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

In response refer to:
2003/2080

JUN 21 2007

Lt. Colonel Craig W. Kiley
U.S. Department of the Army
San Francisco District, Corps of Engineers
1455 Market Street
San Francisco, California 94103-1398

Dear Colonel Kiley:

This document transmits NOAA's National Marine Fisheries Service's (NMFS) biological opinion (Enclosure) based on our review of the U.S. Army Corps of Engineers (Corps) proposal to permit the construction of the Salinas River Diversion Facility. The biological opinion analyzes the effects of the proposed action on threatened South-Central California Coast (S-CCC) steelhead (*Oncorhynchus mykiss*) and their critical habitat in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.).

On July 28, 2006, NMFS issued a draft biological opinion for this project to the Corps and the Monterey County Water Resources Agency (MCWRA). On November 7, 2006, MCWRA provided written comments on the draft biological opinion; the Corps did not provide any comments. On February 6, 2007, NMFS met with MCWRA and their consultants (the Corps did not attend the meeting) to discuss the draft biological opinion and MCWRA's November 7, 2006, comments. This biological opinion incorporates MCWRA's written comments and those provided at the February 6, 2007, meeting as appropriate.

NMFS concludes the proposed action, and interrelated and interdependent actions such as the provision of migration flows for steelhead smolts, are not likely to jeopardize the continued existence of threatened S-CCC steelhead or adversely modify or destroy designated critical habitat for this species. The proposed project is likely to result in take of listed steelhead and, therefore, an incidental take statement is included with this biological opinion. The incidental take statement includes reasonable and prudent measures necessary and appropriate to minimize incidental take of S-CCC steelhead.

If you have any questions about this section 7 consultation, or if you require additional information, please contact Ms. Joyce Ambrosius at (707) 575-6064.

Sincerely,

Mark Helvey

for Rodney R. McInnis
Regional Administrator

Enclosure

cc: Russ Strach, NMFS, Sacramento
Bill Phillips and Curtis Weeks, Monterey County Water Resources Agency, Salinas
Diane Noda, U.S. Fish and Wildlife Service, Ventura
Julie Means, California Department of Fish and Game, Fresno

Enclosure

BIOLOGICAL OPINION

ACTION AGENCY: U.S Army Corps of Engineers, San Francisco District

ACTION: Monterey County Water Resources Agency, Salinas Valley Water Project in Monterey County, California.

CONSULTATION CONDUCTED BY: National Marine Fisheries Service, Southwest Region

FILE NUMBER: SWR/2003/2080 (Admin. No.: 151422SWR2003SR8711)

DATE ISSUED: JUN 21 2007

I. INTRODUCTION

Section 7 of the Endangered Species Act (ESA) of 1973, as amended, requires Federal agencies to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of threatened or endangered species or destroy or adversely modify critical habitat. The section 7 regulations define "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, number, or distribution of that species." The regulatory definition of critical habitat has been invalidated by Federal courts. This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR §402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat (NMFS 2005a).

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) is conducting a formal consultation with the U.S. Army Corps of Engineers (Corps) on the issuance of a permit to the Monterey County Water Resources Agency (MCWRA). MCWRA proposes to control seawater intrusion, improve the efficiency of water delivery in the Salinas Valley for agriculture and urban uses and improve steelhead habitat through the construction of the Salinas River Diversion Facility (SRDF), modification of the spillway at Nacimiento Dam, and changes to the operation of Nacimiento and San Antonio dams. This diversion facility and operational changes, collectively, are known as the Salinas Valley Water Project (SVWP). The SVWP may adversely affect South-Central California Coast (SCCC) steelhead (*Oncorhynchus mykiss*) protected as threatened under the ESA and its designated critical habitat, and, therefore, requires a formal consultation pursuant to section 7(a)(2) of the ESA.

Our task in this consultation is to provide a determination regarding jeopardy and adverse modification relative to the proposed action. This biological opinion also provides the analysis supporting our determination.

MCWRA water management activities in the Salinas basin are extensive and potentially have many impacts to steelhead and their habitat. It is, therefore, important, in light of our analysis, to be clear about what we are, and are not, consulting on. In this biological opinion, we analyze the effects of both the proposed construction/operation of the SRDF and Nacimiento Spillway modification and those changes in flow releases from the Nacimiento and San Antonio dams that would not otherwise occur without the operation of the SRDF. This includes any change in flows along the Salinas River mainstem as well as changes in flows to the Salinas River Lagoon.

We are not analyzing ongoing dam operations and maintenance as a part of the proposed action because they are neither indirect effects nor interrelated or interdependent actions to the proposed action. Most dam operations and maintenance are a part of the environmental baseline to which the effects of the proposed action will be added. As a result, the Incidental Take Statement for this opinion does not exempt any incidental take resulting from those baseline operations. This includes the bulk of the flow released from the Nacimiento and San Antonio dams. One exception is modified operations of these reservoirs to meet the purposes of the proposed action. Those modified operations are considered interrelated with the Corps' proposed action and are considered in the Effects of the Proposed Action section of this opinion.

In this document, we present our analysis and conclusions in the conventional format for biological opinions as described in the Endangered Species Consultation Handbook (U.S. Fish and Wildlife Service and NMFS 1998). It begins with a review of the consultation history and a description of the project. Following that is Status of the Species and Critical Habitat, Environmental Baseline, and Effects of the Proposed Action sections which provide our analysis of the project. The opinion concludes with NMFS' determination regarding the impacts of this proposed project on species survival and recovery, and the value of critical habitat. An Incidental Take Statement follows, which defines the amount or extent of harm to the species and/or their habitat. It also provides terms and conditions to minimize the take.

The Status of the Species and Critical Habitat Section portrays the condition of the species (and their habitat, including critical habitat) relative to the species' probability of survival and recovery and the conservation value of critical habitat by describing how the species is surviving and recovering given its life history strategy and the condition of its environment. The Environmental Baseline describes and analyzes the current and expected future condition of the species and its habitat, including critical habitat, in the action area. The Effects of the Proposed Action section describes and analyzes the effects of the proposed project on habitat, including critical habitat Primary Constituent Elements (PCEs) of critical habitat, given the species' and critical habitat's baseline condition, the exposure of critical habitat and steelhead to the physical, chemical, and biotic changes in the environment as a result of the proposed action, and the expected response of steelhead and critical habitat to these changes. Once the effects are described, we assess the ramifications of the effects to critical habitat and listed species in the action area on the conservation value of critical habitat and the survival and recovery of the species at the Distinct Population Segment (DPS) scale given their status and the environmental baseline.

The issues NMFS is obliged to address in this opinion are wide-ranging, complex, and often not referenced in scientific literature. We base many of our conclusions on explicit assumptions informed by the available evidence. By this, we mean to make a reasonable effort to compile the best scientific and commercial empirical evidence related to the analysis and to then apply general and specific information on salmonid biology from the published literature to make inferences and establish our conclusions.

Second, when we address uncertainty in our analyses we apply that portion of section 7(a)(2) which dictates that Action Agencies are to "insure" that their actions are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitat. In other words, Action Agencies are charged with avoiding Type II errors (*i.e.,* concluding that there was no effect when, in fact, there was an effect). At times this can create a lack of understanding of section 7 determinations within the scientific community, which often focuses on minimizing the potential for Type I errors (*i.e.,* concluding that there was an effect when, in fact, there was no effect); however, it is important to recognize that we have different purposes.

The need to minimize the potential for Type II errors results in providing the benefit of the doubt to the species. This approach is supported by the 1979 Congressional Record created when Congress amended the ESA to allow the Services to develop their biological opinions using the best information currently available or that can be developed during the consultation and concluded that the language "continues to give the benefit of the doubt to the species, and it would continue to place the burden on the action agency to demonstrate to the consulting agency that its action will not violate Section 7(a)(2)" (H.R. Conference Report No. 697, 96th Congress, 2d Session 12, 1979).

II. CONSULTATION HISTORY

MCWRA applied to the Corps for permits for two projects in the Salinas River; the Salinas River Mouth Breaching Program and the SVWP, in 2000 and 2002, respectively. NMFS recommended to the Corps and MCWRA to batch the two projects together as one consultation to simplify the analysis of impacts to listed species. The Corps agreed to combine the two consultations, although the Corps would still issue separate permits; one for the Breaching Program and one for the SVWP. At a meeting on April 1, 2005, MCWRA agreed to that plan. In the course of completing the biological opinion for the SVWP, the issue of batching this project with the river mouth breaching program was revisited. On March 28, 2006, NMFS decided to expedite completion of the consultation for the SVWP by separating the consultations for the SVWP and the lagoon breaching activities. This is reasonable because lagoon management and breaching activities have always been identified as a separate action from the SVWP, and the two actions were originally batched solely as a matter of convenience.

The following is a timeline history of the SVWP consultation:

NMFS received the Corps' letter requesting initiation of section 7 consultation for the MCWRA's SVWP on June 4, 2002.

Prior to receiving the request for consultation, NMFS commented on two versions of the Draft Environmental Impact Report, by letters dated December 17, 1998, and September 6, 2001. These comment letters identified NMFS' concerns regarding potential effects of the project on threatened steelhead.

The biological assessment (BA) for SVWP was received on June 6, 2002. In a letter dated July 26, 2002, NMFS informed the Corps that MCWRA had requested a meeting to discuss and review the BA, and that after meeting and reviewing the BA, NMFS would determine if additional information would be needed to initiate section 7 consultation. NMFS and MCWRA's consultants met on September 18, 2002, October 3, 2002, and December 20, 2002, to discuss the proposed project and evaluate the completeness of the BA. Based on these meetings and review of the BA, NMFS determined the BA was incomplete. In a letter to the Corps dated January 24, 2003, NMFS requested additional information to support section 7 consultation for SVWP. The request sought: 1) information on streamflow regimes under four water management scenarios related to SVWP, 2) a formal response to proposed modifications for smolt outmigration, 3) a clarification of proposed water diversion rates, 4) a description of condition and availability of spawning and rearing habitat in Nacimiento and San Antonio rivers below the existing dams, 5) a description of current water conservation measures in the Salinas Valley, 6) a description of water quality in the Salinas River and action area, and 7) an assessment of potential predation by pinnipeds resulting from implementation of SVWP. NMFS' January 24, 2003, letter also defined the scope of the consultation to include all operations of the Nacimiento and San Antonio dams. MCWRA and NMFS met on February 5, 2003, to discuss this information request. MCWRA provided the information requested in the NMFS January 24, 2003, letter throughout 2003 and 2004.

In a meeting on June 2, 2003, NMFS notified MCWRA that flow criteria identified in the BA for steelhead migration were flawed, provided MCWRA with an analysis of the deficiencies of the information, and requested MCWRA work with NMFS to determine appropriate flows for steelhead migration. During a meeting with MCWRA and its consultants on July 24, 2003, NMFS proposed a field study to develop a flow/depth relationship specific to the action area in the Salinas River. NMFS provided *A Study Plan for Evaluating Passage Flows for Steelhead in the Salinas River* to MCWRA on August 7, 2003.

NMFS, MCWRA, and its consultants held further meetings through the end of 2003, to discuss the status of information requested by NMFS, evaluate the feasibility of completing the proposed flow study, and develop a timeline for initiating and completing section 7 consultation.

On January 13, 2004, NMFS received Water Resources and Information Management Engineering, Inc.'s (WRIME [MCWRA's consultant]) December 2003, *Hydrologic Analysis of Salinas River Flows in Response to NOAA Fisheries Requests for Further Information on the*

Biological Assessment for the Salinas Valley Water Project. On March 4, 2004, another meeting was held with NMFS, MCWRA, and its consultants to discuss the hydrologic analysis report. It was agreed MCWRA would provide NMFS additional information regarding, among other issues, the statistical methodology to address the estimation error for unimpaired flows and a comparison of flow conditions among scenarios for 1949 to 1956 water years.

Between March 5-9, 2004, NMFS, with assistance from MCWRA and California Department of Fish and Game (CDFG) staff, conducted a single event flow study on the middle reach of the river above and below Soledad, based on the study plan from August 7, 2003.

On April 8, 2004, NMFS received the *Amendment to December 2003 Report Hydrologic Analysis of Salinas River Flows,* addressing NMFS' concerns from the March 4, 2004, meeting. In August, 2004, NMFS contracted with Natural Resources Consulting Engineers, Inc. (NRCE) to independently review WRIME's hydrologic analysis and estimates of unimpaired flows in the Salinas River. On October 29, 2004, NMFS, MCWRA, WRIME, and NRCE met to discuss how to determine passage flows and what other information was still needed to initiate consultation. MCWRA informed NMFS that preliminary engineering plans for both the fish screen and the fish ladder would not be completed for at least 3 to 4 months. At this meeting, MCWRA committed to meeting NMFS' fish ladder and fish screen criteria in its engineering plans in order for NMFS to initiate consultation. NMFS agreed to initiate consultation before passage flows were determined and a flow prescription developed; however, NMFS made clear that the biological opinion would not be able to be completed until this information was made available.

In a letter to NMFS dated November 30, 2004, MCWRA committed to meeting the standards outlined in the fish screening and fish ladder criteria for diversion facilities prepared by NMFS and CDFG. They also committed to modifying the slide gate structure at the Salinas River Lagoon to include a fish screen. NMFS initiated section 7 consultation for the SVWP with the Corps on December 9, 2004.

At a meeting on April 1, 2005, NMFS presented its *Salinas Valley Water Project Flow Proposal for the Biological Needs of Steelhead in the Salinas River* to MCWRA. From April through August, 2005, a technical working group made up of staff from NMFS and MCWRA, and its consultants, met on a regular basis to develop the final flow prescription. On September 21, 2005, NMFS received the *Draft Supplement to the Salinas Valley Water Project Biological Assessment* from MCWRA. On October 11, 2005, NMFS received the final *Supplement to the Biological Assessment for the Salinas Valley Water Project, Salinas River, California,* and the *Salinas Valley Water Project Flow Prescription for Steelhead Trout in the Salinas River* from MCWRA. After NMFS' review of the reports, MCWRA provided an *Errata to the Salinas Valley Water Project Flow Prescription for Steelhead Trout in the Salinas River* on November 8, 2005, December 19, 2005 and January 27, 2006. These errata provided corrections and clarifications resulting from NMFS' review.

The Salinas River Channel Maintenance biological opinion was issued to the Corps on July 23, 2003. The Corps 404 permit for this project allows landowners to perform channel maintenance in the Salinas River beginning on September 1 of each year. At that time, MCWRA currently shuts off flows to the river to allow maintenance in the dry river channel. The biological assessment for a Corps permit for the SVWP provides for flows in the Salinas River through October 31, except in very dry years. Included in the *Supplement to the Biological Assessment for the Salinas Valley Water Project, Salinas River, CA*, it was stated the Salinas River Channel Maintenance Project permit would not be modified. This results in these two permits potentially being in conflict with each other. On December 15, 2005, the Corps regulatory biologist contacted MCWRA's assistant general manager to determine which project would take precedence. In a phone conversation on December 19, 2005, the Corps regulatory biologist informed NMFS the SVWP, according to MCWRA, would take precedence over the Channel Maintenance Project.

On July 28, 2006, NMFS issued a draft biological opinion to the Corps and MCWRA. On November 7, 2006, MCWRA provided written comments on the draft biological opinion; the Corps did not provide any comments. On February 6, 2007, NMFS met with MCWRA and their consultants (the Corps did not attend the meeting) to discuss the draft biological opinion and MCWRA's November 7, 2006, comments. This opinion incorporates MCWRA's written comments and those provided at the February 6, 2007, meeting.

A complete administrative record of this consultation is on file in the NMFS Santa Rosa Area Office.

III. DESCRIPTION OF THE PROPOSED ACTION

The Federal action under review in this ESA section 7 consultation is the proposal by the Corps to issue to MCWRA a Clean Water Act (CWA) section 404 permit authorizing the construction of a seasonal river diversion facility with a small dam and diversion structure to impound and distribute increased spring, summer, and early fall reservoir releases (aquifer conservation releases) to provide surface water deliveries for irrigation. Surface water for irrigation will help to offset current groundwater pumping in some areas of the coastal Basin, thereby reducing saltwater intrusion. The diversion facility and dam will be constructed 2008 or 2009 and are expected to take one year of construction to complete. In-channel work will occur during the summer (July 1 - October 31). Information included in the Description of the Proposed Action comes from EDAW 2001, ENTRIX and EDAW 2002, MCWRA 2005a, MCWRA 2005b, MCWRA 2005c, MCWRA 2005d, MCWRA 2006a, and MCWRA 2006b.

A. Background

Groundwater is the source for most of the urban and agricultural water needs in the Salinas River Valley Basin. An ongoing imbalance between the rate of groundwater withdrawal and recharge has resulted in overdraft conditions in the Basin that have allowed seawater from Monterey Bay to intrude inland approximately six miles in the 180-foot deep Aquifer and approximately two miles in the 400-foot deep Aquifer (MCWRA 2005). Since 1949, an average of 10,000 acre-feet (AF) of seawater per year has intruded into Basin aquifers and, by 1999, more than 24,000 acres of land were underlain by seawater intrusion. Previous to basin overdraft, the stratified coastal aquifers were supplied freshwater by the deeper, non-stratified upper valley's aquifer flows. Aquifers intruded with seawater are largely unusable for either agricultural or municipal purposes and many wells have been abandoned or destroyed. The Nacimiento Dam and San Antonio Dam, and its reservoirs, were constructed, in part, to address the overdraft issues. Nacimiento and San Antonio reservoirs began operations in 1957 and 1967, respectively. The two reservoirs, built and operated by MCWRA, provide a total of just over 700,000 AF of storage for subsequent aquifer conservation release, *i.e.*, release of stored water throughout the dry season to recharge the Basin aquifer through the bed of the Salinas River. To halt further groundwater degradation and prevent seawater from moving further inland, aquifer pumping and recharge rates must be brought into balance.

B. Components of the SVWP

As objectives for the SVWP, MCWRA proposes to: halt the increase in seawater intrusion and eventually reduce the amount of seawater in the basin's freshwater aquifers, provide adequate water supplies to meet current and future water needs (the year 2030 was used for the future planning horizon), and improve the hydrologic balance of the groundwater within the Basin. To those ends, MCWRA proposes a series of structural and program-based (operational) components (the SVWP). Implementation of the SVWP would provide water for surface water deliveries and additional aquifer replenishment (aquifer conservation releases) by reoperating the Nacimiento and San Antonio reservoirs and modifying the Nacimiento Dam spillway. Also, the SVWP would offset current groundwater pumping in some areas of the coastal Basin by installing a seasonal river diversion facility with a small dam and diversion structure to impound and distribute increased spring, summer, and early fall reservoir releases (reoperated aquifer conservation releases) to provide surface water deliveries for irrigation. The SVWP does not provide a new source of water for the Basin. Rather it will release less stored water in the fall and winter and release more stored water during the late spring and early fall – a period with historically low precipitation.

All of the activities proposed by MCWRA, if undertaken, may affect ESA-listed species or designated critical habitat. Some of the activities proposed by MCWRA will require a discretionary CWA section 404 permit from a Federal agency – the Corps. Therefore, the Corps is consulting with NMFS to insure that issuance and implementation of the Corps permit is not likely to jeopardize the continued existence of ESA-listed species or result in the destruction or adverse modification of designated critical habitat. MCWRA has proposed some actions which, although they do not require Federal permits, are interrelated or interdependent to the Corps permitted activities. Interrelated activities are activities that are part of a larger action and depend on the larger action for their justification. Interdependent activities are activities that have no independent utility apart from the action under consultation. Interdependent and interrelated activities are analyzed under section 7 of the ESA along with the Federal action. These Federal and nonfederal activities are described in the following subsections.

1. Corps Permitted Activities

MCWRA proposes to install a surface water diversion facility with a small dam and intake structure, fish bypass facilities, a pump station, and a pipeline connection to the Castroville Seawater Intrusion Project (CSIP) system, collectively called the Salinas River Diversion Facility (SRDF). The SRDF will be located at river mile 4.8. When the Salinas River lagoon is closed to the ocean and the lagoon is above approximately 2.0 feet (ft) water surface elevation, standing water will be present at the downstream side of the diversion dam of the SRDF. The SRDF will operate seasonally from April 1 through October 31, if enough surface water is available. As currently proposed, maximum rate of diversion will be 85 cubic feet per second (cfs). The diversion facility will be built to support future expansion to a diversion rate of 135 cfs. Future diversion rates above 85 cfs were not considered by NMFS in this opinion, because the flow prescription to minimize project impacts and benefit steelhead was jointly developed by MCWRA and NMFS based on an assumed maximum diversion rate of 85 cfs. With this assumption, the average diversion of the SRDF will be about 9,700 AF per year (AFY).

The proposed dam will be built with pneumatically controlled interlocking steel gates that will span the width of the Salinas River. The height of the spillway gate will be controlled by inflatable bladders. The foundation of the dam will be set at an elevation slightly below the existing river bed and will be constructed of reinforced concrete with vinyl coated sheet piles driven at the upstream and downstream ends. When in operation, the dam will maintain the upstream water surface elevation of the impoundment within an operating range of approximately 5.0 to 9.0 ft elevation. The total operational storage volume of the impoundment within this range is approximately 108 AF.

The SRDF will include a fish passage system, including intake screens and fish ladder, to provide upstream and downstream steelhead passage, and will be designed and maintained to comply with NMFS and CDFG criteria. For example, MCWRA will construct a trash rack to strain gross debris while allowing fish passage. Beginning April 1, the date when the dam is inflated, and continuing as long as the dam is inflated, the fish passage system will be functional; that is, it will facilitate efficient upstream passage of adult steelhead, as well as provide passive conditions for safely transporting returning adults and juvenile steelhead from the SRDF impoundment to the Salinas River lagoon. The fish ladder will be designed to function over the entire range of operating diversion dam headwater elevations and tailwater flows of 2 to 45 cfs. The entrance to the fish ladder will include orifices with manually operated slide gates, which can be manipulated to generate optimum fish attraction conditions at the entrance. The fishway will be constructed with an auxiliary water supply pipeline. The pipeline will supply water at the fish ladder entrance pool to maintain seasonally dependent bypass flow rates and sufficient attraction for upstream migrants. Bypass flows through the fish ladder will typically be 45 cfs for migration when the lagoon sandbar is open to the ocean, and 15 cfs for migration when the lagoon sandbar is closed and flow is routed to the Old Salinas River (OSR) channel. A minimum flow of 2 cfs will be maintained to the lagoon as long as SRDF irrigation diversions are occurring or aquifer conservation releases from Nacimiento and/or San Antonio reservoirs are being made to the Salinas River. See Description of the Proposed Action, Section III.B.2.c in this opinion, "*Salinas Valley Water Project Flow Prescription for Steelhead Trout*" for more information on flows to the lagoon.

Construction of the proposed instream surface diversion facility will take approximately 12 months. In-channel work will occur when there are no flows in the Salinas River or when flows are minimal and fish passage is not an issue, typically from the beginning of July to the end of

October. Sheet pile cofferdams or more beneficial alternatives[1] will be constructed upstream and downstream of the diversion dam site to prevent the lagoon water surface area and downstream flow from inundating the construction site. The temporary cofferdams will be in place during the dry season and removed by the end of October. The cofferdams will be placed approximately 25 ft upstream and downstream of the outer extremes of the instream construction zone. Any water that collects on the upstream side of the construction site will be pumped around the construction area. River bed access to construct the cofferdams will be made from the construction site riparian corridor access points. The construction site between the cofferdams will need to be dewatered on a daily basis. The accumulated water will be pumped to a discharge point in the riparian corridor, where the discharge will infiltrate into the sandy soils. Best management practices will be used to minimize the potential for accidental release of hazardous materials, sediment, or debris into the river.

In addition to construction of the SRDF, a fish screen will be placed at the inlet to the OSR whenever it is open via the slide gate. The fish screen will meet NMFS and CDFG design criteria. Modification of the slide gate structure will be required to accommodate the fish screen. No information is available to NMFS on the specifics of fish screen installation, including how modification of the slide gate structure will be accomplished.

2. Interrelated and Interdependent Activities

a. Modification of the Spillway on Nacimiento Dam

The California State Department of Water Resources, Division of Safety of Dams (DSOD), and the Federal Energy Regulatory Commission (FERC) have developed a new flood rule curve for Nacimiento Dam. The rule curve designates maximum reservoir surface elevations throughout the year and is designed to protect the dam from being overtopped if a probable maximum flood (PMF) were to occur, which could potentially cause catastrophic failure of Nacimiento Dam. The rule curve ensures adequate storage space in the reservoir to absorb and/or pass the PMF safely. Based on the existing configuration of the spillway on Nacimiento Dam, the DSOD and FERC prescribed a modification to the flood rule curve that would require MCWRA to maintain the reservoir at a lower maximum elevation during fall, winter and spring; thereby reducing the amount of reservoir volume available for aquifer conservation releases or irrigation diversions. However, with an increase in the Nacimiento Dam spillway capacity, DSOD and FERC's rule curve would change, and MCWRA would be able to increase the maximum reservoir elevation to levels not allowed under the more restrictive rule curve.

MCWRA proposes to increase spillway capacity, by lowering the existing spillway crest by approximately 12 ft and installing a gate within the spillway crest. To pass large flood events, the gate would be lowered, increasing the capacity of the reconstructed spillway to safely pass the event. Once the event has ended or at a point later in the winter season, the gate would be raised to increase reservoir water levels when sufficient water is present.

[1] MCWRA continues to explore less intrusive, less costly alternatives to sheet piles for these temporary cofferdams (MCWRA letter to NMFS, November 7, 2006).

Enlarging the spillway will require excavation of approximately 700 to 1,000 cubic yards of concrete, which will be removed from the site during the construction period. Construction for modifications to the spillway will require approximately 12 months. Construction equipment will utilize existing local roadways to access dam facilities.

b. Reoperation of Nacimiento and San Antonio Reservoirs

The proposed spillway modification would allow changes in the way Nacimiento Reservoir is operated. Although no physical modification is proposed at San Antonio Reservoir, the operation and management of Nacimiento Reservoir and San Antonio Reservoir are related. The amount, frequency, and schedule for releases of water from the two reservoirs are linked; therefore, a change in operation at Nacimiento Reservoir translates into a change in operation at San Antonio Reservoir. Under current operations during normal and heavier rainfall years, MCWRA releases water from Nacimiento Reservoir to maintain flood control capacity pursuant to the new DSOD and FERC regulation. By increasing the capacity of the Nacimiento spillway and installing a gate, the reservoir's water can be released faster, and water surface elevation can be lowered further. The gate allows more storage during the winter/spring when water is available, while still maintaining flood capacity, because more water can be held in the reservoir for longer periods between large storms. Given the variability in storms, this extra storage time is calculated to result in a similar amount of water available in the reservoir as was available prior to implementation of DSOD and FERC's new regulation.

Some of the water expected to be stored in the Nacimiento and San Antonio reservoirs will be made available for spring, summer, and early fall release to the SRDF. The proposed reoperation would result in approximately 29,000 AFY of additional stored water that would be available for additional conservation releases (*i.e.*, recharge of the groundwater aquifers), downstream diversion, as well as fish passage.

c. Salinas Valley Water Project Flow Prescription for Steelhead Trout

In an attempt to meet project goals and minimize impacts to ESA-listed steelhead and designated critical habitat, MCWRA has proposed a flow prescription that relies on triggers based on a combination of reservoir conditions and stream flow to initiate fish passage flows. Following is a summary of the *SVWP Flow Prescription for Steelhead Trout in the Salinas River* and subsequent MCWRA submissions (MCWRA 2005a, MCWRA 2005c, MCWRA 2005d, and MCWRA 2006a). These documents are proposed to govern flows and related monitoring activities. The flow prescription will be an adaptively managed action, which may be modified upon mutual agreement of MCWRA and NMFS.

Adult Steelhead Upstream Migration. Adult steelhead upstream migration triggers will be in effect from February 1 through March 31. When flow triggers occur, MCWRA intends to facilitate upstream migration of adult steelhead by insuring flows of 260 cfs at the Salinas River near Chualar (U.S. Geological Survey [USGS] stream gage 11152300) for 5 or more consecutive days when the river mouth is open to the ocean.[2] To insure this minimum flow and duration,

[2] Flow triggers and flow criteria described here are USGS provisional mean daily flow +/- 10 percent.

MCWRA will provide reservoir releases when necessary to augment natural flows. These reservoir releases will occur if the following triggers are met:

- combined storage of Nacimiento and San Antonio reservoirs is greater than 220,000 AF,
- 340 cfs or higher flows are present at the Arroyo Seco near the Soledad gage (USGS stream gage 11152000), and
- 173 cfs or higher flows are present at the Arroyo Seco below the Reliz Creek gage (USGS stream gage 11152050).

Figure 1 provides a visual summary of the conditions for the flow prescription as it relates to upstream migration for adult steelhead.

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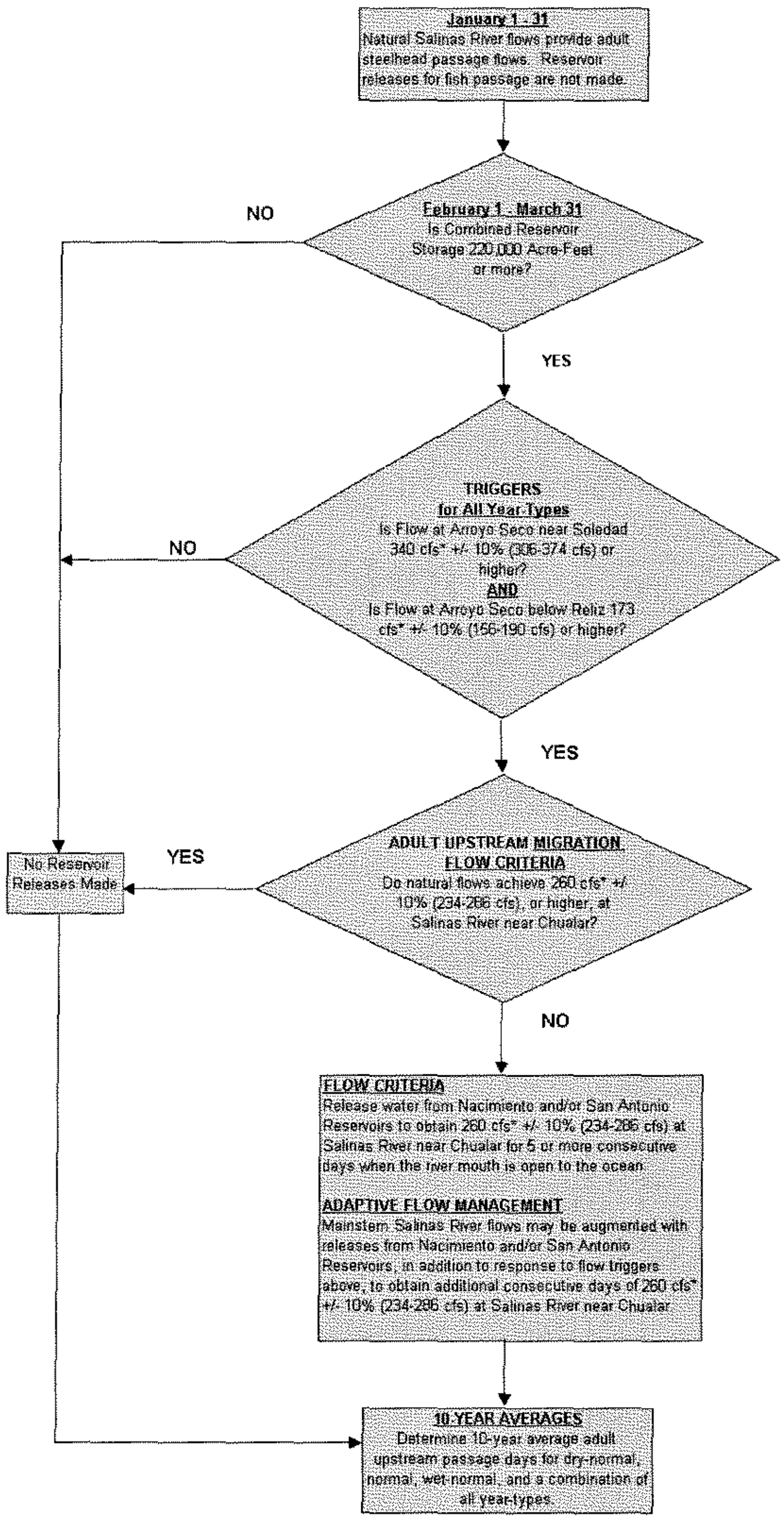

* USGS Provisional Mean Daily Flow

Figure 1. Proposed flow release schedule to enhance upstream migration conditions for adult steelhead.

MCWRA will provide, within a 10 percent variance and averaged over a 10 year period, the cumulative number of annual adult upstream "passage days" in the lower Salinas River, accrued in blocks of 5 or more consecutive days, as occurred historically. Historical passage days are based on USGS gage records at Salinas River near Spreckels for January 1 through March 31 for 1949 through 1994. The annual targeted number of passage days is based on individual water year types (dry, normal, wet) as derived from an index of annual mean flows at the Arroyo Seco near Soledad gage (USGS Stream Gage 11152000). The cumulative number of passage days targets apply to normal water years (25^{th} to 75^{th} percentile mean annual flows). Normal water years have been subdivided into dry-normal, normal-normal, and wet-normal years. The number of passage days targeted for dry-normal, normal-normal, and wet-normal years are 16, 47, and 73 days, respectively. Although MCWRA proposes no January reservoir releases, any blocks of 5 or more consecutive passage days occurring in January will be counted toward the total passage days target. When hydrologic conditions permit, MCWRA may maintain adult upstream passage flow after triggers are no longer met, such as between storm events, when meteorological forecasting indicates the imminent possibility of Arroyo Seco trigger flows reoccurring.

Downstream Migration of Smolting Steelhead. To facilitate the downstream migration of smolts and rearing juvenile steelhead in the Salinas River during normal category water years, MCWRA will provide, beginning March 15^{th}, reservoir releases (hereafter referred to as "block flows") when the following flow triggers are met:

- the water year type is dry-normal, normal-normal, or wet-normal,
- combined storage of Nacimiento and San Antonio reservoirs is 150,000 AF or more, and
- 125 cfs or higher at the Nacimiento River below Sapaque Creek gage (USGS stream gage 11148900), **<u>or</u>** 70 cfs at the Arroyo Seco below Reliz Creek gage (USGS stream gage 11152050).

If block flows are triggered between March 15 and March 31, 700 cfs will be provided at the Salinas River near Soledad (USGS stream gage 11152000) for 5 days, and then thereafter 300 cfs will be maintained in the Salinas River near Spreckels (USGS stream gage 11152500) until April 20. If the block flow triggers occur in April, 700 cfs will be provided at the Salinas River near Soledad for 5 days, and then thereafter 300 cfs will be provided at Spreckels for an additional 15 days. Thus, the duration of the block flow will range from 20 to 45 days. Block flow examples are shown on pages 10 and 11 of MCWRA (2005a). After a block flow is completed, if outmigration of steelhead smolts from the Arroyo Seco to the Salinas River could occur (*i.e.,* flow at the USGS stream gage 11152050 near Reliz is greater than 1 cfs), flow to the ocean will be maintained for 10 days after smolt outmigration flow at the Reliz Creek gage drops below 1 cfs. Figure 2 provides a visual summary of the block flow release schedule for smolt outmigration.

