UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

November 10, 2022 **Refer to NMFS No:** WCRO-2021-03219

Lawrence M. Riley, Regional Manager
Wildlife & Sport Fish Restoration Program
U. S. Fish and Wildlife Service, Pacific SW Region
2800 Cottage Way, Room W-2605
Sacramento, California 95825

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Grant Applications Operation Management of the Shasta Valley and Horseshoe Ranch Wildlife Areas (SVWA and HRWA) in Siskiyou County, California

Dear Mr. Riley:

Thank you for your letter on December 15, 2021, requesting consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for Grant Applications Operation Management of the Shasta Valley and Horseshoe Ranch Wildlife Areas (SVWA and HRWA) in the Shasta River Valley, California.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. As a result, the 2019 regulations are once again in effect, and we are applying the 2019 regulations here. For purposes of this consultation, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

This letter transmits NMFS' final biological opinion pertaining to the proposed action. This biological opinion is based on information provided and considered throughout the consultation, including the U.S. Fish and Wildlife's December 15, 2021 transmittal letter and ESA Evaluation for SONCC coho salmon and its critical habitat, including CDFW's proposed conservation measures, and as revised and clarified by subsequent letters; discussions between NMFS and CDFW staff; and other sources of the best scientific and commercial data available. In this biological opinion, NMFS concludes that the Grant Operations Management of the SVWA and HRWA are not likely to jeopardize the continued existence of SONCC coho salmon nor are they likely to adversely modify their critical habitat. However, NMFS anticipates take of this species will occur during program activities and an incidental take statement is included with the enclosed biological opinion.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)) for this action.

NMFS reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)), and concluded that the action would adversely affect the EFH of coho and Chinook salmon. Therefore, we have included the results of that review in Section 3 of this document. Please contact Jim Simondet at (707) 825-5171, or via email at Jim.Simondet@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

cc: Copy to e-file 151422WCR2021AR00255

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the USFWS - Grant Applications Operation Management - Shasta Valley & Horseshoe Ranch Wildlife Areas

NMFS Consultation Number: WCRO- 2021-03219

Action Agency: U.S. Fish and Wildlife Service

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Southern Oregon/Northern California Coast (SONCC) coho salmon (Oncorhynchus kisutch) ESU	Threatened	Yes	No	Yes	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: November 10, 2022

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1 Background

NOAA's National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at California Coastal NMFS office.

1.2 Consultation History

USFWS requested initiation of consultation on October 20, 2020. Between October 20, 2020, and September 21, 2021, a series of email correspondences and phone calls between NMFS, USFWS, CDFW staff occurred in which NMFS indicated the consultation package was incomplete and further work was needed to prepare a complete package sufficient to initiate for consultation.

On September 21, 2021, a teleconference meeting was held with USFWS, NMFS, and the California Department of Fish and Wildlife (CDFW), who receives grant funding from USFWS for the maintenance of the Shasta Valley Wildlife Area (SVWA) and Horseshoe Ranch Wildlife Area (HWRA), to discuss NMFS' initial evaluation that the Proposed Action was likely to have adverse effects and formal consultation would be required.

On December 15, 2021, USFWS initiated formal ESA and EFH consultation on the proposed action (Project) by submitting a letter including:

(1) CDFW's project statement describing their proposed grant-funded activities; and
(2) An ESA Evaluation for SONCC coho salmon, its critical habitat, and EFH, including CDFW's proposed conservation measures.

On January 14, 2022, a meeting was held with NMFS and USFWS to discuss NMFS's identification that there was insufficient information necessary to proceed with formal consultation.

On January 14, 2022, NMFS issued a Letter of Insufficiency to USFWS and CDFW documenting insufficient information, and identifying additional information necessary to proceed with formal consultation.

On February 1, 2022, NMFS received an email from Justin Cutler, USFWS, with attachments from CDFW regarding NMFS request for additional information- included were: photos, rough maps, non-continuous partial flow data, and a species inventory of holding ponds for the Wildlife Area.

On February 9, 2022, NMFS, USFWS and CDFW held a meeting to discuss the additional information provided to NMFS on February 1, 2022.

On March 23, 2022, a preliminary meeting was held with NMFS and CDFW to discuss the additional CDFW Fisheries Branch support for the Project, including conducting annual fish presence/absence surveys.

On March 23, 2022, a meeting with USFWS, CDFW and NOAA was held to discuss minimum flow requirements for the Little Shasta River and discuss the proposed action details for the SVWA.

On April 14, 2022, NMFS submitted a draft "Letter of SVWA Proposed Action Clarification" to CDFW, and received comments back on April 19, 2022.

On April 28, 2022, a meeting was held with USFWS, CDFW, and NMFS to discuss NMFS' draft letter "SVWA Proposed Action Clarification" and to discuss modifications to the proposed action.

On May 5, 2022, NMFS sent an email to CDFW which included the elements of the "Letter of SVWA Proposed Action Clarification," describing Proposed Water Supply Monitoring, a Proposed Flow Strategy including a table with flow requirements for a wet/dry water year, and Proposed Restoration. NMFS recommended these measures to avoid, minimize, and monitor adverse effects on listed SONCC coho salmon.

On May 25, 2022, Justin Cutler (USFWS) confirmed via email that CDFW agreed with all elements of the NMFS May 5, 2022 email and CDFW would incorporate these measures into the Project.

On July 26, 2022, Justin Cutler confirmed via email that the USFWS requests a 5-year consultation term.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. As a result, the 2019 regulations are once again in effect, and we

are applying the 2019 regulations here. For purposes of this consultation, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

1.3 Proposed Federal Action

Under the ESA, "Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02), whereas under the MSA, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

1.3.1 Description of the Proposed Action

USFWS proposes to authorize and fund the continued management of the SVWA and HRWA through the award of grant funding to the CDFW for a period of five years for the activities (referred to here as the Project) on those lands described in the Proposed Action.

ESA listed SONCC coho salmon and their ESA designated critical habitat do not occur where HRWA diversions take place or in areas affected by this and other HRWA activities. Therefore, the HRWA component of the Proposed Action will not be considered further.

Activities included in managing SVWA lands are meant to protect, preserve and enhance wetlands and provide habitat for wildlife. The CDFW's overall purpose for the 4,657-acre SVWA Project is to manage and maintain approximately 1,000 acres of wetland habitat, and 3500 acres of upland habitat for waterfowl, shorebirds, neotropical migrant songbirds, and upland game, and to protect other wild birds and mammals. The wildlife area also provides recreational opportunities for the public, such as hunting, fishing in its three reservoirs stocked with non-ESA listed species, and wildlife viewing and nature study. CDFW has provided photos and information detailing fish screening in place at the reservoirs to prevent any risk of stocked fish species escapement into the Little Shasta River. In addition, the reservoirs are situated far enough inland that in the event of an overflow of the reservoirs, fish would not be able to travel the significant distance over land to the river system. The operation and maintenance activities by CDFW staff at the SVWA are necessary to ensure the habitat conditions persist and that public use opportunities remain available.

Managing the SVWA involves diverting water from the Little Shasta River to fill three reservoirs: Bass Lake, Trout Lake, and Steamboat Reservoir (see Figures 1 and 2 below).

The CDFW's diversion for the SVWA is located at river mile (RM) 6 on the Little Shasta River. The diversion is an instream cone screen (Figure 3) with a bio engineered grade control structure. Water enters the SVWA through a 36- inch siphon. Based on the screen size and surface area, the structure has the capacity to divert up to 30 cubic feet per second (cfs) flows.

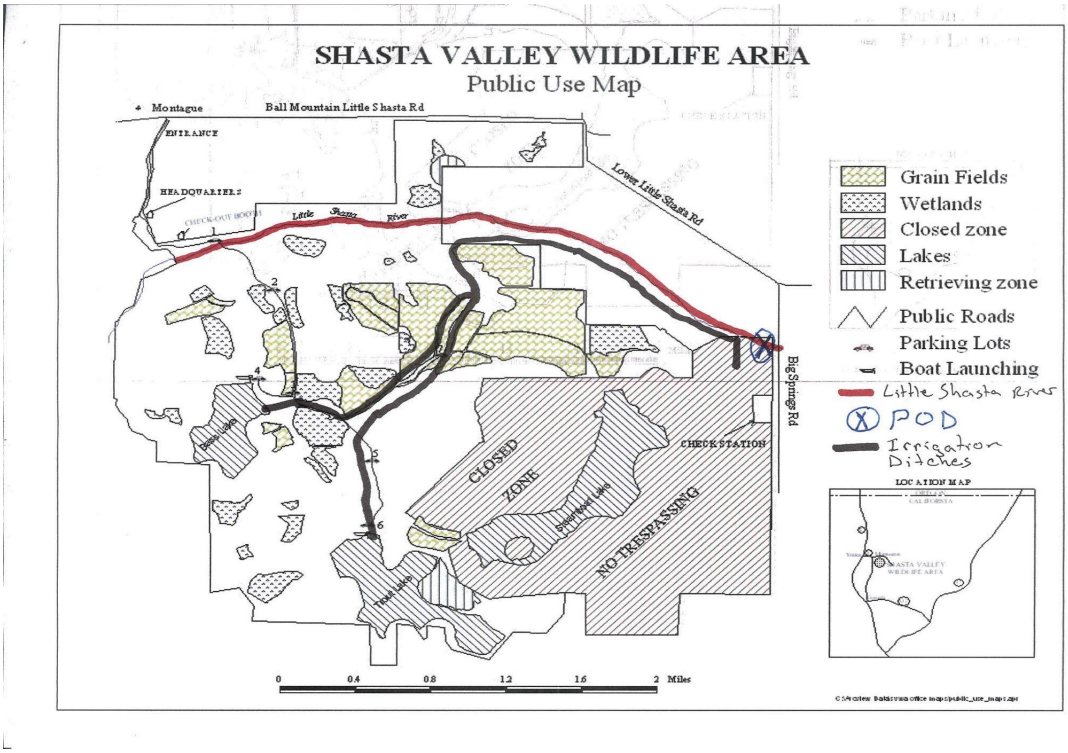

Figure 1. Location of the point of diversion (POD), diversion canals, and the reservoirs: Bass Lake, Trout Lake and Steamboat Lake, used for recreational fishing and irrigation.

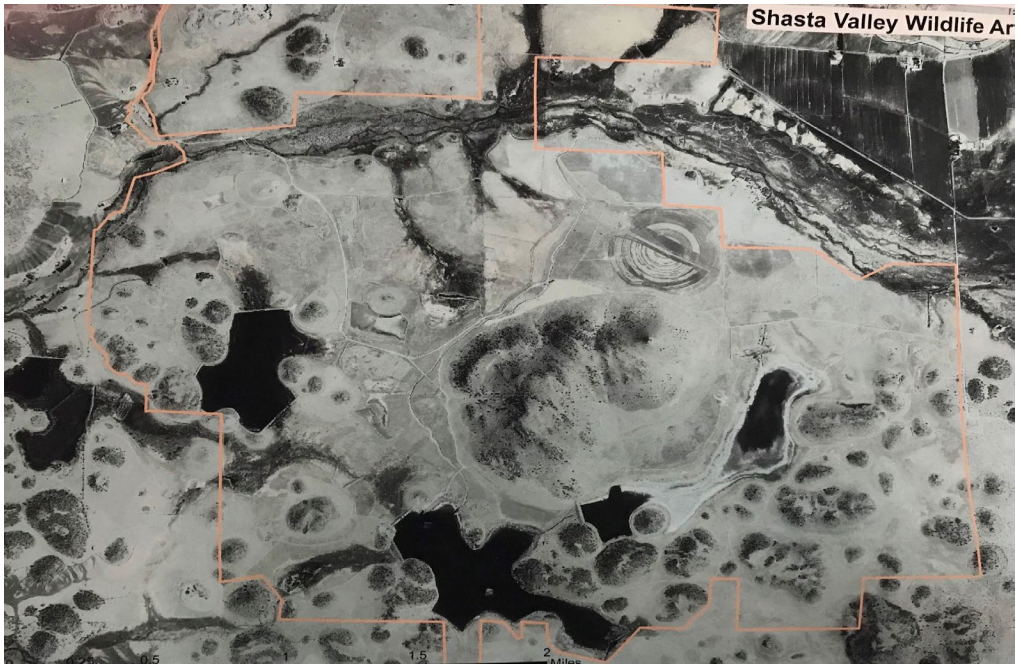

Figure 2. Aerial view of Bass Lake (far left), Trout Lake (middle) and a partially dry Steamboat Lake/Reservoir (right). The pink line denotes Wildlife Area boundary.

Water is utilized from the three storage reservoirs to flood and irrigate managed wetlands, for irrigated pasture upland and grain fields. In addition, Bass and Trout lakes provide recreational fishing for a variety of warm and cold-water species, including bluegill, largemouth bass, sunfish, rainbow trout, yellow perch, and Tui chub.

Water rights allow for diversion up to 35 cfs from the Little Shasta River to fill the reservoirs, (starting with Bass Lake, then Trout Lake, then Steamboat Reservoir). However, due to fish screening and ditch limitations, only 30 cfs can be diverted at any time. The diversion period for water storage starts on November 1st and ends May 1st).

Figure 3. Shasta Valley Wildlife Area Diversion with cone screen over intake pipe (CDFW 2016).

Proposed Flow Strategy:

During the diversion season, CDFW will maintain bypass flows downstream in the Little Shasta River consistent with Table 1. To support the bypass flow schedule, CDFW in coordination with NMFS will develop a water year type classification by December 1, 2022 (see section 2.4.1.2.1. Water Quantity**:** Hydrologic Year Type*)*, and implement bypass flows consistent with Table1 based on water year type.

CDFW will divert a maximum of 30 cfs during the diversion season, and, in wet years, allow for a flushing pulse flow to bypass the diversion site with the first high flow event in the river over 50cfs (see Table 1 below). When diverting, CDFW will maintain a minimum of 10 cfs bypass flow in the Little Shasta River to provide adequate fish passage. At no time will the CDFW divert more than 50 percent of the Little Shasta River surface flow (Table 1). While peak

diversions typically occur during higher flows in January and February, small volumes of water may be diverted in November, December, March, and April, which are typically lower flow months.

Table 1: Proposed Action diversion rates and flow criteria.

