channel banks, with a relatively deep river channel. Substrate is typically sand and fine silt. It is likely that juvenile splittail will be in the water column of the mainstem river adjacent to the proposed Project area. Sacramento splittail has been listed as a threatened species under the California Endangered Species Act.

Other Fish Species

Other fish species that may also be found in the Sacramento River in the area of the proposed Project include river lamprey, Pacific lamprey, hardhead, and California roach.

During July, 1996, boat electrofishing in the East Canal at Kirkville Road caught a wide range of native and introduced fish species. Bluegill and redear sunfish comprised the majority of the catch. The species collected are listed in Table 3.6-6.

The results of boat and backpack electrofishing at the Colusa Basin Drain at Road 99E near Knights Landing are summarized in Table 3.6-7.

Further upstream towards Colusa, boat electrofishing and seining was conducted in 1996 and 1998. Tables 3.6-8 and 3.6-9 list the species found during these sampling efforts.

Factors Affecting Fish Populations These species may spend a large portion of their life in the river mainstem and major tributaries. They evolved to fill a niche in the historic river/floodplain/marsh habitat of the Central Valley, characterized by repeated flood-drought cycles, highly variable flows, cooler temperatures during snowmelt, and potentially warmer temperatures during the summer when river flows were not influenced by reservoir releases. High flooding periods were accompanied by large plumes of turbidity from erosion in the mid-to-lower watershed areas.

TABLE 3.6-6
SUMMARY OF ELECTROFISHING RESULTS AT EAST CANAL

Common Name	Scientific Name	Number Collected	Percentage of Total Catch	Native
Bluegill	*Lepomis macrochirus*	114	31%	No
Redear sunfish	*Lepomis microlophus*	102	28%	No
Largemouth bass	*Micropterus salmoides*	33	9%	No
Warmouth	*Lepomis gulosus*	25	7%	No
Common carp	*Cyprinus carpio*	19	5%	No
Green sunfish	*Lepomis cyanellus*	13	4%	No
Channel catfish	*Ictalurus punctatus*	11	3%	No
White catfish	*Ictalurus catus*	11	3%	No
Sacramento hitch	*Lavinia exilicauda*	9	2%	Yes
Golden shiner	*Notemigonous crysoleucas*	8	2%	No
Black crappie	*Pomoxis nigromaculatus*	5	1%	No
White crappie	*Pomoxis annularis*	4	1%	No
Smallmouth bass	*Micropterus dolomieui*	3	<1%	No
Sacramento sucker	*Catostomus occidentalis*	3	<1%	Yes
Bigscale logperch	*Percina macrolepida*	3	<1%	No
Sacramento pikeminnow	*Ptychocheilus grandis*	1	<1%	Yes
Goldfish	*Carassius auratus*	1	<1%	No
Total Caught		**365**		

TABLE 3.6-7
SUMMARY OF ELECTROFISHING RESULTS AT COLUSA BASIN DRAIN

Common Name	Scientific Name	Number Collected	Percentage of Total Catch	Native
Threadfin Shad	*Dorosoma petenense*	149	71%	No
Common Carp	*Cyprinus carpio*	21	10%	No
White Crappie	*Pomoxis annularis*	11	5%	No
Bluegill	*Lepomis macrochirus*	7	3%	No
Channel Catfish	*Ictalurus punctatus*	7	3%	No
Largemouth Bass	*Micropterus salmoides*	5	2%	No
Western Mosquitofish	*Gambusia affinis*	5	2%	No
Inland Silverside	*Menidia beryllina*	2	<1%	No
Warmouth	*Lepomis gulosus*	2	<1%	No
Sacramento Sucker	*Catostomus occidentalis*	1	<1%	Yes
Total Caught		**210**		

