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

May 31, 2012

In response refer to:
F/SWR/2012/01069

Ms. Robin Schrock
Executive Director
Trinity River Restoration Program
PO Box 1300
South Main Street
Weaverville, CA 96093

Dear Ms. Schrock:

This letter transmits NOAA's National Marine Fisheries Service's (NMFS) final biological opinion (enclosure 1) and Essential Fish Habitat (EFH) consultation (enclosure 2) pertaining to the Bureau of Reclamations' proposed funding of the Buckhorn Dam/Grass Valley Creek Toe Drain and Channel Rehabilitation Project (hereinafter referred to as Project) carried out by the Trinity River Restoration Program (TRRP).

The project is proposed to occur in the late summer and early fall of 2012, and consists of dredging approximately 9,000 cubic yards of sediment including a small bedrock outcropping from Grass Valley Creek, a tributary to the Trinity River in Trinity County, California. Reclamation will fund TRRP to carry out the construction, as well as the following restoration activities that are also considered in the biological opinion: spawning gravel placement, instream barrier modification for fish passage improvement, riparian habitat restoration, large woody debris placement, and creation of off-channel/side-channel habitat features.

The enclosed biological opinion is based on NMFS' review of information provided with TRRP's March 6, 2012 request for formal consultation, a biological assessment (BA) for the project, several e-mails that occurred during the consultation, and site visits by NOAA and TRRP staff. The biological opinion addresses potential effects on the threatened Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*) Evolutionarily Significant Unit (ESU) (70 FR 37160, June 28, 2005) and critical habitat for the SONCC coho salmon ESU (64 FR 24049, May 5, 1999).

Based on the best scientific and commercial information available, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of the SONCC coho salmon ESU and is not likely to result in the destruction or adverse modification of

designated critical habitat for the SONCC coho salmon ESU. NMFS expects the proposed action will result in incidental take of SONCC ESU coho salmon. An incidental take statement is included with the enclosed biological opinion. The incidental take statement includes non-discretionary reasonable and prudent measures and terms and conditions that are expected to reduce the amount or extent of incidental take of SONCC ESU coho salmon because of the proposed action.

The enclosed EFH consultation (enclosure 2) was prepared pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). The proposed action includes areas identified as EFH for coho salmon and Chinook salmon under the Pacific Coast Salmon Fishery Management Plan. Based on our analysis, NMFS concludes that the project would adversely affect EFH for coho salmon and Chinook salmon. However, the proposed project contains adequate measures to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH. NMFS has no additional EFH conservation recommendations to provide at this time. This concludes EFH consultation for the proposed project. Pursuant to 50 CFR 600.920(l), Reclamation must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH.

If you have any questions regarding these consultations, please contact Seth Naman at (707) 825-5180.

Sincerely,

for Rodney R. McInnis
Regional Administrator

Enclosures

cc: Copy to Administrative File: 151422SWR2011AR00118

Enclosure 1

BIOLOGICAL OPINION

DELIBERATIVE DRAFT DO NOT CITE

ACTION AGENCY:	**U.S. Bureau of Reclamation**
ACTION:	**Buckhorn Dam/Grass Valley Creek Toe Drain and Channel Rehabilitation Project**
CONSULTATION CONDUCTED BY:	**National Marine Fisheries Service, Southwest Region**
TRACKING NUMBER:	**151422SWR2011AR00118**
DATE ISSUED:	**May 31, 2012**

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1. BACKGROUND AND CONSULTATION HISTORY

1.1. Background

Two-thirds of Grass Valley Creek (GVC) is underlain by the youngest (127 million years old) and most erosive batholith of decomposing granitic rock found within the entire Klamath River Basin (TCRCD 1998). These predominantly granitic watersheds were intensively roaded and logged without proper erosion control for many decades (TCRCD 1998). Subsequent storms delivered excessive amounts of sand-sized sediment to one of the historically best spawning reaches of the Trinity River (TCRCD 1998). Reclamation began construction on Buckhorn Dam in 1988, with construction completed in November 1991. The dam is located northwest of Redding, California (Figure 1-1). The dam was built to trap decomposed granite eroding from the watershed in order to reduce fine sediment input into the Trinity River. The dam does not have a fish passage system and thus eliminates migration to the upper nine miles of historic headwater habitat. The dam has an uncontrolled "run of the river" concrete spillway that spills during the winter-spring runoff period or storm events. The dam also has a gated conduit system serving as the dam outlet works, which provides cold water to the outlet channel from the bottom of Buckhorn Reservoir. The outlet channel is a natural stream bottom channel with substrate that consists of a high proportion of decomposed granite. The entire length of the outlet channel is approximately 2,300 feet from the dam to the confluence with the concrete-lined spillway channel. After this confluence point GVC continues downstream before reaching the Trinity River 10.8 mi downstream. Reclamation historically has kept the outlet works discharge level at approximately 6 cubic feet per second (cfs) throughout the calendar year, though it has a maximum release capacity of approximately 243 cfs. After the reservoir fills with water, all inflow in excess of 6 cfs is discharged via the spillway.

Toe-drains located at the base of the dam are designed to be dry and to serve as an indicator of dam integrity. Immediately following construction of the dam in 1991, it became clear that the water surface elevation in the outlet channel was causing water to back up into the toe drains. This design flaw made it impossible to measure dam seepage, a key indicator of possible dam failure. Therefore, the inability to measure dam seepage has created a "Safety of Dams" issue and necessitated lowering the elevation of the streambed.

A bedrock outcropping that lies 600 feet downstream of the dam and subsequent beaver activity are the primary controls on the water surface elevation. This bedrock outcropping would need to be removed in order for the slope of the outlet channel to have enough angle to convey water away from the dam. In addition to the need to correct the dam safety issue, the Buckhorn Dam outlet channel could be enhanced to provide additional fish habitat. GVC is a fourth order stream that has coho salmon (*Oncorhynchus kisutch*) living throughout the 10.8 miles of stream length from Buckhorn Dam to the Trinity River. GVC currently serves as one of the vital production tributaries to the Trinity River for threatened coho salmon.

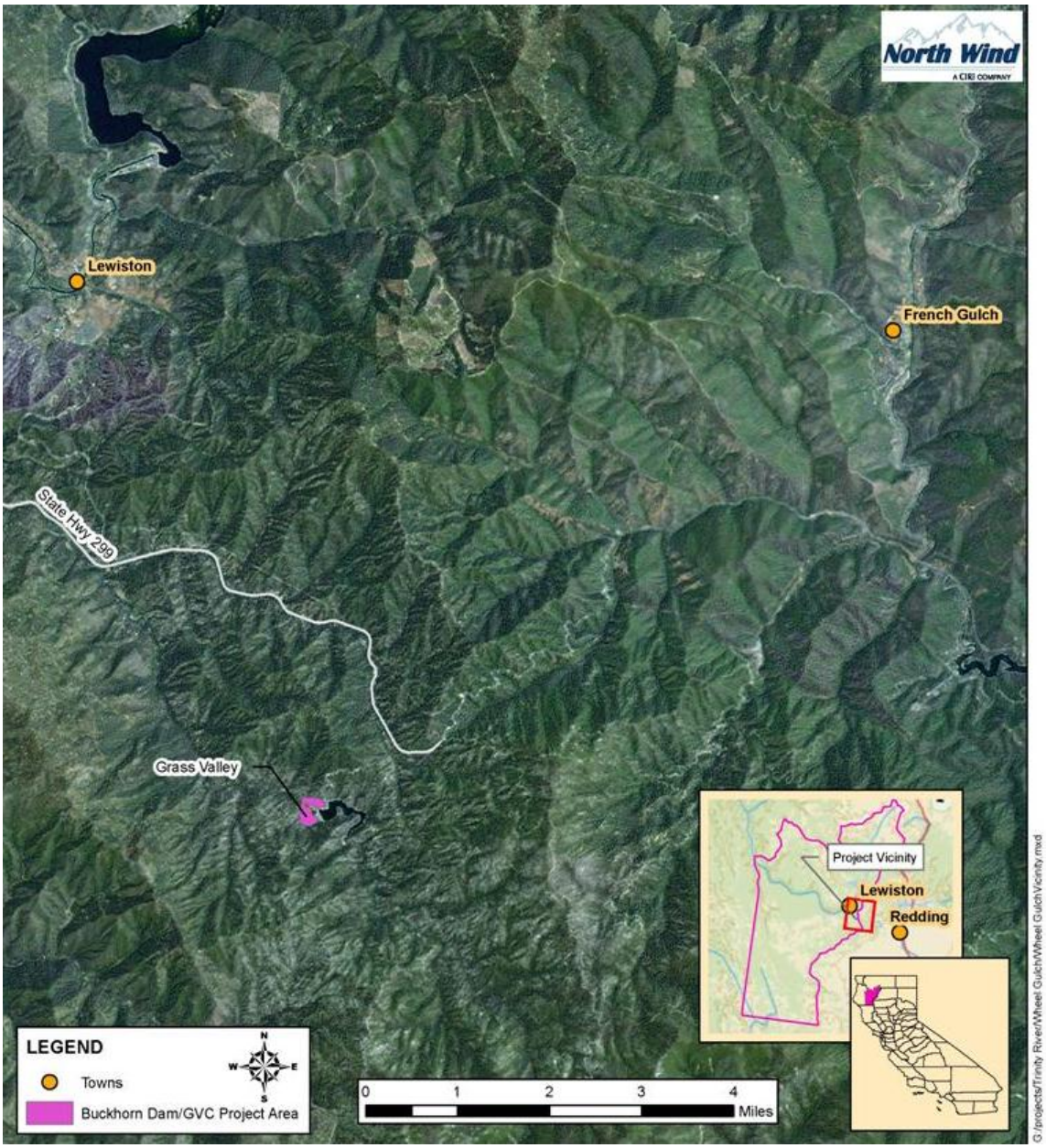

Figure 1-1. Location of Buckhorn Dam and Buckhorn Reservoir. The project location is highlighted pink. Buckhorn Dam and Reservoir can be seen adjacent to the project location.

1.2. History of Consultation

Discussions regarding this project have occurred between National Marine Fisheries Service (NMFS) staff and Trinity River Restoration Program (TRRP) staff for approximately a year and a half. Discourse first centered on a pulse flow of 100 cfs that was released to the outlet channel in April of 2011. NMFS and TRRP staff communicated with each other from February to April 2011 regarding the planned pulse flow in April of 2011 to develop an appropriate hydrograph for

the pulse flow. The objective of the pulse flow was to test the dam outlet works and to flush materials that could be moved (e.g., decomposed granite or portions of a beaver dam located at the bedrock outcropping) from the project reach using only flows.

On June 23, 2011, staff from NMFS, Reclamation, TRRP and the Trinity County Resource Conservation District (TCRCD) visited the project site and toured the proposed action area. Seth Naman (NMFS) and Brandt Guttermuth (TRRP) performed a snorkel survey of the entire outlet channel, including areas downstream and upstream of the bedrock outcropping. Many hundreds of SONCC coho salmon juveniles were observed to be in the outlet channel. However, zero coho salmon were found in the 600 ft of channel upstream of the bedrock outcropping. This suggests the bedrock outcropping and beaver dam act as a barrier for coho salmon.

Seth Naman and Brandt Gutermuth returned to the project area on June 30, 2011 to assess the abundance of coho salmon downstream of the confluence of the outlet channel with the spillway channel. While the outlet channel consists almost exclusively of decomposed granite substrate, GVC downstream of the confluence with the spillway channel contains a mixture of decomposed granite and more natural cobble and gravel in addition to having a more variable and natural flow regime. The object of the survey was to compare the abundance of coho salmon between the outlet channel and the main GVC channel. The results of the survey indicated that coho salmon were at least as abundant in 200 feet of GVC that was surveyed as they were in the outlet channel downstream of the fish barrier.

On November 29, 2011, NMFS received a draft Biological Assessment (BA) from TRRP. NMFS staff provided comments on the draft BA and returned the document to TRRP staff December 12, 2011. On March 6, 2012, NMFS received an initiation package from TRRP including the final BA. NMFS responded to the request for consultation on March 27, 2012 and indicated the request contained sufficient information to initiate consultation.

2. DESCRIPTION OF THE PROPOSED ACTION

2.1. Project Location

Buckhorn Dam is located in Trinity County, California along the eastern border with Shasta County near Buckhorn Summit (Figure 1-1). The dam is located approximately 25 miles west-northwest of Redding, California (Figure 1-1). The dam is situated within the GVC watershed along Upper GVC in a narrow, V-shaped valley (Figure 2). The GVC watershed encompasses 23,525 acres within steep, mountainous terrain ranging in elevation from around 1,600 to 5,950 feet and is an important watershed of the Trinity River Basin. GVC flows northwesterly into the Trinity River about 6 miles downstream from the old Lewiston Bridge. The creek provides spawning and rearing habitat for threatened coho salmon as well as steelhead and Chinook salmon, which are not listed under the Endangered Species Act.

For the purposes of this document, the two water-bearing channels at the base of Buckhorn Dam are defined as: 1) GVC which flows downstream of the spillway and receives all overflow from the Buckhorn Dam Reservoir, and 2) the Buckhorn Dam outlet channel which essentially is the "headwaters of GVC" that has remained at approximately constant flows since the dam was built

(Figure 2). The proposed project is located within the Buckhorn Dam outlet channel and includes portions of Sections 15, 16, and 22, Township 32 North, Range 8 West, of the Mount Diablo Meridian. The project area extends from the Buckhorn Dam outlet works plunge pool downstream approximately 800 feet within the Buckhorn Dam outlet channel. This channel continues for another 1,500 feet to where it confluences with GVC below the spillway.

2.2. Action Area

The action area includes all areas to be affected directly or indirectly by the proposed action and not merely the immediate area involved in the action (50 CFR § 402.02). There is a bedrock outcropping that is approximately 600 feet downstream from the Buckhorn Dam outlet that is proposed to be removed. The area to be dewatered would include a section of the creek up to 200 feet downstream of the bedrock outcropping, for a total of up to 800 feet of dewatered stream. Cold, clear, sediment free water would be pumped from the dam outlet, around the dewatered area, and returned to the channel. Some sediment resulting from construction activities may enter the creek even with appropriate sediment control measures in place. The project could result in high levels of suspended sediment up to 500 feet downstream of the project location. Vehicles will need to cross GVC near the confluence between the spillway and outlet channel. Also, an area dedicated for spoils from the excavation of GVC could leach sediment into the creek. Therefore, the action area includes the entire GVC outlet channel from Buckhorn Dam downstream about 2,300 feet or the downstream extent of a sediment plume and the portion of land bounded by Buckhorn Dam to the north and east and the outlet channel to the south and west.

Figure 2-1. Buckhorn Dam /GVC Toe Drain and channel rehabilitation project area.

2.3. Project Description

The TRRP, on behalf of Reclamation, proposes to remove sediment from GVC, remove a section of bedrock, and improve coho salmon habitat. Implementation of the Buckhorn Dam/GVC project would occur in the late summer and fall of 2012, ending by no later than October 15, 2012. There are two primary design objectives for this project: 1) Reduce water surface elevation in the Buckhorn Dam outlet works/toe drain system and throughout the initial 600 feet of the Buckhorn Dam outlet channel and 2) improve coho salmon rearing and spawning habitat within the reach. TRRP is proposing to excavate approximately 4,500 cubic yards (cy) of material from the outlet channel in order to lower the water surface elevation and dry out the toe drains. This would correct submergence problems on the toe drain system so that toe drain measurements can be made at any time during outlet works releases. An additional 4,500 cy of excavation would occur to remove the bedrock outcropping and beaver dam (currently a barrier to coho salmon migration) and enhance rearing habitat for juvenile coho salmon and steelhead. Clean spawning gravels would be added to the stream bed after excavation is complete. Tracked excavators would be the main type of equipment used for the dredging. Blasting with explosives would not occur.

