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

October 3, 2016

In response refer to:
2016-4152

Chris Quiney
Branch Chief
North Region Office of Environmental—R1 Branch
California Department of Transportation
1031 Butte Street MS 30
Redding, California 96001

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Klamath River Bridge Replacement Project, Siskiyou County, California (EA 02-2E480)

Dear Mr. Quiney:

Thank you for your July 15, 2016, letter requesting initiation of 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.) received in this office July 21, 2016, for the Klamath River Bridge Replacement Project, California Department of Transportation (Caltrans) reference, EA 02-2E480).

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 (MSA)(16 U.S.C. 1855(b)) for this action.

This letter transmits NMFS' final ESA Section 7(a)(2) biological opinion and the MSA EFH consultation for the Caltrans proposed Project located in the Mid-Klamath River Basin, Siskiyou County, California. Caltrans is the designated representative for the Federal Highway Administration (FHWA), which is funding and responsible for carrying out the Project.

The enclosed biological opinion is based on NMFS' review of information provided within Caltrans' July 15, 2016, request for formal consultation, biological assessment, and additional information provided by NMFS to Caltrans and by Caltrans to NMFS. Additionally, stock assessment information provided by US Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW) from juvenile and adult salmon trapping programs provided both transit timing and abundance refinement of several salmonid life stages, as well as hatchery operation practices and salmonid release and return abundances from Iron Gate Hatchery.

The enclosed biological opinion addresses potential adverse effects on the following listed species and designated critical habitat in accordance with section 7 of the ESA of 1973, as amended (16 U.S.C. 1531§ *et seq.*):

Southern Oregon/Northern California Coast (SONCC) evolutionarily significant unit (ESU) of coho salmon (*Oncorhynchus kisutch*)

- Threatened (70 FR 37160; June 28, 2005)
- Designated critical habitat (64 FR 24049; May 5, 1999)

Based on the best scientific and commercial information available, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of the SONCC coho salmon ESU and is not likely to result in the destruction or adverse modification of designated critical habitat for the species. NMFS expects the proposed action will result in incidental take of SONCC coho salmon. An incidental take statement is included with the enclosed biological opinion. The incidental take statement includes non-discretionary reasonable and prudent measures and terms and conditions that are expected to further reduce anticipated incidental take of SONCC coho salmon.

The proposed action includes areas identified as EFH for coho salmon and Chinook salmon, Pacific salmon species managed under the Pacific Coast Salmon Fishery Management Plan (*revised through* Amendment 18, 2014). Based on our analysis, NMFS concludes that the project would adversely affect EFH for Pacific salmon. The proposed action contains measures to minimize adverse effects to EFH and NMFS provides additional Conservation Recommendations to further minimize adverse effects. Caltrans as the action agency, is required by section 305(b)(4)(B) of the MSA, to provide a detailed response in writing to NMFS within 30 days after receiving EFH Conservation Recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH; or if the response is inconsistent with the Conservation Recommendation, Caltrans must provide justification for any disagreements with NMFS over anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

NMFS appreciates Caltran's close and sustained coordination and collaboration throughout the consultation period. Please contact Rebecca Bernard at (707) 825-1622, Northern California Office, Arcata, or via email at rebecca.bernard@noaa.gov if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

Barry A. Thom
Regional Administrator

Enclosures

cc: Keith Pelfrey, Senior Resource Biologist, District 2, Redding, CA
Chelsea Tran-Wong, Associate Environmental Planner, District 2, Redding, CA
Administrative file: 151422WCR2016AR00059

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act (MSA) Essential Fish Habitat Consultation

Klamath River Bridge Replacement Project, Siskiyou County, California

National Marine Fisheries Service (NMFS) Consultation Number: WCR-2016-4152

Action Agency: California Department of Transportation (Caltrans)

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/North California Coast (SONCC) evolutionary significant unit (ESU) of coho salmon (*Oncorhynchus kisutch*)	Threatened	Yes	No	Yes	No

Fishery Management Plan (FMP) That Describes Essential Fish Habitat (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:

Barry A. Thom
Regional Administrator

Date: **October 3, 2016**

TABLE OF CONTENTS

TABLE OF CONTENTS....2
LIST OF ACRONUMS AND ABBREVIATIONS USED....4
1. INTRODUCTION....6
1.1 Background....6
1.2 Consultation History....6
1.3 Proposed Federal Action....7
1.3.1 Culverts....12
1.3.2 Water Drafting....17
1.3.3 Access Roads....17
1.3.4 Vegetation Removal....17
1.3.5 Temporary Work Trestles....18
1.3.6 Steel H-pile Installation for Temporary Trestles....21
1.3.7 Falsework....23
1.3.8 Abutment, Retaining Wall, and Pier Foundation....23
1.3.9 Rock Slope Protection (RSP)....24
1.3.10 Demolition of Existing Bridge Piers and Abutments....24
1.3.11 Staging Areas....25
1.3.12 Construction Waste....25
1.3.13 Avoidance, Minimization, and Conservation Measures 25
1.3.14 Construction Schedule....29

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT....31

2.1 Analytical Approach....32
2.2 Rangewide Status of the Species and Critical Habitat....33
2.2.1 SONCC Coho Salmon General Life History....34
2.2.1.1 Periodicity of Coho Salmon 35
2.2.1.2 Adult Migration and Spawning 35
2.2.1.3 Egg Incubation and Fry Emergence 36
2.2.1.4 Fry 36
2.2.1.5 Parr (sub-yearling) 37
2.2.1.6 Juvenile Rearing 38
2.2.1.7 Juvenile Outmigration 38
2.2.2 Status of SONCC Coho Salmon....39
2.2.2.1 Current Spatial Structure and Distribution 42
2.2.2.2 Current Abundance 43
2.2.2.3 Current Population Productivity 43
2.2.2.4 Current Diversity 44
2.2.3 Status and Description of SONCC Coho Salmon Critical Habitat....45
2.2.3.1 Current Condition of the Critical Habitat 45
2.2.4 Factors Responsible for Decline of SONCC Coho Salmon and Critical Habitat Status....46
2.3 Action Area....48

2.4.1 Status of SONCC Coho Salmon in the Action Area ... 51
2.4.1.1 Upper Klamath River Coho Salmon Population 52
2.4.1.2 Shasta River Coho Salmon Population 56
2.4.2 Status of SONCC Coho Salmon Critical Habitat in the Action Area ... 60
2.4.3 Factors Affecting SONCC Coho Salmon Critical Habitat in the Action Area ... 64
2.5 Effects of the Action ... 67
2.5.1 Effects Related to Individual SONCC Coho Salmon ... 68
2.5.1.1 Sediment and Turbidity 69
2.5.1.2 Crushing 72
2.5.1.3 Hydroacoustic Effects 73
2.5.1.4 Fish Passage 75
2.5.1.5 Entrainment and Stranding 76
2.5.1.6 Stormwater Runoff 77
2.5.1.7 Contaminants 78
2.5.1.8 Riparian Vegetation Removal 78
2.5.1.9 Habitat Loss 79
2.5.2 Effects Related to SONCC Coho Salmon Critical Habitat ... 80
2.5.2.1 Juvenile and Adult Migration Corridor 81
2.5.2.2 Sedimentation 81
2.5.2.3 Vegetation Removal 81
2.6 Cumulative Effects ... 81
2.7 Integration and Synthesis ... 82
2.8 Conclusion ... 83
2.9 Incidental Take Statement ... 83
2.9.1 Amount or Extent of Take ... 83
2.9.2 Effect of the Take ... 85
2.9.3 Reasonable and Prudent Measures ... 85
2.9.4 Terms and Conditions ... 85
2.10 Conservation Recommendations ... 87
2.11 Reinitiation of Consultation ... 87

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION ... 87

3.1 Essential Fish Habitat Affected by the Project ... 88
3.2 Adverse Effects on Essential Fish Habitat ... 92
3.3 Essential Fish Habitat Conservation Recommendations ... 94
3.4 Statutory Response Requirement ... 95
3.5 Supplemental Consultation ... 95

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW ... 95

4.1 Utility ... 95
4.2 Integrity ... 96
4.3 Objectivity ... 96

6. REFERENCES ... 96

LIST OF ACRONUMS AND ABBREVIATIONS USED

Abbreviation	Definition
μPa	micro-Pascal
$μPa^2$*sec	micro-Pascal squared per second
BA	biological assessment
BMPs	best management practices
BCFCF	Bogus Creek Fish Counting Facility
Caltrans	California Department of Transportation
CDFW	California Department of Fish and Wildlife
CMP	corrugated metal pipe
cfs	cubic feet per second
dB	decibels
DBH	diameter at breast height
EFH	essential fish habitat
EFHA	essential fish habitat assessment
ESA	Endangered Species Act
ESU	evolutionary significant unit
FHWA	Federal Highway Administration
FMP	Fishery Management Plan
ft/s	feet per second
FHWG	Fisheries Hydroacoustic Working Group
I-5	United States Interstate 5
L_{PEAK}	peak sound pressure level
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
OHWM	ordinary high water mark
PAHs	polycyclic aromatic hydrocarbons
PBF	physical and biological features
PCE	primary constituent elements
PFMC	Pacific Fisheries Management Council
PIT tag	passive integrated transponder tag
PM	post mile
RM	river mile
RMP	re-vegetation and monitoring plan
RMS	root mean square pressure
RSP	rock slope protection
SEL	sound exposure level
$SEL_{ACCUMULATED}$	accumulated sound exposure level (underwater sound pressure exposure through a pile driving event (e.g., 1 day of pile driving)
$SEL_{CUMULATED}$	cumulated Sound Exposure Level ($SEL_{cumulative} = SEL_{single\ strike} + 10 \log$ (# of pile strikes))
SONCC coho salmon	Southern Oregon/Northern California Coast coho salmon
SRFCF	Shasta River Fish Counting Facility
SPL	sound pressure level

SR	state route
SWPPP	Storm Water Pollution Prevention Plan
TMDL	total maximum daily load
UKTR Chinook salmon	Upper Klamath-Trinity Rivers Chinook salmon
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VSP	viable salmon population

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

The 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.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with the section 305(b)(2) of the Magnusson-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 (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System at, https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts. A complete record of this consultation is on file at the NMFS Northern California Office in Arcata, California.

1.2 Consultation History

On July 2, 2015, Caltrans requested an initial list of species that may occur within the Project action area. NMFS responded via email on July 15, 2015, providing Caltrans with a list of relevant species and source reference information. NMFS subsequently followed up on Caltrans' species list request with an official species list dated on October 10, 2015.

On December 14, 2015, NMFS prepared and subsequently provided a life history table and potential fish exposure to Caltrans depicting life stage presence and enumerating the potential average monthly abundance of coho and Chinook salmon transiting through the proposed Project action area at specific life stages.

On January 22, 2016, NMFS received Caltrans' request to initiate formal ESA consultation and request for MSA EFH consultation.

On February 22, 2016, NMFS provided a letter to Caltrans stating that insufficient information exists in the Project biological assessment (BA) and EFH assessment (EFHA) to discern Project effects to identified ESA listed and MSA managed species.

On March 30, 2016, NMFS met with Caltrans staff to discuss the questions posed in NMFS' February 22, 2016 letter that indicated there was not enough information to initiate consultation. Caltrans indicated that an updated BA would be provided addressing NMFS questions and concerns about the project as presented in the BA; in particular pile driving effects to both natural-origin and hatchery-origin species managed under ESA and the MSA. The potential for need of a Southern Resident Killer Whale consultation was discussed because of the potential juvenile Chinook salmon impacts related to pile driving activities.

Between April 21, 2016 and July 7, 2016, NMFS reviewed and commented on several draft BA's provided by Caltrans.

On July 21, 2016, NMFS received Caltrans request to initiate formal ESA consultation as well as a request to initiate MSA EFH consultation.

On August 3, 2016, NMFS provided a letter indicating the consultation package contained sufficient information in order to initiate formal consultation on the Project.

On August 22, 2016, Amber Kelley met with NMFS to discuss this consultation and the need for an expedited opinion.

This opinion is based on information provided to NMFS by Caltrans with the submittal of a BA, EFHA, and subsequent clarifying information. NMFS also considered other sources of scientific and commercial information, including journal articles and technical reports, unpublished data, and personal communications.

1.3 Proposed Federal Action

"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).

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).

Caltrans proposes to construct a new bridge (Figure 1) over the Klamath River on a new alignment approximately 156 feet west of the existing bridge, as measured from the south bank, and approximately 290 feet west of the existing bridge, as measured from the north bank. This proposed bridge replaces the existing State Route (SR) 263 Bridge (Figure 2) that crosses the Klamath River at the intersection with SR 96, at approximately river mile (RM) 176.8.

Caltrans considered three project alternatives (Caltrans 2016) during project development and settled on the preferred alternative (Alternative 3), to construct a bridge replacement on a new alignment and remove the existing bridge. The proposed arch bridge with slab superstructure design will span the entire Klamath River (Figures), and limits extensive work in the waterway, below the ordinary high water mark (OHWM) while achieving other project goals (Table 1).

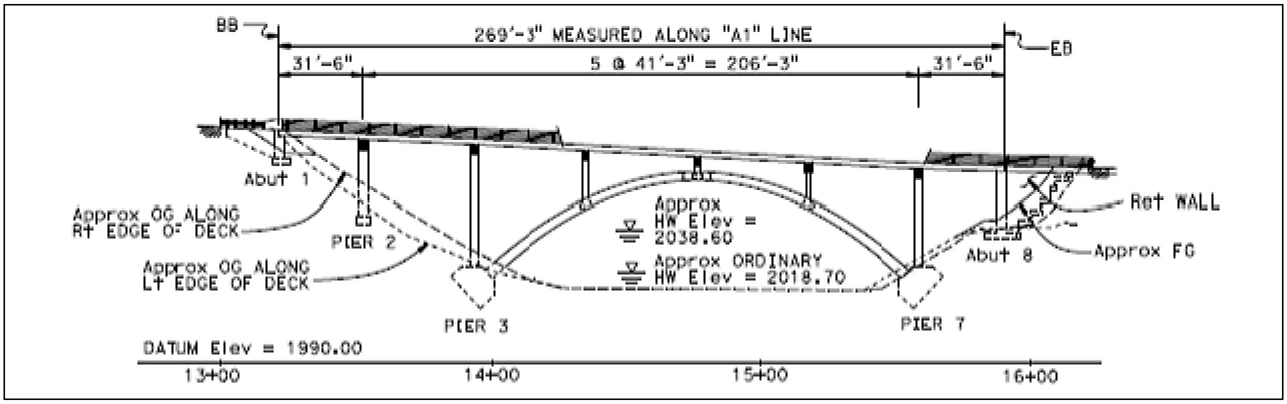

Figure 1. Proposed arch bridge profile and grade (Caltrans 2016).

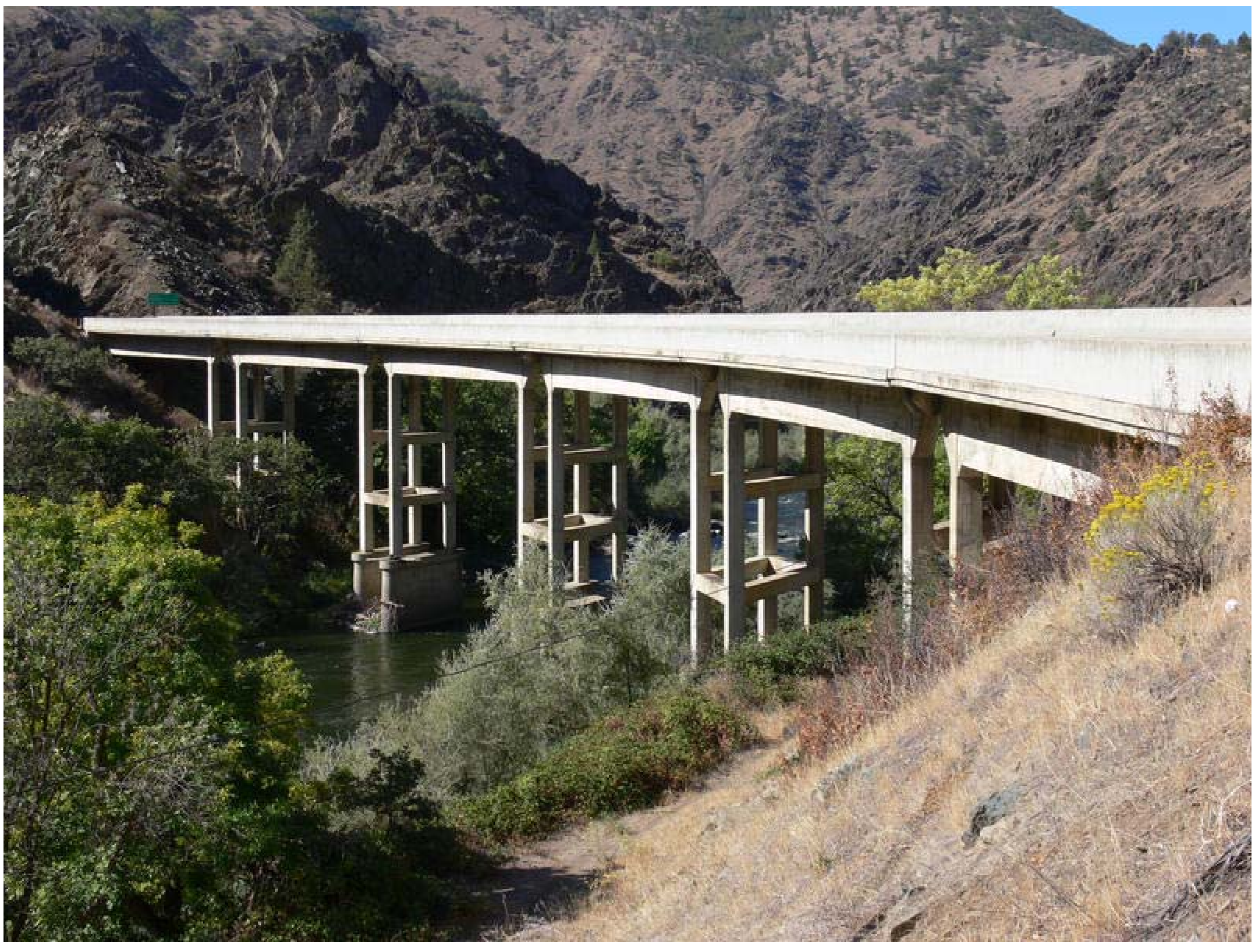

Figure 2. Existing SR 263 bridge over the Klamath River (Caltrans 2016).

The proposed Project is located in Siskiyou County, between the town of Yreka and the intersection with SR 96 west of U.S. Interstate 5 (I-5) (SR 263 at post miles (PM) 56.5/57.8 and at SR 96 PM 102.5/103.5), within the Mid-Klamath River Basin (Figure 3). The proposed, new bridge will rise approximately 50 feet above the Klamath River and will have a 155 to 165 foot arch-span, completely spanning the active channel. The proposed bridge will be approximately 269 feet in length and wide enough to accommodate two, 12-foot wide lanes with eight-foot shoulders, as well having a modified barrier railing to accommodate bicycle travel. A “T” intersection will be created at the junction of SR 263 and SR 96 to accommodate turns for large trucks. The proposed is bridge is shorter, but wider than the existing bridge to accommodate larger trucks as well as non-motorized travel on the shoulders (Table 2).

Table 1. Summary of existing and proposed bridge foundation footprint area (Caltrans 2016).

Existing Bridge Structure	Existing Bridge Area ($feet^2$)	Proposed New Bridge Structure	Proposed Bridge Area ($feet^2$)
Abutment 1 (south abutment)	128	Abutment 1 (south abutment)	480
Pier 2 (tower of 4 columns on 2 pier walls)*	256	Pier 2 (composed of 2 columns)*	20
Pier 3 (tower of 4 columns on 2 pier walls)**	256	Pier 3 (composed of 2 columns)*	96
Pier 4 (tower of 4 columns on 2 pier walls)**	256	Pier 4 (spandrel Pier 4)	0
Pier 5 (tower of 4 columns on 2 pier walls)*	256	Pier 5 (spandrel Pier 5)	0
Pier 6 (tower of 4 columns)	16	Pier 6 (spandrel Pier 6)	0
Abutment 7 (north abutment)	128	Pier 7 (composed of 2 columns)*	96
		Abutment 8 (north abutment)	480
Total	1,296	Total	1,172

*Within riparian zone.
**Below channel bed

Table 2. Summary of existing and proposed bridge dimensions (Caltrans 2016).

Bridge	Dimensions			
	Length (feet)	Width (feet)	Area ($feet^2$)	Area (acres)
Existing	468.17	27.5	12,875	0.2936
Proposed*	269.25	44.0–92.83	15,123	0.3472

Construction of the proposed Project is expected to begin in 2019 and will require two to three work seasons in order to complete all construction activities. In-water activities will occur during the dry season (June 1–October 31). In-water construction activities are expected to be conducted during two discrete periods: the first in-water work period is expected to span 20 weeks, from June 1 through October 31 of the first construction season, and the second in-water work period is expected to span 12 weeks, from August 1 through October 31 of the second construction season. Further, impact pile driving will be confined to July 1 through August 31 to allow for juvenile salmonid clearance through the Project action area as suggested by NMFS and agreed to by Caltrans. Project actions take place instream, in riparian areas, and upland areas.

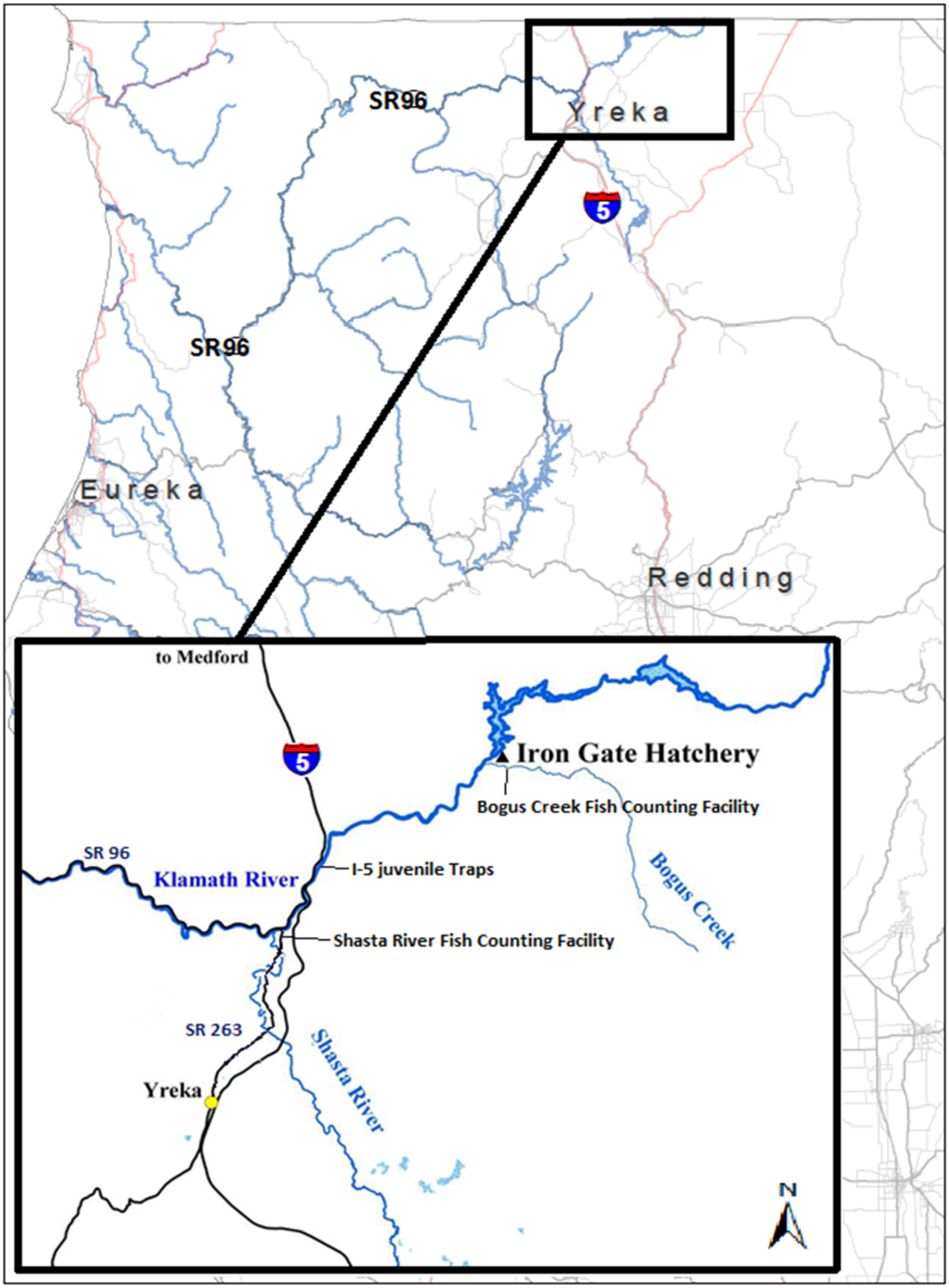

Figure 3. Project location map with identified stock assessment reference sites (inset is based on Knechtle and Chesney 2016).

Detail Summary of the Proposed Action (Caltrans 2016)

- The new bridge will rise approximately 50 feet above the Klamath River and has a 155 to 165-foot arch span (Figure 1 and 4).
- The bridge will be a single 269-foot long arch bridge (Figure 1) with reinforced concrete slab that spans the entire river with no piers in the water below OHWM (Figure 4).
- The width of the bridge will vary from 44 feet on average, to approximately 93 feet at the north abutment (flared intersection) (Figure 4).
- The new bridge will be wide enough to accommodate two 12-foot wide lanes and two eight-foot wide shoulders.
- A T-intersection will be created at the junction of SR 263 and SR 96 to accommodate turns for large Surface transportation Assistance Act trucks as well as legal or permit loads (Figure 4).
- Grading for up to 1,000 feet of roadway construction at the north and south ends of the bridge involves approximately 38,600 cubic yards of excavation, removing a portion of a southerly ridge of rock and grading up to 4 feet deep below the average existing ground elevations on the north side of the project (Figures 4, 5, and 6).
- Existing culverts will either be abandoned (two) or replaced (one) and new culverts (four) will be installed if needed to provide for adequate drainage design (Table 3).
- The deck will have a polyester concrete overlay.
- Type ST-20 bridge barriers modified with bicycle railing will be used. The concrete barrier is attached to the bridge.
- Abutment 1 and Abutment 8 with associated retaining walls will be founded on spread footings. The retaining walls associated with Abutment 8 will be approximately 120 to 130 feet long each and up to two feet thick. These walls will be placed on spread footings and have a maximum height of approximately 24 feet.
- Pier 2 will be supported by two columns on spread footings. Pier 2 is required due to the length of the span between Pier 3 and Abutment 1.
- Piers 3 and 7 consist of two columns each. These columns will be supported by thrust blocks. Micropiles may be required to be installed below each thrust block for support, and anchor rods are installed to connect the thrust block to the arch. Each of the piers will need up to 12 micropiles.
- The arch will be placed on top of the shared thrust blocks. It will consist of four sections. Each arch will be approximately four feet thick at the base.
- Spandrel Piers 4, 5, and 6 will be constructed. The spandrel is the area above the arch and below the bridge deck.
- RSP will be placed in front of Abutments 1 and 8 and associated retaining walls. RSP may also be required around Piers 2, 3, and 7. The RSP will be approximately three feet thick. The toe of the RSP will be “keyed-in” approximately five feet deep. Placement of RSP will require excavation, and excavation may require driven sheet piles to be used as cofferdams.
- A Baker tank (portable settling tank) or a settling basin outside the river or in an adjacent upland area may be employed for the dewatering of cofferdams or casings.
- Falsework will be required in the Klamath River to support the new bridge while it is being constructed and will be removed after the new bridge is completed. The temporary falsework may be required to be left in the river over a single winter.

- The temporary work trestle over Klamath River required to facilitate construction and demolition of the existing bridge will be removed after the new bridge is completed and the old bridge is removed. If required to be left in the river over the winter, the deck of the temporary trestle will be removed during the rainy season so the structure does not interfere with high flows.
- Temporary access roads will be required to access work below the bridge. Construction of these temporary access roads will most likely take place in existing dirt road or driveway. Excavation of these roads may require grading up to four feet deep to push out high spots or fill in the low spots. These roads will have an overall width of approximately 25 feet.
- The existing bridge will be removed after the new bridge is completed.
- Cranes will be used to remove concrete and steel pieces from the existing structure (deck, abutments, abutment foundation, piers, pier foundation, and etc.) that have been sawed or parted with a hydraulic beaker. Excavation up to three feet deep will be required prior to the removal of the abutments. Excavation up to five feet deep will be required prior to the removal of the piers.
- Relocation of existing overhead electrical utilities is anticipated. Caltrans will coordinate with the utility companies for the final design information including location, number and type of conduits, and contact persons for coordination.

Additionally, Caltrans will implement a revegetation and monitoring plan; and mitigate the expected incident take of the state listed species, SONCC ESU of coho salmon resulting from proposed project activities.

1.3.1 Culverts

SR 96 will be widened to construct the proposed T-intersection at SR 263 and SR 96 (Figure 3) to accommodate turns for large Surface Transportation Assistance Act trucks and new road drainage culvert will be needed to support stormwater runoff. These culverts will drain from the inside road shoulder and underneath the road. There are three existing road drainage culverts in the Project action area (Table 3) of which, two will be abandoned and one will be replaced to provide for adequate drainage design. A total of four new culverts needed to convey stormwater runoff from the road have been proposed for installation. The replacement of an existing culvert and installation of the new culverts will be completed above OHWM and from the roadway. All the new culvert outlets will be protected by RSP. Placement of RSP at two of the culverts will permanently impact approximately 200 square feet of riparian vegetation. Stormwater runoff from the existing bridge drains directly into the river from bridge scuppers. The proposed bridge will not have scuppers, instead, stormwater runoff will be directed to culverts where RSP will act as a filtration barrier.