TABLE 3.6-8
SUMMARY OF 1996 ELECTROFISHING AND NETTING RESULTS ON THE SACRAMENTO RIVER AT COLUSA

Common Name	Scientific Name	Number Collected	Percentage of Total Catch	Native
Tule Perch	*Hysterocarpus traski*	76	33%	Yes
Sacramento Sucker	*Catostomus occidentalis*	51	22%	Yes
Sacramento Pikeminnow	*Ptychocheilus grandis*	30	13%	Yes
Prickly Sculpin	*Cottus asper*	24	10%	Yes
Unidentified Lamprey	*Lamprey species*	24	10%	Yes
Hardhead	*Mylopharodon conocephalus*	5	2%	Yes
Bluegill	*Lepomis macrochirus*	4	2%	No
Chinook Salmon	*Oncorhynchus tshawytscha*	4	2%	Yes
Sacramento Splittail	*Pogonichthys ciscoides*	3	1%	Yes
Smallmouth Bass	*Micropterus dolomieui*	2	<1%	No
Common Carp	*Cyprinus carpio*	2	<1%	No
Largemouth Bass	*Micropterus salmoides*	2	<1%	No
California Roach	*Hesperoleucus symmetricus*	1	<1%	Yes
Green Sunfish	*Lepomis cyanellus*	1	<1%	No
Total Caught		**229**		

TABLE 3.6-9
SUMMARY 1998 BOAT ELECTROFISHING AND NETTING ON THE SACRAMENTO RIVER AT COLUSA

Common Name	Scientific Name	Number Collected	Percentage of Total Catch	Native
Sacramento Pikeminnow	*Ptychocheilus grandis*	37	30%	Yes
Sacramento Sucker	*Catostomus occidentalis*	28	23%	Yes
Bluegill	*Lepomis macrochirus*	19	15%	No
Largemouth Bass	*Micropterus salmoides*	17	14%	No
Prickly Sculpin	*Cottus asper*	8	6%	Yes
Smallmouth Bass	*Micropterus dolomieui*	8	6%	No
Threadfin Shad	*Dorosoma petenense*	2	2%	No
Hardhead	*Mylopharodon conocephalus*	1	<1%	Yes
Tule Perch	*Hysterocarpus traski*	1	<1%	Yes
Sacramento Splittail	*Pogonichthys ciscoides*	1	<1%	Yes
Chinook Salmon	*Oncorhynchus tshawytscha*	1	<1%	Yes
Bigscale Logperch	*Percina macrolepida*	1	<1%	No
Total Caught		**124**		

These species evolved under conditions represented by: a meandering mainstem river with sand bars, natural levees, and large wetlands and marshes accessible from the mainstem river during periods of high flow, high nutrient loads, and few predators. Currently, the levee system that was constructed on the Sacramento River isolates the river from the floodplain, altering these conditions to reduce habitat variety in the river system.

These existing conditions represent a high level of disturbance when compared to ideal conditions for these species, and the densities of these species in this mainstem river habitat are likely to be relatively low, when compared to densities that probably historically existed.

Given these conditions, the environmental baseline of the vicinity of the proposed Project area can be characterized as: generally lacking spawning habitat for all salmonid and non-salmonid species addressed except for Pacific lamprey, which may be able to spawn in the rocks along the shoreline; and generally suitable for rearing of non-salmonid species, with probable good rearing conditions for the two lamprey species that utilize sandy to silty substrates for their larval life stages.

Although these fish may have different life-history strategies, adults, juveniles, and larvae utilize the mainstem river in the general vicinity of the proposed Project area for rearing and foraging, as described in the following discussion.

Lamprey (*Lamprey species*). River lamprey are an anadromous species widely distributed along the Pacific coast from Northern California to Alaska. They have been found throughout the mainstem Sacramento River and the downstream Delta. They migrate through the mainstem river and tributaries to spawn in small streams in April and May. Larvae burrow into sandy and silty substrates, near the river bank, where they spend several years maturing. They may spend additional time in fresh and brackish water prior to migrating to the ocean. It is likely that river lamprey utilize the proposed Project area primarily as a migratory corridor, because there is no spawning habitat and very little potential rearing habitat along the rip rapped river banks. They are probably in the water column during their later rearing and emigration stages.

Pacific lamprey spawning occurs in nests constructed in shallow water on gravel and sandy substrates. Eggs are adhesive and are washed into crevices, where they adhere to rock. Adults typically die after spawning. Pacific lamprey larvae rear within their rock crevices and then swim into the mainstream to be carried to muddy-sandy substrate, where they burrow and rear. In the proposed Project area, Pacific lamprey may spawn in the rip-rapped channel and larvae probably rear in the channel substrate. Juveniles may be found in the water column as they migrate downstream to the ocean.