Little Shasta River Supply Bypass Flow and SVWA Diversion Criteria			
	Dry Water Year*	**Average Water Year***	**Wet Water Year***
Minimum Bypass Flows at POD staff gage, based on rating curve and downstream gage	10 CFS	10 CFS	10 CFS
When staff gage and POD gage indicate water supply is 10-20 CFS	CDFW can divert up to 10 CFS if staff gage verifies a minimum bypass of 10 CFS is met.	CDFW can divert up to 10 CFS if Staff gage verifies a minimum bypass of 10 CFS is met.	CDFW can divert up to 10 CFS if staff gage verifies minimum bypass of 10 CFS is met.
When staff gage and POD gage indicate water supply is greater than 20 CFS	CDFW will bypass 50% of water supply when river flows are greater than 20 cfs (water supply = 50 cfs, bypass flows = 25 cfs)	CDFW will bypass 50% of water supply when river flows are greater than 20 cfs (water supply = 50 cfs, bypass flows = 25 cfs)	CDFW will bypass 50% of water supply when river flows are greater than 20 cfs (water supply = 50 cfs, bypass flows = 25 cfs)
Environmental Pulse Flow Supplementation			Bypass first pulse flow of season any time after November 1 (flows over 50 cfs for 48 hours).

*Based on a percentage of average for snow-water exceedance (SWE) evaluations for the Little Shasta River from the 1946 water year to 2019, Average snowpack measured on April 1st at RM 11.5 for a 50-year period of record is 16.6 inches (Lukk et al. 2019).

Water Supply Monitoring:

Timing and quantity of diversions are to be closely monitored to minimize impacts to SONCC coho salmon. CDFW will conduct continuous and accurate flow monitoring during the diversion season (November 1 - May 1) at the locations identified in Figures 5 and 6 and as follows:

1. The diversion shall be measured and recorded using the existing Sontek Pipe IQ (Doppler) placed at the POD (in pipe, as close to fish screen as possible). As an alternative to the Sontek (i.e., in the event of an equipment failure), a weir box, plate and pressure transducer may be used for accurate and reliable diversion measurements on an hourly basis

2. To monitor and verify bypass compliance, a staff gage has been installed approximately three miles downstream of the POD, at a location that is well suited for rating, and a rating curve will be further developed. In the interim, CDFW will collect staff readings of the Little Shasta River daily and record bypass flows (Figure 5). To establish a more continuous flow record, this monitoring location can be correlated with the real-time monitoring station installed by the State Water Board for managing the 2021/2022 emergency drought curtailment orders, while it is in use by the State Water board and once it is rated.

3. To establish a more continuous flow record closer to the POD, CDFW will install a pressure transducer to replace the existing manual staff measurements that will collect river stage on an hourly basis within 0.5 miles of the POD. The State Water Board (SWB) gage may only be in use during the California Water Board emergency drought curtailment period (see Section 2.6.2 Curtailments), therefore a permanent gage near the POD is needed and will be installed within the next five years (Figure 4). To create an accurate rating curve, the stage and discharge relationship will be performed at least 5 times a season during varied flow regimes.

4. DFW will also continually monitor the gage information at the nearest metered station upstream (Little Shasta River near Montague (LSR) gage).

Figure 4. Locations of all current and proposed flow monitoring locations on the Little Shasta River.


Figure 5. CDFW and SWB current point of measurement for manual staff flow readings on the Little Shasta River, downstream of POD.

Anticipated Restoration:

CDFW, with support from their Fisheries Branch and NMFS, will evaluate restoration opportunities on the Little Shasta River within property boundaries, and develop a strategy to improve instream habitat for coho salmon. Within one year, CDFW will report to NMFS on progress associated with the restoration strategy. CDFW and NMFS commit to pursuing funds and having a restoration plan in place by year five and after conducting an environmental impact analysis and Section 7 consultations implementing all restoration actions by year ten. Because restoration actions are not certain to occur in the next five years, NMFS is unable to analyze any effects to critical habitat or SONCC coho salmon these actions may have in this biological opinion.

1.3.2 Shasta Valley Wildlife Area Water Diversion in Context of Shasta River Water Management

Although CDFW proposes a water management strategy for the SVWA, a number of factors in the Basin may influence how and when the strategy is implemented. The SVWA's main diversion period is in the winter months, which is not managed by the Scott and Shasta Water Master District (unless under emergency drought regulations) until the irrigation season starts in the early spring (March/April). The water master is obligated to manage and regulate the Shasta Decree, ensuring diverter's water rights are being fulfilled by regulating diversion based on priority date. They generally do not manage bypass flows, only if the bypass is related to fulfilling other diversion needs. However, in winter 2021/2022, the Water Master did curtail diversion to the SVWA in order to meet the emergency drought regulation flows (See Section 2.6.2) established by the SWB for the Shasta River Canyon.

On the Little Shasta River there are other upstream water rights that influence availability of water at the SVWA, increased diversion in the winter months at these diversions, as well as decreased precipitation, which have limited the availability of water to fulfill the SVWA storage rights. Safe Harbor Agreements, (SHA's), which issue federal Enhancement of Survival permits to non-federal landowners for the purpose of promoting the conservation and recovery of SONCC coho salmon and habitat, are currently being implemented. Those executed agreements, along with state wide curtailments during drought, may change the amount of water available in the future, making the water management strategy proposed at the SVWA important to manage conserved water to improve habitat and conditions in the Little Shasta River and beyond to the Shasta River canyon.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an

opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion, we use the terms "effects" and "consequences" interchangeably.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. Species found in the action area include *Oncorhynchus mykiss* (steelhead), Upper Klamath - Trinity River Chinook Salmon, and Southern Oregon/Northern California Coast (SONCC) coho salmon, which are described further in the Environmental Baseline. Only SONCC coho salmon and their critical habitat are federally listed (species) or designated (critical habitat) and will be considered in this biological opinion.

The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various

watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species.

2.2.1 SONCC Coho Salmon Species Description and General Life History

The SONCC ESU of coho salmon was first listed as threatened on May 6, 1997 (62 FR 24588) and critical habitat designated May 5, 1999 (64 FR 24049). The SONCC coho ESU includes coho salmon from the following artificial propagation programs: The Cole Rivers Hatchery Program; TRH Program; and the IGH Program (50 CFR 223.102(e)). SONCC coho salmon have a generally simple three-year life history. The adults typically migrate from the ocean and into bays and estuaries towards their freshwater spawning grounds in late summer and fall, and spawn by mid-winter. Adults die after spawning. The eggs are buried in nests, called redds, in the rivers and streams where the adults spawn. The eggs incubate in the gravel until fish hatch and emerge from the gravel the following spring as fry. Fish typically rear in freshwater for about 15 months before migrating to the ocean. The juveniles go through a physiological change during the transition from fresh to salt water called smoltification. Coho salmon typically rear in the ocean for two growing seasons, returning to their natal streams as three-year old fish to renew the cycle.

2.2.2 Status of SONCC Coho Salmon and their Critical Habitat

As described in more detail in the Analytical Approach section above, NMFS assesses four population viability parameters to help us understand the status of each species and their ability to survive and recover. These population viability parameters are: abundance, population productivity, spatial structure, and diversity. While there is insufficient information to evaluate these population viability parameters in a thorough quantitative sense, NMFS has used existing information, including the Recovery Plan for SONCC Coho Salmon (NMFS 2014) and the most recent status review for SONCC coho salmon (Williams et al. 2016a) to determine the general condition of each population and factors responsible for the current status of the ESU. We use these population viability parameters as surrogates for reproduction, numbers, and distribution; the criteria found within the regulatory definition of "jeopardize the continued existence of" (50 CFR 402.02). This Opinion also examines the condition of critical habitat throughout the designated area.

2.2.2.1 Status of SONCC Coho Salmon

Although long-term data on SONCC coho salmon abundance are scarce, the available evidence from short-term research and monitoring efforts indicate that spawner abundance has declined since the previous status review for populations in this ESU (Williams et al. 2016a). In fact, most of the 30 independent populations in the ESU are at high risk of extinction because they are below or likely below their depensation threshold, which can be thought of as the minimum number of adults needed for survival of a population.

The distribution of SONCC coho salmon within the ESU is reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which SONCC coho salmon are now absent (NMFS 2001; Good et al. 2005; Williams et al. 2011; Williams et al.

2016a). Extant populations can still be found in all major river basins within the ESU (70 FR 37160 (June 28, 2005)). However, extirpations, loss of brood years, and sharp declines in abundance (in some cases to zero) of SONCC coho salmon in several streams throughout the ESU indicate that the SONCC coho salmon's spatial structure is more fragmented at the population-level than at the ESU scale. The genetic and life history diversity of populations of SONCC coho salmon is likely very low and is inadequate to contribute to a viable ESU, given the significant reductions in abundance and distribution.

2.2.2.2 Status of SONCC Coho Critical Habitat

Critical habitat for SONCC coho salmon is designated to include all river reaches accessible to listed coho salmon between Cape Blanco, Oregon, and Punta Gorda, California. In the critical habitat designation, NMFS identified five essential habitat types (PBFs) for SONCC coho salmon: (1) spawning areas; (2) adult migration corridors; (3) juvenile summer and winter rearing areas; (4) juvenile migration corridors; and (5) areas for growth and development to adulthood. In addition, designated freshwater critical habitat includes riparian areas that provide the following functions: shade, sediment, nutrient or chemical regulation, stream bank stability, and input of large woody debris or organic matter (64 FR 24049, May 5, 1999).

Spawning and rearing are often located in small headwater streams and side channels. Adult and juvenile migration corridors include these tributaries as well as mainstem reaches and estuarine zones. Growth and development to adulthood occurs primarily in near-and off-shore marine waters, although final maturation takes place in freshwater tributaries when the adults return to spawn (64 FR 24049, May 5, 1999).

The condition of SONCC coho salmon critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. Impacts of concern include altered stream bank and channel morphology, elevated water temperature, lost spawning and rearing habitat, habitat fragmentation, impaired gravel and wood recruitment from upstream sources, degraded water quality, lost riparian vegetation, and increased erosion into streams from upland areas (Weitkamp et al. 1995; 70 FR 37160 (June 28, 2005); 64 FR 24049 (May 5, 1999)). Diversion and storage of river and stream flow has dramatically altered the natural hydrologic cycle in many of the streams within the ESU. Altered flow regimes can delay or preclude migration, dewater aquatic habitat, and strand fish in disconnected pools, while unscreened diversions can entrain juvenile fish.

2.2.3 Factors Related to the Decline of Species and Degradation of Critical Habitat

The factors that caused declines include hatchery practices, ocean conditions, habitat loss due to dam building, degradation of freshwater habitats due to a variety of agricultural and forestry practices, water diversions, urbanization, over-fishing, mining, climate change, and severe flood events exacerbated by land use practices (Good et al. 2005; Williams et al. 2016b). Sedimentation and loss of spawning gravels associated with poor forestry practices and road building are particularly chronic problems that can reduce the productivity of salmonid populations. Late 1980s and early 1990s droughts and unfavorable ocean conditions were identified as further likely causes of decreased abundance of SONCC coho salmon (Good et al.

2005). From 2014 through 2016, the drought in California reduced stream flows and increased temperatures, further exacerbating stress and disease. Drought conditions returned to the Klamath Basin in 2020 (Reclamation 2020), leading to reduced river flows. Stream flow is a critical component of coho migration, and reduced flows can cause increases in water temperature, resulting in increased heat stress to fish and thermal barriers to migration.

An additional factor likely to affect SONCC coho salmon and their designated critical habitat is climate change. Of all the Pacific salmon species, coho salmon are likely one of the most sensitive to climate change due to their extended freshwater rearing. Additionally, the SONCC coho salmon ESU is near the southern end of the species' distribution and many populations reside in degraded streams that have water temperatures near the upper limits of thermal tolerance for coho salmon. For these reasons, climate change poses a threat to the viability of the SONCC coho salmon ESU. The best available information suggests that the earth's climate is warming, and that this could significantly impact ocean and freshwater habitat conditions, and thus the survival of species subject to this consultation.

Modeling of climate change impacts in California suggests that average summer air temperatures are expected to continue to increase (Lindley et al. 2007). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe et al. 2004; Kadir et al. 2013). Total precipitation in California may decline; critically dry years may increase (Lindley et al. 2007). Wildfires are expected to increase in frequency and magnitude (Westerling et al. 2011). For Northern California, most models project heavier and warmer precipitation. Extreme wet and dry periods are projected, increasing the risk of both flooding and droughts (DWR 2013).

Recent evidence suggests that climate and weather is expected to become more extreme, with an increased frequency of drought and flooding (IPCC 2019). For example, in the Klamath River, Bartholow (2005) observed a 0.5°C per decade increase in water temperature since the early 1960's, and model simulations predict a further increase of 1-2°C over the next 50 years (Perry et al. 2011). In the coming years, climate change will influence the ability to recover some salmon species in most or all of their watersheds. Coho salmon and steelhead are particularly vulnerable to climate change due to their need for year-round cool water temperatures (Moyle 2002).

2.3 Action Area

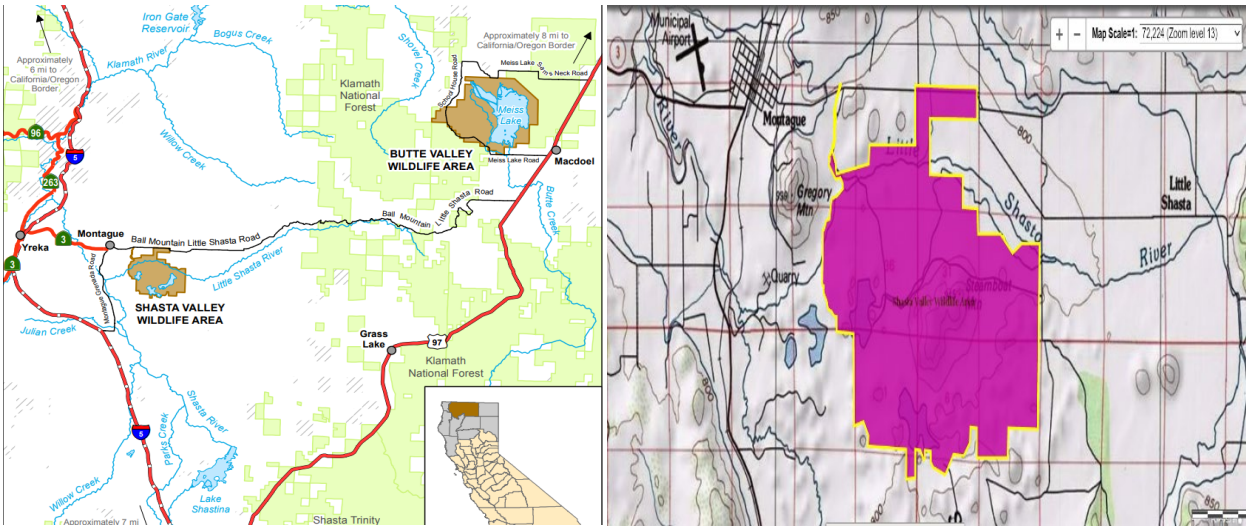

Figure 6. Maps representing the location of SVWA in Northern California (left), and the property boundaries of the wildlife area (right).

