HABITAT CONSERVATION PLAN AND SAFE HARBOR AGREEMENT FOR SEVEN ANADROMOUS FISH POPULATIONS

SIERRA PACIFIC LAND & TIMBER COMPANY

SIERRA PACIFIC INDUSTRIES FORESTLAND MANAGEMENT PROGRAM

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SIERRA PACIFIC INDUSTRIES

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
ASP	Anadromous Salmonid Protection
BLM	US Bureau of Land Management
BMP	best management practice
CAL FIRE	California Department of Forestry and Fire Protection
CalWater	California Department of Water Resources
CDFW	California Department of Fish and Wildlife (formerly known as California Department of Fish and Game)
CEQA	California Environmental Quality Act
CFPRs	California Forest Practice Rules
CFR	Code of Federal Regulations
cfs	cubic feet per second
Core	Watershed category (1, 2, or 3) assigned by NMFS to assess potential contribution for (listed salmonid) species recovery in the Sacramento River basin.
dbh	diameter at breast height
DPS	Distinct Population Segment
ESA	Endangered Species Act
ESP	Enhancement of Survival Permit
ESU	Evolutionarily Significant Unit
F&GC	California Fish and Game Code
FORPRIEM	Forest Practices Rules Implementation and Effectiveness Monitoring
FR	Federal Register
HA	Hydrologic Area (per CalWater)
HCP	Habitat Conservation Plan
HSA	Hydrologic Sub-Area (per CalWater)
HU	Hydrologic Unit (per CalWater)

ITP	Incidental Take Permit
LWD	large woody debris
mg/L	milligram(s) per liter
MWMT	mean weekly minimum water temperature
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity unit(s)
PBFs	physical and biological features
PG&E	Pacific Gas & Electric
READI	Road Erosion and Sediment Delivery Index
RPA	reasonable and prudent alternative
RPF	Registered Professional Forester
Services	National Marine Fisheries Service and US Fish and Wildlife Service
SHA	Safe Harbor Agreement
SMARA	Surface Mining and Reclamation Act
SONCC	Southern Oregon/Northern California Coast
SPI	Sierra Pacific Industries (authorized representative and manager of SPL&T)
SPL&T	Sierra Pacific Land & Timber Company
THP	Timber Harvest Plan
TMDL	total maximum daily load
TRRP	Trinity River Restoration Program
US	United States
USBR	US Bureau of Reclamation
USC	United States Code
US EPA	US Environmental Protection Agency
USFS	US Forest Service
USGS	US Geological Survey
USFWS	US Fish and Wildlife Service
WLPZ	watercourse and lake protection zone

1. INTRODUCTION

Sierra Pacific Land & Timber Company (SPL&T) is the largest private forest land owner in the state of California, with ownership currently encompassing approximately 1.64 million acres of timberland throughout the northern and central portions of the state. Sierra Pacific Industries (SPI) is the authorized representative and manager of SPL&T lands. Rivers and streams on portions of SPL&T lands in the Trinity River and Sacramento River basins provide habitat for anadromous salmonids, including species listed under the federal Endangered Species Act (ESA). SPI forestland management activities (collectively referred herein as "covered activities") have the potential to adversely affect fish species and their habitats that are listed or may be at risk of listing under the ESA (collectively referred to herein as "covered species").

1.1. Overview and Background

SPI has prepared this document to address effects of forestland management in the Sacramento River and Trinity River basins on salmonids under the regulatory jurisdiction of the National Marine Fisheries Service (NMFS), which include the following species and populations:

- Chinook salmon (*Oncorhynchus tshawytscha*) (four Evolutionary Significant Units [ESU]): Central Valley fall- and late fall-run ESU, Central Valley spring-run ESU, Sacramento River winter-run ESU, and Upper Klamath/Trinity River ESU.

- Coho salmon (*O. kisutch*) (one ESU): Southern Oregon/Northern California Coast (SONCC) ESU.

- Steelhead (*O. mykiss*) (two Distinct Population Segments [DPS]): California Central Valley DPS and Klamath Mountains Province DPS.

This document includes two components:

1. A Habitat Conservation Plan (HCP) designed to address potential impacts on listed and non-listed salmonids resulting from SPI timber harvest activities in watersheds with watercourses accessible to anadromous salmonids, or upstream of those watercourses where potential effects from covered activities have the potential to extend to occupied habitat. Section 10(a)(1)(B) of the ESA authorizes NMFS to issue an Incidental Take Permit (ITP) to non-federal parties for the potential incidental taking of endangered and threatened species of anadromous salmonids. In support of an ITP application, applicants must prepare an HCP that provides an assessment of impacts; measures to monitor, minimize, and mitigate for those impacts; and procedures to account for unforeseen or extraordinary circumstances.

2. A Safe Harbor Agreement (SHA) to address potential impacts of SPI timber harvest and other activities on listed salmonids on SPL&T lands in the Sacramento and Trinity River basins upstream of impassable dams where NMFS is proposing to reintroduce populations of listed salmonids. SHAs are voluntary agreements between NMFS and cooperating non-federal landowners that promote voluntary management for protection of endangered and threatened species on non-federal property while giving assurances to participating landowners that no additional future regulatory restrictions will be imposed. In return, NMFS will authorize incidental take by issuing an Enhancement of Survival Permit (ESP) through Section 10(a)(1)(A) of the ESA. The ESP allows participants to take individual listed plants or animals or to modify habitat to return populations and habitat conditions to those agreed upon as baseline. This SHA meets the regulatory standard of producing a net conservation benefit for listed salmonids reintroduced onto SPL&T lands.

SPI developed this document in consultation with NMFS. The outline and content of this document follows the most recent guidance in the 2016 *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (USFWS and NOAA Fisheries 2016), and SHA policies and procedures (NOAA Fisheries 2016; USFWS 2016).

1.2. Document Organization

The information, analysis, and conservation program comprising this document are organized as follows:

- Section 1: The introduction, overview and background, purposes of this document; the scope of the HCP and SHA, including the Action Area, permit duration, covered species, and covered activities; and the requirements and approval criteria for the HCP, SHA, and permits;
- Section 2: A description of SPI timber operations and forest management activities;
- Section 3: A description of the covered species and their habitats;
- Section 4: A description and assessment of the habitat conditions of the HCP Action Area and the SHA Plan Area;
- Section 5: An assessment of the potential for timber operations and other activities to directly or indirectly impact covered species and potentially result in take of listed species;
- Section 6: A description of the conservation strategy, including measures to avoid and minimize take, measures to mitigate unavoidable take, and monitoring and adaptive management criteria;

- Section 7: A description of potential changed or unforeseen circumstances, including fire, windthrow, landslides, and new species listings; and

- Section 8: Guidance on the implementation of the HCP over the permit term, including a description of funding and costs associated with implementing the HCP for the life of the permit.

1.3. Purpose and Need

The National Marine Fisheries Service (2014a, 2014b) and U.S. Bureau of Reclamation (U.S. Bureau of Reclamation 2014, 2016) identified aquatic habitats in the Trinity and Sacramento River basins located upstream of existing man-made barriers to anadromy as high-quality habitat for proposed listed salmonid species reintroduction efforts. These habitats occur on federal and private lands, including lands owned by SPL&T and managed by SPI. NMFS approached SPI during 2016 requesting support for these proposed reintroduction efforts on SPL&T lands. SPI understands the conservation values of these efforts and prepared this HCP/SHA to support ITP and ESP permits covering land management activities on SPL&T lands within the proposed reintroduction areas, and areas within the current range of anadromy.

This document supports SPL&T's ITP and ESP application to comply with Section 10(a)(2)(A) of the ESA. Anadromous salmonids listed under the ESA are found in several watersheds within SPL&T lands, along with other anadromous salmonids that could potentially be listed in the future. Additionally, NMFS proposes to reintroduce listed salmonids above currently impassable barriers into rivers and streams on other portions of SPL&T property. SPI forestland management activities could potentially result in incidental take of those species.

The purposes of the HCP include:

1. Facilitate SPI's compliance with the ESA.
2. Provide NMFS with the basis for authorizing incidental take of covered species resulting from SPI timber management activities.
3. Detail measures that will minimize and mitigate potential take to the maximum extent practicable.
4. Establish measures intended to ensure that any take caused by covered activities is incidental.
5. Ensure that the impacts of unavoidable take will be mitigated.

The purposes of the SHA include:

1. Promote voluntary management of endangered and threatened species on SPL&T lands while giving assurances to SPL&T that no additional future regulatory restrictions will be imposed.

2. Maintain and improve potential habitat identified by NMFS and BOR for reintroduction efforts of covered species in the SHA Plan Area.

1.4. Scope

The scope of this document addresses the HCP Action Area and SHA Plan Area, permit duration, and activities covered by the requested authorizations for incidental take of covered species.

1.4.1. Plan Area and Action Area

The HCP handbook (USFWS and NOAA 2016) defines the Plan Area as all areas that will be used for any activities described in the HCP, including covered activities and the conservation program. Section 7 of the ESA regulations define the "Action Area" as all areas that will be affected directly or indirectly by the Federal action, and not merely the immediate area involved in the action (50 CFR 402.02).

The HCP and SHA each have defined Plan Areas and Action Areas as described below and shown on Figures 1A and 1B. The Plan Areas includes lands owned by SPL&T where SPI forest management covered activities are proposed. The Action Areas include the Plan Areas and adjacent lands potentially affected by covered activities in the Plan Areas.

1.4.1.1. HCP Plan Area

The HCP Plan Area includes all SPL&T lands in planning watersheds currently within the known limits of anadromy. SPL&T owns approximately 355,061 acres within these watersheds (Figure 1A). All planning watersheds within the current limits of anadromy are subject to the Anadromous Salmonid Protection (ASP) of the California Forest Practice Rules (CFPRs). Portions of watersheds that are immediately upstream of areas accessible to anadromous salmonids are included under ASP rules because of potential effects on water quality downstream. A complete list of watersheds covered by the HCP is provided in Appendix A.

1.4.1.2. HCP Action Area

The HCP Action Area comprises areas within planning watersheds in the upper Trinity River basin and the Sacramento River basin currently accessible to anadromous salmonids in which SPL&T owns lands and conducts activities. The HCP Action Area includes lands within these watersheds potentially affected by activities in the HCP Plan Area and is used to establish context and the evaluation area for potential impacts of the covered activities occurring on SPL&T lands. We define potentially affected lands as planning watersheds in which SPL&T owns

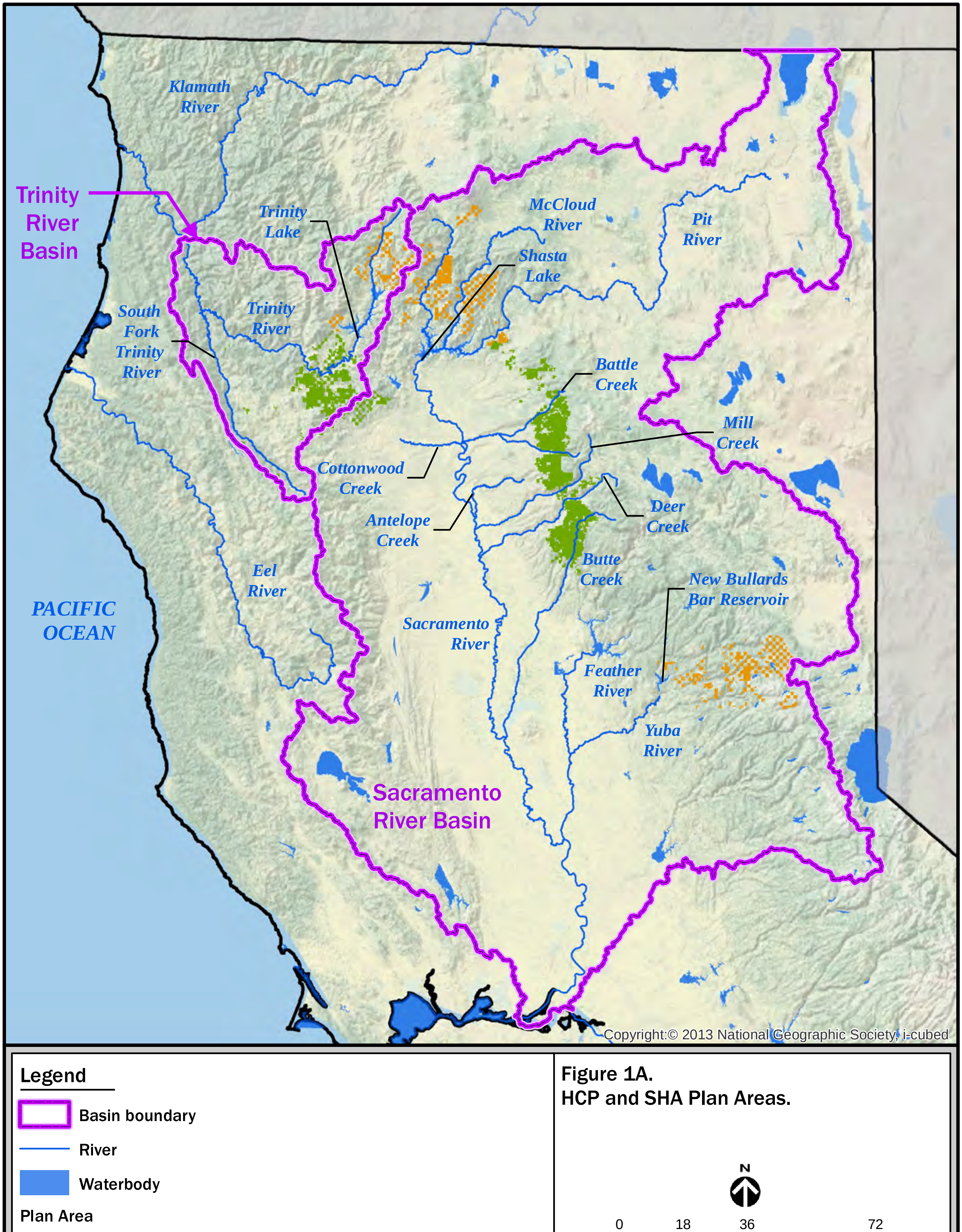

Figure 1A.
HCP and SHA Plan Areas.

National Geographic Society, Topographic base map (2013)

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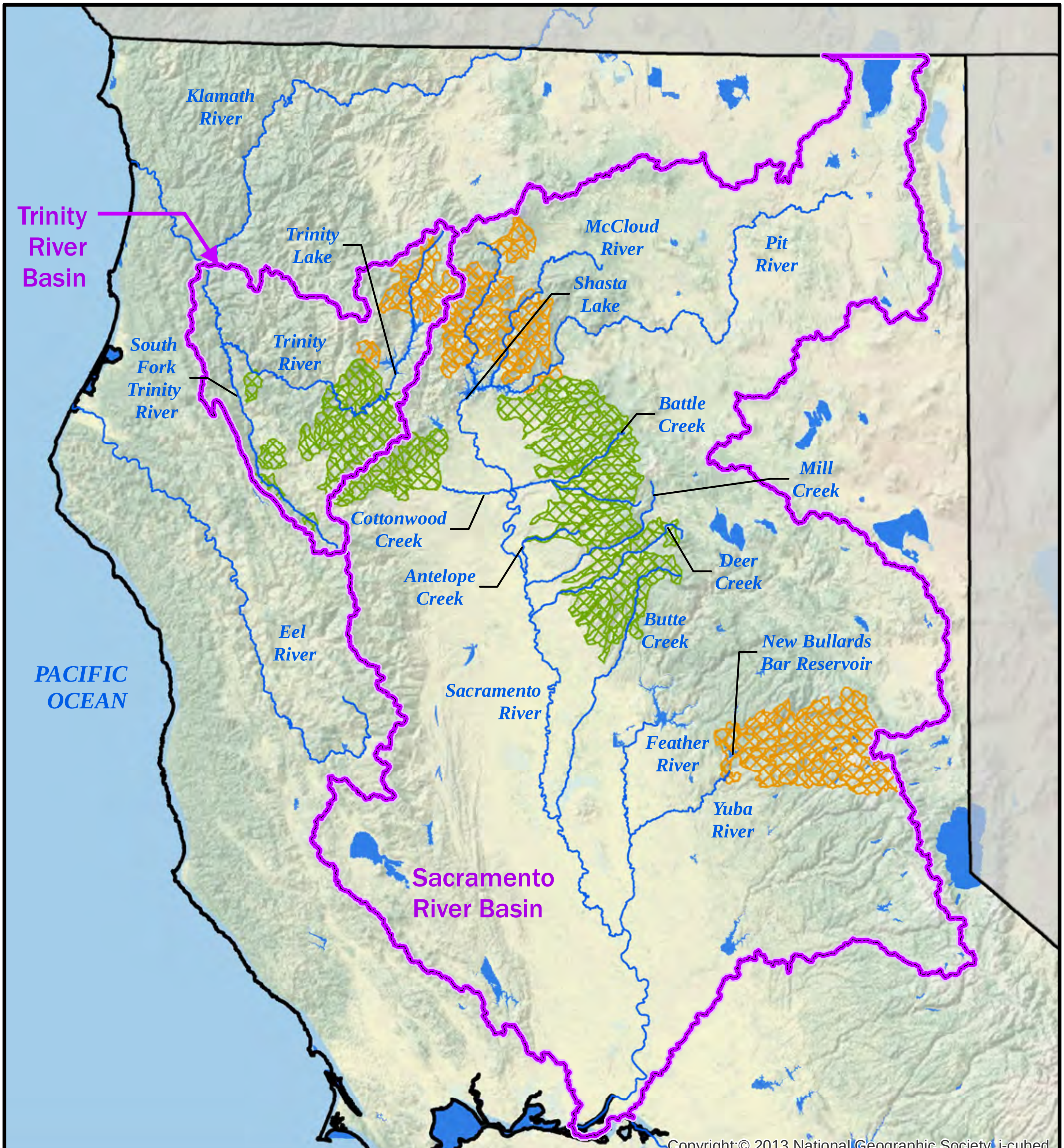


Legend

Basin boundary

River

Waterbody

Action Area

HCP

SHA

Figure 1B.
HCP and SHA Action Areas.

N

0 18 36 72 Mile

HERRERA

National Geographic Society, Topographic base map (2013)

K:\Projects\Y2016\16-06421-000\Project\Report_Figures\Fig1A_ActionArea_letter.mxd (8/12/2019) land, and the adjacent upstream and downstream planning watersheds. The HCP includes all activities described in this document, including covered activities and conservation strategy, within these lands. The ITP coverage is not extended to other land ownerships in the HCP Action Area. The HCP Action Area occurs within 159 planning watersheds covering approximately 1,485,099 acres in the Sacramento River and Trinity River basins (Figure 1B).

1.4.1.3. SHA Plan Area

The SHA Plan Area includes all SPL&T lands in planning watersheds outside the current limits of anadromy in which salmonid reintroductions are proposed. These watersheds are within historically occupied habitat and above currently impassable barriers to anadromy.

The SHA Plan Area includes all SPL&T lands within the SHA Action Area. SPL&T owns approximately 211,824 acres within these watersheds (Figure 1A). These planning watersheds are above the current limits of anadromy and not subject to the ASP rules; however, they are managed under the standard CFPRs. The SHA Plan Area includes: (1) SPL&T lands that will be accessible to reintroduced salmonids, and (2) other SPL&T lands that are upstream of the estimated upper limit of anadromy, which are included in the SHA Plan Area because of potential downstream impacts on water quality associated with covered activities.

1.4.1.4. SHA Action Area

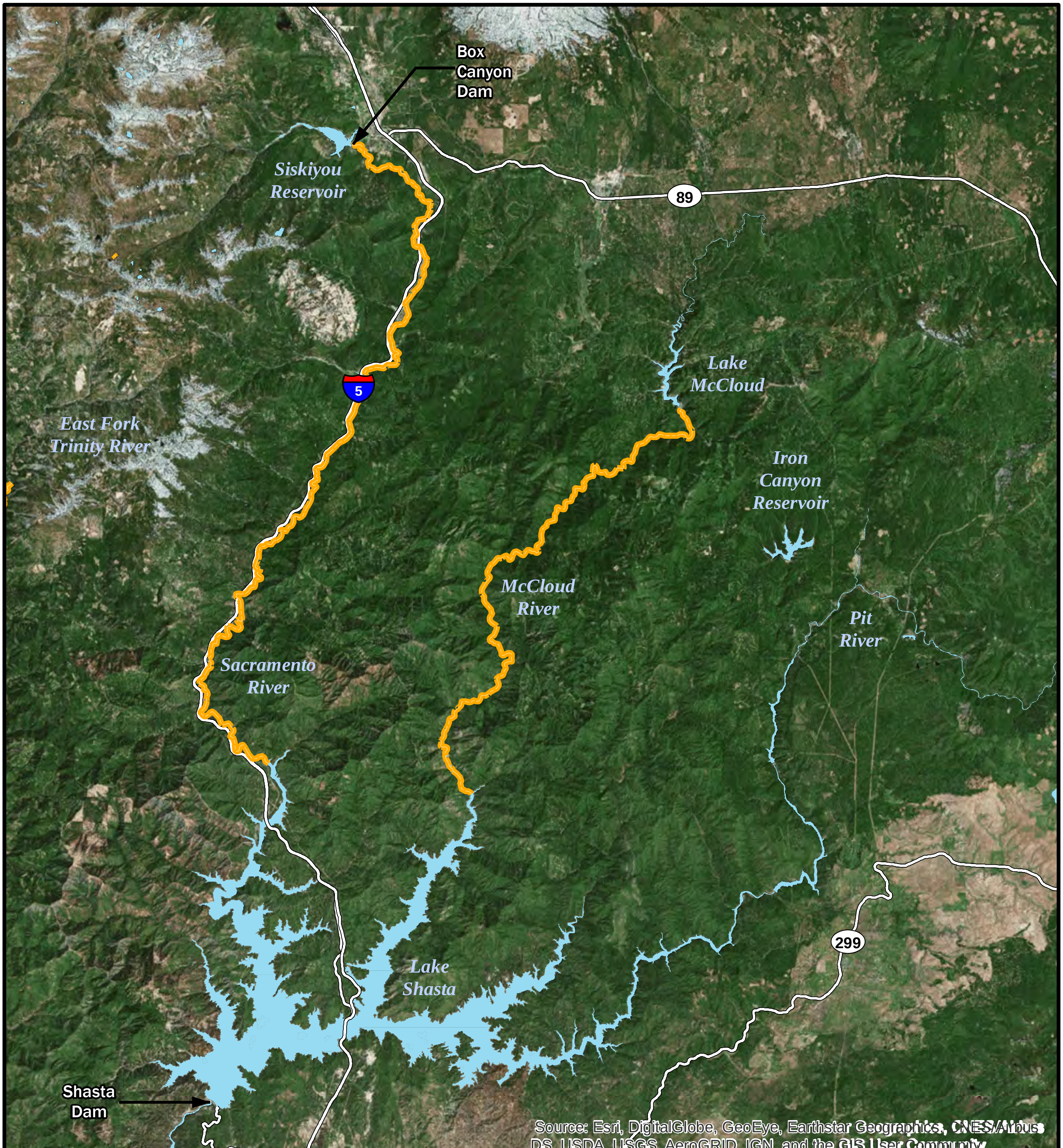
SPL&T proposes to support listed salmonid reintroduction in watersheds with SPL&T ownership above several manmade barriers in the Trinity River and Sacramento River basins consistent with NMFS reintroduction efforts.

The SHA Action Area comprises 130 planning watersheds currently inaccessible to anadromous salmonids in which SPL&T owns lands and conducts activities. The SHA Action Area includes all ownerships within these watersheds and is used to establish context and the evaluation area for potential impacts of the covered activities occurring on SPL&T lands. The SHA incorporates all activities described in this document, including covered activities and conservation strategy, within these lands. The ESP coverage is not extended to other land ownerships in the SHA Action Area.

The 130 planning watersheds included in the SHA Action Area occurs within approximately 1,057,266 acres in the Sacramento River and Trinity River basins (Figure 1B) and occur in the Upper Sacramento River, McCloud River, Battle Creek (downstream from the HCP Plan Area), North, Middle, and South Yuba Rivers, and Stuart’s Fork, Trinity River (upstream from Trinity Reservoir), and East Fork Trinity River (see Figures 2 through 5 for potential salmonid reintroduction locations).

1.4.2. Permit Duration

SPL&T is applying for a coverage term of 50 years for the ITP and ESP.



Legend

Proposed reintroduction area for listed salmonids

River

Lake

Figure 2.
Proposed Salmonid Reintroduction Areas Above Shasta Dam.

N

0 15,000 30,000 60,000 Feet

USDA, Aerial (2012)

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Legend

River

Proposed reintroduction area for listed salmonids

Lake

Figure 3.
Proposed Salmonid Reintroduction Areas in the Battle Creek Watershed.

N

0 15,000 30,000 60,000 Feet

USDA, Aerial (2012)

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Legend

- River
- Proposed reintroduction area for listed salmonids
- Lake

Figure 4.
Proposed Salmonid Reintroduction Areas in the Yuba River Watershed.

N

0 25,000 50,000 100,000 Feet

USDA, Aerial (2012)

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Legend

- Proposed reintroduction area for listed salmonids
- River
- Lake

**Figure 5.
Proposed Salmonid Reintroduction Areas in the Trinity River Watershed.**

N

0 11,000 22,000 44,000 Feet

USDA, Aerial (2012)

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1.4.3. Covered Species

The HCP covers four Chinook salmon ESUs, one coho salmon ESU, and two steelhead DPSs (Table 1).

Table 1. Fish Species Covered Under the Habitat Conservation Plan and Safe Harbor Agreement.

Species	Scientific Name	ESU or DPS	Federal Status	State Status	Critical Habitat	Addressed by HCP	Addressed by SHA
Chinook salmon	*Oncorhynchus tshawytscha*	Central Valley fall/late fall-run ESU	Species of Concern	None	Not applicable	Yes	No
		Central Valley spring-run ESU[a]	Threatened	Threatened[a]	Designated	Yes	Yes
		Sacramento River winter-run ESU	Endangered	Endangered	Designated	Yes	Yes
		Upper Klamath/ Trinity River ESU	Listing Currently not warranted	None[b]	Not applicable	Yes	No
Coho salmon	*O. kisutch*	Southern Oregon/ Northern California Coast ESU	Threatened	Threatened	Designated	Yes	Yes
Steelhead	*O. mykiss*	California Central Valley DPS	Threatened	None	Designated	Yes	Yes
		Klamath Mountains Province DPS	Listing Currently not Warranted	None	Not applicable	Yes	No

[a] Federally-listed Central Valley spring-run ESU includes populations spawning in the Sacramento River and its tributaries. These populations are listed by the State of California as Sacramento River spring-run Chinook salmon.

[b] Petitioned for listing as State endangered; ESU includes fall- and spring-run.

DPS = Distinct Population Segment

ESU = Evolutionarily Significant Unit

Numerous watersheds on lands owned by SPL&T in the Sacramento River basin are upstream of anthropogenic barriers to fish migration and currently inaccessible to anadromous salmonids. The NMFS *Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon, and the Distinct Population Segment of California Central Valley Steelhead* (Recovery Plan) (NMFS 2014a) calls for reintroducing salmon populations to some habitats historically supporting these species, but currently inaccessible because of existing dams, as a primary objective of the recovery effort. The McCloud River, Battle Creek, and Yuba River are all identified as reintroduction priorities (NMFS 2014a). NMFS has also indicated that the Upper Sacramento River may also be a candidate for reintroduction efforts. When listed salmonids are reintroduced in those watersheds, the SPI timber management activities in those watersheds could result in take of listed species. Currently listed species and populations covered under the SHA presented in this document include the Central Valley spring-run Chinook salmon ESU, the Sacramento River winter-run Chinook salmon ESU, the California Central Valley steelhead DPS, and the SONCC coho salmon ESU (Table 1). Covered species in the HCP also include two species currently not listed by the federal or state endangered species acts; Upper Klamath/Trinity River ESU Chinook salmon (fall- and spring-run) and Klamath Mountains Province DPS steelhead.

1.4.4. Covered Activities

The activities covered by the HCP/SHA include SPI timberland management activities in the HCP Plan Area and SHA Plan Area. Covered activities are specifically described in Section 2 of this HCP and include those activities necessary to perform the conservation measures are identified in Section 6, *Conservation Strategy*.

1.5. Coordination with Federal and State Agencies

SPI began discussions with NMFS in 2016 for developing an HCP and SHA. SPI met regularly with NMFS from 2016 to 2019 to discuss the development of an HCP/SHA. SPI collaborated closely with NMFS to establish the list of covered species, HCP and SHA Action Areas and Plan Areas, and proposed conservation strategy. NMFS provided information on proposed salmonid reintroductions used to determine the SHA Plan Area. SPI provided a discussion paper to NMFS outlining the proposed organization, content, and mitigation approach.

SPI also discussed the development of the HCP with the California Department of Fish and Wildlife (CDFW) during spring 2017 and has included CDFW in all discussions with NMFS as described above.

1.6. Permit Structure

The ESA and regulations governing HCPs and SHAs allow for flexibility in how the resulting permits are structured. This HCP/SHA is for a single applicant, SPL&T, applying for permits under Section 10(a)(1)(A) and Section 10(a)(1)(B) of the ESA.

1.7. Alternatives to the Taking

Section 10 of the ESA and its regulations require that an HCP describe actions the applicant considered as alternatives to the take that would result from the proposed action, and the reasons why the applicant did not select any of those alternatives. SPI considered several alternatives that would avoid or reduce the taking that are described in the following sections. The alternatives were ultimately rejected because they did not provide the desired conservation benefit for covered species or the level of regulatory assurance sought by SPL&T.

1.7.1. No Permits/No Plan

Under the No Permits/No Plan alternative, SPI would continue to engage in forestland management activities without developing an HCP and would not receive incidental take coverage for its timber management operations. SPI timber operations and related activities would continue in accordance with existing state and federal regulations, several of which prohibit the take of listed species. SPL&T would not participate in the reintroduction of listed salmonids on SPL&T lands. The alternative was not pursued because it would not provide the level of regulatory certainty SPI seeks for its timber management activities and would not establish a long-term commitment providing conservation benefits for covered species.

1.7.2. Shorter Permit Duration

Under the Shorter Permit Duration alternative, SPL&T would develop an HCP with a permit duration of only 10 years. The alternative was rejected because such a short permit duration is inconsistent with other SPI planning efforts and does not reflect the amount of time needed to realize conservation benefits from re-establishing listed species in the SHA Plan Area.

1.7.3. Road Management/Sediment Reduction Strategy

Unpaved roads are likely the dominant source of land use-related sediment pollution in forested landscapes in the United States, with the potential to impact water quality and aquatic biota (McCashion and Rice 1983; Megahan and Ketcheson 1996; Coe 2006; Cafferata et al. (2007); Goode et al. 2012). The contribution of roads to sediment pollution (Gucinski et al. 2001) has led the State of California to impose BMPs to hydrologically disconnect forest roads from streams and reduce sediment delivery. SPI designed a forest road model called READI (Road Erosion and Sediment Delivery Index) to address forest road sediment production and delivery to streams. READI (Benda et al. 2019) is designed to provide capabilities and flexibilities currently unavailable, as a set, in other road erosion and sediment delivery models. A detailed field inventory collected on SPI’s road network to enumerate, map, and assess all constructed drainage features, forms the foundation for accurate site-specific READI model results. The READI model was designed to link the condition of SPI’s constructed road network with site-specific road segments and crossings that produce sediment, and to identify locations that potentially deliver erosion to the stream network. Detailed descriptions of SPI’s READI model concept and methods are included in this document and in Appendices I and J.