During construction, riparian vegetation will inevitably be damaged or removed in some areas. Reclamation will implement a riparian revegetation plan to enhance and maintain functional riparian vegetation in the action area after construction is complete. There is expected to be no long-term net loss of riparian habitat because lost vegetation would be replanted. After a period of five years, riparian and wetland habitat will be evaluated in a post-project report.

The project reach extends from the Buckhorn Dam outlet works plunge pool downstream to where the outlet channel confluences with GVC below the spillway (Figure 2-1). The primary work area is located within approximately 800 feet of the dam along the outlet channel corridor. The design alters the centerline alignment and profile of the outlet channel, creating more sinuosity, building pool/riffle habitat, lowering streambed elevations, increasing slope, widening the cross-sectional area, and developing inset floodplain benches (
Figure 2-2). The design also redevelops the meander pattern of the 800 feet outlet channel by increasing the meander wavelength to an average of 225 feet (
Figure 2-2). The removal of the bedrock outcropping and beaverdam (currently a barrier to fish migration) would increase the amount of habitat available to coho salmon by 600 linear feet of stream length.

Currently, the bedrock outcropping and associated beaver dam 600 feet downstream of Buckhorn Dam are thought to be the major controls on the streambed elevation and therefore stream surface elevation. With this feature in place, Reclamation cannot measure dam seepage. The elevation of the streambed cannot be lowered without removing this feature because the stream bed would not have enough gradient to convey water away from the dam.

Two coho salmon rearing ponds are included in the project design; both have an approximate area of 6,000 ft^2 (
Figure 2-2). The rearing ponds are adjacent to the outlet channel and are connected with side channels that allow a percentage of flow to divert into the slow water pond habitat. The ponds

are designed with an average depth of six feet but would be built with a variable bottom elevation for diversity of water depth. These pond areas would also be filled with wood material to serve as shelter for rearing salmonids. Large Woody Debris (LWD) structures would be incorporated into the final design for both habitat and geomorphic/hydraulic purposes. The addition of LWD would create cover for coho and provide hard points for necessary flow portioning into the side channel/pond areas.

Spoils generated during excavation would be placed at strategic upland locations shown on Figure 2-1. Clean spawning gravel will be placed in the newly excavated channel after dredging has been completed. Turbidity levels will be monitored upstream within the Buckhorn Dam outlet works (i.e., natural background) and 500 feet downstream of the in-stream construction activities. Access roads and contractor staging areas are indicated on Figure 3 and would remain in as good or better condition as compared with pre-construction. Most of the bedrock encountered during construction would be the weathered quartz diorite and can be penetrated with an excavator.

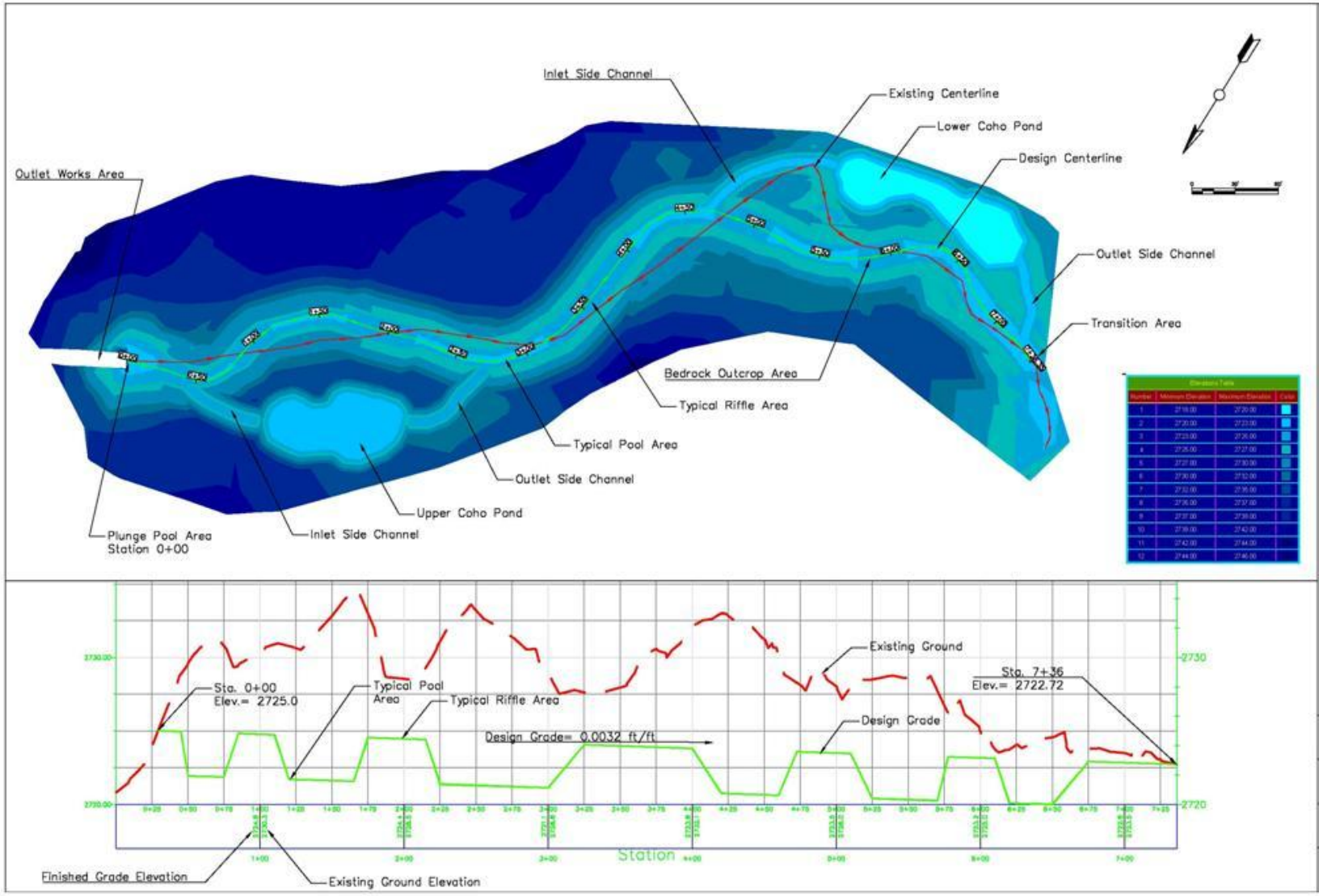

Figure 2-2. Proposed design of channel rehabilitation activities.

Dewatering of the project area would be essential during construction and would be implemented by diverting the normal base flow through a pump system. The first 800 feet downstream of Buckhorn Dam would be dewatered prior to construction. The flow would be pumped and rerouted from behind the outlet-works wing walls, around the project reach, and back into the outlet channel downstream of the construction area. A minimum flow of approximately 5 cfs would be returned to the outlet channel downstream of the dewatered area.

Capture and relocation of fish from within the project area to downstream of the work area would be mandatory before excavation begins. Best management practices would be followed to help reduce the effects of relocation on fish. The most efficient and least harmful methods for capturing fish will be determined prior to construction activities by qualified personnel. If possible, attempts would be made to intentionally scare fish to displace them downstream, or trap them passively using minnow traps or other similar style traps prior to electrofishing to reduce the amount of fish that would need to be captured by electrofishing. If electrofishing is employed, it would be conducted according to NMFS (2000) by fish biologists and technicians trained in the use of electrofishing equipment. Captured fish would be placed in buckets and transported downstream to a suitable release location.

3. ANALYTICAL APPROACH

Pursuant to section 7(a)(2) of the ESA, Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. The following outlines the conceptual framework and key steps and assumptions utilized in the jeopardy and critical habitat destruction or adverse modification risk assessments.

3.1. Legal and Policy Framework

Section 7(a)(2) of the ESA, implementing regulations (50 CFR Part 402), and associated guidance documents require biological opinions to present: (1) a description of the proposed Federal action; (2) a summary of the status of the affected listed species and designated critical habitat; (3) a summary of the environmental baseline within the action area; (4) a detailed analysis of the effects of the proposed action on the affected species and critical habitat; (5) a description of cumulative effects (future non-Federal actions that are reasonably certain to occur within the action area); and (6) a conclusion as to whether the proposed action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat. By regulation (50 CFR 402.02), the “effects of the action” refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. To evaluate whether an action is likely to result in jeopardy to a listed species or result in the destruction or adverse modification of designated critical habitat, consideration is given to the combination of the status of the species and critical habitat, the environmental baseline, the effects of the action, and the cumulative effects of non-Federal actions that are reasonably certain to occur within the action area. An action that is not likely to jeopardize the continued existence of the listed species is one that is not reasonably

expected to appreciably reduce the likelihood of both the survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution (50 CFR 402.02). This 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 analysis with respect to critical habitat. Finally, NMFS evaluates the effects of a project on the likelihood of both survival and recovery of a species (the "jeopardy standard" at 50 CFR 402.02) by evaluating the risk of extinction of the species. This evaluation and the best available scientific information relating to viable salmonid populations (McElhany et al. 2000) are described in the *Ecological Conceptual Framework* below.

3.2. Ecological Conceptual Framework

We use two conceptual models of the species and its critical habitat to evaluate the impact of proposed actions; one for SONCC coho salmon, the other for their critical habitat For this consultation, the first conceptual model is based on a hierarchical organization of individual fish, population unit, diversity stratum, and evolutionarily significant unit (ESU). The guiding principle behind this conceptual model is that the likelihood of survival and recovery of a species is dependent on the likelihood of survival and recovery of populations that comprise the species (organized by diversity strata[1]); and the likelihood of survival and recovery of each population unit is dependent upon the fitness (reproductive success) of the individuals that comprise that population.

To evaluate the effects on SONCC coho salmon ESU critical habitat, we use a second conceptual model (Section 3.4) organized by: (1) the primary constituent elements or essential features of the critical habitat within the action area; (2) the essential habitat types those features support within the action area; (3) the geographic area encompassing the diversity stratum (Interior-Trinity) in which the affected essential habitat features and types are found; and (4) the overall designated area of critical habitat at the ESU scale.

A prerequisite for predicting the effects of a proposed action on a population and a species includes understanding the chances of survival and recovery of the population and species. To do this, we assessed their chances of recovery given their condition and threat regime during the period of impact. A population's viability is defined as the state in which extinction risk of a population is negligible over 100 years and full evolutionary potential is retained (McElhany et al. 2000). A viable population (or species) is one that has achieved the demographic parameters needed to be at low risk of extinction. We equated the risk of extinction of the species with the "likelihood of both the survival and recovery of the species in the wild" for purposes of conducting jeopardy analyses under section 7(a)(2) of the ESA. Our jeopardy assessment, therefore, focuses on whether a proposed action would appreciably increase extinction risk, which is a surrogate for appreciable reductions in the likelihood of survival and recovery.

We adopted the general life cycle approach outlined by McElhany et al. (2000) and used the concept of Viable Salmonid Populations (VSP) as an organizing framework in this consultation. We systematically examined the complex linkages between project effects and viability while

[1] Diversity strata are defined as groups of populations that span the diversity of environments and distribution that currently exists or historically existed within the ESU.

also addressing key risk factors such as climate change and ocean conditions. We use four VSP parameters (abundance, population growth rate [productivity], population spatial structure, and population diversity) that reflect general biological and ecological processes that are critical to the growth and survival of coho salmon, to evaluate the risk of extinction of the SONCC coho salmon ESU (McElhany et al. 2000). These parameters are used as surrogates for the "reproduction, numbers, or distribution" criteria found within the regulatory definition of jeopardy (50 CFR 402.02), with the fourth VSP parameter, diversity, relating to all three jeopardy criteria. For example, numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or constrained resulting in reduced population resilience to environmental variation at local or landscape-level scales.

In our jeopardy risk assessment detailed below, we relied on Williams et al. (2008) for demographic viability criteria of the SONCC coho salmon ESU. The viability objective at the ESU level is that all diversity strata must be viable (Williams et al. 2008). Ultimately, the viability of the ESU depends on the extinction risk of its constituent populations. By requiring all diversity strata to be viable, SONCC coho salmon presence throughout their historical range is ensured, diversity within the ESU will be represented and there will be sufficient connectivity across the ESU.

3.3. Jeopardy Risk Assessment Approach

Our jeopardy risk assessment begins with a diagnosis of the current status of the SONCC coho salmon ESU throughout its geographic range. The diagnosis describes the species legal status, identifies existing threats, and details the distribution and trends of threats throughout the range of the SONCC coho salmon ESU. We describe the species status in terms of the VSP characteristics of the ESU and the diversity strata within the ESU that are affected by the proposed action. In addition, we consider the effects of ongoing changes in climate conditions and the influence of ocean conditions on the species. Because NMFS' opinion as to whether an action is or is not likely to jeopardize a species is based on the ESU scale, the SONCC coho salmon diagnosis presented in the *Status of the Species* and *Critical Habitat* sections of this Opinion provides a point-of-reference that NMFS uses in its final steps in the jeopardy analysis within the *Integration and Synthesis*.

Our jeopardy risk assessment continues with the *Environmental Baseline*, which is designed to assess the current risk of extinction of coho salmon population units at the scale of the action area given their exposure to human activities and natural phenomena. As specified under regulations implementing section 7 of the ESA (50 CFR 402.02), the environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. NMFS uses the analysis of how activities other than the proposed action have impacted the fitness (reproductive success) of individual coho salmon to provide the context or condition of the animals that the proposed action will affect.

In the *Effects of the Action* section, we evaluate how the proposed action will impact the fitness of individual coho salmon. The next step is to determine if these fitness consequences, in combination with interrelated and interdependent action effects and cumulative effects are reasonably likely to result in changes in the risk of extinction of coho salmon populations in the action area. We complete this assessment by relying on the information available about the species and the specific population units in terms of current and needed levels of abundance, productivity, diversity, and spatial structure characteristics, as presented in the *Status of the Species* and the *Environmental Baseline*.

NMFS may conclude that an action is likely to jeopardize the species by increasing the risk of extinction of the species or by keeping the species from attaining viability. If the effects of the action are reasonably likely to increase the risk of extinction of one or more of the coho salmon population units in the action area, we then assess whether this increase is reasonably likely to increase the risk of extinction of the species. Appreciable increases in the extinction risk of the species are considered appreciable reductions in the likelihood of both survival and recovery of the species. Conversely, if no appreciable increases in any population unit's risk of extinction are expected, we would conclude that the proposed action is not likely to appreciably reduce the likelihood of both the survival and recovery of the ESU.

