Chapter 7
Biological Resources—Aquatic Resources

7.1 Environmental Setting

7.1.1 Introduction and Sources of Information

This chapter describes the fish and aquatic invertebrates in the project area. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. Information on existing conditions is derived from other environmental documents prepared for the project area and vicinity, including the following:

- *Baylands Ecosystem Species and Community Profiles: Life Histories and Environmental Requirements for Key Plants, Fish, and Wildlife* (Goals Project 2000);
- Baseline Monitoring of the Pond 2A Tidal Restoration Project (MEC Analytical Systems 2000);
- Napa Salt Ponds Biological Resources (Lewis Environmental Services, Inc., and Wetlands Research Associates, Inc. 1992);
- The Natural Resources of Napa Marsh, Coastal Wetland Series #19 (Madrone Associates 1977);
- Status and Trends Report on Wildlife of the San Francisco Estuary (U.S. Fish and Wildlife Service 1992);
- Species List for the Napa River Salt Pond Restoration Project, Napa and Solano Counties, California (U.S. Fish and Wildlife Service 2001);
- State of the Estuary (Association of Bay Area Governments 1992);
- Huichica Creek Watershed: Natural Resources Protection and Enhancement Plan (Napa County Resource Conservation District 1993); and
- *Draft Subsequent Environmental Impact Report, March 1986, Wastewater Reclamation and Disposal Facilities* (Landon, Wheeler, and Weinstein 1986).
- *Stanly Ranch Specific Plan Draft EIR* (Brady/LSA, August 1998).

- *Los Carneros Recycled Water Irrigation Pipeline Initial Study/Negative Declaration* (Napa Sanitation District, January 11, 1995).

The abundance and distribution of fish species were analyzed from long-term monitoring data collected by DFG at sampling stations in the Bay-Delta estuary. Survey data from midwater trawl, otter trawl, and beach seine catches were used to represent the range of habitats used by species. Information on fish use of tidal marsh habitats was based largely on review of DFG data and discussion with DFG fisheries biologist Kathryn Heib.

Information on species ecology and life history was derived from interpretation of survey data and review of species profiles prepared for the *Baylands Ecosystem Species and Community Profiles* report (Goals Project 2000).

Other studies of value providing species abundance and distribution include the *Science Support for Wetland Restoration in the Napa-Sonoma Salt Ponds, San Francisco Bay Estuary* (Takekawa et al. 2000).

7.1.2 Regulatory Setting

Several federal and state agencies have regulatory authority or responsibility over project-related activities that affect aquatic resources. Table 7-1 summarizes project-related activities, the type of resource affected, and the government agency with regulatory authority over the activity.

7.1.2.1 Federal

The regulatory setting for aquatic resources under ESA and CWA Section 401 is nearly the same as that described in Chapter 4, "Water Quality" (CWA Section 401), and Chapter 5, "Biological Resources—Vegetation" (ESA). The following regulatory requirements also apply for aquatic resources.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act establishes a management system for national marine and estuarine fishery resources. This legislation requires all federal agencies to consult with NMFS regarding all actions or proposed actions permitted, funded, or undertaken that may adversely affect essential fish habitat (EFH). EFH is defined as waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The legislation states that migratory routes to and from anadromous fish spawning grounds also should be considered EFH. The phrase adversely affect refers to the creation of any impact that reduces the quality or quantity of EFH. Federal activities that occur outside an EFH but that may nonetheless have an impact on EFH waters and substrate also must be considered in the consultation process. Under the Magnuson-Stevens

Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must be considered as well.

The Magnuson-Stevens Act states that consultation regarding EFH should be consolidated, where appropriate, with the interagency consultation, coordination, and environmental review procedures required by other federal statutes, such as NEPA, the FWCA, the CWA, and ESA. EFH consultation requirements can be satisfied through concurrent environmental compliance requirements if the lead agency provides NMFS with timely notification of actions that may adversely affect EFH and if the notification meets requirements for EFH assessments. The ESA compliance discussed above would also address the expected project effects on commercially important fish and EFH. NMFS would provide EFH conservation recommendations. With implementation of the EFH conservation recommendations, USFWS is likely to conclude that significant improvement to the EFH of commercially important fish would occur as a result of the Napa River Salt Marsh Restoration Project.

7.1.2.2 State

The regulatory setting for aquatic resources under CESA and California Fish and Game Code Section 1600 *et seq.* is nearly the same as that described in Chapter 5, “Biological Resources—Vegetation.”

Table 7-1. Summary of Regulatory Setting for Aquatic Resources

Project-Related Activity	Regulatory Authority
Construction activities that could adversely affect water quality	RWQCB, permitting authority under Section 401 of the CWA
Alteration of stream channel, bed, or bank, including dredging or discharge of fill	DFG, permitting authority under Section 1601 (Lake or Streambed Alteration Agreement) of the California Fish and Game Code
Effects on species or the habitat of species listed or candidates for listing under ESA	USFWS and NMFS, formal consultation and permitting authority under Section 7 of ESA
Effects on species or the habitat of species listed or candidates for listing under CESA	DFG, consultation and permitting authority under Section 2081 of CESA
Effects on other special-status species, including species of concern and CNPS-listed plants	DFG and USFWS, responsible agencies to review EIR/EIS
Effects on species or the habitat of commercially viable fish	NMFS consultation under Essential Fish Habitat

7.1.2.3 Special-Status Fish Species

Special-status fish species are legally protected under CESA and ESA or other regulations and are considered sufficiently rare by the scientific community to qualify for such listing. For the purpose of this report, the term *special-status fish* refers to species that

- are listed or proposed for listing as threatened or endangered under ESA (50 CFR 17.11 [listed animals] and various notices in the *Federal Register* [proposed species]);
- are candidates for possible future listing as threatened or endangered under ESA (61 FR 40:7596–7613, February 28, 1996);
- are species of concern to USFWS and NMFS;
- meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380);
- are listed or proposed for listing by the State of California as threatened or endangered under CESA (14 CCR 670.5); or
- are fully protected in California (California Fish and Game Code, Section 5515).

7.1.3 Regional Setting

7.1.3.1 Fish

Fish species found in estuaries are of five broad types: nondependent marine, dependent marine, true estuarine, diadromous, and freshwater (Moyle and Cech 1982).

Nondependent marine fishes are those species, commonly found near the oceanic mouth of the estuary, that are not dependent on the estuary to complete their life cycles. Examples of such species in San Pablo Bay are shiner perch (*Cymatogaster aggregata*) and starry flounder (*Platichthys stellatus*).

Dependent marine species need the estuary to complete at least one of their life stages. This need can be for spawning, for rearing of young, or for feeding grounds for adults. An example of a dependent marine species is Pacific herring (*Clupea harengus*), which uses San Pablo Bay for spawning and rearing its young.

True estuarine species complete their entire life cycles in the estuary. In the Bay-Delta estuary, delta smelt (*Hypomesus transpacificus*) and longfin smelt (*Spirinichus thaleichthys*) are estuarine species.

Diadromous fishes are those that migrate through estuaries on their way either to fresh water or to saltwater. There are two types: anadromous species that migrate from saltwater to spawn in fresh water and catadromous species that migrate from fresh water to spawn in the ocean. Young of both types may spend considerable time in estuaries, taking advantage of abundant food (Moyle 2002). The most common anadromous species in San Pablo Bay grow to maturity in the ocean and spawn in fresh water. Examples are chinook salmon, steelhead, and striped bass (*Morone saxatilis*). There are no catadromous species.

Freshwater species are those that complete their entire life cycles in the upper, tidally influenced reaches of the estuary. An important example is splittail (*Pogonichthys macrolepidotus*), although splittail are tolerant of estuarine salinity.

The presence, abundance, and distribution of fish species in the Bay-Delta estuary are determined by numerous abiotic and biological factors (Moyle and Cech 1982). However, there are some general factors that exert a strong influence and explain much of the spatial and temporal variability in species abundance and distribution. In particular, physical and chemical factors such as temperature, salinity, and oxygen levels play important roles in determining the seasonal timing and spatial distribution of fish use.

Most of the species that use the estuary do so on a seasonal basis, taking advantage of favorable conditions to complete their life cycles. The fluctuating and intermediate salinity typical of estuarine habitats is the factor that limits the penetration of both marine and freshwater species into the mixed waters in the interior of the estuary. Accordingly, the specific area of San Pablo Bay in which a species is found is determined largely by the species' salinity tolerances. San Pablo Bay contains a productive and diverse fish community. The considerable inflow of the Sacramento–San Joaquin River system into San Pablo Bay provides a rich source of nutrients to support organic production. In addition, nutrient and organic input from the Napa River, Sonoma Creek, and the Petaluma River further enhances the region's ecological productivity. The freshwater input of all these river systems creates the large spatial and temporal variations in salinity and temperature that characterize San Pablo Bay.