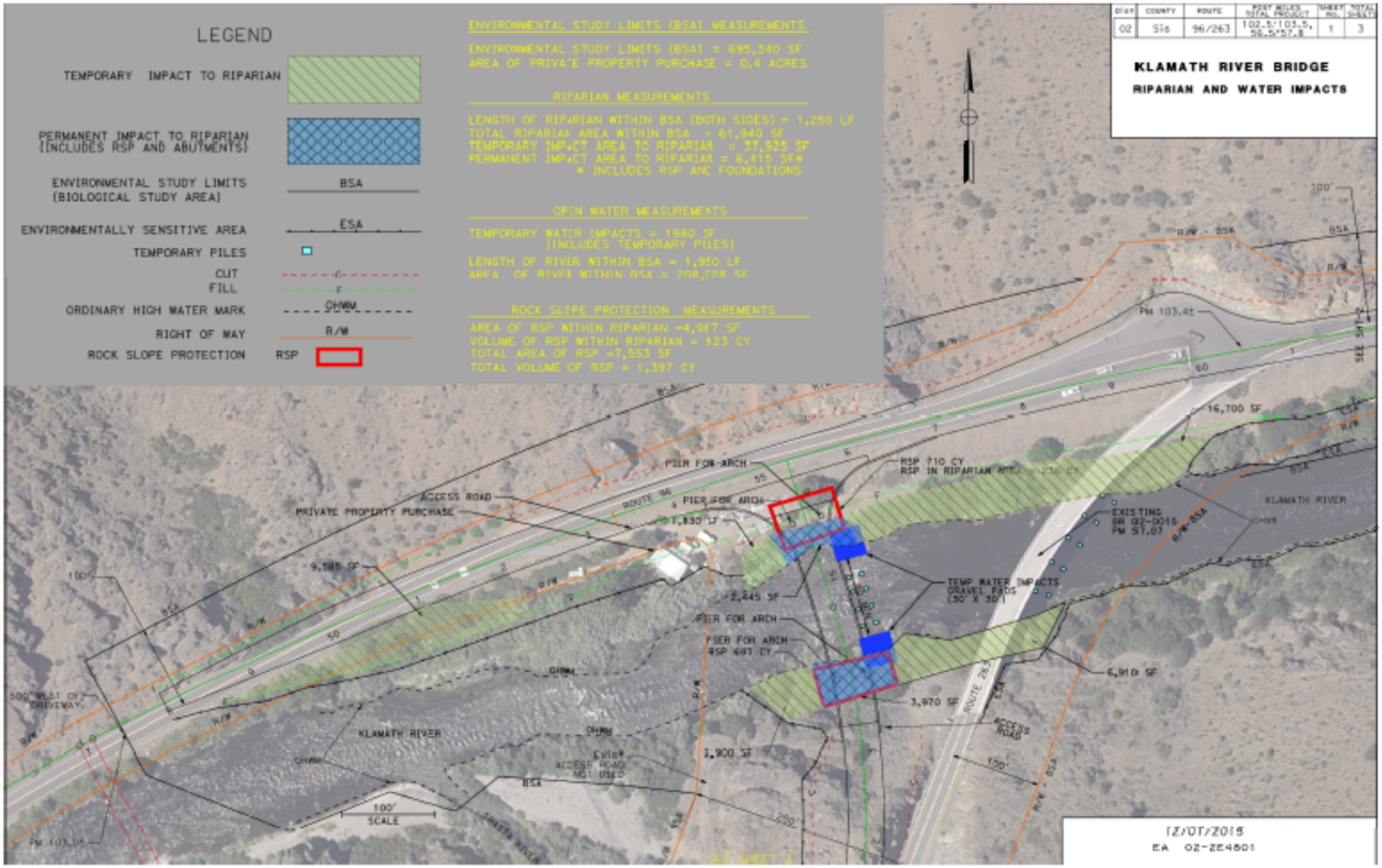

Figure 4. Riparian and water impacts of Klamath River Bridge on SR 263 at SR 96, and new alignment plans for proposed bridge replacement (Caltrans 2016).

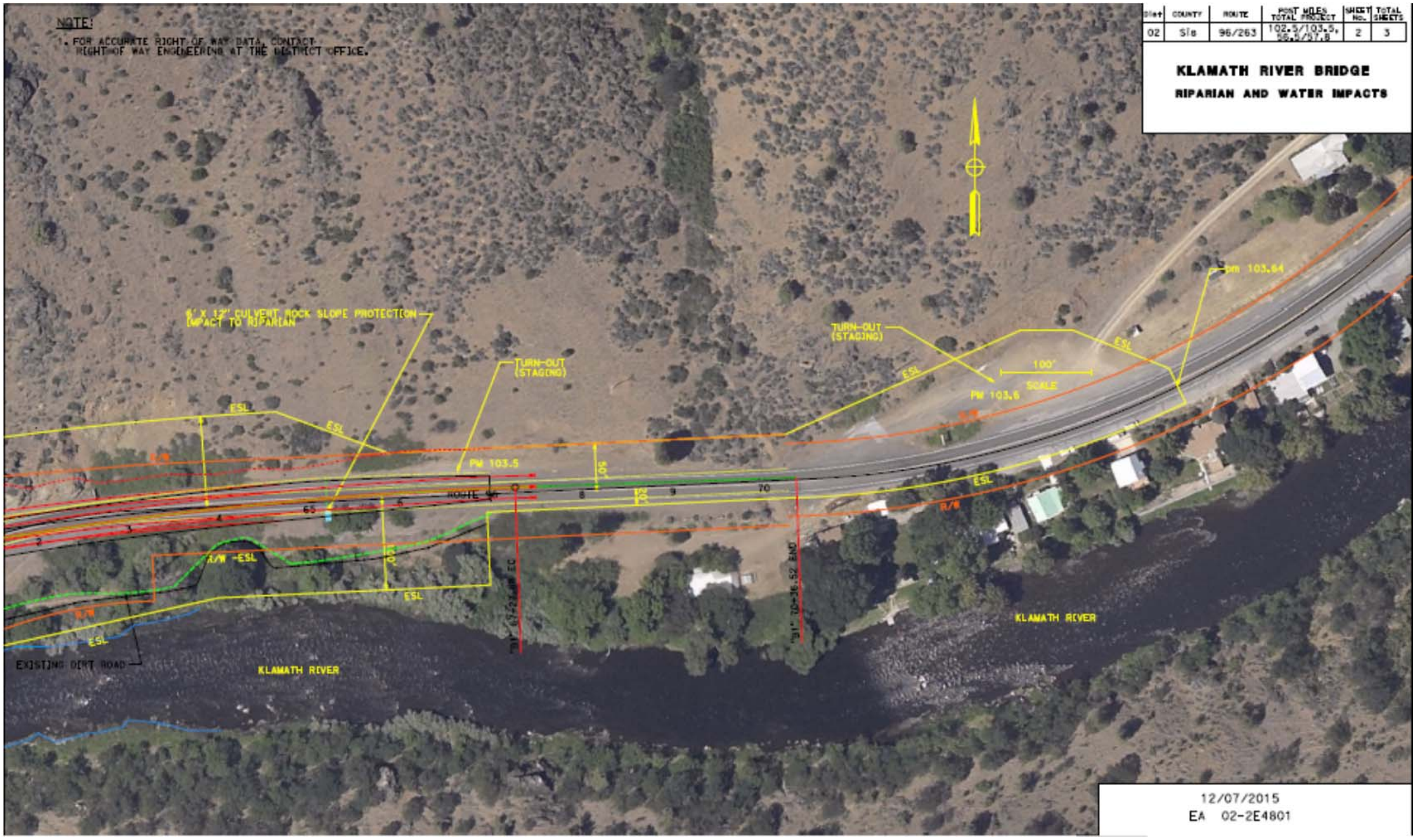

Figure 5. Riparian and upland impacts of staging areas on SR 96 (Caltrans 2016).

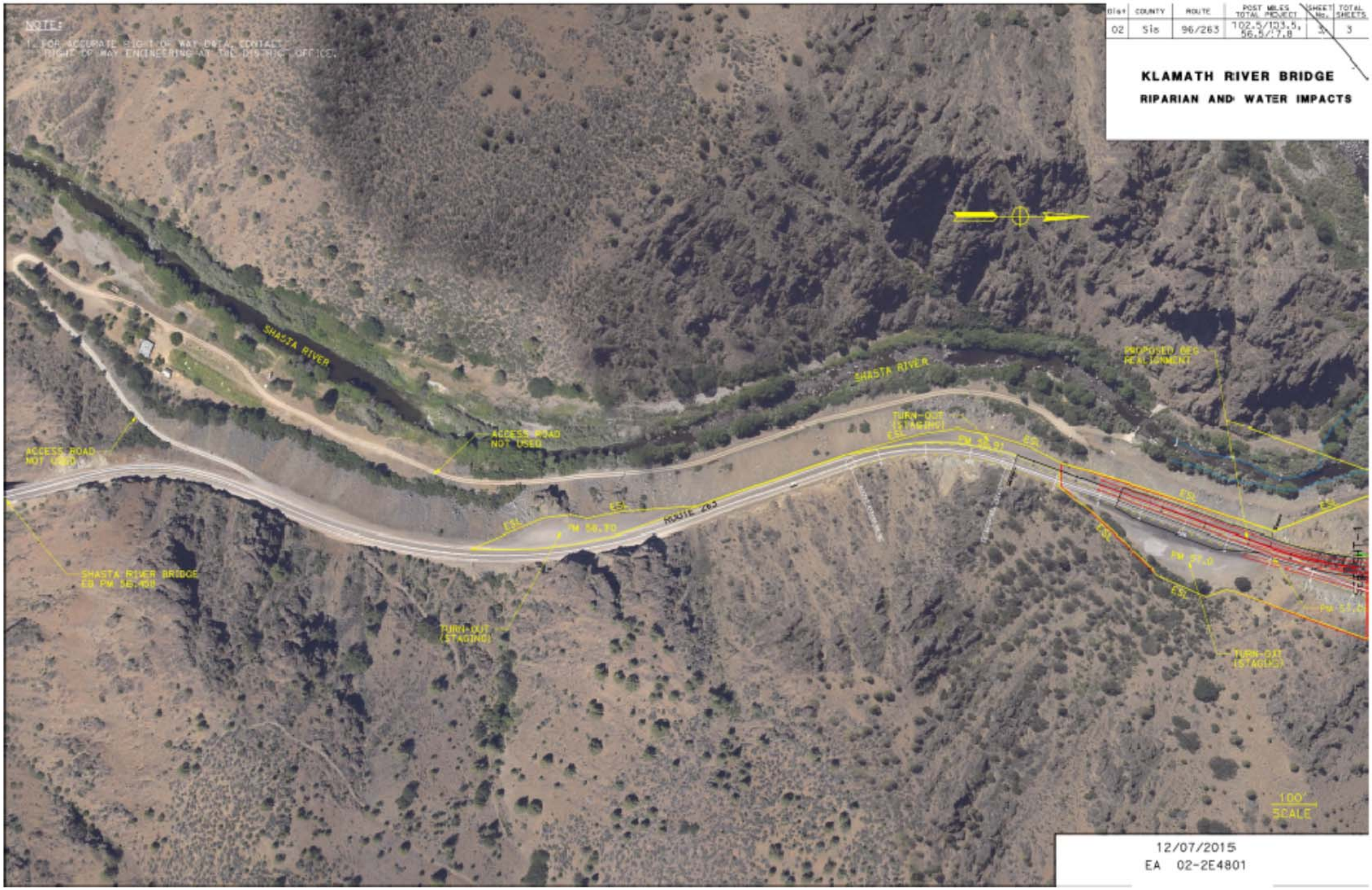

Figure 6. Riparian and upland impacts of staging areas and bridge approach for the Klamath River Bridge on SR 263 (Caltrans 2016). Note: Shasta River to the west, paralleling SR 263.

Table 3. Proposed culvert work. PM=post mile, CMP=corrugated metal pipe (Caltrans 2016).

Culvert Number	Route, PM	Type	Existing Diameter	New Diameter	Existing Condition	Proposed Work	Description of Stormwater Management Work
1	SR 96, PM 103.21	CMP	unknown	24 inches	Poor	Replace	Provide cross-drainage for surface water that flows toward SR 96 from the north. This cross-drainage culvert will pass this surface water from north side of SR 96 to south side of SR 96.
2	SR 96, PM 103.24	CMP	30 inches	Abandon	Good	Abandon (due to slope/configuration)	Remove inefficient cross drainage system
3	SR 96, PM 103.27	CMP	N/A	24 inches	N/A	New Culvert	Provide cross-drainage for surface water that flows toward SR 96 from the north. This cross-drainage culvert will pass this surface water from north side of SR 96 to south side of SR 96.
4	SR 96, PM 103.29	CMP	N/A	24 inches	N/A	New Culvert	Provide cross-drainage for surface water that flows toward SR 96 from the north. This cross-drainage culvert will pass this surface water from north side of SR 96 to south side of SR 96.
5	SR 96, PM 103.31	CMP	N/A	24 inches	N/A	New Culvert	Provide cross-drainage for surface water that flows toward SR 96 from the north. This cross-drainage culvert will pass this surface water from north side of SR 96 to south side of SR 96.
6	SR 96, PM 103.49	CMP	18 inches	Abandon	Fair	Abandon	Remove inefficient cross drainage system.
7	SR 96, PM 103.49	CMP	N/A	24 inches	N/A	New Culvert	Provide cross-drainage for surface water that flows toward SR 96 from the north. This cross-drainage culvert will pass this surface water from north side of SR 96 to south side of SR 96.

1.3.2 Water Drafting

Some minimization measures in the Storm Water Pollution Prevention Plan (SWPPP) (Caltrans 2011) require wetting of stock piles, disturbed areas, and road surfaces for dust abatement and erosion control. Water will likely be drafted from the Klamath River. Should water drafting become necessary for dust suppression or other activities, it will be conducted in accordance with NMFS (2001b) guidelines for water drafting.

Water is expected to be drafted from the Klamath River in the vicinity of the proposed new bridge abutments on either side of the river. A maximum 20,000 gallons of water per day may be drafted daily for major earthwork compaction operation and up to 3,000 gallons daily for concrete curing operations (C. Quiney pers. comm. 2016). During earthwork operations, it may be necessary to draft water up to six times daily, between the hours of 6 a.m. and 7 p.m., from April through October (C. Quiney pers. comm. 2016). When concrete is poured for the new bridge, water drafting may be needed daily during that period up to three times daily in smaller amounts (C. Quiney pers. comm. 2016). During earthwork operations, water would be drafted at a rate of no more than 75 gallons per minute, or 0.167 cubic feet per second (cfs) (C. Quiney pers. comm. 2016). If needed for concrete curing, the maximum rate would be approximately 5 gallons per minute, or 0.011 cfs (C. Quiney pers. comm. 2016).

1.3.3 Access Roads

Temporary access roads will be required to access work below bridge. Proposed, temporary roads will likely be located on the southwest and northwest sides of the new bridge (Figure 3), with an overall with of approximately 25 feet Construction of temporary access roads will primarily incorporate existing dirt roads or driveways. Roads will be graded, then rocked and stabilized prior to use to prevent sediments mobilization, and vehicle furrowing that could cause sediment delivery to the river. Grading for the newly constructed temporary access roads may require grading up to four feet deep to push out high spots or to fill in low spots. Minor vegetation will be removed as needed to gain access for bridge construction.

1.3.4 Vegetation Removal

Minor removal of riparian vegetation will be needed to use the temporary access roads, construct the new bridge abutments and Piers 2, 3, and 7, and the removal of the existing abutments and piers. Removal of the existing Piers 2 and 5 will provide an additional area of 512 square feet within the action area for possible replanting of riparian species. Removal of an existing home and outbuildings directly in the way of the new bridge could provide up to 0.40 acres of onsite replanting opportunity in the northwest quadrant. A proposed re-vegetation and monitoring plan has been prepared to address potential impacts to riparian habitats and identify and map the riparian habitat within the action area proposed for re-vegetation following construction. Any areas of the river banks that are disturbed during construction would be returned to as near pre-construction conditions as feasible. Trees and shrubs proposed for removal are in locations that conflict with the proposed new bridge structure, and in locations where access is necessary to safely facilitate the removal of the existing bridge structure. These trees and shrubs are located along the banks of the Klamath River. Most of these trees have the potential to provide shade to the stream and contribute nutrients to the stream. Their diameter at breast height (dbh) ranges from approximately two inches to 14 inches. Approximately 30 trees will be removed for the entire project (Table 4). Where feasible, rapidly sprouting plants, such as willows, will be cut off at ground level and the root system left intact to promote regeneration.

1.3.5 Temporary Work Trestles

Temporary work platforms (trestles) are required for construction of the proposed bridge and removal of the existing bridge. The trestles will be elevated and supported on temporary piles to maintain water flows. A total of two trestles will be used in the construction of the proposed bridge and removal of the existing bridge. Likely, one trestle will be constructed in 2019, and the other will likely be constructed in 2020. Both trestles would be constructed during the in-water work window between June 1 and October 31. One trestle will be placed directly below or adjacent to the proposed bridge as a work platform to build and support the structure. The second trestle will be used as a work platform to remove the existing structure.

Table 4. Proposed tree and shrub removal within the biological study area (Caltrans 2016).

Location	Species (common name)	dbh (Approximate)	No. of Removal (Approximate)	R0 IND[1]	Nutrient /Shade
North Bank					
	California black oak	8-14 inches	4	NL	Shade
	Oregon ash	4-10	6	FACW	Shade
	Sandbar willow	1-2inches	10	FACW	Both
South bank					
	California black oak	6 inches	1	NL	Shade
	Oregon ash	4-8 inches	4	FACW	Shade
	Sandbar willow	1-2inches	10	FACW	Both
Private Property					
	Big leaf maple	4 inches	1	FACU	No
	Black locust	4 inches	1	FACU	No
	California black oak	4-8 inches	3	NL	No
	Douglas fir	8 inches	1	FACU	No
	Incense cedar	6inches	1	NL	No
Right shoulder					
	California black oak	4-12 inches	5	NL	Shade
	Oregon ash	4-6 inches	2	FACW	Shade
	Willow	1-2 inches	10	FACW	Both

[1]Plant's rating is from Western Mountains, Valleys, and Coast 2013 Regional Wetland Plant List. (Lichvar, R.W. 2013. *The National Wetland Plant List.* 2013 Wetland Ratings. Phytoneuron: in Press—*as cited in* Caltrans 2016). Wetland indicator status: FACU (Facultative Upland), NL (Not Listed), FACW (Facultative Wetland).

Both of the proposed trestles will be designed to resist the 100-year peak flow for the Klamath River as they may be left in the river over the winter, and for that reason, the deck of the temporary trestle will be removed during the rainy season so the structure does not interfere with high flows. The temporary trestle deck will likely consist of steel W-beams overlaid by timber decking. While the piles of the temporary trestle are in place in the water, they will be monitored so that any accumulated debris will be removed at least daily, or more often as necessary, to protect the temporary structure. The piles of the temporary trestle would be monitored so that appropriate measures can be taken to remove debris from the piles which will minimize scouring, as well as protect the temporary trestle.

A minimum 20-foot wide section of the river would remain open between the piles throughout the duration of construction. Although not anticipated, the piles used to support the temporary trestle used to build the new bridge may remain in the river for up to two winters and three summers. In contrast, the piles used to support the temporary trestle used to remove the existing bridge are anticipated to remain in the water for only one season. To minimize disturbance to the river, the trestles will likely be constructed using top down methods where steel piles are first place along the shoreline then topped with the bridge deck units before moving sequentially out into the river. Using this method, Caltrans expects no equipment would operate in the water. Trestles will be removed after the proposed bridge is completed and existing bridge is removed.

The Project proposes the use of two temporary trestle options to build the temporary trestles (work platforms). The trestle option chosen is at the discretion of the contractor. These options are:

- Trestle Option 1 (Table 5): Built-in place temporary trestles to avoid or minimize water impacts using only pilings
- Trestle Option 2 (Table 6): Built-in place temporary trestles to avoid or minimize water impacts using a combination of pilings and gravel work pads

Trestle Option 1

Built-in place temporary trestles using only pilings; likely requiring 24 total, 18-inch H-piles. The trestles will span from the south to the north Klamath River banks to allow access to the proposed and existing bridges. The trestles will be designed by the contractor. The contractor will determine the final number and size of piles but the contractor will specify that piles shall not exceed steel H-pile greater than 18-inches in diameter. The temporary trestles will be up to 40-feet wide with anticipated spans of 15 feet to 25 feet, giving each trestle a total length of approximately 170 feet. Each temporary trestle will likely be supported on 18-inch diameter driven steel H-piles (or equivalent). Dependent on construction schedule, if required to be left in the river over the winter, the deck of the temporary trestle will be removed during the rainy season so the structure does not interfere with high flows. The piles of the temporary trestle would be monitored so that appropriate measures can be taken to remove debris on the piles and to minimize potential scouring. Temporary trestles will be removed after the new bridge is completed and existing bridge is removed. The temporary piles will typically be placed 20 to 25 feet from the from the river’s edge.

Trestle Option 2

Built-in place temporary trestles using a combination of pilings; likely requiring 16, 18-inch H-piles and include two gravel approach pads, one placed at each bank of the river, across from one another. Trestle Option 2 differs from Option 1 in that it proposes to minimize the quantity of temporary piles required and associated acoustic impacts, by constructing gravel approach pads at both ends of the trestles. For the construction of the new bridge, these gravel pads will be placed in the river, one extending from the south bank to 20 feet past Pier 3 and one from the north bank extending 20 feet past Pier 7. For the removal of the existing bridge, gravel approach pads would be placed in the river, one from the south bank extending to Pier 3 and one from the north bank extending to Pier 5. Temporary trestles will be approximately 40 feet shorter than those in Trestle Option 1 and built either upstream or downstream of the proposed and existing.

Table 5. Summary of proposed pile driving assumptions for Trestle Option 1. One trestle, likely built in 2019, will be used to construct the proposed bridge. The second trestle, likely built in 2020, will be used for removal of the existing bridge.

Activity	Hammer		Pile				Total Number of Piles	Number of Piles Driven Per Day	Strikes Per Pile	Maximum Potential Number Strikes per Day	Duration	
	Size	Type	Location	Type	Diameter (inch)	Length (feet)					Hours of Pile Driving Per Day*	Total of Pile Driving Days
Temporary Trestle 1	3.6 metric ton ram	Diesel D36-32	Beneath proposed bridge	Steel H-Pile	18	25	24	3 to 4	100 to 150	600	8	8
Temporary Trestle 2	3.6 metric ton ram	Diesel D36-32	Downstream from existing bridge	Steel H-Pile	18	25	24	3 to 4	100 to 150	600	8	8

*Pile driving is anticipated to occur for approximately half of a normal working day (i.e., 4 hours of pile driving for an 8 hour day), and driving piles with an impact hammer will not be continuous.
Note: Option 1 is designed with trestles that span the entire width of the Klamath River using only non-displacement piles.

Table 6. Summary of proposed pile driving assumptions for Trestle Option 2. One trestle, likely built in 2019, will be used to construct the proposed bridge. The second trestle, likely built in 2020, will be used for removal of the existing bridge.

Activity	Hammer		Pile				Total Number of Piles	Number of Piles Driven Per Day	Strikes Per Pile	Maximum Potential Number Strikes Per Day	Duration	
	Size	Type	Location	Type	Diameter (inch)	Length (feet)					Hours of Pile Driving Per Day*	Total of Pile Driving Days
Temporary Trestle 1	3.6 metric ton ram	Diesel D36-32	Beneath proposed bridge	Steel H-Pile	18	25	16	3 to 4	100 to 150	600	8	5
Temporary Trestle 2	3.6 metric ton ram	Diesel D36-32	Downstream from existing bridge	Steel H-Pile	18	25	16	3 to 4	100 to 150	600	8	5

*Pile driving is anticipated to occur for approximately half of a normal working day (i.e., 4 hours of pile driving for an 8 hour day), and driving piles with an impact hammer will not be continuous.
Note: Option 2 is designed with trestles that span between gravel approach pads placed in the Klamath River using only non-displacement piles.

bridges. The trestles will be designed by the contractor. The contractor will determine the final number and size of piles but the contractor will specify that piles shall not exceed steel H-pile greater than 18-inches in diameter. The temporary trestles would likely be up to 40 feet wide with estimated spans of 15 feet to 25 feet, giving each trestle a total length of approximately 130 feet. The trestles would span between the gravel approach pads to allow access to the proposed and existing bridges as required.

A minimum 80 foot wide section of the river would remain open between the two gravel approach pads, throughout the duration of the construction. The gravel approach pads will remain in the river for the duration of the construction. The linear barriers would be designed to resist winter high flows to prevent them from being swept downstream. While the gravel approach pads are in place in the water, they will be monitored daily to ensure that gravel is not displaced.

If gravel approach pads are employed by the contractor, construction is expected to require up to a total of four days over the project time period; i.e., two each year. Each pad shall be installed and completed in one day during daylight hours. Thus, two days to construct two gravel approach pads will be used for construction of the new bridge and two days for two gravel pads will be used for removal of the existing bridge. The gravel approach pads would vary in height depending on future hydraulic analysis and environmental restrictions but have a maximum height of ten feet and would be reinforced with stepped temporary barrier rail around the perimeter exposed to the river to prevent erosion and sloughing of material into the river. To accommodate both temporary trestles, each gravel approach pad would have an approximate width of 30 feet and length of 30 feet. Placement of the gravel approach pads will be employed from the top of the banks. When forming the gravel approach pads, the barriers shall be installed first and slowly loaded into the river from the top of the river banks. The barriers shall be tapered to each river bank. Larger and similar rock to that currently found in the river will be placed in the lower portion of the gravel approach pads. The barriers will then be filled with one-inch to four-inch diameter, uncrushed, washed and rounded river rocks (i.e., spawning gravel), placed gradually along the edge of the river out until a pad is formed; approximately 18,000 cubic yards of rock and gravel are needed to fill both approach pads for each temporary trestle constructed during each year of the two year project (Trestle 1 and Trestle 2). Both pads for each trestle are expected to cover 1,800 square feet.

The gravel approach pads will be removed after the new bridge is completed and existing bridge is removed. However, the bottom one foot of gravel approach pads would be left in the channel to avoid impacts to the natural bed of the river and to provide a source of suitable spawning gravel to be dispersed by natural flows into the river.

1.3.6 Steel H-pile Installation for Temporary Trestles

Steel H-pile installation requires pile-driving. H-Piles are dimensionally square structural beams that are driven into the ground for deep foundation applications. Most soils at or near the surface do not have the mechanical properties to support large structures. H-pile placement requires driving piles to depths where soil-bearing strata, capable of providing the support needed to keep large structures in place. Because of the substantial amounts of rocky materials expected at the proposed bridge location, the use of a non-displacement (or pre-drilling) method to install all temporary steel H-piles is required for construction of the proposed temporary trestles. Pre-drilling is necessary when the substrate above the bearing stratum are usually stiff and hard (i.e., bedrock). Pre-drilling pilot holes eases pile installation. Pre-drilling also reduces underwater heave and lateral displacement of previously driven adjacent piles. Within the waterway or below the ground water table, the process of pre-drilling will take place within a casing isolated from the rest of the water column. Using a casing during pre-drilling will help prevent streambed material from escaping into the water column. Small amounts of streambed material and water will likely be displaced during pre-drilling operations. The displaced material and water would be pumped into a tank and disposed of at an approved Caltrans disposable site. The pre-drilling and simultaneous dewatering within the isolated casing could reduce water down to the mud line and potentially reduce noise. The pilot holes are drilled slightly smaller than the diameter of the steel H-piles and to within a few feet of the bearing stratum. The H-piles are inserted and then driven to the required penetration resistance, down to the bottom of the pre-drilled hole.

The trestle option chosen, number of piles, and pile size used is at the discretion of the contractor. Levels of underwater sound pressure waves generated from driving H- piles vary depending on the pile size, water depth, and substrate (Caltrans 2015b). To analyze potential magnitude and distance of underwater sound transmission from H-pile driving during this project, contractors are limited to use, to a maximum size H-pile of 18 inches; defining, for the purposes of impact evaluation, a scenario of probable upper limit of transmission of sound pressure wave through the ground. The maximum size H-pile limit was used to calculate and report acoustic effects as well as define number of hours and number of days needed for pile driving (Tables 5 and 6).

A pile driving crane with an impact hammer will generally be used to drive the steel H-piles into the ground. To avoid impacts to juvenile salmon, driving H-piles will take place between July 1 and August 31 when the Klamath River is at its lowest, and on average, after juvenile outmigration clearance. Within the action area, during this time of year, the Klamath River is approximately two to three feet deep. Approximately 100 to 150 strikes per pile are anticipated to drive each pile into the ground. The depth needed to drive each pile varies depending on substrate composition but is assumed to be approximately two to six feet deep. Each pile is expected to require at most, a total of three hours to place including positioning, pre-drilling, and driving. Three to four piles are expected to be placed per day requiring an anticipated maximum of 600 strikes per day (Tables 5 and 6).

- Trestle Option 1: Built in place temporary trestles using only pilings, an estimated total of 24 piles for each temporary trestle will be driven in place. Pile driving activities are anticipated to take approximately 8 days during the period of July 1 through August 31 during each year of the two year project, or 16 days total to install both trestles (Table 5).
- Trestle Option 2: Built in place temporary trestles using a combination of gravel approach pads and pilings, an estimated total of 16 piles for each temporary trestle would be driven in place. Pile driving activities are anticipated to take approximately 5 days during the period of July 1 through August 31 during each year of the two year project, or 10 days total to install both trestles (Table 6).

1.3.7 Falsework

Falsework will be used to support the bridge arch segment while under construction. The temporary falsework would be supported by the trestles steel beams and steel H-piles that are approximately 18-inch diameter (or equivalent).

1.3.8 Abutment, Retaining Wall, and Pier Foundation

The abutments, piers, and retaining walls of the proposed bridge require different foundations. Multiple types of foundations will be used for the construction of the new bridge, including reinforced concrete spread footings and micro-pile footings

Reinforced Concrete Spread Footing Foundations

Abutments 1 and 8 and associated retaining walls of the new bridge will be founded on spread footings. These footings will be 40 feet wide and 15 feet long. The retaining walls associated with Abutment 8 will be approximately 120 to 130 feet long each and a width up to two feet. These walls will be placed on spread footings and have a maximum height of approximately 24 feet. The Abutments spread-footings will be three feet below original grade. The spread-footings for the retaining walls will be approximately two feet deep. All footings are located outside of riparian and stream habitats.