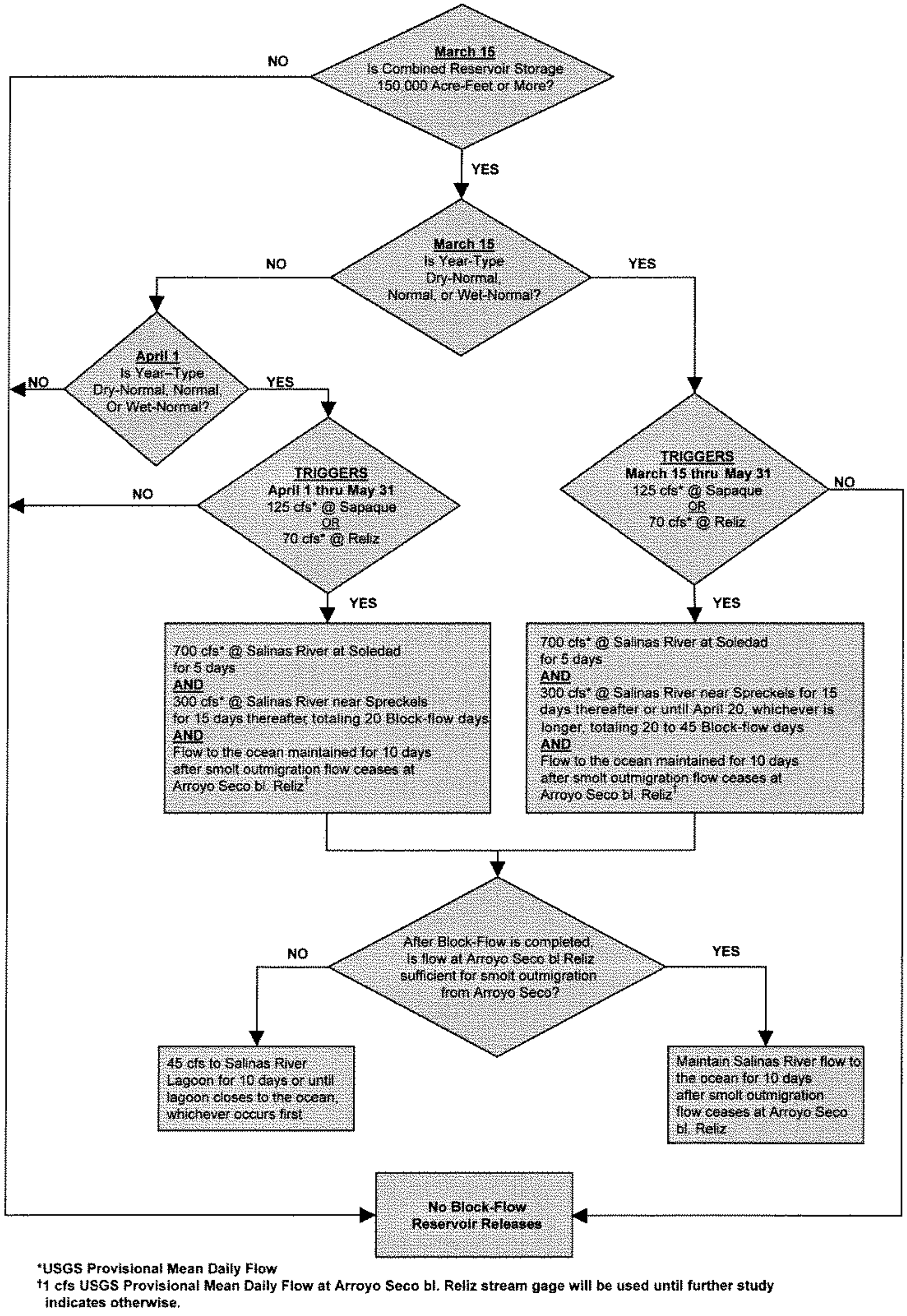

Figure 2. Proposed flow release schedule to enhance outmigration conditions for smolts.

If on March 15th the determination of the water year type category is "wet" or "dry," no reservoir releases are made to meet block flow criteria and the year type will be re-evaluated on April 1st. If on April 1st the water year type is either "wet" or "dry," then no reservoir releases to facilitate smolt migration will occur, though smaller releases may occur as described in the next section.

Downstream Migration of Juvenile and Post Spawn Adult Steelhead. In some years, block flow releases for smolt migration may not occur because triggers for those releases are not met. However, in those years MCWRA will provide reservoir releases and SRDF bypass flows to enhance migration opportunities for juvenile steelhead and post-spawn adult steelhead (kelts). Beginning April 1st, when smolt migration block flows are not triggered, MCWRA will provide reservoir releases under the following circumstances. For dry year-types, MCWRA will provide 2 cfs to the lagoon when the SRDF is operating or during aquifer conservation releases. For non-dry year-types, and if the combined reservoir storage is 220,000 AF or more, MCWRA will provide additional supplemental bypass flows. If the lagoon is open to the ocean, then MCWRA will provide 45 cfs to the lagoon for 10 days or until the lagoon closes to the ocean, whichever occurs first, then 15 cfs to the lagoon through June 30th, then 2 cfs as long as the SRDF is operating or during aquifer conservation releases. If the lagoon is not open to the ocean, then MCWRA will provide 15 cfs to the lagoon through June 30th, then 2 cfs as long as the SRDF is operating or during aquifer conservation releases.

At the end of the irrigation diversion season, the SRDF impoundment will be filled to its storage capacity of about 108 AF of water. Once irrigation diversion from the SRDF is completed for the season, water will be allowed to pass from the full SRDF impoundment to the lagoon at a rate of 2 cfs until the impoundment is effectively emptied (MCWRA 2006a). At a 2 cfs rate of flow from the 108 AF capacity, the impoundment is expected to empty in approximately 27 days. In no case will the SRDF impounded water be stored for more than 29 days. MCWRA reserves the right to empty the SRDF impoundment (by increasing flow releases above 2 cfs) during this 27 day period of 2 cfs flow to the lagoon after the irrigation season, if necessary, to empty the impoundment in time to perform facility maintenance before river flows prevent such maintenance work. For example, the fish screens on the SRDF intake structure will likely require seasonal removal to prevent damage from high winter flows. If rains or river flows are forecasted during or immediately after the 2 cfs end-of-season flows to the lagoon, MCWRA may empty the SRDF impoundment for removal of fish screens before the end of the 27 day period. Figure 3 provides a visual summary of the flow release schedule for juvenile steelhead and kelts.

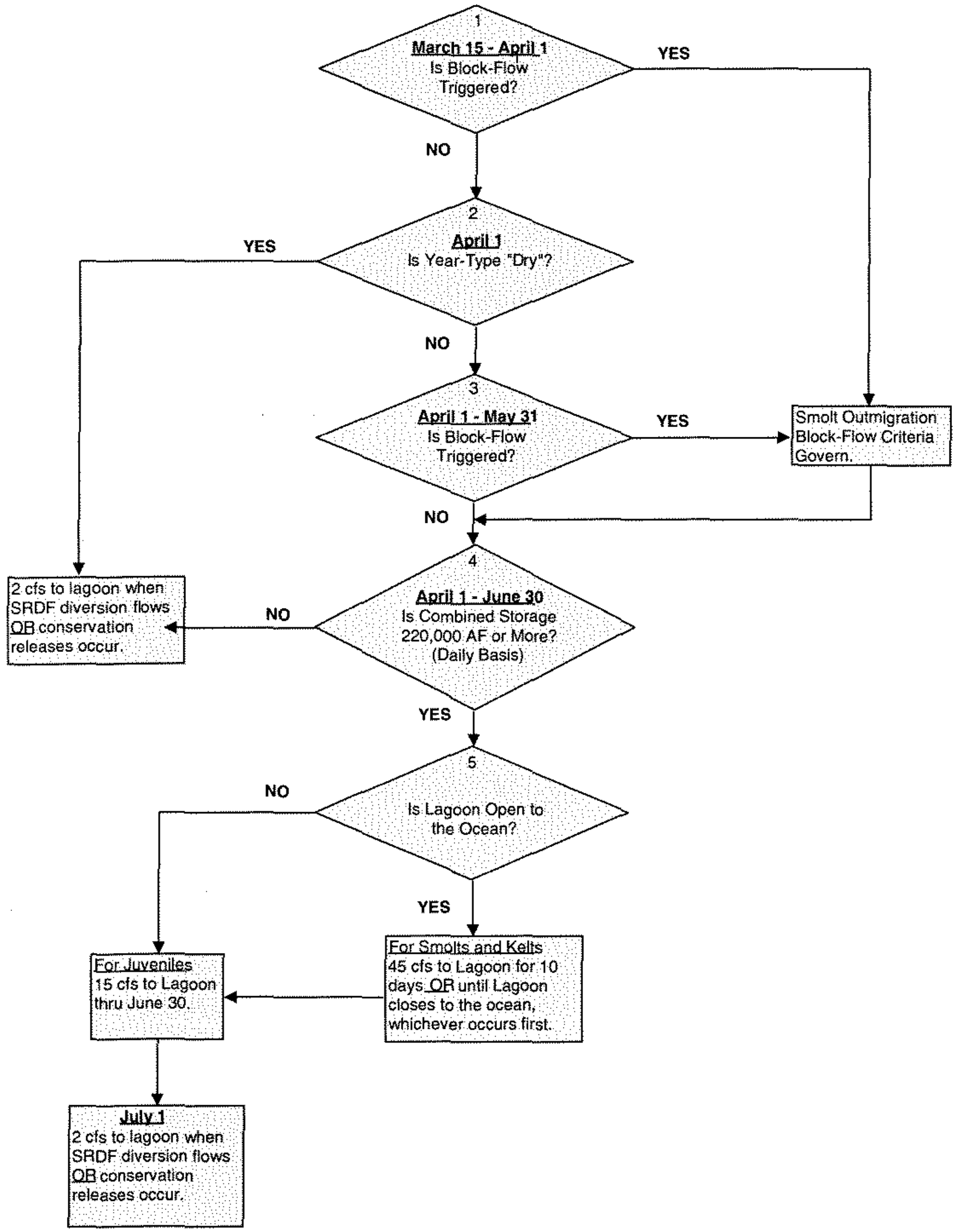

Figure 3. Proposed flow release schedule to enhance downstream migration conditions for juvenile steelhead and kelts.

Spawning and Rearing Habitat in the Nacimiento River. MWCRA will provide, through reservoir release, steelhead spawning and rearing flows for the Nacimiento River below Nacimiento Dam. To provide spawning opportunities, MCWRA proposes a release of 60 cfs from Nacimiento Reservoir beginning the eighth day after the first adult steelhead passage day[3] occurs on the Salinas River near Spreckels after January 1st. These flows will be continued through May 31st. Until further studies are conducted to determine adequate rearing flows in the Nacimiento River below the reservoir during summer and fall, MCWRA will release a minimum of 60 cfs throughout the year as minimum rearing flow as long as the water surface elevation of Nacimiento Reservoir is above the elevation 687.8 feet mean sea level (msl), the reservoir's minimum pool.

d. Water Quality Improvements and Other Changes to the Blanco Drain

The SRDF diversion site is located in the vicinity of the Blanco Drain, which discharges to the Salinas River upstream of the SRDF site. Because water from Blanco Drain is considered unsuitable for irrigation, MCWRA proposes to divert the drain's discharge to a point downstream of the SRDF site whenever the SRDF facility is impounding water for irrigation use.

The Blanco Drain drainage area consists of approximately 6,400 acres of farmland, scattered rural housing, and county roads. Summertime drainage is primarily agricultural drain water. Wintertime drainage is primarily storm runoff. MCWRA operates a pump during the summer to discharge the drain water to the Salinas River.

The Central Coast Regional Water Quality Control Board (CCRWQCB) has listed Blanco Drain as an impaired water body pursuant to Section 303(d) of the CWA for pesticides, with medium priority. To reduce contaminant loads of diazinon and chlorpyrifos from reaching the Salinas River, MCWRA proposes to create a vegetated treatment system within Blanco Drain. A vegetated treatment system generally consists of vegetation throughout a reach of channel bottom designed to reduce water velocity and retain pollutants by various processes, such as microbial degradation, plant uptake, sorption, chemical reactions, and sediment retention. The specific design for the Blanco Drain vegetative treatment has not been completed, and the specific location for the vegetated channel sections has not been identified. MCWRA will monitor the vegetated treatment system to determine the efficacy of contaminant reduction.

In the event that the vegetated treatment system is inadequate to sufficiently reduce diazinon and chlorpyrifos loads within the Blanco Drain, then MCWRA will pursue other options (see page 26 of MCWRA (2005a)). Options include, though are not limited to, diverting the water to the regional wastewater treatment plant for recycling, and diverting Blanco Drain water to Alisal Slough. A specific definition of "inadequate to sufficiently reduce diazinon and chlorpyrifos loads" has not been provided to NMFS.

e. SRDF Maintenance

Maintenance of the SRDF will primarily consist of, but will not necessarily be limited to, periodic removal of deposited sediment, periodic removal of debris, annual scour restoration, annual pressure washing of fish screens, periodic maintenance and lubrication of equipment, and

[3] The first day of passage is the beginning date of the first period with five consecutive days with flows of 260 cfs or higher at Chualar. The first potential spawning day in the Nacimiento River is assumed to be 8 days after the first passage day.

annual removal/installation of equipment. In addition to maintenance of the fish passage and diversion facilities, maintenance of the impoundment area is also anticipated. There is the potential for sediment to accumulate on and upstream of the diversion dam that could potentially affect operations. Periodic maintenance of this area may be necessary to eliminate the build up of sediment if non-diversion season flows are not sufficient to scour and transport accumulated sediment downstream. In dry years, the upper end of the impoundment may be exposed with sufficient frequency to allow vegetation growth. Increased vegetation may exacerbate sediment deposits and channel incision conditions and may reduce the flow capacity of the river channel. Periodic channel maintenance of this area may be required and undertaken as needed.

f. Monitoring Plan

MCWRA has proposed the following measures to monitor the impacts of the SVWP and related activities on the Salinas River steelhead populations and on designated critical habitat. Specific description of monitoring procedures, methods (frequency, *etc.*), and use of monitoring results to adjust project operations has not been developed by the action agency or applicant.

Population Monitoring. MCWRA proposes to monitor migrating adults, smolts, and rearing juveniles in certain areas of the Salinas River basin.

i) Steelhead Population and Steelhead Migration Monitoring

MCWRA will employ imaging sonar technology (*e.g.*, dual frequency identification sonar [DIDSON]) to estimate the number of upstream and downstream migrating steelhead in the Salinas River. The location of instrument deployment will be determined through consultation with other imaging sonar users and NMFS staff. A reasonable location is thought to be the SRDF site.

MCWRA proposes the following monitoring time periods: adult populations and migrations will be monitored from January 1 through March 31 when passage flow is occurring; and smolt, juvenile and kelt emigrant monitoring will occur from April 1 through May 31. MCWRA may operate the SRDF dam prior to April 1 to manage river flow for improving adult upstream migrant or smolt downstream migrant monitoring. Steelhead images collected by the imaging sonar system will be archived for reporting and later reference.

In addition to the imaging sonar technology for monitoring populations, the SRDF impoundment will also be sampled once each fall to determine if steelhead and predatory fish use the SRDF impoundment for rearing during the summer months of operation. In addition to enumerating numbers of each fish species present, data collected from captured steelhead will include: length, weight, external condition, and standardized description of degree of smoltification. Scale samples and photographs will be taken from representative fish. MCWRA and its contractors will use procedures for the safe handling of ESA-listed steelhead.

ii) Nacimiento River Steelhead Fry Stranding Survey

In late-March or April of years when substantial adult upstream migration is detected, a steelhead fry stranding survey will be performed in the Nacimiento River downstream of Nacimiento Dam. MCWRA proposes the following approach to that stranding survey: the surveys will commence shortly after the beginning of flow release reduction from Nacimiento Dam. Flows will be reduced to 125 cfs, and then to the minimum spawning release of 60 cfs. The survey will document the rate of flow decrease and river stage decline and the location and estimated numbers of stranded steelhead fry. If surveys in two separate years are completed and steelhead fry are present, but little or no stranding is found, this survey will cease. If stranding is found to occur, and the stranding is isolated to few or small areas, MCWRA may pursue streambed alteration for the benefit of stranded steelhead fry, through proper permitting authorities. If steelhead fry stranding occurs in numerous or larger areas, MCWRA will modify the incremental rate of decrease in Nacimiento Reservoir releases to the extent possible.

Habitat Monitoring. The habitat monitoring proposed for the SVWP will include monitoring of river flow throughout most of the basin during steelhead migration seasons, and water quality monitoring in the potential rearing areas of the Nacimiento River, the Salinas River lagoon, and the SRDF impoundment site.

i) Migration Habitat Monitoring

MCWRA will monitor provisional real-time data, and provisional and final mean daily flow data, as reported by the USGS at the following locations:

USGS 11148900	NACIMIENTO R BL SAPAQUE C NR BRYSON CA
USGS 11152500	SALINAS R NR SPRECKELS CA
USGS 11152300	SALINAS R NR CHUALAR CA
USGS 11151700	SALINAS R A SOLEDAD CA
USGS 11152050	ARROYO SECO BL RELIZ C NR SOLEDAD CA
USGS 11152000	ARROYO SECO NR SOLEDAD CA

Flow releases from the two reservoirs will also be monitored. When the SRDF is in operation, MCWRA will monitor flow through the SRDF fish ladder and flow over the top of the SRDF dam. To insure the performance of the SRDF screening system, MCWRA will complete a one-time assessment of SRDF intake screen entrance velocities. Necessary adjustments will be made to comply with NMFS and CDFG fish screen entrance velocity standards prior to project start-up. To insure the performance of the SRDF fish ladder, MCWRA will annually complete a ladder flow performance test to verify stage-flow characteristics for the full range of SRDF impoundment operational stages. The purpose of this test is to identify flow characteristics through the fish ladder for accurate flow regulation during SRDF operation.

ii) Rearing Habitat Monitoring

MCWRA will monitor rearing habitat conditions in the Nacimiento River below Nacimiento Dam, in the Salinas River Lagoon, and the SRDF impoundment. Flow or water surface elevation and water quality parameters of temperature, dissolved oxygen (DO), salinity and specific pesticide concentrations will be monitored at selected locations, as follows.

In the Nacimiento River below Nacimiento Dam, MCWRA will monitor minimum, maximum, and mean daily water temperature via electronic instrumentation and data logger for the period of April 1st through October 31st at the Nacimiento River near Nacimiento Ranch (approximately 5 miles downstream of Nacimiento Dam), and at Nacimiento River near Highway 101 (approximately 10 miles downstream of Nacimiento Dam).

In the Salinas River lagoon, MCWRA will monitor and record water temperature, DO, and salinity (as specific electrical conductance (SEC)) via electronic instrumentation and data loggers near Highway 1 and at a point estimated to be representative of lower lagoon conditions. Instruments will be placed where access and security are adequate. Temperature, SEC, and DO at these locations will be recorded at two depths, near-surface and mid-water. MCWRA will also monitor for diazinon and chlorpyrifos (organophosphate pesticides) in the lagoon no less than four times during the SRDF operating season at these same locations (once in April, June, August, and October).

Additionally, pesticide concentrations for Blanco Drain will be monitored and recorded for the period of April through the first significant storm flow discharge to the Salinas River no less than four times during the SRDF operating season (once in April, June, August, and October). Monitoring of the Blanco Drain discharge to the Salinas River will include provisional and final mean monthly flows for the period of April through the first significant storm flow. The monitoring location will be upstream of the point where Blanco Drain discharge meets the Salinas River.

Lagoon water surface elevation will be monitored and recorded at the OSR channel slide gate for the entire water-year once or more per week during periods when lagoon elevation is stable; and two to five times per week during periods when lagoon conditions are less stable, such as prior to sandbar breaching, when the sandbar is in the process of closing, or when the lagoon is closed to the ocean and inflow to the lagoon is substantially higher or lower than outflow through the OSR slide gate. Bypass flows from the SRDF impoundment to the lagoon will be continuously monitored and recorded during SRDF operation.

When the SRDF is in operation, MCWRA will monitor temperature, salinity, and DO in the SRDF impoundment. Temperature will be monitored at two locations: near the inlet to the SRDF impoundment (approximately three miles upstream of the diversion dam), and near the SRDF. DO and salinity (SEC) in the SRDF impoundment will be monitored near the diversion dam during SRDF operation no less than once per 6-hour period. DO will be measured at a point near mid-water depth. The depth of DO measurement may vary due to the varying nature of impoundment water surface elevation during SRDF operations. The ubiquitous nature of surface water SEC will allow its measurement at the SRDF inlet to be considered representative of river water at that location. Additionally SRDF impoundment water depth will be continuously monitored during SRDF operations.

C. Action Area

The action area is defined as all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The project will have direct and indirect effects on the Nacimiento River downstream of Nacimiento Dam, the San Antonio River downstream of San Antonio Dam, and the Salinas River from the confluence with the Nacimiento River to the ocean (Figure 4). The action area also includes the six mile segment of the lower Arroyo Seco River alluvial fan, which may have some hydrologic connection with main stem Salinas River flows. The area at the confluence of the Arroyo Seco River and the Salinas River is known as the Arroyo Seco cone, a location where much of the surface flow percolates into the substrate and becomes subsurface flow. In the lower Arroyo Seco River flow crosses porous gravel and sand deposits, and the river becomes braided and shallow. Typically this section of the Arroyo Seco percolates all stream baseflow, except during and shortly after winter and spring runoff events. These conditions also occur within the Salinas River approximately one mile above and one-half mile below the Arroyo Seco/Salinas River confluence. We have included the alluvial fan of the lower Arroyo Seco as part of the action area because of the possibility that flow management at Nacimiento Dam will affect groundwater levels that influence surface flows in the lower Arroyo Seco.

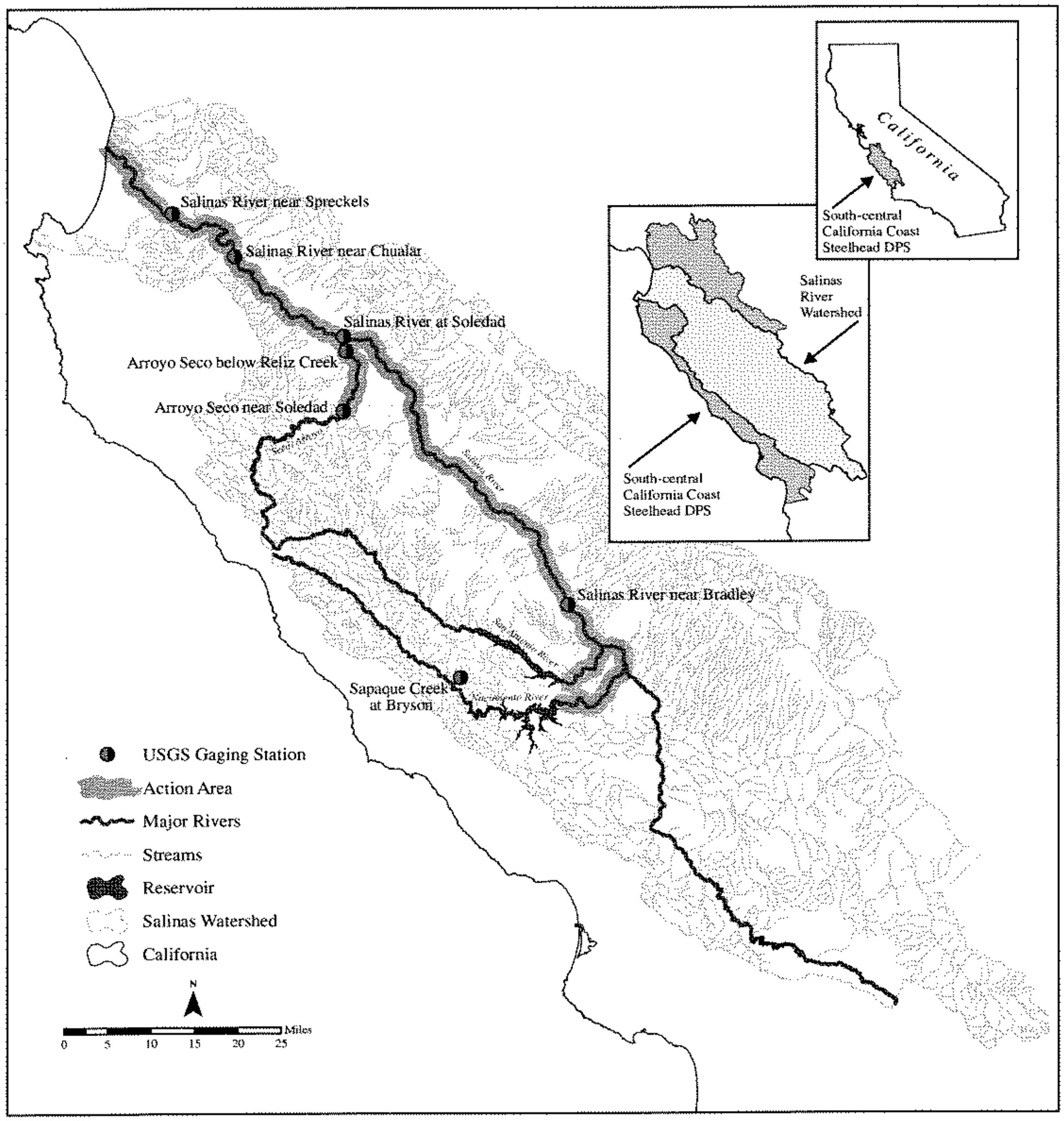

Figure 4. Action area shown in the context of the Salinas River watershed with locations of relevant stream flow gages.

IV. STATUS OF THE SPECIES AND CRITICAL HABITAT

A. Introduction

The purpose of this section is to portray the condition of the species and their habitat relative to the species' probability of extinction and the conservation value of critical habitat. We do this by describing our conceptual model of how the species is surviving given its life history strategy and the condition of its environment. We address these issues in a series of analytical steps beginning with the identification of sub-populations within the DPS. Once that is established, we assess the viability of each sub-population in terms of its abundance, productivity, spatial distribution, and diversity. We then evaluate the threats to this viability by identifying stressors to the species, including stressors to primary constituent elements (PCE) of critical habitat, and the sources of those stressors. We then combine these analyses to estimate the relative status (current risk of extinction) for each sub-population. Our final step in this section is to: 1) conduct a metapopulation analysis using the extinction risk profiles already generated, and 2) describe the current value of critical habitat for the species conservation.

B. Life History

A brief overview of steelhead life history is provided below. Further detailed information is available in the NMFS Updated Status of Federally Listed Evolutionary Significant Units (ESUs) of West Coast Salmon and Steelhead (Good *et al.* 2005) and the NMFS final rule listing the SCCC steelhead DPS (71 FR 834).

Steelhead are anadromous fish, meaning they are born in fresh water, migrate to the ocean where most of their growth occurs, and then eventually return to fresh water to spawn. It is widely acknowledged that steelhead life history strategies are the most variable of all salmonids (Shapovalov and Taft 1954, Barnhart 1986, Busby *et al.* 1996, McEwan 2001). They usually spend 1 to 3 years in fresh water, 1 to 4 years in the ocean, and then return to fresh water to spawn (McEwan and Jackson 1996). Steelhead are iteroparous, capable of spawning multiple times in their lives, but of the steelhead that spawn multiple times, 70 to 85 percent spawn only twice (Barnhart 1986).

Adult steelhead migrate to fresh water between November and June, peaking in March. Spawning begins shortly after adult fish reach spawning areas. Steelhead typically select spawning areas at the downstream end of pools, in gravels ranging from approximately 0.5 to 4.5 inches in diameter (Pauley *et al.* 1986). Fry emerge from their gravel "nests" (redds) in 4 to 8 weeks, depending on temperature. After emergence, fry have poor swimming ability. They move into shallow, low velocity areas in side channels and along channel margins to escape high velocities and predators (Everest and Chapman 1972), and progressively move toward deeper water as they grow (Bjornn and Rieser 1991). Cover is an important habitat component for juvenile steelhead, both as a velocity refuge and as a means of avoiding predation (Shirvell 1990, Meehan and Bjornn 1991). Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles.

After a period of one or more years juvenile steelhead undergo the biological process of "smoltification" in which juvenile salmonids become physiologically adapted for downstream migration and entry into saltwater. Juvenile fish that have undergone smoltification are called smolts. The fish's size and photoperiod are key factors determining the onset of smoltification (Schreck 1982, Raleigh 1984, Bjornn and Reiser 1991). Although smoltification may commence sometime in mid to late winter, juvenile steelhead generally become fully ready to make the migration sometime in spring. In California, the outmigration of steelhead smolts typically begins in March and ends in late May or June (Titus *et al.* 2002). Snider (1983) states that in the Carmel River, most juvenile steelhead migrate to the ocean between April and June. This is the typical time for the smolt migration of steelhead and salmon in coastal watersheds along the western United States (Busby *et al.* 1996, Weitkamp *et al.* 1995).

In addition to transforming into individuals capable of survival in the ocean, younger juveniles or those which have not entered the smolt stage may disperse downstream and rear in mainstem, estuarine, and lagoon habitats. This is thought to be an integral phase of salmonid life history at a time when physiological adaptation, foraging, and refugia from predators are critical (Healey 1982, Simenstad *et al.* 1982). Because rearing juvenile steelhead often migrate downstream in a search for available habitat (Bjornn 1971), significant percentages of the juvenile population can end up rearing in coastal lagoons and estuaries (Zedonis 1992, Shapovalov and Taft 1954).

C. Extinction Risk Profiles

This section will be used as the foundation for determining whether the proposed project will be expected to reduce appreciably the likelihood of both the survival and recovery of SCCC steelhead by reducing, either directly or indirectly, the reproduction, numbers, or distribution of that species, or result in the destruction or adverse modification of critical habitat. We define extinction risk as the probability of SCCC steelhead becoming extinct[4] in the wild in the foreseeable future.

In this analysis, we first identify sub-populations within the DPS. We then assess the population viability of each sub-population in terms of estimated abundance, population growth rate, spatial structure, and diversity. This is followed by our assessment of threats to each sub-population. Threats are defined as stressors that limit the viability of the population and the sources responsible for the creation of those stressors. We refer to the combined assessments of population viability and threats as sub-population extinction risk profiles. This establishes the link between threats and their effects on the sub-populations. Finally, we assess metapopulation dynamics in order to establish the functional relationship of each sub-population to the overall SCCC steelhead DPS and provide an extinction risk assessment at the DPS scale.

1. Sub-Populations

For the purposes of this opinion, we consider sub-populations to be equivalent to demes; both are defined as local, randomly interbreeding groups of individual salmonids. The reason for identifying sub-populations within the SCCC steelhead DPS is to account for potentially different extinction risks (Cooper and Mangel 1999) within the DPS and to support the overall analysis of risk to the species.

The criteria we chose for defining sub-populations is based on the metapopulation concept described in Cooper and Mangel (1999), where a metapopulation is defined as a group of populations (or demes) linked by dispersal such that the dispersal affects both the genetics of the demes as well as their abundance and dynamics. It is further suggested in Meffe and Carroll (1997) that a deme is an appropriate conservation unit as they are likely to represent diversity elements within the population as a whole. Since the specific genetic makeup of DPS sub-populations is unknown, we propose using the following criteria to define sub-populations:

[4] Our use of the term extinction refers to quasi-extinction rather than absolute extinction.

a. *Spatial Autonomy:* This is expressed through either geographic separation and/or barriers to migration.
b. *Ecological Setting:* Differences in ecological conditions may include differences in climate (such as annual precipitation) or geology, *etc.*
c. *Historical Context:* Small groups or a few individuals may be considered a unique sub-population if they are likely descendants of a robust population that no longer exists (such as with the Nacimiento/San Antonio sub-population). Other individuals sighted sporadically in areas generally considered inhospitable, however (such as in the Estrella watershed), may be considered strays from another sub-population as it is unlikely they represent the vestige of a unique lineage.

These considerations should reflect some degree of local adaptation via differences in selective regimes[5] (Busby *et al.* 1996, Meffe and Carroll 1997). However, whether they actually represent accurate biological breakpoints should be considered secondary to whether or not they provide a useful means of evaluating the relationships of population units within the DPS as a whole.

Within the DPS, coastal drainages differ markedly in ecological setting from interior watersheds due primarily to their smaller size and proximity to coastal climatic influences. This difference combined with the physical distances between the mouths of the inland watersheds (*i.e.,* the Pajaro and Salinas rivers) from those of the other watersheds, as well as the long migration distances within the rivers, represent the most pronounced split in population structure within the DPS. These two major divisions (coastal and interior) are further sub-divided into a total of 12 sub-populations (Table 1 and Figure 5).

Table 1. Summary of population viability assessments for the 12 sub-populations in the SCCC steelhead DPS. See text and NMFS (2006) for definition of terms.

Sub-Population	Abundance	Growth Rate	Spatial Structure	Diversity
Carmel River	Intermediate	Negative Trend	Somewhat Reduced	Severely Altered
Big Sur	Intermediate	Stable or Variable	Somewhat Reduced	Retains Some Elements
San Simeon	Low Abundance	Stable or Variable	Highly Fragmented	Severely Altered
Morro Bay	Low Abundance	Negative Trend	Somewhat Reduced	Severely Altered
Pismo Beach	Low Abundance	Negative Trend	Somewhat Reduced	Severely Altered
Salsipuedes	Intermediate	Negative Trend	Somewhat Reduced	Severely Altered
Llagas	Intermediate	Stable or Variable	Highly Fragmented	Retains Some Elements
San Benito	Low Abundance	Negative Trend	Highly Fragmented	Severely Altered
Gabilan	Low Abundance	Negative Trend	Highly Fragmented	Severely Altered
Arroyo Seco	Low Abundance	Stable or Variable	Somewhat Reduced	Severely Altered
San Ant./Nac.	Low Abundance	Negative Trend	Highly Fragmented	Severely Altered

[5] The range of environmental conditions which confer specific heritable traits to a population via natural selection.

Upper Salinas	Low Abundance	Negative Trend	Highly Fragmented	Severely Altered
Lower Salinas[6]	Unoccupied	Unoccupied	Unoccupied	Unoccupied
Estrella	Unoccupied	Unoccupied	Unoccupied	Unoccupied

2. Extinction Risk Profiles

This section provides a summary of the extinction risk profiles generated for the 12 sub-populations in the SCCC steelhead DPS. The assessment is based on our current understanding of each sub-population's viability and the threats to that viability. A detailed description of the analysis methods is contained in NMFS (2006). Assessments of abundance, population growth rate, spatial structure, and diversity are the constituent components of the population viability assessments. The threats assessment is based on descriptions of the physical stressors limiting production within sub-populations as well as the sources responsible for the stressors. We also describe the stressors in terms of their influence on the PCE of critical habitat. Our conclusions for each component of this analysis are based on interviews with local biologists, review of NMFS' critical habitat and fisheries resource databases, an independent database of fisheries references (CEMAR 2005), spatially-related information (such as land use), and our best professional judgment (NMFS 2006). The purpose of these profiles is to provide a qualitative assessment of the status of the species in support of our analysis of risk to the DPS posed by the effects of the proposed action.

a. *Population Viability*

We evaluated population viability for each sub-population using the four population viability criteria described in McElhany *et al.* (2000) (Table 1). Abundance was defined as the estimated number of spawning adults in a given year and was characterized as high, intermediate, or low, relative to probable historic abundance.[7] Population growth rate was defined as the sub-population's ability to replace itself given its intrinsic reproductive rate in the context of its environment. Growth rate was described as either a positive trend, one that is near replacement value (or variable), or one that is negative. Spatial structure was defined as the geographic distribution of the species at any life stage. Consideration was given to the loss of an area's ability to support certain life stages, such as spawning and rearing, even if the species was still considered present (*i.e.*, the area functions as a migration corridor). Spatial structure was characterized as widely distributed relative to historical condition, somewhat reduced, or very limited and/or highly fragmented. Diversity was defined as the genetic, morphologic, physiological, behavioral, or ecological variation that exists within a sub-population. We assumed that the trajectory of these evolutionary traits is influenced by the environmental conditions that impose a selective regime on the sub-population. Since the actual genetic and

[6] We assume the Lower Salinas has no sub-population of its own, but supports a lagoon and migration corridor which are occupied by steelhead from other sub-populations.