Hardhead (*Mylopharodon conocephalus*). Hardhead are freshwater residents of the Central Valley river-stream system. Little is known about their life history. They appear to spawn in May through August, and based on observed larval distribution, they may prefer areas with sand, gravel, and decomposed granite substrate. They spawn in mainstem rivers and tributaries. Adults may be found near the surfaces of pools and side pools of creeks and rivers, as well as near inshore weedy areas of reservoirs and lakes. There is some potential for spawning of hardhead in

the vicinity of the proposed intake site, although the bottom substrate may be too silty. There is little rearing and adult habitat as the proposed water intake site lacks submerged and emergent vegetation.

Hardhead were collected infrequently during the fishery monitoring in 1993, 1995 and 1996 (four in 1993, 15 in 1995, and one in 1996) at the RD 108 Wilkins Slough intake. An insufficient number of hardhead were collected to provide detailed information on either the seasonal distribution or length frequency of fish in the area, although they were collected in low numbers during the spring and late fall and winter. Because hardhead were collected in fishery samples at the RD 108 Wilkins Slough Diversion, they are expected to be present in the vicinity of the proposed Project area.

California Roach (*Hesperoleucus symmetricus).* California roach is a short-lived (1-3 year) native freshwater minnow, found throughout the Sacramento/San Joaquin River system and in non-tidal freshwater tributaries to the Bay-Delta. The species spawns from March through June, congregating in small groups for spawning. Eggs are deposited in rock crevices, on coarse gravels, or on tules. Eggs hatch in about 5 days, and after egg sac absorption, juveniles move into shallow nearshore habitats along the stream. As they mature, they move into the main water column.

Juvenile and adult California roach were collected in fishery samples at RD 108 Wilkins Slough diversion, and in fishery sampling near Sacramento. California roach were collected infrequently in fishery sampling at the RD 108 Wilkins Slough Diversion, with a total of 97 collected in 1993, four in 1995, and 12 in 1996. As a result of low numbers collected, information regarding the seasonal and length distribution of roach inhabiting the area is considered qualitative. Roach were collected sporadically throughout the spring - summer 1993 sampling period (Demko *et al.* 1994). Roach were collected during the spring and early winter at lengths ranging from 38 to 76 mm based on fishery collections during 1995 and 1996 (Hanson 1996; Hanson and Bemis 1997). The low numbers of roach collected indicate that the Sacramento River in the vicinity of the RD 108 Wilkins Slough and mainstem Sacramento River in the vicinity of the proposed Project area is not a significant juvenile rearing area, probably because gravels and tules are not present in large numbers and river velocities are relatively high. However, it is likely that some California roach juveniles and adults are present within the proposed Project area.

Striped bass juveniles, sub-adults, and adults were collected during fishery studies, primarily during the spring and early summer within the Sacramento River in the general vicinity of the proposed Project area. Adult striped bass are harvested by recreational anglers from the Sacramento River area. Spawning by adult striped bass within the Sacramento River, in the general vicinity of Sacramento and Knights Landing, has been observed in other studies (CDFG unpublished data). Striped bass is a non-native species.

Impact 3.6-4: Construction of the intake facility would have a substantial adverse effect on fish or other aquatic species, such as by increasing turbidity, degrading water quality or otherwise altering suitable aquatic habitat. (Less than Significant with Mitigation)

Construction Impacts

The reach of the Sacramento River, extending from the proposed construction area of the intake/diversion extending approximately 1,000 ft downstream of the diversion/intake siting option, was considered for impacts related to construction-related turbidity and sediment impacts. The immediate vicinity of the intake/diversion structure was analyzed for all other potential issues under this impact. The potential environmental consequences of the proposed Project are expected to be similar for winter-run and spring-run Chinook salmon, and steelhead, and are addressed collectively in the following discussion.

With installation of the temporary cofferdam, the active in-river construction activities would be isolated from the waterway. Therefore, construction-related impacts to water turbidity and sedimentation would be limited to the actual installation and removal of the temporary cofferdam. Effects from removal of the cofferdam are expected to be minor and not a potentially significant impact. Potential effects of water quality on the various salmonid fish species will vary depending on the timing of cofferdam construction. Shaded areas of Table 3.6-17 indicate periods when salmonid runs and lifestages are present in the vicinity of the diversion/intake siting options. Fish abundance during these periods varies monthly and annually. Construction of the cofferdam would normally be limited to the period between April and September when river flows are relatively low.

