
1 4.1 BIOLOGICAL RESOURCES

2 4.1.1 Environmental Setting

3 This section of the Environmental Impact Report (EIR) identifies potential impacts to
4 biological resources, principally fish and aquatic invertebrates, and describes mitigation
5 measures to reduce significant Project impacts associated with the proposed
6 San Francisco Bay and Delta Sand Mining Project (Project). The proposed Project would
7 extend existing sand mining operations by Hanson Marine Operations (Hanson) and
8 Jerico Products, Inc./Morris Tug & Barge (Jerico) (the applicants) for another 10 years,
9 and requires leases from the California State Lands Commission (CSLC) and approvals
10 from other agencies (see Section 1.3, Permits, Approvals, and Regulatory Requirements,
11 in Section 1.0, Introduction).

12 The approach used in this analysis relies upon recent available scientific studies of
13 marine communities in the San Francisco Bay-Delta, including: regional biological and
14 ecological habitat reports (National Oceanic and Atmospheric Administration [NOAA]
15 2007); long-term regional studies such as the ongoing Regional Monitoring Program for
16 Water Quality in San Francisco Estuary (RMP); the California Department of Fish and
17 Game's (CDFG) San Francisco Bay Study (CDFG 2000-2007); the 2009 Interagency
18 Ecological Program (IEP) for the San Francisco Estuary (Estuary); and other California
19 Environmental Quality Act (CEQA) documents (Chambers Group, Inc. 2007; Jones and
20 Stokes 2003). Information on terrestrial biological resources such as the California
21 Natural Diversity Database (CNDDDB) (CDFG 2009a) and other published literature were
22 also reviewed. The discussion below summarizes the information presented in these
23 documents, which may be consulted for additional detail. In addition, Applied Marine
24 Sciences (AMS) performed two studies in support of the EIR analysis: a
25 characterization of sediment and invertebrates within and outside the CSLC lease areas
26 (AMS 2009a [Appendix F]); and an assessment of fish and invertebrate entrainment¹
27 effects from commercial aggregate sand mining (AMS 2009b [Appendix E]).

28 Biological Communities

29 The San Francisco Bay-Delta is the second largest estuary in the United States and
30 supports numerous aquatic habitats and biological communities. It encompasses
31 479 square miles, including shallow mudflats. San Francisco Bay is divided into four

¹ The term "entrainment" as used in this assessment refers to the direct uptake of aquatic organisms by the suction created at the hydraulic drag head and in the water used to create the hydraulic lift.

1 main basins: South Bay, Central Bay, San Pablo or North Bay, and Suisun Bay. The
2 discussion and assessment in this EIR of aquatic habitats and associated biota for the
3 San Francisco Bay-Delta focus primarily on the following regions:

- 4 • Central Bay, which is located between the Oakland Bay Bridge and the
5 Richmond-San Rafael Bridge and connects to the Pacific Ocean through the
6 Golden Gate;
- 7 • North Bay/San Pablo Bay, which stretches between the Richmond-San Rafael
8 Bridge and the Carquinez Bridge; and
- 9 • Suisun Bay, a large shallow embayment that lies east of the Carquinez Strait
10 which transforms into the diked wetlands of the western Delta.

11 *Project Site*

12 As discussed in Section 2.0, Project Description, commercial sand mining occurs in the
13 western portion of Central Bay, at Middle Ground Shoal in Suisun Bay, and along the
14 main navigation channel in the western Delta. San Francisco Bay Conservation and
15 Development Commission (BCDC) permit conditions allow sand mining in water depths
16 greater than 30 feet in the Central Bay, with 90 feet as the physical limit of mining
17 equipment. Mining leases in the Central Bay are roughly bounded by Angel Island to the
18 east, the Tiburon Peninsula and Richardson Bay to the north, the Golden Gate to the
19 west, and the San Francisco Embarcadero to the south (see Figure 2-1a). In the Suisun
20 Bay and Delta area, one State lease (consisting of two segments) (see Figure 2-1b) and
21 one privately owned parcel (Middle Ground Shoal; see Figure 2-2) are located east of
22 Carquinez Strait; mining in these areas occurs primarily along the upper edge of the
23 shipping channel, along a band of the channel where decreasing water velocity allows
24 coarser sand fractions to settle out.

25 The marine habitats where sand mining occurs consist of open water pelagic (midwater)
26 habitat and soft substrate benthic (bottom) habitat. No mining occurs in the nearshore
27 subtidal (soft or hard substrate) or intertidal habitats, within submerged aquatic
28 vegetation beds or emergent saltwater marsh or wetlands. The following sections
29 describe the marine habitats and associated biota within the Bay-Delta that could be
30 affected by sand mining operations.

31 **Central Bay.** Spanning the entrance to the Pacific Ocean, Central Bay contains the
32 deepest areas of the Estuary and the most natural and human-made hard bottom
33 substrate (NOAA 2007). Beneath the Golden Gate, the seafloor reaches depths of
34 361 feet with strong tidal currents running through the Golden Gate and throughout

1 Central Bay (NOAA 2007). These strong tidal flows maintain deeper water depths,
2 despite the large volume of sediment that has historically moved through the Bay from
3 the Delta and local streams. In the western part of Central Bay, where sand mining
4 occurs, the substrate is mostly coarse mobile sand intermixed with pebble, cobble and
5 gravel (NOAA 2007; AMS 2009a). Pockets of mud are also interspersed with the
6 coarser sediment material. Typically, Central Bay waters are colder and saltier than
7 other regions of the Bay-Delta.

8 **Suisun Bay and Western Delta.** Suisun Bay is a large shallow embayment that lies
9 east of the Carquinez Strait and consists of two shallow bays (Honker and Grizzly), the
10 deeper Suisun Bay, and a deep water channel connecting them. Its proximity between
11 the western Delta and North (San Pablo) Bay results in strong tidal flow of ocean water
12 mixed with freshwater flows from the Sacramento, San Joaquin, and Napa Rivers. As a
13 consequence, this estuarine water tends to be mesohaline (moderately saline, ranging
14 from 5 to 18 parts per thousand [ppt]) (NOAA 2007).

15 The western Delta, generally described as the area near the confluence of the
16 Sacramento and San Joaquin Rivers, is subject to substantial tidal effects, although salt
17 intrusion is rare (Herbold and Moyle 1989). Sediments tend to be finer sands, silts and
18 clays in the shallows and shoals and graded along the main navigation channels where
19 sand mining occurs (NOAA 2007; AMS 2009a). Water temperatures in the western
20 Delta fluctuate more than in other regions of the Bay-Delta because of its proximity to
21 seasonally colder Sacramento and San Joaquin freshwater flow and its greater distance
22 from and influence by marine waters through the Golden Gate (NOAA 2007).

23 *Open Water Pelagic Environments*

24 The open water pelagic environment is the predominant habitat of the Bay-Delta and
25 includes the area between the water surface and the seafloor. The physical conditions
26 of the open water environment are constantly changing with tidal flow and season. Each
27 of the main basins is heavily influenced by ocean water brought into the Bay by the daily
28 tidal cycle and by freshwater flow into the Bay by the many rivers and tributaries that
29 flow through the Bay-Delta. The pelagic environment is predominantly inhabited by
30 planktonic² organisms floating and swimming in the water, fish, marine birds, and
31 marine mammals. These communities are described below.

² Plankton are generally small, passively or weakly moving organisms, including algae, larval invertebrates and protozoans that float or drift in great numbers in salt water, especially at or near the surface.

1 **Plankton Community.** Due to its proximity to the ocean, the open water environment of
2 Central Bay is most like the open water environment along the coast. With a lack of
3 significant freshwater inflow, the phytoplankton (microscopic plant) and zooplankton
4 (microscopic animal) communities are almost entirely marine in composition and
5 seasonality. Phytoplankton species throughout the Bay-Delta are typically tolerant of broad
6 salinity and temperature ranges because of the normal annual fluctuations between
7 marine and freshwater influences (NOAA 2007). The species composition and distribution
8 of phytoplankton communities in Central Bay and Suisun Bay are beyond the scope of this
9 EIR section, and are discussed in detail in the NOAA (2007) *Report on the Subtidal*
10 *Habitats and Associated Biological Taxa in San Francisco Bay.*

11 The zooplankton community consists of small invertebrate organisms that spend their
12 entire life cycle in the water column and predominantly feed on phytoplankton species and
13 small suspended organic particles. These include microzooplankton, copepods,
14 cladocerans, and the larvae of benthic and pelagic invertebrate animals. Other
15 components of the zooplankton community include larval forms of shrimp, krill, barnacles,
16 worms, and other invertebrates. Zooplankton species typically change seasonally with a
17 few species being present throughout the year. Likewise, the abundance and distribution
18 of zooplankton species vary substantially within the Estuary in response to seasonal
19 cycles and environmental factors such as salinity gradients. In the high-salinity portions of
20 Central Bay, the primary zooplankton are calanoid copepods (*Acartia clausi*, *A. tonsa*, and
21 *Paracalanus parvus*). In the low-salinity regions of Suisun Bay and the western Delta the
22 primary zooplankton are also calanoid copepods (*Eurytemora affinis* and *A. clausi*) and the
23 opossum shrimp (*Neomysis mercedis*). The cladocerans (*Daphnia pulex* and *D. parvula*),
24 and calanoid copepods (*Diaptomus* spp. and *Limnocalanus macrurus*) are the primary
25 zooplankton species in the freshwater portions of the Delta (Hanson Environmental 2004;
26 NOAA 2007). Zooplankton taxa found throughout the Bay include *A. clausi*, *A.*
27 *californiensis*, *Oithona davisae*, harpacticoid copepods, tintinnids, and the larvae of
28 gastropods, bivalves, barnacles, and polychaetes (Ambler et al. 1985).

29 Meroplankton are marine organisms that are planktonic for a part of their life cycle,
30 usually the larval stage. They predominantly occur in North Bay and originate from adult
31 fish species including Pacific herring (*Clupea pallasii*), longfin smelt (*Spirinchus*
32 *thaleichthys*), and plainfin midshipmen (*Porichthys notatus*) (NOAA 2007).

33 **Pelagic Fish Community.** Forty-six fish species have been documented to use Central
34 Bay pelagic waters; three of these 46 species account for more than 98 percent of the

1 total abundance of fish regularly encountered by CDFG during their monthly IEP fish
2 monitoring program between 2000 and 2007 (Table 4.1-1) (CDFG 2000-2007).

3 **Table 4.1-1. Pelagic Fish Community Composition for Central Bay Based on 2000**
4 **to 2007 Midwater Trawl Data (Fish/Hectare-Meter)^{1,2}**

Species	Common Name	2000 to 2007 Mean	Percent Composition
<i>Engraulis mordax</i>	Northern anchovy	575	90.8%
<i>Clupea pallasii</i>	Pacific herring	35	5.5%
<i>Sardinops sagax</i>	Pacific sardine	11	1.8%
<i>Atherinopsis californiensis</i>	Jacksmelt	3	0.5%
<i>Cymatogaster aggregata</i>	Shiner surfperch	3	0.4%
<i>Atherinops affinis</i>	Topsmelt	1	0.2%
<i>Peprilus simillimus</i>	Pacific pompano	1	0.2%
<i>Hyperprosopon argenteum</i>	Walleye surfperch	1	0.2%

¹ Species also present with less than 0.2 percent of total abundance include: American shad, barred surfperch (*Amphistichus argenteus*), bat ray (*Myliobatis californica*), bay goby (*Lepidogobius lepidus*), bay pipefish (*Syngnathus leptorhynchus*), big skate (*Raja binoculata*), black perch (*Embiotoca jacksoni*), brown smoothhound (*Mustelus henlei*), California grunion (*Leuresthes tenuis*), California halibut, cheekspot goby (*Ilypnus gilberti*), Chinook salmon (*Oncorhynchus tshawytscha*), diamond turbot (*Hypsopsetta guttulata*), English sole (*Parophrys vetulus*), kelp greenling (*Hexagrammos decagrammus*), leopard shark (*Triakis semifasciata*), lingcod (*Ophiodon elongatus*), longfin smelt, Pacific electric ray (*Torpedo californica*), Pacific sanddab (*Citharichthys sordidus*), Pacific staghorn sculpin (*Leptocottus armatus*), Pacific tomcod (*Microgadus proximus*), pile perch (*Rhacochilus vacca*), plainfin midshipman, queenfish (*Seriphus politus*), steelhead trout, redbtail surfperch (*Amphistichus rhodoterus*), river lamprey (*Lampetra ayresii*), speckled sanddab (*Citharichthys stigmaeus*), starry flounder, striped bass, surf smelt (*Hypomesus pretiosus*), threadfin shad, threespine stickleback, white croaker, white seaperch (*Phanerodon furcatus*), whitebait smelt (*Allosmerus elongatus*), and yellowfin goby.

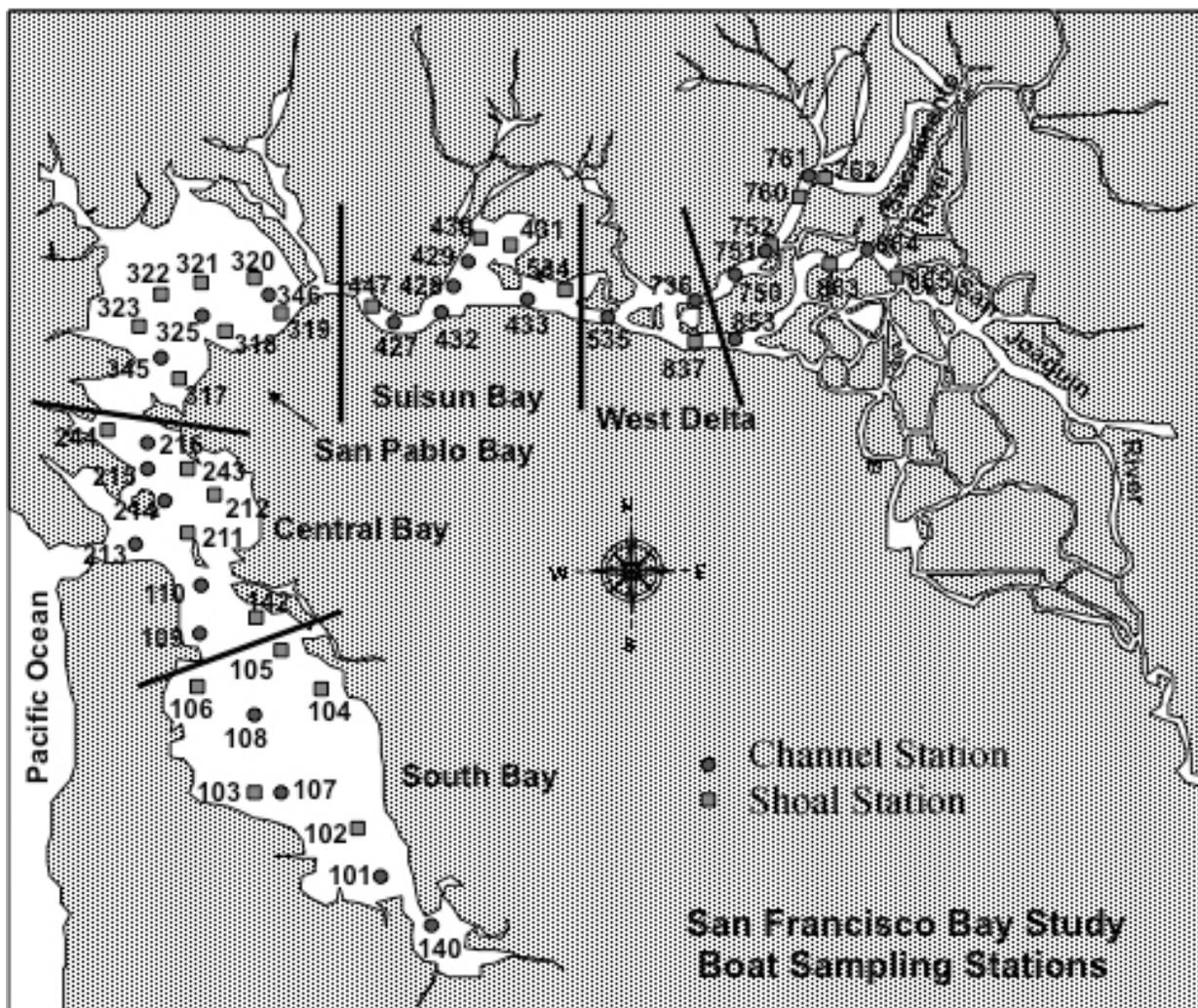
² Hectare-Meter refers to a hectare-sized area 1 meter deep.

Source: CDFG 2000-2007

5 Figure 4.1-1 illustrates the station locations for the Bay-Delta Fish Monitoring Program
6 conducted by CDFG as part of the IEP for the Bay-Delta.

7 Three species that dominate the pelagic fish community in Central Bay are northern
8 anchovy (*Engraulis mordax*), which accounts for up to 91 percent of those fish inhabiting
9 the water column, Pacific herring, and Pacific sardine (*Sardinops sagax*). Other common
10 fish include jacksmelt (*Atherinopsis californiensis*), shiner surfperch (*Cymatogaster*
11 *aggregata*), topsmelt (*Atherinops affinis*), Pacific pompano (*Peprilus simillimus*), walleye
12 surfperch (*Hyperprosopon argenteum*), California grunion (*Leuresthes tenuis*), and white
13 croaker (*Genyonemus lineatus*). The remaining 36 species individually account for less
14 than 0.1 percent of the fish species present (CDFG 2000-2007).

15



1
 2 Source: Hieb, in AMS 2009b **Figure 4.1-1**
 3 Location of CDFG Trawling Stations

4 Other important species or species that are observed in Central Bay pelagic waters
 5 include longfin smelt and California halibut (*Paralichthys californicus*) (CDFG 2000-2007).
 6 The presence of more outer coast species in Central Bay compared to other regions of the
 7 Bay-Delta is a result of the Central Bay's proximity to the Golden Gate channel and Pacific
 8 Ocean.

9 In Suisun Bay, the pelagic fish community is dominated by northern anchovy, longfin
 10 smelt, striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), Chinook
 11 salmon (*Oncorhynchus tshawytscha*), Pacific herring, threadfin shad (*Dorosoma*
 12 *petenense*), delta smelt (*Hypomesus transpacificus*), yellowfin goby (*Acanthogobius*
 13 *flavimanus*), splittail (*Pogonichthys macrolepidotus*), and plainfin midshipman

1 (Table 4.1-2). These 11 taxa account for 98 percent of all taxa present in Suisun Bay
 2 between 2000 and 2007 (CDFG 2000-2007). Other common fish taxa include starry
 3 flounder (*Platichthys stellatus*), Pacific staghorn sculpin (*Leptocottus armatus*), white
 4 croaker, threespine stickleback (*Gasterosteus aculeatus*), Shokihaze goby (*Tridentiger*
 5 *barbatus*), topsmelt, white sturgeon (*Acipenser transmontanus*), shimofuri goby
 6 (*Tridentiger bifasciatus*), and common carp (*Cyprinus carpio*). Another 12 species,
 7 including steelhead trout (*Oncorhynchus mykiss*), a species listed as threatened under
 8 the Federal Endangered Species Act (ESA), comprise less than 0.1 percent of fish
 9 present in Suisun Bay (Table 4.1-2).