[7] Reference to historical condition of both population (earliest estimates of population numbers) and habitat is used repeatedly throughout this process because we assume it to be a reasonable reference point for conditions that are capable of supporting viable populations. A characterization of high means that numbers approximate those of the earliest population estimates available.

other forms of diversity were often unknown, the diversity of habitats and their divergence from historical conditions were used as a surrogate as described above. Diversity was characterized as

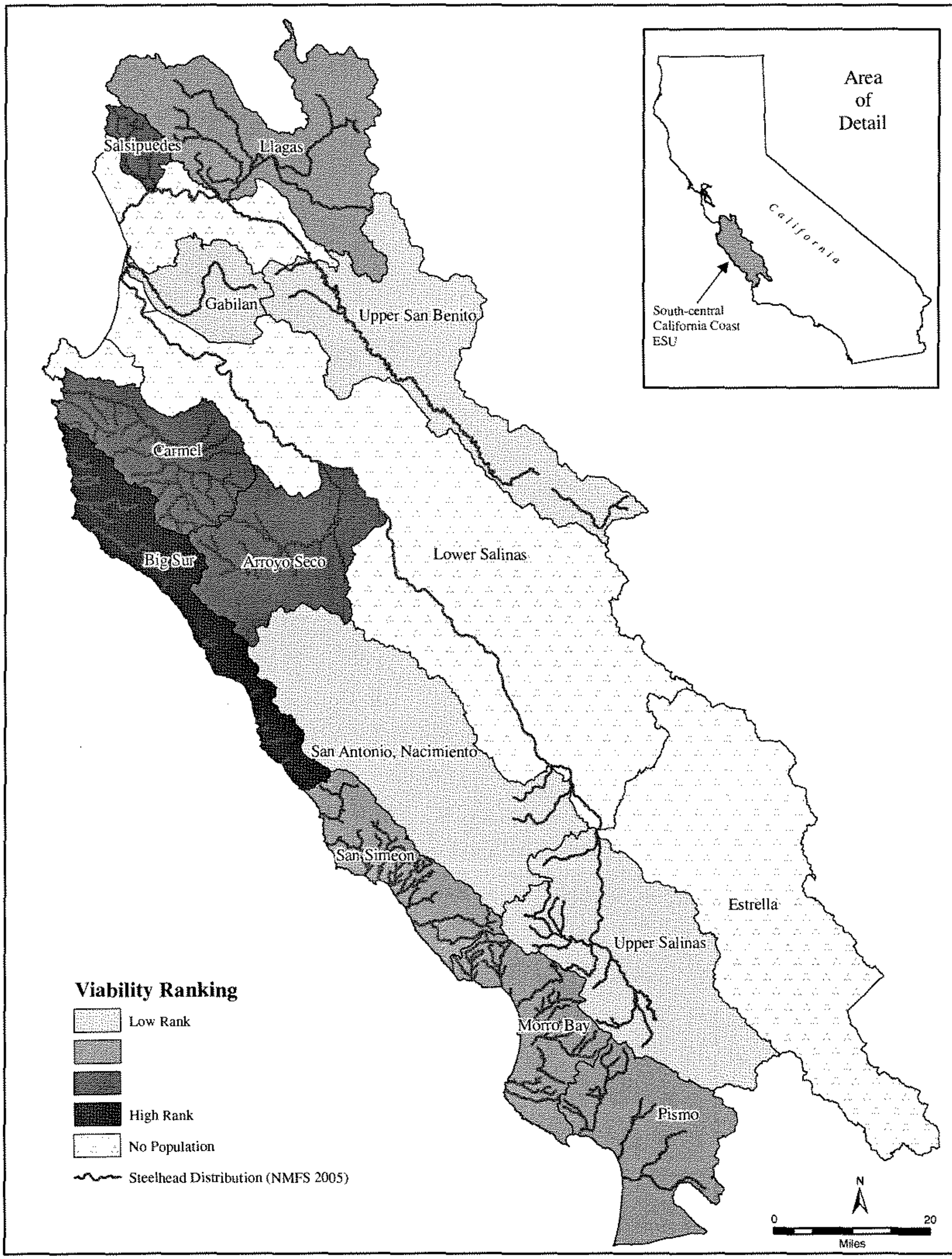

Figure 5. Relative population viability ranking of SCCC DPS sub-populations based on extinction risk profiles (NMFS 2006). A high rank indicates the population is currently more viable than those with lower rank.

either similar to historical (either traits or habitat), altered but retaining key elements, or severely altered from historic condition.

A viable population is defined as an independent population[8] that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year time frame (McElhany *et al.* 2000). Because this analysis does not explicitly consider whether each sub-population is or was potentially independent, one cannot infer an absolute value for viability. However, the SCCC Steelhead Recovery Domain Technical Recovery Team has identified the Salinas River system as one of the few populations within the SCCC steelhead DPS with the potential to support a viable sub-population (Capelli 2006). We conclude based on our analyses, that no sub-population in the DPS currently meets the definition of viable, and that only those in the Salinas, Pajaro, and Carmel basins have the potential to become fully viable as defined above. It is relevant to note that several of the potentially viable sub-populations, including the Upper Salinas, are among the lowest ranking sub-populations under current conditions. Table 1 and Figure 5 display the relative viability (or lack thereof) of sub-populations in the SCCC steelhead DPS.

Historical data on the SCCC DPS are sparse. In the mid-1960s, CDFG (1965) estimated that the DPS-wide run size was about 17,750 adults. No comparable recent estimate exists at the DPS scale; however, estimates exist for five river systems (Pajaro, Salinas, Carmel, Little Sur, and Big Sur), indicating runs of fewer than 500 adults where previous runs had been on the order of 4,750 adults (CDFG 1965). Time-series data only exist for one basin (the Carmel River), and indicate a decline of 22 percent (%) per year over the interval 1963 to 1993. More recent data indicate that the abundance of adult spawners in the Carmel River has increased slightly, although the time series is too short to conclude whether or not this is a true reflection of population growth (Good *et al.* 2005).

b. *Sub-Population Threats*

We assessed the threats to each sub-population by considering threats as both stressors to the population via changes in the properly functioning condition of critical habitat PCEs, and as sources of stressors. A detailed description of the method of analysis is contained in NMFS (2006). A stressor was defined as the physical, chemical, or biological conditions that have the greatest influence on limiting the production of steelhead within the range of the sub-population. We summarized the top four stressors for each sub-population in Table 2 in order of severity. Sources were defined as the primary causative agents associated with each stressor. Sources acting within each sub-population are presented in order of severity in Table 3. Figure 6 depicts the relative ranking of threats for all sub-populations within the DPS.

[8] An independent population is defined as one in which exchanges with other populations have negligible influence on its extinction risk (Bjorkstedt *et al.* 2005).

Table 2. Summary of Threats assessments (stressors) for the 12 sub-populations in the SCCC steelhead DPS.

Sub-populations	Top Stressors 1	2	3	4
Carmel River	Summer Base Flow, Flow-related passage	Barriers, Flow-related passage	Degraded estuarine habitat	Channelization
Big Sur	Sedimentation	Flow-related passage, Degraded estuarine habitat	None	None
San Simeon	Summer Base Flow	Sedimentation	Low DO	None
Morro Bay	Summer Base Flow	Habitat Degradation	Barriers	None
Pismo Beach	Summer Base Flow	Habitat Degradation	Barriers	None
Salsipuedes	Sedimentation	Barriers	Summer Base Flow, Flow-related passage	Channelization
Llagas	Flow-related passage	Barriers	Channelization	Summer Base Flow
San Benito	Flow-related passage	Summer Base Flow, Flow-related passage	None	None
Gabilan	External barriers, Flow-related passage	Barriers	Toxic contamination	Channelization
Arroyo Seco	Flow-related passage	Barriers	Summer Base Flow	None
San Ant./Nac.	Barriers	Competition	None	None
Upper Salinas	Summer Base Flow, Flow-related passage[9]	Summer Base Flow, Flow-related passage	Water temperature	Barriers
Lower Salinas[10]	Flow-related passage	Degraded estuarine habitat	Toxic contamination	Channelization

[9] Both summer base flow and flow-related passage barriers were listed as the top two stressors for the Upper Salinas sub-population because they were of equal priority and we could not discern one over the other.
[10] Threats to the Lower Salinas were included because it serves a critical function to several sub-populations and is central to our analyses.

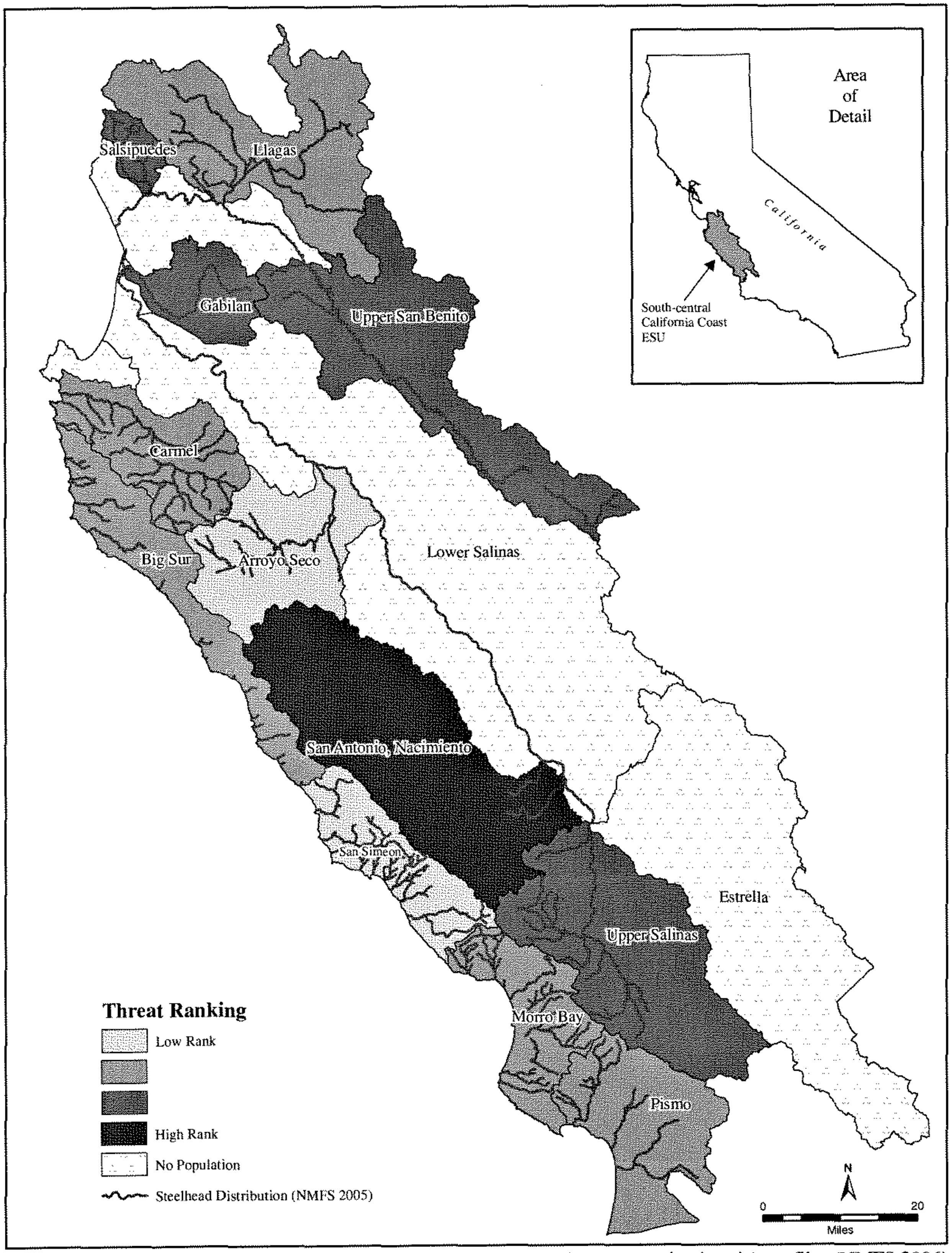

Figure 6. Relative ranking of threats to SCCC DPS sub-populations based on extinction risk profiles (NMFS 2006). Areas with high rank indicate where threats are most severe.

Table 3. Summary of Threats assessments (sources) for the 12 sub-populations in the SCCC steelhead DPS.

Sub-populations	Sources 1	2	3	4
Carmel River	Groundwater and surface diversions	Large Dams	Lagoon Breaching	Urbanization
Big Sur	Historic logging and rural develop.	Groundwater and surface diversions	None	None
San Simeon	Groundwater and surface diversions	ag, grazing, urbaniz., roads	Grazing	None
Morro Bay	Groundwater and surface diversions	ag, grazing, urbaniz., roads	dams, roads	None
Pismo Beach	Groundwater and surface diversions	ag, grazing, urbaniz., roads	dams, roads	None
Salsipuedes	Agriculture	Seasonal Dams, diversion facilities, road crossings	Groundwater and surface diversions	Agriculture and urbanization
Llagas	Large Dams, Diversions	Large Dams, Summer Dams	Agriculture and urbanization	Large Dams, Diversions
San Benito	Gravel mining and road crossings	Groundwater and surface diversions	None	None
Gabilan	Lagoon, OSR[11], and harbor mgt.	Road Crossings	Agriculture and urbanization	Agriculture and urbanization
Arroyo Seco	Salinas River flows	Gravel mining, water diversion, and road crossings	Groundwater and surface diversions	None
San Ant./Nac.	Large Dams	Introduced Trout	None	None
Upper Salinas	Groundwater and surface diversions	Large Dams	Groundwater and surface diversions and grazing	dams, roads
Lower Salinas	Dams, groundwater and surface diversions	Dams, diversions, and flood control	Agriculture and urbanization	Agriculture and urbanization

Sub-populations occupying the inland watersheds of the Pajaro and Salinas rivers show a strong pattern of flow-related passage issues as stressors to the populations. This suggests that freshwater migration PCE is typically impaired in this region. Our source analysis suggests there are a variety of factors contributing to this impairment, but most are related to water use in some way. Ground water pumping, surface water diversions, and dams associated with agricultural and urban developments all potentially contribute to reductions in surface flows which can limit upstream migration of adult steelhead and downstream migration of smolts, depending on the time of year. Changes in channel configuration from channelization and gravel mining, however, can also affect surface flows.

Reduced summer base flows impair the properly functioning condition of freshwater rearing PCE by reducing the amount of available rearing space, exacerbating high temperatures, and

[11] OSR = The Old Salinas River channel.

otherwise reducing the survival of steelhead fry, parr, and pre-smolts. The source analysis again reveals a strong pattern of water use. The same issues of ground water pumping, surface water diversions, and dams associated with agricultural and urban developments that apply to the migration PCE, also apply to the rearing PCE, although the specifics may differ. For example, migration corridors are more likely influenced by water releases from major dams as well as aquifer depletion, whereas rearing habitats, being more often off of the mainstem, are likely more specifically influenced by lowering of groundwater levels.

D. DPS-Wide Threats

Unlike the threats assessment portion of the Extinction Risk Profiles, which was specific to each sub-population, this section addresses threats that are common to all sub-populations or affect steelhead primarily at the DPS scale.

1. Anthropogenic Influences

Habitat destruction and fragmentation have been linked to increased rates of species extinction over recent decades (Davies *et al.* 2001). A major cause of the decline of steelhead is the loss or decrease in quality and function of essential habitat features (*i.e.,* PCEs of critical habitat). Most of this loss and degradation of habitat, including critical habitat, has resulted from anthropogenic watershed disturbances caused by water diversions, the influences of large dams, agricultural practices (including irrigation), urbanization, loss of wetland and riparian losses, roads, grazing, gravel mining, and logging. While individual components of this list of threats have waxed and waned over the last 100 years, the general trend has been one of increasing and intractable pressure on aquatic resources. This degradation of critical habitat is occurring because of the loss of essential habitat components necessary for steelhead persistence. Degradation of critical habitat has reduced its value for steelhead conservation and exacerbated the adverse effects of natural environmental variability such as drought, poor ocean conditions, and predation.

a. *Water Use*

Depletion and storage of natural flows have altered natural hydrological cycles in many California rivers and streams in general, and within streams providing habitat to SCCC DPS steelhead in particular. Alteration of stream flows has increased juvenile salmonid mortality for a variety of reasons including: impaired migration from insufficient flows or habitat blockages; loss of rearing habitat due to dewatering and blockage; stranding of fish resulting from rapid flow fluctuations; entrainment of juveniles into unscreened or poorly screened diversions; and increased juvenile mortality resulting from increased water temperatures (Chapman and Bjornn 1969, Bergren and Filardo 1993, 61 FR 56138).

b. *Fishing Harvest*

There are few good historical accounts of the abundance of steelhead harvested along the California coast (Jensen and Swartzell 1967). However, Shapovalov and Taft (1954) report that very few steelhead were caught by commercial salmon trollers at sea but considerable numbers were taken by sports anglers in Monterey Bay. There are also many anecdotal reports of recreational fishing and poaching of instream adults (Franklin 2005) which suggests a relatively high level of fishing pressure.

California regulations allow catch-and-release winter-run steelhead angling in many of the river basins occupied by the DPS, specifying that all wild steelhead must be released unharmed (NMFS 2003a). The original draft of CDFG's 2000 Fishery Management and Evaluation Plan recommended complete closure of the Salinas system to protect steelhead there, but the final regulations did not implement this recommendation, allowing both summer trout angling and winter-run catch-and-release steelhead angling in selected parts of the system (NMFS 2003a).

c. *Artificial Propagation*

Releasing large numbers of hatchery fish can pose threats to steelhead stocks through genetic impacts, competition for food and other resources, predation of hatchery fish on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production (Waples 1991). The genetic impacts of artificial propagation programs are primarily caused by the straying of hatchery fish and the subsequent hybridization of hatchery and wild fish. Artificial propagation threatens the genetic integrity and diversity that protect overall productivity against changes in the environment (61 FR 56138).

2. Environmental Influences

a. *Climate Change*

The most relevant trend in climate change is the warming of the atmosphere from increased greenhouse gas emissions. The acceptance of global warming as a scientifically valid and anthropogenically driven phenomenon has been well established by the United Nations Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change, and others (Davies *et al.* 2001, UNFCCC 2006, and Watson *et al.* 2001). These changes are inseparably linked to the oceans, the biosphere, and the world's water cycle. Changes in the distribution and abundance of a wide array of biota confirm a warming trend is in progress, and that it has great potential to affect species' survival (Davies *et al.* 2001, Schneider and Root 2002). In general, as the magnitude of climate fluctuations increases, the population extinction rate also increases (Good *et al.* 2005). Global warming is likely to manifest itself differently in different regions. For example, in California, the overall amount of precipitation may increase. Another impact predicted for this region by the California Energy Commission is an increase in critically dry years (Cayan *et al.* 2006). Many of the threats already identified for this DPS are related to lack of surface flow in streams. Future climate change may therefore substantially increase risk to the species by exacerbating dry conditions.

b. *Ocean Conditions*

Variability in ocean productivity has been shown to affect salmon production both positively and negatively. Beamish and Bouillion (1993) showed a strong correlation between North Pacific salmon production and marine environmental factors from 1925 to 1989. Beamish *et al.* (1997) noted decadal-scale changes in the production of Fraser River sockeye salmon that they attributed to changes in the productivity of the marine environment. They also reported the dramatic change in marine conditions occurring in 1976-77 (an El Niño year), when an oceanic warming trend began. These El Niño conditions, which occur every three to five years, negatively affect ocean productivity. Johnson (1988) noted increased adult mortality and decreased average size for Oregon Chinook salmon (*O. tshawytscha*) and coho salmon during the strong 1982-83 El Niño. Of greatest importance is not how steelhead perform during periods of high marine survival, but how prolonged periods of poor marine survival affect the viability of populations. Salmon populations have persisted over time, under pristine habitat conditions, through many such cycles in the past. It is less certain how they will fare in periods of poor ocean survival when their freshwater, estuary, and nearshore marine habitats are degraded (Good *et al.* 2005).

c. *Reduced Marine-Derived Nutrient Transport*

Reduction of marine-derived nutrients (MDN) to watersheds is a consequence of the past century of decline in salmon abundance (Gresh *et al.* 2000). MDN are nutrients that are accumulated in the biomass of salmonids while they are in the ocean and are then transported to their freshwater spawning sites. Salmonids may play a critical role in sustaining the quality of habitats essential to the survival of their own species. MDN (from salmon carcasses) has been shown to be vital for the growth of juvenile salmonids (Bilby *et al.* 1996, Bilby *et al.* 1998). The return of salmonids to rivers makes a significant contribution to the flora and fauna of both terrestrial and riverine ecosystems (Gresh *et al.* 2000). Evidence of the role of MDN and energy in ecosystems suggests this deficit may result in an ecosystem failure contributing to the downward spiral of salmonid abundance (Bilby *et al.* 1996). The loss of this nutrient source may perpetuate salmonid declines in an increasing synergistic fashion.

d. *Marine Mammal Predation*

Predation by marine mammals is not believed to be a major factor contributing to the decline of West Coast steelhead relative to the effects of fishing, habitat degradation, and hatchery practices. Harbor seal (*Phoca vitulina*) and California sea lion (*Zalophus californianus*) numbers have increased along the Pacific Coast (NMFS 1999). However, at the mouth of the Russian River in Sonoma County within the Central California Coast steelhead DPS, Hanson (1993) reported foraging behavior of California sea lions and harbor seals with respect to anadromous salmonids was minimal. Hanson (1993) also stated predation on salmonids appeared to be coincidental with the salmonid migrations rather than dependent upon them. Nevertheless, this type of predation may have substantial impacts in localized areas.

F. Metapopulation Analysis

A metapopulation analysis allows us to determine whether project impacts increase the DPS' risk of extinction by evaluating the functional relationships of the sub-populations in the context of their individual extinction risks.

A metapopulation is a population of sub-populations linked by immigration and dispersal such that both the genetics of the individual sub-populations and their dynamics (such as abundance) are affected (Cooper and Mangel 1999). These sub-populations are generally geographically separate units and often become more common as habitat fragmentation splits large populations into smaller units that maintain some gene flow (Meffe and Carroll 1997). For the purposes of this opinion, we consider the SCCC steelhead DPS to be a metapopulation comprising 12 sub-populations. A DPS is defined as a population that is: 1) markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, and behavioral factors; and 2) significant to its taxon (71 FR 834). This definition does not include resident *O. mykiss*, though non-anadromous rainbow trout typically share rearing habitat with steelhead and are probably not reproductively isolated. We consider the role of these non-anadromous *O. mykiss* in this analysis because they may, particularly in the inland basins, represent source material for anadromous sub-populations that are likely to provide added resilience against extinction when the anadromous component is unable to successfully complete the migratory components of its life-cycle (NMFS 2004).

We conclude in the following analysis that the SCCC steelhead DPS is suffering a significant decline in overall abundance and productivity, it is becoming increasingly fragmented, and that four sub-populations have become or are nearly extirpated. These population trends in conjunction with the large scale anthropogenic influences on habitat condition lead to the conclusion that this DPS continues to decline toward extinction.

1. Biogeographic Patterns

a. *Degree of Isolation*

Wild populations generally have some degree of genetic population structure based on biogeographic patterns that exist along a spectrum between complete genetic isolation and free genetic exchange. These biogeographic structures have important implications for genetic management (and by extension, extinction risk) because they are often altered by human actions, which may seriously affect fitness and local adaptation (Meffe and Carroll 1997). The spatial relationship between sub-populations in the SCCC steelhead DPS is one of increasing isolation. This combined with declines in abundance is leading to the imminent loss of four of the 12 sub-populations.

For any population, replacement of individuals to sustain the population is achieved either by reproduction from within the population or from immigration from outside sources. For SCCC steelhead sub-populations, sources of immigration may be strays from other sub-populations or contributions from resident fish. Our assessment concludes that no current sub-population has the requisite viability to function as a source population. Therefore, while some exchange of strays may occur at low levels, this function has been greatly diminished. This is likely to add additional risk to the DPS, as straying between sub-populations is an important factor in maintaining metapopulation structure (Hill *et al.* 2002).

Connectivity between sub-populations is an important factor influencing gene flow and recolonization potential (Good *et al.* 2005). The degree to which connectivity contributes to this exchange is a function of migration distance and the challenges to migration along the way. Garza *et al.* (2006) found a pattern of isolation by distance reflected in multiple genetic signatures for steelhead along the California coast. This strongly suggests that the greater the migration distance, the less reproductive interaction occurs between sub-populations. While challenges to migration do not preferentially deter straying, they do reduce the success of any adult attempting to migrate and, therefore, increase the degree of isolation.

Coastal sub-populations of SCCC steelhead remain well connected because they are closer together and have somewhat higher abundance. The connections between sub-populations in the Pajaro and Salinas River systems, however, are far more tenuous, particularly in the upper basins (Upper Salinas and San Benito). This is because those sub-populations have a higher degree of geographic separation from the potential source populations along the coast[12], and they face greater challenges to successful migration related to impaired stream flows and degraded habitat in the mainstem channels. Reduced migration opportunities due to flow manipulations in the Salinas River are discussed further in the Baseline section.

b. *Fragmentation*

The anadromous components of four of the twelve sub-populations that make up the SCCC DPS are at imminent risk of extirpation. The loss of sub-populations from an already diminished DPS can further reduce the DPS's ability to persist (Bjorkstedt *et al.* 2005).

The four populations at highest risk of extirpation are: San Benito, Gabilan Creek, Nacimiento/San Antonio, and the Upper Salinas. This conclusion is based on the extinction risk profiles described above and on their degree of isolation as mentioned in the previous section. If these extirpations occur, they will represent a substantial reduction in the distribution of the DPS (as described below).

2. Importance of the Salinas Basin to the SCCC DPS

Steelhead sub-populations of the Salinas basin play a significant role in the survival of the SCCC DPS because: 1) they represent a large distributional component of the overall range of the DPS, 2) they inhabit ecologically distinct areas unique to the DPS, and 3) they exhibit unique life history traits. To be considered viable, a DPS should contain multiple sub-populations, maintain wide geographic distribution, and contain sub-populations that display diverse life-histories and phenotypes (McElhany *et al.* 2000). These Salinas basin sub-populations contribute to all three of these viability criteria.

a. *Distribution*

The loss of the sub-populations in the Salinas basin would mean the removal of the largest area of streams currently occupied by any sub-population in the DPS. In terms of watershed acreage and stream miles, the Salinas River is the largest river in the DPS (Figure 4). The Salinas River comprises approximately 48 percent of the DPS in terms of acreage and approximately 48 percent of the DPS in terms of total stream miles (*i.e.,* "blue line watercourse" on 1:100,000

[12] As previously stated, no sub-populations in this DPS are considered true sources because we do not consider them viable, though they may still contribute strays at low levels. It is, therefore, possible for sub-populations to function both as sources and as sinks (Hill *et al.* 2002).

topographic map). Currently, the Salinas River watershed comprises approximately 19 percent of the DPS in terms of miles of occupied spawning and/or rearing habitat (Table 4). Of the five larger watersheds in the DPS, the Salinas River has the most occupied habitat remaining. Without the Salinas River basin population, only smaller coastal populations and the Pajaro River basin populations would remain, and the total amount of occupied habitat in the DPS would be reduced by nearly 20 percent.

Table 4. Miles of occupied stream habitat within five of the larger watersheds of the SCCC DPS. Data derived from NMFS Critical Habitat database (NMFS 2005b).

Watershed	Currently occupied habitat	Proportion of occupied habitat in the DPS[13]
Salinas River	149 miles	19 percent
Pajaro River	144 miles	18 percent
Carmel River	92 miles	11 percent
Big Sur	36 miles	4 percent
Little Sur	15 miles	2 percent
Small Coastal Streams	368 miles	46 percent

b. *Ecological Uniqueness*

As described previously, there are two general ecological habitat types in this DPS: coastal basins and two inland basins. The coastal ecoregion is represented by the Carmel, Big Sur, San Simeon, Morro, and Pismo sub-populations. The inland ecoregion is represented by the Salinas sub-populations and the Llagas and San Benito sub-populations of the Pajaro River. These areas are typically drier and warmer than the coastal region. They also have longer migration routes and differing hydrologic regimes. These generally different environmental conditions confer unique selective regimes that likely supported and may still support unique life history traits as described below. The San Benito, Nacimiento/San Antonio, and the Upper Salinas sub-populations are also three of the four populations at highest risk of extirpation in the DPS. If the Salinas River basin sub-populations were lost, the only remaining sub-populations in the interior ecoregion would be those of the Pajaro River basin. Extinction risk profiles suggest that habitat loss has been acute in the Pajaro River basin and that the sub-populations' abundance, distribution, growth rate, and genetics are in poor condition. The risk of losing the entire inland geographic area inhabited by SCCC steelhead is high. Thus, as a substantial component of the inland ecoregion, the Salinas sub-populations are important to the conservation of ecological diversity of the SCCC DPS.

c. *Unique Life History Traits*

Steelhead of the Salinas basin are likely to possess unique life history traits that have allowed them to persist in this ecoregion. Fish surviving in this environment would need to possess the ability to migrate longer distances under more variable hydrologic conditions than in shorter, wetter coastal areas. They would need the ability to survive warmer water temperatures that would prevail as well. And finally, they probably would display increased plasticity between anadromous and resident forms of *O. mykiss*, as this would permit them to better survive periodic

[13] NMFS (2005) estimates there are 804 miles of occupied spawning and/or rearing habitat in the SCCC DPS.

drought conditions when lack of flows in the mainstem would prevent migration to and from the ocean. The retention of these traits within the DPS may take on added importance if climate conditions would increase the likelihood of serious droughts (as discussed in the section on climate change). Historically, different geographic and life history components that were minor producers during one climatic regime have dominated during others. Hilborn *et al.* (2003) used this observation to demonstrate that the bio-complexity of fish stocks is critical for maintaining their resilience to environmental change. We conclude that this argument would hold true for sub-populations of the Salinas River.

Based on watershed size, location, ecological context, and overall status of SCCC steelhead, a viable steelhead population in the Salinas River has the potential to lessen fragmentation in the distribution of SCCC steelhead, contribute to the genetic diversity of the species, and ameliorate the overall extinction risk of the DPS.

G. Critical Habitat

To assist in the designation of critical habitat, NMFS convened several Critical Habitat Analytical Review Teams (CHART). The CHART were tasked with determining the relative conservation value of each area or watershed occupied by listed steelhead and/or Chinook salmon. The CHART scored each habitat area based on several factors related to the quantity and quality of the physical and biological features. Specific areas used for the steelhead DPSs were CALWATER Hydrologic Units (HU), which contain Hydrologic Sub-areas (HSAs). Each HSA was considered in relation to adjacent HSAs and with respect to the population occupying that HSA. Based on a consideration of the raw scores for each HSA, and a consideration of that HSAs contribution to the overall population structure of the DPS, the CHART rated each HSA as having a "high," "medium," or "low" conservation value. The conservation value of a given HSA is the relative importance of the HSA to conservation of the DPS. High-value HSAs were those deemed to have a high likelihood of promoting DPS conservation while low-value HSAs were expected to contribute to conservation in only a minor way.

NMFS developed a list of PCEs specific to salmon and steelhead and relevant to determining whether occupied stream reaches within an HSA fit the definition of "critical habitat." These PCEs include sites essential to support one or more of the lifestages of the DPS (*i.e.*, sites for spawning, rearing, migration, and foraging). These sites in turn contain physical or biological features essential to the conservation of the DPS (for example, spawning gravels, water quality and quantity, side channels, forage species). Specific types of sites and the features associated with them include, but are not limited to the following:

1. Freshwater migration corridors free of obstruction and excessive predation with adequate water quantity to allow for juvenile and adult mobility; cover, shelter, and holding areas for juveniles and adults; and adequate water quality to allow for survival.

2. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

3. Freshwater rearing sites with sufficient water quantity and floodplain connectivity to form and maintain physical habitat conditions and allow salmonid development and mobility; sufficient water quality to support growth and development; food and nutrient resources such as terrestrial and aquatic invertebrates and forage fish; and natural cover such as shade, submerged and overhanging large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

4. Estuarine areas that provide uncontaminated water and substrates; food and nutrient sources to support growth and development; and connected shallow water areas and wetlands to cover and shelter juveniles.

The CHART analysis identified most of the coastal drainages as having high conservation value, reflecting the relatively high productivity of the freshwater rearing PCE and its value in maintaining connectivity and a wide distribution. The inland HSAs were more evenly divided with the driest areas generally possessing the lowest conservation value. Notably, however, the HSAs containing the Arroyo Seco, Nacimiento/San Antonio, and Upper Salinas sub-populations had high conservation value to the DPS. This reflects the importance of freshwater migration, freshwater spawning, and freshwater rearing PCEs unique within the inland ecotype.

H. Conclusions

Given the evidence, we conclude that this DPS continues to decline toward extinction. The ecological impacts on the DPS from human development have been steadily increasing over time, forcing the DPS unidirectionally toward an ever-increasing risk of extinction. If these trends persist, the most plausible result will be deterministic extinction. Deterministic extinctions occur with the cumulative loss or otherwise permanent change of a critical component in the species' environment that ultimately overwhelms the species' ability to survive and reproduce (Rieman *et al.* 1993). Habitat conditions in the SCCC steelhead DPS have been increasingly degraded by a pattern of progressively intense anthropogenic encroachment on water resources, riparian habitat, and channel geometry. This pattern applies particularly to the two inland basins, and is exemplified by the increases in irrigated lands and urbanization in the Salinas Valley (as described in the Land and Water Use portion of the Baseline section below). Some of the coastal basins (*i.e.,* Big Sur) are more isolated and, therefore, experience less of this trend and may have a higher likelihood of persistence. However, southern coastal sub-populations are experiencing threats similar to those of the interior basins. Overall, sub-populations have responded with declines in abundance, productivity, and increases in the degree of isolation and fragmentation; both within and between sub-populations. Diversity in life-history traits has also been eroded as flow and habitat conditions have imposed selective regimes divergent from the historical context. This trend is most acute in the interior basins because they are the most isolated, have the most depleted populations, and face the greatest threats. However, the threats to the coastal populations are still significant and their severity is reflected in the generally poor population status of the coastal sub-populations.

V. ENVIRONMENTAL BASELINE

The Environmental Baseline provides the foundation upon which the effects analysis is built. By establishing the historical, current, and future condition of the species and the habitat in the action area, we describe and analyze the conditions to which we will add the effects of the project under consultation. Our description of the historical condition of the ecosystem provides a context for subsequent trends, and it is also useful in describing the properly functioning condition of critical habitat and the viable state of steelhead populations. Current conditions in the action area include a description of the impacts of all the activities that have contributed to the current status of critical habitat and the species sub-populations. Our ability to understand factors contributing to the baseline condition is also important for predicting future conditions. By anticipating what the status of habitat and sub-populations would be, given a projection of all relevant factors into the future without the SVWP, we establish the basis for evaluating the effects of SVWP on critical habitat and the species in the effects analysis by adding these effects to the anticipated future status.

A. Historical Habitat Conditions

The following section describes the unaltered condition of the major ecological components of the Salinas River as we perceive them to have been prior to European settlement and development of the basin. This provides a context for the description of current baseline conditions that follows. It also helps to define the properly functioning condition of habitat, including critical habitat, within the action area. In the absence of a specific plan for recovery, we assume that the natural conditions under which the species evolved provide ecological conditions that sustain the long term survival of steelhead in the basin.

1. Mainstem Salinas River and Tributaries

The mainstem Salinas River is a migration corridor for adult steelhead migrating upstream from the ocean to tributary spawning areas. Spawning and rearing habitats are located in tributary streams. Kelts, smolts, and rearing juveniles use the mainstem Salinas River to migrate downstream to the ocean or lagoon.