SPI investigated alternatives that would change the timing, frequency, location, and overall approach to conducting road management related to forestland management activities. Two road management alternatives were considered; road improvements (sediment reduction) planned on a “THP basis” and road improvements (sediment reduction) following an “assessment basis” using SPI’s READI model.

The Timber Harvest Plan (THP) basis alternative consists of assessing, planning, and constructing road improvements based on roads used for certain THPs, including appurtenant roads. The assessment basis alternative consists of using SPI's READI model to assess and select road improvements at priority sites based on sediment reduction potential on a planning watershed basis, regardless of whether the road is used for current THP purposes.

SPI rejected the THP basis alternative and selected the assessment basis alternative, as this alternative reduces potential species take more quickly over time as potential locations of greater sediment input are given priority for remediation in a planning watershed.

1.8. Summary of Relevant Laws and Regulations

SPI's timberland management activities are regulated by the Z'berg-Nejedly California Forest Practices Act of 1974 and the CFPRs, which serve as the implementing regulations supporting the Act. SPI complies with the CFPRs and will continue to do so under this HCP/SHA. SPI prepared this document to comply with the ESA and the National Environmental Policy Act (NEPA), and the following sections summarize the processes and requirements for each of those laws, as well as the California Fish & Game Code and the National Historic Preservation Act.

1.8.1. Federal Endangered Species Act

The purpose of the ESA is to conserve threatened and endangered species and the ecosystems upon which they depend (ESA Section 2(b)). Congress has amended the ESA several times over the years, including adding the authority to allow incidental take in 1982. The ESA Sections 9, 10, and 7 are most relevant to the HCP and are briefly summarized below.

1.8.1.1. Section 9

Section 9 of the ESA prohibits the take of any fish or wildlife species listed as endangered. Section 9 prohibits damage or destruction of plants listed as endangered on federal property or on non-federal lands when doing so in knowing violation of any state law or regulation or in the course of any violation of a state criminal trespass law. Take is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." NMFS defines "harm" (50 CFR 222.102) as "… an act which actually kills or injures fish or wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering."

1.8.1.2. Section 10

Section 10 of the ESA provides exceptions to the Section 9 prohibitions on take of listed species via two kinds of permits. Section 10(a)(1)(A) ESA permits authorize the take of listed species for scientific purposes or to enhance the propagation or survival of listed species. Section 10(a)(1)(B) ESA permits authorize the incidental take of listed species caused by otherwise lawful activities.

This combined HCP/SHA is intended to support issuance of a Section 10(a)(1)(A) ESP and a Section 10(a)(1)(B) ITP to SPL&T for covered activities discussed herein.

1.8.1.2.1. Section 10 (a)(1)(A) Enhancement of Survival Permit Requirements

Under Section 10(a)(1)(A) of the ESA, NMFS is authorized to approve ESPs, which provide a mechanism to promote endangered species conservation on non-federal lands. An ESP and associated SHA allow landowners to improve habitat for listed species without incurring additional restrictions if the range or population of the species increases.

Section 10 of the ESA authorizes NMFS to enter into a SHA and issue ESPs for listed species. A SHA is entered into pursuant to NMFS's final Safe Harbor Policy (64 FR 32717) and final regulations (50 CFR § 222.308) and implements the intent of the parties to follow the procedural and substantive requirements of Section 10(a)(1)(A) of the ESA.

SHAs must address the following requirements:

- Specify the species and/or habitats and identify the SHA Plan Area.
- Describe the agreed upon baseline conditions for each of the covered species within the SHA Plan Area.
- Identify management actions that would accomplish the expected net conservation benefits to the species and the agreed upon timeframes for the management actions to remain in effect to achieve the anticipated net conservation benefits.
- Describe the anticipated results of the management actions and any incidental take associated with the management actions.
- Incorporate a notification requirement, where appropriate and feasible, to provide either US Fish and Wildlife Service (USFWS), NMFS, or both Services jointly, or appropriate state agencies with a reasonable opportunity to rescue individual specimens of a covered species before any authorized incidental take occurs.
- Describe the activities expected to return to baseline conditions and the nature of the expected incidental take upon termination of the SHA.
- Satisfy other requirements of Section 10 of the ESA.
- Identify a schedule for monitoring and the responsible parties that will monitor maintenance of baseline conditions, implementation of terms and conditions of the SHA, and any incidental take as authorized in the ESP.

In determining whether to issue an ESP, NMFS will consider, among other application criteria, the following factors:

- Whether the permit was applied for in good faith;
- Whether the permit, if granted and exercised, will not operate to the disadvantage of the endangered species;
- Whether the permit would be consistent with the purposes and policy set forth in section 2 of the Act;
- Whether the permit would further a bona fide and necessary or desirable scientific purpose or enhance the propagation or survival of the endangered species, taking into account the benefits anticipated to be derived on behalf of the endangered species;
- The status of the population of the requested species and the effect of the proposed action on the population, both direct and indirect;
- If a live animal is to be taken, transported, or held in captivity, the applicant's qualifications for the proper care and maintenance of the species and the adequacy of the applicant's facilities;
- Whether alternative non-endangered species or population stocks can and should be used;
- Whether the animal was born in captivity or was (or will be) taken from the wild;
- Provision for disposition of the species if and when the applicant's project or program terminates;
- How the applicant's needs, program, and facilities compare and relate to proposed and ongoing projects and programs;
- Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application; and
- Opinions or views of scientists or other persons or organizations knowledgeable about the species which is the subject of the application or of other matters germane to the application.

1.8.1.2.2. Section 10(a)(1)(B) Incidental Take Permit Requirements

To qualify for an ITP, an applicant must develop, fund, and implement an approved conservation plan, often termed an HCP. An HCP must specify the following information, described in 50 CFR § 222.307:

- The type of application.
- The name, address, and telephone number of the applicant.

- The affected species or stocks and a description of their status, distribution, and biological requirements.
- A detailed description of the proposed activity, including the anticipated dates, duration, and specific location.
- A conservation plan, based on the best scientific and commercial data available, which specifies the following:
  - The anticipated impact of the proposed activity on the species or stocks;
  - The anticipated impact of the proposed activity on the habitat of the species or stocks and the likelihood of restoration of the affected habitat;
  - The steps that will be taken to monitor, minimize, and mitigate such impacts, and the funding available to implement such measures;
  - The alternative actions to such taking that were considered and the reasons why those alternatives are not being used; and
  - A list of all sources of data used in preparation of the plan, including reference reports, environmental assessments and impact statements, and personal communications with recognized experts on the species or activity who may have access to data not published in current literature.

NMFS will issue an ITP if it finds that the following criteria of ESA Section 10(a)(1)(B) and applicable regulations at 50 CFR § 222.307 are met:

- The taking will be incidental to otherwise lawful activities.
- The applicant will, to the maximum extent practicable, monitor, minimize, and mitigate the impacts of such takings.
- The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.
- The applicant has amended the conservation plan to include any measures (not originally proposed by the applicant) that the Assistant Administrator determines are necessary or appropriate; and
- There are adequate assurances that the conservation plan will be funded and implemented, including any measures required by the Assistant Administrator.

1.8.1.3. Section 7

Federal agencies must consult with NMFS, under Section 7 of the ESA, on discretionary actions they fund, authorize, or carry out that may affect a listed species or its designated critical habitat. As part of the consultation process, NMFS produces a biological opinion that analyzes the effects of issuing the ITP, together with cumulative effects (as that term is defined in the ESA Section 7 regulations), on affected listed species and critical habitat to determine whether that permit action is likely to jeopardize the continued existence of the listed species or to destroy or adversely modify designated critical habitat. If the HCP and ITP also cover any proposed or candidate species or may affect proposed critical habitat, NMFS also conducts analyses of effects for those species and habitats in the same biological opinion.

1.8.2. National Environmental Policy Act

The stated purposes of NEPA are: to encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

Issuance of an ITP or ESP is a federal action subject to NEPA. NMFS will consider its obligations under NEPA prior to taking final action under the ESA.

1.8.3. California Forest Practices Act

Timber harvest on private lands in California is regulated by the Z'Berg-Nejedly Forest Practice Act and its implementing regulations, the CFPRs. Those legal authorities require that landowners develop THPs for all commercial timber harvests. A THP is an environmental review document outlining what timber the landowner intends to harvest, how it will be harvested, and the steps that will be taken to reduce or prevent environmental damage. THPs are prepared by Registered Professional Foresters (RPFs) licensed by the State Board of Forestry and Fire Prevention. THPs are submitted to the California Department of Forestry and Fire Protection (CAL FIRE) for review and approval and must comply with all applicable state and federal regulations. Other state trustee agencies, including CDFW, California Geologic Survey, and California Department of Water Resources, will participate in a multi-disciplinary review process that will provide input to CAL FIRE during the review process and will issue separate enforceable permits to protect trustee resources. CAL FIRE periodically inspects logging operations to ensure compliance with the approved THP and has the authority to shut down operations, and cite or fine RPFs, licensed timber operators, and landowners if forestry practices are out of compliance with the THP.

1.8.4. California Fish and Game Code

The California Fish and Game Code (CFGC) establishes several processes pertinent to the CFPRs and implementation of the California Endangered Species Act (CESA) that are relevant to this HCP/SHA. The most prominent is the Consistency Determination process in CFGC Section 2080.1, which allows an applicant who has obtained a federal incidental take statement (federal Section 7 consultation) or a federal incidental take permit (federal Section 10(a)(1)(B)) to request that the Director of CDFW find the federal documents consistent with CESA.

Additional aquatic and riparian protections related to timber harvest are provided by the CFGC process (CFGC 1600 et seq.), which provides for protection and conservation of the fish and wildlife resources of California. SPI is required to obtain a Section 1600 Agreement from the CDFW for any forest management activities that divert or obstruct the natural flow of a river, stream, or lake; substantially change or use material from the bed, channel, or bank of any river, stream, or lake; or deposit debris, waste, or other materials that could pass into any river, stream, or lake. CDFW can recommend additional minimization measures that may be incorporated into the CFGC Section 1600 Agreement and become enforceable requirements if agreed to by the applicant. Such measures may include timing restrictions, erosion control best management practices (BMPs), and design criteria for water crossing structures to protect water quality and fish life. For emergency projects that require immediate repair, the landowner is required to apply for a CFGC Section 1600 permit from CDFW within 14 days of emergency repairs.

1.8.5. National Historic Preservation Act

The National Historic Preservation Act (NHPA) authorizes the Secretary of the Interior to maintain a National Register of Historic Places and to approve state historic preservation programs that provide for a State Historic Preservation Officer with adequate qualified professional staff, a state historic preservation review board, and public participation in the state program.

Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings on historic properties. Issuance by NMFS of an ITP and ESP is considered a federal undertaking subject to NHPA compliance. The procedures in Section 106 define how federal agencies meet these statutory responsibilities. The Section 106 process seeks to accommodate historic preservation concerns with the needs of federal undertakings through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties.

SPI complies with NHPA by following the CFPRs functional equivalent process that includes archeology surveys and training for THP approval. Consequently, NHPA requirements will be addressed through individual forest practices applications with the State.

2. COVERED ACTIVITIES

The sections below describe SPI timber operations and forest management activities, including management activities covered and not covered by the California Environmental Quality Act (CEQA).

2.1. SPL&T OWNERSHIP AND SPI MANAGEMENT CONTEXT

SPI implements conservation measures consistent with the current CFPRs and the long-term sustained yield plan SPI has been operating under since 1999. SPI-managed properties are entered and managed on a California Planning Watershed basis. SPL&T ownership within these watersheds varies significantly, as shown in Appendix B. Each of these planning watersheds has management constraints based on soil type, topography, slope stability, watercourse type, road density, fish presence, wildlife protection, and harvest unit adjacency. These planning watersheds are assessed for tree spacing and density once per decade to provide adequate growing space for trees while improving forest health.

Over time, the area of even-aged stands created through even-aged silviculture will decline through the life of the Option A demonstration of maximum sustained yield (CFPRs 933.11) (i.e., SPI's sustained yield plan). Multi-aged management allows stands to accumulate more volume per acre; therefore, the sustainable volume target can be met from smaller areas. As currently estimated, 20 to 30 percent of the HCP Plan Area and SHA Plan Area will not be subject to even-aged silviculture during the term of this HCP. A fully regulated 60- to 80-year harvest rotation would lead to an annual harvest of 1.2 to 1.7 percent of the land available for even-aged silviculture.

The following discussion is presented as property-wide percentages and those percentages are generally applicable to the planning watershed scale. The relative proportion of SPL&T's land subject to even-aged silviculture per decade has decreased from the first decade of the sustained yield plan as follows:

- 22 to 25 percent in decade one (1999 through 2009)
- 16 to 18 percent in decade two (2009 through 2018)

The relative proportion of SPL&T land subject to even-aged silviculture per future decade is projected as follows:

- 13 to 16 percent in decade three (2019 through 2028) (HCP decade one)
- 11 to 13 percent in decade four (2029-2038) (HCP decade two)

Starting in decade five of the sustained yield plan, most of the projected harvest volume will be accomplished by commercial thinning, and therefore the actual clearcutting in decades 5 through 7 (HCP decades 3 to 5) ranges from 1 percent to 3 percent annually. The stands where this commercial thinning will occur are the stands generated by the harvesting in the first two decades of the Option A (1999-2019).

Figures 6 through 8 illustrate SPI's 100-year projection of inventory, harvest, growth, tree diameters (in diameter at breast height [dbh]), and habitat distribution over that period. Over time, SPI will operate on fewer square miles, with larger trees and higher harvest volumes each decade.

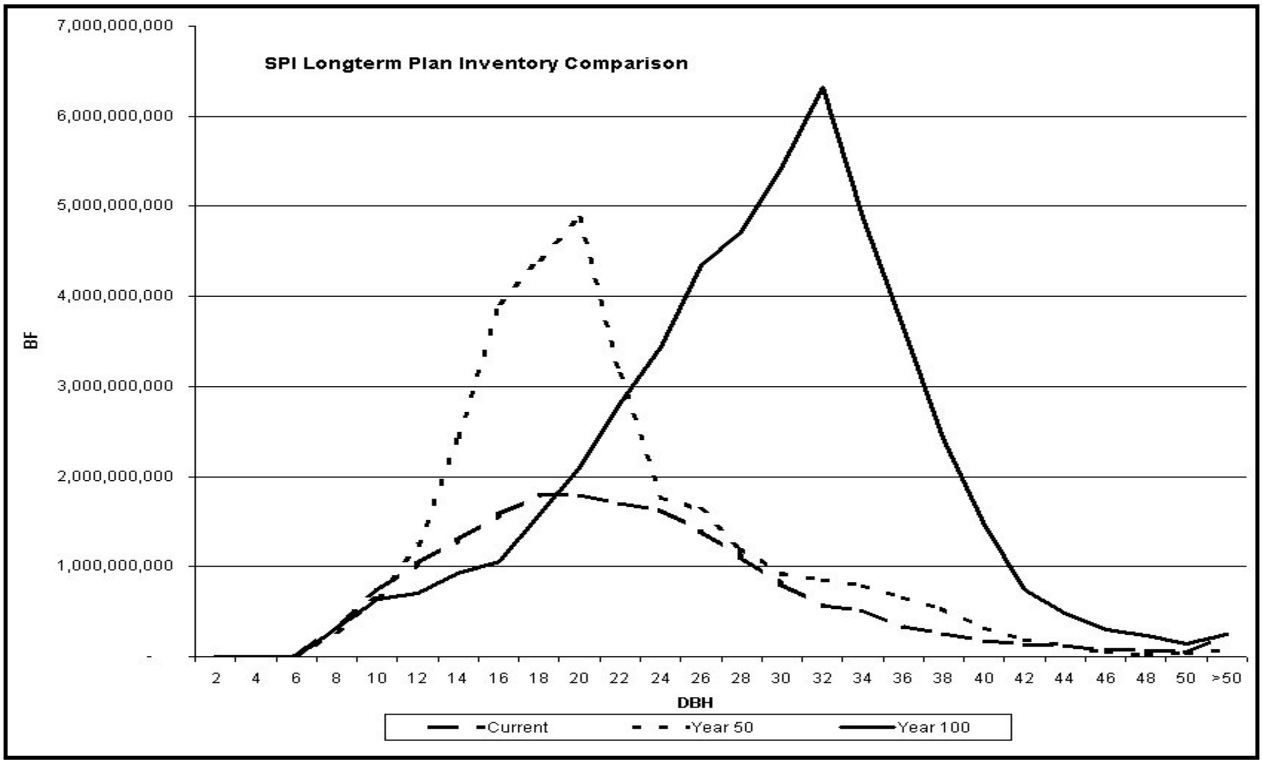


Figure 6. Tree Diameters Over Time (SPI 1999 Option "A").

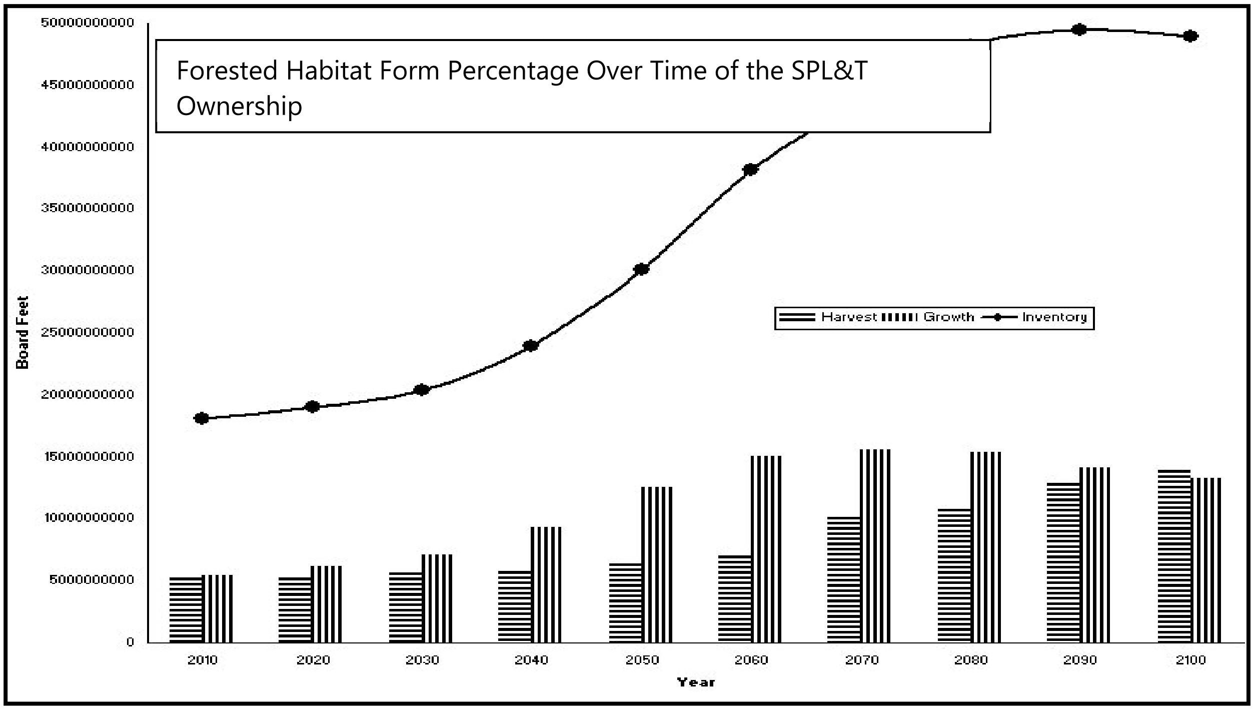


Figure 7. Forest Inventory, Harvest and Growth (SPI 1999 Option "A").

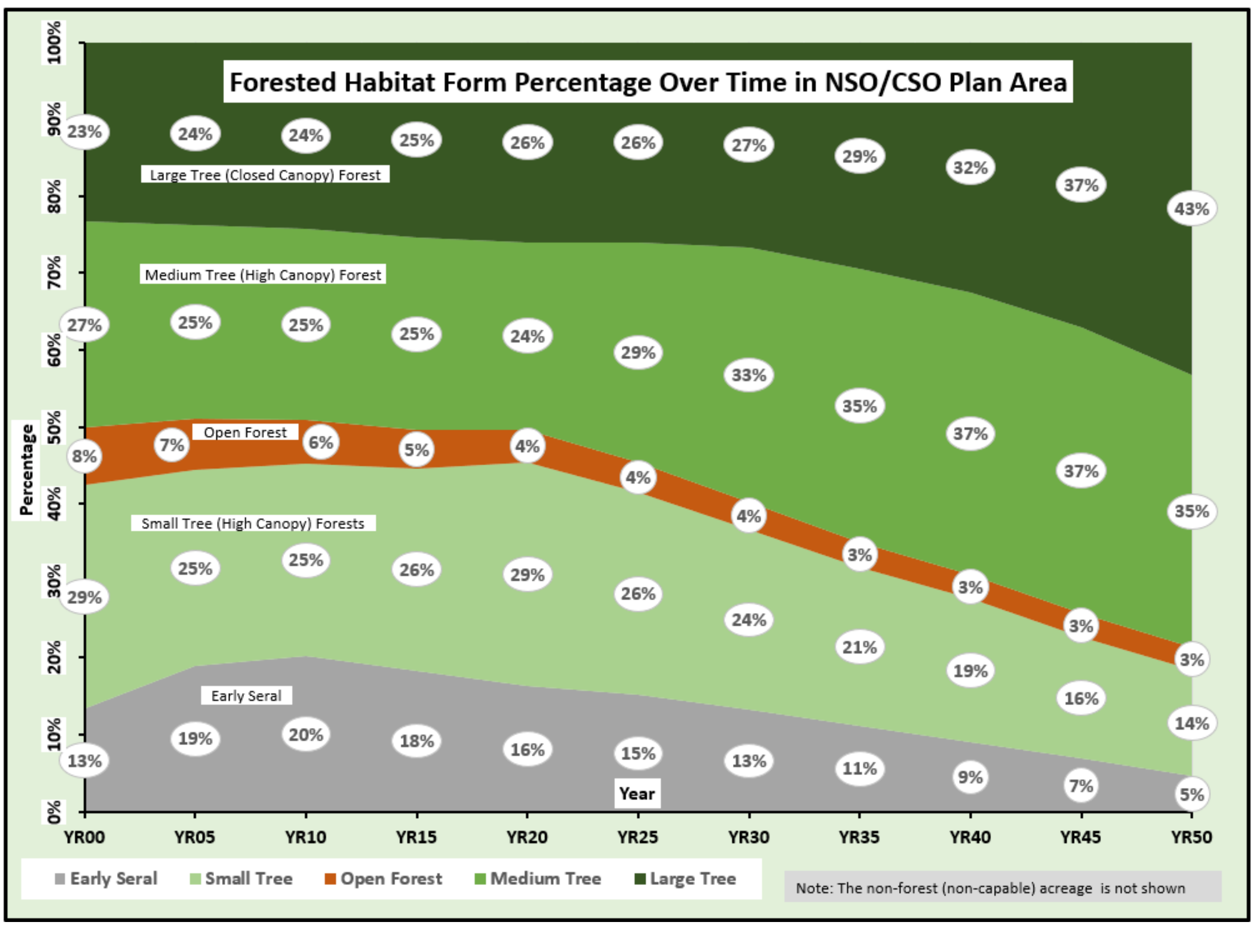


Figure 8. Forest Habitat Distribution Change Over Time (SPL&T Spotted Owl HCP).

CFPR rules require project monitoring during the life of the permit and for up to three years after project completion. Monitoring elements include annual inspections of operational areas to verify tree stocking levels, adequacy of road maintenance practices including stream crossing functionality and mitigation of erosion/sediment production. The policy of conducting entries into every watershed on a decadal basis and completing the evaluations outlined above during the life of the THP and for a period after THP completion is a form of continuous monitoring conducted by SPI and the permitting agencies, including CAL FIRE, CDFW, the California Geologic Survey, and the California Department of Water Resources. By the time the first decade evaluations and surveys are complete and harvest areas are certified as free to grow under the CFPRs, the next decadal planning process begins with a new round of monitoring activities initiated as part of the THP planning process. Road surveys, terrestrial and aquatic species surveys and all other assessments required by the CFPRs begin again. Each entry into the planning watershed provides an opportunity to review risks associated with covered species identified in this HCP and SHA, and a monitoring opportunity to assess HCP and SHA implementation.

SPI management practices that result in growing larger trees on a smaller area increases the inventory volume per square mile and reduces the area requiring tree density control through on-the-ground management activities. The general trend towards reduced disturbance over time reduces the risk to listed species.

This HCP and SHA will be implemented in a manner consistent with the approved fisher Candidate Conservation Agreement with Assurances (SPI 2016) and the spotted owl HCP currently being developed. These permits will constrain SPL&T's managed landscape by incorporating harvest deferrals and set-asides, instituting limited operating periods, mandating habitat retention areas, and limiting the acreage available for even-aged management.

SPI responds to wildfire by moving its logging capacity as feasible out of "green" tree harvesting to harvesting the trees damaged by the wildfire. Over the 20-year period of the Option A, SPI has never exceeded the annual limits on harvesting even with large wildfires that occurred during that period. This harvest of "substantially damaged timberland" is conducted under the Emergency Notice process of the CFPRs. That process requires no exceptions to and full implementation of the CFPRs operational rules. More detail is provided in Section 6, *Conservation Strategy*, of this HCP.

The CFPRs regulate all industrial forest management activities and are the primary means by which the goals and conservation measures within the HCP/SHA will be achieved. The CFPRs include implementation measures for timber harvesting and erosion control; site preparation; water course and lake protection; and logging roads, landings, and crossings that ensure SPI management within a planning watershed will not result in any significant adverse environmental impacts (CFPRs Articles 4, 5, 6 and 12). The CFPRs in these Articles mandate that any potential negative impacts be mitigated into insignificance. For the purposes of this HCP, we define significant adverse environmental impacts as a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance (CFPRs 895.1). Extensive and long-term post-harvest monitoring by CAL FIRE and other state and federal agencies (Cafferata and Munn 2002) states "results to date show that implementation rates of the Forest Practice Rules related to water quality are high and that individual practices required by the Forest Practice Rules are effective in preventing hillslope erosion features when properly implemented" (pg. 84).

SPL&T land ownership and distribution in relation to activities with the potential to affect listed species is important in understanding the context of this HCP/SHA. The example shown below, taken from the Trinity River total maximum daily load (TMDL) for the Trinity River system, helps provide a perspective on the potential effects that SPI management may have within the larger California landscape (US EPA 2001).

> *The Trinity River is the largest tributary to the Klamath River, draining an area of approximately 3,000 square miles (1.92 million acres), about 2,000 of which are covered by this TMDL. The majority of the basin (approximately 70 percent) is under public ownership, including the Trinity Alps Wilderness areas, the Shasta-Trinity National Forest, Six Rivers National Forest, Bureau of Land Management, Bureau of Reclamation, and various state and county entities. The Hoopa Valley Tribe occupies 144 square miles (92,160 acres) of the lower basin, while industrial timber companies and other private landowners make up the remaining portions of the basin's 456 square miles (291,840 acres) or 22 percent of the area covered by the TMDL.*

SPL&T ownership represents approximately 7 percent of the area covered by the TMDL. While SPL&T is the largest private landowner in the TMDL area, the percentage ownership is still relatively small evaluated against the entire TMDL coverage area.

The proposed actions required under SPI's 100-year management plan (SPI Option "A") may have the potential to affect listed species. SPI has proposed monitoring surrogates to evaluate potential risk and disturbance on a watershed basis. Management activities are conducted under the CFPRs and protection measures described in Articles 4, 5, 6, and 12 are the most pertinent to reducing risk to listed species. Evaluations by multi-agency review team members focus on those activities which may affect sensitive biologic resources. Proposed projects must demonstrate compliance with all the CFPRs and identify any ongoing legacy issues which may be contributing to detrimental effects. Plans must be submitted to address legacy issues if anthropogenic in nature.

The surrogates proposed to measure management effects on listed species are temperature and sediment (or turbidity). Conservation measures associated with Article 6 of the CFPRs provide for high canopy closure (70 to 85 percent) along listed species bearing streams and provisions for no harvest core zones and retention of 7 to 13 of the largest dbh trees per acre along the stream protection zones.

Conservation measures implemented under CFPRs Articles 4, 5, and 12 minimize soil disturbance within watercourse zones, and provide for soil stabilization when disturbance areas are exceeded. Waterbars are required to reduce overland sediment movement and provide for hydrologic disconnection of roads from watercourses. The hydrologic disconnection of roads from watercourses for this HCP and SHA will be conducted using the READI model to identify, prioritize and implement ongoing management efforts to reduce the connection between roads and watercourses. The effort to minimize road/watercourse connection has been on-going since the early 1970s, when predecessor companies began building roads to access previously roadless areas. The road construction methods utilized for much of the current SPL&T ownership was conducted using best management practices for those times. As SPI has entered each planning watershed under the 100-year management plan, road construction and maintenance techniques have been improved to further reduce risk of sediment delivery to receiving waterbodies. As a result, most of the watersheds within SPL&T ownership have a current baseline condition of 80 percent of the road system being hydrologically disconnected. Using the READI model to identify hydrologic disconnection opportunities within the planning watersheds will allow SPI to move the ownership over time to an estimated 85 to 90 percent disconnection on SPL&T forest roads during the life of this plan. The READI model and related Conservation Strategy included in this HCP will help identify and prioritize an implementation schedule that will move ownership towards this desired future condition.

Activities covered under this document (described in subsections below) include timber operations as defined by the CFPRs conducted by SPI in the HCP Action Area and SHA Plan Area. Such timber operations are included in an approved THP, Emergency, or Exemption Notification in accordance with the CFPRs and their accompanying CEQA analyses. HCP covered activities also include actions that are not timber operations per the CFPRs but may be conducted as part of THP activities that are covered by a CEQA analysis or other statutes; as described in Section 2.2. Many other covered activities do not require THPs, notifications under the CFPRs, or specific CEQA analysis. Those activities are discussed in Section 2.3. As described in Section 5, most covered activities are unlikely to affect covered species; however, they are also included as covered activities.

SPI will follow all conservation measures to covered species in the HCP and included in the CFPRs (CFPR 936.9). Those conservation measures differ between watersheds regulated by CFPR ASP and watersheds not subject to CFPR ASP. Measures within ASP watersheds, such as increased buffer width and canopy cover along streams, are more stringent than those in non-ASP watersheds to further minimize potential impacts of timber operations on anadromous salmonids. For the purposes of this HCP, SPI will apply the ASP rules at CFPR 936.9 and not evoke 936.9(w), which provides deviations from the ASP rules for circumstances where other permits (e.g., an HCP) may apply.

Additional aquatic protections related to forest management are provided by the California Fish and Game Code process (F&GC 1600 et seq.), which provides for protection and conservation of the fish and wildlife resources of California. SPI is required to obtain a 1600 Agreement from CDFW for any forest management activities that diverts or obstructs the natural flow of a river stream or lake; substantially change or use material from the bed, channel, or bank of any river, stream, or lake; or deposit debris, waste, or other materials that could pass into any river, stream, or lake (F&GC 1600 et seq.). CDFW can recommend additional minimization measures that may be incorporated into the 1600 Agreement and become enforceable requirements if agreed to by the parties. Such measures may include timing restrictions, erosion control practices, and design criteria for water crossing structures to protect water quality and fish life. For emergency projects that require immediate repair, the landowner is required to notify CDFW. These Agreements are exclusive and not superseded by this HCP or SHA.

SPI has also developed numerous other avoidance and minimization measures to reduce environmental impacts from specific activities. Those and other measures are described in Section 6.4.