3.4. Destruction or Adverse Modification Risk Assessment Approach

To determine if the proposed action is likely to result in the destruction or adverse modification of designated critical habitat for the SONCC coho salmon ESU, we analyze the effects of the action on the elements of critical habitat identified as essential to the conservation of the species. In the *Status of SONCC Coho Salmon ESU Critical Habitat* section, our critical habitat destruction or adverse modification risk assessment begins with a discussion of the biological and physical features (primary constituent elements or essential features) essential to the conservation of SONCC coho salmon ESU, the current conditions of such features, and the factors responsible for those current conditions. Next, in the *Environmental Baseline* section, NMFS discusses the current condition of critical habitat in the action area, the factors responsible for that condition, the conservation role of those specific areas, and the relationship of critical habitat designated in the action area to the entire designated critical habitat at the ESU scale.In the *Effects* section, NMFS characterizes the effects of the proposed action on critical habitat designated in the action area. This analysis builds on the habitat-based assessment described for the jeopardy analysis above. That is, using the best scientific and commercial data available, we estimate the effect of the proposed action on water quantity/quality and instream habitat because these effects may influence substrate and sediment levels, water quality conditions, and other general conditions of watersheds that support the biological and ecological requirements of the species. If the effects of the project, when added to the environmental baseline and combined with the effects interrelated and interdependent actions and cumulative effects, are not reasonably likely to reduce the value of constituent elements essential to the conservation of SONCC coho salmon in the action area, then the action is not likely to destroy or adversely modify designated critical habitat at the ESU scale. Conversely, if the conservation value of the affected essential habitat features in the action area is likely to be reduced, NMFS must then determine whether the impacts reduce the function of the overall critical habitat at the ESU scale for the conservation of the species or reduce the current ability of the critical habitat to establish essential habitat features and functions. Different areas and features of critical habitat will have

varying roles in the recovery of wild, self-sustaining salmon populations. For the final steps, NMFS evaluates whether, with implementation of the proposed action, critical habitat would remain functional to serve the intended conservation role for the SONCC coho salmon ESU or retain its current ability to establish those features and functions essential to the conservation of the species.

4. STATUS OF THE SPECIES

The proposed action may affect coho salmon in the SONCC ESU (70 FR 37160, June 28, 2005), and critical habitat designated for the SONCC coho salmon ESU (64 FR 24049, May 5, 1999). This opinion analyzes the effects of the proposed action on coho salmon in the SONCC ESU, and critical habitat designated for the SONCC coho salmon ESU. The SONCC coho salmon ESU was listed as threatened on May 6, 1997 (62 FR 24588), and the listing determination was reconfirmed on June 28, 2005 (70 FR 37160) with the addition of three artificial propagation programs. 50 CFR 223.203 provides protective regulations issued under ESA Section 4(d) that are applicable to the SONCC coho salmon ESU. In the latest status review by NMFS, Williams et al. (2011) concluded that the SONCC coho salmon ESU is likely to become endangered in the foreseeable future, this conclusion being consistent with earlier assessments (Good et al. 2005). NMFS (2011) recently determined that the ESU, although most populations are declining in abundance, should remain listed as threatened.

4.1. Coho Salmon Life History

Coho salmon adults migrate and spawn in small streams that flow directly into the ocean, or tributaries and headwater creeks of larger rivers (Sandercock 1991, Moyle 2002). Adults migrate upstream to spawning grounds from September through late December, with a peak in migration during October and November. Spawning occurs mainly in November and December and some cases as late as January. Fry emerge from the gravel in the spring, approximately 3 to 4 months after spawning. At a length of 38 to 45 mm, fry may migrate a considerable distance to rearing areas (Sandercock 1991, Nickelson et al. 1992). Juvenile rearing usually occurs in tributary streams with a gradient of 3 percent or less, although they may use streams of 4 percent or 5 percent gradient. Juveniles have been found in streams as small as one to two meters wide. They may spend 1 to 2 years rearing in freshwater (Bell and Duffy 2007), or emigrate to an estuary shortly after emerging from spawning gravels (Tschaplinski 1988). After their first summer, most coho salmon juveniles will redistribute into non-natal rearing streams, lakes, or ponds, often following rainstorms, where they continue to rear (Peterson 1982). Emigration from streams to the estuary and ocean generally takes place from February through June, with the peak period being the end of April through May.

4.2. SONCC Coho Salmon ESU Structure

Williams et al. (2006) identified 45 populations within the SONCC coho salmon ESU, and further categorized the historical populations based on their distribution and demographic role (*i.e.*, independent, dependent, or ephemeral; Figure 4-1). Nineteen populations were

characterized as functionally independent, defined as those sufficiently large to be historically viable-in-isolation and whose demographics and extinction risk were minimally influenced by immigrants from adjacent populations. Twelve populations were characterized as potentially independent, defined as those that were potentially viable-in-isolation, and are demographically influenced by immigrants from adjacent populations. Seventeen populations were characterized as dependent, which means they are believed to have had a low likelihood of sustaining themselves over a 100-year time period in isolation. These populations received sufficient immigration to alter their dynamics and extinction risk. Finally, two populations were characterized as ephemeral, meaning that they are both small enough and isolated enough that they were only intermittently present. However, the final number of populations, and attributes of each population have undergone review by NMFS (2012a). Some changes to the findings of Williams et al. (2008) have occurred as the understanding of the SONCC coho salmon ESU grows (NMFS 2012a).

Williams et al. (2008) calculated the minimum spawner abundance of each SONCC coho salmon population needed to be categorized at low and high risk of extinction using a predictive GIS model. These were deemed "low risk" and "high risk" spawner thresholds. The low risk spawner thresholds were the minimum number of spawners required for a given population to be considered viable. The abundance of spawners is just one of several criteria that must be met for a population to be considered viable. Williams et al. (2008) acknowledged that a viable salmonid population at the ESU scale is not merely a quantitative number that needs to be attained. Rather, for an ESU to persist, populations within the ESU must be able to track changes in environmental conditions. When the location or distribution of an ESU's habitat changes, a species can avoid extinction either by adapting genetically to the new environmental conditions, or by spatially tracking the environmental conditions to which it is adapted (Pease et al. 1989). An ESU persists in places where it is able to track environmental changes, and becomes extinct if it fails to keep up with the shifting distribution of suitable habitat (Thomas 1994).

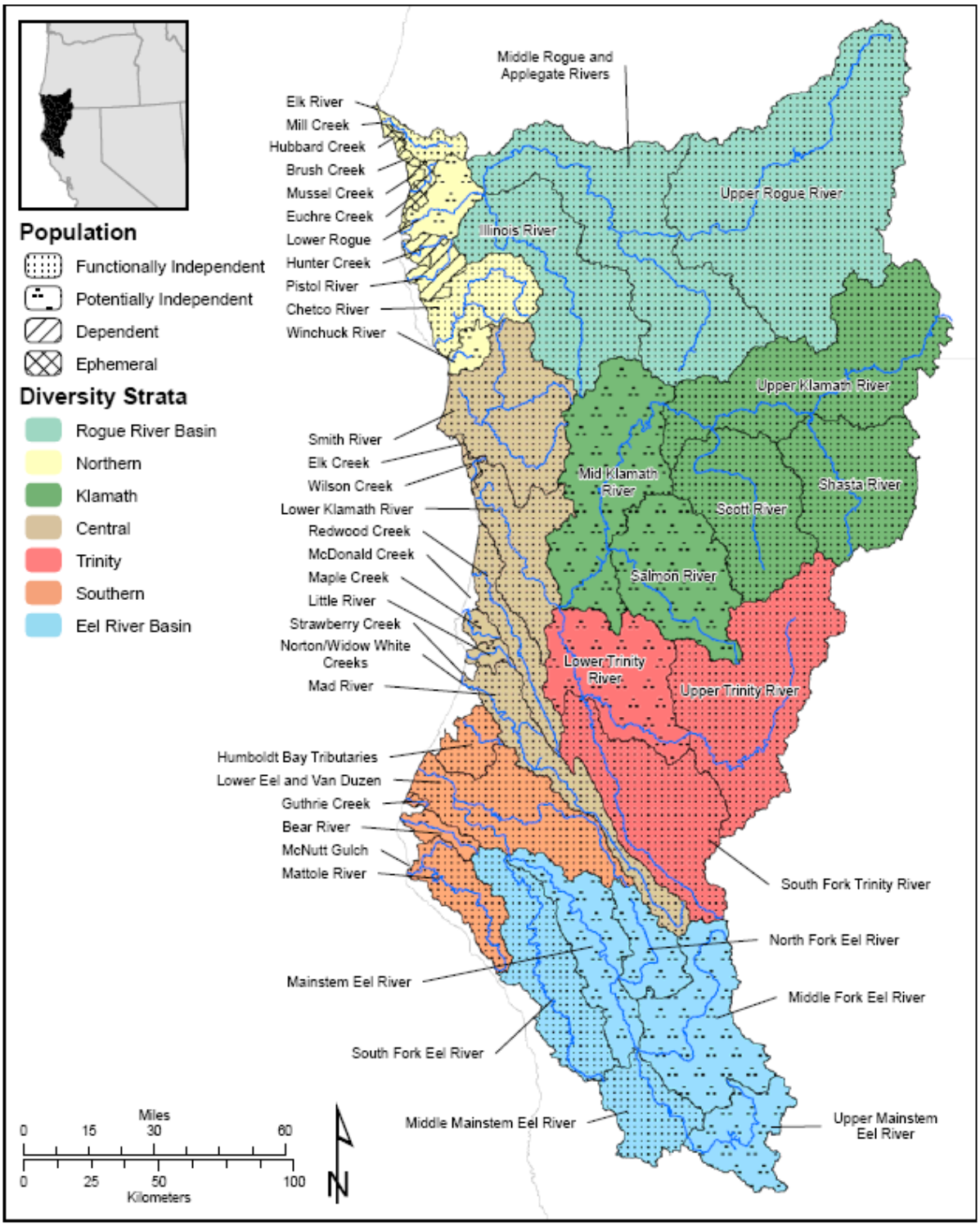

Figure 4-1. Diversity strata for populations of coho salmon in the SONCC ESU. From Williams et al. (2006).

Williams et al. (2006) organized the 45 populations of coho salmon in the SONCC ESU into seven diversity strata largely based on the geographical arrangement of the populations and basin-scale environmental and ecological characteristics (Figure 4-1). To obtain the number of spawners needed for each strata to be viable, Williams et al. (2008) added the minimum spawner abundance of each independent SONCC coho salmon population needed to be categorized at low risk of extinction for each diversity strata and multiplied the number by 50 percent (Table 4-1). The resulting numbers were the minimum numbers of spawners needed in each stratum for stratum viability (Table 4-1).

Table 4-1. Diversity strata of the SONCC coho salmon ESU, including the number of population types (F: functionally independent, P: potentially independent, D: dependent, and E: ephemeral) and the minimum number of spawners needed to satisfy 50 percent of the total number of spawners in a strata needed to meet stratum viability (Williams et al. 2008).

	Population types (*n*)				50% Total
Diversity Strata	F	P	D	E	stratum spawners
Northern Coastal Basins	2	2	3	2	6,050
Central Coastal Basins	4	2	5	0	13,200
Southern Coastal Basins	3	1	2	0	11,000
Interior-Rogue River	3	0	0	0	22,650
Interior-Klamath	3	2	0	0	17,900
Interior-Trinity	2	1	0	0	6,350
Interior-Eel	2	4	0	0	13,950

Williams et al. (2008) provided a set of rules that will result in certain configurations of populations and strata that will result in a viable SONCC coho salmon ESU. In order for the SONCC coho salmon ESU to be viable, each of the diversity strata needs to be viable. In order for a diversity stratum to be viable, at least two, or 50 percent of the independent populations (Functionally Independent or Potentially Independent), whichever is greater, must be viable, and the abundance of these viable independent populations collectively must meet or exceed 50 percent of the abundance predicted for the diversity stratum when it is at low risk of extinction. The populations that are required to meet the viability criteria are called “core populations” (NMFS 2012a). Third, all dependent and independent populations not expected to meet the low-risk threshold within a diversity stratum must exhibit occupancy patterns that indicate sufficient emigration is occurring from the “core populations.” Finally, the distribution of extant populations, both dependent and independent, needs to maintain connectivity within and among diversity strata.

4.3. SONCC Coho Salmon Population Viability

Four principal parameters were used to evaluate the extinction risk for threatened SONCC coho salmon: population size, population growth rate, spatial structure, and diversity. These specific viable salmonid populations (VSP) parameters are important to consider because they are predictors of extinction risk, and the parameters reflect general biological and ecological processes that are critical to the growth and survival of salmon (McElhany et al. 2000). While Williams et al. (2008) provided the number of spawners needed to meet stratum viability (population size), quantitative metrics related to the other three VSP parameters (growth rate, spatial structure, and diversity) were not given. To some extent, however, the condition of each individual VSP parameter is manifested in the current population abundance, because it is the keystone measure of viability. The spatial structure and diversity criteria are embedded within the 50 percent minimum spawner abundance predicted for any given stratum (Table 4-1).

4.3.1. Population Size

In the latest Status Review of the SONCC coho salmon ESU, Williams et al. (2011) concluded that the ESU is likely to become endangered in the foreseeable future. Williams et al. (2011) stated that all available evidence from shorter-term research and monitoring efforts indicate that conditions have worsened for populations in this ESU since the last formal status review was published (Good et al. 2005). The adult returns of several populations of the SONCC coho salmon ESU have been very low, with several populations less than the high risk spawner threshold (NMFS 2011). Coho salmon have been absent from the Bear River as well as many tributaries of the Eel River in recent years. Juvenile coho salmon monitoring in Redwood Creek (Sparkman 2011) and several tributaries to the lower Trinity River (HVTF 2010) show sharp declines in the number of trapped coho salmon juveniles in recent years. The populations that have the lowest adult returns and that are very close or below their high risk thresholds (Shasta, Mattole, Bear and others) tend to be in the east and southern portions of the ESU (NMFS 2011), fitting the range contraction model for population collapse whereby the range of a species contracts inward (Channell and Lomolino 2000). None of the seven diversity strata appears to support a single viable population; therefore, none of the diversity strata are considered viable at this time.

Several of the SONCC coho salmon populations are subject to small population dynamics including depensation (Fagan and Holmes 2006; Melbourne and Hastings 2008), and have a high risk of extinction due to their population sizes being near or below the high risk spawner thresholds. These populations are subject to both demographic and environmental stochasticity, increasing their extinction risk. Depensation occurs when populations are reduced to very low densities and per capita growth rates decrease as a result of a variety of mechanisms [*e.g.*, failure to find mates and therefore reduced probability of fertilization, failure to saturate predator populations (Liermann and Hilborn 2001)]. Depensation results in negative feedback that accelerates a decline toward extinction (Williams et al. 2008).

4.3.2. Population Growth Rate (Productivity)

The productivity of a population (*i.e.*, production over the entire life cycle) can reflect conditions (*e.g.*, environmental conditions) that influence the dynamics of a population and determine abundance. In turn, the productivity of a population allows an understanding of the performance of a population across the landscape and habitats in which it exists and its response to those habitats (McElhany et al. 2000). In general, declining productivity equates to declining population abundance. There are no numeric targets established for population growth rate for SONCC coho salmon. McElhany et al. (2000) suggested a population's natural productivity should be sufficient to maintain its abundance above the viable level (a stable or increasing population growth rate). This guideline is a reasonable goal in the absence of numeric population growth rate targets.

As discussed above in the population abundance section, available data indicates that many populations have declined, which may reflect a reduction in productivity. For instance, the Shasta River population has declined in abundance by almost 50 percent from one generation to the next (Williams et al. 2011). Two partial counts from Prairie Creek, a tributary of Redwood Creek, and Freshwater Creek, a tributary of Humboldt Bay, show a negative trend (NMFS 2011). Data from the Rogue River basin also show recent negative trends. In general, SONCC coho salmon have declined substantially from historic levels. Productivity does not appear to be sufficient to maintain viable abundances in many SONCC coho salmon populations. Because productivity appears to be negative for most SONCC ESU coho salmon populations, this ESU is not currently viable in regard to population productivity.

