UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

JUN 29 2004

In Reply Refer To:
SWR-03-SA-8893:JSS

Michael S. Jewell
Chief, Central California/Nevada
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Dear Mr. Jewell:

This document transmits the National Marine Fisheries Service's (NOAA Fisheries) biological opinion based on our review of the proposed Rock Island Marina project and associated housing development in Contra Costa County, California, and its effects on endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run Chinook salmon *(O. tshawytscha)*, and threatened Central Valley steelhead *(O. mykiss)* in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. • 1531 *et seq.*). Your April 22, 2003, request for section 7 consultation was received on April 23, 2003. A response was sent to your agency on June 18, 2003, requesting additional information from the U.S. Army Corps of Engineers (Corps) and the applicant regarding the proposed project and its effects upon listed salmonids. Information completing the consultation package from the applicant and Corps was received by NOAA Fisheries on August 26, 2003, and formal consultation was initiated on that date.

This biological opinion (Enclosure 1) is based on information provided in the April 22, 2003, section 7 consultation initiation package; telephone conversations held May 2, 2003, between staff from NOAA Fisheries and Ms. Diane Moore of Moore Biological Consultants, regarding project alternatives and agency concerns; and responses dated July 17 and 26, 2003, to NOAA Fisheries' requests for additional information on the proposed project. A complete administrative record of this consultation is on file at the Sacramento Area Office of NOAA Fisheries.

The biological opinion concludes that the Rock Island Marina project, including the associated housing development, proposed by the applicant and permitted by the Corps, is not likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. NOAA Fisheries believes that there will be some incidental take of Sacramento River winter-run Chinook salmon, Central

Valley spring-run Chinook salmon, and Central Valley steelhead as a result of the project's implementation. Therefore, an incidental take statement is included with the biological opinion. This statement contains reasonable and prudent measures that NOAA Fisheries believes are necessary and appropriate to avoid, minimize, and monitor project impacts. Terms and conditions to implement the reasonable and prudent measures are presented in the incidental take statement and must be adhered to in order for the take exemptions of section 7(o)(2) of the ESA to apply (16 U.S.C. 1536[o][2]). The incidental take coverage provided by this biological opinion covers the actions of the construction phase and the routine operation and activities of the marina and housing development during their operational lifetime. It does not provide for the incidental take of listed salmonids as a result of the operation of watercraft associated with the marina or in any illegal discharge of materials to the waters of the United States.

This document also transmits NOAA Fisheries' Essential Fish Habitat (EFH) Conservation Recommendations for Pacific salmon (*Oncorhynchus* spp.) and groundfish as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as amended (16 U.S.C. 1801 *et seq.*; Enclosure 2). The Corps has a statutory requirement under section 305(b)(4)(B) of the MSA to submit a detailed response in writing to NOAA Fisheries within 30 days of receipt of these Conservation Recommendations that includes a description of the measures proposed for avoiding, mitigating, or offsetting the impact of the activity on EFH (50 CFR 600.920 [j]). If unable to complete a final response within 30 days, the Corps should provide an interim written response within 30 days before submitting its final response.

If you have any questions regarding this response, please contact Jeffrey Stuart in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Mr. Stuart may be reached by telephone at (916) 930-3607 or by Fax at (916) 930-3629.

Sincerely,

Rodney R McInnis

Rodney R. McInnis
Acting Regional Administrator

Enclosures (2)

cc: James Starr, California Department of Fish and Game
Ryan Olah, U. S. Fish and Wildlife Service
Diane Moore, Moore Biological Consultants
Mr. Eric Johnston, Hawkeye Builders, Inc.

Enclosure 1

BIOLOGICAL OPINION

AGENCY: U.S. Army Corps of Engineers, Sacramento District

ACTIVITY: Rock Island Marina Project

CONSULTATION CONDUCTED BY: Southwest Region, National Marine Fisheries Service

FILE NUMBER: SWR-03-SA-8893

DATE ISSUED: JUN 29 2004

I. CONSULTATION HISTORY

On April 23, 2003, the U.S. Army Corps of Engineers, Sacramento District Office (Corps) requested consultation with the National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA). The Corps sought concurrence that the Rock Island Marina project was not likely to adversely affect endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run Chinook salmon *(O. tshawytscha)*, and threatened Central Valley steelhead *(O. mykiss)*.

On May 2 and 30, 2003, and June 5, 11, and 13, 2003, Jeffrey Stuart of NOAA Fisheries corresponded with Diane Moore of Moore Biological Consultants, by telephone, email, and in person to discuss details of the project including the effects of treated wood used in the marina construction on aquatic habitat, and the management of stormwater discharge from the housing development into Sand Mound Slough. Ms. Moore is the environmental consultant for Mr. Eric Johnston, Hawkeye Builders, Inc./Rock Island Homes, Inc., hereafter referred to as the applicant.

On April 23, 2003, NOAA Fisheries received a request for consultation on the proposed project. On June 18, 2003, NOAA Fisheries responded with a request for additional information on the proposed project, including the housing development and its stormwater outfall. On July 19, 22, and 26, 2003, and August 26, 2003, NOAA Fisheries received further information on the project from the Corps and the project's consultants. Included in the updated project description was a proposed purchase of mitigation credits at both the Medford Island Conservation Bank and the Kimball Island Mitigation Bank to compensate for adverse impacts to wetlands and shallow water habitat. On October 10, 2003, NOAA Fisheries informed the Corps that formal consultation for the Rock Island Marina project was initiated on August 26, 2003.

II. DESCRIPTION OF THE PROPOSED ACTION

The Corps proposes to authorize two permits under section 10 of the Rivers and Harbors Act and section 404 of the Clean Water Act to dredge approximately 15,000 cubic yards (cy) of material from the waters of Sand Mound Slough and fill approximately 5.57 acres of wetlands to construct a residential subdivision and associated private marina on the western margin of Sand Mound Slough. The subdivision will consist of 91 new single family homes on approximately 36 acres of Hotchkiss Tract in the western Sacramento-San Joaquin Delta. Within the waters of Sand Mound Slough, the applicant intends to construct a 100-slip marina, comprised of 91 private slips and 9 common slips.

A. Project Activities

1. Residential Development

The applicant intends to create a planned development of 91 residential units on approximately 36 acres along the western shore of Sand Mound Slough. The development will consist of 27 single family detached homes and 64 attached units *(i.e.,* townhouses) at the southern terminus of Sand Mound Boulevard. The units will be clustered around small, centralized man-made lakes.

The development of this property will necessitate the extension of Sand Mound Boulevard approximately 1,800 feet from the current end of the county-maintained portion of the road to the proposed development site. The new road extension is in an area that is zoned for residential development by the City of Oakley, and may be developed in the future. However, NOAA Fisheries has not received information on any future development that may occur within the immediate area of the Rock Island development. A total of approximately 5,800 linear feet of roadway will be paved with a total area of approximately 194,330 square feet of impervious surface created. The paving of the driveways for the single family detached dwellings will result in an estimated additional 121,000 square feet of paved surface. The development is expected to increase traffic in the area by 60 percent to approximately 2,400 vehicle trips per day from the existing level of 1,500 vehicle trips per day.

The construction phase of the Rock Island Marina will involve the reconfiguration of the parcel of land that the development is situated upon. The land will be surveyed, graded and shaped for the future home sites and roadways. In order to achieve this condition, NOAA Fisheries expects existing vegetation will be scraped from the construction site, and soil elevations established according to project plans. Roadways will be cut into the soil, and base layers of gravel deposited prior to surfacing the roadbed with asphalt. Trenches will be dug to provide for utilities such as water, gas, and sanitary sewer lines and the developer will install all municipal utilities, including electric, sewer, and potable water lines. The developer also will install street lighting according to county codes as well as improving traffic signage and traffic flow within the area of the development, as prescribed by the county.

2. Stormwater Management

The developer plans to create a drainage system that will collect all surface storm water in earthen ditches that run south to north within the development and then discharge this water into the Reclamation District 799 (RD 799) drainage ditch bordering the northern edge of the development. The RD 799 ditch has its water pumped over the levee into Sand Mound Slough through an existing pump and outfall structure.

The plans for the storm water collector ditches call for a vegetated surface that will retard storm water flow velocities and capture sediments from the runoff. The ditches are to be constructed as a series of small basins, approximately eight inches deep, and will be connected by 18-inch diameter culverts that will run along the edges of Sand Mound Boulevard within the development. Concrete wing walls will be constructed around a new 60-inch diameter reinforced concrete pipe that will allow the RD 799 ditch to pass under Sand Mound Boulevard. The developer plans to construct a new intake structure on the RD 799 ditch to replace the current pump platform. The platform will be 20 feet by 20 feet and supported by metal sheet-piles, resulting in the loss of approximately 80 square feet of in-channel surface area (0.002 acres). The existing 25-horsepower (hp) pump will be replaced with a 50-hp pump. To allow for the future installation of an additional 50-hp pump, required by RD 799 for increased runoff volumes, a second pump pad will be constructed on the new platform. A new concrete wing wall and trash rack will be constructed for the pump intake. The existing 12-inch diameter outfall pipeline will be replaced with a new steel outfall pipe that is 18-inches in diameter. A second 18-inch steel outfall pipeline will be installed parallel to this one to accommodate the future pump. The pipelines will extend 280 linear feet to the east, and cross over the western levee bank to Sand Mound Slough, where they will discharge to the water. A cutoff wall will be constructed three feet from the hinge point of the pipes, and a siphon breaker installed on each pipe as it descends into Sand Mound Slough. The cutoff wall will prevent seepage from the water side of the levee along the path of the pipelines that could lead to instability in the levee. The siphon breakers will prevent water from Sand Mound Slough from flowing backwards into the RD 799 ditch should there be a loss of power to the pump or periods when the float switch at the pump is not activated. The water surface level of the RD 799 ditch is -9.8 feet below mean sea level (msl) whereas the slough's water level is at msl, creating a substantial hydrostatic head between the two water levels. The outlet of the outfall pipe will be located at an elevation of -7.0 feet msl. The developer intends to provide screening for the outlet of the pipe, but has not decided on a final design style.

3. Marina

The developer plans to construct a 100-slip marina comprised of 13 docks for the use of the residents of the subdivision and their guests. Twelve, eight-slip docks will be for the use of homeowners and guests. A four-slip common dock with pump out facilities for the discharge of onboard sanitary wastes also will be constructed. The footprint of the typical eight-slip dock will extend approximately 109 feet out into the channel from the levee crest. An additional 15 feet of channel will *be* associated with the outside edge of the dock structure for mooring vessels. Each individual floating dock structure will be 66 feet wide by 72 feet long with four slips on each side, and held in place with six piles. The floating dock structure will be attached to the shore by a 37-foot long gangplank and walkway. Each eight-slip dock structure with associated berthed boats will cover approximately 4,800 square feet of water surface area. The four-slip common dock will cover approximately 2,400 square feet of water surface area. The total surface area covered by the dock structures and berthed vessels will be approximately 60,200 square feet (1.4 acres).

A total of 91 piles will be driven for the marina complex, which will place approximately 413 cy of fill (0.01 acres) into the open water habitat of Sand Mound Slough. The developer intends to use concrete or steel piles, with final determination by the subcontractor building the marina facilities. Piles will be driven into the substrate using a barge-mounted pile driver equipped with a 3,000 pound drop hammer. The floats for the docks will be fabricated from fiberglass with encapsulated foam flotation, and the deck material will be either concrete or vinyl. The developer has proposed using pressure-treated Douglas fir lumber fastened with galvanized hardware for deck supports.

The sanitary pump-out facility will be located on the four-slip common dock at the north end of the marina. The sanitary sewer pump will be located on the crest of the levee, and a suction line with flexible joints will extend to the pump-out facility on the common dock. The dock-side hookups will be equipped with check valves to prevent backflow in the line. The pump will discharge to a 4-inch sanitary sewer line that will run down the inland side of the levee and connect to the main sewer line for the development.

4. Dredging

In order to provide boating access to the marina, the developer intends to dredge approximately 15,000 cy of material from 3.60 acres of tidal shallow water habitat. The Sand Mound Slough channel will be dredged to a -8.0 foot msl elevation below the marina docks, and to -6.0 feet msl elevation out to the middle of the channel. Dredging operations will take place in a 1,680-foot by 180-foot area (*i.e.*, approximately 7 acres), of which only about half actually will be dredged. Dredging will be accomplished using a barge mounted suction dredge with a hydraulic cutter head. Dredge spoils will be pumped over the levee to a constructed dredge material placement site measuring 200 feet by 400 feet located within the subdivision property. Internal levees will be constructed to create a serpentine flow path from the inflow pipeline to the discharge pipeline for decant water, which will be discharged back into the southern end of the slough. Future maintenance dredging anticipated for the continued operation of the marina is expected to require separate Corps permits.

B. Proposed Conservation Measures

Design features integrated into the project description by the Corps and applicant to avoid, minimize, or compensate for potential impacts to listed species include the following:

1. Use of steel or concrete pilings, and concrete or vinyl decking, instead of treated wood; and

2. Purchase of mitigation credits at both the Medford Island Conservation Bank and Kimball Island Mitigation Bank to offset losses of shallow water and wetland habitat.

C. Action Area

The action area includes all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). For the Rock Island Marina project, the action area is considered to be the 36-acre footprint of the housing development located at the southeast corner of Hotchkiss Tract at the intersection of Sand Mound Slough and Rock Slough; the shoreline of the housing development which encompasses approximately 0.4 miles of the western levee of Sand Mound Slough, north of the levee separating Rock Slough from Sand Mound Slough; and the waters of Sand Mound Slough and the adjacent waters of the Sacramento-San Joaquin Delta including Dutch Slough, Taylor Slough, Piper Slough, portions of Franks Tract and the portion of Sand Mound Slough between Dutch Slough and Old River. These adjacent, interconnected waterways provide the only access for vessels berthed at the Rock Island Marina to the Delta, and as such will be impacted most directly by the increase in vessel traffic from the marina.

NOAA Fisheries does not expect that it will be possible to determine the extent of the effects from contaminants resulting from this project upon the Delta aquatic environment as a whole due to the substantially larger volume of Delta waters and the additional input of other sources of contaminants. The Delta region encompasses approximately 738,000 acres. Of these 738,000 acres, there are approximately 60,000 acres of waterways with about 57,238 acres of navigable waterways. The project's marina construction will directly impact only about 7 acres of waters and indirectly impact somewhat more area due to the effects of water movement in the Delta. This amounts to less than 0.01 percent of the Delta's waterways. Therefore, although there can be adverse effects to listed salmonids within the immediate area of the project, these effects will rapidly diminish as the distance increases away from the project area. This reduction in discernable effects is due to the substantial dilution within the larger water volumes found in the Delta's main channels and mixing from tidal and river currents within these water bodies.

III. STATUS OF THE SPECIES AND HABITAT

This biological opinion analyzes the effects of the Rock Island Marina project on the following federally listed species:

(1) Sacramento River winter-run Chinook salmon--endangered;
(2) Central Valley spring-run Chinook salmon—threatened; and
(3) Central Valley steelhead–threatened.

Critical habitat is not designated for the Central Valley spring-run Chinook salmon or Central Valley steelhead Evolutionarily Significant Units (ESUs), and the action area is not within the region designated as critical habitat for Sacramento River winter-run Chinook salmon. Therefore, critical habitat for winter-run Chinook salmon is not affected by the proposed action.

A. Species Life History, Population Dynamics, and Likelihood of Survival and Recovery

1. Sacramento River Winter-run Chinook Salmon ESU

The Sacramento River winter-run Chinook salmon was formally listed as threatened in November 1990 (55 FR 46515), and was reclassified as endangered under the ESA on January 4, 1994 (59 FR 440). On June 16, 1993 (58 FR 33212), NOAA Fisheries designated critical habitat for the winter-run Chinook salmon.

The first adult winter-run Chinook salmon migrants appear in the Sacramento-San Joaquin River system during the early winter months (Skinner 1962). Within the Delta, winter-run adults begin to move through the system in early winter *(i.e.,* November-December), with the first upstream adult migrants appearing in the upper Sacramento River during late December (Vogel and Marine 1991). Adult winter-run presence in the upper Sacramento River system peaks during the month of March. The timing of migration may vary somewhat due to changes in river flows, dam operations, and water year type. Spawning occurs primarily from mid-April to mid-August with peak activity occurring in May and June in the river reach between Keswick Dam and the Red Bluff Diversion Dam (RBDD) (Vogel and Marine 1991). The majority of winter-run Chinook salmon spawners are three years old, although some two-year-old and four-year-old fish are also present.

Emigration of juvenile winter-run Chinook past the RBDD may occur as early as late July or August, but generally peaks in September and can extend into the next spring in dry years (Vogel and Marine 1991). In the mainstems of larger rivers, juveniles tend to migrate along the margins of the river, rather than in the increased velocity found in the thalweg of the channel. When the channel of the river is greater than 9 to 10 feet in depth, the juvenile salmon inhabit the surface waters (Healy and Jordan 1982).

Juvenile winter-run Chinook salmon occur in the Sacramento-San Joaquin Delta from October through early May based on data collected from trawls, beach seines, and salvage records at the State and Federal water projects (California Department of Fish and Game [DFG] 1998). The peak of juvenile arrivals is from January to March. They tend to rear in the freshwater upper delta areas for about the first two months (Kjelson *et al.* 1981, 1982). As they mature, Chinook fry and fingerlings prefer to rear further downstream where ambient salinity is up to 1.5 to 2.5 parts per thousand (Healy 1980, 1982; Levings *et al.* 1986).