2.2. Management Activities Covered by CEQA Analysis

The following sections describe the HCP covered activities with respect to their coverage under CEQA. Forest practices under the CFPRs are conducted within a "functional equivalent CEQA program" (Public Resources Code 2180.5) and requires that significant adverse environmental impacts affected by the project are mitigated to insignificant levels. Timber operations and certain other management actions are conducted as part of the functional equivalent program, as discussed in Section 2.2.1. The CFPRs include some flexibility accounting for the variation of environmental conditions throughout California. These flexibilities are expressed by specific rules affording plan-specific alternatives to the standard applicable rules. These alternatives are subject to the same multi-agency review process and approvals as standard rules.

For the purposes of this HCP/SHA, if these circumstances are determined necessary and SPI proposes an exception, exemption, alternative practice, in-lieu practice, or other deviation from standard rules relating to WLPZ or road erosion issues covered under Water Course and Lake Protection, and Logging Roads, Landings, and Logging Road Watercourse Crossings (CFPR Articles 6 and 11 [Northern]), SPI will notify NMFS 10 business days in advance of filing the THP and provide an opportunity to participate in the review process. Once notified, NMFS may elect to engage or oppose the deviation. Absent any comment or opposition from NMFS, the in-lieu practice will proceed according to the THP approval process.

The CFPRs are updated annually by the State Board of Forestry. Under this HCP/SHA, SPI will follow the Z'Berg-Nejedly Forest Practice Act and relevant Public Resource Codes, and all CFPRs current for each year of the permit period.

Other management actions that are not defined as timber operations and that do not require a THP or notifications under the CFPRs are covered by CEQA analysis under other statutes, as discussed in Section 2.3.

2.2.1. Activities Conducted Under a THP

Timber operations and other management activities are conducted under a THP, pursuant to the CFPRs. Timber operations are defined by the California Forest Practices Act (Division 4, Chapter 8 of the Public Resources Code). Operations are described in detail when they occur as part of an approved THP or Emergency or Exemption Notification, which satisfies CEQA analysis requirements. The CFPRs require winter operating plans if operations are planned in the winter period (November 15 to April 1). The winter period operating plan shall include specific measures used in the winter operating period to avoid or substantially lessen erosion and soil movement into watercourses, and soil compaction from timber operations. A winter period operating plan shall include the following:

- Erosion hazard rating
- Mechanical site preparation methods
- Yarding system (constructed skid trails and tractor road watercourse crossings)
- Operating period
- Erosion control facilities timing
- Consideration of form of precipitation-rain or snow
- Ground conditions (soil moisture condition, frozen)
- Silvicultural system-ground cover
- Operations within the WLPZ
- Equipment use limitations
- Known unstable areas
- Logging roads and landings

Activities conducted under a standard THP include:

- Felling and bucking timber
- Yarding timber
- Loading and landing operations
- Transportation of forest products and equipment
- Chipping

- Timber salvage
- Road construction, reconstruction, maintenance, and abandonment
- Drafting
- Watercourse crossing facility placement and maintenance
- Site preparation
- Prescribed burning
- Mastication

Other activities that may be conducted as part of a THP and its accompanying CEQA analysis include, but are not limited to, machinery maintenance, machinery fueling, and fuel storage.

2.2.1.1. Timber Felling and Bucking

Timber felling under THPs occurs while harvesting stands of commercial sized trees. Felling timber involves cutting a standing tree and dropping it in a desired location. Bucking is the process of cutting a tree into appropriate log lengths. Such activities are typically performed using handheld chainsaws. On low to moderate slopes, felling may be accomplished using machines such as feller-bunchers or harvesters. Those machines can be tracked or wheeled and have an articulated boom capable of grabbing, cutting, and stacking the tree for yarding.

2.2.1.2. Timber Yarding

Yarding, or skidding, is the movement of logs from the point of felling to the log landing (the area where forest products are concentrated prior to loading for transportation to a different location for further processing). Yarding can be done via ground-based, cable, or aerial techniques. Ground-based yarding is usually done with tracked or rubber-tired tractors to skid or drag logs to the landing. The tractors have powered grapple attachments or winch lines to grasp the logs, and require temporary logging roads, or skid trails (also known as tractor roads), on which to operate.

Cable yarding uses steel cables or wire ropes to skid logs to a road or landing using a yarder (an engine-powered system of winches and cables suspended from spars and/or towers used to haul logs). There are two classes of cable yarding: high lead and skyline. In high lead logging systems, a cable runs from a yarder through pulley blocks anchored to stumps at the far end of the cut. Skyline logging uses a carriage that runs along a skyline cable, providing vertical lift to the logs, increasing yarding speed and minimizing ground disturbance.

Aerial yarding is used to transport logs in areas with steep or unstable terrain, or restricted road access. Logs are lowered to the log loading areas with cables or grapples suspended from cables. Helicopters then transport the logs to the landing. Aerial yarding minimizes soil disturbance but requires a large landing area to deposit logs and load trucks safely, and a separate service landing area for the helicopter.

2.2.1.3. Loading and Landing Operations

Additional processing of logs may occur after they have been yarded to a landing or roadside. Logs are delimbed, bucked into shorter segments, or cut to remove breakage. Such work is usually done with handheld chainsaws or a mechanical delimber (a machine like an excavator mounted with a long boom and cutting head). Logs are then loaded onto trucks using a shovel (also known as a heel-boom loader) or front-end loader.

2.2.1.4. Transport of Forest Products and Equipment

Logs and rock are usually transported along roads by trucks and trailers. Helicopters may also be used to transport logs. The SPI road system includes logging roads, cooperative (co-op) roads, and occasionally county roads. Logging roads are owned and managed by SPI. Co-op roads occur on SPL&T and other lands, and are managed by other cooperating agencies, typically the U.S. Forest Service or Bureau of Land Management. County roads are managed by the particular county. The co-op and county road maintenance activities are subject to NEPA or CEQA review, and state or federal permitting and consultations applicable to the specific agency and maintenance funding source.

Each THP identifies specific roads used for that project, including skid roads, logging roads, and appurtenant roads; all of which become part of the THP, and include all upgrade and maintenance requirements. Appurtenant roads are typically defined in THPs as the road system used during the project up to the point it reaches a publicly owned or maintained roadway.

For the purposes of this HCP/SHA, the covered activities and HCP/SHA Plan Areas include all SPI roads in which SPI has legal management rights (i.e., all SPI roads).

2.2.1.5. Chipping

Branches and tops of trees may be chipped to rearrange the structure of post-harvest residue. Chipping takes place almost exclusively on landings but may also occur on harvest parcels. Chips may be hauled offsite or left in place.

2.2.1.6. Timber Salvage

Timber salvage is the removal of trees that are dead, dying, or deteriorating due to damage from fire, wind, insects, disease, flood, or another injurious agent. Most salvaged timber comes from trees damaged by fire (by either prescribed burns or wildfire), drought, insects, or age. Salvage provides for economic recovery of trees. All salvage is conducted under a CAL FIRE-Exemptions and Emergency Notice that requires the timber operator to conduct all salvage operations within the confines of the CFPRs.

2.2.1.7. Road and Landing Construction, Reconstruction, Maintenance, and Abandonment

SPI constructs and maintains roads and landings in the Action Area to provide site access and to transport logs and harvesting equipment. Roads and landings (including those portions of co-op roads on SPL&T lands) are designed, constructed, and maintained according to the CFPRs to reduce environmental impacts, specifically adverse impacts on:

- Fish and wildlife habitat and listed species of fish and wildlife
- Water quality and the beneficial uses of water
- Soil resources
- Significant archaeological and historical sites
- Air quality
- Visual resources
- Conditions increasing fire hazard

The CFPRs list numerous practices associated with road and landing design, construction, and maintenance. Those practices most relevant to salmonid protection in this HCP are included in Section 6.4. SPI anticipates approximately 3-5 miles of new road construction in the HCP and SHA Plan Areas annually during the first decade of the permit period, 1.5-3 miles during the following decade, then no new road construction during the final three decades. SPI also holds a Master Timber Harvesting Operation Lake and Streambed Alteration Agreement (MATO) with the CDFW for the SPI Lassen District. The MATO is a programmatic CDFW 1600 Agreement and with amendments will continue through the HCP permit period.

The typical order of work for road construction is as follows:

- Road segment preparation, entailing road alignment layout, equipment mobilization, installation of temporary erosion and sediment control structures, and establishing limits for clearing and grading.
- Construction access and staging, which involves clearing and grubbing of vegetation for new access roads and staging areas. The footprint for construction access and staging areas is kept as small as possible, and no equipment is staged in WLPZs.
- Road construction, entailing clearing and grading the areas within the new road footprint. Timber along the road alignment is felled and yarded. Hillslope areas are excavated and/or filled as necessary to create the desired road width and grade. Roads also include vehicle turnouts and log landings. Roads and landings may be surfaced with

rock, lignin, pavement, or other surface treatments to reduce maintenance needs and limit dust and/or sediment dispersal.

Roads and landings are designed to reduce impacts to riparian habitats by minimizing potential sediment input to receiving waterbodies. Roads are outsloped (sloped away from the hillside toward the outside edge of the road) where feasible to disperse water evenly from the road surface and reduce soil erosion and minimize concentrated runoff. Rolling dips (constructed breaks in the road grade designed to drain water from the road surface) are constructed at regular intervals. Stabilization measures, as stipulated in the CFPRs, are incorporated into road and landing design and construction.

Each THP includes identification of roads, including appurtenant roads, used for the project and an evaluation of each watercourse crossing to determine adequate condition, design standard, and culvert size (if applicable). Watercourse crossings requiring repair are upgraded at that time to 100-year flood design standards. In addition to routine on-going maintenance, this results in specific watercourse evaluations in each planning watershed per decade.

Road and landing maintenance refer to activities that do not require substantial changes to the road prism to maintain stable operating surfaces, functioning drainage facilities, and stable cut banks and fill slopes. Roads and landings are maintained throughout their useful life to provide site access and reduce environmental impacts. Maintenance commonly includes rocking the surface or adding other surface material, surface grading, localized shaping or outsloping, clearing rock slides and bank slumps, repairing slumping or sliding fills, restoring the functional capacity of ditches and cross drains, repairing or replacing culverts and bridges, installing or replacing rolling dips or other surface drainage structures, and dust abatement. Dust is controlled by spraying surfaces with water collected from nearby waterbodies (see Section 2.2.1.8). Road and landing maintenance also include vegetation control, which may be accomplished by hand cutting or pulling, burning, masticating/grinding, or other mechanical control methods. Construction and maintenance work are typically performed using graders, rock crushers, compactors, chip spreaders, asphalt grinders, backhoes, excavators, dump trucks, cranes, concrete trucks, concrete saws, jackhammers, and pile drivers.

2.2.1.8. Water Drafting

Water drafting involves pumping water directly from a stream or other water body to fill tank trucks or trailers. The water is used to control road dust, for road maintenance, road construction, surfacing, prescribed fuel reduction burning, and wildfire suppression. Water may also be obtained using gravity-fed systems that provide water directly to storage reservoirs or tanks. Existing drafting locations within or adjacent to watercourses are occasionally excavated and cleaned of debris to increase their in-channel storage area for drafting purposes. SPI typically uses 4,000-gallon water trucks for drafting operations. Pumps are screened to prevent fish and other aquatic life from entering the pump intake, and the drafting rate is capped at 350 gallons per minute to reduce the risk of fish being impinged against the screen. Most drafting occurs in summer and early fall.

2.2.1.9. Watercourse Crossing Facility Placement and Maintenance

Roads often cross watercourses, requiring the installation of culverts, bridges, or fords. In most instances, such crossings are included in a THP; crossings not covered by a THP are discussed in Section 2.2.2.2 of this HCP. The number of such crossings is minimized to reduce environmental impacts. Crossing facilities on fish-bearing watercourses are designed to allow for unrestricted passage of all life stages and unrestricted water passage. Any in-water work necessary to construct road crossings is conducted during in-water work periods specified in applicable CFPRs.

2.2.1.10. Site Preparation

Site preparation refers to activities following timber harvest intended to improve site conditions for natural regeneration or planted seedlings. Those activities help maximize timber productivity, reduce fire hazards, prevent substantial adverse effects on soil resources and fish and wildlife habitat, and prevent degradation of water quality. Activities are conducted as soon as possible after a site has been logged so that planting will not be delayed.

Site preparation activities consist of slash management; control of weeds, brush, or undesirable species; and mechanical soil treatments. Note that site preparation is included as a timber operation under the CFPRs and is covered by the THP prepared for the harvest. Site preparation activities are subject to WLPZs and other aquatic protections of the CFPRs.

Slash is residue such as branches, leaves, and small logs remaining at a site after trees have been harvested. Slash may be retained on site without treatment, treated by chipping, mastication (i.e., grinding or chopping slash or vegetation into small chunks), removed for utilization as biomass, or treated by prescribed burning. The CFPRs require that accidental deposits of slash within Class I and Class II watercourses be removed. Slash deposited into Class III watercourses must also be removed unless it is stable within the channel. Slash management may be required when accumulations of slash following timber harvesting constitute a fire hazard or present a physical barrier to effective planting. Insects can also breed in slash, increasing the risk of forest disease outbreaks.

Prescribed fire may be used in site preparation to remove slash and to help control grasses, forbs, brush and non-merchantable tree species that might outcompete planted seedlings. Burning usually is conducted in the first spring or fall following a timber harvest when fuel and weather conditions meet the requirements of the prescribed burn plan. Timing is dependent on temperature, wind, humidity, and fuel moisture conditions that are conducive to low-intensity burns. Low-intensity fires allow for retention of large woody debris (LWD) and organic material in the soil. Burns are designed and controlled to prevent fires from encroaching into WLPZs.

SPI anticipates burning activities during the permit period will be restricted to burning landing piles left following harvest activities. Broadcast burning is highly unlikely. Prescribed burning may be included in fuelbreak maintenance and would be conducted by resource agency fuelbreak partners (i.e., USFS, CAL FIRE).

Weeds, brush, and non-merchantable species can also be controlled using mechanical means. Vegetation removal methods include drum chopping (pulling steel drums fitted with large blades across a site to crush and chop vegetation), shearing (using a specialized bulldozer blade with sharpened teeth along the bottom edge that cuts or shears stumps and trees near the soil surface), root raking (using a specialized bulldozer blade with widely spaced teeth along the bottom edge to push logging debris into piles), and mulching (shredding or tearing vegetation with teeth on a roller attached to a bulldozer, skidder, bobcat, or mulching machine).

Mechanical soil treatment uses machinery to loosen the soil to improve root penetration and water infiltration. Methods include ripping or subsoiling (pulling a set of shanks through the soil at a depth of between 10 to 40 inches. Mechanical soil treatment currently used by SPI consists of "contour tilling," following clearcut harvesting. This technique results in very low to zero erosion to surrounding or downslope areas, as each contour serves to dissipate overland waterflow. SPI anticipates 30% of the annual clearcut harvest in the HCP Plan Area will be subject to these activities during the permit term, most of which would occur in portions of the plan area characterized by less steep topography (i.e., Lassen and Stirling Districts).

2.2.1.11. Machinery Maintenance, Fueling, and Fuel Storage

Under standards in the CFPRs, machinery may be maintained and fueled within the THP area, and fuel may also be stored in the Action Area. Maintenance, fueling, and fuel storage must be conducted outside WLPZs. Petroleum products and cleaning agents must be disposed of in proper dumps or water treatment facilities. SPI is committed to avoiding and minimizing environmental impacts of such activities.

2.2.2. Management Actions Covered by Other CEQA Analyses

Management actions covered by other CEQA analyses are rock pit development and rock processing; transport of aggregate products and heavy equipment; watercourse crossing installation; and machinery maintenance, fueling, and fuel storage. CEQA analysis occurs under applicable regulatory frameworks relating to Regional Water Quality Control Board Waste Discharge permits or waivers, CDFW 1600 Agreements, the Surface Mining and Reclamation Act of 1975 (SMARA; Public Resources Code, Sections 2710–2796), or California Department of Pesticide Regulation. Government oversight of the implementation of those regulations is provided through CAL FIRE, CDFW, the regional water quality control boards, the California Department of Conservation's Office of Mine Reclamation, the State Mining and Geology Board, and County Agricultural Commissioners. SPI personnel and their contractors who are responsible for such management actions have the appropriate licenses from the State of California. An RPF must consult with other resource professionals in cases where additional expertise is required. Violations of the applicable regulations can result in civil and criminal penalties for the responsible party.

2.2.2.1. Rock Pit Development and Rock Processing

Rock pit development generates aggregate for use on SPI's forest roads. SPI implements activities related to rock pit development and rock processing in compliance with the CFPRs. If rock is sold or used on other than SPL&T forestland a SMARA plan is required. The SMARA policies include regulation of surface mining operations to assure that adverse environmental impacts are minimized and mined lands are reclaimed to a usable condition. Proposed SMARA project compliance includes studies, analyses, planning, review, permitting, and agency consultations meeting CEQA standards. Surface Mining and Reclamation Act quarries are uncommon on SPL&T lands. No SMARA quarries currently occur on SPL&T lands in the HCP/SHA Plan Areas and SPI anticipates no additional quarries would be proposed during the permit period.

Most of SPI's rock pits are adjacent to existing roads. Rock pit development rarely requires tree removal because the depth of the soil over the rock layer being accessed is usually shallow; large, mature trees rarely grow in suitable rock pit sites. Rock source development involves removing vegetation (if present), excavation of the overburden (soil), and then excavation of the aggregate. The average rock pit excavation generally disturbs less than 0.0015 square mile (1 acre) of land. Rock pits may gradually increase in size over time but generally do not exceed 0.008 square mile (5 acres).

Aggregate excavation may require ripping and pushing with a tractor crawler and/or digging with an excavator. Depending on the rock formation, aggregate extraction may require drilling and blasting. Mechanical crushing of extracted aggregate may also be necessary to achieve the desired size and uniformity. SPI uses rock aggregate of various sizes to strengthen road prisms, road surfaces, and crossing facilities. Rock pit development and reuse of a rock source is intermittent.

2.2.2.2. Watercourse Crossing Installations Not Covered by THPs

In addition to watercourse crossings described above (Section 2.2.1.9), some crossings are installed and maintained on an as-needed basis outside a THP. Activities that significantly alter the bed, bank, or stream channel of a watercourse require a 1600 Agreement from CDFW. The 1600 Agreement is a CEQA process as described above. When included in THPs, these agreements are evaluated and authorized through the THP review process; agreements outside a THP are subject to individual CEQA review and authorization. Typical 1600 Agreement conditions include timing restrictions, erosion control practices, fish and amphibian exclusion, and design criteria to protect water quality and fish life.

2.3. Management Activities Not Requiring CEQA Analysis

Several covered activities are not subject to THP approval or other CEQA review; including routine road maintenance, mastication of vegetation within road rights-of-way, timber cruising, timber harvest preparation, pre-commercial thinning, construction and operation of communication sites, scientific research, emergency fire suppression, harvest of minor forest products, and grazing. These activities do not require the THP process or other CEQA review because the Board of Forestry determined they are minor and potential impacts from these activities are negligible. SPI included these activities in the HCP/SHA for disclosure purposes to show they were considered, and because they occasionally occur in the HCP and SHA Plan Areas. These activities may be conducted by SPI employees, contractors, agents, or other designees, and are described below.

2.3.1. Road Maintenance

Road maintenance is required under the CFPRs, both within active THPs and on other lands. Within THP areas, road maintenance is covered by the THP. Outside of THPs, the CFPRs do not require a specific permit or CEQA analysis for road maintenance because impacts to natural resources are minimal, as these features are existing disturbed road surfaces. General maintenance is conducted on an as-needed basis to ensure the integrity of the road prism, road drainage, and associated watercourse crossing facilities, and does not require substantial changes to the road prism. Except for mastication for fuel breaks described in Section 2.3.3, road maintenance does not require removing substantial amounts of vegetation—only small brush and tree seedlings, branches, or grass that has grown in the traveled way. SPI applies standard BMPs (Weaver et al. 2015) during road maintenance and standard CFPRs WLPZ buffers.

2.3.2. Mastication of Roadway Rights-of-Way

Mechanical mastication of vegetation along roads helps roads function more effectively as fuel breaks by reducing the flammability of fuels (vegetation) adjacent to the road. Mastication uses a tractor with a masticator head, which extends roughly 23 to 30 feet from the edge of the road. Mastication of roadway rights-of-way targets brush, trees up to 6 inches dbh, and limbs of larger trees. Such work usually does not require CEQA analyses, but a THP is required if timber is removed for commercial use. SPI applies CFPRs WLPZ buffers during roadway mastication, and mastication does not occur in WLPZs.

2.3.3. Fuel Break Construction and Maintenance

Fuel breaks in forested stands must be covered by THPs. Other construction and maintenance of fuel breaks in low stocked or brush fields do not require THPs and, therefore, are exempt from the CEQA analyses. Most of the current and proposed fuel breaks have been or will be constructed under the THP process. Such activities include hand-cutting, mechanical methods, and prescribed fire. Some prescribed burning is done outside areas covered by THP site preparation standards. For such activities, SPI applies relevant THP mitigation methods such as WLPZs buffers and standards for watercourse crossings, road and landing construction, and equipment management. Approximately 9,232 acres of fuel breaks currently occur on SPL&T lands in the HCP/SHA Plan Areas, with an additional 5,291 acres formally planned. Additionally, SPI estimates approximately 4,773 additional acres will be proposed during the permit period. The planned and proposed fuel breaks will be completed during the first decade of the permit period, with maintenance occurring throughout the remaining four decades.

2.3.4. Emergency Fire Suppression

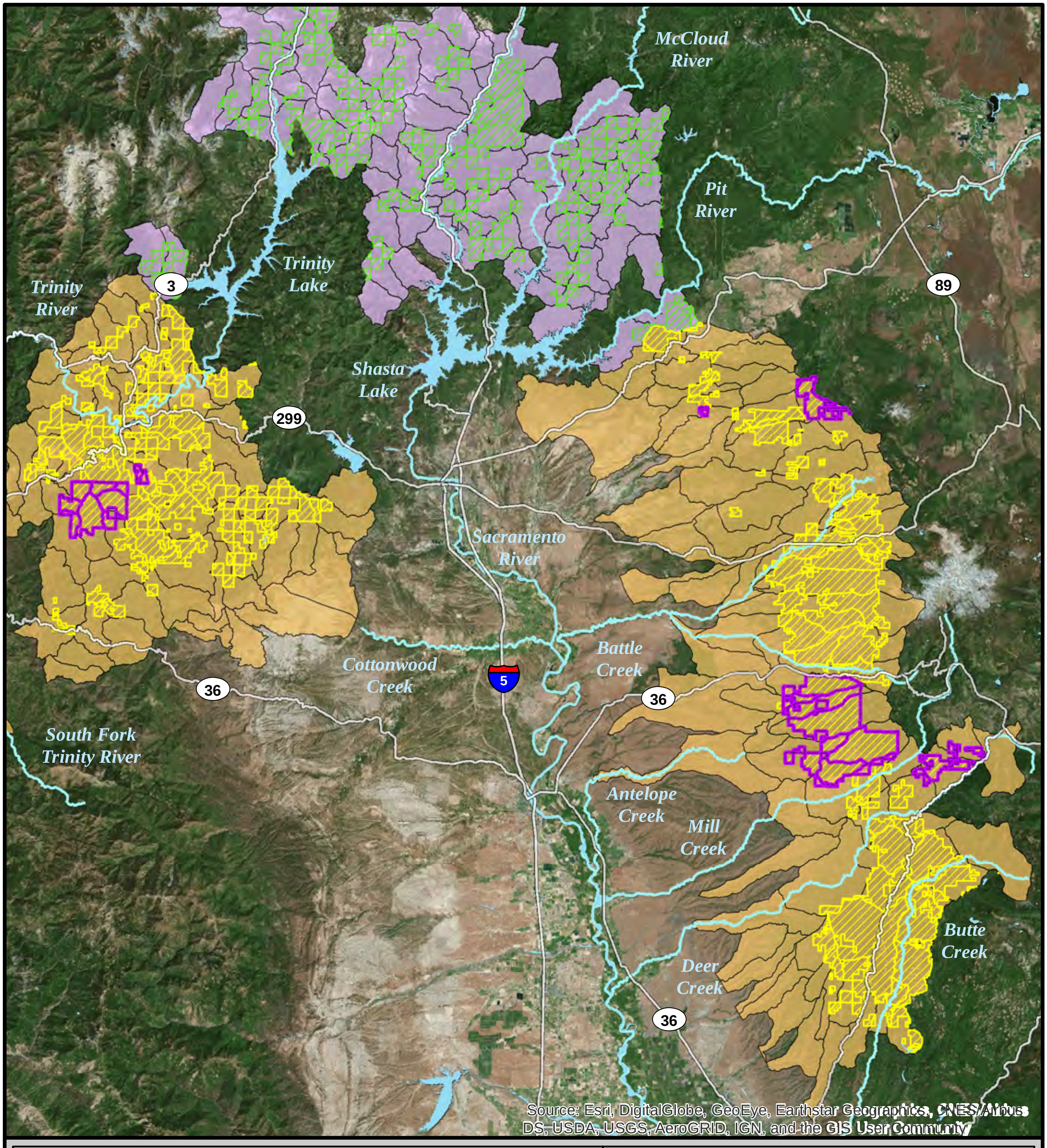
SPI contractors occasionally control wildfires during emergencies to limit fire impacts within the HCP covered area. Fire suppression actions seek to either directly or indirectly limit or stop the spread of fire across the landscape. Activities include building fire lines by hand or mechanically with crawler dozers, water drafting, spraying water, spraying fire retardant, and lighting backfires. This involvement occurs during the initial attack only, as fire suppression activities on SPL&T lands are coordinated with and performed by state and federal agencies. Those activities are performed under existing regulations employed by these agencies regarding natural resource protection. Post-fire rehabilitation is performed by the state or federal incident lead agency per their guidelines. Such activities by state and federal agencies are not covered by permits issued to SPL&T under this HCP.

2.3.5. Harvest of Minor Forest Products

SPI permits harvest of minor forest products on its forestlands. Minor forest products include burls, stumps, greenery (such as boughs, shrubs, and ferns), cones, firewood, Christmas trees, and mushrooms. Permits issued by SPI are conditioned to ensure that harvesting is conducted in a way that protects sensitive habitats and avoids and minimizes incidental take of covered species. Harvesting is allowed only in predesignated areas and is generally subject to constraints such as watercourse protection zones, slope limitation, weather conditions, and access road designation. Firewood collection is primarily limited to firewood generated in otherwise authorized commercial harvests, which have met all required retention standards for wildlife and snags. SPI does not allow firewood collection in WLPZs.

2.3.6. Grazing

SPI issues cattle grazing permits on approximately 98 square miles (62,492 acres) in the HCP Action Area: 74.5 square miles (47,652 acres) in the Sacramento River basin and 23.2 square miles (14,840 acres) in the Trinity River basin (Figure 9). Grazing allotments on SPL&T lands in the HCP Plan Area are part of larger federal grazing leases administered and monitored by the USFS.



Legend

- Grazing Area
- HCP Plan Area
- SHA Plan Area
- HCP Action Area
- SHA Action Area
- River
- Highway
- Lake

Figure 9.
SPI Grazing Areas Within the HCP Plan Area and HCP Action Area.

N

0 6.5 13 26 Mile

USDA, Aerial (2012)

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The Sacramento Basin grazing allotments occur in the Old Cow Creek, Antelope Creek, and Deer Creek watersheds. SPL&T's Sacramento Basin allotment includes up to 125 head for approximately 6 months annually, typically late-spring through early-fall. The allotments include 17.3 stream miles in these three watersheds, approximately 5.4 miles of which are subject to anadromy. The Trinity River basin allotments occur in the Browns Creek and Hayfork Creek watersheds and include 35 head of cattle for approximately 6 months annually. Approximately 6.2 miles of Browns Creek and the North Fork Hayfork Creek in the allotment are subject to anadromy. The Trinity River basin allotments are also active between late-spring through summer.

Grazing permits issued by SPI require licensees to abide by all state and federal laws and prohibit licensees from overgrazing the property. Licensees must maintain proper distribution of livestock by frequent herding via horseback or vehicles and properly locating salt grounds outside of WLPZs. Licensees must also agree to use the property in accordance with the best approved range management practices. SPI foresters monitor grazing activity to ensure permit compliance.

2.3.7. Transportation of Materials and Heavy Equipment

Except for activities regulated by THPs, no CEQA analysis is required for general transportation of materials and equipment. Transportation of rock pit aggregate and heavy equipment involves semi-trucks traveling to and across the road network within the HCP Plan Area and SHA Plan Area. Vehicles used for hauling materials and equipment include water trucks, end-dump trucks, low beds, and belly dump trucks. Due to the alignments and grades of the roads typically used for such activities, hauling operations generally occur at speeds less than 25 miles per hour.

2.3.8. Conversion of Brush Fields to Timber Plantations

Rarely, SPI may convert dense chaparral stands located in timberlands, such as historic fire areas, to conifer plantations. In such cases, shrub species are crushed or killed, and the ground is prepared for planting using mechanical methods such as masticating or bulldozing, or prescribed fire. The CFPRs do not regulate these activities, and no THP filing is necessary unless commercial timber is removed. In such activities, SPI applies appropriate standard THP methods such as WLPZs, watercourse crossing standards, road and landing construction standards, and equipment management.

3. COVERED SPECIES

This document addresses potential impacts on three salmonid species, which are “covered species” in both the ITP and ESP: Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), and steelhead (*Oncorhynchus mykiss*). The covered species include four Chinook salmon ESUs, one coho salmon ESU, and two steelhead DPSs occurring in the Sacramento and Trinity River watersheds (Table 2). This section describes the status, distribution, habitat use, and critical habitat within the Action Area for each ESU and DPS addressed in this document.

<table>
<tr><th colspan="5">Table 2. Distribution and Designated Critical Habitat for Covered Species.</th></tr>
<tr><th>Basin</th><th>Species</th><th>ESU or DPS</th><th>Distribution within HCP Action Area</th><th>Critical Habitat within HCP Action Area</th></tr>
<tr><td rowspan="4">Sacramento</td><td rowspan="3">Chinook salmon</td><td>Central Valley fall- and late fall-run ESU</td><td>Battle Creek, Clear Creek, Cottonwood Creek, Cow Creek, Deer Creek, Mill Creek</td><td>Not applicable; ESU is not listed</td></tr>
<tr><td>Central Valley spring-run ESU</td><td>Antelope Creek, Battle Creek, Big Chico Creek, Clear Creek, Cottonwood Creek, Cow Creek, Deer Creek, Mill Creek</td><td>Designated; same as known distribution (70 FR 52488)</td></tr>
<tr><td>Sacramento River winter-run ESU</td><td>Battle Creek</td><td>Designated; same as known distribution (58 FR 33212)</td></tr>
<tr><td>Steelhead</td><td>California Central Valley DPS</td><td>Antelope Creek, Battle Creek, Big Chico Creek, Clear Creek, Cottonwood Creek, Cow Creek, Deer Creek, Mill Creek, Paynes Creek</td><td>Designated; same as known distribution (70 FR 52488)</td></tr>
<tr><td rowspan="3">Trinity</td><td>Chinook salmon</td><td>Upper Klamath/ Trinity River ESU</td><td>Hayfork Creek, Trinity River, South Fork Trinity River</td><td>Not applicable; ESU is not listed</td></tr>
<tr><td>Coho salmon</td><td>Southern Oregon/ Northern California Coast (SONCC) ESU</td><td>Lower Trinity River, Upper Trinity River, South Fork Trinity River</td><td>Designated; same as known distribution (64 FR 24049)</td></tr>
<tr><td>Steelhead</td><td>Klamath Mountains Province DPS</td><td>Trinity River, Trinity River tributaries</td><td>Not applicable; DPS is not listed</td></tr>
</table>

DPS = Distinct Population Segment

ESU = Evolutionarily Significant Unit

HCP = Habitat Conservation Plan

3.1. Species and Habitat Descriptions

General descriptions for the covered species and their habitats are provided in the subsections below.