As Table 3.6-16 indicates, there is no period of time for cofferdam construction that would avoid potential effects on salmonids. All Chinook salmon runs would be present in the vicinity of the diversion/intake siting options during the June through August periods. However, these periods would have lower abundances of fish relative to other periods (Vogel and Marine, 1991). Therefore, construction during the June through August period would cause the least disturbance to salmonid runs and lifestages.

Effects of Increased Turbidity and Suspended Sediments

Increased sedimentation rates could result if fine sediment is discharged to the Sacramento River during Project construction. Increased sedimentation may adversely affect water quality and

channel substrate composition. Specific rates of sedimentation are dependant upon the duration, volume, and frequency at which sediments are contributed to the surface water flow. Substantial sedimentation rates may smother fish eggs and fish food (i.e., benthic invertebrates) and degrade spawning habitat. Furthermore, suspended sediments increase the turbidity of the water. High rates of turbidity can result in direct mortality or deleterious sublethal effects (e.g., gill abrasion, decreased visibility during foraging) to fish. Construction of the cofferdam will divert water from around work in the actively flowing channels. This will reduce the potential for sediment or other pollutants to enter the waterways and to impact downstream resources.

TABLE 3.6-17
PRESENCE OF SALMONID FISH SPECIES IN VICINITY OF DIVERSION/INTAKE SITING OPTIONS

		Presence In Vicinity Of Diversion/Intake Siting Options					
Salmonid Run	**Life Stage**	**Apr and May**	**May and Jun**	**Jun and Jul**	**Jul and Aug**	**Aug and Sep**	**Sep and Oct**
Spring run Chinook	Juvenile	▒					
	Adult	▒	▒	▒	▒	▒	
Winter run Chinook	Juvenile			▒	▒	▒	▒
	Adult	▒	▒	▒	▒		
Fall run Chinook	Juvenile	▒	▒				
	Adult			▒	▒	▒	▒
Late-Fall Run Chinook	Juvenile	▒	▒	▒	▒	▒	▒
	Adult	▒					
Steelhead	Juvenile	▒	▒				
	Adult					▒	▒

Shaded areas represent presence of fish in the vicinity of the diversion/intake siting options. Density and number of fish may vary.

SOURCE: Vogel & Marine, 1991

Following cofferdam construction, the area behind the cofferdam will be dewatered. The only mechanism for creation of turbidity and suspended sediments during construction is therefore the driving of pilings to support the installation of the cofferdam. The period of increased turbidity would be limited to the period of installation of the cofferdam, which is expected to occur in a period of about four weeks.

Driving pilings creates vibrations at the edge of the pilings as they enter the sediment, causing displacement of sediment and re-suspension of fines. This occurs at the surface of the channel bottom, where a narrow stream of fine sediments may be re-suspended. Heavier sediments would be re-suspended no more than several inches, and are expected to fall back out of suspension within less than 100 feet. Based on studies of similar construction activities the area with increases in turbidity and suspended sediments would be no larger than 100 feet wide and 1,000 feet (300 meters) long. Coarser sediments would be a very small portion of the sediment plume and suspended sediment levels would not exceed ambient suspended sediment levels outside this small area. Due to the small area affected, there would be no adverse impact to ambient water quality.

Effects on Salmonid Fish Species

Increased turbidity and suspended sediments would occur intermittently during construction of the cofferdam; water quality conditions would be expected to return to background levels within hours after construction activity is completed. These short-term increased turbidity and suspended sediment concentrations would have the potential to adversely affect protected fish species. This

would be a potentially significant impact. This would include potential migration of winter-run Chinook salmon through critical habitat within the proposed Project area, and Essential Fish Habitat (EFH) for salmon, depending on the seasonal period when site preparation and installation/removal of the cofferdam occurs.

Because site preparation and installation of the cofferdam are most likely to occur during periods of reduced flows in the Sacramento River, the likelihood of adverse affects to winter-run, spring-run, and fall-run Chinook fry migration, critical and essential fish habitat and steelhead migration would be low. The vulnerable life-stages of these species would not be in the river system during this time. The fish present would be large and unlikely to be affected by the Project. Spring-run and fall-run Chinook salmon and juvenile steelhead may occur in the proposed Project area during the spring and would potentially be exposed to increased suspended sediment concentrations.