Species Types and Abundance

DFG conducts annual fish surveys in San Pablo Bay. The results of the catches from these surveys are described below. The 15 most abundant fish species in order of decreasing total catch in the Bay-Delta estuary surveys over the last 21 years were

- northern anchovy (*Engraulis mordax*),
- longfin smelt,
- Pacific herring,
- white croaker (*Genyonemus lineatus*),
- English sole (*Parophrys vetulus*),

- yellowfin goby (*Acanthogobius flavimanus*),
- Pacific staghorn sculpin (*Leptocottus armatus armatus*),
- striped bass,
- Bay goby (*Lepidogobius lepidus*),
- jacksmelt,
- plainfin midshipman (*Porichtus notatus*),
- shiner perch,
- speckled sanddab (*Citharichthys stigmaeus*),
- starry flounder, and
- topsmelt (Atherinops affinis).

These species accounted for 98.9% of the total catch. Northern anchovy, the most abundant fish in north San Francisco and San Pablo Bays, accounted for 73.2% of the total catch. The other fish species in this category ranged from 8.4% to less than 0.4% of the total catch. The distribution of species by abundance, therefore, is far from uniform. Rather, a few relatively abundant species comprise the majority of the catch. (California Department of Fish and Game 1999.)

Sixteen species were caught by DFG over the last 21 years at a moderate level. These were, in order of decreasing total catch,

- arrow goby (*Clevelandia ios*),
- chinook salmon,
- American shad (*Alosa sapidissima*),
- threespine stickleback (*Gasterosteus aculeatus*),
- brown smoothhound (*Mustelus henlei*),
- dwarf surfperch (*Micrometrus minimus*),
- cheekspot goby (*Ilypnus gilberti*),
- surf smelt (*Hypomesus pretiosus*),
- Bay pipefish (*Sygnathus leptorhynchus*),
- walleye surfperch (*Stizostedion vitreum*),
- inland silverside,
- threadfin shad (*Dorosoma petenense*),
- delta smelt,
- brown rockfish,
- California halibut (*Paralichthys californicus*), and
- California tonguefish (Symphurus atricauda).

The abundant and moderately abundant species collectively accounted for 99.8% of the total catch from 1980 to 1995. That is, roughly 31 species accounted for almost all of the total catch in the north San Francisco and San Pablo Bays. (California Department of Fish and Game 1999.)

The remaining species can be considered relatively rare in the catch. Some of these (e.g., splittail) are special-status species and are addressed accordingly. Many of the other infrequently caught species are occasional marine species that generally have low and variable abundance in the estuary. Others (e.g., hitch [*Lavinia exilicauda*]) are freshwater species swept into the estuary during high flow events.

Northern anchovy was most frequently caught in the DFG surveys, followed by longfin smelt, English sole, white croaker, and Bay goby. In general, northern anchovy and longfin smelt are the two most abundant species in north San Francisco and San Pablo Bays and occur throughout the water column as they feed opportunistically. English sole is a flat fish that is typically found on the bottom; Bay goby is also a demersal fish.

In shallow-water habitat, Pacific herring, northern anchovy, yellowfin goby, jacksmelt, Pacific staghorn sculpin, and topsmelt each contributed more than 5% to the total beach seine catch.

Tidal marshes provide habitat for residents, partial residents, tidal visitors (or tidal transients), and seasonal visitors (or seasonal transients). Residents are those species (e.g., killifish) that complete their entire life cycles in the marsh. Partial residents (e.g., inland silverside [*Menida beryllina*]) are found in the marsh as juveniles throughout the year. Tidal visitors are typically larger fishes (e.g., jacksmelt [*Atherinopsis californiensis*], and flounders) that move into the marsh at high tide to feed on the abundant juvenile fish and invertebrates. Seasonal visitors are species that use the tidal marsh as spawning or nursery areas (e.g., sticklebacks) or as seasonal refuges from predators (e.g., chinook salmon [*Oncorhynchus tshawytscha*]).

The broad range of environmental conditions in tidal marsh leads to highly variable species composition and abundance. Single-event sampling can yield low species numbers (e.g., six species at Napa River Salt Marsh Pond 2A), whereas species occurrence over a year or several years can be quite high (e.g., 63 species reported at Bair Island marshes). Large fluctuations in species composition and numbers, as well as biomass, are typical of coastal wetland systems (Moyle and Cech 1982, Williams and Desmond 2001). Variability is caused not only by seasonal and tidal movements of fishes but also by differing responses of fishes to environmental stressors (e.g., salinity, temperature, abundance of prey, and predators). The spatial and temporal dynamics contribute to the importance of fish in the transport of nutrients and energy across habitats at multiple trophic levels in the estuarine foodweb (Allen 1982, Kneib 1997, Kwak and Zedler 1997, Williams and Desmond 2001).

The ecological benefits that vegetated tidal marsh offers to assemblages of fish species have been well documented (Kneib 1997). Fish migrate with the tides onto the marsh surface to feed and frequently exhibit a fuller gut at high or ebbing tides than at other times (Harrington and Harrington 1961, McIvor and Odum 1988, Rozas and LaSalle 1990, Rountree and Able 1992, Kneib 1997). A bioenergetics model of killifish has indicated that sporadic foraging on marsh surfaces, in conjunction with tidal cycles, enhances growth (Madon 2001). Marsh vegetation is known to provide cover from predators for transient and resident fish species (Ryer 1988). Moreover, several transient visitors (mostly species from the silverside family Atherinidae, such as topsmelt) and resident species (e.g., killifish) spawn in marsh vegetation (Kneib 1997).

Open water areas adjacent to tidal marshes are important habitat for fishes such as white sturgeon (*Acipenser transmontanus*) and brown rockfish (*Sebastes auriculatus*) (Goals Project 1999). Deep water and channels also serve as migration corridors for anadromous fishes such as chinook salmon and steelhead (*Oncorhynchus mykiss*).

7.1.3.2 Aquatic Marine Invertebrates

Aquatic marine invertebrates occur in deep bay, tidal channel, and shallow subtidal and intertidal habitats. Most aquatic marine invertebrate communities throughout the Bay-Delta estuary are dominated by a relatively uniform composition of invasive nonnative species (Carlton 1979, URS 2001). However, estuarine habitats in north San Francisco and San Pablo Bays are less saline than those in south San Francisco Bay as a result of the considerable freshwater inflow from the Sacramento–San Joaquin River systems. Consequently, the estuarine invertebrates in north San Francisco and San Pablo Bays are generally more tolerant of, or rely on, brackish water.

Estuarine habitats support zooplanktonic and benthic invertebrates found throughout San Pablo Bay. Zooplankton are floating and free-swimming invertebrates that are suspended in the water column. They include such species assemblages as rotifers; cladocera; copepods; tunicates; larval forms of annelid worms, gastropods, and bivalves; and a plethora of crustaceans including Dungeness crab (*Cancer magister*). Zooplankton can be found throughout the water column in deep bay, channel, and shallow subtidal and intertidal habitats. Many of the zooplanktonic forms have larval or immature stages that, upon maturing, drop out of the water column to live in the benthos. Many benthic invertebrates are filter feeders (e.g., some polycheate worms, bivalves, and anemones) that rely upon both zooplankton and phytoplankton as food. Zooplankton are also ecologically important as a food resource for numerous other invertebrates and fish (e.g., anchovies, smelt).

A substantial decrease of native zooplankton in San Francisco Bay has been documented over the last 20 years (URS 2001). This decrease has resulted from loss of estuarine habitat and the introduction of invasive nonnative species that either compete with or feed on the native zooplankton. The introduced Asian clam (*Potamocorbula amurensis*) and two introduced Asian mysid shrimp have profoundly affected the zooplankton community and those native species dependent upon it (e.g., the native mysid shrimp *Neomysis mercedis*) by competing with the zooplankton for phytoplankton or by feeding on the zooplankton directly (URS 2001).

Benthic invertebrates in their adult life stages are primarily associated with substrates and include sessile invertebrates, infauna, and epibenthos. Sessile invertebrates include sponges, anemones, hydroids, tubeworms, oysters, mussels, barnacles, and other species permanently or semipermanently attached to their substrates. These species are typically dependent on plankton for food and are, in turn, ecologically important as food resources for other invertebrates, fish, birds, and mammals.

Infauna are invertebrates that burrow or bore through mud, clay, or shale. Examples are polycheate and oligocheate worms, most bivalves, some gastropods, and some crustaceans. Some infaunal species filter plankton from the water, whereas others prey on other infauna. Most live within a few centimeters of the substrate surface.

Epibenthos are motile invertebrates that live on specific substrates. This group includes numerous gastropods, scallops, octopi, pycnogonids, some insects, starfish, sea urchins, and the vast majority of crustaceans, including crabs and shrimp. Most epibenthic invertebrates are herbivores or predators. Epibenthic invertebrates include Dungeness crab, rock crabs, and caridean shrimp. The muddy and sandy bottom in open water areas and major channels is important habitat for large invertebrates, including California bay shrimp, Dungeness crab, and rock crab.