4.3.3. Spatial Structure

Understanding the spatial structure of a population is important because the population structure can affect evolutionary processes and, therefore, alter the ability of a population to adapt to spatial or temporal changes in the species' environment (McElhany et al. 2000). There are no numeric spatial structure targets for SONCC coho salmon. In the absence of such targets, McElhany et al. (2000) suggested the following: "As a default, historical spatial processes should be preserved because we assume that the historical population structure was sustainable but we do not know whether a novel spatial structure will be."

Although there is considerable year-to-year variation in estimated occupancy rates, it appears that there has been no dramatic change in the percent of coho salmon streams occupied from the late 1980s and early 1990s to 2000 (Good et al. 2005). Williams et al. (2011) note that all of the seven diversity strata in the SONCC coho salmon ESU are occupied by coho salmon. However, the number of streams and rivers currently supporting coho salmon in this ESU has been greatly reduced from historical levels, and watershed-specific extirpations of coho salmon have been documented (Brown et al.1994, CDFG 2004b, Good et al. 2005, Moyle et al. 2008, Yoshiyama and Moyle 2010). Given that all diversity strata are occupied, the spatial structure of the SONCC coho salmon ESU is likely to be sufficient for stratum viability. However, extirpations, loss of brood years, and sharp declines (in some cases to zero) in abundance of SONCC coho salmon in several streams throughout the ESU indicate that with regard to spatial structure the SONCC coho salmon ESU is likely to become more fragmented in the near future.

4.3.4. Diversity

Diversity, both genetic and behavioral, is critical to success in a changing environment. Salmonids express variation in a suite of traits, such as anadromy, morphology, fecundity, run timing, spawn timing, juvenile behavior, age at smolting, age at maturity, egg size, developmental rate, ocean distribution patterns, male and female spawning behavior, and physiology and molecular genetic characteristics. The more diverse these traits (or the more these traits are not restricted), the more diverse a population is, and the more likely that individuals, and therefore the species, would survive and reproduce in the face of environmental variation (McElhany et al. 2000). However, when this diversity is reduced due to loss of entire life history strategies or to loss of habitat used by fish exhibiting variation in life history traits, the species is in all probability less able to survive and reproduce given environmental variation.

The primary factors affecting the phenotypic, genetic, and life history diversity of SONCC coho salmon appear to be the influence of hatcheries and out-of-basin introductions. In addition, some populations are extirpated or nearly extirpated (i.e., Middle Fork Eel, Bear River, Upper Mainstem Eel) and some brood years have low abundance or may even be absent in some areas (e.g., Shasta River, Scott River, Mattole River, Mainstem Eel River), which further restricts the diversity present in the ESU. The ESU's current genetic variability and variation in life history likely contribute significantly to long-term risk of extinction. Given the recent trends in abundance across the ESU, the genetic and life history diversity of populations is likely very low and is inadequate to contribute to a viable ESU.

4.3.5. Risk of Extinction of the SONCC Coho Salmon ESU

The precipitous decline in abundance from historical levels and the poor status of population viability metrics in general are the main factors behind the extinction risk faced by SONCC coho salmon. The cause of the decline is likely from the widespread degradation of habitat, particularly those habitat attributes that support the freshwater rearing life-stages of the species. Presently, several of the populations are heavily influenced by hatchery production, which impacts several of the viability metrics. The viability of an ESU depends on variety of factors, including the number and status of populations, spatial distribution of populations, the characteristics of large-scale catastrophic risk, and the collective diversity of the populations and their habitat (Lindley et al. 2007). Due to data limitations, Williams et al. (2011) agree with the previous assessments in CDFG (2002), Good et al. (2005), and Weitkamp et al. (1995) that the SONCC coho salmon ESU is likely to become endangered in the foreseeable future. Based on the above descriptions of the population viability parameters, and qualitative viability criteria presented in Williams et al. (2008), NMFS concludes that the SONCC coho salmon ESU is currently not viable and is at high risk of extinction.

4.4. Factors Affecting SONCC Coho Salmon

Artificial propagation (62 FR 24588, May 6, 1997), predation by marine mammals (60 FR 38011, July 25, 1995), disease, and harvest are the most prevalent factors affecting SONCC coho salmon. Factors affecting Critical Habitat of SONCC coho salmon are covered in section 5.3 *Factors Affecting SONCC Coho Salmon ESU Critical Habitat*.

4.4.1. Harvest

Fishing has decreased as a factor affecting the SONCC coho salmon ESU due to prohibitions on commercial and sport harvest. Incidental mortality of SONCC coho salmon in Chinook salmon directed fisheries in the ocean is thought to be less than 13 percent in any given year as indicated by pre-season projections by the Pacific Fishery Management Council. Coho salmon harvested by Native American tribes is primarily incidental to larger Chinook salmon subsistence fisheries in the Klamath and Trinity Rivers. The Yurok fishery has been monitored since 1992 and during that time harvest has ranged from 27 to 1,168 coho salmon annually. Based on estimates of upstream escapement (in-river spawners and hatchery returns) this fishery is thought to amount to an average harvest rate of 4.4 percent for the period (CDFG 2004). Harvest by the Hoopa Valley Tribe of coho salmon is also, in general, incidental to the Chinook salmon directed fishery and amounts to a few hundred fish annually (Hoopa Valley Tribal Fisheries, unpublished data).

4.4.2. Predation and Disease

Ceratomyxosis, which is caused by *C. shasta*, has recently been identified as one of the most significant diseases for juvenile salmon due to its prevalence and impacts in the Klamath Basin (Nichols et al. 2003). Predation has been listed as a minor factor contributing to the decline and listing of coho salmon in the SONCC coho salmon ESU (60 FR 38011, July 25, 1995). Hillemeier (1999) assessed pinniped predation rates within the Klamath River estuary during August, September, and October 1997, and estimated that a total of 223 adult coho salmon were consumed by seals and sea-lions during the entire study period.

4.4.3. Artificial Propagation

In addition to a few smaller hatcheries, three large mitigation hatcheries (Cole Rivers Hatchery on the Rogue River, Iron Gate Hatchery on the Klamath River, and Trinity River Hatchery on the Trinity River) release roughly 14,215,000 hatchery salmonids into SONCC coho salmon ESU rivers annually. Ecological interactions such as predation and competition for food and habitat (Kostow and Zhou 2006, Naman 2008) can occur at times when juveniles are released into streams, in the near-shore ocean habitats, or when adults return to spawn. Genetic interactions that occur when hatchery salmonids spawn with wild salmonids (Chilcote 2003, Araki et al. 2007, Arakai et al. 2009) in the Trinity, Klamath, and Rogue rivers likely reduce the productivity of wild coho salmon in these populations. The result is progeny with lower survival (Kostow 2004; Arakai et al. 2009) and ultimately, a reduction in the fitness of the natural stock (Chilcote 2003; Araki et al. 2007) due to outbreeding depression (Reisenbichler and Rubin 1999)

5. STATUS OF SONCC COHO SALMON ESU CRITICAL HABITAT

5.1. Summary of Designated Critical Habitat

Critical habitat for the SONCC coho salmon ESU includes all accessible waterways, substrate, and adjacent riparian zones between the Mattole River in California, and the Elk River in Oregon, inclusive (64 FR 24049, May 5, 1999). Excluded are: (1) areas above specific dams identified in the FR notice, (2) areas above longstanding natural impassible barriers (*i.e.* natural waterfalls), and (3) tribal lands. In designating critical habitat, NMFS considers the following requirements of the species: (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing offspring; and, generally, (5) habitats that are protected from disturbance or are representative of the historical geographical and ecological distributions of this species (see 50 CFR 424.12(b)). In addition to these factors, NMFS also focuses on the known physical and biological features (essential features) within the designated area that are essential to the conservation of the species and that may require special management considerations or protection. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation.

Within the range of the SONCC coho salmon ESU, the life cycle of the species can be separated into five essential habitat types: (1) juvenile summer and winter rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; (4) adult migration corridors; and (5) spawning areas. Areas 1 and 5 are often located in small headwater streams and side channels, while areas 2 and 4 include these tributaries as well as mainstem reaches and estuarine zones. Growth and development to adulthood (area 3) occur primarily in near- and off-shore marine waters, although final maturation takes place in freshwater tributaries when the adults return to spawn. Within these areas, essential features of coho salmon critical habitat include adequate: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions (64 FR 24049, May 5, 1999).

5.2. Current Condition of Critical Habitat at the ESU Scale

Because coho salmon spend extended periods of time rearing in freshwater (Bell and Duffy 2007), they may be more susceptible to changes within the freshwater environment than fall-run Chinook salmon for example, which predominately migrate to the ocean shortly after emerging from spawning gravels. While some relatively unimpaired streams exist within the ESU, decades of intensive timber harvesting, mining, agriculture, channelization, and urbanization have altered coho salmon critical habitat, sometimes to the extent that it is no longer able to support one or more of the life stages of coho salmon. Below, we provide a summary of the condition of the essential habitat types necessary to support the life cycle of the species (64 FR 24049, May 5, 1999).

5.2.1. Juvenile Summer and Winter Rearing Areas

Juvenile summer and winter rearing areas should contain adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, and space. These essential features are necessary to provide sufficient growth and reasonable likelihood of survival to smoltification. In the SONCC coho salmon ESU, juvenile summer rearing areas have been compromised by low flow conditions, high water temperatures, insufficient dissolved oxygen concentration levels, excessive nutrient loads, invasive species, habitat loss, disease effects, pH fluctuations, sedimentation, removal or reduced-recruitment of LWD, stream habitat simplification, and loss of riparian vegetation. Winter rearing areas suffer from high water velocities due to excessive surface runoff during storm events, which can cause the removal or non-recruitment of LWD, and consequent stream habitat simplification. Changes to streambeds and substrate, as well as removal of riparian vegetation, have limited the amount of invertebrate production in streams, which has in turn limited the amount of food available to rearing juvenile coho salmon. Some streams in the ESU remain somewhat intact relative to their historical condition, but the majority of the waterways in the ESU fail to provide sufficient juvenile summer and winter rearing areas.

5.2.2. Juvenile Migration Corridors

Juvenile migration corridors need to have sufficient water quality, water quantity, water temperature, water velocity, and safe passage conditions in order for coho salmon juveniles and smolts to emigrate to estuaries and the ocean, or to redistribute into non-natal rearing zones. Adequate juvenile migration corridors need to be maintained throughout the year because smolts emigrate to estuaries and the ocean from the early spring through the late summer, while juveniles may redistribute themselves at any time in response to fall freshets or while seeking better habitat and rearing conditions. In the ESU, juvenile migration corridors suffer from low flow conditions, disease effects (*e.g.,* Ceratomyxosis in the Klamath River), high water temperatures and low water velocities that slow and hinder emigration or upstream and downstream redistribution. Low dissolved oxygen (DO) levels, excessive nutrient loads, insufficient pH levels, and other water quality factors also affect juvenile migration corridors.

5.2.3. Adult Migration Corridors

Adult migration corridors should provide satisfactory water quality, water quantity, water temperature, water velocity, cover/shelter and safe passage conditions in order for adults to reach spawning areas. Adult coho salmon generally migrate in the fall or winter months to spawning areas. During this time of year, suspended sediment makes respiration for adults difficult. Removal or non-recruitment of woody debris and stream habitat simplification limits the amount of cover and shelter needed for adults to rest during high flows. Low flows in streams can physically hinder adult migration, especially if fall rainstorms are late or insufficient to raise water levels enough to ensure successful passage. Higher water temperatures resulting from low flows or higher ambient air temperatures could require more metabolic energy reserves (Crozier et al. 2008). Poorly designed culverts and other road crossings have truncated adult migration corridors and cut off hundreds of miles of stream habitat throughout the SONCC coho salmon ESU. While adult migration corridors are a necessary step in the lifecycle for the species, the condition of this particular essential habitat type in the ESU is probably not as limiting, in terms

of conservation of the species, as other essential habitat types, such as juvenile summer and winter rearing areas.

5.2.4. Spawning Areas

Spawning areas for SONCC coho salmon must include adequate substrate, water quality, water quantity, water temperature, and water velocity to ensure successful redd building, egg deposition and egg to fry survival. Coho salmon spawn in smaller tributary streams from November through January in the ESU. A widespread problem throughout the ESU is sedimentation and embedding of spawning gravels, which makes redd building for adults difficult and decreases egg-to-fry survival. Excessive runoff from storms, which causes redd scouring, is another issue that plagues adult spawning areas. Low or non-recruitment of spawning gravels is common throughout the ESU, limiting the amount of spawning habitat.

5.2.5. SONCC Coho Salmon Critical Habitat Summary

The current function of critical habitat in the SONCC coho salmon ESU has been degraded over the past century. Although there are exceptions, the majority of streams and rivers in the ESU currently have impaired habitat. Additionally, critical habitat in the ESU often lacks essential features and elements due to ongoing human activities. For example, large dams, such as Iron Gate Dam on the Klamath River, California, stop the recruitment of spawning gravels, which impacts both an essential habitat type (spawning areas) as well as an essential feature of spawning areas (substrate). Water utilization in many regions throughout the ESU reduces summer base flows, which limits the establishment of several essential features such as water quality and water quantity.

5.3. Factors Affecting SONCC Coho Salmon ESU Critical Habitat

The major activities identified as responsible for the degradation of SONCC coho salmon ESU habitat include logging, road building, grazing, mining, urbanization, stream channelization, dams, wetland loss, beaver trapping, water withdrawals, and unscreened diversions for irrigation (62 FR 24588, May 6, 1997). Climate change and poor ocean conditions are two other factors that have been more recently recognized as contributing to the degradation of SONCC coho salmon ESU habitat.

5.3.1. Land Use

Timber harvest activities, including road building, can result in high sediment delivery to streams, reduced quantities of large woody debris (LWD) and removal of riparian vegetation. This causes a reduction in food supply, filling of pools, reduced quality of spawning gravels due to the higher level of fine sediment, reduced habitat complexity, channelization, poor water quality, elevated summer temperatures, and an increase severity of peak flows during heavy precipitation. Agricultural operations have degraded habitat and limited both water quality and quantity through the filling and diking of wetlands, irrigation diversions, grazing in riparian areas, compaction of soils in upland areas from livestock, and the use of pesticides and fertilizers

(Spence et al. 1996). A large proportion of estuaries and floodplains, important for coho salmon growth and survival, have been converted to agricultural land. Channelization and diking associated with flood control or agricultural operations reduces habitat by limiting stream complexity and increasing stream velocities, which can be detrimental to both adult and juvenile coho salmon life stages. Diking leads to the direct loss of habitat through disconnection of channel, floodplain, and wetland habitat and to the loss of hydrologic function. In nearly all the estuaries within the ESU, the majority of historical estuarine habitat has been diked off from the channel for agriculture and flood protection. Substantial residential development and urbanization has contributed to habitat impairment. Development often leads to degraded habitat through stream channelization, floodplain drainage, damage or loss of riparian and wetland areas, pollution, stream simplification, and consumptive water use (Botkin et al. 1995). Mining activities in the ESU have decreased significantly from historical levels, however, mining operations have been increasing in recent decades. The greatest threat from most types of mining stems from its potential impacts on riparian areas and water temperature and spawning gravels. Watershed restoration activities have improved freshwater critical habitat conditions in some areas, especially on Federal lands. Additionally, in areas where riparian vegetation has been replanted or enhanced, stream temperatures and cover for salmonids has been positively affected.