As previously discussed, the turbidity plume resulting from site preparation would not be expected to extend across the entire Sacramento River, but rather the plume would be expected to extend downstream from the site along the edge of the channel. As a result of the limited distribution of the plume within the river, salmonids would have the opportunity to readily avoid the plume during either upstream or downstream migration.

The projected localized increase in turbidity during portions of the construction periods may result in short-term (hours or days) changes in behavior or distribution of salmonids within the immediate vicinity of the site but would not be expected to have adverse effects such as mortality or blockage of migration on special-status salmonids. The suspended sediment and turbidity concentrations and duration of exposure for Chinook salmon or steelhead in the Sacramento River during cofferdam installation would be expected to be substantially below levels that would result in adverse effects. Mitigation Measures 3.6-4a and 3.6-4b would reduce impacts related to sedimentation and turbidity during construction to less than significant.

Effects on Non-salmonid Fish Species

Turbidity and sedimentation impacts related to cofferdam construction could also effect non-salmonid fish species. Pacific lamprey may spawn and rear in the proposed Project area, although the spawning substrate in this reach may tend more towards silt and mud than the sand-gravel preferred by this species. Ammocoetes of both Pacific lamprey and river lamprey are likely in the proposed Project area. Eggs, larvae, juveniles, and adults will be subject to increased levels of suspended sediments during construction. Given the generally higher tolerance for turbidity exhibited by non-salmonids, the low levels of turbidity, that would be generated by the project would not be likely to lead to adverse effects on any life history stage. Mitigation Measures 3.6-4a and 3.6-4b would reduce turbidity and sedimentation impacts to non-salmonids to less than significant.

Loss of Habitat

The construction of temporary cofferdams and the diversion/intake structure would remove up to 0.10 acres (33,000 square feet) of aquatic habitat along banks of the river. Although various special-status fish species are present seasonally in the area, the habitat found at this portion of the Sacramento River is not unique and is characterized by levees stabilized with riprap and lacking in emergent vegetation, a relatively deep, high velocity channel, and silt and sand substrate. The area is not used as spawning habitat by salmonids. Juvenile Chinook salmon and steelhead use the area as a migratory corridor and juvenile foraging area during downstream migration. Juvenile and adult salmon and steelhead would continue to utilize the Sacramento River as a migratory corridor.

Given the presence of riprap and a lack of submerged aquatic and emergent vegetation cover habitat, the area of channel where the facility will be placed would not be considered to have favorable rearing habitat quality for salmon or steelhead; in addition, there are smallmouth and largemouth bass in the river, which are non-native warm water predators on juvenile salmonids. Use of the channel with its lack of cover habitat under present conditions does not provide any advantages to juvenile salmonids and carries high risk of predation. The net value of the channel lost due to the Project therefore would be low.

A new vertical fish screen in this reach of the river would not reduce movement in the migration corridor and the difference in habitat quality between the riprapped and unvegetated channel margin and a fish screen would be minor. The change in habitat is not likely to adversely affect Chinook salmon or steelhead populations, critical habitat for winter-run Chinook salmon (or pending critical habitat for spring-run Chinook salmon and Central Valley steelhead). Implementation of Mitigation Measure 3.6-4c would reduce these effects to less than significant.

Other Impacts from Diversion Construction

Adult and juvenile salmonids may be stranded behind the cofferdam following initial construction and at any time when high river flows would overtop the cofferdam. Fish stranded behind the cofferdam would be rescued (netted) and returned to the river. The life history stage affected during the initial closing of the cofferdam will depend on construction timing. The preferred timing for construction of the cofferdam would be during low-flow periods in the fall (July-September).

Construction during this time period would have the greatest effect on winter-run Chinook salmon juveniles rearing and migrating through the project reach. Early spring cofferdam construction schedules would shift effects to spring-run Chinook salmon juveniles, fall-run/late-fall-run Chinook salmon juveniles, and winter run Chinook salmon adults. Adults on their spawning runs may be stranded, but large adult fish can be more readily removed from the cofferdam area during dewatering.