10 **Table 4.1-2. Pelagic Fish Community Composition For Suisun Bay Based on 2000**
 11 **to 2007 Midwater Trawl Data (Fish/Hectare-Meter)¹**

Species	Common Name	2000 to 2007 Mean	Percent Composition
<i>Engraulis mordax</i>	Northern anchovy	6.6	33.0%
<i>Spirinchus thaleichthys</i>	Longfin smelt	4.1	20.4%
<i>Morone saxatilis</i>	Striped bass	3.3	16.2%
<i>Alosa sapidissima</i>	American shad	2.3	11.5%
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	0.9	4.7%
<i>Clupea pallasii</i>	Pacific herring	0.7	3.5%
<i>Dorosoma petenense</i>	Threadfin shad	0.4	2.2%
<i>Hypomesus transpacificus</i>	Delta smelt	0.4	1.9%
<i>Acanthogobius flavimanus</i>	Yellowfin goby	0.4	1.8%
<i>Pogonichthys macrolepidotus</i>	Splittail	0.3	1.4%
<i>Porichthys notatus</i>	Plainfin midshipman	0.2	0.8%

¹ Species present with less than 0.4 percent of total abundance include: starry flounder, Pacific staghorn sculpin, white croaker, threespine stickleback, Shokihaze goby, topsmelt, white sturgeon, common carp, shimofuri goby, steelhead trout, jacksmelt, bay goby (*Lepidogobius lepidus*), bluegill (*Lepomis macrochirus*), English sole (*Parophrys vetulus*), hardhead (*Arius felis*), Mississippi silverside (*Menidia audens*), Pacific lamprey (*Lampetra tridentata*), Pacific pompano, river lamprey (*Lampetra ayresii*), shiner surfperch, and speckled sanddab (*Citharichthys stigmæus*).

Source: CDFG 2000-2007

12 The presence of sculpin, gobies, and carp in midwater sampling events by CDFG in
 13 Suisun Bay is the result of the shallow water depths throughout much of this area. The
 14 pelagic fish community in the western Delta is similar in composition and dominant species
 15 to Suisun Bay, with one exception: the northern anchovy is a minor species (AMS 2009a).
 16 In recent years, the fish populations in the western Delta, Suisun Bay, and to a lesser
 17 degree San Pablo Bay, have changed significantly. Four of the dominant pelagic species,
 18 delta smelt, longfin smelt, striped bass, and threadfin shad have undergone significant

1 decline since 2000 (American Fisheries Society [AFS] 2007). The delta smelt is listed
2 under both the Federal and State ESAs. The longfin smelt is listed under the California
3 ESA but is not listed under the Federal ESA. This decline has, in part, been attributed to
4 the invasive Asian clam (*Corbula amurensis*) and severely altered water flow from the
5 Sacramento and San Joaquin Rivers (AFS 2007).

6 Northern anchovy are also protected under the Coastal Pelagic Fishes Management Plan.
7 Finally, the Project area is located within the established migration corridor for steelhead
8 trout adults and smolts. Both the main shipping channel and adjacent shallows are used
9 by migrating steelhead trout for movement and foraging. Although CDFG data (CDFG
10 2000-2007) did not identify steelhead trout in the Project area in any significant numbers,
11 individuals can be expected during migration periods.

12 Under the Pacific Coast Salmon Fishery Management Plan, the entire San Francisco Bay-
13 Delta Estuary has been designated as Essential Fish Habitat (EFH) for Spring-, fall/late
14 fall- and winter-run Chinook salmon (Pacific salmon) (Pacific Marine Fisheries Council
15 [PMFC] 2003). Winter- and spring-run Chinook salmon are listed under the Federal and
16 State ESAs as endangered and threatened, respectively. These areas serve as a
17 migratory corridor, holding area, and rearing habitat for both adult and juvenile salmon.
18 Likewise, the Pacific Pelagic Fishery Management Plan identifies the Bay-Delta as EFH
19 for fish managed under their program, which includes Pacific herring, northern anchovy,
20 and Pacific sardine (PMFC 1998).

21 **Marine Bird Community.** The San Francisco Bay-Delta is an important wintering and
22 stop-over site for the Pacific Flyway. More than 300,000 wintering waterfowl use the region
23 and associated ponds (NOAA 2007). Bird guilds that use the open waters of the Bay-Delta
24 include the diving benthivores, which feed in deeper water on benthic invertebrates;
25 dabblers, which feed in the upper water column of shallow subtidal areas; piscivores,
26 which feed on fish; and opportunistic predators (NOAA 2007). The majority of birds using
27 the Bay-Delta are bay and sea ducks.

28 The dominant marine birds regularly inhabiting or using the areas of the Bay-Delta where
29 sand mining occurs include cormorants (*Phalacrocorax* spp.), pigeon guillemot (*Cephus*
30 *columba*), herring gull (*Larus argentatus*), mew gull (*L. canus*), and California brown
31 pelican (*Pelecanus occidentalis californicus*). California brown pelican was recently
32 delisted but remains a Fully Protected species under the California Fish and Game Code
33 (Fish & G. Code, § 3511, subd. (b)(2)). Among the diving benthivores guild, canvasback
34 (*Aythya valisineria*), greater scaup (*A. marila*), lesser scaup (*A. affinis*), and surf scoter

1 (*Melanitta perspicillata*) are the most common, although canvasback abundance has
2 declined in recent years (NOAA 2007). Osprey (*Pandion haliaetus*) are also frequently
3 observed throughout the Bay-Delta (NOAA 2007).

4 **Marine Mammal Community.** Seven species of marine mammals occur within the Bay-
5 Delta. The harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), harbor
6 porpoise (*Phocoena phocoena*), and gray whale (*Eschrichtius robustus*) are the most
7 common that use the open waters of the Bay-Delta for migrating, foraging, and resting
8 (NOAA 2007). While these species typically concentrate their activities in Central Bay and
9 adjacent portions of South Bay and North Bay, some harbor seals, harbor porpoise, and
10 California sea lions travel throughout the Bay-Delta and up into the Sacramento River in
11 search of salmon and other forage. There are no major haul-outs or rookeries in the North
12 Bay for marine mammals. All these species are protected under the Federal Marine
13 Mammal Protection Act of 1972 (MMPA; 16 United States Code [U.S.C.] § 1361 et seq.).

14 Harbor seals are the only year-round residents of the Bay-Delta, with colonies located at
15 Castro Rocks in San Pablo Bay, Yerba Buena Island in Central Bay, and Mowry Slough in
16 South Bay (NOAA 2007). The harbor seal population is estimated to be between 500 and
17 700 individuals (NOAA 2007). Harbor seals forage throughout the Bay-Delta feeding on
18 schooling fish such as smelt, anchovies, herring, rockfish, sculpin, perch, and midshipmen,
19 along with squid and mysid shrimp. California sea lions use the Bay-Delta for refugia and
20 forage but do not pup or breed within the Estuary (NOAA 2007). Sea lions are most
21 prevalent in the Bay-Delta when migrating between their primary breeding areas in the
22 Farallon and California Channel Islands and when both Pacific herring and salmon are
23 present in the Bay-Delta in large numbers during spawning (NOAA 2007).

24 The harbor porpoise is a near-shore species that is commonly observed near the Golden
25 Gate channel and other areas of Central Bay. Individuals observed in San Francisco Bay
26 are believed to be of a distinct genetic stock, the San Francisco-Russian River Stock that
27 range between Point Arena and Monterey Bay (NOAA 2007). Some eastern Pacific gray
28 whales and humpback whales have been documented entering the Bay during their
29 annual migrations between Alaska and Mexico, often injured or lost, or pausing to feed in
30 soft sediments or seek shelter with their young (NOAA 2007). Eelgrass (*Zostera marina*)
31 is an important resource to all marine mammals that occur in the Bay as eelgrass beds
32 tend to concentrate food items and are an ideal place for harbor seals, sea lions and gray
33 whales to feed on schooling fishes during winter months when herring are in their highest
34 abundance in the Bay (NOAA 2007).

1 *Benthic and Demersal Environment*³

2 **Soft Sediment Habitat.** The primary bottom habitat in the sand mining lease areas is soft
3 bottom substrate with a combination of mud/silt/clay (particles 0.001 to 0.062 millimeter
4 [mm] in diameter), sand (particles 0.062 to 2.0 mm in diameter), and pebble/cobble
5 (particles 2 to 256 mm in diameter), with varying amounts of intermixed shell fragments.
6 Exposure to wave and current action, temperature, salinity, and light penetration
7 determines the composition and distribution of organisms within these soft sediments.
8 Most surveys and other information sources indicate unconsolidated sediments are
9 present throughout the Bay-Delta and are the most common substrate type in the Bay.
10 The locations where sand mining occurs in Central Bay and the Delta consist primarily of
11 coarser sand components with minimal silt and clay fractions. Small rocks, cobbles, gravel,
12 and shell debris are also present (AMS 2009a).

13 The soft gravel, sand and silt sediments of the Bay-Delta are subdivided into several
14 habitat categories, including channel edge, slough channel, main channel, and shallow
15 subtidal (NOAA 2007). Each of these soft-substrate habitat categories has different
16 ecological conditions that result in different benthic infaunal communities. Central Bay
17 contains primarily main channel and shallow subtidal shoal areas whereas Suisun Bay and
18 the western Delta contain all four categories (NOAA 2007). Sand mining occurs in main
19 channel or deep channel habitat in the Central Bay and main channel habitat in the Delta
20 mining leases. In the Delta mining sites, mining occurs along the upper edge of the
21 channel and not along the channel bottom where the finer sediments accumulate.

22 **Benthic Infauna and Epifauna.** The benthic invertebrate community can be generally
23 classified into infauna that live within the bottom substrate and epifauna that live on the
24 substrate. At any given site, these communities appear as a patchwork of different species
25 groups that are recovering from local disturbances such as sand or current movement.
26 Different invertebrate groups respond differently to environmental conditions and
27 disturbance, thus, the makeup of the invertebrate community reflects the quality and
28 character of the environment where the groups reside.

29 In its assessment of benthic infauna in Central Bay mining leases, AMS reported a low
30 diversity, low abundance community composed of 107 taxa which appeared to be heavily
31 influenced by sediment disturbance and instability (AMS 2009a). This sediment instability
32 is the result of the high currents that characterize the portion of Central Bay near the

³ The benthic zone is the ecological region that includes the sediment surface and subsurface. The demersal zone is the lowest portion of the water column that is near to and influenced by the seabed.

1 Golden Gate channel. AMS observed a region-wide community where the benthic infauna
2 community is dominated by nematodes, polychaetes, oligochaetes and nemertean, all of
3 which are worms, and amphipods (AMS 2009a). Total animal density was estimated at
4 about 2,000 individuals per square meter (m²), which is similar to recent findings in the
5 Alcatraz Shoal region of Central Bay (MEC and Cheney 1990). Other dominant taxa
6 reported by AMS included several native and introduced bivalves (clams) and the
7 holothurian sea cucumber (*Leptosynapta* spp.) (AMS 2009a).

8 Central Bay samples identified that dominant taxa were further observed to separate or
9 cluster into five sub-groups. One subgroup was characterized by high species diversity
10 with equally abundant amphipod, bivalve, and polychaete species (AMS 2009a); this
11 community was associated with the coarsest sands and gravels. A second subgroup, with
12 slightly higher species diversity, was dominated by the bivalve *Nutricula*, spp., followed by
13 polychaetes, amphipods, bivalves, and nematodes. The three remaining subgroups
14 showed extremely low species diversity; of these three subgroups, two were
15 overwhelmingly dominated by nematodes with a lesser abundance of polychaetes.

16 In Suisun Bay and the western Delta, the invertebrate benthic community in the Delta
17 channels is dominated in both abundance and biomass by two invasive clams, *Corbula*
18 *amurensis* and *Corbicula fluminea* (NOAA 2007). Other key species include polychaetes
19 and the small marine crustacean, *Nippoleucon hinumensis* (NOAA 2007). In its
20 assessment of the Delta mining leases, AMS observed the same overwhelming
21 dominance of the infauna by *C. amurensis* in Middle Ground Shoal and in the western
22 Delta mining leases (AMS 2009a). The less saline tolerant Asian clam, *C. fluminea*,
23 assumed dominance in the eastern and more freshwater areas of the mining leases.

24 **Megabenthos.** The dominant mobile crustaceans in Central Bay include blackspotted
25 shrimp (*Crangon nigromaculata*), bay shrimp (*Crangon franciscorum*), Dungeness crab
26 (*Cancer magister*), and the slender rock crab (*Cancer gracilis*), which may burrow into or
27 live on the benthos. Other species of shrimp are present in Central Bay but are
28 significantly reduced in individual abundance compared to the California bay and
29 blackspotted shrimps (NOAA 2007). All of these mobile invertebrates provide an important
30 food source for carnivorous fish, marine mammals, and birds in the San Francisco Bay
31 food web. They occur in large numbers throughout Central Bay, San Pablo Bay, and
32 South Bay. Dungeness crab use most of San Francisco Bay, as they do all estuaries along
33 the north Pacific coast, as an area for juvenile growth and development prior to returning
34 to the ocean as sexually mature adults (Tasto 1979; Pauley et al. 1989). They are present

1 in Suisun Bay in small numbers compared to other parts of the Bay-Delta, and infrequently
2 occur in the western Delta (AMS 2009b).

3 The abundance of blackspotted shrimp typically peaks from May through August, and
4 again from December to February (Hieb 1999). The bay shrimp is the most common
5 *Crangon* species in San Francisco Bay (NOAA 2007). A strong positive relationship has
6 been described between bay shrimp and freshwater outflow in spring (NOAA 2007; CDFG
7 1987); bay shrimp are most common in the Central Bay, most likely using San Francisco
8 Bay as an extension of their coastal habitat (Hieb 1999).

9 Large mobile invertebrates common in Suisun Bay include Dungeness crab, blackspotted
10 shrimp, a gastropod snail (*Ilyanassa obsoleta*), the American spider crab (*Pyromaia*
11 *tuberculata*) and the nudibranch (*Sakuraeolis enosimensis*) (NOAA 2007).

12 **Submerged Aquatic Vegetation.** Subtidal plants and submerged aquatic vegetation
13 occur throughout the Bay-Delta on both soft and hard substrate. Several species of green
14 algae and eelgrass (*Zostera marina*) occur on shallow unconsolidated subtidal habitat in
15 Central Bay (NOAA 2007). The green algae *Ulva* is commonly observed on exposed
16 mudflats; *Gracillaria* prefers quiet embayments like Richardson Bay and on the leeside of
17 islands, such as Angel and Alcatraz Islands (Silva 1979). Eelgrass, as a shallow subtidal
18 and intertidal flowering plant, inhabits bays, estuaries, and the leeside of islands, such as
19 Treasure, Angel, Yerba Buena, and Alcatraz Islands (Merkel & Associates 2004). The
20 largest eelgrass bed in Central Bay and the second largest in San Francisco Bay is
21 located in Richardson Bay; additional large beds can be found along the Tiburon
22 Peninsula; in Kiel Cove; on either side of Pt. Richmond and along the Richmond
23 breakwater; throughout the Emeryville flats and along the Emeryville Marina breakwater;
24 and adjacent to the Bay Bridge Toll Plaza (Merkel & Associates 2004). Bed locations and
25 size are determined by water depth and turbidity. Eelgrass can only become established in
26 areas of the Bay-Delta where water depth and turbidity allow light to penetrate to the
27 seafloor (Merkel & Associates 2004). As a result, no eelgrass beds are located where
28 sand mining occurs because of the deeper water depths.

29 Although eelgrass is the dominant submerged plant throughout most of San Francisco
30 Bay, it has limited presence east of the Carquinez Strait (Merkel & Associates 2004). The
31 dominant submerged aquatic vegetation beds in Suisun Bay include widgeon grass
32 (*Ruppia maritima*) and Sago pondweed (*Potamogeton pectinatus*), which occur
33 surrounding Simmons, Ryer, and Roe Islands and in Little Honker Bay. Sago pondweed

1 and widgeon grass are identified as important food sources for waterfowl in North
2 America, although their importance and role in the Estuary is unknown (NOAA 2007).

3 **Demersal Fish.** Many different fish species spend all or part of their life cycle in
4 association with the demersal zone, including flatfish, gobies, poachers, eelpouts, and
5 sculpins, which all live in close association with the benthos during their sub-adult and
6 adult lives. Others, such as Chinook salmon, steelhead trout, and longfin smelt use the
7 benthos for foraging. In total, 71 demersal fish species were collected during CDFG
8 surveys between 2000 and 2007 (CDFG 2000-2007); of these 21 species, speckled
9 sanddab (*Citharichthys stigmaeus*), bay goby (*Lepidogobius lepidus*), plainfin midshipmen,
10 Pacific staghorn sculpin, shiner surfperch, white croaker, longfin smelt, Pacific tomcod
11 (*Microgadus proximus*), and cheekspot goby (*Ilypnus gilberti*) accounted for 96 percent of
12 the species present in the survey period (Table 4.1-3).

13 **Table 4.1-3. Demersal Fish Community Composition for Central Bay Based on**
14 **2000 to 2007 Otter Trawl Data (Fish/Hectare-Meter)¹**

Species	Common Name	2000 to 2007 Mean	Percent Composition
<i>Citharichthys stigmaeus</i>	Speckled sanddab	519	28.4%
<i>Lepidogobius lepidus</i>	Bay goby	424	23.2%
<i>Porichthys notatus</i>	Plainfin midshipman	301	16.5%
<i>Parophrys vetulus</i>	English sole	265	14.5%
<i>Leptocottus armatus</i>	Pacific staghorn sculpin	102	5.6%
<i>Cymatogaster aggregata</i>	Shiner surfperch	82	4.5%
<i>Genyonemus lineatus</i>	White croaker	23	1.3%
<i>Spirinchus thaleichthys</i>	Longfin smelt	22	1.2%
<i>Microgadus proximus</i>	Pacific tomcod	13	0.7%
<i>Ilypnus gilberti</i>	Cheekspot goby	11	0.6%
<i>Artedius notospilotus</i>	Bonyhead sculpin	9	0.5%

¹ Species with less than 0.5 percent of total abundance include bay pipefish, Pacific herring, Pacific sanddab, showy snailfish (*Liparis pulchellus*), California tonguefish (*Symphurus atricaudus*), saddleback gunnel (*Pholis ornate*), California halibut, curlfin sole (*Pleuronichthys decurrens*), yellowfin goby and brown smoothhound.

Source: CDFG 2000-2007

15 Other species of importance or concern present in Central Bay demersal environments
16 include Pacific herring and numerous anadromous species that spend their adult lives in
17 the open ocean, but use the San Francisco Bay Estuary on their way upriver to spawn and
18 as a rearing area for juveniles on their way down from their natal river to the open ocean.
19 Native anadromous species include Chinook salmon, steelhead trout, and both green

1 sturgeon (*Acipenser medirostris*) and white sturgeon. Introduced anadromous species
2 include striped bass and American shad (NOAA 2007).

3 Brown rockfish (*Sebastes auriculatus*) and surfperches (family *Embiotocidae*) are the most
4 common fishes associated with natural hard substrates (NOAA 2007). Shiner surfperch
5 move from South and North Bays to Central Bay as they mature (DeLeon 1999). During
6 winter months, Pacific herring enter euhaline (marine waters for which the salinity ranges
7 from 30 to 35 ppt) areas of San Francisco Bay to spawn during periods of low salinity
8 (NOAA 2007). Schools of adult herring enter the Bay during fall and winter, depositing
9 adhesive eggs onto submerged aquatic vegetation and hard bottom substrate (O'Farrell
10 and Larson 2005).