Juvenile Chinook salmon forage in shallow areas with protective cover, such as intertidal and subtidal mudflats, marshes, channels and sloughs (McDonald 1960; Dunford 1975). Cladocerans, copepods, amphipods and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson *et al.* 1982; Sommer *et al.* 2001). Shallow water habitats are more productive than the main river channels, supporting higher growth rates, partially due to higher prey consumption rates, as well as favorable environmental temperatures (Sommer *et al.* 2001). Optimal water temperatures for the growth of juvenile Chinook salmon in the Sacramento-San Joaquin Delta are 54 to 57 °F (Brett 1952). In Suisun and San Pablo Bays water temperatures reach 54 °F by February in a typical year. Other portions of the Delta do not reach this temperature until later in the year, often not until after spring runoff has ended.

Juvenile Chinook salmon follow the tidal cycle in their movements within the estuarine habitat, following the rising tide into shallow water habitats from the deeper main channels, and returning to the main channels when the tide recedes (Levy and Northcote 1981; Levings 1982; Healey 1991). As juvenile Chinook salmon increase in length, they tend to school in the surface waters of the main and secondary channels and sloughs, following the tide into shallow water habitats to feed (Allen and Hassler 1986). Kjelson *et al.* (1982) reported that juvenile Chinook salmon also demonstrated a diel migration pattern, orienting themselves to nearshore cover and structure during the day, but moving into more open, offshore waters at night. The fish also distributed themselves vertically in relation to ambient light. During the night, juveniles were distributed randomly in the water column, but would school up during the day into the upper 3 meters of the water column. Fry remain in the estuary until they reach a fork length of about 118 mm (*i.e.*, 5 to 10 months of age). Emigration from the delta may begin as early as November and continue through May (Fisher 1994; Myers *et al.* 1998).

Winter-run Chinook salmon are particularly susceptible to extinction due to the limitations of access to suitable spawning grounds and the reduction of their genetic pool to one population (NOAA Fisheries 1997). Sacramento River winter-run Chinook salmon also have lower fecundity compared to other races of Chinook salmon in the Central Valley, averaging 1,000 to 2,000 eggs less per female than the other runs. Winter-run fish average 3,700 eggs per female fish, whereas Central Valley late fall-run Chinook salmon have an average of 5,800 eggs per female, spring-run Central Valley Chinook salmon average 4,900 eggs per female, and fall-run Chinook salmon average 5,500 eggs per a female (Fisher 1994). Both environmentally and anthropogenically-mediated changes to the habitat have led to declines in the Sacramento River winter-run populations (see Figure 1) over the past three decades.

2. Central Vallev Spring-run Chinook Salmon ESU

NOAA Fisheries listed Central Valley spring-run Chinook salmon as threatened on September 16, 1999 (50 FR 50394). Many of the same factors that have led to the decline of the Sacramento River winter-run Chinook salmon ESU are also applicable to the Central Valley spring-run Chinook salmon ESU, particularly the exclusion from historical spawning grounds found at higher elevations in the watersheds. Historically, spring-run Chinook salmon were abundant throughout the Sacramento River and San Joaquin River systems. They constituted the dominant run of salmon in the San Joaquin River system prior to being extirpated by the construction of low elevation dams on the main tributaries of the watershed. Spring-run Chinook salmon typically spawned in higher elevation watersheds such as the San Joaquin, American, Yuba, Feather, Sacramento, McCloud, and Pit Rivers. Currently, spring-run Chinook salmon cannot access most of their historical spawning and rearing grounds in the Central Valley due to the construction of impassable dams in the lower portions of the Central Valley's waterways. Today, the only streams that are considered to harbor naturally spawning wild stocks of spring-run Chinook salmon are Mill, Deer, and Butte Creeks. All of these creeks are east-side creeks that do not have a major dam or migration barrier. Some additional spawning occurs in the Feather River and mainstem Sacramento River, but the genetic characteristics of fish that spawn in these locations suggest introgression with both spring-run and fall-run hatchery fish. Elevated water temperatures, agricultural and municipal water diversions, regulated water flows, entrainment into unscreened or poorly functioning screened diversions, and riparian habitat degradation all have negatively impacted the Cental Valley spring-run Chinook salmon ESU.

Adult Central Valley spring-run Chinook salmon migrate into the Sacramento River system between March and July, peaking in May through June. They hold in cold water streams at approximately 1,500 feet above sea level prior to spawning, conserving energy expenditures while their gonadal tissue matures. They spawn from late August through early October, peaking in September (Fisher 1994, Yoshiyama *et al.* 1998). Between 56 to 87 percent of adult spring-run Chinook salmon that enter the Sacramento River basin to spawn are three-year-olds (Fisher 1994). Spring-run Chinook salmon fry emerge from the gravel from November to March and spend about 3 to 15 months in freshwater habitats prior to emigrating to the ocean (Kjelson *et al.* 1981). Downstream emigration by juveniles occurs from November to April. Upon reaching the Delta, juvenile spring-run Chinook salmon forage on the same variety of organisms while utilizing the same type of habitats as previously described for Sacramento River winter-run Chinook salmon juveniles.

Adult escapement/spawning stock estimates for the past thirty years have shown a highly variable population for the Central Valley spring-run Chinook salmon ESU. Even though the abundance of fish may increase from one year to the next, the overall average population trend has a negative slope during this time period (see Figure 2). These variations in annual population levels may result from differences in individual tributary cohort recruitment levels. Central Valley spring-run Chinook salmon, like Sacramento River winter-run Chinook salmon, have a lower fecundity than the larger-sized fish of the Central Valley fall/late fall runs. This, coupled with the need for cold water to over-summer in while waiting for gonadal tissue to mature, places the Central Valley spring-run Chinook salmon population at a higher risk for population declines than the fall-/late fall-run populations. Warmer summer water temperatures increase the likelihood of disease and lowered fertility in fish that have to hold in sub-optimal conditions.

3. Central Valley Steelhead

On March 19, 1998, NOAA Fisheries listed the Central Valley steelhead as threatened (63 FR 13347). Historically, Central Valley steelhead once were found throughout the Sacramento River and San Joaquin River drainages, where waterways were accessible to migrating fish. Steelhead historically were present in the upper San Joaquin River basin, above the current Friant Dam location. Steelhead commonly migrated far up tributaries and into headwater streams where cool, well oxygenated waters are present year-round. Currently, within the Central Valley, viable populations of naturally produced steelhead are found only in the Sacramento River and its tributaries (U.S. Fish and Wildlife Service [FWS] 1998). Wild steelhead populations appear to be restricted to tributaries on the Sacramento River below Keswick Dam, such as Antelope, Deer, and Mill creeks, and in the Yuba River, below Englebright Dam (McEwan and Jackson 1996). At this time, no significant populations of steelhead remain in the San Joaquin River basin (FWS 1998). However, small persistent runs still occur on the Stanislaus and perhaps the Tuolumne Rivers. Steelhead are found in the Mokelumne River and Cosumnes River, but may be of hatchery origin. It is possible that other naturally spawning populations exist in other Central Valley streams, but are not detected due to a lack of sufficient monitoring and genetic sampling of presumed resident rainbow trout (Interagency Ecological Program [IEP] Steelhead Project Work Team 1999).

Central Valley steelhead all are considered to be winter-run steelhead (McEwan and Jackson 1996), which are fish that mature in the ocean before entering freshwater on their spawning migrations. Prior to the large scale construction of dams in the 1940s, summer steelhead may have been present in the Sacramento River system (IEP Steelhead Project Work Team 1999). The timing of river entry is often correlated with an increase in river flow, such as occurs during freshets and precipitation events with the associated lowering of ambient water temperatures. The preferred water temperatures for migrating adult steelhead are between 46 and 52 °F (Bjornn and Reiser 1991). Entry into the river system occurs from July through May, with a peak in late September. Spawning can start as early as December, but typically peaks between January and March, and can continue as late as April, depending on water conditions (McEwan and Jackson 1996). Steelhead are capable of spawning more than once (iteroparity) as compared to other salmonids which die after spawning (semelparity). However, the percentage of repeat spawning often is low, and is predominated by female fish (Busby *et al.* 1996). Steelhead prefer to spawn in cool, clear streams with suitable gravel size, water depth, and water velocities. Ephemeral streams may be used for spawning if suitable conditions in the headwaters remain during the dry season and are accessible to juvenile fish seeking thermal refuge from excessive temperatures and dewatering in the lower elevation reaches of the natal stream (Barnhart 1986).

In Central Valley streams, fry emergence usually occurs between February and May, but can occur as late as June. After emerging from the gravel, fry migrate to shallow, protected areas associated with the margins of the natal stream (Barnhart 1986). Fry will take up and defend feeding stations in the stream as they mature, and force smaller, less dominant fry to lower quality locations (Shapovalov and Taft 1954). In-stream cover and velocity refugia are essential for the survival of steelhead fry, as is riparian vegetation, which provides overhead cover, shade, and complex habitats. As fry mature, they move into deeper waters in the stream channel, occupying riffles during their first year in fresh water. Larger fish may inhabit pools or deeper runs (Barnhart 1986). Juvenile steelhead feed on a variety of aquatic and terrestrial invertebrates, and may even prey on the fry and juveniles of steelhead, salmon, and other fish species. Steelhead juveniles may take up residence in freshwater habitat for extended periods of time prior to emigrating to the ocean. Optimal water temperatures for fry and juveniles rearing in freshwater is between 45 and 60 °F. The upper lethal limit for steelhead is approximately 75 °F (Bjornn and Reiser 1991). Temperatures over 70 °F result in respiratory distress for steelhead due to low dissolved oxygen (DO) levels.

Steelhead typically spend one to three years in freshwater before migrating downstream to the ocean. Most Central Valley steelhead will migrate to the ocean after spending two years in freshwater, with the bulk of migration occurring from November to May, although some low levels may occur during all months of the year. The out-migration peaks from April to May on the Stanislaus River whereas the American River has larger smolt-sized fish emigrating from December to February and smaller sized steelhead fry coming through later in the spring (March and April). Feather River steelhead smolts are observed in the river until September, which is believed to be the end of the outmigration period (CALFED Bay-Delta Program [CALFED] 2000a).

Over the past 30 years, the naturally spawned steelhead populations in the Upper Sacramento River have declined substantially (see Figure 3). Central Valley steelhead are susceptible to population declines due to the lack of cool summer water temperatures required for the survival of juvenile fish. Summer flows for many tributaries are influenced by water diversions to support agriculture. Instream flows are frequently reduced, and the ambient water temperatures in the tailwater sections of the tributaries may exceed the tolerances of juvenile steelhead, thereby causing morbidity and mortality in the fish inhabiting these sections.

B. Habitat Condition and Function

The freshwater habitat of salmon and steelhead in the Sacramento-San Joaquin drainage varies in function, depending on location. Spawning areas are located in accessible, upstream reaches of the Sacramento or San Joaquin Rivers and their watersheds where viable spawning gravels and water conditions are found. Spawning habitat condition is strongly affected by water flow and quality - especially temperature, DO, and silt load - all of which can greatly affect the survival of eggs and larvae.

Migratory corridors are downstream of the spawning areas and include the Sacramento-San Joaquin Delta. These corridors allow the upstream passage of adults and the downstream emigration of outmigrant juveniles. Migratory habitat condition is strongly affected by the presence of barriers which can include dams, unscreened or poorly screened diversions, and degraded water quality.

Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Non-natal, intermittent tributaries also may be used for juvenile rearing (Maslin 1999). Rearing habitat condition and function may be affected by annual and seasonal flow and temperature characteristics. Specifically, the lower reaches of streams often become less suitable for juvenile rearing during summer. Rearing habitat condition and function are strongly affected by habitat complexity, food supply, and presence of predators of juvenile salmonids. Some complex, productive habitats with floodplains remain in the system *(e.g.,* the lower Cosumnes River, and Sacramento River reaches with setback levees *[i.e.,* primarily located upstream of the City of Colusa]). However, the channelized, leveed, and rip-rapped river reaches and sloughs that are common in the Sacramento-San Joaquin River systems typically have low habitat complexity, low abundance of food organisms, and offer little protection from either fish or avian predators.

C. Factors Affecting the Species and Habitat

Sacramento River winter-run and Central Valley spring-run Chinook salmon, as well as Central Valley steelhead historically all utilized higher elevation watersheds for holding, spawning, and rearing. For example, winter-run Chinook salmon historically spawned in the headwater reaches of the little Sacramento, McCloud and Lower Pit River systems, which had cool, stable temperatures for successful egg incubation over the summer. Populations of winter-run Chinook salmon may have numbered over 200,000 fish (Moyle *et al.* 1989, Rectenwald 1989, Yoshiyama *et al.* 1998). Construction of Shasta Dam blocked access to all of the winter-run Chinook salmon's historical spawning grounds by 1942. Preservation of a remnant winter-run population was achieved through manipulation of the dam's releases to maintain a cold water habitat in the Sacramento River below the dam as far downstream as Tehama. Other large dams constructed on the natal streams *(e.g.,* the American, Feather and Yuba Rivers) of Central Valley spring-run Chinook salmon and Central Valley steelhead resulted in the loss of access to much of the historical spawning and rearing habitat of these species. Current spawning areas located downstream of dams often are subject to flow and temperature fluctuations and consequent egg and larval mortality resulting from reservoir operation.

Dam construction also has led to alterations in the hydrology of the Sacramento-San Joaquin River system. This has resulted both in reductions in the volume of water flowing through the system and the timing of peak flows that stimulate migratory behavior in both juvenile and adult fish. Currently, less than 40% of historical flows reach San Francisco Bay through the Delta. The reduction in the peak flows has led to alterations in the cycling of nutrients and changes in the transport of sediment and organic matter, which can lead to distinct alterations in the historical distribution of animal and plant communities upon which the juvenile Chinook salmon depend upon for their forage base and for protective cover. Alterations in flow patterns have also reduced freshwater outflows at the western margins of the Delta. This situation has led to fluctuating salinity levels within the western margin of the Delta and has changed the location and extent of the productive mixing zone between saline and fresh water bodies. Changes in the flushing rate and increased residence time of Delta water also has enhanced the degradative effects of an increased input of contaminants and pollutants to the water system.

Other factors affecting the species and habitat *(e.g.,* levee construction and loss of shallow water habitat, Central Valley Project [CVP] and State Water Project [SWP] operations, invasive species, *etc.)* are especially pertinent to the western Sacramento-San Joaquin Delta *(i.e.,* the location of the action area) and are discussed below under *IV. Environmental Baseline.*

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species within the action area. The environmental baseline "includes the past and present impacts of all Federal, State or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation process" (50 CFR §402.02).

The action area is in the western Sacramento-San Joaquin Delta, within the boundaries of northern Contra Costa County. The development is on the west side of Sand Mound Slough, near its southern terminus. Sand Mound Slough is a shallow slough that historically connected to Rock Slough in the south, and flows northward towards Old River. Dutch Slough and Piper Slough intersect with Sand Mound Slough along its northern bank and the flooded Franks Tract adjoins the slough at its confluence with Old River (see Figure 4). Sand Mound Slough typically is less than 10 feet deep and frequently is much shallower in its southern reaches. Currently, a dike divides Sand Mound Slough from Rock Slough. Two tidally-activated flap gates, on approximately 18-inch diameter culverts, prevent water from flowing upstream into Rock Slough from Sand Mound Slough on an incoming tide. However, water can flow from Rock Slough into Sand Mound Slough on a receding tide. Rock Slough is used as a water conveyance channel for the Contra Costa Canal, which supplies drinking water to northern Contra Costa County. Currently, the lands west of Sand Mound Slough are being developed for private homes and condominiums. The lands east of Sand Mound Slough still are primarily agricultural. Numerous private docks and marinas are situated on the northern reaches of Sand Mound Slough, and on Piper Slough and Dutch Slough (Bethel Island area). Sand Mound Slough has a few large walnut trees *(Juglans* spp.) on its western levee bank within the project area, along with smaller willow (*Salix* spp.) and landscaping trees. The eastern bank of the slough has several large stands of willow along the water, with root structure in the channel. Further north along the slough, tules

(*Scirpus* spp.) form mid-channel islands. The channel also has high densities of the invasive aquatic weed ***Egeria densa*** growing in it.

Studies conducted by the California Department of Boating and Waterways (DBW) in their Sacramento-San Joaquin Delta Boating Needs Assessment (2003) show that the western Delta has approximately 51% of the navigable waterways in the Delta, and has the highest concentration of marinas, fifty-six, which accounts for approximately 59 percent of the total number of marinas in the Delta region. These fifty-six marinas have 5,990 slips, two thirds of which are covered. In addition, 3,272 dry boat storage units are available in the western Delta besides the in-water facilities. This would account for nearly 10,000 permanently stored boats in this region. Statistics collected by DBW indicate that nearly 213,000 boats utilize the Delta, approximately 23 percent of the State's total boat numbers. Therefore, the vast number of boats apparently come from outside of the Delta region to utilize the waterways of the Delta.

A. Physical Habitat Alteration

The action area is in the Sacramento-San Joaquin Delta, which historically was dominated by freshwater marsh habitat. Nearly 1,400 km^2 of freshwater marsh in the Delta have been diked and drained primarily to create farmland. Industrialization and urbanization reclaimed even more acreage until today only about 6 percent of the original 2,200 km^2 area of native wetlands remains (Conomos *et al.* 1985). The original wetlands served as significant foraging areas for numerous species, and enhanced nutrient cycling and retention as well as acting as natural filters to enhance ambient water quality.