5.3.2. Dams and Barriers

Besides often acting as fish passage barriers dams and diversions can lead to altered hydrologic function within a watershed. Permanent dams within this ESU are almost always associated with water control features for flood control, municipal or agricultural water uses, and hydropower operations. When the natural flow regime of a river is controlled or changed by a dam (shifts in timing and magnitude of flow events), the hydrology to which SONCC coho salmon evolved is altered, reducing the ability of the river to support salmon. Temporary dams are usually built for recreational or agricultural purposes on private land. Many dams have diversions associated with them. Water diversion can lead to decreased flows and impaired water quality. Fish passage barriers like culverts and dams reduce the available stream habitat on virtually all SONCC coho salmon ESU river systems and block access to high quality spawning and rearing habitat. The most common types of barriers include road-stream crossings (*e.g.*, culverts), dams, and diversions, which are pervasive throughout the SONCC coho salmon ESU.

5.3.3. Climate Change

Climate change has affected, and will continue to affect, the critical habitat in the SONCC ESU through the increase in stream temperatures and through altered hydrology and streamflow. In addition to these direct impacts, the effects of climate change on habitat are often superimposed upon the local effects within river systems of other impacts such as logging, water utilization, and development (Mayer 2008, Van Kirk and Naman 2008). Although climate models diverge with respect to future trends in precipitation, there is widespread agreement that temperature is likely to continue increasing as will the trend toward lower snow water equivalent (SWE) and earlier snowmelt, resulting in lower summer stream flows (Zhu et al. 2005, Vicuna et al. 2007). Behrenfeld et al. (2006) found that ocean productivity is closely coupled to climate variability. Warm ocean regimes are characterized by lower ocean productivity (Behrenfeld et al. 2006,

Wells et al. 2006), which may affect salmon by limiting the availability of nutrients regulating the food supply, thereby increasing competition for food (Beamish and Mahnken 2001). A transition to a warmer climate state and sea surface warming may be accompanied by reductions in ocean productivity which affect fisheries (Ware and Thomson 2005; Behrenfeld *et al.* 2006).

6. ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The *Environmental Baseline* provides a reference condition to which we add the effects of the proposed action, as required by regulation (50 CFR 402.02).

6.1. Population Units in the Action Area

Coho salmon in GVC are part of the Upper Trinity River population unit in the Interior-Trinity Diversity Stratum within the SONCC coho salmon ESU (Figure 4-1). There are no consistent coho salmon monitoring data available for GVC. One informal survey was conducted by the California Department of Fish and Game (Hill 2012).

6.2. Conservation Value of Critical Habitat in the Action Area

Grass Valley Creek is an important tributary to the Upper Trinity River that provides unique habitat for coho salmon. The creek lies near the terminus of anadromous fish migration in the Upper Trinity River, providing important tributary spawning and rearing habitat near the eastern boundary of the SONCC coho salmon ESU. Cold water releases from the hypolimnion of Buckhorn Reservoir create optimal rearing conditions for juvenile coho salmon in the upper portions of the creek during the summer months. Hamilton ponds, two small sediment catchments in the lower portion of GVC, provide excellent off channel rearing conditions for coho salmon. Several reconnaissance surveys have found numerous juvenile coho salmon using Hamilton Ponds, as well as the portion of the creek immediately downstream of Buckhorn Dam for spawning and rearing. Movement data from PIT tagged juvenile coho suggest that the creek is frequently used by coho salmon as a non-natal rearing area (Quinn 2012). The geographic location of the creek, combined with diverse and unique habitat and confirmed presence and use of coho salmon, establishes that GVC is of high conservation value in the SONCC coho salmon ESU.

6.3. Conservation Value of the Upper Trinity River Population Unit

Population units of the Trinity River have a high conservation value. The Upper-Trinity population is unique within the Trinity River system as these coho salmon are currently the longest migrating adult coho salmon in the Interior-Trinity stratum. The run timing of the Upper Trinity River population is earlier (September and October) than those fish in the Lower Trinity Population (November through January) adding to life history diversity. The upper Trinity River population may serve as an important source population for the Lower Trinity and South Fork Trinity populations. The Upper Trinity River population unit also protects the ESU against range shrinkage by maintaining an inland population that is one of the furthest east migrating population units in the ESU.

6.4. Periodicity and Life History of Coho Salmon in the Action Area

Coho salmon utilize varied freshwater habitat largely based upon life-stage and season (Groot and Margolis 1991, Quinn 2005). However, habitat use can also be influenced by the quality of existing habitat and watershed function, factors that likely play a large role in coho salmon survival. The periodicity of coho salmon life-stages in the Upper Trinity River are shown in Figure 6-1.

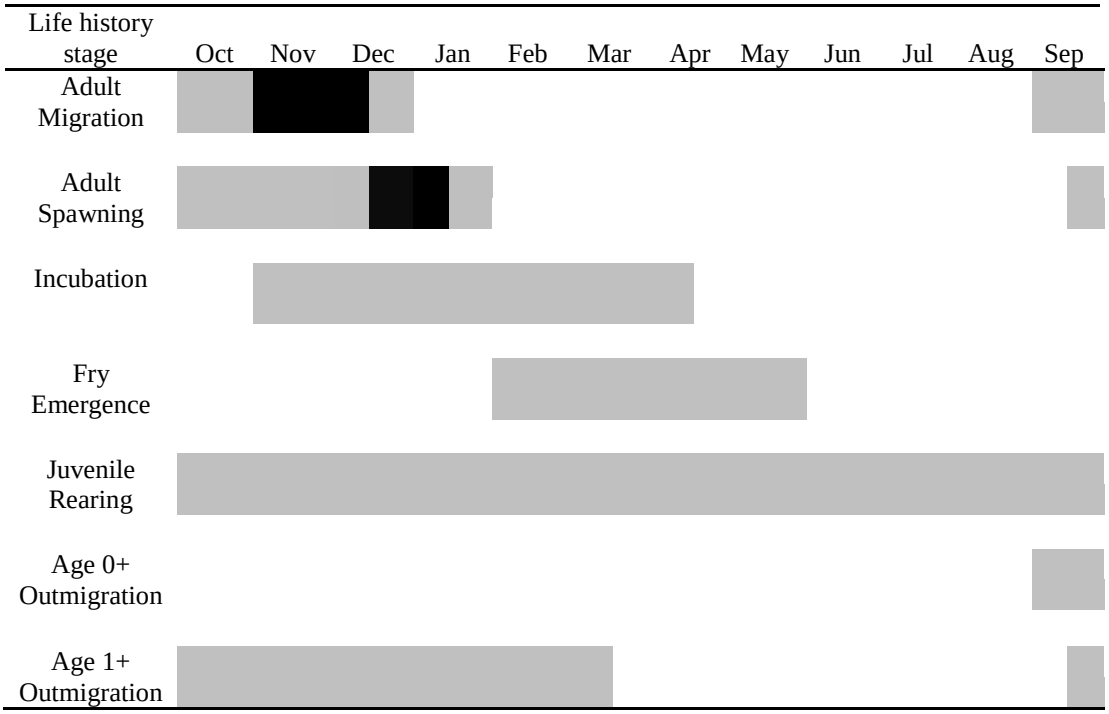

Figure 6-1. Life stage periodicities for coho salmon within the Upper Trinity River. Black areas represent peak use periods; those shaded gray indicate non-peak periods. Sources: Ackerman *et al.* (2006), USFWS and HVT (1999), HVTF. (2005), Pinnix and Quinn (2009), Sinnen *et al.* (2009), USFWS and HVT (1999).

6.5. Current Status of Coho salmon in the action area

Coho salmon in GVC are not monitored and no redd surveys, adult spawner surveys or juvenile coho salmon surveys are available. However, sporadic observations of coho salmon have been made in the recent past. Hill (2012) found approximately six coho salmon in close proximity to Buckhorn Dam including the outlet channel and downstream of the confluence with the spillway channel. Hill (2012) also found two redds in the same area, assumed to be from spawning coho salmon, one of which was made directly in decomposed granite. On a site tour June 23, 2011, Seth Naman (NMFS) and Brandt Guttermuth (TRRP) performed a snorkel survey of the entire outlet channel, including areas downstream and upstream of the bedrock outcropping. Many hundreds of SONCC coho salmon juveniles were observed in the outlet channel and in areas just downstream of the confluence with the spillway channel. The outlet channel substrate in most areas is comprised almost entirely of decomposed granite. Given the high concentrations of juvenile coho salmon in the outlet channel and immediately downstream and the observation of a coho salmon redd in the decomposed granite, it is reasonable to assume that adult coho salmon have found some degree of success in using decomposed granite as a spawning substrate. Zero coho salmon were found in the 600 ft of channel upstream of the bedrock outcropping. The bedrock outcropping and beaver dam likely act as a barrier for coho salmon. Quinn (2012) found that hatchery coho salmon routinely stray into GVC. Hatchery strays likely reduce the productivity (recruits produced per spawner) of the population of coho salmon using GVC, though they may provide important demographic support. Quinn (2012) also found that many PIT tagged juvenile coho salmon migrated upstream into GVC. This suggests that the creek is frequently used by coho salmon in the Upper Trinity River population as a non-natal rearing area. Documentation of hundreds of juvenile coho salmon using GVC upstream to the terminus of anadromous fish migration is evidence the creek serves as an important spawning and rearing area for coho salmon in the Upper Trinity Population.

6.6. Current Status of the Upper Trinity River Population

The number of fish of natural origin is likely greater than the depensation threshold of 365 spawners (1,900 average spawners from 1997 to 2010; Sinnen *et al.* 2010), but in most years far below the low-risk spawner threshold of 7,300 spawners. The population growth rate for the Upper Trinity River Population is negative (less than two recruits per female spawner), and the population relies on the heavy influence of hatchery fish to maintain current abundance levels (NMFS 2012a). NMFS (2012a) concluded that the Upper Trinity River Population is at a moderate risk of extinction because the number of spawners likely exceeds the depensation threshold of 365 adult coho salmon spawners, but falls short of the low risk spawner threshold of 7,300 spawners.

6.7. Current Status of Critical Habitat in the Action Area

Grass Valley Creek provides adequate summer and winter rearing areas for juvenile coho salmon. Cold water low in suspended sediment is released from Buckhorn Dam throughout the summer months, providing important thermal refugia for rearing coho salmon during times of elevated air temperatures. In some portions of the action area, decomposed granite likely limits benthic macroinvertebrate production. The action area has a sufficient juvenile migration corridor and there are no fish passage problems, except there is a bedrock outcropping that

beavers have built a dam around which appears to be a barrier to fish migration. This limits access to approximately 600 feet of potential spawning, rearing, and migration area. The adult migration corridor in the action area remains intact and viable and supports adult migration. Consistent flows of 6 cfs from Buckhorn Dam provide sufficient flow for adult migration. However, simple, static flows from dam releases are known to create a suite of ecological problems (Poff et al. 1997). The single flow from the dam likely reduces important environmental cues for coho salmon, and reduces or eliminates geomorphic functions of high flushing flows. While the action area supports spawning of adult coho salmon (Hill 2012), it is likely that spawning success is limited to some extent by the large portion of the substrate comprised of decomposed granite.

6.8. Current Status of Critical Habitat in Upper Trinity River Population

In the winter months, juvenile coho salmon rearing areas are compromised by low flow conditions and lack of flow variability in the mainstem Upper Trinity River. Water quality in the Upper Trinity River is primarily impacted on a localized basis by fine sediment loading and temperature impairments. The Trinity River watershed in Trinity County has been listed as a sediment impaired waterbody in California's 1995 CWA 303(d) list, adopted by the State of California North Coast Regional Water Quality Control Board. This sediment impairment has resulted in the filling of pools, widening of channels, and simplified stream habitat in upper Trinity River Population Unit. Mainstem temperatures in the Upper Trinity are generally cool, but temperatures in the summer months, particularly in dry water years, reduce habitat availability in many streams, including the mainstem Trinity River. Given the amount of timber harvest that has occurred in the Upper Trinity River Population Unit, a lack of LWD is likely limiting the quality and quantity of complex habitat features used for summer and winter rearing.

Most areas support a viable juvenile migration corridor; however several barriers to migration remain in place and untreated (NMFS 2012a). Water quality during juvenile emigration is usually sufficient, except during peak temperature periods (July and August). Seaward migration of juveniles is often triggered by incremental increases in flow (Tripp and McCart 1983, Annear *et al.* 2002). Elevated flows occur only once during the year in the mainstem Trinity River and there is little flow variability to trigger or aid in fish migration. Water temperatures can be stressful during July and August, particularly during warm spells in dry and critically dry water years. The current physical and hydrologic conditions of the adult migration corridor in the Upper Trinity River Population Unit are largely intact. High water temperatures, particularly in years of low flow and above average air temperatures, reduce the function of the adult coho salmon migration corridor and can create unsafe passage conditions in the early fall. Water velocity and water quantity are typically sufficient for migrating adult coho salmon.

Lewiston Dam blocks the transport of gravel to the Upper Mainstem Trinity River; thereby diminishing the quantity and quality of salmonid spawning habitat. Spawning gravel augmentation under the TRRP takes place below the Fish Hatchery and at the cableway site near Lewiston. This augmentation has offset some of the loss of spawning gravels in the mainstem river and will likely continue to do so in the future. Water temperatures and water velocities are generally sufficient for spawning but sedimentation from tributaries is problematic due to the detrimental effect of fine sediment on spawning habitat. Another issue is redd superimposition that occurs in the mainstem river near the hatchery as a result of overcrowding (in large part due

to the high numbers of adult hatchery strays) and limited spawning habitat. Static flows in this area throughout the salmon and steelhead spawning season likely limit the distribution of suitable spawning areas and contribute to the high occurrence of superimposition.

6.9. Factors Affecting SONCC Coho Salmon in the Action Area

Coho salmon individuals in the action area are likely affected by straying of hatchery fish, as coho salmon hatchery strays have been documented using tributaries including GVC (Quinn 2012). While no estimates of the number of brown trout in the action area were available, brown trout have been found in many tributaries throughout the upper Trinity River. Coho salmon in GVC are likely exposed to a variety of natural sources of mortality including bird predation and lack of sufficient food resources. Many of the factors listed below that affect the Upper Trinity River Population Unit also effect GVC coho salmon.

6.10. Factors Affecting SONCC Coho Salmon in the Upper Trinity River Population

Trinity River coho salmon are harvested by the Yurok and Hoopa Tribes and inadvertently by recreational fishermen (recreational harvest is not permitted). They are also killed as a result of contact in Chinook salmon directed ocean fisheries. The total mortality in all fisheries for marked adult coho salmon ranged from 7 percent to 12 percent of the total adult run size from 1997 to 2008. The total mortality in all fisheries for unmarked adult coho salmon ranged from 6 percent to 15 percent of the total adult run size from 1997 to 2008.

The main areas of disease infection occur in the Klamath River upstream of the confluence of the Klamath and Trinity rivers. Therefore, juvenile disease is unlikely to be a significant factor in juvenile coho salmon mortality from the Trinity River. By the time adult coho salmon enter the Lower Trinity River, columnaris (gill rot) is probably not a significant stressor. Predation has been listed as a minor factor contributing to the decline and listing of coho salmon in the SONCC coho salmon ESU (62 FR 24588, May 6, 1997).