An action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" [50 CFR § 402.02]. The action area for the Proposed Action (Project) consists of the SVWA, as well as the Little Shasta River downstream of the SVWA diversion and the Shasta River downstream of the Little Shasta River to its confluence with the Klamath River (Figure 6). The SVWA is located approximately 1.5 miles east of Montague, in Siskiyou County, California.

2.4 Environmental Baseline

The “environmental baseline” refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency’s discretion to modify are part of the environmental baseline (50 CFR 402.02).

2.4.1. SONCC Coho Salmon

SONCC coho are the only federally listed species in the action area. While the *Status of SONCC coho* section (2.2.2.1) discussed the viability of the SONCC coho salmon ESU as a whole, this

section will focus on the condition of SONCC coho salmon and their critical habitat in the action area, and factors affecting their condition within the action area. Note that SONCC coho and their critical habitat are not found in the reservoirs or other portions of the SVWA that exist outside of the Little Shasta River. Therefore, these areas are not described below.

For SONCC coho salmon, we describe a portion of the Little Shasta River that extends downstream from the point of diversion to where it flows into the Shasta River, and from that intersection, downstream to where the Shasta River meets the Klamath River. The Little Shasta River is a tributary of the Shasta River, providing primary drivers for the elements of a Viable Salmonid Population (VSP) for Shasta Valley coho populations. Both are key habitats for recovery of the ESU, and are important to understand in the context of the proposed action. Therefore, both are described below.

2.4.1.1 Condition of the Species in the Action Area

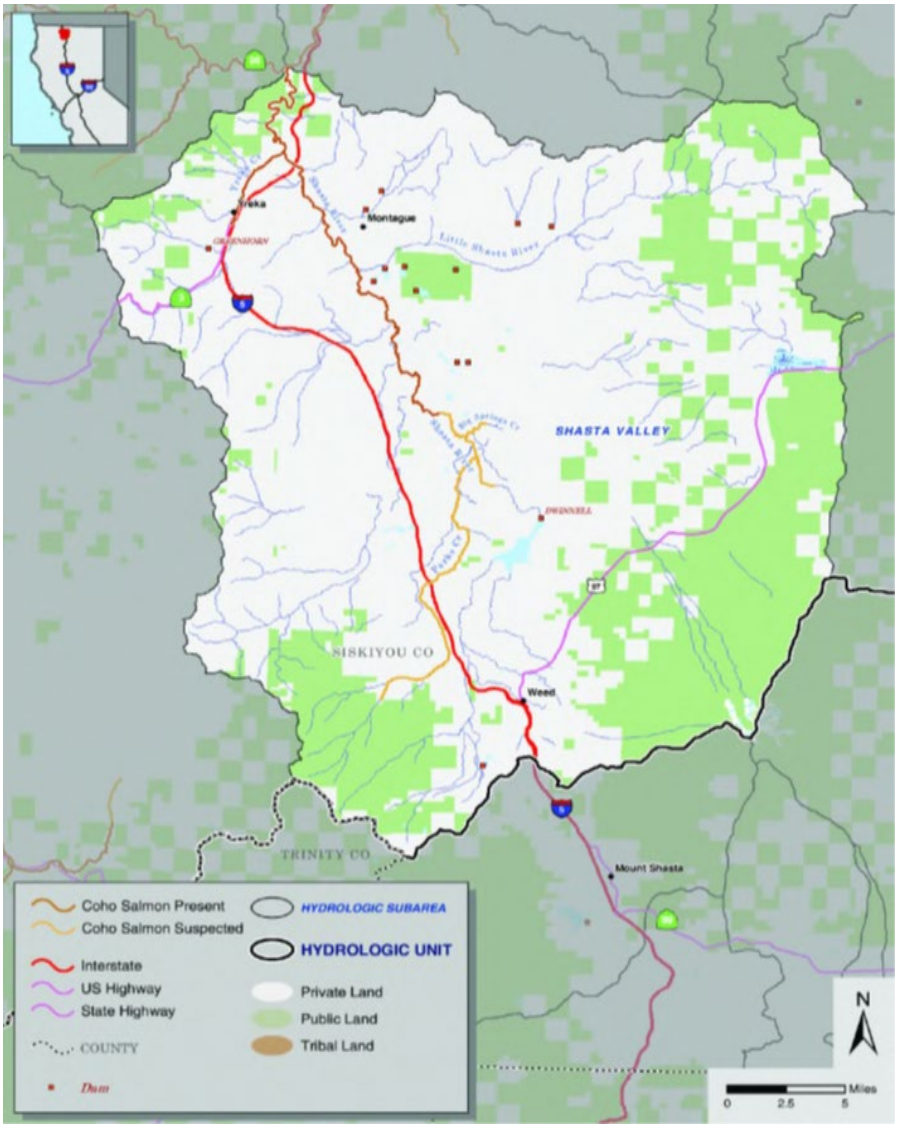

Figure 7. Shasta Valley Hydrologic Area

2.4.1.1.1 Shasta River Basin

Abundance and Distribution

The diversity and complexity of physical and environmental conditions found within the Shasta River basin, which includes the action area, created unique life history strategies and diverse coho salmon habitat. The Shasta River flows through the Shasta Valley before entering the Shasta River Valley and eventually meeting the Klamath River. Historical instream river conditions, fostered by unique cold spring complexes, created abundant summer rearing and off channel overwintering habitat that were favorable for production of coho salmon in the Shasta River basin. The current distribution of coho salmon spawners (Figure 7) is concentrated in the mainstem Shasta River from river mile 32 to about river mile 36, Big Springs Creek, lower Parks Creek (all outside the action area), and in the Shasta River Canyon (river mile 0 to 7). Juvenile rearing is also occurring in these same areas, and occasionally in lower Yreka Creek (Garwood 2012) and the upper Little Shasta River (Whelan 2006). The Little Shasta River enters the Shasta River from the east at river mile 16.3, and the section downstream of the SVWA is included in the action area, as is the Shasta River downstream of this confluence to the Klamath River, which includes the Shasta River Canyon. CDFW has conducted adult spawning surveys and fish counts at weirs since 1934. Weir counts indicate that the minimum number of adult spawning coho salmon in the Shasta River have varied between 0 to 400 for most years, with a high of approximately 900 returning adults in 1978 (CDFW 2013b). These data may not account for the entire adult coho salmon brood year numbers, as weirs were sometimes removed due to high flows before all coho salmon spawners had entered the Shasta River. However, these brood year population estimates are low and have not trended upward over time. Due to habitat degradation in the basin from diversions and hatchery influence, the Shasta River population is currently persisting at a high-risk level.

The current SONCC coho salmon distribution is both a small fragment of the current Shasta River stream network and of the modeled Intrinsic Potential in the basin (Williams et al. 2006, 2008). Coho salmon runs in the Shasta Valley Hydrologic Area (HA) averaged little more than 1,000 fish annually in the late 1950s (CDFG 1959). In the early 1960s, the runs were estimated to average 600 fish (CDFG 1979). Current counts are lower than these earlier estimates, with the number of adult salmon from 2014- 2020 being 50 or less fish annually (Giudice and Knechtle 2021). The abundance level is well below a viable population, which is estimated to be 4,700 fish (NMFS 2014).

Loss of habitat in the Shasta Valley HA due to diversions is a major factor contributing to this decline, which has seen a 95% decrease in population since the 1950's. With current numbers of returning spawners at an all-time low, the impacts of habitat loss can be seen in terms of magnifying effects on a dwindling number of coho salmon in this region. With only 50 returning fish (2020 estimates), any dewatering of tributaries, increased stream temperatures, or inhibition to fish passage could magnify effects to an entire year-class of Shasta River Population of coho salmon.

Hatcheries

Straying of hatchery fish is another important stressor on the SONCC coho salmon ESU, including in the Shasta River. The average annual percentage of hatchery coho salmon in the Shasta River from 2001 to 2010 was 23 percent, with a high of 73 percent in 2008 (CDFW 2013b; Ackerman et al. 2006). However, starting in 2010, all returning adult coho salmon to Iron Gate Hatchery that were not used as broodstock were returned back to the Klamath River where they would have the opportunity to spawn naturally in the upper Klamath River or nearby tributary streams. This management recommendation was included in the Hatchery and Genetics Management Plan (HGMP) for the coho salmon program at Iron Gate Hatchery (IGH) to reduce the immediate threat of demographic extinction for coho salmon populations in the Upper Klamath River and Shasta River (CDFW &, PacifiCorp 2014).

The program includes conservation measures, genetic analysis, and rearing and release techniques that will improve fitness and reduce straying of hatchery fish to natural spawning areas. As a result of this change in management the number of hatchery strays into the Shasta River has increased since 2010 to comprise an average of 71% of the total adult return. The number of natural origin adults returning between 2010 and 2014 has ranged between 8 and 62 fish, well below depensation. Therefore, the Shasta River natural origin coho salmon population is at high risk of extinction given the unstable and low population size and presumed negative population growth rate. NMFS has estimated that, in order to contribute to stratum and ESU viability, the Shasta River core population should have at least 4,700 spawners.

2.4.1.1.2 Little Shasta River

A portion of the action area for this consultation is found within the Little Shasta River as described above in section 2.3. The Little Shasta River is 27.5 miles long, stretching from the headwaters that emerge from springs which are located in two discrete mountain meadows situated in the upper elevations of Ball Mountain, to its confluence with the Shasta River. The SVWA property includes approximately 2.5 miles of the Little Shasta River and the SVWA diversion site for the Area is located at river mile (RM) 6.

In the foothills reach upstream of the action area, between RM 17.4 and RM 11.8, riparian conditions are excellent with a dense and diverse riparian canopy, mature trees, and stable banks. The gradient in this reach is low to medium and there are numerous riffles and pools. During a field survey conducted on June 15, 2015, trout were observed in the Little Shasta River from a view point on Ball Mountain Road. The aquatic habitat condition in this reach appears to be very good.

Currently, streamflows are inadequate to encourage salmonid upstream migration into the Little Shasta River foothills reach (above the Musgrave/Hart Diversions), particularly early in the fall for Chinook salmon. Spawning habitat may be abundant in the foothills reach and above, but has not been investigated. Spring and summer rearing habitat are also not confirmed but are presumed suitable to at least moderate rearing densities and growth rates. Downstream migration in the spring months may be hampered by flow diversions. The original Hart-Haight diversion, upstream of the action area (at approx. RM 18) marks a transition in the Little Shasta River from the foothills reach to the bottomlands (Figure 10). Below this diversion, seasonally occurring

low-flow conditions disconnected the bottomlands from the foothills. In addition to the zero-flow conditions observed in this reach (which includes the action area) during the summers, macroinvertebrate and fish data indicated degraded ecological function (Lukk et al. 2019). During the irrigation season, the bottomlands reach has unsuitably high summer water temperatures or is dewatered.

Below ~ RM 11, riparian conditions tend to be unprotected and poor (Figures 8, 9). The bottomlands reach of the Little Shasta River is flow impaired by surface water diversion and groundwater pumping, and spring water from the Table Rock Springs Complex is diverted for agricultural use. During the summer months there is often no flow observed in the channel in the lower reaches of the river.

The Little Shasta River deposits most of its coarse sediment load within the valley, prior to reaching the mainstem Shasta River. Reaches containing suitable spawning gravels occur primarily upstream of RM 10, which is upstream of the SVWA and outside the action area. (CDFW 2016). The lower eight miles of the Little Shasta River, including the SVWA action area, traverse a low gradient valley, which likely has gaining stream flows (McBain and Trush 2013). The water table in the valley reach intersects the land surface in various locations, creating ponds and wet meadows in the depressions (Mack 1960).

Figure 8. Little Shasta River bottomlands reach.

Figure 9. Little Shasta River on the Shasta Valley Wildlife Area

In the SVWA portion of the action area, the lower 5.9 miles of the Little Shasta River is a low gradient, highly sinuous, valley bottomlands reach with sediment dominated by sand and small gravel and occasional coarse riffles. These bottomlands reach contains areas of u-shaped stream channel downstream of the SVWA. Water depths and velocities are lower due to the low gradient. Gravel bars are not visible in aerial photographs, indicating a lack of storage of spawning gravel sized sediment (CDFW 2016).

Abundance and Distribution

Numerous fish surveys have been conducted on the Little Shasta River over the years, including fyke trapping, snorkel surveys, red counts, and carcass surveys. Despite this, no presence of adult coho have been documented in the Little Shasta River from these surveys. However, adult Chinook have been documented (infrequently) suggesting that the river could also be utilized by coho salmon, which share many of the same habitat requirements.

SVWA staff conducted fyke trap surveys in the action area from 2001- 2009 near the mouth of the Little Shasta River (RM 0.5). Despite multiple surveys over those years, CDFW has not seen coho salmon in the lower Little Shasta River (CDFW 2016). Redd surveys have been conducted when river conditions allowed from 2001 to present, and no adult salmon (i.e., coho or Chinook), or salmon redds (i.e., coho or Chinook) were observed.

Adult spawning and carcass surveys were conducted on the Little Shasta River during December and January of 2017 and again during October, November, December and January 2018. Spawning and carcass surveys were conducted at two primary reaches on the Hart property (upstream of the action area) (Figure 10) and no salmon redds, live salmon, or carcasses were observed during the period of study. During snorkel surveys, numerous fishes were observed on the upper Hart property. Most abundant was *O. mykiss*, followed by speckled dace (Lukk et al. 2019). No coho salmon (*Oncorhynchus kisutch*) or Chinook salmon (*Oncorhynchus tshawytscha*) were observed during the survey period.