11 California halibut became common in San Francisco Bay in the 1980s and 1990s when
12 abundances increased, apparently as a result of a succession of warm water and El Niño
13 years (Baxter et al. 1999). Adult California halibut enter the Bay to forage and spawn, and
14 juveniles use intertidal sand and mud flats for refuge and feeding (Pearson and Owen
15 2001). California halibut is found from South Bay to the Carquinez Strait, but highest
16 juvenile catches are in South Bay (Greiner et al. 2005). The plainfin midshipman is a
17 demersal, marine fish that burrows into soft sediments during the day and moves into the
18 water column to feed at night (Fitch and Lavenberg 1971).

19 The demersal fish population in Suisun Bay is not as diverse as that in Central Bay. It
20 consists of over 39 species, but eight taxa accounted for 94 percent of total fish
21 abundance between 2000 and 2007 (Table 4.1-4) (CDFG 2000-2007).

22 Dominant species include striped bass, yellowfin goby, Shokihaze goby, Pacific staghorn
23 sculpin, longfin smelt, starry flounder, plainfin midshipman, and English sole (*Parophrys*
24 *vetulus*) (CDFG 2000-2007). Another 19 species account for 5 percent of the individuals
25 present throughout each year and include shimofuri goby, threespine stickleback,
26 American shad, river lamprey (*Lampetra ayresii*), Pacific lamprey (*Lampetra tridentata*),
27 splittail, bay goby, delta smelt, speckled sanddab, threadfin shad, Pacific herring, prickly
28 sculpin (*Cottus asper*), white sturgeon, white catfish (*Ictalurus catus*), California halibut,
29 sand sole (*Psettichthys melanostictus*), white croaker, Chinook salmon and shiner
30 surfperch; green sturgeon are also present, but are observed in low numbers (CDFG
31 2000-2007).

32

1 **Table 4.1-4. Demersal Fish Community Composition for Suisun Bay Based on**
 2 **2000 To 2007 Otter Trawl Data (Fish/Hectare-Meter)¹**

Species	Common Name	2000 to 2007 Mean	Percent Composition
<i>Morone saxatilis</i>	Striped bass	34.7	26.85%
<i>Acanthogobius flavimanus</i>	Yellowfin goby	24.4	18.93%
<i>Tridentiger barbatus</i>	Shokihaze goby	22.2	17.20%
<i>Leptocottus armatus</i>	Pacific staghorn sculpin	14.5	11.21%
<i>Spirinchus thaleichthys</i>	Longfin smelt	9.4	7.31%
<i>Platichthys stellatus</i>	Starry flounder	9.2	7.14%
<i>Porichthys notatus</i>	Plainfin midshipman	4.8	3.70%
<i>Parophrys vetulus</i>	English sole	1.8	1.41%
<i>Tridentiger bifasciatus</i>	Shimofuri goby	1.1	0.86%
<i>Gasterosteus aculeatus</i>	Threespine stickleback	0.8	0.64%
<i>Alosa sapidissima</i>	American shad	0.8	0.62%
<i>Lampetra ayresii</i>	River lamprey	0.7	0.54%
<i>Lampetra tridentata</i>	Pacific lamprey	0.7	0.52%
<i>Pogonichthys macrolepidotus</i>	Splittail	0.7	0.52%
<i>Lepidogobius lepidus</i>	Bay goby	0.5	0.35%
<i>Hypomesus transpacificus</i>	Delta smelt	0.4	0.32%
<i>Citharichthys stigmaeus</i>	Speckled sanddab	0.4	0.32%

¹ Species with less than 0.5 percent of total abundance include: threadfin shad, Pacific herring, prickly sculpin (*Cottus asper*), white sturgeon, white catfish (*Ictalurus catus*), California halibut, sand sole (*Psettichthys melanostictus*), white croaker, Chinook salmon, shiner surfperch, cheekspot goby, diamond turbot, tule perch (*Hysterocarpus traskii*), channel catfish (*Ictalurus punctatus*), common carp, arrow goby (*Clevelandia ios*), brown smoothhound, goldfish (*Carassius auratus*), green sturgeon, bonyhead sculpin (*Artedius notospilotus*), rainwater killifish (*Lucania parva*), and Pacific sanddab.

Source: CDFG 2000-2007

3 The demersal fish community inhabiting the western Delta is similar to that inhabiting
 4 Suisun Bay and shows the influence of freshwater Delta flow. Twelve taxa represent 95.3
 5 percent of the fish present: striped bass, Shokihaze goby, yellowfin goby, white catfish,
 6 channel catfish, longfin smelt, starry flounder, American shad, shimofuri goby, tule perch,
 7 Pacific lamprey, and Pacific staghorn sculpin (CDFG 2000-2007). Other fish species in the
 8 western Delta that account for 4 percent of the individuals present include splittail, delta
 9 smelt, river lamprey, white sturgeon, bigscale logperch (*Percina macrolepida*), prickly
 10 sculpin, Chinook salmon, threadfin shad, threespine stickleback, plainfin midshipman,
 11 green sturgeon, and Pacific herring. In both Suisun Bay and the western Delta, an exotic
 12 oriental shrimp (*Palaemon macrodactylus*) and bay shrimp are the dominant mobile
 13 invertebrates (NOAA 2007).

1 **Special Status Species**

2 With regard to special-status species, the Project area provides habitat for several special
3 status fish and marine mammals. The distribution of fish species in the Project area is
4 based on available literature and CDFG trawl studies conducted between 2000 and 2007.
5 Several terrestrial wildlife species, all birds, also forage in the vicinity of Project activities.
6 These species are described below.⁴

7 *Fish*

8 **Green sturgeon (*Acipenser medirostris*)**. The southern Distinct Population Segment
9 (DPS) of the green sturgeon is listed as a threatened species under the Federal ESA, with
10 the only known spawning habitat available in the upper Sacramento River. The green
11 sturgeon is the most widely distributed member of the sturgeon family and the most
12 marine-oriented of the sturgeon species. Green sturgeons range in the nearshore waters
13 from Mexico to the Bering Sea and are common occupants of bays and estuaries along
14 the western coast of the United States (Moyle et al. 1995). Adults in the San Joaquin Delta
15 are reported to feed on benthic invertebrates including shrimp, amphipods, and
16 occasionally small fish while juveniles have been reported to feed on opossum shrimp and
17 amphipods (Moyle et al. 1995). Adult green sturgeons migrate into freshwater beginning in
18 late February with spawning occurring March through July; and peak activity is in April and
19 June. After spawning, juveniles remain in fresh and estuarine waters for one to four years
20 and then begin to migrate out to the sea (Moyle et al. 1995). Although green sturgeon are
21 caught and observed in the lower San Joaquin River, spawning is not known to occur
22 within the river.

23 The CDFG's IEP Data (CDFG 2000-2007) indicate that green sturgeons are uncommon
24 inhabitants in the portion of Central Bay, Suisun Bay, and the western Delta where the
25 Project is located. They occur within the shallows and use the navigation channel to
26 migrate between the ocean and the Sacramento River. In March 2006, the National

⁴ The baseline population data for Coho salmon (*Oncorhynchus kisutch*), based on CDFG survey data (CDFG 2000-2007) and agency consultations to date (e.g., NMFS 2006), show only historical accounts of species presence in the streams of Marin and Sonoma Counties that are tributary to San Pablo Bay. Presently, Coho salmon spawning is only associated with coastal streams outside the Golden Gate and does not occur in streams tributary to the Central Bay or Suisun Bay Project areas. If present in these areas, their population numbers are too small to be reflected in monthly CDFG trawling surveys. Due to their infrequent presence and habitat use in the Project area, Coho salmon are not analyzed further in this EIR.

1 Marine Fisheries Service (NMFS)⁵ issued a Conference Opinion to address the effects of
2 sand mining activities in the Central Bay and Delta on green sturgeon (NMFS 2006), as
3 discussed in the Impacts section, below.

4 **Delta smelt (*Hypomesus transpacificus*).** Delta smelt is listed as a threatened species
5 under the Federal ESA and an endangered species under the California ESA. The delta
6 smelt is a small, slender-bodied fish that is able to tolerate a wide salinity range and is
7 native to the Sacramento-San Joaquin Estuary. This species, which has a one-year life
8 span, lives primarily along the freshwater edge of the saltwater-freshwater interface
9 (approximately 2 ppt salinity) of the Sacramento-San Joaquin Delta.

10 It is critical to note that the survival or abundance of multiple biological populations in the
11 San Francisco Estuary, including delta smelt populations, is positively related to
12 freshwater flow, a relationship which is described in terms of “**X²**”, where “X” is the
13 distance from the Golden Gate Bridge and “2” is where the salinity at the bottom of the
14 water column is 2 practical salinity units (psu=ppt) (Hollibaugh 1996). Flows associated
15 with this low-salinity zone deliver nutrients to shallow water habitats in Suisun Bay and
16 correlate to fish abundance (USFWS 2005).

17 Delta smelt live in schools and primarily feed on planktonic crustaceans, small insect
18 larvae, and mysid shrimp (Moyle 2002). Prior to spawning, delta smelt migrate upstream
19 from the brackish-water habitat to river channels and tidally influenced backwater sloughs
20 to spawn. Migration and spawning occur between December and June (Moyle 2002). The
21 species has been collected in large quantities in Suisun Bay and Central Bay. The delta
22 smelt has no commercial or recreational value, but is considered a key indicator species of
23 the environmental health of the Delta. In 2006 and 2007, the delta smelt population in the
24 Delta dropped to record low levels prompting additional measures by Federal and State
25 agencies to protect it. The CDFG’s IEP Data (CDFG 2000-2007) indicate that delta smelt
26 are present in low numbers in Suisun Bay and the western Delta (Table 4.1-2). This
27 species was detected during CDFG surveys in Central Bay (CDFG 2000-2007).

28 In 2006, the US Fish and Wildlife Service (USFWS) issued a formal Letter of
29 Concurrence which identified that sand mining activities in the Sacramento-San Joaquin
30 Estuary are not likely to adversely affect delta smelt (USFWS 2006). This concurrence

⁵ Subsequently renamed NOAA Fisheries, the agency continues to be referred to, and refers to itself, as NMFS or NOAA Fisheries; it is referred to herein as NMFS.

1 was based on the implementation of specific permit conditions, which are identified in
2 the Impacts discussion, below.

3 **Longfin smelt** (*Spirinchus thaleichthys*). Longfin smelt, listed in April 2010 as a
4 threatened species under the California ESA, is a small schooling fish that inhabits the
5 freshwater section of the lower Delta and has been observed from south San Francisco
6 Bay to the Delta. The bulk of the San Francisco Bay population occupies the region
7 between the Carquinez Strait and the Delta (CDFG 2009b, Miller and Lea 1972). They
8 have been collected in large numbers in Montezuma Slough, Suisun Bay, and near the
9 Pittsburgh and Contra Costa power plants. In the fall and winter, adults from San
10 Francisco and San Pablo Bays migrate to fresher water in the Delta to spawn. The
11 spawning habits of longfin smelt are similar to the delta smelt and both species are
12 known to school together. Larval stages are known to inhabit Suisun Bay and move
13 south within the Bay-Delta as they grow larger in April and May (CDFG 2009b, Ganssle
14 1966). The larvae are pelagic and found in the upper layers of the water column.
15 Longfin smelt are rarely found in waters warmer than 22 degrees Celsius (° C), and
16 adults are predominantly found in the middle and lower portions of the water column.
17 The CDFG's IEP Data (CDFG 2000-2007) indicate that longfin smelt is one of the
18 dominant species comprising the mid-water and bottom fish populations in Suisun Bay
19 and the western Delta near the Project area (Table 4.1-2), and is present, though to a
20 lesser extent, in the Central Bay (Table 4.1-1).

21 **Sacramento splittail** (*Pogonichthys macrolepidotus*). The Sacramento splittail is
22 a California species of special concern that is native to the San Francisco Estuary and
23 the Central Valley in California. This small minnow was once prevalent in lakes and
24 rivers throughout the Central Valley and in the Delta, but water diversions and habitat
25 alteration, among other causes, have contributed to its demise. CDFG trawling records
26 indicate that splittail occur in all portions of the Project area including Central Bay
27 (Table 4.1-2) and the Delta (Table 4.1-4) (CDFG 2000-2007). Remnant populations of
28 splittail in the Delta require adequate freshwater outflow and periodic floodplain
29 inundation. This species was formerly listed as a Federal threatened species and was
30 delisted in 2003 despite a strong consensus by scientists that it should retain its
31 protected status.

32 **Pacific herring** (*Clupea pallasii*). Pacific herring are protected under the Magnuson-
33 Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and are
34 both a popular sport fish and a commercially important species. The Pacific herring is a
35 small schooling marine fish that enters estuaries and bays to spawn. This species is

1 known to spawn along the Oakland and San Francisco waterfronts and attaches its egg
2 masses to eelgrass, algae (including *Gracilaria* sp. and *Laminaria* sp.), and hard
3 substrates such as pilings and breakwater rubble. Spawning usually takes place between
4 October and March with a peak between December and February. After hatching, juvenile
5 herring typically congregate in the Bay during the summer and move into deeper waters in
6 the fall. In areas of San Francisco Bay where eelgrass and other aquatic vegetation is not
7 abundant, herring are known to broadcast eggs on rocks, rocky jetties, pilings, sandy
8 beaches, and other submerged objects (Barnhart 1988). An individual can spawn only
9 once during the season, and the spent female returns to the ocean immediately after
10 spawning. The CDFG data (2000-2007) indicate that Pacific herring are present in Central
11 Bay, Suisun Bay, and the western Delta and comprise a major component of the mid-
12 water (pelagic) fish community.

13 **Sacramento River winter-run, Central Valley spring-run, and Central Valley fall/late**
14 **fall-run Chinook salmon (*Oncorhynchus tshawytscha*).** The population of Chinook
15 salmon, also known as king salmon, in the San Francisco Bay-Delta is comprised of three
16 distinct evolutionarily significant units (ESUs): winter-run, spring-run, and fall/late fall-run.
17 These ESUs are distinguished by the seasonal differences in adult upstream migration,
18 spawning, and juvenile downstream migration. Chinook salmon are anadromous fish,
19 spending three to five years at sea before returning to freshwater to spawn. These fish
20 pass through San Francisco Bay waters to reach their upstream spawning grounds. In
21 addition, juvenile Chinook salmon migrate through the Bay en route to the Pacific Ocean.

22 Sacramento River winter-run Chinook salmon, listed as endangered under the State and
23 Federal ESAs, migrate through San Francisco Bay from December through July with a
24 peak in March (Moyle 2002). Spawning is confined to the mainstream Sacramento River
25 and occurs from mid-April through August (Moyle 2002). Juveniles emerge between July
26 and October, and are resident in their natal stream five to 10 months followed by an
27 indeterminate residency period in estuarine habitats (Moyle 2002).

28 Central Valley spring-run Chinook salmon, listed as threatened under the State and
29 Federal ESAs, migrate to the Sacramento River from March to September with a peak
30 spawning period between late August and October (Moyle 2002). Juvenile Chinook
31 salmon emerge between November and March, and are resident in streams for a period of
32 three to 15 months before migrating to downstream habitats (Moyle 2002).

33 The Central Valley fall/late fall-run Chinook salmon is a Federal candidate for listing, and a
34 California species of special concern. These salmon enter the Sacramento and

1 San Joaquin Rivers from June through December and spawn from October through
2 December, with a peak in November.

3 Adult and juvenile (smolts) winter-run, spring-run, and fall-run Chinook salmon are present
4 in the Central Bay, Suisun Bay, and the western Delta Project areas during migrations to
5 and from upstream freshwater spawning habitat. Although principally found in the main
6 channels, they can use adjacent shallows for foraging. The CDFG data (CDFG 2000-
7 2007) indicate that Chinook salmon represented less than 0.2 percent of the Central Bay
8 fish community from 2000 to 2007 and nearly 5 percent of the Suisun Bay fish community
9 (Tables 4.1-1 and 4.1-2).

10 In 2006, NMFS issued a Biological and Conference Opinion (BO) to address the effects of
11 sand mining activities in the Central Bay and Delta on Chinook salmon (NMFS 2006), as
12 discussed in the Impacts section, below.

13 **Central Valley and Central California Coast steelhead trout (*Oncorhynchus mykiss*).**
14 Steelhead trout populations in the Central California Coast ESU and Central Valley DPS
15 are listed as threatened under the Federal ESA. Steelhead trout possess the ability to
16 spawn repeatedly, maintaining the ability to return to the Pacific Ocean after spawning in
17 freshwater. Juvenile steelhead trout may spend up to four years residing in freshwater
18 prior to migrating to the ocean as smolts. Steelhead trout smolts enter San Francisco Bay
19 during outmigration between November and May. Most Sacramento River steelhead trout
20 migrate out towards the ocean in spring and early summer, transiting through the Project
21 area. The CDFG's IEP Data (CDFG 2000-2007) suggest that steelhead trout can be
22 expected in the Central Bay, Suisun Bay and the western Delta Project areas in very
23 small numbers (Tables 4.1-1 and 4.1-2).

24 In 2006, NMFS issued a BO to address the effects of sand mining activities in the Central
25 Bay and Delta on steelhead trout (NMFS 2006), as discussed in the Impacts section,
26 below.

27 *Birds*

28 **Osprey (*Pandion haliaetus*).** Osprey are a California species of special concern;
29 additionally, the take, sale, or purchase of osprey is prohibited pursuant to Fish and Game
30 Code section 3505. They feed on fish and typically nest within 1 mile of water (Airola and
31 Shubert 1981). They summer throughout California, and winter in Central and South
32 America, but some stay in the San Francisco Bay Area year-round. Osprey establish nests
33 from mid-March to early April. In October, most migrate south to Central and South

1 America. Foraging habitat is potentially available in Suisun Bay and the western Delta,
2 though nesting habitat is absent.

3 **California brown pelican (*Pelecanus occidentalis californicus*).** The California brown
4 pelican is a subspecies of pelican that is found on the Pacific coast from California to
5 Mexico. Formerly listed as endangered under both the State and Federal ESAs, the
6 California brown pelican was de-listed in 2009; however, it remains a Fully Protected
7 species under Fish and Game Code section 3511. It is found in coastal salt water,
8 beaches, bays, marshes, and the open ocean. Breeding takes place between March and
9 August along the southern California coast, from the Channel Islands to Baja California
10 (Zeiner et al. 1990). They migrate north from June to November. Brown pelicans feed on
11 fish in both shallow and deep waters, using structures such as breakwaters, pilings, and
12 salt-pond dikes as roosts. They are common in Central Bay and San Pablo Bay, and may
13 forage in the Central Bay Project area. This species does not nest in the Bay Area.

14 **Double-crested cormorant (*Phalacrocorax auritus*).** Double-crested cormorants are a
15 State species of special concern. They rest and roost on offshore rocks, islands, steep
16 cliffs, dead branches of trees, wharfs, jetties, transmission lines, bridges, or marine
17 terminals. Double-crested cormorants are colonial breeders and have established large
18 colonies on both the Bay and Richmond-San Rafael Bridges. They are year-long residents
19 of California, are common in Central Bay and San Pablo Bay, and may forage in the
20 Central Bay Project area, though nesting habitat is absent.

21 **California least tern (*Sternula antillarum*).** The California least tern is a State and
22 federally listed endangered species and a Fully Protected species in California. The
23 migratory least tern is known to breed in San Francisco Bay between April and August.
24 They nest on the ground in abandoned salt ponds and along estuarine shores. Least terns
25 have been known to nest on dredge-spoil islands as well as areas next to airport runways
26 and industrial ports. Nesting sites do not occur near any of the mining lease sites.