TRH releases roughly 4.3 million Chinook salmon, 0.5 million coho salmon and 0.8 million steelhead annually. Between 1997 and 2008, hatchery coho salmon constituted between 77 percent and 97 percent of returns (adults plus grilse) to the Willow Creek weir in the Lower Trinity River (Sinnen et al. 2009). Hatchery fish are known to create a host of genetic (Araki et al. 2009) and ecological (Kostow 2009) problems for naturally produced salmonids, often leading to poor reproductive success (Buhle et al.2009; Chilcote et al. 2011). However, in some cases they may provide important demographic support to a population, particularly at extremely low population sizes.

Catch per unit effort of brown trout at the Junction City weir has more than doubled since 2000 (CDFG unpublished data). Total catch increased from consistently less than 100 fish in the 1980s and 1990s to nearly 300 fish in the 2000s, despite the shorter trapping seasons after 2000 (CDFG unpublished data). Brown trout eat other fish species, and compete with them at all life stages for food, rearing habitat and spawning habitat (Wang and White 1994, McHugh and Budy 2006).

6.11. Factors Affecting Critical Habitat in the Action Area

Most of the land in the action area is owned by the Bureau of Land Management with some owned by the Bureau of Reclamation. Coho salmon in the action area continue to be affected by the legacy of timber harvesting and road building in the GVC drainage and the resulting sedimentation of the stream with decomposed granite. The decomposed granite likely reduces the success of coho salmon spawning and limits invertebrate production. Since the early 1980s, substantial efforts including land purchases, road decommissioning, ordinances prohibiting off-road vehicle use, and revegetation have significantly reduced the amount of sediment entering the creek. These efforts have benefited coho salmon habitat. No mining activities or residential development occur near the action area. There are no water diversions or residential water use upstream of or near the action area.

6.12. Factors Affecting Critical Habitat in the Upper Trinity River Population Unit

Timber harvest, both past and present continues to be a factor that affects critical habitat of coho salmon. Sedimentation, changes in stream hydrology, and lack of large woody debris recruitment contribute to degraded habitat conditions for SONCC coho salmon in the Upper Trinity River Population. The many roads in watersheds impact small tributary streams. The Fish Passage Assessment database lists 162 road stream crossing barriers in the Upper Trinity River (CFPAD 2008). Of these, at least 17 were identified as complete barriers to adult and juvenile salmonid passage in the Upper Trinity River (CFPAD 2008). Most of the habitat with the greatest potential to support coho salmon in this area occurs in areas with road densities greater than 2.5 miles/sq. mile, and much of that habitat is in areas with greater than 3 miles/sq. mile. Of particular importance are the many roads in the Weaver and Douglas City areas, where small tributary streams containing reaches with high or medium potential for coho salmon exist.

If done improperly, mining can degrade riparian areas and damage in-stream habitat. Past mining activities have degraded some riparian areas to the point where future recruitment of vegetation is impossible. Small-scale agricultural operations exist in the Upper Trinity River Population Unit, such as small farms, vineyards and localized cattle grazing operations. Irrigation of cannabis crops in many watersheds likely decreases summer and fall base flow. Numerous wells and diversions for domestic uses currently occur throughout the watershed and may reduce stream flows during critical low-flow periods. The population of Trinity County increased 9.9 percent from 2000 to 2006 according to the U.S. Census Bureau (U.S. Census Bureau 2008), equating to an annual increase of 1.7 percent. Human population in the Trinity River drainage is tempered by the large amount of publicly-owned land as well as the steep surrounding terrain. In the mainstem Trinity River, low flows during the winter months limit habitat availability for rearing coho salmon, and high summertime water temperatures, particularly in dry water years, reduce the function of the critical habitat.

7. EFFECTS OF THE ACTION

In this section, we identify the impacts that individual coho salmon and essential features of critical habitat will experience as a result of the proposed action. According to the TRRP, approximately 800 feet of stream will be dewatered. Coho salmon are present in the downstream 200 feet of the reach to be dewatered. The action area extends from Buckhorn Dam downstream 2,300 feet to the confluence of the outlet and spillway channels.

7.1. Insignificant or Discountable Effects to SONCC Coho Salmon or Their Critical Habitat

Some components of the proposed action may result in effects that are not likely to adversely affect SONCC coho salmon or their critical habitat. These effects are expected to be insignificant or discountable as explained further below.

7.1.1. Noise, Motion, and Vibration Disturbance from Heavy Equipment Operation

Noise, motion, and vibration produced by heavy equipment operation is expected to occur as a result of the proposed action. Use of equipment will occur primarily outside the wetted channel. Channel crossings by heavy equipment and trucks will be kept to a minimum and occur only at designated low water crossing zones that are fortified with rock in order to limit sedimentation resulting from the stream crossings. Heavy equipment will be used briefly in the wetted channel to construct cofferdams. However, this is expected to result in insignificant adverse effects to SONCC coho salmon. Listed salmonids will be able to avoid equipment working in the stream channel by temporarily relocating to suitable habitat near the worksite.

7.1.2. Disturbance to Riparian Vegetation

Loss of riparian vegetation is expected to be small in scale, particularly because coho salmon are only present in 25 percent of the stream reach that would be affected, because minimization measures will be in place, and because disturbed vegetation will be replanted. Attempts will be made to retain existing riparian vegetation, though some shrubs and an occasional tree would likely be damaged during construction. Most riparian vegetation that would be damaged is expected to be typical riparian species such as willows and other shrubs, which are generally easier to recover or reestablish. Reclamation will implement a riparian revegetation plan to enhance and maintain functional riparian vegetation in the action area after construction is complete. There is expected to be no long-term net loss of riparian habitat. After a period of five years, riparian and wetland habitat will be evaluated in a post-project report. Therefore, NMFS anticipates only an insignificant and short-term loss of riparian habitat and function within the action area to result from the proposed action.

7.1.3. Chemical Contamination from Equipment Fluids

Equipment refueling, fluid leakage, and maintenance activities within and near the stream channel pose a low risk of contamination and effects to SONCC coho salmon individuals.

Equipment and materials will be stored away from wetland and surface water features. Vehicles and equipment will be washed prior to crossing the stream channel or performing work in the action area. Vehicles used during construction will receive proper and timely maintenance to reduce the potential for mechanical breakdowns leading to a spill of materials. Maintenance and fueling will be conducted in an area at least 150 feet away from waters of GVC or within an appropriate secondary fueling containment area. Gasoline engines and pumps operated on the floodplain will be isolated from the ground by an impermeable barrier. Reclamation will develop and implement site-specific BMPs, a water pollution control plan, and emergency spill control plan. Given the measures that would be established to minimize the probability of a fuel spill and contamination from construction equipment, the likelihood of poisoning coho salmon individuals with contaminants is low. Therefore, water quality degradation from toxic chemicals associated with the proposed action is discountable.

7.1.4. Reduced Benthic Macroinvertebrate Community

Benthic (i.e., bottom dwelling) aquatic macroinvertebrates may be temporarily lost or their abundance reduced when stream habitat is dewatered (Cushman 1985). Effects to aquatic macroinvertebrates resulting from stream flow diversions and dewatering will be temporary because instream construction activities occur only during the low flow season, and rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates are expected following rewatering (Cushman 1985, Thomas 1985, Harvey 1986). In addition, the effect of macroinvertebrate loss on juvenile coho salmon is likely to be negligible because 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. The section of the stream to be dewatered that contains fish is short, approximately 200 feet. Therefore, the loss of aquatic macroinvertebrates resulting from dewatering activities is expected to be insignificant.

7.1.5. Structural Placement

The proposed action includes the addition of LWD to the outlet channel. When large structures such as logs are added to a streambed, salmonids could be crushed and killed. However, the outlet channel will be dewatered prior to any LWD being added to the outlet channel. TRRP staff will relocate juvenile salmonids and those not relocated will likely be killed by dessication from the dewatering (covered below). Therefore, the negative effects to SONCC coho salmon from structural placement are discountable. Over the long term, NMFS expects the addition of LWD to positively affect SONCC coho salmon in GVC as placement of LWD has been associated with increased density of coho salmon (Roni and Quinn 2001).

7.2. Adverse Effects to Listed Species

In this section, we identify the direct and indirect adverse effects of the proposed action on SONCC coho salmon and their designated critical habitat. The proposed action would occur in the late summer and fall of 2012, ending by no later than October 15, 2012. Implementing the proposed action during this time would significantly reduce the probability that any adult

SONCC coho salmon would be affected by the proposed action. Dewatering, fish relocation, and increased mobilization of sediment within the stream channel will result in direct effects to SONCC coho salmon. A small percentage of juvenile coho salmon are expected to be injured or killed as a result of the proposed activities.

7.2.1. Dewatering

Dewatering of the project area would be essential during construction and would be implemented by diverting the normal base flow through a pump system. The water would be pumped and rerouted from behind the outlet-works wing walls, around the project reach, and back into the outlet channel downstream of the construction area. Because there are no coho salmon near the dam outlet works, no measures would be necessary to screen the water intake to avoid entrapment of fish that might otherwise be residing upstream of the intake structure. In total, the proposed project would dewater 800 feet of stream, with the downstream 200 feet containing coho salmon.

Exposure

Because the proposed dewatering would occur during the late summer and early fall prior to the adult coho salmon migration period, the life stage most likely to be exposed to potential effects of dewatering is juvenile coho salmon. No adult coho salmon or coho salmon eggs are expected to be present in the action area during construction. Data from a weir operated by CDFG near Willow Creek, California (approximately 93 river miles downstream of the action area) indicates that coho salmon migration in the mainstem Trinity River begins to peak in mid-October (CDFG 2008, Sinnen et al. 2009). Coho salmon that spawn in tributaries of the Trinity River do not enter the tributaries until fall rains raise discharge, typically in December, and sometimes as late as January. Therefore, adult coho salmon are unlikely to be present near the action area prior to the end of construction on October 15, 2012.

Response

The effects of dewatering would result from the placement of the cofferdams, the trapping of individuals in the isolated area, and the diversion of streamflow. Rearing juvenile coho salmon could be killed or injured if crushed during placement of the cofferdams, though crushing is expected to be minimal due to ability of most juveniles to evade large objects. Stream flow diversions could harm coho salmon by concentrating or stranding them in residual wetted areas before they are relocated (Cushman 1985), or causing them to move to adjacent areas of poor habitat (Campbell and Scott 1984). Juvenile coho salmon that are not caught during the relocation efforts would be killed from either construction activities or desiccation.

Slight changes in flow are anticipated to occur within and downstream of the project site during dewatering activities. These fluctuations in flow, outside of the dewatered area, are anticipated to be small, gradual, and short-term, which should not result in any harm to coho salmon. NMFS expects that stream flow near the project site would be the same as free-flowing conditions, except during dewatering and in the dewatered reach where stream flow is bypassed. We expect that stream flow diversion and dewatering in the construction area would cause temporary loss,

alteration, and reduction of aquatic habitat. The extent of temporary loss of juvenile coho salmon rearing habitat should be minimal because the dewatered reach that contains coho salmon is less than 200 feet long. The TRRP will restore and enhance the site prior to project completion, by including the two coho salmon rearing ponds and two side channels , and increasing the sinuosity of the outlet channel.

Effects associated with dewatering activities will be minimized due to the multiple minimization measures that will be utilized including passive trapping of coho salmon prior to more potentially lethal techniques like electrofishing. Juvenile coho salmon that avoid capture in the project work area will likely die during dewatering activities. NMFS expects that the number of coho salmon that will be killed as a result of barrier placement and stranding during site dewatering activities is very low, likely less than one percent of the total number of salmonids in the project area based on NMFS (2012b; also, see Fish Relocation, next section of this Opinion). The low number of juveniles expected to be injured or killed as a result of dewatering is based on the avoidance ability of juveniles to disturbance, the small area that would dewatered, and because most coho salmon will be captured beforehand.

7.2.2. Fish Relocation

Qualified fish biologists specifically trained in the use of electroshocking techniques will capture and relocate fish (and amphibians) downstream from the reach to be dewatered to minimize adverse effects of dewatering to listed salmonids Juvenile coho salmon will be passively captured using minnow traps prior to any electrofishing activities. Captured fish will then be transported quickly and released to a suitable downstream location.

Exposure

The life stage most likely to be exposed to fish relocation activities are juveniles. For the same reasons mentioned above in the Dewatering section of this Opinion, no adult coho salmon or coho salmon eggs are expected to be affected by fish relocation activities.

Response

Any fish collecting gear, whether passive or active (Hayes 1983), has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of 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. Water temperatures will be low during the fish collection activities as water is released from the hypolimnion of Buckhorn Reservoir. This will reduce the compounding effects of high water temperatures and stress from fish relocation activities. 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 sublethal effects including spinal injuries (Habera et al. 1999). Although chronic effects may occur, most effects from electrofishing occur at the time of capture and handling.

Most of the stress and death from handling result from differences in water temperature between

the stream and the temporary holding containers, dissolved oxygen levels, the amount of time that fish are held out of the water, and physical injury. Handling-related stress increases rapidly if water temperature exceeds 18 °C or dissolved oxygen is below saturation. However, due to coldwater release from Buckhorn Reservoir, water temperature is not expected to exacerbate stress levels. A qualified fisheries biologist will relocate fish, following NMFS (2000) electrofishing guidelines. Because of these measures, direct effects to, and mortality of, juvenile coho salmon and steelhead during capture will be minimized.

The area to be dewatered and the area chosen for relocation will not differ in water temperature, reducing stress on juveniles by eliminating discrepancies in water temperature. Relocated fish may also have to compete with other salmonids, which can increase competition for food and habitat. Some of the fish at the relocation sites may choose not to remain in these areas and may move downstream to areas that have more habitat and lower fish densities. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse.

Fish relocation activities are expected to minimize individual project impacts to juvenile coho salmon by removing them from construction area where they would have experienced high rates of injury and mortality. Fish relocation activities are anticipated to only occur in the 200 feet of the outlet channel downstream of the bedrock outcropping. Rearing juvenile coho salmon in the immediate project work area will be subject to disturbance, capture, relocation, and related short-term effects. Most of the take associated with fish relocation is anticipated to be non-lethal, however, a limited number of rearing juvenile coho salmon may become injured or die. In addition, the number of fish affected by increased competition is not expected to be significant at the fish relocation site, based upon the short stream reach to be dewatered.

Effects associated with fish relocation activities will be significantly minimized due to the multiple minimization measures that will be utilized. These including using personnel that have been specifically trained with the use of electrofishing equipment, minimizing the density of captured fish in containers used for transportation, minimizing the difference in water temperature of containers used for transportation and GVC, and using a suitable location to relocate captured fish. The proposed action would occur during the summer low-flow period after emigrating smolts have left GVC and before adult fish travel upstream. Therefore, the majority of SONCC coho salmon will be age-0 with some age 1+. Although most mortality of coho salmon during fish relocation activities will occur at the age-0 stage because there will be more age-0 fish present than age 1+ fish, there is a potential of mortality of age 1+ fish.