3.1.1. Species

The covered species occupy a wide range of stream reaches based on their run timing and biological adaptations (Table 3).

Chinook salmon is the largest species of Pacific salmon, a group of anadromous fish that hatch and rear in freshwater streams, continue to rear and grow in the ocean for a period of months to years, and return to freshwater streams to spawn. Populations of Chinook salmon are differentiated according to the season of spawning migration. Spring-run Chinook salmon enter fresh water in the spring and migrate the farthest into stream systems. Fall-, late-fall, and winter-run salmon return to fresh water later in the year, and typically spawn in the lower reaches of tributary streams. There are two distinct life history strategy types (stream-type and ocean-type) that are differentiated by the amount of time spent rearing in fresh water. While variable depending on timing of emergence, stream flows, and temperature; generally, stream-type Chinook salmon have a longer freshwater residency before they perform extensive offshore migrations, while ocean-type Chinook salmon, including Central Valley fall- and upper Klamath/Trinity River populations, usually migrate to sea within the first 3 months of life. Spring-run Chinook salmon juveniles may reside in freshwater for 12 to 16 months, but some migrate to the ocean as young-of-the-year in the winter or spring months within eight months of hatching (NMFS 2014b).

The coho salmon is an anadromous salmonid native to watersheds draining into the North Pacific Ocean. Like Chinook salmon, coho salmon hatch and rear in freshwater streams, spend a portion of their life growing in the ocean, and return as adults from the ocean to spawn in natal streams. Most juvenile coho salmon remain in freshwater rearing habitat for approximately 18 months; spend 18 months in the ocean; then return to natal streams to spawn at the age of 3 years. A small portion of males (known as jacks), spend only a couple of months in the ocean and return as 2-year-old spawners.

Oncorhynchus mykiss is the most widely distributed salmonid in the western United States. The species has two alternate life history strategies: the anadromous form, referred to as steelhead trout, and the non-anadromous, resident form, called rainbow trout. The two life history strategies often overlap in distribution and are morphologically distinguishable only in the adult life stage based on size, with steelhead typically larger. The anadromous steelhead trout is the species discussed in this document. Steelhead, like other anadromous salmonids, emerge from redds in freshwater streams and rivers, spend a portion of their life at sea, and then return to fresh water to spawn. Steelhead can be divided into two reproductive types based on the state of sexual maturity when they re-enter fresh water and the duration of spawning migration. The stream-maturing type (also known as summer-type) enters fresh water in a sexually immature condition, whereas the ocean-maturing type (also known as winter-type) enters fresh water with well-developed gonads and spawns shortly thereafter. The covered species in this HCP include the California Central Valley steelhead and Klamath Mountains Province steelhead DPS.

Table 3. Key Characteristics of Covered Species.								
Species	**ESU or DPS**	**Adult Migration**	**Spawning Period**	**General Spawning Reaches**	**Spawning Habitat**	**Incubation Period[a] (days)**	**Rearing Habitat**	**Rearing Timing (months)**
Chinook salmon	Central Valley fall- and late fall-run ESU (stream- and ocean-type)	Jul to Dec (fall-run) Oct to Dec (late fall-run)	Oct to Dec (fall-run) Jan to Apr (late fall-run)	Lower reaches of streams	Spawn in: • Pool tails or slightly upstream • Water depth: 1 to 23 feet • Water velocity: 0.5 to 5 cfs • Substrate size: 0.5 to 4 inches • Temperature: 37.4°F to 60.8°F	32 to 159	• Fry seek cover in shallow water along channel margins or in low velocity channel bottoms. • Overwintering juveniles seek shelter under large boulders and woody debris, and in side channels or other low-velocity refugia. • Fry young-of-the-year and yearling smolts also use estuarine habitat. • Summer maximum weekly average temperatures (MWAT) below 63.32°F (NMFS recommendation for coho).	1 to 7 (fall-run) 7 to 13 (late fall-run)
	Central Valley spring-run ESU (stream- and ocean-type)	Mar to Sep	Aug to Oct	Most stream reaches as conditions allow; generally further upstream than other salmon runs and steelhead				3 to 15
	Sacramento River winter-run ESU (stream-type)	Dec to Aug	Apr to Aug	Lower reaches of streams				5 to 10
	Upper Klamath/ Trinity River ESU (stream- and ocean-type)	Sep to Dec	Oct to Dec	All stream reaches				3 to 15
Coho salmon	Southern Oregon/ Northern California Coast (SONCC) ESU	Sep to Nov	Oct to Jan	All stream reaches	Spawn in: • Pool tails, upper sections of watershed • Water depth: 0.1 to 1 foot • Water velocity: 1 to 2.5 cfs • Substrate size: 0.4 to 8 inches • Temperature: 41.0°F to 59.0°F	36 to 48	• Mix of pools and riffles with abundant in-stream and overhead cover. • Fry seek out shallow water along stream margins, backwaters, and side channels. • Summer parr found mainly in pools. • Overwintering juveniles seek shelter from high flows in side channels, backwaters, under large boulders and woody debris. • Summer MWAT below 63.32°F.	12 to 18
Steelhead	California Central Valley steelhead DPS	Jul to May	Dec to Apr	All stream reaches	Spawn in: • Pool tails or slightly upstream • Water depth: 0.3 to 5 feet • Water velocity: 0.6 to 5.3 cfs • Substrate size: 0.2 to 5 inches • Temperature: 41.0°F to 55.4°F	18 to 80	• Fry tend to school and seek out shallow water along stream margins. • Larger fry and juveniles maintain territories in pool and run habitat. • Summer MWAT below 63.32°F (NMFS recommendation for coho).	12 to 36
	Klamath Mountains Province steelhead DPS	Sep to Mar (winter-run) Jul to Nov (fall-run) Apr to Jun (summer-run)	Nov to Mar (winter-run) Jan to May (fall-run) Dec to Jan (summer-run)	All stream reaches				12 to 24

[a] Incubation period varies depending on water temperature.

°F = degrees Fahrenheit

cfs = cubic feet per second

DPS = Distinct Population Segment

ESU = Evolutionarily Significant Unit

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3.1.2. Habitat

In general, salmonids have similar habitat requirements for spawning, rearing, and migration, although there are some specific habitat preferences that may vary between species and populations (Table 3). Spawning habitat requirements for salmonids include sufficient water quality and quantity to support spawning, incubation, and larval development, as well as suitable substrate for creating redds, sufficient flow to provide oxygen to incubating eggs, and adequate water quantity to protect the eggs from predators.

Chinook salmon typically spawn in larger streams that have higher water velocities and larger gravels than are used by other salmonids (Table 3). Water quality, depth, and velocity are critical for the survival of eggs. Redds also require enough flow of clean water with low amounts of fine sediment to supply the eggs with sufficient oxygen, but high velocity flows can cause scouring of the streambed and dislodge the eggs. Eggs are more vulnerable to predation and disturbance in shallow waters (Healey 1991). Chinook salmon spawning habitat ranges from water depths between 1 to 23 feet, although most spawning occurs from 1 to 3.2 feet (Healey 1991); at water velocities of 0.3 to 5 cubic feet per second (cfs) (Healey 1991), and in substrate between 0.5 and 4 inches (Bell 1991). Egg incubation and alevin development rate is temperature dependent, with Chinook salmon spawning in waters between 37.4 and 60.8°F (degrees Fahrenheit; Healey 1991). Fry emergence is completed within approximately 83 days following spawning at an average developmental water temperature of 53.6°F (Healey 1991).

Coho salmon spawn in smaller streams than do Chinook salmon, but in larger, lower-gradient streams than do steelhead. Redds are usually created near the head of a riffle, just below a pool where the water changes from a laminar to a turbulent flow and has medium to small gravel substrate from 0.4 to 8 inches in size (Reeves et al. 1989). Coho salmon spawn in water between 0.1 and 1 foot deep with water flow between 1 and 2.5 cfs (Sandercock 1991). Before fry emergence, the redds must have adequate clean water, as the eggs are vulnerable to siltation, freezing, gravel scouring and shifting, desiccation, and predation. Like Chinook salmon, coho egg development and incubation are inversely related to water temperature, which varies between 41.0 and 59.0°F for coho spawning in California (Sandercock 1991). In most Oregon and California streams, incubation lasts from 38 to 48 days, depending on water temperature (Shapovalov and Taft 1954).

Steelhead spawn and rear higher upstream than Chinook or coho salmon, using smaller streams with higher gradients (CDFW 2015a). Steelhead spawn in gravels and small cobbles, typically found at pool tailouts. Redds are usually built using gravel from 0.2 to 5 inches, in water depths of 0.3 to 5 feet, where velocities are between 0.6 and 5.3 cfs (CDFW 2015a). Steelhead embryos incubate for 18 to 80 days, with an optimal temperature range between 41.0 and 55.4°F (CDFW 2015a).

Salmonid freshwater rearing habitat requirements are generally the same for all species and populations, and they include floodplain connectivity to form and maintain physical habitat conditions that support juvenile growth and mobility, and natural cover such as shade, submerged and overhanging large wood, logjams, and undercut banks. Those features provide juvenile salmonids access to areas needed for forage and growth, and to develop behaviors that help ensure their survival. The amount of time spent rearing in freshwater varies between species, species-types, and populations (Table 3). Some salmonids may begin their migration from freshwater within 1 to 10 days after emerging from their redds (Healey 1991), while other salmonids may reside in freshwater streams for up to 18 months (Sandercock 1991).

For migrating salmonids, the corridor must be free of obstruction, have sufficient water quantity and quality conditions, and provide natural cover that supports juvenile and adult mobility and survival. Such features are essential for juveniles because they provide various habitats to help juveniles avoid high flows and predators, and successfully compete as they migrate to sea. Similarly, such features are essential for adults because they allow fish in a non-feeding condition to successfully swim upstream, avoid predators, and reach spawning areas on limited energy stores. Factors that affect migration include low flow conditions, water temperature, dissolved oxygen levels, and the food availability (Sandercock 1991).

3.2. Sacramento River Basin

The Sacramento River basin HCP Action Area is used by several salmonid populations. The sub-reaches occupied by salmonid species in the HCP Action Area include Antelope, Big Chico, Clear, Cottonwood, Cow, Deer, Mill and Paynes (Appendix B). Clear, Deer, and Mill Creeks are particularly sensitive to covered activities as these streams support populations that are critically low and important for species recovery. Other reaches within the HCP Action Area may not be presently used by salmonid species but contribute to supporting salmonid populations and are considered part of the Action Area, as covered actions within these reaches may affect anadromous fish populations located downstream.

In the *Central Valley Salmon and Steelhead Recovery Plan* (NMFS 2014a), the Central Valley Technical Review Team identified population groups (hereafter referred to as diversity groups), which are delineated based on climatological, hydrological, and geographic characteristics, and reflect the historical distribution of each species. Rivers and streams within these diversity groups are placed into Cores. Cores are watershed categories (1, 2, or 3) assigned by NMFS to assess potential contribution for (listed salmonid) species recovery in the Sacramento River basin. The three Core categories are based on their potential to support spring-run Chinook salmon or steelhead populations with low extinction risk. Additionally, NMFS (2014a) classifies rivers and streams within these diversity groups currently outside anadromy limits are classified as Primary, Candidate, or Non-candidate based on their priority for spring-run Chinook salmon or steelhead reintroduction.

SPL&T lands in the HCP Plan Area and SHA Plan Area included in the NMFS recovery and reintroduction classifications include three diversity groups, seven Core 1 or 2 rivers or streams, and four Primary or Candidate watersheds. Collectively, these lands represent 79.25 miles, of which 9.71 miles are subject to anadromy. The rivers and streams on SPL&T lands in the HCP

Plan Area and SHA Plan Area included in the NMFS recovery and reintroduction classifications are summarized in Table 4.

Table 4. NMFS Recovery and Reintroduction Classifications of Rivers and Streams on SPL&T Lands in the HCP Plan Area and SHA Plan Area.

Diversity Group	River, Creek, or Sub-reach	Classification	HCP or SHA Plan Area	SPL&T Stream Ownership (miles)	SPL&T Stream Ownership of Anadromous Waters (miles)
Basalt and Porous Lava	Battle Creek	Core 1	HCP Plan Area	11.00	0.00
	Little Sacramento River (upper Sacramento River)	Candidate	SHA Plan Area	3.83	N/A
	McCloud River	Primary	SHA Plan Area	0.00	N/A
Northwestern California	Cottonwood/Beegum	Core 2	HCP Plan Area	4.42	0.43
Northern Sierra Nevada	Middle Yuba River (above Englebright)	Primary	SHA Plan Area	5.71	N/A
	South Yuba River (above Englebright)	Candidate	SHA Plan Area	0.53	N/A
	Butte Creek	Core 1 and Core 2	HCP Plan Area	16.06	0.00
	Big Chico	Core 2	HCP Plan Area	18.76	0.00
	Deer Creek	Core 1	HCP Plan Area	0.80	0.77
	Mill Creek	Core 1	HCP Plan Area	3.08	3.08
	Antelope Creek	Core 2	HCP Plan Area	15.05	5.43

Source: NMFS 2014a.

The HCP Action Area and HCP Plan Area overlap the Basalt and Porous Lava diversity group, the Northern Sierra Nevada diversity group, and the Northwestern California diversity group. SPL&T lands subject to anadromy within the HCP Plan Area in these diversity groups are limited to approximately 15.3 stream miles occurring in 11 planning watersheds; which represent approximately 2 percent of the total stream miles occurring on SPL&T lands in the Sacramento Basin HCP Plan Area (Appendix D, Table D-2).

The Basalt and Porous Lava diversity group includes the upper Sacramento River, McCloud River, Pit River, Battle Creek, and Cow Creek watersheds. SPL&T lands occurring in this diversity group include one Core 1 stream and one Core 2 stream. Battle Creek is a Core 1 stream for spring-run Chinook salmon and steelhead, while Cow Creek is a Core 2 stream for steelhead. The upper Sacramento River and McCloud River are considered Candidate and Primary watersheds for reintroduction, respectively.

The Northwestern California diversity group consists of streams that enter the main stem Sacramento River from the northwest (NMFS 2014a). Streams in the Northwestern California diversity group overlapping with the HCP Action Area and HCP Plan Area include Clear and

Cottonwood Creeks. Clear and Cottonwood Creeks are Core 1 and Core 2 streams, respectively, for spring-run Chinook salmon and steelhead.

The Northern Sierra Nevada diversity group is composed of streams tributary to the Sacramento River from the east. The Northern Sierra Nevada diversity group overlapping with the HCP Plan Areas includes Butte, Big Chico, Deer, Mill, and Antelope Creeks; and the North, Middle, and South Yuba River watersheds. SPL&T lands occurring in this diversity group include five Core 1 or Core 2 streams. Deer and Mill Creeks are Core 1 watersheds for spring-run Chinook salmon and steelhead, while Antelope Creek is a Core 2 watershed for spring-run Chinook salmon and a Core 1 watershed for steelhead. Big Chico Creek is a Core 2 watershed for spring-run Chinook salmon and steelhead. Butte Creek is a Core 1 watershed for spring-run Chinook salmon and a Core 2 watershed for steelhead. The North, Middle, and South Yuba River watersheds are considered Primary watersheds for reintroduction for spring-run Chinook salmon and steelhead, while the South Fork Yuba River is a Candidate for spring-run Chinook salmon reintroduction.

The Sacramento River basin supports three Chinook salmon ESUs and one steelhead DPS (Table 2). The current status, distribution, presence and habitat use in the HCP Action Area for those species is described in the following sections. The Central Valley spring-run Chinook salmon and the Sacramento River winter-run Chinook salmon ESUs, and the Central Valley steelhead DPS have populations identified within the diversity groups. Since the Central Valley fall- and late fall-run Chinook salmon ESU is not listed under the ESA, it was not included in the recovery plan (NMFS 2014a), and there is no information on historical and current distribution or extinction risk within the HCP Action Area.

3.2.1. Central Valley Fall- and Late Fall-Run Chinook Salmon ESU

Fall-run Chinook salmon migrate upstream as adults from July through December and spawn from early October through late December. The timing of runs varies between waterbodies. Late fall-run Chinook salmon migrate into the rivers from mid-October through December and spawn from January through mid-April.

3.2.1.1. Status and Distribution

In 1999, NMFS determined the Central Valley fall- and late fall-run Chinook salmon ESU was not warranted for listing (64 FR 50393), but NMFS made the ESU a candidate species due to specific risk factors. The listing status was changed to species of concern in 2004 due to habitat loss and the strong reliance on hatchery production (CDFW 2015b). Chinook salmon from the Central Valley fall- and late fall-run ESU provide substantial economic activity in commercial and recreational fishing, which are regulated by NMFS and CDFW.

The Central Valley fall- and late fall-run Chinook salmon ESU is currently the most widely distributed run of Chinook salmon in the Central Valley (Figure 10). The ESU includes all naturally spawned fall-run Chinook salmon in the San Joaquin and Sacramento River basins east of the

Carquinez Strait in California. Natural spawning abundance was high until 1999. The late fall portion of the Sacramento River run continues to have low but stable numbers, whereas the number of main stem fall-run spawners continues to decline in the Upper Sacramento River, as indicated by counts at Red Bluff Dam (Voss 2016). The dam counts represent the total number of fishes returning, including hatchery fish. Many streams with high abundance in the ESU are influenced by hatchery programs, especially in the Feather and American Rivers and Battle Creek (Myers et al. 1998), so the contribution of hatchery fish to the overall persistence of the wild portion of the ESU is not clear.

Over 70 percent of spawning habitat for all Chinook salmon ESUs in the Central Valley drainage of California has been blocked by dams (Yoshiyama et al. 2001). Habitat for fall-run Chinook salmon spawning has been impacted less by dam construction than spawning habitat for other ESUs because fall-run Chinook salmon mainly spawn at low elevations (Yoshiyama et al. 2001). The historical distribution of late fall-run Chinook salmon is not well documented because the late fall-run Chinook salmon was not recognized as distinct from fall-run Chinook salmon until after the Red Bluff Diversion Dam was constructed in 1966. The late fall-run Chinook salmon most likely spawned in the Upper Sacramento and McCloud Rivers, reaches now blocked by Keswick and Shasta Dams. There is also some evidence that late fall-run Chinook salmon once spawned in the San Joaquin River and other large San Joaquin River tributaries (Yoshiyama et al. 1998).

3.2.1.2. Critical Habitat

The Central Valley fall-run and late fall-run Chinook salmon ESU is not listed under the ESA. Therefore, no critical habitat has been designated.

3.2.1.3. Presence and Habitat Use in the HCP Action Area

In general, Central Valley fall-run and late fall-run Chinook salmon have limited spawning range within the HCP Plan Area. Historically, fall-run Chinook salmon spawned mostly in river reaches now blocked by Keswick Dam, which included the Upper Sacramento River and McCloud River. At present, fall- and late fall-run Chinook salmon spawn in the Sacramento River up to the Keswick Dam (not in the HCP Plan Area). They also spawn in the Bear Creek, Cottonwood Creek, Cow Creek, Clear Creek, Deer Creek, and Mill Creek watersheds (SHN Consulting Engineers 2001; Heiman and Knecht 2010; CDFW 2014a, 2014b; CDFW 2015b, 2015c). Although the reaches of Cottonwood, Cow, Clear, Deer, and Mill Creeks that are within the HCP Plan Area are above areas where fall and late-fall Chinook salmon spawn, the effects of the covered activities, especially effects to water quality, may extend downstream of the covered lands into habitat used for spawning and rearing.

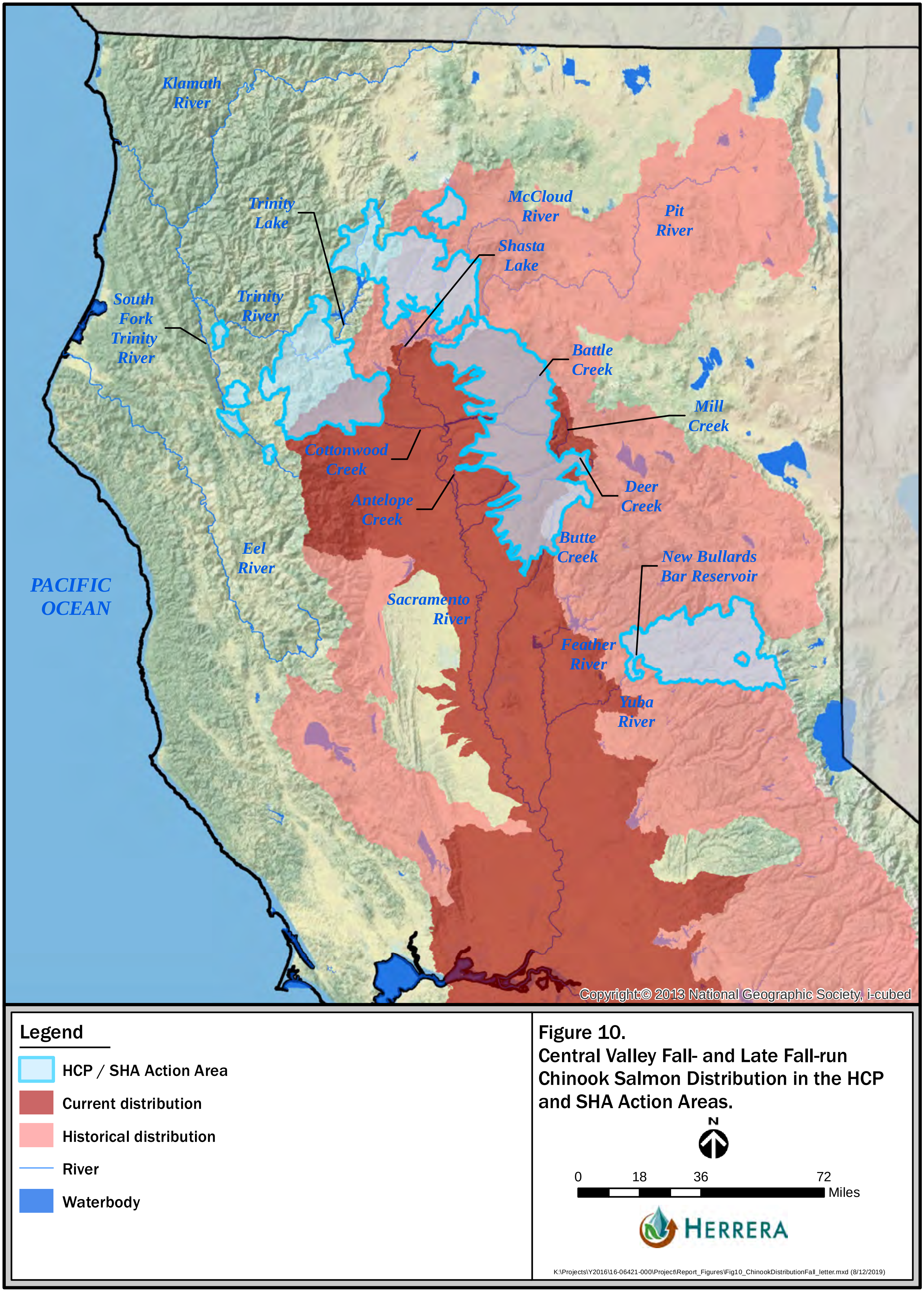


Figure 10.
Central Valley Fall- and Late Fall-run Chinook Salmon Distribution in the HCP and SHA Action Areas.

Of the different runs of salmon that spawn in the Upper Sacramento River and tributaries, only fall-run Chinook salmon consistently return to Bear Creek. Between 1949 and 2002, spawning runs varied between fewer than 10 fish to up to 500 (Heiman and Knecht 2010). The continued decline of salmon in Bear Creek reflect the overall decline of the Sacramento River fall-run Chinook salmon (Heiman and Knecht 2010).

All three forks of Cottonwood Creek support fall-run Chinook salmon, with an estimated average annual return of 1,000 to 1,500 fall-run Chinook salmon. Numbers have fallen in recent years, consistent with the overall decline of fall-run Chinook salmon in the Sacramento River (Heiman and Knecht 2010; Williams et al. 2016). Spawning occurs downstream from the HCP Action Area and HCP Plan Area, but the effects of the covered activities may extend downstream of the covered lands into reaches of Cottonwood Creek used for spawning and rearing.

In lower Clear Creek (below Whiskeytown Dam), fall-run Chinook salmon populations averaged 2,000 fish annually from 1954 to 1994; the populations ranged from 500 to 10,000, depending on the year (Heiman and Knecht 2010). The removal of the Saeltzer Dam in 2000 and management efforts focusing on improving stream conditions restored passage to a significant reach of Clear Creek below Whiskeytown Dam (Heiman and Knecht 2010). From 2000 to 2018, fall-run Chinook salmon populations averaged approximately 8,500 fish annually, ranging from approximately 2,350 to 16,000 fish (CDFW 2019). Spawning occurs downstream from the HCP Action Area and SHA Plan Area, but the effects of the covered activities may extend downstream of the covered lands into reaches of Clear Creek used for spawning and rearing.

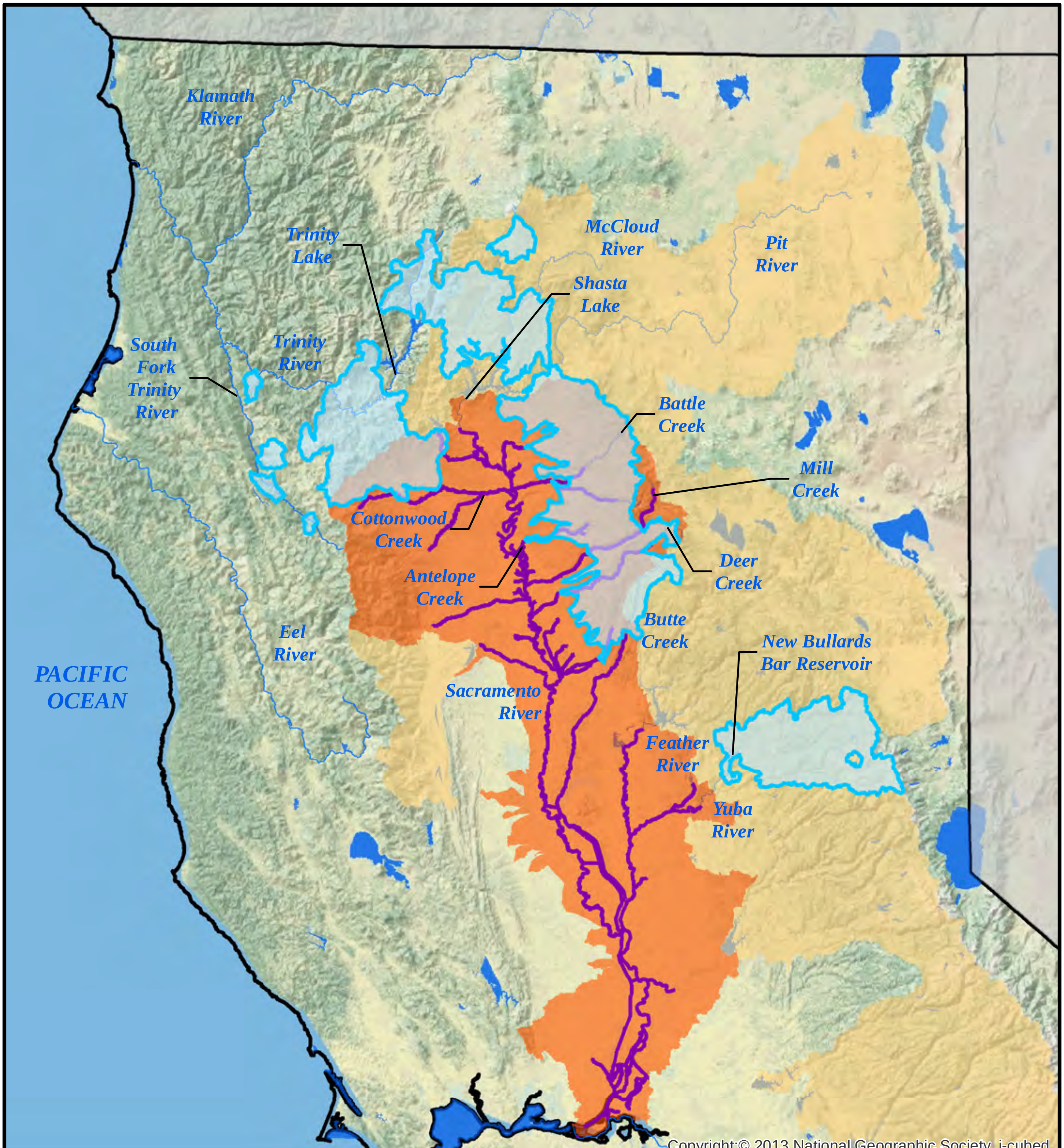
In Mill Creek, fall-run Chinook salmon mainly use the lower 6 miles. Annual counts from 1952 through 1994 reported an average run size of 2,000 fish. However, given the decline reported in 2010 for the Sacramento River fall-run salmon, current runs are presumed to be much smaller (Heiman and Knecht 2010). The lower 6 miles of Mill Creek used by fall-run Chinook salmon is located approximately 20 miles downstream of the HCP Action Area.

3.2.2. Central Valley Spring-Run Chinook Salmon ESU

The Central Valley spring-run Chinook salmon ESU is another distinct run of Chinook salmon that spawns, rears, and migrates in the Sacramento-San Joaquin River system (Figure 11). Fish from that ESU enter the Sacramento River from late March through September, with the peak migration occurring between May and June (Yoshiyama et al. 1998). Spring-run Chinook salmon in the Sacramento River exhibit both stream-type and ocean-type life history strategies, emigrating as fry, subyearlings, and yearlings after rearing in freshwater from 3 to 15 months (Healey 1991; Yoshiyama et al. 1998).

3.2.2.1. Status and Distribution

The Central Valley spring-run Chinook salmon ESU was listed as a threatened species in 1999 due to the small number of non-hybridized populations and low population sizes (64 FR 50393). Historically, spring-run Chinook salmon were the most abundant salmonid in the Central Valley;



Legend

- HCP / SHA Action Area
- Critical habitat (riverine)
- Current distribution
- Historical distribution
- River
- Waterbody

Figure 11.
Central Valley Spring-run Chinook Salmon Distribution and Critical Habitat in the HCP and SHA Action Areas.

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K:\Projects\Y2016\16-06421-000\Project\Report_Figures\Fig11_ChinookDistributionSpring_letter.mxd (8/12/2019) however, large dams eliminated access to almost all historical habitat (NMFS 2014a). Abundance has declined dramatically from historical levels, and much of the present-day production is from artificial propagation in hatcheries (NMFS 2014a). According to Williams et al. (2016), "The viability of Central Valley spring-run Chinook salmon appears to have improved since the 2010 assessment, but this ESU is far from being viable and is still facing relatively high extinction risk."

The spring-run Chinook salmon historically occupied the upper and middle reaches of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud, and Pit Rivers, with smaller populations in most other tributaries with sufficient cold-water flow to maintain spring-run adults through the summer prior to spawning (Table 5) (Myers et al. 1998; NMFS 2014a). Dam construction and habitat degradation were previously thought to have eliminated spring-run Chinook salmon populations from the entire San Joaquin River basin (Campbell and Moyle 1991); however, recent reports describe adult Chinook salmon returning in February through June to San Joaquin River tributaries showing spring-run characteristics (Williams et al. 2016), suggesting small runs occur in portions of the San Joaquin River basin.

Table 5. Central Valley Spring-Run Chinook Salmon Current and Historical Presence within the HCP Action Area and SHA Action Area.