27 *Mammals*

28 **California gray whale (*Eschrichtius robustus*).** The California gray whale is protected
29 by the MMPA. Identified as Eastern North Pacific stock found along the west coast of
30 North America, the California gray whale was delisted from the Endangered Species Act
31 in 1994 (alternately, stock found along the coast of Eastern Asia are still depleted and
32 endangered). During annual migrations, this baleen whale is a frequently observed
33 marine mammal along the west coast, where it can be observed in shallow coastal
34 waters. They are bottom feeders and suck sediment and benthic amphipods from the

1 ocean floor. California gray whales occasionally enter San Francisco Bay, but are not
2 expected in Suisun Bay or the western Delta Project areas.

3 **Humpback Whale (*Megaptera novaeangliae*).** The humpback whale is protected by the
4 MMPA, and is listed as endangered throughout its range under the ESA. Humpbacks are
5 also baleen whales, and they filter feed on krill, plankton, and small fish. They will
6 sometimes make “bubble nets” to corral their prey, a behavior that is unique to this whale.
7 Humpback whales live in all major oceans, and the California/Oregon/Washington stock
8 winters in coastal Mexico/Central America and migrates to the California coast and
9 southern British Columbia in summer and fall. During migration, they stay near the ocean
10 surface and prefer shallow waters during feeding and calving. They are best known for
11 their large pectoral fins, aerial displays of breaching, and surface-slapping performed with
12 their pectoral fins, tails, and heads. Humpback whales occasionally enter San Francisco
13 Bay, and wayward whales have infrequently wandered into the Sacramento River Delta,
14 but they are not expected in Suisun Bay or the western Delta Project areas.

15 **Pacific harbor seal (*Phoca vitulina*).** The Pacific harbor seal is protected by the MMPA.
16 It is a common, resident marine mammal along the west coast. They prefer to stay close
17 to shore in subtidal and intertidal habitats such as bays, estuaries, and sometimes
18 venture into rivers. Groupings of various sizes can haul out on rocks, mudflats, and
19 sandy/cobble coves (Zeiner et al. 1990). In general, the same sites are used over many
20 years. Pacific harbor seals in the Bay feed on yellowfin goby, northern anchovy, Pacific
21 herring, Pacific staghorn sculpin, plainfin midshipman, and white croaker (Harvey and
22 Torok 1994). Pacific harbor seals may forage and occur year-round throughout the
23 Central Bay, Suisun Bay, and the western Delta Project areas.

24 **Harbor Porpoise (*Phocoena phocoena*).** The harbor porpoise is protected by the
25 MMPA. Harbor porpoises are distributed discontinuously throughout the world’s northern
26 oceans, and occur along the Pacific coast from southern California to Alaska. There are 10
27 stocks of harbor porpoises in U.S. waters, including the San Francisco-Russian River
28 stock which encompasses the Bay and extends from Point Arena in the north to Monterey
29 in the south, and is estimated at approximately 9,200 individuals (NMFS 2009). They are
30 non-social animals usually observed in groups of two to five, and when surfacing for air,
31 they arch their backs and roll from beak to fluke. Their primary threat is entrapment in
32 fishing gillnets and trawls. They are commonly found in bays, estuaries, and harbors, and
33 may be encountered in the Central Bay, Suisun Bay and the western Delta Project areas.

1 **California sea lion (*Zalophus californianus*).** Like other marine mammals, the California
2 sea lion is protected by the MMPA. A common, abundant marine mammal, they are found
3 along the west coast. They breed in Southern California and the Channel Islands after
4 which they migrate up the Pacific coast to the Bay. They haul out on offshore rocks, and
5 may forage in the vicinity of Project activities in Central Bay. Sea lion haul out areas are
6 limited in Suisun Bay and the western Delta, though sea lions may forage in these areas
7 as well.

8 **Sensitive Natural Communities**

9 Sensitive communities include those that are especially diverse, regionally uncommon,
10 considered sensitive natural communities by CDFG, or are otherwise covered by State,
11 Federal, or local regulations. CDFG tracks the status of sensitive natural communities
12 throughout California. No sensitive natural communities occur in the Project area.

13 **Designated Critical Habitat**

14 The USFWS and NMFS designate critical habitat with the purpose of contributing to the
15 conservation of threatened and endangered species and the ecosystems upon which
16 they depend. The designation of an area as critical habitat provides additional protection
17 to habitat only when there is a Federal nexus with regard to a proposed action, for
18 example, when a Federal agency is implementing or issuing a permit for a project.
19 Critical habitat protection is only relevant when other statutory or regulatory protections,
20 policies, or other factors relevant to agency decision-making would not prevent the
21 destruction or adverse modification of habitat. Designation of critical habitat triggers the
22 prohibition of destruction or adverse modification of that habitat. It does not require
23 specific actions to restore or improve habitat.

24 The lease areas occur within designated critical habitat for Chinook salmon in the
25 California Central Valley and Central California Coast ESUs. On October 9, 2009,
26 NMFS designated all of San Francisco Bay-Delta as critical habitat for the green
27 sturgeon. Central Bay is also EFH for Chinook salmon, steelhead trout, and green
28 sturgeon. EFH is defined as all fish habitat types that contain the waters and substrates
29 necessary for spawning, breeding, or growth, as defined in the Magnuson-Stevens Act.

30 **Fish and Invertebrate Entrainment Background**

31 Hydraulic suction head dredging, as used for sand mining in the Bay-Delta, creates an
32 environmental condition where benthic infauna and epifauna, adult and juvenile fish,
33 mobile macroinvertebrates, and planktonic larvae are captured (entrained) along with the

1 sand and water (Hanson Environmental 2004; LFR Levine Fricke [LFR] 2004). Scientific
2 concerns about the potential ecological effect of fish and invertebrate taxa entrainment by
3 suction dredges have resulted in numerous studies being conducted since the late 1970s
4 that are summarized by Hanson Environmental and AMS (Hanson Environmental 2004;
5 AMS 2009b). The majority of these investigations were concerned with hydraulic suction
6 dredge entrainment of Dungeness crab and salmon by maintenance dredging operations,
7 though other more recent studies were conducted in San Francisco Bay, specifically
8 targeting sand mining operations.

9 These studies collectively reveal that benthic infauna is particularly vulnerable to
10 entrainment, with mobile megabenthic and demersal organisms slightly less so
11 (Nightingale and Simenstad 2001). In addition, the physical environmental conditions
12 present at the dredging location, local population dynamics (species presence, density
13 and seasonal movements), and the natural behavior patterns of individual species affect
14 what taxa are entrained as well as the number of individuals per species that are
15 susceptible to entrainment. Because most of these studies were conducted to assess the
16 potential environmental effect of maintenance dredging for regulatory and resource
17 managers, study results are typically presented as the number of entrained individuals,
18 for a specific taxa, per volume of material dredged. Data reported in this manner cannot,
19 unfortunately, be readily applied to other locations because of critical differences between
20 the sites in terms of the physical conditions and biological community parameters
21 mentioned above.

22 Woodbury demonstrated that small fish (both adults and juveniles) are capable of being
23 entrained during routine harbor maintenance operations in San Francisco Bay and in
24 numbers greater than previously believed (Woodbury 2008). Hanson Environmental
25 demonstrated: (1) that even when the drag head is approximately three feet off the
26 seafloor, as it is during barge ballasting operations, and when operating at normal or near
27 normal operational pump speeds, small adult and juvenile fish are entrained; (2) that when
28 fish are potentially concentrated in a shallow channel, some sand mining equipment can
29 create sufficient suction to capture larger and faster swimming species, including Chinook
30 salmon smolts; and (3) that entrainment of fish during the night may be greater than during
31 daylight hours (Hanson Environmental 2006).

32 Because of concerns by State and Federal agencies about the potential magnitude of
33 entrainment by sand mining in the Bay-Delta, a literature-based entrainment study was
34 conducted to estimate entrainment of demersal fish, planktonic larvae, megabenthic
35 invertebrates, commercially important fish and invertebrate species, and special status fish

1 species inhabiting Bay-Delta waters (AMS 2009b [Appendix E]). Entrainment estimates
2 were based upon the level of mining effort in each of the mining lease areas in the Bay-
3 Delta based on information presented for a representative year, and fish densities as
4 estimated from CDFG trawling studies (Hanson Environmental 2004; CDFG 2000-2007).

5 AMS calculated entrainment estimates which indicate that entrainment of fish larvae,
6 juveniles and adults, and invertebrate taxa are occurring during sand mining in Central
7 Bay, Suisun Bay and the western Delta (AMS 2009b). In the Central Bay mining leases,
8 for the nine dominant fish species identified from CDFG 2000-2007 data, the number of
9 juveniles and adults estimated to be entrained ranged from 54 to 37,901 individuals per
10 year. Bay gobies were estimated to be the most entrained species (37,901) followed by
11 speckled sanddabs (36,739), plainfin midshipmen (27,393), English sole (22,346), Pacific
12 staghorn sculpin (10,098), and shiner surfperch (5,802) (AMS 2009b [Appendix E]). These
13 entrainment estimates represented between less than 0.1 percent and 0.6 percent of the
14 estimated Central Bay regional abundance index for each species. All of the northern
15 anchovy and most of the Pacific herring are predicted to be entrained as planktonic larvae.
16 Bay gobies were also entrained in significant numbers as planktonic larvae.

17 AMS noted that in the Potrero Power Plant 316(b) entrainment study (AMS 2009b;
18 TENERA 2005), the Pacific sand lance accounted for 11 percent of all larvae collected,
19 yet were reported by CDFG in very small numbers. They attributed this inconsistency to
20 the sand lance's natural predator avoidance behavior which ultimately results in low
21 estimates of entrainment based on trawl data but very high actual entrainment by suction
22 dredges (McGraw & Armstrong 1990). McGraw & Armstrong estimated that Pacific sand
23 lance individuals were being entrained at a rate of 594 individuals per 1,000 cubic yards
24 of dredged material in Grays Harbor, Washington. AMS estimated that if the sand lance's
25 density in Central San Francisco Bay were similar to Grays Harbor, Pacific sand lance
26 could be directly entrained as adults and juveniles in numbers as high as 700,000
27 individuals per year, which would make them also the most entrained fish species in San
28 Francisco Central Bay by an order of magnitude over all other estimated taxa (AMS
29 2009b).

30 At the Middle Ground Shoal mining lease in Suisun Bay, AMS estimated entrainment for
31 the 14 dominant species reported to be present based on CDFG 2000-2007 data (AMS
32 2009b). Individual species entrainment estimates ranged between one (1) and 2,680
33 individuals occurring per year from sand mining operations. Calculated entrainment
34 estimates indicate that Pacific herring (2,680), striped bass (456), Shokihaze goby (268),

1 yellowfin goby (223), Pacific staghorn sculpin (207), starry flounder (103), longfin smelt
2 (73), and plainfin midshipmen (43) were the most entrained fish species (AMS 2009b).

3 As observed with the Central Bay entrainment estimates, Pacific herring were primarily
4 entrained by sand mining operations as planktonic larvae and may represent a higher
5 estimate than may actually be occurring in Middle Ground Shoal due to the lack of suitable
6 spawning habitat in that region of the Bay-Delta. These levels of entrainment for all
7 species, except Pacific herring, were estimated to represent between less than 0.1 percent
8 and 0.5 percent of the total abundance index for each species within Suisun Bay. AMS
9 estimated that longfin smelt, delta smelt, and Chinook salmon may be entrained by Middle
10 Ground Shoal mining operations at an annual rate of 73, seven, and one fish, respectively
11 (AMS 2009b). They suggested that the low estimate for Chinook salmon was, in part, the
12 result of this species being under-represented in CDFG otter trawl data used to calculate
13 entrainment estimates. Chinook salmon's natural ability to avoid the slow moving trawl,
14 their behavioral tendency to inhabit demersal waters only during nighttime hours and
15 pelagic waters during daylight hours, and the collection of CDFG trawls predominantly
16 during daylight hours, all contribute to the low reported densities for Chinook salmon (AMS
17 2009b [Appendix E]).

18 In the western Delta, AMS estimated entrainment numbers for the 11 dominant species
19 identified from CDFG monthly trawl data to best represent the demersal fish community
20 inhabiting the sand mining leases in the area (AMS 2009b). Individual species entrainment
21 estimates ranged between zero and 176 individuals per year. Calculated entrainment
22 estimates indicate that Shokihaze goby (176), yellowfin goby (56), white catfish (45),
23 longfin smelt (21), striped bass (12), channel catfish (7), starry flounder (4), and delta smelt
24 (4) were the most entrained fish species. These levels of entrainment were estimated to
25 represent between 0.0 percent and 0.2 percent of the total abundance index for each
26 species within the western Delta. Chinook salmon was estimated to be entrained at a rate
27 of one (1) fish per year as a result of sand mining activities in the western Delta. As
28 discussed previously for the Suisun Bay mining operations, this estimate may be low due
29 to potential underestimates of Chinook salmon presence in CDFG data from which the
30 entrainment estimates were made.

31 AMS also calculated entrainment estimates for important megabenthic invertebrates
32 including caridean shrimp and Dungeness crab. Both Dungeness crab and several
33 species of caridean shrimp are important forage for Bay-Delta fish as well as supporting
34 major commercial fisheries in the region (AMS 2009b).

1 Of the three Bay-Delta mining regions, Central Bay, Suisun Bay (Middle Ground Shoal),
2 and the western Delta, juvenile Dungeness crab are only found in significant numbers in
3 Central Bay. AMS estimated that in Suisun Bay, between 61 and 79 juvenile crabs were
4 entrained annually in years for which juvenile crab were relatively abundant; for years in
5 which they were not, as has been the case for the last several years, they estimated the
6 annual entrainment of juvenile crabs to be less than one (AMS 2009b). At Middle Ground
7 Shoal, AMS estimated that for those years in which juvenile crab were abundant,
8 approximately one adult would be removed from the population (AMS 2009b).

9 For the Central Bay mining lease sites, the entrainment of Dungeness crab juveniles was
10 predicted to be much greater. AMS estimates suggested that approximately 851 adults
11 would be removed annually from future populations of mature crabs as a result of sand
12 mining activities, representing between 0.2 percent and 1 percent of future adult
13 populations for any single year based upon the eight-year study period (2000-2007) (AMS
14 2009b). The potential effect of sand mining entrainment in the Bay-Delta on commercial
15 landings of Dungeness crab were estimated to range between less than 0.01 percent and
16 0.08 percent per year (AMS 2009b).

17 Of the 17 species of caridean shrimp observed by CDFG in Bay-Delta waters, nine
18 species dominate the local food web and mobile megabenthic community. Of these, only
19 bay shrimp are commercially harvested (for use as bait for sturgeon and striped bass sport
20 fishing). All of the major shrimp species in the Bay-Delta represent important prey for many
21 fish that inhabit the Estuary, such as green and white sturgeon, striped bass, leopard
22 shark (*Triakis semifasciata*), Pacific staghorn sculpin, starry flounder, English sole, pile and
23 rubberlip perch (*Rhacochilus vacca* and *R. toxotes*), Pacific tomcod, and brown rockfish
24 (Baxter et al. 1999). As such, these shrimp represent a key component of the food web.

25 In the Central Bay mining leases, AMS estimated that blacktail shrimp were the most
26 frequently entrained species from sand mining activities, whereas bay shrimp were
27 estimated to be more heavily entrained in both Middle Ground Shoal and the western
28 Delta (AMS 2009b). Bay-wide, approximately 1.2 million shrimp were estimated to be
29 entrained by sand mining activities in the Central Bay, Middle Ground Shoal, and the
30 western Delta, representing an estimated 0.5 percent of the estimated shrimp abundance
31 indices for those regions. Of these 1.2 million shrimp, one million were blacktail shrimp
32 entrained at the Central Bay mining leases.

33 Since bay shrimp are harvested commercially, AMS compared entrainment numbers with
34 commercial fish landing data and estimated that sand mining activities entrained, on

1 average, between 3 percent and 6 percent of the annual commercial landings (AMS
2 2009b). Since the bay shrimp commercial fishery was market driven by local demand for
3 frozen and live shrimp for sport fishing, the annual landings did not represent either the
4 potential fishery landings or the ability of the local bay shrimp population to support a
5 larger fishery (AMS 2009b).

6 **Invasive and Non-Native Species**

7 New species of estuarine and marine animals are inadvertently or intentionally introduced
8 into California waters annually. Often referred to as introduced, non-indigenous, alien,
9 non-native, or exotic species, most pose little or no threat to native ecosystems or
10 biological communities. However, a few have the potential to severely disrupt local
11 ecosystems, fisheries, and human infrastructure (Ray 2005). California has the largest
12 number of known introduced estuarine and marine animals in North America, with the
13 Bay-Delta reporting over 200 taxa (Ray 2005). Introduced species now dominate all
14 benthic communities within the Bay-Delta. Known invasive species appear to be
15 dominated by polychaete worms, mollusks, and crustaceans, but this may be more
16 reflective of the ease of identification and detection than their actual representativeness.
17 Of the known invasive species in California waters, 54 species of mollusks, 47 species of
18 polychaetes, and 36 species of amphipods have been reported (Ray 2005). Invaded
19 habitats tend to have low natural diversity, relatively simple food webs, and a history of
20 recent natural or anthropogenic disturbance (Ray 2005). Estuaries and sheltered coastal
21 areas appear to be among the most invaded habitats because they are typically naturally
22 disturbed, low-diversity systems, and are historic centers of anthropogenic disturbance
23 from shipping, industrial development, and urbanization (Ray 2005).

24 Invasive organisms are introduced by a variety of methods, the most prevalent being
25 shipping, of which the largest single source is the discharge of ballast water. Other
26 methods of introduction include: fouling organisms that have attached themselves to ship
27 hulls, navigation buoys, anchors and anchor chains; recovered flotsam; releases of “live”
28 rock and plants from the aquarium trade; and accidental release of animals from packing
29 materials by restaurants serving live seafood and by the live bait industry (Ray 2005).
30 Finally, many invasive species were deliberately introduced into California waters such as
31 striped bass, channel and white catfish, and giant pacific oysters.

32 A few of the most damaging introduced species in the Bay-Delta include the Chinese
33 mitten crab (*Eriocheir sinensis*), the European green crab (*Carcinus maenas*), the Asian
34 clam (*Corbula amurensis*), and the isopod *Sphaeroma quoyanun*. The Chinese mitten
35 crab is found throughout the Bay-Delta and is displacing native intertidal crabs. The Asian

1 clam has completely changed the subtidal benthic infaunal community in the western Delta
2 and because of its voracious feeding on bacterioplankton, phytoplankton, and copepod
3 larvae, it has significantly reduced the phytoplankton community in the North Bay and
4 western Delta, resulting in reduced zooplankton and fish abundances and distributions
5 (Ray 2005). It is one of the factors attributed to the decline of delta and longfin smelt
6 populations in the Bay-Delta (AFS 2007).

7 The Asian kelp (*Undaria pinnatifida*), which is native to Japan and Asian waters, arrived in
8 coastal Southern California in 2000 and quickly spread northward. Two small kelp
9 populations were identified in San Francisco Bay in May 2009. As this species can quickly
10 foul natural and human-made structures, management efforts are underway by the CSLC
11 and NOAA, in cooperation with the Smithsonian Environmental Research Center, to
12 remove the kelp. The Asian kelp could drastically alter native ecosystems in San
13 Francisco Bay as it competes for light and space with native populations of marine algae,
14 plants and animals.