A major impact of levee construction has been the conversion of shallow-water habitats that were found along the margins of waterways into deeper rip-rap lined channels. Shallow-water habitats are considered essential foraging habitats for juvenile salmonids, often supporting complex and productive invertebrate assemblages. The substrate that is provided by the stone rip rap is unsuitable for the colonization of native estuarine invertebrate species. Native species (*e.g.*, clams, oligochaetes, chironomids, and amphipods) typically utilize soft substrates for colonization in the estuary rather than hard substrates. Likewise, levee construction has disconnected the rivers and Delta from their historical floodplains. Juvenile salmonids utilize flood plains for foraging and as a refuge from high flow velocities during flood events. Maintenance dredging of the channels can result in increased levels of suspended sediment, the formation of anoxic bottom waters, and increased saltwater intrusion into upstream areas, all of which may cause stress to fish and trigger physiological or behavioral responses.

B. Water and Sediment Quality

The water quality of the Delta has been negatively impacted over the last 150 years. Increased water temperatures, decreased DO levels, and increased turbidity and contaminant loads have degraded the quality of the aquatic habitat for the rearing and migration of salmonids. The California Water Quality Control Board-Central Valley Region (Regional Board) in its 1998

Clean Water Act §303(d) list characterized the Delta as an impaired waterbody having elevated levels of chlorpyrifos, DDT, diazinon, electrical conductivity, Group A pesticides (aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan and toxaphene), mercury, low DO, organic enrichment, and unknown tpxicities (Regional Board 1998, 2001).

In general, water degradation or contamination can lead to either acute toxicity, resulting in death when concentrations are sufficiently elevated, or more typically, when concentrations are lower, to chronic or sublethal effects that reduce the physical health of the organism, and lessens its survival over an extended period of time. Mortality may become a secondary effect due to compromised physiology or behavioral changes that lessen the organism's ability to carry out its normal activities. For example, increased levels of heavy metals are detrimental to the health of an organism because they interfere with metabolic functions by inhibiting key enzyme activity in metabolic pathways, decrease neurological function, degrade cardiovascular output, and act as mutagens, teratogens or carcinogens in exposed organisms (Rand 1995; Goyer 1996). For listed species, these effects may occur directly to the listed fish or to its prey base, which reduces the forage base available to the listed species.

Sediments can either act as a sink or as a source of contamination depending on hydrological conditions and the type of habitat the sediment occurs in. Sediment provides habitat for many aquatic organisms and is a major repository for many of the more persistent chemicals that are introduced into the surface waters. In the aquatic environment, most anthropogenic chemicals and waste materials including toxic organic and inorganic chemicals eventually accumulate in sediment (Ingersoll 1995).

Direct exposure to contaminated sediments may cause deleterious effects to listed salmonids. This may occur if a fish swims through a plume of the resuspended sediments or rests on contaminated substrate and absorbs the toxic compounds through one of several routes: dermal contact, ingestion, or uptake across the gills. Elevated contaminant levels may be found in localized "hot spots" where discharge occurs or where river currents deposit sediment loads. Sediment contaminant levels can thus be significantly higher than the overlying water column concentrations (U.S. Environmental Protection Agency [EPA] 1994). However, the more likely route of exposure to salmonids is through the food chain, when the fish feed on organisms that are contaminated with toxic compounds. Prey species become contaminated either by feeding on the detritus associated with the sediments or dwelling in the sediment itself. Therefore, the degree of exposure to the salmonids depends on their trophic level and the amount of contaminated forage base they consume. Response of salmonids to contaminated sediments is similar to water bourne exposures.

C. Water Operations

Operations of the CVP and SWP pumps in the South Delta have significantly altered water flow patterns in the Delta. When exports are high, water is drawn into the southern portions of the

Delta through the Delta Cross Channel, Georgiana Slough and Three Mile Slough from the mainstem of the Sacramento River. Fish are drawn with these altered flow patterns towards the pumping facilities. These alterations in water flow have resulted in fish from both the Sacramento River and the San Joaquin River systems being drawn into the South Delta as a result of the water diversions. Lower survival rates are expected due to the longer migration routes (Brandes and McLain 2001), where fish are exposed to increased predation, higher water temperatures, more unscreened water diversions, degraded water quality, reduced availability of food resources, and entrainment into the CVP/SWP export facilities near Clifton Court Forebay in the South Delta (FWS 1990, 1992). Currently, the CVP/SWP pumping facilities are operated to avoid pumping large exports of water during critical migratory or life stage phases of listed fish. Real time monitoring of fish movements, and the development of more efficient fish screens have led to a decrease in the numbers of fish lost to the projects, but entrainment still accounts for significant losses to the listed fish populations. Other significant water diversions occur in the western Delta at the Rock Slough pumping plant (currently unscreened) which supplies water to northern Contra Costa County. Additionally, Herren and Kawasaki (2001) reported that the Delta region had 2,209 other diversions based upon their field observations. Of these diversions, 90 percent measured between 12 and 24 inches and only 0.7 percent had screens on the intakes designed to protect fish from entrainment.

D. Invasive Species

Invasive species greatly impact the growth and survival of juvenile salmonids in the Delta. Non-native predators such as striped bass, largemouth bass, and other sunfish species present an additional risk to the survival of juvenile salmonids migrating through the Delta that was not historically present prior to their introduction. These introduced species are often better suited to the changes that have occurred in the Delta habitat than are the native salmonids. The presence of the Asian clam (*Potamocorbula amurensis)* has led to alterations in the levels of phyto- and zooplankton found in water column samples taken in the Delta. This species of clam efficiently filters out and feeds upon a significant number of these planktonic organisms, thus reducing the populations of potential forage species for juvenile salmonids. Likewise, introductions of invasive plant species such as the water hyacinth (*Eichhornia crassipes*) and *Egeria densa* have diminished access of juvenile salmonids to rearing habitat (Peter Moyle, University of California, Davis, personal communication April 25, 2002). *Egeria densa* forms thick "walls" along the margins of channels in the Delta. This growth prevents the juvenile salmonids from accessing their preferred shallow water habitat along the channel's edge. In addition, the thick cover of *Egeria* provides excellent habitat for ambush predators, such as sunfish and bass, which can then prey on juvenile salmonids swimming along their margins. Water hyacinth creates dense floating mats that can impede river flows and alter the aquatic environment beneath the mats. DO levels beneath the mats often drop below sustainable levels for fish due to the increased amount of decaying vegetative matter produced from the overlying mat. Like *Egeria,* water hyacinth is often associated with the margins of the Delta waterways in its initial colonization, but can eventually cover the entire channel if conditions permit. This level of infestation can produce barriers to salmonid migrations within the Delta.

The introduction and spread of *Egeria* and water hyacinth have created the need for aquatic weed control programs that utilize herbicides targeting these species. The *Egeria densa* Control Program (EDCP) resulted in the treatment of 1,583 acres in its first two years with diquat and fluridone (Department of Boating and Waterways 2000). Diquat, the active ingredient of Reward®, has been shown to have an acute toxicity to salmonids at concentrations as low as 11 parts per million (ppm) for juveniles and potentially as low as 0.76 ppm for larval fish. Fluridone, the active ingredient of Sonar® has been shown to have an acute toxicity of 7 to 12 ppm in rainbow trout (O. *mykiss*). Both herbicides are expected to have environmental concentrations one to two orders of magnitude lower than acutely toxic levels, but only after complete mixing in the water column. Furthermore, sublethal effects related to the herbicides may occur even at the lower concentrations, and indirect adverse effects from the dieback of the treated aquatic vegetation on water quality may cause take of listed salmonids within the treatment area.

The DBW control program targeting water hyacinth, has been in operation from 1982 through 1999 in the Delta. It has recently been reinstated, and a long-term opinion for years 3-5 has been issued this year by NOAA Fisheries. DBW has employed herbicides as the preferred method of control for water hyacinth for 17 years. Chemicals previously utilized in DBW's control program included the aquatic herbicides Weedar®64 (2,4-Dichlorophenoxyacetic acid, dimethylamine salt) (2,4-D), Rodeo® (glyphosate, N-(phosphonomethyl) glycine (isopropylamine salt), and Reward® (diquat dibromide); the adjuvants Activator 90® (alkyl polyoxyethylene ether and free fatty acids), Placement® (amine salts of organic acids, aromatic acid, aromatic and aliphatic petroleum distillate), SR-11® (alkyl aryl polyethoxylates, compounded silicone and linear alcohol), Agri-dex® (paraffin base petroleum oil and polyoxyethylate polyol fatty acid esters), Bivert® (amine salts of organic acids, aromatic acid, aromatic and aliphatic petroleum distillates), and SurpHtac®(polyozyethylated (6) decyl alcohol, 1-aminomethanamide dihydrogen tetraoxosulfate); and the activator Magnify®(ammonium salts, alkyl polyglucoside, and dimethylpolysilozane). From 1983-1999, a total of 17,613 acres were treated with 4,861 applications of primarily 2,4-D (> 95 percent of the total applied herbicides). For the last 6 years of the program, a total of 8,361 gallons of herbicide and 4,914 gallons of adjuvants were used in the Water Hyacinth Control Program (WHCP). An estimated 959 gallons of Weedar®64, 16 gallons of Rodeo®, and 320 gallons of Placement® were applied to Delta waters in the 2001 WHCP season, covering 1002 acres of Delta waters. The DBW estimates that it used a maximum of 1,850 gallons of herbicide on 199 sites in the Delta during the 2002 treatment season.

2,4-D has a 96-hour LC_{50} *(i.e.,* lethal concentration at which 50 percent of exposed test organism die) ranging from 1.4 ppm to 358 ppm with a median of 27.3 ppm for rainbow trout, and a median of 14.8 ppm for Chinook salmon. Glyphosate has a 96-hour LC_{50} of 130 to 210 ppm for salmonids depending on water hardness. Diquat has been shown to have an acute toxicity to salmonids at concentrations as low as 11 parts per million (ppm) for juveniles and potentially as low as 0.76 ppm for larval fish. As stated previously, the herbicides are expected to have environmental concentrations one to two orders of magnitude lower than acutely toxic levels, but only after complete mixing in the water column. Sublethal effects related to the herbicides may occur even at the lower concentrations, and indirect adverse effects from the dieback of the treated aquatic vegetation on water quality may cause take of listed salmonids within the treatment area.

E. Habitat Restoration and Environmental Monitoring

Examples of habitat restoration projects conducted under the auspices of the California Bay-Delta Authority (CBDA, formerly known as CALFED) in the Delta region include large scale restoration projects on the Mokelumne and San Joaquin Rivers, purchase of additional upstream flows, and improvement of water quality throughout the watershed (CALFED 2000b). In general, habitat restoration projects are expected to increase habitat complexity or quality, and increase the growth and survival of rearing salmonids by creating conditions that increase the food supply or improve conditions for feeding and successful migration, and decrease the probability of predation.

FWS' Anadromous Fish Restoration Plan (AFRP) has developed numerous actions in the Delta specifically intended to improve the outmigration and survival of juvenile salmon in the Delta *(e.g.,* Delta Cross Channel closures, export curtailments, positive Q west conditions [positive delta outflow]; FWS 1998). AFRP actions also include non-flow fish management projects such as physical facilities to improve fish passage, channel restoration to improve rearing habitat and migration corridors, and fish screen installation to prevent the entrainment of juvenile fish.

The information gathered by the IEP monitoring program is used to adjust operations of the CVP and SWP. IEP projects explore predator-prey relationships; fish abundance and size distribution; geographic distribution; population studies; impacts from water operations; nursery values; entrainment monitoring; and fish screen criteria development. These projects serve not only to improve environmental conditions in the Delta, but also expand the knowledge base of the Delta's ecosystem. However, routine fish surveys conducted within the Delta almost universally results in the bycatch of listed salmonids, and thereby constitute an added source of mortality.

F. Presence of Listed Salmonids in the Project Area

Sand Mound Slough is a terminal slough that is not along the primary migration route of the listed salmonids. However, listed salmonids occur in the waters of Sand Mound Slough and the waters within the surrounding region, including Old River, the San Joaquin River, and Rock Slough. They may enter Sand Mound Slough from either Dutch Slough and Old River to the north, or from Rock Slough through the tidal flap gates to the south. Since the early 1990s, fish monitoring studies have been conducted on the Contra Costa Canal (CCC; DFG 2003) by the Contra Costa Water District (CCWD) as part of the conditions of their biological opinions from the FWS for delta smelt *(Hypomesus transpacificus)*, and from NOAA Fisheries for Sacramento River winter-run Chinook salmon. Data collected between 1994 and 1996 at pumping plant #1 indicated that juvenile Chinook salmon and steelhead were entrained by the CCWD pumps (see

Table 1). Later monitoring studies were moved downstream to the headworks of the CCC and utilized different sampling protocols that prevent direct comparison to the previous data set. Although these studies never encountered salmonids, they sampled a much smaller cross section of the canal and probably missed salmonids which easily could have avoided the sampling nets. More recent studies with modified sampling protocols have again captured juvenile salmonids, indicating their continued presence in the CCC (NOAA Fisheries 2004).

The IEP monitoring program (IEP 2003) consistently has shown the presence of both Chinook salmon and steelhead at sampling sites in the lower San Joaquin River at Jersey Point, Old River, and False River (at its junction with the main stem of the San Joaquin River), particularly during the early winter (December) through late spring (May) months. These sampling sites are within an approximate 5-mile radius of the project site (see Figure 4). The complex circulation pattern created by daily tidal influence, ambient river flows and the CVP and SWP pumping schedules moves salmonid juveniles throughout the waterways of the project area. Modeling by the Department of Water Resources (DWR) and the U.S. Bureau of Reclamation indicate that the net overall circulation pattern in this part of the Sacramento-San Joaquin Delta results in water entering Franks Tract from both the Old River channel on the east and Sand Mound Slough on the south, and exiting westwards through False River (see Figure 5). However, a substantial volume of water still moves southward from the mouth of Old River towards the SWP and CVP pumping facilities near Tracy, California. Water entering the mouth of the Old River channel can be from either the Sacramento River basin via Three Mile Slough, Georgiana Slough, or the Mokelumne River, or from the San Joaquin River basin to the south. Some of the water conveyed through Old River can enter Rock Slough, carrying salmonids from both basins into this channel, as illustrated by the CCWD fish monitoring data. The tidally-operated flap gate separating Rock Slough from Sand Mound Slough allows passage of juvenile salmonids into Sand Mound Slough on the ebbing tide, and hence back into the water circulation pattern previously described. The complex circulation pattern described above illustrates how salmonids from the Sacramento and San Joaquin River systems can be carried by ambient flows into the project area, where they can be exposed to the adverse effects of the project. Adult fall-run Chinook salmon have been observed by staff of Moore Biological Consultants trying to enter the downstream stream side of the culverts during an ebbing tide (Diane Moore, pers. comm., 2003). •

V. EFFECTS OF THE ACTION

Pursuant to section 7(a)(2) of the ESA (16 U.S.C. §1536), Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. This biological opinion assesses the effects of the Rock Island Marina project on endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, and threatened Central Valley steelhead. The Rock Island Marina project is likely to adversely affect listed species and habitat through the construction and operation of a 100-slip marina, dredging activities in Sand Mound Slough to accommodate boating activity, and the increased stormwater effluent associated with the 91-home development adjacent to the slough. In the *Description of the Proposed Action* section of this Opinion, NOAA Fisheries provided an overview of the action. In the *Status of the Species* and *Environmental Baseline* sections of this Opinion, NOAA Fisheries provided an overview of the threatened and endangered species that are likely to be adversely affected by the activity under consultation.

Regulations that implement section 7(a)(2) of the ESA require that biological opinions evaluate the direct and indirect effects of Federal actions and actions that are interrelated with or interdependent to the Federal action to determine if it would be reasonable to expect them to appreciably reduce listed species' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (16 U.S.C. §1536; 50 CFR §402.02).

NOAA Fisheries generally approaches "jeopardy" analyses in a series of steps. First, NOAA Fisheries evaluates the available evidence to identify direct and indirect physical, chemical, and biotic effects of the proposed actions on individual members of listed species or aspects of the species' environment (these effects include direct, physical harm or injury to individual members of a species; modifications to something in the species' environment - such as reducing a species' prey base, enhancing populations of predators, altering its spawning substrate, altering its ambient temperature regimes; or adding something novel to a species' environment - such as introducing exotic competitors or a sound). Once NOAA Fisheries has identified the effects of the action, the available evidence is evaluated to identify a species' probable response, including behavioral reactions, to these effects. These responses then will be assessed to determine if they can reasonably be expected to reduce a species' reproduction, numbers, or distribution (for example, by changing birth, death, immigration, or emigration rates; increasing the age at which individuals reach sexual maturity; decreasing the age at which individuals stop reproducing; among others). The available evidence is then used to determine if these reductions, if there are any, could reasonably be expected to appreciably reduce a species' likelihood of surviving and recovering in the wild.

A. Approach to Assessment

1. Information Available for the Assessment

To conduct the assessment, NOAA Fisheries examined an extensive amount of evidence from a variety of sources. Detailed background information on the status of these species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, governmental and non-governmental reports, scientific meetings, and environmental reports submitted by the project proponents. Additional information investigating the effects of the project's actions on the listed salmonid species in question, their anticipated response to these actions, and the environmental consequences of the actions as a whole also were obtained from the aforementioned resources.

2. Assumptions Underlying This Assessment

In the absence of definitive data or conclusive evidence, NOAA Fisheries must make a logical series of assumptions to overcome the limits of the available information. These assumptions will be made using sound, scientific reasoning that can be logically derived from the available information. The progression of the reasoning will be stated for each assumption, and supporting evidence cited.

In assessing the impacts of anthropogenic noise on the listed salmonid species, NOAA Fisheries used the available data for several different species of fish for which acoustic experimental data is available, including the hearing specialist, fathead minnow (*Pimephales promelas*) and the hearing generalist, pink snapper (*Pagrus auratus*). Protective acoustic levels were then developed that were protective of fish in general, due to the lack of species specific data for salmonids.