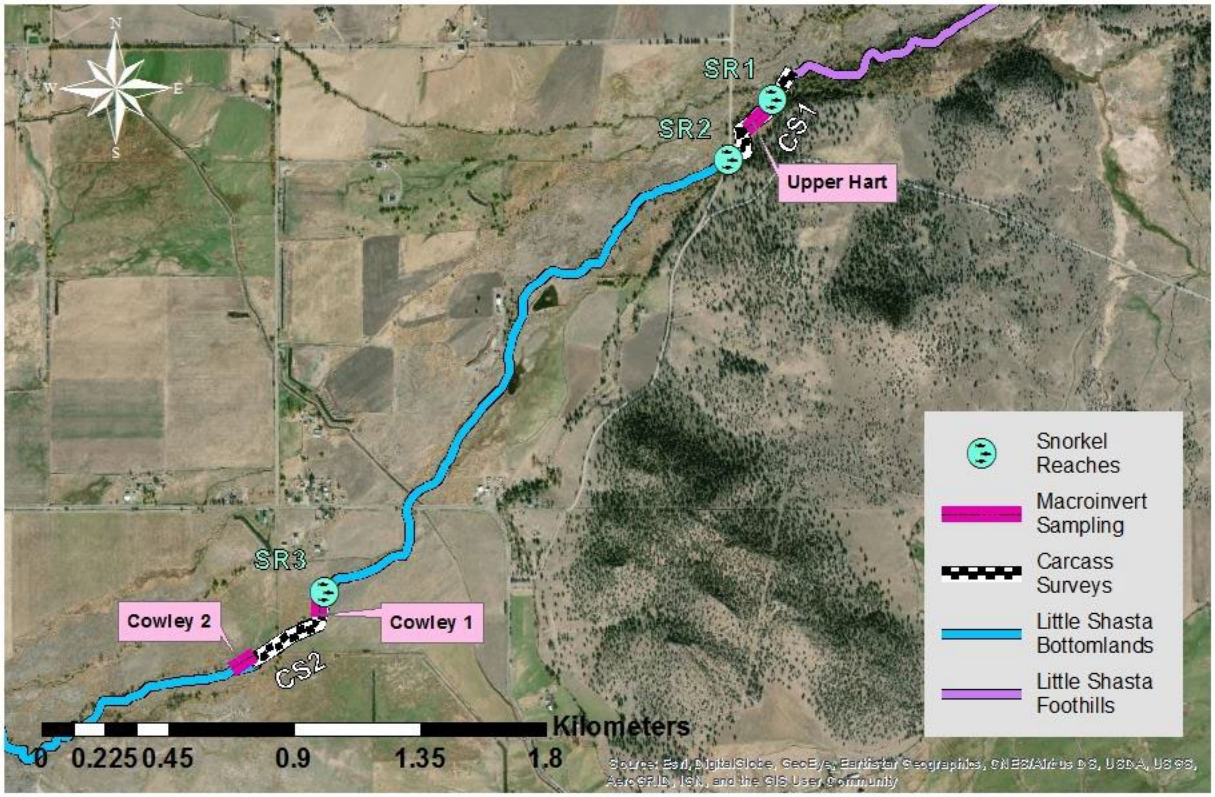

Figure 10. Map showing the location of the Hart property, location of carcass and snorkel surveys, and habitat designations of bottomlands and foothills reach of the Little Shasta River. The action area is located downstream of these river sections.

CDFW documented adult Chinook salmon in the Little Shasta River in 2000 (CDFW 2016) when upstream irrigators stopped irrigating in early October. This coincided with a large run of Chinook salmon in the Shasta River. When the cold spring water was released into the Little Shasta River, favorable conditions were created for salmonid passage into the valley reach. LSR gage records showed an average of 5 cfs in October, peaking at 13 cfs in November, and Chinook spawning was documented up to RM 10 where the fish encountered a passage barrier at Hart's diversion. Thirteen redds were recorded during that run. Within the Little Shasta River, there has been a single, known instance in which coho salmon have been observed since the SVWA opened in 1991. On June 23, 2006, (3) juvenile coho salmon were captured upstream of the SVWA and subsequently released into the Shasta River.

There is not much quantitative data about how the watershed was historically utilized by salmonids and specifically, coho salmon. Currently, the lack of flow during the summer months precludes juvenile coho summer rearing below RM 10. Fall-run Chinook salmon and *O. mykiss* have been documented in the river when early rains occurred and/or irrigators shut off their diversions creating conditions that allowed for upstream migration (CDFW 2016).

2.4.1.2 Condition of Critical Habitat in the Action Area

In the critical habitat designation, NMFS identified five PBFs for SONCC coho salmon: (1) spawning areas; (2) adult migration corridors; (3) juvenile summer and winter rearing areas; (4) juvenile migration corridors; and (5) areas for growth and development to adulthood. Within the action area, we examine the conditions that make up each PBF including adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions.

2.4.1.2.1 Water Quantity

Hydrologic Year Type

In order to develop a water year type classification by December 1st of each year to help determine whether a flushing flow will occur (Table 1), the use of Snow-Water Exceedance (SWE) evaluations for the Little Shasta River starting in 1946 (Lukk et al. 2019) give us a predictive estimate of water -year classifications. Streamflow magnitudes at the LSR gage appear largely reliant on available snowpack in the Little Shasta River headwaters (LSH). Snow depth and snow-water equivalent data from the Little Shasta River Snow Course (Figure 11) can help identify basic hydrologic year types, i.e., "wet", "normal", "dry" year-typing methodology (Nichols et al. 2016). The average snowpack recorded at (LSH) at RM 11.5 (last 50-year span) was 16.6 inches. The 2017 and 2018 water years were classified as "normal" based on snow-water content exceedance evaluations, while the 2019 and 2016 water years were classified as "wet" (Figure 11). The 2017 water year had an April 1 average snowpack depth of 15.5 inches, placing it at 93% of the average for this site. The following 2018 water year had an April 1 average snowpack depth of 13.0 inches (78% of the average). In contrast, the 2016 water year had 23.5 inches of snowpack (142% of the average), and the 2019 water year had an April 1 average snowpack of 22.0 inches (133% of the average).

These "normal" and "wet" water years were preceded by a "dry" 2015. This water year was the last in a 5-year drought observed throughout the state, and marked the first recorded zero-snow condition on April 1 (0% of the average) in the basin.

Flushing Flows

While it is impossible to precisely predict future hydrological conditions, based on previous hydrological records (Figure 11) and accounting for climactic variation in a five year period, NMFS conservatively estimates a flushing flow to be implemented from 0-1 times in the next 5 years, possibly as late as December.

Examining the last 5 years of flow data for November (the optimal month for flushing flows to occur) at the LSR gage, which is upstream of the SVWA, flows never reached the 50 cfs bypass rate needed for a flushing flow. However, recent gage readings (2017- 2021) for December have seen higher flow rates than November and may be a more reliable month for a flushing flow to occur in the near future.

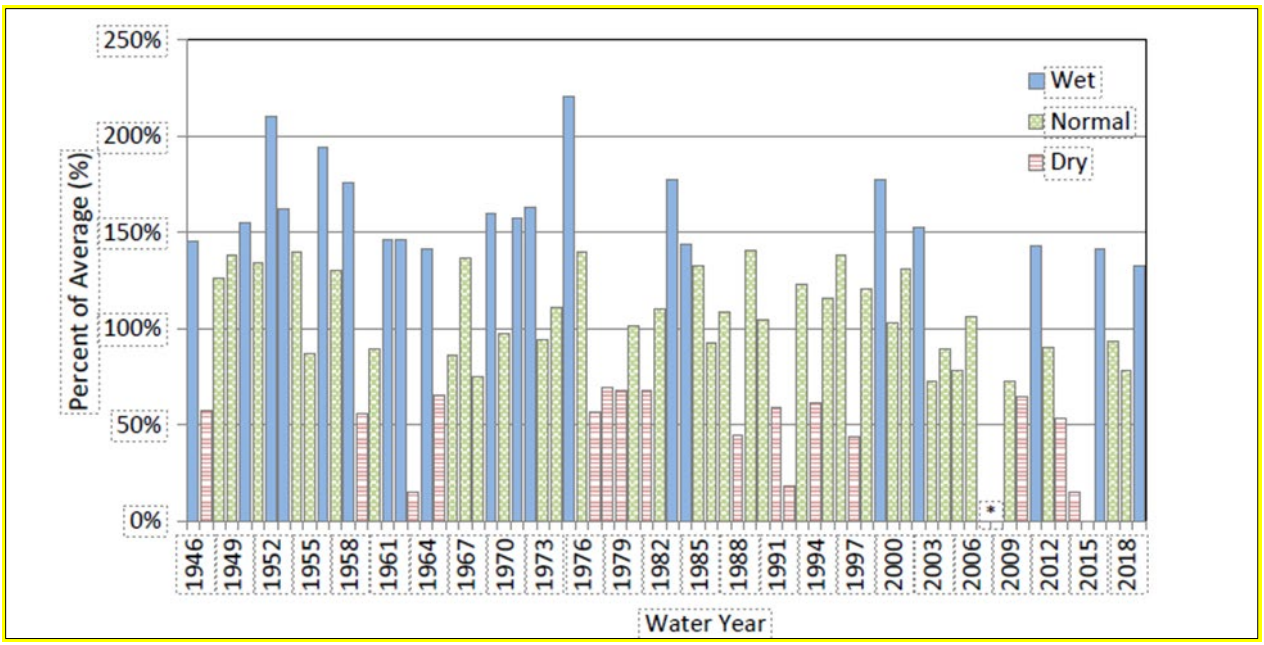

Figure 11. Snow-water exceedance (SWE) evaluations for the Little Shasta River from the 1946 water year to most recent (2019), given in percent of the average (16.6 in). Data obtained from the CDEC station "LSH". (*Note: no data was recorded for the 2007 and 2008 water years.)

2.4.1.2.2 Shasta River Basin

The Shasta River in the action area, downstream of the confluence with the Little Shasta River, has not been well-studied in relation to SONCC coho habitat. The Shasta Valley, including the action area, is part of the Klamath River Hydrological Unit (HU) that has been studied by CDFW as part of a recovery plan for coho salmon (CDFW 2004) and consists of one HSA, the Shasta Valley HSA (Figure 7), which covers approximately 794.8 square miles. The conditions found in this HSA are also indicative of those found in the downstream portion of the Shasta River which includes a part of the action area.

The Shasta River originates in the higher elevations of the Eddy Mountains, southwest of the town of Weed in Siskiyou County, California. It flows approximately 50 miles in a northerly direction, passing through the Shasta Valley. After leaving the valley, and below the confluence with the Little Shasta River, it enters a steep-sided canyon where it flows for seven river miles before emptying into the Klamath River[1], 176.6 river miles upstream from the Pacific Ocean.

The Shasta River drains a portion of the Cascade Province to the east and a portion of the Klamath Province to the west. Numerous springs and a number of small tributaries enter the Shasta River as it passes through the Shasta Valley. Glacial melting from Mt. Shasta and precipitation provide the principal source of recharge for the river. Major tributaries include Parks Creek, Big Springs Creek, Little Shasta River, and Yreka Creek. The highest point in the watershed is Mt. Shasta at an elevation of over 14,000 feet. Where the Shasta River enters the Klamath River, the elevation is just over 2,500 feet.

[1] This portion of the Shasta River, from the confluence with the Little Shasta River downstream to the Klamath River, is part of the action area for this consultation as described in section 2.3.

Seventy-two percent of the watershed is in private ownership. Access to the Shasta River and its tributaries is limited to a few miles of the lower Shasta River still in public ownership, at public road crossings, and at locations where few landowners provide access. The portion (approximately three river miles) of the Shasta River that passes through Shasta Canyon is in BLM ownership. It is afforded protected status as an Area of Critical Environmental Concern.

Problems facing coho salmon critical habitat in the Shasta River HSA include reduced summer flows, loss of channel maintenance flows, fish access limitations, high water temperatures, low levels of DO, elevated nutrient levels, turbidity, limitation of spawning gravel quantity, loss of spawning gravel quality, loss of riparian habitat, barriers to fish passage, unscreened water diversions, lack of funding for planning and studies necessary to precede restoration or fill data gaps, and lack of on-the-ground access for studies.

Figure 12. Little Shasta River from headwaters to the mouth and confluence with the Shasta River and approx. locations of SVWA, Hart Ranch, and the LSR flow gage. (Scale in miles, black bars delineate approximate reach boundaries.)

2.4.1.2.3 Little Shasta River

Streamflow

The total volume of water diversions from the Little Shasta River during the irrigation season total 91.76 cfs. Nichols et al. (2016) found that the Little Shasta River is over-appropriated and based on historical data of unimpaired flow, cumulative water rights of first priority water right holders often exceed natural summertime stream flows in the Little Shasta River Valley. Diversion of water from the upper Little Shasta River typically results in dry stream channel downstream (including the action area) of the Hart-Haight diversion near the Hart Ranch (Figure 12) during the summer irrigation season.

The Shasta Valley Resource Conservation District (SVRCD) and McBain and Trush (2013) describe several significant springs near the base of Table Rock (Figure 12) that historically contributed additional flow to the Little Shasta River downstream of the USGS gaging station. They estimated that base flows in the Little Shasta River ranged from 10 cfs to 20 cfs, including conservatively estimated spring flow contributions of 10 cfs (which they felt were likely higher). Nichols et al. (2016) estimated that groundwater springs near Table Rock actually contributed approximately 20 cfs of additional flow to the Little Shasta River downstream of the USGS LSR gaging station.

Diversions

Numerous diversions occur both upstream (Hart- Haight and Musgrave) and within the action area downstream of the SVWA, primarily for irrigation purposes and stock watering. The SVWA exercises the use of nine water rights licenses to divert water for both storage and immediate use. All nine licenses have been amended to include fish and wildlife enhancement as a beneficial use. Two licenses provide for year-round water use of up to 9 cfs, however, due to the priority of these two rights, they are not exercised outside of the winter diversion period. The remaining seven licenses allow for diverting water from the Little Shasta River for the purpose of storage in the three storage reservoirs located in the SVWA. These three storage reservoirs; Trout, Bass and Steamboat reservoirs are licensed to store up to 6,500-acre feet of water per year. As noted above in the project description, SVWA water rights allow for the diversion of up to 35 cfs, however, due to fish screening and delivery ditch limitations, only 30 cfs can be diverted at any time. The diversion period for water storage starts on November 1st (for Bass Lake) and ends May 1st (Steamboat Reservoir).

Water Quality

Near the mouth of the Little Shasta River in the action area, Lukk et al. (2019) found water quality that showed elevated levels of organic material in the form of nitrogen, phosphorus, and carbon. Continuous months of low flow in the Little Shasta, exacerbated by instream diversions, can create conditions for dissolved organic carbon (DOC) to concentrate in the substrate near the river mouth (Lukk et al 2019), allowing it to pull DO out of the water with the first flows of the season. This could result in DO levels low enough to be within lethal range for coho salmon. A one-time sampling event for a period of 3 months in the winter of 2020 recorded a low of 3.7mg/L near the confluence of the Shasta River (personal communication, Ann Willis, August

25, 2022). Reduced concentrations of dissolved oxygen can negatively affect the swimming performance of migrating salmonids, and upstream migration by adult salmonids is typically a stressful endeavor. Sustained swimming over long distances requires high expenditures of energy and, therefore, requires adequate levels of dissolved oxygen. Migrating adult Chinook salmon in the San Joaquin River exhibited an avoidance response when dissolved oxygen was below 4.2 mg/L, and most Chinook waited to migrate until dissolved oxygen levels were at 5 mg/L or higher (Carter 2008). Thus, NMFS expects that when low DO occurs near the mouth of the Little Shasta River, salmonids migrating upstream will face stressors due to low oxygen levels, and migration will be delayed or avoided.