Peak discharges from the Nacimiento and San Antonio rivers likely transported and sorted sediment throughout the lower Salinas River. Aerial photography taken before the dams were constructed indicates that seasonal high flows and natural floods caused flushing and scouring of the Salinas River channel, and the lack of dry season flow prevented excess growth of vegetation in the channel (ENTRIX and EDAW 2002). The expansive flood-prone width of the channel was not levied. There was likely mature vegetation in the flood-prone channel and other riparian vegetation that stabilized sandbars, provided zones of lowered flow velocity creating resting areas for migrating adult steelhead, and general cover for migrating steelhead. Under historic conditions, it is also likely there were higher sandbars, deeper pools, and during winter months, more water in the channel for a longer period of time. These conditions likely provided sufficient migration conditions necessary to maintain the Salinas River steelhead sub-populations.

The frequency and duration of flow events that facilitated adult steelhead upstream passage and smolt emigration were variable and directly dependent upon the frequency and intensity of precipitation in the Salinas watershed. The Salinas River was torrential in character (Snyder 1913); it had a very large flood discharge during the rainy season and was practically dry during the summer, except in the lower portion. During the dry season, its low velocity current shifted course over broad stretches of wind-blown sand, entirely disappearing at times and again rising to the surface (Snyder 1913). After the advent of winter rains, however, it presented "a broad expanse of seething water which often threatened everything before it" (Snyder 1913).

The Nacimiento, San Antonio, and Arroyo Seco rivers were the three principal spawning areas and comprised some of the best spawning and rearing habitats in the watershed (Snyder 1913, Titus *et al.* 2002, Good *et al.* 2005). NMFS (2005c) has estimated about 435 miles of spawning and rearing habitat were present in the watershed (circa early 1900s). Steelhead were probably able to access spawning and rearing habitat throughout the Salinas River watershed more easily under historic conditions given that many recent passage impediments (*e.g.*, road crossings, instream gravel mining sites, inadequate flows, and stream diversions) did not exist during the nineteenth and early twentieth century.

2. <u>Salinas River Lagoon</u>

The Salinas River flows through the Salinas River Lagoon before entering the Pacific Ocean. Unless otherwise noted, the following information is provided by the *Draft Salinas River Lagoon Management and Enhancement Plan* (The Habitat Restoration Group *et al.* 1992). Historical information (*i.e.,* late 1800s) indicates the floodplain adjacent to the Salinas River and the lagoon appeared to support extensive areas of wetland-type vegetation, with riparian woodland vegetation bordering the channel in the vicinity of the present river mouth. Historically, the Salinas lagoon likely provided rearing habitat for juvenile steelhead year round. In 1910, the area of open water in the lagoon was approximately 340 acres. The Salinas River turned to the north adjacent to Mulligan Hill, joined with the mouth of Elkhorn Slough, where it emptied into Monterey Bay. Historical accounts of the area describe the lower Salinas Valley as supporting shallow lakes, sloughs, marsh vegetation, and willow thickets. A series of north-south oriented lakes occurred east of the lagoon. This freshwater marsh ecosystem, including the lower Salinas River was likely an integral component of a larger wetland complex that included Elkhorn Slough and the Pajaro River mouth.

B. Development of land and water use

The historical habitat conditions in the Salinas River watershed have changed over time. Much of the change is due to the development of land and water use. The following discussion of these changes is used to describe the factors contributing to the current condition of habitat within the action area.

1. <u>Mainstem Salinas River</u>

As of 1904, only a comparatively small portion of the fertile lands of the Salinas Valley were being irrigated (Hamlin 1904). As the area developed, agriculture became the primary land use. Since the late 1940s, irrigated acreage within the Salinas Valley has increased substantially, with steady increases in the 1940s and 1950s, and more rapid increases in the 1960s and 1970s

(EDAW 2001). As the agricultural and urban areas have expanded, so have the water needs of the Salinas Valley (ENTRIX and EDAW 2002).

Recharge to the groundwater basin occurs primarily from precipitation, return flows from irrigated lands, and stream recharge from the Arroyo Seco and Salinas rivers. Average precipitation in the Salinas Valley ranges from 15 to 60 inches in the mountain ranges on either side of the Salinas Valley, and 10 to 15 inches within the Salinas Valley itself. Most of the precipitation occurs in winter, from November through March. Historically, groundwater elevations in the Salinas Valley have been declining due to heavy dependence on the basin's aquifer for agricultural and urban purposes. Declining groundwater levels, basin overdraft, and seawater intrusion are a serious concern to farmers, municipalities in the Basin, MCWRA, and the State Water Resources Control Board. Overdraft and seawater intrusion were first documented in the Salinas Valley in 1946, in a report published by the then-named State Department of Public Works, Division of Water Resources (Bulletin No. 52).

The Nacimiento and San Antonio dams were constructed to help remedy this problem. Beginning operations in 1957 and 1967, respectively, these dams were designed to provide elevated flows to increase aquifer recharge during the growing season, April through October. The dams also provide flood control benefits. The Nacimiento and San Antonio reservoirs have been operated to optimize Salinas River groundwater recharge by storing winter runoff for subsequent release during the irrigation season, when the potential for recharge is highest. The two reservoirs are operated to minimize Salinas River outflow to the ocean (ENTRIX and EDAW 2002). Nevertheless, seawater intrusion continues because the rainfall in the Salinas Valley does not sufficiently recharge aquifers to meet current groundwater demands, which exceed natural recharge rates and recharge provided by the dams.

As shown in the *Salinas Valley Historical Benefits Analysis – Final Report* (Montgomery Watson 1998), annual seawater intrusion has historically averaged 11,000 AFY, while basin overdraft has averaged approximately 19,000 AFY, during the 1949 to 1994 hydrologic period. Given the hydrologic conditions described above, and prior to the pumping of groundwater for agricultural and urban purposes and dam operations, there was likely a better connectivity between groundwater and surface flows. This would have resulted in greater availability of persistent stream flows following the first rainfall event, the channel refilling quicker between rainfall events, and a more frequently wetted and deeper channel.

The lower 24 miles of the Salinas River has an extensive levee system, constructed by the Corps and private landowners. These levees in combination with sediment deposition have reduced the river's channel capacity (Grice Engineering and Geology, Inc. [GEG] 1998). Since 1952, MCWRA, the Corps, and private landowners have periodically cleared the lower Salinas River channel (GEG 1998). Contrary to the landowner's intent, these activities exacerbated channel capacity and sediment transport problems. By widening low flow channels and spreading water across a larger area, water velocities are decreased, a condition that promotes sediment deposition (Mount 1995).

The riparian vegetation of the lower Salinas River has been modified due to agriculture, flood control levees, vegetation removal by landowners along the river, urban activities, and periods of drought. Riparian vegetation is now limited to small patches and narrow strips along the river banks, mostly between the flood control levees (White and Broderick 1992).

2. Salinas River Lagoon

From the late 1800s to the late 1950s, major changes occurred in the lagoon. A program for drainage operations and reclamation was established as early as 1877. By 1910, extensive areas, primarily wetlands, had been reclaimed as large areas north and south of the lower Salinas Valley were already under cultivation by 1901. Following a series of storms during winter 1909-1910, the river changed course, creating a river mouth at its present location. The river segment that formerly ran to Elkhorn Sough is now referred to as the OSR channel. The OSR still connects the lagoon to Elkhorn Slough, but it has been modified by agricultural activity, maintenance dredging, and hydraulic structures. The entrance to the OSR from the present-day lagoon is currently blocked by a levee with a manual slide gate. The OSR is a trapezoidal drainage ditch with minimal riparian vegetation and a number of partial barriers and tide gates.

Between 1910 and 1990, the area of open water in the lagoon decreased from about 340 acres to about 130 acres. The diversion of the river mouth and wetlands reclamation also dramatically altered the freshwater fish community of the Salinas River/Elkhorn Slough complex. In addition to these changes to the size and location of the lagoon, the construction and operation of the Nacimiento and San Antonio dams have reduced freshwater inflow to the lagoon (ENTRIX and EDAW 2002). The diversion of effluent from the Alisal and Salinas Wastewater Treatment Plants in 1983 and 1989, respectively, also reduced freshwater inflow into the lagoon.

The lagoon is now a repository for irrigation return flow laden with toxic contaminants including a variety of pesticides (Routh 1972). For example, the Blanco Drainage Ditch is an eight-mile long unlined channel that drains approximately 6,000 irrigated acres west of Salinas to the Salinas River (EDAW 2001). It originates just south of the city of Salinas and flows north approximately parallel to the Salinas River before flowing into the upper most portion of the Salinas River lagoon (Larson 2004). Historically a freshwater wetland, the system was channelized to drain storm and agricultural runoff (Kozlowski *et al.* 2004).

Mechanical breaching of the sandbar to prevent flooding of agricultural root zones and fields has been carried out without a Corps permit since approximately 1910. MCWRA became the responsible agency for the sandbar breaching in the mid-1960s. MCWRA has applied for a 10-year permit from the Corps to conduct breaching; NMFS and the Corps are currently engaged in a separate formal consultation for this activity. During lower flows, lagoon water surface elevation management is accomplished by adjusting flows through a slide gate to the OSR which empties into Moss Landing Harbor.

C. Current and Future Status of Habitat in the Action Area

This section establishes the current and future condition of steelhead habitat in the action area absent the SVWP. This projection of baseline conditions will become the foundation for our adding the effects of the proposed project in the *Effects of the Action* section. The factors affecting current and future conditions can help us: (1) present a clear picture of what factors are responsible for the current status of the SCCC DPS and their critical habitat in the action area; (2) analyze factors that are likely to cause ongoing and future impacts to the status of the species and habitat in the action area; and (3) add expected project impacts to non-project related impacts that are part of the environmental baseline. These three items in turn are important for determining how the population is likely to respond to the proposed project.

The factors described above have severely degraded steelhead migration, spawning, and rearing habitat PCEs in the Salinas River Basin, and are largely responsible for the decline of steelhead in the Salinas River. Steelhead migration habitat has been degraded by dams and their operations, which preclude access to spawning and rearing habitats and limit stream flows. Flood control efforts have scoured the mainstem and reduced resting and hiding cover, while also contributing to reduced migration at low flows. Road crossings in the watershed create partial or complete migration barriers. Spawning and rearing habitat has been degraded by dam operations that reduce the amount of habitat space available and/or may disrupt redds. Lagoon management has created conditions in which few, if any, steelhead can successfully rear in the lagoon. Agriculture contributes toxic materials to the lower river and lagoon. Fish planting has increased the competition wild steelhead face for food, and may degrade their genetic viability. Many of these conditions are expected to continue into the future.

1. Migration Habitat

Steelhead use of upper Salinas River tributaries is dependent upon the presence of a migration corridor in the mainstem Salinas River (Titus *et al.* 2002). One of the main limitations to migration within the Salinas River Basin is the limited availability of adequate flows coupled with the long distances (over 110 miles to the upper tributaries) to suitable spawning and rearing grounds. The number of days within the migration period where flows are adequate for migration is highly variable from year to year, and groundwater pumping has shortened this window. In addition, levees, channel clean outs, road crossings, and removal of riparian vegetation have reduced the availability, and quality, of migration habitat for steelhead.

a. *Water Withdrawals from the Underflow of the Salinas River*

The predominant land use within the Salinas Valley is irrigated agriculture. Pumping of water from shallow wells for agricultural and urban purposes has lowered groundwater levels to below mean sea level and contributed to the intrusion of seawater into coastal aquifers. As groundwater supplies have become intruded with seawater, pumping has shifted to deeper aquifers.

The aquifers in the lower Salinas River have been severely depleted (EDAW 2001). As a result surface flows are more readily absorbed into the ground, a phenomenon that can reduce the total surface flow available for steelhead migration. The Nacimiento and San Antonio dams, which were built to store winter flows for release during spring, summer, and fall, further reduce surface flows needed to support steelhead migrations. As the result of the combination of pumping and reservoir storage, the flow of the Salinas River to the lagoon and ocean has been reduced from 533,000 AFY (Simpson 1946) to a current estimate of less than 240,000 AFY (EDAW 2001).

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b. Dams

Three major dams, which form the Nacimiento, San Antonio, and Santa Margarita reservoirs, have significantly altered the distribution and abundance of steelhead in the Salinas watershed. These dams and their reservoirs have blocked the migration of steelhead to major tributary spawning and rearing habitats. The dams have also appreciably affected the river's hydrology and reduced the availability of flows needed to sustain the migrations of steelhead in the Salinas River. This section briefly reviews these aspects of the existing environmental baseline.

NMFS (2005c) estimated that in the early 1900's, the Salinas River watershed contained about 435 miles of stream supporting spawning and rearing habitats for steelhead. Areas above the present sites of the Nacimiento and San Antonio dams comprised some of the best historical spawning and rearing habitats in the watershed (Snyder 1913, Titus *et al.* 2002). The Salinas Dam, which forms the Santa Margarita Reservoir in San Luis Obispo County, and the Nacimiento and San Antonio dams were constructed without fish passage facilities, and, therefore, the historic habitats above these dams are no longer available to steelhead. As a result, 286 miles of spawning and rearing habitat for steelhead have been lost; an estimated 149 miles of spawning and rearing habitat remain in the watershed (NMFS 2005c).

Habitat destruction and fragmentation have been linked to increased rates of species extinction (Davies *et al.* 2001), and it is well documented that loss of salmonid habitats leads to commensurate declines in species abundance (California Fish Commission 1877, Clark 1929, Yoshiyama *et al.* 1998). The substantial loss of habitat due to the existing dams has increased the importance of conserving and enhancing the remaining habitats for SCCC steelhead in the watershed.

Reservoir storage operations in the watershed have significantly affected the magnitude and frequency of flows supporting steelhead migrations in the mainstem Salinas River. However, the extent to which the dams have affected passage flows is dependent upon the prevailing hydrologic conditions as well as a stream segment's distance from the dams. The dams have substantially affected passage conditions during dry and normal water years; however, they appear to have had little effect on adult passage during wet years. For example, before the Nacimiento and San Antonio dams were constructed, in February and March of <u>dry years</u>, mean daily flow at Spreckels exceeded 315 cfs during 10% of the days, and it exceeded 663 cfs during 5% of the days (Figure 7). This contrasts markedly with records for the post-dam period when the 10% and 5% exceedence flows during February and March of <u>dry years</u> were reduced to 38 and 93 cfs, respectively. Such losses of elevated flow are significant given that adult steelhead need flows in excess of several hundred cfs to safely and efficiently traverse the Salinas River between Chualar and Bradley (as discussed later in this section). The dams appear to have had little effect on opportunities for upstream passage in February and March during <u>wet years</u>, when flows generally remained well over 1000 cfs at Spreckels. In fact, during wet years since the two major dams were constructed, flows have exceeded about 200 cfs at Spreckels during 90% of the days in February and March.

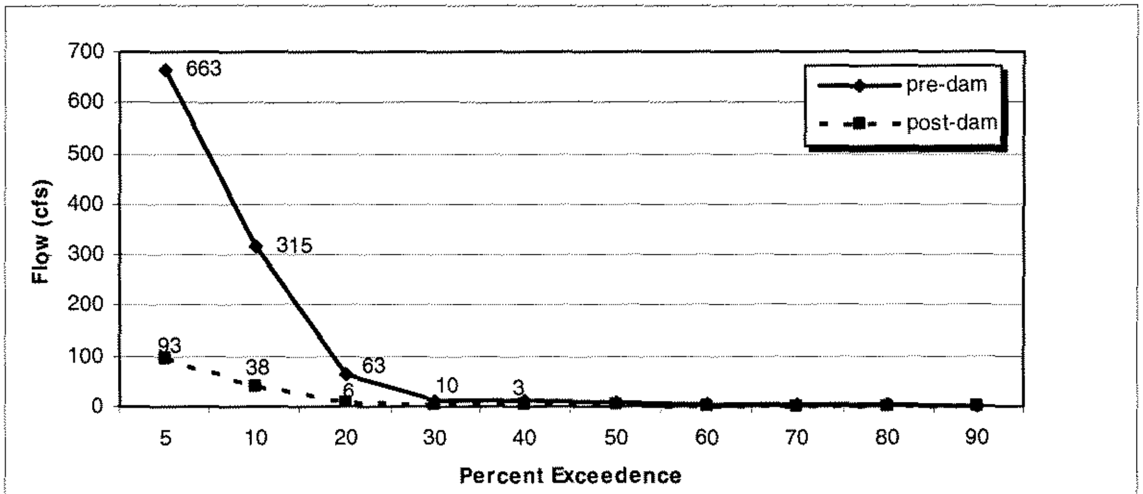

Figure 7. Frequency of flows at Spreckels during February and March of dry years before and after construction of Nacimiento and San Antonio dams.

The third category of water year, "normal years" is of particular interest because, using the classification system of WRIME (2003), they represent 50 percent of all years and they provide intermediate flows that are more likely to be influenced by the dams than flows during wet years. Analysis of flow frequencies at Spreckels during the winter period of normal years reveals minor differences between pre-dam years and years after the construction of Nacimiento and San Antonio dams. Since construction of the dams, flows during normal years exceeded 300 cfs at Spreckels on 52% of the days in February and March. This is slightly down from pre-dam years when flow exceeded 300 cfs during 55% of the days in February and March during normal years (Table 5).

Table 5. The percent exceedence of flows between 200 and 500 cfs on the Salinas River at the Spreckels gage during February and March in normal years from 1929 to 1956 (pre- Nacimiento and San Antonio Dam period) and from 1970 to1999 (post-dam period). Records include 15 normal water years for the pre-dam period and 11 for the post-dam period. Data from USGS gage records.

Flow (cfs)	Pre-Dam Exceedence	Post-Dam Exceedence
500	45	42
400	49	46
300	55	52
200	63	62

Operations of the Nacimiento and San Antonio dams have had a greater effect on stream flows in the Salinas River in the vicinity of Bradley and Soledad, which are located upstream from the confluence of the Arroyo Seco, a major unregulated tributary of the Salinas River. Analysis of modeled hydrographs for baseline and without-dams scenarios (WRIME 2003) show that peak flows at Bradley have been diminished by the dams (Table 6). The dams have reduced the number of days when flow exceeds 300 cfs (the approximate minimum flow providing effective passage, see NMFS 2005c) at Bradley to about one-third that estimated to occur without the dams during normal water years (Figure 8).

Table 6. Estimated peak flows (cfs) under baseline conditions at the Bradley gage during representative storm events, both with and without the Nacimiento and San Antonio dams. Data source: SVIGSIM model results (WRIME 2003).

Date	With Dams	Without Dams	Date	With Dams	Without Dams
Dec 1956	5000	20,000	Dec 1983	30,000	30,000
Jan 1956	7000	17,000	Dec 1986	100	4000
Feb 1957	400	1000	Feb 1986	7000	30,000
Mar 1957	200	700	Mar 1987	400	3000
Jan 1963	2000	30,000	Feb 1991	500	1100
Feb 1963	3000	9000	Mar 1991	6000	10,100
Feb 1979	5000	7500	Feb 1992	6000	10,500
Jan 1980	10,500	10,500	Mar 1992	800	4000

The dams also appear to have influenced the duration of time that flows remain elevated and conducive to fish passage. To understand this problem, it is first necessary to consider the effects of variable flow on fish migrations and their rates of movement. When flows are not consistently sustained at levels that facilitate upstream passage, migrating fishes are forced to suspend their movements and temporarily reside in limited holding pools, where they are vulnerable to predation and poaching. If the stream becomes dewatered or flow in the mainstem Salinas River drops to very low levels (*e.g.*, less than 50 cfs), stranding may occur. A variety of studies suggest that steelhead and salmon migrate upstream at a rate of about 5 to 10 miles per day, although faster rates have been documented (Sandercock 1991, Dettman and Kelly 1986, Bjornn *et al.* 2003, FERC 2000). At a rate of 5 to 10 miles per day, it would take 4 to 8 days for steelhead to migrate the 40 miles from the upper end of the Salinas lagoon to the mouth of the Arroyo Seco River. Additional days would be needed for the adults to ascend the river to its headwaters.

NMFS (2005c) examined the issue of adult passage flows and developed minimum passage flow recommendations based on USGS hydrologic records, the results of Hagar Environmental Science (HES) (1996), and additional fieldwork, data and analysis performed by NMFS during spring 2004. In NMFS (2005c), we adopted a continuous, one-foot minimum depth across at least 10 feet of riffle crest as the minimum passage criteria for critical riffles. Site specific analysis of depth-discharge relations at representative riffles in the vicinity of Soledad, Chualar, and Spreckels indicate that flows of at least 260 cfs, and 150 cfs are needed to facilitate safe and efficient upstream passage of steelhead at Chualar and Spreckels, respectively. NMFS (2005c) recommended that in the absence of further site-specific information, 260 cfs should be regarded as a minimum flow affording efficient upstream passage of adult steelhead in the vicinity of Soledad upstream from the mouth of Arroyo Seco. However, this recommended minimum passage flow for Soledad may be low, given that reaches near Soledad have a wider and lower gradient channel than reaches near Chualar.

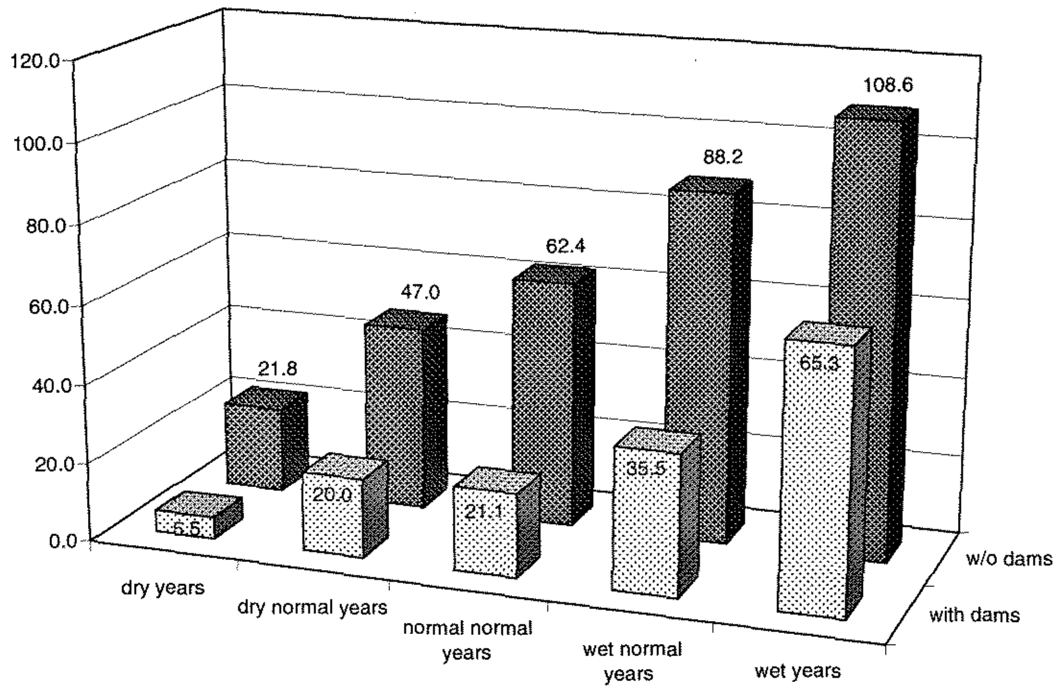

Figure 8. Estimated mean number of adult steelhead passage days (>300cfs) at the Bradley gage both with and without the influence of the Nacimiento and San Antonio dams. Data derived from multiple Salinas Valley Integrated Ground and Surface Model (SVIGSM) runs (WRIME 2000, 2005).

To evaluate the effects of the Nacimiento and San Antonio dams on sustained passage flows, NMFS (2005) examined the number of days that were available for passage using the assumption that flows exceeding the minimum passage threshold were not useful unless they were sustained for at least five consecutive days. This assumption is reasonable for a river prone to episodes of low flow during the middle of the rainy season. Hydrologic data show that flows of at least 200, 300, or 400 cfs are often sustained for weeks in the Salinas River; however, there are also sporadic instances when flows only exceeded passage thresholds for a few days. We reasoned that minimum passage flows are of questionable utility to the fish if it occurs for only 3 or 4 days after which the fish are stranded somewhere in the lower river channel. With five consecutive days of sustained passage flows, adult steelhead have a reasonable chance of reaching the Arroyo Seco River.

Opportunities for upstream migration with sustained passage flows for five or more days declined appreciably in dry years after the Nacimiento and San Antonio dams were constructed (Table 7). Based on USGS gage data at Spreckels, sustained flows of 150 cfs for five or more days declined in dry years from an average of 9 days per season during pre-dam years to less than 2 days after the dams were constructed. The average duration of less than 2 days is a mathematical mean including several years in which there were no passage events lasting for at least five days. The duration of passage days did not decline appreciably at Spreckels after the dams were built during normal or wet years. For example, between January 1 and March 31 of normal years, the median numbers of passage days were 55 and 56 for the pre-dam and post-dam construction periods, respectively. The absence of an extended pre-dam record of stream flows at Soledad and Bradley precludes quantitative analysis of the duration of sustained passage flows in the middle and upper Salinas River. However, modeled hydrographs of baseline and without dams scenarios at Bradley (Figure 8) suggest the dams have caused a significant reduction in passage opportunity in these areas. Comparable modeled hydrographs for the Spreckels reach are consistent with long-term USGS data that suggest the dams have had a minimal effect on upstream passage opportunity in the lower river during winter months, except during dry years.

Table 7. Average number of upstream passage days at Spreckels between January 1 and March 31 before and after construction of the Nacimiento and San Antonio dams. Passage days include only days associated with sustained flows of at least 150 cfs at Spreckels for five or more consecutive days. Data derived from USGS gage records.

Period	Total Years	Water Year-Type	Average Passage Days	Median Passage Days
1930-1956	8	Dry	9	5
1930-1956	15	Normal	53	55
1930-1956	4	Wet	84	86
1970-2003	10	Dry	1.6	0
1970-2003	15	Normal	47	56
1970-2003	9	Wet	76	81

In addition to impairing flows for adult upstream migration, the construction of the Nacimiento and San Antonio dams and their historic operations have appreciably altered stream flows in the mainstem Salinas River during April and May, a critical period in the life history of anadromous steelhead. Spring is the period when many age 1+ and older juvenile steelhead transform into the smolt stage and migrate from tributary rearing habitats to the ocean. The substantial reduction of flows in spring may well be the most significant effect of the existing dams on the steelhead population of the Salinas River (NMFS 2005c). When spring flows are substantially reduced, smolts are unable to migrate from their rearing habitats to the ocean, thus causing a break in the species life cycle.

To evaluate the effects of the dams on spring flows, NMFS (2005c) examined existing data from the USGS stream gage at Spreckels for water year types identified by WRIME (2003). WRIME identified dry, normal, and wet years based on 99 years of record of mean annual flow for the Arroyo Seco River, with wet years representing 0-25% exceedence values; normal years representing 26-75% exceedence values, and dry years representing >75% exceedence values. Records from the USGS gage at Spreckels provide strong evidence that the dams have significantly reduced flows that facilitate downstream migration of steelhead smolts, at least during normal years. The Spreckels gage recorded stream flow for 15 normal years prior to the filling of the Nacimiento Reservoir in 1957 and 11 normal years since completion of the San Antonio Reservoir in 1965. These data show that prior to the dams, in normal years stream flow exceeded 542 cfs during 20% of the time between April 1 and May 15; whereas after both dams were constructed, the 20th percentile exceedence flow was only 193 cfs at this same time of year in normal water years (Figure 9). Likewise, the 30% exceedence flow (*i.e.*, the flow that was exceeded 30% of the time) at Spreckels was reduced from 294 to 81 cfs during normal years between April 1 and May 15.

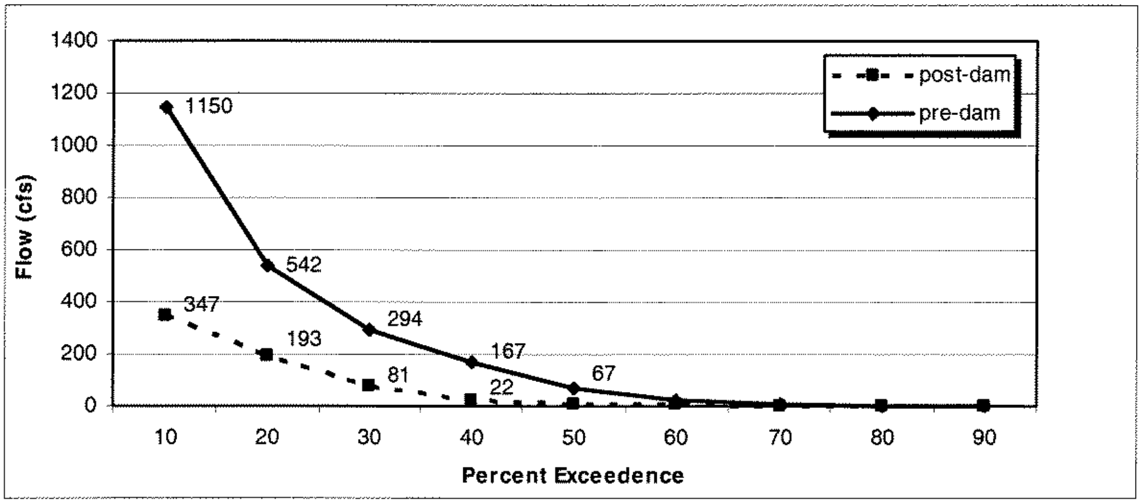

Figure 9. Percent exceedence flows at Spreckels during April 1-May 15 in normal years before and after construction of Nacimiento and San Antonio dams (15 normal pre-dam water years, 11 normal post-dam water years).

Table 8. Number of downstream passage days on the Salinas River at Spreckels between April 1 and May 15 during three historic periods and under two alternative downstream passage flow criteria (minimum average daily flows of 150 and 200 cfs at Spreckels).

Min. Q at Spreckels (cfs)	Period	Water Year-Type	Total Years	Average Passage Days	Median Passage Days
150	1930-1945	Dry	4	0.0	0
150	1930-1945	Normal	9	28.9	30
150	1930-1945	Wet	3	42.3	45
150	1946-1969	Dry	8	1.6	0
150	1946-1969	Normal	11	2.8	0
150	1946-1969	Wet	5	42.6	45
150	1970-2003	Dry	10	0.0	0
150	1970-2003	Normal	15	8.3	3
150	1970-2003	Wet	9	37.2	45
200	1930-1945	Dry	same as	0.0	0
200	1930-1945	Normal	for	25.9	27
200	1930-1945	Wet	150 cfs	41.0	45
200	1946-1969	Dry		1.4	0
200	1946-1969	Normal		2.5	0
200	1946-1969	Wet		41.6	45
200	1970-2003	Dry		0.0	0
200	1970-2003	Normal		6.4	0
200	1970-2003	Wet		34.6	44

The dams appear to have had little effect on the frequency of elevated flows at Spreckels during spring in dry and wet years. For example, the frequency of daily flows of 150 or 200 cfs at Spreckels in April and May were essentially unchanged between the wet years prior to dam construction and those following dam construction (Table 8). Similarly, average daily flows of 150 or 200 cfs were virtually non-existent between April 1 and May 15 during dry years regardless of the presence of the dams.

Table 8 differentiates between years prior to 1945 and later years because flows between April 1 and May 15 were unusually low during the pre-dam period 1946-1956, and they were especially low after the dams were constructed. The reason that spring flows were consistently low from 1946 to 1956 is not known. During that period there was a total of five water years that can be classified as normal; yet in each of those normal years, flows never exceeded 150 cfs at Spreckels during April and May. Four additional years between 1946 and 1956 were classified as dry and only one (1952) was a wet water year. The unexplained reduction in spring flows during normal years may have been due to increased pumping of subterranean flow in the years immediately after World War II.

The effects of the dams on spring flow is even more apparent if one compares the records for only the month of April, the single most important month for the outmigration of salmon and steelhead smolts in California. The 20% exceedence flow at Spreckels for April during the 15 normal water years prior to the Nacimiento Dam was 871 cfs; the 20% exceedence flow for April for the 11 normal years following construction of the two dams was 275 cfs. Furthermore, the gage data show that before the dams were constructed, flow exceeded 469 cfs at Spreckels during 30% of the time in "normal" Aprils; whereas after the dams were constructed, the 30% exceedence flow in normal Aprils has been only 193 cfs. These differences are especially significant given that much of the Salinas River is relatively shallow at flows less than about 200 cfs, and that the mouth of the Salinas can become closed when inflow is less than about 100 to 200 cfs.

There is a paucity of data concerning the effects of the dams on spring flows in upstream reaches of the Salinas River. However, the USGS gage at Bradley provides five years of data for normal years prior to dam construction and 11 years of data recorded after both dams were constructed. These limited data suggest that the two large reservoirs have had little or no effect on elevated stream flows in the vicinity of Bradley during normal years between April 1 and May 15. For example, the 20% exceedence flows for normal years in the pre- and post dam periods were 327 and 280 cfs, respectively. Given that the pre-dam years reflect only five years of data; this difference may not be significant. The reason why April and May flows in the vicinity of Bradley are less affected by the dams may be due to the manner in which the dams are operated. In late March or April, MCWRA begins to release "conservation flows" from the dams for aquifer recharge in the lower valley. Those aquifer conservation flows probably contribute to maintaining relatively high flows at Bradley during spring.

These impacts are expected to continue into the future, except as modified by the proposed action. In addition to impacts on spring flows, the dams have also reduced peak flows during the winter, with additional adverse effects to migration habitat, as described below in the next section.

c. Flood Control

Where peak discharges are greatly reduced, channel aggradation can occur due to the lack of flows with sufficient stream power to scour material supplied by tributaries (Mount 1995). NMFS believes the reduction of peak discharges from operations of the Nacimiento and San Antonio reservoirs has resulted in the aggradation of sediment throughout the lower Salinas River.

Flood control in the Salinas River basin also includes levees and channel maintenance. The use of the Salinas River floodplain for agriculture, coupled with the torrential nature of winter stream flows, has resulted in the construction of an extensive levee system along the lower 24 miles of the Salinas River to prevent flooding of agricultural fields and other properties. Sediment is removed from the channel to maintain the levees and channel capacity. Active clearing of sediment and straightening of the channel has contributed to channel aggradation. Model analysis completed for the lower 24 miles of the river indicates clearing the active channel of sandbars (around which the low flow channel meandered), in order to decrease the elevation of the water surface profile, decreased water velocity and the channel's ability to convey bedload efficiently, also resulting in-channel aggradation (GEG 1998).

As a consequence, fluvial sand dunes have covered the river bed in many areas and disrupted the formation of a low flow channel.[14] During three separate over flights by NMFS staff (September 2001, May 2003, and November 2003), sand dunes were observed and photo documented for several tens of miles. Sand dunes likely exist within the majority of over 100 river miles, from near Spreckels to the Bradley stream gage. Sinuous and arc shaped dunes are attached to both banks of the low-flow channel and the channel lacks a defined route for unimpeded steelhead passage. These observations indicated to NMFS that the dunes likely represent sequential and repetitive fish passage impediments for migratory steelhead. Velocity refuges and resting areas have also likely been lost.

When sediment is removed from the channel for flood control, vegetation is removed as well. Natural vegetation provides areas of refuge from high velocities for upstream migrating fish. During floods, high stream velocities lay down the flexible streamside vegetation into mats that hug the streambank, reducing water velocity along the streambank face (Platts 1984). Riparian vegetation provides cover and protection from predators for both adult and juvenile steelhead. Vegetation also stabilizes sandbars, which provide zones of lowered velocity that benefit steelhead migration.

No systematic study of the riparian vegetation in the Salinas River has been completed since White and Broderick (1992). Currently, willows are present along narrow strips along the river banks and have encroached into the channel due to year-round groundwater recharge releases from Nacimiento and San Antonio reservoirs. A mature canopy is lacking, however, and *Arundo donax* has invaded and degraded areas of the riparian habitat. *Arundo donax* displaces native riparian species resulting in a single species canopy that is highly susceptible to fire, uses three times the amount of water of native riparian vegetation, and lacks the morphology to provide

[14] Prior to flood peak discharge reduction, higher peak flows modified dune crests by incising them and causing the development of a low flow channel through the entire dune field.

shade for instream habitat (Santa Ana Watershed Project Authority [SAWPA] 2002). Although the current distribution of *Arundo donax* has not been mapped within the Salinas River watershed, it appears to be spreading along the lower Salinas River.