In assessing the impacts of artificial structure placed within the waters of Sand Mound Slough (*i.e.,* docks, pilings, and boats) on populations of salmonid predators in the slough, NOAA Fisheries evaluated available literature on structure and aquatic habitat for fish predators inhabiting other water bodies (*e.g.,* reservoirs). Available information for predatory behavior and piscivory by largemouth bass (*Micropterus salmoides*) and sunfish (*Lepomis* and *Pomoxis* spp.) was examined, and the potential risks to juvenile salmonids in the structure-enhanced Sand Mound Slough were then inferred.

B. Assessment

The Rock Island Marina project, including the associated housing development, is expected to adversely affect listed salmonids during both the construction and marina operation phases of the project. The construction phase is expected to require several months to a few years to complete, whereas the long-term operation of the marina and the effects of the developed neighborhood will occur indefinitely. The primary impacts of the project on listed salmonids are expected to result from pile-driving activities and short- and long-term effects of the project on water quality , and other habitat components of Sand Mound Slough and adjacent waterways.

1. Short-term impacts

a. *Construction Phase of the Housing Development*

The applicant has not proposed a schedule of construction actions, including the periods in which these actions will take place. Therefore, NOAA Fisheries will assume that these activities will take place throughout the year, dependent on the needs of the contractors, rather than in deference to sensitive environmental periods. During this phase of the project, construction related impacts are likely to degrade the water quality in Sand Mound Slough if protective measures are not incorporated into the construction plans. In order for listed salmonids to be affected by the construction activities of the project, they must be in the vicinity of the project. Fish monitoring studies have indicated that the presence of listed salmonids in the action area is seasonal. Both juvenile and adult listed salmonids will occur most frequently in the action area during the period between late December and mid-May, although some salmonids may be present at other times of the year (DFG 2003). NOAA Fisheries anticipates that stormwater discharges from the project site also are likely to occur during this period, and that these may result in sediment and construction vehicle-related contaminants entering the waters of Sand Mound Slough.

Clearing the project area of vegetation in combination with the presence of lightweight peat soils may lead to increased levels of the dust and erosion associated with construction. Loss of vegetation increases the effects of wind transport of soil particles due to the lack of stabilization by vegetative root structures and above ground leaves and stems. These biological structures hold the soils in place and reduce the wind velocity at the ground surface, thus substantially reducing the transport of soil particles. Roots and above ground plant structures also break up the erosive effects of precipitation by absorbing the energy of falling rain and enhancing infiltration of the rain water into the soil. The denuding of the surface soils will elevate the risk of sediment being carried into irrigation collection canals by wind or water, and subsequently entering the waters of Sand Mound Slough. Suspended sediments can affect salmonids in several ways, including causing 1) habitat avoidance, 2) reduced feeding and growth, 3) respiratory impairment, 4) reduced tolerance to disease and toxicants, and 5) physiological stress (Waters 1995). Construction activities may be expected to increase the chance of contaminants from vehicular fluid and material spills *(e.g.,* petroleum products) entering nearby waterways as well. Any contaminant spills would be expected to be small, due to the size (typically less than 100 gallons) of the fuel tanks or fluid reservoirs on the construction equipment, decreasing the likelihood of acute toxic effects directly resulting in mortality. However, sublethal effects from petroleum products may include reduced reproductive success, narcosis, interference with movement, declines in the immune response, development of lesions and tumors, and disruption of chemosensory function (Rand 1995).

Impact minimization measures usually are stipulated in local, regional, or State permits to control these possible discharges into waterways, but the project applicant has not yet specified which best management practices (BMPs) they will be implementing. NOAA Fisheries anticipates that legal discharges will be minimized to the extent that they should be diluted relatively quickly, and hence that impacts to listed salmonids and their habitat should be small, localized, and non-lethal. If the BMPs are properly employed, any accidental spill that should occur will most likely not reach any aquatic resources in amounts that will cause demonstrable acute adverse effects. However, should a failure of the BMPs or the volume of spill be such that a substantial amount of material reaches the aquatic habitat and causes acute adverse effects, then this would be considered an illegal discharge under the Clean Water Act, and no incidental take would be exempted.

b. *Marina Construction*

The construction of the marina facility will have direct impacts upon the waters of Sand Mound Slough. However, it is anticipated that the period of marina construction will be relatively short (weeks) compared to the construction of the upland housing component of the project (months to years). As stated previously, the applicant has not provided a schedule for any of the construction activities, including pile driving for the marina. NOAA Fisheries will assume that these activities may take place at any time throughout the year, depending on the needs of the contractors and the availability of specialized equipment, rather than in deference to sensitive environmental periods. The pile-driving activities will adversely affect listed salmonids if they are directly exposed to these activities. As previously mentioned, listed salmonids are expected to be present during the period between late December and mid-May, although some salmonids may be present at other times of the year. If these marina-related construction activities were to occur during this time period, injury resulting in loss of hearing sensitivity, disorientation, or even death may occur. Conversely, if these marina-related construction activities were to be conducted during the June 1 to October 31 time period, adverse effects to listed salmonids could be avoided due to the absence of listed salmonids in the project area, and no additional avoidance measures would be necessary.

Pile driving will intermittently and temporarily increase noise levels in the slough. The acoustic energy created by the pile driving process often exceeds the levels necessary for permanent damage (≥ 180 dB, [ref 1 μpascal]), and may even result in death for many species of fish, including salmonids, if they are found within close proximity of the pile-driving activity. Driving concrete piles in Suisun Bay caused sound energy levels to exceed 180 dB (ref 1 upascal) at a range of 10 m when the pile driving activity took place without sound attenuation bubble curtains in place (NOAA Fisheries 2002). NOAA Fisheries required the use of sound attenuation devices, in this case a bubble curtain, to reduce the sound intensity level to 150 dB [ref 1 upascal] at a distance of 10 m from the pile and a depth of 1 meter below the water's surface.

The range of adverse effects of pile driving on fish may vary depending on tides, current velocities, water temperatures, and the frequency of the resonance from the pile. The channel width in Sand Mound Slough is approximately 92 m, and the sound level may not attenuate sufficiently within this distance to avoid adverse effects upon listed salmonids that may be within the confines of the channel. In acoustic sensitivity studies conducted by Scholik and Yan (2002), a 176 dB noise intensity that was recorded at a distance of 1 m from a 70 hp outboard motor, was attenuated to 142 db (ref 1 upascal) at a distance of 50 m, indicating that sufficient energy was still present at a range of 50 m to affect hearing sensitivity in the test fish. In addition to possible tissue damage, juvenile fish may be subjected to higher predation rates if by avoiding the pile-driving location they are forced to occupy habitats with a higher predator density or less protective cover. Besides the obvious effects of acoustic impacts, operation of the pile driving barge and its support vessels is expected to cause an increase in turbidity and suspended sediment in the slough. Sediment and aquatic vegetation will be disturbed by the propeller wash of vessels maneuvering the barge into position in the confines of Sand Mound Slough. This suspension of bottom sediments can cause direct injuries to the sensitive gill and eye tissues of listed salmonids, as well as resuspending potential contaminants attached to particles in the substrate.

The final assembly of the marina floats and mooring facilities will be accompanied by an increase in noise and activity, but these impacts are expected to be minor, intermittent, and brief, and hence not likely to adversely affect listed salmonids. Potentially toxic materials may be spilled into the waters of Sand Mound Slough during the marina construction phase, ranging from pressure-treated wood shavings and saw dust to organic solvents used for painting and sealing of the dock materials used in the construction of the slips or lubrication of equipment. NOAA Fisheries expects that containment of these types of discharges will be required by the local and State permitting agencies such as the Regional Water Quality Control Board, Central Valley Region, and hence not likely to adversely affect listed salmonids.

c. *Dredging*

The project will entail the removal of approximately 15,000 cy of dredge spoils from the area occupied by the future marina and channel. The dredging process will use a barge mounted hydraulic cutterhead suction dredge to remove the bottom substrate. Auxiliary boats will be used to move the barge from site to site within the slough and to serve as water taxis to move supplies and personnel from shore to the barge. Dredge spoils will be piped over the levee to a receiving pond on the construction site. Dredging operations will cause temporary disturbances of the bottom, resulting in an increase in turbidity within the slough. This may be exacerbated by the shallow depths and narrow channel widths at the marina site, resulting in a diminished volume of water in which the dredging activities will take place, and hence a greater concentration of suspended sediment. The removal of up to several feet of accumulated sediment will damage or destroy any benthic communities within the dredged area. In addition, the exposure of anoxic sediment is likely to result in a decrease in ambient DO in the water column above the dredged area as the organic materials and reduced compounds are oxidized. The amount of oxygen consumed is dependent upon the biological and chemical oxygen demand of the substrate. This oxidation of the substrate can potentially release toxic compounds from the substrate into the overlying water column. Similarly, the dredged spoils in the holding ponds can be expected to undergo the same oxidation process, and release compounds into the decant water as their ionic charge changes. The capacity for the slough to absorb this level of habitat and water quality degradation is limited by the exchange of water between Sand Mound Slough and the surrounding Delta waters. Tidal action and the small inflow from Rock Slough will eventually flush the degraded water out of the slough via the Delta water bodies to the north *(i.e.,* Dutch Slough, Piper Slough and Franks Tract).

The project proponent has not stated a preferred work window for dredging. Depending on when the dredging activities take place, listed salmonids may be exposed to the degraded water quality and habitat conditions previously mentioned. If dredging takes place during the

November to June time period, there is the likelihood that migrating juvenile salmonids will be exposed to the suspended dredging materials in Sand Mound Slough as well as diminished habitat value from the disrupted benthic environment and reduced forage base. Such conditions will cause elevated stress on the migrating fish and reduce its physiological fitness. As with the pile driving activities, adverse effects related to dredging can be avoided by conducting this activity during the June 1 to October 31 time period when listed salmonids are not anticipated to be in the vicinity of the project area.

In addition to the immediate effects of the dredging process, the dredged contours of the proposed marina and channel have a reversed slope, which may create long-term effects upon circulation and ambient water quality in the slough. The water under the marina is deeper than the main channel, and thus will tend to accumulate depositional materials faster than the main channel. As the depositional material fills the basin under the marina, it will also accumulate any contaminants and organic materials present in the water column, thus leading to the degradation of the water body at the end of the slough. NOAA Fisheries anticipates that higher levels of organic materials in the depression under the marina will create a reduced level of DO in the overlying water column. As the organic material decomposes, oxygen will be consumed from the overlying water column. The combination of low tidal flushing and increased biological oxygen demand (BOD) will diminish the level of DO in the water column and adversely affect any salmonids within the depressed DO zone. Salmonids have higher oxygen requirements than many other fish species and function best in waters that have DO levels above 5 mg/l. At levels lower than this, physiological stress occurs; levels below 3 mg/l may eventually result in death. Proper tidal flushing action would be achieved with slough geometry where the main channel is deeper than the surrounding bottom. Tidal flushing action would then reduce the tendency for the end of the slough to become stagnant, thereby reducing the likelihood of adverse effects to listed salmonids from poor water quality *(e.g.,* elevated contaminants and reduced DO level).

2. Long-term Impacts

a. *Stormwater Effluent from the Housing Development*

The build out of the housing development will convert approximately 26 acres of current agricultural lands to urban development. In general, the transformation of the agricultural lands to single and multi-family residences will increase the relative percentage of impervious surface within the project area. The 2000 Maryland Stormwater Design Manual (Maryland Department of the Environment [MDE] 2000) states:

> "development dramatically alters the local hydrologic cycle. The hydrology of a site changes during the initial clearing and grading that occur during construction. Trees, meadow grasses, and agricultural crops that had intercepted and absorbed rainfall are removed and natural depressions that had temporarily ponded water are graded to a uniform slope. Cleared and graded sites erode, are often severely

> compacted, and can no longer prevent rainfall from being rapidly converted into stormwater runoff."

Representative values for the percentage of impervious surface area created by the density of housing proposed for this project *(i.e.,* approximately 3 dwelling units per acre) is 30 to 40 percent (Stormwater Center 2003). As the impervious surface area increases, the time to peak flow in the region's watershed following a rain event decreases, and hence, less recharge of the groundwater occurs in the affected area. As the infiltration rates of rainwater into the aquifer decrease, groundwater flows to streambeds likewise decrease, and stream base flow diminishes during the dry periods compared to an undisturbed watershed. The increase in surface flow over the impervious area results in an increase in pollutant concentrations in the runoff. The California Department of Transportation (Caltrans) has indicated that the following classes of pollutants typically increased in watersheds with an increase in urbanization and impervious surface area (Caltrans 2003; see Table 2 for additional information):

- Total Suspended Solids
- Nutrients (Phosphorus and Nitrogen compounds)
- Pesticides and Herbicides
- Particulate Metals
- Dissolved Metals
- Pathogens (Bacteria and viruses)
- Litter and rubbish
- Biological and Chemical Oxygen Demand
- Total Dissolved Solids

In a typical urbanized watershed, the decline in the physical habitat, coupled with lower base flows and higher stormwater pollutant loads, results in severe impacts to the health and structure of the aquatic community. Recent studies have indicated that the following general changes in aquatic ecology occur following urbanization of a watershed (MDE 2000; Stormwater Center 2003):

- decline in aquatic insect and freshwater invertebrate diversity
- decline in fish diversity
- degradation of aquatic habitat

A major component of stormwater runoff contamination comes from vehicular use of roadways and the subsequent deposition of toxic compounds upon the roadway from car emissions, brake linings, and lubrication fluids. The increased population resulting from the proposed housing development of the community will substantially increase the vehicular traffic within the project area. Currently, access to the development site is along one road, Sand Mound Boulevard, which carries 1,500 vehicle trips per day. Following completion of the development, traffic is expected to increase by 60 percent on the project area's roadways. Substantial amounts of sediment and pollutants are generated during daily roadway use and scheduled repair and maintenance operations. These pollutants threaten local water quality by contributing heavy metals, hydrocarbons, sediment, and debris to stormwater runoff that typically enters local and regional waterways. In California, the highly toxic "first flush" events that correspond to the first rainfall after a period of dry weather carry the accumulated contaminants on the roadbed into the nearest watercourse. Table 3 indicates some of the more typical contaminants that can be found in highway runoff and their primary sources (Stormwater Center 2003).

There are numerous engineering and management techniques currently employed across the country to avoid or minimize the degradative effects of urban stormwater runoff. Planning manuals have been developed by several states and municipalities that address the design and construction of suitable stormwater management trains that control and remove the potential contaminants from the stormwater waste stream before they enter into natural water courses (MDE 2000; Caltrans 2003).

The proposed development has integrated a vegetated swale design as the stormwater conveyance method to the RD 799 agricultural return ditch on the northern boundary of the project site. A linear series of over-excavated depressions (basins) will run parallel to Sand Mound Boulevard on both sides of the road alignment (east and west). The basins will be approximately eight inches deep and connected to one another by culverts. The depressions are anticipated to act as passive sediment traps and the slope of the basins will allow the flow of water to be routed south to north along the series of basins. The design is believed by the applicant to be sufficient in size to allow sediments to settle out of stormwater flows, and the vegetation capable of filtering out any contaminants present in the storm flow. However, the applicant has not provided any data that indicates that the vegetated swales will operate as designed. Information regarding the expected volume of runoff from the impervious surfaces of the development for a typical profile of storm events for northern Contra Costa County have not been presented.

In addition, the efficiency of the vegetated swale design for the retention of the different forms of contaminants needs to be evaluated. As indicated previously, urban and suburban developments produce a spectrum of contaminant types, each with its own unique characteristics influencing its removal from the stormwater stream. A single vegetated swale system can not adequately remove all of the types of contaminants that are likely to be found in the stormwater stream coming from the Rock Island Marina development. The removal efficiencies of different urban stormwater BMPs were compiled in a national database (Brown and Schueler 1997), which indicated that vegetated swales are fairly efficient in removing total suspended solids (TSS) from the stormwater effluent (81%), but perform poorly for total (34%) and soluble (38%) phosphorus, and for nitrate and nitrite-nitrogen (31%) carried in the stormwater stream. Vegetated swales also removed about half of the metals and hydrocarbons in the effluent, but tended to remove lower proportions of soluble metals than particulate metals. Interestingly, vegetated swales tend to export bacteria to their receiving waters rather than reducing the bacterial load of the incoming stormwater.

Effects to salmonids primarily would be expected to be sublethal due to the dilution that would occur in the Delta waterways of the action area. However, these compounds can be expected to lower DO (organic matter), affect neurological pathways (heavy metals and pesticides), alter endocrine function (petroleum products and detergents), and cause cancer (polyaromatic hydrocarbons [PAHs]) in aquatic organisms, including salmonids.

b. *Marina Effects*

The marina will provide up to 60,200 square feet of shaded floating structure from the docks, finger slips and vessels at full operational status. The 91 pilings will provide a variable amount of vertical structure depending on tidal stage in the slough. The structure created by the marina facilities will provide hard substrate for the colonization of algae and associated invertebrate communities (periphyton). Small forage fish will be attracted to feed upon the algal and invertebrate communities, which in will turn attract and concentrate larger predatory fish species (Johnson *et al.* 1988, Lynch and Johnson 1989, Johnson and Lynch 1992). The more complex the structure, the more attractive it is for forage fish species, such as small centrarchids or minnows, that will hide in the small interstices of the structure (Walters *et al.* 1992, Rold *et al.* 1996). The artificial structure provided by the pilings and floating dock structures in Sand Mound Slough will serve to attract predatory species such as bluegill *(Lepomis macrochirus)*, largemouth bass *(Micropterus salmoides)*, striped bass *(Morone saxatilis)*, and Sacramento pikeminnow (*Ptychocheilusgrandis*) that are resident in the Delta. These predatory fish species are known to prey on juvenile salmonids in the Delta.