2.4.1.3 Climate Change

Many of the impacts of climate change described above in the Species Status section (2.2.3) are likely to occur in the action area in the future. Threats coho salmon in the action area may face include more frequent and extended droughts and forest fires associated with accelerating global climate change. For fish, some of these impacts represent key stressors which have, even under normal climate conditions, significantly impaired underlying watershed functional processes, and eroded water quality.

Flooding

High flows associated with floods can result in complete loss of eggs and alevins as they are scoured from the gravel or buried in sediment (Sandercock 1991). Juveniles and smolts can be stranded on the flood plain, washed downstream to poor habitat such as isolated side channels and off-channel pools, or washed out to sea prematurely. Peak flows can induce adults to move into isolated channels and pools or prevent their migration through excessive water velocities.

Streams can be drastically modified by erosion and sedimentation in large flood flows almost to the extent of causing uniformity in the stream bed (Spence et al. 1996). After major floods, streams can take years to recover pre-flood equilibrium conditions. Flooding is generally not as devastating to salmon in morphologically complex streams, because protection is afforded to the fish by the natural instream structures such as LWD and boulders, stream channel features such as pools, riffles, and side channels and an established riparian area (Spence et al. 1996).

The Shasta Basin contains an underlying crystalline formation with shallow soils which produce a more rapid response to storms, making it susceptible to flood events. This can lead to the scour and removal of gravel and substrate in the Basin, as experienced in the Little Shasta River, which contains sections that are prone to having placed gravel wash away during large winter flood events, making it hard to retain spawning substrate in those areas. The Shasta Valley, like the majority of Northern California, is predicted to experience heavier and warmer precipitation, and a loss of snowpack in the near future as a result of climate change. Extreme wet and dry periods are projected, increasing the risk of both flooding and droughts (DWR 2013).

Drought

The Little Shasta River and Shasta Valley have seen three consecutive years of drought, including the 2022WY, which was the fourth driest for the period of record (through 1984).

Combined with heavy agricultural use in the Valley, this can lead to river flows being insufficient for fish passage for Chinook and coho salmon. Recently in August of 2022, the Shasta River flows dropped to levels so low they became a barrier for fish passage and caused fish already instream to become stranded, as irrigation diversions were turned on during a period of drought. The SWB has begun to adopt minimum flows for salmonids and curtailments enforced for emergency drought conditions in the Shasta Valley. As the prevalence of drought will likely continue to increase as a result of global climate change, the reduced streamflows will reduce habitat quantity and result in increased water temperature, increased heat stress to fish, and thermal barriers to migration in the Shasta Valley, which includes the action area.

2.4.1.4 Restorative Actions

Section 1707

The State Water Board has issued a Section 1707 permit to add Fish and Wildlife as a Beneficial Use to all water rights for the Hart-Haight property, upstream of the SVWA. This essentially allows the Harts to keep any or all of their water right instream for the benefit of fish, without risking loss of said water rights due to lack of use. The 1707 was approved by the State Water Board in 2021 and a supplemental decree was filed with the Siskiyou County Courts. Any water left instream due to conservation on the Hart Ranch, as stipulated by the 1707 and supplemental decree, would be bypassed by all downstream water right holders to a secondary point of diversion, which was designated at the mouth of the Little Shasta River. Beneficial effects of the agreement would serve to reduce the amount of cold-water resources (e.g., water sourced from springs, or surface water fed by springs) being utilized for irrigation and stock-water, increase cold water returns to the river system, and improve fish passage on the property during critical migration times for coho salmon.

Curtailments

On June 15, 2021, CDFW transmitted a letter providing recommendations to inform proposed drought emergency regulation for the Shasta and Scott Rivers: *SWB Shasta Scott Drought Emergency Plan for 2022* (CDFW 2022). CDFW is providing drought emergency minimum flow recommendations by month as daily averages. Each value will be measured at the identified gages (Table 2) in cfs. Minimum flows and other recommendations were developed in consultation with NMFS and are not intended to set the stage for long-term management considerations, nor should they be construed to provide adequate protections for salmonids over extended periods of time. They only provide drought emergency minimum flow recommendations for all life stages of salmon during the current drought emergency. These drought emergency minimum flows are intended to enable salmonids in these rivers to survive drought emergency conditions.

On August 17, 2021, the SWB approved the drought emergency regulation that included CDFW recommended drought emergency minimum flows for the Shasta River Canyon at SRY (Shasta River - Yreka gage). Minimum flow rates were designed to help juvenile salmonids survive and to support the migration of mature fall-run Chinook and coho salmon. The Office of Administrative Law adopted the drought emergency regulation for the Shasta and Scott Rivers, and has been enforced since August 30, 2021. The SWB re-adopted the emergency regulation in

April 2022 as drought conditions persisted in the basin and updated the minimum flow requirements as shown in Table 3 below. Drought emergency minimum flows for the Shasta River Canyon during the winter (125 cfs) could result in the curtailment of all and any diversion in the Little Shasta River. If any curtailment orders by the State Water Board were to be issued for the Little Shasta River, these would supersede the SVWA diversion rates laid out in the proposed action.

Table 2: Minimum flow rates for SWB Drought Emergency Regulations, updated April 2022.

	Daily Average Minimum Drought Emergency Flow Requirements (cfs)											
Shasta (Yreka) USGS 11517500	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing	135	135	135	70	50	50	50	50	50	125	150	150
Proposed	125	125	125-105[a]	70	50	50	50	50	50-75[b]	105	125	125

a Minimum flow at the Yreka gage March 1-24 = 125 cfs, March 25-31 = 105 cfs.
b Minimum flow at the Yreka gage September 1-15 = 50 cfs, September 16-30 = 75 cfs.

2.4.1.5 Relevant Federal Actions in the Action Area that Have Undergone ESA Section 7 Consultation

NMFS has performed a number of other ESA Section 7 consultations on Federal actions in the action area. NMFS has performed two previous informal consultations with USFWS in the action area (2013, 2015) for activities related to the maintenance of SVWA and HRWA lands, and NMFS concurred with the federal action agency that their proposed action was not likely to adversely affect listed species or their critical habitat under NMFS' jurisdiction. Other Federal actions that NMFS has consulted on in the action area include:

In December of 2013 Montague Water Conservation District (MWCD) entered into a Settlement Agreement with the Klamath River Keeper and the Karuk Tribe and completed the permitting process with the U.S. Army Corps of Engineers to implement a Conservation and Habitat Restoration and Enhancement Project (CHERP). In issuing the permit, the Corps conducted an ESA Section 7 consultation with NMFS. The result of that consultation was a NMFS non-jeopardy biological opinion. The Settlement Agreement includes development of a long-term water conservation and flow enhancement program to improve conditions for coho salmon downstream in the Shasta River through lining of irrigation canals, releasing of stored water from Dwinnell Reservoir to the upper Shasta River, augmenting flows in the upper Shasta River through groundwater releases, bypassing additional flows at its Parks Creek Diversion, and potential water exchanges with downstream diverters.

The Safe Harbor Agreement Template was signed in November of 2020, and establishes the general requirements for the National Marine Fisheries Service, under authority of Endangered Species Act section 10(a)(1)(A) and implementing rule and policy, to issue Enhancement of Survival Permits to non- federal landowners in the Shasta River Basin, When granting Enhancement of Survival Permits, NMFS must consult internally under section 7 of the ESA to ensure that activities conducted under issued research permits do not appreciably reduce the likelihood of survival and recovery of ESA-listed species. The Safe Harbor Agreement for the Shasta River Basin is an agreement with landowners for the purpose of promoting the conservation, enhancement of survival, and recovery of the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of coho salmon.

In 2018, NMFS issued a Section l0(a)(l)(A) Enhancement of Survival Permit for the Safe Harbor Agreement for Voluntary Habitat Enhancement Activities Benefitting Southern Oregon and Northern California Coast Coho salmon *(Oncorhynchus kisutch)* for the Hart Ranch, private lands along the Little Shasta River. In compliance with section 7(a)(2) of the ESA, in the accompanying biological opinion, NMFS analyzed the effects of the issuance of Permit 21088 authorizing incidental take of Southern Oregon/Northern California Coast (SONCC) coho salmon *(Oncorhynchus kisutch).* NMFS issued a non-jeopardy opinion. No take was associated with this consultation but diversion from the Little Shasta River at the property were found to adversely affect volumes of water during the spring and summer and cause the stream channel downstream of the Hart Haight diversion to go dry during most years. These diversion operations, including those diversions by the Section 10 permit Applicant, hinder riparian restoration and reestablishment downstream of the diversion, negatively affecting coho salmon critical habitat. Beneficial management activities as part of the agreement include enhancing, restoring, or maintaining habitat for SONCC coho salmon through various agricultural water infrastructure modifications that will facilitate water use efficiency, the modifications will limit direct water diversions from the Little Shasta River and improve fish passage into and through the section of the Little Shasta River crossing the Enrolled Property during critical migration times for coho salmon.

2.5 Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

Although coho salmon are not currently found in the Little Shasta River, it is part of SONCC coho salmon critical habitat. To account for all possibilities for utilization of this habitat, NMFS will be conservative and expect that coho salmon would be likely to enter the Little Shasta at least once in the next five years if the hydrological conditions allowed for fish passage. NMFS, conservatively, also expects that wet hydrological conditions would happen at least once over the

next 5 years, and would likely allow SVWA to continue to divert after April 1st, contributing to the adverse effects in the Shasta River as described below.

2.5.1 Effects of the Action on Critical Habitat

The Recovery Plan for SONCC coho (NMFS 2014) outlines PBFs within the critical habitat that are crucial for the survival and recovery of the ESU. The PBFs are also discussed above in Sections 2.2.2.2 and 2.4.1.2. Here we outline the effects, if any, that the SVWA Project will have on those PBFs in the same manner as discussed in Section 2.4.1.2. Namely, within the action area, we examine the effects on the conditions that make up each PBF including adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions.

2.5.1.1 Water Quality

Temperature

Diversions for the SVWA take place primarily during the winter months, and when upstream flows allow, during the early spring when temperatures in the Little Shasta River remain cool and suitable for salmon spawning. There have been years where limited streamflow in the Little Shasta River during winter months has led to the channel freezing over for short periods of time (as with the below zero temps in December of 2013). However, these events occurred in drier hydrological years, and occurred upstream as well as downstream of the diversion point, so the impacts of the SVWA diversions are likely not a contributing factor to freezing.

The SVWA diversion has little effect on temperatures in the lower Shasta River, as temperatures in the Shasta River during most of the diversion period are generally suitable for all salmonid life stages. The exception is if SVWA diversion occurs in April, when the irrigation season commences across the Shasta River watershed.[2] In this instance, reduced flows out of the Little Shasta and in the mainstem Shasta due to irrigation, combined with the increased tailwater contributions from agriculture could contribute to increased temperatures in the Shasta River canyon in the late spring, reducing the suitability of juvenile rearing habitat.

When diversions at the SVWA do occur after April 1st, it would further reduce flow available in lower Little Shasta and contribute to warmer temperatures found in the Shasta at the confluence with the Little Shasta and downstream to the Klamath, which will adversely affect juvenile rearing habitat in the early spring. However, the Little Shasta is only one of many tributaries contributing to flows and temperatures in the Shasta River, and so the overall effect of any reduced flows from SVWA diversions on temperatures will be minimal.

[2] The SVWA historically has not always been able to divert in April due to the other diverters starting irrigation in the Little Shasta River and due to the low priority of the SVWA water rights.

2.5.1.2 Water Quantity

Streamflow

Water quantity at the SVWA POD site and downstream in the Little Shasta River is dependent on upstream diversions. Previous studies showed that surface water diversions led to the disconnection of aquatic habitat sites downstream of Hart-Haight diversion (RM 11.5) from the upper reach during the summer irrigation season (Nichols et al. 2016). Seasonal high-flow events, freezing temperatures, and a lack of flow gages and monitoring of irrigation diversions and groundwater pumping on the Little Shasta River make it difficult to assess the prevalence of continuous streamflow in the action area. Although the SVWA permits allow for a diversion season starting on November 1st and ending on May 1st, once the irrigation season starts on March 1st, reduced flow in the Little Shasta River at the SVWA limits the amount of days for holding pond diversions, and in dry years they have ended diversions as early as March 1st.

During the winter diversion period (see Table 1), the projected continued reduction in the duration (and increased rate of recession) of elevated winter river discharge downstream of the SVWA diversion due to baseline conditions could artificially truncate the availability of winter juvenile rearing habitat for juvenile coho salmon.

Quantity of streamflow also has the potential to impact lateral channel connectivity, which would influence a rivers' relationship to adjoining wetlands and floodplains. The periodic inundation of floodplains that occurs during large flow events and the resulting exchange of water, sediment, organic matter, nutrients, and organisms have a beneficial effect on juvenile habitat and rearing. In many areas of the bottomlands region of the Little Shasta River, downstream of the SVWA diversion, the channel is shaped like a half-pipe (NMFS 2013). With at least 10 cfs in the Little Shasta River in those areas, the riverbed is inundated and already climbing the steep slopes of the banks, meaning inundation of floodplains and wetlands would likely start occurring at flows of 10 cfs. As part of the proposed action, CDFW has the ability to divert up to 50% of flows up to the screening capacity at the POD (30 cfs). This action effectively reduces a 60 cfs streamflow to 30 cfs, or a 20 cfs streamflow to 10 cfs, and at the same time reduces the chances of channel connectivity during the SVWA diversion period within the action area.

Effects of the SVWA diversion to Shasta River Canyon flows are mostly limited to late spring when the diversion overlaps with the commencement of the irrigation season throughout the Shasta River watershed on April 1. In comparing streamflow data at the Shasta River canyon gage (SRY) from 2007 to 2021 to the flow recommendations outlined in the 2014 McBain and Trush Shasta Canyon IFN Final Report, flows in the canyon were below the flow recommendation for salmon life stages seven of the fourteen years analyzed. Thus, NMFS expects at least some minor level of adverse effects to critical habitat when SVWA diverts after April 1st, which would contribute to reduced mainstem and off-channel rearing habitat for fry and juvenile salmonids. The rest of the SVWA diversion period seems to have little effect on Shasta River Canyon flows, as historically flows have been reasonably within the recommended thresholds of 135 to 195 cfs, depending on water year type, as outlined in the 2014 IFN report.