Spread footing construction requires excavation and shoring. The top of the footing must be located below the anticipated scour elevation. The bottom of the footing must be founded on rock or densely compacted soil. Sheet piles may be vibrated into the ground to be used as temporary shoring for foundation work. Footing excavations that are below the ground water table require dewatering. Water is pumped from the excavated-shored footing area into a portable settling tank or a settling basin outside the river or in an adjacent upland area.

The installation of spread footing may require sheet piles for shoring. Sheet piles are usually interlocking steel “AZ”-type piles that are about two feet wide and range in length. They are commonly used to construct walls and cofferdams. If ground conditions allow, sheet piles can be installed using a vibratory hammer. A vibratory hammer uses an oscillatory hammer that vibrates the sheet pile, causing the sediment surrounding the sheet pile to liquefy and allow penetration. Peak sound pressure levels for vibratory hammers can exceed 180 decibels (dB); however, the sound from these hammers rises relatively slowly. The vibratory hammer produces sound energy that is spread out over time and is generally 10 to 20 decibels (dB) lower than impact pile driving (Caltrans 2015b).

Micro-piles

Piers 3 and 7 of the proposed bridge consist of two columns each. These columns will be supported by thrust blocks (Figure 1). Micro-piles are required to be installed below each thrust block for support, and anchor rods are installed to connect the thrust block to the arch. Each of the piers requires approximately 12 micro-piles. Micro-piles are high-capacity, small-diameter (approximately eight inches) steel casings that are drilled into place, reinforced with an internal structural bar and casing, and grouted.

1.3.9 Rock Slope Protection (RSP)

RSP will be placed in front of proposed bridge Abutments 1 and 8 and associated retaining walls. RSP may also be required around Piers 2, 3, and 7 or where needed to protect abutments, retaining walls, piers, and roadway embankments from damage during storms. Placement of RSP will require excavation, and excavation may require driven sheet piles to be used as shoring. Excavation of up to five feet will be needed to “key-in” the RSP. The RSP will be approximately three feet thick. Use of RSP will be limited to the minimum necessary to protect infrastructure. All RSP placements are expected to occur outside of the river channel and displace a combined area of 5,187 square feet (0.12 acres) with a volume of 933 cubic yards.

RSP will also be placed under all new culvert outlets. RSP is expected to prevent erosion from undermining the area below the outlet and to keep the fill slope from becoming incised and destabilized to protect the highway. RSP will also protect the embankment from erosion and insure the drainage systems continue to function into the future.

1.3.10 Demolition of Existing Bridge Piers and Abutments

A catchment device will be constructed to collect all demolition debris, preventing debris falling within the riverbed or water course. The catchment device will likely consist of wood and/or steel that would temporarily attach to the existing piers and abutments above ground or water level. The catchment device will be deployed for the duration of the demolition process to catch debris and prevent it from entering the water. The existing bridge superstructure is supported by reinforced concrete towers on concrete piers walls (Figure 2); all on spread footings. The abutments are also on spread footings, which are concrete, reinforced with steel. The piers and abutments will likely be demolished utilizing a pneumatic hammer attached to an excavator arm. This will occur as the bridge deck is being removed in sections. The in-water piers will be removed to a point just above the water level. The reinforcing steel will be cut with a torch or other cutting device. Once the in-water piers are removed to the water line, it is anticipated that a crane will hook onto the spread footings and what remains of the piers and lift it out of the channel. The footing will be brought to an upland area where it will be broken into small pieces. The debris will likely be removed with a thumb equipped excavator bucket, placed in a container and transferred to an approved staging area/temporary upland stockpile site.

The temporary trestle will be placed between July 1 and August 31; therefore, existing bridge piers would most likely be removed following the construction of the temporary trestle. Temporary trestle will be removed upon the removal of the existing bridge. There should be minor sediment when lifting out the remaining cut pier and footing since the existing overburden is shallow and consists mainly of gravel. The contractor will be required to follow guidelines specify in the 401 Water Quality Certification issued by the North Coast Regional Water Quality Control Board as well as the Caltrans Standard Specifications; specifically Section 13: Water Pollution Control and Section 14: Environmental Stewardship for the protection of water quality in the action area.

1.3.11 Staging Areas

Parking, staging, and storage of equipment and materials will take place in previously disturbed open areas located along SR 263 (PM 56.70, 56.91, and 57.0) and SR 96 (PM 103.4 and 103.6) These areas are existing pullouts within the action area (Figures 3, 4, and 5). These areas are devoid of trees or ground vegetation. Existing plants, if any, are ruderal.

In the event that temporary material stock piles (e.g., RSP) need to be placed within the 100 year floodplain, it must not occur during the rainy season October 15 through June 15, unless material can be relocated within (i.e., before) 12 hours of the onset of a storm.

Support work such as equipment fueling or repair may be conducted during hours of darkness in upland staging areas.

1.3.12 Construction Waste

The removal of existing bridge and associated bridge components including embankment and roadway approaches will result in waste. The contractor provides evidence to Caltrans that the waste materials have been hauled to an approved disposal site.

1.3.13 Avoidance, Minimization, and Conservation Measures

The following conservation measures shall be implemented as part of the proposed project to avoid and minimize potential effects to listed salmonids:

1. The terms and conditions of the regulatory permits and agreements obtained from the California Department of Fish and Wildlife (CDFW), California Regional Water Quality Control Board (CRWQCB), U.S. Army Corps of Engineers (USACOE), and NOAA's NMFS shall be adhered to.
2. Prior to use, equipment must be checked daily and periodically during the day for leaks. If leaking, equipment cannot be used until the leak is fixed.
3. Before entering the job site, all equipment must be cleaned to remove external oil, grease, dirt, or mud.
4. Equipment must be pressure washed prior to arrival on the project site and prior to leaving the project site. Only weed-free equipment is allowed in the action area.
5. No equipment maintenance or fueling shall be done within or near any streambed or flowing stream where petroleum products or other pollutants from the equipment may enter these areas under any flow. If it is not feasible to move equipment (e.g., big crane) for fueling or maintenance, contractor shall implement a plan that includes measures to prevent any pollutants from entering Klamath River.
6. Areas immediately adjacent to the project work area will be fenced with environmentally sensitive area fencing in order to prevent unnecessary disturbance and minimize potential accidental removal of vegetation beyond designated impact areas.

7. The Engineer will notify the environmental construction liaison and/or Caltrans biologist at least two weeks prior to the start of construction for direction of the placement of environmentally sensitive area fencing.
8. OHWM will be shown on a scaled project plan sheet.
9. Above OHWM, before constructing temporary access roads, cut existing vegetation leaving a 2-inch stump to allow regeneration. Do not remove roots. After constructing temporary access roads, the finished subgrade must be covered with a heavy duty nonwoven geotextile fabric, (e.g., subgrade enhancement fabric, Class 10 RSP fabric or other authorized geotextile fabric), and then covered with a sufficient depth of clean, washed angular rock to prevent either stormwater erosion or further disturbance of subgrade soils by construction equipment. Upon completion of construction activities, geotextile fabric and rock must be completely removed and disposed of at an authorized Caltrans disposal site. Any existing soil materials excavated to create temporary access roads must be stockpiled and used to restore original ground contours after completion of construction activities and removal of geotextile fabric and rock.
10. Below OHWM, access the work area by using temporary trestles or by placing a minimum 6-inch thick temporary gravel approach pad of uncrushed, rounded, natural river rock with no sharp edges that has been washed at least once to ensure it is free of oils, clay, debris, and organic matter ranging in size from 0.5 inch to 4 inches (spawning gravel). Before placing temporary gravel approach pads, cut riparian vegetation leaving a 2 inch stump to allow regeneration. Do not remove roots.
11. The rainy season is defined as October 15 through June 15.
12. Excavated material will not be stored or stockpiled below OHWM. Any excavated material that will not be placed back in the banks or channel will be removed and disposed of at a Caltrans authorized disposal site.
13. During construction, a catchment system such as a platform, net, or tarp will be suspended under both the new bridge and the existing bridge to effectively catch all fallen debris and prevent it from entering the river.
14. All waste (concrete, asphalt, etc.) generated during construction will be disposed of at a Caltrans authorized disposal site.
15. Construction activities associated with construction or removal of the bridges, including but not limited to dewatering, construction of temporary gravel approach pad, construction of temporary trestles, and construction of temporary falsework will be conducted during daylight hours.
16. If any lighting is necessary for equipment fueling or repair conducted during hours of darkness, it shall be directed away from the Klamath River.
17. Temporary stream exclusion structures placed below OHWM (e.g. temporary sheet metal piling for cofferdams) will be placed between June 1 and October 31, must extend above the height of OHWM, and must be designed to withstand the forces of a 100-year flood and may remain within the river throughout the year.
18. Below OHWM, temporary trestles may cross the river. Temporary trestles must be designed to withstand the forces of a 100-year flood, and may remain below OHWM and within the

river throughout the year. Temporary trestle decking below OHWM must be removed between November 1 and May 31. Temporary trestle decking must not at any time become flooded by high water events.

19. While temporary trestle piling is in place in the water, monitor piling and remove any accumulated debris at least daily, or more often as necessary, to protect the temporary structure.
20. All other in-channel activities below OHWM (e.g., including but not limited to driving piles, etc.) will occur between June 1 and October 31. Driving piles will occur between July 1 and August 31.
21. Motorized construction equipment will not enter the water.
22. After construction is complete, all facilities installed by the Contractor during construction, including but not limited to falsework, temporary trestles, and temporary access road materials will be removed, excavated soil materials will be replaced and original ground contours will be restored outside the project cut/fill lines.
23. When removing all facilities installed during construction:
    1. Remove all rock and geotextile fabric used to surface the temporary access roads and dispose of these materials at a Caltrans authorized disposal site.
    2. When removing the gravel from temporary gravel approach pads leave bottom one foot in the channel to avoid impacts to the natural bed of the river.
24. Modified or disturbed portions of the river and banks will be restored as nearly as possible to natural and stable contours.
25. A Storm Water Pollution Prevention Plan (SWPPP) will be developed prior to project construction, which contains best management practices (BMPs) from the Storm Water Quality Handbook (Caltrans 2011), in conformance with Caltrans Standard Specifications Section 7-1.01G.
26. A Spill Prevention, Control, and Countermeasures (SPCC) Plan will be developed and included the SWPPP to minimize avoid the potential of a leak or spill of petroleum or hydraulic products within the channel, which will also include actions to take in the event of a spill or leak.
27. Temporary or permanent BMPs such as silt fences, straw wattles, or catch basins will be placed below all construction activities at the edge of surface water features and around the base of stock piles to intercept sediment before it reaches the waterway.
28. Sediment built up at the base of BMPs will be removed before BMP removal to minimize any accumulated sediment from being mobilized.
29. If water drafting is needed for construction activities, water drafting from the Klamath River may take place from June 1 through October 31.
30. Water drafting will require the implementation of NMFS (2001) water drafting specifications. Implementation consists of (but is not limited to):
    1. Diversion rate shall not exceed 10 percent of the surface flow and reduction in pool volume will not exceed 10 percent

2. Openings in perforated plate or woven wire mesh screens will not exceed 3/32 inches
3. Drafting operator shall actively observe the drafting operation, pumping shall cease and the screen cleaned if it becomes more than 10 percent obstructed by debris

31. Stream width, depth, velocity, and slope that provide upstream and downstream passage of adult and juvenile fish will be preserved according to current NMFS and CDFW guidelines and criteria or as developed in cooperation with NMFS and CDFW to accommodate site-specific conditions.
32. If gravel approach pads are employed, each pad shall be installed and completed in one day during daylight hours.
33. When forming the gravel approach pads, the barriers shall be the first to be installed and slowly loaded into the river from the top of the river banks. The barriers shall be tapered to each river bank. The gravels shall then be placed gradually along the edge of the river out until a pad is formed.
34. A qualified biologist will be required onsite to monitor the activities associated with the gravel approach pad placement activities.
35. A minimum of 80 foot wide section of the river shall be maintained between gravel approach pads throughout the duration of the construction for safe fish passage.
36. A minimum of 20-foot-wide section of the river shall be maintained between piles throughout the duration of the construction for safe fish passage.
37. If one or more Chinook or listed salmonids are found dead or injured, all project activities shall cease and NMFS and CDFW shall be contacted immediately. Project activities may resume only after NMFS and CDFW have reasonable assurances that no additional mortalities of Chinook or listed salmonids will occur.
38. If chemical contamination has been detected, all project activities shall cease and NMFS, CDFW and California Regional Water Quality Control Board (CRWQCB) shall be contacted immediately. Project activities may resume only after NMFS, CDFW, and CRWQCB have reasonable assurances that chemical contamination has ceased.
39. Pile driving will take place either on dry ground outside the river channel perimeter or within an isolation casing or dewatered cofferdam.
40. All Pile driving activities will employ the smallest pile driver and minimum force necessary complete the work.
41. Prior to pile driving activities, a qualified biologist supplied by the contractor shall prepare and submit an underwater noise monitoring plan for review and approval by NOAA/NMFS. The "Underwater Noise Monitoring Template" (FHWG 2013) can be accessed at http://www.dot.ca.gov/hq/env/bio/fisheries_bioacoustics.htm. A copy is provided in Appendix H of the Biological Assessment.
42. Acoustic monitoring will be performed onsite by a qualified biologist supplied by the contractor. Regular decibel readings will be collected and documented during all pile driving activities to ensure noise thresholds are not exceeded. Underwater sound generated by pile driving (decibel readings) must adhere to the monitoring plan approved by NOAA/NMFS.

43. When reporting the results of underwater sound generated by pile driving to NOAA/NMFS, a copy of the underwater noise monitoring plan and report will also be provided to Caltrans, Office of Environmental Services, North Region-Redding-R1 (Attention: Chelsea Tran-Wong).
44. BMPs for concrete mixing and waste management will be implemented as described in the SWPPP and will include the use of erosion control devices, maintenance of stockpile and spoil sites to prevent runoff, use of clean gravel, clean rock material and mulching activities.
45. Placement of concrete or concrete slurry to construct bridge footings must be conducted in a dry area (e.g. within a dewatered cofferdam) to prevent contact of wet concrete with water. Concrete or concrete slurry will not come into direct contact with flowing water.
46. Use of RSP will be limited to the minimum necessary to protect infrastructure. RSP and other construction materials, such as isolation casing or sheet piling, will be washed prior to entering the river perimeter to remove sediment and/or contaminants.
47. Disturbance or removal of vegetation will not exceed the minimum necessary to complete construction activities or the project.
48. Vegetated areas which are disturbed will be replanted using native riparian plant species that are part of the baseline of the area.
49. Non-native plant species removed during construction will be replaced with native species.
50. Measures will be implemented to prevent the spread of invasive, non-native species such as weed-free equipment only in the action area, use of weed free mulches, and use of re-vegetation seed and plants consisting of native species.
51. The disturbed vegetated areas will be restored as described in the proposed Revegetation Management Plan (Caltrans 2016).
52. Where unintended soil compaction occurs in areas slated for re-vegetation, compacted soils will be loosened after heavy construction activities are complete, including the temporary access roads placed outside of existing dirt road areas.
53. Any disturbed ground must be received appropriate erosion control treatment (e.g. mulching, seeding, planting) prior to the end of the construction season, prior to cessation of operations due to forecasted wet weather, within seven days of project completion, or during the appropriate planting season. BMP's and BMP maintenance will use all practicable techniques to prevent sediment from entering any water body.
54. Additional monitoring of the construction site during the first rain event that will result in overland flow will be required to minimize the effects of sedimentation. If erosion is noted, Caltrans shall take immediate measures to increase erosion control measures (i.e., placement of additional mulching, silt fences, straw wattles, etc.).

1.3.14 Construction Schedule

The proposed project is scheduled (Table 7) as a two or three season project, anticipated to begin between 2019 and 2020. Construction site preparation activities may occur prior to the in-water work window. In-water work activities will occur during the dry season (June 1–October 31). In-

Table 7. Generalized project action sequencing and timeline of the proposed Klamath River bridge replacement project. The proposed project is scheduled as a two, or three season project, anticipated to begin in 2019. Construction of the proposed project is expected to span 18 months and 360 working days.

	Year-one (Months)												Year-two (Months)											
Proposed Action	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Tree removal	■																							
Establish equipment and materials staging areas, and concrete truck washout	■	■	■	■	■																			
Mobilize/Road work		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Culvert installation (4), replacement (1), and RSP placed at outlet		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
In-water work						■	■	■	■	■								■	■	■	■	■		
Construct gravel approach pads						■												■						
Pile driving work window							■	■											■	■				
Install temporary trestle (proposed bridge year-1 and existing bridge year-2) piles							■	■											■	■				
Construct new bridge						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Pave new bridge and approaches (usually pave roads May to October)																	■	■	■	■	■	■		
Winterize construction site; apply erosion control BMPs										■	■													
Demolish existing bridge and remove abutments and piers																		■	■	■	■	■		
Pave roadway																		■	■	■	■	■		
Seed and plant up-slope (riparian and upland) and down-slope (river-side) banks at access roads and other disturbed areas associated with both the existing bridge removal and the replacement bridge—implement three-year revegetation and monitoring plan.																					■	■	■	
Note: Structure construction could potentially be performed throughout the year																								

water work activities in the Klamath River would be conducted during two anticipated discrete periods. If unforeseen conditions require a third season of construction, a similar in-water work window from June 1 through October 31 will be enforced, as well as the July 1 through August 31 pile driving restriction.1.3.15 Interrelated and Interdependent Actions

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02).

The State of California Fish and Game Code Section 2081 (b) (2) requires that action agencies fully mitigate for take of California Endangered Species Act listed species. SONCC coho salmon ESU is listed as threatened under California Endangered Species Act. Mitigation for the expected mortality of sub-yearling juvenile coho salmon, as a result of implementing this proposed project, is expected to result as a separate and secondary proposed action (interdependent) of the proposed project. Exact mitigation strategies for this project have not been determined at this time.

As final mitigation plans become clear, Caltrans must notify NMFS with their determination whether any impacts may trigger re-initiation of section 7 consultation, or to discuss modification of the plans to avoid impacts Therefore, additional actions, such as mitigation actions identified and proposed by Caltrans after the issuance of this NMFS biological opinion, which may affect ESA-listed species or designated critical habitat, will require reinitiation of consultation.

Additionally, Caltrans indicated that prior to any project activities that could incidentally take SONCC coho salmon, they will submit to CDFW documentation to show that Caltrans has allocated sufficient funds, acceptable to and approved by CDFW, in the Expenditure Authorization for the project to ensure implementation of all measures to minimize and fully mitigate the incidental take of state listed species resulting from construction of the Project (Caltrans 2016). This documentation (i.e., written document provided by Caltrans), should identify specific project minimization and mitigation components that are in accordance with State of California Fish and Game Code Section 2081 (b)(4) and in accordance with State of California Fish and Game Code Section 2081 (b)(2) to fully mitigate for take and the costs associated with Project components.

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 provides 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 "to jeopardize the continued existence of a listed species," which is "to engage in an action that 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 for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace 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.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a Reasonable and Prudent Alternative to the proposed action.

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. 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' current "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 current function of the essential PBFs that help to form that conservation value.

Climate Change

One factor affecting the rangewide status of SONCC coho salmon, and aquatic habitat at large is climate change. Climate change is likely to have negative implications for the conservation value of designated critical habitats in the Pacific Northwest (CIG 2004; Scheuerell and Williams 2005; Zabel et al. 2006; ISAB 2007; and Crozier et al. 2008). Average annual Northwest air temperatures have increased by approximately 1.8°F since 1900, or about 50 percent more than the global average warming over the same period (ISAB 2007). The latest climate models project a warming of 0.18°F to 1.08°F per decade over the next century. According to the Independent Scientific Advisory Board's (ISAB) recurring reports (https://www.nwcouncil.org/fw/isab/), these effects may have the following physical impacts within approximately the next 40 years:

- Warmer air temperatures will result in a shift to more winter/spring rain and runoff, rather than snow that is stored until the spring/summer melt season.
- With a shift to more rain and less snow, snowpack will diminish in those areas that typically accumulate and store water until the spring/summer melt season.
- With a smaller snowpack, these watersheds will see their runoff diminished and exhausted earlier in the season, resulting in lower stream flows in the June through September period.
- River flows in general and peak river flows are likely to increase during the winter due to more precipitation falling as rain rather than snow.

Water temperatures will continue to rise, especially during the summer months when lower streamflow and warmer air temperatures will contribute to warming regional waters. These changes will not be spatially homogenous. Areas with elevations high enough to maintain temperatures well below freezing for most of the winter and early spring are expected to be less affected. Low-lying areas that have historically received scant precipitation contribute little to total streamflow and are likely to be more affected. These long-term effects may include, but are not limited to, depletion of cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, increased bio-energetic and disease stresses on fish, and increased competition among species. In addition, as climate change reduces the carrying capacity of habitat within the range of SONCC coho salmon, species viability may be more difficult to achieve (NMFS 2011;

NMFS 2014b). The reduced genetic diversity resulting from depressed population sizes may limit the ability of individual SONCC coho salmon to adapt to changing climatic conditions.

Climate change effects contributing to warming and reduced snowpack (Barr et al. 2010), an increase in the number of fire ignitions, and historic land management practices including timber harvest and fire suppression activities have led to an increase in the number of large wildfires (1,000 acres or more) and the total area burned annually across the western US, within the SONNC coho ESU, and the Klamath-Trinity Mountains. Wildfire effects (e.g., reduction or elimination of ground cover, root cohesion/strength decreases, and soil disturbance increases) lead to increases in mass-wasting and landsliding, especially debris flows and hyperconcentrated flows within critical habitat watersheds with moderate to high severity burned areas. Elevated levels of sediment erosion from surface erosion, mass-wasting, and landsliding are compounded by forest management actions including road networks, timber harvest activities, and historical fire suppression actions (Barr et al. 2010). The increase in wildfire and sediment erosion has led to a degradation of the PBFs and the conservation value of critical habitat across the SONCC coho salmon ESU.

2.2.1 SONCC Coho Salmon General Life History

Coho salmon is an anadromous fish species that generally exhibits a relatively simple three-year life cycle. Adults typically return from the ocean beginning their freshwater spawning migration in the late summer and fall, spawn by mid-winter, and then die. Spawning occurs mainly in November to December in small streams that flow directly into the ocean, or tributaries and headwater creeks of larger rivers (Sandercock 1991; Moyle 2002). Depending on river temperatures, eggs incubate in ‘‘redds’’ (gravel nests excavated by spawning females) for 1.5 to four months before hatching as ‘‘alevins’’ (a larval life stage dependent on food stored in a yolk sac). Following yolk sac absorption, alevins emerge from the gravel as young juveniles or ‘‘fry’’ and begin actively feeding. Juvenile rearing usually occurs in tributary streams with a gradient of three percent or less, although they may move up to streams of four percent or five percent gradient. Juveniles have been found in streams as small as 3.3 to 6.6 feet wide. They may spend one to two years rearing in freshwater (Bell and Duffy 2007), or emigrate to an estuary shortly after emerging from spawning gravels (Tschaplinski 1988). Parr, or sub-yearling coho salmon are juveniles that are less than one year old, also termed 0+, or 0-age. In this opinion, we use the term sub-yearling. Coho salmon juveniles are also known to “redistribute” into non-natal rearing streams, lakes, or ponds, often following rainstorms, where they continue to rear (Peterson 1982), and often disperse in response to high water temperatures as is strongly evident in the Klamath River (Deas et al. 2006; Sutton et al. 2007; Sutton and Soto 2010)

Juveniles rear in fresh water for up to 15 months, and then migrate to the ocean as “smolts” in the spring. Coho salmon typically spend about another 15 months in the ocean before returning to their natal stream to spawn as 3-year-olds. Some precocious males, called ‘‘jacks,’’ return to spawn after only six months at sea. Coho salmon were historically distributed throughout the North Pacific Ocean from central California to Point Hope, Alaska, through the Aleutian Islands, and from the Anadyr River, Russia, south to Hokkaido, Japan. Historically, this species probably inhabited most coastal streams in Washington, Oregon, and northern and central California. NMFS identified six coho salmon ESUs in Washington, Oregon, and California (Weitkamp et al.

1995), including the SONCC coho salmon. The SONCC coho salmon ESU is composed of 41 populations bordered between their southern extents of Punta Gorda, California to their northern extent of Cape Blanco, Oregon.

2.2.1.1 Periodicity of Coho Salmon

The biological requirements of SONCC coho salmon in the action area vary depending on the life history stage present at any given time (Spence et al. 1996; Moyle 2002). In the action area for this consultation, the biological requirements for SONCC coho salmon are the habitat characteristics that support successful adult spawning, embryonic incubation, emergence, juvenile rearing, migration and feeding. Generally, during salmonid spawning migrations, adult salmon prefer clean water with cool temperatures and access to thermal refugia, dissolved oxygen near 100 percent saturation, low turbidity, adequate flows and depths to allow passage over barriers to reach spawning sites, and sufficient holding and resting sites. Anadromous fish select spawning areas based on species-specific requirements of flow, water quality, substrate size, and groundwater upwelling (Sandercock 1991). Embryo survival and fry emergence depend on substrate conditions (e.g., gravel size, porosity, permeability, and dissolved oxygen concentrations), substrate stability during high flows, and, for most species, water temperatures of 57ºF or less (Quinn 2005). Habitat requirements for juvenile rearing include seasonally suitable microhabitats for holding, feeding, and resting (Moyle 2002). Migration of juveniles to rearing areas requires access to these habitats. Physical, chemical, and thermal conditions may all impede movements of adult or juvenile fish (Moyle 2002). This section outlines the life history traits and seasonal periodicities of coho salmon in the Klamath River Basin (Table 8).

Table 8. Life stage periodicities for coho salmon within the Klamath River Basin. Black areas represent peak use periods, those shaded gray indicate non-peak periods (Leidy and Leidy 1984; Moyle et al. 1995; USFWS 1998; NRC 2004; Justice 2007; Carter and Kirk 2008).

Life History Stage	Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep	
Adult migration																								
Adult spawning																								
Incubation																								
Fry emergence																								
Juvenile rearing																								
Juvenile redistribution																								
Smolt outmigration																								

2.2.1.2 Adult Migration and Spawning

Adult coho salmon typically begin entering the lower Klamath River in late September (but as early as late August in some years), with peak migration occurring in mid-October (Ackerman et al. 2006). They move into the portion of the mainstem from Iron Gate Dam to Seiad Valley (RM 129) from the late fall through the end of December (USFWS 1998). Many returning adults seek out spawning habitat in sub-basins, such as the Scott, Shasta and Trinity rivers, as well as smaller mainstem tributaries throughout the basin with unimpeded access, functional riparian corridors and clean spawning gravel. Coho salmon generally migrate when water temperature is in the range of 55ºF to 60ºF, the minimum water depth is seven inches, and the water velocity does not exceed eight feet per second (f/s) (Sandercock 1991). However, coho salmon have been known to migrate at water temperatures up to 66ºF in the Klamath River (Strange 2011). Coho salmon spawning within the Klamath River basin usually commences within a few weeks after arrival at the spawning grounds (NRC 2004) between November and January (Leidy and Leidy 1984).

Coho salmon spawning has been documented in low numbers and as early as November 15 within the mainstem Klamath River. From 2001 to 2005, Magneson and Gough (2006) documented a total of 38 coho salmon redds between Iron Gate Dam (RM 190.14) and the Indian Creek confluence (RM 109), although over two-thirds of the redds were found within 12 river miles of the dam. Many of these fish likely originated from the IGH. The amount of mainstem spawning habitat downstream of Iron Gate Dam has been reduced since construction of the dam because, for one thing, the introduction of spawning gravel from upstream sources has been interrupted.

2.2.1.3 Egg Incubation and Fry Emergence

Coho salmon eggs typically hatch within 8 to 12 weeks following fertilization, although colder water temperatures likely lengthen the process (Bjornn and Reiser 1991). Upon hatching, coho salmon alevin (newly hatched fish with yolk sac attached) remain within redds for another 4 to 10 weeks, further developing while subsisting off their yolk sac. Once most of the yolk sac is absorbed, the 30 to 35 millimeter fish (then termed "fry") begin emerging from the gravel in search of shallow stream margins for foraging and safety (NRC 2004). Within the Klamath River, fry begin emerging in mid-February and continue through mid-May (Leidy and Leidy 1984).

2.2.1.4 Fry

After emergence from spawning gravels within the mainstem Klamath River, or as they move from their natal streams into the river, coho salmon fry distribute themselves upstream and downstream while seeking favorable rearing habitat (Sandercock 1991). Further redistribution occurs following the first fall rain freshets as fish seek stream areas conducive to surviving high winter flows (Ackerman and Cramer 2006). They do not persist for long periods of time at water temperatures from 71.6ºF to 77ºF (Moyle 2002 and references therein) unless they have access to thermal refugia. Lethal temperatures range from 75 to 86ºF (McCullough 1999), but coho salmon fry can survive at high daily maximum temperatures if (1) high quality food is abundant, (2) thermal refugia are available, and (3) competitors or predators are few (NRC 2004). Large woody debris and other instream cover are heavily utilized by coho salmon fry (Nielsen 1992; Hardy et al. 2006), indicating the importance for access to cover in coho salmon rearing.

2.2.1.5 Parr (sub-yearling)

As coho salmon fry grow larger (2–2.4 inches) they transform physically (developing vertical dark bands or "parr marks"), and behaviorally begin partitioning available instream habitat through aggressive agonistic interactions with other juvenile fish (Quinn 2005). These 50 to 60 millimeter fish are commonly referred to as "parr", or "sub-yearlings" and will remain at this stage until they migrate to the ocean. Typical sub-yearling rearing habitat consists of slow moving, complex pool habitat commonly found within small, heavily forested tributary streams (Moyle 2002; Quinn 2005). When rootwads, large woody debris, or other types of cover are present, growth is bolstered (Nielsen 1992), which increases survival. Water temperature requirements of parr are similar to that of fry.