The presence of structure in the aquatic habitat also influences the reproductive success of largemouth bass and other centrarchids (Hunt and Annett 2002). Studies have shown that centrarchids prefer nesting near patches of physical structure, both simple and complex in nature. Nesting centrarchids have been observed in the southern end of Sand Mound Slough (J. Stuart, pers. obs., June 2003) in the shallow sandy areas adjacent to the riprapped levee banks. The introduction of further structure into the waters of Sand Mound Slough, as will occur with the construction of the marina, would be expected to enhance the centrarchid populations in this water body. Furthermore, the juxtaposition of *Egeria densa* weed beds near the dredged central channel may enhance predation on juvenile salmonids traversing the slough during outgoing tides. Piscivory by largemouth bass was shown to occur earlier in the life stage of this fish when open water habitat replaced vegetated habitat in the littoral zone of a lake (Bettoli *et al.* 1992). Young-of-the-year largemouth bass fed on small invertebrates in vegetated habitats, but switched to a fish-based diet at a smaller size when the invertebrate forage base was diminished due to clearing of aquatic macrophytes from the habitat. Under the conditions created by the introduction of the marina facility in Sand Mound Slough, predatory fish populations, particularly centrarchids, may be expected to increase and the predation rate on migrating juvenile salmonids may be expected to increase in response to this expanding population and the alterations in the slough's habitat values.

The marina facility is projected to provide recreational boating access to the residents of the new subdivision as well as a limited number of guests. It is reasonable to anticipate that many of these new recreational boats will be powered craft versus sail or manually driven watercraft, given the typical makeup of similar marinas in the Delta (DBW 2003). The location of the marina at the end of Sand Mound Slough will require watercraft to transit the entire length of the slough to access the marina facilities, thus subjecting the slough to increased effects of boating activities (see section c. *Boating Activities* below).

The EPA has cited marinas as a source of nonpoint pollution in U.S. waterways (EPA 2001). The forms of water pollution that are characteristic of marinas include poor water circulation and flushing within the marina, petroleum spills from storage tanks and boat fueling, bilge oil discharges, and runoff from boat hull maintenance and engine repairs. Additional "poor housekeeping" practices such as in-water boat washing with detergents and solvents, lack of appropriate refuse and recycling containers for solid and liquid wastes, and inadequate sanitary facilities for the public can also lead to nonpoint sources of pollution.

The direct measurement of contaminant concentrations in the water resulting from the marina operations is possible with generally available analytical equipment *(i.e.,* gas chromatography with mass spectroscopy) and this data can be used to extrapolate the biological effects of the toxicant upon the aquatic habitat and the organisms present in Sand Mound Slough and the surrounding action area. The project's marina construction will directly impact only about 7 acres of waters and indirectly impact somewhat more area due to the effects of water movement in the action area. As indicated previously in section *II. C. Action Area,* this amounts to less than 0.01 percent of the Delta's waterways. Therefore, although the contaminants can travel out of the defined action area due to tides, winds and river currents, the demonstrable effects of the marina-derived contaminants will be most discernable by analytical and biological assays within the immediate vicinity of the action area.

Since the Rock Island Marina will be situated near the terminal end of Sand Mound Slough, an area that has limited wave or wind driven circulation, and minimal tidal flushing, the pollutants that are introduced into the waters of the Slough by the marina's activities can, over time, be expected to increase in concentration in the water column, sediments, and aquatic organisms (EPA 2001). The pollutants that can be expected to be generated and enter a marina basin include nutrients and pathogens from pet waste and overboard sewage discharge, sediments from shore side erosion, fish waste from dockside fish cleaning, petroleum hydrocarbons from fuel, oil, and organic solvents, toxic metals from antifouling materials and metal components of hulls and engines, as well as liquid and solid wastes from boating and shoreside activities. The different forms of pollutants have a wide variety of effects upon the aquatic habitat and the organisms that reside within that habitat. These effects are frequently adverse and result in illness or death for the exposed aquatic organism. For example, disorientation or loss of mobility due to the physiological effects of the contaminant exposure would place the exposed fish at a higher risk of predation than a non-exposed fish. In addition, exposure to some pollutants in the slough may reduce the immune response of salmonids, increasing their susceptibility to future pathogens and the risk of morbidity and mortality. This lowered immune response has been shown to last for a considerable period and may even affect ocean survivability later on.

c. *Boating Activities*

(1) *Noise.* Recent studies by Scholik and Yan (2002) studied the effects of boat engine noise on the auditory sensitivity of the fathead minnow (*Pimephales promelas*), a hearing specialist. The majority of noise generated from the motor is derived from the cavitation of the propeller as it spins in the water. Fish were exposed to a recording of the noise generated by a 55 hp outboard motor over a 2-hour duration. The noise level was adjusted to 142 dB (re:1µPa), which was equivalent to the noise levels measured at 50 m from a 70 hp outboard motor. The experimental fish suffered a drop in hearing sensitivity over the range of frequencies normally associated with their hearing capabilities. These responses were measured using electrophysiological responses of their auditory nerves under general anesthesia. Studies by McCauley, Fewtrell, and Popper (2003) on the marine pink snapper *(Pagrus auratus)*, a hearing generalist like salmonids, indicated that high-energy noise sources (approximately 180 dB [re:1µPa] maximum) can damage the inner ears of aquatic vertebrates by ablating the sensory hairs on their inner ear epithelial tissue as revealed by electron microscopy. Damage remained apparent in fish held up to 58 days after exposure to the intense sound. Although little data from studies utilizing salmonids is available, NOAA Fisheries assumes that some level of adverse impacts to salmonids can be inferred from the above results.

The loss of hearing sensitivity may adversely affect a salmonid's ability to orient *itself (i.e.,* due to vestibular damage), detect predators, locate prey, or sense their acoustic environment. Fish also may exhibit noise-induced avoidance behavior that causes them to move into less-suitable habitat. In the current action, this may result in salmonids fleeing the boating associated noise and moving into habitat conditions that harbor centrarchid predators. Likewise, chronic noise exposure can reduce their ability to detect piscine predators either by reducing the sensitivity of the auditory response in the exposed salmonid or masking the noise of an approaching predator. Disruption of the exposed salmonid's ability to maintain position or swim with the school will enhance it's potential as a target for predators. Unusual behavior or swimming characteristics single out an individual fish and allow a predator to focus its attack upon that fish more effectively.

(2) *Toxics.* The operation of internal combustion engines for powered watercraft are a significant source of petroleum pollution in U.S. waterways (Woods Hole Oceanographic Institute [WHOI] 1998). Two-stroke engines (the predominant form of engine used to power personal watercraft and many types of outboard motors) are the worst polluters of the three main types of engines used to provide propulsion to watercraft. Two-stroke engines are preferred for smaller boats by manufacturers due to their higher thrust-to-weight ratios. However, two-stroke engines are highly inefficient in burning the gasoline and lubricating oil mix used to fuel them. Two-stroke engines may pass up to 40 percent of the fuel mixture unburnt through the compression chamber and into the cooling exhaust water, where it then passes into the exhaust

stream leaving the engine propulsion unit (San Diego County Grand Jury Report 2003). In contrast, a four-stroke engine is highly efficient in burning its fuel mixture, and does not require lubricating oils to be mixed with the gasoline to provide lubrication to the piston in the compression chamber. A four-stroke engine may only pass one tenth the amount of hydrocarbons through its exhaust compared to a two-stroke engine (WHOI 1998), but would be expected to have higher levels of carbon monoxide and nitrogen oxides present due to its higher combustion temperatures.

The uncombusted gasoline and petroleum products from the exhaust of the two-stroke engine are directed first into the water to muffle the sound of exhaust. Approximately one half of the uncombusted gasoline-oil mixture immediately evaporates into the air at the water-air interface, contributing to air pollution. The remaining 50 percent of the petroleum mixture remains in the water column, sometimes for extended periods of time depending on the particular compound and the depth to which the compounds are mixed. The deeper the mixing layer, the longer the compounds remain in solution. Lighter molecular weight compounds such as benzene, toluene, ethylbenzene, and xylene will continue to evaporate from the surface of the water, while heavier, more complex compounds such as PAHs will eventually sink to the bottom or to deeper water levels.

The petroleum products present in the exhaust of two-stroke engines have been shown to adversely affect aquatic organisms, including rainbow trout *(O. mykiss).* Researchers who exposed fish and other aquatic organisms to engine exhaust and its extracted constituents found disruptions of normal biological function at several different levels of biological organization including sub-cellular, cellular, metabolic, and histopathology (WHOI 1998).

The toxicity of petroleum products depends upon their composition and the relative percentage of the water soluble fraction (WSF), particularly the aromatic constituents. Rudolph *et al.* (2002) showed that juvenile rainbow trout *(O. mykiss)* exposed to varying concentrations of the WSF developed liver damage and external and internal lesions. The degree of effects surprisingly was more highly correlated with the duration of the exposure rather than the concentration of the exposure.

The less soluble compounds of petroleum products are more likely to be environmentally persistent, and associated with organic particulate matter or sediment. Compounds like PAHs are well known mutagens, carcinogens, and teratogens (Di Guilo *et al.* 1995; Rand 1995) that can form toxic metabolites. Metabolism of PAHs create intermediate metabolites that can covalently bind with nucleic acid bases and form adducts to these bases. These adducts prevent the proper transcription and translation of the genetic material if not repaired by the host's internal repair mechanisms. Altered DNA sequences can be manifested in several different types of further genetic expression such as point mutations, codon frame shifts in translation of RNA, and promotion of genes, such as oncogenes that may lead to cancer, that were previously unexpressed in the genome.

Exposure to PAHs and other aromatic compounds typical of petroleum hydrocarbon contamination from industry, spills, and engine exhausts was shown to suppress immune responses in fall-run Chinook salmon *(O. tshawytscha)* in the Pacific Northwest by Varanasi *et al.* (1993) and Arkoosh *et al.* (1998, 2001). This research indicated a high correlation between exposure to sediments, which contained elevated levels of aromatic and chlorinated organic compounds indicative of contaminants found in urban estuaries, and reductions in the primary and secondary humoral immune responses of juvenile Chinook salmon. The 1998 study indicated that this response resulted from both direct exposure and through the benthic species in the forage base of the fish sampled from the estuaries. Significant concentrations of these organic contaminants were bioaccumulated by the juvenile Chinook salmon during their relatively short residence time in the estuary. The followup study in 2001 exposed the marine-adapted smolts of Chinook salmon to the aromatic and chlorinated organic compounds extracted from contaminated sediments through intraperitoneal injections and then measured their response to the marine bacterial pathogen, *Vibrio anguillarum*. The exposed fish suffered significantly higher pathogen-related mortality than the control fish. These results further indicated that although the exposure of juvenile fish migrating through the estuary is relatively short in duration, the immunosuppression may extend into their early ocean life, thus potentially influencing recruitment to adult stages later on.

Introducing more petroleum products to Sand Mound Slough may affect salmonids both directly and indirectly. Direct effects include physical coating of the fish's gill filaments (reduction in oxygen uptake efficiency), disruption of the absorptive function of the gastrointestinal tract, and toxicological effects which can cause sickness or death in exposed fish. Indirect effects are less conspicuous and may result from increased susceptibility to pathogens and parasites present in the environment or adverse effects of petroleum products on other organisms which may cause alterations in the forage base available to the salmonids, changes in nutrient cycling in the aquatic environment, or physical changes in the habitat characteristics used by the fish *(e.g.,* shaded riverine aquatic habitat vegetation that dies from petroleum exposure). The magnitude of the adverse effects is dependent on several variables, including the location, timing, volume, and duration of boating activity and the types of engines used. The San Diego County Grand Jury Report (2003) estimated that on the four day July 4, 2000, holiday weekend in Mission Bay, San Diego, up to 2,500 gallons of gasoline and 250 gallons of lubricating oil were spilled in the bay from the exhausts of two-stroke motors. Of this amount, half was expected to have evaporated into the air, and the rest to have contaminated the bay's water. The amount was estimated from the operation of 513 watercraft over this period. There are considerably more watercraft that operate daily in the Delta, as well as those that are trailered into the Delta from outside the region (DBW 2003). It is estimated that several thousand boats may utilize the Delta on any given weekend during the summer months and that the mild California winters do not preclude year round boating use of the Delta, including winter months. Therefore, salmonids can be expected to encounter boating activity during the months when they are migrating, and that residual petroleum contaminants from summer usage may still be encountered during this time too. The addition of the Rock Island Marina to Sand Mound Slough will ensure that additional loads of contaminants will be discharged to the waters of the slough through the increased boating activity resulting from the new marina. Boating habits of owners with closely available docks encourage year-round boating, and the Rock Island Marina and its associated community is designed to promote this lifestyle.

(3) ***Erosion.*** Increased boating activity in the Sacramento-San Joaquin Delta is expected to cause increased levels of turbidity and erosion. Studies presented at the WHOI workshop on the Environmental Impacts of Boating (WHOI 1998) reported that boating in the shallow waters of coastal Florida and Massachusetts created sediment plumes that were clearly visible from the air and could be followed for miles. The action of the propeller and the hydraulic wake created by the passing hull dislodged sediments from the bottom and where the propeller actually came close to or contacted the bottom, left scars in rooted submerged vegetation, and dredged a furrow along the bottom. Substantial amounts of uprooted or fragmented vegetation were evident in the high traffic areas. In these studies and others presented at the workshop, wakes from the boat hulls were characterized into two forms, one associated with the surface wake that erodes shorelines (which is a concern for levee stability), and the other with the pressure wave created by the hull traveling through the water. The pressure wave is further comprised of two forms. The first is a low frequency wave created by the water displaced by the hull itself, and the second is a high frequency wave generated by the propulsion unit of the boat. The turbidity created by the passage of boats in shallow water can be long lasting, depending on the density and characteristics of the bottom sediment. Coarse sand or gravel quickly settles out of the water column and does not create light penetration problems for submerged vegetation. However, fine organic mucks or silt can remain suspended for hours or longer, blocking light needed for photosynthesis in submerged aquatic vegetation. Sediments may also cause adverse effects to aquatic organisms that have to respire through gills (see above section 1 .b. *Marina Construction)* and may smother benthic organisms that cannot move out of the impacted area. In narrow confined channels, such as are commonly found in the Delta, boat wakes increase the shoreline erosion along the waterline of the bank. This degrades emergent vegetation and increases turbidity along the wash zone of the waves created by the wake of the passing boat. Increased boating activity also is expected to increase the spread of *E. densa* by shredding the plants in shallow waters and spreading viable fragments into the nearby waterways associated with Sand Mound Slough. Increased infestation of this plant reduces usable habitat in the Delta for listed salmonids while increasing habitat for non-native predators, like bass and sunfish.

(4) *Propeller Strikes.* Increased boating activity will increase the potential for injury and mortality by propeller strikes to aquatic organisms. The WHOI workshop included a talk on the potential for propeller related injuries to zooplankton. Although juvenile salmonids are not considered zooplankton, they do feed on organisms which have zooplankter life stages and thus could be adversely affected by the decrease in zooplankton levels of their forage base. Reductions in the populations of forage species for juvenile salmonids can reduce the physiological fitness of those salmonids transiting the Delta by reducing growth rates and the caloric intake necessary for successful smoltification and the accumulation of lipid reserves for the downstream emigration to the San Francisco Bay estuary and the ocean. Furthermore, recent studies by Gutreuter *et al.* (2003) examined the entrainment of different non-salmonid fish

species by tugboat propellers on the Mississippi and Illinois Rivers and found measurable incidences of fish mortality (0.53 to 2.52 fish per km traveled). These vessels are slow moving and the propellers turn at much lower revolutions than the typical recreational vessel. In the Delta, there are many more recreational vessels that travel at substantially higher speeds than the commercial tugboats examined in the aforementioned studies. The potential for fish-propeller encounters increases with the "volume" of water passed through by the propeller and the rate at which the propeller travels horizontally through the water. Fish eggs and larvae presumably are least able to avoid propeller strikes, and these life stages of salmonids do not occur in the Delta. However, it is reasonable to conclude that increased boating activity may subject a greater proportion of the listed salmonid populations in the Delta to the adverse effects of propeller strikes, as well as to the acoustic harassment discussed previously. NOAA Fisheries would expect juvenile salmonids to be most vulnerable due to their more limited swimming abilities compared to adults (Wolter and Arlinghaus 2003). Although the motorized watercraft moored at this marina are likely to utilize much greater areas of the Delta than just Sand Mound Slough for their recreational activities, the adverse effects of the boating activities associated with the proposed project may be expected to have the greatest impact in the narrow, confined waterways of the action area. Once the watercraft enter the larger Delta, their relative impact to salmonids when compared to the overall impact of Delta boating will be diminished, and more difficult to distinguish. In addition, the greater surface area of the Delta, as a whole, may likely reduce the chance encounter of the salmonids with the propeller especially when compared to confined waterbody operations.

VI. CUMULATIVE EFFECTS

For purposes of the ESA, cumulative effects are defined as the effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR §402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultations pursuant to section 7 of the ESA.

Non-federal actions that may affect the action area include ongoing agricultural activities and increased urbanization. Agricultural practices in the Delta may adversely affect riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow in stream channels flowing into the Delta. Unscreened agricultural diversions throughout the Delta entrain fish including juvenile salmonids. Grazing activities from dairy and cattle operations can degrade or reduce suitable critical habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the receiving waters of the Delta. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may adversely affect salmonid reproductive success and survival rates (Dubrovsky *et al.* 1998, 2000; Daughton 2003).