The removal of riparian vegetation results in limitations to steelhead migration within the Salinas River. Channel maintenance activities (*e.g.*, vegetation management and removal) administered by MCWRA since 2003 likely harm SCCC DPS steelhead in the Salinas River by delaying or reducing opportunities for upstream migration (NMFS 2003b). Flood control actions, and their impacts on steelhead and their habitat, are expected to continue in the future.

d. Road Crossings and Other Impediments

If the timing and magnitude of flows allow steelhead to migrate upstream through the lower mainstem of the Salinas River, fish must then be able to pass over a number of road crossings and small dams to reach spawning and rearing habitat. Such impediments are located in the Salinas River and its tributaries, including the Thorne Road crossing, Clark Colony Diversion, a gravel mining site near Sweetwater Creek, and three low-water crossings located at Sycamore Flat, Millers Lodge, and Government Camp (ENTRIX and EDAW 2002) in the Arroyo Seco River. In the upper Salinas River, multiple barriers to anadromy from small dams and road crossings also limit distribution. It is unknown if any of these fish passage barriers will be fixed to allow for steelhead migration in the future. NMFS assumes they will not for the purposes of this analysis.

The gravel mining site near Sweetwater Creek was analyzed by NMFS during formal consultation with the Corps in 2005 in response to the gravel operator's application for a Corps permit. During consultation, NMFS estimated previous gravel extraction operations in the Arroyo Seco River have reduced the average number of passage days for adult upstream migration through the mining site in the Arroyo Seco by as much as 60 days. NMFS determined the proposed gravel extraction operations will continue to suppress the Arroyo Seco River steelhead population by restricting passage, maintaining poor rearing habitat, and precluding the development of a properly functioning channel in the vicinity of the mining site. Because the proposed gravel mine was likely to continue the large reduction in passage days, and because of the importance of the Arroyo Seco sub-population to Salinas River steelhead and the S-CCC DPS, NMFS issued a draft jeopardy opinion on July 20, 2005.

e. Lagoon Management

MCWRA utilizes mechanical breaching and the OSR slide gate to prevent flooding after the mouth of the lagoon closes. When the mouth of the lagoon closes, MCWRA opens the slide gate to the OSR. Sending a portion of the lagoon's inflow through the OSR channel slows or eliminates (depending upon inflow) the rise in lagoon water surface level. If lagoon inflow is large enough to raise the lagoon's surface water level even with the OSR slide gate open, MCWRA will mechanically breach the lagoon's bar if flooding is imminent.

MCWRA's management of the lagoon has prevented nearly all natural breaches of the lagoon. Due to the long history (*i.e.*, approximately 100 years) of artificial breaching of the sandbar, natural breaching of the sandbar at the river mouth has not been documented (ENTRIX 2001) although it may have occurred once (ENTRIX 2001, ENTRIX 2002).

MCWRA's mechanical breaching of the lagoon bar and operation of the slide gate at the OSR to prevent flooding affects steelhead migration opportunities from the lagoon to the ocean and vice versa. One likely adverse effect of mechanical breaching is the premature entry of adult steelhead to the river when upstream flows are not available. Conversely mechanical breaching may benefit immigrating and emigrating adult steelhead and smolts under some flow conditions.

2. Spawning and Rearing Habitat

Most spawning and rearing habitat in the Salinas River Basin occurs in tributary streams. In order to spawn and hatch successfully, steelhead need clean gravel substrates, appropriate water flow and quality through the gravels to carry oxygen to their eggs and flush away wastes, and refuge from predators. Rearing steelhead need cool clean water and habitat complexity (pools and riffles) providing food and refuge from predators.

a. Dams

Reservoir storage operations have greatly affected the quality of rearing and spawning habitats for steelhead in the Nacimiento River. The approximately 10-mile segment of the Nacimiento River between the Nacimiento Dam and the river's confluence with the Salinas River remains accessible to steelhead. However, stream flow in this segment is entirely regulated by the dam, with resulting impacts to the quality of steelhead habitat in this segment (ENTRIX 2002). The lower Nacimiento River is characterized by a low gradient and long, wide sections with sparse riparian vegetation. Typical substrate consists of gravel with lesser amounts of sand and cobble (Page *et al.* 1995). Water temperatures in this stream are highly variable and dependent on reservoir releases, air temperature, and reservoir storage. In general, water released through the reservoir outlet is at a relatively constant temperature of 52 degree Fahrenheit (°F) to 54° F (11.1° Celsius (C) to 12.2 ° C). The water warms rapidly as it moves downstream, generally in proportion to fluctuation in daily air temperature. At minimum release levels (25 to 30 cfs), water temperature can increase to as much as 73°F (22.8° C) within 5 miles of the dam, and 75°F (23.9° C) within 10 miles of the dam. During the summer conservation release period (with flows of 300 cfs or more), water temperature is generally maintained at less than 64°F (17.8° C) within 5 miles of the dam, and 68°F (20° C) or less within 10 miles of the dam.

Much of the habitat in the lower Nacimiento River is potentially usable for steelhead. Several potential spawning areas have been documented in the lower river and there are many deep pools. At times, there may be unfavorably warm water temperatures in the lower Nacimiento River, but deep pools may provide thermal refugia for steelhead.

Currently flows in the lower Nacimiento River during traditional steelhead spawning times (January through March) are not representative of naturally occurring (historical) patterns and are affected by flow regulation at the Nacimiento Dam. Releases from Nacimiento Dam, from January through March, have been managed to meet minimum flow requirements of 25 cfs pursuant to a 1985 agreement with CDFG. ENTRIX (2003) developed a model of weighted-usable-area to evaluate aquatic habitat conditions related to steelhead spawning in the lower Nacimiento River (downstream of Nacimiento Dam) and concluded that optimal steelhead spawning conditions occurs at approximately 100 cfs; 80% of maximum weighted-usable-area (*i.e.,* 80% of optimal levels of spawning habitat) is present at 60 cfs. Therefore, historic winter minimum flows for the project have substantially reduced spawning habitat in the lower Nacimiento River. Spring and summer aquifer conservation releases of about 300 to 400 cfs elevate flows to substantially higher than pre-project conditions. Flood control releases from Nacimiento Dam can yield discharges of several thousand cfs.

Water management activities (manipulations of flow regime in unnatural patterns) continue to decrease the quality of the remaining habitat, thereby reducing the likelihood of survival of steelhead in the Nacimiento River. Low flows during the spawning season likely limit the amount of available spawning habitat, and low flows during late winter and spring likely dewater redds leading to increased mortality. High flow releases (300 cfs to 400 cfs) risk disrupting juvenile rearing. Based on existing conditions in the Nacimiento River (lack of boulders and large wood in the stream), the general water velocity ranges for rearing juveniles, and the volume of water released, NMFS expects these flows limit suitable rearing habitat. The velocities associated with these releases limit the ability of juvenile steelhead to use some areas and the volume of water eliminates riffle habitat. Additionally, these high flow releases risk flushing steelhead downstream to the Salinas River, where rearing conditions are worse due to higher temperatures.

Flows in the approximately five-mile segment of the San Antonio River between San Antonio Dam and the Salinas River are similarly affected by flow regulation. Releases from San Antonio Dam, from January through April, range from 3 cfs to several thousand cfs and are managed to meet minimum flow requirements (3 cfs), aquifer conservation releases, and flood control releases. Current flow and temperature parameters in the San Antonio River downstream of San Antonio Reservoir preclude rearing, and spawning gravel is thought to be limited (HES 2001).

NMFS assumes that the dam operations described above will continue into the future, except as modified by the proposed action.

b. Lagoon Management

As described above, several factors are responsible for current habitat conditions in the lagoon including: land reclamation, water diversion, and lagoon management (operation of the OSR, and mechanical sandbar breaching). The establishment of the Nacimiento and San Antonio dams, coupled with the diversion of effluent from the Alisal and Salinas Wastewater Treatment Plants in 1983 and 1989, respectively, has reduced freshwater inflow into the lagoon. Probable environmental changes resulting from these combined events were: (1) the increase of salinity in the lagoon; and (2) lower water levels in the lagoon, especially during the dry season. These combined changes have likely created less suitable conditions for freshwater emergent plant, aquatic invertebrate, fish, and wildlife species, while decreasing habitat suitability for rearing steelhead and increasing the habitat suitability for brackish water flora and fauna in the lagoon. The lack of freshwater inflow into the lower Salinas River may also contribute to increased pesticide concentrations in the lagoon by reducing dilution.

A review of recent breaches (HES 2003, HES 2004, HES, Casagrande and Watson 2003) and other information indicates that periodic breaching has likely caused a number of adverse effects to steelhead and their rearing habitat. These likely effects include: the loss of available freshwater rearing habitat, degradation of water quality in the lagoon, forced entry of juveniles into the ocean, and premature entry of adult steelhead to the river when upstream flows are not available. These adverse effects from breaching have likely been occurring for nearly 100 years.

Previous surveys have failed to document more than one juvenile steelhead rearing in the lagoon going back to 1990 (HES 2001, HES 2003, HES 2004, HES 2005).[15] The following habitat conditions are likely responsible for the absence of large numbers of steelhead in the lagoon. The lagoon has marginal water quality conditions such as: high temperature, transient low DO, and high turbidity (MCWRA 2005b). Limited opportunities exist for juvenile steelhead to enter the lagoon, and habitat has been lost. The lagoon is more turbid than many coastal lagoons (HES 2004). Under existing conditions, NMFS expects few juvenile steelhead to utilize the lagoon for rearing because rearing space and cover are limited, and water quality is poor.

Should steelhead enter the OSR when the slide gate is open, they will find themselves in a trapezoidal drainage ditch with little to no riparian vegetation or other shade or cover. The OSR is five miles long and shallow, with four potential steelhead passage impediments: a gated tidal barrier, two road culverts, and the slide gate between the lagoon and the OSR (ENTRIX 2001). An additional potential passage impediment may be insufficient water depth in portions of the channel during low flow periods (ENTRIX 2001). Any juveniles that enter the OSR are subject to mortality from poor water quality, lack of flow during low tides, and heavy predation pressure.

c. *Agriculture*

The lower Salinas River system, from the lagoon to the Gonzales Road crossing, is listed as impaired on the CWA section 303(d) list for a variety of water quality stressors including pesticides, nutrients, salinity, and sedimentation. Agriculture is listed as the primary potential source of all these contaminants. Many of the agricultural crops in the area receive significant use of organophosphates such as chlorpyrifos and diazinon. The Blanco Drainage Ditch is a constant source of these pollutants to the lagoon and the lower river. It is likely that water quality conditions are causing toxicity to the prey base of steelhead as well as direct effects to steelhead based upon toxicity data (NMFS 2005c).

d. *Fish Planting*

Steelhead/rainbow trout have been planted throughout the Salinas River drainage including the Nacimiento River, Arroyo Seco River, Trout Creek, and Tassajara Creek (Titus *et al.* 2002). Stocking of fish from outside of the DPS continues in the Nacimiento River. The impact of stock transfers increases dramatically if non-native salmonids are planted on top of wild populations for generations (Steward and Bjornn 1990). Out-of-DPS hatchery releases of steelhead and rainbow trout into the Arroyo Seco River watershed occurred in 15 years between

[15] One steelhead (435 millimeters in length) was captured in April 1991 (ENTRIX and EDAW 2002).

1912 and 1993 with some years having multiple release sites in the watershed (Kittleson Environmental Consulting 2003).

NMFS expects out-of-basin planting has likely degraded the genetic integrity of the steelhead fishery in the Salinas River, and non-native fish will continue to compete with native SCCC steelhead in the Nacimiento River. Competition, genetic introgression, and disease transmission resulting from hatchery introductions may significantly impact the production and survival of wild steelhead (NMFS 1996). Competition, which can occur among hatchery and native adults for spawning sites and food, may lead to decreased numbers of wild fish. Introduction of hatchery fish can lead to the displacement of wild fish from their usual microhabitats and shifts in their foraging behavior. Competition can lead to low survival of wild fish (Busby *et al.* 1996). The ability of a wild stock to cope with an introduced disease is reduced if the stock's genetic variability has been reduced through selection or genetic drift (Busby *et al.* 1996).

As described above, the original draft of CDFG's 2000 Fishery Management and Evaluation Plan recommended complete closure of the fishery in the Salinas system to protect steelhead there, but the final regulations did not implement this recommendation, allowing both summer trout angling and winter-run catch-and-release steelhead angling in selected parts of the system (NMFS 2003a). NMFS expects out of basin stocking, and the effects to steelhead and steelhead rearing habitat described above, to continue into the future.

D. Status of Critical Habitat in the Action Area

The following streams in the Salinas watershed have been designated Critical Habitat for SCCC Steelhead: the Salinas River from the mouth upstream to 7.5 miles below Santa Margarita Lake, Arroyo Seco, Nacimiento and San Antonio rivers (below the dams), and upper Salinas River tributaries including San Marcos Creek, Summit Creek, Sheepcamp Creek, Willow Creek, Jack Creek, Paso Robles Creek, Santa Rita Creek, Graves Creek, Atascadero Creek, Tassajera Creek, Santa Margarita Creek, and Trout Creek (70 FR 52488). The historical function of the lagoon likely provided rearing habitat for juvenile steelhead year round (The Habitat Restoration Group *et al.* 1992), and the historical function of the mainstem Salinas River likely provided sufficient migration opportunities for adults and smolts to maintain the Salinas River steelhead sub-populations.

Consistent with the HSA designations described under the Status of the Species and Critical Habitat, Section IV, the Salinas Sub-basin contains 12 HSAs, seven of which are occupied by steelhead. The action area, and/or areas supporting sub-populations influenced by the action area, contains six HSAs: Neponset, Chualar, Soledad, Upper Salinas Valley, Arroyo Seco and Paso Robles. The SCCC DPS CHART rated the Arroyo Seco and Paso Robles as having "high" conservation values while the remaining four HSAs were rated as having "low" conservation values. Migration corridors within these low value HSAs, however, were given high conservation value ratings because steelhead must migrate through these areas to reach the high value HSAs.

A multitude of anthropogenic activities have diminished the functional value of critical habitat PCEs in the action area for the SCCC steelhead DPS, as described above. The existing proportions of each habitat type (spawning, rearing, migration, and estuarine) within the action area are shown in Table 9 with indications of habitat quality as described by the NMFS CHART. This degradation has prevented designated critical habitat within the action area from functioning properly (*e.g.*, inadequate flows, increased water temperatures, degraded habitat, lack of access to suitable habitat and degraded lagoon rearing habitat). We conclude that this degradation is primarily responsible for the concurrent decline in steelhead abundance and viability in the basin.

Table 9. The number of stream miles containing each PCE within the action area, rated as good, fair, poor, and unknown by the CHART for the redesignation of Critical Habitat (NMFS 2005b).

Area	PCE	Good	Fair	Poor	Unknown	Total Miles
Arroyo Seco River[16]	Migration	0.0	0.0	12.5	0.0	12.5
	Sub-total					12.5
San Antonio River	Spawning	0.0	0.0	8.3	0.0	8.3
	Rearing	0.0	0.0	8.3	0.0	8.3
	Migration	0.0	0.0	8.3	0.0	8.3
	Sub-total					8.3
Nacimiento River	Spawning	12.3	0.0	0.0	0.0	12.3
	Rearing	0.0	0.0	12.3	0.0	12.3
	Migration	12.3	0.0	0.0	0.0	12.3
	Sub-total					12.3
Mainstem Salinas River	Rearing	0.0	0.0	6.6	0.0	6.6
	Migration	0.0	0.0	107.2	0.0	107.2
	Estuarine	0.0	0.0	6.6	0.0	6.6
	Sub-total					107.2
Entire Action Area	Spawning	12.3	0.0	8.3	0.0	20.6
	Rearing	0.0	0.0	27.2	0.0	27.2
	Migration	12.3	0.0	128.0	0.0	140.3
	Estuarine	0.0	0.0	6.6	0.0	6.6
	Total					140.3

The migration PCE has experienced substantial impairment in terms of its ability to support mobility and subsequent survival of both smolts and adults. As described above, this is mostly the result of intensive water use in the Salinas Valley, which has resulted in alteration of the river's hydraulic system, including the construction and operation of three major dams. The impairment of this PCE is likely to persist through the foreseeable future unless impacts from land and water use in the Salinas River valley are reduced. Similarly the status of estuarine, spawning, and rearing PCEs are also unlikely to change without reductions in impacts from land and water uses.

E. Historical Condition of Salinas River Steelhead Populations

The action area is used by three sub-populations of SCCC steelhead (the Upper Salinas, Nacimiento/San Antonio, and the Arroyo Seco) primarily for migration to and from spawning

[16] Much of the Arroyo Seco River habitat is not reflected in this table because it is outside the action area. Refer to Table 10 to see the overall proportion of Arroyo Seco River habitat relative to the Salinas basin.

and rearing habitat in other portions of the watershed.[17] Although these sub-populations primarily reside outside the action area, they are discussed here because their survival and recovery are partially dependent on migratory conditions within the action area, which may be subject to the effects of the proposed action.

While there are numerous early observations of steelhead (and Chinook salmon) in the watershed (Franklin, 2005, Titus *et al.* 2002), none attempted to quantify populations. One of the first biological surveys of steelhead in the basin was an assessment of the fish community of tributaries to Monterey Bay. In this report referring to steelhead abundance in the Salinas River circa 1909, Snyder (1913) states: "At high water they [steelhead] are said to enter all the streams in large numbers." Historically, Salinas River steelhead were distributed throughout the headwaters of the upper basin, the major tributaries draining the western side of the basin (*i.e.,* the east side of the Coast Range), and in Gabilan Creek (Titus *et al.* 2002). The three principal producers of steelhead were likely the Nacimiento, San Antonio, and Arroyo Seco rivers because they contained some of the best spawning and rearing habitats in the watershed (Snyder 1913, Titus *et al.* 2002, Good *et al.* 2005). Dettman (1988) estimated that the Arroyo Seco River had the potential to support a run of a few thousand spawners. The NMFS Updated Status Review characterized the upper Salinas River as having had a "small" population historically (Good *et al.* 2005). NMFS (2005b) has estimated about 435 miles of spawning and rearing habitat was present in the Salinas River watershed in the early 1900s. The Nacimiento, San Antonio, upper and mainstem Salinas Rivers, and the lagoon likely provided sufficient spawning and rearing habitat, sufficient migration opportunities for adults and smolts, and year around rearing habitat to maintain a viable steelhead population in the Salinas basin.

F. Current Status of the Salinas River Steelhead Population

The progression of impacts to steelhead habitat, including critical habitat, in the basin has been accompanied by a progressive decline in steelhead abundance. The specifics of the steelhead decline have not been well documented, but a few point estimates exist. These estimates, found in Dettman (1988), are as follows: 1) a U.S. Fish and Wildlife Service catch estimate of 3,600 adults in 1946, 2) a U.S. Fish and Wildlife Service average run size estimate of 900 fish in 1951, and 3) a Kelley and Dettman estimate of less than 500 adults as of 1983.

The last 25 years of the retrospective and the entire prospective account of the Salinas population essentially shows an anadromous population that is failing to reproduce itself due to low survivorship in multiple life-stages. The only reason for its continued persistence may be the continued input of new adults from both resident fish and straying from other watersheds.

NMFS concludes the Salinas River run of steelhead has declined to an adult abundance averaging less than 50 fish (EDAW 2001). This remnant population faces a host of risks intrinsic to the low abundance of each sub-population. Small populations are generally at greater risk of extinction because as their numbers vary in response to environmental changes, the population can dip to critically low numbers more easily than larger populations (Gilpin and Soule 1986, Pimm *et al.* 1988). Small populations also tend to be highly vulnerable to naturally-

[17] Some spawning and rearing habitat occurs below Nacimiento Dam, and additional rearing habitat occurs in the Salinas Lagoon.

occurring random extinctions (Boughton and Fish 2003). All else being equal, small populations are at a greater risk of extinction than large populations primarily because several processes that affect population dynamics operate differently in small populations than they do in large populations. Some of these processes are deterministic density effects, environmental variation, genetic processes, demographic stochasticity, and ecological feedback (McElhany *et al.* 2000).

A discussion of the three sub-populations is presented below, beginning with the Upper Salinas sub-population.

1. Upper Salinas Sub-population

The Upper Salinas population has the longest migration route of the DPS and is located in the driest portion of the occupied DPS. NMFS infers from the following evidence that an anadromous run of *O. mykiss* still exists in extremely low numbers in the upper Salinas watershed.

Abundant historical observations of adult steelhead in most of the perennial tributaries have been documented by Franklin (2005). The earliest observations date back to 1890, with most occurring in the 1930s and 1940s. In addition, Titus *et al.* (2002) cites several surveys documenting steelhead presence in the 1950s.

In addition to evidence of historic presence, over 20 separate observations of adult steelhead throughout the area since 1993 have provided evidence for a continued presence of an anadromous population (Ashley 1999, Highland 1999, Franklin 2005) (Figure 10). The presence of steelhead has also been independently confirmed by CDFG staff who concur that anadromous reproduction of steelhead does occur when flow conditions permit successful migration of adults to the area, although CDFG estimates these conditions are limited to only a few times per decade (J. Nelsen (2006) and D. Highland (2005), CDFG, personal communication). Observation by NMFS staff confirm that limited spawning and rearing conditions still exist at least in Paso Robles Creek and its tributaries, which would allow for some degree of reproductive success.

Resident *O. mykiss* also exist in the Upper Salinas and co-occur with steelhead in many areas of the upper watershed. It is likely that these non-anadromous fish play an important role in the population dynamics and evolutionary potential of the anadromous population (NMFS 2004). The contribution of resident *O. mykiss* to the ephemeral anadromous population via polymorphism[18] provides a plausible explanation for the apparent persistence of an anadromous population (NMFS 2004). Straying from other sub-populations may also help explain the persistence of the anadromous population, but the decline in source populations and habitat fragmentation has increasingly isolated the Upper Salinas sub-population.

[18] Polymorphism is the expression of alternative life histories within a population. In this case, parents of resident origin can give rise to both anadromous and resident phenotypes (NMFS 2004).

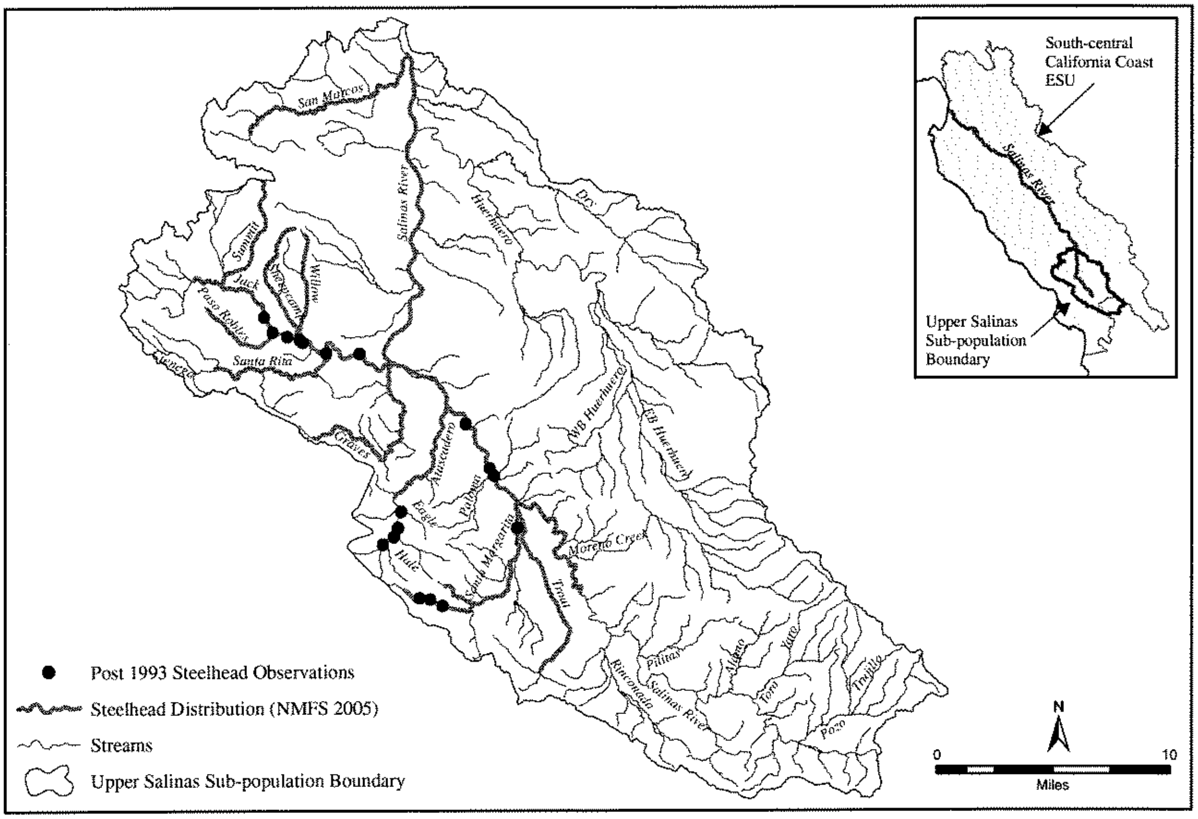

Figure 10. Observations of adult steelhead within the range of the Upper Salinas sub-population of SCCC steelhead since 1993 (NMFS 2005b).

The existing condition of this steelhead sub-population is poor. NMFS' assessment of population viability is based on our evaluation of a comprehensive database of all fisheries related observations (CEMAR, NMFS databases), interviews with CDFG staff (J. Nelsen and D. Highland), and review of various other sources as indicated. As with most sub-populations in the SCCC DPS, abundance in the Upper Salinas at all life stages is low relative to historic conditions. The introduction of serious threats (described below) and associated habitat degradation, has most likely substantially reduced its abundance.

Population growth rate is a measure of a population's reproductive performance (*i.e.*, its ability to replace itself). NMFS' assessment of the population growth rate is that it declined sharply after installation of the three major dams, and the anadromous population has been failing to replace itself since that time. This is evidenced by extremely low abundance and the presence of habitat conditions that make successful completion of the species' life cycle at replacement values unlikely. CDFG staff concurs with NMFS' determination that the anadromous population has been failing to replace itself (J. Nelsen, CDFG, personal communication, 2006). The record of observations (*e.g.*, CEMAR, NMFS databases) also indicates a corresponding decline in the frequency of observations.

The spatial distribution of spawning and rearing within the geographic range of the Upper Salinas sub-population is very limited and fragmented relative to its historic condition. This is primarily due to widespread loss of surface water in summer months which limits rearing, outmigration, and to some extent successful spawning. Multiple barriers to anadromy from small dams and road crossings also limit distribution. The Salinas Dam is responsible for the largest reduction in anadromous habitat of any of the barriers within the range of the Upper Salinas sub-population.

Genetic variability represents the reservoir upon which future evolutionary potential of the population depends (Busby *et al.* 1996). While NMFS has no direct evidence of genetic diversity for this sub-population, significant changes in environmental conditions have likely constrained the diversity of life history traits this population must have previously possessed. For example, favorable conditions necessary for early season migration may have been largely eliminated by retaining early storm flows behind the three major dams. This reduces the reproductive success of adults possessing the trait for early run timing and is thereby likely to reduce the frequency of alleles responsible for this trait in the population. This erosion of behavioral and genetic diversity has in turn the potential to limit the ability of the population to cope with future environmental challenges (Reiman *et al.* 1993). For example, if early migration traits are lost, the population will be reduced in years when climate conditions (early rains) favor fish that arrive early. Similar erosion of traits are also likely applicable to smolt outmigration, and lagoon rearing as well. In general, increased inbreeding will lead to reductions in average reproductive fitness, and is inevitable in small populations (Brook *et al.* 2002).

The most severe habitat-based threats are flow related passage conditions, and reduction in summer base flows. Flow related passage refers to the ability of adults to successfully migrate the 117 river miles to the upper Salinas and the ability of smolts to successfully outmigrate. The magnitude, frequency, duration, and timing of flow releases from the three major dams, on top of a semi-arid river system possessing chronically depleted aquifers, have affected adult and smolt migration. Reduction in summer base flows has resulted in the loss of up to two thirds of the historic rearing habitat for Upper Salinas steelhead (J. Nelsen, CDFG, personal communication, 2006).

Additional threats associated with the extremely low population size are also likely to affect the persistence of the Upper Salinas sub-population, including the loss of productivity, known as depensatory density-dependent effects, and loss of behavioral and genetic diversity. Depensatory processes at low population abundance result in high extinction risks for very small populations because any decline in abundance further reduces a population's average productivity, resulting in a spiraling slide toward extinction (McElhany *et al.* 2000). This process is likely a factor given the extremely low abundance of this sub-population. The loss of genetic diversity in small populations has already been discussed.

The primary threats to the Upper Salinas steelhead sub-population are the limited migration opportunities from the existing flow regime in the mainstem channel and the reduced rearing habitat from reduced summer base flows associated with groundwater pumping and surface water diversions. These threats are manifested in low overall abundance, negative trends in population growth, reduced and fragmented distribution, and erosion of genetic and ecological diversity. The severity of the threats and the poor ratings for all four population viability criteria make the overall extinction risk for the Upper Salinas steelhead sub-population very high.

2. Nacimiento/San Antonio Sub-population

The Nacimiento River is one of three main anadromous tributaries to the Salinas River. The confluence of the Salinas and Nacimiento rivers is approximately 110 miles upstream from the mouth of the Salinas River. The current steelhead population in the Nacimiento River is likely at very low abundance. A redd survey conducted on February 26, 2003, between river mile 0 and approximately river mile 7 resulted in zero redds observed. The three miles of river closest to the dam were not surveyed. This un-surveyed area is thought to have the best spawning and rearing habitat (see below). Based on sightings in 1998 (Hill 2003, ENTRIX, and EDAW 2002) and an unconfirmed sighting in 2001 (TN & Associates, Inc. 2004), steelhead are believed present within the Nacimiento River during years with high winter flow events in the Salinas River.

Nacimiento River steelhead have been affected by the damming of the Nacimiento River, water release methods and schedules from Nacimiento Reservoir, groundwater pumping and other water diversions, limited migration opportunities in the Salinas River, and fish stocking managed by the CDFG.

Most of the Nacimiento River downstream of the dam is degraded from conditions that support robust steelhead populations. One area of the Nacimiento River continues to contain aquatic habitat in relatively good condition for steelhead. Reconnaissance level habitat surveys conducted immediately downstream of the Dam in spring 2000 documented the presence of steelhead spawning and rearing habitat with good cover, relatively cool water temperatures and dense riparian vegetation, and less fine sediments than found downstream. Even with these relatively better habitat conditions, habitat value for steelhead in this area is heavily influenced by flow levels and quality of water released from the reservoir (EDAW 2001).

The San Antonio River was one of the three most important spawning and rearing tributaries for Salinas River steelhead (Titus *et al.* 2002). The confluence of the Salinas and San Antonio rivers is approximately 107 miles upstream from the mouth of the Salinas River. Following construction of the San Antonio Dam, the pattern of flow releases from the dam was not predicted to provide perennial flow conditions in the lowermost San Antonio river, and CDFG decided against developing a fishery downstream from the dam (Titus *et al.* 2002). Although the availability of steelhead spawning and rearing habitat was limited in the lower San Antonio River even before dam construction, CDFG still identified steelhead as inhabitants of the San Antonio River below the reservoir as of 1981 (Titus *et al.* 2002). Presumably, it was assumed that steelhead still entered the lower river from the Salinas River when runoff was sufficient to provide a continuous migration corridor. However, lack of access to historic spawning and rearing habitats in the perennial headwaters greatly limits steelhead use of the San Antonio River (Titus *et al.* 2002). Currently, hydrologic conditions downstream of San Antonio Dam and other habitat conditions do not favor steelhead (ENTRIX and EDAW 2002). NMFS staff walked the lower San Antonio River in August 2004, and noted riparian vegetation, gravels, and shading that could likely provide suitable spawning and rearing habitat. Nonetheless, surveys of the lower San Antonio River completed after the placement of San Antonio Dam show steelhead use is low.

Currently, flows in the lower San Antonio River are affected by regulated discharges from San Antonio Dam and do not represent naturally occurring flow patterns during traditional steelhead spawning times. Releases from San Antonio Dam from January through April range from 3 cfs to several thousand cfs and are managed to meet minimum flow requirements, "aquifer conservation" releases, and flood control releases.

Given the devastating effects of the Nacimiento and San Antonio dams on access to habitat, the ongoing artificial flow patterns and the resulting crash in steelhead abundance, we conclude that this sub-population faces a high risk of extinction.

3. Arroyo Seco River Sub-population

The mouth of Arroyo Seco River is located approximately 45 miles upstream from the Salinas River mouth. One of the first known records of steelhead in the Arroyo Seco was documented by Snyder (1913). According to Snyder (1913) "[t]he dead bodies of large steelheads (sic) were occasionally seen in Uvas, *Arroyo Seco* (emphasis added), and Nacimiento creeks." Snyder documented steelhead in the Arroyo Seco at three of four survey stations; two, four, and six miles above the Arroyo Seco's confluence with the Salinas River. Steelhead were not documented at the survey station located one mile above the Arroyo Seco/Salinas River confluence. Historically, steelhead likely accessed all of the Arroyo Seco and its tributaries below permanent migration barriers (Best 1954, Johnson 1978, Recknagel 1979, Titus *et al.* 2002).

Steelhead and steelhead habitat in the Arroyo Seco River are adversely affected by Salinas River flows, conditions in the lower Arroyo Seco River, road crossings, and previous gravel mining activities. These factors hinder and prevent steelhead from reaching spawning and rearing habitat in the Arroyo Seco River and in some cases contribute to spawning and rearing habitat degradation. Halligan (2000) states the primary limiting factors for rearing steelhead appear to be high temperatures, the abundance of non-native predatory fish, and the intermittent nature of adequate migration flows in the lower Arroyo Seco River and Salinas River.

Because the Arroyo Seco River and its tributaries likely support the largest remnant sub-population of Salinas River steelhead, and given the threats they currently face, we conclude the sub-population's risk of extinction is fairly high; this risk is less than that faced by populations upstream because the Arroyo Seco retains a high proportion of usable habitat.

G. Importance of Sub-populations and Habitat in the Action Area

Identifying sub-populations within the SCCC serves to identify significant biological resources or diversity elements within the population which may represent important conservation components within the DPS. Steelhead sub-populations of the Salinas basin play a significant role in the survival of the SCCC steelhead DPS because these sub-populations: (1) represent a large distributional component of the overall range of the DPS, (2) inhabit ecologically distinct areas unique to the DPS, and (3) exhibit unique life history traits. The loss of sub-populations from an already diminished DPS can have profound implications for its persistence (Bjorkstedt *et al.* 2005).

Based on its current condition and the loss of spawning habitat in the Nacimiento and San Antonio rivers, the Arroyo Seco River is the most important remaining steelhead habitat in the Salinas River watershed. The largest un-dammed tributary with steelhead habitat in the Salinas River watershed, the Arroyo Seco River is also the closest Salinas River tributary to the Pacific Ocean with suitable spawning and rearing habitat. The relatively close proximity of the Arroyo Seco River to the ocean is likely the primary reason the anadromous form of *O. mykiss* persists in the Salinas River watershed. The Arroyo Seco River also contains the majority of spawning habitat in the basin and half of the rearing habitat (Table 10). Anthropogenic manipulation of water flow in the Salinas River watershed has made successful migration into and out of the upper tributaries more difficult than migration opportunities to and from the Arroyo Seco River.