Some coho salmon sub-yearlings redistribute following the first fall rain freshets, when fish seek stream areas conducive to surviving high winter flows (Ackerman and Cramer 2006; Soto et al. 2008; Hillemeier et al. 2009). The Yurok Tribal Fisheries Program and the Karuk Tribal Fisheries Program have been monitoring juvenile coho salmon movement in the Klamath River using passive integrated transponder (PIT) tags. Some coho salmon sub-yearlings, tagged by the Karuk Tribal Fisheries Program, have been recaptured in ponds and sloughs over 90 RM away in the lower six to seven miles of the Klamath River. The PIT tagged fish appear to leave the locations where they were tagged in the fall or winter following initial fall freshets before migrating downstream in the Klamath River to off-channel ponds near the estuary where they are thought to remain and grow before emigrating as smolts the following spring (Voight 2008). Several of the sub-yearlings (~2.6 inches) that were tagged at locations like Independence Creek (RM 95), were recaptured at the Big Bar trap (RM 51), which showed pulses of emigrating coho salmon during the months of November and December following rainstorms (Soto et al. 2008). Some PIT-tagged sub-yearlings traveled from one stream and swam up another, making use of the mainstem Klamath during late summer cooling events. Summer cold fronts and thunderstorms can lower mainstem temperatures, making it possible for juvenile salmonids to move out of thermal refugia during cooling periods in the summer (Sutton et al. 2004)

Juvenile coho salmon (sub-yearlings and smolts) have been observed residing within the mainstem Klamath River between Iron Gate Dam and Seiad Valley throughout the summer and early fall in thermal refugia during periods of high ambient water temperatures (>71.6°F). Mainstem refugia areas are often located near tributary confluences, where water temperatures are 3.6 to 10.8°F lower than the surrounding river environment (NRC 2004; Sutton et al. 2004). Sutton and Soto (2010) showed that juvenile coho salmon started using thermal refugia when the Klamath River main-stem temperature approached approximately 66.2 °F. The majority of the juvenile coho salmon within the studied thermal refugia were found in the slower velocity habitat associated with cover. Juvenile coho salmon counts in the studied thermal refugia dramatically decreased at temperatures >71.6–73.4 °F, suggesting that this approximates their upper thermal tolerance level (Sutton and Soto 2010). Habitat conditions of refugia zones are not always conducive for coho salmon because several thousand fish can be crowded into small areas, particularly during hatchery releases. Crowding leads to predator aggregation and increased competition, which triggers density dependent mechanisms.

Robust numbers of rearing coho salmon have been documented within Humbug (RM 171.5), Beaver (RM 163), Horse (RM 147.3) and Tom Martin Creeks (RM 143; Soto 2012), whereas juvenile coho salmon have not been documented, or are documented in very small numbers, using cold water refugia areas within the Middle and Lower Klamath Populations (Sutton et al. 2004). No coho salmon were observed within extensive cold-water refugia habitat adjacent to lower river tributaries such as Elk Creek (RM 107), Red Cap Creek (RM 53), and Blue Creek (RM 16) during past refugia studies (Sutton et al. 2004). However, Naman and Bowers (2007) captured 15 wild coho salmon ranging from 2.6 inches to 3.3 inches in the Klamath River between Pecwan and Blue creeks near cold water seeps and thermal refugia during June and July of 2007.

2.2.1.6 Juvenile Rearing

Peak emigration timing varies throughout the basin from April until July, depending on the watershed and the age class of fish moving (Pinnix et al. 2007). Many coho salmon parr migrate downstream from the Shasta River and into the mainstem Klamath River during the spring months after emergence and a brief (<3 month) rearing period in the Shasta River (Chesney et al. 2007). Water diversions and agricultural operations cause a loss of habitat (decrease in flow, increase in water temperature) in the Shasta River in the summer months and subsequent displacement of young of the year coho salmon from the Shasta River canyon (Chesney et al. 2007). In several different years, biologists from California Department of Fish and Wildlife (CDFW) noticed a distinct emigration of sub-yearling smolts around the week of May 21 on the Shasta River. Analysis of scale samples indicates that most of these fish are less than one year old (Chesney et al. 2007). Unlike the sub-yearling coho salmon in the canyon that are leaving the Shasta River due to loss of habitat, these fish appeared to be smolting.

A significant proportion of juvenile coho salmon in the Klamath basin display complex movement patterns to seek out suitable habitat. Juveniles migrate as fry out of systems like the Scott and Shasta rivers where water temperatures increase during the summer months (Adams 2013, *cited by* NMFS 2014b) and seek out cold water streams to rear in the summer months. Another movement event occurs in the fall as mainstem flows rise and juveniles seek slow off-channel habitat to rear during the winter months (Witmore 2014). Juveniles seek out low gradient tributaries that are connected to the floodplain that can provide overwinter habitat.

2.2.1.7 Juvenile Outmigration

Outmigrating smolts (yearlings) are usually present within the mainstem Klamath River between February and the beginning of July, with April and May representing the peak migration months (Table 8). Migration rate tends to increase as fish move downstream (Stutzer et al. 2006). Yet, some coho salmon smolts may stop migrating entirely for short periods of time if factors such as water temperature inhibit migration. Within the Klamath River, at least 11 percent of wild coho salmon smolts exhibited rearing-type behavior during their downstream migration (Stutzer et al. 2006). Salmonid smolts may further delay their downstream migration by residing in the lower river and/or estuary (Voight 2008). Sampling indicates coho salmon smolts are largely absent from the Klamath River estuary by July (NRC 2004).

The USGS and USFWS conducted studies aimed at estimating the survival of coho salmon smolts in the Klamath River. Between 2006 and 2009, the annual estimates of apparent survival of radio-tagged hatchery coho salmon from Iron Gate Dam to RM 20.5 ranged from 0.412 to 0.648 (Beeman et al. 2012). The current data and models indicate little support for a survival difference between hatchery and wild fish in 2006, but considerable model uncertainty exists (Beeman et al. 2007). Survival was lower in the reach from Iron Gate Hatchery to the Scott River than in reaches farther downstream (Beeman et al. 2012).

The variability of early life history behavior of coho salmon observed by Chesney et al. (2007) and by the Yurok and Karuk tribes mentioned in the sections above is not unprecedented; coho salmon have been shown to spend up to two years in freshwater (Bell and Duffy 2007), migrate to estuaries within a week of emerging from the gravels (Tschaplinski 1988), enter the ocean at less than one year of age at a length of 2.4 inches 2.8 inches (Godfrey et al. 1975), and redistribute into riverine ponds following fall rains (Peterson 1982; Soto et al. 2008; Hillemeier et al. 2009). Taken together, the research by the Yurok and Karuk tribes, plus the research from outside the Klamath Basin, indicate that coho salmon in the Klamath River exhibit a diversity of early life history strategies, utilizing the mainstem Klamath River throughout various parts of the year as both a migration corridor and a rearing zone.

2.2.2 Status of SONCC Coho Salmon

On July 19, 1995, NMFS publicly announced its status finding and intent to propose the SONCC coho salmon ESU, which includes populations spawning from the Elk River (Oregon) in the north to the Mattole River (California) in the south, as threatened under the federal ESA. Its finding was published in the Federal Register on July 25, 1995 (60 FR 38011) and made final on April 25, 1997. NMFS published its final decision to list SONCC coho salmon as threatened under the federal ESA on May 6, 1997 (62 FR 24588).

On May 5, 1999, NMFS announced designation of critical habitat for coho salmon in the Federal Register (64 FR 24049-24062). Designated critical habitat includes all river reaches accessible to listed coho salmon between Cape Blanco, Oregon and Punta Gorda, California. Accessible reaches are those within the historic range of the ESU that can still support any life stage of coho salmon. Designated critical habitat also includes the adjacent riparian zone, which is defined as the area adjacent to a stream that provides shade, sediment, nutrient or chemical regulation, stream bank stability, and is a source of large woody debris or organic matter (64 FR 24049-24062). The Klamath River Bridge site and associated action area are within the designated critical habitat for SONCC coho salmon.

In 2005, NMFS reaffirmed SONCC coho salmon status as a threatened species and also listed three hatchery stocks as part of the ESU (70 FR 37160), these stocks are the Cole Rivers Hatchery Program, Trinity River Hatchery Program, and Iron Gate Hatchery Program. In 2006, Williams et al. described the historical population structure of coho salmon in the SONCC coho salmon ESU based on the location and amount of potential coho salmon habitat, with an assumption that the relative abundance of different populations mirrored the amount of intrinsic habitat potential in each watershed. In 2008, Williams et al. then described the SONCC coho salmon historical population structure as containing 19 functionally independent populations, 12 potentially independent populations, and 17 small dependent populations, and two ephemeral populations (Figure 7). Williams et al. (2008) also organized the independent and dependent populations of coho salmon in the SONCC ESU into diversity strata largely based on the geographical arrangement of these populations and basin-scale environmental and ecological characteristics (Figure 7).

NMFS completed a status review of the SONCC coho salmon ESU (Williams et al. 2011a) and determined that the ESU, although trending in declining abundance, should remain listed as threatened. The primary factors affecting diversity of SONCC coho salmon appear to be low population abundance, ocean survival conditions, and drought effects (Williams et al. 2011a). The most recent status review was completed in 2016, and NMFS determined that drought and ocean conditions seem to be driving recent declines in abundance, however there does not appear to be a change in extinction risk since the 2011 status review (Williams et al. 2016).

Viable Salmonid Populations Framework for Coho Salmon

In order to assess the status, trend, and recovery of any species, a guiding framework that includes the most appropriate biological and demographic parameters is required. For Pacific salmon, McElhany et al. (2000) defined a viable salmonid population (VSP) as an independent population that has a negligible probability of extinction over a 100-year time frame. The VSP concept provides guidance for estimating the viability of populations and larger-scale groupings of Pacific salmonids such as an ESU or DPS. Four VSP parameters form the key to evaluating population and ESU/DPS viability: (1) abundance; (2) productivity (i.e., population growth rate); (3) population spatial structure; and (4) diversity (McElhany et al. 2000).

Williams et al. (2008) built on the population structure and the concepts of Viable Salmonid Populations (VSP), defined by McElhany et al. (2000), to establish the extinction risk criteria at both population and ESU scales. The population extinction risk criteria represent an extension of an approach developed by Allendorf et al. (1997), and include metrics related to population abundance (effective population size), population decline, catastrophic decline, spawner density, hatchery influence, and population viability assessment. Therefore, these four VSP parameters were used to evaluate the extinction risk of the SONCC coho salmon ESU.

VSP parameters are predictors of extinction risk, and reflect general biological and ecological processes that are critical to the growth and survival of salmon (McElhany et al. 2000). Populations that fail to satisfy several extinction risk metrics are likely at greater risk than those that fail to satisfy a single metric. If a spawning population is too small, the survival and production of eggs or offspring may suffer because it may be difficult for spawners to find mates, or predation pressure may be too great to maintain sustainable population abundance (Liermann and Hilborn 2001, Williams et al. 2008). This occurrence, called depensation, accelerates a decline toward extinction. To determine the status and trend of the SONCC coho salmon ESU, NMFS uses the population extinction risk criteria and the concept of a VSP for evaluating populations within the ESU (McElhany et al. 2000). The following subsections provide the evaluation of the current status and trend of the SONCC coho salmon ESU based on the four VSP parameters. The subsections further inform the jeopardy analysis and determination in the Integration and Synthesis found in section 2.7.

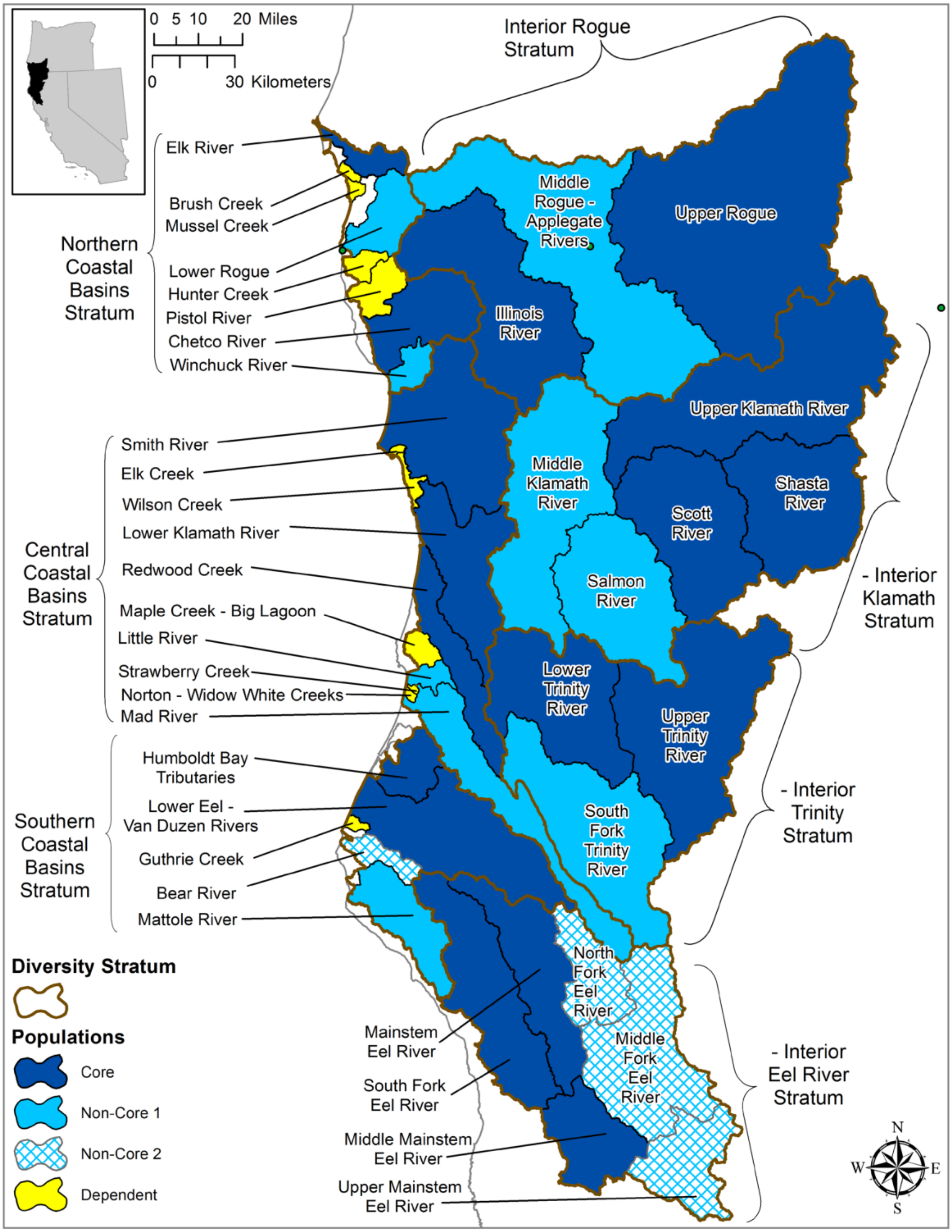

Figure 7. Bounds of the SONCC coho salmon populations and diversity stratums (Figure ES-4, Final Recovery Plan for the SONCC ESU of coho salmon NMFS 2014b).

2.2.2.1 Current Spatial Structure and Distribution

The SONCC ESU of coho salmon is composed of 41 populations between Punta Gorda, California and Cape Blanco, Oregon (NMFS 2014b). Historical and current distribution and characteristics of the population structure of SONCC coho salmon in northern California are described in Williams et al. (2006), the coho salmon status reviews (CDFG 2002; Good et al. 2005; NMFS 2011; NMFS 2014b)—figure 5 (NMFS 2014b), and the presence and absence update for the northern California portion of the SONCC coho salmon (Brownell et al. 1999).

The distribution of coho salmon within the SONCC ESU is reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which they are now absent (NMFS 2001a; Good et al. 2005; NMFS 2011; NMFS 2014b). Scientists at the NMFS Southwest Fisheries Science Center compiled a presence-absence database for SONCC coho salmon ESU-wide, using information for coho salmon streams listed in Brown and Moyle (1991), other streams where NMFS found historical or recent evidence of coho salmon presence, and information assembled in the 2002 Status Review of California coho salmon North of San Francisco (CDFG 2002).

Using the NMFS database, Good et al. (2005) compiled information on the presence of coho salmon in streams throughout the SONCC ESU, which closely matched the results of Brown and Moyle (1991). Garwood (2012) compiled coho salmon data through 2004 to generate a historical coho salmon stream list for the California watersheds of the SONCC ESU. Garwood (2012) verified the presence of juvenile coho in 325 of the streams from the Brown and Moyle (1991) study, and identified 217 additional streams. From 2001 to 2003, the California Department of Fish and Game (CDFG) conducted 628 surveys in 301 streams across the California portion of the SONCC ESU. Coho salmon were detected in 153 of 245 sampled historic coho salmon streams (Garwood 2012).

The number of streams and rivers currently supporting coho salmon in this ESU has been greatly reduced from historical levels, and watershed-specific extirpations of coho salmon have been documented (Brown et al.1994, CDFG 2004, Good et al. 2005, Moyle et al. 2008, Yoshiyama and Moyle 2010). In summary, information on the SONCC ESU of coho salmon indicates that their distribution within the ESU has been reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which they are now absent (Williams et al. 2011a). However, extant populations can still be found in all major river basins within the ESU (70 FR 37160).

Given that all diversity strata are occupied (Williams et al. 2011a), the spatial structure of the SONCC coho salmon ESU is broadly distributed throughout its range. 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.

2.2.2.2 Current Abundance

In California, seven independent populations are currently monitored at the “population unit” scale. Most of this monitoring produces estimates of adult escapement based on random subsampling within the population area. In contrast, the counts from the Shasta River are not based on an estimate. In this location, the actual numbers of fish passing a video weir are counted. The Shasta River and Scott River adult counts represent the longest-term population-unit spatial scale monitoring currently underway in the SONCC coho salmon ESU. With implementation of the California Coastal Monitoring Plan, monitoring activities have been established at five population units; these monitoring activities provide appropriate data to assess population viability. There are now four years of data (estimated number of redds) for Smith River, Redwood Creek, Humboldt Bay, and the South Fork Eel River, although only the first two years of data were available for the Smith River at the time of this assessment. The Mattole River population has a time series of two years and has the lowest estimated number of redds (47) of any of the five new time series (Williams et al. 2016).

Trends in abundance were only calculated for those populations where at least six years of data were available (redd estimate: Smith River, Redwood Creek, Humboldt Bay Tributaries, Mattole River, South Fork Eel River; video weir adults: Scott River and Shasta River). The slope of the abundance trend line (log transformed abundance) for both the Shasta River and Scott River did not differ from zero (Williams et al. 2016). If monitoring continues, at the time of the next assessment in 2020 the Scott River will have more than 12 years of data. In addition, the time series information for Smith River, Redwood Creek, Humboldt Bay, South Fork Eel River, and the Mattole River will all be at least two generations in length (six years) if all of the described monitoring continues.

The most recent five-year status review (Williams 2016; NMFS 2016) describe that the slope of the trend line for the longest existing time series of abundance (Shasta River) did not differ from zero. For the 2011 five-year status update, Williams et al. (2011) describes that none of the time series examined (other than West Branch and East Fork Mill Creek), had a positive short-term trend and further examination of these time series data indicated that the strong 2001 brood year was followed by a decline across the entire ESU.

2.2.2.3 Current Population Productivity

Besides the population-unit spatial scale estimate that are required to assess population viability, there are two other data sets that provide insight into the condition of coho salmon in the ESU although at spatial scales that do not allow for assessing population viability. An estimate of spawners from 2002-03 to 2013-14 in Freshwater Creek, a Humboldt Bay tributary, shows a trend that is not significantly different than zero ($p > 0.07$) over the 13-year period. The Freshwater Creek monitoring site supports a Life Cycle Monitoring station operated as outlined in the Coastal Monitoring Plan (Ricker and Anderson 2014). This Life Cycle Monitoring provides data to understand the relationships between redd counts and estimated adult escapement. This is a critical relationship to understand, as Coastal Monitoring Plan efforts currently focus on redd counts for many practical reasons. In addition, this and other Life Cycle

Monitoring stations will provide estimates of marine survival that will provide context when evaluating trends in abundance and effectiveness of restoration activities (Williams et al. 2016).

In addition, of concern to the viability of SONCC coho salmon is that recent favorable marine conditions in 2007 and 2008 *did not* result in improved marine survival resulting in increased adult returns. In 2008, adult spawner populations (fish resulting from the 2005 brood year) within the Oregon Coast coho salmon ESU rebounded from recent declines (Lewis et al. 2009), while escapement of many SONCC coho salmon populations, including those in the Rogue River, declined to near record low numbers (Williams et al. 2011). However, despite the recent information from the Shasta River indicating increases in adult escapement in 2011, 2012, and 2013, 2014, 2015 (62, 115, 163, 46, 45 adults respectively), likely responding to a period of favorable ocean conditions, the total number of spawning adults remains below recovery levels.

As discussed above in the abundance section, available data indicate that the abundance of many populations have declined, which may reflect a reduction in productivity. For instance, the Shasta River population has declined in abundance by almost 50 percent from one generation to the next (Williams et al. 2011). Partial counts from Prairie Creek, a tributary of Redwood Creek, and Freshwater Creek, a tributary of Humboldt Bay show a negative trend. In general, SONCC coho salmon have declined substantially from historic levels. Productivity does not appear to be sufficient to maintain viable abundances in many SONCC coho salmon populations. Because productivity appears to be negative for most SONCC coho salmon populations, this ESU is not currently viable in regard to population productivity (Williams et al. 2008; Williams et al. 2011; Williams at al. 2016).

2.2.2.4 Current Diversity

The primary factors affecting the diversity of SONCC coho salmon appear to be low population abundance and the influence of hatcheries and out-of-basin introductions. Although the operation of a hatchery tends to increase the abundance of returning adults (70 FR 37160; June 28, 2005), the reproductive success of hatchery-born salmonids spawning in the wild is likely less than that of naturally produced fish (Araki et al. 2007). As a result, the higher the proportion of hatchery-origin spawners, the lower the overall productivity of the population, as demonstrated by Chilcote (2003). Williams et al. (2008) considered a population to be at least at a moderate risk of extinction if the contribution of hatchery coho salmon spawning in the wild exceeds five percent. Populations have a lower risk of extinction if no or negligible ecological or genetic effects are demonstrated as a result of past or current hatchery operations. Because many of the most productive watersheds in the SONCC coho salmon ESU (i.e., Rogue River, Klamath River, and Trinity River) remain heavily influenced by hatcheries and have little natural production (Weitkamp et al. 1995; Good et al. 2005; NMFS 2014b), many of these populations are at high risk of extinction relative to the genetic diversity parameter.

In summary, most independent populations in the SONCC coho salmon ESU are at risk of extinction because they are below or are likely below their depensation threshold (NMFS 2014b). SONCC coho salmon have declined from historic levels, and their current productivity does not appear sufficient to maintain viable abundances in many SONCC coho salmon populations. The number of streams currently supporting SONCC coho salmon have been reduced from historical levels, and some brood years have low abundance or may even be absent in some areas (e.g., Shasta River, Mattole River, Mainstem Eel River), further restricting current diversity the ESU. Given the recent trends in reduced abundance across the ESU, genetic and life history diversity of populations are likely low and insufficient to contribute to a viable ESU. All of these factors contribute to the current elevated extinction risk of SONCC coho salmon.

2.2.3 Status and Description of SONCC Coho Salmon Critical Habitat

SONCC coho salmon ESU critical habitat can be separated into five essential habitat types of the species' life cycle. The five essential habitat types include: (1) juvenile summer and winter rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; (4) adult migration corridors; and (5) spawning areas. Within these areas, essential features of coho salmon critical habitat include adequate: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions (64 FR 24049; May 5, 1999).

Critical habitat for the SONCC ESU of coho salmon encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between Cape Blanco, Oregon and Punta Gorda, California (64 FR 24049, May 5, 1999). Excluded are: (1) areas above specific dams identified in the Federal Register notice; (2) areas above longstanding natural impassible barriers (i.e., natural waterfalls in existence for at least several hundred years); and (3) tribal lands. Critical habitat consists of the water, substrate, and river reaches (including off-channel habitats) in specified areas. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of coho salmon. These river habitats are important for a variety of reasons, such as supporting the feeding and growth of juveniles and serving as spawning habitat for adults. Limiting factors identified for this species include loss of channel complexity, connectivity and sinuosity; loss of floodplain and estuarine habitats; loss of riparian habitats and large in-river wood; reduced stream flow; poor water quality, temperature and excessive sedimentation; and unscreened diversions and fish passage structures. The current condition of critical habitat for SONCC coho salmon is discussed below.

2.2.3.1 Current Condition of the Critical Habitat

The condition of SONCC coho salmon critical habitat, specifically its ability to provide for their conservation, is degraded from conditions known to support viable salmon populations. NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat: logging, agricultural and mining activities, urbanization, stream channelization, dams, freshwater and estuarine wetland loss, and water withdrawals for irrigation. All of these factors were identified when SONCC coho salmon were listed as threatened under the ESA, and all factors continue to negatively affect this ESU.

Because the diversity of life history strategies of coho salmon include spending one and sometimes up to two years rearing in freshwater (Bell and Duffy 2007), they are especially susceptible to changes within the freshwater environment, more so than fall-run Chinook salmon, which migrate to the ocean shortly after emerging from spawning gravels. The condition of critical habitat throughout the range of the SONCC coho salmon ESU is degraded, relative to historical conditions. While some relatively unimpaired streams exist within the ESU, decades of intensive timber harvesting, mining, agriculture, channelization, and urbanization have altered coho salmon critical habitat, sometimes to the extent that it is no longer able to support one or more of the life stages of coho salmon.

Coho Salmon ESU Critical Habitat Summary

The current function of the majority of critical habitat in the SONCC coho salmon ESU has been degraded and fails to support functioning essential habitat features. Although there are exceptions, the majority of streams and rivers in the ESU have impaired habitat. Additionally, critical habitat in the ESU often lacks the ability to establish essential features due to ongoing human activities. For example, large dams, such as William L. Jess Dam on the Rogue River in Oregon, stop the recruitment of spawning gravels and large wood, which impacts both an essential habitat type (spawning areas) as well as an essential feature of spawning areas (substrate). Water use in many regions throughout the ESU reduces summer base flows, which limits the establishment of several essential features such as water quality and water quantity.

2.2.4 Factors Responsible for Decline of SONCC Coho Salmon and Critical Habitat Status

When the SONCC coho salmon ESU was listed, the major factors identified as responsible for the decline of coho salmon in Oregon and California and/or degradation of their habitat included logging, road building, grazing, mining, urbanization, stream channelization, dams, wetland loss, beaver trapping, artificial propagation, over-fishing, water withdrawals, and unscreened diversions for irrigation (62 FR 2458, May 6, 1997; Weitkamp et al. 1995). More recently, others (Good et al. 2005; Williams et al. 2011; NMFS 2014b; Williams et al. 2016) have reiterated these same causes of decline. The lack, or inadequacy, of protective measures in existing regulatory mechanisms, including land management plans (e.g., State Forest Practice Rules), Clean Water Act section 404 regulatory activities, urban growth management, harvest and hatchery management have also contributed by varying degrees to the decline of coho salmon. In addition to these factors responsible for the current status of the SONCC coho salmon ESU and their critical habitat, ocean conditions, reduction in marine derived nutrients, small population size, and climate change also affect the current status of SONCC coho salmon ESU. Below, some of these activities are presented in more detail.

The factors that caused declines in the SONCC ESU of coho salmon include hatchery practices, climate change, 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; and severe flood events exacerbated by land use practices (Good et al. 2005, NMFS 2014b).

Sedimentation and loss of spawning gravels associated with poor forestry practices and roadbuilding are particularly chronic problems that can reduce the productivity of salmonid populations. Non-native Sacramento pikeminnow (*Ptychocheilus grandis*) have been observed in the Eel River basin and could be acting as predators on juvenile steelhead as thermal conditions lead to niche overlap of the two species (Good et al. 2005). Droughts and unfavorable ocean conditions during the late 1980s and early 1990s were identified as likely causes of decreased abundance of SONCC coho salmon (Good et al. 2005). Reduced flows can cause increases in water temperature, resulting in increased heat stress to fish and thermal barriers to migration.

The current drought period (since water year 2012), in California, (State of California [http://gov.ca.gov/news.php?id=18379] 2014; NMFS and CDFW 2014, NMFS 2014b), has the potential to desiccate rearing and holding areas, creating migration barriers that could eliminate year-classes or entire populations as it continues into water year 2016—*see* http://www.water.ca.gov/waterconditions/ and http://ca.gov/drought/.

MacFarlane et al. (2008) compared data on adult returns of returning coho salmon in California for return season 2004/05, compared to subsequent adult returns of their progeny in return year 2007/08. The data indicated a 73 percent decline in returning adults in 2007/08 (offspring from 2004/2005 adults), compared to adult returns in 2004/2005. MacFarlane et al. (2008) speculated that because the spatial extent of the decline observed between coho parent and subsequent returning adult offspring, was wide-ranging throughout California and Oregon, ocean conditions were the main causative mechanism for decline. MacFarlane et al. (2008) further supported their hypothesis with observations of low adult Chinook returns to California that as juveniles, experienced sub-optimal ocean conditions during the same time as did coho juveniles.

NMFS (2014) describes climate change impacts as detrimental to Pacific salmon through altered runoff patterns causing a precipitation shift from snow to rain, earlier snowmelt, lower summer flows, and more intense storms that will increase peak flows in freshwater. When combined with ocean acidification and large ocean processes (e.g. El Nino, Southern Oscillation), climate change is expected to reduce ocean productivity and further alter estuarine habitat as sea level rises. Warmer winter air temperatures will decrease the snowpack in northern California and southern Oregon by up to 75 percent by 2040 and nearly 100 percent by 2080 (Doppelt et al. 2008) resulting in earlier and higher high flows, and earlier and lower low flows.

Battin et al. (2007) predicted that Chinook salmon spawner capacity throughout the Pacific Northwest was proportional to minimum discharge during the spawning period; reduction trends in flow would result in reductions in spawning capacity due to habitat limitations. Widespread declines in springtime snow water equivalent have occurred in much of the North American West since the 1920s, especially since the mid-twentieth century (Knowles and Cayan 2004; Hamlet et al. 2005; Regonda et al. 2005; Mote 2006). These trends have resulted in earlier onsets of springtime snowmelt and stream flow across western North America (Regonda et al. 2005; Stewart et al. 2005), as well as lower flows in the summer (Stewart et al. 2005). Low flows are also important for juvenile Coho due to space and food limitations, while low flows may be associated with temperature limitations in other areas (Ebersole et al. 2009).