The Delta and East Bay regions, which include portions of Contra Costa, Alameda, Sacramento, San Joaquin, Solano, Stanislaus and Yolo counties, are expected to increase in population by nearly 3 million people by the year 2020 (California Commercial, Industrial and Residential Real Estate Services Directory 2002). Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. The project site is within the region controlled by the City of Oakley's 2020 General Plan (2002) and is called the Cypress Corridor Expansion Area (Off Island Bonus Area). City plans project an estimated additional 18,900 people residing in this 2,700 acre area at full build-out under the General Plan.

Increased urbanization is expected to result in increased wave action and propeller wash in Delta waterways due to increased boating activity. This potentially will degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments thereby potentially resuspending contaminated sediments and degrading areas of submerged vegetation. This in turn would reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids. Increased boat operation in the Delta will likely also result in more contamination from the operation of engines on powered craft entering the water bodies of the Delta.

VII. INTEGRATION AND SYNTHESIS

Short-term *(i.e.,* construction-related) adverse effects of the Rock Island Marina project are expected to be confined to Sand Mound Slough, and long-term adverse effects *(e.g., from* increased urban stormwater, marina operation, and increased boating activity) are expected to be greatest in Sand Mound Slough and decrease in intensity as they radiate outward from this location. NOAA Fisheries does not expect the project to affect the likelihood of survival and recovery of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, or Central Valley steelhead because Sand Mound Slough is a terminal slough that is not along the primary migration route of the listed salmonids and accounts for only a fraction of the usable waterways within the Delta.

Short-term project effects are expected to result in the harm, harassment, or mortality of listed salmonids if the construction phase occurs when listed salmonids are likely to be present in the project area. This would correspond to the months between December and May when listed adult or juvenile salmonids are present within the Sacramento-San Joaquin Delta. The in-water construction phase for the proposed marina and the stormwater outfall is anticipated to be fairly short in duration. NOAA Fisheries anticipates that pile driving and dredging would require only a few weeks if the work is done in a continuous fashion. The positioning and final placement of the floating dock structures would require a few additional weeks for completion. The upland construction of the housing sites and associated infrastructure is anticipated to take much longer, perhaps several months to a year or more, depending on the size of the work crew and the construction schedule.

The primary factor likely to result in harm, harassment, or mortality of listed salmonids during the short-term phase of the project will be the construction of the marina, particularly the pile-driving phase. Direct mortality can result from excessive underwater acoustic energy generated by the pile driving. Indirect mortality can result from the stunning effect of **the** acoustic energy at sublethal levels, thus making the affected fish more susceptible to predation by both aquatic and avian predators. Potential morbidity may occur from the dredging due to the confined waters and shallow depth of Sand Mound Slough. Boat-induced turbidity in the confined slough is expected to occur as a result of the positioning of the pile driving and dredging barges. This activity is expected to increase sediment impacts to fish by impacting their behavior and physiology. The adverse effects of the boating activity related to the pile-driving actions and dredging will be accentuated by the lack of a substantial flushing flow through the slough. This will cause sediments and any associated contaminants to be retained at the southern end of the slough where the project is sited. As with all boating and maritime construction activities, there is an increased potential for petroleum and fluid spills from equipment during their operation. The operation of mechanized equipment in the slough during the dredging and subsequent marina construction activities can be expected to cause at least some contamination Of the water during this phase from leaking fuel and lubricating fluids. Listed salmonids present in the slough during these activities will be exposed to these compounds and may potentially experience morbidity and mortality, depending on the concentrations of contaminants seen.

Upland construction is expected to have a lower potential for mortality, morbidity, and harassment of listed salmonids than the in-water activities. During the wet winter months, elevated erosion from the denuded soils of the construction site can be expected to enter the irrigation drain ditch and the suspended sediments and contaminants pumped into the waters of Sand Mound Slough through the outfall pump. These effects are expected to be minimized by the implementation of standard construction BMPs that are frequently required by local and State regulatory authorities in their permitting process for construction activities *(i.e.,* straw wattles, debris fences, and holding basins).

Morbidity and some mortality are anticipated to occur continually over the long-term as a result of occupancy of the housing development and operation of the marina complex. The increased runoff volume derived from the impermeable surfaces within the development will result in an increased volume of stormwater being discharged to Sand Mound Slough. Unless suitable management programs are incorporated into the stormwater system, the "normal" urban activities associated with residential development will increase the levels of contaminants in stormwater runoff from this site. This condition will increase the level of contaminants entering the waters of Sand Mound Slough above current levels. Furthermore, due to the expected increase in impermeable surfaces *(e.g.,* roofs and driveways), the amount of stormwater entering Sand Mound Slough from the project site is expected to increase during the wet season (November-

April) when listed salmonids are most likely to be in the area, thus increasing the likelihood of adverse effects.

The operation of the marina over the long-term will result in morbidity and mortality from increased levels of contaminants entering the water due to activities such as boat washing, hull cleaning, engine operation, *etc.* The floating and submerged structures created by the marina will attract both forage and predator fish. The artificially-increased concentration of predators associated with the marina and dredged channel is expected to increase the likelihood of predation by these fish upon the juvenile salmonids migrating past this structure.

Boating activities also are expected to result in harm, harassment, and mortality in both the Sand Mound Slough waterway (point of origin) and wherever the boating traffic extends to in the Delta. Increased boating traffic is expected to result in increased pollution from gasoline and lubricating oils, particularly from two-stroke engines. Boating activities also will result in increased turbulence and turbidity with associated effects upon nutrient loading, BOD, erosion of fragile shorelines, and the smothering of submerged aquatic vegetation. Operation of engines in recreational watercraft will increase the noise in the aquatic environment of the Delta. Normal engine sound levels can affect fish behavior and hearing and impede foraging and migration. The operation of propellers in shallow, confined environments can increase the incident of entrainment by the blades of the propeller, resulting in mortality and morbidity. Increased boating activity also is expected to increase the spread of *E. densa.* This may affect aquatic habitat quality such that populations of the non-native fish species will be favored and decrease the likelihood of the survival of juvenile salmonids migrating through the Delta waterways.

A small proportion of the listed salmonid populations will be exposed to the detrimental effects of the action. The section of Sand Mound Slough where the project actions will occur encompasses only 0.01 percent of the total Delta waterways surface area. The waters of Sand Mound Slough are not considered by NOAA Fisheries to be a main migratory corridor for listed salmonids, although some rearing of juveniles may occur there. We conclude that less than 0.01 percent of the outmigrating juvenile populations would be present in Sand Mound Slough during the fish's movement through the Delta, and thus potentially could be harmed, harassed, or killed by project activities. This would amount to 100 fish per every million juveniles migrating through the Delta.

Exposure of adult listed salmonids to the adverse effects of the project is more difficult to quantify. Presence in Sand Mound Slough likely would result from straying into these waters due to false attraction of fish from Rock Slough. The flow of water into Sand Mound Slough from Rock Slough is tidally driven, and also is dependent on the exporting actions of the SWP and CVP, which create a mix of water from both the Sacramento and San Joaquin River basins in the South Delta. Therefore, it is conceivable that adult listed salmonids from either drainage may be falsely attracted into Sand Mound Slough. While present in the slough, adult fish would be exposed to the detrimental effects of the proposed action. The risk to fecundity, gamete viability, and eventual hatching success of fertilized eggs is unknown. However, the risk of exposure to the adult population is assumed to be even less than the risk to the juvenile population (≤0.01 percent). This level of exposure would be less than one Sacramento River winter-run Chinook salmon for a population of 9,000 adults; two adult Central Valley spring-run Chinook salmon in an adult population of 20,000, and less than one adult Central Valley steelhead in a population of 3,000 fish.

VIII. CONCLUSION

After reviewing the best available scientific and commercial information, the current status of - Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead, the environmental baseline, the effects of the proposed Rock Island Marina project, and the cumulative effects, it is NOAA Fisheries' biological opinion that the Rock Island Marina project, as proposed, is not likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, or Central Valley steelhead, or result in the destruction or adverse modification of the designated critical habitat for Sacramento River winter-run Chinook salmon.

Notwithstanding this conclusion, NOAA Fisheries anticipates that some activities associated with this project may result in the incidental take of these species. Therefore, an incidental take statement is included with this biological opinion for these actions.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NOAA Fisheries as an act which kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered in this Incidental Take Statement. If the Corps: (1) fails to assume and implement the terms and conditions of the Incidental Take Statement, and/or (2) fails to require the applicant, Hawkeye Builders, Inc./Rock Island Homes, Inc., to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps and the applicant must report the progress of the action and its impact on the species to NOAA Fisheries as specified in this Incidental Take Statement (50 CFR §402.14[i][3]).

This Incidental Take Statement is applicable to the construction and normal operations of the Rock Island Marina project, including the associated housing development, as described in the project biological assessment and the responses to NOAA Fisheries' information requests (Moore 2003a, b).

A. Amount or Extent of Take

NOAA Fisheries anticipates that the proposed Rock Island Marina and associated housing development will result in the incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead due to direct and indirect impacts within Sand Mound Slough and the associated waterways of the Delta caused by the construction and operation of the marina and stormwater outfall system. The incidental take is expected to be in the form of death, injury, harassment, and harm.

The numbers of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead taken will be difficult to quantify because dead and injured individuals will be difficult to detect and recover. The amount of take, however, can be quantified by the direct impacts to the approximately seven acres of shallow water habitat affected by the proposed project through dredging and installation of the marina, and the subsequent marina operations. Take also is expected to occur offsite due to the activities of marina based watercraft and the dissipation of marina related contaminants. Take is expected to include:

1. All Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead juveniles harmed, harassed, or killed due to acoustic damage associated with pile driving activities during the initial construction of the marina. Acoustic impacts that exceed the threshold of 150 dB (ref 1 µpascal) as measured at a depth of one meter in the water column and at a distance of 10 m from the pile being driven will be considered to have caused harm to the exposed fish through behavioral and physiological modifications. This level of acoustic energy has been shown in studies to be at the threshold of behavioral and physiological changes in exposed fish species.

2. All Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead juveniles harmed, harassed, or killed from altered habitat conditions caused by the construction of the marina and the initial dredging of the

channel. Such conditions may include loss of benthic organism diversity, temporary loss of riparian habitat, or increased predation risks. Take is not expected to exceed seven acres of water surface area as described in the project description for the marina and channel dredging.

3. All Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead juveniles and adults that are harmed or killed from exposure to contaminants resulting from unintentional releases to waters of the Delta during initial construction activities, initial channel and marina dredging, and long-term operation of the marina and stormwater outfall to Sand Mound Slough. Coverage for incidental take of listed salmonids is restricted to water column concentrations of contaminants which do not exceed the published freshwater aquatic organism standards that are most protective of listed salmonids as stipulated in the *California Toxics Rules* (40 CFR §131), California's *Water Quality Goals* (2000), and the *Fourth Edition of the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins* (1998), or criteria found in the scientific literature that are specific for the listed *Oncorhynchus* species. Contaminant concentrations that exceed the water quality criteria set forth in these publications are considered illegal discharges and are not covered by the incidental take statement of this opinion. NOAA Fisheries anticipates that take of listed salmonids, whether in the form of mortality or morbidity, will occur at contaminant levels below the acute and chronic criteria levels.

4. All Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead juveniles harmed, harassed, or killed due to the operation of motorized water craft within the confined sloughs of the action area. Take is expected to result from the erosion and degradation of the riparian banks and an increase in turbidity in nearshore aquatic habitats as a result of boat wakes from marina patrons, and is not expected to exceed 25 percent of the normal rate of erosion for the project area (as per Corps 1994 permit conditions for the Brookside development on Fourteen Mile Slough and the Calaveras River, San Joaquin County). Boat speeds are not expected to create excessive wakes within the marina area (not to exceed approximately 5 miles per hour (mph), *i.e.* "No wake zone") in Sand Mound Slough adjacent to the marina (as per Corps 1994 permit conditions for the Brookside development on Fourteen Mile Slough and the Calaveras River, San Joaquin County).

Other incidental take associated with the operation of motorized watercraft *(e.g.*, impacts to zooplankton populations, discharges of pollutants from Clean Air Act-compliant boat engines, *etc.*) or illegal discharges of materials to the waters of the U.S. from the proposed Rock Island marina are not included in this incidental take statement because the Corps does not have the authority to regulate these activities.

B. Effect of the Take

In the accompanying biological opinion, NOAA Fisheries determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

C. Reasonable and Prudent Measures

Pursuant to section 7(b)(4) of the ESA, the following reasonable and prudent measures are necessary and appropriate to minimize take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead.

1. Measures shall be taken to reduce the stormwater volume and contaminant loads entering the waters of Sand Mound Slough during the short-term construction phase and the long-term use of the development.

2. Measures shall be taken to limit the adverse effects of pile driving and dredging activities in Sand Mound Slough associated with construction of the marina.

3. Measures shall be taken to reduce or eliminate the impacts of the marina and its ongoing operations upon listed salmonids and their habitat.

4. Measures shall be taken to reduce or eliminate the impacts to listed salmonids and their habitat from the operation of boats in Sand Mound Slough.

5. Measures shall be taken to monitor the ongoing effects of the marina and its associated development on water quality in Sand Mound Slough and the population status of predatory fish species within the slough.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Corps and the applicant must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. **Measures shall be taken to reduce the stormwater volume and contaminant loads entering the waters of Sand Mound Slough during the short-term construction phase and the long-term use of the development.**

    a. The applicant shall develop a comprehensive stormwater management plan. This plan shall be delivered to NOAA Fisheries for review and comment at least 90 days prior to the start of construction at the address in section 1 ©) (iii) below.

The plan should include BMPs that follow those described in an acknowledged stormwater design manual. Examples of such documents are those from the States of Maryland, Delaware, and Washington, the Caltrans Project Planning and Design Guide, or the County of Santa Barbara's Design Guidelines for Stormwater Quality Treatment Facilities. These BMPs shall include design components such as:

i. permeable paving in driveways and common walkway areas,

ii. roof runoff management protocols,

iii. vegetated swales and detention basins with a designed water quality volume to hold first flush events (minimum 2.5 year rain event),

iv. sediment control protocols for both construction and long-term phases of the project,

v. hydrocarbon and contaminant traps integrated into the BMP treatment train,

vi. pollution reduction programs within the community.

b. The applicant shall install air quality control BMPs during the construction phase to reduce and minimize the escapement of dust and dirt from the job site. These BMPs shall include:

I. vehicle washes to remove soils from tires and chassis before exiting the job site,

ii. control of dust by water spray or other environmentally suitable material, and

iii. avoidance of earth moving construction activities when winds exceed threshold for dust control (greater than 10 mph).

c. All servicing of vehicles and equipment shall take place in an upland area away from water bodies and drains and abide by the following conditions:

I. a vehicle pad with spill containment walls shall be used to refuel or service vehicles or equipment on site. The spill containment walls will be sized to hold a volume larger than the biggest anticipated spill,

ii. spill control kits and spill response protocols will be on site at all times and all workers instructed in their use, and

iii. any spill larger than 50 gallons will be reported to the Sacramento Area Office of NOAA Fisheries at the following address within 24 hours:

Attn: Supervisor
National Marine Fisheries Service
650 Capitol Mall, Suite 8-300
Sacramento, California 95814-4706

Office: (916) 930-3601
Fax: (916) 930-3629

2. Measures shall be taken to limit the adverse effects of pile driving and dredging activities in Sand Mound Slough associated with construction of the marina.

a. Pile driving and marina dredging shall occur between June 1 and October 31 to avoid and minimize impacts to listed salmonids in Sand Mound Slough.

b. Pile driving and dredging will be conducted in a manner which minimizes resuspension of sediments into the water column. Techniques such as the placement of silt curtains and working during slack tides may be employed to limit the extent of the turbidity plume from dredging. Turbidity shall not exceed the criteria established in the Basin Plan for the Sacramento River and San Joaquin River watersheds.

c. Settling ponds for dredge material shall be constructed in accordance with the Corps regulations for these structures. Decant waters from the ponds will meet all applicable water quality criteria prior to discharge into Sand Mound Slough.

3. Measures shall be taken to reduce or eliminate the impacts of the marina and its ongoing operations upon listed salmonids and their habitat.

a. The applicant shall develop a long-term management plan for the continued use and operation of the marina. This plan shall incorporate measures such as described in the publication, *EPA National Management Measures-Guidance to Control Nonpoint Source Pollution from Marinas and Recreational Boating* (EPA 2001) into the operations of the marina. At a minimum, the following issues should be addressed in the long-term operations plan:

I. *Marina flushing.* Design the marina such that tides and/or currents will aid in the flushing of the site or renew its water quality,

ii. *Water quality assessment.* Assess water quality as part of the marina siting and design. Conduct ongoing water quality monitoring to insure compliance with water quality criteria,

iii. *Habitat assessment.* Site and design the marina to protect against adverse effects on aquatic organisms, wetlands, submerged native aquatic vegetation, or other important riparian and aquatic habitat areas as designated by local, State, or Federal governments,

iv *Shoreline and streambank stabilization.* Where significant shoreline or streambank erosion occurs, shorelines and streambanks shall be stabilized. Vegetative methods are preferred over structural methods,

v. *Stormwater runoff management.* Implement effective runoff control strategies that include the use of pollution prevention activities and proper design of boat maintenance areas,

vi. *Fuel spills.* Designate a dock in the marina for refueling of boats. Have spill containment equipment storage on this dock and trained personnel to respond to the spill in a quick and timely fashion. Prohibit refueling within the marina except at the specified dock. This includes refueling of watercraft from private fuel containers,

vii. *Petroleum control.* Reduce the amount of fuel and oil from boat bilges and fuel tank air vents entering marina and surface waters. Educate marina patrons as to the appropriate BMPs to control petroleum spills and their environmental consequences,

viii. *Fluid material management.* Provide and maintain appropriate storage, transfer, containment, and disposal facilities for liquid material, such as oil, harmful solvents, antifreeze, and paints, and encourage recycling of these materials,

ix. *Solid waste management.* Properly dispose of solid waste produced by the patrons of the marina. These wastes may result from the operation, cleaning, maintenance, and repair of boats. BMPs should limit the entry of solid wastes to surface waters,

x. *Fish waste management.* Install fish cleaning stations at the marina that provide for the proper disposal of wastes and can be cleaned to prevent fouling of surface waters,

xi. *Sewage facility management.* Install a sewage pumpout, dump stations, and adequate restroom facilities for the marina patrons to reduce the release of sewage to surface waters. Design these facilities to allow ease of access, and post signage to promote their use,

xii. *Maintenance of sewage facilities.* Ensure that sewage pumpout facilities are maintained in operational condition and encourage their use by the marina patrons,

xiii. *Boat cleaning.* For boats that are in the water, perform cleaning operations that minimize to the greatest extent practicable, the release to surface waters of (1) harmful cleaners and solvents and (2) paint residue from in-water hull cleaning,

xiv. *Boat operation.* Manage boating activities where necessary to decrease turbidity and physical destruction of shallow water habitat,

xv. *Public education.* Public education, outreach, and training programs . should be instituted for the boating patrons, as well as the marina operators, to prevent improper disposal of polluting materials and impart the marina BMPs to the boating patrons.

b. This long-term plan shall be sent to the Sacramento Area Office of NOAA Fisheries at the address in section 1 (c)(iii) for review and comment 90 days prior to construction of the marina. The long-term plan shall be implementable for the operation of the marina in perpetuity by the applicant's successors.