Table 10. Number of stream miles of designated critical habitat PCEs within the range of several sub-populations of SCCC steelhead in the Salinas basin. These data show the relative importance of the Arroyo Seco River in supporting steelhead in the Salinas River.

Sub-Population	Spawning	Rearing	Migration
Arroyo Seco	68.5	68.5	84.6
San Antonio/ Nacimiento	20.6	20.6	20.6
Upper Salinas	21.1	40.2	48.1
Lower Salinas	2.4	9.0	149.1

The complete loss of spawning and rearing habitat due to dams and the inaccessibility to spawning and rearing areas in the upper portions of the watershed during most years has increased the relative importance of remaining high quality habitats for SCCC steelhead in the watershed. The infrequent nature of flow events sufficient for migration to the upper portions of the Salinas River watershed, coupled with the distance adults must travel to reach them and smolts must travel to reach the ocean, has made the long-term persistence of steelhead in the river's upper tributaries tenuous. The conservation of steelhead habitats in the Arroyo Seco River watershed is critical for the persistence of this species in the Salinas River.

Based on watershed size, location, ecological context, and overall status of SCCC steelhead, the Salinas River has the potential (if it were to support a viable steelhead population) to prevent fragmentation in the distribution of SCCC steelhead, contribute to the genetic diversity of the species, and ameliorate the overall extinction risk of the DPS.

VI. EFFECTS OF THE PROPOSED ACTION

In this section, we analyze the direct and indirect effects of the proposed action, and the interdependent and interrelated actions, on threatened SCCC steelhead and its designated critical habitat. We approach the effects analysis by prioritizing effects, giving most attention to those having the greatest potential consequences to steelhead and their habitat. For the more substantial effects, we identify which PCE of critical habitat will likely be affected, and how the PCE will be affected given its baseline condition. For this project, the effects of flows on migration habitat received our highest priority. We quantified these effects using a flow model called the Salinas Valley Integrated Ground and Surface Model (SVIGSM) developed for MCWRA (WRIME 2003). Once this was done, we overlaid the effects on habitat on top of the biological requirements of steelhead and information about steelhead population abundance and distribution of individuals to determine the extent to which individuals are exposed to the changes in critical habitat and what their response is expected to be to such changes.

We have categorized effects into those related to instream flows and those concerned with construction and maintenance-related effects. Because flow-related effects are the most significant due to their long-term consequences, we identify which PCE of critical habitat will be affected, how the PCEs are likely to be affected given their baseline conditions, and how those changes affect the conservation value of critical habitat in the action area. In the Integration and Synthesis, we then address effects at the larger scale of sub-populations and critical habitat within the Salinas basin given baseline conditions. Finally, we judge the effect of population and critical habitat changes at the basin scale on the DPS scale for the species and critical habitat.

It is important to note that NMFS analyzed changes in stream flows based on the maximum proposed diversion rate at the SRDF of 85 cfs. The SRDF is designed to divert water at up to 135 cfs. Diversions above 85 cfs may require reinitiation of consultation if they would result in changes to the effects on SCCC steelhead analyzed and described below.

A. Flow-Related Effects

1. Adult Migration

To assess the flow related effects of the project on adult steelhead migration, it is important to first establish what flows are needed to facilitate that migration. This is not simply a matter of identifying the minimum flows at which steelhead are able to pass upstream. It is also necessary to consider how often and for what duration these passage flow events must be present to facilitate successful annual migrations of the species. For example, we know that adult steelhead historically migrated upstream during winter and early spring. However, even before agricultural development in the Salinas Valley and construction of the major dams, steelhead were probably not able to migrate during the lowest flows of winter. Indeed, during dry years, opportunities for upstream passage were probably of limited duration. Thus, at least three questions need to be answered to address the question of properly functioning conditions for adult migrations in the Salinas River. Firstly, what are the flows at which fish are able to successfully and efficiently move upstream? Secondly, how often do those "passage flows" need to be present to sustain a viable steelhead population? Lastly, it is important to know when those "passage flows" occur with respect to other hydrologic events in the watershed (*e.g.*, what is the relationship of passage flows in the mainstem with rainfall-runoff events in key tributaries). For this analysis, we defined properly functioning condition of adult migration corridors primarily as stream flow supporting depths and velocities conducive to upstream passage in shallow riffles at a frequency and duration comparable to years prior to the construction of the dams when steelhead runs were substantial in the Salinas River.

As described in the environmental baseline (Section V.C.2), NMFS (2005c) examined the issue of adult passage flows and determined that at least 260 cfs and 150 cfs are needed to facilitate safe and efficient upstream passage of steelhead at Chualar and Spreckels, respectively. NMFS (2005c) recommended that in the absence of further site-specific information, 260 cfs should be regarded as a minimum flow affording efficient upstream passage of adult steelhead in the vicinity of Soledad upstream from the mouth of Arroyo Seco. However, this recommended minimum passage flow for Soledad may be low, given that reaches near Soledad have a wider and lower gradient channel than reaches near Chualar.

To address the issues of how often and for what duration flows need to exceed these minimum passage thresholds in order to support good passage conditions, we considered both the rate at which adult steelhead migrate upriver as well as the amount of time that flows exceeded those levels during periods when steelhead were relatively abundant in the Salinas River.

As described in the environmental baseline (Section V.C.1.b), studies indicate that steelhead and salmon migrate upstream at a rate of about 5 to 10 miles per day, although faster rates have been documented. At a rate of 5 to 10 miles per day, steelhead would take four to eight days to migrate the 40 miles from the upper end of the Salinas lagoon to the mouth of the Arroyo Seco River. At this rate of migration, adult steelhead would need eight to 16 days of flow conducive for passage for them to traverse 80 miles to the mouth of the Nacimiento River.

In an effort to quantify historic passage opportunity, assess proper functioning conditions, and conserve the adult migration PCE of critical habitat, we have discounted the value of stream flow events in which upstream passage thresholds are exceeded for brief, isolated events. Given the estimated rate of upstream movement of 5 to10 miles per day and the location of the mouth of the Arroyo Seco at Rivermile 46, we reasoned that events in which upstream passage thresholds are met for less than five days would very likely result in the stranding of adult fish in the lower river. Fish trapped in the lower river would be subjected to the potentially higher water temperatures in the lower river and losses due to predation and poaching. We recognize that some survival and successful reproduction may be had by fishes entering the river during brief (< 5 day) events when flows are conducive to passage; however, our analysis of upstream passage opportunity has centered on assessing the frequency of and promoting the conservation of flows that are more likely to facilitate successful migrations to the Arroyo Seco and other upstream tributaries. With five consecutive days of sustained passage flows, events that routinely happen during most winters, adult steelhead have a reasonable chance of reaching the spawning and rearing habitat of the Arroyo Seco River.

Thus for this analysis, we consider properly functioning conditions for the adult upstream migration corridor (*i.e.*, a PCE of critical habitat) to be the occurrence of flows conducive to upstream passage for a seasonal cumulative duration consistent with that present prior to the construction of Nacimiento and San Antonio dams, with the assumption that effective passage days must be associated with passage flows sustained for at least five consecutive days for the Aroyo Seco subpopulation. Table 7 in the environmental baseline section shows the estimated number of passage days that occurred at Spreckels during normal years prior to the construction of the dams. We have not stipulated a minimum duration of passage flows for fishes to reach the upper Salinas River (*e.g.*, upstream from Bradley), because we assume that migrating fish can reach the upper Salinas by migrating during multiple high flow events and holding in deeper areas when flows are not conducive to passage over shallow riffles. We doubt these deeper areas provide high quality holding habitat; cover for fish is sparse in this area of the Salinas River.

The persistence of steelhead in the upper Salinas River indicates that some holding areas of adequate quality are likely to exist upstream of Bradley during some years.

With the construction and operation of the SVWP, MCWRA will increase flow releases from Nacimiento Dam during the period April 1 through October 31 as part of its annual release schedule. This will be done primarily for the purpose of providing more water for surface diversions and secondarily to promote increased aquifer recharge during the peak of the agricultural irrigation season in the Salinas Valley. An integral part of this plan is to reduce reservoir releases during the period November through March by an average of 42,300AF per year (EDAW 2001).

The draft biological opinion for this project attempted to examine the effects of increased water storage during winter months using MCWRA's Salinas Valley Integrated Groundwater and Surface water Model (SVIGSM). However, in discussions on the draft opinion, NMFS and MCWRA agreed that this model was too imprecise to quantify subtle changes in surface flow relations in the vicinity of the Arroyo Seco cone and surface flow changes associated with planned flow augmentation to promote steelhead passage. In addition, in that earlier analysis, NMFS had analyzed erroneous model output for contrasting flow scenarios in the Arroyo Seco River. That earlier model analysis also erroneously assumed that flows would be augmented for adult passage in December and January. For these reasons, we have revised the analysis of project effects on passage opportunity for adult steelhead. Our revised analysis does not rely on SVIGSM, but rather depends on USGS stream gage records and focuses largely on potential impacts of additional storage in Nacimiento Reservoir during the months of December and January.

The Project's plan to increase the storage capacity of the Nacimiento Dam, increase water storage in Nacimiento Reservoir during winter months, and augment flow in the Salinas River during spring and summer will probably affect adult steelhead migration because it will diminish stream flows during the winter period when adult steelhead are migrating upstream. In its *SVWP Flow Prescription for Steelhead Trout in the Salinas River*, MCWRA proposes to mitigate project effects on passage flows for adult migrating steelhead by ensuring that, during normal water years, the total number of passage days for adult steelhead in the lower mainstem (*i.e.*, at Chualar) will be unchanged from that which historically occurred between January 1 through March 31 prior to construction of the Nacimiento Dam. NMFS agreed that the SVWP project would have little effect on adult steelhead passage opportunity during dry and wet water years. To maintain the historic number of adult passage days in the lower river during normal years, MCWRA proposes to augment flow during natural runoff events with releases, as needed, from Nacimiento Reservoir. The plan calls for meeting discrete numbers of adult upstream passage days for dry-normal, normal-normal, and wet-normal water years (see Description of Proposed Action, Section III.2.C). MCWRA's objective for the flow prescription for adult passage flows is to ensure that opportunities for adult upstream passage are not diminished from either preproject or predam levels. However, MCWRA proposes to only supplement flows for upstream passage during the months of February and March. Adult migrations in April would be benefited by the additional release of flows to facilitate the downstream migration of smolts (see Smolt Outmigration discussion below). Water releases for smolt outmigration, which would occur in response to flow triggers between March 15 and May 31, would also promote safe downstream passage of reproductively spent fish (kelts), and thus potentially increase the number of repeat spawners within the population.

Releases will not be made to augment the number of adult upstream passage days during December and January. The increased storage capacity of Nacimiento Dam poses some risk to passage opportunity for adult steelhead in December and January. This increased capacity will alter the flood rule curve for operations at Nacimiento Dam and potentially allow increased water storage in the reservoir during December and January in years when the reservoir was not extensively drawn down during the previous year. Reduced reservoir releases during December and January have the potential to diminish flow in the mainstem Salinas during those months, and it may possibly reduce flow in the lowermost reach of the Arroyo Seco. We believe that surface flow may be affected in the downstream most reach of the Arroyo Seco River because the area in the vicinity of the confluence of the Salinas River and the Arroyo Seco River is a geologic feature with unusually high, natural infiltration rates. Known as the Arroyo Seco cone, this area encompasses the alluvial fan of the Arroyo Seco River. For surface flows in the lower Arroyo Seco River to remain connected to the Salinas mainstem, it is necessary for large volumes of water to pass over and infiltrate the alluvial fan, thereby augmenting subsurface flow. Stream flow data from the USGS gages on the Arroyo Seco at Reliz and at "the Arroyo Seco near Soledad" show that surface flows early in the season are often much higher at the more upstream station than at the lower station at Reliz. This illustrates the substantial percolation of water needed to rewet the subsurface channel in the lower Arroyo Seco River. The anticipated reduced volume of water to be released from the Nacimiento Dam during early winter has the potential to decrease surface flows in the Salinas River, and therefore it may decrease the total flow available to charge the highly porous aquifer in the Arroyo Seco cone during December and January. The extent to which flow reductions in the Salinas mainstem would affect surface flow in the lowermost reach of the Arroyo Seco River in December and January is not known, and it cannot be reliably quantified using existing USGS gage data or existing tools such as the existing ground-surface water model developed for the Salinas River (*i.e.*, SVIGSM). However, given that surface flow in the lower Arroyo Seco River and much of the subterranean flow underlying the lower Arroyo Seco River is likely derived from inflow from the unregulated Arroyo Seco River watershed, flow reductions in the upper Salinas would probably have relatively limited effects on surface flows in the lower Arroyo Seco River. Therefore, we assume that the changes in operations at the Nacimiento Dam would have only minor effects on passage opportunity in the lower Arroyo Seco River during December and January. However, there is some uncertainty concerning this assumption, and therefore we believe that this issue warrants follow-up monitoring to confirm this assumption.

Any reduction in adult passage opportunity in December and January would affect a substantial temporal component of the steelhead run. Although the exact timing of adult upstream migration in the Salinas River is not known, data from other Central California coastal streams indicate that adult steelhead in this area migrate upstream primarily from December through April (Figure 11).

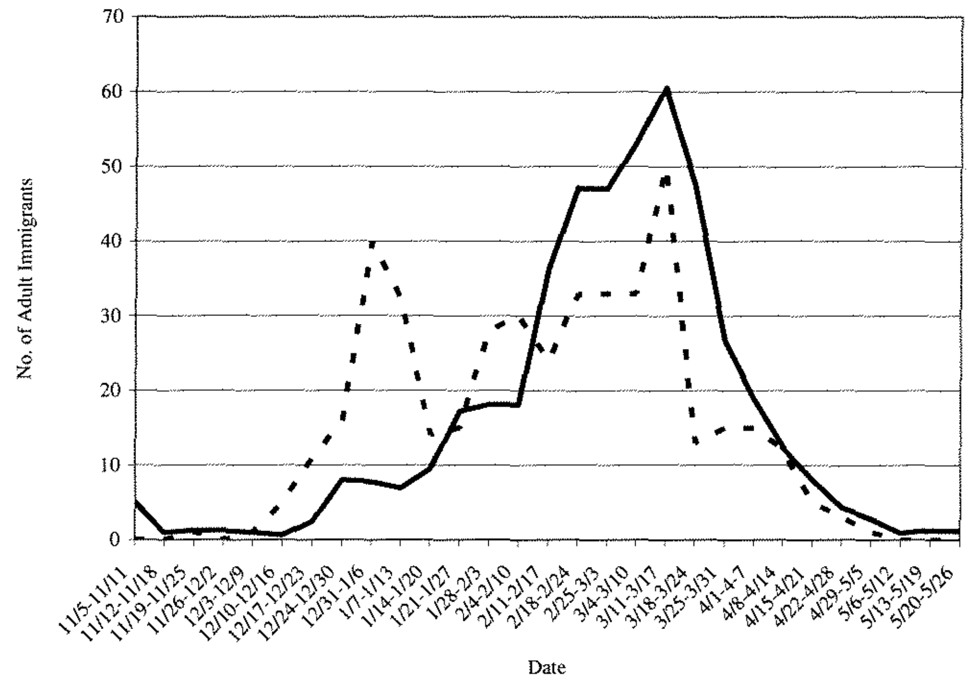

Figure 11. Timing of immigrating adult steelhead in Waddell Creek, Santa Cruz County (1933-1942; dashed line) and the Carmel River, Monterey County (1992-2005; solid line). Source: Waddell Creek information: Shapovalov and Taft (1954) and Carmel River information: Dave Dettman, Monterey Peninsula Water Management District, unpublished data.

The greatest effect of increased storage in Nacimiento Reservoir on flows in the mainstem Salinas would occur in the segment immediately downstream from the mouth of the Nacimiento River. Tributary inflow would attenuate the effects of Nacimiento Reservoir storage in more downstream segments, especially those below the confluence of the relatively large Arroyo Seco River.

NMFS analyzed the effects of additional project storage in December and January on adult passage opportunity using existing USGS data to develop a worst case scenario. This worst case scenario assumes that the new project operations will enable storage of 100% of all Nacimiento River flows except for a continuous 60 cfs minimum bypass flow at the Nacimiento Dam. To contrast this scenario with existing conditions, we compared historic flow records for the USGS gages at Bradley and the USGS Salinas gage at Soledad with simulated daily flows at these gages assuming that the contribution from the Nacimiento River were held to a constant 60 cfs. For example, flow at Bradley under this maximum storage scenario was calculated as:

(daily flow @ USGS Bradley gage) — (daily flow @ USGS gage below Nac. Dam) + 60cfs

Our assessment of worst case effects from maximal storage at Nacimiento Reservoir during December and January required us to assume a minimum passage flow needed for adult steelhead to ascend shallow riffles in the vicinity of Bradley and Soledad. As described in

Section V.C.1.b, we know that a flow of about 260 cfs is needed to facilitate efficient, safe passage at Chualar, and that upstream at Soledad, the mainstem Salinas becomes progressively wider and has less gradient. We do not know what minimum flow is needed for efficient passage at Bradley; however, given the greater width and reduced gradient in this area, we assume that it is greater than that for Chualar. Given the uncertainties of the minimum passage flow at Soledad and Bradley, we analyzed the effects of complete storage of Nacimiento flows (except for the minimum bypass release) using two alternative minimum passage flows (300 cfs and 380 cfs) for shallow reaches at Soledad and Bradley.

Table 11 shows that for water years 1995 through 2005, complete storage of all flow from the Nacimiento River during December and January (except for a constant 60 cfs minimum bypass flow) would reduce passage opportunity at Bradley by 1 to 8 days in some years. The number of years in which passage flow is affected and the number of days that passage is reduced depends on the assumed minimum passage flow at Bradley. With a minimum passage flow of 300 cfs at Bradley, total storage of all Nacimiento River flow (except the bypass flow) would reduce passage by 1 to 8 days at Bradley in 5 of 11 years. The true impact of a loss of one or two days (as projected for 1999 and 2001, under an assumed minimum passage criteria of 300 cfs) is uncertain and dependent on whether passage flows in the lower river were conducive for fish to migrate the approximately 80 miles to Bradley. If minimum passage flow was actually 300 cfs at Bradley and there was no additional tributary inflow entering the Nacimiento River downstream of the Nacimiento Dam, a reduction of 7 or 8 days would likely preclude steelhead passage above Bradley during December and January of water years with similar hydrologic characteristics as 2002 and 2004. With a minimum passage flow of 380 cfs at Bradley, total storage of all Nacimiento flow (except the bypass flow) would reduce passage by 3 and 5 days in two of the 11 years. In the remaining years that we analyzed, total storage of all Nacimiento River flow (except the bypass flow) would have no adverse affect on adult upstream passage opportunity at Bradley, although in 1998, the addition of the 60 cfs bypass flow would have benefited adult passage at Bradley. The reason for this relatively minor effect of a theoretical total storage of Nacimiento River flow in December and January is probably because flows are generally naturally low during the early portion of most winters, and if it does rain the Nacimiento Dam already impounds almost all flow in that river during that period. We do not present our results for a similar analysis for the Salinas River at the Soledad gage; however, we estimate that, total storage in Nacimiento Reservoir (except for the minimum bypass) would diminish passage opportunity at that site on only 1 of 11 years, and the increased project bypass flow would benefit adult passage at Soledad in 1 of 11 years.

This analysis of a worst case early-winter scenario also considered the effect of theoretical maximum storage in Nacimiento Reservoir on median monthly flows in the Salinas River at Bradley. Table 11 shows that for the period 1995-2005, elimination of all flow from the Nacimiento River (except the 60 cfs bypass flow) would reduce median flow at Bradley during December and January in 7 of 11 years. Baseline historic flows at Bradley may be frequently less than the assumed 300+ cfs that we assumed is needed for efficient, safe upstream passage in this segment; however, reductions in flow from 170-200 cfs to less than 100 cfs in December and January could adversely affect adult steelhead that are holding and waiting to resume upstream movements to their natal streams during high flow events. Reduction of baseline flows that are naturally and generally less than minimum passage criteria increase the risk that in early winter some fish may be stranded in shallow isolated areas where they are vulnerable to predation or where they may become beached in areas where surface flow ceases.

The results of this assessment of a worst case scenario (Table 11) is a theoretical exercise that identifies the general magnitude of the potential project impacts to adult steelhead passage opportunity at Bradley during December and January. It does not include consideration of any mitigating tributary flow that might enter the Nacimiento River downstream from the dam, and it does not account for any dam releases that might exceed 60 cfs during potential flooding events in December and January. Nevertheless, it does illustrate the potential for increased reduced flows in the upper Salinas River in the vicinity of Bradley, and it indicates that effects on passage opportunity in December and January occur in a limited number of years. The precise number of years in which effects would actually occur is unknown and dependent on the minimum passage flow at Bradley, the extent of tributary inflow to the Nacimiento River below the dam, and whether the Nacimiento Dam truly stores 100% of all inflow to its reservoir except for the 60 cfs minimum bypass release. Our results also show that adult passage is not affected during years when there is relatively good passage opportunity during early winter.

When flow conditions are impassable to fish, their up- or downstream movement is delayed for as long as that condition persists. Delayed fish may expend energy reserves. Factors that lengthen the migration period or require increased energy consumption could deplete the fish's energy reserves, resulting in reduced spawning success (Berman and Quinn 1991, Geist *et al.* 2000) or increased pre-spawning mortality (Beiningen and Ebel 1970, Gray 1990, Snelling *et al.* 1992). If adult steelhead are prevented from entering their natal stream as a result of inadequate flows, they may attempt to spawn in a different stream or in unsuitable habitat. Whether they successfully spawn elsewhere or not, the loss of spawning opportunity due to poor access effectively reduces reproductive success in the natal stream.

Table 11. Estimated number of adult steelhead passage days at Bradley during December and January under baseline conditions (1995-2005) and under a scenario with maximum storage in Nacimiento Reservoir with exception of a 60 cfs minimum flow at the Nacimiento Dam. Also shown is the median flow for the period December through January for those two scenarios.

	Assume minimum 300 cfs		**Assume minimum 380 cfs**		**Baseline**	**Project**
Water Year	**Baseline** Passage Days	**Project[1]** Passage Days	**Baseline** Passage Days	**Project** Passage Days	**Median flow for December-January**	**Median flow for December-January**
1995	22	22	22	22	180	223
1996	0	0	0	0	51	90
1997	48	48	43	42	3340	1685
1998	16	17	11	13	118	158
1999	1	0	0	0	204	104
2000	4	0	3	0	185	91
2001	2	0	0	0	196	96
2002	7	0	0	0	173	89
2003	0	0	0	0	62	101

2004	8	0	5	0	93	83
2005	33	33	32	32	690	412

[1]Project passage days at Bradley are calculated as (Flow at Bradley gage) – (Flow at Nacimiento gage below dam) + 60 cfs

In summary, increased storage capacity of the Nacimiento Reservoir will enable MCWRA to store additional water during winter months, with resulting decreases in flow in the Nacimiento and Salinas Rivers. The reductions in winter flow coincide with runs of adult steelhead, and they have the potential to reduce opportunities for upstream passage of adults at numerous shallow riffles in the mainstem. MCWRA proposes to mitigate impacts to adult migrations by releasing flows from Nacimiento Reservoir, as necessary, to ensure that the number of days for upstream adult passage is not diminished below predam (1930-1956) and preproject levels in normal water years. The SVWP should have minimal effect on adult passage during dry and wet years. MCWRA's plan for augmenting flows to facilitate steelhead passage will only occur between February 1 and late May. The project has the potential to reduce passage opportunity for adult steelhead during December and January. The reduction of passage opportunity to the upper Salinas River in early winter months would be confined to a few days in a minority of years. MCWRA's flow releases, intended to replicate the historical total number of passage days that occurred between January 1 through March 31, will partially offset losses of passage opportunity during the early winter period. We assume surface flows in the lower Arroyo Seco River in the vicinity of the Arroyo Seco cone are largely dependent on inflow from that river. For that reason we assume that flow reductions associated with additional storage in the Nacimiento Reservoir during early winter would have a minor effect on surface flows in the lower Arroyo Seco River. However, given the complex and poorly understood hydrology of the Arroyo Seco cone, it would be appropriate for MCWRA to further examine the relationship of mainstem flows to adult steelhead passage opportunity in the lower Arroyo Seco River.

In addition to the potential for reduced adult passage opportunity in the Salinas River from additional winter storage, we determined that the block flow releases proposed for smolts may contribute to the need for additional lagoon breaching by increasing the amount of water that reaches the lagoon in the spring. Based on modeled flows and historical breaching records (MCWRA 2005a), we found that block flow releases may directly contribute to the need for an additional breach in 3 of 46 years. Increased lagoon breaching could result in higher risk of premature entry of adult steelhead to the river when upstream flows are not available. NMFS believes this additional risk to migrating adults is minimal because 1) the frequency of additional breaching is low, and 2) additional breaches would only occur once in a given year and they would most likely occur in late March or April when enough flows are likely present upstream in most years to facilitate adult migration. As noted above, the Corps and NMFS are currently consulting on lagoon breaching. The effects of lagoon management as a whole, including approaches for breaching, will be addressed in a forthcoming consultation and subsequent biological opinion.

2. Smolt Outmigration

Properly functioning condition of smolt outmigration habitat should include mainstem flows sufficient to maintain juvenile mobility and survival during the outmigration season. Adequate flows must be available along the smolt migration route during spring months for steelhead to complete their life cycle. Bjornn and Reiser (1991) state that the timing of seaward migrations of salmonids that rear for an extended period in streams appears to be regulated by photoperiod, although stream flow, water temperature, and growth may be factors in some areas. Although not all smolt migrations are triggered by elevated flows, stream flow does affect the travel rates of most migrating smolts. The downstream migration of smolts is largely a passive process (Fried *et al.* 1978). Berggren and Filardo (1993), who examined the time that it takes juvenile steelhead to migrate through reaches in the Snake and Columbia rivers, reported that estimates of smolt travel time for yearling steelhead were inversely related to average river flows (higher average flows resulted in shorter travel times). Fried *et al.* (1978) stated that water current was the main factor influencing routes and rates of smolt movements.

The exact magnitude and duration of flows necessary to facilitate downstream smolt migration through the Salinas River is unknown. However, to assist our assessment of the project's effects on flows for smolt outmigration, we have assumed that properly functioning habitat conditions for this phase of the steelhead life history include substantial sustained flows for several weeks during the period of migration (late March through early June). By substantial, we assume sustained flows of at least several hundred cfs are needed at Spreckels to facilitate efficient and safe movement of smolt through the mainstem and to maintain an open mouth at the river's confluence with the ocean. We base this assumption on the following:

1) travel rates of smolts are directly related to stream flow (Berggren and Filardo (1993),
2) increased flow provides greater depths, currents, and surface turbulence all of which help to increase travel rates and survival of smolts (Fried *et al.* 1978; Berggren and Filardo 1993; Cada *et al.* 1994),
3) the Salinas River supported runs of several thousand steelhead during the 1930's and early 1940's when flows in April often exceeded 1000 cfs for several weeks at Spreckels (see Environmental baseline, Section V.C.1.b),
4) flows at Spreckels were greatly curtailed during April and May after 1945 (see Environmental baseline, Section V.C.1.b), and since that time, runs of steelhead in the Salinas River have been nearly extirpated,
5) flows less than about 250 cfs are shallow (*i.e.,* along riffle crests depths are generally less than about one ft) in the Salinas River between Soledad and Chualar (NMFS 2005c), and
6) the mouth of the Salinas River often closes when flows drop below 100 to 200 cfs.

The demonstrated adverse effect of the operations of the Nacimiento and San Antonio dams on passage flows for smolt outmigration (NMFS 2005c) has likely contributed to the decline of steelhead in the Salinas River watershed. The SVWP will appreciably reduce this risk to the steelhead population by providing enhanced flow conditions for smolt (and kelt) migrations to the ocean. The SVWP will increase flow releases from Nacimiento Dam to benefit outmigration of smolts during the period March 15 through May 31 of normal water years. Hydrologic records suggest that, during wet years, both existing operations and the proposed SVWP would have no appreciable effect on downstream passage flows for smolts. In dry years, flows were consistently low in April and May, even during the pre-dam period (NMFS 2005c).

As described in the environmental baseline (Section V.C.1.b), spring flows declined substantially following increased pumping of groundwater for agricultural production and the construction of the Nacimiento and San Antonio dams. Prior to these developments (during the 1930's and 1940's), the Salinas River supported a relatively abundant steelhead population. The flow prescription for the SVWP attempts to restore flows conducive to downstream smolt migrations by providing "block flow" releases during normal water years timed to natural runoff events as indicated by gages on relatively unregulated streams in the upper Nacimiento River and the Arroyo Seco.

Hydrologic model results (WRIME 2005) indicate that block-flow releases consisting of minimum flows of at least 700 cfs for five days in the Salinas River at Soledad followed by flows at Spreckels of 300 cfs or higher for an additional 15 days will occur in 12 of 18 normal years (*i.e.*, 67%) under SVWP operations. This frequency of elevated flow during April is comparable to the period 1930-1946 when the river continued to support a relatively substantial run of steelhead (U.S. Fish and Wildlife Service estimated a catch of 3,600 adults in 1946), and when 71% of normal water years had elevated flows (>1000cfs for several days) at Spreckels during April. Under SVWP operations, flow at Spreckels between April 1 and May 15 of normal years is expected to exceed 150 cfs 54% of the time. This contrasts with the 1949-1994 modeled baseline (with dams) when flow exceeded 150 cfs only 11% of the time, and it is slightly more than the 40% of the time that flow exceeded 150 cfs during the pre-dam period in normal years (MCWRA 2005a).

The SVWP will increase the frequency of years that substantially elevated flows are present during the month of April. The Flow Prescription calls for flows of 700 cfs at Soledad and at least three weeks of flow at or above 300 cfs at Spreckels in April. It is likely that this prescription for block flows will facilitate smolt passage and appreciably improve smolt survival during their movement to the lagoon and ocean. Flows of 700 cfs at Soledad will provide substantial flow to help transport downstream migrating smolts in the mainstem, and sustained flows of 300 cfs will maintain an open estuary and provide continuous stream depths that would exceed those needed by even larger adult steelhead. As described above, elevated flows can also trigger smolt movements and promote increased survival of smolts during their migrations. However, it is not certain that the precise magnitude, duration, and timing of the block flow releases will be completely effective. Given the complexity of steelhead life history, channel morphology and hydraulics of the Salinas River and Arroyo Seco River, as well as the absence of data concerning smolt migrations in the Salinas River, it is not possible to identify the precise flows needed to facilitate effective smolt passage in this system without monitoring.

In addition to the benefits of the proposed "block flow" releases, the additional planned releases of lesser flows (*i.e.*, 45 cfs, 15 cfs, and 2 cfs), either following block flow releases or during years when triggers for block flows are not met, will also facilitate movement of smolts to the lagoon and will likely greatly reduce the risk of juvenile migrants becoming stranded in the mainstem relative to recent historic operations.

3. Juvenile Movement and Rearing

In addition to the annual outmigration of smolts, younger pre-smolt juveniles (age 0+ and 1+) also migrate downstream in response to habitat density and environmental cues of temperatures and flow (Bjornn 1971). As a result, significant percentages of pre-smolt juveniles can end up rearing in mainstems or coastal lagoons and estuaries (Zedonis 1992, Shapovalov and Taft 1954, Trush 2002). If migration corridors for juvenile steelhead are degraded or unavailable, these colonizing individuals are likely to perish.

Properly functioning condition for juvenile migratory habitat includes sufficient flows and cover for juveniles to reach downstream rearing areas such as lagoons. Water temperatures must also be low enough for juveniles to migrate successfully, and the number of predators should be minimal.

NMFS believes juvenile migration to the lagoon will be improved by the SVWP. Smolt block flows will be provided to the lagoon during spring in some normal years, and flows from 2 to 45 cfs will be provided during the late spring through the summer of all years in which aquifer conservation releases are provided. These flows to the lagoon will connect both the aquifer conservation release flows and smolt block flows to the lagoon, ensuring an uninterrupted migration corridor for rearing juveniles. However, other important habitat elements for juvenile migration, such as cool water temperatures, and cover from predators, may remain degraded.

In the mainstem, the provision of flows to the lagoon is expected to result in greater survival of juveniles that migrate to the lagoon during late spring and summer. Currently (without the proposed SVWP), juveniles that enter the Salinas River and move downstream are likely stranded and killed because conservation releases for aquifer recharge are metered so that flow percolates to the aquifers in the Salinas Valley, and outflow to the lagoon is avoided.

Steelhead attempting to rear in the lagoon during the late winter and early spring may experience degradation in habitat conditions if the frequency of lagoon breaching increases due to the provision of block flows. Breaching can result in habitat degradation when saltwater enters the lagoon and the water column becomes stratified with freshwater near the surface and the heavier more saline water on the bottom. After the mouth of the lagoon closes, that saltwater layer can become anoxic as the result of solar heating, microbial action, and the lack of mixing between aerated, fresh surface waters and the saline waters on the bottom of the lagoon (Smith 1990). After the lagoon closes, habitat rearing conditions can return to pre-breaching levels if there is sufficient freshwater input from upstream. The quality of subsequent rearing habitat conditions is based on, but not limited to, the severity of the previous breach, the extent of the freshwater evacuation, and the outlet channel's configuration. Higher freshwater inflow likely shortens the time needed for habitat conditions to return to pre-breaching levels. However, any input of freshwater from spring storms or agricultural runoff during summer or fall is offset by outflow into the OSR.

The information available indicates that breaching frequency may increase slightly over baseline conditions. In most years block flow releases would be associated with natural runoff events when the mouth of the river is already open. However, based on modeled flows and historical breaching records (MCWRA 2005a), we found that block flow releases may directly contribute to the need for an additional breach in 3 of 46 years. This small increase in breaching may result in reduced survival for steelhead rearing in the lagoon in years when an additional breaching occurs due to a block flow release. NMFS cannot accurately quantify the likely reduction in survival because of the very limited steelhead production in the lagoon in recent years and the uncertainties regarding future use of the lagoon. Although migration opportunities to the lagoon will improve and there will be increased summer releases associated with the SVWP, there may not be much of an improvement in rearing habitat conditions in the lagoon. We therefore are uncertain regarding future use of the lagoon. Nevertheless, we believe that this additional risk to survival is minimal because 1) the frequency of additional breaching is low, and 2) additional breaches would only occur once in a given year and they would most likely occur in late March or April prior to the high summer temperatures that contribute to anoxic conditions in strongly stratified waters. As noted above, the Corps and NMFS are currently consulting on lagoon breaching. The effects of lagoon management as a whole, including approaches for breaching, will be addressed in a forthcoming consultation and subsequent biological opinion.

4. Spawning and Rearing in the Nacimiento River

Spawning habitat in properly functioning condition contains the proper set of stream channel physical conditions that promote spawning and egg survival. Stream flows, substrate, and water temperatures must be suitable for spawning to occur; cover from predators is also important (Bjornn and Reiser 1991). Eggs need the proper amount of intergravel flow to bring dissolved oxygen to developing embryos and wash away wastes (Bjornn and Reiser 1991). As described in the Environmental Baseline section, ENTRIX (2003) developed a model of weighted-usable - area that concludes optimal steelhead spawning conditions in the Nacimiento River occur at flows of approximately 100 cfs. Eighty percent of maximum weighted-usable-area spawning habitat occurs at 60 cfs.

Rearing habitat in properly functioning condition provides living space (different combinations of water depth and velocity), shelter from predators and harsh environmental conditions, food resources, and suitable water quality and quantity, for growth and survival during summer and winter (Bjornn and Reiser 1991). Young-of-the-year and yearling steelhead generally use riffles and runs (*e.g.*, Roper *et al.* 1994) during much of a given year where these habitats exist. However, young-of-the-year and older juveniles may seek cover and cool water in pools during the summer (Nielsen *et al.* 1994).