Past forestry practices have harvested canopy-creating trees from stream-side habitat affects cover from predation, water temperature, the watershed's ability to absorb precipitation, water flow timing, erosion, bank stability, retention of in-stream woody debris, recruitment of large woody debris, and habitat complexity. Removal of near-stream vegetation can result in increased water temperature, both short- and long-term (Moring et al. 1994; Johnson and Jones 2000). The decrease in habitat complexity, loss of stream function, and loss of access to accessible off-channel habitat, and temperature refugia have contributed to reduced summer and rearing capacity for juvenile coho salmon (CDFG 2002).

Hatchery practices as a causative mechanisms of salmonid decline include hatchery straying and mixing with wild spawners where the resulting progeny exhibit lower survival then their wild stock counterparts (McGinnity et al. 2003; Kostow 2004), ultimately leading to a reduction in the reproductive success of the wild stock (Reisenbichler and McIntyre 1977; Fleming et al. 2000, Chilcote 2003; Araki et al. 2007). Flagg et al. (2000) found that, except in situations of low wild fish density, increasing releases of hatchery fish can negatively impact naturally produced fish through habitat displacement. Kostow et al. (2003) and Kostow and Zhou (2006) found that over the duration of the steelhead hatchery program on the Clackamas River, Oregon, the number of hatchery steelhead in the upper basin regularly caused the total number of steelhead to exceed carrying capacity, triggering density-dependent mechanisms that impacted the natural population. Competition between hatchery and wild salmonids in the ocean can also lead to density-dependent mechanisms that effect wild salmonid populations (Beamish et al. 1997; Levin et al. 2001; Sweeting et al. 2003), especially during periods of poor ocean productivity (Beamish et al. 1997; Levin et al. 2001; Sweeting et al. 2003).

Dam operations disrupt hydrologic signals that salmon use throughout their life history by dampening peak flows and increase low flows—the converse of climate change. Dam construction has limited, or blocked upstream migration access to spawning and rearing habitat and remains one of the single most disruptive anthropogenic factors to decline (NMFS 2014b).

2.3 Action Area

"Action area" means 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 proposed project is located in Siskiyou County along SR 263 between the town of Yreka, California and the intersection with SR 96 near (I-5) (Figure 3). The legal description of the proposed project location is Township 46 N, Range 06 W, and Section 18 according to the Hawkinsville United States Geological Survey (U.S.G.S.) 7.5 minute quadrangle.

Because impact pile driving has the potential to effect a large area (distance—1,473 feet), both upstream and downstream of the impact site, for acoustic impact reaching the threshold at onset of physical injury, the effective footprint of the action area is approximately 2,946 lineal feet. The distance at which an acoustic impact experiences a behavior noise threshold is 15,229 feet (behavior noise threshold 150 dB (re: 1 µPa) RMS). The action area construction footprint of the proposed Project is approximately 695,340 square feet (15.96 acres) and has a linear length of 1,950 feet on the mainstem Klamath River; SR 96 parallels the river (SR 96 upstream extent at ~PM 103.64 and the downstream to ~PM 103.27). The existing Bridge is at PM 103.45 on SR 96. The action area also includes that section of SR 263 that covers staging areas, new bridge approach, and temporary access roads, as well as upland and riparian vegetation removal—the southern extent of the action area at SR 263 PM 56.70 to the Klamath River at PM 57.03, or ~1,740 lineal feet. SR 263 parallels the Shasta River along the action area. Added to the actual footprint of all proposed actions, the action area includes proposed areas used for sign posts, areas used for staging equipment and/or materials, access roads, temporary trestles, and placement of temporary gravel pads (Caltrans 2016) (Figures 4, 5, and 6). The action area includes the portion of the river from the furthest points of upstream and downstream of the effects of the action, in particular where it is anticipated that turbidity/suspended sediment mobilized by this proposed project will dilute to undetectable levels 300 feet down stream of the project action. Additionally, the acoustic impact area, defined as the distance within which an injury threshold sound pressure level is exceeded (Caltrans 2015b) or is the distance from the noise source (i.e. pile driving) to the point at which the target (fish) and behavior threshold are reached. Caltrans calculated the distance of the acoustic impact area, as 2,487 feet (829 meters from the pile driving activity.

The proposed new bridge will cross over the Klamath River on a new alignment approximately 156 feet west (downstream) of the existing bridge, measured at the south bank, and approximately 290 feet west of the existing bridge, measured at the north bank. The existing bridge is situated immediately south of the junction of SRs 263 and 96 and near the confluence of the Shasta and Klamath Rivers located approximately at Klamath River, RM 176.8 (Figure 3, Table 9). The proposed bridge is approximately 0.7 to 0.11 RM (400–600 feet) east (upstream) from the Shasta River's confluence with the Klamath River. Additionally the project action area is located 13.3 RMs downstream from the Iron Gate Dam and 12.8 RMs from Iron Gate Hatchery (RM 189.6).

The action area is within the Klamath Mountains geomorphic province (Irwin 1994) which is composed of a series of geologic terranes derived from accumulated oceanic crust and upper mantle, volcanic arcs, and rock of mixed origin. The steep, soil-covered mountainous terrain is underlain by a mixture of severely faulted and folded meta-sedimentary and meta-volcanic rocks interspersed by plutonic (granitic), volcanic, and sedimentary rocks. The highly weathered and erodible granitic rocks are chronic sources of sand and finer sediment to streams.

The majority of the action area's watershed has steep soil-covered hillslopes that are at or near sediment mobilization thresholds (i.e., highly prone to landslides), based on Klamath National Forest cumulative watershed effects modeling results (KNF 2012, 2014). The steep hillslopes and incised topography are a product of tectonic uplift and hillslope erosion from stream flow and past glacial activity. River incision and hillslope erosion from soil creep, surface erosion, mass-wasting, and landsliding have determined hillslope steepness, as well as the height of adjacent ridges and mountains (Larsen and MacDonald 2007; Roering 2004). Climate, biology, and lithology continue to determine both local hillslope soil production and erosion rates. Local hillslope stability is regulated by rainfall, hillslope steepness, frictional and cohesive/strength properties of the soils and roots, and subsurface hydrology (Hales et al. 2009).

The Klamath River Basin covers approximately 1,531 square miles of the mainstem Klamath River and associated tributaries (excluding the Trinity, Salmon, Scott and Shasta River subbasins) from the estuary to Link River Dam. Although anadromous fish passage is currently blocked at Iron Gate Dam, coho salmon once populated the basin at least to the vicinity of and including Spencer Creek at RM 228 (Hamilton et al. 2005). Over one-third of the river has been rendered inaccessible to anadromous fish species by a series of dams that regulate flow and reallocate water, while remaining accessible habitat poses challenges due to decreased flows and high summer water temperatures (NRC 2004). Today, coho salmon occupy a small fraction of

Table 9. Location of points in relationship to the proposed project and relative to the Project action area (*see* Figure 3). All locations and distances are approximate.

Location	Klamath River, River Mile (RM)
Iron Gate Dam	RM 195
Iron Gate Hatchery	RM190.14
Bogus Creek confluence with Klamath River (the mouth of Bogus Creek is approximately 75 feet downstream of the entrance to the adult collection axillary ladder at Iron Gate Hatchery)	RM 189.6
• Bogus Creek Fish Counting Facility (BCFCF)	Located on Bogus Creek approximately 0.3 miles (1580 feet) upstream from the creek mouth
• Bogus Creek juvenile outmigration trap	2015—located directly upstream of BCFCF
Mainstem Klamath River juvenile outmigrant traps (3):	
1. Below the confluence with Bogus Creek	RM 191.23
2. Located on the left bank downstream of the Carson Creek confluence with the Klamath River and upstream of the I-5 Klamath River Bridge crossing	RM 182.4
3. Near the Kinsmen Creek confluence (upstream of the confluence with the Scott River)	RM 147.61
Existing SR 263 Bridge	RM 176.85
Proposed new SR 263 Bridge	RM 176.8
Shasta River confluence with Klamath River	RM 176.7
4. Shasta River Fish Counting Facility (SRFCF)	Located approximately 700 feet from the confluence of the Shasta and Klamath Rivers
5. Shasta River juvenile outmigration trap	Located directly downstream of the adult fish counting facility
Location	**Distance relative to Klamath River Bridge action area**
Iron Gate Dam	13.2 river miles upstream
Iron Gate Hatchery	12.9 river miles upstream
Bogus Creek confluence with Klamath River	12.8 river miles upstream
Mainstem I-5 juvenile outmigrant traps	5.2 river miles upstream
Shasta River mouth to *existing* SR 263 Bridge	~400 and 600 feet downstream (south and north bank respectively) from confluence of the Shasta and Klamath Rivers
Shasta River mouth to *proposed new* SR 263 Bridge	~240 and 310 feet downstream (south and north bank respectively) from confluence of the Shasta and Klamath Rivers

their historical area (NRC 2004) due to migration barriers and habitat degradation. The United States Bureau of Reclamation (USBR) operates the Klamath Project, which diverts water from the Klamath River for the purpose of irrigated agriculture. Annual diversions in a typical year have ranged from 43,172 to 55,507 hectare meters (350,000 to 450,000 acre feet) (USBR 2005).

A major decline of anadromous fishes during the past century and a half has occurred in the Klamath River Basin as a result of a variety of flow- and non-flow-related factors (West Coast Chinook Salmon Biological Review Team 1997; Hardy 2012). Coho salmon were once numerous and widespread within the Klamath River basin (Snyder 1931). However, the small populations that remain occupy limited habitat within tributary watersheds and in the mainstem Klamath River below Iron Gate Dam (CDFG 2002; NRC 2004). Coho salmon use of freshwater habitat is largely based on life-stage and season (Sandercock 1991; Quinn 2005). However, habitat use can also be influenced by the quality of existing habitat and watershed function, factors which will likely play a large role in determining coho salmon survival in the future. Historically, coho salmon contributed to economically and culturally important subsistence, sport, and commercial fisheries. Currently, due to catch restrictions, they are now only caught as by-catch and in some tribal fisheries.

2.4.1 Status of SONCC Coho Salmon in the Action Area

The action area of this Project is encompassed by the Upper Klamath River population, while the downstream end of the Project action area overlaps with the mouth of the Shasta River, and thus also effects the Shasta River population of coho salmon. The species' recovery plan (NMFS 2014b) provides population profiles of the Klamath River populations within the action area (Table 10).

Using a variety of methods including weirs, traps, and tributary spawning surveys, and an Intrinsic Potential (IP) database, Ackerman et al. (2006) estimated the abundance of coho salmon in the Upper Klamath River population to be between 100 to 4,000 adults, far lower than the 8,500 spawners needed for this population to achieve a low extinction risk (Williams et al. 2008). Similarly, the Shasta River population with an estimated abundance between 74 to 410 adults is far below the 4,700 spawners to achieve a low extinction risk (Table 10).

While the *Status of the Species* section discussed the viability of the SONCC coho salmon ESU as a whole, this section provides a more in-depth discussion of the extinction risk of the Upper Klamath River and Shasta River populations. The former population will be adversely affected by the proposed action. The SONCC coho salmon from the latter Shasta River population also passes through the lower section of the action area. But this population is described more briefly because, as described in the *Effects of the Action* (section 2.3), individuals from this population are unlikely to experience significant effects from the Project.

Within the California portion of the SONCC coho salmon ESU, estimating the risk of extinction of a given coho salmon population is difficult since longstanding monitoring and abundance trends are largely unavailable. Williams et al. (2008) proposed biological viability criteria, including population abundance thresholds. The viability criteria developed by Williams et al. (2008) address and incorporate the underlying viability concepts (i.e., abundance, productivity, diversity and spatial structure) outlined within McElhany et al. (2000), and are intended to provide a means by which population and ESU viability can be evaluated in the future when more population data become available. Comparing population estimates against population viability thresholds proposed by Williams et al. (2008) allow NMFS to make conservative assumptions concerning the current risk of extinction of Klamath River mainstem and tributary populations.

Table 10. Status of the Upper Klamath River and Shasta River populations of SONCC coho found within the action area as outlined in the species recovery plan.

ESU	Population Outlines	
Most recent 5-Year Status Review of the ESU/DPS[1]	SONCC Coho Salmon Recovery Plan[1]	
Population within the Action Area	Upper Klamath River	Shasta River
Diversity Stratum within Action Area	Interior Klamath	Interior Klamath
Role within ESU	Core, Functionally Independent	Core, Functionally Independent
Extinction Risk	High	High
Depensation Threshold	Likely below	Likely below
Depensation Spawners Threshold	425 adults	144 adults
Spawners Required for ESU Viability	8,500 adults	4,700 adults
Limiting Stresses	Barriers; Altered hydrologic function	Impaired Water Quality; Altered hydrologic function
Limiting Threats	Dams/Diversions; Roads	Agricultural Practices; Dams/Diversions
Most Recent Population Abundance estimate	1,016 redds[2] (2015: 14 adults[3] Bogus Creek)	2011–2015 average : 45 adults[4]

[1]Williams et al. 2011, 2016; NMFS 2014b.
[2]Williams et al. 2008.
[3]Knechtle and Chesney 2016.
[4]Chesney and Knechtle 2016b.

2.4.1.1 Upper Klamath River Coho Salmon Population

Summary

The Upper Klamath River population of SONCC coho salmon is currently comprised of approximately 64 miles of mainstem habitat and numerous tributaries to the mainstem Klamath River upstream of Portuguese Creek to Iron Gate Dam (RM 195). Historically, the population extended upstream of the Iron Gate Dam to Spencer Creek (RM 228).

Exposure to Project effects in the Upper Klamath River may occur in the mainstem Klamath River, particularly in refugia associated with tributaries to the mainstem Klamath River, and in all Klamath tributary habitat accessible to Upper Klamath River SONCC coho salmon. Though primarily developed to collect Chinook salmon data, and opportunistically coho salmon data, as a component of the Klamath River Project initiated in 1978, a video counting station was incorporated at Bogus Creek in 2003 and total coho salmon female spawner (hatchery plus natural origin) to natural origin recruit analysis for years 2004, 2005, 2007–2012, 2015, and 2016 exist (Knechtle and Chesney 2016c, https://nrm.dfg.ca.gov/Search.aspx?q=bogus+creek+spawning).

Spatial Structure and Diversity
Four mainstem dams block access to approximately 76 miles of spawning, rearing, and migratory habitat for SONCC coho salmon (USDOI and CDFG 2012). As a result, coho salmon within the Upper Klamath River population spawn and rear primarily within several of the larger tributaries between Portuguese Creek and Iron Gate Dam, namely Bogus, Horse, Beaver, and Seiad creeks.

A small proportion of the population spawns within the mainstem channel, primarily within the section of the Klamath River several miles below Iron Gate Dam. Juvenile coho salmon have a preference for tributary rearing habitat, however juvenile coho salmon have been observed residing within the mainstem Klamath River downstream of Iron Gate Dam within the upper reaches of the Klamath River throughout the summer and early fall (Sutton et al. 2007). These fish are almost always closely associated with cold water refugial habitat and extensive instream cover near tributary confluences, where water temperatures are 3.6–10.8ºF lower than the surrounding river environment (NRC 2004; Sutton et al. 2004) which usually exceeded their published thermal tolerance limits (Brett 1952; Brett et al. 1982), moving into the thermal refugia when main-stem temperatures exceed 71.6–73.4 ºF (Sutton et al. 2007). Surveys by CDFG (now CDFW) between 1979 to 1999 and 2000 to 2004 showed coho salmon moderately well distributed downstream of Iron Gate Dam. Juveniles were found in 25 of the 48 surveyed tributary streams, with sustained presence in Portuguese, Seiad, Grider, Beaver, Little Bogus, and Bogus creeks (Garwood 2012). Streams with coho salmon presence during both the 1979 to 1999 and 2000 to 2004 intervals included Grider, Seiad, Horse, Walker, Beaver, W. Fork Beaver, Cottonwood, Bogus, Little Bogus, and Dry creeks. The Karuk Tribe (2009) conducted juvenile surveys between 2002 and 2005, and found coho salmon using Tom Martin, Walker, Seiad, Grider, Beaver, Humbug, O'Neil, and Horse creeks. No juvenile coho salmon were found in Lumgrey, Willow, Bittenbender, Barkhouse, Empire, Cottonwood, Bogus, and Kuntz creeks during these surveys. The Karuk Tribe found adult coho salmon spawning in Fort Goff, Grider, Horse, and Seiad creeks, during surveys in 2013-2014 (Corum 2014).

Given that most of the fish in the population come from Iron Gate Hatchery and the fact that hatchery fish are also known to have reduced genetic and life history diversity (e.g., all released as yearlings from one location), the overall life history diversity of the population is likely limited. The loss of habitat upstream of Iron Gate Dam and poor conditions in the mainstem between April and September also contribute to the loss of life history diversity. Smolt and adult migration are now confined to a short period of time when conditions in the mainstem are favorable and mainstem rearing and spawning is likely reduced from historic levels given the degradation of mainstem habitat.

In summary, the more restricted and fragmented the distribution of individuals within a population, and the more diversity, spatial distribution, and habitat access diverge from historical conditions, the greater the extinction risk. Williams et al. (2008) determined that at least 20 coho salmon per IP-km of habitat (425 total IP-kms) are needed (8,500 spawners total) to approximate the historical distribution of Upper Klamath River coho salmon and habitat. The current population is well below this, (as described above) and has a reduced genetic and life history diversity.

Population Size and Productivity

If a spawning population is too small, the survival and production of eggs or offspring may suffer because it may be difficult for spawners to find mates, or predation pressure may be too great. This situation accelerates a decline toward extinction. Williams et al. (2008) determined at least 425 coho salmon must spawn in the Upper Klamath River each year to avoid such effects of extremely low population sizes (depensation). The low risk spawner threshold for the population is 8,500 spawners.

Based on juvenile surveys in the Upper Klamath between 2002 and 2005, there is low production in the Upper Klamath tributaries, with fewer than 200 juveniles found in most tributaries and most years (Karuk Tribe 2012). The greatest number of juveniles was just over 1000, in Horse Creek in 2005. CDFW began operating a juvenile outmogrant trap on Bogus Creek (near the Bogus Creek Fish Counting Facility) in 2015 (Chesney and Knechtle 2015b). During a second year of juvenile outmigration trapping in 2016, another installation site was chosen because of sedimentation issues, however, expanded juvenile outmigrant estimates were not calculated in 2016 due to low numbers trapped where trap efficiencies could not be calculated (Chesney and Knechtle 2016c). Consequently, only one year of smolts per adult production could be calculated from an estimated 7,566 smolts in 2015, produced from 446 adults, or 17.0 smolts per adult.

During spawn years 2012-2013 and 2013-2014, the total observed coho salmon adults for surveyed streams (excluding Bogus Creek) was at least 20 and 80, respectively, with the majority of coho salmon found spawning in Seiad Creek (Corum 2014). Bogus adult coho salmon counts are collected by video at the Bogus Creek Fish Counting Facilities (Knechtle and Chesney 2016), and provide a reliable current time series of adult spawners (Table 11; Figure 3) to represent a major portion of the Upper Klamath SONCC coho salmon population. Annual returns to Bogus Creek are significantly affected by hatchery strays (i.e., 52 percent from 2004 to 2015) but have averaged 154 adult coho salmon during the 2004 to 2015 period (Knechtle and Chesney 2016). Knechtle and Chesney's (2016) spawner recruit analysis (years 2004, 2005, 2007–2012) indicate the production of natural origin coho salmon is Bogus Creek may be limited to roughly 150 adults. By comparison, Walker Creek and Grider Creek represent tributaries that are important for non-natal rearing of juvenile coho salmon, and to a lesser extent spawning and rearing of natal fish. Though adult coho salmon can access these streams, the value of the IP habitat is low to moderate (NMFS 2014b with spawning habitat sporadic and dispersed. Some adult coho salmon can and probably do spawn in Walker and Grider creeks, but have not been observed during surveys (USFS and Karuk Tribe 2014). It is likely that less than 20 adults total return annually to Walker and Grider creeks. Most recently, 2015-2016 spawning surveys have resulted in zero observations of adult coho salmon in Walker and Grider creeks (J. Grunbaum, pers. comm. *as cited in* Caltrans 2016). A potential natural barrier to fish passage is located 1.5 miles upstream from the mouth of Walker Creek with the majority of fish found in the lower 0.7 mile of Walker Creek. Grider Creek provides habitat in the lower 7.35 miles of the watershed for some adults and up to thousands of juvenile coho salmon, comprised of natal Grider Creek juvenile coho salmon as well as non-natal juvenile coho salmon from neighboring tributaries.

Tributary spawner surveys indicate low numbers of coho salmon (<100) in the remaining habitat. Using a variety of methods, including these data and an IP database, Ackerman et al. (2006) developed run size approximations for tributaries in the Upper Klamath River reach. Ackerman et al. (2006) estimated the abundance of the Upper Klamath River population to be between 100 and 4,000 adults, far lower than the 8,500 spawners needed for this population to achieve a low extinction risk (Williams et al. 2008).

Table 11. Estimated number of SONCC coho salmon spawners in Bogus Creek collected from the adult salmon video weir at the Bogus Creek Fish Collection Facility (Knechtle and Chesney 2016).

Adult Brood Year	Adult Estimate
2004	414
2005	117
2006	44
2007	233
2008	111
2009	7
2010	154
2011	142
2012	185
2013	446
2014	97
2015	14
Average	163.7

Extinction Risk

The Upper Klamath River population is at a high risk of extinction given its low population size and negative population growth rate. The population growth rate of the Upper Klamath population has not been estimated but given the current trends in spawner abundance and the high incidence of hatchery fish and inbreeding depression, population growth is likely negative. The combination of low population abundance and a negative population growth rate mean that the population is at an elevated risk of extinction. In addition, habitat is often not fully occupied, such that the high risk criteria described by Williams et al (2008) are met or exceeded. NMFS' determination of population extinction risk is also based on the available information about population productivity, spatial structure, and diversity, described above.

Role in SONCC Coho Salmon ESU Viability

The Upper Klamath River population is a core, functionally independent population within the Interior Klamath River diversity stratum; historically having had a high likelihood of persisting in isolation over 100-year time scales, and with population dynamics or extinction risk over a 100-year time period that are not substantially altered by exchanges of individuals with other populations (Williams et al. 2006). To contribute to stratum and ESU viability, the Upper Klamath River core population needs to have at least 8,500 spawners. Sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and continue to represent critical components of the evolutionary legacy of the ESU. Besides its role in achieving demographic goals and objectives for recovery, as a core population the Upper Klamath population may serve as a source of spawner strays for nearby populations. At present, the capacity of the Upper Klamath coho salmon population to provide recruits to adjacent independent populations is limited due to its low spawner abundance. Conversely, recruits straying from the nearby populations in the Klamath basin may enhance recovery of the Upper Klamath River population. Additionally, Upper Klamath River tributaries, refugia, and mainstem habitat function as migratory and rearing habitat for fish from populations located upstream (i.e., Scott and Shasta). Therefore, restoration of the Upper Klamath River is important for recovery of these populations as well.

2.4.1.2 Shasta River Coho Salmon Population

Summary

The Shasta River system produces outmigrant coho salmon smolts that transit through the Project action area and, thus, may be affected by Project activities. The Shasta River coho salmon population status (Table 10) is also high risk of extinction (NMFS 2014b) Annual Shasta River adult SONCC coho salmon counts are collected by video at the Shasta River Fish Counting Facilities (*see location* Figure 3) (Chesney and Knechtle 2016b), and provide a reliable current time series of naturally produced adult spawners for the Shasta River. A rotary screw trap, operated by CDFW and part of the Juvenile Salmonid Outmigration Study (part of the ongoing Anadromous Fisheries Resource Assessment and Monitoring Program), is used to capture and estimate abundance, timing, and species of out-migrating juvenile salmonids located directly downstream of the Shasta River Fish Counting Facility, and approximately 2,250 feet upstream from the mouth of the river (Debrick at al. 2015). Shasta River coho salmon population exposure to Project impacts may occur in the Project action area composed of the mainstem Klamath River and the mouth of the Shasta River. Exposure, via juvenile (ocean migration of smolts and redistribution of natal rearing juveniles) and returning adult migration corridors of Shasta River origin SONCC coho salmon occurs downstream of the existing and proposed new bridge alignments, but within the bounds of the Project action area.

Spatial Structure and Diversity

The Shasta River population is considered a Functionally Independent population within the SONCC coho salmon ESU (Williams et al. 2006). 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 is concentrated in the mainstem Shasta River from RM 32 to about RM 36, Big Springs Creek, lower Parks Creek, and in the Shasta

River Canyon (RM 0 to 7). Juvenile rearing is also occurring in these same areas, and occasionally in lower Yreka Creek (Garwood 2012). The diversity of the population is threatened by hatcheries. Information analyzed by the California Hatchery Scientific Review Group (2012) and presented in the Hatchery and Genetic Management Plan for Iron Gate Hatchery Coho Salmon (CDFW and PacifiCorp 2014), suggest that hatchery and natural fish have already interbred in upper Klamath Basin tributaries near Iron Gate Hatchery particularly in the Shasta River basin. The total impacts of hatchery strays on populations like that of the Shasta River are not well understood. However, the use of observed straying rates and preliminary genetic typing indicate that hatchery releases have negatively affected and superseded natural populations (Garza 2012).

Population Size and Productivity

In California, seven independent populations are currently monitored at the "population unit" scale. Most of this monitoring produces estimates of adult escapement based on random subsampling within the population area. In contrast, the counts from the Shasta River are not based on an estimate. In this location, the actual numbers of fish passing a video weir are counted. Only the video weir count from the Shasta River meets the minimum duration to assess under the viability criteria (12 years) (Table 12). In 2010, monitoring became even more important with the release of a California Department of Fish and Game (CDFG) report stating that two of the three coho cohorts on the Shasta River were "functionally extinct" with populations and production rates in decline (Chesney 2010). As such, extremely low numbers of coho salmon passed the weir in 2014 and 2015 (46 and 45 coho salmon respectively, Chesney and Knechtle 2015s, 2016b), which is less than the depensation threshold of 144 fish (NMFS 2014b), and that only four of those fish in the 2014 return were considered to be 3-year olds (Chesney and Knechtle 2015a). The Shasta River count is now 14 years in duration (4+ generations) and from this time series a slight decline is apparent, although the slope of the decline for the population trend (log transformed abundance) is not significantly different from zero (Williams et al. 2016). The recent five-year trend of adult coho salmon spawners (86) (Table 12) is below the depensation threshold for the Shasta River population (144). Productivity may also be impaired (NOAA 2014). Recent comparisons (Table 12) of the estimated number of the number of coho salmon smolts produced per returning adult in the Shasta River has averaged 19.2 and ranged 2.1 to 46.6 for brood years 2001–2013 (Chesney and Knechtle 2016b; Debrick et al. 2015). By brood year, the number of smolts produced per returning adult has been trending downwards, (Table 12, Figure 8) suggesting that in-river conditions have not improved sufficiently to initiate recovery of the Shasta River coho salmon population (NMFS 2014b).

A combination of techniques used by CDFW, video fish counting weirs and spawning ground surveys, are used to estimate the number of returning adult Chinook and coho salmon to the Shasta River. These estimates indicate that the minimum number of adult spawning coho salmon have varied between 0 to 400 for most years, with a high of approximately 900 returning adults in 1978 (Chesney and Knechtle 2013; *note: these data may not account for 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*). The 2001–2015 average return estimate to the Shasta River is 122 adult coho salmon (Chesney and Knechtle 2016b). These brood year population estimates remain low, and have not trended upward over time.

Table 12. Estimated adult returns, juvenile out migrants, and ratio of coho salmon smolts produced per adult return coho salmon spawner in the Shasta River system (Chesney and Knechtle 2016b—adult trap; Debrick et al. 2015—juvenile trap).

Adult Return Year	Adult Estimate	Smolt Year	Smolt Point Estimate	Smolts Produced per Adult
2001	291	2003	11,052	38.0
2002	86	2004	1,799	20.9
2003	187	2005	2,054	11.0
2004	373	2006	10,833	29.0
2005	69	2007	1,178	17.1
2006	47	2008	208	4.4
2007	255	2009	5,396	21.2
2008	30	2010	169	5.6
2009	9	2011	19	2.1
2010	44	2012	2,049	46.6
2011	62	2013	494	8.0
2012	115	2014	850	7.4
2013	163	2015	6,279	38.5
2014	46	2016		
2015	45			
Average	122		3,260	19.2
Last five year average	86		2,541	18.0

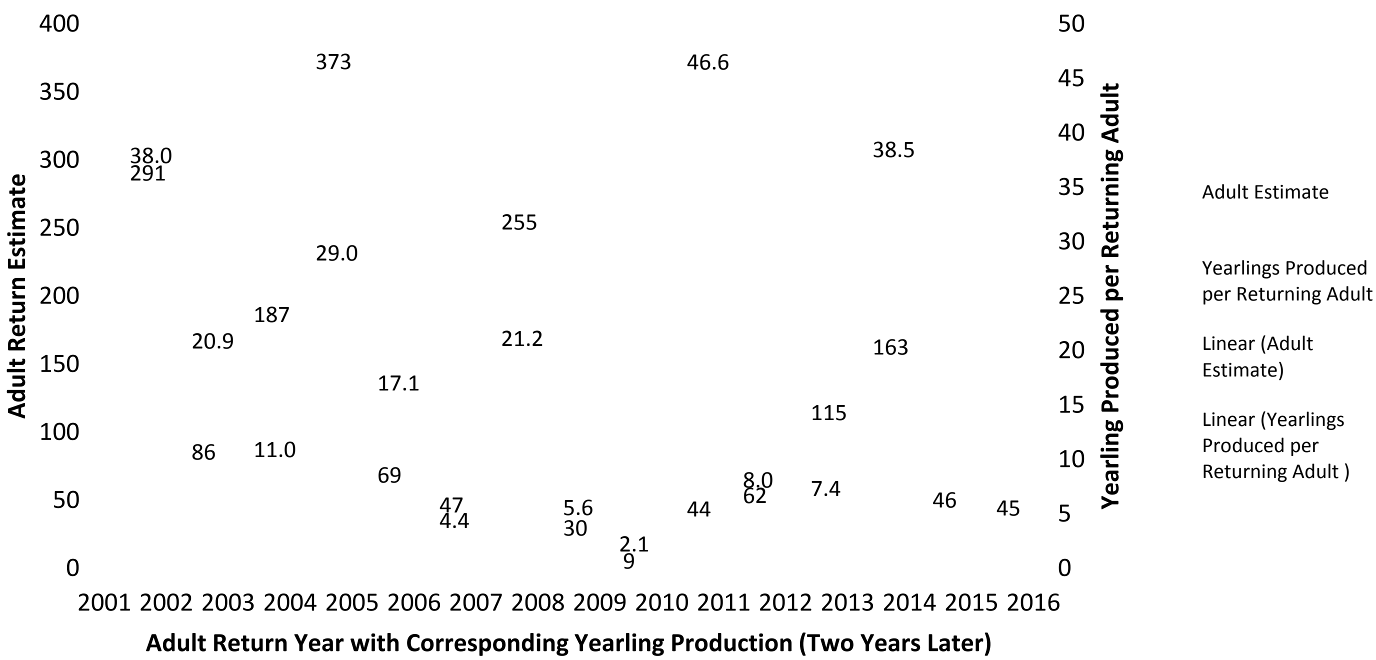

Figure 8. Adult coho salmon estimates and ratio of smolt coho salmon produced per adult return with trend lines for the Shasta River, adult year brood years 2001–2015. Data from Chesney and Knechtle 2016b—adult trap; Debrick et al. 2015—juvenile trap.