Fish Passage

SVWA actions have the potential to affect the adult coho salmon migratory passage availability into and through the Little Shasta River. To evaluate the potential effect, NMFS considers CDFW's criteria for the development of passage flows (*Critical Riffle Analysis for Fish Passage in California (DFG-IFP-001)*(CDFW 2012, 2013a*)* for salmon: contiguous, and total passable width. Critical riffle analysis in the action area conducted by DFW in November- December of 2013 and 2014, when species migration occurs, showed that coho fish passage in 2013 (shown in the 2013/2014 graphs below) at the low water crossing at Shasta Valley Wildlife Area was contiguous for adult coho at 5 cfs, at the 10% minimum criteria level (Figure 13), and the total passage ability for adult coho salmon resulted in fish passage at approximately 6.75 cfs at the 25% minimum criteria level (Figure 14).

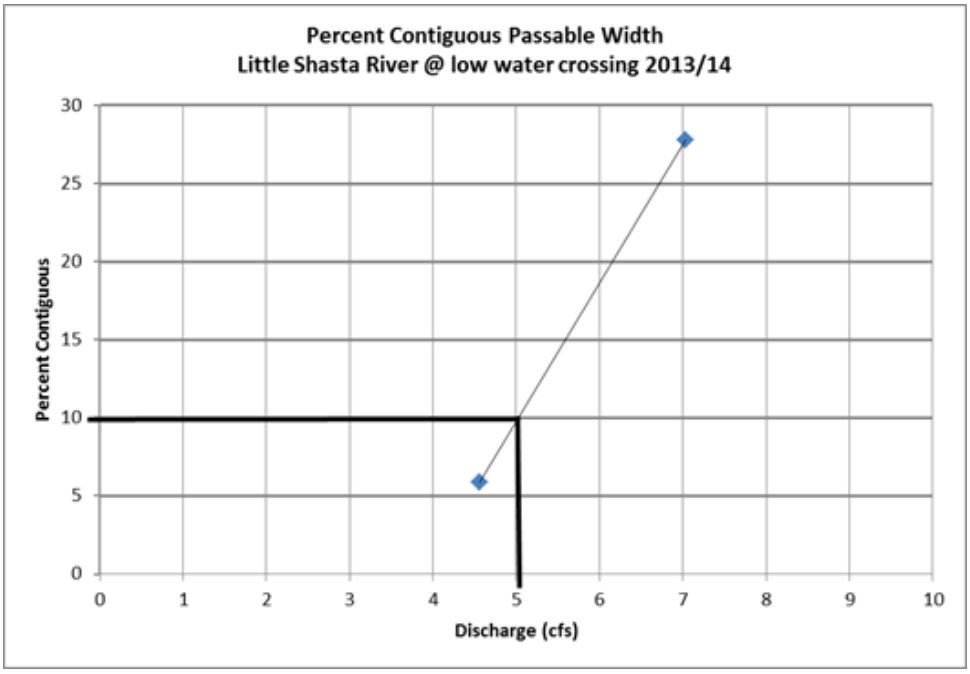

Figure 13. For contiguous fish passage, at least 10% of the entire length of the transect must be contiguous for the minimum depth established for coho salmon (0.7ft. for coho).

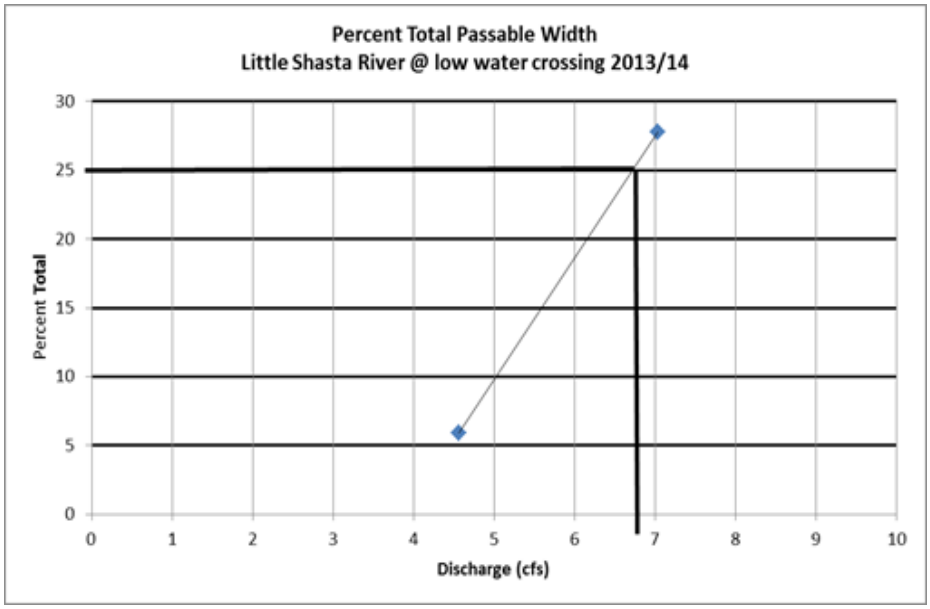

Figure 14. Total passage ability for adult coho is equal to at 25% of the entire transect being at least the minimum depth established for passage of coho (0.7ft.).

The results of the Critical Riffle Analysis for November and December of the following year, 2014, at the low water crossing at Shasta Valley Wildlife Area showed contiguous adult coho passage at approximately 5.75 cfs, at the 10% minimum criteria level. The total passage ability for adult coho salmon resulted in fish passage at approximately 9.5 cfs at the 25% minimum criteria level. More recent river stage height gage readings taken by SVWA staff in the winter of 2016-2017 and again in 2017- 2018 confirm a rated curve of (2) ft. and (1.85) ft. respectively at the 10 CFS flow rate, well above the 0.7ft minimum depth required for adult passage. Thus, the Critical Riffle Analysis confirms that the 10 cfs bypass flow will allow fish passage of all life stages of coho salmon in the Little Shasta River portion of the action area.

Effects of the SVWA diversion to fish passage in the Shasta River Canyon are limited to late spring when the diversion overlaps with the commencement of the irrigation season for the entire Shasta River watershed, on April 1. This would not affect adult coho salmon passage, as the rest of the SVWA diversion period that overlaps with coho salmon migration has little effect on Shasta Canyon flows, which have been primarily above the flow requirements needed for adult passage identified in the 2014 IFN Report.

2.5.1.3 Foraging

Food sources including macroinvertebrates are not expected to be impacted by the Proposed Action, and are not a limiting factor for the Little Shasta River. Stream macroinvertebrate surveys were conducted by Lukk et al. (2019) and compared benthic macroinvertebrate communities at the Foothills reach just upstream of SVWA, and the Bottomlands reach that contains the SVWA, and found greater densities of invertebrates at the Bottomlands (~4900 invertebrates·m-2). The Foothills reach exhibited a smaller but more diverse macroinvertebrate community.

Shasta River

Effects from the proposed action are very limited in the Shasta River and downstream to the Klamath River. Macroinvertebrate production in the Shasta River Canyon reach would not likely be impacted by the SVWA Proposed Action, as winter flows in the Canyon which support macroinvertebrate production would only be minimally affected and thus would remain sufficient to support a food source for salmonids.

2.5.1.4 Instream Habitat Availability in the Action Area

In normal years, the agricultural diversions in the Little Shasta River run from March 1st through October. The natural stream morphology of the Little Shasta River at the SVWA site includes poor riparian conditions, and because of irrigation diversions upstream, the river bed often runs dry during the summer irrigation season. Reaches of the Little Shasta River that contain suitable spawning gravel occur primarily upstream of the SVWA, starting around RM 10.

The impacts of the diversions to the SVWA holding ponds, which can be up to 30 cfs and 50% of the total river flow taken from the Little Shasta, will have some reduction (<5%) of shallow edge habitat along the margins of the streambed. This would result in a slight reduction of habitat that could be used for spawning and rearing in the Little Shasta River within the action area if in the near future (5 years) this stretch of river were to become more suitable for spawning. However, a loss of <5% along the stream margins would still provide an adequate channel to allow for fish migration through the action area to more suitable areas upstream for spawning and rearing.

In normal years, the water association agricultural diversions from the Shasta River run from April 1st to October. The natural stream morphology of the Shasta Canyon reach is mostly a confined channel with some good riparian and spawning habitat. The diversion of the SVWA is not anticipated to reduce habitat availability in the Shasta River reach downstream of the confluence with the Little Shasta, as the diversion amount is a relatively small percentage of stream flow available in the Shasta River during the winter months when most other irrigation diversion is off. However, in reviewing the flow recommendations outlined in the 2014 McBain and Trush Shasta Canyon IFN Final Report, NMFS expects at least some minor level of adverse effects when the SVWA diverts after April 1, as the reduced flows would contribute to reduced mainstem and off-channel habitat for fry and juvenile salmonids.

2.5.1.5 Minimization Measure of Proposed Action on Critical Habitat

Flushing Flows

To address concerns of low dissolved oxygen (DO) levels during the winter at the river mouth (see *Section 2.4.1.2.3 Little Shasta River: Water Quality*), and as described in the Proposed Action (Table 1), after the beginning of the diversion season (starting November 1st) and during a wet water year, CDFW will allow the first flow over 50 cfs to bypass their diversion and generate a pulse flow (i.e. a flushing flow) traveling to the Little Shasta River mouth for 48hrs. UC Davis studies show that a few good pulse flows lasting 1-3 days can wash out the DOC concentrations at the river mouth. This pulse flow timing is meant to precede coho spawning migration, and would serve to flush out carbon and alleviate low DO levels prior to the migration

of adult coho into the Little Shasta River. There has not been any long-term monitoring, or a consistent flow record for the Little Shasta River in recent years to fully understand how frequently higher flows will be available to create a flushing flow to the Little Shasta River mouth. In reviewing the last 5 years of data from the LSR gage, which is upstream of the SVWA, November (the optimal time for spawning migration) peaked at 25 cfs in 2017, but otherwise flows were fairly consistent at around 10 cfs for the remainder of the record, and as low as 5 cfs in 2021. It is impossible to precisely predict future hydrological conditions due to natural climatic variations (*e.g.,* winter snowpack depth, timing of summer onset, *etc.*), but based on recent flow records, the possibility of implementing a pulsed flushing flow in the next 5 years is low (0-1 time in the next 5 years). However, if pulsed flushing flows are implemented, they may occur in December, based on likely climate conditions.

If a pulse flow event were to occur, the additional water allowed downstream by SVWA will minimize impacts of the proposed action and the effects on water quality at the mouth of the Little Shasta River. In addition, if flows were to remain below 50 cfs in November and December for the next 5 years and flushing flows were not implemented it would not preclude coho salmon passage upstream, but may delay migration until sufficient flows provided suitable oxygen levels. Non-flushing flows still require a 10 cfs minimum bypass, which is designed to provide adequate fish passage throughout the diversion period.

2.5.2 Effects of the Action on SONCC Coho Salmon

Fish presence data indicates coho salmon are highly unlikely to be present in the Little Shasta River currently. However, as a result of restoration actions throughout the Shasta River Basin, we expect coho salmon abundance to improve and coho salmon are likely to be present in the Little Shasta River at some point during the 5-year action period. Table 2 below outlines the potential for presence or absence of coho life stages in the action area.

Table 3. Likelihood of presence of coho in the action area during the SVWA diversion period (November 1st- May 1st) at least once in the next 5 years

ACTION AREA LOCATION	EGG	JUVENILE	ADULT
Little Shasta River (SVWA)	Presence not likely	Presence likely, but flow dependent	Presence likely

ACTION AREA LOCATION	EGG	JUVENILE	ADULT
Shasta River (between Little Shasta River and Klamath River)	Presence likely	Presence likely	Presence likely

Due to the timing of diversions and morphology of the streambed in the action area, we expect not all life stages of coho salmon will be impacted by the proposed action (Table 3).

Little Shasta River

The life stage present in the action area during winter months will be adult coho salmon migrating upstream to spawn. Adult migration of SONCC coho salmon typically occurs between September and late December, with the majority occurring before December. Spawning occurs from mid-September through December.

Emergent fry and juveniles from adults spawning in the Little Shasta upstream of SVWA would then emigrate downstream to feed and shelter in the action area in March- May. In the event that the stream channel runs dry upstream of the action area as a result of the onset of irrigation season on March 1st, any redds would likely become dewatered and would not survive to then emigrate as juveniles downstream into the action area.

Although past records show that dry channel conditions are typical in the Little Shasta after March1st, as noted above, NMFS expects that at least once over the next five years, coho eggs will survive and hatch upstream of the action area and fry and juveniles will migrate downstream into the action area to rear.

Shasta River

The area of the Shasta River downstream of the Little Shasta River to the confluence with the Klamath River (Shasta Canyon) will be occupied by adult migrating coho, egg incubation, and juveniles rearing along the mainstem Shasta River during the SVWA diversion period.

2.5.2.2 Diversion Effects to Coho Life Stages

The behavior, ecology, and survival of coho salmon are inextricably linked to characteristics of the natural streamflow regime (Richter et al. 1997; Trush et al. 2000; Lytle and Poff 2004), in general, alterations in the pattern and magnitude of discharge, including reductions in the amount and extent of surface flow, translate into changes in the quality and quantity of freshwater migration corridors for coho salmon, with negative effects on individuals within the affected area. In the same manner, there is a flow-related dependency of many features of aquatic habitat and the inextricable connections among flow, riverine habitat, and coho salmon life history, habitat requirements, and population metrics.

Adult migration and spawning

Reduction of instream flows can result in adult coho salmon choosing not to migrate into or through riverine areas (REFs). We analyzed the flow reductions in the Little Shasta River resulting from the SVWA diversions (up to 50% flow) and concluded upstream migration would not be precluded by diversions as long as a 10 cfs bypass was maintained, as included in the proposed action (See our critical habitat effects analysis above for more information). Thus, the SVWA stream diversions are not likely to affect adult spawning opportunities.

Reduction of instream flow in the Shasta River reach downstream of the Little Shasta River resulting from the SVWA diversion would not likely affect adult migration and spawning, as flows in the Lower Shasta River are generally adequate for adult passage in November and December, as the irrigation season is over by October 1 throughout most of the basin and flows rebound quickly. The SVWA diversion's impacts on flows in the Shasta River during the adult migration period (SVWA diversion season is November 1- May 1) are too small to affect adult migration habitat as described above in the critical habitat section, and thus migrating adults in the Shasta River would not be adversely affected.

Eggs and Juveniles:

Due to the current poor spawning habitat found in the Little Shasta River at SVWA (and downstream) because of a lack of suitable spawning substrate, the likelihood of egg deposition and development in this area are miniscule. Suitable spawning habitat is found upstream of the SVWA property (outside of the action area).