MCWRA will increase minimum flows downstream of Nacimiento Dam from 25 cfs to 60 cfs during the steelhead spawning season. MCWRA will continue the 60 cfs release throughout the year to improve rearing habitat. This minimum flow criterion will be in effect as long as the surface elevation of Nacimiento Reservoir remains above elevation 687.8 feet msl, the reservoir's minimum pool. Based on the weighted-usable-area model developed by ENTRIX (2003), this increase in minimum flows during the spawning period will provide near optimal spawning conditions downstream of the dam. We anticipate this increase in minimum flows will also provide rearing habitat.

As described previously, the three miles closest to the dam are thought to have the best rearing habitat where stream temperatures are cooler, riparian vegetation is more dense and substrate components are larger compared to conditions further downstream (ENTRIX and EDAW 2002).

Reconnaissance level habitat surveys document habitat area with good cover characteristics in the reaches downstream of the dam under low flow (30 to 50 cfs) and high flow (300 cfs) conditions (ENTRIX and EDAW 2002). Based on existing conditions in the first three miles downstream of the dam, NMFS anticipates that an increase in base flows from 25 cfs to 60 cfs will provide adequate rearing habitat during spring, summer and fall in the first three miles downstream of the dam in years when the Nacimiento Reservoir is above its minimum pool level. Based on MCWRA's 17,740 day of record regarding minimum pool elevations in Nacimiento Reservoir, the minimum pool elevation (or lower) was reached on 670 days, or 3.78 percent of the time. The 670 days (number of days) occurred during the following six water years: 1960 (95), 1961 (150), 1970 (62), 1972 (33), 1977 (81) and 1990 (249). All but 1970 (normal water year) were dry water years. Rearing habitat will also be increased further downstream, but critical habitat for steelhead in this location will still be degraded by other factors such as limited riparian vegetation and high flow releases (300 cfs to 400 cfs) associated with summer releases for aquifer recharge that risk disrupting juvenile rearing and flushing steelhead downstream to the Salinas River, where rearing conditions are worse due to higher temperatures..

After flood control and aquifer recharge releases from Nacimiento Dam, flows will be ramped down to 60 cfs as described above. Flow reductions from levels above 420 cfs will be unaffected by the SVWP and are not considered in this opinion.[19] When flows reach 420 cfs, the SVWP will ramp down flows such that changes in stage will be approximately 0.3 feet per hour (MCWRA 2005a). This rate is higher than rates recommended for the protection of steelhead fry (0.16 feet per hour; Hunter 1992 as cited in ENTRIX and EDAW 2002). The risk of fry stranding is also affected by channel form, gradient, and substrate conditions (MCWRA 2005a). These ramping rates are an improvement over a portion of baseline ramping procedures, which ramped flows down faster to lower summer water releases.

In the Nacimiento River, the increase in baseflows during the summer and fall will likely increase available habitat for rearing juvenile steelhead. However, the baseline condition of aquifer conservation flow delivery from the dam that limits suitable rearing habitat may counteract gains associated with increased minimum flows for juveniles in the Nacimiento River. Fish that experience these ongoing baseline conditions are likely to lose the gains they made due to increased minimum flows during the rearing season (late spring through fall). NMFS cannot quantify the number of juvenile steelhead affected by the increase in base flows.

Bases on the proposed ramp down rates that are higher than rates recommended for the protection of steelhead fry, NMFS expects there to be a risk of fry stranding in the Nacimiento River downstream of the dam. However, this risk cannot be quantified based on the information available. MCWRA has proposed to conduct monitoring during the period following fry emergence to determine the magnitude of fry stranding and to implement adaptive management should large amounts of fry stranding occur. Even though MCWRA has not defined 'large amounts of fry stranding', NMFS assumes that either: fry stranding will be minimal, limited to only a few individual fish; or that MCWRA will take corrective measures within one or two

[19] Flow releases above 420 cfs in the Nacimiento River are for flood control purposes and are made from the high-level gauges, and all flow reductions in the San Antonio River are not affected by the SVWP and are part of the baseline for the purposes of this analysis.

years to reach minimal levels of fry stranding. In either case, fry stranding is likely to be reduced from baseline conditions.

B. Effects Related to Construction, Operation, and Maintenance Activities

MCWRA intends to work year-round on streamside construction actions to build the SRDF, install a fish screen at the OSR inlet, change the Nacimiento spillway, and improve the Blanco Drain. Given that steelhead are present in some locations throughout the Salinas River watershed all months of the year, there is a potential for streamside construction activities to indirectly affect steelhead. NMFS anticipates that the risk for effects associated with construction activities will be generally restricted to a single year at any one construction site because work at each site is anticipated to take one year to complete. Steelhead may be present at the SRDF and OSR sites if the channel has water during construction, and in-channel work at these sites is likely to directly affect steelhead. Specific description of the OSR construction activities is not available; Based on our knowledge of similar construction activities, NMFS has made certain assumptions regarding these activities, as described below.

1. Toxic Contamination

Equipment refueling, fluid leakage, and equipment maintenance activities within and near the stream channel pose some risk of contamination of aquatic habitat and subsequent injury or death to listed salmonids. NMFS anticipates that MCWRA and its contractors will maintain any and all fuel storage and refueling sites in upland locations well away from the stream channel; that vehicles and construction equipment be in good working condition, showing no signs of fuel or oil leaks, and that any and all servicing of equipment be conducted in an upland location. In addition to toxic chemicals associated with construction equipment, water that comes into contact with wet cement during construction can adversely affect water quality by raising the pH of water, which may result in injury or death to ESA-listed steelhead. For instream construction sites, NMFS does not anticipate any localized or appreciable water quality degradation from toxic chemicals or adverse effects to ESA-listed salmonids associated with the proposed construction. As the stream will be dry or dewatered around the instream construction sites, MCWRA and its contractors have ample opportunity to attend to any spill prior to toxic chemicals reaching flowing waters of the Salinas River. For streamside construction activities, NMFS anticipates that MCRWA's best management practices, used to minimize the potential for accidental release of hazardous materials, sediment, or debris into the river (ENTRIX and EDAW 2002), and responses by MCWRA to any accidental spill of toxic materials should be sufficient to restrict the effects to the construction site and not enter the waterways. Our anticipation is based on the proven effectiveness of these practices in similar applications.

2. Sound

Placing of sheet piles during cofferdam construction at the SRDF (between July 1 and October 31) is the only significant source of above ambient sound levels on this project. Underwater pressure waves generated by pile placement may adversely impact fish (NMFS 2003c). Rapid increases in hydrostatic pressure and subsequent decreases to below ambient pressures can lead to a range of effects on fish from death to sub-lethal behavioral changes. The degree to which an individual fish exposed to sound will be affected is dependent on a number of variables, including, but not limited to, species and size of the fish, distance from the source, peak sound pressure and frequency, depth of the water around the pile, bottom substrate composition and texture, and effectiveness of any sound attenuation technology (reviewed in NMFS 2003c). Also, sound patterns are affected by the size and type of placement machine and size and material of the pile placed. MCWRA has not determined if sheet piles for the SRDF cofferdams will be placed using an impact hammer or vibrating hammer.

NMFS (2003c) reviewed pile driving effects for fish and concluded that underwater sound levels between 165 and 190 peak decibels (dB_{peak}) in Carquinez Strait were expected to cause stress, agitation, and behavioral changes, and sound pressure levels greater than 190 dB_{peak} were expected to cause direct permanent injury or mortality of salmonids. Placing piles with an impact hammer regularly result in sound levels in excess of 190 dB_{peak}. Illingworth and Rodkin, Inc. (2006) reported sound levels in water at intervals from 5 meters (m) to 40 m from sheet pile driven with an impact hammer in a wetted area; only at 40 m from the pile were sound levels recorded that were less than 190 dB_{peak} (188 dB_{peak}). Placing piles with a vibrating hammer are thought to create lower, acceptable sound levels than piles placed with an impact hammer. Since the type of placement system has not been identified, NMFS will consider the effect of the higher of the two systems – use of an impact hammer. NMFS anticipates harmful sound levels from sheet pile placement and assumes that all steelhead within 40 m distance from the activity will be exposed to above-ambient, potentially lethal, sound levels at the SRDF site.

Only juvenile steelhead could be affected by pile driving because pile driving will occur during the summer, when other life history stages are unlikely to be present at the site. Risk to steelhead is minimal as the river at the project site is often dry in the summer. However, if surface water is present, a few juvenile steelhead may be present and may be harmed or killed by pile driving. The number of steelhead present is likely to be 10 or fewer, as described below in section 5.*a. Fish Relocation Activities*.

3. Increased Mobilization of Sediment within the Stream Channel at the SRDF and OSR Sites

Instream and nearstream construction activities may cause temporary increases in stream turbidity (reviewed in Furniss *et al.* 1991, Reeves *et al.* 1991, and Spence *et al.* 1996). Clearing, grading, stockpiling soil, and excavation are some actions that result in soil disturbances and may increase the amount of sediment entering a stream from an offstream site. NMFS anticipates that short-term increases in turbidity will occur during proposed dewatering activities, construction and removal of cofferdams, construction of the inflatable dam, maintenance of the inflatable dam, and construction and decommissioning of temporary roads at the SRDF site. Specific construction activities have not been described for the OSR site. Because installing a fish screen is likely a smaller undertaking than the SRDF construction, NMFS assumes any disturbances of the channel which could create turbidity will be smaller in magnitude than at the SRDF site.

Sediment may affect salmonids by a variety of mechanisms. High concentrations of suspended sediment can disrupt normal feeding behavior and efficiency (Cordone and Kelly 1961, Bjornn *et al.* 1977, Berg and Northcote 1985), reduce growth rates (Crouse *et al.* 1981), and increase plasma cortisol levels (Servizi and Martens 1992). High turbidity concentrations can reduce dissolved oxygen in the water column, result in reduced respiratory functions, reduce tolerance to diseases, and can also cause fish mortality (Sigler *et al.* 1984, Berg and Northcote 1985, Gregory and Northcote 1993, Velagic 1995, Waters 1995). Even small pulses of turbid water will cause salmonids to disperse from established territories (Waters 1995), which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival. Increased sediment deposition can fill pools and reduce the amount of cover available to fish, decreasing the survival of juveniles (Alexander and Hansen 1986).

NMFS assumes that MCWRA will be compliant with any and all permit requirements included in a RWQCB permit; thereby reducing the likelihood of increasing sediment mobilization and turbidity.

NMFS expects small temporary increases in localized turbidity in years when the Salinas River is wetted at the SRDF and OSR sites. If the Salinas River is not wetted at the SRDF and OSR sites during construction, then NMFS expects no change in turbidity from background levels. If turbidity increases at the construction sites, it is likely to result in some limited behavioral effects, such as temporarily vacating preferred habitat or temporarily reduced feeding efficiency. Because these behavioral changes are likely to be of low magnitude and short duration, they are not expected to reduce the survival chances of individual steelhead. At the Nacimiento and Blanco Drain sites, steelhead are not expected to be present and sediment generation, if any, is expected to be minimal and temporary.

4. <u>Loss of Riparian Vegetation</u>

The functional values of riparian corridors and the benefits they provide to aquatic systems in general, and stream fish populations in particular, are well documented (Karr and Schlosser 1978, Lowrance *et al.* 1985, Castelle *et al.* 1994, Wang *et al.* 1997, Bilby and Bisson 1998) and include: creation and maintenance of instream habitat complexity, shade for cooler water temperatures, mediation and filtration of sediments and nutrients, and bank stability.

Some riparian vegetation may be removed at the SRDF site to facilitate heavy equipment access to the Salinas River. NMFS anticipates that vegetation removal will be limited. For example, vegetation will only be removed to the extent needed to allow equipment to reach the construction site. No appreciable impacts to stream temperature, cover, or other aspects of steelhead habitat affected by riparian vegetation are anticipated. The Salinas River is relatively wide at the SRDF site; riparian vegetation therefore does not have a dominant influence on steelhead habitat at this site. For these reasons, limited vegetation removal is not likely affect steelhead or their habitat. Riparian removal is not anticipated at the OSR site.

5. <u>Instream Construction Activities</u>

The modification to the spillway at Nacimiento Dam will require no instream construction actions. Instream construction actions are proposed for construction of the SRDF, the OSR fish screen, and the vegetated treatment system in Blanco Drain. Although MCWRA may undertake in-channel activities in Blanco Drain, NMFS anticipates no impacts to steelhead related to construction of the vegetation treatment system. The source of the water in the Blanco Drain is seepage or runoff from adjacent fields or local precipitation; fish would not enter the drain through those mechanisms. The outlet culvert of Blanco Drain, where the drain enters the Salinas River, has a flap gate on its downstream end, preventing fish passage into Blanco Drain. Even if the flap gate fails and some fish are able to enter the drain, current water quality conditions are such that survival is not likely. NMFS anticipates no steelhead within the Blanco Drain and, therefore, no effects to steelhead from construction actions in the Blanco Drain. However, NMFS does anticipate positive effects on steelhead in the Salinas River lagoon and OSR from improved water quality following installation of the vegetated treatment systems in Blanco Drain (see Section III.B.2.d for additional information). The following description of instream construction activities relates only to the SRDF and installation of the fish screen at the OSR. Specific information on fish screen installation at the OSR is not available; NMFS has made certain assumptions regarding this activity, as described below.

Instream construction activities will be limited annually to July 1 through October 31. The Salinas River near the SRDF and OSR sites has no steelhead spawning habitat. The SRDF site may have some rearing habitat, and is used as a migration corridor for adult and juvenile steelhead. Similarly, a few juvenile steelhead may rear near the OSR inlet during some years, and adult and juvenile migrating steelhead would pass in the vicinity of the inlet during their migrations. This construction window is outside the anticipated migration and spawning period for Salinas River steelhead (Fukushima and Lesh 1998). Therefore, NMFS anticipates no impacts to migrating adult or smolt steelhead and no effects on steelhead spawning related to instream construction activities. NMFS does anticipate some impacts to juvenile steelhead from instream construction activities as described below. The number of juvenile steelhead present at the SRDF and OSR sites during construction is likely less than would be found in streams with better rearing habitat conditions.

Wet channel crossings and the placement of sheet piles, for cofferdams, at the SRDF site can directly affect ESA-listed steelhead by crushing or startling the fish and being a source of turbidity. Crossing will occur only during placement and removal of the sheet piles. Placement of the sheet pile will occur in July and removal in October. In most, though not all years, Salinas River surface flows at the site are low or nonexistent during the proposed construction window. A pile driver (impact or vibration hammer) is the only heavy equipment that will cross during placement of the sheet pile. Other heavy equipment may be used for construction of the SRDF, though those will be used between the cofferdams – in the dewatered portion of the stream.

There is a potential for adverse affects to juvenile ESA-listed steelhead in some years when water is present at the construction site during July. As the pile driver is driven across the channel, NMFS anticipates that most steelhead at the site will swim away without being harmed, but that some juvenile steelhead may retreat to interstitial spaces in the sediment or near woody debris and other instream elements of cover. Those hiding fish may be injured or killed during the wet channel crossings. Given the limited amount of juvenile steelhead likely present, the number of juvenile steelhead injured or killed by construction activities at the SRDF during wet crossings and sheet pile placement is likely to be a low number of individuals.

NMFS assumes that installation of a fish screen at the OSR may require dewatering of the area directly adjacent to the inlet to the OSR, and fish relocation. Impacts of dewatering and fish relocation are likely to be similar as described for the SRDF. However, NMFS assumes that sheet piles will not be used to dewater the OSR site.

a. Fish Relocation Activities

Given the inter-annual variation in precipitation and water management activities, NMFS does not know the amount of water that will be present at the site of the SRDF during the construction period. MCWRA proposes to dewater a portion of the Salinas River, if wetted, to facilitate construction of the SRDF. If water is present at the site during the proposed construction period, then steelhead may be present. Before the project site is dewatered, qualified biologists will capture and relocate fish away from the project work site to minimize mortality from dewatering. Fish within the cofferdams (those not harmed or killed by pile driving) will be captured by seine, dip net and/or electrofisher, and then transported and released to a suitable instream location. Since the cofferdams will be put in slowly and will be constructed of sheet pile, most juvenile steelhead will likely avoid the area affected by pile driving. Most, if not all, remaining juvenile steelhead will be rescued from the area between the cofferdams. Any steelhead then remaining in the area between the cofferdams will likely not survive subsequent dewatering.

To estimate the number of steelhead taken, we assume the distance between cofferdams to be approximately 100 feet. Because habitat conditions are poor in this reach, we also assume a very low density of juvenile steelhead. We are unaware of any density estimates of juvenile steelhead in the lower mainstem. However, 2002 surveys in the lower Arroyo Seco River yielded a density estimate of 0.6 juvenile steelhead per 100 meters of stream (Cassagrande *et al.* 2003). Assuming this density in the construction area would yield approximately two fish. Given the amount of uncertainty and anticipated variability, we make the prudent estimate that up to 10 juvenile steelhead could be taken in association with fish relocation activities if water is present during SRDF construction. NMFS assumes that a similar sized area will need to be dewatered to install the fish screen at the OSR. Similar to above, NMFS estimates that a maximum of 10 juvenile steelhead will need to be relocated during OSR fish screen installation.

Fish relocation activities pose a risk of injury or mortality to rearing juvenile salmonids. Any fish collecting gear, whether passive (Hubert 1996) or active (Hayes *et al.* 1996) has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish capture varies widely depending on the method used, the ambient conditions, and the expertise and experience of the field crew. The effects of seining and dip netting on juvenile salmonids include stress, scale loss, physical damage, suffocation, and desiccation. Electrofishing can kill juvenile salmonids, and researchers have found serious sub-lethal effects including spinal injuries (Reynolds 1996, Nielsen 1998). The long-term effects of electrofishing on salmonids are not well understood. Although chronic effects may occur, it is assumed that most impacts from electrofishing occur at the time of sampling.

Since fish relocation activities will be conducted by qualified fisheries biologists following both CDFG and NMFS electrofishing guidelines, direct effects to and mortality of juvenile salmonids during capture will be minimized. Data from two years of similar salmonid relocation activities in Humboldt County indicate that average mortality rate is below one percent (Collins 2004).

Although sites selected for relocating fish should have similar water temperature as the capture site and should have adequate habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with other fish causing increased competition for available resources such as food and habitat. Some of the fish released at the relocation sites may choose not to remain in these areas and may move either upstream or downstream to areas that have more habitat and a lower density of fish. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse.

NMFS cannot accurately estimate the number of fish affected by competition. However, we do not expect the impact of relocating steelhead from the SRDF or OSR construction sites to other areas in the lower Salinas River will impact the watershed populations of these species based on the small area that will likely be affected and the small number of salmonids likely relocated. Relocating steelhead from the SRDF and OSR construction sites will increase the survival of those fish, because fish not moved would perish during dewatering or construction activities.

b. Dewatering

NMFS anticipates temporary changes in stream flow within and downstream of the project site during dewatering activities. The fluctuations in flow downstream are anticipated to be small, gradual, and short-term. At the SRDF and OSR construction sites, approximately 100 linear feet of the Salinas River will be dewatered from July 1 to October 31 during one year at each site. Dewatering of the project work area is expected to cause temporary loss, alteration, and reduction of aquatic habitat. Stream flow diversions could harm individual juvenile steelhead by concentrating or stranding them in residual wetted areas before they are relocated (Cushman 1985).

Benthic (*i.e.,* bottom dwelling) aquatic macroinvertebrates may be killed or their abundance reduced when aquatic habitat is dewatered (Cushman 1985). However, effects to aquatic macroinvertebrates resulting from stream flow diversions and dewatering will be temporary because construction activities will be relatively short-lived, and rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates is expected following re-watering (Cushman 1985, Thomas 1985, Harvey 1986). In addition, the effect of macroinvertebrate loss on juvenile steelhead is likely to be negligible. Food from upstream sources (via drift) would be available downstream of the dewatered areas since stream flows will be maintained around the project work site and food sources derived from the riparian zone will not be affected by the project. Also, few steelhead are expected to be present or near during construction. Based on the foregoing, the loss of aquatic macroinvertebrates as a result of dewatering activities is not expected to adversely affect ESA-listed steelhead.

6. <u>Summary of Construction Effects</u>

Given that the in-channel construction activities are limited in temporal and spatial scope, and taking into account the degraded condition of habitat, NMFS estimates that few juvenile steelhead will be killed during instream construction activities for the SRDF and OSR.

Activities that are expected to result in steelhead mortality include pile driving, dewatering, heavy equipment crossing, and fish relocation.

Anticipated effects to critical habitat at the SRDF and OSR sites are limited, since the areas are used primarily as a migration corridor. NMFS anticipates only minor impacts to the channel substrate that will be returned to normal conditions when the river channel is re-watered following construction. The critical habitat directly beneath the final instream SRDF facility will be permanently changed due to the presence of the dam. There may also be a small permanent change to critical habitat at the OSR inlet. These permanent changes are not expected to reduce the value of habitat for steelhead. The change to channel substrate at the OSR site is unlikely to affect the spawning PCE because this PCE is not present at this location. The migration and rearing PCEs at the OSR site will be improved by the addition of a fish screen to prevent fish from becoming entrained in the OSR. Permanent changes to the channel from the placement of the SRDF are discussed below in *11. Impacts to Channel Hydrology/Fluvial Geomorphology from Dam Placement*.

7. Fish Passage Operations

Fish passage structures are designed to provide passage by mimicking natural hydraulic conditions that meet a fish's swimming ability. It is usually not possible for such structures to accommodate all flows at which fish may be migrating. In this case, the fish passage system (ladder and intake screens) will be operating when the dam is inflated and water is being diverted for offstream use. The ladder will be designed to function over the entire range of operating diversion dam headwater and tailwater conditions (flows of 2 to 45 cfs). As the ladder and screens will be designed to comply with NMFS and CDFG criteria for adult steelhead migrating upstream and smolts, juveniles, and kelts migrating downstream, NMFS expects any impacts to migrating fish traveling through the fish passage system will be insignificant.

8. Impounding and Releasing Water

The adverse effects of rapid, artificial fluctuations in stream flows on fisheries resources are well documented (Cushman 1985). The level of impact is dependent in part on the shape of the channel; as channel slope decreases, risk of stranding and beaching increases (NMFS 2001). Raising the rubber dam and impounding water may result in reduction of flow to the channel downstream of the dam until the dam's capacity is reached. Juvenile steelhead, adults, smolts, and kelts could become stranded if flows are reduced rapidly downstream of the dam when it is filled. Similarly, rapid release of flows at the end of the diversion season could result in reduction in habitat space in the impoundment behind the dam. Although few juveniles are expected in the vicinity of the SRDF due to water temperatures in excess of 25°C (EDAW 2001), those that are present could become stranded or beached[20].

NMFS believes the risk of stranding or beaching when the rubber dam is raised in the spring (April 1) is minimized because bypass flows of 2 to 45 cfs will be provided through the fish

[20] Beached fish are those fish that are separated from aquatic habitat because they were unable to follow receding water levels. Such fish are likely to die from desiccation in as little as ten minutes. Stranded fish are fish trapped in the waters of isolated pools.

ladder. In addition, block flows for smolt migration will be provided in some years. These flows (block flows and/or 45 cfs) should keep the channel wetted downstream and prevent stranding or beaching of juveniles.

In the fall, when the diversion season ends, MCWRA will slowly empty the SRDF impoundment over a 27-day period by releasing water from the impoundment to the lagoon at a rate of 2 cfs. It is possible that the impoundment of water at the SRDF will create rearing habitat for juvenile steelhead, and that some steelhead may choose to rear in the impoundment. The 2 cfs release rate should prevent any beaching of juvenile steelhead that may be rearing in the impoundment because water levels will recede slowly enough that juveniles will be able to seek out wetted habitats as the impoundment shrinks. However, a few juveniles could become stranded in pools that are disconnected from the main-channel. NMFS cannot accurately estimate the risk because the configuration of the channel bed behind the dam may change after winter storms. These fish are likely to die via dessication or predation as pools dry up, unless early fall rains occur sufficient to provide connection to the remaining flowing channel.

For this analysis, NMFS will assume that twice the number of juvenile fish expected to be in the vicinity of the SRDF during construction will choose to rear in the SRDF, or 20 juvenile fish. This is reasonable because the SRDF is likely to create somewhat better habitat conditions than the mainstem Salinas River by increasing habitat space for juvenile fish.

MCWRA will empty the impoundment at a much faster rate if larger areas of dry channel are needed behind the dam to perform maintenance work prior to fall rains. A faster rate of water release is likely to increase the risk that juvenile steelhead will become stranded if any are rearing in the impoundment. NMFS cannot predict how much risk of stranding will increase, or the frequency (number of years in the next ten years, for example) that MCWRA will need to empty the impoundment at a fast rate in the fall.

Therefore, in some years as many as 20 juvenile fish may become stranded or beached in the Salinas River when the impoundment is drained at the end of the year.

9. Fish Screens

All water withdrawals from the SRDF will be screened to avoid entraining and/or impinging of steelhead. Fish screens will be designed and implemented to conform to the NMFS and CDFG fish screening criteria similar to criteria described in NMFS (1997). Because these criteria were developed to avoid harm to salmonids and have proven effective in other applications, we conclude the SRDF and diversions are not likely to adversely affect steelhead.

A fish screen or screens will also be placed at the inlet to the OSR whenever the OSR is open via the slide gate. Similar to above, because the screen will meet NMFS and CDFG screening critieria, we conclude the operation of the proposed fish screen at the OSR is not likely to adversely affect steelhead.

10. Maintenance Actions

MCWRA anticipates annual maintenance of the SRDF, including some in-channel maintenance to remove sediment from around the SRDF. Most of the in-channel maintenance is likely to occur at the end of the irrigation season, once the SRDF is emptied. At this time of the year, adult migration has not yet begun. Once aquifer conservation releases end, the Salinas River upstream of the impoundment is expected to be dry (no juvenile migration flows are released) and juveniles will be unable to migrate downstream to the area where maintenance may occur. The only juveniles likely to be present are those that may be stranded when the impoundment is drained (as described above). These fish are likely to perish prior to maintenance activities.

Impact on channel habitat from these maintenance activities is likely to be minimal as the Salinas River in this area is sand dominated. NMFS assumes, based on discussions with MCWRA, that they will not leave the channel bed in a condition which results in fish stranding (depressions/holes) during winter/spring steelhead migrations. In any event, the large flows expected most winters are likely to reconfigure the sandy channel in the vicinity of the SRDF. Any channel modifications are, therefore, likely to be obscured by the time juvenile steelhead are likely to interact with habitat in this area.

Other maintenance of the facility will primarily consist of periodic removal of small amounts of deposited sediment, periodic removal of small amounts of debris, annual pressure washing of screen panels and baffles, periodic maintenance and lubrication of equipment, and annual removal/installation of equipment. Sediment deposits that are small in volume may need to be removed to ensure proper operation of the facility. These deposits in the diversion and fishway structure will most likely be hosed out using river water. When the dam is lowered at the end of the diversion season, the diversion fore bay will be closed and the fish screens will be removed to prevent damage during high-water events. The diversion structure, fish ladder, and pump station may be completely dewatered for access and inspection. A few juvenile fish may become stranded in the ladder. These fish will die if they are not rescued. Based on the size of the ladder and low numbers of juvenile fish expected in the area, NMFS estimates as many as three fish may be stranded in the ladder.

In dry years, when the water surface elevation in the impoundment may fluctuate, the upper end of the impoundment may be exposed with sufficient frequency to allow vegetation growth. Increased vegetation may exacerbate sediment deposits and channel incision conditions and may reduce the flow capacity of the river channel. Periodic channel maintenance of this area will be required during drought periods and undertaken as needed. NMFS assumes that heavy equipment will not enter flowing water, and that maintenance will not require dewatering (other than lowering the dam, as described above). However, if turbidity arises because of SRDF maintenance activities, it will be transported downstream to the lagoon and likely result in some limited behavioral effects to juvenile steelhead, such as temporarily vacating preferred habitat or temporarily reduced feeding efficiency. These behavioral changes are not expected to reduce the survival chances of individual steelhead due to the limited duration.

Emergency maintenance may be required after a severe storm event to re-establish fish facility functions and fish passage conditions. Such maintenance would likely occur when adults and smolts are present in flows moving through the facility. Emergency maintenance may also be required in the spring (when adults and/ or smolts and juveniles are present) to ensure that the diversion facility and fish passage system can be operated as intended. NMFS's review of the facility and its location in the Salinas River indicates that sedimentation could be more severe than at other similar fish passage facilities. Sand may have to be removed from in and around much of the facility.

In this consultation, NMFS will not analyze impacts from emergency maintenance to remove sediment or repair SRDF structures during the rainy season (November through May). The magnitude, frequency, and duration of impacts from these activities cannot be accurately predicted in advance based on the information available because the range of sediment inundation will vary based on flood magnitude, which will also vary. Such activities, if they occur in the wetted channel, are assumed by NMFS to require emergency permits from the Corps. NMFS and the Corps will consult separately on these activities.

Given that steelhead are not likely present in the Blanco Drain, NMFS anticipates no negative affect to steelhead associated with maintenance activities related to the vegetated treatment system. However, NMFS does anticipate positive effects on steelhead and critical habitat in the Salinas River lagoon and OSR if maintenance activities can keep the vegetated treatment system functioning at or near full capacity, rather then senescing.

11. Impacts to Channel Hydrology/Fluvial Geomorphology from Dam Placement

When an obstruction (such as the proposed, inflatable dam) is placed in the path of a free-flowing water body, a series of natural riverine adjustments will occur over time. These fluvial geomorphic changes may be large scale and persistent, requiring constant adaptive management responses and river restraining or restoration measures. While inflatable dams of the sort proposed for this project have been successfully operated in many other riverine systems, geotechnical information indicates the river bed in the project location is dominated by sandy soils and substrates. The unique geomorphology of this particular river reach may give rise to unanticipated degrees and frequencies of change in future years. In a sand-dominated riverine substrate such as this reach of the Salinas River, one might expect adaptive management requirements to be more intensive and costly than other river systems with a more stable geomorphic and riparian makeup.

Due to the dynamic nature of fluvial geomorphology and river hydraulics, an abrupt physical change in the hydraulic grade line, propagated by the physical presence of the proposed dam and its substructures, might initiate sequential changes, both upstream and downstream for significant distances. These adverse phenomena may be highly exacerbated by the sandy, unstable nature of the substrates and banks.

If enough scour below the sill occurs, the proposed structure may create a passage impediment to adult steelhead migrating upstream. If such an impediment persisted, it could impair the successful migration and subsequent spawning and reproduction of steelhead throughout the Salinas basin. However, MCWRA has proposed to replace any scour below the dam structure with an appropriate amount of fill. We assume this to mean that passage conditions will be maintained at the site throughout the adult migration season with only minor delays to adult migration.

VII. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

A. Urbanization

EDAW (2001) reviewed information from the Association of Monterey Bay Area Governments, the metropolitan planning organization for Monterey, Santa Cruz, and San Benito counties, to determine the anticipated human populations projected to the year 2020. By 2020, human population for the Salinas Valley is expected to increase about 88% over current levels, an increase of approximately 2.5% annually. MCWRA anticipates a concomitant increase in total urban water use of 40,000 AFY by 2030. MCWRA anticipates that urban acreage within the Salinas Valley will increase from 37,500 acres (1995) to 66,890 acres (2030), an increase of nearly 30,000 acres. Much of this development would be expected to occur on land currently used for agricultural activities.

Increased development for urban uses will increase the amount of impervious surfaces in the watershed. Roofs, parking lots, roads, and other impervious surfaces have dramatic affects on hydrology (reviewed in Calder 1993, Urbonas and Roesner 1993, and Brabec *et al.* 2002). Impervious surfaces prevent water from soaking into the ground. The volume and velocity of storm water runoff is directly proportional to the amount of impervious surfaces. Increased storm water volume and velocity cause increased erosion and sedimentation. Also, runoff from paved driving and parking surfaces may contain increased levels of heavy metals, hydrocarbons, and other pollutants leading to water quality degradation. Impervious surfaces may increase water temperature by increasing insulation of surface water that would otherwise infiltrate through soils. In undeveloped areas, storm water can soak into the ground, allowing soil and vegetation to filter out some pollution and moderate temperature. Whereas in developed areas, the sediment and other pollutants that collect on impervious surfaces wash directly into streams without the benefit of any natural treatment. Residential lawns and landscapes are potential sources of pollution from soil erosion and improperly applied lawn and garden chemicals. Those toxins often pass from storm drain systems without any treatment to local streams. Actions that affect stream flow (surface or subsurface), sediment loading, water quality, and water temperature negatively affect the survival, timing, and growth of salmonids.

B. Agriculture

MCWRA expects that the total amount of irrigated acreage in the Salinas Valley will decrease less than one percent (about 2000 acres) by 2030 (EDAW 2001). Also, MCWRA anticipates a dramatic increase in vineyard development coinciding with a decrease in field crops, pasture, and orchards. Because of conversions of land from agricultural uses and shifting of cropping patterns, MCWRA anticipates a reduction of 60,000 AFY in agricultural water uses by 2030

(EDAW 2001). During this period, MCWRA assumes that vineyard development will occur primarily on land not currently under irrigation and located on the margins of the Valley. Agricultural activities have had a dramatic effect on water tables and sedimentation delivery on a local scale. Withdrawing groundwater can reduce streamflow and increase water temperature in nearby streams reducing available aquatic habitat. Sediment delivery, from increased erosion, to streams can reduce the quality of remaining aquatic habitat. For vineyards developed in areas not currently used for agriculture, NMFS expects that local streams will be negatively affected; the magnitude of effect depends upon the relative amount of withdrawal when compared with local streams and groundwater.

C. Future Urban and Agriculture Water Use Summary

In total, MCWRA anticipates that total water use in the Basin is expected to decrease from 463,000 AFY in 1995 to 443,000 AFY in 2030, a reduction of 20,000 AFY[21]. However, given that Salinas River flow to the lagoon and ocean have been reduced from 533,000 AFY (Simpson 1946) to less than 240,000 AFY (EDAW 2001), NMFS anticipates that future water consumption will continue to have negative effects on aquatic habitat and steelhead populations similar to the impacts described above.

No information is available to suggest other cumulative effects beyond those attributable to ongoing state and private actions described above in the environmental baseline.

VIII. INTEGRATION AND SYNTHESIS OF EFFECTS

In this biological opinion, we analyzed the proposed construction, operation, and maintenance of the SRDF, installation of a fish screen at the OSR, changes in flow releases from the Nacimiento dam related to SRDF operations, flows to enhance steelhead migration (*i.e.*, the Flow Prescription), and other actions that are interrelated with and/or interdependent to the construction of the SRDF. While construction activities will be limited to one or two years, dam operation and flow releases are likely to persist into the foreseeable future. We therefore analyzed the relevant effects for the foreseeable future (*i.e.*, for the next 20 years) in the context of the variable hydrology that has been observed, with consideration given to future trends that may depart from the historical pattern.

We identified three SCCC steelhead PCE's in the Salinas River that will be influenced by the proposed action. They are: freshwater migration corridors in the mainstem and lower Arroyo Seco River, and freshwater spawning and freshwater rearing sites in the lower Nacimiento River. For this analysis we also differentiated adult migration and smolt migration in the freshwater migration corridor PCE to better describe the nature of anticipated changes to that PCE. Each PCE has the potential to be influenced by changes in flow associated with the proposed action. Whether the influence is beneficial or not depends on the PCE and its location.

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[21] Water for agricultural use is expected to decrease by 60,000 AFY, while water for urban uses is expected to increase by 40,000 AFY.

We conclude that there will likely be no adverse effect on adult passage opportunities in the adult migration corridor in the mainstem Salinas River below the Nacimiento River in normal water years during the months of February, March and April. In those months, controlled flow releases by MCWRA during the receding limbs of storm hydrographs may improve passage opportunities for adult steelhead. We also conclude that changes in storage operation at Nacimiento Dam will have minimal effects on passage flows in dry and wet water years. However, there will likely be reductions in adult upstream passage opportunities between November and January in the mainstem Salinas River due to potential decreased releases from the reservoirs. However these decreases will be relatively minor and they will be partially offset by increases in adult passage opportunities in February and March of most normal water years. Thus, the overall PCE function for adult migration is likely to remain at or near baseline condition.