4. Measures shall be taken to reduce or eliminate the impacts to listed salmonids and their habitat from the operation of boats in Sand Mound Slough.

a. The Corps and the applicant shall post signage that limits boats to a 5 mph "no wake zone" in the channel along the entire length of Sand Mound Slough to its intersection with Dutch Slough to decrease turbidity, shore erosion, and damage to sensitive habitat and organisms.

b. The Corps and the applicant shall install marker buoys to define the main channel and signage to restrict boating traffic from entering the shallow water areas of the slough.

c. The Corps and the applicant shall replant levee slopes at the waterline with native vegetation *(e.g.,* tules, willows, alders, *etc.)* to reestablish riparian growth and create suitable habitat complexity for salmonids. These vegetative buffers also will help reduce wake induced turbidity and shoreline erosion.

d. The Corps and the applicant shall provide to the Sacramento Office of NOAA Fisheries at the address in section l(c)(iii) a management plan for the restoration of riparian areas affected by the proposed project which shall include monitoring schedules, success criteria, and adaptive management plans to achieve the restoration goals no later than 90 days prior to the initiation of construction.

5. **Measures shall be taken to monitor the ongoing effects of the marina and its associated residential development on water quality in Sand Mound Slough and upon the population status of predatory fish species within the slough.**

a. The applicant shall provide to NOAA Fisheries an annual water quality report by December 31 of each year. Water quality testing in Sand Mound Slough should occur at least three times per year for five years. Tests should be conducted once each during the dry and wet seasons and once after a busy boating weekend *(i.e.,* Memorial Day, Fourth of July, or Labor Day) to examine the effects of the marina on slough water quality. Water samples should be assayed for heavy metals, petroleum and hydrocarbons, organic solvents, pesticides, turbidity, total and dissolved solids, and BOD. The sampling protocol shall be reviewed by NOAA Fisheries prior to implementation by the applicant.

b. Water quality from the stormwater treatment train should be assayed for compliance with water quality criteria following first flush rain events for at least the first five years. At least two samples shall be taken, once at the first measurable rain following the dry season, and sometime during the wet season following two weeks of dry weather. Water quality constituents to be tested are the same as in 5(a) above.

c. The applicant shall provide five years of ongoing monitoring of fish populations in the slough during the summer (June) and early fall (September) of each year to determine the relative changes in forage and predatory fish populations. A fish monitoring plan will be developed and sent to NOAA Fisheries for review prior to commencing sampling and within 90 days of completion of the marina. Annual updates and a final report will be sent to NOAA Fisheries at the address in section 1(c)(iii) by December 31 of each year.

X. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on a listed species or critical habitat or regarding the development of pertinent information.

1. The Corps and applicant should support and promote aquatic and riparian habitat restoration within the Delta region, and encourage practices that avoid or minimize negative impacts to salmon and steelhead.

2. The Corps and applicant should support anadromous salmonid monitoring programs throughout the Sacramento-San Joaquin Delta and Suisun Bay to improve the understanding of migration and habitat utilization by salmonids in this region.

In order for NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NOAA Fisheries requests notification of the implementation of any conservation recommendations.

XI. REINITIATION OF CONSULTATION

This concludes formal consultation on the actions outlined in the May 16, 2003, request for consultation received from the Corps. This biological opinion is valid for the Rock Island Marina project described in the BA and Corps application package received by NOAA Fisheries. As provided for in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of taking specified in any incidental take statement is exceeded, 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered, 3) the agency action is subsequently modified in a manner that causes an effect to the listed species that was not considered in the biological opinion, or 4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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Table 1:

Salmonid Recovery at the Contra Costa Canal, Pumping Plant No. 1
January 1994 through August 1996
Source: DFG 2003

Month	Chinook Salmon (All Runs)			Winter-Run Sized Chinook Salmon			Spring-Run Sized Chinook Salmon			Steelhead		
	1994	1995	1996	1994	1995	1996	1994	1995	1996	1994	1995	1996
January	0	0	4 (1)	0	0	1	0	0	0	0	0	3
February	0	2 (2)	0	0	0	0	0	0	0	2	1	4
March	6	1	2	2	0	1	0	0	2	7	6	1
April	20 (1)	40	14	0	5	2	16	40	12	1	6	2
May	73 (12)	18	19	0	1	0	13	13	11	0	1	3
June	2	33(1)	1	0	0	0	0	1	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	-	0	0	0
September	0	0	-	0	0	-	0	0	-	0	0	-
October	0	0	-	0	0	-	0	0	-	0	0	-
November	0	0	-	0	0	-	0	0	-	0	0	-
December	0	1	-	0	0	-	0	0	-	0	0	-
Total	101 (13)	95(3)	40(1)	2	0	4	29	54	25	10	14	13

Numbers in parentheses indicates partial fish that were collected in the sieve-net.

Actual numbers of salmonids captured in the sieve-net on the downstream side of Pumping Plant No. 1 of the Contra Costa Canal, January 1994 through August 1996. Sampling was not continuous and measured only a portion of the total time of the monitoring period. The net sampled between 90 and 100 percent of the flow through the pumping facility when in place.

Table 2:

Stormwater Contamination Concentrations from Various Land Uses. Values are in mg/1 (ppm)

Source: http://www.Stormwatercenter.net/monitoring

Pollutant	New Surburban	Older Suburban	Hardwood Forest	National Urban
Phosphorus				
Total	0.26	1.08	0,15	-
Ortho	0.12	0.26	0.02	-
Soluble	0.16	-	0.04	0.59
Organic	0.1	0.82	0.11	-
Nitrogen				
Total	2	13.6	0.78	-
Nitrate	0.48	8.99	0.17	-
Ammonia	0.26	1.1	0.07	-
Organic	1.25	-	0.54	-
TKN	1.51	7.2	0.61	2.72
COD	3S.6	163.0	> 40.0	124.0
BOD (5 day)	5.1	-	-	-
Metals				
Zinc	0.037	0.397	-	0.380
Lead	0.018	0.389	-	0.350
Copper	-	0.105	-	-

Abbreviations:

TKN	Total Kjeldahl Nitrogen
COD	Chemical Oxygen Demand
BOD	Biological Oxygen demand

Table 3:

Highway Runoff Constituents and Their Primary Sources
Source: EPA (1993)

Constituent	Primary Sources
Particulates	Pavement wear, vehicles, atmospheric deposition
Nitrogen, Phosphorus	Atmospheric deposition, roadside fertilizer application
Lead	Tire wear, automobile exhaust
Zinc	Tire wear, motor oil, grease
Iron	Auto body rust, steel highway structures, moving engine parts
Copper	Metal plating, brake lining wear, moving engine parts, bearing and bushing wear, fungicides and insecticides
Cadmium	Tire wear, roadside insecticide application
Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and gasoline, lubricating oils, metal plating, brake lining wear, asphalt paving
Manganese	Moving engine parts
Sulphate	Roadway beds
Petroleum	Spills, leaks, or blow-by of motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate

Annual Estimated Sacramento River Winter-run Chinook Salmon Spawning Escapement from 1967-2002

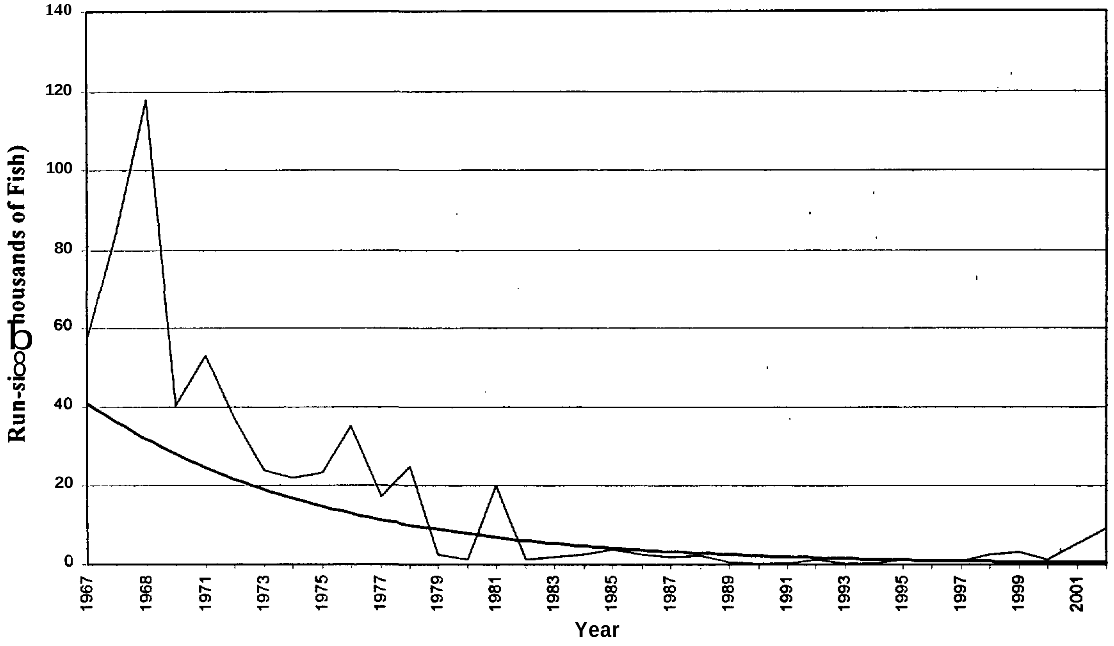

Figure 1:
Annual estimated Sacramento River winter-run Chinook salmon Adult escapement.
Sources: PFMC 2002, NOAA Fisheries 1997
Trend line for figure 1 is an exponential function: $Y = 46.606\ e^{-0.1269x}$ $R^2 = 0.5449$

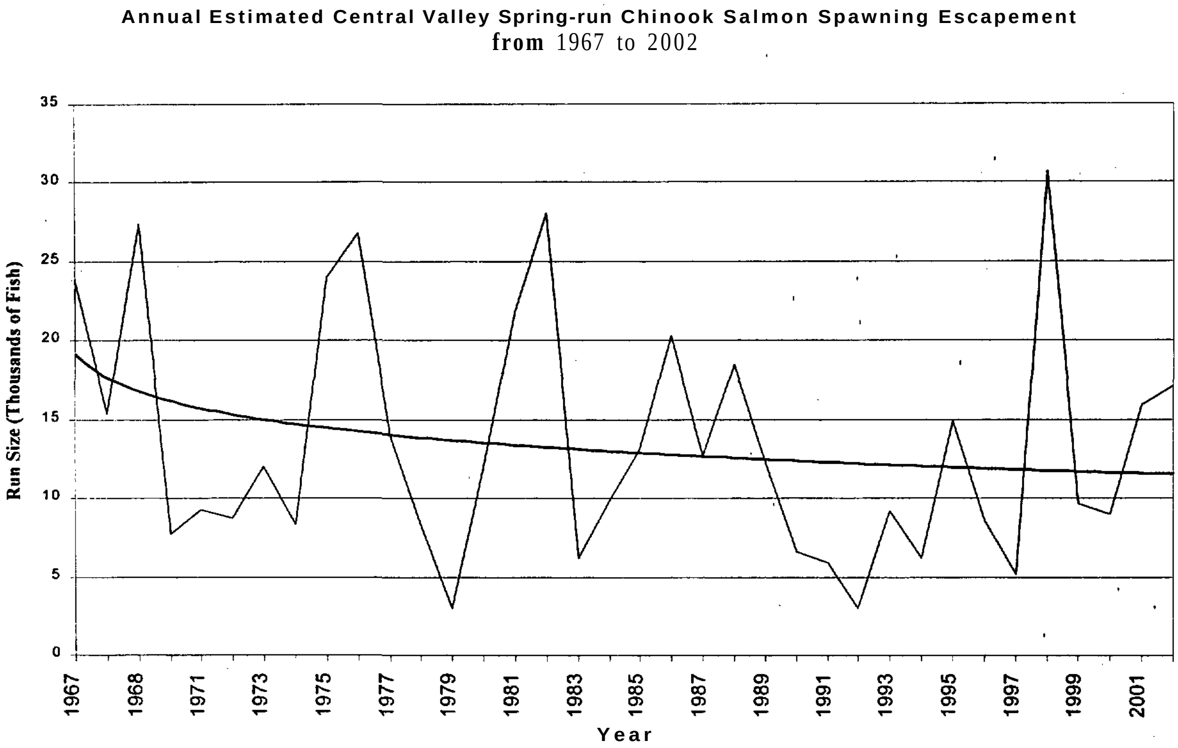

Figure 2:
Annual estimated Central Valley spring-run Chinook salmon adult escapement for the Sacramento River Basin.
Sources: PFMC 2002, Yoshiyama 1998
Trend line for figure 2 is an exponential function: Y = -2.1276 Ln (x) + 19.146, R^2 = 0.0597

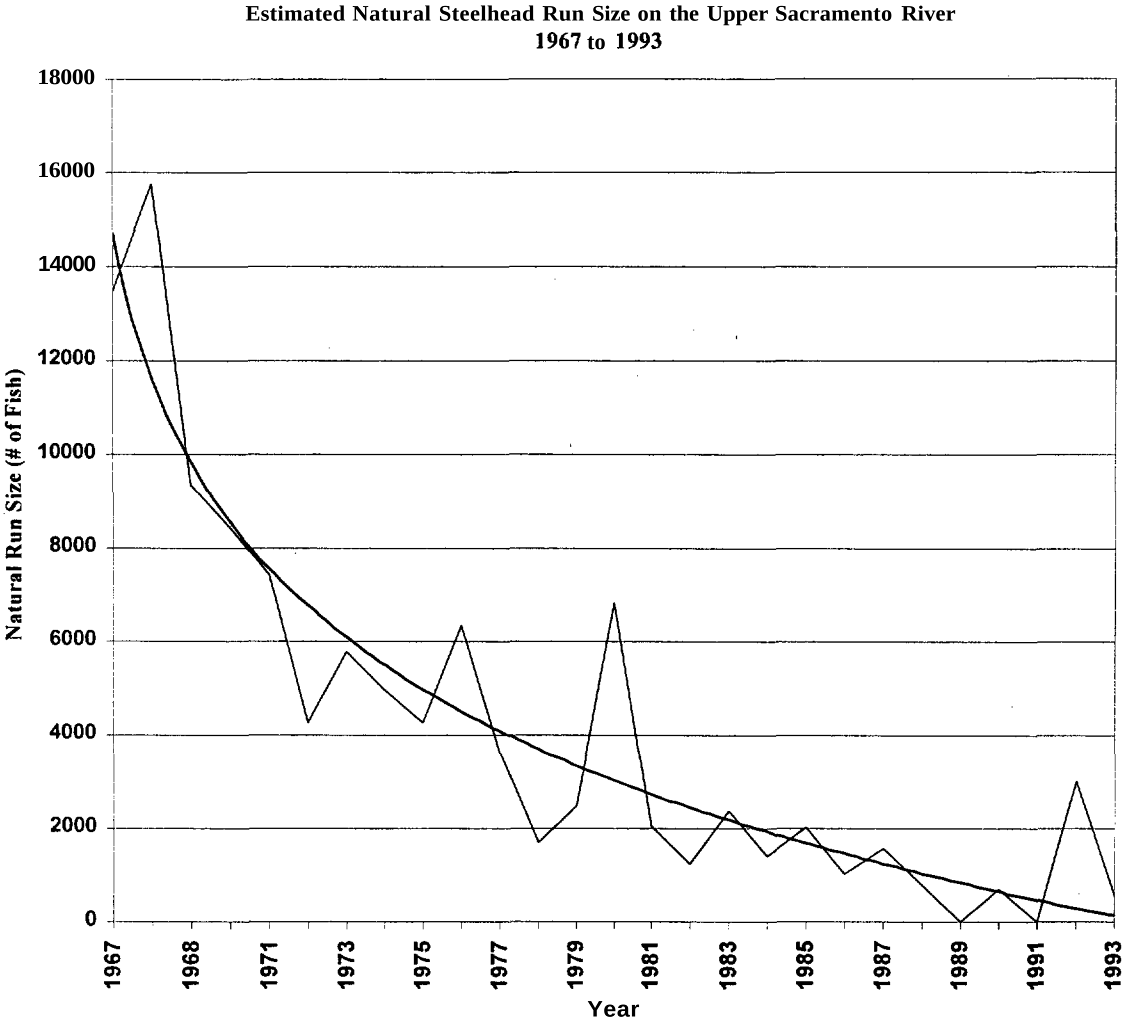

Figure 3:
Estimated natural steelhead escapement in th upper Sacramento River
Source: McEwan and Jackson 1996
Trend line for Figure 4 is a logarithmic function: Y= -4419 Ln(x) + 14690 $R^2 = 0.8574$
Note: Sampling for steelhead at the Red Bluff Diversion Dam ended in 1993.