15 **4.1.2 Regulatory Setting**

16 This subsection briefly describes Federal, State, and local regulations, permits, and
17 policies pertaining to biological resources and wetlands as they apply to the proposed
18 Project.

19 **Federal**

20 *Clean Water Act*

21 The U.S. Army Corps of Engineers (ACOE) and the U.S. Environmental Protection
22 Agency (U.S. EPA) regulate the discharge of dredged or fill material into waters of the
23 United States, including wetlands, under Section 404 of the Clean Water Act (CWA).
24 Projects that would result in the placement of dredged or fill material into waters of the
25 United States require a Section 404 permit from the ACOE.

26 *Federal Endangered Species Act*

27 The USFWS, which has jurisdiction over listed (i.e., threatened and endangered) plants,
28 wildlife, and resident fish, and NMFS, which has jurisdiction over anadromous fish and
29 marine fish and mammals, oversee the Federal ESA (16 U.S.C. § 1531 et seq.) and other
30 Federal provisions related to the protection of fish and wildlife resources. The Federal ESA
31 prohibits the “take” of any fish or wildlife species listed as threatened or endangered and
32 the destruction or adverse modification of habitat that could hinder species recovery.
33 Section 7 of the ESA requires all Federal agencies to consult with the USFWS and/or

1 NMFS, as appropriate, if they determine a project “may affect” a species listed under the
2 Federal ESA to ensure that Federal agency actions do not jeopardize the continued
3 existence of a listed species or destroy or adversely modify critical habitat for listed
4 species. If it is determined that a project will adversely affect a listed species, but not result
5 in jeopardy, the USFWS or NMFS may issue a BO. If take is expected, the BO will also
6 contain an incidental take statement and “reasonable and prudent measures” that must be
7 implemented by the project proponent to minimize the level of take of the species. If the
8 USFWS or NMFS determines the project will jeopardize the continued existence of the
9 species, the BO will instead contain one or more “reasonable and prudent alternatives” to
10 the project that, if implemented, would avoid jeopardizing the species.

11 *Federal Migratory Bird Treaty Act*

12 The Federal Migratory Bird Treaty Act (16 U.S.C. § 703, Supplement I, 1989) prohibits
13 killing, possessing, or trading in migratory birds, except in accordance with regulations
14 prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of
15 birds, bird nests, and eggs.

16 *Marine Mammal Protection Act*

17 The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. § 1361 et seq.) prohibits
18 the taking (including harassment, disturbance, capture, and death) of any marine
19 mammals except as set forth in the MMPA. An incidental harassment authorization under
20 Section 101(a)(5)(D) of the MMPA can be issued for activities other than commercial
21 fishing that may impact only small numbers of marine mammals. This covers activities that
22 do not occur longer than one year and only have a negligible impact on the species.

23 *Magnuson-Stevens Fishery Management and Conservation Act*

24 The Magnuson-Stevens Act as amended by the Sustainable Fisheries Act of 1996 (Public
25 Law 104-297), established requirements for EFH descriptions in Federal Fisheries
26 Management Plans (FMPs) and requires Federal agencies to consult with NMFS on
27 activities that may adversely affect EFH. The Magnuson-Stevens Act requires all Fishery
28 Management Councils to amend their FMPs to describe and identify EFH for each
29 managed fishery. The Pacific Fisheries Management Council currently manages four
30 major fisheries, of which the salmon, pelagic fish, and groundfish fisheries are pertinent to
31 the proposed Project.

32 The Magnuson-Stevens Act also requires consultation for all Federal agency actions that
33 may adversely affect EFH (i.e., direct versus indirect effects); it does not distinguish

1 between actions in EFH and actions outside EFH. Any reasonable attempt to encourage
2 the conservation of EFH must take into account actions that occur outside of EFH, such as
3 upstream and upslope activities that may have an adverse effect on EFH. Therefore, EFH
4 consultation with NMFS is required by Federal agencies undertaking, permitting, or
5 funding activities that may adversely affect EFH, regardless of the activity's location. Under
6 Section 305(b)(4) of the Magnuson-Stevens Act, NMFS is required to provide EFH
7 conservation and enhancement recommendations to Federal and State agencies for
8 actions that adversely affect EFH. However, State agencies and private parties are not
9 required to consult with NMFS unless State or private actions require a Federal permit or
10 receive Federal funding. Although the concept of EFH is similar to that of critical habitat
11 under the Federal ESA, measures recommended to protect EFH by NMFS are advisory,
12 not directory.

13 **State**

14 *California Endangered Species Act*

15 The California ESA (Fish & G. Code, § 2050 et seq.) was enacted in 1984; subsequent
16 amendments took effect in 1998. The California ESA is intended to conserve, protect,
17 restore, and enhance species designated as endangered or threatened, and their habitat,
18 and further directs all State agencies, boards, and commissions to seek to conserve
19 endangered and threatened species, and to use their authority in furtherance of that policy.
20 The California ESA, pursuant to section 2080, prohibits the take⁶ of endangered,
21 threatened, and candidate species except as authorized by other provisions of the Fish
22 and Game Code. This includes sections 2080.1 and 2081, which provide mechanisms by
23 which the CDFG may authorize take, including take that is incidental to, and not the
24 purpose of, an activity or project. However, the CDFG may only authorize the incidental
25 take of species listed under the California ESA using one of the above-listed statutory
26 sections if it finds that the impacts of the authorized taking will be minimized and fully
27 mitigated, that funding to carry out all required measures is assured, and that the
28 authorized taking will not jeopardize the continued existence of the species. Because of
29 the presence of listed species in the proposed Project area and the likelihood of
30 entrainment of these species, the CDFG stated, in its comments on the 2010 Draft EIR
31 (Memo from Charles Armor, Regional Manager, CDFG-Bay Delta Region, to Chris Huitt,
32 CSLC, September 27, 2010):

⁶ "Take" is defined specifically in the Fish and Game Code to mean "hunt, pursue, catch, capture, or kill," or an attempt to do any such act.

1 “The draft EIR states that the Project operations will likely “take” listed species
2 including Delta smelt, longfin smelt, winter-run Chinook salmon and Central Valley
3 spring-run Chinook salmon. As such, the Applicants will need an Incidental Take
4 Permit (ITP) from the Department for all State-listed species to address impacts of
5 the “taking” pursuant to Fish and Game Code sections 2080.1 or 2081(b), and
6 California Code of Regulations, Title 14 Section 783 et seq.”

7 *Other Relevant California Fish and Game Code Sections*

8 Lake or Streambed Alteration. Sections 1600-1616 of the Fish and Game Code relate to
9 activities affecting the natural flow of a stream, river, or lake. Fish and Game Code section
10 1602 states that it is unlawful for any person to "substantially divert or obstruct the natural
11 flow of, or substantially change or use any material from the bed, channel, or bank of, any
12 river, stream, or lake" without first notifying CDFG of that activity. Thereafter, if CDFG
13 determines and informs the entity that the activity will not substantially adversely affect any
14 existing fish or wildlife resources, the entity may commence the activity. If, however, CDFG
15 determines that the activity may substantially adversely affect an existing fish or wildlife
16 resource, the entity may be required to obtain from CDFG a Lake or Streambed Alteration
17 Agreement, which will include reasonable measures necessary to protect the affected
18 resource(s), before the entity may conduct the activity or activities described in the
19 notification. CDFG interprets "streambed" to encompass all portions of the bed, banks, and
20 channel of any stream, including intermittent and ephemeral streams, extending laterally to
21 the upland edge of riparian vegetation. It should be noted that the ACOE Section 404
22 jurisdiction is a subset of CDFG's Fish and Game Code section 1600 jurisdiction. Because
23 certain areas proposed for dredging are within areas subject to CDFG's streambed
24 alteration jurisdiction, it is anticipated that the applicants will be required to notify CDFG as
25 required by Fish and Game Code section 1602, and negotiate an agreement if it is
26 determined to be necessary by CDFG staff.

27 Nests and eggs. Under Fish and Game Code section 3503, it is unlawful to take, possess,
28 or needlessly destroy the nest or eggs of any bird, except as provided by other sections of
29 the Fish and Game Code (e.g., California ESA provisions) or any regulation made
30 pursuant thereto. Section 3503.3 of the California Fish and Game Code extends this
31 prohibition and its limitations to the take, possession, or destruction of any birds in the
32 orders Falconiformes (hawks) or Strigiformes (owls), or of their nests and eggs.

33 Fully Protected Species. Fish and Game Code sections 3511 (birds), 4700 (mammals),
34 5050 (reptiles and amphibians), and 5515 (fish) list the species that are designated as
35 Fully Protected Species. Species given this designation, but for two narrow exceptions,
36 may not be taken or possessed at any time. If a Fully Protected Species is also listed

1 under the California ESA, CDFG cannot issue authorization to incidentally take that
2 species, and a project proponent would be required to avoid take.

3 *San Francisco Bay Plan/McAteer-Petris Act*

4 The McAteer-Petris Act of 1965 established the Bay Conservation and Development
5 Commission (BCDC) and authorized the agency to prepare an enforceable plan to
6 analyze, plan, regulate, and otherwise guide the future protection and use of San
7 Francisco Bay and its shoreline. BCDC implements the San Francisco Bay Plan and
8 regulates filling and dredging in the Bay, its sloughs and marshes, and certain creeks and
9 their tributaries. BCDC jurisdiction includes the waters of the Bay as well as a shoreline
10 band that extends inland 100 feet from the high tide line. Any fill, excavation of material,
11 or substantial change in use within BCDC jurisdiction requires a permit from BCDC.

12 BCDC completed and adopted the San Francisco Bay Plan in 1968 and submitted it to the
13 California Legislature and Governor in January 1969. It has been amended since then,
14 most recently in October 2011 (BCDC 2011). The resource protection policies of the Bay
15 Plan that are relevant to the current Project include those that identify fish, wildlife and
16 aquatic organisms in the Bay, water quality, habitats including tidal marshes, tidal flats and
17 subtidal areas, and dredging. The Bay Plan also presents 11 mitigation policies that cover
18 the full lifespan of a project, from the initial project design to monitoring and management
19 of mitigation areas. These general policies include avoiding and minimizing impacts on
20 Bay natural resources through project design; the siting of compensatory mitigation areas;
21 the amount and type of required compensatory mitigation; the need for management and
22 monitoring of mitigation areas; coordination with local, State, and Federal agencies that
23 have jurisdiction over protected resources; the use of alternatives; and guidance on the
24 use of mitigation banks and fee-based mitigation. Specific San Francisco Bay Plan
25 policies relative to these resources and activities are presented in Table 4.1-5.

26 *Suisun Marsh Protection Plan (SMPP) and Suisun Marsh Preservation Act*

27 The SMPP seeks to preserve and enhance the diversity of habitats in the Suisun Marsh
28 and surrounding upland areas to maintain wildlife habitat, preserve the integrity of marsh
29 waterways, managed wetlands, tidal and seasonal marshes, and lowland grasslands in
30 Suisun Marsh; and also maintain existing uses of upland grasslands and cultivated areas
31 surrounding the critical habitats of the Suisun Marsh in order to protect the Marsh and
32 preserve valuable marsh-related wildlife habitats. Although no marsh or wetland habitats
33 occur within the Delta sand mining leases, the channels where sand mining occurs in
34

Table 4.1-5. San Francisco Bay Plan Polices

Bay Plan Policies	Description
Fish, Other Aquatic Organisms and Wildlife	<ol style="list-style-type: none"> 1. To assure the benefits of fish, other aquatic organisms and wildlife for future generations, to the greatest extent feasible, the Bay's tidal marshes, tidal flats, and subtidal habitat should be conserved, restored and increased. 2. Specific habitats that are needed to conserve, increase or prevent the extinction of any native species, species threatened or endangered, species that the California Department of Fish and Game has determined are candidates for listing as endangered or threatened under the California ESA, or any species that provides substantial public benefits, should be protected, whether in the Bay or behind dikes. 4. The Commission should: <ol style="list-style-type: none"> (a) Consult with the California Department of Fish and Game and the U.S. Fish and Wildlife Service or the National Marine Fisheries Service whenever a proposed project may adversely affect an endangered or threatened plant, fish, other aquatic organism or wildlife species; (b) Not authorize projects that would result in the "taking" of any plant, fish, other aquatic organism or wildlife species listed as endangered or threatened pursuant to the State or Federal ESAs, or the Federal Marine Mammal Protection Act, or species that are candidates for listing under the California ESA, unless the project applicant has obtained the appropriate "take" authorization from the U.S. Fish and Wildlife Service, National Marine Fisheries Service or the California Department of Fish and Game; and (c) Give appropriate consideration to the recommendations of the California Department of Fish and Game, the National Marine Fisheries Service or the United States Fish and Wildlife Service in order to avoid possible adverse effects of a proposed project on fish, other aquatic organisms and wildlife habitat.
Tidal Marshes and Tidal Flats	<ol style="list-style-type: none"> 1. Tidal marshes and tidal flats should be conserved to the fullest possible extent. Filling, diking, and dredging projects that would substantially harm tidal marshes or tidal flats should be allowed only for purposes that provide substantial public benefits and only if there is no feasible alternative. 2. Any proposed fill, diking, or dredging project should be thoroughly evaluated to determine the effect of the project on tidal marshes and tidal flats, and designed to minimize, and if feasible, avoid any harmful effects.
Subtidal Areas	<ol style="list-style-type: none"> 1. Any proposed filling or dredging project in a subtidal area should be thoroughly evaluated to determine the local and Bay-wide effects of the project on: (a) the possible introduction or spread of invasive species; (b) tidal hydrology and sediment movement; (c) fish, other aquatic organisms and wildlife; (d) aquatic plants; and (e) the Bay's bathymetry. Projects in subtidal areas should be designed to minimize and, if feasible, avoid any harmful effects. 2. Subtidal areas that are scarce in the Bay or have an abundance and diversity of fish, other aquatic organisms and wildlife (e.g., eelgrass beds, sandy deep water or underwater pinnacles) should be conserved. Filling, changes in use, and dredging projects in these areas should therefore be allowed only if: (a) there is no feasible alternative; and (b) the project provides substantial public benefits.

Table 4.1-5. San Francisco Bay Plan Policies

Bay Plan Policies	Description
	<p>5. The Commission should continue to support and encourage expansion of scientific information on the Bay's subtidal areas, including:</p> <ul style="list-style-type: none"> (a) inventory and description of the Bay's subtidal areas; (b) the relationship between the Bay's physical regime and biological populations; (c) sediment dynamics, including sand transport, and wind and wave effects on sediment movement; (d) areas of the Bay used for spawning, birthing, nesting, resting, feeding, migration, among others, by fish, other aquatic organisms and wildlife; and (e) where and how restoration should occur.
Dredging	<p>1. Dredging and dredged material disposal should be conducted in an environmentally and economically sound manner. Dredgers should reduce disposal in the Bay and certain waterways over time to achieve the [Long Term Management Strategy (LTMS)] goal of limiting in-Bay disposal volumes to a maximum of one million cubic yards per year. The LTMS agencies should implement a system of disposal allotments to individual dredgers to achieve this goal only if voluntary efforts are not effective in reaching the LTMS goal. In making its decision regarding disposal allocations, the Commission should confer with the LTMS agencies and consider the need for the dredging and the dredging projects, environmental impacts, regional economic impacts, efforts by the dredging community to implement and fund alternatives to in-Bay disposal, and other relevant factors. Small dredgers should be exempted from allotments, but all dredgers should comply with policies 2 through 12.</p> <p>2. Dredging should be authorized when the Commission can find: (a) the applicant has demonstrated that the dredging is needed to serve a water-oriented use or other important public purpose, such as navigational safety; (b) the materials to be dredged meet the water quality requirements of the San Francisco Bay Regional Water Quality Control Board; (c) important fisheries and Bay natural resources would be protected through seasonal restrictions established by the California Department of Fish and Game, the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service, or through other appropriate measures; (d) the siting and design of the project will result in the minimum dredging volume necessary for the project; and (e) the materials would be disposed of in accordance with Policy 3.</p> <p>7. All proposed channels, berths, turning basins, and other dredging projects should be carefully designed so as not to undermine the stability of any adjacent dikes, fills or fish and wildlife habitats.</p> <p>12. The Commission should continue to participate in the LTMS, the Dredged Material Management Office, and other initiatives conducting research on Bay sediment movement, the effects of dredging and disposal on Bay natural resources, alternatives to Bay aquatic disposal, and funding additional costs of transporting dredged materials to non-tidal and ocean disposal sites.</p>

Source: BCDC 2011

1 Suisun Channel and Middle Ground Shoal are identified as critical waterways for the
2 preservation and enhancement of the Suisun Marsh and therefore fall within the
3 jurisdiction of the SMPP. The Suisun Marsh Preservation Act was enacted in 1977 to
4 incorporate the findings and policies contained in the SMPP into State law. It was enacted
5 to preserve the integrity and assure continued wildlife use of the Suisun Marsh, including
6 the preservation of its waterfowl-carrying capacity and retention of the diversity of its flora
7 and fauna.

8 *Other State Policies and Regulations Regarding Waters of the U.S. and Wetlands*

9 State regulation of activities in waters and wetlands resides primarily with the CDFG
10 and the State Water Resources Control Board (SWRCB). BCDC has similar authority
11 for wetlands within San Francisco Bay, and the California Coastal Commission has
12 review authority for wetland permits within its planning jurisdiction. The CDFG provides
13 comment on ACOE permit actions under the Fish and Wildlife Coordination Act. The
14 SWRCB, acting through the nine Regional Water Quality Control Boards (RWQCBs),
15 must certify that an ACOE permit action meets State water quality objectives (Clean
16 Water Act § 401).

17 *Water Quality Control Plan for the San Francisco Region (Basin Plan)*

18 Pursuant to the Porter-Cologne Water Quality Control Act (Wat. Code, § 13000 et seq.),
19 each of California's nine RWQCBs must prepare and periodically update basin plans that
20 set forth water quality standards for surface and groundwater, as well as actions to control
21 nonpoint and point sources of pollution to achieve and maintain these standards. Basin
22 plans offer an opportunity to achieve wetlands protection based on water quality
23 standards. Water quality for the Project is under the jurisdiction of the San Francisco
24 RWQCB (SFRWQCB).

25 The SFRWQCB is responsible for developing and implementing the *San Francisco Bay*
26 *Basin Water Quality Control Plan* (Basin Plan), last revised in 1995, which documents
27 approaches to implementing State and Federal policies in the context of actual water
28 quality conditions. The SFRWQCB's other activities include permitting waste discharges,
29 and implementing monitoring programs of pollutant effects. For more information about the
30 State and Regional Board regulations and permits that affect the proposed Project, see
31 Section 4.3, Hydrology and Water Quality.

1 *Solano County - Local Suisun Marsh Protection Policies*

2 The County's local protection program is the *Solano County Policies and Regulations*
3 *Governing the Suisun Marsh* (Solano County 1982). The Marsh and Wetland Habitats
4 Land Use Proposals Policies seek to preserve and enhance wherever possible the
5 diversity of wildlife and aquatic habitats in Suisun Marsh and surrounding upland areas to
6 maintain unique wildlife resources.