A significant decrease in native benthic invertebrate fauna in San Francisco Bay has been documented over the last several decades (URS 2001). This decline has resulted primarily from habitat loss and the introduction of invasive nonnative species that either compete with or feed on the native benthic invertebrates. It is estimated that 40%–100% of the benthic invertebrate fauna in any area of the bay are nonnative species (Carlton 1979, URS 2001). Asian clam, green crab (*Carcinus maenas*), and Chinese mitten crab (*Eriocheir sinensis*) are invasive nonnative species of particular ecological concern that have become well established in the bay.

Along the intertidal mudflats and beaches, a variety of mites, springtails, flies, and beetles scavenge among flotsam along beach and estuary margins. Tiger beetles, many carabid beetles, and various fly species are active predators on these scavenging insects. Tiger beetle is a common insect predator, particularly on mudflats, tidal channel edges, and salt pans. Some crab species are amphibious, and scavenge or prey on other invertebrates on the mudflats, vegetated wetland margins, or rocky shoreline areas during low tides.

Invertebrate fauna important to the commercial fishery include *Cancer* crabs (primarily the Dungeness crab and rock crabs) and caridean shrimp. *Cancer* crabs and caridean shrimp are estuarine species that typically do not occur in deep water. These crustaceans are important scavengers and predators in the estuary and are also important as food for crabs, fish, birds, and mammals. Rock crabs and caridean shrimp support substantial fisheries in San Francisco Bay.

Dungeness crabs in the bay mature at nearly twice the rate of those in populations outside the bay, probably as a result of higher water temperatures. Early planktonic larval stages (zoea) typically are limited to the central bay, but later planktonic larval stages (megalops) are found throughout the bay. Immature nonplanktonic stages prefer the brackish water areas that occur throughout the estuary as far upstream as Suisun Bay (California Department of Fish and Game 1999). When Dungeness crabs approach breeding age, they migrate back to the central bay.

San Francisco Bay supports the largest Dungeness crab nursery in the world, but it is illegal to harvest Dungeness crab in the bay (California Department of Fish and Game 1999). Historically, the bay sustained an annual harvest of more than 9 million pounds of Dungeness crab. Since the 1960s, the harvest has decreased to between 2 and 3 million pounds annually, and the commercial fishery in the San Francisco region is now restricted exclusively to the coast outside the bay (California Department of Fish and Game 1999).

7.1.3.3 Aquatic Freshwater Invertebrates

Regional creeks and streams provide habitat for numerous macroinvertebrates, such as crustaceans, mollusks, annelids, and aquatic insects. Many aquatic insects spend their larval stage on the stream bottom. Representative macroinvertebrates include aquatic insects such as stoneflies, caddis flies, riffle beetles, mayflies, sow bugs, damselflies, dragonflies, and crane flies; crayfish; leeches; snails; and aquatic worms.

7.1.4 Project Setting

The Napa River Unit borders the northern edge of San Pablo Bay and includes estuarine reaches of the Napa and Sonoma Rivers. More than 15 fish species and 60 macroinvertebrate species use the habitats of the Napa River Unit. The land forms and the species in the project area are described below.

In addition to the aquatic habitats of the Napa River Unit, several other aquatic habitats are associated with the pipeline routes of the Water Delivery Option. As described in Chapter 2, “Site Description and Options,” three pipelines are currently proposed and four potential future pipelines are being considered for this option, and several of them cross various streams and creeks. Table 7-2 summarizes the stream/creek crossings associated with each pipeline.

Table 7-2. Pipeline Stream/River Crossings

Pipeline	Unnamed Creeks (total number)	Named Creeks, Sloughs, and Rivers
Sonoma	5	Schell Slough, Huichica
Napa	2	Napa River, Suscol, Carneros
CAC	0	Napa River
Las Gallinas	0	Gallinas, Miller, Pacheco, Arroyo San Jose
Las Gallinas/Novato	0	Novato, Simonds Slough, Petaluma River
Petaluma	6	Wheat, Stage Gulch
Las Gallinas/Novato/Petaluma	2	Tolay, Sonoma, Steamboat Slough

Another aquatic resource consideration is the release of treated wastewater by the Project and Program Components of the Water Delivery Option into local creeks, sloughs, rivers, and San Pablo Bay during the wet season. SVCSD discharges treated wastewater into Schell Slough and Hudeman Slough during a winter discharge period of November 1 through April 30. Discharges to the sloughs are not permitted during the remainder of the dry season and the wastewater is used for reclamation on agricultural fields and wetlands, and also stored in large ponds. The normal discharge location is Schell Slough and averages about 3.5 mgd. For a short period at the beginning of each winter discharge period, the ponds are drained into Hudeman Slough. NSD is also permitted for winter-only discharges to the Napa River with an average flow rate of about 15 mgd; treated wastewater is reclaimed during the dry season.

7.1.4.1 Land Forms

Napa River Estuary

The Napa River estuary includes tidal channels and deep open water. The Napa River Unit borders approximately 5 miles of the Napa River estuary.

Salinity in the Napa River estuary varies from 0 ppt to 22 ppt. Low salinity occurs during winter storms when large freshwater flows occur in the Napa and Sonoma Rivers, forcing higher salinity into downstream reaches. High flow from the Sacramento and San Joaquin Rivers may also reduce salinity by forcing the salinity gradient in the bay farther downstream. High salinity occurs during the summer when freshwater inflow is relatively low. Figure 4-1 in Chapter 4, “Water Quality,” shows salinity variability at Point San Pablo and the San Mateo Bridge for each month.

Water in the Napa River is typically turbid and has a high level of suspended sediments (see Chapter 4, “Water Quality”). Sediments in the Napa River near the project are mostly muddy coarse sands, fine clays, and silts.

7.1.4.2 Species

Based on results from Takekawa et al. (2000), Ponds 1, 2, and 3 can sustain fish life, and Ponds 1, 2, 3, 4, and 7 can sustain invertebrate life. No surveys were conducted on Ponds 5, 6, 6A, 7A, and 8 as part of the Takekawa et al. (2000) studies. The surveys captured 16 fish species in Ponds 1, 2, and 3. Pacific staghorn sculpin, yellowfin goby, striped bass, and American shad were the dominant species captured in Pond 1. Much lower numbers of fish were present in Pond 2, and were primarily striped bass and inland silverside. More fish were captured in Pond 3 than Pond 2, primarily Shimofuri goby (*Tridentiger bifasciatus*), longjaw mudsuckers (*Gillichthys mirabilis*), inland silverside, and rainwater killifish (*Lucania parva)*. No fish were captured in Pond 4 (Takekawa et al. 2000). Fish surveys were not conducted as part of the studies by Takekawa et al. (2000) in Ponds 5, 6, 6A, 7, 7A, or 8 because of elevated salinity levels. Fish surveys conducted as part of the restoration of Pond 2A revealed 19 species in this pond (MEC Analytical Systems 2000).

Invertebrate surveys in 1999 revealed 62 macroinvertebrate taxa groups. The greatest number of taxa occurred in Ponds 1 and 2, including 12 polycheate worms, six bivalves, 20 crustacean taxa, 12 insect families, and 12 other taxa. Pond 3 was notably lower with nine taxa, and Ponds 4 and 7 contained six and three taxa, respectively. (Takekawa et al. 2000).

The DFG fish surveys collected several special-status species and/or evolutionarily significant units (ESUs) in San Pablo Bay. It is difficult to quantify the precise number of special-status species collected and whether the chinook salmon that were taken belonged to the Sacramento River winter-run ESU (listed as endangered under ESA [59 FR 440, January 4, 1992] and CESA); the Central Valley spring-run ESU (listed as threatened under ESA [64 FR 50393, September 16, 1999] and CESA); or the Central Valley fall-run/late fall–run ESU (a federal candidate species [64 FR 50393, September 16, 1999]), and a California species of special concern [SSC]); Central Valley fall-run and late fall–run chinook salmon have been designated by NMFS as a single ESU.

A fish rescue conducted by SCWA staff on August 17, 2000, to remove fish stranded by cofferdams revealed the following species (listed in Table 7-3) in Hudeman Creek:

Table 7-3. Aquatic Species in Hudeman Creek

Common Name	Scientific Name
Yellowfin goby	*Acanthogobius flavimanus*
Mosquitofish	*Gambusia affinis*
Shimofuri goby	*Tridentiger bifasciatus*
Bay shrimp	*Crangon franciscorum*
Prickly sculpin	*Cottus asper*
Threespine stickleback	*Gasterosteus aculeatus*
Inland silverside	*Menidia beryllina*
Mitten crab (captured and destroyed)	*Eriocheir sinensis*

Source: Martini pers. comm.

None of these species are designated threatened, endangered, or of concern by federal or state resource agencies. However, Hudeman Creek and Slough are considered a portion of the Napa River Unit and could potentially provide habitat for the special-status species described in Section 7.1.4.3 below.