Although salmonids respond well to handling, there could be incidental injury and death to individuals of the various salmonid species as a result of handling; it is also probable that the rescue program would not capture and release every juvenile. Depending on the season when the

cofferdam would be installed, some minor but unquantifiable loss of salmonids due to stranding would be probable. This would be an adverse direct effect. Implementation of Mitigation Measures 3.6-4b and 3.6-4d would reduce these impacts to less than significant.

Non-salmonid Fish Species

During cofferdam construction, it is likely that eggs, larvae, and adults of non-salmonid fish species (except Sacramento splittail, which generally do not initiate spawning runs until high flows occur) may be adversely affected. These effects would occur as a result of an initial stranding behind cofferdams and subsequent injury or death during fish rescue operations. Stranding also could occur following cofferdam construction, if flows were high and the cofferdams were overtopped. The frequency of such effects is unpredictable. Implementation of Mitigation Measures 3.6-4b and 3.6-4d would reduce these impacts to non-salmonid fish species to less than significant.

Project Operations and Water Transfer Impacts

Potential entrainment impacts to fish and aquatic habitat from operations of the proposed Project are addressed under Impact 3.6-6. Potential impacts of diversions under the Project Partners, water rights permits are addressed under impact 3.6-7. There would be no impacts to fish and aquatic habitats as a result of implementing water transfers from upstream water rights holders, because these transfers would cause slightly higher river flows between the transferor's release point and the proposed Project's diversion.

> **Mitigation Measure 3.6-4a:** Implementation of Mitigation Measure 3.4-1a (implementation of a Stormwater Pollution Prevention Plan (SWPPP) and erosion control measures), as well as Best Management Practices (BMPs) for construction activities, would reduce potential impacts to special-status fisheries species and habitat resulting from sedimentation and turbidity. Specific measures aimed at protecting fisheries resources include:
>
> - All instream construction activities will be conducted during the low-flow period of April 15 through October 15.
>
> - Sediment curtains will be placed around the construction or maintenance zone to prevent sediment disturbed during trenching activities from being transported and deposited outside of the construction zone.
>
> - Silt fencing will be installed in all areas where construction occurs within 100 feet of known or potential steelhead habitat.
>
> - Fresh concrete will be isolated from wetted channels for a period of 30 days after it is poured. If a 30-day curing period is not feasible, a concrete sealant approved for use in fisheries habitat may be applied to the surfaces of the concrete structure. If a sealant is used, the manufacturer's guidelines for drying times will be followed before reestablishing surface flows within the work area.

- Spoil sites (concrete wash areas) will be located so they do not drain directly into the Sacramento River. If a spoil site drains into the Sacramento River, catch basins will be constructed to intercept sediment before it reaches the channel. Spoil sites will be graded to reduce the potential for erosion.

Mitigation Measure 3.6-4b: Installation of the cofferdam for construction of the intake structure is expected to result in short-term increases in local suspended sediment concentrations that may affect the distribution and behavior of sensitive fish species and their habitat. To avoid and minimize these impacts, site preparation and installation of the sheet pile cofferdam will occur during the summer and fall.

Mitigation Measure 3.6-4c: In order to offset the permanent loss of 0.1 acres of channel margin habitat or shallow water habitat because of installation of the diversion/intake facility, off-site mitigation habitat shall be purchased in a ratio agreeable to CDFG and other agencies consulted.

Mitigation Measure 3.6-4d: Installation of a cofferdam and dewatering may result in stranding and the loss of protected fish and other species. The Project Partners will ensure that a qualified fisheries biologist will design and conduct a fish rescue and relocation effort to collect fish from the area within the cofferdam involving the capture and return of those fish to suitable habitat within the Sacramento River. To ensure compliance, a fisheries biologist shall provide observation during initial dewatering activities within the cofferdam. The fish rescue plan will be provided for review and comment to NOAA Fisheries, USFWS, and CDFG prior to implementation.

The success of this dewatering measure will be the effective capture and removal of fish from the area to be dewatered with a minimum of capture and handling mortality for those fish returned to the Sacramento River. Implementation of the fish rescue and relocation program will avoid and minimize impacts to Chinook salmon, steelhead, other fish, and macroinvertebrate species, and thus reduce impacts to less than significant.