Diversity Group	River, Creek, or Sub-Reach	Historical Presence	Current Presence	Population Risk of Extinction	HCP Action Area	SHA Plan Area
Basalt and Porous Lava	Battle Creek	Yes	Yes	Moderate	No	Yes
	Cow Creek	Yes	Yes	Uncertain	Yes	Yes
	Upper Sacramento River	Yes	No	NA	No	Yes
	McCloud River	Yes	No	NA	No	Yes
	Pit River	Yes	No	NA	No	Yes
Northern Sierra Nevada	Antelope Creek	Yes	Yes	High	Yes	Yes
	Big Chico Creek	Yes	Yes	High	Yes	Yes
	Butte Creek	Yes	Yes	Low	No	Yes
	Deer Creek	Yes	Yes	High	Yes	Yes
	Mill Creek	Yes	Yes	High	Yes	Yes
	North Yuba River (above New Bullards Bar Reservoir)	Yes	No	NA	No	Yes
	Middle Yuba River (above Englebright Reservoir)	Yes	No	NA	No	Yes
	South Yuba River (above Englebright Reservoir)	Yes	No	NA	No	Yes
Northwestern California	Clear Creek	Yes	Yes	Moderate	Yes	Yes
	Cottonwood/ Beegum Creek	Yes	Yes	High	Yes	Yes

NA = not applicable
HCP = Habitat Conservation Plan
SHA = Safe Harbor Agreement
Source: NMFS 2014a

Of the historical 18 independent populations of Central Valley spring-run Chinook salmon, four are currently considered independent: Battle, Deer, Mill, and Butte Creeks (Williams et al. 2016). The remaining Sacramento River region populations have had very low returns, often zero or near zero since 2007, and are considered dependent (Williams et al. 2016). Early-running Chinook salmon have been documented in the main stem Sacramento River and the Feather River, but it is difficult to make a population determination because fish in the early-run ESU frequently hybridize with those in the fall-run ESU. In addition, millions of spring-run Chinook salmon have been propagated at the CDFW hatchery on the Feather River, which began operation in the mid-1960s (NMFS 2014a). As of 1998, most of those hatchery fish had been released outside of the Feather River basin (Myers et al. 1998, Williams 2016), and half of all spring-run releases have been outside of their natal waters. These release practices increased the potential for hatchery fish to interbreed with fish from naturally spawning populations, reducing genetic diversity; however, since 2014 the Feather River Hatchery has released spring-run Chinook salmon juveniles into the Feather River (Williams 2016).

Loss of historical spawning and rearing habitat remains a limiting factor to spring-run Chinook salmon, as these areas are still inaccessible due to dams (Figure 11). Since the ESU was listed, limited spawning habitat expansion has occurred compared to the amount of historical habitat loss. Notable exceptions include the removal of the Saeltzer Dam on Clear Creek in 2000, which opened 10 miles of habitat; repair of a partial low flow barrier on Cottonwood Creek in 2010, which improved access to 30 miles of habitat; and removal of the Wildcat Dam in 2010, which facilitated access to 3 miles of North Fork Battle Creek below Eagle Canyon Dam (Williams et al. 2016). The threatened listing for the ESU was reaffirmed in 2016 (81 FR 33468).

3.2.2.2. Critical Habitat

Critical habitat was designated for the Central Valley spring-run ESU of Chinook salmon on September 2, 2005 (70 FR 52488). NMFS critical habitat listings include relevant physical and biological features (PBFs) that are provided protections of the ESA. PBFs for Central Valley spring-run Chinook salmon in fresh water include:

1. *Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development*
2. *Freshwater rearing sites with:*
    a. *Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility.*
    b. *Water quality and forage supporting juvenile development.*
    c. *Natural cover, such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.*

3. *Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover, such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks, supporting juvenile and adult mobility and survival.*

The HCP Action Area contains designated critical habitat for this ESU (Figure 11), and includes Antelope Creek, Battle Creek, Big Chico Creek, Butte Creek, Clear Creek, Cottonwood Creek, Cow Creek, Deer Creek, and Mill Creek.

Potential limiting factors for Central Valley spring-run Chinook salmon in the Basalt and Porous Lava diversity group during spawning, rearing, or migration include manmade barriers blocking access to historical habitat, passage impediments and flow fluctuations from hydropower operations, and loss of rearing habitat (NMFS 2014a). Agricultural diversions and diversion dams, warm water temperatures, manmade barriers blocking access to historical habitat, entrainment from diversions, and loss of channel connectivity represent potential limiting factors in the Northern Sierra Nevada diversity group; while warm water temperatures, limiting spawning habitat availability, loss of rearing habitat, and manmade barriers blocking access to historical habitat are limiting factors in the Northwestern California diversity group (NMFS 2014a).

These potential limiting factors functionally do not occur in the HCP Plan Area, as these activities occur in areas outside SPL&T lands. Potential impacts to Central Valley spring-run Chinook salmon include indirect effects related to the covered activities such as potential stream temperature increases, and increased sedimentation and turbidity. The status of water quality and hydrology of the HCP Action Area is described in Section 4.1.5 and the potential impacts of covered actions are discussed in Section 5.1.

3.2.2.3. Presence and Habitat Use in the HCP Action Area

Due to the presence of large dams in major river systems limiting habitat access throughout the Central Valley, the largest Central Valley spring-run Chinook salmon ESU populations in the HCP Action Area are currently limited to Mill and Deer Creek (Williams et al. 2016). Small populations also occur in Antelope, Battle, Big Chico, Clear, Cottonwood, and Cow Creeks (Williams et al. 2016). Appendix C includes a map of the known spring-run Chinook salmon populations. SPL&T lands in the HCP Action Area include the previously described Core 1 and Core 2 watersheds.

Central Valley spring-run Chinook salmon use Mill Creek for spawning, rearing, and migration (NMFS 2014a). Mill Creek is essentially undammed, with only two low irrigation diversions operated by the Los Molinos Mutual Water Company. Both diversion dams are designed to allow passage for migrating fish during high flows and have fish ladders for low flow conditions (Mill Creek Conservancy 2017). There are no physical passage barrier limits to the upstream migration of adult salmonids; however, the combined effect of higher stream gradients and lower streamflows can restrict access to the headwater reaches, which extends to near Morgan Hot Springs, approximately 3 miles downstream of Lassen Volcanic National Park (Armentrout et al. 1998). Beginning in the early 2000s, and until at least 2005, streamflows have been augmented through a water exchange program to improve upstream passage for spring-run Chinook salmon (CalWater 2005). Population estimates conducted since 1947 show a decline in returns in recent years. Prior to 1990s, the average run size was approximately 1,200; since early 1990s, the average run size has been around 400 (Heiman and Knecht 2010).

In Deer Creek, spring-run spawning extends from Upper Falls downstream nearly 30 miles, but the distribution of spawning can vary based on water temperature and the amount of runoff (Armentrout et al. 1998). A fish ladder built in 1943 provided passage above the Lower Falls to an additional 5 miles of habitat, now used for adult holding, rearing and spawning. A second fish ladder was built over Upper Falls in the early 1950s but is not operational (NMFS 2014a).

Although not considered separate extant viable populations, spring-run Chinook salmon use Antelope Creek, Big Chico Creek, Clear Creek, Cottonwood Creek, and Cow Creek for spawning and rearing in low numbers (Williams et al. 2016). Historically, Antelope Creek supported spring-run Chinook salmon (Reynolds et al. 1993); however, at least until 2009, the operation of two water diversions during irrigation season impeded or prevented the upstream migration of spring-run in low-flow years (Chappell 2009). Spring-run Chinook salmon spawning occurs in approximately 16 miles of the Antelope Creek watershed from upstream of Judd Creek on the North Fork, to Buck's Flat on the South Fork, downstream to approximately Facht Place on the mainstem (Armentrout et al. 1998, NMFS 2014a).

Big Chico Creek also historically supported low numbers of spring-run Chinook salmon that used the creek opportunistically (Reynolds et al. 1993), but a viable population was no longer believed to exist (CH2MHill 1998; Williams et al. 2016). Spring-run Chinook salmon have been observed spawning and rearing in the 9-mile stretch below Iron Canyon in the foothill reach of Big Chico Creek, but passage through Iron Canyon fish ladder has been impeded in low flow years (Chappell 2009).

Since the Dedicated Project Yield Program began providing additional water year-round to increase streamflow since 2001, Clear Creek has been able to provide spawning, rearing, and migration conditions for spring-run Chinook salmon (Giovannetti and Brown 2007). Because the additional streamflow also provided access to fall-run Chinook salmon, the US Fish and Wildlife Service (USFWS) became concerned about the effects of hybridization and redd superimposition between spring-run and fall-run Chinook salmon. In 2003, USFWS installed a temporary picket weir at river mile 8.09 to limit spring-run Chinook salmon to 10 miles of spawning habitat (Newton and Brown 2005). The weir ensures spatial separation of the two runs. The weir is installed in late August and removed in early November to allow access for Central Valley steelhead (Chappell 2009).

In an evaluation of Cottonwood Creek before 1998, spring-run spawning and rearing habitat was found to be limited to the South Fork above the confluence with Maple Creek (CH2M Hill 1998); however, in 2002, some spawning was documented on the North Fork (CH2M Hill 2002). Access on the North Fork is limited by a natural barrier upstream of the Ono Bridge (Chappell

2009). Access on the South Fork is limited by a constructed barrier approximately 3.5 miles upstream of Maple Creek.

The Cow Creek watershed occurs in the Basalt and Porous Lava diversity group, which collectively supported historical winter-run and spring-run Chinook salmon and steelhead populations, presumably because most streams in this area receive large inflows from springs during the summer (NMFS 2014a). Currently, while spring-run Chinook salmon were observed in low numbers in Cow Creek (CH2M Hill 1998), the lack of summer holding pools makes the creek unsuitable for spring-run Chinook salmon (SHN Consulting 2001). The Cow Creek watershed is predominantly rain-fed, and likely only supports spring-run Chinook salmon in years with above-normal rainfall (CH2M Hill 1998).

3.2.3. Sacramento River Winter-Run Chinook Salmon ESU

Sacramento River winter-run Chinook salmon adults enter the San Francisco Bay from November through May and begin their migration in the Sacramento River from December through early August. The winter-run Chinook salmon primarily spawn in the main stem of the Sacramento River between Keswick Dam and the Red Bluff Diversion Dam between late April and mid-August, with a peak in June and July (NMFS 2014a).

3.2.3.1. Status and Distribution

The Sacramento River winter-run Chinook salmon ESU was listed as threatened in 1989 (54 FR 32085). The status was revised to endangered in 1994 (59 FR 440) and confirmed as endangered in 2005 (70 FR 37160) due to continued decline and increased variability of run sizes since the first listing, as well as continuing threats to the population. The endangered listing for the ESU was reaffirmed in 2016 (81 FR 33468). Winter-run Chinook salmon are distinguished from other Chinook salmon populations in the Sacramento River Basin by their unique run timing and genetic characteristics.

Historically, winter-run Chinook salmon spawned in the upper reaches of Sacramento River tributaries, including the McCloud River, Pit River, and Upper Sacramento River (i.e., the Sacramento River above Lake Shasta, also referred to as the Little Sacramento in some sources), and Battle Creek (Table 6). The Shasta, Keswick, and Battle Creek Hydroelectric Dams now block access to historical spawning areas (Figure 12). Despite the loss of historical habitat, winter-run Chinook salmon can take advantage of cool summer water releases downstream of Keswick Dam. Since 1998, the Sacramento River winter-run Chinook salmon have been supplemented and supported by releases of hatchery fish from the Livingston Stone National Fish Hatchery (NMFS 2014a). Rearing habitat, migration corridors, and food web production have been reduced by urban and agricultural development, levee construction and channelization, and water delivery operations (NMFS 2009).

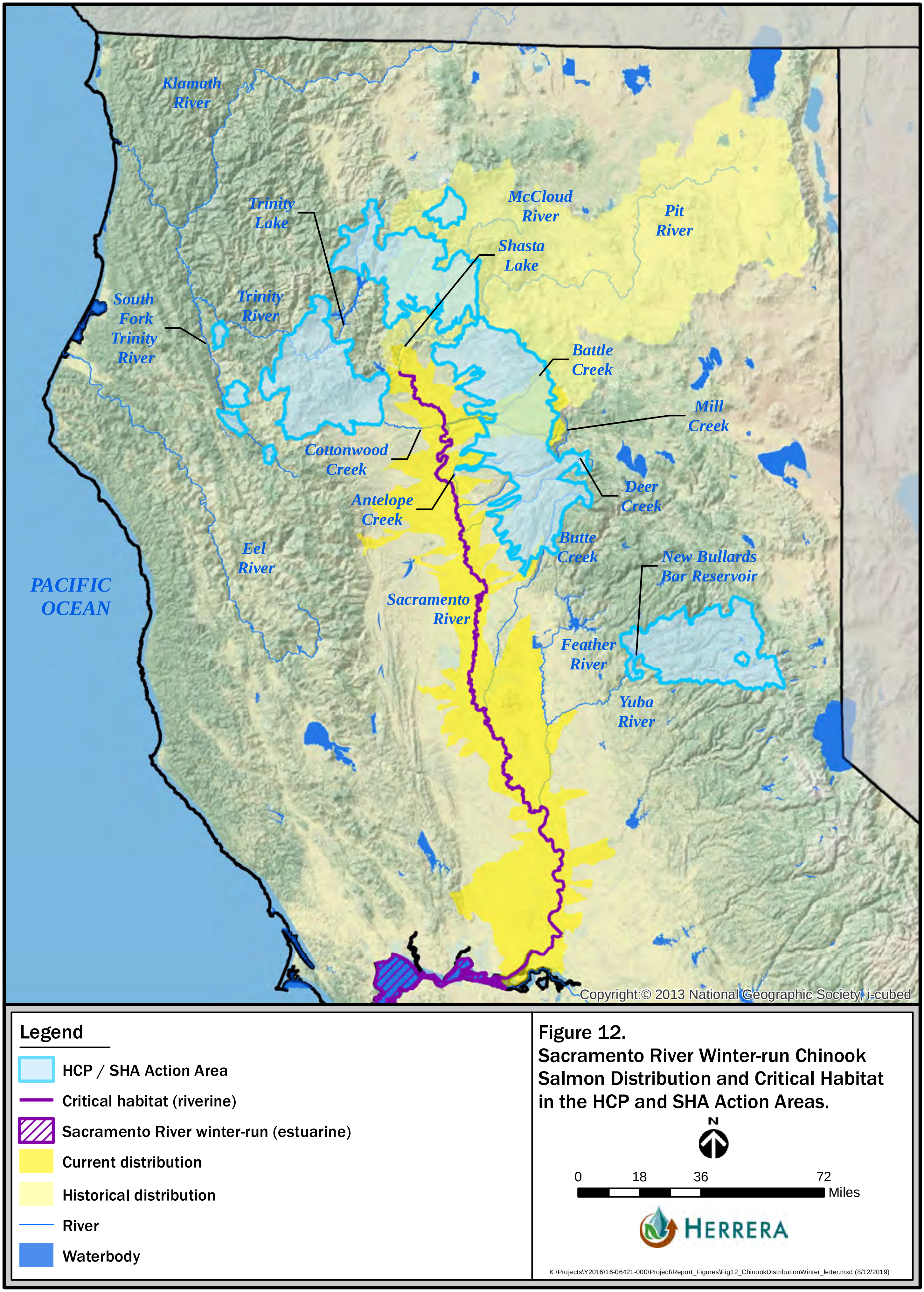


Figure 12.
Sacramento River Winter-run Chinook Salmon Distribution and Critical Habitat in the HCP and SHA Action Areas.

Table 6. Sacramento River Winter-Run Chinook Salmon Current and Historical Presence in the HCP Action Area and SHA Action Area.						
Diversity Group	**River, Creek, or Sub-Reach**	**Historical Population**	**Current Population**	**Population Risk of Extinction**	**HCP Action Area**	**SHA Plan Area**
Basalt and Porous Lava	Battle Creek	Yes	No	NA	No	Yes
	McCloud River	Yes	No	NA	No	Yes
	Pit River	Yes	No	NA	No	Yes
	Upper Sacramento River (above Lake Shasta)	Yes	No	NA	No	Yes

HCP = Habitat Conservation Plan

SHA = Safe Harbor Agreement

NA = not applicable

Source: NMFS 2014a

3.2.3.2. Critical Habitat

Critical habitat for Sacramento River winter-run Chinook salmon was designated in 1993 (58 FR 33212). The associated PBFs are the same as for the Central Valley spring-run Chinook salmon and are described in Section 3.2.2.2 of this HCP.

Like the spring-run Chinook salmon, the Sacramento River winter-run Chinook salmon are affected by forest management and timber operation activities that affect water quality (temperature, suspended sediment, turbidity), hydrology (low flow), and available diverse habitat (large wood recruitment). Although there is no overlap between winter-run Chinook salmon habitat and the HCP Action Area and SHA Action Areas, many of the effects of covered actions extend downstream. The status of water quality, hydrology, and available habitat is described in Section 4.1.5 of this HCP, and the impacts of covered actions are described in Section 5.1.

3.2.3.3. Presence and Habitat Use in the HCP Action Area

Currently, the Sacramento River winter-run Chinook salmon do not use the HCP Action Area for any life history stage. Natural spawning is restricted to the Sacramento River downstream of the Keswick Dam (NMFS 2014a), which is outside the HCP Action Area. That location is precarious because limited supplies of cold water in Lake Shasta can be insufficient for winter-run Chinook salmon in critically dry or consecutively dry years (Reynolds et al. 1993; NMFS 2014a). The Sacramento River winter-run Chinook salmon may use the lower reaches of Battle Creek for rearing and juvenile foraging, but the Eagle Canyon Dam on Battle Creek blocks access to historical spawning grounds. The upper portion of Battle Creek is within the HCP Action Area, above areas where winter-run Chinook salmon may spawn. Battle Creek is subject to a large restoration effort led by the U.S. Bureau of Reclamation for salmonid species including Sacramento River winter-run chinook salmon, spring-run Chinook salmon, and steelhead (<https://www.usbr.gov/mp/battlecreek/index.html>).

The current situation could change if the winter-run Chinook salmon were reintroduced into former habitat above dams on the Sacramento River and tributaries. SPL&T owns forestlands in watersheds where such reintroductions might occur. Proposals to reintroduce winter-run Chinook salmon into streams above several dams in the Sacramento River are discussed in more detail in Section 4.3, *Safe Harbor Agreement Plan Area*, of this HCP.

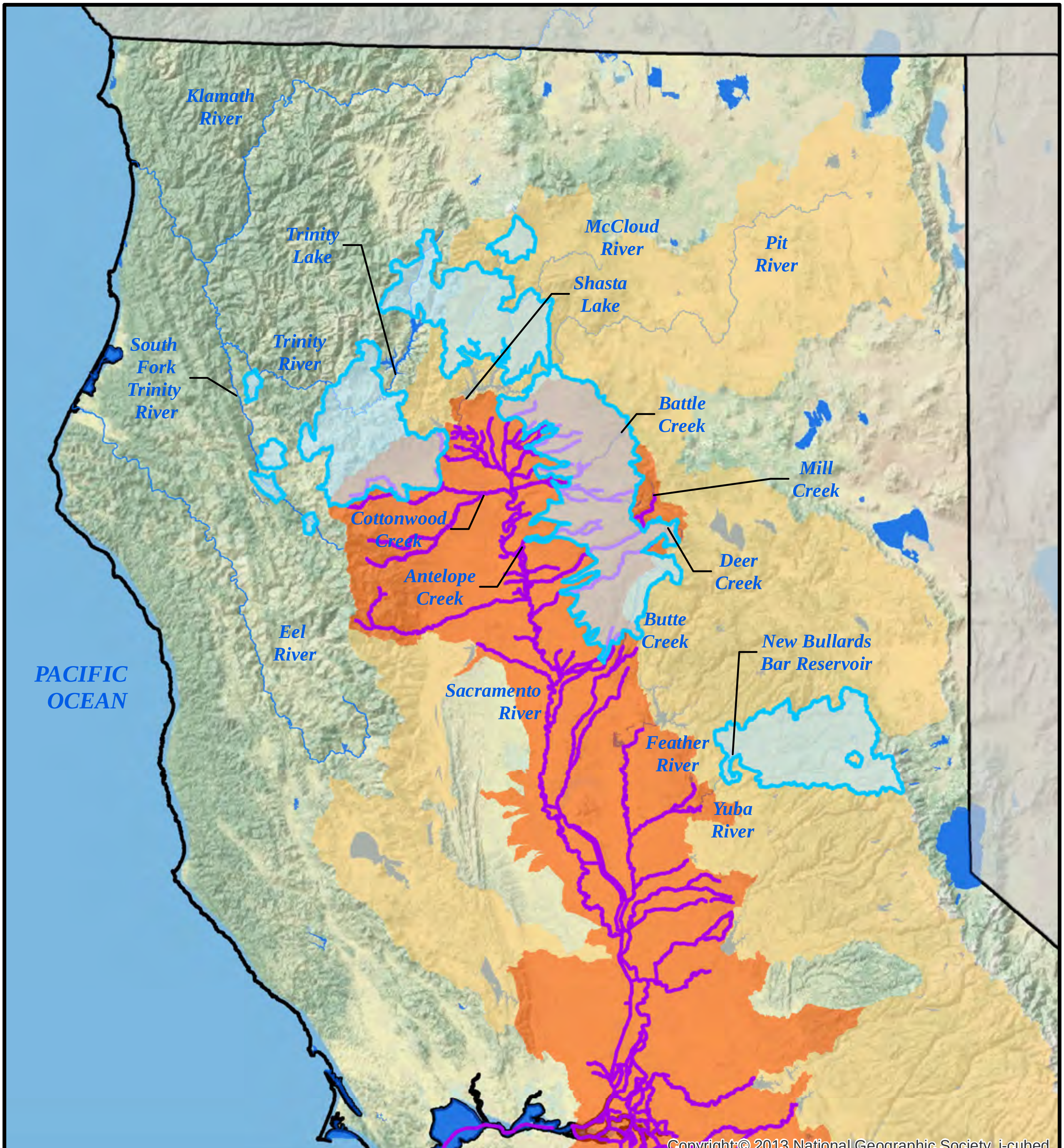
3.2.4. California Central Valley Steelhead DPS

Currently, Central Valley steelhead are considered "ocean-maturing" (i.e., winter) steelhead, although summer steelhead may have been present prior to construction of large dams (Moyle 2002). Ocean maturing steelhead enter fresh water with well-developed gonads and spawn shortly after river entry. Central Valley steelhead enter fresh water from August through April. They hold until flows are high enough in tributaries to enter for spawning (Moyle 2002). Steelhead adults typically spawn from December through April, with peaks from January through March in small streams and tributaries where cool, well oxygenated water is available year-round (McEwan 2001). Depending on water temperature, steelhead eggs may incubate in redds for 1.5 to 4 months before hatching as alevins. Following yolk sac absorption, alevins emerge from the gravel as young juveniles or fry and begin actively feeding (Moyle 2002). The Central Valley steelhead DPS is found throughout the California Central Valley region in accessible portions of the San Joaquin River and Sacramento River watersheds (Figure 13).

3.2.4.1. Status and Distribution

The California Central Valley steelhead DPS was originally listed as threatened in 1998 (63 FR 13347). The listing was revised in 2006 to reaffirm threatened status and include the Coleman National Fish Hatchery and Feather River Hatchery stocks (71 FR 834). The threatened status was based on habitat degradation and destruction, blockage of freshwater habitats, water allocation problems, and interaction with introduced and nonnative stocks. The threatened listing for the ESU was reaffirmed in 2016 (81 FR 33468). The Central Valley steelhead are considered ocean-maturing steelhead, although stream-maturing steelhead may have been present prior to construction of large dams (Moyle 2002).

Prior to dam construction, water development, and watershed perturbations, Central Valley steelhead were distributed throughout the Sacramento and San Joaquin Rivers (McEwan 2001). Steelhead were found from the Upper Sacramento and Pit Rivers, now inaccessible due to Shasta and Keswick Dams, south to the Kings River and, possibly, the Kern River systems, and in both east- and west-side Sacramento River tributaries (Yoshiyama et al. 1996). Existing wild steelhead populations in the Sacramento River basin occur in the Upper Sacramento River below Keswick Dam and its tributaries, including Antelope, Battle, Big Chico, Clear, Cottonwood, Cow, Deer, and Mill Creeks, and the Yuba River (Table 7). Other Sacramento River basin populations may exist in Big Chico and Butte Creeks, and a few wild steelhead are produced in the American and Feather Rivers (McEwan 2001). Hatchery-supported populations of steelhead also occur below dams in the Mokelumne River, American River, Feather River, and Battle Creek.



Legend

- HCP / SHA Action Area
- Critical habitat (riverine)
- Current distribution
- Historical distribution
- River
- Waterbody

Figure 13.
Central Valley Steelhead Distribution and Critical Habitat in the HCP and SHA Action Areas.

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Table 7. Central Valley Steelhead Current and Historical Presence in the HCP Action Area and SHA Action Area.						
Diversity Group	**River, Creek or Sub-Reach**	**Historical Population**	**Current Population**	**Population Risk of Extinction**	**HCP Action Area**	**SHA Action Area**
Basalt and Porous Lava	Battle Creek	Yes	Yes	High	Yes	Yes
	Cow Creek	Yes	Yes	Uncertain	Yes	Yes
	Upper Sacramento River	Yes	No	NA	No	Yes
	McCloud River	Yes	No	NA	No	Yes
	Pit River	Yes	No	NA	No	Yes
Northern Sierra Nevada	North Yuba River (above New Bullards Bar Reservoir)	Yes	No	NA	No	Yes
	Middle Yuba River (above Englebright Reservoir)	Yes	No	NA	No	Yes
	South Yuba River (above Englebright Reservoir)	Yes	No	NA	No	Yes
	Antelope Creek	Yes	Yes	Uncertain	Yes	Yes
	Big Chico Creek	Yes	Yes	Uncertain	Yes	Yes
	Butte Creek	Yes	Yes	Uncertain	No	Yes
	Deer Creek	Yes	Yes	Uncertain	Yes	Yes
	Mill Creek	Yes	Yes	Uncertain	Yes	Yes
Northwestern California	Cottonwood/ Beegum Creek	Yes	Yes	Uncertain	Yes	Yes
	Clear Creek	Yes	Yes	Uncertain	Yes	Yes

HCP = Habitat Conservation Plan

SHA = Safe Harbor Agreement

NA = not applicable

Source: NMFS 2014a

In 1996, NMFS estimated the total population of Central Valley steelhead to be fewer than 10,000 fish, compared to 40,000 in the 1960s (NMFS 2014a). Most of the steelhead populations in the Central Valley, including the Battle Creek population, are supplemented by releases of juvenile hatchery fish (Williams et al. 2016). Population data may be slightly skewed because most of the dedicated monitoring programs in the Central Valley occur on rivers that are stocked annually, except for Mill and Clear Creeks (Williams et al. 2016).

Impassable dams block access to 80 percent of historically available habitat (Figure 13); they also block access to all historical spawning habitat for about 38 percent of historical steelhead populations (Lindley et al. 2006). Restoration actions have provided access to some previously inaccessible areas.

Central Valley steelhead were thought to be extirpated from the San Joaquin River system until monitoring detected small populations of steelhead in the Stanislaus, Mokelumne, Merced, Tuolumne, and Calaveras Rivers, and other streams previously thought to be devoid of steelhead (McEwan 2001). It is uncertain whether *O. mykiss* in those rivers are predominantly resident rainbow trout or anadromous steelhead; presumably, both the anadromous and resident life history forms are present. On the Stanislaus River, small numbers of steelhead smolts were captured in the past in rotary screw traps at Caswell State Park and Oakdale each year since 1995.

3.2.4.2. Presence and Habitat Use in the HCP Action Area

Historical presence and habitat use for Central Valley steelhead is not as well documented as for the Central Valley Chinook salmon (Chappell 2009). Yoshiyama et al. (1996) concluded that steelhead distribution was probably broader than Chinook salmon distribution due to steelhead's greater jumping ability, the timing of upstream migration, and less restrictive preferences for spawning gravels. At least until 2009, the distribution was also largely unknown due to limited monitoring efforts (Chappell 2009). Much of the known steelhead distribution is based on dated Chinook salmon monitoring data (Busby et al. 1996; Low 2007; Chappell 2009).

Within the HCP Action Area, Central Valley steelhead are found in most accessible tributaries of the Sacramento River basin, including but not limited to Antelope, Battle, Big Chico, Clear, Cottonwood, Cow, Deer, and Mill Creeks. A detailed map of the known distribution of spawning and rearing Central Valley steelhead, and overlap of their distribution with SPL&T lands, is provided in Appendix C.

Many of those tributaries include upper reaches within SPL&T ownership. It is possible that naturally spawning populations exist in many other streams but are undetected due to lack of monitoring programs (NMFS 2014a). Access to the Upper Sacramento River is blocked by Keswick Dam, so streams on SPL&T lands in those areas do not currently support anadromous steelhead (although many contain non-anadromous rainbow trout).

There is little information available on steelhead distribution and abundance in Antelope Creek (NMFS 2014a); however, Armentrout et al. (1998) speculated they probably use the same spawning areas as Central Valley spring-run Chinook salmon and may extend beyond that range, as they are smaller in size and can use smaller substrates for spawning. Spring-run Chinook salmon spawning occurs in approximately 16 miles of the Antelope Creek watershed from upstream of Judd Creek on the North Fork, to Buck's Flat on the South Fork, downstream to approximately Facht Place on the mainstem (Armentrout et al. 1998, NMFS 2014a).

In Battle Creek, steelhead can access approximately 14 miles of spawning and rearing habitat in the North Fork and approximately 18 miles in the South Fork. The Battle Creek main stem has several potential passage barriers: Coleman National Fish Hatchery (CNFH) barrier weir, CNFH Intake 3 diversion weir, the Orwick Diversion Dam, and the Coleman Powerhouse tailrace (CalWater 2005). Since 1996 and until at least 2009, the fish ladder on the CNFH barrier weir provided passage above the barriers (Chappell 2009). In the past, steelhead were also reported to pass over the barrier weir and access the upper watershed during periods of high flow (Kier Associates 1999). Central Valley steelhead have been identified as priority species for restoration in Battle Creek above CNFH as part of the Battle Creek Salmon and Steelhead Restoration Project (<https://www.usbr.gov/mp/battlecreek/index.html>) and is considered to have high potential to support a viable independent population (Williams et al. 2016).

Central Valley steelhead occur in Big Chico Creek along with resident trout. The specific steelhead distribution and numbers data are limited due to the lack of species-specific monitoring (Chappell 2009); however, they are believed to use the foothill zone to spawn except in low water years when they spawn in the lower river (NMFS 2014a).

Steelhead spawning habitat along Clear Creek is limited by the amount of suitable spawning substrate. Before 2001, a gravel augmentation project involved injecting small gravel below Whiskeytown Dam to improve steelhead spawning (Giovannetti and Brown 2007). A study of steelhead redds between 2001 and 2007 found 30 to 40 percent of the redds had injection gravel in them, suggesting that the habitat is still limiting spawning, or that the gravel injection is providing more suitable spawning habitat for steelhead (Giovannetti and Brown 2007; Chappell 2009). Williams et al. (2016) stated that steelhead population numbers had increased since first estimated in 2003 but had decreased in the most recent 3 years of analysis.

As of 2009, steelhead used all the forks and the main stem of Cottonwood Creek for spawning, rearing, and migrating (Chappell 2009). However, an evaluation in 2002 indicated low flows restrict access to large portions of those habitats (CH2M Hill 2002). Low flows in years with limited precipitation may limit the availability of habitat given the flashy nature (CH2M Hill 2002).