No specific studies have been conducted to determine species occurrences in Schell Slough. However, Schell Slough is considered a portion of the Napa River Unit and could potentially provide habitat for species such as those listed for Hudeman Creek (see Table 7-3) and the special-status species described in Section 7.1.4.3 below.

The Napa River provides habitat for species such as striped bass, steelhead, green sturgeon (*Acipenser medirostris*), Pacific lamprey (*Lampetra tridentata*), large- and smallmouth bass (*Micropterus salmoides, M. dolomieui*), catfish, threadfin shad (*Dorosoma petenense*), yellowfin goby, tule and shiner perch (*Hysterocarpus traski* ssp., *Cymatogaster aggregata*), delta and longfin smelt, prickly sculpin, carp (*Cyprinus carpio)*, Sacramento sucker (*Catostomus occidentalis*), and stickleback (Coats pers. comm.). Special-status species found in the Napa River are described in Section 7.1.4.3 below.

7.1.4.3 Listed and Fully Protected Species

California Freshwater Shrimp

The California freshwater shrimp (*Syncaris pacifica*) is a state-listed and federally listed endangered species. It can be found in pool areas of low-elevation, low-gradient streams, among exposed live tree roots of undercut banks, overhanging woody debris, or overhanging vegetation. It inhabits only 17 stream segments in Marin, Napa, and Sonoma Counties. The species is known to occur in Huichica Creek and portions of Sonoma Creek.

Chinook Salmon

Chinook salmon use San Francisco Bay as a migratory corridor as they move from fresh water to the ocean as juveniles and from the ocean to fresh water as adults. Adults generally use deeper channels, whereas juveniles are more likely to use shallow habitats, including tidal flats, for feeding and as refuge from predators. Chinook salmon are not likely to occur in Petaluma Creek, Sonoma Creek, or Novato Creek (Stern pers. comm.). Chinook salmon have been collected in the Napa River upstream of the project area (Napa River Fisheries Monitoring Program 2002).

Critical habitat has been designated to include San Francisco Bay north of the San Francisco–Oakland Bay Bridge for the Sacramento River winter-run ESU (58 FR 33212, June 16, 1993).

Coho Salmon

Coho salmon (*Oncorhyncus kisutch*) is federally listed as threatened and state-listed as endangered. This species is rarely found in San Pablo Bay, only occupying streams in Marin County south of the Novato Creek complex (Stern pers. comm.). Like chinook salmon, adults migrate through the deeper open-water channels, and juveniles sporadically move into the shallow bay and tidal flats for feeding. No coho salmon were collected either during the DFG surveys at any stations near the potential mitigation complexes or during the sampling associated with Pond 2A (MEC Analytical Systems 2000). Critical habitat has been designated to include the drainages of San Francisco and San Pablo Bays (65 FR 7764, February 16, 2000).

Steelhead

DFG collected a few "rainbow trout" in open water and beach surveys in the north bay. These fish were likely steelhead from the central California coast steelhead or Central Valley ESUs. Central Valley steelhead is federally listed as threatened (63 FR 13347, March 19, 1998) and is a California species of special concern. Central California coast steelhead is also federally listed as threatened (62 FR 43938, August 18, 1997) and is a California species of special concern.

Like chinook salmon, Central Valley steelhead use San Pablo Bay as a migratory route. Central California coast steelhead spawn and rear in the Petaluma River, Sonoma Creek, and Napa River and are present in San Pablo Bay near the mouths of these systems between October 1 and June 15 (U.S. Fish and Wildlife Service 1993, Stern pers. comm.).

Delta Smelt

Delta smelt is federally listed as threatened (58 FR 12854, March 5, 1993), and its critical habitat was designated on December 19, 1994. Delta smelt critical habitat includes the following geographic areas—areas of all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear, Suisun Cutoff, First Mallard (Spring Branch), and Montezuma Sloughs; and the existing contiguous waters contained within the Delta. DFG surveys collected delta smelt at a moderate level in both the open water and beach surveys. Delta smelt typically occupy open surface water habitat with salinities lower than 12 ppt, and they move toward the shallow edge waters and slow-moving sloughs to spawn. Delta smelt have been captured in the 20-mm surveys conducted by DFG from 1995 through 2001, with the exception of 1997 when delta smelt apparently were absent. Three individuals were collected over a 4-year period at the Pond 2A restoration project (MEC Analytical Systems 2000).

Splittail

Splittail is federally listed as threatened (64 FR 5963, February 8, 1999); no critical habitat has been designated for this species. Splittail is typically found in shallow water of salinity levels lower than that of waters occupied by the special-status species described above. Splittail was very infrequently collected in the DFG open-water and beach surveys but was regularly collected during the Pond 2A restoration project (MEC Analytical Systems 2000). The species is known to occur in the Napa and Petaluma Rivers and Petaluma Marsh (U.S. Fish and Wildlife Service 1993, 1996) near the Petaluma River, Novato Creek, and South of SR 37 complexes.

Longfin Smelt

Longfin smelt is a federal species of concern and California species of special concern. It was the most abundant special-status species collected during the DFG open-water and beach surveys. Longfin smelt mainly uses open water and is rarely found in shallow areas such as those adjacent to potential mitigation complexes. No longfin smelt were collected during the Pond 2A restoration project (MEC Analytical Systems 2000), and very few were collected during the DFG beach seine samples near the project area.

Other Species

Green sturgeon, Pacific lamprey, and river lamprey (*Lampetra ayresi*) were infrequently captured in the DFG surveys and were not collected during the Pond 2A restoration project (MEC Analytical Systems 2000). Green sturgeon are demersal fish, and lamprey are anadromous fish likely to be found in open water. All three species are not currently listed but are federal species of concern and California species of special concern.

7.2 Environmental Impacts and Mitigation Measures

7.2.1 Methods and Significance Criteria

7.2.1.1 General Significance Criteria

Impacts on aquatic resources were analyzed quantitatively and qualitatively. Criteria based on the State CEQA Guidelines were used to determine the significance of aquatic resources impacts. The project would have a significant impact on aquatic resources if it would substantially

- interfere with or prevent the movement or migration of any fish species;
- reduce or degrade the habitat of a state or federal special-status species, potentially resulting in a reduction in species abundance;
- reduce the amount of aquatic habitat; or
- reduce fish populations.

The term *substantial* reduction in a population, its habitat, or its range has not been quantitatively defined in CEQA. What is considered substantial varies with each species and with the particular circumstances pertinent to a particular geographic area.

7.2.1.2 Methods

Relative to fish habitat, the primary environmental conditions potentially affected by project actions include water quality, substrate, continuity, and habitat area and type.

Water Quality

Water quality elements potentially affected by the project include salinity, DO, BOD, contaminants, water temperature, and suspended sediment. The significance of water quality impacts relative to fish habitat was determined based on whether implementation of the project would result in a substantial change in water quality that would physiologically stress sensitive fish species.

Fish respond to salinity through a number of physiological, behavioral, and ecological mechanisms that affect survival, growth, migration, and reproduction. Specific responses of fish to salinity in the Napa River and sloughs have not been investigated. Salinity in the Napa River estuary and in San Pablo Bay can vary substantially throughout the year and on a daily basis for any fixed location (Table 7-3 and Figure 4-1 in Chapter 4, "Water Quality"). Salinity impacts associated with each of the options were assessed using general preference or tolerance ranges from the literature for each of the relevant life stages of the sensitive aquatic species (Table 7-4). These criteria include salinity ranges based on the measured preferences, growth, food conversion efficiencies, and swimming performance of various life stages under controlled laboratory conditions. Salinity outside the optimal range may affect the abundance of aquatic organisms through blockage of movement or migration, reduced egg viability, reduced survival of eggs to the larval stage, and reduced survival of rearing juveniles. Because numerous factors influence the response of fish to salinity regimes under natural conditions (e.g., fish size, temperature acclimation, food availability, genetic variation, water chemistry, predation, disease), the criteria are applied to assess generally whether the potential for an adverse or beneficial effect would exist given a change in salinity from baseline conditions.

Aquatic organisms that occur in the lower Napa River and San Pablo Bay are estuarine species that are currently subject to daily and seasonal changes in salinity levels. Estuarine species must be able to tolerate environmental changes (e.g., benthic species) or must be able to move to more optimal conditions (e.g., planktonic species). Physiologically, fish in salty water decrease their rate of water intake, and chloride cells in the gills remove excess salts back to the environment. What the chloride cells do not remove, the kidney will process, and saltwater fish will secrete a urine high in salt. Fish in fresh water are exposed to an environment that has less salt than the organism. The fish must drink copious amounts of water to receive the necessary salts, and then produce a highly dilute urine, once the salt has been removed from the water and taken into their bodies.

Because of the dynamic nature of their surrounding environment, estuarine fish must be able to react to fresh water and saltwater. Most estuarine species are capable of surviving a wide salinity range. Table 7-4 identifies salinity preferences for some of the species found in the lower Napa River and San Pablo Bay. Estuarine fish exposed to conditions less than optimal may move to areas with more suitable salinity.