Impact Significance After Mitigation: Less than significant.

Impact 3.6-5: Construction of the Project intake structure would generate noise or vibrations that would adversely affect the behavior, movement, and local distribution of special-status fish. (Less than Significant)

Construction Impacts

Installation of sheet piles and beams during construction of the cofferdam would be performed using a vibrating method, with sheet piling installation occurring on a continuous basis for up to 4 weeks. Both vibratory and percussion hammers produce sound waves that can be perceived by fish. Based on studies of the use of sound as a potential barrier to fish movement (Hanson 1996), salmonid behavioral responses to sound are inconsistent. There is some potential for fish to avoid the side of the river in response to pile driving. Vibrating hammers do not produce sound pressure levels at the 180 db pressure level that would result in damage and increased mortality to fish.

In the event that river bottom substrate does not allow installation of sheet piles and beams using the vibrating technique, limited use of a percussion hammer would be required. The percussion hammer would produce underwater sound pressure levels that would potentially affect salmonid behavior and physiology. The bottom substrate is expected to be relatively soft, based on results of core sampling at the site and similar substrate conditions encountered during installation of the cofferdam during construction of the RD 108 fish screen. Based on these conditions, it is expected that a relatively small percussion hammer would be used and underwater sound pressure levels would be less than the 180 db pressure level that would result in damage and increased mortality to fish.

The percussion hammer, if needed for cofferdam installation, would be used on an intermittent and short duration basis. Use of the percussion hammer would be minimized to the maximum extent possible. However, depending on the seasonal period of cofferdam installation, there is the probability that juvenile and/or adult salmonids would be in the area and would be affected by exposure to elevated underwater sound pressure levels. Given the limited and intermittent use of the percussion hammer, the relatively soft bottom substrate, and the rapid attenuation of sound in water, the area of potential affect is expected to be small and the magnitude of potential adverse effects is expected to be low. Impacts would be less than significant.

Project Operations and Water Transfer Impacts

The diversion of surface water that would be available through the new water rights permit or water transfer would introduce minor levels of noise or vibration into the aquatic environment from intake pump operation. However, this increase would not exceed 60 to 70 db and would be contained and attenuated by the pump station structure. Minimal noise and vibration increases would occur outside the pump station, and would therefore result in a less-than-significant impact to fish and other aquatic resources.

Mitigation: None required.

Impact 3.6-6: Operation of the intake facility would cause entrainment and/or impingement mortality of special-status fish or other aquatic species. (Less than Significant)

Project Operations Impacts

Operation of the proposed water intake structure has the potential to directly and indirectly impact fishery resources and aquatic habitat within the Sacramento River and Delta by entrainment of fish eggs and larvae that are not effectively excluded from the intake by the positive barrier fish screen. Operation of the positive barrier fish screen, designed and operated in accordance with CDFG, NMFS, and USFWS criteria, would minimize entrainment and impingement of juvenile, sub-adult, and adult fish at the new intake. Operating staff would inspect and repair the facility, as needed to meet criteria, and would maintain a stock of replacement screens that would be installed rapidly in case repair is needed. Long-term operation is therefore expected to be reliable;

periods of non-function would be brief. Given that approach velocities to the screen would be low (the maximum screen approach velocity would be 0.33 foot/second), the net effect on fish swimming behavior in the vicinity of the diversion is predicted to be insignificant (Morinaka 2000). In addition, the fish screen would provide only minimal cover for ambush predators such as bass. Typically, the performance of a positive barrier fish screen is expected to reduce entrainment and impingement of fish and macroinvertebrates by 95% or more when compared to an unscreened diversion.

Fish exposure to screens may cause injury and may affect swimming behavior, resulting in increased vulnerability to predation. NMFS and CDFG approach velocity criteria have been established to minimize changes in swimming behavior and fish contact with the screen. In addition, screens have been designed to present a non-abrasive surface to fish that may come in contact with them. The low approach velocities provided by the screen would offset some of these effects. The fish screen has been designed to have a smooth exterior surface and upstream and downstream transition areas that reduce or eliminate areas where juvenile salmonids are concentrated or disoriented to reduce the risk of predation, as well as to reduce or eliminate structural locations offering cover for ambush predatory fish such as bass.