Coho Smolt Production and Smolt to Adult Survival
Debrick et al. (2015) estimated smolt to adult survival by year for Shasta River coho smolt outmigrants (Table 13). The average smolt to adult survival of 4.10% does not include the adult percent return reflected in Brood Years 2011 and 2012. Since 2010, Iron Gate Hatchery has released all returning coho salmon that are surplus to their operation (D. Chesney, pers. comm. 2016). This has resulted in increasing numbers of Iron Gate Hatchery strays into the Shasta River (Table 14). Including IGH strays in the returning Shasta River adult total exaggerates the actual percent return of adults or smolt to adult survival.

Extinction Risk
The Shasta River population is at high risk of extinction given the low and unstable population, and because the ratio of the three consecutive years of lowest abundance within the last twelve years to the amount of IP-km in the Shasta River watershed is less than one, the criterion described by Williams et al. (2008). NMFS' determination of population extinction risk is based on the viability criteria provided by Williams et al. (2008).

Table 13. Shasta River coho smolt produced per returning adult and percent return of total adults (Debrick et al. 2015). (Note: that the column "Adults Returning in" refers to the "Return Year" column). *Italics are preliminary data.*

Adults	year of emigration	Smolt produced	smolts per adult	% Return	Adults Returning in	Return Year
291	2003	11,052	37.98	3.37%	373	2004
86	2004	1,799	20.92	3.84%	69	2005
187	2005	2,054	10.98	2.29%	47	2006
373	2006	10,833	29.04	2.35%	255	2007
69	2007	1,178	17.07	2.63%	31	2008
47	2008	208	4.43	4.33%	9	2009
255	2009	5,396	21.16	0.82%	44	2010
31	2010	169	5.45	36.69%	62	2011
9	2011	19	2.11	605.26%	115	2012
44	2012	2,049	46.57	7.96%	163	2013
62	2013	494	7.97	9.31%	46	2014
115	2014	850	7.39	*4.10%*	*35*	*2015*
163	2015	6,279	38.52	*4.10%*	*257*	*2016*

Role in SONCC Coho Salmon ESU Viability
The Shasta River population is a core, Functionally Independent population within the Interior Klamath River diversity stratum. To contribute to stratum and ESU viability, the Shasta River core population needs at least 4,700 spawners. Sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and continue to represent critical components of the evolutionary legacy of the ESU. Besides its role in achieving demographic goals and objectives for recovery, the Shasta River population may also serve as a source of spawner strays for nearby coastal populations. At present, the capacity of the Shasta River coho

salmon population to provide recruits to adjacent independent populations is extremely limited due to its low spawner abundance. Conversely, recruits straying from the nearby Scott River and Upper Klamath River may enhance recovery of the Shasta River population**.**

Table 14. Shasta River 2011-2014 adult coho salmon counted at the Shasta River Adult counting facility and estimated to origin—hatchery and natural adult coho (Debrick et al. 2015)*.

Total Adults Returning in	Brood Year	% Hatchery Strays	Hatchery Adults	Natural Origin Adults
62	2011	71%	44	18
115	2012	70%	81	35
163	2013	62%	101	62
46	2014	83%	38	8

*Data from the above table composed from Chesney and Knechtle 2012, Chesney and Knechtle 2013, Chesney and Knechtle 2014, and Chesney and Knechtle 2015—Debrick et al. 2015).

2.4.2 Status of SONCC Coho Salmon Critical Habitat in the Action Area

The majority of the mountain ranges surrounding the project location are less than 6,000 feet in elevation. Klamath River Bridge is located within the Scott Bar Mountain United States Geological Survey (USGS) minute quadrangle at an elevation of approximately 2,000 feet. The immediate area surrounding the Project action area is defined by rugged mountainous terrain with rounded ridges, steep sides, and narrow canyons.

Critical habitat within the Project action area includes 1950 lineal feet of the mainstem Klamath River surrounding RM 176.85 and the Shasta River at the confluence with the Klamath River RM 176.7. Although anadromous fish passage is currently blocked at Iron Gate Dam, coho salmon once populated the basin at least to the vicinity of and including Spencer Creek at river mile (RM) 228 (Hamilton et al. 2005). Today, SONCC coho salmon occupy a small fraction of their historical area (NRC 2004) due to migration barriers and habitat degradation.

The present temperature regime in the mainstem Klamath River Basin is often near the warm limits for salmonid adults July through September and near the warm limits for rearing juveniles May through October (Dunne et al. 2011), elevating the importance of Klamath River tributaries and their confluence areas as thermal refugia from high water temperatures in the Klamath River Basin. Mainstem tributaries both upstream and downstream of the action area provide limited, thermally-suitable summer, natal and non-natal, rearing habitats for juvenile coho salmon. Stream flow measurements were obtained from a USGS stream gage, number 11517500, Shasta River, near Yreka, California, 0.5 miles upstream of its mouth. The mouth of the Shasta River and its confluence with the Klamath River is within the bounds of the Project biological study area. Water temperatures as measured at the CDFW juvenile outmigrant trap location, approximately 2,250 feet upstream of the mouth of the Shasta River, indicate that both summer time flow and temperatures are not suitable for juvenile rearing.

The climate is temperate with a mean annual temperature of approximately 66.7 ºF. The proposed project vicinity experiences hot summer temperatures and cold winters. Average maximum temperatures are in the 90s (ºF) during July and August, while temperatures are in the low 30s (ºF) from November through March. The mean annual precipitation is 18.52 inches, some of which falls as snow, primarily between November and March, based on records from February 1, 1893 through January 20, 2015 (Western Region Climate Center, 2015).

Vegetation and Shade

The proposed project is located within the Scott Bar Mountain subsection of the Klamath Mountains Section, and within the Klamath Mixed Conifer of the California Floristic Province (USDA 1998). Klamath Mixed Conifer vegetation within the proposed project corridor is sparse and disturbed. Agriculture and developed habitats are found along the Klamath River from Iron Gate Dam to the Shasta River. The mixture of conifer and hardwood forests normally found within the Klamath range is extremely meager in the adjacent and surrounding mountain ranges and slopes with barren habitat, consisting of exposed rock making up the majority of the surrounding landscape. Disturbances such as recreational activities, commercial, and residential uses have also contributed to the alteration of the landscape. Frequent wildfires in the region have also left deep fire scars, and upland plant communities have reverted to montane chaparral in some areas.

The mainstem Klamath River from Iron Gate Dam to Shasta River contains abundant woody riparian vegetation. Riparian vegetation in the proposed project location is however confined to the narrow corridors on either side of perennial streams, especially in areas characterized by narrow valleys and steep hill slopes. Water flows, water levels in the river, and sediment influence the growth of the riparian vegetation in the project area. Tree-dominated stands are small to medium (one to 14 inches dbh) in size. Dominant species are alder, Oregon white oak, black oak, big-leaf maple, Oregon ash, willow, and some black cottonwood. Understory vegetation is most commonly Himalayan blackberry. The average width of the riparian zone within the Project action area is approximately five to 40 feet. The vegetation grows from the bottom to the top of the banks. The action area contains approximately 61,940 square feet (1.42 acres) of riparian habitat.

Existing riparian tree and shrub growth within the action are is sparse but, provides some localized shaded stream margins along the river banks (Figures 4, 5, 6). The existing bridge provides the majority of stream-shade (approximately 12,875 square feet, or 0.30 acres) to aquatic wildlife in the action area. The river is oriented northeasterly/southwesterly at the existing bridge location in a canyon where morning and evening shade are most pronounced.

Hydrology

Historically, annual precipitation patterns define distinct dry and wet cycles that are closely related to runoff in the Klamath River (PacifiCorp 2012). The Klamath River originates at Upper Klamath Lake in the State of Oregon, and has six dams which are used for hydropower, supply of irrigation water, and to control and regulate the levels of flow in the river as well as lake levels in Upper Klamath Lake. Flows downstream of Iron Gate Dam to the lower part of the basin are reduced and altered seasonally due to water management along the upper reaches.

Water levels in the Klamath River and tributaries are influenced by snowmelt and inputs from groundwater. Stream flows normally peak during the late spring and/or early summer from snowmelt runoff, but can vary greatly dependent on hydrology conditions (J. Montesi personal comm. 2016; PacifiCorp 2012). Low flows within this watershed typically occur during the late summer or early fall, after the snowmelt and before the runoff from the fall storms moving in from the Pacific Ocean (J. Montesi personal comm. 2016; PacifiCorp 2012). The hydroelectric dams in the mainstem Klamath River above the action influence river flow and ensure flows meet or exceed specific prescribed flow releases (PacifiCorp 2012). Average annual precipitation ranges from about 10 to more than 50 inches, and the lower basin precipitation varies greatly reaching 100 inches in some areas (PacifiCorp 2012). The average annual precipitation at the bridge site is near 20 inches.

Agriculture activities have degraded water quality through reductions in flow, increases in nutrient inputs, and increased water temperatures. Agriculture runoff contributes nitrates and phosphates into the waterways. Historical mining transported huge amounts of sediments into the waterways and released mercury into the environment. Ranching reduced riparian cover along stream corridors. Logging altered peak flow magnitudes and increased soil erosion. These effects have decreased water flows and water quality as well as fish habitat. As mentioned above, the construction of hydroelectric dams has also reduced hydrologic function and water quality as well as habitat availability and quality for the coho salmon. The dams block access to approximately 76 miles of spawning, rearing, and migratory habitat for coho salmon (NMFS 2014b).

Stream Conditions

The depth of water within the proposed project limits is relatively shallow, ranging from approximately two to three feet deep in the summer and from four to five feet deep in the winter. The live channel has a width of 106 feet during the summer low flow, while in the winter it has a potential widen to162 feet. The Klamath River flow is about 780 cfs in the summer and up to 5,600 cfs in the winter. Water temperatures average 68−72.5°F in the summer months but can get as high as 80°F. Winter temperatures average between 37 and 43°F.

Stream conditions in the Klamath River are affected by irrigation and operations of hydroelectric dams to support water withdrawals, transfers, and diversions throughout the Klamath River Basin. These activities have altered the natural timing and volume of flows and have led to poor water quality including higher water temperatures (NMFS 2014b). Increased water temperatures, elevated nutrient levels, low dissolved oxygen concentrations, elevated pH, potential ammonia toxicity, increased incidence of fish disease, an abundance of aquatic plant growth, high chlorophyll-a levels (both planktonic and periphytic algae), and high concentrations of potentially toxinogenic blue-green algae, particularly in the impounded reaches, decrease the quality and quantity of suitable habitat for fish and aquatic life (NCRWQCB 2010). The quality of surface and ground waters in the North Coast Region of California is governed by the Water Quality Control Plan for the North Coast Region (Basin Plan) (NCRWQCB 2011) as developed and implemented by the Regional Water Board. The entire Klamath River and its tributaries are currently listed as impaired under section 303 (d) of the Clean Water Act as outlined in the Klamath River Total Maximum Daily Load (TMDL) for temperature, nutrients, dissolved oxygen, and Microcystin (NCRWQCB 2010). A significant cause of water quality impacts in the Klamath River basin is the modification of natural water quality dynamics that has occurred due to human caused alterations of the landscape such as altered: flows and flow pattern; slope and stream channel stability; vegetation type, age, and density; and nutrient and organic matter availability (NCRWQCB 2010).

High nutrient concentrations stimulate excessive growth of algae and aquatic plants, degrading water quality by causing fluctuations in pH and dissolved oxygen. Total phosphorous typically ranges from 0.1 to 0.25 milligrams per liter (mg/L), and total nitrogen level ranges from <0.1 to over 2.0 mg/L in the Klamath River between Iron Gate Dam and Seiad Valley. Dissolved oxygen levels regularly fall below 8 mg/L (USDOI and CDFG 2012), and can get as low as 2–4 mg/L. Dissolved oxygen levels below 5mg/L trigger water quality conditions that can be stressful to salmon. Low levels of dissolved oxygen are a result of oxygen consumption by algae and other aquatic plants found in the Klamath River. PH levels generally vary daily, seasonally, and by location. Daily pH usually peaks in late afternoon or early evening. Seasonally, pH is highest during late-summer and early-fall months (August through September). PH values are frequently above the California, and California North Coast Basin Plan guidelines maximum of 8.5 units (USDOI and CDFG 2012).

Water temperature in the Klamath River downstream of Iron Gate Dam (Table 15) has an average monthly range of 37−43°F in January and 68−72.5°F in July and August (Bartholow 2005 *as cited in* Stillwater Sciences 2009); however, water temperatures can often get as high as 80°F in the summer (Karuk Tribe 2015, *as cited in* Caltrans 2016). Water quality is generally poor when water temperatures exceed 77°F (Karuk Tribe 2011).

Stream Flows

River flow depends on water year and variable hydrologic conditions. As a result of hydroelectric dam operations, discharge from Iron Gate Dam increases from around 1,000 cfs to about 4,000 cfs in April and decreased after April to about 1,000 cfs in early July through September (Magneson 2015) (Table 16). During the month of August, the median flow of the Klamath River at Iron Gate Dam is about 1,000 cfs. During the month of March, the median flow at Iron Gate is about 2,500 cfs. The median flows are greatest in March, during spring runoff, but the largest of the peak flows occur in December and January (U.S. Bureau of Reclamation 2012).

Table 15. Average monthly water temperatures* (Caltrans 2016).

Year	Months											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	--	--	--	50.44	54.19	60.15	68.06	69.89	65.83	58.34	52.17	--
2012	--	--	--	--	61.12	63.14	67.94	69.88	65.97	60.29	52.60	--
2013	--	--	--	53.40	60.72	64.34	68.48	68.20	65.23	56.23	50.31	--
2014	38.69	40.51	46.84	52.34	61.41	70.29	70.29	69.76	65.56	59.67	51.43	46.52
2015	41.22	43.68	46.26	54.11	60.30	66.76	70.62	68.31	64.61	60.03	53.68	

*Calculated based on Iron Gate Dam gage data From 2011/01/01–2015/11/30 (Karuk Tribe 2015, *as cited in* Caltrans 2016). Dashes indicate data were not available.

Since the implementation of irrigation systems and completion of the hydroelectric dams, inflows to the Klamath River Basin have been significantly reduced. This flow reduction has affected the natural seasonal flow patterns, changing timing of peak and base flows of the Klamath River (NMFS 2014b). The tributaries downstream of Iron Gate Dam contribute significant amounts of flows during all times of the year, though the specific ratio of tributary contribution downstream from Iron Gate Dam does change with the time of the year.

Table 16. Estimated flows, depth, length, and width of active stream, mainstem Klamath River within the action area (Caltrans 2016).

Time of Year	Flows (ft3/sec)	Velocities (ft/sec)	Depth (feet)	Length (feet)	Width (feet)
Summer	780	0.8–7.02	2-3	1,950	106
Winter	5,600	2.7–8.6	4-5	1,950	162

Streambed

The natural channel bed material consists of mostly alluvium ranging from medium cobbles, coarse sand to silty sand with smaller amounts of fine-grained material interspersed, generally devoid of aquatic vegetation. At the bridge site large outcrops of bedrock exist. Fish habitat within the proposed project site has been formed primarily by boulders and areas of scour behind the piers of the existing bridge. The streambed gradient (approximately 0.0022 feet/foot) is low, without abrupt drops or turbulent water and lacks back pools.

Stream Habitat

The immediate project area contains approximately 208,028 square feet (4.80 acres) of stream habitat (Caltrans 2016). The existing bridge is the primary source of shade over the river, where riparian vegetation provides little cover and only along the river margins if at all. This part of the river lacks rooted aquatic vegetation to provide suitable cover for aquatic wildlife.

2.4.3 Factors Affecting SONCC Coho Salmon Critical Habitat in the Action Area

Lands in the action area are used primarily for timber production, agriculture, grazing on allotments, and recreation. The action area is mostly undeveloped, but has sustained a great number of management activities in the past. A few homes are established on private property, generally along creeks and rivers at lower elevations. Fish habitat in the action area has been affected by: sediment erosion and passage barriers from: road-derived sediment mobilization and loss of floodplains from streamside roads; alteration of stream banks; reduction of shade and large wood debris recruitment to streams from past logging activities; alteration of stream flows from PacifiCorp dams located on the mainstem Klamath River upstream from the action area; and similar alteration of flows in the Shasta River from the Dwinnell Dam located upstream in the Shasta Valley.

Since the implementation of irrigation systems and completion of the hydroelectric dams, inflows to the Klamath River Basin have been significantly reduced. This reduction has affected the timing of peak and base flows of the Klamath River (2014).

California has experienced well below average precipitation in each of the past four water years (2012, 2013, 2014, and 2015), record high air temperatures the past two water years (2014 and 2015), and record low snowpack in 2015. Anomalously high air temperatures have made this a "hot drought", in which high air temperatures substantially amplified annual water deficits during the period of below average precipitation. Some paleoclimate reconstructions suggest that the current four-year drought is the most extreme in the past 500 or perhaps more than 1000 years. Anomalously high surface temperatures have made this a "hot drought", in which high surface temperatures substantially amplified annual water deficits during the period of below average precipitation. These climate anomalies have likely had negative impacts on the freshwater, estuary, and marine phases for many populations of Chinook salmon, coho salmon, and steelhead. These impacts are not yet fully apparent in the adult return data that form the basis of the latest status review (Williams et al. 2016).

Water temperature influences almost every biological and physiological process of salmon, including disease resistance. Current thermal conditions in the Klamath River are considered sub-optimal for juvenile salmon. In addition to borderline temperatures, salmonids must contend with the myxozoan parasite *Ceratomyxa shasta*, a significant cause of juvenile salmonid mortality in this system. Ray et al. (2012) examined thermal effects on *C. shasta*- induced mortality Klamath River Chinook and coho salmon to assess the influence of elevated temperatures on parasite- induced mortality during the spring/summer migration period and compared disease progression in both species, demonstrating that elevated water temperatures resulted in higher mortality and faster reduced mean days to death. Further, their analysis showed that the magnitude of this effect varied among years and was more closely associated with parasite density than with temperature (Ray et al. 2012).

For the past decade, ceratomyxosis (enteronecrosis) has been regarded as the major cause of mortality in fall Chinook (*Oncorhynchus tshawytscha*) and coho (*O. kisutch*) salmon (Foott et al. 2002; Fujiwara et al. 2011). Ceratomyxosis is caused by the myxozoan parasite *Ceratomyxa shasta*, which is present throughout the Pacific Northwest, but its negative impacts on native salmonids are most thoroughly documented in the Klamath River. Severe ceratomyxosis in outmigrating juvenile fish contributes to reduce recruitment and adult returns (Fujiwara et al. 2011; Stone et al. 2008).

A 2006 study showed that *C. shasta* abundance was low at the outflow of Iron Gate Reservoir (RM 190), but increased in the main stem Klamath River between the I-5 bridge crossing (RM 177) and the confluence of the Scott River (RM 144; Hallett and Bartholomew. 2006). This section of the Klamath River has been termed the "infectious zone" and this general pattern of parasite abundance remains steady, but the size of the infectious zone and the magnitude of parasite densities change seasonally and annually (Bartholomew et al. 2010).

Drought conditions resulted in limited water supplies in the upper basin and reservoirs, precipitating decreased river flows in the Klamath River. Low flows and higher than average river temperatures can create habitat conditions that are more favorable to *C. shasta* transmission: early release and concentration of the parasite infectious spore stage in the small volumes of water result in higher infectious inoculation of the fish host (True et al. 2015). *Ceratomyxosis* prevalence can be greater under such conditions, compared to environmental conditions that promote higher river flows (decreased spore concentration) and cooler river water temperatures (slowed spore development and disease progression) (True et al. 2015).

The lower Shasta River, including the action area has an extensive history of gold mining with remnant mine tailings piles and altered channel morphology still present along the banks of the river from activities that occurred from the 1850s through the 1930s. Large dredge mining activities ended around 1950 in the Shasta Basin; including in Yreka Creek, but riparian area remain poorly vegetated and erodible in these sites (Shasta Valley Resource Conservation District 2005 *as cited in* NMFS 2014b) These past operations continue to be a threat for coho salmon along the west side of the Shasta Basin through legacy effects of remnant tailing piles, altered channel morphology, and potential remaining gold mining-associated pollution inputs.

Hydrologic and dependent geomorphic conditions in the Shasta River downstream from Big Springs Creek are largely defined by spring flow from Big Springs Creek and other small springs and spring-fed tributaries. These freshwater springs provide continuous flow of cool water originating primarily from glaciers on Mt. Shasta, and this has historically kept the Shasta River watered throughout the year (Snyder 1931). The hydrology of the Shasta River has been and continues to be affected by Dwinnell Dam, surface water diversions, and interconnected groundwater pumping. The construction of Dwinnell Dam and the Parks Creek diversion by the Montague Water Conservation District in about 1926 has altered the natural flow and sediment transport regime in both the upper Shasta River and lower Parks Creek and also blocked access to about 22 percent of the available fish habitat for anadromous salmonids (NRC 2004). The loss of spawning gravesl, woody debris, pools, side channels, springs, and accessible wetlands from land use conversions, have also contributed to reduced summer and winter rearing capacity for juvenile coho salmon. Further alterations to stream channel function from agricultural practices includes irrigation tailwater returns, damage to riparian habitat from livestock grazing and a reduction in the number of beaver ponds, which provide important habitat attractive to rearing coho salmon.

Continuing to experience sustained drought, Shasta River flow in 2015 was consistently below the fourteen year average throughout the year (Debrick et al. 2015). In 2015, the maximum weekly maximum temperature (maximum average of daily maximum temperatures for each week) observed at the Shasta Fish Counting Facility occurred during July and was 82.7°F. The maximum weekly average temperature was 77.7°F, which occurred during July. The seasonal maximum temperature was 84.3°F and occurred July 1. It is worth noting that diurnal temperature fluctuations became greater especially after the start of the irrigation season in the beginning of April (Debrick et al. 2015). Because stream flow was already reduced to below average with the onset of spring, agricultural demands further reduced flow and contributed not only to the enhanced diurnal changes, but also to the general increase in temperature as the 2015 season progressed (Debrick et al 2015).

Ongoing climate change may alter SONCC coho salmon critical habitat, including critical habitat in the action area, by intensifying impacts associated with progressively more extreme weather over the long-term. For example, suitable freshwater habitat availability for juvenile coho salmon rearing and migration is expected to decrease in the future due to climate warming (Mote et al. 2003, Battin et al. 2007). Thus, competition for limited thermal refuge areas among salmonds will increase. Bartholow (2005) found a warming trend of 0.9°F/decade in the Klamath River and a decrease in average length of river with temperatures below 59°F (5.1 miles/decade), underscoring the importance of mainstem Klamath thermal refugia areas. However, hatchery releases are expected to remain constant during this period of shrinking freshwater habitat availability. This may increase the detrimental impacts to naturally produced coho salmon from density-dependent mechanisms in the freshwater environment. If warming continues, hatcheries will likely continue to have adverse impacts on the effective use of habitats by naturally produced coho salmon, if shared use of these habitats by natural and hatchery stocks exceed capacity limitations and food supplies. In spite of these hatchery-related risks to Klamath coho salmon populations, including those in the action area, hatchery releases are likely to continue. This is due to the significantly depressed status of the Upper Klamath, Scott, and Shasta populations, to which hatchery releases of coho salmon can contribute towards coho salmon abundance, one of the VSP criteria (NMFS and USFWS 2013).

Ongoing effects of wildland fires followed by storm events, in and around the action area, impact upland and riparian habitat. For instance, the August 2016 Glade Fire in Hawkinsville, California, adjacent to Yreka Creek has burned over 700 acres of excessively dry hillside vegetation burned in just a few hours. Storm events following such fires routinely mobilize sediment downslope and then downstream into the Project action area. Until drought conditions change, wildland fires, and the storms that follow them, are expected to continue to occasionally send pulses of sediment into Project action area streams.

2.5 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

In this section, we identify specific stressors associated with the proposed action, the likelihood of threatened species and designated critical habitat exposure to those stressors, the responses of listed species and critical habitat to their exposure to those stressors, and the consequences of those responses to the various listed resources. Based on the results of these analyses, we assess the risks that the proposed project poses to listed species and critical habitat. For threatened species, our assessment focuses on the risk of increasing the extinction probability of these species, for designated critical habitat our assessment focuses on the risk of reducing the conservation value of the habitat designated for the endangered and threatened species, including whether the action maintains the critical habitat in a degraded state.

Our effects analysis begins by asking whether, and to what degree, we expect listed species and their designated critical habitat would be exposed to stressors reasonably expected to result from the proposed activities. Stressors from the proposed action can be divided into two general categories, those that are a result of construction activities and are immediate in time (direct effects), and those that are reasonably certain to occur post construction such as latent changes in habitat as the creek establishes a new scour pattern (indirect effects) and flushes out project-related sediments.

2.5.1 Effects Related to Individual SONCC Coho Salmon

Exposure

In this section, we used various sources of stock assessment data to evaluate the potential effects of the action by describing potential exposure to salmonid life stages within the action area. Stock assessment data (abundance, life stage, and timing) consists of ongoing sampling and survey studies (adult and juvenile) conducted by CDFW as part of the Klamath River Project for Shasta River and Bogus Creek; mainstem Klamath River salmonid trapping efforts conducted by the U.S. Fish and Wildlife Service and the Karuk Tribe (Klamath River Project) below the confluence of Bogus Creek and the Klamath River (RM 191.23) and at RM 182.4 near the I-5 bridge; and Iron Gate Hatchery juvenile release records and hatchery return records (Table 17). We used average monthly juvenile trap catches and hatchery releases, and advanced the catch, or release distribution to either one week, or two weeks later to reflect river travel time from juvenile trap capture or hatchery release, downstream to the action area. This analysis evaluated the exposure of coho salmon to the effects of the Project and provided the rational for limiting impact pile driving to a work window of July 1 through August 31 to minimize the potential exposure of juvenile coho salmon. The impact pile driving work window also avoids returning adult coho salmon where they are not expected to be transiting the action area during July and August.

Average juvenile releases from Iron Gate Hatchery, average adult hatchery rack returns, average estimated number of juvenile outmigrants from tributary and mainstem trap captures (B. Pinnix 2015, pers. comm.; Gough et al. 2015), and tributary video weir counts of returned adults were calculated by month for a calendar year (Table 17). Coho salmon abundance and potential exposure to proposed project activities were estimated for each month of a calendar year, allowing for evaluation of potential project effects on individual coho salmon exposure to project activities. The monthly average abundance presented in Table 17, is not meant to be viewed as an annual cumulative (those are calculated separately as an annual basis), rather a monthly, expectation of average abundance in the action area.

Shasta River juvenile trap catches indicate that redistributing Shasta River sub-yearling coho salmon migration occurs later than outmigrating coho salmon smolts. Sub-yearling redistribution peaks in May compared to a smolt peak in April (Daniels et al. 2013; Debrick and Stenhouse 2014; Debrick et al. 2015) (Figure 9). Any potential deviation in migration timing is highly unlikely to increase exposure (due to migration delay) of yearling or sub-yearling juvenile coho salmon to project actions (i.e. pile driving in July).

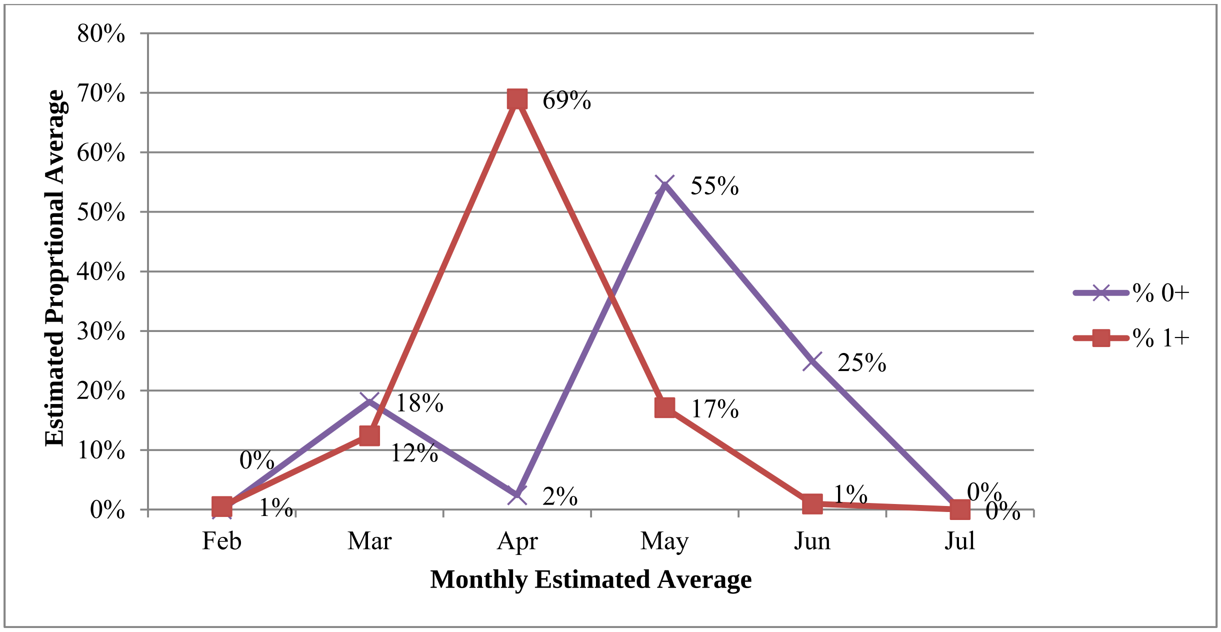

Figure 8. Average monthly (years 2013–2015) outmigration timing of sub-yearling (0+) and smolt (1+) coho salmon captures at the Shasta River juvenile outmigrant trap. CDFW (Daniels et al. 2013; Debrick and Stenhouse 2014; Debrick et al. 2015).