7 **4.1.3 Significance Criteria**

8 The thresholds for determining the significance of impacts for this analysis are listed
9 below. These thresholds also encompass the factors taken into account under CEQA to
10 assess an impact in terms of its context and intensity. A biological resource impact is
11 considered significant if:

- 12 • There is a potential for the Project to “take” any part of the population of a special
13 status species (such as State or federally endangered species) through direct
14 effects or indirect harm through the disturbance or loss of its habitat.
- 15 • A net loss occurs in the functional habitat value of a sensitive biological habitat,
16 or any area of special biological significance.
- 17 • There is a potential for the movement or migration of fish to be impeded.
- 18 • A substantial loss occurs in the population or habitat of any native fish or
19 vegetation or if there is an overall loss of biological diversity, with substantial
20 defined as any change that could be detected over natural variability.

21 **4.1.4 Impact Analysis and Mitigation**

22 As described in the Setting section above, sand mining activities would not take place in
23 the nearshore subtidal (soft or hard substrate) or intertidal habitats, within submerged
24 aquatic vegetation beds or emergent saltwater marsh or wetlands, but rather in largely
25 unvegetated sandy deposits. Therefore, there would be no impact to the population or
26 habitat of any native vegetation.

27 The proposed Project may impact areas where the presence of special-status species is
28 presumed, based on: occurrence of suitable habitat; known distribution; or CNDDDB
29 occurrence. Mitigation for impacts to special-status species would be implemented to
30 reduce the potential for “take” of listed or otherwise special-status species, and to lessen
31 or avoid other Project-related impacts to these species, such as increased vulnerability to
32 predation or avoidance of use of habitat near Project activities due to disturbance, noise,
33 or siltation. In some cases, work timing and avoidance of sensitive periods would avoid

1 significant impacts to fish and wildlife. Special-status fish and wildlife species that have the
2 potential to occur in the vicinity of the Project include:

- Delta smelt
- Longfin smelt
- Green sturgeon
- Chinook salmon
- Steelhead trout
- Pacific herring
- California brown pelican
- California gray whale
- California sea lion
- Harbor seal
- Harbor porpoise
- Humpback whale

3 Table 4.1-6, located at the end of Section 4.1.4, Impact Analysis and Mitigation, provides a
4 summary of biological resource impacts and mitigation measures (MMs).

5 **Existing Permit Conditions**

6 In 2006 NMFS issued a BO to address the effects of sand mining activities in the Central
7 Bay and Delta on green sturgeon, Chinook salmon, and steelhead trout. The USFWS
8 issued a formal Letter of Concurrence addressing the effects of sand mining activities on
9 the delta smelt. The measures listed below are required as conditions of the NMFS BO
10 and the USFWS Letter of Concurrence (NMFS 2006; USFWS 2006). The CSLC, as the
11 lead agency under CEQA, is responsible for ensuring that potentially significant impacts
12 are reduced to the extent feasible. CSLC determined that these measures should be
13 incorporated into the Project. Therefore, while these measures have been imposed by
14 NMFS and USFWS, and are part of the existing permit context as long as the BO is in
15 effect, if the CSLC approves the proposed Project, the measures would be considered part
16 of the “approved Project” and as such would be required to be implemented by the
17 Applicants regardless of the status of the BOs. The measures contained in the BO are as
18 follows:

- 19 • When priming the pump or clearing the pipe, the end of the pipe shall be held at
20 a height in the water column no greater than 3 feet off the bottom (NMFS 2006).
- 21 • Limited volume per year: existing State and Federal permits regulate the annual
22 volume of sand that can be harvested from each lease area. These limits serve
23 to reduce the potential risk of adverse effects of sand mining on subtidal habitat
24 and aquatic resources (USFWS 2006).
- 25 • Water depth limitation to avoid sensitive habitat: in Central Bay, sand mining
26 occurs in relatively deep water (from 30 to 90 feet). Within the region of Middle
27 Ground Shoal and Suisun Bay, sand mining typically occurs in waters 15 to
28 45 feet deep. Due to equipment constraints, such as the barge and tug draft and
29 the suction drag head minimum operation depth (due to pipe length and angle

1 during operation), sand mining cannot occur in shallow water areas. For
 2 instance, Applicants cannot practically mine in areas with less than 20 feet of
 3 water or in areas with depths greater than approximately 80 feet of water. In
 4 addition to equipment constraints, all recently issued ACOE mining permits
 5 prohibit sand mining within 200 feet of any shoreline. The permits also prohibit
 6 sand mining within 250 feet of any water having a depth of 9 feet or less (mean
 7 lower low water [MLLW]), or 30 feet (MLLW), depending on the location in the
 8 estuary (USFWS 2006).

- 9 • Limited mining areas: sand mining is restricted to specific CSLC-designated
 10 lease areas. Mining is not permitted outside of the lease areas. The lease areas
 11 and specific locations within the lease areas where sand deposits occur and
 12 mining activity is most frequent, are characterized by relatively high river and tidal
 13 current velocities, are areas of sediment (sand) accumulations, have a low
 14 percentage of fine sediments, and are dynamic areas with frequent natural
 15 disturbance as evidenced by the presence of sand wave formations. These
 16 limitations reduce and avoid the risk of mining in sensitive subtidal habitat located
 17 outside the designated lease areas (USFWS 2006).
- 18 • Monitoring actual mining locations: current sand mining permits require detailed
 19 tracking and accounting of the specific locations of each mining event. Results of
 20 the tracking are submitted to BCDC and CSLC quarterly in accordance with
 21 permit conditions. Tracking mining locations serves to ensure that mining occurs
 22 only within designated lease areas and that mining avoids sensitive subtidal
 23 habitat located outside of a lease area (USFWS 2006).

24 Impact Discussion

25 Impact BIO-1: Potential displacement of special status species

26 **Commercial sand mining in the San Francisco Bay-Delta may result in the direct**
 27 **and indirect physical displacement of special status fish species, including delta**
 28 **smelt, longfin smelt, green sturgeon, Chinook salmon, steelhead trout, and**
 29 **Pacific herring, Fishery Management Plan-managed pelagic fish and groundfish,**
 30 **marine bird species such as California brown pelican, and protected marine**
 31 **mammals, including California gray whale, humpback whale, California sea lion,**
 32 **harbor seal, and harbor porpoise (Less than Significant, Class III).**

33 The proposed Project may have minor direct impacts to the free movement or foraging of
 34 special status fish, birds, and marine mammals during active sand extraction activities in
 35 Central Bay, Suisun Bay, and the western Delta. All of these animals are known to use the
 36 waters where sand mining occurs. The potential effects are expected to be minimal since
 37 sand mining in these locations occurs for only a few hours during each sand mining event,
 38 physically occupies a small area of the region they are mining in, and during mining, the
 39 mining equipment remains predominantly stationary. Most of these species, especially the

1 marine mammals and birds, can be considered relatively acclimated to interactions with
2 humans and vessels and are capable of easily avoiding sand mining barges. Based on
3 these findings, the temporary displacement of fish from active mining areas is considered
4 less than significant.

5 **Impact BIO-2: Potential impacts to fish and wildlife species from increased noise**

6 **Sand mining activities result in increased noise at the location of the suction drag**
7 **head on the seafloor that can result in increased disturbance to marine biota,**
8 **especially fish, including special status fish species (Less than Significant,**
9 **Class III).**

10 Sand mining operations in the San Francisco Bay-Delta produce additional noise from
11 vessel engines, propeller turbulence, the centrifugal pump used to lift the mined sand to
12 the hopper barge, and at the hydraulic drag head itself (Hanson Environmental 2004).
13 Although many of these noises (e.g., engine noise and propeller turbulence) are
14 comparable to other common noise sources throughout the Bay-Delta and might be
15 considered part of the normal background-noise level, others that are unique to dredging
16 and sand mining result in additional noises at potentially different sound frequencies that
17 could have an effect on Bay-Delta marine biota. These biota include marine mammals and
18 special status fish such as delta smelt, longfin smelt, green sturgeon, Chinook salmon,
19 steelhead trout, Pacific herring, and Fishery Management Plan-managed pelagic fish and
20 groundfish.

21 Sustained underwater noise elicits behavioral responses by fish and marine mammals,
22 such as erratic avoidance, altered foraging, and suspended or aborted reproductive
23 behaviors, as well as physiological effects, such as damaged hearing, ruptured internal
24 organs, and death. Key factors in determining the potential for impacts from noise and
25 severity of the potential impact are generally the intensity, frequency, and duration of the
26 noise (Hanson Environmental 2004). Although few data have been gathered concerning
27 underwater noise generated by hydraulic suction dredging in general and sand mining in
28 the Bay-Delta in particular, sufficient information exists to determine the kind of noise
29 generated by sand mining in the Bay-Delta and to assess its potential effect on resident
30 marine biota. Hanson Environmental provides a review of pertinent scientific studies
31 concerning hydraulic dredging and other applicable anthropogenic noise sources (Hanson
32 Environmental 2004). Underwater ambient noise levels in areas relatively free from
33 anthropogenic activities are typically in the 88 to 108 decibel (dB) range, with an average
34 level of 98 to 100 dB; measured frequencies range from 155 to 407.5 hertz (Hz) in the
35 Sacramento-San Joaquin Delta (Hanson Environmental 2004).

1 Various studies have shown that sand mining using a hydraulic suction head produces
2 noise levels above ambient background levels. Such sound is produced during operations
3 from the tug engines, propeller rotation, centrifugal pumps, dredge head, and wave action
4 against the hull of the tug and barge. Noise generation persists at the mining location (i.e.,
5 stationary pothole, trolling line or moving pothole) during the average 3- to 4.5-hour mining
6 event. Hydraulic suction dredge operations can generate noise as high as 130 to 140 dB
7 at the dredge head. Most underwater sound from suction dredges are at low frequencies,
8 around 400 Hz, but vary between 20 and 1,000 Hz (Richardson et al. 1995). At this
9 amplitude, suction dredge sounds can decrease to 120 dB (22 dB above ambient
10 measured noise levels) at a distance of 0.75 mile and continue dropping to levels between
11 112 dB and 117 dB at a distance of 1.25 to 8.1 miles (Hanson Environmental 2004).
12 These studies also report that the lower awareness threshold, or sound level at which fish
13 and marine mammals are reported to detect sound, is around 120 dB. At 140 to 160 dB
14 modified behavior such as avoidance or startle responses occur, and at sound levels
15 above 160 dB, physiological impacts occur (Hanson Environmental 2004). Furthermore,
16 sounds in the 180 to 220 dB level are likely to cause damage to sensory receptors of the
17 ears in fish. Concerning sound effects on fish eggs and invertebrates, Bennett et al.
18 indicated that 105 to 167 dB sounds in the 100 to 5,600 Hz range resulted in little to no
19 effect on the development of fish eggs and zooplankton (Bennett et al. 1994). Finally,
20 Hanson Environmental determined that sounds in the range and frequency generated by
21 sand mining do not result in acute mortality of most of the common fish species present in
22 the Bay-Delta, including Chinook salmon, steelhead trout, American shad, delta smelt,
23 inland silversides, sturgeon, catfish, Pacific herring, golden shiner, and select species of
24 macroinvertebrates (Hanson Environmental 2004).

25 In summary, noise generated by sand mining is marginally above ambient levels and only
26 within the range detectable by fish (and most likely marine mammals) over a very small
27 area of the Bay-Delta located immediately around the sand mining operation. Noise levels
28 generated by sand mining at the hydraulic suction dredge's location are within the sound
29 range that can elicit behavioral responses, such as altered swimming direction and speed,
30 by fish and marine mammals, but are expected to occur only immediately adjacent to the
31 drag head and below intensity levels that are likely to cause physical damage to sensory
32 receptors or other physiological effects (Hanson Environmental 2004). Because such
33 impacts are largely localized, result in no permanent loss of habitat, result in no net loss in
34 the functional value of habitat, do not impede or prevent fish migration, and do not result in
35 any substantial loss in population, habitat, or biological diversity, the temporary increase in
36 noise above ambient levels due to sand mining activities is considered less than
37 significant.

1 **Impact BIO-3: Potential sand mining impacts on benthic habitat, infauna,**
2 **epifauna, and foraging habitat**

3 **San Francisco Bay-Delta sand mining results in the temporary disturbance,**
4 **alteration and loss of soft substrate benthic habitat and associated benthic**
5 **infauna and epifauna, which could affect foraging habitat for special status fish,**
6 **marine bird species, such as California brown pelican, and protected marine**
7 **mammals including California gray whale, humpback whale, California sea lion,**
8 **harbor seal, and harbor porpoise and affect Bay-Delta food web dynamics (Less**
9 **than Significant, Class III).**

10 Hydraulic suction dredging of Bay-Delta sediments during sand mining disturbs, alters,
11 and results in the loss of soft sediment habitat and associated benthic infauna and
12 epifauna. Removal of soft sediment and associated biota causes a short-term, localized
13 reduction in available forage for macroinvertebrates and benthic feeding fish. If sediment
14 composition changes in an area after sand mining, then the replacement infaunal and
15 epifaunal communities differ from the communities present before mining.

16 Hanson Environmental summarized several scientific studies that evaluate the effects of
17 dredging on benthic communities, recovery, and potential effects on higher trophic levels
18 (Hanson Environmental 2004). In its assessment of the benthic infaunal communities in the
19 Bay-Delta mining leases in Central Bay, Suisun Bay, and the western Delta, AMS
20 investigated whether sand mining activities had any detectable effect on community
21 composition and abundance (AMS 2009a). AMS reported that the benthic infauna
22 community in Central Bay was very low in species diversity and individual species
23 abundances compared to other areas of the Bay-Delta and that sandy sediments with little
24 silt and clay fractions, and low organic composition, characterized the sediment
25 composition in the areas of the mining leases where mining occurs (AMS 2009a). These
26 findings were consistent with the known high-energy environment in all of the mining
27 leases, wherein most fine sediment fractions remain in suspension in the water column.
28 AMS also reported that they could detect no effect of sand mining in the Central Bay
29 leases, and surmised that this is attributable to the natural instability of the sediments in this
30 area caused by the high-energy regime that is present in west Central Bay (AMS 2009a).

31 AMS' findings in the Delta mining leases were similar but less conclusive. The benthic
32 infaunal communities in the western Delta and Suisun Bay have become so altered and
33 dominated both in abundance and biomass by the invasive Asian clam (*Corbicula*
34 *amurensis*) that no significant effects of sand mining on the infaunal community could be
35 detected (AMS 2009a). AMS reported similar low sediment fines and organic composition
36 in the areas of the mining leases where sand mining occurs.

1 Recovery of benthic infaunal and epifaunal communities following dredging is controlled by
2 many physical and ecological factors, including: the areal extent of dredging; the
3 operational method of dredging; the temporal occurrence of the dredging relative to natural
4 recruitment; the species composition of adjacent undisturbed sediments; the sediment
5 composition after dredging; and other factors (Nairn et al. 2001; Newell et al. 1998). The
6 recovery of benthic infauna following dredging to a community composition of similar
7 diversity and abundance is reported to take between one and 10 years (Newell et al. 1998;
8 Hammer et al. 1993). AMS estimated that recovery of the infaunal communities in both the
9 Central Bay and Delta mining leases appeared to occur within a few years to compositions
10 similar to un-mined areas and were at similar water depths and sediment composition
11 (AMS 2009a). Because the dominant species in the Delta is the Asian clam, which in
12 many cases is larger than the sizing screens used on the mining leases, it is probable that
13 many of these individuals are returned to the Delta floor unharmed during mining
14 operations.

15 Because of the high-energy conditions present in the mining leases, discharged silts,
16 clays, and organic sediments in the barge overflow plume are expected to remain in
17 suspension and settle out away from the active mining leases along with other fines held in
18 suspension. As a consequence, the potential for these fines to alter or change the
19 sediment composition in areas with similar coarser sediment composition is unlikely.

20 In summary, sand mining results in short-term changes in habitat composition and
21 associated marine infauna and epifauna in areas of the Bay-Delta mining leases where
22 sand extraction has just occurred; however, these changes do not appear to last more
23 than a few years and do not appear to result in any detectable changes in infaunal
24 composition or forage suitability. Thus, the alteration of soft substrate benthic habitat under
25 the proposed Project is not expected to substantially affect the availability or distribution of
26 foraging habitat for fish, or marine birds and mammals. As a result, this potential impact is
27 considered less than significant.

28 **Impact BIO-4: Discharge of suspended sediments may potentially release**
29 **contaminants into waters that affect plankton and wildlife species**

30 **The discharge of suspended sediments in the overflow plume during sand mining**
31 **will increase suspended sediment concentrations (SSC) and potentially release**
32 **organic and inorganic contaminants into Bay-Delta waters affecting plankton and**
33 **fish populations including delta smelt, longfin smelt, green sturgeon, Chinook**
34 **salmon, steelhead trout, Pacific herring, and Fishery Management Plan-managed**
35 **pelagic fish and groundfish (Less than Significant, Class III).**

1 During hydraulic suction dredge mining, fine sediment fractions consisting of clays, silts,
2 and organic material that are intermixed with the extracted sand are discharged in the
3 barge overflow plume causing increases in the SSC of Bay-Delta waters, which typically
4 disperse after three to four hours following completion of a mining event (Hanson
5 Environmental 2004). Sustained levels of SSC can cause environmental degradation,
6 including reduced phytoplankton productivity, and can result in deleterious effects to fish,
7 including physiological stresses from clogged gills, eroded gill and epithelial tissues,
8 impaired foraging activity and feeding success, delayed hatching, altered swimming
9 behavior and movement including migration patterns of juvenile and adult fish, and
10 possible death (Clarke and Wilber 2000; Anchor Environmental 2003). At a minimum,
11 increased SSC results in behavioral avoidance and exclusion behaviors from otherwise
12 suitable habitat and reduced feeding rates and growth (Clarke and Wilbur 2000; Hanson
13 Environmental 2004). The response of fish to suspended sediments varies among
14 species, life stage, and the specifics of the suspended sediments.

15 In addition to increases in SSC from the overflow plume, the release of sediment fines
16 could also result in increased organic and inorganic contaminant loading of Bay-Delta
17 waters, posing increased risk of toxicity exposure to Bay-Delta biota, including plankton,
18 fish, and invertebrates. As discussed in Section 4.3, Hydrology and Water Quality, multiple
19 areas within the Bay-Delta, including Central Bay, Suisun Bay, and the Sacramento San
20 Joaquin Delta are listed as an impaired water body under Clean Water Act Section 303(d)
21 for several organic and inorganic pollutants. These pollutants include mercury, PCBs,
22 dioxins, furan compounds, dieldrin, selenium, DDT, and chlordane.

23 Because of concerns over the potential effects of hydraulic dredging and the effects of
24 disposing of dredged sediments into marine and estuarine environments, substantial
25 scientific literature exists on this topic, much of which is reviewed in Clarke and Wilbur and
26 Anchor Environmental (Clarke and Wilbur 2000; Anchor Environmental 2003). Hanson
27 Environmental also reviews many of these studies and how they apply to sand mining in
28 the San Francisco Bay-Delta (Hanson Environmental 2004). Recent work by Colby and
29 Hoss provides insight into behavioral effects of increased subsurface countercurrents from
30 dredging on fish, including Pacific herring and other species that inhabit the Bay-Delta
31 aquatic habitats (Colby and Hoss 2004). Finally, several past and more recent studies in
32 the Bay-Delta (e.g., MEC and Cheney 1990; SFEI 2008; MEC 1993) address concerns
33 about increased SSC and the toxic effects of increased contaminant loading from dredging
34 plumes and dredged sediment disposal.