The main stem of Cow Creek and tributaries including North Cow, Old Cow, and South Cow Creeks provide spawning habitat for steelhead (SHN 2001). Diddy Wells Falls, Clover Creek Falls, and Upper Whitmore Falls create barriers to upstream migration, particularly during normal and low flow years (Chappell 2009). Cow Creek also provides some habitat for rearing steelhead; however, these areas are limited in most years by low flows and high-water temperatures (Chappell 2009).

There is very little information on the distribution and abundance of steelhead on Deer Creek and Mill Creek, but the steelhead range is expected to include and extend beyond the range of spring-run Chinook salmon (Armentrout et al. 1998). In Deer Creek, spring-run Chinook salmon spawning extends from Upper Falls downstream nearly 30 miles (Armentrout et al. 1998). In Mill Creek, spring-run Chinook salmon habitat is only limited by the availability of holding pools and potential low flows combined with high stream gradient in the upper headwater reaches (Armentrout et al. 1998).

3.3. Trinity River Basin

The HCP Action Area in the Trinity River basin is used by several salmonid populations and includes the Lower, Middle, and South Fork Trinity River CalWater Hydrologic Areas (HA's). These HA's include 53 planning watersheds known or potentially occupied by the covered species occurring in the Trinity River basin.

Along the southern Oregon and northern California coast, NMFS identified seven diversity strata (like diversity groups identified for the Central Valley populations) for grouping listed SONCC coho salmon populations with similar geologic and genetic features (Williams et al. 2006; NMFS 2014b). Of the seven diversity strata, only the Interior Trinity diversity strata overlaps with the SPL&T HCP Action Area. The Interior Trinity diversity strata includes the Lower Trinity River, South Fork Trinity River, and Upper Trinity River populations (NMFS 2014b).

SPL&T lands within the SONCC coho salmon range included in the HCP Plan Area include approximately 13.2 stream miles occurring in 13 planning watersheds in the Lower and Middle Trinity River populations. These areas represent approximately 1.7 percent of the total stream miles occurring on SPL&T lands in the Trinity River Basin HCP Plan Area (Appendix E, Table E-2) and approximately 13 percent of all SONCC coho habitat in the Lower and Middle Trinity River populations.

SPL&T lands within the Upper Klamath/Trinity River Chinook salmon ESU and Klamath Mountains Province steelhead DPS range included in the HCP Plan Area contain an additional 47.4 stream miles occurring in 31 planning watersheds in the Lower, South Fork Trinity, and Middle Trinity River populations. These streams represent approximately 6.3 percent of the total stream miles occurring on SPL&T lands in the Trinity River Basin HCP Plan Area, and approximately 14 percent of all Upper Klamath/Trinity River Chinook salmon ESU and Klamath Mountains Province steelhead DPS habitat in the Lower, Middle, and South Fork Trinity River populations. Collectively, covered species on SPL&T lands in the Trinity River Basin occur in 31 planning watersheds included in the Lower, South Fork Trinity, and Middle Trinity River population areas. These planning watersheds include approximately 60.6 stream miles subject to anadromy; or approximately 8 percent of the total stream miles in SPL&T ownership within the Trinity River Basin (Appendix E, Table E-2).

One Chinook salmon ESU, one coho salmon ESU, and one steelhead DPS occur in the Trinity River basin. Neither the Upper Klamath/Trinity River Chinook salmon ESU nor the Klamath Mountains Province steelhead DPS are listed under the federal ESA. The SONCC coho ESU is listed as threatened. The following sections describe the presence and habitat use of those populations in the Interior Trinity diversity strata. The SONCC coho ESU is also listed as threatened under the CESA, and the Upper Klamath-Trinity River spring Chinook salmon ESU has been recently petitioned for listing as endangered under the CESA.

3.3.1. Upper Klamath/Trinity River Chinook Salmon ESU

The Upper Klamath/Trinity River Chinook salmon ESU includes fall- and spring-run Chinook salmon in the Klamath River and Trinity River basins (Figure 14).

3.3.1.1. Status and Distribution

The Upper Klamath/Trinity River Chinook salmon ESU was proposed for federal listing in 1998, but NMFS determined listing to be unwarranted (63 FR 11482). Salmon in the ESU exhibit both stream-type and ocean-type life history strategies. Genetic differences are not regarded as substantial enough to separate spring-run and fall-run into separate ESUs (Myers et al. 1998).

Within the Klamath River basin, Chinook salmon populations have been reduced by 95 percent from historical levels due to dams, irrigation diversions, mining, timber harvest, and floods. Fall- and spring-run Chinook salmon spawn and rear in the Trinity River and in the Klamath River upstream of the mouth of the Trinity River.

In the Trinity River basin, Chinook salmon spawn in the main stem and south fork (with their upstream distribution limited by Lewiston Dam); at the Trinity River Hatchery below Lewiston Dam; and in the North Fork, the South Fork, Hayfork Creek, New River, Mill Creek, and Canyon Creek. Historically, most spawning occurred in the main stem between the North Fork Trinity River and Ramshorn Creek. Portions of that area are now blocked by Trinity and Lewiston Dams. Spawning in the main stem now occurs primarily above Cedar Flat and in downstream tributaries, as well as in the lower 2 miles of Hayfork Creek (CDFW 2015d). In the Trinity River, the distribution of redds is highly variable. The reaches closest to the Trinity River Hatchery support substantial spawning.

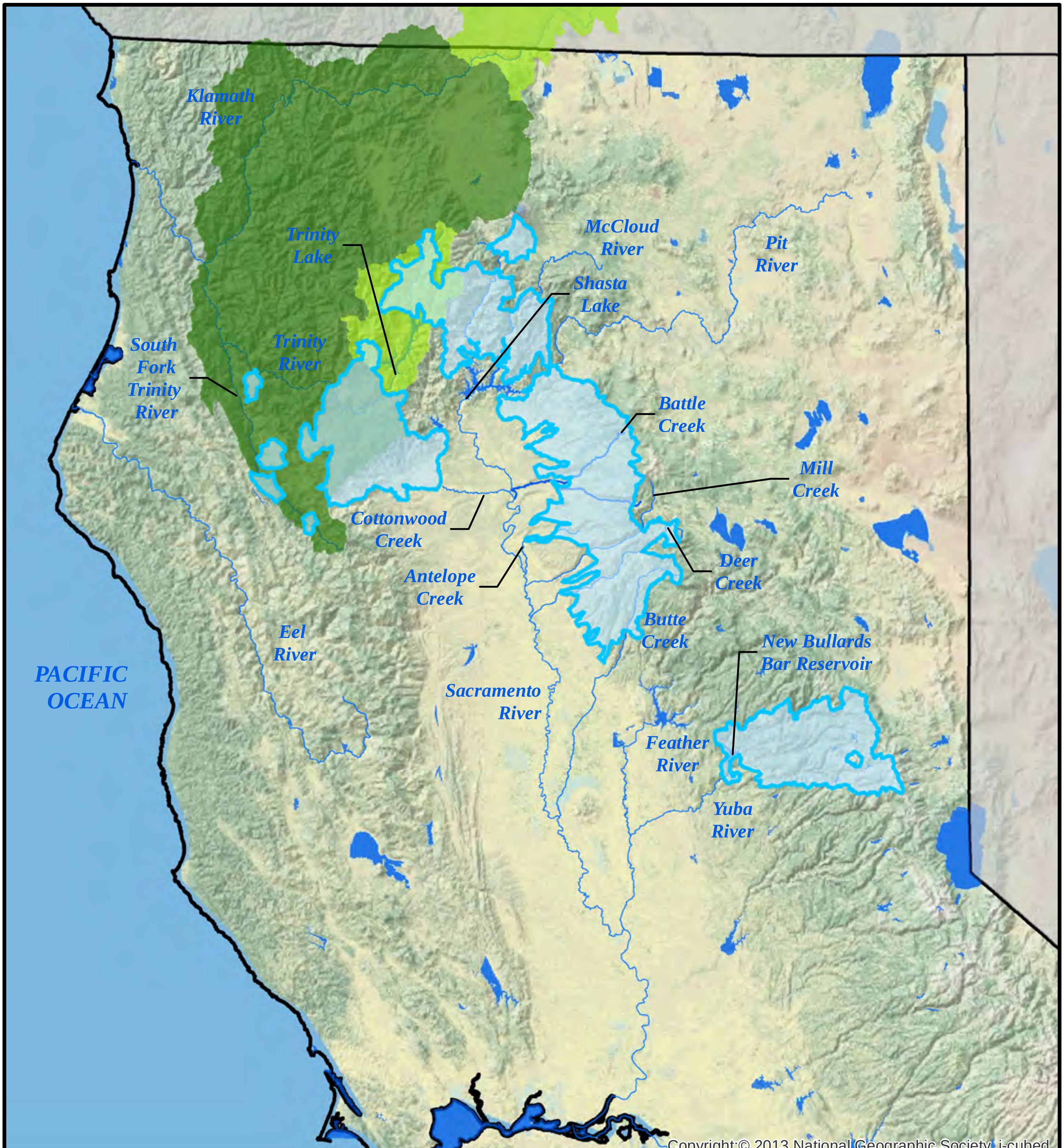
In the Klamath River basin, Chinook salmon formerly ascended into Upper Klamath Lake, Oregon, to spawn in the major tributaries to the lake (Williamson, Sprague, and Wood Rivers), but access to the lake was blocked by Copco Dam, built in 1917. Currently, Chinook salmon are known to spawn in the main stem Klamath River below Iron Gate Dam; at Iron Gate Hatchery below Iron Gate Dam; and in Bogus Creek, Shasta River, Scott River, Indian Creek, Elk Creek, Clear Creek, Salmon River, Bluff Creek, Blue Creek, and the lower reaches of some of the other smaller tributaries to the main stem river (CDFW 2015d).

3.3.1.2. Critical Habitat

The Upper Klamath/Trinity River Chinook salmon ESU is not listed under the ESA. Therefore, no critical habitat has been designated.

3.3.1.3. Presence and Habitat Use in the HCP Action Area

Historically, most spawning occurred between the North Fork Trinity River and Ramshorn Creek (above current Trinity Reservoir). Spawning now occurs primarily above Cedar Flat, and in



Legend

- HCP / SHA Action Area
- Current distribution
- Historical distribution
- River
- Waterbody

Figure 14.
Upper Klamath/Trinity River Chinook Salmon Distribution in the HCP and SHA Action Areas.

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K:\Projects\Y2016\16-06421-000\Project\Report_Figures\Fig14_UpKlamathTrinityChinookDistr_letter.mxd (8/12/2019) downstream tributaries and the main stem Trinity River, as well as in the lower 2 miles of Hayfork Creek (CDFW 2015d), which is outside the HCP Plan Area. In the Trinity River, the distribution of redds is highly variable. The reaches closest to the Trinity River Hatchery (located below the Lewiston Dam) support substantial spawning.

Within the Action Area, Upper Klamath/Trinity River Chinook salmon spawn in the main stem and South Fork Trinity River (with their upstream distribution limited by Lewiston Dam), and in Hayfork Creek (Myers et al. 1998). The HCP Plan Area includes a portion of the North Fork Hayfork Creek watershed.

3.3.2. Southern Oregon/Northern California Coast Coho ESU

The SONCC coho salmon ESU is separated into seven diversity strata and 40 populations, each of which supports several independent coho populations (NMFS 2016). The Interior Trinity River diversity stratum of SONCC coho salmon includes portions of the HCP Action Area (Figure 15). There is some diversity of life history strategies in the Trinity River based on data of run timing and outmigration, but the information is not well documented (NMFS 2014b). Coho salmon enter the Trinity River between September and November; spawning in the river and tributaries continues into January (CDFG 2009). Dispersing of age 0+ coho salmon and outmigration of age 1+ coho salmon occurs over several months between March and September (CDFG 2009).

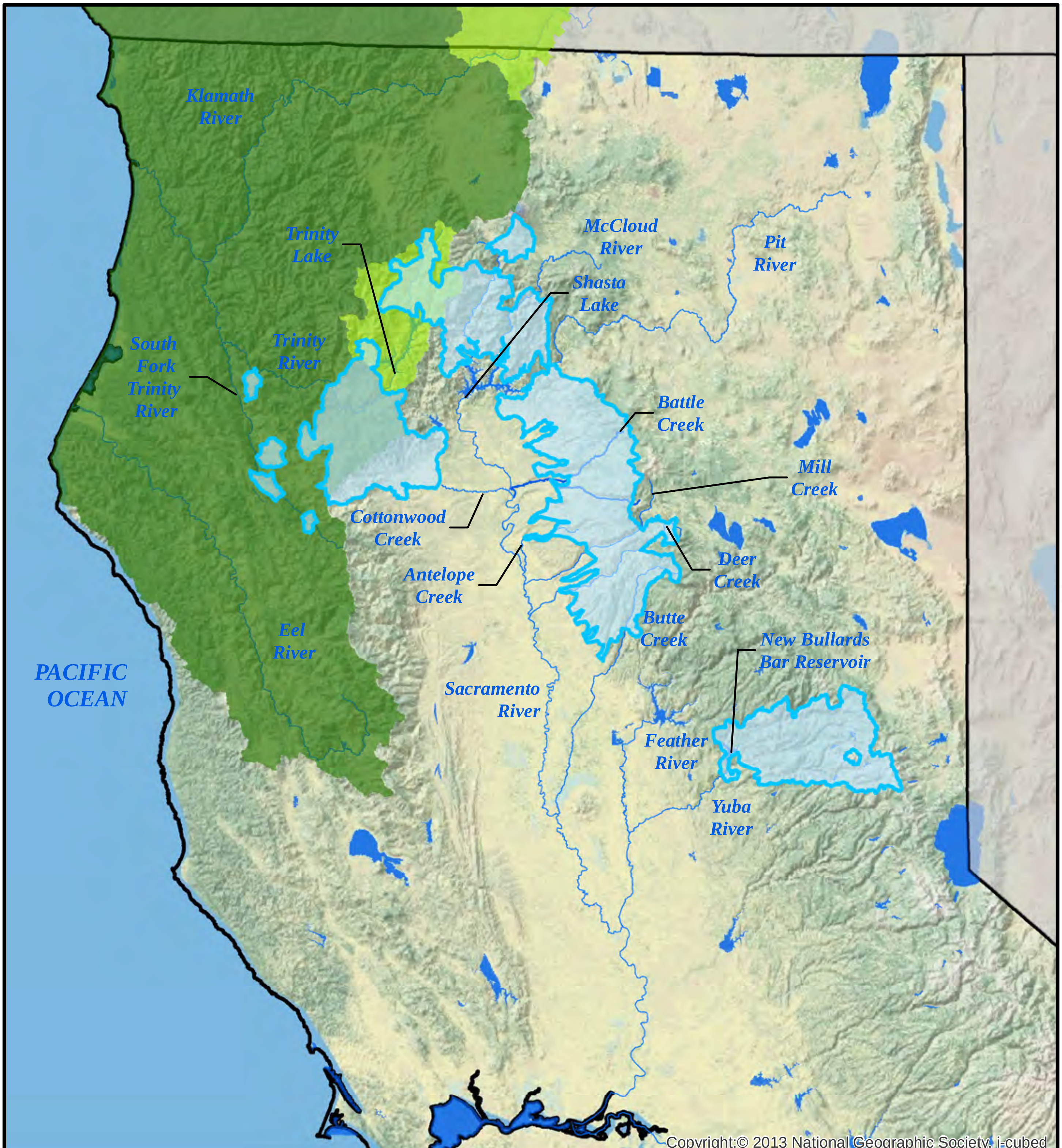
3.3.2.1. Status and Distribution

The SONCC coho salmon ESU was listed as threatened in 1997 (62 FR 24588), and the listing was reaffirmed in 2005 (70 FR 37160) and 2016 (81 FR 33468). Populations of coho salmon once ranged across the western part of North America from the coastal river basins of Alaska to interior areas of Washington, and probably inhabited most coastal streams in Washington, Oregon, and northern and central California. The Interior Trinity River diversity stratum includes populations in the Lower Trinity River, Upper Trinity River, and South Fork Trinity River (Table 8).

In the Lower Trinity River, several tributaries are known to support coho salmon spawning and rearing (Appendix B). Given the habitat quality, it can be inferred that coho salmon were historically widely distributed in tributaries throughout the Lower Trinity River sub-basin, but it was likely rare for coho salmon to spawn in the main stem Lower Trinity River (NMFS 2014b).

Coho salmon are thought to have been well distributed throughout the Upper Trinity River sub-basin, with the highest concentrations in the lower gradient tributaries. Accurate estimates of coho salmon production below Lewiston prior to dam construction are not available; however, presence was documented prior to the construction of the Trinity River Diversion (NMFS 2014b). The current coho salmon distribution has been confirmed in a variety of streams in the Upper Trinity River sub-basin (Table 8).

Coho salmon are limited in their distribution in the South Fork Trinity River basin and occur only in the main stem South Fork Trinity River (up to Butter Creek), Butter Creek, Hayfork Creek (up to



Legend

- HCP / SHA Action Area
- Current distribution
- Historical distribution
- River
- Waterbody

Figure 15.
Southern Oregon/Northern California Coast Coho Salmon Distribution in the HCP and SHA Action Areas.

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Corral Creek), Eltapom Creek, Olsen Creek, and Madden Creek (NMFS 2014b). These streams are outside the HCP and SHA Action Areas. Although there are no known barriers to migration for coho salmon in the South Fork Trinity River, coho salmon are not observed upstream of Butter Creek (NMFS 2014b). It is likely that habitat conditions, such as high-water temperatures and low dissolved oxygen, currently limit distribution of coho salmon in the South Fork Trinity River sub-basin.

Table 8. SONCC Coho Salmon Current and Historical Presence in the HCP Action Area and SHA Action Area.

Diversity Strata	River, Creek, or Sub-Area	Current Population	HCP Action Area	SHA Action Area
Interior Trinity	Barker Creek	Yes	Yes	No
	Browns Creek[1]	Yes	Yes	No
	Little Browns Creek[1]	Yes	Yes	No
	Cedar Creek	Yes	Yes	No
	Deadwood Creek[1]	Yes	Yes	No
	Dutch Creek	Yes	Yes	No
	East Fork Trinity (above Trinity Reservoir)	No	No	Yes
	Eltapom Creek	Yes	Yes	No
	Grass Valley Creek	Yes	Yes	No
	Hayfork Creek	Yes	Yes	No
	Indian Creek[1]	Yes	Yes	No
	Reading Creek[1]	Yes	Yes	No
	Rush Creek[1]	Yes	Yes	No
	Salt Creek	Yes	Yes	No
	Stewarts Fork	No	No	Yes
	Trinity River (main stem)[1]	Yes	Yes	No
	Trinity River (main stem above Trinity Reservoir)	No	Yes	Yes
	South Fork Trinity River	Yes	Yes	No
	Weaver Creek	Yes	Yes	No
	East Weaver Creek	Yes	Yes	No
	West Weaver Creek	Yes	Yes	No

Source: NMFS (2014b)

[1] Includes planning watersheds within HCP Plan Area

3.3.2.2. *Critical Habitat*

NMFS designated critical habitat for SONCC coho salmon in 1999 (64 FR 24049), which includes all river reaches accessible to listed coho salmon from Cape Blanco, Oregon, to Punta Gorda, California. The Trinity River, South Fork Trinity River, and accessible tributaries all fall within the critical habitat designation. As defined in the designation, accessible reaches include those that can be reached by any life stage. Thus, several creeks that are tributary to the Trinity River within the HCP Action Area are within designated critical habitat for SONCC coho salmon.

Key emerging or ongoing habitat concerns that contribute to the decline in SONCC coho salmon numbers include insufficient instream flow, unsuitable water temperature, and insufficient winter and summer rearing habitat (NMFS 2016). Like spring-run Chinook salmon, the SONCC coho salmon may be limited by forest management and timber operation activities that affect water quality (suspended sediment, turbidity, temperature), hydrology (low flow), and available diverse habitat (large wood recruitment). The status of water quality and hydrology of the HCP Action Area is described in Section 4.1.5, and the impacts of covered actions are described in Section 5.

3.3.2.3. Presence and Habitat Use in the HCP Action Area

Within the HCP Action Area, SONCC populations are found in the Upper and South Fork Trinity River sub-basins. Appendix C includes a detailed map of the known distribution of spawning and rearing coho salmon in the Trinity River and its tributaries, and their overlap with SPL&T lands.

Approximately 2 miles of the Lower Trinity River is located within the downstream end of the HCP Action Area. Coho salmon have been observed spawning and rearing in Mill Creek, Horse Linto Creek, Tish Tang Creek, and Sharber-Peckham Creek (NMFS 2014b). Coho salmon presence has also been documented in Manzanita, Big French, Cedar, Supply, Campbell, and Hostler Creeks, and East Fork New River (NMFS 2014b).

Currently, in the Upper Trinity River population area, coho salmon are known to spawn in the main stem Trinity River in the Douglas City/Weaverville area, where several tributaries originating from SPL&T lands (Indian, Reading, Browns, Little Browns, Grass Valley, and Rush Creeks) join the river (NMFS 2014b). Those creeks are used by coho salmon to some degree and are sometimes accessible to both adult and juvenile coho salmon, but population estimates for individual tributaries are unavailable (NMFS 2014b). Coho salmon are also found in several streams within the HCP Action Area in the Upper Trinity River sub-basin, including Sidney Gulch, Deadwood Creek, Weaver Creek, East Weaver Creek, and West Weaver Creek. In the main stem Trinity River, rearing juvenile coho salmon occur in highest densities within the first 7 miles downstream of Lewiston Dam, and none use the main stem downstream of river mile 101 (NMFS 2014b). Further upstream on the main stem, coho salmon access to the Upper Trinity River is blocked by the Lewiston and Trinity Dams. Therefore, there is no coho salmon access to tributaries emanating from SPL&T lands in that area. Areas above Lewiston and Trinity Dams are discussed in the SHA but not included in this HCP.

In the main stem South Fork Trinity River, coho salmon are limited in their distribution and occur only in the South Fork Trinity River, Hayfork Creek, and Rattlesnake Creek. Although there are no known passage barriers on the South Fork Trinity River, coho salmon habitat use upstream of Rattlesnake Creek and the upper reaches of the South Fork Trinity River is limited, likely due to habitat conditions such as high seasonal water temperatures and low dissolved oxygen. There are no historical accounts of coho salmon in the Hayfork Valley, which is downstream from SPL&T lands in the Hayfork Creek watershed (NMFS 2014b).

3.3.3. Klamath Mountains Province Steelhead DPS

The Klamath Mountains Province steelhead ESU consists of three principal runs distinguished by migration timing: the Klamath Mountains Province winter-run (ocean-maturing) steelhead, the Klamath Mountains Province fall-run (stream-maturing) steelhead, and the Klamath Mountains Province summer-run (stream-maturing) steelhead (Figure 16). Although there is some degree of genetic differentiation among steelhead in the three runs, genetic analysis does not support the hypothesis that winter-, fall-, and summer-run steelhead populations are separate, independent populations. Therefore, all life history variations of the Klamath Mountains Province ESU are considered a single population source (CDFW 2015a).

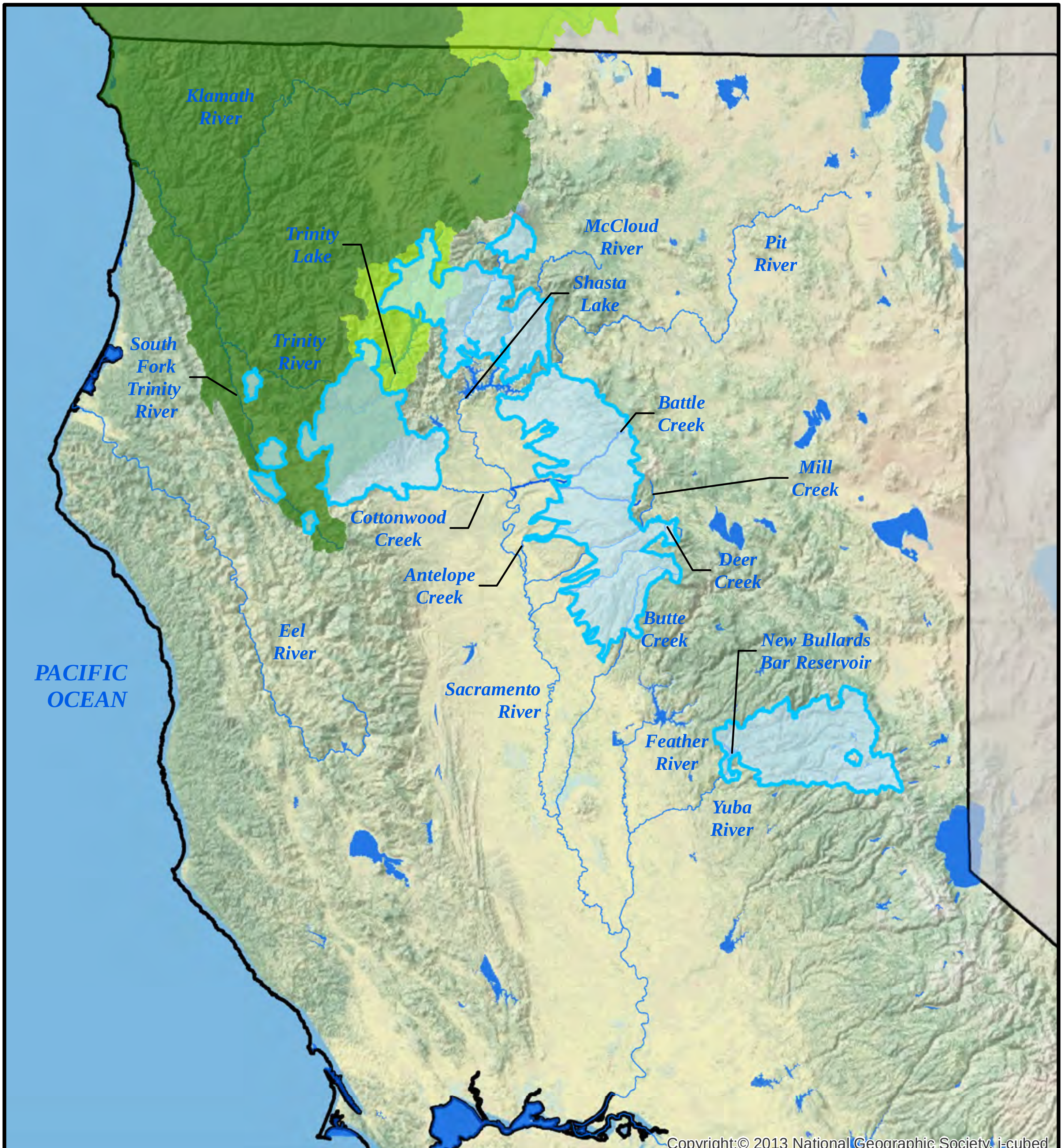
3.3.3.1. Status and Distribution

The Klamath Mountains Province steelhead DPS was initially proposed for listing as threatened in 1995 (60 FR 14253), but NMFS determined the listing was not warranted. NMFS again proposed to list the DPS in 2001 (66 FR 9808) and again determined it did not warrant listing as threatened or endangered (66 FR 17845). The ESU is listed as a species of High Concern by CDFW and appears to be undergoing a long-term decline (Moyle et al. 2015).

Klamath Mountains Province steelhead are found in the Klamath/Trinity River basin and streams north to the Elk River, Oregon, including the Smith River (California) and Rogue River (Oregon). In the Klamath River, the upstream limit of steelhead migration is Iron Gate Dam near the Oregon border. The historical range included tributaries to Upper Klamath Lake in Oregon (Hamilton et al. 2005). Lewiston Dam blocks access to over 105 miles of streams in the upper water shed of the Trinity River (Moyle et al. 2008).

Given that much of the habitat for the Klamath Mountains Province summer steelhead is blocked by dams, it is likely that the summer steelhead in the Klamath River basin are only a fraction of their original numbers (CDFW 2015a). Two hatcheries, the Iron Gate Hatchery and Trinity River Hatchery, supplement existing populations in the Klamath Mountains Province ESU. While most of the brood stock returning to the Iron Gate Hatchery are from the Klamath River, some eggs were imported from the Trinity River Hatchery and from the Cowlitz Trout Hatchery (Washington) in the late 1960s (Busby et al. 1994). The Trinity River Hatchery has also used imported eggs from the Iron Gate Hatchery, the Sacramento River and Eel River basins, the Willamette River in Oregon, and the Washougal River in Washington (Busby et al. 1994).

The fall steelhead are largely a stream-maturing run that have been classified as summer-run steelhead by NMFS (Busby et al. 1994, 1996). Stream-maturing forms (fall- and summer-runs) are more limited in distribution and face a higher likelihood of near-term extinction than ocean-maturing forms (winter-run steelhead) (CDFW 2015a). Fall-run steelhead use the Lower Trinity River for spawning and rearing. In the main stem Trinity River, suitable water temperatures



Legend

- HCP / SHA Action Area
- Current distribution
- Historical distribution
- River
- Waterbody

Figure 16.
Klamath Mountains Province Steelhead Distribution in the HCP and SHA Action Areas.

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K:\Projects\Y2016\16-06421-000\Project\Report_Figures\Fig16_SteelheadDistributionKlamathMtns_letter.mxd (8/12/2019) downstream of Lewiston Dam provide habitat for summer steelhead, but their current abundance is unknown. There is no historical information on summer steelhead in the South Fork Trinity River, and all current counts are combined with "half-pounder" steelhead (i.e., immature summer steelhead (CDFW 2015a).

3.3.3.2. Critical Habitat

The Klamath Mountains Province steelhead DPS is not listed under the ESA. Therefore, no critical habitat has been designated.

3.3.3.3. Presence and Habitat Use in the HCP Action Area

Details of the abundance and distribution of Klamath Mountains Province steelhead throughout the Trinity River basin is largely unknown. The Klamath Mountains Province steelhead probably occur as spawners and juveniles in most accessible Trinity River tributaries with suitable water quality, including those in the HCP Action Area.

For the purposes of this HCP, the geographic extent of Klamath Mountains Province steelhead DPS is assumed to include all Class I streams as defined in the CFPRs in all planning watersheds within the HCP Action Area. This area includes all streams considered currently accessible and otherwise restorable for these covered species. Using the Class I stream designation represents a conservative estimate of anadromy in the HCP Plan Area, as this designation is based on fish presence, regardless of anadromous or resident status.

4. ENVIRONMENTAL BASELINE AND COVERED SPECIES

Understanding baseline environmental conditions and species ecology in the Plan Area and Action Area is important for analyzing the effects of activities on covered species, and in addressing permit requirements under Section 10 of the ESA. The baseline has been shaped by geology and climate, and climate change is modifying historical precipitation and weather patterns. Existing land use both on and adjacent to the Plan Area and Action Area have degraded the baseline. Conservation strategies and mitigation are described in Section 6 of this HCP.

The environmental baseline conditions on SPL&T lands in the HCP and SHA Plan/Action Areas are influenced by SPI timberland management activities and the CFPRs. Sections 4.1 and 4.2 describe baseline conditions in the Action Area for the Section 10(a)(1)(B) ITP. Section 4.3 describes baseline conditions in the Action area for Section 10(a)(1)(A) ESP.

4.1. Sacramento Basin HCP Action Area

This section provides baseline information for covered species and Core watersheds in the Sacramento Basin portion of the HCP Action Area. This section includes descriptions of common environmental conditions, techniques to monitor and assess ownership road conditions, the relationships of SPL&T lands and the limits of anadromy, and other environmental conditions present in these watersheds. This section uses recent population information and NMFS Recovery Plan (NMFS 2014a) classifications to summarize priority watersheds.