Additionally, in this opinion, we assume an average water year discharge (Table 18) driving migration timing for juvenile and adult coho salmon. River discharge volume influences salmon migration timing. In 2006, during a high water year (Table 18) outmigrating juvenile salmon delayed migration—as observed at the USFWS I-5 juvenile outmigrant trap in 2006 (B. Pinnix pers. com. 2015). Project effects are analyzed based on average water year in regards to migration timing and subsequent exposure to project actions.

2.5.1.1 Sediment and Turbidity

Short-term, minor increases in sediment suspension and turbidity are anticipated to occur within 300 feet of any disturbed area. These inputs are likely to occur during in-water work (gravel approach pad installation (one day per pad), impact pile driving (four hours per day, up to 8 days per trestle), and during the removal of the existing bridge piers and footings (likely a few days). Effects of the Project are anticipated to include small, temporary increases in mobilized sediments through ground disturbing activities such as temporary access road construction, excavating a widened roadway on SR 96, excavation for bridge abutments and piers, H-pile installation, and removal of the existing bridge abutments and piers. These ground disturbing activities will expose soils to erosion, or mobilize soils after riparian and upland vegetation has been removed. The delivery of sediment will be most pronounced where soil has been disturbed as a result of riparian vegetation removal and construction activities. In-stream and near-stream construction activities, especially those which use heavy equipment or disturb the soil, may cause temporary increases in turbidity through the mobilization of sediment and inputs to the river (*reviewed in* Furniss et al. 1991; Reeves et al. 1991; and Spence et al. 1996), particularly following the first significant rainfall. In high enough concentrations, sediment can affect salmonid feeding behavior and efficiency, resulting in reduced growth rates. High turbidity

Table 17. Average expected monthly abundance of SONCC coho salmon, by life stage and origin, in the action area. Monthly values are not cumulative, monthly averages for the listed year range. The "annual" column is the annual abundance, averaged over the year range.

	Average MONTHLY estimated abundance for population and life stage for years defined														
Iron Gate Hatchery Coho Production	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Annual	Jun 1–Oct 31	Jul 1–Aug 31
Juvenile Release IGH (age-1) ave 2012–2016[1]							91,082	27,568					78,379	0	0
Return Adult IGH ave 2010–2014[1]		71	477	138	47								585	71	0
Wild Coho Production															
Juvenile (age-0) I-5 Mainstem Trap--ave 2009–2013 [2]							10	91	76	43	28		208	71	28
Juvenile (age-1) Bogus Creek Trap 2015 only[3]							904	5,424	1,237	0			7,565	0	0
Juvenile (age-1) Shasta River Trap ave 2011–2015[4]						3	140	1,531	262	1	0		1,941	1	0
Juvenile (age-0) Shasta River Trap ave 2013–2015[4]						0	448	60	1,351	616	0		2,475	616	0
Return Adult (Bogus Creek) ave 2011-2015[5]	0	1	119	33	73	5							169	1	0
Return Adult (Shasta River) ave 2011-2015[6]	0	10	56	10	0							0	73	10	0
Wild origin juvenile outmigration monthly distribution															
I-5 Trap age-0							4%	37%	31%	17%	11%				
Bogus Creek Trap age-1							12%	72%	16%	0%	0%				
Shasta River Trap age-1						0.2%	7.2%	79.0%	13.5%	0.1%	0.0%				
Shasta River Trap age-0						0%	18%	2.4%	54.6%	25%	0%				
Bogus Creek Adult	0%	1%	70%	20%	43%	3%									
Shasta River Adult	0%	13%	76%	13%	1%										0%

[1]Iron Gate Hatchery—Data provided by Keith Pomeroy, (Iron Gate Hatchery Manager).
[2]USFWS—Data provided by Bill Pinnix 2015 (Fish and Wildlife Biologist) data from the I-5 juvenile trap--Klamath River Project monitoring.
[3]CDFW—Chesney and Knechtle 2015b; [4]CDFW—Debrick and Stenhouse 2014, Debrick et al. 2015; [5]CDFW—Knechtle and Chesney 2016c Yreka Klamath River Project Video Summary; [6]CDFW—Chesney and Knechtle 2016b, Yreka Klamath River Project Video Summary.

Table 18. Water year annual average discharge at USGS gages on the Shasta River, near the mouth of the river and the Klamath River, below Iron Gate Dam.

Water Year	Discharge (ft^3/sec)	
	USGS 11517500 Shasta River near Yreka, CA	USGS 11516530 Klamath River below Iron Gate Dam, CA
2000	180.2	2,063
2001	107.6	1,340
2002	124.7	1,375
2003	195.7	1,382
2004	151.9	1,340
2005	153.5	1,256
2006*	358.5	3,095
2007	161.4	1,581
2008	135.7	1,629
2009	100.8	1,335
2010	109.1	1,207
2011	212.4	1,980
2012	135.1	1,478
2013	108.0	1,141
2014	87.8	1,085
2015	132.1	1,094
Mean	153.4	1,524
*Water year 2006 relative to the mean	234%	203%

[1]The term USGS "water year" in reports that deal with surface-water supply is defined as the 12-month period October 1, for any given year through September 30, of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months (http://water.usgs.gov/nwc/explain_data.html).

concentrations can reduce dissolved oxygen in the water column, affecting respiratory function. Also, in response to exposure to elevated turbidity, salmonids may disperse from established territories, which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival.

Much of the research described above focuses on high levels of turbidity. Minimization measures (Section 1.3.13) and BMPs (Caltrans 2015a, 2016), such as re-vegetation plan, are expected to limit the input of sediment into the stream reducing both the likelihood of sediment mobilization and transport to stream courses and result in only minor increases to existing levels of turbidity. Sediment will most likely be mobilized during the placement and removal of diversion structures and during the first rain events in the fall, transporting suspended sediment to the stream. The increase in turbidity will be temporary as the sediment becomes diluted to undetectable levels as compared to the background levels of turbidity during the storm event.

Pre-drilling pilot holes (non-displacement) for H-pile installation within the streambed will take place within a casing, which isolates the drill from the rest of the water column. The casing used during pre-drilling will prevent most streambed material from escaping into the water column, though small amounts of streambed material and water can be displaced during pre-drilling operations. However, because the displaced material and water will be pumped from the casing into a tank for later disposal at an approved Caltrans disposable site, only minimal amounts of sediment are expected to mobilize into the waterway during H-pile placement, and the occurrence would be temporary, and take place when neither juvenile nor adult coho salmon are expected in the action area.

Minor amounts of sediment are expected to be temporarily mobilized during demolition of the existing bridge, specifically, lifting out the remaining cut piers and footings because the existing overburden is shallow and consists mainly of gravel. Small amounts of sediment and turbidity are expected to be temporarily mobilized from the riverbed during removal of piers and footing from the existing bridge. However, neither juveniles, nor adults are expected to be transiting the action area when either piers or footings are removed and thus, coho salmon will not be exposed to sediment or turbidity effects caused by demolition of the bridge.

Coho salmon are not expected to be present during most of the sediment producing activities of the project, and thus are not expected to be exposed to the majority of the project-related sediment effects. However, after the first fall or winter rains interact with disturbed portions of the action area, minor erosion is expected to increase turbidity for a short duration. During the first winter flows that mobilize sediment from disturbed riparian areas, the effects are expected to completely dissipate within 300 feet or less downstream (Caltrans 2016).

2.5.1.2 Crushing

The Option 2 trestle scenario includes the construction of a gravel approach pad at each end of the trestle span, located on each bank of the river. Summer rearing habitat is not available in the action area, and sub-yearling juveniles are assumed to use the action area as a migratory corridor, as they search for and redistribute to suitable summer rearing habitat outside the action area. The likelihood of smolt outmigrants transiting the Project action area is minimal as they are expected to have already cleared the area by the end of May (Table 17). Adult coho salmon are extremely unlikely to be in the action area in June. Therefore, construction of each gravel pad has the potential to adversely affect sub-yearling juveniles by crushing, as there is a possibility that individual sub-yearling coho salmon may be present near the margins of the river.

Each gravel approach pad will be built in one day. Two trestles, one to construct the proposed bridge and a second trestle to demolish the existing bridge will be needed for the project. Therefore, two gravel approach pads will be constructed each year of the project. Potential harm juvenile coho salmon would most likely take place during the initial lowering of the barriers into the river, likely in the month of June, each year of the project. Construction will occur during daylight hours when juvenile coho salmon migration activities are expected to be at their lowest. Preparation activities on top of the banks, prior to placing the gravel approach pads, will likely dissuade juvenile coho salmon from the area of direct disturbances as the species exhibit avoidance responses to visible and audible disturbances.

Barriers for the gravel approach pads will be placed slowly in-channel to allow any juvenile salmonids to flee from the area and avoid being crushed. By proceeding in a downstream direction, and placing the barrier oblique to the river margin in a tapering shape, any fish present are expected to move away from construction activities. Gravel will be deposited slowly so that any fish present will startle and avoid the area. Gaps on the downstream end of the approach pad barrier to allow any fish behind the barrier to escape into the river.

Small numbers of sub-yearling juvenile coho salmon are expected to be injured, or crushed from placing gravel approach pads in the river

2.5.1.3 Hydroacoustic Effects

Temporary work trestles will be constructed with 18-inch steel H-piles (Tables 5 and 6). H-Piles will be installed with an impact pile hammer. Impact pile driving produces underwater sound pressure waves from the contact of the impact hammer with the top of the H-pile. During pile-driving, the energy of the strike travels down the H-pile underwater and into the ground. These sound waves are also transmitted through water. Levels of underwater sound pressure generated from driving H-pile vary depending on the pile size, water depth, and substrate (Caltrans 2015b).

Coho salmon may be injured or killed when exposed to high underwater sound pressure levels (SPLs) generated from driving H-piles with impact hammers (Hastings and Popper 2005, Theiss and Buehler 2006, and Caltrans 2015b). Pathologies associated with very high SPLs are collectively known as barotraumas. Common types of barotraumas include hemorrhage and rupture of internal organs such as the swim bladder and kidneys. Death can be instantaneous, occur within minutes after exposure, or occur several days later (Gisiner 1998). If the swim bladder bursts and the air escaped from the body cavity, the fish may sink to the bottom. If the swim bladder bursts but the air stays inside the body cavity, the fish is likely to stay afloat but is disoriented and has limited swimming ability (FHWG 2015). High SPLs can also damage fish's sensory hair and otoliths (Caltrans 2015b) resulting in hearing loss. The Fisheries Hydroacoustic Working Group (FHWG) stablished injury and behavior thresholds for fish (Table 19) resulting from impact pile driving (FHWG 2008).

Table 19 Underwater noise thresholds to fish exposed to elevated levels of underwater sounds produced during pile driving (FHWG 2008).

Effect	Metric	Fish mass	Threshold
Onset of physical injury	Peak pressure	N/A	206 dB (re: 1 μPa)
	Accumulated Sound Exposure Level (SEL)	≥ 2 g	187 dB (re: 1μPa^2•sec)
		< 2 g	183 dB (re: 1μPa^2•sec)
Adverse behavioral effects	Root Mean Square Pressure (RMS)	N/A	150 dB (re: 1 μPa)

Pile driving depth varies depending on the soil bed but assumed to be approximately two to six feet deep for the action area. The number of strikes to drive each pile varies depending on specific site conditions but for the purpose of the impact analysis, is assumed to be 100 to 150 per pile (Tables 5 and 6). The production rate of pile installation will vary depending on contractor operations but is assumed to be three to four piles per day. Therefore, approximately 600 strikes per day would be expected (Tables 5 and 6).

Existing measured data from projects with similar site conditions were used but extrapolated as only data from the use of smaller sized H-piles was available. No examples of sound pressure levels from driving 18-inch H-piles were available from previously monitored projects (Caltrans 2016). Extrapolated surrogate sound data, fitted to 18-inch H-piles, provided sound level values used to populate the NMFS (2012) Pile Driving Calculator spreadsheet (http://www.dot.ca.gov/hq/env/bio/fisheries_bioacoustics.htm). Pre-drilling and simultaneous dewatering within the isolated casing is expected to reduce water down to the mud line and provide for some attenuation of underwater sound pressure generated by pile driving. The isolation casing is assumed to provide five dBs of sound reduction. Using the assumed five dBs of sound attenuation, the source levels used to generate distances of sound wave transmission would be reduced to:

- 209 dB (re: 1 μPa) PEAK
- 184 dB (re: 1μPa^2•sec) SEL
- 190 dB (re: 1 μPa) RMS

The transmission loss constant[1] (i.e., rate at which sound pressure attenuates) must also be determined to complete the analysis. In general, the higher the attenuation constant[2] (F value), the faster sound attenuates. The F value for H-type piles ranges from five to 30 at 10 meters (32.8 feet). A conservative use of a transmission loss constant of 15 was used in the analysis (Caltrans 2016).

Using these values, the transmission distance traveled of threshold underwater sound waves was estimated for the proposed pile size using the NMFS Calculator (NMFS 2012). The distance to threshold sound pressure levels measured at 10 meters (32.8 feet) for proposed 18-inch H-piles are as follows:

- 16 meters (52.5 feet) to reach the 206 dB (re: 1 μPa) Peak
- 449 (1,473 feet) meters to reach the 187 dB (re: 1μPa^2•sec) Cumulative SEL for fish ≥ 2 g
- 4,642 (15,230 feet) meters to reach the 150 dB (re: 1 μPa) RMS

The use of the surrogate data as a comparable value likely results in a conservative estimated output from the NMFS calculator. The levels estimated for project impact pile driving for 18-inch H-pile are expected to exceed the peak and cumulative SEL dB threshold values for onset of physical injury. However, because piles will only be installed during the pile driving window restriction of July 1 through August 31, and given assumed average migration timing (Table 17) and expected river travel time, no smolts or adult coho salmon are expected to be transiting the project action area. Because sub-yearling juveniles redistribute as a response to rising, or

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[1] Transmission Loss = The initial sound pressure level (dB) produced by a sound source (i.e., pile driving) *minus* the ambient sound pressure level or a target sound pressure level (e.g., the injury threshold for salmon). Transmission loss also can be thought of as the change in sound pressure level between D_1 and D_2. As applied here transmission loss is a negative number.

[2] F = A site-specific attenuation factor based on several conditions, including water depth, pile type, pile length, substrate type, and other factors.

suboptimal water temperatures, as evidenced by observations from the Shasta River outmigrant studies, their peak timing of re-distribution appears to be in May. Because the water temperatures in the mainstem Klamath River are often lethal to juvenile fish during the summer, any mainstem rearing sub-yearlings are expected to be associated with cool water seeps that may be found at tributary mouths. Still, as the USFWS data at the I-5 outmigrant trap (Table 17) demonstrated, there is some potential for sub-yearlings to be redistributing during summer and may transit, though not rear in the action area.

Juvenile coho salmon could be subjected to underwater noise levels exceeding the behavior or onset of physical injury thresholds. The temporary changes in behavior fish may exhibit in response to pile driving noise include startling, altering behavioral displays, avoidance, displacement, reduced feeding success, potentially leading to reduced growth rates. However, the number of juvenile coho salmon exhibiting any one of these responses as a result of underwater sound pressure from pile driving activities will be minimal because on average, only a small number of juvenile sub-yearling coho salmon have the potential to be present in the action area. Therefore, an estimate of up to 4.3 percent of sub-yearlings (Table 17) per each year of the project that may be transiting the action area may be negatively impacted from pile driving activities during each year of the project.

Installation of sheet piles with vibratory hammers will occur outside of the wetted channel (Figure 1) to isolate bridge foundation construction from soils and any groundwater seepage. Fish can die when exposed to lower SPLs if exposed for longer periods of time. A vibratory hammer produces generally 10 to 20 dB lower SPLs than driving H-pile with an impact hammer (Caltrans 2015b). Vibratory hammers can produce SPLs that exceed 180 dB but differ from pile driving in that the sound rises relatively slowly. However, the use of vibratory hammers are unlikely to injure fish or expected to meaningfully interfere with behaviors such as migration, rearing, or foraging in the action area. Injury or behavior disturbance noise thresholds have not yet been established for vibratory pile driving by the FHWG.

2.5.1.4 Fish Passage

Caltrans evaluated the project action effects to water velocities and water surface elevations from placement of two temporary work trestles constructed of approximately 24 (if using trestle option 1) in-channel H-piles. Secondly, Caltrans evaluated the effects of trestle option 2, which includes 16 in-channel H-piles and two gravel approach pads per trestle. In either scenario, two trestles will be needed to achieve project objectives. One trestle is expected to remain in the river over winter, while the second will be placed during the second summer of the project and removed that same season after the existing bridge is removed. A minimum 20 foot wide section of the river would remain open between the piles throughout the duration of construction.

Trestle option 1 is expected to consist of 24, 18-inch H-piles. Caltrans evaluated the effects to water velocities and water surface elevations from the combined placement of temporary piles within the Klamath River. Caltrans analyzed the five percent exceedance flow rate of 5,600 cubic feet per second (cfs) to calculate channel water velocities. The 25-year recurrence interval flow of 23,000 cfs was used to calculate impacts to the water surface elevation during potential high flows while the temporary piles are in place. Flows rates (Table 20) were measured below the

Iron Gate Dam, located approximately 13.5 miles (or 13.2 RM) upstream from the Klamath River Bridge. At a flow rate of 5,600 cfs, water velocities in the Klamath River when the temporary piles are in place range from 2.5 to 7.4 feet per second (ft/s); approximately 0.8 ft/s slower to 0.2 ft/s faster than existing velocities. A velocity up to approximately 0.2 ft/s faster than existing conditions would be similar to the flow going around an existing boulder in a channel. As illustrated, the velocity expected to increase immediately around each pile is negligible. At a flow rate of 23,000 cfs, the water surface elevation when the temporary piles are in place would be about 0.8 feet higher than under existing conditions. However, this is still about six feet lower than the 100-year water surface elevation, so no significant flooding impacts are anticipated expected to significantly impact fish passage.

Trestle option 2 scenario is configured with a combination of 16 piles and gravel approach pads on each river bank at the ends of the trestle. For this option, a minimum 80-foot wide section of the river would remain open between the two gravel approach pads, throughout the duration of the construction. As for trestle option 1 above, Caltrans evaluated the river flow velocity and elevation given the expected in-channel structures. The five percent exceedance flow rate of 5,600 cfs was used to calculate channel water velocities in the Klamath and indicated a river velocity range from 3.3 to 8.6 ft/s was expected. This is about 0.4 ft/s slower to 0.6 ft/s faster than existing velocities. Bell (1991), reported that typical cruising speeds for adult coho salmon range up to 4 ft/s, while typical sustained speeds range up to 10 ft/s, and darting speeds range up to 22 ft/s. The width of the 80-foot wide channel between the gravel approach pads will be approximately 30 feet, based on the width of the temporary gravel approach pads. Consequently, adult coho salmon transiting the action will need to maintain a speed of 8.6 ft/s for approximately 30 feet. Since typical sustained speeds (i.e., high speed for several minutes) for adult coho salmon range up to 10 ft/s, maintaining a speed of 8.6 ft/s for 30 feet would be well within the range for the adult coho salmon and is not expected to delay fish passage. Secondly, the 25-year recurrence interval flow of 23,000 cfs was used to calculate impacts to the water surface elevation during potential high flows while the temporary piles and gravel pads are in place indication the surface elevation of the Klamath River in the action area is expected to be about 1.2 feet higher than under existing water surface elevation conditions. The expected velocities and increase in water surface elevations are not expected to influence the passage of any life stage of coho salmon. The temporary piles and gravel pads are not anticipated to impact the flow of the river significantly.

The gravel approach pads result in approximately 3,600 square feet (0.08 acre) loss of riverine habitat that could be used for migration and/or rearing. The temporary loss of habitat, and specifically its location on either bank, will require migrating fish to move into the middle of the river in order to pass through the approximately 80-foot opening between the gravel approach pads, which could result in migration delays, but delays are not expected to influence the passage of any life stage of coho salmon where delays would decrease the fitness of individuals.

2.5.1.5 Entrainment and Stranding

Some minimization measures in the SWPPP require wetting of stock piles, disturbed areas, and road surfaces for dust abatement and erosion control. Caltrans will use water drafting to respond to these minimization measures. Caltrans further stated water drafting will be conducted in

Table 20. Flow data at existing bridge (calculated based on Iron Gate Dam gage data*) (Caltrans 2016).

Recurrence interval	Flow (cfs)	Water surface elevation just upstream of existing bridge (feet)	Depth in deepest part of channel (feet)	Average depth (feet)	Width in the widest part of the channel (feet)	Average width (feet)
2-year	6,500	2,024.1	10-12	6-8	195	168
5-year	11,700	2,027.5	14-15	9-10	213	183
10-year	16,700	2,030.4	16-18	12-13	223	194
25-year	23,000	2,033.5	19-21	15-17	235	205
50-year	34,100	2,038.4	24-26	19-21	272	234
100-year	40,200	2,040.7	26-28	22-23	280	248
5% exceedance** (~avg winter high flow)	5,600	2,023.1	8-9	4-5	190	162
90% exceedance** (~avg summer low flow)	780	2,018.0	4-5	2-3	153	106

*Flows are adjusted based on additional watershed area between Iron Gate Dam and the project site, and a projected 7% increase in peak flows if the series of dams is removed in the future. The additional watershed area is due to the bridge being 13.5 miles downstream of Iron Gate Dam. The total watershed area at the bridge is 4,830 square miles, and the watershed area of the Iron Gate Dam gage is 4,630 square miles. This is based on topographic mapping and data from USGS about the Iron Gate Dam gage site. "It is conservatively estimated that the discharge of 100-year flood would increase by approximately 7% immediately downstream of Iron Gate Dam after Dam Removal" (U.S. Bureau of Reclamation 2011 *as cited in* Caltrans 2016).

**Exceedance flow is defined as follows: 5% exceedance flow is the flow at which the flow is higher than that value 5% of the time. Flow is higher than the 90% exceedance flow 90% of the time.

accordance with NMFS (NMFS 2001b) guidelines for water drafting. These specifications provide operating guidelines for pumping rate. Water will be drafted from the Klamath River from April through October. Given the total number of days that water drafting may occur (214 days), at a maximum rate of 23,000 gallons per day, the maximum volume of water that the project may draft is 4,922,000 gallons (15.1 acre feet) each construction season. Additionally, the project will draft water up to a maximum rate of approximately 75 gallons per minute (0.2 cfs) during earthwork operations, or if needed for concrete curing, the rate would be approximately 5 gallons per minute (0.013 cfs), NMFS finds that the effect to stage height, in terms of reductions in discharge by drafting 0.2 cfs, has minimal effects to the habitat availability for coho salmon (NMFS 2014a) and extremely unlikely to entrain or strand coho salmon juveniles or adults.

2.5.1.6 Stormwater Runoff

Stormwater runoff will be conveyed from the new and wider T-intersection alignment at SR 263 and SR 96 through new culverts. RSP will be placed below all new culvert outlets to protect embankments from erosion and insure the drainage system functions to convey stormwater runoff from the roadway. Up to 5,187 square feet of RSP (933 cubic yards) will be placed in front of proposed abutments 1 and 8 and the associated retaining wall, and may also be required around Piers 2, 3, and 7 to protect abutments, retaining walls, piers, and roadway embankments from damage during storms. All RSP placements will to occur outside of the river channel.

Polycylic aromatic hydrocarbons (PAHs) are a group of chemicals that occur in coal, crude oil, and gasoline. Waterways located near urban centers often receive inputs of PAHs from municipal and industrial activities (USEPA 1997; Brown et al. 1998), which may be absorbed by juvenile salmon and their prey (Johnson et al. 2007; McIntyre et al. 2014) and may result in reduced growth and reduced resistance to disease (Arkoosh et al. 1998). State Route 96 is a rural highway where the current average annual daily traffic for the bridge is approximately 900 vehicles per day, of which 38 vehicles are trucks. A wider bridge will not result in more traffic; therefore the traffic-related PAHs are expected to be similar to pre-project levels. Also, surfacing the bridge approaches and new bridge deck are not expected to increase stormwater runoff and associated chemicals in the long-term, because the "first wash" effect described by Johnson et al. (2007) is expected only at the close of construction activities each year after the onset of the first precipitation event and to a lesser degree thereafter (Hall and Anderson 1988). Therefore, the potential effects of contaminant delivery from roadways, on the water quality of the rearing and migratory corridor functions of critical habitat, are likely low given the short amount of roadway associated with the project. Loss of rearing and migratory corridor function of the critical habitat is not anticipated, nor is the reduction in fitness of juvenile coho salmon residing in the action area.

2.5.1.7 Contaminants

Equipment refueling, fluid leakage and equipment maintenance near the stream channel pose some risk of contamination to aquatic habitat. Construction equipment will not enter the wetted channel. However, the Project has the potential to result in the delivery of petroleum products to the stream network through the use of power tools within and near the riparian zone, either through spills or leaks. Spill plans and BMPs for managing petroleum products should prevent or minimize the probability of runoff of hazardous materials in the unlikely event of a spill or leak associated with vehicles or construction equipment. Therefore, the potential for exposing any life stage of listed salmonids to petroleum products is extremely unlike with minimization measures and BMPs in place (Section 1.3.13).

2.5.1.8 Riparian Vegetation Removal

Riparian vegetation removal for the proposed construction activities will result in both temporary and permanent losses of riparian vegetation. Temporary impacts include the clearing of banks to allow access to construct the new bridge and removal of the existing bridge. Permanent impacts include loss of habitat due to placement of small amount of RSP in front of two culverts, and placement of new bridge abutments and piers: approximately 0.87 acres of temporary riparian removal and 0.15 acres of permanent removal are anticipated. Though shade trees will be removed, the amount removed relative to the riparian vegetation remaining in the near vicinity is proportionately small. Additionally, the removal of existing Piers 2 and 6, and existing home and outbuildings could ultimately provide up to an additional 0.41 acre of area where riparian vegetation can be planted within the action area, which results in a net gain of 0.26 acres for re-vegetation activities. These areas provide an opportunity for onsite replanting of riparian species.

All planting will take place onsite as space allows and if necessary, Caltrans will mitigate offsite for additional planting requirements.

The project has the potential to result in increases to stream temperatures by removing vegetation within the riparian areas. Removing small trees and shrubs may result in minor reduction of shade which has the potential to slightly increase site specific, action area water temperatures. However, the project utilizes BMPs and incorporates minimization measures, as well as a revegetation management plan (Caltrans 2016) to minimize or to prevent increases in stream temperatures that would otherwise contribute minutely to the sub-lethal to lethal temperatures that currently exist for coho salmon in the action area during summer.

Proposed actions may cause a potential temporary increase in temperature although that increase is not expected to be measurable downstream of the project. Water-temperatures are anticipated to remain at ambient levels because the action area is relatively small and the amount of vegetation present that could shade the river is already minimal. Water impoundment and diversion are the major contributing factors that would alternate and modify water quality within this segment of the river including the action area. Both the wider bridge and vegetation replanting are anticipated to improve shading and improve favorable summer water temperatures.

Riparian vegetation is an important source of nutrient inputs to streams such as leaf litter (Cummins et al. 1973) and terrestrial invertebrates that drop into the stream (i.e., allochthonous food subsidies). Leaf litter provides the trophic base for aquatic macro-invertebrate communities that in turn are part of the fundamental food source for salmonids (Hawkins et al. 1982; Beschta 1991; Bretscko and Moser 1993). In general, terrestrial invertebrates can comprise more than 33 to 50 percent of juvenile salmon diets (Allan et al. 2003). Because there are very few trees proposed for removal in the action area that provide shade or food subsidies to the river, the removal of vegetation associated with this project is not likely to increase stream temperature or reduce food subsidies. Minor loss of vegetation cover may cause fish to become susceptible to predators and may reduce foraging habitat and input of food subsidies from terrestrial insects for juveniles and leaf litter utilized by stream detritivores (Cummins et al. 1973). This could lead to competition in unaffected areas. Because the action area is only used as a migration corridor, fish exposure will be minor. The area of riparian vegetation is relatively small, and the amount of vegetation removed relative to the riparian vegetation remaining in the vicinity is proportionately small, therefore reductions in leaf litter and corresponding reductions in prey are anticipated to be minimal and temporary.

2.5.1.9 Habitat Loss

Placement of gravel approach pads results in habitat reduction of 1,800 square feet of area per trestle (0.08 acres) and up to 18,000 cubic yards of gravel per trestle, are expected to cover benthic habitat for approximately 18 months and five months each, respective of each trestle. Though minimal in area compared to the remainder of the action area, the area of gravel approach pads for the proposed bridge construction is not likely to substantially reduce the density of macroinvertebrates for coho salmon within the action area. Moreover, at the time of the minor reduction, few feeding coho salmon will be in the action area. Some macroinvertebrate recolonization will occur after placement on the approach pad structure and be available to outmigrants the following year. After approach pad removal, benthic and infaunal aquatic macroinvertebrate recolonization of disturbed areas is rapid (about one month) (Doeg et al. 1989; Cushman 1985; Harvey 1986). Impacts to benthic habitat will be temporary, minor, and minimal without causing long-term reductions to coho salmon forage.

Trestle H-piles are expected to temporarily remove up to 48, or 32 (depending on trestle option scenario) square feet of in-water habitat. In contrast removal of the existing bridge will return approximately 512 square feet of permanent in-water habitat with the removal of existing bridge. The proposed bridge spans the wetted channel without in-water piers. Short term impacts of the reduction of in-water habitat from temporary trestle piles is not expected to change the foraging behavior of transiting coho salmon nor substantially impact their migratory behavior as piles will be placed so that a minimum of 20-foot wide section of the river will remain open between piles.