1 These studies collectively indicate that hydraulic suction dredge sand mining in the
2 San Francisco Bay-Delta results in an elevation of SSC within the plume located
3 immediately down current of the dredging barge. Hanson Environmental estimated that
4 the turbidity plume from sand mining in the Bay-Delta could last up to 9.5 hours
5 (Hanson Environmental 2004). Data from MEC and Cheney, MEC, and Anchor
6 Environmental suggest that the time duration in the Bay-Delta at which sand mining
7 generated total suspended solid (TSS) levels might exceed 100 mg/L⁷ may never
8 occur; if it did, it should last from a few minutes to one hour after dredging concludes
9 (MEC and Cheney 2990; MEC 1993; Anchor Environmental 2003). Thereafter,
10 discharged sediment either settles out on the seafloor or reaches background turbidity
11 levels and remains in suspension due to high-energy conditions present in the sand
12 mining leases. The areal extent of the plume in which TSS concentrations could be
13 greater than 100 mg/L is estimated to be extremely small and located immediately down
14 current of the discharge source. Ambient background turbidity levels are routinely
15 achieved at a distance of less than 400 yards.

16 In summary, commercial sand mining in the Bay-Delta causes short-term increases in
17 SSC and may elevate organic and inorganic contaminants associated with silts, clays,
18 and organic matter discharged in the overflow plume. However, materials in the sand
19 particle size that are targeted by sand miners tend to be low in fine sediment (e.g., less
20 than 10 percent) and as a consequence have low levels of contaminants. Although
21 some increased contaminant loading occurs from resuspended fine sediment fractions,
22 the contaminants appear to remain bonded to the sediment and not available. As a
23 result, no toxicity to aquatic organisms has been demonstrated from the discharge
24 plume from commercial sand mining operations in the Bay-Delta. This finding is
25 consistent with an assessment of the effects of short-term water quality impacts due to
26 maintenance dredging and disposal on sensitive species in San Francisco Bay
27 conducted by the San Francisco Estuary Institute (SFEI 2008). Based on these findings,
28 impacts to Bay-Delta marine biota from discharge plumes would be less than significant.

⁷ SSC concentrations greater than 100 mg/L are the estimated acute sublethal threshold for physiological effects to juvenile and adult fish, fish larvae, fish eggs and invertebrates.

1 **Impact BIO-5: Disturbance of sediments at the seafloor could result in increased**
2 **turbidity, SSC, and release of contaminants that potentially impact plankton and**
3 **wildlife species**

4 **Disturbance of sediments at the seafloor during sand mining could result in**
5 **increased turbidity and suspended sediment concentrations at the seafloor and**
6 **the potential release of organic and inorganic contaminants to Bay-Delta waters**
7 **affecting plankton and fish populations including special status fish species such**
8 **as delta smelt, longfin smelt, green sturgeon, Chinook salmon, steelhead trout,**
9 **Pacific herring, and Fishery Management Plan-managed pelagic fish and**
10 **groundfish (Less than Significant, Class III).**

11 This potential impact is similar to the potential impact discussed in BIO-4 above,
12 concerning the overflow plume from sand mining barges during sand mining operations.
13 The data on increased TSS concentrations at which physiological effects occur for aquatic
14 taxa and the potential toxic effect of increased contaminant loading still apply; however,
15 little to no scientific data exist to evaluate what TSS concentrations are present
16 immediately adjacent to and down current of the hydraulic suction drag head.

17 Since the material being disturbed at the seafloor is identical to that being placed into the
18 sand mining barge, the potential for any toxic impact on marine taxa is the same as for the
19 overflow plume. No toxic impact is therefore anticipated. The potential exposure of
20 organisms living in or on the seafloor, including demersal fish, benthic infauna and
21 epifauna, and mobile invertebrates such as crabs and shrimp is also expected to be
22 minimal. The material mined is typically sand-sized, and quickly resettles when
23 resuspended (Hanson Environmental 2004). The finer grained sediment fractions (i.e.,
24 material with a particle size 95 percent less than 200 micrometers (μm), or 1/5 of a mm)
25 can be expected to float away with the current and either remain in suspension or settle
26 out over a broad area of the seafloor, down current of the point of disturbance, as part of
27 the natural deposition of suspended sediments. As a result, the time period that demersal
28 fish and other benthic taxa will be exposed to increased SSC is less than the exposure
29 times that result in physiological effects to marine taxa discussed in BIO-4 above. The
30 high-energy regime present in the areas of the sand mining leases in the Bay-Delta that
31 cause the natural grading of seafloor sediments will quickly dissipate any seafloor
32 sediment plume caused by the suction drag head. Impacts to Bay-Delta marine biota from
33 increased turbidity and sediment resuspension at the seafloor from the suction drag head
34 would therefore be less than significant.

1 **Impact BIO-6: Sand mining could result in smothering or burial of, or mechanical**
2 **damage to, infauna and epifauna, and reduced fish foraging**

3 **Resettlement of discharged sediments from the barge overflow plume and**
4 **disturbed sediments at the seafloor during sand mining could potentially result in**
5 **the smothering, burial, or loss of soft substrate benthic infauna and epifauna, and**
6 **hard substrate epifauna, and could indirectly reduce fish foraging (Potentially**
7 **Significant, Class II).**

8 The resuspension of bottom sediments and the natural settlement of discharged fine
9 fraction sediments in the discharge plume during sand mining could bury benthic infauna
10 and epifauna down current of the sand mining operation. Studies conducted for the
11 U.S. Department of the Interior, Minerals Management Service (now named the Bureau of
12 Ocean Energy and Management) for offshore sand mining for beach replenishment along
13 the U.S. East and Gulf coasts and aggregate mining in the North Sea indicate that the
14 eventual settlement of resuspended and released sediment during hydraulic dredging
15 occurs over a fairly large area, depending on the oceanographic dynamics present (Nairn
16 et al. 2001; Newell et al. 1998). Typically, the more energy in the water column, the larger
17 the area over which the resuspended sediments settle out and the thinner the layer of
18 deposition. Soft substrate infauna and epifauna live in an environment of constant
19 deposition, and as a result are acclimated to occasional burial. As discussed above, the
20 areas within the Bay-Delta where sand mining occurs are characterized by high energy
21 and tidal flow. As a result, any resuspended or discharged sediments from the overflow
22 plume, especially the finer silt, clay, and organic sediments, can be assumed to be kept in
23 suspension and deposited back on the seafloor over a broad region of the Bay-Delta, or
24 open ocean in the case of Central Bay.

25 Within and adjacent to the Central Bay mining leases are the Bay-Delta's largest areas of
26 natural sub-tidal hard substrate, such as Arch Rock, Harding Rock, Shag Rock, and
27 Blossom Rock (Chin et al. 2004; NOAA 2007). The Suisun Bay and western Delta mining
28 leases have no known natural or artificial hard benthic substrate in or adjacent to them
29 (NOAA 2007). The high natural currents present in the Central Bay mining leases are
30 expected to keep any resuspended material in suspension and redeposited over a fairly
31 broad area of the seafloor or out into the ocean. The increased SSC caused by sand
32 mining is not, therefore, anticipated to result in more deposition at these hard bottom areas
33 in Central Bay than occurs normally. Impacts to Bay-Delta hard bottom marine biota from
34 increased turbidity and sediment resuspension at the seafloor from the suction drag head
35 and settling of the overflow plume would therefore be less than significant. Hanson
36 Environmental indicated that sand miners avoid these hard bottom areas, as the sand

1 deposits are of poor quality for mining and the rocky substrate can damage mining
2 equipment. However if mining were to occur in these areas it could cause mechanical
3 damage to the benthic community inhabiting the hard substrate areas, which could result
4 in a significant impact to these biotic communities (Hanson Environmental 2004).

5 **MM for Impact BIO-6: Sand mining could result in smothering or burial of, or**
6 **mechanical damage to, infauna and epifauna, and reduced fish foraging**

7 **MM BIO-6. Establish a 100-foot buffer around hard bottom areas within and**
8 **adjacent to Central Bay mining leases.** Sand mining dredging operations must
9 maintain a sufficient buffer zone around all hard bottom areas, especially Harding,
10 Shag, and Arch rocks, such that dredging equipment does not come into physical
11 contact with these sensitive hard bottom areas. This buffer zone will, at a minimum,
12 be 100 feet from the outward edge of any hard bottom feature. In the event dredging
13 equipment comes into physical contact with any hard bottom area during the term of
14 the leases, it shall be immediately reported to the CSLC, who shall establish a new
15 minimum buffer zone distance.

16 **Rationale for Mitigation**

17 MM BIO-6 would prevent mechanical damage to hard substrate areas, thereby
18 avoiding damage to the associated benthic community.

19 **Impact BIO-7: Sand mining will cause entrainment and mortality of common and**
20 **managed aquatic species**

21 **The Project will cause the entrainment and mortality of common and managed**
22 **juvenile and adult fish, invertebrates, and plankton, including Dungeness crab,**
23 **Pacific herring, and Fishery Management Plan-managed pelagic fish and**
24 **groundfish during sand mining (Less than Significant, Class III).**

25 AMS examined the estimated annual entrainment for Dungeness crab and splittail, as well
26 as common fish and managed pelagic fish and groundfish that occur in the Project area
27 (AMS 2009b).

28 Of the three Bay mining regions (Central Bay, Middle Ground Shoal, and western Delta),
29 juvenile Dungeness crab are only found in significant numbers in Central Bay and are not
30 regularly observed in the western Delta. In an assessment of invertebrate entrainment,
31 AMS found that within Suisun Bay, mining operations at Middle Ground Shoal were
32 estimated to entrain between 61 and 79 juvenile crabs in years crabs are relatively
33 abundant (AMS 2009b). For years in which the juvenile Dungeness crab population in the
34 Estuary is low, as it has been for the last several years, the estimated annual entrainment
35 of juvenile crabs is less than one (AMS 2009b).

1 Within the Central Bay mining leases, entrainment of Dungeness crab juveniles is
2 predicted to be higher than that at Middle Ground Shoal, with an average of approximately
3 850 adults estimated to be removed annually from future populations of adult crabs. Based
4 on the estimated total number of Dungeness crab juveniles inhabiting the Central Bay
5 region of San Francisco Estuary and their estimated survival to adulthood, the juvenile
6 crabs entrained by sand mining activities in Central Bay represented approximately
7 0.2 percent to 1 percent of future adult populations over the eight-year study period (AMS
8 2009b).

9 These losses are estimated to represent approximately 0.01 percent to 0.08 percent of
10 commercially landed Dungeness crab at San Francisco ports, depending on the year.
11 Juvenile crab entrained at Middle Ground Shoal by sand mining operations was estimated
12 to result in the loss of less than 0.0001 percent of the landed adult catch between 2000
13 and 2007. Thus, on average, San Francisco Estuary sand mining activities were estimated
14 to cause the loss of less than 0.1 percent of the annual harvested Dungeness crab
15 harvests through entrainment. Based on the small number of Dungeness crabs that would
16 be entrained by sand mining operations, which represents a tiny fraction of the overall
17 San Francisco Bay crab population, Project impacts to Dungeness crab are considered
18 less than significant.

19 AMS found that the potential environmental impacts of entrainment of non-special status
20 taxa, managed pelagic fish, and groundfish appears to be minimal, and is therefore less
21 than significant (AMS 2009b).

22 While this impact is considered less than significant without mitigation, the required NMFS
23 and USFWS operational conditions will reduce entrainment and mortality of common and
24 non-listed invertebrate and fish species such as Dungeness crab, white sturgeon, splittail,
25 managed pelagic fish and groundfish during sand mining.

26 **Impact BIO-8: Regular operation of sand mining activities will cause entrainment**
27 **and mortality of delta and longfin smelt**

28 **The Project would result in a significant impact to delta smelt and longfin smelt**
29 **as a result of entrainment and mortality during sand mining operations impacting**
30 **adult life stages of the delta smelt and longfin smelt thereby exceeding the**
31 **established significance level criteria thresholds (Significant, Class I).**

32 AMS conducted a study to assess the potential for sand mining to entrain and kill delta
33 smelt and longfin smelt (AMS 2009b). The study predicted that, in the Middle Ground
34 Shoal and western Delta mining leases, sand mining would entrain an estimated

1 0.3 percent of the regional abundance index for delta smelt within the Bay-Delta region.
2 The model developed in the study estimated that sand mining would entrain zero, three,
3 and six individuals per year in the Central Bay, Middle Ground Shoal, and western Delta
4 lease areas, respectively. For longfin, smelt the study predicted that, in each of the three
5 mining lease areas (Central Bay, Middle Ground Shoal, and western Delta), sand mining
6 would entrain less than 0.3 percent of the regional abundance index for that species. The
7 model developed in the study estimated that sand mining would entrain an average of 750,
8 72, and 20 individual longfin smelt annually in the Central Bay, Middle Ground Shoal, and
9 western Delta lease areas, respectively (AMS 2009b). Estimated entrainment for longfin
10 smelt was higher than for other species, because longfin smelt swim throughout the water
11 column periodically.

12 The effects of sand mining on delta smelt populations were the subject of the 2006
13 USFWS Letter of Concurrence (USFWS 2006). This letter concluded that sand mining
14 activities were not likely to have an adverse effect on the threatened delta smelt or affect
15 critical habitat that occurs in the Project area, as long as specific permit conditions are
16 implemented. These conditions are identified at the beginning of this section. They include
17 measures to avoid and minimize take of delta smelt by keeping mining activities away from
18 sensitive near-shore and shallow-water habitat, limiting mining volumes, defining mining
19 areas, and imposing limitations on priming the dredge pump.

20 While the USFWS concluded in its 2006 Letter of Concurrence that sand mining activities
21 were unlikely to adversely affect delta smelt, based upon the analysis of the information
22 presented in this EIR and consultation with CDFG staff, the CSLC concluded that there is
23 sufficient evidence to conclude that incidental take of both delta smelt and longfin smelt
24 will occur as a result of Project activities. Most notably, CDFG and its partners are involved
25 in several programs to monitor the abundance and population trends of Delta and longfin
26 smelt, including the "Smelt Larva Survey" (Adib-Samii 2010a, Baxter 2009) and "20mm
27 Survey" (Adib-Samii 2010b), which include sampling stations in the vicinity of proposed
28 Project activities. These survey programs along with other Delta monitoring efforts can
29 provide information on larval and post-larval/juvenile smelt distribution and relative
30 abundance in near real-time, and indicate that delta and longfin smelt are present in
31 varying numbers where mining would occur, and therefore, would be subject to
32 entrainment and mortality. Incidental take of delta smelt and longfin smelt is considered
33 potentially significant given the listing of these species under the California ESA and the
34 critically low population numbers now being observed.

1 Because the Project is expected to result in the incidental take of delta and longfin smelt,
2 the CSLC expects that the Applicants will be required to obtain an Incidental Take Permit
3 (ITP) pursuant to section 2081 of the California Fish and Game Code to carry out the
4 Project in compliance with the California ESA. The CDFG would only issue an ITP if it
5 meets certain criteria for issuance, including finding that the impacts of the taking are
6 minimized and fully mitigated through required permit measures; that the Applicants have
7 ensured funding adequate to carry out the required measures; and that implementation of
8 the Project would not jeopardize the continued existence of the species. Nonetheless, for
9 purposes of this analysis, impacts related to the entrainment mortality of delta and longfin
10 smelt are considered significant. The CSLC has identified MM BIO-8 as a feasible
11 measure that would reduce this impact; however, the impact will remain significant.

12 **MMs for Impact BIO-8: Regular operation of sand mining activities will cause**
13 **entrainment and mortality of delta and longfin smelt**

14 **MM BIO-8a. Applicants shall implement operational measures to minimize the**
15 **potential for entrainment and mortality of delta and longfin smelt.**

16 • **Timing of dredging relative to X2.** To protect delta and longfin smelt and
17 potentially eggs and young larvae from mortality related to entrainment, sand
18 mining activities shall be restricted upstream of the X2 location (i.e., the
19 location of 2 parts per thousand (ppt) salinity) from December 1 through June
20 30 each year. This location changes during the water year in response to river
21 flows and its location is tracked on the following website:
22 <http://cdec.water.ca.gov/cgi-progs/queryDaily?X2>. The degree and duration of
23 mining restrictions, and the specific locations where mining should be
24 restricted during this sensitive seasonal period will be based on factors
25 including the specific location of X2 relative to mining activities, species
26 presence and relative abundance in the Project area based on sampling data
27 from the nearest survey stations, and the overall status of the species
28 (population trend). Specific seasonal restrictions will be set through
29 consultation with the California Department of Fish and Game (CDFG) and
30 would likely be a requirement of any Incidental Take Permit that may be
31 issued for the Project.

32 • **Current restrictions on sand mining operations,** as specified in the
33 National Marine Fisheries Service Biological Opinion (NMFS 2006) and the
34 U.S. Fish and Wildlife Service Letter of Concurrence (USFWS 2006), serve to
35 avoid and minimize take of delta smelt. Currently there are no Federal
36 restrictions on longfin smelt. Due to similar life stages, however, State delta
37 smelt restrictions and conditions will be applied to both smelt species. These
38 conditions include restrictions on pump priming, limiting the total mining
39 volume, prohibiting mining in areas of shallow water depth and in proximity to
40 shorelines, restricting mining to the designated lease areas which are away

1 from sensitive habitat, and monitoring and reporting the location of each
2 mining event.

3 **MM BIO-8b. Applicants shall provide off-site mitigation to compensate for the**
4 **impacts of the taking that may be unavoidable.**

- 5 • **Compensatory mitigation measures** shall include restoration of delta and
6 longfin smelt spawning and rearing habitat, and/or purchase of California
7 Department of Fish and Game (CDFG)-approved mitigation credits, unless
8 otherwise specified in an Incidental Take Permit, in an amount based on
9 factors including the distribution and relative abundance of the species in
10 areas subject to mining activities and the implementation of the above-
11 specified minimization measures, such that the amount of compensatory
12 mitigation required is roughly proportional to the impacts of the taking on the
13 species. Determination of the restoration area or credits required will be
14 accomplished through consultation with CDFG and is expected to be
15 specified in the Incidental Take Permit. Currently, mitigation credits for delta
16 and longfin smelt are available through the Liberty Island Mitigation Bank.

17 **Rationale for Mitigation**

18 Sand mining operations using moving pot-hole and stationary pot-hole methods
19 (5,000-15,000 gallons per minute slurry rate) are proposed for regions generally
20 described as: 1) the western Delta from Broad Slough at the San Joaquin River
21 downstream to Chipps Island, 2) Suisun Bay southeast of Ryer Island or the Middle
22 Ground Shoal, and 3) south and west of Angel Island and westward to a line directly
23 south of Point Cavallo (south end of Richardson Bay). The Project would be permitted
24 to move 2,040,000 cubic yards of material per year. The moving pot-hole method drag-
25 head is 4 feet high by 3 feet wide and is typically buried 12-18 inches deep, leaving
26 substantial open area to entrain bottom oriented fishes. The stationary pot-hole method
27 limits the amount of time the drag head is in unimpeded contact with the water column,
28 but minimization still allows priming and clearing the head within 3 feet of the bottom.
29 Priming and clearing would occur at least once per day and at every change in dredge
30 location. Priming and clearing within 3 feet of the bottom could entrain delta and longfin
31 smelt. Moreover, delta smelt eggs are adhesive and will attach to substrates in
32 freshwater. CDFG has made a recent observation of a delta smelt egg attached to
33 sand particles, and longfin smelt eggs in studies of Lake Washington stocks were
34 predominantly attached to sand particles (CDFG 2009). Dredging in freshwater
35 upstream of X2 location during winter and spring (December 1 through June 30) could
36 take delta and longfin smelt eggs, and delta smelt larvae which are also bottom
37 oriented for a short period soon after hatching.