Fry emergence from suitable spawning habitat upstream of the action area near RM 10 in the Little Shasta in March- May coincides with the irrigation season and the disconnection of the stream channel upstream of the SVWA (starting March 1st). During a wet water year, if coho salmon were to spawn in habitat reaches upstream of the SVWA, streamflow may be adequate after March 1 for coho juveniles to make their way downstream to the SVWA in the Little Shasta River, where a small number of these juveniles would likely be adversely affected by a (<5%) reduction of stream habitat used for shelter and foraging along the edges of the river channel that would result from SVWA diversions. Adversely affected juveniles are likely to have their survival chances reduced resulting in injury or death from lack of shelter. As noted above, NMFS assumes that coho would spawn upstream and coho juveniles would make their way downstream during at least one of the next five years.

Egg incubation and fry emergence in the Shasta River reach downstream of the Little Shasta River confluence would not likely be affected by the minor reductions in flows resulting from the SVWA diversion, as flows in the winter months are generally adequate as irrigation in the basin is not occurring.

2.5.2.4 Minimization Measure of the Proposed Action for Coho Salmon

CDFW will ensure adequate adult coho salmon passage to accommodate spawning in the Little Shasta River upstream of the SVWA property. CDFW has proposed to only divert when flows were over 10 cfs, and divert only up to 50% of total streamflow, thereby always ensuring 10 cfs or more was bypassed in the river past the point of diversion (i.e., if river flows were 30 cfs, 15

cfs would be bypassed, for 40 cfs, 20 cfs would be bypassed, up to a max of 30 cfs taken for diversions). Since critical riffle analysis has confirmed adult coho salmon passage at 10 cfs in the Little Shasta River, these adaptive management actions as part of CDFW's proposal will ensure adult coho salmon that find their way upstream to the action area (in the next 5 years) will not face barriers to passage in the action area on, or downstream of the SVWA property based on diversion rates.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). 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.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult, if not impossible, to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

2.6.1 Other Conservation Actions

Current and ongoing conservation measures to improve instream availability of water for fish species in the Little Shasta River and Shasta River are likely to contribute to habitat improvements for coho salmon and other fish species in the next 5 years.

Curtailments

As described above in the Environmental Baseline, SWB approved drought emergency regulation in 2021 that included CDFW recommended drought emergency minimum flows for the Shasta River Canyon. These minimum flow rates (described in Section 2.4.1.4) were designed to help juvenile salmonids survive and to support the migration of mature fall-run Chinook and coho salmon during periods of drought by conserving water left instream. These curtailments are likely to continue into the future given the likelihood of increased droughts.

Section 1707

Similar projects to the Hart-Haight Section 1707 permit (described in Section 2.4.1.4 Restorative Actions) are currently being conceptualized at the Musgrave diversion, also upstream from the SVWA. It is anticipated that any upcoming projects would also require a subsequent Section 1707 issued by the state to protect the water from being diverted from downstream or lower priority diverters, which would include the SVWA diversion. The potential benefits to coho salmon from these conservation actions in the next 5 years would be improved fish passage resulting from more conserved water left instream.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1 Status of the Species and Critical Habitat

The ESU includes more robust populations (e.g., Scott River), but also smaller, less productive populations (Shasta River). None of the seven diversity strata appear to currently support a single viable population as defined by the viability criteria. However, from our review of all available data sources all diversity strata are currently occupied. Information in the recovery plan (NMFS 2014) indicates the SONCC coho salmon ESU overall remains at moderate to high demographic risk. In fact, most of the 30 independent populations in the ESU are at high risk of extinction because they are below or likely below their depensation threshold, which can be thought of as the minimum number of adults needed for survival of a population.

The Shasta River population is currently persisting at a high-risk level. Population estimates are low and have not trended upward over time, going from just over 1,000 fish annually (1950's) to 50 or less annually (2014-2020), with a large percentage of those of hatchery origin. Freshwater survival of juvenile coho salmon in the Shasta River Population is likely low due to myriad risks and habitat degradation previously described in this biological opinion. The Shasta River Population has a high risk of extinction, with substantial genetic and other depensation risks associated with low numbers of adult spawners and the high hatchery stray component in the population.

2.7.2 Environmental Baseline

The environmental baseline provides context for a broad range of past and present actions and activities that have affected SONCC coho salmon and their critical habitat in the action area and contributed to their current condition. These include hatchery and habitat actions.

Hatchery Influence

Hatcheries were identified as a key limiting factor for SONCC coho salmon by the recovery plan (NMFS 2014). Recent improvements have begun to address this key limiting factor in Core populations. As a result of the Klamath dam removal process beginning in 2023, hatchery production for the Klamath River populations will be moved to a smaller facility at Fall Creek. The resulting reduction in Chinook salmon hatchery production should help increase the reproductive fitness of the natural population of coho salmon in the Shasta River, including the action area, in the long term (because of reduced predation and competition).

Habitat Limitations

Habitat was also identified as a key limiting factor in the recovery plan (NMFS 2014). Continued water diversion activities, combined with other anthropogenic and environmental factors, are expected to continue to adversely affect the current extinction risk of the Shasta River coho salmon population.

Water quantity in the Little Shasta River portion of the action area is dependent on upstream agricultural diversions, and often leads to the disconnection of sites downstream of Hart-Haight diversion (RM 11.5) from the upper reach of the Little Shasta River during the summer irrigation season, beginning May 1. Summer irrigation withdrawals from the Little Shasta and Shasta Rivers combined with drought conditions in the Shasta Basin will continue to reduce the available rearing habitat for coho salmon in the action area.

In summary, although some instream improvements through emergency curtailments and 1707 permits are expected to occur in the lower Shasta River and the Little Shasta River, coho salmon are expected to experience continued degraded water quality conditions and low flow conditions in the Shasta and Little Shasta Rivers, including in the action area, in the foreseeable future.

2.7.3 Effects of the Action

NMFS expects that the magnitude and extent of adverse effects from the proposed action on coho salmon and critical habitat in the action area to be minimal.

Effects on Species

Adverse effects from diversion activities and the resulting <5% loss of stream margin habitat are likely to be experienced by only a very small number of the juvenile coho salmon that are likely to be present in the action area during one or more of the next five years. Based on CDFW's observations and surveys in the Little Shasta River, over the next five years NMFS anticipates only a very small proportion of the total number of rearing juvenile coho salmon for the Shasta River Basin population will be found within the Little Shasta River. However, if SVWA diversions continue past April 1st, as described above in the effects section, the loss of streamflow would adversely affect a small portion of juvenile coho rearing and dispersal in the Shasta Canyon, in the Shasta River. No effects to other coho salmon life history stages are anticipated due to the proposed action.

Effects on Critical Habitat

With regard to coho salmon critical habitat, the proposed action will result in minor loss and minimal habitat alteration within the action area. The SVWA diversions will cause the loss of a small percentage (< 5%) of rearing (e.g., shallow edge habitat) habitat (i.e., decreasing edge habitat marginally as some volume of water is removed from the river) that may become available with increased restoration efforts in the Little Shasta River. However, this reduction will not inhibit fish passage (migratory corridors) because of the adherence to CDFW's fish passage protocol (CDFW 2012, 2013a). Thus, the magnitude of anticipated effects is low. In the event that the SVWA will experience flow great enough to allow diversion after April 1st, the

downstream habitat in the Shasta Valley would become further impaired due to SVWA diversions, resulting in warmer water and less rearing habitat and off-channel habitat for juvenile coho salmon. The downstream effects to the Shasta River will be miniscule because the Little Shasta River is only one of many tributaries that add additional flow during the SVWA diversion period. However, there will be some minor adverse effects to rearing and dispersal habitat space in the Shasta River, if SVWA diversions occur after April 1.

2.7.4 Climate Change

In our review of the status of SONCC coho salmon we account for how climate change is expected to impact the ESU during all stages of their complex life cycle, described in *Section 2.2.3*. In addition to the effects of rising temperatures, other effects include alterations to instream flow patterns in freshwater and changes to food webs in freshwater habitats. There is high certainty that predicted physical and chemical changes will occur across the SONCC Coho Salmon ESU. However, the ability to predict bio-ecological changes to fish or food webs in response to these physical/chemical changes is extremely limited, particularly to different populations or among diversity strata, leading to considerable uncertainty. As we continue to deal with a changing climate, management actions may help further alleviate some of these potential adverse effects (e.g., protection of cold water refugia, modifying some hatcheries to serve as a genetic reserve for natural populations).

2.7.5 Cumulative Effects

Ongoing and future restoration actions in the Shasta River sub-basin, such as those identified at the Hart-Haight diversion and the Musgrave diversion on the Little Shasta are expected to result in improvements to coho salmon habitat and will likely improve the overall viability of the population; however, NMFS does not expect the recently completed restoration actions to completely offset the impacts currently facing Shasta River coho salmon.

Summary

Within the broader context of coho salmon conservation in the Shasta watershed, the Little Shasta River could play an important role in the recovery of listed salmonids in the basin. Ongoing restoration work in the Little Shasta is expected to improve habitat for coho salmon, but agricultural needs will continue to challenge the Shasta River coho salmon population.

NMFS expects coho salmon to make their way into the Little Shasta River at least once in the next five years, where juvenile salmon emerging from upriver of the action area will emigrate downstream to feed and shelter. Diversions drawn from the river by SVWA will create a small reduction in habitat available for a small portion of juveniles, which face stressors from similar reductions in habitat throughout the action area and within the Shasta River Valley. A very small number of juvenile coho salmon are likely to be lost during the next five years due to diversion of water by the SVWA. SONCC coho salmon rearing habitat elsewhere in the Shasta River will not be affected and coho salmon rearing in these areas will help the population absorb these small losses.

In NMFS' judgement, these minor losses are unlikely to appreciably reduce the numbers, reproduction, or distribution of the SONCC coho salmon ESU or appreciably reduce the value of their critical habitat for conservation.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is likely to adversely affect critical habitat for SONCC coho salmon, but not likely to jeopardize the continued existence of the SONCC coho salmon ESU or adversely modify or destroy their designated critical habitat.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that 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" is defined by regulation as 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). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

As described in the Effects to Critical Habitat section of this biological opinion, NMFS expects the proposed action will result in incidental take of juveniles in the action area indicated by the loss of a small percentage (<5%) of stream habitat margins in the Little Shasta River during the diversion period. NMFS expects the small percentage loss in the Little Shasta will be indicative of downstream effects in the Shasta River. The loss of habitat during coho salmon spawning season will decrease available streambed habitat that could be utilized for emerging salmon fry during wet seasons when the streambed does not otherwise become disconnected from the upper channel with the onset of irrigation season.

The amount of incidental take of coho salmon resulting from the small loss of stream margins related to the proposed action is not practicable to measure because fry lost during the next five years are very small, making them difficult to find in river channels before they are eaten by scavengers. The loss of stream habitat is the only source of take, so regardless of what numerical take actually occurs from the action, the number will necessarily be directly based on the amount

of habitat loss that actually results from the action. As such, the habitat loss take surrogate is directly correlated with the unquantified anticipated level of numerical take, thereby making it a suitable surrogate for the numerical take. Thus, NMFS will use the loss of stream margin habitat in the Little Shasta River as a surrogate for take in the entire action area, and if the measured 5% loss of habitat is exceeded during the diversion period within the next 5 years, the amount or extent of incidental take of coho salmon will be considered exceeded.

2.9.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).
NMFS believes that the following reasonable and prudent measures and terms and conditions are necessary and appropriate to minimize the impacts of the amount or extent of incidental take of SONCC ESU coho salmon.

1. CDFW in coordination with NMFS will develop a water year type classification by December 1, 2022 (see section 2.4.1.2.1. Water Quantity**:** Hydrologic Year Type).
2. CDFW will monitor and report on water quantity as related to incidental take of coho salmon in the Little Shasta River.

2.9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. USFWS has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would lapse.

NMFS has worked with CDFW to take actions to minimize impacts to ESA listed species and critical habitat and minimize incidental take as laid out in the proposed action, including providing minimum flows, flushing flows, and creating a restoration plan. Therefore, the terms and conditions will focus on the reporting requirements for the monitoring and survey actions already discussed in Section 1.3.1 Description of the Proposed Action.

1. SVWA flow monitoring and diversion rates will be compiled and analyzed and a report submitted annually to: Klamath Branch Supervisor, Arcata, California.

2. Presence/Absence surveys: When river conditions allow, CDFW will continue to conduct redd surveys and/or adult salmon spawning and carcass surveys, as well as report out on findings from any other supplemental presence/absence surveys for the Little Shasta

River conducted by outside entities for research and environmental analysis. These will be submitted annually to: Klamath Branch Supervisor, Arcata California.

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

As part of the Proposed Action, a restoration plan developed by CDFW will be in place by year five. Restoration activities will increase the likelihood that coho entering the Little Shasta will find suitable water quality conditions to support migration, and spawning, and juvenile recruitment.

California Environmental Flows Framework (CEFF) habitat recommendations (Yarnell et al. 2022) for the Little Shasta River include management actions that support increased floodplain functionality in winter and spring and promote higher stream flows in the summer. Limited floodplain connection reduces winter recharge to shallow groundwater exacerbating limited surface-groundwater connectivity during the summer and fall seasons. Actions could include, but are not limited to, strategic stream channel restoration to improve floodplain connectivity, riparian fencing and planting to promote a more robust riparian vegetation community, installation of Beaver Dam Analogs (BDA)s or other large wood structures that promote instream habitat diversity and increased residency time of surface water, It is NMFS recommendation that restoration activities focus on improving the spawning and juvenile rearing habitat in the wildlife area through the following activities:

- Addition of spawning gravel to riffles. The gravel will also provide a breeding ground for aquatic insects for juvenile fish.

- Building floodplain connectivity through the use of BDA's. BDA's help with natural floodplain function and allow flood flows to inundate riparian habitat adjacent to the stream channel, creating complex, highly productive habitat for juvenile salmonids. Woody debris in stream channels also helps retain spawning gravel and create spawning habitat.

- Increase riparian cover (fencing) along stream banks. Plantings will help stabilize the streambanks and create shade and cover for juvenile fish.

2.11 Reinitiation of Consultation

This concludes formal consultation for USFWS - Grant Applications Operation Management Shasta Valley & Horseshoe Ranch Wildlife Areas.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service 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 taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the 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 action.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

3.1 Essential Fish Habitat Affected by the Project

The Pacific Coast Salmon Fishery Management Plan (FMP; PFMC, 2012) covers salmon fisheries stocks off of the coasts of Washington, Oregon, and California. The identification of Pacific Salmon EFH in the FMP is based on the habitat utilized by Coho, Chinook, and Pink Salmon. The Action Area, including the Little Shasta River and the Shasta River to the confluence of the Klamath River, has been identified as EFH for Chinook salmon and coho salmon.