4.1.1. Geology

North of the Sierra Nevada, the Cascade Range creates the northeastern boundary of the HCP Action Area. The Cascade Range, which extends from southern British Columbia to northern California, is a chain of volcanic cones created through tectonic activity (Tehama County Resource Conservation District 2010). The Tuscan Formation of the Pliocene age, primarily consisting of ancient volcanic mudflows, dominates the geology of the watersheds of the northeastern California tributaries of the Sacramento River (Armentrout et al. 1998). Geologic diversity is also supplied by flows of igneous volcanic rock that overlay the Tuscan Formation to form the Mill and Lost Creek Plateaus. Glacial processes shaped some of the higher elevation landforms (Armentrout et al. 1998).

The Basalt and Porous Lava diversity group and the Northern Sierra Nevada diversity group share similar geology and topography (California Geological Survey 2010). The units are primarily in the Tuscan Formation and consist of long, generally parallel streams incised into relatively mobile, volcanic deposits. As waters move from the steep mountainous region to the valley, they form broad and overlapping alluvial fans where erosion from the mountains has been deposited to create separate and distinct soil profiles (Tehama County Resource Conservation District 2010).

On the western portions of the Sacramento River valley in the Northwestern California diversity group, mountains and foothills of the Coast Range and Klamath Mountains Provinces form an 80-mile-wide boundary between the ocean and valley. The mountains consist of various highly erosive formations of poorly lithified, marine sedimentary rocks, in addition to the decomposed granitic soils of the Shasta Bally Batholith (California Geological Survey 2010). Large, active landslides contribute to the sediment discharge in the area and are caused by relatively high rainfall amounts and poorly composed bedrock.

4.1.2. Watershed Conditions

Recent assessments of watershed conditions that pose continuing threats to ESA-listed fish in the Sacramento River basin (NMFS 2014a; Williams et al. 2016) include but are not limited to low flows; passage issues and diversions in reaches below forested regions; road density and stream crossings; current and past timber harvests; and wildfires. Appendix D, Table D-1 provides information from the HCP Plan area summarizing the number of road miles, stream crossings and past harvest within planning watersheds encompassing SPL&T lands.

In planning watersheds where road inventories have been conducted, Table D-1 presents additional information showing the number of connected sites and percentage of road miles connected to stream channels. This information relates to the potential for sediment production from existing roads affecting listed fish and provides a correlation between the planning watersheds with permanent monitoring stations and other planning watershed data. Appendix D, Table D-1 includes watershed conditions data for Judd Creek and Upper San Antonio Creek which both have long-term monitoring and planning watershed condition data. These two monitoring watersheds show disconnection values of approximately 76 and 90 percent, with approximately 5 and 13 percent of road-related sediment delivering to streams. The remaining planning watersheds in which READI has been completed show disconnection values ranging from approximately 60 to 99 percent, with an average of 56 percent. Road related sediment contributing to streams ranges from approximately 3 to 23 percent, and averages 16 percent. The potential sediment production values are slightly greater in the planning than monitoring watersheds; however, the average value in the planning watersheds is near the range in the monitoring watersheds and suggests comparable results overall. Additional READI model data from un-surveyed planning watersheds and additional monitoring watersheds included to support HCP/SHA monitoring (i.e., greater sample size) will strengthen the correlation between monitoring and other planning watersheds.

Appendix D, Table D-2 shows the planning watersheds (and streams included in Table D-1) and provides road mile and stream crossing summary information relative to the amount of streams subject to anadromy. These summaries show 11 of 79 of planning watersheds in the Sacramento River basin portion of the HCP Action Area are subject to anadromy, approximately 15 miles of anadromous stream reaches occur on SPL&T lands in these planning watersheds, and 3.5 road miles and four stream crossings occur in these anadromous stream reaches. Additionally, of the four stream crossings occurring in anadromous stream reaches, only two consist of wet crossings (fords).

Precipitation in the Sacramento River basin varies from 25 to 80 inches per year over the range in elevations in the region (approximately 180 to 8,200 feet) (Armentrout et al. 1998; Big Chico Creek Watershed Alliance 2017). Flows are lowest in September, increase through October and November, and decrease again in late spring and summer (Kondolf 2001). Peak flows from the watershed are dominated by rain-on-snow events, with most flow events occurring during winter months (December through February) when snow is present in the transient zone (above approximately 3,000 feet in elevation). Earlier season peaks in flow (September through November) are most likely rain events with little snow influence. Later peaks (mid-March through May) are mostly likely snowmelt-generated peaks (NMFS 2014a).

4.1.3. Historical and Existing Land Management

Historically, fire has helped sustain natural forest communities and influenced the composition and structure of forests in the watersheds prior to European settlement. The advent of fire suppression early in the 1900s, together with the reduction of fire ignitions by native peoples, have resulted in fire frequencies much different than those present prior to European settlement (Armentrout et al. 1989). Intense wildfires remove groundcover and large wood recruitment near streams, and they increase erosion and peak flows until vegetation can recover (Roby and Azuma 1995). In recent years, five watersheds in the HCP Action Area have been the sites of large fires (greater than 10 square miles) (Appendix D, Table D-1), with intense fires predominating. The combination of increasing air temperatures, decreasing precipitation, and fire suppression practices have increased the frequency and severity of wildfires in the Central Valley of California (Westerling and Bryant 2008). In 2017, the Central Valley watersheds within SPL&T covered lands experienced 16 wildfires that burned 1.45 square miles (928 acres) of land (CAL FIRE 2017).

Road construction and operation has long been understood to be a major factor in water quality degradation (Lieberman and Hoover 1948). More recent research has found logging roads can be a source of landslides and elevated turbidity (Keppeler et al. 2008). Sections 4.3.4.2 and 4.4.2 of this HCP provide additional detail on sediment delivery related to roads, landings, and skid trails.

4.1.4. Water Quality

Water quality conditions are described for portions of the Sacramento River basin, as available; however, most available data are from areas well downstream of the HCP Action Area. Available data from locations upstream of salmonid occupancy relevant to baseline conditions and are included in the analysis as described in the following watershed sections. Additional monitoring efforts are suggested and will be implemented as part of the HCP conservation strategy (see Section 6.6) to establish a baseline and inform adaptive management measures and actions (Section 6.7).

4.1.5. Temperature

SPI monitors water temperature at two water quality monitoring stations that are representative of SPI management in the HCP Action Area (Upper San Antonio Creek and Judd Creek) and one in the SHA Action Area (Hazel Creek), as well as several stations outside the HCP and SHA Action Areas (Figure 17). Monthly average daily water temperatures for water years 2008 to 2017 were similar for each station and ranged from -1°C in the winter to 18°C in the summer (Appendix F). Monthly maximum daily water temperatures were slightly higher, ranging from 0°C in the winter to 21°C in the summer (Appendix F).

4.1.6. Suspended Sediment

In water quality parameters, suspended sediment refers to the particulate matter moved by water and is typically measured as milligrams of particulate matter to liters of water (mg/L). Although the watersheds within the Sacramento River basin HCP Action Area have not been sampled for suspended sediment for impaired watershed studies (California Environmental Protection Agency 2017), several watersheds have evidence of increased sedimentation. The Deer Creek and Mill Creek watersheds had increased sedimentation due to road construction and clearcutting within the HCP Action Area in the past (Armentrout et al. 1998). More recently, several timber harvest roads have been decommissioned, reducing the sediment loads from previously recorded levels (NMFS 2014a). The Northwestern California diversity group, including the Cottonwood Creek and Clear Creek watersheds, has large quantities of fine sediment in the river system because of historical gold mining activity that used dredge, hydraulic, and ground-sluicing techniques; and due to removal of the McCormick-Saeltzer Dam on Clear Creek (NMFS 2014a).

4.1.7. Turbidity

Turbidity, the measure of cloudiness of a liquid by organic matter or inorganic particles, is quantified in nephelometric turbidity units (NTU). Based on criteria developed by the California Regional Water Quality Control Board, the increases in turbidity attributable to controllable water quality factors shall not exceed the following limits (CRWQCB 2016):

- Where natural turbidity is between 0 and 5 NTU, increases shall not exceed 1 NTU.
- Where natural turbidity is between 5 and 50 NTU, increases shall not exceed 20 percent.
- Where natural turbidity is between 50 and 100 NTU, increases shall not exceed 10 NTU.

Legend

- Water quality monitoring location
- HCP Action Area
- SHA Action Area
- Basin boundary
- River

Figure 17.
SPI Water Quality Monitoring Station Locations.

N

0 15 30 60 Mile

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SPI monitors turbidity at one water quality monitoring station in the HCP Action Area and one in the SHA Action Area. An additional monitoring station is located outside both plan areas (San Antonio Creek), Average daily NTU is generally very low (0 to 10 NTU); however, several measurements in 2016 and 2017 exceeded 10 NTU and reached as high as 35 NTU (Appendix F). Average daily maximum NTU is usually less than 20 NTU, but values as high as approximately 110 NTU occurred in 2017 (Appendix F).

4.1.8. Aquatic Habitat

Aquatic habitat in the Sacramento River basin has been degraded by dam construction and operation, water diversions, livestock grazing, mining, and development; particularly in the lower watershed reaches. The HCP Action Areas occur in the upper reaches and headwaters, which typically provide high quality fish habitat compared to lower watershed reaches subject to greater levels of these impacts. See NMFS (2014a) for descriptions of HCP watersheds downstream of SPL&T ownership. General information on these lower reaches that may impact fish accessibility to the HCP Action Area are summarized below.

4.1.9. Riparian Function

Riparian corridors serve multiple purposes and functions for protecting streams. They preserve water quality by creating shade to maintain cooler water temperatures and filtering sediment from runoff before it enters streams and rivers; protect stream banks from erosion; provide a storage area for flood waters; and provide food and habitat for fish and wildlife. The purpose and function of the riparian corridors is to provide habitat functions in fish bearing streams. Habitat functions include hardwood canopy retention to provide detritus as a food source for benthic macroinvertebrates, which in turn become a food source for fish. Large diameter trees maintained near the watercourses provide potential LWD, thus increasing stream complexity, pool formation, and cover for salmonids. Maintaining cold-water inputs from springs and smaller order watercourses (accomplished using CFPRs canopy retention requirements) provide temperature modifications for the larger, wider fish-bearing stream channels.

To protect riparian conditions and function within the areas of timber harvest on private lands, CFPRs were established in the early 1970s. Initial rules focused on reducing activities within near proximity to streams and retaining live canopy to produce shade. With the establishment of the Threatened and Impaired Watershed Rules in the late 1990s and the ASP rules in 2010, the goals for improved riparian corridors include higher canopy closure, greater numbers of large diameter trees, greater retention of high value wildlife features and less exposed soil in the vicinity of watercourses. CFPR requirements for assessing post-harvest riparian corridor conditions include canopy closures averaging 70 percent, average diameter of overstory trees exceeding 24 inches, no cut core areas of 30 feet on each side of a fish bearing stream, an inner zone of 70 feet within minimal harvest occurring and soil stabilization required when greater than 100 square feet of exposed soil occurs as part of CEQA approved projects.

Riparian corridors within SPL&T lands meet the CFPRs requirements and are regularly verified during post-harvest inspections. Additionally, riparian corridors in portions of the HCP Plan Area occupied by anadromous fish meet the CFPR ASP rules for anadromous watersheds. SPI plot data in WLPZs from the HCP Plan Area from 5,564 plots covering 22,256 acres shows on average 16.9 trees per acre ≥ 22 inches dbh; of those, 14 are conifers and 2.9 are hardwoods. These areas are within 100 feet of the stream edge and average 310 trees per acre and 153 square feet of basal area. These areas also have canopy closures exceeding 80 percent. Given the CFPR and ASP rules, and the conservation measures in the HCP, these conditions will persist throughout the life of the HCP and continue providing high quality and functional riparian habitat.

Additional consideration of the differences between vertical canopy cover and ecological shade suggests greater amounts of stream shade occur within riparian areas in the HCP/SHA Plan Areas. The CFPR 50 percent (vertical) canopy cover standard is measured by height independent techniques using overlapping tree crown cover (e.g., spherical densitometer) and provides conservative total canopy cover estimates. When considering canopy closure measurements from techniques that are height dependent (e.g., modeled index using forest plot data), results show vertical canopy cover greater than 60 percent corresponds to approximately 85 percent or greater ecological shade canopy, as these techniques account for non-overstory species that otherwise provide stream shade.

4.1.10. Baseline Conditions and Covered Species Status in Specific Watersheds

The baseline conditions in watersheds under SPL&T ownership are described in subsections below.

4.1.10.1. Clear Creek

Most of SPL&T ownership in the Clear Creek watershed is above Whiskeytown Dam and Reservoir, which block access by anadromous fish to the upper watershed. In the Clear Creek watershed below Whiskeytown Dam, there are 2.09 square miles (1,340 acres) of SPL&T lands in the HCP Action Area. SPL&T lands in the portion of the watershed below the dam are in headwater tributaries 5 miles upstream from the main stem of Clear Creek, and over 20 miles from the Clear Creek/Sacramento River confluence. SPL&T owns less than one percent of the Clear Creek watershed area below Whiskeytown Dam.

Table 9 provides baseline conditions for selected metrics on lands managed by SPI in the watershed. SPI manages lands in one planning watershed (Andrews Creek) and owns 16.7 percent of that watershed. No anadromous stream habitat occurs in the Andrews Creek watershed. SPL&T lands in this watershed contain approximately 3.2 road miles, none of which are located within 300 feet of anadromous stream habitat. SPL&T ownership in the watershed contains approximately 6.6 miles of perennial stream above anadromy and 6.2 miles of seasonally flowing streams. Roads cross these channels at five sites in the watershed and none are in anadromous stream habitat.

Table 9. Baseline Conditions for SPL&T Lands in the Clear Creek Watershed.											
Planning Watershed Name	Miles of Anadromous Stream Habitat	Miles of Perennial Stream	Miles of Seasonal Stream	Road Length (mile)	Road Length in Andromous Stream and 300-foot Corridor (mile)	Number of Stream Crossings	Number of Stream Crossings in Anadromous Stream Habitat	Current Percent of Road Length Delivering to Streams	Percent Planning Watershed Burned by Wildfire (2007-2018)	Percent Planning Watershed in SPL&T Ownership	Distance to Anadromy (miles)
Andrews Creek	0.00	6.59	6.19	3.24	0.00	5	0	8.24	100.00	16.70	6.10

All SPL&T lands in the watershed are managed for long-term timber production and, therefore, the planning watershed has high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the National Park Service and Bureau of Land Management. Little to no timber harvest occurs on these lands, and what forest management that does occur generally consists of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in the planning watershed is directly correlated with the portion of the watershed managed by SPI.

Since 1964, a portion of the flow from the Trinity River basin has been imported into the Sacramento River basin through the Clear Creek tunnel to Whiskeytown Lake (USDOI 2008; NMFS 2014a) and into Clear Creek. Flows provided to Clear Creek below Whiskeytown Dam are consistently at least 200 cfs from October through June. During the summer months, flows are increased to provide suitable water temperatures for holding adult salmon (NMFS 2009) that enter Clear Creek from the Sacramento River. Clear Creek is the first major tributary to the Sacramento River below Shasta and Keswick Dams.

Historically there were approximately 25 stream miles available for Chinook salmon use in Clear Creek. Construction of Whiskeytown Dam reduced that habitat; the remaining habitat has been estimated at 16 miles (Western Shasta Resource Conservation District 1998). Central Valley spring-run Chinook salmon had been extirpated in Clear Creek but have repopulated the stream; Williams et al. (2016) estimated the recent 3-year total spawning run at 822 fish, placing the population at moderate extinction risk. Williams et al. (2016) estimated the 3-year total spawning run of Central Valley steelhead in Clear Creek at 761 fish. The total had increased since first estimated in 2003 (Williams et al. 2016) and the population extinction risk is considered uncertain (NMFS 2014a). USFWS became concerned about the effects of hybridization and redd superimposition between spring-run and fall-run Chinook salmon. In 2003, USFWS installed a temporary picket weir at river mile 8.09 to limit spring-run Chinook salmon to 10 miles of spawning habitat (Newton and Brown 2005) and ensure spatial separation of the two runs. The weir is installed in late August and removed in early November to allow access for Central Valley steelhead (Chappell 2009).

Steelhead spawning habitat along Clear Creek is limited by the amount of suitable spawning substrate. Before 2001, a gravel augmentation project involved injecting small gravel below Whiskeytown Dam to improve steelhead spawning (Giovannetti and Brown 2007). A study of steelhead redds between 2001 and 2007 found 30 to 40 percent of the redds had injection gravel in them, suggesting that the habitat is still limiting spawning, or that the gravel injection is providing more suitable spawning habitat for steelhead (Giovannetti and Brown 2007; Chappell 2009).

Clear Creek is classified as a Core 1 watershed for spring-run Chinook salmon and Central Valley DPS steelhead by NMFS in the Central Valley Recovery Plan (NMFS 2014a). Core 1 populations have been identified based on their known ability or potential to support independent viable populations. Core 1 populations form the foundation of the NMFS recovery strategy and meet defined population-level biological recovery criteria for low risk of extinction (NMFS 2014a). NMFS believes that Core 1 populations should be the first focus of an overall recovery effort.

4.1.10.2. Cottonwood Creek

Cottonwood Creek is the largest undammed tributary in the upper Sacramento River Basin. The watershed encompasses over 938 square miles (600,320 acres) of the northwest side of the Sacramento Valley, primarily in Shasta County, from the interior Coast Range and Klamath Mountains to the Sacramento River near the town of Cottonwood. SPL&T lands in the HCP Action Area encompass approximately 20,178 acres, or about 3.4 percent of the Cottonwood Creek watershed.

The baseline condition for selected metrics on SPL&T lands are summarized in Table 10. SPI manages lands in 12 planning watersheds in the Cottonwood Creek watershed, with ownership ranging from approximately 4 to 55 percent. Approximately 0.43 mile of anadromous stream habitat occurs in one planning watershed (Taylor Gulch). SPL&T lands contain approximately 114 road miles, less than 0.25-mile of which is within 300 feet of anadromous stream habitat. SPL&T ownership contains approximately 90.5 miles of perennial stream above anadromy and 120 miles of seasonally flowing streams. Roads cross these channels at 385 sites in the watershed, though only two crossings are in anadromous stream habitat.

Table 10. Baseline Conditions for SPL&T Lands in the Cottonwood Creek Watershed.											
Planning Watershed Name	**Miles of Anadromous Stream Habitat**	**Miles of Perennial Stream**	**Miles of Seasonal Stream**	**Road Length (miles)**	**Road Length in Anadromous Stream and 300-foot Corridor (miles)**	**Number of Stream Crossings**	**Number of Stream Crossings in Anadromous Stream Habitat**	**Current Percent of Road Length Delivering to Streams**	**Percent Planning Watershed Burned by Wildfire (2007-2018)**	**Percent Planning Watershed in SPL&T Ownership**	**Distance to Anadromy (miles)**
Moon Fork Cottonwood Creek	0.00	14.25	29.39	5.85	0.00	55	0	40.21	100.00	55.29	3.11
North Fork Cottonwood Creek	0.00	18.46	22.13	10.66	0.00	77	0	39.42	100.00	44.68	1.12
Taylor Gulch	0.43	9.26	19.73	11.09	0.15	73	2	35.70	83.09	33.38	0.00
Jerusalem Creek	0.00	14.66	13.64	28.27	0.00	64	0	8.41	38.41	37.03	1.98
Ducket Creek	0.00	2.72	0.96	1.42	0.00	1	0	10.69	69.23	5.53	6.69
Eagle Creek	0.00	9.22	9.12	4.97	0.00	19	0	14.40	100.00	23.84	5.65
Wilson Creek	0.00	0.22	1.37	1.95	0.00	2	0	2.40	79.10	6.68	19.51
Harrison Gulch	0.00	2.29	3.13	3.83	0.00	16	0	27.08	0.00	7.69	4.32
Swett Canyon	0.00	1.40	0.22	0.65	0.00	0	0	0.00	98.65	4.70	2.20
Knob Gulch	0.00	6.00	4.46	10.25	0.00	16	0	5.89	7.69	14.07	1.58
Lower Duncan Creek	0.00	2.53	4.29	12.71	0.00	18	0	9.03	98.29	21.48	1.85
Upper Duncan Creek	0.00	11.02	11.92	22.12	0.00	44	0	5.00	47.69	24.22	0.53

All SPL&T lands in the watershed are managed for long-term timber production and, therefore, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the National Park Service, Bureau of Land Management, and the Shasta-Trinity National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI.

In an evaluation of Cottonwood Creek before 1998, spring-run Chinook salmon spawning and rearing habitat was found to be limited to the South Fork above the confluence with Maple Creek (CH2M Hill 1998). However, in 2002, some spawning was documented on the North Fork (CH2M Hill 2002). Access on the North Fork is limited by a natural barrier upstream of the Ono Bridge (Chappell 2009). Access on the South Fork is limited by a constructed barrier approximately 3.5 miles upstream of Maple Creek. In recent years populations have been very low; Williams et al. (2016) estimated that the total spawners in the three most recent years was only four fish.

As of 2009, Central Valley steelhead used all the forks and the main stem of Cottonwood Creek for spawning, rearing, and migrating (Chappell 2009). An evaluation in 2002 indicated that low flows restrict access to large portions of those habitats (CH2M Hill 2002). Low flows in years with limited precipitation may limit the availability of habitat given the flashy nature of flows in the watershed (CH2M Hill 2002). Williams et al. (2016) did not provide a steelhead population estimate for Cottonwood Creek.

Cottonwood Creek was designated as a Core 2 watershed for spring-run Chinook salmon and Central Valley DPS steelhead by NMFS in the Central Valley Recovery Plan (NMFS 2014a).

4.1.10.3. Cow Creek

The Cow Creek watershed encompasses approximately 425 square miles (272,000 acres) in the northeastern corner of the Sacramento Valley and neighboring mountains. Cow Creek accounts for approximately 21 percent of the peak discharge for the Sacramento River between Shasta Dam and Red Bluff (Heiman and Knecht 2010). An estimated 66 miles of anadromous fish habitat occurs in Cow Creek, although recent fish counts suggest much less production (Heiman and Knecht 2010). SPL&T lands in the HCP Action Area include approximately 8 percent (21,805 acres) of the Cow Creek watershed.

Baseline conditions for selected metrics on SPL&T lands in the Cow Creek watershed are summarized in Table 11. SPI manages lands in 17 planning watersheds with ownership ranging from 1 to 48 percent. Anadromous stream habitat occurs in 4 of the 17-planning watersheds, a total of approximately 5.6 miles of anadromous stream habitat, including Beal, Tucker, Glendenning, and Mill Creek. SPL&T lands in the watershed contain approximately 194 road miles, 2.2 miles of which is located within 300 feet of anadromous stream habitat (Table 11). SPL&T ownership contains approximately 56 miles of perennial stream above anadromy and 85 miles of seasonally flowing streams. Roads cross these channels at 343 sites in the watershed; however, no crossings are in anadromous stream habitat.

Table 11. Baseline Conditions for SPL&T Lands in the Cow Creek Watershed.											
Planning Watershed Name	**Miles of Anadromous Stream Habitat**	**Miles of Perennial Stream**	**Miles of Seasonal Stream**	**Road Length (miles)**	**Road Length in Anadromous Stream and 300-foot Corridor (miles)**	**Number of Stream Crossings**	**Number of Stream Crossings in Anadromous Stream Habitat**	**Current Percent of Road Length Delivering to Streams**	**Percent Planning Watershed Burned by Wildfire (2007-2018)**	**Percent Planning Watershed in SPL&T Ownership**	**Distance to Anadromy (miles)**
Atkins Creek	0.00	1.22	6.11	2.12	0.00	1	0	33.03	0.00	13.75	5.04
Mill Creek (south Cow Creek)	0.84	1.37	0.00	1.75	0.80	0	0	38.45	0.00	1.05	0.00
Beal	1.16	4.36	3.00	14.03	1.16	35	0	38.61	0.00	7.13	0.00
Tucker	3.09	15.81	9.99	47.97	3.09	105	0	22.81	0.00	40.78	0.00
Huckleberry	0.00	11.98	9.21	45.09	0.00	52	0	15.40	0.00	38.06	2.40
Glendenning	0.52	4.60	14.54	32.17	0.52	40	0	15.13	0.00	26.73	0.00
Fern	0.00	2.27	0.89	2.03	0.00	9	0	26.65	0.00	2.88	8.59
Buckhorn	0.00	2.21	3.22	9.57	0.00	16	0	14.73	0.00	12.74	5.28
Coal Gulch	0.00	0.11	0.79	0.96	0.00	1	0	26.45	0.00	1.41	3.38
Silver Lake	0.00	0.00	0.00	0.07	0.00	0	0	NA	0.00	1.38	16.36
Little Valley	0.00	1.16	1.24	7.00	0.00	5	0	4.13	0.00	9.59	10.50
Mill Creek (Little Cow Creek)	0.00	0.00	0.92	1.75	0.00	0	0	0.00	0.00	5.65	13.22
Lookout Mountain	0.00	2.49	1.85	1.24	0.00	2	0	NA	0.00	2.62	11.45
Cedar Creek	0.00	0.88	2.30	3.47	0.00	15	0	NA	0.00	3.35	13.12
McCandless	0.00	10.68	25.56	15.13	0.00	49	0	21.35	0.00	48.05	6.93
Ingot	0.00	0.35	1.52	1.17	0.00	3	0	14.82	0.00	2.55	5.13
Upper Oak Run Creek	0.00	2.43	3.64	8.97	0.00	10	0	4.62	0.00	15.69	10.66

All SPL&T lands in the watershed are managed for long-term timber production. As a result, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portions of the watershed is managed by other private timberland owners. The largest public forest ownership consists of the Latour State Forest managed by CAL FIRE.

The Cow Creek watershed occurs in the Basalt and Porous Lava diversity group, which once supported historical winter-run and spring-run Chinook salmon and steelhead populations, presumably because most streams in this area receive large inflows from springs during the summer (NMFS 2014a). However, current use by anadromous species is low. Key stressors to salmonid habitat use in Cow Creek include passage barriers, low flow conditions, and fire management (Chappell 2009; NMFS 2014a). Approximately 278 recorded points of diversion create passage barriers and contribute to reduced flows (Heiman and Knecht 2010). Pacific Gas and Electric Company's (PG&E) hydropower diversions on South Cow Creek also contribute to reduced summer flows (NMFS 2014a). Fire management, including both controlled burns and fire suppression, has had several lasting effects along Cow Creek, such as reduced vegetated cover and increased erosion during runoff (SHN Consulting Engineers 2001). Livestock grazing and human population growth in the Cow Creek watershed have reduced riparian vegetation, leading to increased erosion and water temperatures (USFWS 1995; NMFS 2014a).

The Cow Creek watershed is predominantly rain-fed, and likely only supports spring-run Chinook salmon in years with above-normal rainfall (CH2M Hill 1998). Spring-run Chinook salmon were observed in low numbers in Cow Creek in the past (CH2M Hill 1998), but the lack of summer holding pools makes the creek mostly unsuitable for spring-run Chinook salmon (SHN Consulting 2001). Flows are so consistently low, resulting in passage barriers and elevated water temperatures, that CDFW does not consider Cow Creek suitable for spring-run Chinook salmon (Chappell 2009).

Central Valley steelhead are known to spawn in the Cow Creek main stem and tributaries, including North Cow, Old Cow, and South Cow Creeks (SHN 2001). In most years, spawning is limited by low flows and high-water temperatures (Chappell 2009). Several waterfalls, including Diddy Wells Falls, Clover Creek Falls, and Upper Whitmore Falls, create natural barriers to upstream migration, particularly during normal and low flow years. In Old Cow Creek, the upper limits of use by steelhead extend onto SPL&T lands (Appendix C). Williams et al. (2016) did not provide a steelhead population estimate for Cow Creek. Cow Creek was designated as a Core 2 watershed for steelhead by NMFS in the Central Valley Recovery Plan (NMFS 2014a).

4.1.10.4. Bear Creek

The Bear Creek watershed covers approximately 157 square miles (100,480 acres) from the west slope of Latour Butte to the Sacramento River between Cow and Cottonwood Creeks and supported primarily by rainfall (Heiman and Knecht 2010). SPL&T lands in the HCP Action Area comprise approximately 4.23 square miles (2,705 acres), or about 2.3 percent of the Bear Creek watershed, and occur in the forested headwater reaches.

Baseline conditions for selected metrics of the Bear Creek watershed are summarized in Table 12. SPI manages lands in two planning watersheds with ownership ranging from approximately 2 to 25 percent, and no anadromous stream habitat occurs in these planning watersheds. SPL&T lands contain approximately 23 road miles, none of which are located within 300 feet of anadromous stream habitat. SPL&T ownership contains approximately 4 miles of perennial stream above anadromy and 6 miles of seasonally flowing streams. There are 24 road crossings in the Bear Creek watershed, none of which are in anadromous stream habitat.

All SPL&T lands in the watershed are managed for long-term timber production. As a result, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portions of the watershed is managed by other private timberland owners.

Table 12. Baseline Conditions for SPL&T Lands in the Bear Creek Watershed.

Planning Watershed Name	Miles of Anadromous Stream Habitat	Miles of Perennial Stream	Miles of Seasonal Stream	Road Length (miles)	Road Length in Anadromous Stream and 300-foot Corridor (miles)	Number of Stream Crossings	Number of Stream Crossings in Anadromous Stream Habitat	Current Percent of Road Length Delivering to Streams	Percent Planning Watershed Burned by Wildfire (2007-2018)	Percent Planning Watershed in SPL&T Ownership	Distance to Anadromy (miles)
North Fork Bear Creek	0.00	0.19	2.01	3.06	0.00	3	0	NA	0.00	2.72	2.70
Upper South Fork Bear Creek	0.00	3.54	1.26	20.05	0.00	21	0	13.84	0.00	25.40	25.40

Bear Creek Stream flows are highly variable. The average flow is 82 cfs, and peak storm flow can reach 5,000 cfs; however, low flows are a main limiting factor to salmonid access and habitat use (Chappell 2009). Irrigation diversion and groundwater pumping contribute to the summer low flow conditions. Water rights in Bear Creek are not adjudicated, and 56 appropriative water right holders divert water for domestic use, irrigation, livestock watering, power generation, and recreation (Heiman and Knecht 2010). The diversions are in lower portions of the watershed, approximately 10 miles downstream from the HCP Action Area.

Bear Creek is not designated by NMFS in the Central Valley Recovery Plan (NMFS 2014a).

4.1.10.5. Battle Creek

Battle Creek currently provides approximately 6 miles of anadromous fish habitat from its confluence with the Sacramento River upstream to the Coleman Fish Hatchery; additionally, winter-run salmon can access Battle Creek upstream of the hatchery using a fish ladder that is opened during the peak migration period (NMFS 2014a). Historically, 87 miles were available to anadromous fish and current restoration projects are expected to return approximately 42 miles to anadromy. SPL&T lands in the HCP Action Area includes approximately 32 percent (73,212 acres) of the Battle Creek watershed, which has an area of approximately 360 square miles

(230,400 acres). Baseline conditions for selected metrics within Battle Creek are summarized in Table 13. SPI manages lands in 14 planning watersheds with ownership ranging from less than 1 to approximately 79 percent. No anadromous stream habitat occurs in those watersheds. SPL&T lands contain approximately 611 road miles, none of which occurs within 300 feet of anadromous stream habitat. SPL&T ownership contains approximately 90 miles of perennial stream above anadromy and 233 miles of seasonally flowing streams. Roads cross these channels at 622 sites in the watershed and no crossings occur in anadromous stream habitat.