38 **Residual Impacts**

39 While implementation of MMs BIO-8a and BIO-8b would reduce the magnitude of
40 potential entrainment effects on delta and longfin smelt, it would likely not reduce the
41 impact to a less-than-significant level. Although there are no current broadly applied

1 programs for offsetting sand mining impacts to delta and longfin smelt, implementation
2 of MMs BIO-8a and BIO-8b would require actions intended to both reduce and offset
3 impacts related to incidental take of delta and longfin smelt. There are no other feasible
4 mitigation measures available at this time, although it is anticipated that CDFG staff will
5 establish recommended conditions that will be included in the ITP that is expected to
6 be issued for the Project. However, even with extensive consultation with CDFG during
7 development of the draft EIR, because specific measures are developed by the CDFG
8 on a case-by-case basis through their permitting process and are therefore not
9 available for inclusion in the draft EIR, approval of the Project would be subject to a
10 Statement of Overriding Considerations under CEQA by the CSLC.

11 While the CSLC as the lead agency for the Project must do all that is feasible to
12 address significant impacts even where a subsequent permit from another agency is
13 necessary, the required measures may specify performance standards which would
14 ensure the mitigation of the significant effect and which may be accomplished in more
15 than one specified way, when such specificity is infeasible or impractical at the time of
16 preparation of the EIR. The specific conditions for mitigating the impacts of the
17 incidental take of delta and longfin smelt would be formulated based on the CDFG's
18 review of the Applicant's ITP application and the final EIR, should one be certified.
19 Because a determination of the exact timing of mining restrictions necessary to reduce
20 the entrainment of delta and longfin smelt (which may vary from year to year), and of
21 the quantity of compensation necessary to mitigate the impacts of the taking lies with
22 the specialized scientific expertise of the CDFG, who would be conducting its
23 evaluation after completion of the EIR, the above measures are provided as
24 performance standards that the CSLC expects will be met through specific conditions
25 set forth in the ITP.

26 **Impact BIO-9: Green sturgeon, Chinook salmon, and steelhead trout will be**
27 **impacted during sand mining**

28 **The Project will cause the entrainment and mortality of green sturgeon, Chinook**
29 **salmon and steelhead trout during sand mining (Potentially Significant, Class II).**

30 A recent AMS study estimated that Chinook salmon are entrained at a rate of one fish per
31 year in the Middle Ground Shoal and western Delta mining leases as a result of sand
32 mining activities, with no entrainment in Central Bay (AMS 2009b). AMS notes, however,
33 that this estimate may be low due to potential underestimates of Chinook salmon
34 presence in CDFG data from which the AMS entrainment estimates were made. NMFS in
35 its BO for commercial sand mining in the San Francisco Bay-Delta, used a different
36 modeling approach to estimate entrainment of special status species, including Chinook
37 salmon and green sturgeon, than was used by AMS. NMFS estimated that between 143
38 and 273 Federal ESA-listed salmonid smolts could be entrained annually by all
39 commercial sand mining in the western Delta and Suisun Bay mining leases, with 13
40 being Central Valley steelhead trout, 43 to 87 Sacramento River winter-run Chinook

1 salmon, and 87 to 173 Central Valley spring-run Chinook salmon (NMFS 2006). NMFS
2 estimated that one Central California Coast steelhead trout smolt would be entrained
3 every 100 years. NMFS assumes that only one juvenile green sturgeon is entrained
4 annually by the Project proponent's sand mining activities (NMFS 2006). Based upon the
5 analysis of the information presented in this EIR and consultation with CDFG staff, the
6 CSLC concluded that sufficient evidence exists to conclude that incidental take of Chinook
7 salmon, steelhead trout, and green sturgeon will occur as a result of Project activities. The
8 entrainment of Chinook salmon, steelhead trout, and green sturgeon is considered
9 significant given their listing status under the California and/or Federal ESAs.

10 The implementation of operational conditions required by NMFS and the USFWS would
11 reduce Project impacts to green sturgeon and steelhead trout to less than significant;
12 however, additional measures are needed to reduce Project impacts to Chinook salmon.
13 In its 2006 BO, NMFS recommended the adoption of several conservation measures to
14 further reduce impacts to salmon smolts during sand mining activities (NMFS 2006). Two
15 measures are incorporated as mitigation requirements in this EIR to reduce Project
16 impacts on migrating salmon smolts. Because the Project is expected to result in the
17 incidental take of Chinook salmon, the CSLC expects that the Applicants will be required
18 to obtain an ITP pursuant to section 2081 of the California Fish and Game Code to carry
19 out the Project in compliance with the California ESA. The CDFG would only issue an ITP
20 if it meets certain criteria for issuance, including finding that the impacts of the taking are
21 minimized and fully mitigated through required permit measures, that the Applicants have
22 ensured funding adequate to carry out the required measures, and that implementation of
23 the Project would not jeopardize the continued existence of the species. The
24 implementation of MMs BIO-9a and BIO-9b would reduce the potential to entrain migrating
25 salmon smolts in the Delta mining leases during critical migration time periods. Because of
26 the limited time outmigrating Chinook salmon smolts occur in mining areas, the relatively
27 small fraction of smolts that would be entrained when compared to the total number of
28 smolts, and the very small number of steelhead trout and green sturgeon that would be
29 affected, these measures, along with operational conditions required by NMFS and the
30 USFWS, would minimize Project effects on salmonids, such that impacts due to
31 entrainment of these species would be reduced to less than significant. While these
32 measures will reduce the impacts to a less-than-significant level under CEQA, additional
33 measures may be imposed by CDFG in any ITP that may be issued for Chinook salmon to
34 ensure impacts are fully mitigated under the California ESA. These measures could
35 include off-site compensation or contributing to the restoration of Chinook salmon habitat,
36 or any other combination of requirements deemed necessary by CDFG.

1 **MMs for Impact BIO-9: Green sturgeon, Chinook salmon, and steelhead trout will**
 2 **be impacted during sand mining**

3 **MM BIO-9a. Sand mining halted during peak Chinook salmon migration.** Sand
 4 mining in the western Delta and Suisun Bay leases shall be halted during the
 5 approximate two-week peak Chinook salmon smolt outmigration period through the
 6 Delta as monitored by USFWS at Chipps Island. Mining operations in the Delta and
 7 Suisun Bay lease areas will be coordinated with the fish monitoring program during
 8 the months of March to May to determine the appropriate non-work closure period.⁸

9 **MM BIO-9b. Sand mining limited to daylight hours from January 1 to May 31.**
 10 Sand mining in western Delta and Suisun Bay leases shall be limited to daylight hours
 11 during the period January 1 to May 31 to minimize entrainment of migrating salmon
 12 smolts through the Delta, which tend to be more surface-oriented during the daytime.

13 **Rationale for Mitigation**

14 MMs BIO-9a and BIO-9b would reduce potentially significant impacts to less-than-
 15 significant levels by limiting mining to specific time periods so that fish species would
 16 be least affected.

17 **Impact BIO-10: Potential effects on fish movement and migration**

18 **Physical modification of bottom habitat through the removal of sediment has the**
 19 **potential to affect fish movement or migration (Less than Significant, Class III).**

20 This potential impact considers the behavior of moving or migrating fish relative to their
 21 physical environment and whether the incremental modification of bottom topography as a
 22 result of sand removal has the potential to impede fish movement. Most studies of fish
 23 movement have focused on adult stream fishes, particularly salmonids. Studies of sand
 24 mining effects on such species are specific to stream habitats where physical barriers such
 25 as culverts, drop structures, and dams pose an impediment to fish movement.

26 Based on CDFG trawling studies (CDFG 2000-2007), the most common fish species in
 27 Central Bay demersal habitat where the majority of sand mining will occur are speckled
 28 sanddab, bay goby, plainfin midshipmen, Pacific staghorn sculpin, shiner surfperch, white
 29 croaker, longfin smelt, Pacific tomcod and cheekspot goby (Table 4.1-3). Together these
 30 species constitute more than 97 percent of the fish community and represent those

⁸ USFWS permitting requirements for the Central Valley Project and State Water Project require continued funding of annual juvenile salmon surveys with emphasis on winter-run Chinook salmon. One objective of this program is to monitor the relative abundance and timing of juvenile Chinook salmon rearing and migration through the Lower Sacramento River and Delta. Based out of the USFWS Stockton Fish and Wildlife Office, surveys include trawling at Chipps Island to estimate the number of unmarked fish emigrating from the Delta.

1 species that could be most affected by bottom changes. In Suisun Bay and the western
 2 Delta, 12 species dominate the bottom community, including striped bass, Shokihaze
 3 goby, yellowfin goby, white catfish, channel catfish, longfin smelt, starry flounder,
 4 American shad, shimofuri goby, tule perch, Pacific lamprey, and Pacific staghorn sculpin.
 5 The majority of these are common, non-migratory species for which mining traces would
 6 not create a movement barrier.

7 Anadromous species that migrate through the Central Bay, Suisun Bay, and western Delta
 8 Project areas, including Chinook salmon and steelhead trout, principally use the middle to
 9 upper portions of the water column in the Project areas (Tables 4.1-2 and 4.1-4) and
 10 principally rely on sensory cues such as chemical signals rather than bottom topography
 11 during migratory movements. Sand mining does not occur in areas with less than 20 feet
 12 of water, within 200 feet of any shoreline, or within 250 feet of any water having a depth of
 13 9 to 30 feet MLLW, depending on the location in the estuary. CDFG studies indicate that
 14 such areas provide the principal movement corridors for migratory fish. Thus, the most
 15 frequently used movement corridors would not be affected by the Project.

16 Because migratory fish tend to use mid-water and shallow water areas for movement, and
 17 these areas would not be affected by proposed activities, and also because the effects are
 18 expected to be minor and temporary, impacts to fish movement or migration corridors
 19 would be less than significant.

Table 4.1-6. Summary of Biological Resources Impacts and Mitigation Measures

Impact	Mitigation Measures
BIO-1: Potential displacement of special status species.	Less than Significant impact; no mitigation necessary.
BIO-2: Potential impacts to fish and wildlife species from increased noise.	Less than Significant impact; no mitigation necessary.
BIO-3: Potential sand mining impacts on benthic habitat, infauna, epifauna, and foraging habitat.	Less than Significant impact; no mitigation necessary.
BIO-4: Discharge of suspended sediments may potentially release contaminants into waters that affect plankton and wildlife species.	Less than Significant impact; no mitigation necessary.
BIO-5: Disturbance of sediments at the seafloor could result in increased turbidity, suspended sediment concentrations, and release of contaminants that potentially impact plankton and wildlife species.	Less than Significant impact; no mitigation necessary.

Table 4.1-6. Summary of Biological Resources Impacts and Mitigation Measures

Impact	Mitigation Measures
BIO-6: Sand mining could result in smothering or burial of, or mechanical damage to, infauna and epifauna, and reduced fish foraging.	BIO-6. Establish a 100-foot buffer around hard bottom areas within and adjacent to Central Bay mining leases.
BIO-7: Sand mining will cause entrainment and mortality of common and managed aquatic species.	Less than Significant impact; no mitigation necessary.
BIO-8: Regular operation of sand mining activities will cause entrainment and mortality of delta and longfin smelt.	BIO-8a. Applicants shall implement operational measures to minimize the potential for entrainment and mortality of delta and longfin smelt. BIO-8b. Applicants shall provide off-site mitigation to compensate for the impacts of the taking that may be unavoidable.
BIO-9: Green sturgeon, Chinook salmon, and steelhead trout will be impacted during sand mining.	BIO-9a. Sand mining halted during peak Chinook salmon migration. BIO-9b. Sand mining limited to daylight hours from January 1 to May 31.
BIO-10: Potential effects on fish movement and migration.	Less than Significant impact; no mitigation necessary.

1 **4.1.5 Impacts of Alternatives**

2 **No Project Alternative**

3 The No Project Alternative would result in the cessation of mining of sand from the Bay-
4 Delta estuary for the next 10 years. Therefore, the biological impacts described above that
5 would occur under the proposed Project would not occur under the No Project Alternative.

6 **Long-Term Management Strategy Management Plan Conformance Alternative**

7 This alternative would require proposed sand mining operations to comply with the
8 temporal and spatial restrictions on dredging contained in the *Long-Term Management*
9 *Strategy for the Placement of Dredged Material in the San Francisco Bay Region*
10 *Management Plan 2001* (LTMS Management Plan). The LTMS Management Plan
11 Conformance Alternative would restrict sand mining in the Central Bay lease sites to a
12 five- to six-month period, and in the Suisun Bay and western Delta sites for a three-month
13 period each year. This alternative would allow for the same volume of sand extraction as
14 in the Project as proposed, but mining would likely be more intensive during the LTMS
15 work windows, followed by no mining for the remainder of the year.

1 Because mining would occur in the same locations, this alternative would have the
2 potential to cause mechanical damage to the benthic communities inhabiting hard
3 substrate areas, and Impact BIO-6 and the identified MM would apply. Because the
4 LTMS was specifically intended to protect special status species, and the protective
5 measures required by the 2006 NMFS conference opinion would remain in effect, this
6 alternative would avoid most of the Project's significant impacts associated with Impact
7 BIO-8, on delta and longfin smelt, and Impact BIO-9, on green sturgeon, Chinook salmon
8 and steelhead trout. However, since adoption of the LTMS, the longfin smelt has been
9 listed under the State ESA and the southern distinct population segment of the green
10 sturgeon has been listed under the Federal ESA. Protection of these species is not
11 considered in the LTMS. Therefore, Impacts BIO-8 and BIO-9 and the identified mitigation
12 measures would apply under this alternative. As under the Project, the impact on delta
13 and longfin smelt would remain significant even though LTMS temporal restrictions
14 combined with the temporal restriction contained in MM BIO-8a may incrementally reduce
15 the impact. MMs BIO-8a and BIO-8b would be necessary as they provide enhanced and
16 refined protection for both delta and longfin smelt not contained in the LTMS. Although
17 green sturgeon is not included in the LTMS (because it was listed after the LTMS was
18 adopted), the measures included in the 2006 NMFS conference opinion would reduce
19 impacts on this species to less than significant.

20 **Clamshell Dredge Mining Alternative**

21 The Clamshell Dredge Mining Alternative would employ a method other than suction
22 dredge mining for recovering sand from the floor of the Bay-Delta estuary. The volume of
23 sand and lease sites mined would remain the same as for the proposed Project. Because
24 mining would occur in the same locations, it would have the potential to cause
25 mechanical damage to the benthic communities inhabiting hard substrate areas, and
26 MM BIO-6 would apply. Because the clamshell method does not involve suction, the
27 potential for entrainment of fish is greatly reduced. Furthermore, fish are likely to be able
28 to avoid the clamshell bucket, and not to become entrapped within it. However, as
29 discussed in Section 4.3, Hydrology and Water Quality, clamshell bucket mining would
30 involve raising the clamshell up through the entire water column, and would likely create a
31 more extensive plume of elevated turbidity and suspended sediment than would the
32 proposed Project. The clamshell method would also require more time per volume of
33 sand extracted than would suction dredge mining. However, Sustar et al. found that the
34 turbidity and suspended sediment characteristics of plumes resulting from clamshell and
35 suction head dredging were similar (i.e., the range of measured SSC values within the
36 plumes were similar) (Sustar et al 1976). As such, the potential for the Clamshell Dredge

1 Alternative to adversely affect biological resources would be less than under the proposed
2 Project, and would likely be less than significant.

3 **Reduced Project Alternative**

4 The Reduced Project Alternative would reduce the allowable mining volumes in all lease
5 areas to a level equivalent to current baseline volumes (i.e., the average mined per year at
6 each Project parcel from 2002 to 2007), as described in Section 3.0, Alternatives and
7 Cumulative Projects. All other aspects of the Project would remain the same, including
8 mining methods, equipment, and locations. Because mining would occur in the same
9 locations, this alternative would have the potential to cause mechanical damage to the
10 benthic communities inhabiting hard substrate areas, although the reduced volume of
11 operations would reduce the impact. Nevertheless, the impact would be significant and
12 Impact BIO-6 would apply. The Reduced Project Alternative would reduce the number of
13 individuals of listed species that mining operations would be likely to entrain or otherwise
14 kill, thus reducing the level of incidental take. Therefore, this alternative would reduce the
15 severity of Impacts BIO-8 and BIO-9. However, the likelihood exists that some take would
16 still occur; therefore, these impacts would remain significant. As under the Project, MMs
17 BIO-8a and BIO-8b would reduce the severity of Impact BIO-8, but this impact would
18 remain significant; MMs BIO-9a and BIO-9b would mitigate impact BIO-9 to less than
19 significant.

20 **4.1.6 Cumulative Projects Impact Analysis**

21 As discussed throughout this section, the proposed sand mining operations would result in
22 temporary, mostly less-than-significant impacts on biological resources within Central Bay,
23 Suisun Bay, and the western Delta. The majority of Project impacts on biological
24 resources would be limited to within the mining lease areas. Mining activities occur on
25 relatively disturbance-prone bottom habitat, which is expected to recover to pre-mining
26 conditions within a period of several months to years. Other projects in San Francisco Bay
27 would also contribute to the incremental loss of biological resources, specifically through
28 the entrainment of juvenile and adult fish, and invertebrates. As identified in Section 3.0,
29 Alternatives and Cumulative Projects, these projects include the Potrero Generating Plant
30 on the south San Francisco waterfront, (which ceased operation in January 2011); Marin
31 Municipal Water District Desalination facility; Bay Area Regional Desalination Project;
32 dredging and dredge materials disposal per the LTMS; dredging to potentially deepen
33 and/or widen parts of the John F. Baldwin Ship Channel in San Francisco Bay, the
34 Stockton Deep Water Ship Channel, and the Sacramento River Deep Water Ship
35 Channel; and various waterfront and restoration projects around the Bay. Environmental

1 analysis is either underway or completed for most of these projects, and several are under
2 construction or have recently been completed.

3 Three impacts of the proposed Project are considered to be significant prior to mitigation
4 – mechanical damage to the benthic communities inhabiting hard substrate areas (BIO-6),
5 the potential entrainment of delta and longfin smelt (Impact BIO-8); and the loss of green
6 sturgeon and migrating Chinook salmon smolts (Impact BIO-9). Continuation of existing
7 permit conditions in conjunction with implementation of MMs BIO-6, BIO-8a, BIO-8b, BIO-
8 9a, and BIO-9b, would reduce Impacts BIO-6 and BIO-9 to less-than-significant. The
9 severity of BIO-8, however, would remain significant.

10 The cumulative projects described above, as well as larger-scale impacts to these
11 species, including water diversions, habitat modification, and pollution, result in a
12 cumulative impact that has resulted in the listing of these species under the State and
13 Federal ESAs. With the specified mitigation measures, the Project would not be expected
14 to make a considerable contribution to cumulative impacts to benthic communities,
15 Chinook salmon, or green sturgeon; neither would the other, less-than-significant
16 biological impacts of the Project combine with other projects to cause a significant impact,
17 either because their contribution to such an impact would not be cumulatively
18 considerable, or because the cumulative impact itself would not be significant.

19 The Project's significant unavoidable impact on longfin smelt and delta smelt, however, is
20 cumulative in nature: the Project itself would not be the primary cause of the decline of
21 these species, but it would contribute to that decline. Therefore, Impact BIO-8 is
22 considered significant and unavoidable for the Project, both individually and cumulatively.