Sessile or benthic organisms or passive swimmers are not able to move away from unsuitable conditions, and so they are much more tolerant of variable conditions. Sessile or benthic organisms such as clams typically will close their shells or burrow into the mud until conditions improve, or until they acclimate to the new conditions. The sessile and benthic communities in the Napa River are adapted to periods of high salinity, particularly during the summer months.

Similar to salinity, fish respond to water temperature through a number of physiological, behavioral, and ecological mechanisms that affect survival, growth, migration, and reproduction. Although water temperature in the bay varies over a relatively narrow range during a year or over the course of a day (Table 7-3 and Figure 4-1 in Chapter 4, "Water Quality"), water temperature in shallow marsh areas may reach levels detrimental to some species. Water temperature tolerances for selected species are shown in Table 7-4.

Table 7-4. Salinity Tolerance, Temperature Preference, Timing, and Likely Presence at the Project Site for Various Fish Species

Species/Life Stage	Salinity Tolerance (ppt)	Temperature Preference (Degrees Celsius)	Timing	Likely Presence at Site
Delta smelt				
Spawning	0–6	7–22 (prefer <15)	Feb–July	Mar–May
Larvae	0–18.4	7–18	Mar–July	Mar–May
Juvenile, adult	(prefer less than 10)	< 22 but can tolerate to 28	Apr–July	Apr–June
Splittail				
Larvae	< 3		Feb–July	Feb–Apr
Juvenile, adult	0–23 (prefer 0–10)	15–23	May–July	Year round
Steelhead				
Juvenile	0–25	7–16	Jan–May	Jan–May
Fall-run chinook				
Juvenile	0–25	13–16	Jan–Jun	Jan–Jun
Winter-run chinook				
Juvenile	0–25	13–16	Dec–Apr	Dec–Apr
Spring-run chinook				
Juvenile	0–25	13–16	Nov–May	Nov–May
California halibut	18–35	15–16.5		Feb–Aug
Starry flounder	4–24		Year round	Winter and spring
Pacific herring				
Larvae (wang)	8–18	6–15	Dec–Jun	Dec–June
Northern anchovy				
Larvae (wang)	Unknown–35	10–23	Feb–Apr; Jul–Sept	Feb–Apr; Jul–Sept
Longfin smelt				
Larvae	2–18	7–14.5	Feb–Apr	Feb – Apr
Adult	0–32 (prefer 15–30)	16–18	Jan-Jun	Apr– Jun
Striped bass				
Spawning, larvae	0–Unknown	15–20	Apr–June	Apr–Jun
Juvenile, adult	0–35	up to 30	Year round	Year round
Green and white sturgeon	0–35		Year round	Year round
Rotifers	Some species prefer >5–10 while others require <5–10		Year round	Year round
Opossum shrimp	10		Year round	Year round

Periods of localized, high-suspended-sediment concentrations and turbidity owing to channel disturbance can result in clogging and abrasion of gill filaments. Clogging and abrasion of gill filaments could cause a thickening of the gill epithelium, resulting in reduced respiratory capacity, and an increase in stress level, reducing tolerance of a fish or other aquatic organisms to disease and toxicants (Waters 1995). Physiologically, high suspended sediment creates a loss of visual capability, leading to reduction of feeding opportunities for sight-feeding aquatic organisms and potentially affecting growth rates. High sediments may also smother eggs. However, high sediment levels are characteristic of tidal habitats in San Pablo Bay (e.g., marshes in the bay may accrete more than a foot of sediment a year [Siegel 1998]), and species that occur in the bay are adapted to relatively high sediment conditions.

Substrate

Dredging and construction activities could disturb existing substrates and the associated benthic organisms. The assessment is based on whether implementation of the project would result in substantial disturbance of substrate area and changes to the quantity or quality of fish habitat that could measurably affect the abundance and production of fish and other aquatic organisms.

Continuity

Continuity includes water depth, velocity, and flow connectivity conditions that support the movement and migration of fish species. Continuity affects movement by fish and other organisms and potential exposure to adverse environmental conditions (e.g., water temperature, desiccation, predation). The level of significance of impacts on fish movement was assessed based on whether the project would create conditions that would either impede movement to avoid adverse environmental conditions or impede movement to habitat needed to complete specific life history events (e.g., spawning, rearing).

Potential effects on depth and continuity include creation of intertidal areas temporarily disconnected from the estuary and entrainment in diversions. Fish near diversion points may be entrained with the diverted flow. The probability of entrainment and subsequent mortality is a function of the size of the diversion, the location of the diversion, the behavior of the fish, and other factors, such as fish screens, presence of predatory species, and water temperature. In general, larger diversions, relative to the proportion of flow diverted, entrain proportionately more fish than small diversions.

Habitat Area and Type

The project could change the area of habitat available to fish species or integral to production of food organisms. The assessment is based on whether implementation of the project would result in substantial change in species habitat area that could measurably affect the abundance and production of fish and other aquatic organisms.

7.2.2 No-Project Alternative

7.2.2.1 Impact A-1: Reduced Water Quality as a Result of Uncontrolled Breaches of Levees

Under the No-Project Alternative, there would be no change in the management of the salt ponds by DFG. High salt conditions would continue to occur in the existing ponds closed to tidal influence, including saline concentrates in Pond 8 and bittern in Pond 7, a repository of concentrated soluble salts other than sodium chloride. The pond levees would continue to be subject to catastrophic failure or inundation of the ponds by high tide elevations in extreme storm events.

Following a breach of the levees, the duration and magnitude of high salinity in the Napa River would increase; a simulated summer breach on the Napa River indicated that ambient salinity would increase by approximately 12 ppt for several months (Philip Williams and Associates 2002a). A breach on a slough could result in greater effects because there would be less dilution. It is likely that levees would remain breached and high-salinity water discharged to the Napa River estuary for several weeks. Typically, levees fail in the winter when there is a greater amount of fresh water flowing downstream. The greater amount of freshwater could dilute the salt in the inundated ponds, but the initial change in salt concentration in the Napa River could be substantial, particularly if the upper ponds were breached (see Chapter 4, “Water Quality”). If the breach were to occur when the flows of the surrounding sloughs and Napa River were low, and the more sensitive life stages of aquatic organisms were present (Table 7-4), the salinity changes in the Napa River could cause substantial adverse impacts on the aquatic organisms in the vicinity. This impact is considered significant. This alternative would result in no project being implemented, however; therefore, no mitigation is required.

7.2.2.2 Impact A-2: Reduced Water Quality during Construction Activities

- Repair of levees requires mobilizing construction equipment to the breach site. Contaminants (e.g., petroleum products) associated with the operation of equipment and other construction activities may enter the Napa River. The contaminants could adversely affect aquatic organisms by affecting their growth, reproduction, and overall survival.

In addition, sediment would be mobilized during repair activities. The increased suspended sediment could adversely affect benthic and planktonic organisms, including fish. The effect, however, would likely be minimal because of the relatively small area affected and the high rates of sediment mobility in the Napa

River and San Pablo Bay. This impact is considered less than significant. For this reason, and because this alternative would result in no project being implemented, no mitigation is required.

7.2.2.3 Impact A-3: Disturbance of Substrate and Associated Benthic Organisms during Repair of Levee Breaches

Ongoing erosion of inboard levees by wind and waves and scour of outboard levees, in conjunction with high tides and high rainfall events, would likely result in one or more levee breaches. DFG would potentially fix the levees on an emergency basis, requiring the mobilization of construction equipment to the site. Repair of the levees could disturb the substrate and associated organisms in the vicinity of the breach. The levee repairs as well as levee maintenance would require movement of substrate, which could disturb local benthic organisms. Recolonization of the area by benthic organisms is expected to occur shortly after repairs are completed. This would be short-term, resulting in less-than-significant effects on benthic organisms. This impact is considered less than significant. For this reason, and because this alternative would result in no project being implemented, no mitigation is required.

7.2.2.4 Impact A-4: Stranding of Fish and Other Aquatic Organisms as a Result of Levee Repairs

Levee breaches and repairs would strand fish and other aquatic organisms that move into the ponds during the period the levee fails. Whether organisms are stranded from the main population depends on the timing of the levee failure and the timing of the levee repair. Delta smelt, juvenile chinook salmon, and other species could die as a result of becoming stranded in the ponds after levee failure and before levee repair. If a substantial breach coincides with peak occurrence of a sensitive species life stage, such as larval delta smelt, and the levee is repaired during the period of species presence, species abundance during that and subsequent years could be affected. Therefore, this impact is considered significant. This alternative would result in no project being implemented, however; therefore, no mitigation is required.