We conclude that the smolt outmigration habitat in the action area is likely to experience improvements in opportunities for passage in up to 67% of normal water years throughout the mainstem as a result of deliberate releases of block-flows from Nacimiento or San Antonio Dam for the express purpose of improving this PCE function. While these releases will be limited to normal years, we anticipate an appreciable improvement in passage conditions for smolts because the number of downstream passage days in normal years will approximate pre-dam conditions. Smolt outmigration during early winter (December and January) in the upper mainstem Salinas, however, is likely subject to the same process as described for adult passage (*i.e.*, decreased flows), and therefore smolts in the upper main stem may experience some reduction in passage opportunities during this period.

The condition of the spawning PCE in the lower Nacimiento River is likely to benefit from the proposed increase in winter base flows above existing condition. However, summer rearing habitat will likely continue to be impaired due to high flows resulting from the existing aquifer conservation flow release strategy.

Regardless of the SVWP, critical habitat within the action area will remain degraded by ongoing, widespread and persistent anthropogenic activities. Freshwater migration corridors will continue to be adversely affected by ongoing water regulation at Nacimiento and San Antonio Dams during dry years and some normal years, and rearing and spawning habitats in both Nacimiento River and San Antonio River will continue to be adversely affected by reservoir operations. Stream morphology, riparian vegetation and channel complexity will remain degraded, and pollution from agricultural runoff will continue to adversely affect the quality of steelhead habitat in the Salinas River. However, despite the continued diminished state of the watershed's critical habitat, the SVWP's Flow Prescription for steelhead will likely contribute to the restoration of habitat conditions needed for the survival of steelhead. This component of the SVWP will provide much needed flows that facilitate outmigration of the smolt-stage and other juvenile steelhead from both the upper Salinas and the Arroyo Seco River. The SVWP Flow Prescription will also maintain opportunities for upstream migration of adult steelhead in the river's mainstem, although it will shift a greater number of passage days to the February - March time period, and it will annually sustain surface inflow to the river's lagoon during spring, summer and the warmer months of fall. Although the project may cause the loss of a few passage days for adult steelhead during early winter in a small number of years, passage opportunity for smolts emigrating from both the main stem and the Arroyo Seco to the ocean will be enhanced by block flow releases during spring. Historic operations of the dams without the SVWP have greatly diminished opportunities for steelhead to migrate out of the upper Salinas and Arroyo Seco Rivers to the lagoon. The Nacimiento and San Antonio dams have been operated with the objective of maximizing aquifer recharge and, to the extent possible, eliminating outflow to the lagoon and ocean. Operators at the dam sought to manage flows such that surface flow in the Salinas River stopped at Spreckels. Consequently the downstream migration corridor in the Salinas River from the confluence of the Arroyo Seco River to the ocean has been severely degraded and often absent during April and May. With the implementation of the Flow Prescription, the downstream migration corridor from the Arroyo Seco River and upper Salinas River will be substantially enhanced.

Given that the number of opportunities for adult migration in the mainstem will be essentially maintained during normal water years, opportunities for smolt migration will be improved for both upper Salinas and Arroyo Seco subpopulations in up to 67% of normal water years, surface flows will be restored to the lower river and lagoon during the spring and summer, and spawning habitats will be enhanced in the Nacimiento River, the existing overall conservation value to the DPS of critical habitat in the action area is not likely to be further degraded when the effects are added to the baseline condition.

In addition to consideration of critical habitat, we analyzed the effects of the proposed action on SCCC steelhead within the action area when added to the species' baseline condition. We did this primarily by evaluating how habitat changes would likely affect survivorship at each stage in the species life cycle and the effect of these changes to sub-populations, the Salinas basin in total, and at the DPS scale. We considered changes in abundance, population growth rate, spatial distribution, and genetic and ecological diversity. We also considered the direct loss of juvenile steelhead possible at the SRDF and OSR construction sites.

When we consider the effects of the action added to current and future baseline conditions, we conclude that there would not be any appreciable change in survivorship in wet years, because ample passage opportunities are likely to remain both for adult and smolt migration. We infer improved smolt survival in normal years in the upper watershed from smolt block flow releases and improving spring flow conditions in the mainstem. We also assume a minor reduction in the total number of early run adult spawners in the upper Salinas during the first 3 to 4 years after implementation of the project, especially if these are dry, dry-normal, or normal water years. However, increased smolt survival brought about by the enhanced flows in the lower Salinas River during spring should directly result in higher returns of adults from the ocean to both the Arroyo Seco and upper Salinas Rivers in subsequent years. Likewise, the annual provision of continuous flows to the lagoon from spring through late October should enhance the survival of juvenile steelhead moving from both the upper Salinas and Arroyo Seco Rivers, with concomitant increases in the numbers of adults returning to spawn. Another likely benefit of the Flow Prescription will be the improved chances that reproductively spent adults will be able to return to the ocean during block flow releases, with increased chances for repeat spawning by these individuals in subsequent years. Given these considerations, we do not believe the overall reproductive capacity of either the upper Salinas or Arroyo Seco sub-populations will be adversely affected in the long run despite the potential for moderate, short-term impacts.

Our analysis of the effects of the SVWP on smolt migration recognizes that there remains some uncertainty regarding the effectiveness of the block flow releases for smolt passage. That uncertainty is related to the complexity of steelhead life history, channel morphology and hydraulics of the Salinas River and Arroyo Seco River, as well as the absence of data concerning the timing and duration of smolt migrations in this system. While we expect appreciable improvement in smolt outmigration in two-thirds of normal years, the factors described above hinder our ability to determine the precise magnitude of benefits from block flow releases.

With respect to the construction of the SRDF and OSR screen, we do not expect that the possible loss of a few juvenile steelhead during one summer of construction will have an appreciable impact on steelhead sub-populations in the Salinas River. Similarly, we anticipate that loss in some years of the small number of juvenile fish that may choose to rear in the SRDF impoundment will have little, if any impact on steelhead sub-populations in the watershed.

The increased survivorship we infer both for smolts and juvenile migrants from increased migration flows is likely to result in an increase in steelhead abundance in the Salinas basin, with some limitations. Because all life stages are likely experiencing reduced survival given the baseline condition, improvements to any single life stage do not necessarily result in a population level response. Fortunately, we anticipate improved survival in two key life stages: smolts and juvenile migrants. While the increased smolt and juvenile migration flows do not address the entire life cycle, they do partially address a major limitation: migration flows. Smolt survival in particular is likely to provide benefits because the dams have had a major impact to this life stage and the necessary flows are being returned to near historical conditions in normal years.

Another limitation to an increase in steelhead abundance is the different rates of survival in wet, normal, and dry year-types. Because there are fewer passage opportunities in dry years, as well as other adverse consequences of drought conditions, we assume overall steelhead production is lower during dry years. If dry years persist beyond the reproductive life span of most salmonids (three or four years), the chronic reduction in reproductive success may significantly reduce population abundance. We anticipate, given our limited understanding of future climate change that the likelihood of such drought conditions will increase to some degree. To the extent improvements in flow will be limited to normal years, the project will not prevent increases in drought conditions, if and when they occur, from further limiting population abundance.

Because population growth rate is a function of abundance, reproduction and survival, we anticipate the improved migration survival described above will result in some improvement in growth rates for all sub-populations within the Salinas basin. However, the improvement in growth rates is likely only to slow the decline of Salinas River steelhead, because of the population's overall negative growth trend, and current and expected future habitat conditions (including the potential for increased droughts).

We do not anticipate any change in the existing distribution of the species for two reasons. First, maintaining opportunities for access to spawning and rearing areas and increased survival at the smolt life stage will increase the chances of survival throughout the basin and therefore reduce the risk of extirpation and reduce the risk of population fragmentation. Second, there is no reason to believe that additional impediments that might further limit the species distribution will be associated with this project.

Steelhead of the Salinas basin likely possess several unique traits that allow them to survive in their particular environment. These include the ability to cope with relatively long migration distances, increased tolerance of warm water temperatures, a greater reliance on the resident life-cycle strategy, and a wide distribution in migration timing as described in the *Status of the Species* and *Environmental Baseline* sections. Because the population of steelhead in the Salinas River has been severely depressed for several decades, we assume that there has been a loss of genetic diversity underlying these traits. These small sub-populations also face a host of risks intrinsic to their low abundance. Small populations are generally at greater risk of extinction because as their numbers vary in response to environmental changes, the population can dip to critically low numbers more easily than larger populations (Gilpin and Soule 1986, Pimm *et al.* 1988). Small populations also tend to be highly vulnerable to naturally-occurring random extinctions (Boughton and Fish 2003), and to adverse effects of demographic stochasticity. While many of these risks are not likely to be alleviated, the proposed action may provide some risk reduction by improving adult and smolt migration habitat in some months and in some water year types.

Although steelhead sub-populations of the Salinas basin probably consist of little more than 50 spawning adults in any given year, most of which spawn in the Arroyo Seco River, they play a significant role in the survival of the SCCC DPS for several reasons: 1) they represent a large distributional component of the overall range of the DPS, 2) they inhabit ecologically distinct areas unique to the DPS, and 3) they exhibit unique life history traits. Based on watershed size, location, ecological context, and overall status of SCCC steelhead, the Salinas River has the potential (if it were to support a viable steelhead population) to prevent fragmentation in the distribution of SCCC steelhead, contribute to the genetic diversity of the species, and ameliorate the overall extinction risk of the DPS. Because we found no appreciable reduction in the functioning condition of the action area's aquatic habitat, and because changes to habitat will not likely cause a population response that would adversely affect subpopulation viability, we anticipate no appreciable reductions in the reproduction, numbers, or distribution of the species as a result of this proposed project.

IX. CONCLUSION

After reviewing the best available scientific and commercial data, the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the installation of a seasonal river diversion facility with a small dam and diversion structure in the mainstem Salinas River together with MCWRA's proposed flow prescription for steelhead in the Salinas River is not likely to jeopardize the continued existence of threatened SCCC steelhead.

After reviewing the best available scientific and commercial data, the current status of the SCCC critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the installation of a seasonal river diversion facility with a small dam and diversion structure in the mainstem Salinas River together with MCWRA's proposed flow prescription for steelhead in the Salinas River is not likely to adversely modify or destroy critical habitat for SCCC steelhead.

X. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA 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 NMFS as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which 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 the purpose of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps and its permittee for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps: (1) fails to assume and implement the terms and conditions, or (2) fails to require any permittee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to any permit, grant document, or contract, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

A. Amount or Extent of Take

Natural factors, other human impacts on the species, limited visibility in aquatic habitats, fish movement in streams, and small fish body size make it difficult to determine precise numbers of salmonids likely to be harmed or killed by the proposed project. For example, determining the precise number of early migrating adult steelhead prevented from migrating upstream by the proposed project is difficult because: 1) steelhead numbers fluctuate year-to-year based on natural factors (*i.e.*, ocean conditions) and other human impacts (*i.e.*, fishing), 2) steelhead often cannot be observed when migrating in rivers and streams, 2) scavengers are likely to eat carcasses of steelhead that die before they can be counted, and 3) even if carcasses are collected, cause of death can be difficult to determine. Because NMFS is unable to determine the precise number of steelhead that may be affected by all SVWP activities, we will use habitat impacts as a surrogate for take; in those instances where we can reasonably estimate the number of individuals likely to be impacted, we do so. Therefore, habitat degradation by individual PCE's specified by location, timing, magnitude, and duration of the impacts will be surrogates for take.

Where these adverse changes to habitat occur, we expect a resulting take of steelhead as described in the effects analysis.

We consider the freshwater migration corridors PCE in terms of adult migration, and separately as smolt migration. For adult migration, reduced passage opportunities will be limited spatially to the mainstem Salinas River and temporally to the months of December through April, with a bias towards the earlier months. We define the magnitude of these changes by the reduction in the percentage of migration opportunities. These are variable by year-type as well as by month as described in the effects analysis. For the smolt outmigration component of the freshwater migration corridors PCE, reduced passage opportunity is also defined by the number of passage days and is limited to the same periods and locations as adult migration opportunities. However, our ability to quantify these changes is more limited than for adult passage because we lack specific minimum flow passage criteria for this life stage. Therefore, we have used the estimated reduction in the percentage of adult migration opportunities as an index of the changes in passage days for smolts. We recognize that flow prescriptions that promote smolt passage will benefit the steelhead run in the Arroyo Seco and Salinas Rivers in up to 67% of normal water years. However, increased storage capacity of Nacimiento Reservoir will likely diminish flows in the mainstem Salinas River, and this will likely contribute to the periodic take of some fish due to stranding. If the number of days that daily average flow equals or exceeds 260 cfs at the USGS gage at Chualar is less than a total of 16, 47, and 73 days[22] per winter during dry-normal, normal-normal, and wet-normal water years, the amount of incidental take anticipated in this biological opinion will be exceeded.

As described below in the *Terms and Conditions*, fish sampling in the Salinas River basin will be required. Based on the existing conditions in the basin (*e.g.*, reduced summer base flows that have reduced the amount of available rearing space, exacerbating high temperatures, and otherwise reducing the survival of steelhead fry, parr, and pre-smolts) we do not expect many juveniles to be captured during fish sampling activities. However, based on the existing conditions in the Arroyo Seco River (the largest un-dammed tributary with steelhead habitat in the Salinas River watershed and closest Salinas River tributary to the Pacific Ocean with suitable spawning and rearing habitat) NMFS expects more juveniles will be captured here than elsewhere in the basin. Based on the low mortality rates for typical capture efforts, we anticipate no more than one percent of the juvenile steelhead captured will be killed during these capture activities. If more than 500 juvenile steelhead are captured (or mortality of either captured pre-smolts or smolts exceeds 3%), either in the mainstem Salinas, Nacimiento or Arroyo Seco Rivers, the amount of incidental take authorized in this biological opinion will be exceeded.

We do not anticipate any adverse change to freshwater spawning or rearing PCEs, and therefore no take of spawning adults, eggs, fry, or juveniles from habitat changes of this type are expected. However, if adverse changes to these PCEs occur, we would assume that the anticipated level of incidental take would also be exceeded.

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[22] Flow releases from Nacimiento Dam will be adaptively managed with the intention of meeting the above target passage days within 10%. For example, in a dry-normal year, if total passage days were less than 14.4 days, incidental take may be exceeded.

In the effects analysis, we also concluded that up to a total of 20 juvenile steelhead could be captured and relocated annually in association with fish relocation activities at the SRDF and the OSR. Based on the low mortality rates for typical relocation efforts, we anticipate no more than one percent of the juvenile steelhead present in the areas to be dewatered will be harmed or killed during relocation and dewatering efforts. If more than 20 juvenile steelhead are captured and relocated annually, then the amount of anticipated incidental take will have been exceeded.

At the end of the diversion season, MCWRA will empty the impoundment. Based on existing habitat conditions and our knowledge of fish densities in similar habitat conditions, we concluded that up to 20 fish may die annually via dessication or predation as pools dry up in association with decommissioning the impoundment. Because the maximum length of the impoundment is approximately three miles and dead or dying juvenile steelhead may be eaten by predators before the fish are quantified, it will be difficult to verify the number of juvenile steelhead that may have died in association with decommissioning the impoundment. NMFS expects MCWRA's plan to empty the impoundment over 27 days will minimize the likelihood of steelhead getting stranded, however if in a single year more than 20 fish are known to have died via dessication or predation as pools dry up, the amount of incidental take will have been exceeded.

In addition, several fish may be present in the fish ladder when flows are discontinued at the end of each season. If more than three fish are stranded in the ladder in association with the annual decommissioning of the fish ladder, take will have been exceeded.

B. Effect of the Take

In the accompanying opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to SCCC steelhead.

C. Reasonable and Prudent Measures

Pursuant to section 7(b)(4) of the ESA, the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize take of SCCC steelhead. Measure 1 applies to construction of the SRDF. Measures 2 and 3 apply to the following interrelated and interdependent activities: the operation of the SRDF, other flow releases, and monitoring.

1. Construction-related activities shall be implemented in a manner that minimizes harm, injury, and mortality to steelhead.
2. Ongoing operations of the SRDF shall be conducted in a manner that minimizes harm, injury, and mortality to steelhead.
3. Additional operational management agreements between MCWRA and NMFS will be implemented in a manner that minimizes degradation of steelhead habitat and integrates an adaptive approach to implement the SVWP Flow Prescription for steelhead and provides flows fostering the recovery of steelhead sub-populations in the Salinas Watershed.

D. Terms and Conditions

In order to be exempt from the take prohibitions of section 9 of the ESA, the Corps, MCWRA, and their contractors or designees must comply with the following Terms and Conditions for Reasonable and Prudent Measure 1 described above. MCWRA must also comply with the following Terms and Conditions for Reasonable and Prudent Measures 2 and 3, in order to be exempt from the take prohibitions of the ESA.

The following terms and conditions implement Reasonable and Prudent Measure 1 to minimize take of steelhead from construction-related activities.

1. The Corps or MCWRA shall coordinate and collaborate with NMFS on designs for the SRDF and structures related to fish passage and fish screening to ensure that appropriate design criteria minimizing effects to steelhead can be developed for each individual project component. Prior to commencement of construction on the SRDF or any structures related to fish passage or fish screening, the Corps or MCWRA shall submit the final engineering design for the SRDF and structures related to fish passage and fish screening to NMFS for evaluation and acceptance prior to implementation. The Corps or MCWRA shall also submit any other reports accompanying the final design, including geotechnical information on the impact of the final design on Salinas River channel morphology. The designs (and reports) should be sent to the NMFS Santa Rosa Area Office, Attention: Team Leader, Fisheries Engineering Team, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528.

2. At least fourteen days prior to beginning in-channel construction, the Corps or MCWRA shall notify the Santa Rosa Area Office Supervisor, Protected Resources Division, by letter, of the date in-channel construction will commence. The purpose of this contact is to provide an opportunity for NMFS staff to observe in-channel construction activities. The Santa Rosa Area Office address is: 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528.

3. The Corps or MCWRA shall allow any NMFS employee(s) or any other person(s) designated by NMFS, to accompany field personnel to visit the site during construction.

4. Prior to SRDF construction, MCWRA shall inform workers of the importance of protecting steelhead and their habitats and provide workers training sufficient to ensure protection of steelhead and steelhead habitats.

5. Water that comes in contact with wet concrete and has a pH greater than 9.0 must not be allowed to enter the ground or stream but shall be either: (1) pumped to a separate, lined basin, and then pumped to a truck or upland for disposal or treatment (not within the bank to bank of any waterway); or (2) pumped directly to a truck for disposal at a site that is not within the top of bank to top of bank of any waterway.

6. Construction equipment used within the stream channel will be checked for leaks each day prior to work within the creek channel (top of bank to top of bank) and if necessary action will be taken to prevent fluid leaks. If leaks occur during work in the channel (top

of bank to top of bank), Corps, MCWRA, or their contractor will contain the spill and remove the affected soils.

7. Once in-channel construction is finished, all project introduced material (pipe, gravel, false work, filter fabric, demolition debris, *etc.*) must be removed, leaving the stream as it was before construction. Excess materials will be disposed of at an approved disposal site.

8. Riparian trees greater than 3" in diameter that are removed to access or construct the SRDF will be replaced with native riparian trees at a 3:1 ratio with the goal of 1:1 replacement of removed trees after three years. Trees removed permanently by the placement of the SRDF will be replaced directly upstream or downstream of the construction site as described above.

9. The standard for success for revegetation activities shall be 80 percent survival of plantings or 80 percent ground cover for broadcast planting of seed after a period of three years. If either success criteria is not met, Corps and MCWRA shall collaborate with NMFS to develop and undertake a satisfactory plan for revegetation.

10. The Corps and MCWRA shall provide a written report to NMFS by January 15 following completion of construction. The report shall be submitted to the NMFS Santa Rosa Area Office Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report shall contain, at a minimum, the following information:

    a. Construction-related activities. The report shall include the dates construction began and was completed; a discussion of any unanticipated effects or unanticipated levels of effects on steelhead, a description of any and all measures taken to minimize those effects and a statement as to whether or not the effects had any affect on ESA-listed fish; the number of steelhead killed or injured during the project action; and photographs taken before, during, and after the activity from photo reference points.

    b. Revegetation. The report shall include a description of the locations planted, the area (m^2) revegetated, a plant palette, planting methods, the efforts taken to ensure success of new plantings, performance or success criteria, and pre- and post-planting color photographs of the revegetated area.

    c. Fish Relocation. The report shall include a description of the location from which fish were removed and the release site (per RPMs 16, 17, and 18) including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport steelhead; if an electrofishing unit was used for fish collection, a copy of the logbook must be included; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

d. Fish Passage. To ensure performance of the SRDF fish ladder, MCWRA shall coordinate with NMFS in order to complete a fish ladder flow performance test to verify stage-flow characteristics for the full range of SRDF impoundment operational stages. The report shall document how the SRDF fish passage structure when in place meets or exceeds the NMFS guidelines for salmonid passage. The report shall document at what flows salmonid passage through the structure is possible and a description of the frequency, duration, and timing of those flows at the structure.

e. Fish Screens. The report shall document how the SRDF and OSR fish screens when in place meets or exceeds the NMFS guidelines for fish screening.

11. The Corps and MCWRA shall ensure that turbidity and sedimentation resulting from the onset of fall/winter rains on disturbed soils are minimized. Prior to the first rain of the season, all soils within 100 feet of the Salinas River disturbed by construction activities, including the River's banks, shall be revegetated or erosion control materials and devices shall be in place to minimize sedimentation and turbidity generated by precipitation.

12. A biologist shall monitor in-channel activities and performance of sediment control or detention devices for the purpose of identifying and reconciling any condition that could adversely affect steelhead or their habitat.

13. Sediment controls shall be maintained until soils are revegetated or otherwise stabilized. Sediment shall be removed from sediment controls once it has reached one-third of the exposed height of the control. Whenever straw bales are used, they shall be staked and dug into the ground 12 cm. Catch basins shall be maintained so that no more than 15 cm of sediment depth accumulates within traps or sumps.

14. Contractors must have a supply of erosion control materials onsite to facilitate a quick response to unanticipated storm events or emergencies.

15. Water for dust abatement, if necessary, must be acquired from an off-site source. Water drafting from the action area is not permitted.

16. The Corps and MCWRA shall retain a qualified biologist with expertise in the areas of anadromous salmonid biology, including handling, collecting, and relocating steelhead; salmonid/habitat relationships; and biological monitoring of steelhead. The Corps and MCWRA shall ensure that all biologists working on this project be qualified to conduct fish collections in a manner which minimizes all potential risks to ESA-listed steelhead. Electrofishing, if used, shall be performed by a qualified biologist and conducted according to the *NOAA Fisheries Guidelines for Electrofishing Waters Containing Steelhead Listed Under the Endangered Species Act*, June 2000.

17. ESA-listed fish shall be handled with extreme care and kept continuously in water to the maximum extent possible during rescue activities. All captured fish shall be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream and fish shall not be removed from this water except when released. To avoid predation the biologist shall have at least two containers and segregate young-of-year fish from larger age-classes and other potential aquatic predators. Captured steelhead will be relocated, as soon as possible, to a suitable instream location in which suitable habitat conditions are present to allow for adequate survival of transported fish and fish already present.

18. If any steelhead are found dead or injured, the biologist shall contact the Santa Rosa Area Office Supervisor, Protected Resources Division, at (707) 575-6050. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length, and be frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than NMFS Santa Rosa Area Office without obtaining prior written approval from the Santa Rosa Area Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate.

19. The biologist shall monitor the construction site during placement and removal of cofferdams to ensure that any adverse effects to steelhead are minimized. The biologist shall be on site during all dewatering events to ensure that all ESA-listed steelhead are captured, handled, and relocated safely. The biologist shall notify the Santa Rosa Area Office Supervisor, Protected Resources Division by phone at (707) 575-6050 one week prior to capture activities in order to provide an opportunity for NMFS staff to observe the activities.

20. If during sheet pile placement activities residual pools are left in the Salinas River within 500 feet upstream and downstream of the construction site, a biologist must observe those residual pools for evidence of adverse responses by steelhead to the pile placement activities. That biologist shall rescue any steelhead from those residual pools which appear to be adversely affected by pile placement activities. All rescued fish will be handled and released as described above.

The following terms and conditions implement Reasonable and Prudent Measure 2 to minimize harm, injury, and mortality to steelhead associated with ongoing operation of the SRDF.

21. The Corps and MCWRA shall provide written reports annually to NMFS. The reports shall be submitted to the NMFS Santa Rosa Area Office Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. Each report's minimum content is as follows:

    a. Fish Passage. The report shall document for the previous water year all flow releases from Nacimiento Reservoir and San Antonio Reservoir, stream flow monitoring data collected by MCWRA as identified in the Migration Habitat Monitoring section of this biological opinion, a description of the days and dates engineered block flows occurred (MCWRA shall telephone or email NMFS when engineered block flows occur), and number of adult and smolt passage days whether engineered block flows occurred or not. This report shall be provided to NMFS annually no later than July 1.

b. Fish Screens. The report shall document at what date and stream flow the screens were installed and removed. This report is due annually no later than July 1.

c. Fish Relocation. The report shall include a description of the location from which fish were removed (SRDF ladder or impoundment) and the release site (per RPMs 16, 17, and 18) including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport steelhead; if an electrofishing unit was used for fish collection, a copy of the logbook must be included; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

22. To reduce the likelihood of stranding steelhead during final drawdown of the impoundment, MCWRA shall manage the impoundment created by the SRDF such that surface elevation is reduced by no more than 0.16 feet per hour (or 2 inches per hour) as specified in NMFS guidance on the operation of seasonal dams (NMFS 2001).

23. A qualified biologist shall capture any steelhead remaining in the fish passage structures or stranded in the impoundment at the end of the irrigation season, and handle and release them as described under RPMs 16, 17, and 18 of this incidental take statement.

24. The Corps or MCWRA shall monitor stream course, bank stability, the structural integrity of the SRDF and related fish passage and screening structures, as well as stream habitat, each summer for a period of three years to determine if any adverse changes to the channel morphology have occurred in association with the SRDF and related structures. A report, detailing the results of this monitoring, shall be produced subsequent to the three year period. The Corps and MCWRA will be responsible for rectifying any adverse changes in a timely manner, if they occur.

25. MCWRA shall develop a channel maintenance plan addressing conditions upstream and downstream of the SRDF. The channel maintenance plan shall be developed cooperatively with NMFS no less than 30 days prior to construction activities. The channel maintenance plan shall include, but not be limited to, the following measures:

    a. Collection of annual channel cross sections upstream and downstream of the SRDF,

b. A description of potential responses to streambed scour associated with the SRDF,
c. Lowflow channel protection measures, and
d. A description of sediment and vegetation removal activities.

26. MCWRA shall begin creating a vegetated treatment system within Blanco Drain prior to the completion of SRDF construction activities. Prior to creating the vegetated treatment system, MCWRA shall provide to NMFS the specific design and the specific location for the vegetated channel sections. The purpose of this Term and Condition is to have the treatment implemented before the SVWP is operating. In the event that vegetated treatment is inadequate to reduce diazinon and chlorpyrifos, MCWRA shall implement other measures, as described in their January 27, 2006, errata, prior to April 1 of the following irrigation season.

The following terms and conditions implement Reasonable and Prudent Measure 3 to provide for a monitoring and adaptive management approach to implement the SVWP Flow Prescription for Steelhead and providing flows fostering the recovery of steelhead in the Salinas River watershed.

27. MCWRA shall develop and implement a plan to monitor physical habitat and biological parameters for the purposes of providing relevant information to be used in an adaptive management approach to water management and steelhead conservation in the Salinas River. The monitoring program shall include, but not be limited to, the following:

    a. Biological Monitoring. Three measures of steelhead population status shall be monitored in order to better understand the current condition of steelhead in the basin, and to detect coarse-level changes in population status. These measures will be: Adult abundance, smolt abundance, and juvenile densities.

        i. Adult steelhead escapement will be monitored from December 1 through March 31 using a DIDSON camera. MCWRA shall provide NMFS with verification that DIDSON operators have appropriate training. The use of DIDSON to monitor adult and smolt steelhead migration shall occur annually for not less than 10 years, unless NMFS and MCWRA mutually agree to an alternative time frame. Data on migration timing and abundance shall be collected. If quantitative abundance estimates cannot be achieved, a sampling approach shall be used to provide an index of annual run size.

        ii. To confirm the adequacy of block flow releases, the timing and abundance of steelhead smolts shall be monitored using four downstream migrant traps (*e.g.*, rotary screw traps) to quantify downstream migration of smolts in the Arroyo Seco and Salinas rivers. This shall occur annually for not less than 10 years, unless NMFS and MCWRA mutually agree to an alternative time frame.

iii. Information on the effectiveness of juvenile passage at the SRDF shall also be collected with the DIDSON camera effort, which shall extend that sampling period through June 15.

iv. To evaluate juvenile steelhead response to changes in stream flows, juveniles shall be monitored by establishing multiple index reaches of no less than 30 meters in the Arroyo Seco River and Nacimiento River. Multiple-pass dive-counts and/or electrofishing (depletion sampling) shall be conducted annually at the index reaches to provide distributional information, estimate juvenile rearing densities, and to provide samples for determining the proportion of the population derived from anadromous stock. Sampling shall occur between July 1 and October 31 annually for not less than 10 years, unless NMFS and MCWRA mutually agree to an alternative time frame.

v. In addition to the index reach monitoring, annual stranding surveys shall be conducted below the Nacimiento dam to assess the effects of downramping of dam release flows on multiple age-classes of juvenile steelhead. If after five years, the index reach monitoring described above indicates no juvenile steelhead are present (*i.e.,* only resident *O. mykiss* are) then stranding surveys may be reduced to those years when substantial adult upstream migration of steelhead are detected.

(1) All juvenile steelhead found stranded during the surveys shall be rescued and relocated as soon as possible to a location in which suitable habitat conditions are present to allow for adequate survival of rescued fish as well as the fish already present.

b. Physical Monitoring. The condition of migration habitat in the action area shall be assessed and monitored in order to verify that flow releases are meeting their intended objectives as they relate to adult and smolt migration.

i. Minimum passage criteria for adult and smolt steelhead shall be refined by measuring the flow/depth relationship at critical riffles in the vicinity of Bradley, Soledad, and Arroyo Seco below Reliz. This will be completed within the first three years of SVWP implementation. Measurements will be taken during the declining limb of the summer and winter hydrographs when stream flows are at or near 400 cfs, 300 cfs and 150 cfs.

ii. USGS gaging station data will be analyzed throughout the action area to monitor the effectiveness of flow release strategies in providing adequate passage opportunities for adult and smolt steelhead.

c. Reporting Requirements. The following shall be included as monitoring report components:

i. A fully developed monitoring plan and implementation schedule shall be developed in collaboration with NMFS and provided to NMFS prior to the operation of SRDF.

ii. Annual reporting of the biological monitoring results shall be provided to NMFS by no later than April 15 of the next year. For example, the report for biological monitoring in 2008 is due by April 15, 2009. This report should assess the status of Salinas River steelhead populations in light of the monitoring results and provide direction for future monitoring needs.

iii. To verify passage conditions and inform the adaptive management strategy, an integrated passage analysis for the basin shall be provided annually to NMFS. All factors contributing to, or limiting, the successful migration and subsequent reproduction of steelhead in the Salinas River shall be considered and discussed in this report. This shall include, but not be limited to, a spatial and temporal assessment of passage opportunities from the mouth of the river to various spawning sites upstream, given the timing, migration rate, and existing status of steelhead in the basin.

28. Adaptive Management Strategy

a. The implementation of the Salinas Valley Flow Prescription for Steelhead Trout (as defined in the Description of the Proposed Action), shall be evaluated annually for its effectiveness in improving steelhead habitat in the action area. This evaluation shall be based on the best scientific and commercial data available and shall include consideration of MCWRA monitoring results, other pertinent survey data, and published literature as they become available. The annual evaluation of a given water year shall be provided to NMFS by April 15 of the following water year. For each year, provisional gauge data will be provided in the next April report; subsequent annual reports will provide shift corrected (i.e., final) USGS gauge data (reports will include provisional data from the most recent year and shift corrected data from the previous year).

b. If the annual evaluation indicates the flow prescription is not performing as expected, MCWRA shall develop modified flow prescriptions to attain or surpass the improvements originally defined in the Description of the Proposed Action. These modifications should include consideration of any opportunities to improve steelhead habitat conditions if they are identified.

c. All modified plans shall be mutually agreed upon by MCWRA and NMFS prior to implementation.

d. This adaptive process shall continue in an iterative fashion for the life of the project.

29. MCWRA shall provide NMFS with real-time operational information to Santa Rosa Area Office Supervisor, Protected Resources Division by phone at (707) 575-6050. The notification shall include:

    a. Notification of water year type category on March 15,
    b. Notification of water year type category on April 1,
    c. Notification of when block flows for smolt passage have begun, and
    d. Notification of when block flows for smolt passage cease.

XII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the Act 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 listed species or critical habitat, to help implement recovery plans, or to develop information.

1. To improve water quality entering the lagoon from the Blanco Drain, the Applicant could route the effluent through the nearby waste treatment facility and release the treated wastewater into the lagoon. To further this goal of reducing the discharge of pollutants to the biologically important lagoon, the Corps should provide funding and technical assistance to MCWRA to identify sources of pollutants entering Blanco Drain. This could be followed up with the development of collaborative partnerships with those parties associated with the sources for the purpose of reducing toxic inputs into Blanco Drain.

2. The major portion of historical steelhead spawning and rearing areas of the Salinas River is currently blocked by Nacimiento and San Antonio dams. To mitigate for the historical loss of steelhead spawning and rearing habitats in the Salinas River watershed, the Corps should fund and provide technical assistance to MCWRA and NMFS to conduct a feasibility study to evaluate fish passage opportunities at Nacimiento and San Antonio dams.

3. Summer and fall rearing habitat in the lower Nacimiento River is adversely affected by flow manipulations. The Corps should provide technical assistance to MCWRA to evaluate the feasibility of developing a pipeline to deliver conservation flows from Nacimiento Dam to the mainstem Salinas River rather than using the natural channel below the dam. This would allow for a flow regime to be implemented in the lower Nacimiento River for the benefit of summer steelhead rearing habitat while still allowing for delivery of conservation or irrigation flows.

4. The Corps should provide technical assistance and expedited permitting to MCWRA to change the location or operation of the gate connecting the Salinas River lagoon to the Old Salinas River Channel. Currently, the upper layer of water is drawn off the lagoon when the gate is opened. This upper layer of water is mostly freshwater because the lagoon is typically stratified. By diverting more of the saltwater in the lower layer,

bypass flows from the SRDF are likely to be more beneficial to steelhead as more freshwater rearing habitat is likely to be retained in the lagoon.

5. The Corps and MCWRA should identify and prioritize any maintenance and construction projects (e.g. culvert replacement) that if implemented, can improve salmonid migration or in-stream environmental conditions.

6. Flood flows play an important role in river geomorphology and the production and maintenance of steelhead habitat. NMFS recommends that the Corps and MCWRA, in consultation with NMFS, design and implement a study to determine if there are any impacts on the ecological characteristics of the Salinas River due to flood control operations. And, if adverse impacts are identified, the Corps and MCWRA should identify alternative operational protocols to minimize adverse impacts to the ecological characteristics of the Salinas River.

7. During those years when block flows are released and the lagoon mouth is open on March 15, NMFS recommends that MCWRA make every reasonable attempt keep the mouth open from March 15 until the end of the block flow releases. This will minimize adverse effects to Western snowy plovers.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

XIII. REINITIATION NOTICE

This concludes formal consultation on the proposed SVWP. As provided 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 incidental take is exceeded, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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