NMFS (2012b) presented death and injury rates from dewatering and fish relocation activities gathered from a large number of restoration projects carried out in California. NMFS (2012b) found it is reasonable to assume that no more than 0.6 percent of captured coho salmon will be injured and no more than 0.6 percent of captured coho salmon will be killed during dewatering and fish relocation. There are no estimates available of the number or density of juvenile coho salmon in the 200 feet of the outlet channel containing coho salmon that would be dewatered. High densities of coho salmon in the mainstem Trinity River are approximately 2.1 coho salmon per linear foot of stream bank (Martin 2012). In the area to be dewatered containing coho salmon, there is approximately 400 feet of stream bank (200 × 2), which would yield 840 juvenile coho salmon assuming a similar density of coho salmon as areas with high densities on

the mainstem Trinity River. Therefore, NMFS assumes that no more than five juvenile coho salmon (840 × 0.006) would be injured and no more than five (840 × 0.006) juvenile coho salmon would be killed during dewatering and fish relocation activities.

7.2.3. Increased Mobilization of Sediment within the Stream Channel

Dewatering, dredging, removing bedrock, reshaping the stream channel and stream crossings by trucks and equipment is likely to increase background suspended sediment loads for short periods during and following completion of the proposed action. Although riparian restoration may involve ground disturbance, the magnitude and intensity of this ground disturbance is expected to be small and isolated to the riparian area.

Exposure

Sediment-related effects are expected during the construction (late summer to October 15), as well as during peak-flow winter storm events when remaining loose sediment is mobilized. During summer construction, the life stage most likely to be exposed to potential effects of increased sediment mobilization is juvenile coho salmon for the same reasons discussed above. As higher winter flows mobilize loose sediment, adult coho salmon may also be exposed to increased turbidity. Removal of the bedrock outcropping and dredging of the stream channel is expected to have the biggest effect on increasing suspended sediment in GVC. However, minimization measures, such as adding clean spawning gravels on top of the remaining fine sediment in the dewatered channel prior to returning flow, will limit the amount of sediment released. The increased mobilization of sediment is not likely to degrade spawning gravel downstream because project related sediment mobilization should be minimized by the use of cofferdams and because the project reach where construction will be occurring will be dewatered. Small amounts of sediment are expected to affect only a short distance downstream, and should be easily displaced by either higher fall or winter flows. In the winter, the high flows will carry excess fine sediment downstream to point bars and areas with slower water velocities. Because redds are built where water velocities are higher, the minimally increased sediment mobilization is not expected to smother existing redds. Therefore, coho salmon eggs and alevin are not expected to be exposed to the negligible increase in sediment on redds. Clean spawning gravels will be added to the project reach and a fish barrier will be removed which NMFS expects to have positive effects for coho salmon in GVC.

Response

Some increase in suspended sediment is expected during the dewatering phase of the project resulting from stream crossings by trucks and equipment and placement of cofferdams. Erosion and runoff during precipitation and snowmelt would increase the supply of sediment to GVC after the construction has ended. Heavy equipment operation in upland and riparian areas would increase soil compaction, which would increase runoff during precipitation. However, soil will be lightly disturbed prior to the completion of riparian revegetation to reduce compaction and ensure recruitment by native plants.

Based on turbidity monitoring conducted during several restoration projects carried out by the TRRP on the Trinity River, the proposed action is not expected to result in suspended sediment levels greater than 20 Nephelometric Turbidity Units (NTU) more than 500 feet downstream of the dewatered outlet channel. For comparison, turbidity levels necessary to impair feeding are likely in the 100 to 150 NTU range (Harvey and White 2008). Much of the research presented in the paragraph below focused on turbidity levels significantly higher than those likely to result from the proposed action, especially with implementation of the proposed minimization measures. In contrast, the lower concentrations of sediment and turbidity expected from the proposed action are unlikely to be severe enough to cause injury or death of listed juvenile coho salmon. Instead, the anticipated levels of turbidity and suspended sediment resulting from the proposed action will likely result in only minor and temporary behavioral effects.

High concentrations of suspended sediment can disrupt normal feeding behavior (Berg and Northcote 1985), reduce growth rates (Crouse et al. 1981), and increase plasma cortisol levels (Servizi and Martens 1992). Increased sediment deposition can fill pools and reduce the amount of cover available to fish, decreasing the survival of juveniles (Alexander and Hansen 1986) and holding habitat for adults. Excessive fine sediment can interfere with development and emergence of salmonids (Chapman 1988). Upland erosion and sediment delivery can increase substrate embeddedness. These factors make it harder for fish to excavate redds, and decrease redd aeration (Cederholm et al. 1997).

7.3. Effects to Critical Habitat

7.3.1. Adverse Effects to Critical Habitat

Juvenile rearing sites require cover and cool water temperatures during the summer low flow period. Adverse effects to rearing habitat will primarily occur as a result of dewatering the channel and increasing sediment input during instream activities. Juvenile coho salmon in GVC will temporarily lose access to 200 feet of stream that is currently serving as an important rearing area. Loss of rearing sites could also occur by the filling of pools with fine sediment. However, these adverse effects are expected to be temporary, of short duration, and of limited magnitude.

As explained above, spawning habitat is not likely to be adversely affected by the temporary increase in fine sediment resulting from the proposed action. The addition of spawning gravels to the action area is expected to benefit rearing habitat. After the first fall rains, disturbed

sediment in the action area may enter GVC. Where limited settling of mobilized sediment does occur in spawning habitat, the minimally increased sediment is not expected to degrade spawning habitat due to the small amount and short term nature of the effects. Spawning habitat is located where water velocities are higher, where mobilized fine sediment is less likely to settle. Winter flows in GVC are expected to clear any residual deposited sediment.

Migratory habitat is essential for juvenile salmonids outmigrating to the ocean as well as adults returning to their natal spawning grounds. The proposed action would result in a temporary loss of 200 feet of GVC as a migration corridor. However, because the upstream end of the project reach is Buckhorn Dam, and the bedrock outcropping and associated beaver dam currently appear to be a barrier to upstream migration, no coho salmon are expected to migrate downstream into the action area during the proposed activities.

7.4.1 Beneficial Effects to Critical Habitat

The proposed Action is expected to increase quantity and quality of rearing habitat over the long term by giving coho salmon access to an additional 600 linear feet of GVC above the bedrock outcropping that currently serves as a barrier to migration, reducing the amount of decomposed granite, adding clean Trinity River origin spawning gravels, adding two coho salmon rearing ponds, adding large woody debris, adding two side channels, and increasing the meander frequency of GVC. Although this project is expected to result in take of SONCC coho salmon and short term effects to Critical Habitat, the proposed action is anticipated to improve coho salmon habitat and coho salmon survival over the long-term.

Misguided restoration efforts often fail to produce the intended benefits and can even result in further habitat degradation. Improperly constructed projects can cause greater adverse effects than the pre-existing condition. The TRRP has significant expertise and experience in stream restoration. Because TRRP is leading this proposed action, NMFS expects a high probability of success.

Instream Habitat Improvements

Placement of LWD into streams can result in the creation of pools that influence the distribution and abundance of juvenile salmonids (Beechie and Sibley 1997). LWD influences the channel form, retention of organic matter and biological community composition. In small (<10 m bankfull width) and intermediate (10 to 20 m bankfull width) streams, LWD contributes channel stabilization, energy dissipation and sediment storage (Cederholm et al. 1997). Presence and abundance of LWD is correlated with growth, abundance and survival of juvenile salmonids (Fausch and Northcote 1992). Because LWD will be added to GVC, the Proposed Action is expected to result in survival enhancements for coho salmon in the action area.

Coho salmon rely on off channel ponds, wetlands, and side channels during their extended freshwater rearing phase. These habitat features provide a diverse array of rearing areas, feeding opportunities, and habitat complexity that can bolster survival and growth of salmonids (Jeffres et al. 2008). Because the proposed action includes the addition of two side channels and two

ponds to the action area, coho salmon are expected to benefit through increases in survival and growth.

Sediment in the action area is composed of a large portion of decomposed granite. While it appears that some coho salmon spawn in the decomposed granite, it can be assumed that egg-to-fry survival of coho salmon would be improved if the sediment were of larger sized spawning gravels, and there was a lower proportion of the sand sized decomposed granite. By adding clean, Trinity River origin spawning gravels to the action area, the proposed action is expected to increase egg-to-fry survival of coho salmon in GVC. In addition, the benthic macroinvertebrate community is expected to benefit from the addition of gravel, which will increase the food base for coho salmon in the action area and lead to increased survival.

Instream Barrier Removal for Fish Passage Improvement

During a snorkel survey on June 23, 2011, Seth Naman (NMFS) and Brandt Guttermuth (TRRP) performed a snorkel survey of the entire outlet channel, including areas downstream and upstream of the bedrock outcropping. Many hundreds of SONCC coho salmon juveniles were observed to be in the outlet channel. However, zero coho salmon were found in the 600 ft of channel upstream of the bedrock outcropping. This suggests the bedrock outcropping and beaver dam act as a barrier for coho salmon. Because this migration barrier would be removed, the proposed action is expected to increase the quantity of habitat to coho salmon in GVC. In addition to the increased distribution of coho salmon in GVC, the barrier removal is expected to increase adult returns to the creek by increasing the carrying capacity of the action area, assuming that the increase in abundance of juvenile coho salmon from the proposed action is not compensated for (offset) by a similar increase in mortality at some other location or life stage.

8. INTERRELATED AND INTERDEPENDENT EFFECTS

Effects of the proposed action are analyzed together with the effects of other activities that are interrelated to, or interdependent with, that action. These include actions that are part of the proposed action and depend on the proposed action for their justification (interrelated actions) as well as actions that have no independent utility apart from the proposed action (interdependent actions). No interrelated and independent effects are expected to occur as a result of this proposed action.

9. CUMULATIVE EFFECTS

NMFS must consider both the “effects of the action” and the cumulative effects of other activities in determining whether the action is likely to jeopardize the continued existence of the SONCC coho salmon ESU considered in this Opinion or result in the destruction or adverse modification of critical habitat designated for the SONCC coho salmon ESU. 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. Although some actions may reasonably be expected to occur based on their past occurrence, we lack information on the extent or location of many actions and therefore cannot include them in *Cumulative Effects*. We include below only those actions for which we have definitive information from which to determine future effects on SONCC coho salmon. Other factors, for which we lacked definitive information about future actions, were discussed in the *Environmental Baseline*.

9.1. Forestry Activities

Past forestry activities caused substantial effects to salmonids is GVC. The basin is comprised of decomposed granite, which deteriorated rapidly and caused a large increase in the amount of fine sediment entering into GVC. The sand like material filled in spawning gravels and reduced habitat for benthic macroinvertebrates which limited the food supply for SONCC coho salmon. The effects continue today but to a much more limited degree. The amount of timber harvesting planned in the action area has been dramatically reduced or eliminated. In addition, upslope restoration activities including revegetation and road decommissioning has significantly reduced the amount of decomposed granite entering the action area. Given the reduction in the amount and intensity of logging in the action area and the increase in restoration activities, the effect of future logging activities on SONCC coho salmon in the action area is unlikely to be significant.

9.2. Mining

Little, if any mining occurs throughout the action area because access by the public to the area is restricted via multiple locked gates. The effect from mining on SONCC coho salmon in the action area is expected to be negligible.

9.3. Residential Development

Residential growth in the action area is expected to be very limited. Much of the area is either publicly owned land or private timber lands. In Trinity County, the population is expected to grow at a rate of 0.6 percent annually between 2010 and 2020 (NMFS 2012a). The effect from residential development on SONCC coho salmon in the action area is expected to be negligible.

10. INTEGRATION AND SYNTHESIS

SONCC coho salmon populations throughout their range have shown substantial decreases in both numbers and distribution. Abundance in populations in the larger basins (e.g., Eel and Klamath) continue to decline (NMFS 2011). The poor condition of their habitat in many areas and the compromised genetic integrity of some stocks pose a serious risk to the survival and recovery of the SONCC coho salmon ESU. Based on the above information, Williams et al. (2011) concluded that the SONCC coho salmon ESU is likely to become endangered in the foreseeable future. SONCC coho salmon face a variety of threats that are expected to continue into the future including water utilization, climate change, urbanization, mortality in fisheries, current and legacy effects of timber harvesting, and habitat loss from dikes and stream channel

simplification. While coho salmon in the Upper Trinity River Population unit are dominated by hatchery returns, recent weir estimates indicate that many hundreds, even thousands of unmarked coho salmon returned to the Trinity River (Sinnen *et al.* 2010).

Most of the negative effects of the proposed action (*e.g.* increased suspended sediment load in GVC) are expected to be short in duration and of limited magnitude, resulting mainly in slight changes in juvenile coho salmon behavior. The proposed action is unlikely to negatively affect adult coho salmon or coho salmon eggs. While the proposed action is likely to result in lethal take of up to five juvenile coho salmon, NMFS expects the proposed action is unlikely to reduce the abundance of returning adult coho salmon. Instead, the action may improve population viability by increasing rearing habitat for SONCC coho salmon.

The proposed action would result in effects to SONCC coho salmon ESU critical habitat including dewatering of 800 feet of GVC and increases in suspended sediment load. However, these effects are limited in duration, magnitude and geographic extent. Overall, the proposed action is expected to have substantial benefits to coho salmon in GVC by opening up an additional 600 linear feet of stream to spawning and rearing, increasing habitat complexity, and improving spawning substrate. In the long term, NMFS expects that the improvements to critical habitat from the proposed action will lead to increased growth and survival of juvenile coho salmon, increased spawning success of adult coho salmon, and ultimately, greater adult returns of coho salmon to GVC, assuming mortality is not compensatory. Similarly, NMFS expects that the proposed action will result in benefits to the primary constituent elements of critical habitat in GVC by improving the quality of substrate in turn leading to better food production, increasing space, and improving the amount of cover and shelter with the addition of large woody debris.

NMFS has determined the above effects are not likely to appreciably increase any population unit's risk of extinction.. This is based on the small geographic extent of the proposed action, limited temporal extent of the proposed action, and the few juvenile coho salmon that can be expected to be killed as a result of the proposed action. In the long term, the proposed action is expected to have beneficial effects for SONCC coho salmon in the Upper Trinity River Population Unit.

11. CONCLUSION

After reviewing the current status of the SONCC coho salmon ESU and its 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 action, as proposed, is not likely to jeopardize the continued existence of the SONCC coho salmon ESU, and is not likely to result in the destruction or adverse modification of SONCC coho salmon ESU critical habitat.

12. INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the ESA prohibits the take of endangered species without a specific permit or exemption. Protective regulations adopted pursuant to section 4(d) extend this

prohibition to threatened species. 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 [ESA section 3(19)]. Harm is further defined by NMFS regulations as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering (50 CFR 222.102). Incidental take refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). 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 (ITS).

The measures described below are non-discretionary, and must be implemented by Reclamation so that they become binding conditions of any grant or permit issued, as appropriate, in order for the exemption in section 7(o)(2) to apply.Reclamation has a continuing duty to regulate the activity covered by this incidental take statement. If Reclamation (1) fails to assume and implement the terms and conditions or (2) fails to require the permittee or grantee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Reclamation 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)).

12.1 Amount or Extent of Take

NMFS expects the proposed project will result in incidental take of SONCC ESU coho salmon. Juvenile coho salmon will be harmed, injured, or killed from the dewatering and fish relocating activities at the project sites. Specifically, incidental take is expected to be in the form of capture during dewatering and fish relocation activities. NMFS expects no more than 840 juvenile SONCC ESU coho salmon will be captured, no more than 0.6 percent of the captured coho salmon will be injured, and no more than 0.6 percent of the captured coho salmon will be killed. Thus, NMFS expects no more than 5 juvenile SONCC ESU coho salmon to be injured and no more than five juvenile coho salmon will be killed as a result of the proposed action.