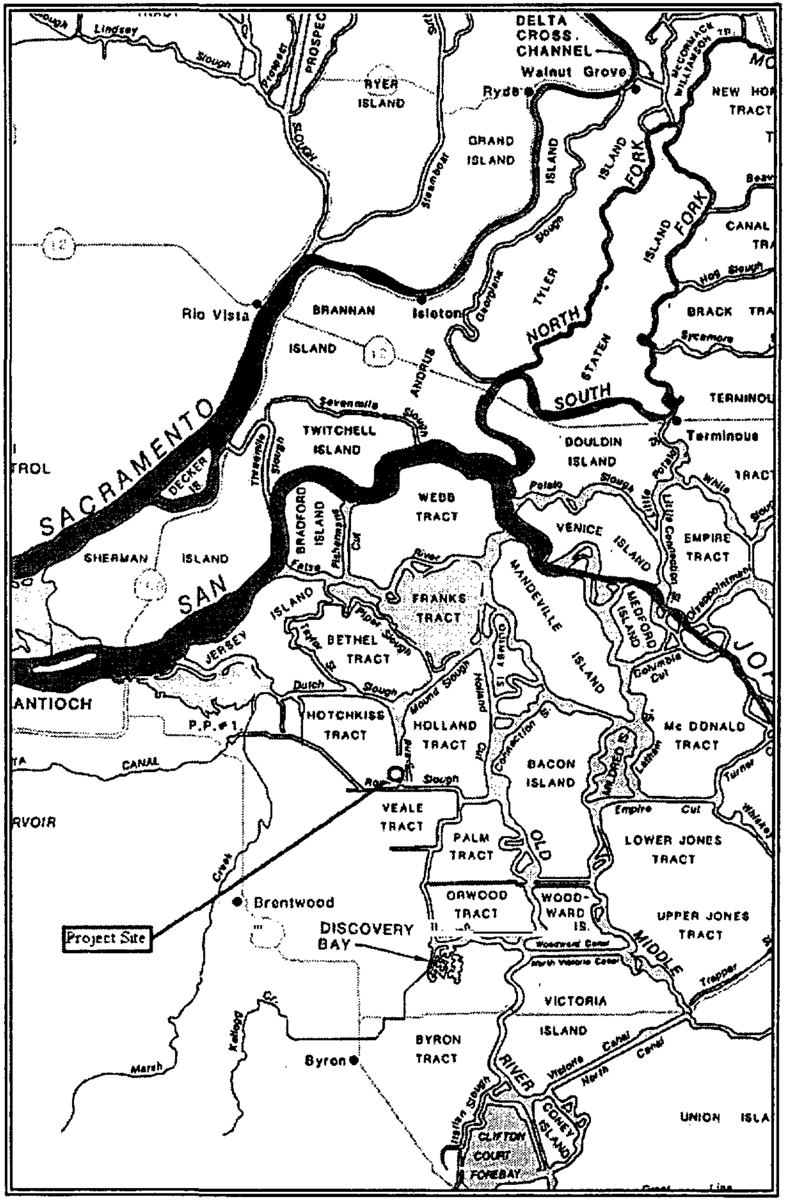

Figure 4:
Project Site for Rock Island Marina and Subdivision, Contra Costa County California
Intersection of Sand Mound Slough and Rock Slough

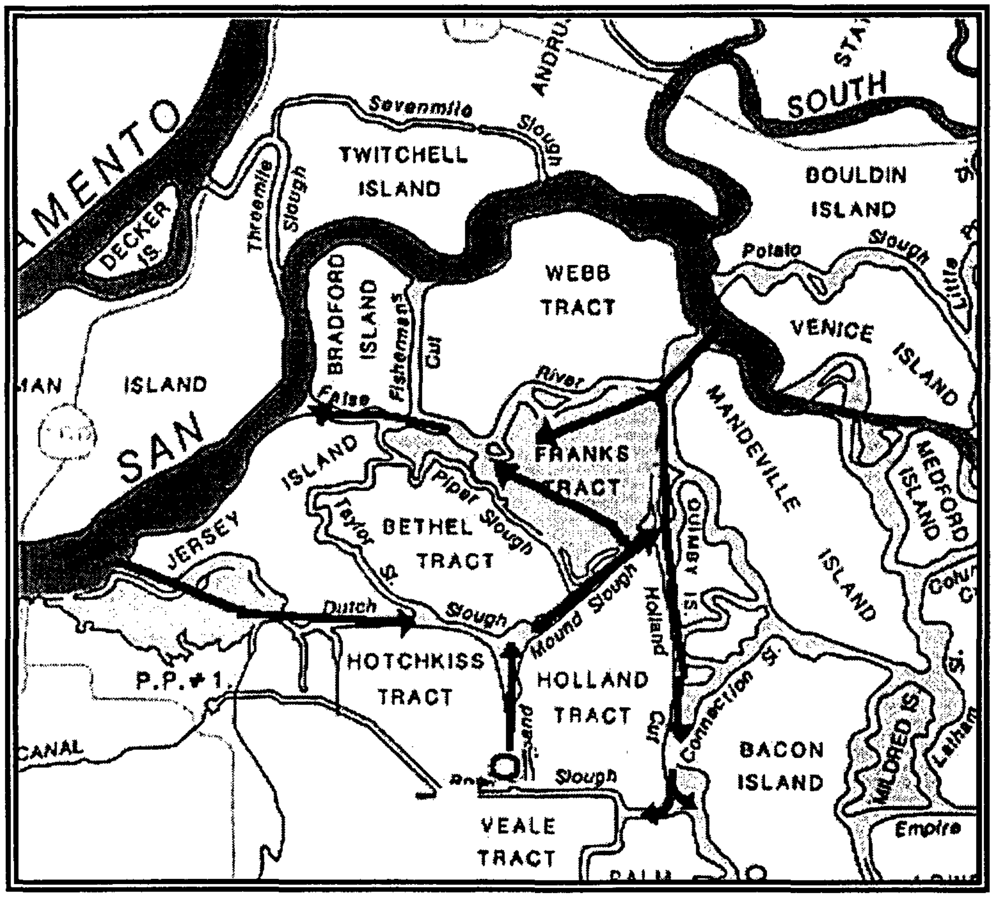

Figure 5:
Generalized net tidal circulation pattern in project area according to modeling by DWR

Enclosure 2

Magnuson-Stevens Fishery Conservation and Management Act

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended (U.S.C. 180 *et seq.}*, requires that Essential Fish Habitat (EFH) be identified and described in Federal fishery management plans (FMPs). Federal action agencies must consult with the National Marine Fisheries Service (NOAA Fisheries) on any activity which they fund, permit, or carry out that may adversely affect EFH. NOAA Fisheries is required to provide EFH conservation and enhancement recommendations to the Federal action agencies.

EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purposes of interpreting the definition of EFH, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; “necessary’ means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle. The proposed project site is within the region identified as EFH for Pacific salmon in Amendment 14 of the Pacific Salmon FMP and for starry flounder *(Platichthys stellatus*) and English sole (*Parophrysvetulus)* in Amendment 11 to the Pacific Coast Groundfish FMP.

The Pacific Fishery Management Council (PFMC) has identified and described EFH, Adverse Impacts and Recommended Conservation Measures for salmon in Amendment 14 to the Pacific Coast Salmon FMP (PFMC 1999). Freshwater EFH for Pacific salmon in the California Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers *et al.* (1998), and includes the San Joaquin Delta hydrologic unit *(i.e.,* number 18040003), Suisun Bay hydrologic unit (18050001) and the Lower Sacramento hydrologic unit (18020109). Sacramento River winter-run Chinook salmon *(Oncorhynchus tshawytscha*), Central Valley spring-run Chinook salmon *(O. tshawytscha*), and Central Valley fall-/late fall-run Chinook salmon *(O. tshawytscha)* are species managed under the Salmon Plan that occur in the San Joaquin Delta, Suisun Bay and Lower Sacramento units.

Factors limiting salmon populations in the Delta include periodic reversed flows due to high water exports (drawing juveniles into large diversion pumps), loss of fish into unscreened agricultural diversions, predation by introduced species, and reduction in the quality and quantity of rearing habitat due to channelization, pollution, rip-rapping *etc.* (Kondolf *et al.* 1996a, 1996b; Dettman *et* *al.* 1987; California Advisory Committee on Salmon and Steelhead Trout 1988). Factors affecting salmon populations in Suisun Bay include heavy industrialization within its watershed and discharge of waste water effluents into the bay. Loss of vital wetland habitat along the fringes of the bay reduce rearing habitat and diminish the functional processes that wetlands provide for the bay ecosystem.

A. Life History and Habitat Requirements

1. Pacific Salmon

General life history information for Central Valley Chinook salmon is summarized below. Information on Sacramento River winter-run and Central Valley spring-run Chinook salmon life histories is summarized in the preceding biological opinion for the proposed project (Enclosure 1). Further detailed information on Chinook salmon Evolutionarily Significant Units (ESUs) are available in the NOAA Fisheries status review of Chinook salmon from Washington, Idaho, Oregon, and California (Myers *et al.* 1998), and the NOAA Fisheries proposed rule for listing several ESUs of Chinook salmon (63 FR 11482).

Adult Central Valley fall-run Chinook salmon enter the Sacramento and San Joaquin Rivers from July through April and spawn from October through December (U.S. Fish and Wildlife Service [FWS] 1998). Chinook salmon spawning generally occurs in clean loose gravel in swift, relatively shallow riffles or along the edges of fast runs (NOAA Fisheries 1997).

Egg incubation occurs from October through March (Reynolds *et al.* 1993). Shortly after emergence from their gravel nests, most fry disperse downstream towards the Delta and estuary (Kjelson *et al.* 1982). The remainder of fry hide in the gravel or station in calm, shallow waters with bank cover such as tree roots, logs, and submerged or overhead vegetation. These juveniles feed and grow from January through mid-May, and emigrate to the Delta and estuary from mid-March through mid-June (Lister and Genoe 1970). As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Along the emigration route, submerged and overhead cover in the form of rocks, aquatic and riparian vegetation, logs, and undercut banks provide habitat for food organisms, shade, and protect juveniles and smolts from predation. These smolts generally spend a very short time in the Delta and estuary before entry into the ocean. Whether entering the Delta or estuary as fry or juveniles, Central Valley Chinook salmon depend on passage through the Sacramento-San Joaquin Delta for access to the ocean.

2. Starry Flounder

The starry flounder is a flatfish found throughout the eastern Pacific Ocean, from the Santa Ynez River in California to the Bering and Chukchi Seas in Alaska, and eastwards to Bathurst inlet in Arctic Canada. Adults are found in marine waters to a depth of 375 meters. Spawning takes place during the fall and winter months in marine to polyhaline waters. The adults spawn in shallow coastal waters near river mouths and sloughs, and the juveniles are found almost exclusively in estuaries. The juveniles often migrate up freshwater rivers, but are estuarine dependent. Eggs are broadcast spawned, and the buoyant eggs drift with wind and tidal currents. Juveniles gradually settle to the bottom after undergoing metamorphosis from a pelagic larvae to a demersal juvenile by the end of April. Juveniles feed mainly on small crustaceans, barnacle larvae, cladocerans, clams and dipteran larvae. Juveniles are extremely dependent on the condition of the estuary for their health. Polluted estuaries and wetlands decrease the survival rate for juvenile starry flounder. Juvenile starry flounder also have a tendency to accumulate many of the contaminants in the environment.

3. English Sole

The English sole is a flatfish found from Mexico to Alaska. It is the most abundant flatfish in Puget Sound, Washington and is abundant in the San Francisco Bay estuary system. Adults are found in nearshore environments. English sole generally spawn during late fall to early spring at depths of 50 to 70 meters over soft mud bottoms. Eggs are initially buoyant, then begin to sink just prior to hatching. Incubation may last only a couple of days to a week depending on temperature. Newly hatched larvae are bilaterally symmetrical and float near the surface. Wind and tidal currents carry the larvae into bays and estuaries where the larvae undergo metamorphosis into the demersal juvenile. The young depend heavily on the intertidal areas, estuaries and shallow near shore waters for food and shelter. Juvenile English sole feed on small crustaceans such as copepods, amphipods, and on polychaete worms. Polluted estuaries and wetlands decrease the survival rate for juvenile English soles. The juveniles also have a tendency to accumulate many of the contaminants found in their environment and this exposure manifests itself as tumors, sores, and reproductive failures.

II. PROPOSED ACTION

The proposed action is described in section II *(Description of the Proposed Action)* of the preceding biological opinion for endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, Central Valley steelhead *(O. mykiss)*, and critical habitat for winter-run Chinook salmon (Enclosure 1).

III. EFFECTS OF THE PROJECT ACTION

The effects of the proposed action on Sacramento River winter-run and Central Valley spring-run Chinook salmon habitat are described at length in section V *(Effects of the Action)* of the preceding biological opinion, and generally are expected to apply to Pacific salmon EFH. The effects on EFH for the two species of flatfish are expected to be similar to those for salmon.

IV. CONCLUSION

Based on the best available information, NOAA Fisheries believes that the proposed Rock Island Marina project and its associated housing development may adversely affect EFH for Pacific salmon and groundfish during its construction and normal long-term operations.

V. EFH CONSERVATION RECOMMENDATIONS

NOAA Fisheries recommends that the reasonable and prudent measures from the biological opinion be adopted as EFH Conservation Recommendations for EFH in the action area. In addition, certain other conservation measures need to be implemented in the project area, as addressed in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). NOAA Fisheries anticipates that implementing those conservation measures intended to minimize disturbance and sediment and pollutant inputs to waterways would benefit groundfish as well.

Riparian Habitat Management–In order to prevent adverse effects to riparian corridors, the U.S. Army Corps of Engineers (Corps) and Hawkeye Builders, Inc./Rock Island Homes, Inc. (applicant) should:

- Maintain riparian management zones of appropriate width on Sand Mound Slough that influence EFH.
- Reduce erosion and runoff into waterways within the project area.
- Minimize the use of chemical treatments within the riparian management zone to manage nuisance vegetation along the levee banks and reclamation district's irrigation drain.

Bank Stabilization–The installation of riprap or other streambank stabilization devices can reduce or eliminate the development of side channels, functioning riparian and floodplain areas and off channel sloughs. In order to minimize these impacts, the Corps and the applicant should:

- Use vegetative methods of bank erosion control whenever feasible. Hard bank protection should be a last resort when all other options have been explored and deemed unacceptable.
- Determine the cumulative effects of existing and proposed bio-engineered or bank hardening projects on salmon EFH, including prey species before planning new bank stabilization projects.
- Develop plans that minimize alterations or disturbance of the bank and existing riparian vegetation.

Conservation Measures for Construction/Urbanization–Activities associated with urbanization (*e.g.*, building construction, utility installation, road and bridge building, storm water discharge) can significantly alter the land surface, soil, vegetation, and hydrology and subsequently adversely impact salmon EFH through habitat loss or modification. In order to minimize these impacts, the Corps and the applicant should:

- Plan development sites to minimize clearing and grading.

- Use Best Management Practices (BMPs) in building as well as road construction and maintenance operations such as avoiding ground disturbing activities during the wet season, minimizing the time disturbed lands are left exposed, using erosion prevention and sediment control methods, minimizing vegetation disturbance, maintaining buffers of vegetation around wetlands, streams and drainage ways, and avoid building activities in areas of steep slopes with highly erodible soils. Use methods such as sediment ponds, sediment traps, or other facilities designed to slow water runoff and trap sediment and nutrients.

- Where feasible, reduce impervious surfaces.

Wastewater/Pollutant Discharges-Water quality essential to salmon and their habitat can be altered when pollutants are introduced through surface runoff, through direct discharges of pollutants into the water, when deposited pollutants are resuspended (*e.g.*, from dredging), and when flow is altered. Indirect sources of water pollution in salmon habitat includes run-off from streets, yards, and construction sites. In order to minimize these impacts, the Corps and the applicant should:

- Monitor water quality discharge following National Pollution Discharge Elimination System requirements from all discharge points.

- For those waters that are listed under Clean Water Act section 303 (d) criteria (*e.g.*, the Delta), establish total maximum daily loads and develop appropriate management plans to attain management goals.

- Establish and update, as necessary, pollution prevention plans, spill control practices, and spill control equipment for the handling and transport of toxic substances in salmon EFH (*e.g.*, oil and fuel, organic solvents, raw cement residue, sanitary wastes, etc.). Consider bonds or other damage compensation mechanisms to cover clean-up, restoration, and mitigation costs.

VI. STATUTORY REQUIREMENTS

Section 305 (b) 4(B) of the MSA requires that the Federal lead agency provide NOAA Fisheries with a detailed written response within 30 days, and 10 days in advance of any action, to the EFH conservation recommendations, including a description of measures adopted by the lead agency for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR §600.920[j]). In the case of a response that is inconsistent with our recommendations, the Corps must explain its reasons for not following the recommendations, including the scientific justification for any disagreement with NOAA Fisheries over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

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