7.2.2.5 Impact A-5: Entrainment of Fish and Other Aquatic Organisms through Diversions into the Managed Ponds

Ongoing operations of tide gates and pumps could entrain fish and other organisms into the ponds. Depending on the water quality and habitat in the pond, fish entrained into the ponds could live or die. Based on available information, tide gates and pumps are not screened, and entrain fish—particularly into Ponds 1, 1A, 2, and 3. This practice would continue. The entrainment of some species, specifically the delta smelt, splittail, and chinook salmon, poses a problem as these species are listed under the ESA. The potential mortality of these species is considered likely as a result of predation by native and nonnative species, changing water quality conditions, or inability to escape from the ponds. Therefore, this impact is considered significant. This alternative would result in no project being implemented, however; therefore, no mitigation is required.

7.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

7.2.3.1 Impact A-5: Entrainment of Fish and Other Aquatic Organisms through Diversions into the Managed Ponds

Currently, only Ponds 1, 1A, 2, and 3 support fish life. Ponds 1, 1A, 2, 3, 4, and 7 sustain macroinvertebrate life. Ponds 5, 6, 6A, and 8 are able to sustain salt-tolerant macroinvertebrates intermittently depending on their salinity levels. As water is brought into the ponds from the various intakes and tidal gates, fish or zooplankton could be entrained with the flow. The diversions, however, are small relative to the net and tidal flow volume of the affected sloughs and the Napa River, and the number of fish entrained is also expected to be proportionately small. However, the level of entrainment could be substantially greater than expected if fish behavior results in active movement into the area influenced by the diversion. Larval splittail are unlikely to be present under most circumstances because spawning occurs in areas with very low salinity and greater habitat complexity. Steelhead entrainment also would be expected to be minimal, although steelhead behavior in marsh and tidal habitats is poorly understood. Larval, juvenile, and adult delta smelt also could be entrained, although their open-water habitat would likely minimize entrainment in the diversions. Some entrained species may be capable of surviving entrainment in the ponds, depending on water quality and other environmental conditions in the pond. Under existing conditions, however, fish would be vulnerable to predation by nonnative and native species, changing water quality conditions, or inability to escape the ponds to complete their life history. This impact is considered significant. Implementation of Mitigation Measure A-1 below would reduce this impact to a less-than-significant level.

During the early stages of salinity reduction, fish and other aquatic organisms entrained into the ponds could be subjected to water quality conditions that are detrimental or even fatal. During the latter stages of salinity reduction, pond conditions would improve, providing habitat for some fish and aquatic organisms. As pond levels would change daily, fish and other organisms could become stranded and unable to leave the ponds. However, because the ponds would be inundated at least twice per day with the high tide, the stranding would be only temporary and most estuarine species are adapted to tidal variation. This impact is considered less than significant. No further mitigation is required.

Mitigation Measure A-1. Minimize Entrainment of Sensitive Species

Development and implementation of this mitigation measure will be consistent with the terms and conditions of take authorization provided under ESA and CESA consultation for the project. Monitoring for fish entrainment would be implemented during periods of potential presence of ESA–listed (i.e., delta smelt, splittail, steelhead, winter-run chinook salmon, and spring-run chinook salmon) and sensitive (e.g., green sturgeon, longfin smelt) species. The monitoring would provide an estimate of the number of each species entrained by the Pond 5 and 6 diversions. Sufficient information should be obtained to assess the relative estimated population level effect of entrainment. The additional information may include results of ongoing surveys by other entities (e.g., DFG, USFWS).

If the assessment of entrainment, based on analysis of monitoring data, indicates a potential measurable effect on population abundance and production, measures could be implemented to minimize entrainment losses. The measures may include construction of fish screens, change in operations timing, and change in location and design of intakes. Fish screens would follow the criteria established by NMFS, USFWS, and DFG and would minimize entrainment losses of juvenile and adult fish. Water quality and species monitoring stations may be established in the affected sloughs and in the Napa River to provide information on the distribution of fish species. The data would support real time operations that could minimize entrainment of all life stages, including larval and early juvenile fishes that would not benefit from fish screens. To the extent practicable, seasonal or diurnal operations that coincide with periods of minimum occurrence may be sufficient to avoid and minimize entrainment of most species life stages.

7.2.3.2 Impact A-6: Short-Term Reduction in Aquatic Habitat Suitability during Construction Activities

Under this option, construction would be required to build the water intakes and discharge control structures, and maintain levees. Fish screens would be added to the intake structures. DFG provides guidance for construction projects to minimize their effects on delta smelt, but these seasonal restrictions are for the Suisun Marsh and do not extend into the Napa River or San Pablo Bay (California Department of Fish and Game 1996); however, the water control structures would be constructed in the late spring and summer months to avoid the sensitive life stages of protected species (e.g., delta smelt larvae).

The potential exists for fuel spills into the waterway during construction. Various contaminants, such as fuel oils, grease, and other petroleum products used in construction activities, could be introduced into the system either directly or through surface runoff. Contaminants may be toxic to fish or cause altered oxygen diffusion rates and acute and chronic toxicity to aquatic organisms, thereby reducing growth and survival.

Adding soil to existing levees, as well as importing material or excavating an internal borrow ditch within each of the ponds, has the potential to increase the amount of sediment returned to the Napa River or Napa Slough. Consequently, the impact on the more susceptible aquatic organism communities in adjacent waters is considered significant. Implementation of Mitigation Measure WQ-1, “Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices” (described in Chapter 4, “Water Quality”) and Mitigation Measure A-2 below would reduce this impact to a less-than-significant level.

Mitigation Measure A-2. Install Cofferdams to Minimize In-Water Construction

The Corps and DFG’s contractor will install cofferdams around the in-water portion of the intakes and outfalls if needed. Once the cofferdam is in place, trapped water will be pumped back to the Napa River and Napa Slough. A biologist may inspect the site at any time to ensure biologically friendly conditions. As needed, the levees will be repaired to eliminate the risk of breaching.

7.2.3.3 Impact A-7: Reduction in Aquatic Habitat Suitability because of the Deterioration of Water Quality

Initiation of the salinity reduction process as part of project operations would result in the discharge of moderately to highly saline water that could lead to the deterioration of water quality, reduction of aquatic habitat suitability for special-status species, and restriction of movement of fishery resources. There are no quantitative standards established for salinity discharges, but the San Francisco Bay RWQCB has a narrative standard that states that the allowable increase in salinity cannot adversely affect beneficial uses, such as fish. The specific water quality effects are described in Chapter 4, “Water Quality.”

The extent of the project’s effects on beneficial uses depends on the species’ tolerance of salinity, ability of the species’ life stage to move within an estuarine system, and ability of individual fish to maintain their position relative to different salinity gradients. While some measures would be in place to protect aquatic resources, such as limiting the discharge of water from the lower ponds to a dilution ratio of no less than 10:1 and limiting the dilution of Pond 7 to a ratio of less than 100:5, a substantial increase in salinity could pose a problem to some species. For example, the delta smelt’s use of the Napa River above the project area may be inhibited if a salinity gradient is substantially greater than existing conditions. However, the gradient would not be uniform across the Napa River and would affect the portion of the river within the plume of discharged water. In addition, most estuarine species are adapted to changing salinity and will maintain their position in the appropriate salinity gradient. The effects of increased salinity could be nominal if the total salinity thresholds are controlled. Fish typically would move on the tides and maintain their position in their desired salinity range. Benthic organisms are also adapted to changing salinity, as long as the salinity does not increase above present annual maximums.

Other constituents could also affect receiving waters and be toxic to aquatic organisms, degrading habitat and affecting fish populations. Because of potential adverse affects on aquatic habitat suitability and fish populations, this impact is considered significant. Implementation of the following mitigation measures would reduce this impact to a less-than-significant level:

- WQ-2, “Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring”;
- WQ-3, “Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements”;
- WQ-4, “Monitor Pond Water Quality and Use Adaptive Management”; and
- A-3, “Assess and Maintain Salinity Levels Protective of Aquatic Resources” (described below).

Measures WQ-2, WQ-3, and WQ-4 are described in Chapter 4, “Water Quality.”

Mitigation Measure A-3. Assess and Maintain Salinity Levels Protective of Aquatic Resources

The data developed through Mitigation Measure WQ-4 will be assessed relative to the salinity and other water quality requirements of listed and sensitive fish species, including delta smelt. If the assessment of water quality, based on analysis of monitoring data, indicates a potential measurable effect on population abundance and production for listed and sensitive fish species (Table 7-4), measures could be implemented to minimize the water quality effects. The measures may include change in discharge magnitude, timing, duration, and frequency and change in design of discharge facilities. The data would support real time operations that could minimize effects on all life stages. To the extent practicable, seasonal or diurnal operations that coincide with periods of minimum occurrence may be sufficient to avoid and minimize water quality effects.

7.2.3.4 Impact A-8: Disturbance of Substrate and Associated Benthic Organisms during Construction Activities

The construction of the control structures as well as levee maintenance would require movement of substrate, which could disturb local benthic organisms. Recolonization of the area by benthic organisms is expected to occur shortly after construction is completed. Movement of substrate would be short-term, resulting in less-than-significant effects on benthic organisms. This impact is considered less than significant. No mitigation is required.