2.5.2 Effects Related to SONCC Coho Salmon Critical Habitat

The five essential habitat types for critical habitat include: (1) juvenile summer and winter rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; (4) adult migration corridors; and (5) spawning areas. In this project, the short duration and temporary disruption by Project activities diminish the suitability of the action area for use by both juvenile and adult coho salmon as a migration corridor while transiting the action area.

Within the essential habitat types (spawning, rearing, migration corridors), essential features of coho salmon critical habitat include adequate (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions (64 FR 24049, May 5, 1999).

The Klamath River is designated as critical habitat within the action area and is a migration corridor for outmigration (juveniles migrating to the ocean), migration to rearing habitat in tributaries (including off-channels habitat), and migration for adults returning to spawning grounds (hatchery). The critical habitat of SONCC coho salmon will be subject to temporary and permanent Project activities (Table 21) that may result in:

1. Permanent increase of impervious surface area from proposed bridge roadway approaches on a new bridge alignment that will be paved; widened T-intersection at SR 96 and SR 263; proposed bridge piers, abutments, retaining wall, and RSP—a total area of approximately 5,187 square feet, or 0.12 acres of riparian habitat;
2. Temporary impacts to river-bed habitat from pile placement (96 square feet) and gravel approach pads (36,000 square feet);
3. Temporary impacts (including removal) of riparian and upland vegetation; and
4. Temporary impacts from impact pile driving (up to a total of 16 days, four hours a day).

Table 21. Estimated permanent and temporary impacts within the action area (Caltrans 2016).

Type	Riparian Area	
	Square Feet	Acres
Permanent	6,615	0.15
Temporary	37,925	0.87

2.5.2.1 Juvenile and Adult Migration Corridor

Temporary trestles constructed to build the new bridge and remove the old bridge will create only temporary changes in stream velocities or water surface elevations (*see Effects to Individual SONCC Coho Salmon* section above) and are not expected to adversely affect critical habitat. The proposed removal of the existing bridge (Figure 2), with its in-water piers (an area footprint of 512 square feet—Table 1), replaced with a proposed bridge design without in-water piers is expected to improve the existing baseline as it pertains to a more natural development of physical and biological features within the action area channel—uninhibited by in-water piers.

Hydroacoustic effects will be temporary (up to eight days per year) and occur when most salmon are not transiting the action area.

2.5.2.2 Sedimentation

The project will have limited effects to critical habitat from ground disturbing activities that may cause a minimal increase in turbidity and sediment entering the river. As described in section 2.5.1 above, any mobilization of sediment into the waterway would be minimal since BMPs and avoidance measures will be implemented. Therefore, we do not expect increased sediment to reduce pool depth or affect downstream spawning gravels. Therefore, the effects of project-related sediment on critical habitat are extremely minimal.

2.5.2.3 Vegetation Removal

Existing trees and shrubs (Table 4) located along the banks of the Klamath River within the action area have the potential to provide shade and contribute nutrients to the stream; the minor reduction in shade and nutrients from riparian vegetation removal is expected to be temporary until replanted vegetation becomes established. Further, where feasible, rapidly sprouting plants, such as willows, will be cut off at ground level and root system will be left intact to promote regeneration. Removal of riparian vegetation is expected to have minor effects to critical habitat because minimization measures will reduce the effects to critical habitat, disturbed areas will be replanted.

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). 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.

SONCC coho salmon and critical habitat may be affected by future non-federal activities, such as timber harvest and road construction, (the effects of which are described in the *Environmental Baseline* section). In the long term, climate change may produce temperature and precipitation changes that may adversely affect SONCC coho salmon habitat in the action area.

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 diminishes the value of designated or proposed critical habitat for the conservation of the species.

In the *Status of the Species* section, NMFS summarized the current risk of extinction, the factors that led to the current listing status, and the current risk of extinction including past and ongoing human activities, climate change, and ocean conditions of the SONCC coho salmon ESU. NMFS also summarized the current status of critical habitat for the SONCC coho salmon ESU. NMFS determined that juvenile sub-yearling coho salmon would be adversely affected by the Project as a result of crushing from installation of gravel approach pads and hydroacoustic effects associated with pile driving. NMFS also determined that the Project would adversely affect critical habitat because of effects to juvenile migration PBFs, and may affect but not likely to adversely affect adult migration PBFs.

Summary

The five essential habitat types for critical habitat include: (1) juvenile summer and winter rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; (4) adult migration corridors; and (5) spawning areas. In this project, the short duration and temporary disruption by Project activities diminish the suitability of the action area for use by both juvenile and adult coho salmon as a migration corridor while transiting the action area. Of all the effects of the proposed action, NMFS believes that the risks from *crushing during in-water gravel approach pad placement* and *hydroacoustic effects during impact pile driving* are the most significant project effects to coho salmon when used as a juvenile migratory corridor. However, by adopting recommendations early in the consultation process (July 1-August 31 impact pile driving window), implementing minimization measures (gravel approach pad installation methodology), and by placing gravel approach pad barrier blocks slowly in-channel, any fish present are expected to startle from or avoid the area of activity and continue their outmigration or non-natal redistribution. NMFS believes that coho salmon abundance and productivity will likely improve over the next ten years for the Upper Klamath, Middle Klamath, Shasta, and Scott river populations (NMFS 2013). NMFS believes the proposed action is not likely to result in a level of habitat reduction where coho salmon sub-yearlings and smolts in the Upper Klamath and Shasta River populations will have reduced life history diversity. Finally, NMFS does not expect the proposed action will reduce the spatial structure of coho salmon in the action area because the proposed action is not expected to create any permanent physical, biological, or chemical barriers. A temporary migration barrier may occur during the four hours of pile driving during daylight hours for the expected five or eight days of impact pile driving, per year. However, with conservation and minimization measures implemented by Caltrans, the impact pile driving work window, July 1 through August 31, encompasses a timeframe when extremely low numbers of juveniles and no adults are expected to be transiting the Project action area.

While factoring the environmental baseline conditions of the action area, the status of the Upper Klamath River and Shasta River coho salmon populations and their critical habitat, the status of the SONCC coho salmon ESU and its critical habitat, and the cumulative effects of future state or private activities, NMFS believes the proposed action is not likely to increase the extinction risk of the Upper Klamath and Shasta coho salmon populations. Therefore, the proposed action is not likely to increase the extinction risk of the SONCC coho salmon ESU.

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, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of SONCC ESU of coho salmon or destroy or adversely modify its 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 incidental take statement.

2.9.1 Amount or Extent of Take

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

1. Impact pile driving is confined to a time window from July 1 through August 31. Incidental take of coho salmon sub-yearling juveniles is expected to occur during pile driving activities as a consequence of underwater sound pressure (barotrauma) produced from impact pile driving. Sound pressure levels will be used as a surrogate for take. An acoustic monitoring plan will be used to monitor sound pressure waves, and if threshold values are exceeded beyond the spatial limits or distances presented, take is assumed to have been exceeded. Exposure to pile driving activities is expected to result in the injury, or mortality of up to 4.3 percent* of sub-yearling juvenile coho salmon anticipated to be transiting the action area (Table 17) in the month of July during each year of implementation of the project—a project total of four sub-yearling juvenile coho salmon.

   *Estimate of take of sub-yearling juveniles during pile driving:

   Values defined
   - A = Pile driving during up to 8 days
   - B = Pile driving for up to 4 hours per day
   - C = 31 days in the month of July
   - D = hours in a day
   - E = 4 hour periods in the month of June
   - F = 28, or the number of sub-yearling juvenile coho observed at the USFWS I-5 outmigrant trap (Table 17) in July

   Formulas:

C / (B / D)	=	E	number of four-hour periods in the month of June;
E / A	=	0.043	the portion of the hours in June expected for pile driving;
F * 0.04	=	1.2	number of sub-yearling juveniles exposed to hours of pile driving per year

2. If used, placement of each of the gravel approach pads has the potential to take sub-yearling juveniles during their construction by way of crushing or impaired migration. Placement of the gravel work pads themselves will be used as surrogate for expected take through injury, or mortality to individuals by crushing. Up to 6.7 percent of sub-yearling juveniles anticipated to be transiting the action area (Table 17) during the month of June during gravel approach pad installation are expected to either be injured, or a direct mortality as a result from being crushed under approach pad barriers or gravel during each year of implementation of the project—a project total of six juvenile sub-yearling coho salmon.

   *Estimate of take of sub-yearling juveniles during gravel approach pad installation:

   Values defined
   - A = Number of days to install gravel approach pad
   - B = Number of gravel approach pads
   - C = Number of days to install two approach pads per trestle
   - D = 30 days in the month of June

- E = 43, or the number of sub-yearling juvenile coho observed at the USFWS I-5 outmigrant trap (Table 17) in June

Formulas:

A * B	=	C	number of days to install gravel approach pads for each trestle;
C / D	=	0.067	the portion of days in June expected for gravel approach pad placement;
E * 0.067	=	2.97	number of sub-yearling juveniles exposed to gravel approach pad installation per year

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 or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental taking of SONCC coho salmon:

To ensure that incidental take is not exceeded, the following measures will be implemented

1. Ensure that construction methods, minimization measures, and monitoring are properly implemented and assist in the evaluation of Projects effects on SONCC coho salmon.

2. Ensure acoustic effects do not exceed levels analyzed in the opinion.

3. Reduce possibility of direct crushing during installation of gravel approach pads.

4. Notify NMFS if take of listed species, as described above in Section 2.9.1 is exceeded prior to project completion or if methods used during Project implementation differ from those analyzed in this opinion.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Caltrans or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). FHWA or any applicant 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 incidental take statement (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 likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:
    a. Prepare and provide NMFS with an underwater noise monitoring plan as outlined by the FHWG and found on the Caltrans website (http://www.dot.ca.gov/hq/env/bio/fisheries_bioacoustics.htm), two months prior to the start of the project.
    b. Caltrans shall follow the contractor requirements as outlined in the FHWA Monitoring Template Preliminary results for the daily monitoring activities will be reported to Rebecca.Bernard@NOAA.gov (NMFS, Arcata, California) at the close of each day after monitoring concludes for the day.
    c. In addition, a final draft report including data collected and summarized from all monitoring locations will be submitted to NMFS within 90 days of the completion of hydroacoustic monitoring. The results will be summarized in graphical form and include summary statistics and time histories of impact sound values for each pile.
    d. A final report will be prepared and submitted to NMFS within 30 days following receipt of comments on the draft report from NMFS. The underwater sound pressure level profile, as monitored during impact pile driving, will be used to document the effects of the action on listed species in the action area and if/when the physical injury threshold is reached

2. The following terms and conditions implement reasonable and prudent measure 2: Caltrans shall follow the contractor requirements as outlined in the FHWA Monitoring Template. Insure impact pile driving activities are as outlined to occur in the Effects section (section 2.5.1.3) of the opinion. If the timing of pile driving breaches the pile driving work window; the number of piles or the number of strike is higher than expected; or the number of days of pile driving are greater than expected, Caltrans will contact NMFS as soon as the deviation is expected to occur to discuss potential alternative solutions. Therefore, conditions that result in an acoustic footprint greater than the following would require discussion with NMFS:

    - 16 meters (52.5 feet) to reach the 206 dB (re: 1 μPa) Peak
    - 449 (1,473 feet) meters to reach the 187 dB (re: 1μPa^2•sec) Cumulative SEL for fish ≥ 2 g
    - 4,642 (15,230 feet) meters to reach the 150 dB (re: 1 μPa) RMS

3. The following terms and conditions implement reasonable and prudent measure 3: Insure that the amount of time used for gravel approach pad installation does not exceed the time described in the BA and subsequently analyzed in the opinion.

4. The following term and condition implements reasonable and prudent measures 4:
    a. Caltrans shall contact NMFS within 24 hours of meeting or exceeding take of listed species prior to project completion,
    b. Caltrans shall notify NMFS biologist, Rebecca Bernard by phone at (707) 825-1622, or email at Rebecca.bernard@noaa.gov. This contact acts to review the activities resulting in take and to determine if additional protective measures are required. Any and all coho salmon mortalities shall be retained, placed in an

appropriately sized sealable plastic bag, labeled with the date and location of collection, fork length, and be frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS.

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).

1. Caltrans should consider using bioswales whenever possible, or other stormwater filtering techniques to decrease road runoff contaminants entering the river to increase the quality of the habitat baseline to help increase the value of critical habitat, reducing exposure to individual salmon.

2. Caltrans should consider incorporating the temporary trestle, Option 1 senario, for the existing bridge demolition work trestle. This measure decreases migration impairment and the potential for harm of individual transiting salmonids.

3. If the contractor choses the temporary trestle, Option 2, Caltrans should consider methods, such as, providing a gap at the downstream end of the barrier to ensure that any fish that may become entrained behind the approach pad barrier during construction, has continuous escape access to the river prior to completing the gravel backfill and barrier closure.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Klamath River Bridge Replacement Project.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this 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 CONSULTATION

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." 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) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Caltrans and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the Pacific Fisheries Management Council (PFMC) and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

Essential Fish Habitat is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802[10]). "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle. The term "adverse effect" means any impacts which reduce the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrates and loss of, or injury to, benthic organisms, prey species, and their habitats, and other ecosystem components. Adverse effects may be site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.910). The EFH consultation mandate applies to all species managed under a Fishery Management Plan (FMP) that may be present in the action area.

In the Mid-Pacific Region, the PFMC works with NMFS to develop FMPs and designate EFH for commercial fish species. SONCC coho salmon ESU (including Iron Gate Hatchery coho salmon production) and the Upper Klamath-Trinity Rivers (UKTR) Chinook salmon ESU (including Iron Gate Hatchery Chinook production), which are managed under the Pacific Coast Salmon FMP, occur within the Project action area.

The Bogus Creek Fish Counting Facility (Knechtle and Chesney 2016) and Shasta River Fish Counting Facility (Table 11) (Chesney and Knechtle 2016bc) adult video count data combined with adult spawning ground surveys are used to enumerate adult Chinook and coho salmon returns to the Shasta and Bogus Creek, downstream from Iron Gate Hatchery. Complimentary juvenile outmigration trapping occurs in the vicinity of the adult counting facilities to enumerate juvenile Chinook and coho salmon. A fyke net was used in Bogus Creek (Chesney and Knechtle 2016c) and a screw trap were used on Shasta River (Debrick et al. 2015) to capture juvenile outmigrants (Table 12). Both projects use mark recapture methodology to enumerate the outmigration of juvenile salmonids. For coho salmon, these fish represent two populations of the Interior Klamath Domain for SONCC coho salmon—the Shasta River population and the Upper Klamath populations; including the Iron Gate Hatchery coho production. For Chinook salmon, the Upper Klamath Trinity River ESU is not currently listed under ESA (Williams et al. 2011). The ESA analysis for critical habitat (section 2.4.3) evaluates and outlines project impacts to SONCC coho salmon critical habitat; which for use in this document are complementary to coho salmon EFH.

For the EFH assessment, we assume average juvenile and adult migration timing—primarily as observed in the last five year trend (Table 22). We also assume that the Iron Gate Hatchery juvenile release timing will be observed as analyzed in this opinion. Additionally, we assume an average water year discharge (Table 18) driving migration timing for juvenile and adult Chinook and coho salmon. River discharge volume influences salmon migration timing. In 2006, during a high water year (Table 18) outmigrating juvenile salmon delayed migration—as observed at the USFWS I-5 juvenile outmigrant trap in 2006 (B. Pinnix, pers. comm. 2015). Project effects are analyzed based on an average water year in regards to migration timing and subsequent exposure to project actions. Environmental factors influence salmon behavior. The monthly abundances of Chinook (Table 22) and coho salmon juveniles and adults outlined in Table 17, are calculated from juvenile outmigration traps, hatchery release and return data, and adult video weir and spawning data during average water year discharge. Deviations to water year discharge, like that observed in 2006 may result in migration timing differences and thus, potentially, the monthly abundance of each life stage of Chinook and coho salmon transiting the action area. For juvenile coho salmon, outmigration timing is earlier than for Chinook salmon and deviations in migration timing for Chinook salmon juveniles may result in increased exposure of individuals when evaluating exposure to project actions; this is less of an issue with coho salmon.

Moreover, Chinook hatchery releases are tied to water temperature that influences rate of development and the ability to bring the fish up to a size to insert coded wire tags (K. Pomeroy, 2015 pers. comm.). Iron Gate Hatchery is under regional agreement to release age-0 Chinook on, or before June 15. Travel time for juveniles to reach the Project action area from the hatchery is approximately one week to 10 days (K. Pomeroy 2015 pers. comm.), and two weeks is likely conservative to expect clearance through the action area. The primary driver behind the recommendation to delay the impact pile driving work window to July, is Chinook salmon clearance through the project action area. In 2011, juvenile Chinook salmon became ill in the hatchery and were dosed and subsequently released two weeks later at the end of June. The USFWS documented the later migration timing at the I-5 outmigration trap as a result of delayed release at the hatchery. The monthly abundance of Chinook salmon outlined in Table 22, assumes all juvenile Chinook will be released on, or before June 15. Delays to this practice potentially increase the number of fish exposed to project actions; gravel approach pad installation and of more concern, impact pile driving. Fine coordination between project actions and hatchery release schedule during the two seasons of the project can result in the minimization of impacts to individual Chinook salmon.

The EFH in the Project action area is used as a migratory corridor for outmigrating and redistributing juveniles and returning adults. There is no suitable habitat for either juvenile rearing, or spawning.

Juvenile Migration Corridor

Natural juvenile *Chinook* salmon migrate out from natal streams to the Klamath River mainstem and downstream from February to July (Table 22), transiting through the action area on their way to the Pacific Ocean. The Iron Gate Hatchery Chinook salmon release program goals are 950,000 juveniles released in spring and 5,000,000 juveniles released in summer (K. Pomeroy pers. comm. 2015). The Iron Gate Hatchery juvenile Chinook salmon release schedule is June 15, though water temperatures influence growth and the size at which juvenile Chinook salmon can be suitably marked and tagged, therefore releases can occur earlier than June 15 (K. Pomeroy, pers. comm. 2015). Based on the Iron Gate Hatchery program goals for juvenile Chinook salmon (5.1 million age-0 and 0.9 1 million age-1) (*though variable annually*, Table 24), and trap and release study data for natural

Chinook salmon—Shasta River (~2.74 million) (Table 23) and Bogus Creek ~0.335 million), on average, the annual estimate of ~8.972 million juvenile Chinook salmon may transit through the action area as they migrate downstream to the ocean (Table 22).

The Iron Gate Hatchery *coho* salmon production goal is 75,000 smolts released March 15—May 1, but recently an average of 78,379 juveniles have been released (Table 17). The annual average (7,565) of juvenile outmigrants from Bogus Creek may transit the action area and the annual average (1,941 yearling and 2,475 sub-yearling) of juvenile outmigrants from Shasta River may traverse within the bounds of the Project action area. Additionally, the USFWS trap at the I-5 location catches an annual average of 208 sub-yearling redistributing juveniles which have the potential to transit the Project action area. Therefore, on average, approximately 90,569 may use the Project action area as a migration corridor.

Adult Migration Corridor

Natural adult *Chinook* salmon return to spawn within the Klamath River basin from September to December (Table 22), transiting through the action area on their way to spawning streams and reaches. The Iron Gate Hatchery adult return timing is more compressed, arriving at the hatchery October through November after transiting the Project action area. A combined annual average 6,727 Bogus Creek adults and 14,811 Shasta River adults (Table 23), as well as 13,982 Iron Gate Hatchery adults—a average total of 35,518 (Table 24) may transit the Project action area.

Natural adult *coho* salmon return to spawn within the Klamath River basin from October to February (Table 17), transiting through the action area on their way to spawning streams and reaches. The Iron Gate Hatchery adult return timing is similar, arriving at the hatchery October through February after transiting the Project action area. A combined annual average 169 Bogus Creek adults and 73 Shasta River adults, as well as 585 Iron Gate Hatchery adults—a average total of 817 may transit the Project action area.

Table 22. Average expected monthly abundance of Chinook salmon, by life stage and origin, in the Project action area. Monthly values are not cumulative, monthly averages for the listed year range. The "annual" column is the annual abundance, averaged over the year range. June1 to October 31 is the in-water work window and July1 to August 31 is the impact pile driving work window.

	Average MONTHLY estimated abundance for population and life stage for years defined														
Iron Gate Hatchery Chinook Salmon Production	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Ave. Annual	Jun 1–Oct 31	Jul 1–Aug 31
Juvenile Release IGH and Trap Efficiency (age-0) ave. 2012–2016[1]							3,430	19,493	2,627,146	2,133,164			4,227,205	2,133,164	0
Juvenile Release IGH (age-1) ave. 2011–2015[1]			1,002,035										1,002,035	0	0
Return Adult IGH ave. 2013–2015[2]		11,333	2,648	1									13,982	11,333	0
Wild Chinook salmon Production															
Juvenile (age-0) I-5 Mainstem Trap (H and W)—ave. 2009–2013[3]						557	204,341	374,856	294,675	71,140	104,855[8]		937,639	175,995	0
Juvenile (age-0) Bogus Creek Trap ave. 2015–2016[4]							177,824	81,911	72,426	6,167			335,244	6,167	0
Juvenile (age-0) Shasta River Trap ave. 2011–2015[5]						542,586	1,659,712	345,089	168,843	21,009	0		2,737,239	21,009	0
Return Adult Bogus Creek ave. 2011-2015[6]	412	6,028	286	1	0	0							6,727	6,440	0
Return Adult Shasta River ave. 2011-2015[7]	7,185	7,430	191	5	1								14,809	14,614	0
Wild origin juvenile outmigration and returning adult monthly distribution															
Bogus Creek Trap Age-0							52.6%	24.2%	21.4%	1.8%					
Bogus Creek Adult	6.1%	89.6%	4.2%	0.0%	0.0%	0.0%									
Shasta River Trap Age-0						19.8%	60.6%	12.6%	6.2%	0.8%	0.0%				
Shasta River Adult	48.5%	50.2%	1.3%	0.0%	0.0%										

[1]Iron Gate Hatchery—Data provided by Keith Pomeroy, (Iron Gate Hatchery Manager).
[2]CDFW website—https://nrm.dfg.ca.gov/documents/ContextDocs.aspx?cat=Fisheries--FishProductionDistribution&sub=Anadromous_Fish_Trap_Counts
[3]USFWS—Data provided by Bill Pinnix (Fish and Wildlife Biologist) data from the I-5 juvenile trap--Klamath River Project monitoring.
[4]CDFW—Chesney and Knechtle 2015b, 2016c; [5]CDFW—Debrick and Stenhouse 2014, Debrick et al. 2015; [6]CDFW—Knechtle and Chesney 2016, Yreka Klamath River Project Video Summary; [7]CDFW—Chesney and Knechtle 2016b, Yreka Klamath River Project Video Summary.
[8]Iron Gate Hatchery released 4,993,567 sub-yearling Chinook salmon on June 23rd 2011—late release because fish had gotten sick and were dosed at the hatchery and held for two weeks to assure they were OK (Steve Gough USFWS 4/6/2016).

Table 23. Estimated number of age-0 smolts produced per returning adult Chinook salmon spawner in the Shasta River system (Chesney and Knechtle 2016b—adult trap; Stenhouse et al. 2015—juvenile trap).

Adult Brood Year	Adult Estimate	Age-0 Smolt Outmigration Year	Age-0 Smolt Point Estimate	Age-0 Smolt Produced per Returning Adult
2001	11,093	2002	3,162,429	285.1
2002	6,818	2003	1,020,064	149.6
2003	4,289	2004	2,486,076	579.6
2004	962	2005	297,208	308.9
2005	2,129	2006	83,387	39.2
2006	2,184	2007	579,735	265.4
2007	2,036	2008	938,503	461.0
2008	6,362	2009	718,949	113.0
2009	6,287	2010	2,347,783	373.4
2010	1,348	2011	654,625	485.6
2011	11,388	2012	166,500	14.6
2012	29,544	2013	5,218,270	176.6
2013	8,021	2014	4,744,838	591.6
2014	18,357	2015	2,901,966	158.1
2015	6,745	2016		
Average	7,838		1,808,595	285.8
Last five year average	14,811		2,808,595	285.3

3.2 Adverse Effects on Essential Fish Habitat

After further review of the Iron Gate Hatchery juvenile salmonid release schedule, combined with natural-origin juvenile salmonid outmigration timing, and their river travel timing and behavior, as well as adult salmonid return timing of hatchery and natural-origin salmonids, NMFS recommended conservation alternatives that included a delay and truncation of impact pile driving activities to July 1 through August 31 during each project year. This conservation alternative responds to and allows time for clearance of juvenile salmonids transiting through the Project action area during out migration, and further avoids returning adult salmon. Caltrans evaluated NMFS's request and subsequently agreed, as such Caltrans has proposed that impact pile driving activities be implemented during the work window of July 1 through August 31. Caltrans further communicated that given the truncated, impact pile driving activity window that "Trestle Option 2" scenario, proposed as the second of two alternative work trestle designs, provides a time savings that responds to the reduced pile driving work window. This option incorporates in-channel gravel work pads, installed on each river bank, requiring fewer steel H-piles.

Table 24. Estimated return rates of Iron Gate Hatchery Chinook salmon sub-yearling (age-0) and yearling (age-1) CWT releases (Chesney and Knechtle 2016a).

Brood Year	Total Age-0 Release	Number CWTs Smolts Released (Age-0)	Return Percent (%)	Total Age-1 Release	Number CWTs Yearlings Released (Age 1+)	Return Percent (%)	Total Releases
2001		198,311	0.006%		110,167	0.693%	
2002		210,114	0.175%		109,711	0.269%	
2003		261,888	0.027%		48,592	0.123%	
2004		205,950	0.336%		98,752	0.218%	
2005		209,754	0.092%		103,157	0.431%	
2006		309,671	0.072%		103,361	0.223%	
2007		307,204	0.111%		103,879	0.289%	
2008		986,141	0.027%		192,339	0.102%	
2009		1,119,054	0.914%		264,253	0.220%	
2010	4,528,056	671,755	0.370%	852,129	261,332	0.026%	5,380,185
2011*	3,937,879	1,158,028	0.232%	944,369	286,947	0.292%	4,882,248
2012*	5,031,515	1,040,836	0.093%	1,148,932	263,614	0.006%	6,180,447
2013*	4,111,728	1,117,134	0.002%	979,668	263,836	0.0015%	5,091,396
2014	4,427,279			993,717			5,420,996
2015	3,826,185			943,489			4,769,674
2016	3,739,317						
Average							

Effects of the proposed action on Chinook salmon EFH are the same as those of coho salmon outlined in the effects to coho salmon critical habitat section in the ESA analysis. The effects to Chinook and coho salmon EFH are as follows:

1 Temporary habitat degradation from impact pile driving.
2 Temporary habitat degradation and loss of benthic macroinvertebrate production from installment of gravel approach pads for up to 18 months.
3 Increased sedimentation resulting in loss of macroinvertebrate production and degradation of spawning habitat. Increased turbidity due to increased suspension of sediments during construction and removal of temporary crossing and work pads.
4 Removal of riparian vegetation, both temporary and permanent.
5 Permanent reduction of habitat from installation of proposed bridge piers, footings, abutments, retaining walls, bridge roadway approaches, roadway widening, and RSP.
6 Increase of chemical contamination from road run-off due to increase in bridge deck area.

The effects of the above actions on EFH are described in the associated ESA critical habitat section of the opinion in sections 2.4.2 through 2.4.3, respectively, and are expected to be the same for Chinook salmon. Effects determination for species and life stage are summarized in Table 25.

After reviewing the effects of the Klamath River Bridge Project, NMFS has determined that the proposed action would adversely affect coho salmon and Chinook salmon EFH.

Table 25. Adverse effects to EFH with potential impacts on Chinook and coho salmon. Species, origin, and life stage of fish transiting through the action area during in-water, construction activities. Work windows: in-water work window June 1—October 31 and pile driving work window July 1—August 31.

Adverse Effect	Chinook Salmon Life Stage and Origin					
	Hatchery Origin			Natural Origin:		
	0-age	1-age	Adult	0-age	1-age	Adult
Migration Corridor						
In-channel, gravel approach pad installation	Yes	No	Yes	Yes	Yes	Yes
Impact pile driving	No	No	No	No	No	No

Adverse Effect	Coho Salmon Life Stage and Origin				
	Hatchery Origin		Natural Origin:		
	1-age	Adult	0-age	1-age	Adult
Migration Corridor					
In-channel, gravel approach pad installation	No	Yes	Yes	Yes	Yes
Impact pile driving	No	No	Yes	No	No

3.3 Essential Fish Habitat Conservation Recommendations

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 15.96 acres of designated EFH for Pacific Coast salmon.

1. Coordinate with Iron Gate Hatchery so that Caltrans is informed of all juvenile hatchery coho salmon releases during proposed Project years and that any age-0 juvenile Chinook hatchery releases that occur beyond the June 15 program schedule are discussed prior to those program releases. Because exposure of juvenile Chinook salmon to pile driving increases if hatchery fish are released past June 15, juveniles would be transiting the action area during the pile driving work window. Coordinating with the USFWS on observations at the I-5 mainstem trap site may facilitate river travel time estimates if hatchery releases are delayed.
2. Observe any deviation from average water year discharges, particularly a wet water year such as that listed in Table 18 during 2006 that may cause juvenile outmigrants to delay migration or redistribution. Tracking the surface water discharge of the Klamath and Shasta Rivers can help ascertain whether a non-normal water year is in evidence.

Coordinating with mainstem (USFWS I-5 trap) and tributary (CDFW Shasta River and Bogus Creek Fish Counting Facilities) stock assessment biologists can also inform Caltrans whether migration timing may not be average.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, Caltrans 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 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

Caltrans 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)).

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.

4.1 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 Caltrans. Other interested users could include Klamath River Indian Tribes, California Department of Fish and Wildlife, USFWS, and US Forest Service—Klamath Nation Forest. Individual copies of this opinion were provided to the Caltrans. This opinion will be posted on the Public Consultation

Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 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.

4.3 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 and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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