12.2 Effect of the Take

In the accompanying opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the SONCC coho salmon ESU.

12.3 Reasonable and Prudent Measures

NMFS believes that the following reasonable and prudent measures are necessary and appropriate to minimize take of SONCC ESU coho salmon resulting from implementation of the action.

1. Reclamation shall take measures to minimize the amount or extent of incidental take of listed salmonids resulting from fish relocation.
2. Reclamation shall take measures to minimize the amount or extent of incidental take of listed salmonids resulting from dewatering and instream construction.
3. Reclamation shall report 1) the number of fish captured, the number of fish injured, the number of fish killed and 2) the results of riparian vegetation monitoring.

12.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, Reclamation or their designee(s) must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. The following terms and conditions implement Reasonable and Prudent Measure No. 1, which states that Reclamation shall take measures to minimize the amount or extent of incidental take of listed salmonids resulting from fish relocation.

    1.1. Prior to any electrofishing, Reclamation shall attempt to capture fish in the action area using minnow traps or other passive trapping techniques no less than two weeks prior to any construction activities. Any captured fish shall be transported downstream and placed in GVC below a block net to prevent their upstream migration into the area to be dewatered. If passive capture is deemed successful, this method shall be used to capture coho salmon until catch per unit effort is reduced to less than one fish captured in a 24-hour period.

    1.2. Reclamation shall take measures to minimize crowding of transported fish in transport containers.

    1.3. Reclamation shall take measures to ensure water temperatures in transport containers, the outlet channel where fish will be captured, and the relocation area do not differ by more than 1°C.

    1.4. All electrofishing shall be conducted according to NMFS *Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act* (2000).

    1.5. Personnel using electrofishing equipment must have completed a training course in the use of electrofishing techniques.

    1.6. The backpack electrofisher shall be set as follows when capturing fish:

	Initial	Maximum
A) Voltage:	100 Volts	300 Volts
B) Duration:	500 µs (microseconds)	5 ms (milliseconds)
C) Frequency:	30 Hertz	70 Hertz

1.7. A minimum of three passes with the electrofisher shall be conducted to ensure maximum capture probability of salmonids within the area proposed for dewatering.

1.8. No electrofishing shall occur if water conductivity is greater than 350 microSiemens per centimeter (µS/cm) or when instream water temperatures exceed 17.8 °C. Water temperatures shall be measured at the pool/riffle interface. Direct current (DC) shall be used.

1.9. A minimum of one assistant shall aid the fisheries biologist by netting stunned fish and other aquatic vertebrates.

2. The following terms and conditions implement Reasonable and Prudent Measure No. 2, which states that Reclamation shall take measures to minimize the amount or extent of incidental take of listed salmonids resulting from dewatering and instream construction.

2.1. Stream crossings shall be minimized to the greatest extent possible.

2.2. Reclamation shall install two temporary bridges over GVC to reduce or eliminate stream crossings in the wetted channel.

2.3. Prior to the start of construction activities, Reclamation shall retain a qualified biologist to identify potential construction access routes necessary for the project to ensure that these features avoid and/or minimize to the fullest extent possible impacts to riparian habitats and wetland waters. In addition, Reclamation shall clearly identify, and flag in the field, biologically sensitive areas (e.g., jurisdictional waters and riparian habitat) to be protected, and shall provide the contractor with specific instructions to avoid any construction activity within these features to the fullest extent possible. Reclamation shall inspect and maintain flagged areas on a regular basis throughout the construction phase.

2.4. Areas where ground disturbance will occur shall be identified in advance of construction and limited to only those areas that have been approved by the project leader in advance.

2.5. All vehicular construction traffic shall be confined to the designated access routes and staging areas.

2.6. Disturbance shall be limited to the minimum necessary to complete all project activities.

2.7. All supervisory construction personnel shall be informed of environmental concerns, permit conditions, and final project specifications

2.8. Reclamation shall prepare an erosion and sedimentation control plan (Storm Water Pollution Prevention Plan [SWPPP]) and shall ensure that its measures for erosion control will be prioritized based on proximity to the stream. The following shall be used as a guide to develop this plan:

- Restore disturbed areas to pre-construction contours to the fullest extent feasible.
- Salvage, store, and use the highest quality soil for revegetation.
- Discourage noxious weed competition and control noxious weeds.
- Leave drainage gaps in topsoil and spoil piles to accommodate surface water runoff.
- To the fullest extent possible, cease excavation activities during significantly wet or windy weather.
- Use bales, wattles, and/or silt fencing as appropriate.

- Before seeding disturbed soils, work the topsoil to reduce compaction caused by construction vehicle traffic.
- After construction, rip project edges to encourage revegetation.
- Locate spoil sites such that they do not drain directly into a surface water feature, if possible. If a spoil site will drain into a surface water feature, construct catch basins to intercept sediment before it reaches the feature. Grade and vegetate spoil sites to reduce the potential for erosion.
- Put sediment control measures in place prior to the onset of the rainy season to ensure that surface water runoff does not occur. Monitor and maintain project areas in good working condition until disturbed areas have been seeded and mulched or revegetated in another fashion. If work activities take place during the rainy season, put erosion control structures in place at the end of each construction day.

2.9. Reclamation shall monitor turbidity levels in the Buckhorn Dam outlet works (i.e., natural background) and 500 feet downstream of the in-stream construction activities that could increase turbidity. Field turbidity measurements shall be collected whenever a visible increase in turbidity is observed. In addition, monitoring frequency shall be a minimum of every two hours during in-stream work periods and when activities commence that are likely to increase turbidity levels above any previously monitored levels.

2.10. If grab sample results indicate that turbidity levels exceed 20 nephelometric turbidity units (NTU) at 500 feet downstream from project activities, remedial actions shall be implemented to reduce and maintain turbidity at or below 20 NTU immediately downstream of the 500 linear foot zone of dilution. Potential remedial actions include halting or slowing construction activities and implementation of additional best management practices (BMPs) until turbidity levels are at or below 20 NTU.

2.11. Fill gravels used on the streambeds and stream banks shall be composed of washed, spawning-sized gravels from a local Trinity River Basin source. Gravel shall be washed to remove any silts, sand, clay, and organic matter and shall be free of contaminants such as petroleum products.

2.12. Reclamation shall prepare and implement a SWPPP that describes BMPs for the project, including silt fences, sediment filters, and routine monitoring to verify effectiveness. Proper implementation of erosion and sediment controls shall be adequate to minimize sediment inputs into the Trinity River until vegetation regrowth occurs. All required controls and BMPs, including sediment and erosion control devices, shall be inspected daily during the construction period to ensure that the devices are properly functioning. Excavated and stored materials shall be kept in upland activity areas with erosion control properly installed and maintained. Excavated and stored materials shall be staged in stable upland activity areas. All applicable erosion control standards shall be followed during stockpiling of materials.

2.13. To minimize the potential for increases in turbidity and suspended sediments entering the outlet channel and GVC as a result of access routes, Reclamation shall implement the following protocols:

- Keep bare soil to the minimum required by designs. Erosion control devices/measures shall be applied to areas where vegetation has been removed as needed to reduce short-term erosion prior to the start of the rainy season.
- Keep runoff from bare soil areas well dispersed. Dispersing runoff keeps sediment on-site and prevents sediment delivery to streams. Direct any concentrated runoff from bare soil areas into natural buffers of vegetation or areas with more gentle slopes where sediment can settle out.
- Disconnect and disperse flow paths that might otherwise deliver fine sediment to the stream channel.
- Decompact or rip disturbed areas so that surfaces are permeable and surface water runoff is minimized.

2.14. Reclamation shall prepare and implement a spill prevention and containment plan in accordance with applicable federal and state requirements.

2.15. Reclamation shall ensure that any construction equipment that will come in contact with outlet channel waters is inspected daily for leaks prior to entering the dewatered or flowing channel. External oil, grease, and mud shall be removed from equipment using steam cleaning. Untreated wash and rinse water shall be adequately treated prior to discharge if that is the desired disposal option.

2.16. Reclamation shall ensure that hazardous materials, including fuels, oils, and solvents, are not stored or transferred within 150 feet of the active stream channel. Areas for fuel storage, refueling, and servicing shall be located at least 150 feet from the active channel or within an adequate secondary fueling containment area.

2.17. Gas pumps and engines shall be stored and maintained on impermeable barriers so that any leaking petroleum products are isolated from the ground. In addition, the construction contractor shall be responsible for maintaining spill containment booms onsite at all times during construction operations and/or staging of equipment or fueling supplies. Fueling trucks shall maintain a spill containment boom at all times.

2.18. When using imported erosion control materials (as opposed to rock and dirt berms), use only certified weed-free materials, mulch, and seed.

2.19. Preclude the use of rice straw in riparian areas.

2.20. Limit any import or export of fill to materials that are known to be weed free.

2.21. Ensure all construction equipment is thoroughly washed prior to entering the worksite. Equipment shall be inspected to ensure that it is free of plant parts as well as soils, mud, or other debris that may carry weed seeds.

2.22. Use a mix of native grasses, forbs, and non-persistent non-native species for seeding disturbed areas that are subject to infestation by non-native and invasive plant species. Where appropriate, use a heavy application of mulch to discourage introduction of these species. Planting plugs of native grass species may also be used to accelerate occupation of disturbed sites and increase the likelihood of reestablishing a self-sustaining population of native plant species.

2.23. Within the first 5 years after project construction, if it is determined that the project has caused non-native invasive vegetation to out-compete desired planted or native colonizing riparian vegetation, opportunities to control these non-native species shall be considered. When implementing weed control techniques, the approach shall consider using all available control methods known for a weed species.

2.24. Reclamation shall implement a riparian revegetation plan to maintain functional riparian habitat within the project area. There shall be no net long-term loss of wetlands and riparian habitat as compared with pre project conditions.

3. The following terms and conditions implement Reasonable and Prudent Measure No. 3, which states that Reclamation shall report 1) the number of fish captured, the number of fish injured, the number of fish killed and 2) the results of riparian vegetation monitoring.

3.1. Reclamation shall prepare a report that details the following:

- Length of GVC that was dewatered
- Methods used to capture fish
- Number and species of fish captured by capture method
- Number and species of fish injured by capture method
- Number and species of fish killed by capture method

Reclamation shall submit this report by December 31, 2012, to the Northern California NMFS office:

National Marine Fisheries Service
Northern California Office Supervisor
1655 Heindon Road
Arcata, California 95521

3.2. 5 years after completion of project construction, Reclamation shall evaluate riparian and wetland habitat in a post-project delineation report. This report shall be submitted by October 15, 2017, to the Northern California NMFS office:

National Marine Fisheries Service
Northern California Office Supervisor
1655 Heindon Road
Arcata, California 95521

13. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop additional information.

NMFS recommends that Reclamation establish a coho salmon monitoring program to assess the effectiveness of the habitat modifications resulting from the proposed action. Qualified fish biologists should be consulted to develop monitoring protocols for coho salmon and their use of the constructed habitat features in GVC. In order for NMFS to be kept informed of actions that

minimize or avoid adverse effects or benefit listed species or their habitats, we request notification of the implementation of any conservation recommendations.

14. REINITIATION OF CONSULTATION

This concludes the formal consultation on the proposed action outlined in the request. 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. If the amount or extent of incidental take described in the ITS is exceeded, formal consultation shall be reinitiated immediately.

15. REFERENCES

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16. FEDERAL REGISTER NOTICES

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17. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established new requirements for "Essential Fish Habitat" (EFH) descriptions in Federal fishery management plans and required Federal agencies to consult with NOAA's National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH. EFH for Pacific Coast salmon has been described in appendix A, Amendment 14 to the Pacific Coast Salmon Fishery Management Plan. The Trinity River Restoration Program (TRRP), on behalf of the U.S. Bureau of Reclamation (Reclamation), plans to carry out the Buckhorn Dam/Grass Valley Creek Toe Drain and Channel Rehabilitation Project. The project will affect Grass Valley Creek within Trinity County, California, which has been designated EFH for salmon.

Only species managed under a Federal fishery management plan are covered under the MSFCMA. Coho and Chinook salmon are managed under Federal fishery management plans, whereas steelhead are not. Therefore, these EFH Conservation Recommendations address only coho salmon and Chinook salmon and do not address steelhead.

17.1. LIFE HISTORY AND HABITAT REQUIREMENTS

Detailed information on the life history and habitat requirements for coho and Chinook salmon is available in the Status of the Species section of the accompanying biological opinion, as well as NMFS status reviews of west coast salmon from Washington, Oregon, and California (Good *et al*. 2005; Williams et al. 2011).

17.2. PROPOSED ACTION

The TRRP, on behalf of Reclamation, proposes to remove sediment from GVC, remove a section of bedrock, and improve coho salmon habitat. Implementation of the Buckhorn Dam/GVC project would occur in the late summer and fall of 2012, ending by no later than October 15, 2012. TRRP is proposing to excavate approximately 4,500 cubic yards (cy) of material from the outlet channel in order to lower the water surface elevation and dry out the toe drains. This would correct submergence problems on the toe drain system so that toe drain measurements can be made at any time during outlet works releases. An additional 4,500 cy of excavation would occur to remove the bedrock outcropping and beaver dam (currently a barrier to coho salmon migration) and enhance rearing habitat for juvenile coho salmon and steelhead. Clean spawning gravels would be added to the stream bed after excavation is complete. Tracked excavators would be the main type of equipment used for the dredging. Blasting with explosives would not occur. Dewatering of the project area would be essential during construction and would be implemented by diverting the normal base flow through a pump system.

The proposed Action is expected to increase quantity and quality of rearing habitat over the long term by giving coho salmon access to an additional 600 linear feet of GVC above the bedrock outcropping that currently serves as a barrier to migration, reducing the amount of decomposed granite, adding clean Trinity River origin spawning gravels, adding two coho salmon rearing ponds, adding large woody debris, adding two side channels, and increasing the meander frequency of GVC. Additional details of the proposed action can be found in the Proposed Action section of the accompanying biological opinion.

17.3. EFFECTS OF THE PROJECT ACTION

EFH will likely be adversely affected by implementation of the Proposed Action. As described and analyzed in the accompanying biological opinion, NMFS anticipates some short- term sediment and turbidity will occur up to about 1500 feet downstream of the project location. Increased turbidity could further degrade already degraded habitat conditions in this area affected by the proposed project. Flowing water will be temporarily diverted up to 800 feet around the project, resulting in short-term loss of habitat space and short-term reductions in macro-invertebrates (food for salmon). Chemical spills from construction equipment may occur, but NMFS believes the chance of spills is low based on the avoidance and minimization measures to be implemented when heavy construction equipment is used.

The duration and magnitude of direct effects to EFH associated with implementation of the proposed action will be significantly minimized due to the multiple minimization measures utilized during project implementation. The proposed action is small in both geographic and temporal extent, limiting the effects of the project on coho salmon and Chinook salmon. Implementation of the proposed action is expected to improve the function and value of EFH and short-term adverse effects will be offset by anticipated long-term benefits.

17.4. CONCLUSION

After reviewing the effects of the proposed action NMFS concludes that the action, as proposed, will adversely affect the EFH of coho or Chinook salmon within Grass Valley Creek in Trinity County.

17.5. EFH CONSERVATION RECOMMENDATIONS

Although there may be temporary adverse affects associated with the proposed action, the quality of EFH will be enhanced over the long term and thus NMFS provides no conservation recommendations.

17.6. LITERATURE CITED

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