7.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B are similar to those under Salinity Reduction Option 1A (Impacts A-5, A-6, A-7, and A-8). The primary difference for Option 1B would result from breach of Pond 3 levees that would increase the short-term magnitude of higher salinity, reduce the duration of higher salinity, and focus the timing of saline discharge to coincide with a period of relatively high outflow and decreasing salinity in the receiving water body. Key differences in biological effects are described below.

7.2.4.1 Impact A-5: Entrainment of Fish and Other Aquatic Organisms through Diversions into the Managed Ponds

Potential effects on fish would be the same as described under Salinity Reduction Option 1A for Ponds 1, 1A, 2, 4, 5, 6, 6A, 7, and 8. As water is brought into the ponds from the various intakes and tidal gates, fish or zooplankton could be entrained with the flow. Entrainment of fish and other aquatic organisms under Salinity Option 1B, however, would be less than under Salinity Option 1A because Pond 3 would be opened to tidal action via a 50-foot-wide breach. Movement of fish and other organisms with tidal flow through the breach, either into or out of Pond 3, would be unimpeded. Most mobile aquatic species would move in and out of the pond on their own volition. The impact of fish entrainment in ponds not breached is considered potentially significant. Implementation of Mitigation Measure A-1, “Minimize Entrainment of Sensitive Species,” would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

7.2.4.2 Impact A-6: Short-Term Reduction in Aquatic Habitat Suitability during Construction Activities

Salinity Reduction Option 1B, with breach of Pond 3, would have fewer in-water construction elements and therefore fewer potential effects on aquatic habitat suitability. Instead of intakes and outfalls, this option would provide one 50-foot breach on Pond 3. Breaching Pond 3 would result in a temporary increase in sediment associated with opening the breach. The effects of short-term temporary increases in suspended sediment would dissipate over a relatively small area and during a relatively short period. The change in suspended sediment attributable to levee breach is not expected to be substantially greater than the sediment carried during a 2-year storm event. Other construction activities would be the same as under Salinity Reduction Option 1A. The potential impact on the more susceptible aquatic organism communities in adjacent waters is considered significant. Implementation of Mitigation Measure WQ-1, “Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices” (described in Chapter 4, “Water Quality”) would reduce this impact to a less-than-significant level.

7.2.4.3 Impact A-7: Reduction in Aquatic Habitat Suitability as a Result of the Deterioration of Water Quality

Compared to Salinity Reduction Option 1A, the primary difference for Option 1B would result from breach of Pond 3 levees that would increase the short-term magnitude of higher salinity, reduce the duration of higher salinity, and focus the timing of saline discharge to coincide with a period of relatively high outflow and decreasing salinity in the receiving water body. The breach of Pond 3 would occur following a high streamflow event that reduces salinity in the Napa River (Figure 4-9). The increase in salinity in the Napa River in response to high saline flow from Pond 3 could increase salinity to approximately 7 ppt, which would dissipate to less than 5 ppt within 48 hours (Philip Williams and Associates (2002b). Prior to the high streamflow, however, salinity in the Napa River was higher than the short-term maximum in response to the breach. The increase in salinity is relatively local, affecting an area extending approximately 0.5 mile upstream and downstream of the Pond 3 breach. The increase in salinity attributable to the breach occurs immediately following an equivalent or greater rate of decrease in salinity, and the area affected is relatively local. The biological effect is likely minimal because the organisms present would of necessity be either tolerant of a wide range in salinity (e.g., benthic organisms) or sufficiently mobile to move quickly to suitable salinity conditions. The area affected and the duration of effect are relatively small.

Option 1B would result in a more rapid rate of desalination in the ponds than would Salinity Reduction Options 1A and 2 and could avoid chronic local effects associated with long-term salinity reduction options. However, potential adverse effects of salinity reduction in the remaining ponds on aquatic habitat suitability and fish populations are considered significant. Implementation of the following mitigation measures would reduce this impact to a less-than-significant level:

- WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring";
- WQ-3, "Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements";
- WQ-4, "Monitor Pond Water Quality and Use Adaptive Management"; and
- A-3, "Assess and Maintain Salinity Levels Protective of Aquatic Resources."

Measures WQ-2, WQ-3, and WQ-4 are described in Chapter 4, "Water Quality." Measure A-3 is described under Salinity Reduction Option 1A.

7.2.4.4 Impact A-8: Disturbance of Substrate and Associated Benthic Organisms during Construction Activities

The construction of the control structures, levee maintenance, and levee breaching would require movement of substrate, which could disturb local benthic organisms. Recolonization of the area by benthic organisms is expected to occur shortly after construction is completed. This disturbance would be short-term, resulting in less-than-significant effects on benthic organisms. This impact is considered less than significant. No mitigation is required.

7.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C are nearly the same as those under Salinity Reduction Option 1B (Impacts A-5, A-6, and A-8). The primary difference between Option 1C and Option 1B is the breach of Pond 4, as well as Pond 3, during high streamflow events as described below.

7.2.5.1 Impact A-7: Reduction in Aquatic Habitat Suitability as a Result of the Deterioration of Water Quality

Compared to Salinity Reduction Option 1B, the primary differences for Option 1C result from breaching Pond 3 and Pond 4/5 levees. The breach of Ponds 3 and 4 would increase the short-term magnitude of higher salinity, reduce the duration of higher salinity, and focus the timing of saline discharge to coincide with a period of relatively high outflow and decreasing salinity in the receiving water body. Biological effects are similar to those described for Salinity Reduction Option 1B and are likely minimal because organisms present would of necessity be either tolerant of a wide range in salinity (i.e., benthic organisms) or sufficiently mobile to move to suitable salinity conditions. The increase in the Napa River would be approximately 18 ppt dropping to approximately 12 ppt in 48 hours and dissipating to less than 5 ppt within 2 weeks. The area affected by the increase in salinity would be approximately 2.5 miles (4,000 meters) along the Napa River (Figure 7-1).

Salinity Reduction Option 1C would result in a more rapid rate of desalination in Ponds 3 and 4 than would Salinity Reduction Options 1A and 2 and could avoid chronic local effects associated with long-term salinity reduction options. However, potential adverse effects of salinity reduction in the remaining ponds on aquatic habitat suitability and fish populations are considered significant. Implementation of the following mitigation measures would reduce this impact to a less-than-significant level:

- WQ-2, “Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring”;
- WQ-3, “Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements”;
- WQ-4, “Monitor Pond Water Quality and Use Adaptive Management”; and
- A-3, “Assess and Maintain Salinity Levels Protective of Aquatic Resources.”

Measures WQ-2, WQ-3, and WQ-4 are described in Chapter 4, “Water Quality.” Measure A-3 is described under Salinity Reduction Option 1A.

7.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 are nearly the same as those under Salinity Reduction Option 1A for Impacts A-5, A-6, and A-8. Impact A-7 is slightly different and is described below. Under this option, the alteration of water quality resulting from project discharge would affect San Pablo Bay, a typically high saline environment, instead of Napa Slough. Ponds 7, 7A, and 8, the high salinity and bittern ponds, would be discharged through Ponds 6, 6A, 2, 1A, and 1 and then into San Pablo Bay. Ponds 3, 4, and 5 would be discharged to the Napa River. Construction and entrainment effects would be similar to those identified in Salinity Reduction Option 1A.

7.2.6.1 Impact A-7: Reduction in Aquatic Habitat Suitability because of the Deterioration of Water Quality

The effects on the Napa River would be less than those under Option 1A because less project water would be discharged into the river, but implementation of Mitigation Measure A-3, "Assess and Maintain Salinity Levels Protective of Aquatic Resources," would reduce the impact on delta smelt and other fish species to less than significant. This measure is described under Salinity Reduction Option 1A.

Water quality in Ponds 1, 1A, and 2 could be substantially degraded by diluting and mixing bittern in these ponds before discharging it to San Pablo Bay. Bittern dilution would occur only at approximately 1:40, or 2 to 2.5 times the allowable open water discharge concentration. This elevated discharge of bittern could adversely affect aquatic habitat, creating unsuitable conditions for fish and aquatic invertebrates. Therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level.

San Pablo Bay forms shallow open water with extensive mudflats and marshes along its northern borders. It contains a large volume of water, receiving inflow from Suisun Bay, as well as freshwater systems including the Napa River. Freshwater inflows are usually higher during the rainy season, from November to April, but the level of inflow varies from year to year. San Pablo Bay is so saline that it is unlikely to support delta smelt and splittail except for a short duration during the wettest years when these species are carried downstream.

The effect of discharging higher salinity water to San Pablo Bay is expected to be negligible for aquatic resources because of the species' ability to avoid the discharge and because the discharge would not affect the overall salinity level of San Pablo Bay. Therefore, the impact on San Pablo Bay is considered less than significant. No further mitigation is required.