EFH for Chinook salmon and coho salmon are managed under the MSA, under the authority of which EFH for coho salmon and Chinook salmon is described in Amendment 14 to the Pacific Coast Salmon Fishery Management Plan (FMP) (50 CFR 660.412). EFH includes the water quality and quantity necessary for successful spawning, fry, and parr habitat for coho salmon and Chinook salmon.

3.2 Adverse Effects on Essential Fish Habitat

Potential effects to EFH in the Action Area are related to limited streamflow during the winter diversion period, as described in *Section 2.5.1.2.* As a result of CDFW drafting water to fill reservoirs on SVWA land from November 1 through April 30, a small percentage of edge habitat in the Little Shasta River will be lost (< 5%) for salmon migration and spawning. The EFH habitat in the Little Shasta River has only once been utilized by Chinook salmon that we know of, and the presence of coho salmon has not been detected, therefore, there is little to no effect on the utilization of MSA-managed species in the Little Shasta River at this time. However, the proposed action takes measures to ensure future coho salmon populations (for the next 5 years) would find suitable habitat and river conditions to be able to expand their distribution and range in the Shasta Valley by providing minimum flows of 10 cfs, which are adequate for both adult coho salmon and Chinook passage.

The Shasta Canyon reach is mostly a confined channel with some good riparian and spawning habitat. The diversion of the SVWA is not anticipated to reduce habitat availability in the Shasta River reach downstream of the confluence with the Little Shasta, as the diversion amount is a relatively small percentage of stream flow available in the Shasta River during the winter months when most other irrigation diversion is off.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

As part of the Proposed Action, a restoration plan developed by CDFW will be in place by year five. Restoration activities will increase the likelihood that coho entering the Little Shasta will find suitable water quality conditions to support migration, and spawning, and juvenile recruitment. It is NMFS recommendation that restoration activities focus on improving the spawning and juvenile rearing habitat in the wildlife area through the following activities:

- Addition of spawning gravel to riffles. The gravel will also provide a breeding ground for aquatic insects for juvenile fish.

- Building floodplain connectivity through the use of BDA's. BDA's help with natural floodplain function and allow flood flows to inundate riparian habitat adjacent to the stream channel, creating complex, highly productive habitat for juvenile salmonids. Woody debris in stream channels also helps retain spawning gravel and create spawning habitat.

- Increase riparian cover (fencing) along stream banks. Plantings will help stabilize the streambanks and create shade and cover for juvenile fish.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, CDFW and USFWS must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation

Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The USFWS must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

If you have specific FWCA recommendations, include the following section. Numbering may change, depending upon inclusion of EFH consultation.

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are USFWS, Wildlife & Sport Fish Restoration Program.

Other interested users could include CDFW, Wildlife Branch.

Individual copies of this opinion were provided to the USFW. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.

gov/welcome]. The format and naming adhere to conventional standards for style.

Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

5. REFERENCES

Ackerman, N. K., B. Pyper, I. Courter, and S. P. Cramer. 2006. Estimation of Returns of Naturally Produced Coho to the Klamath River - Review Draft. Klamath Coho Integrated Modeling Framework Technical Memorandum Series. Technical Memorandum #1 of 8(Submitted to the Bureau of Reclamation Klamath Basin Area Office): 26.

Bartholow, J. M. 2005. Recent water temperature trends in the lower Klamath River, California. North American Journal of Fisheries Management. 25(1): 152-162.

Carter, K. 2008. Effects of temperature, dissolved oxygen/total dissolved gas, ammonia, and pH on salmonids. California Regional Water Quality Control Board, North Coast Region.

California Department of Fish and Game (CDFG). 1959. Preliminary report on fish and wildlife in relation to plans for water development in Shasta Valley. California Department of Water Resources Bulletin 87, Shasta Valley Investigation. 1964.

California Department of Fish and Game (CDFG). 1979. The status of salmon populations in California Coastal Rivers. CDFG, Anadromous Fisheries Branch.

California Department of Fish and Game (CDFG). 2004. Recovery Strategy for California Coho Salmon. Report to the California Fish and Game Commission, Species Recovery Strategy 2004-1. February.

California Department of Fish and Wildlife (CDFW). 2012. Shasta River Fish Passage and Longitudinal Habitat Connectivity, Fish Passage Study Plan. Prepared by Normandeau Associates, Inc.

California Department of Fish and Wildlife (CDFW). 2013a. Standard Operating Procedure for Critical Riffle Analysis for Fish Passage in California. DFG-IFP-001. October 2012, updated February 2013. CDFW Instream Flow Program, Sacramento, CA.

California Department of Fish and Wildlife (CDFW). 2013b. Shasta River Chinook and coho salmon observations in 2012, Siskiyou County, CA. CDFW, Northern Region, Yreka Fisheries Office, 1625 South Main St., Yreka, CA. May 10, 2013. 27 pp.

California Department of Fish and Wildlife and PacifiCorp. 2014. Hatchery and Genetic Management Plan for Iron Gate Hatchery Coho Salmon. Prepared for: National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Arcata, California

California Department of Fish and Wildlife (CDFW). 2016. Little Shasta River: a compendium of available information. Prepared by Yreka Fisheries, California Department of Fish and Wildlife. September 7, 2016.

California Department of Fish and Wildlife (CDFW). 2022. Letter to Eileen Sobeck, Executive Director State Water Resources Control Board, re: Re-adopt Drought Emergency

Regulation on the Shasta and Scott Rivers with Modified and Additional Recommendations. April 20, 2022.

DWR (Department of Water Resources). 2013. San Francisco Bay Hydrologic Region. California Water Plan Update 2013. State of California Natural Resource Agency Department of Water Resources, Sacramento, California.

Garwood, J. 2012. Historic and recent occurrence of coho salmon (Oncorhynchus kisutch) in California streams within the Southern Oregon/Northern California Evolutionarily Significant Unit. California Department of Fish and Game, Fisheries Branch Administrative Report.

Giudice, D., and M. Knechtle. 2021. Shasta River Salmonid Monitoring 2020. Siskiyou County, CA. California Department of Fish and Wildlife. Shasta River Report. Klamath River Project. May 3, 2021.

Good, T. P., R. S. Waples, and P. B. Adams. 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce. NOAA Technical Memorandum. NMFS-NWFSC-66. June. 598.

Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P Maurer, N.L Miller, S.C.Moser, S.H. Schneider, K.N. Cahill, E.E. Cleland, and L. Dale. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the national academy of sciences, 101(34), pp.12422-12427.

IPCC. 2019. IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)].

Kadir, T. & L. Mazur, C. Milanes, and K. Randles, (2013). 2013 Report: Indicators of Climate Change in California.

Lindley, Steven T., et al. 2007. Framework for assessing viability of threatened and endangered Chinook salmon and steelhead in the Sacramento–San Joaquin Basin. San Francisco Estuary and Watershed Science 5.1.

Lukk, A., P. Vasquez-Housley, R. Lusardi, and A. Willis. 2019. Little Shasta River 2017-2019: Pre-Project Assessment of the Proposition 1 Ecosystem Restoration Grant Activities. Report prepared for California Trout and California Wildlife Conservation Board.

Lytle, David A., and N. LeRoy Poff. 2004. Adaptation to natural flow regimes. Trends in Ecology & Evolution 19, no. 2:94-100.

Mack, S., 1960. Geology and ground-water features of Shasta Valley, Siskiyou County, California. US Government Printing Office.

McBain and Trush, I. 2013. Study plan to assess Shasta River salmon and steelhead recovery needs.(http://www.fws.gov/arcata/fisheries/reports/dataSeries/SVRCD%20Shasta%20River%20Final%20Study%20Plan.pdf).

McBain and Trush. 2014. Shasta Canyon IFN Final Report: Shasta River Canyon Instream Flow Needs Assessment. Prepared by McBain & Trush, Inc. and Department of Environmental Resources Engineering, Humboldt State University. Prepared for Ocean Protection Council and California Department of Fish and Game. March 7, 2014.

McElhany, P., M. H. Rucklelshaus, M. J. Ford, T.C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units.

Moyle, P. B. 2002. Inland fishes of California. University of California Press, Berkeley and Los Angeles, CA.

Moyle, P. B., R. A. Lusardi, P. J. Samuel, and J. V. E. Katz. 2017. State of the salmonids: status of California's emblematic fishes. Center for Watershed Sciences, University of California– Davis and California Trout, San Francisco, California.

Nichols, A., A. Willis, D. Lambert, E. Limanto, and M. Deas. 2016. Little Shasta River Hydrologic and Water Temperature Assessment: April to December 2015. Report prepared for The Nature Conservancy, California. April 2016.

National Marine Fisheries Service (NMFS). 2001. Status review update for coho salmon (*Oncorhynchus kistuch*) from the central California coast and the California portion of the Southern Oregon/Northern California coasts evolutionarily significant units (revision). 40.

National Marine Fisheries Service (NMFS). 2013. Informal consultation pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) and its implementing regulations (50 CFR Part 402) for the Shasta Valley Wildlife Area (SVWA) and the Horseshoe Ranch Wildlife Area. Consultation WR-2013-9686. November 22, 2013.

National Marine Fisheries Service (NMFS). 2014. Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (*Oncorhynchus kisutch*). National Marine Fisheries Service. Arcata, CA.

National Marine Fisheries Service (NMFS). 2018. Documentation of Endangered Species Act section 7 consultation (151401 WCR 20 l 8SR00005) for the issuance of the section 1 0(a)(l)(A) Enhancement of Survival Permit for the "Safe Harbor Agreement For Voluntary Habitat Enhancement Activities Benefitting Southern Oregon and Northern California Coast Coho Salmon (Oncorhynchus kisutch) on Private Lands in the Shasta Valley, Siskiyou County, California." Permit 21088 (151401 WCR2018SR00005) February 13, 2018.

Perry, R. W., J. C. Risley, S. J. Brewer, E. C. Jones, and D. W. Rondorf. 2011. Simulating daily water temperatures of the Klamath River under dam removal and climate change scenarios. 2331-1258.

PFMC (Pacific Fishery Management Council). 1998. Description and identification of essential fish habitat for the Coastal Pelagic Species Fishery Management Plan. Appendix D to Amendment 8 to the Coastal Pelagic Species Fishery Management Plan. Pacific Fishery Management Council, Portland, Oregon. December.

PFMC. 2005. Amendment 18 (bycatch mitigation program), Amendment 19 (essential fish habitat) to the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington groundfish fishery. Pacific Fishery Management Council, Portland, Oregon. November.

PFMC. 2007. U.S. West Coast highly migratory species: Life history accounts and essential fish habitat descriptions. Appendix F to the Fishery Management Plan for the U.S. West Coast Fisheries for Highly Migratory Species. Pacific Fishery Management Council, Portland, Oregon. January.

PFMC. 2008. Management of krill as an essential component of the California Current ecosystem. Amendment 12 to the Coastal Pelagic Species Fishery Management Plan. Environmental assessment, regulatory impact review & regulatory flexibility analysis. Pacific Fishery Management Council, Portland, Oregon. February.]

PFMC. 2014. Appendix A to the Pacific Coast Salmon Fishery Management Plan, as modified by Amendment 18. Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon.

United States Bureau of Reclamation (Reclamation). 2020. 2020 Drought Plan, Klamath Project, Oregon-California Interior Region 10, California-Great Basin. U.S. Department of the Interior. April 2020.

Richter, B., J. Baumgartner, R. Wigington, and D. Braun. 1997. How much water does a river need? Freshwater Biology, *37*(1), pp.231-249.

Sandercock, F. K. 1991. Life history of coho salmon (*Oncorhynchus kisutch*) Pages 397-445 *in* C. Groot, and L. Margolis, editors. Pacific Salmon Life Histories. University of British Columbia Press, Vancouver, B.C.

Spence, B. C., G. A. Lomnicky, R. M. Hughes, and R. P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. December. 356.

Trush, W.J., S.M. McBain, and L.B. Leopold. 2000. Attributes of an alluvial river and their relation to water policy and management. Proceedings of the National Academy of Sciences, 97(22), pp.11858-11863.

Weitkamp, L., A., T. C. Wainwright, G. J. Bryant, G. B. Milner, D. J. Teel, R. G. Kope, and R. S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. NOAA Technical Memorandum, NMFS-NWFSC-24.

Westerling, A.L., B.P. Bryant, H.K. Preisler, T.P. Holmes, H.G. Hidalgo, T. Das, S.R. Shrestha. 2011. Climate change and growth scenarios for California wildfire. Climate Change 109(1):445-463.

Whelan, Jim. 2006. California Department of Fish and Game (CDFG). Memo to Files from Jim Whelan, Siskiyou County Resource Assessment Northern California-North Coast Region Department of Fish and Game. June 23. CDFG, 2012.

Williams, T. H., E. P. Bjorkstedt, W. G. Duffy, D. Hillemeier, G. Kautsky, T. E. Lisle, M. McCain, M. Rode, R. G. Szerlong, R. S. Schick, M. N. Goslin, and A. Agrawal. 2006. Historical Population Structure of Coho Salmon in the Southern Oregon/Northern California Coasts Evolutionarily Significant Unit. Santa Cruz, CA. NOAA-TM-NMFS-SWFSC-390, 84.

Williams, T.H., B. Spence, W. Duffy, D. Hillemeier, G. Kautsky, T. Lisle, M. McCain, T. Nickelson, E. Mora, and T. Pearson. 2008. Framework for assessing viability of threatened coho salmon in the Southern Oregon / Northern California Coasts Evolutionarily Significant Unit. NOAA Technical Memorandum NMFS-SWFSC-432.

Williams, T.H., S.T. Lindley, B.C. Spence, and D.A. Boughton. 2011. Status Review Update for Pacific Salmon and Steelhead Listed Under the Endangered Species Act: Southwest. May 17, 2011 – Update to 5 January 2011 report. National Marine Fisheries Service Southwest Fisheries Science Center. Santa Cruz. CA.

Williams, T. H., N. Mantua, A. Van Atta, J. Ly, Z. Ruddy, and J. Weeder. 2016a. 2016 5-Year Review: Summary & Evaluation of Southern Oregon/Northern California Coast Coho Salmon.

Williams, T. H., B. C. Spence, D. A. Boughton, R. C. Johnson, L. Crozier, N. Mantua, M. O'Farrell, and S. T. Lindley. 2016b. Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. 2 February 2016 Report to National Marine Fisheries Service – West Coast Region from Southwest Fisheries Science.

Willis, Ann. 2022. Personal communication RE: information on dissolved oxygen concentrations found during surveys of the Little Shasta River. Communication to Asil Donna (NOAA Affiliate) from A. Willis (UC Davis), 8/25/2022.

Yarnell, S., A.Willis, R. Lusardi, and R. Peek. 2022. Applying the California Environmental Flows Framework (CEFF) to Little Shasta River. Center for Watershed Sciences, University of California, Davis. September 2022.