As part of fish screen operations and maintenance, an automatic screen cleaning system, consisting of a mechanical rake, will be installed to reduce debris accumulations and help maintain uniform approach velocities over the screen surface, thereby avoiding turbulence and "velocity hot spots", which increase the vulnerability of fish to localized impingement on the screen surface. The screen cleaning system will continue to function throughout Project operations.

Salmonid Fish Species

For salmonids, the seasonal distribution of fish within the Sacramento River is dependent upon a variety of factors, including the timing of spawning activity, egg incubation and hatching, larval dispersal, juvenile rearing, and, for a number of species, seasonal patterns in juvenile and adult migration. For many species, such as Chinook salmon and steelhead, adults migrate seasonally upstream through the Delta to spawning and juvenile rearing areas located in upstream tributary areas. Juvenile lifestages of these species subsequently emigrate from the upstream rearing areas, moving downstream through the Delta before entering coastal marine waters.

Based on these data, and the fact that there is no salmonid spawning habitat in the project reach of the river, the screens are not anticipated to entrain any eggs or larvae of salmonids and will not entrain emigrating fry or smolts, which are too large to pass through the screen mesh. No direct mortality is therefore anticipated for salmonids. Relatively high flow velocities in the areas directly adjacent to the fish screens (sweeping velocity) are anticipated, which will reduce debris buildup, entrainment, and screen contact and injury.

Operation of the fish screen would substantially reduce the effects of diversions on local current patterns and water velocities in the vicinity of the intake, and reduce a flow cue that may affect juvenile salmonid behavior.

Although it is likely that there would be some eggs and larvae of some salmonid species in the vicinity of the potential diversion/intake facility locations, screen operations would reduce the entrainment of larval stages and adults consistent with the NMFS or CDFG requirements. Impacts therefore would be considered less than significant.

Non-salmonid Fish Species

The adult life-stages of non-salmonid species are, given their evolutionary history in the Sacramento-San Joaquin River system, relatively tolerant of a wide range of flow, temperature, and turbidity conditions. Their spawning migrations generally occur in spring and summer, when turbidities from runoff are high, and these species are adapted to conditions in freshwater and estuaries. Sacramento splittail spawn in the winter when vegetated habitat on the flat grassy benches along the river bank is flooded during periods of high flow and turbidity. The juveniles of the non-salmonid species all spend considerable time in the freshwater system, and thus have also adapted to variable conditions. With the exception of the Pacific lamprey, these species are unlikely to spawn in or adjacent to the proposed Project area levees. Larvae and juveniles of all non-salmonid species are likely to be in the substrate or water column for most of the year, and eggs of Sacramento splittail may adhere to submerged vegetation associated with riprap. The potential vulnerability of fish species having planktonic eggs or larvae may result in some entrainment of these early lifestages into the water diversion. While some entrainment is likely to occur it would be at very low levels. Impacts to these species would be less than significant.

Delta smelt generally inhabit reaches of the Sacramento River downstream of the proposed Project area. Although Delta smelt typically inhabit low salinity estuarine portions of the Delta system, fish identified as Delta smelt have been collected infrequently and in very low numbers in the Sacramento River near Sacramento. It is unlikely that Delta smelt would be found in the Project area and therefore, impacts would be less than significant.

Sacramento splittail have been collected in fisheries studies in the Sacramento River within the general area of the proposed diversion locations as both juveniles and adults. Larval and early juvenile stages of splittail may also occur in the area. Design criteria for fish screens are expected to be protective of juvenile and older splittail. Early lifestages of splittail (e.g., larvae and early juveniles) would, however, be vulnerable to entrainment at a proposed surface water diversion, because the screen mesh size used in the positive barrier fish screen would not completely exclude fish larvae. However, vulnerability of splittail to entrainment at a fish screen is expected to be low. Thus, impacts to Sacramento splittail would be less than significant.

Entrainment potential is low for all non-salmonid species and is especially low for all juveniles and adults. Impacts therefore would be considered less than significant.

Water Transfer Impacts

The diversion of surface water that would be available under the new water rights permit or through the water transfers would result in only slight increases in river flow between the water sellers' points of delivery and the Project diversion/intake. Water transfers would therefore not result in increased entrainment or impingement impacts to fish or other aquatic species. No impact would occur with implementation of water transfers.