7.2.7 Water Delivery Option

7.2.7.1 Impact A-6: Short-Term Reduction in Aquatic Habitat Suitability during Construction Activities

Water Delivery Project Component

Construction of the Sonoma Pipeline would cause no reduction in fish populations or aquatic habitat during creek crossings because construction activities would be conducted using jack-and-bore or other trenchless techniques, and erosion control measures as outlined in Chapter 4, "Water Quality," would be implemented. SVCSD currently releases its treated wastewater into Schell and Hudeman Sloughs during the wet season. This incremental loss of water source would only occur during the wet season and is not expected to result in a substantial overall reduction in the amount of aquatic species habitat or species abundance in the subject sloughs. This impact is considered less than significant. No mitigation is required.

Construction of the Napa Pipeline would cause no degradation or reduction in fish populations or aquatic habitat in all but a single drainage because construction activities would be conducted using jack-and-bore or other trenchless techniques or bridge attachment methods (as on the Carneros Creek crossing). An unnamed drainage on the Stanly property would be crossed using open-trench methods. This drainage is ephemeral and would be crossed only when dry, thereby avoiding any impacts on aquatic habitat. Also, erosion control measures as outlined in Chapter 4, "Water Quality," would be implemented along the Napa Pipeline. NSD currently releases its treated wastewater into the Napa River during the wet season and only when a 10:1 dilution can be achieved. The loss of this water source to the Napa River would not substantially reduce aquatic species habitat or abundance. This impact is considered less than significant. No mitigation is required.

Construction of the CAC pipeline would cause no degradation or reduction in fish populations or aquatic habitat because construction activities would use an existing pipeline to cross the Napa River, thereby avoiding the need for construction in aquatic habitat. Also, erosion control measures as outlined in Chapter 4, "Water Quality," would be implemented. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

The exact alignments and construction methods for the potential future pipelines have not yet been determined. It is anticipated that the use of jack-and-bore or other trenchless methods would be used to some degree on most, if not all, of the potential future pipelines in order to reduce or avoid potential impacts on waterways. At present, however, there are no specific construction plans. Therefore, there is the potential that pipeline construction would occur directly across creeks and substantially reduce or degrade aquatic species habitat and species abundance. This impact is considered significant. Implementation of Mitigation Measure A-4 would reduce this impact to a less-than significant level.

The WWTPs operated by the LGVSD, Novato SD, and the City of Petaluma currently release their treated wastewater into Gallinas and Miller Creek and the Petaluma and Napa Rivers, respectively. The loss of this water source to Gallinas and Miller Creeks and the Petaluma River would not substantially reduce aquatic species habitat and abundance.

Mitigation Measure A-4: Use Trenchless Technology during Construction to Protect Aquatic Species

Jack-and-bore or other trenchless methods will be used for the crossing of existing creeks and streams by potential future pipelines.

7.2.7.2 Impact A-9: Substantial Interference with the Movement or Migration of Fish Species

Water Delivery Project Component

Installation of the Sonoma Pipeline would not affect the movement or migration of fish species at creek crossings because construction activities would be conducted using jack-and-bore or other trenchless techniques. Implementation of the Water Delivery Option from SVCSD would remove all wastewater discharges into Schell Slough and the majority of discharges into Hudeman Slough. This incremental loss of water source would occur only during the wet season and is not expected to result in a substantial overall reduction in the amount of aquatic habitat for fish movement and migration in the subject sloughs. Therefore, this impact is considered less than significant. No mitigation is required.

Installation of the Napa Pipeline would not affect the movement or migration of fish species at creek crossings in all but a single drainage because construction activities would be conducted using jack-and-bore or other trenchless techniques or bridge attachment methods (as on the Carneros Creek crossing). An unnamed drainage on the Stanly property would be crossed using open-trench methods. This drainage is ephemeral and would be crossed only when dry, thereby avoiding any impacts to the movement or migration of fish species. The removal of wastewater discharge to the Napa River would not have any impact because of the required 10:1 dilution rate. Therefore, this impact is considered less than significant. No mitigation is required.

Installation of the CAC Pipeline would not affect the movement or migration of fish species at creek crossings because construction activities would use an existing pipeline to cross the Napa River, thereby avoiding the need for construction in aquatic habitat. This impact is considered less than significant. No mitigation is required.

Water Delivery Program Component

The exact alignments and construction methods for the Program Component pipelines have not yet been determined. It is anticipated that the use of jack-and-bore or other trenchless methods would be used to some degree on most, if not all, of the potential future pipelines to reduce or avoid potential impacts on waterways. At present, however, there are no specific plans, provisions, or commitments to use jack-and-bore or other trenchless methods for those potential future pipelines; hence, there is the potential that pipeline construction would occur directly across creeks and streams and that impacts on the movement or migration of fish species would occur. This impact is considered significant. Implementation of Mitigation Measure A-4, "Use Trenchless Technology during Construction to Protect Aquatic Species," would reduce this impact to a less-than-significant level. This measure is described under Impact A-6 above.

7.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

7.2.8.1 Beneficial Impact A-10: Substantial Increase in Habitat Area and Types

Many aquatic species prefer shallow-water conditions. For example, splittail require shallow habitat for spawning and larval rearing. This option would improve habitat area and complexity. The project would result in the reestablishment of natural structural features (i.e., increased marsh and shallow and deepwater areas), which would potentially reactivate and maintain ecological processes that sustain healthy fish, wildlife, and plant populations.

The restored habitat types under this option would include substantial new subtidal habitat.

This option would result in a greater variety of slough channel sizes, a large increase in slough habitat, and greater connections among San Pablo Bay, the Napa River, and the tidal salt marsh, which would be beneficial to estuarine fish, including the listed fishes, as well as other aquatic species (e.g., Dungeness crab). There would be large tracts of tidal marsh that extend up the Napa River that allow fish and wildlife species to adjust to changes in salinity that occur seasonally and over longer periods because of variations in precipitation.

This option would also improve tidal circulation throughout the system, improving water quality. It would also greatly increase production of organic detritus by tidal marshes, increasing the ecological productivity of San Pablo Bay. Finally, this option would provide a natural, self-sustaining system that could adjust to naturally occurring changes in physical processes with minimum ongoing intervention.

The provision of cover and rearing habitat as a result of this option is considered a beneficial impact. No mitigation is required.

7.2.8.2 Impact A-11: Short-Term Construction-Related Impacts

Impacts on aquatic resources under this option are similar to those under Salinity Reduction Options 1 and 2. Under this option, there would be construction involved in removing intake and outfall structures and replacing them with breaches that provide for maximum tidal exchange; breaching levees in areas with minimal existing marsh, and near historical channels to encourage the scouring of remnant slough channels; filling the borrow ditches adjacent to levee breaches with sediment to keep them from capturing tidal circulation; and regrading select unneeded levees at or slightly above MHHW.

This impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described in Chapter 4, "Water Quality."

7.2.8.3 Impact A-12: Stranding of Fish in Restored Tidal Habitat

Once the ponds are opened up for use by aquatic organisms, there is a potential for stranding in pans (areas that are disconnected at low tide). Depth, water temperature conditions, and salinity would limit the use of these areas and provide cues for movement out of the marsh habitat on declining tides. This is a natural condition and occurs in other tidal marsh, mudflat, and shallow-water areas, and the pans are reinundated on the next incoming tide. The design of borrow ditch blocks also minimizes potential for stranding in borrow ditches that surround the ponds. Therefore, this impact is considered less than significant. No mitigation is required.

7.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

The impacts under this option are nearly the same as those under Habitat Restoration Option 1 for Beneficial Impact A-10 and Impact A-12. Impact A-11 is slightly different and is described below.

7.2.9.1 Impact A-11: Short-Term Construction-Related Impacts

This impact is nearly the same as under Habitat Restoration Option 1 except that construction of the new levee in Pond 2 would require in-water construction. This impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described in Chapter 4, "Water Quality."

7.2.10 Habitat Restoration Option 3: Pond Emphasis

The impacts under this option are nearly the same as those under Habitat Restoration Option 1 for Beneficial Impact A-10 and Impact A-12. Impact A-11 is slightly different and is described below.

7.2.10.1 Impact A-11: Short-Term Construction-Related Impacts

This impact is nearly the same as that under Habitat Restoration Option 1 except that improving the levee between Ponds 4 and 5 would require in-water construction. This impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described in Chapter 4, "Water Quality."

7.2.11 Habitat Restoration Option 4: Accelerated Restoration

The impacts under this option are nearly the same as those under Habitat Restoration Option 1 for Beneficial Impact A-10 and Impact A-12. Impact A-11 is slightly different and is described below.

7.2.11.1 Impact A-11: Short-Term Construction-Related Impacts

This impact is nearly the same as that under Habitat Restoration Option 1 except that there would be more active management in the development of the different habitat types. Increasing the number and length of starter channels and importing sediment are proposed under Habitat Restoration Option 4. These enhanced design features would result in increased amounts of construction in the ponds but could shorten the period prior to realizing restoration benefits. The construction impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would reduce this impact to a less-than-significant level. This measure is described in Chapter 4, "Water Quality."