All SPL&T lands in the watershed are managed for long-term timber production and, therefore, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the Lassen National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI.

All SPL&T lands in the Battle Creek watershed are located upstream from the upper limits of anadromy due to the presence of the PG&E Eagle Canyon Dam on the North Fork and a natural barrier on the South Fork.

Battle Creek was designated as a Core 1 watershed for spring-run Chinook salmon and Central Valley DPS steelhead by NMFS in the Central Valley Recovery Plan (NMFS 2014a). Battle Creek is supported by snowpack and spring-fed creeks that maintain streamflow until late summer and provide suitable holding and spawning water temperatures (Chappell 2009). The average September streamflow of 255 cfs is one of the largest of any of the tributaries to the Sacramento River (Kier Associates 1999).

Sacramento River winter-run Chinook salmon spawned in Battle Creek historically, but access to spawning habitat was blocked by development of the Pacific Gas & Electric Hydropower project. The viability of the Sacramento River winter-run Chinook salmon ESU will be improved by re-establishing winter-run Chinook salmon to their historical spawning and rearing habitat

Central Valley steelhead spawn in Battle Creek and in Coleman National Fish Hatchery. Except for hatchery data, population trend data are limited. Total return spawners in Battle Creek and the Hatchery have increased, but natural spawners apparently decreased by 17 percent per year from 2000 to 2010 (Williams et al 2016), placing them in the category of moderate extinction risk. Steelhead can presently access approximately 14 miles of spawning and rearing habitat in the North Fork of Battle Creek and approximately 18 miles in the South Fork.

Planning Watershed Name	Miles of Anadromous Stream Habitat	Miles of Perennial Stream	Miles of Seasonal Stream	Road Length (miles)	Road Length in Anadromous Stream and 300-foot Corridor (miles)	Number of Stream Crossings	Number of Stream Crossings in Anadromous Stream Habitat	Current Percent of Road Length Delivering to Streams	Percent Planning Watershed Burned by Wildfire (2007-2018)	Percent Planning Watershed in SPL&T Ownership	Distance to Anadromy (miles)[a]
Bridges Creek	0.00	3.66	3.50	31.47	0.00	21	0	14.41	0.00	52.89	9.20
Lower Manzanita Creek	0.00	3.83	0.10	32.61	0.00	8	0	8.41	0.00	43.33	8.19
Upper Battle Creek	0.00	6.90	3.25	21.86	0.00	24	0	17.45	0.00	21.86	10.45
Bailey Creek	0.00	11.14	12.40	112.1	0.00	45	0	5.54	18.60	78.50	2.46
Canyon Creek	0.00	14.59	38.70	95.97	0.00	119	0	16.41	51.24	67.41	3.51
Bear Creek	0.00	9.94	10.93	68.36	0.00	49	0	11.08	0.59	57.73	0.05
undefined	0.00	0.00	0.00	0.02	0.00	0	0	NA	0.00	0.06	7.79
Lower Digger Creek	0.00	6.76	43.51	45.12	0.00	102	0	22.11	37.12	52.34	6.50
Upper Digger Creek	0.00	12.94	18.86	51.62	0.00	67	0	14.08	1.88	46.35	12.00
Cold Creek	0.00	7.54	3.77	24.84	0.00	14	0	17.63	0.00	49.14	16.30
Grapevine Spring	0.00	2.82	35.82	29.70	0.00	61	0	28.11	44.48	68.01	12.88
Panther Creek	0.00	7.32	22.29	51.89	0.00	58	0	16.94	2.58	60.91	16.38
Ripley Creek	0.00	0.00	0.12	4.03	0.00	0	0	0.00	100.0	5.98	10.37
Soap Creek	0.00	2.22	39.29	41.59	0.00	54	0	15.82	70.29	54.74	12.18

Table 13. Baseline Conditions for SPL&T Lands in the Battle Creek Watershed.

[a] These distances may change in the near future depending upon re-establishment of anadromous salmonids in upper Battle Creek resulting from Battle Creek Restoration Program activities. SPL&T lands are upstream of natural barriers to anadromy and the upper limits of the restoration program project area; therefore, no anadromy will occur on SPL&T lands even if the program is fully successful.

Water quality is an important concern in Battle Creek because of the presence of threatened Chinook salmon and steelhead in Battle Creek and downstream areas. Battle Creek drains into the Sacramento River between Redding and Red Bluff. The uppermost portion of the watershed is under federal management by either the Lassen National Forest or Lassen National Park. Very little timber harvest has taken place on the Lassen National Forest, but there is a large legacy network of unpaved roads and historic harvest units. Most of the land from elevation 3,000 to 5,000 feet is owned by SPL&T and is actively managed for timber production. Within this elevation zone there also are some smaller private inholdings, and these are used primarily for timber production, orchards, wineries, grazing and small ranchettes. The area below 3,000 feet is almost entirely privately owned and subjected to various uses, including grazing, irrigated pasture, and vineyards (James and MacDonald 2012).

A substantial amount of monitoring and assessments have been conducted in Battle Creek during recent decades. According to Ward and Moberg (2004) there was little direct evidence that road or other land-use factors played a significant role in explaining the variability of key stream condition indices at the watershed scale, although they were not able to rule out road or other land uses as sediment sources. Tussing and Ward (2008) reported that fine sediment scores were unfavorable for salmonids at six of ten sampling sites evaluated in the Battle Creek watershed during 2006. NMFS (2014a) cited a report that attributed increased amounts of fine sediment in Battle Creek to significant private land timber harvest between 2005 and 2009. However, CAL FIRE et al. (2011) did not find significant erosion and sediment delivery impacts related to clear-cut harvesting in the assessment area. Road locations with proper BMP installation showed little sediment discharge, while both private and public roads with poor BMP installation contributed low to moderate amounts of fine sediment to streams.

In 2001, a watershed assessment on Battle Creek evaluated instream sediment conditions in the upper watershed. Fine sediment levels were found to be higher than favorable for salmonid production but similar to levels in other northern California streams (Battle Creek Watershed Conservancy 2004). A similar study in 2006 found more favorable stream conditions, indicating an improving trend (Heiman and Knecht 2010). Turbidity monitoring conducted by SPI in the Battle Creek watershed indicates turbidity values are consistently low: mean daily values less than 5 NTU occur 82 percent of the time, and less than 1 percent of the mean daily turbidity values were above 25 NTU (James and MacDonald 2012). High turbidity values are more commonly observed in wet years and are not correlated with the amount or type of timber harvest, which is likely attributable to the effective implementation of BMPs, as well as relatively benign site conditions (James and MacDonald 2012). High turbidity typically lasts less than 6 to 8 hours, and no days had continuous turbidity values exceeding 25 NTU. These results are consistent with other studies in the Battle Creek watershed (CAL FIRE et al. 2011) and indicate that turbidity represents very little threat to salmonid species (James and MacDonald 2012).

In 2015, the USFWS noted unusual and deleterious quantities of sand and fine sediments in the South Fork of Battle Creek and in the main stem below the South Fork in the spring and summer and concluded that former high-density spawning areas on South Fork Battle Creek and the North Fork/South Fork confluence were no longer suitable for salmonid spawning due to high fine sediment composition. The USFWS also stated that the sediment was presumably originating from the area of the 2012 Ponderosa fire in the South Fork Battle Creek watershed (USFWS 2015). Several studies were conducted to evaluate the impact of the Ponderosa fire and post-fire treatment methods. A 2017 survey of fine sediments mobilized subsequent to the Ponderosa fire by large rain and runoff events indicated that sediments had been significantly reduced as a result of high flows in the winter of 2016-2017. Aquatic invertebrate populations were recovering, Chinook salmon holding and spawning areas previously described as unsuitable were re-categorized as suitable by USFWS biologists, and management actions to prevent Chinook salmon from spawning unsuccessfully in the reach (such as blocking entry to South Fork Battle Creek) were no longer recommended (Stanley et al. 2017). SPI conducted a 4-year study of erosion associated with post-fire salvage logging immediately after the Ponderosa fire. Unlogged control swales had higher levels of sediment production than salvage-logged swales. In salvage logged swales, reduced sediment yield was related to more ground disturbance, particularly in swales that had been treated with contour subsoiling. Sediment delivery from all swales declined over the course of the study due to increased vegetation growth. The study suggests that substantial beneficial reductions in erosion can be realized by salvage logging and implementing associated BMPs on slopes of less than 35 percent (James and Krumland 2018).

All anadromous species have unrestricted access to the lower portion of Battle Creek below Coleman National Fish Hatchery. All upstream fish access above Coleman Hatchery is controlled at a weir at the Hatchery. Above these facilities, fish passage has been limited for decades by a series of small structures that divert water for hydroelectric power production (NMFS 2014a).

In 2010, construction began on extensive modifications under the Battle Creek Salmon and Steelhead Restoration Project Adaptive Management Plan. Phase 1 of the project, which includes passage improvements to the North Fork Battle Creek, have been completed and in 2018 the Restoration Program released approximately 20,000 juvenile winter-run Chinook salmon into Battle Creek, anticipating a return migration in 2020. The purpose of the Restoration Project is to restore approximately 42 miles of habitat in Battle Creek and an additional 6 miles of tributary habitat. The project is intended to improve conditions for Central Valley spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, and Central Valley DPS steelhead.

4.1.10.6. Paynes Creek

Paynes Creek is a small tributary of the Sacramento River originating from springs located near Mineral, California. The stream flows west through the eastside foothills and enters the Sacramento River main stem above Red Bluff Diversion Dam. SPL&T lands in the HCP Action Area includes approximately 11.2 percent (6,638 acres) of the Paynes Creek watershed, which encompasses approximately 93 square miles (59,520 acres). Anadromy in Paynes Creek is limited by low flow conditions. Although no dams are located on the stream, Paynes Creek has 16 seasonal diversions for irrigation and livestock watering that affect flows. The lowermost irrigation diversion is 2 miles upstream from the confluence and provides water to irrigate the agricultural water rights to holders in the Bend District (NMFS 2014a). The diversions are approximately 25 miles downstream of the HCP Action Area.

The baseline condition for selected metrics in the Paynes Creek watershed is summarized in Table 14. SPI manages lands in two planning watersheds with ownership ranging from 21 to

54 percent. No anadromous stream habitat occurs on SPL&T lands in these planning watersheds. SPL&T lands in the watershed contain approximately 42 road miles. SPL&T ownership in the watershed contains approximately 13 miles of perennial stream above anadromy and 21 miles of seasonally flowing streams. There are 48 roads crossings in the Paynes Creek watershed, none of which cross anadromous waters.

Table 14. Baseline Conditions for SPL&T Lands in the Paynes Creek Watershed.

Planning Watershed Name	Miles of Anadromous Stream Habitat	Miles of Perennial Stream	Miles of Seasonal Stream	Road Length (miles)	Road Length in Anadromous Stream and 300-foot Corridor (miles)	Number of Stream Crossings	Number of Stream Crossings in Anadromous Stream Habitat	Current Percent of Road Length Delivering to Streams	Percent Planning Watershed Burned by Wildfire (2007-2018)	Percent Planning Watershed in SPL&T Ownership	Distance to Anadromy (miles)
Plum Creek	0.00	1.82	6.79	7.96	0.00	11	0	15.87	0.00	20.58	3.75
Chapman Gulch	0.00	11.62	14.03	33.85	0.00	37	0	8.67	0.00	54.30	3.92

All SPL&T lands in the watershed are managed for long-term timber production. As a result, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the Lassen National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI. Paynes Creek supports fall-run Chinook salmon when water conditions are adequate (USFWS 1995), but low flows and inadequate spawning gravel have been identified as significant factors limiting salmon production. In 1988, CDFW built five spawning riffles using 1,000 tons of spawning gravel; however, the reconstructed riffles have been sparsely used due to low flows during drought conditions (NMFS 2014a). Spring-run Chinook salmon are not known to use Paynes Creek, lack of pool habitat and low flow likely precludes this species. Central Valley steelhead probably enter the stream, but there is no population estimate (Williams et al. 2016). The upper limit of anadromy in Paynes Creek is unknown; given the limiting instream flows and opportunistic use, anadromy is likely limited to the lower stream reaches.

4.1.10.7. Antelope Creek

Antelope Creek provides approximately 30 miles of anadromous fish habitat from its confluence with the Sacramento River upstream, and 2 and 3 miles of habitat on the North and South Forks of Antelope Creek, respectively, above their confluence (Armentrout et al. 1998). SPL&T lands in the HCP Action Area includes approximately 38.9 percent (30,622 acres) of the Antelope Creek watershed, which has an area of approximately 123 square miles (78,720 acres). This watershed is long and narrow, with moderate to steep slopes in the upper reaches of the watershed (Chappell 2009).

Baseline conditions for selected metrics in the Antelope Creek watershed is summarized in Table 15. SPI manages lands in seven planning watersheds with ownership ranging from 21 to 99 percent. Anadromous habitat is present in three of the seven planning watersheds: Deadhorse, McCarthy and Panther Creeks and totals 5.4 miles. These streams are the upper limit of anadromy. SPL&T lands contain approximately 374 miles of road, of which less than a mile of road is located within 300 feet of anadromous habitat. SPL&T ownership contains 75 miles of perennial stream above anadromy and 99 miles of seasonally flowing streams. There are 313 road crossings in the watershed, though only two crossings (both in Deadhorse Creek) are in anadromous habitat.

All SPL&T lands in the watershed are managed for long-term production of timber. As a result, the planning watersheds have high levels of road use and historical timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the Lassen National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI. There are 374.2 miles of road and 313 stream road crossings on SPL&T lands in the watershed (Table 15).

Salmon and steelhead passage of is sometimes impaired by natural low flows, and low flows resulting from two diversions located approximately 27 miles downstream of SPL&T ownership (USFWS 1995; CDFW 2017). Unimpaired natural flows are often less than the combined water rights of the two diversions, resulting in a total dewatering of Antelope Creek (92 cfs from 1940 to 1980) during some critical migration periods (USFWS 1995). Sufficient flows are required for passage during upstream migration so adults can access holding and spawning habitat, and for outmigrating fry.

The only long-term streamflow record in Antelope Creek is from a US Geological Survey (USGS) gauge located 1.2 miles upstream of the Edwards Diversion Dam, which operated from 1941 to 1982. To estimate the current hydrograph, SPI used a nearby stream gauge located in Judd Creek, a stream and planning watershed tributary to Antelope Creek with similar geology, to generate a synthetic hydrograph for Antelope Creek during water years 2010 to 2014. That hydrograph showed critically low spring and summer flows (less than 50 cfs) when flows in lower Antelope Creek are most affected by water diversion at the Edwards Diversion Dam (USFWS 2015).

Table 15. Baseline Conditions for SPL&T Lands in the Antelope Creek Watershed.											
Planning Watershed Name	Miles of Anadromous Stream Habitat	Miles of Perennial Stream	Miles of Seasonal Stream	Road Length (miles)	Road Length in Anadromous Stream and 300-foot Corridor (miles)	Number of Stream Crossings	Number of Stream Crossings in Anadromous Stream Habitat	Current Percent of Road Length Delivering to Streams	Percent Planning Watershed Burned by Wildfire (2007-2018)	Percent Planning Watershed in SPL&T Ownership	Distance to Anadromy (miles)
Judd Creek	0.00	11.80	11.20	46.70	0.00	34	0	9.60	0.00	71.30	2.80
Deadhorse Creek	4.03	21.10	23.30	89.70	0.90	66	2	14.50	0.21	56.20	0.00
Refuge	0.00	1.60	11.40	36.20	0.00	27	0	NA	0.00	98.60	0.30
Panther Spring	0.14	2.60	18.20	41.50	0.00	41	0	23.30	0.00	30.40	0.00
McCarty Creek	1.27	29.80	14.30	94.90	0.00	71	0	17.10	0.00	76.80	0.00
Plum Creek	0.00	1.80	6.80	14.50	0.00	15	0	NA	0.00	20.60	3.70
Chapman Gulch	0.00	11.60	14.00	50.70	0.00	59	0	NA	0.00	54.30	3.90

Habitat in the upper watershed is in good condition (NMFS 2014a). Monitoring of habitat by the Lassen National Forest (USDA 2006) found low levels of pool tail surface fines during surveys conducted between 1999 and 2006. Levels in the main stem of Antelope Creek averaged between 4.1 percent and 6.5 percent surface fines. Pool tail surface fines in the South Fork of Antelope Creek averaged between 3.9 and 11.7 percent over the same period.

Antelope Creek was designated as a Core 2 watershed by NMFS in the Central Valley Recovery Plan. Core 2 populations have a moderate risk of extinction and contribute to the recovery strategy for spring-run Chinook salmon by supporting geographically diverse populations. During surveys conducted in 1983, 59 spring-run Chinook salmon adults were observed. Monitoring of adult spring-run Chinook salmon have been conducted annually since 1983. Over that period, the number of adults ranged from 0 to 154, with an average of 23. No fish were observed during 5 years of monitoring efforts, most recently in 2013. Spring-run Chinook salmon have access to approximately 9 miles of spawning habitat in Antelope Creek, starting from 1.6 miles downstream of Paynes Creek crossing to McClure Place on the North Fork Antelope Creek (Chappell 2009) to Buck's Flat on the South Fork Antelope Creek (Armentrout et al. 1998). Williams et al. (2016) estimated a 10-year population decline of about 37 percent.

Antelope Creek is designated as a Core 1 watershed for steelhead because it has a high potential to support a viable population of Central Valley steelhead and the widespread presence of the species throughout the watershed. Core 1 populations form the foundation of the recovery strategy for steelhead and meet the population-level biological recovery criteria for low risk of extinction. Armentrout et al. (1998) speculated that steelhead probably use the same spawning areas as Central Valley spring-run Chinook salmon and may have access to habitats beyond known anadromous waters.

Very little information is available on Central Valley steelhead distribution and abundance in Antelope Creek and adult counts are limited. Moore (2001) used snorkel and foot surveys from March through May 2001, to count adult steelhead and steelhead redds in Antelope Creek. These surveys observed a total of 47 steelhead and 52 redds in about 53 percent of the accessible anadromous habitat in Antelope Creek. In 2007 and 2008, CDFG installed a video camera and observed 140 adult Central Valley steelhead move through the newly constructed fish ladder at the Edwards Diversion.

Steelhead begin migration into Antelope Creek during the late-fall and winter, primarily when flows increase from storms. Ladder counts at Clough Dam, on Mill Creek, between 1953 and 1963, show that adult steelhead migrate upstream from September through June (Van Woert 1964). Harvey (1995) observed two distinct migration peaks in Van Woert's (1964) data. The largest peak occurred from late-October to mid-November and accounted for 30 percent of the run. A smaller peak occurred in the first 2 weeks of February and accounted for 11 percent of the run.

Anadromous salmonid habitat in the Antelope Creek watershed occurs at elevations of approximately 2,000 feet and below, resulting in an increased susceptibility to warmer water temperatures and potentially less optimal conditions for anadromous salmonids, compared to some of the other northern Sierra Nevada watersheds (i.e., Mill and Deer creeks).

4.1.10.8. Mill Creek

The Mill Creek watershed originates in Lassen Volcanic National Park and has a drainage area of approximately 134 square miles (85,760 acres). SPL&T lands in the HCP Action Area encompass approximately 8.80 square miles (5,631 acres), or about 6.5 percent of the Mill Creek watershed; all in the forested upper portions of the watershed. Mill Creek is a long, narrow watershed, and like other main Sacramento River tributaries in this region, Mill Creek descends through steep-walled canyons before emerging on the valley floor about 10 miles from the confluence with the Sacramento river. Mill Creek is unusual compared to most stream systems in having warmer stream temperatures in its headwater regions due to geothermal activity, trending to cooler temperatures as it flows downstream. The creek also has a sustained "milky" appearance through spring and summer due to water generated from melting glaciated slopes in the Mt. Lassen region (Heiman and Knecht 2010). Although the upper watershed is relatively undisturbed with a natural flow regime, three water diversions in the lower portions of the creek alter flow, increase stream temperatures, and impede fish passage during low flow conditions (Chappell 2009; NMFS 2014a). These diversions are approximately 23 miles downstream of the HCP Action Area.

The baseline conditions for selected metrics in the Mill Creek watershed are summarized in Table 16. SPI manages lands in 2 planning watersheds with ownership ranging from approximately 8 to 32 percent. Approximately 3 miles of anadromous stream habitat occurs in these planning watersheds. SPL&T lands contain approximately 374 road miles, and approximately 0.33 mile of road is located within 300 feet of anadromous stream habitat. SPL&T ownership contains approximately 9 miles of perennial stream above anadromy and 19 miles of seasonally flowing streams. There are 23 road crossings in the watershed, none of which occur in anadromous stream habitat.

Table 16. Baseline Conditions for SPL&T Lands in the Mill Creek Watershed.

Planning Watershed Name	Miles of Anadromous Stream Habitat	Miles of Perennial Stream	Miles of Seasonal Stream	Road Length (miles)	Road Length in Anadromous Stream and 300-foot Corridor (miles)	Number of Stream Crossings	Number of Stream Crossings in Anadromous Stream Habitat	Current Percent of Road Length Delivering to Streams	Percent Planning Watershed Burned by Wildfire (2007-2018)	Percent Planning Watershed in SPL&T Ownership	Distance to Anadromy (miles)
Mill Creek Rim	2.05	10.81	17.95	18.73	0.31	23	0	12.11	19.06	32.53	0.00
South of Big Bend	1.03	1.11	1.53	1.14	0.00	0	0	0.00	8.33	8.83	0.00

All SPL&T lands in the watershed are managed for long-term timber production. As a result, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the Lassen National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI.

Unimpaired natural flows are often less than the combined water rights of the diverters, and flow records show that authorized diversions may result in a total dewatering of the creek during critical salmonid migration periods (USFWS 1995; Sacramento River Watershed Program 2017) disconnecting the upper watershed from the Sacramento River. Only during wet water years does Mill Creek maintain flow and connectivity from the Sacramento River confluence through the upper watershed year-round (CDFW 2014a). NMFS (2014a) identified restoration of fish passage and improvement of flows at Mill Creek diversions as high priorities for recovery of Central Valley spring-run Chinook salmon and steelhead.

Mill Creek is essentially undammed, and existing diversions are designed to allow passage for migrating fish during high flows and with fish ladders for low flow conditions (Mill Creek Conservancy 2017). There are no physical passage barrier limits to the upstream migration of adult salmonids; however, the combined effect of higher stream gradients and lower streamflow can restrict access to the headwater reaches (Armentrout et al. 1998). Beginning in the early 2000s until at least 2005, streamflow was augmented through a water exchange program to improve upstream passage for spring-run Chinook salmon (CalWater 2005). A video weir was established at the Ward diversion dam, enabling counts of salmon and steelhead beginning in the 2008-2009 season (NMFS 2016).

Central Valley spring-run Chinook salmon use Mill Creek for spawning, rearing, and migration (NMFS 2014a). Population estimates conducted since 1947 show a decline in returns in recent years. Prior to the 1990s, the average annual run size was approximately 1,200 fish; while the average run size over the past 20 years was around 400 (Heiman and Knecht 2010). Williams et al. (2016) estimated a 10-year decline of about 5 percent, and that the total of runs for the 3 most recent years was 2,091 fish. According to Williams et al. (2016), the risk of extinction of the Mill Creek population had improved from high-risk to moderate risk since an assessment completed in 2010.

Central Valley steelhead spawn and rear in Mill Creek. Limited steelhead distribution and abundance information is known for Mill Creek; however, their range is expected to include that of the spring-run Chinook salmon and likely extends further upstream (Armentrout et al. 1988; Chappell 2009). Williams et al. (2016) did not report a population estimate for steelhead in Mill Creek. Access for anadromous fish extends to near Morgan Hot Springs, approximately 3 miles downstream of Lassen Volcanic National Park (Armentrout et al. 1998). SPL&T lands subject to anadromy in Mill Creek are limited to approximately 3 miles of tributary streams occurring in the Mill Creek Rim and South of Big Bend planning watersheds.

Mill Creek, along with Antelope and Deer creeks, are considered high value watersheds for fisheries restoration in the Central Valley, as these streams support most of their native species assemblages. Since these streams lack large water storage projects blocking or inundating miles of historical spawning habitat, most headwater stream habitat in Mill Creek is available to anadromous fish (NMFS 2014a). Mill Creek was designated as a Core 1 watershed for spring-run Chinook salmon and Central Valley DPS steelhead by NMFS in the Central Valley Recovery Plan (NMFS 2014a).

4.1.10.9. Deer Creek

The Deer Creek watershed originates near the summit of Butte Mountain at an elevation of approximately 7,320 feet and drains an area of approximately 134 square miles (146,560 acres). Generally, the watershed includes a forested upper area where ownership is shared between Lassen National Park, the Lassen National Forest, and SPL&T. These areas consist of a central area of unmanaged steep canyons where ownership is largely US Forest Service (USFS), US

Bureau of Land Management (BLM), and private ranchlands; and relatively flat privately-owned grazing and agricultural areas located below the canyon lands in the Sacramento Valley.

SPL&T lands in the HCP Action Area includes approximately 13.2 percent (19,349 acres) of the Deer Creek watershed. Table 17 provides baseline condition for selected metrics on lands managed by SPI in the watershed. SPI manages lands in eight planning watersheds with ownership ranging from less than 1 to 75 percent. Approximately 0.7 -mile of anadromous stream habitat occurs in one of the planning watersheds. SPL&T lands contain approximately 189 road miles, none of which are located within 300 feet of anadromous stream habitat. SPL&T ownership contains approximately 41 miles of perennial stream above anadromy and 65 miles of seasonally flowing streams. The Deer Creek watershed has 285 road crossings, though none occur in anadromous stream habitat.

Table 17. Baseline Conditions for SPL&T Lands in the Deer Creek Watershed.

Planning Watershed Name	Miles of Anadromous Stream Habitat	Miles of Perennial Stream	Miles of Seasonal Stream	Road Length (miles)	Road Length in Anadromous Stream and 300-foot Corridor (miles)	Number of Stream Crossings	Number of Stream Crossings in Anadromous Stream Habitat	Current Percent of Road Length Delivering to Streams	Percent Planning Watershed Burned by Wildfire (2007-2018)	Percent Planning Watershed in SPL&T Ownership	Distance to Anadromy (miles)
Carter Creek	0.00	0.00	0.00	0.10	0.00	0	0	NA	0.00	0.15	4.74
State Creek	0.00	1.80	6.30	10.30	0.00	28	0	NA	0.00	14.59	5.37
Round Valley	0.00	7.30	4.10	34.40	0.00	36	0	NA	24.41	37.86	1.92
North Fork Calf Creek	0.00	0.80	3.20	3.90	0.00	9	0	NA	0.00	22.78	0.80
Cement Creek	0.00	10.80	9.70	44.60	0.00	50	0	NA	6.60	38.12	1.31
Calf Creek	0.77	4.30	9.90	18.40	0.00	16	0	14.40	15.90	35.66	0.00
Devils Kitchen	0.00	1.70	2.70	9.60	0.00	15	0	NA	0.00	8.39	4.41
Transfer	0.00	15.80	28.90	67.90	0.00	131	0	NA	0.00	75.30	1.70

All SPL&T lands in the watershed are managed for long-term timber production. As a result, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the Lassen National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI.

Deer Creek, like Mill, Battle, and Butte creeks, is recognized for supporting one of four remaining self-sustaining Central Valley spring-run Chinook salmon populations (NMFS 2014a, Williams et al. 2016). Spring-run Chinook salmon enter during higher flows and use deep pools in the canyon into the summer months. Spring-run Chinook salmon spawning extends from Upper Falls downstream nearly 30 miles, but the distribution of spawning can vary based on water temperature and the amount of annual runoff (Armentrout et al. 1998). A fish ladder built in 1943 provided passage above the Lower Falls to an additional 5 miles of habitat, now used for adult holding, rearing and spawning. A second fish ladder was built over Upper Falls in the early 1950s but is not operational (NMFS 2014a). Deer Creek contains approximately 40 miles of anadromous fish habitat and is considered a high value watershed for fisheries restoration in the Central Valley, as the stream lacks large water storage projects blocking or inundating miles of historical spawning habitat (NMFS 2014a). Most headwater stream habitat in Deer Creek is still available to anadromous fish and the stream provides habitat for one or more riverine life history requirements for both spring-run Chinook salmon and Central Valley steelhead (NMFS 2014a).

Status of Central Valley steelhead in Deer Creek is apparently poorly understood. Neither NMFS (2014a), NMFS (2016a), nor Williams et al. (2016) provided a population estimate. Williams et al (2016) estimated the total spring-run spawners over the most recent 3-year period at 2,272 fish, and stated that since 2010, the extinction probability of Deer Creek spring-run Chinook salmon had improved from high risk to moderate risk; however, NMFS (2014a) reports the extinction probability as high.

Hydrology of the lower Deer Creek watershed is affected by fish passage barriers, low flows, and road construction. The Deer Creek watershed has three diversion dams and four diversion ditches on the 10 miles of stream between the canyon mouth and the Sacramento River (NMFS 2014a). In wet water years, there is enough flow for upstream migration of adult fall-run and spring-run Chinook salmon and steelhead. However; during low flow years, the combined water rights can dewater the stream and render it inaccessible to salmonids by reducing flows below the 50 cfs necessary for salmonid migration (Reynolds et al. 1993; CDFW 2014b). Low flows may also prevent downstream migrating smolts from reaching the Sacramento River (McEwan and Jackson 1996). The lower portion of the Deer Creek watershed has long stream channel reaches with limited riparian vegetation and minimal LWD (CDFW 2014b).

SPL&T lands subject to anadromy in Deer Creek are limited to less than 1-mile of stream occurring in the Calf Creek planning watershed. Deer Creek was designated as a Core 1 watershed for spring-run Chinook salmon and Central Valley DPS steelhead by NMFS in the Central Valley Recovery Plan (NMFS 2014a).

4.1.10.10. Big Chico Creek

The Big Chico Creek watershed originates from the southwest slope of Colby Mountain and encompasses an area of approximately 72 square miles (46,080 acres) (NMFS 2014a), of which approximately 48.81 square miles (31,237 acres), or 68 percent, consists of SPL&T lands included in the HCP Action Area. The baseline condition for selected metrics in the Big Chico watershed is summarized in Table 18.

Table 18. Baseline Conditions for SPL&T Lands in the Big Chico Creek Watershed.

Planning Watershed Name	Miles of Anadromous Stream Habitat	Miles of Perennial Stream	Miles of Seasonal Stream	Road Length (miles)	Road Length in Anadromous Stream and 300-foot Corridor (miles)	Number of Stream Crossings	Number of Stream Crossings in Anadromous Stream Habitat	Current Percent of Road Length Delivering to Streams	Percent Planning Watershed Burned by Wildfire (2007-2018)	Percent Planning Watershed in SPL&T Ownership	Distance to Anadromy (miles)
Ninemile Creek	0.00	17.7	34.2	56.6	0.0	166.0	0.0	NA	15.08	87.4	12.8
Campbell Creek	0.00	43.3	70.4	105.4	0.0	317.0	0.0	NA	1.39	95.2	7.0
Cascade Creek	0.00	21.4	10.9	76.8	0.0	64.0	0.0	NA	0.00	82.7	17.9
Bear Lake	0.00	18.2	28.0	35.4	0.0	98.0	0.0	NA	4.11	53.1	2.3
West Branch Mud Creek	0.00	4.9	1.9	16.5	0.0	11.0	0.0	NA	0.00	25.2	6.4
Promontory Point	0.00	3.4	5.3	20.4	0.0	15.0	0.0	NA	0.00	3.05	18.4
Rock Creek	0.00	2.1	1.6	9.3	0.0	4.0	0.0	NA	0.00	22.5	19.9

SPI manages land in seven planning watersheds with ownership ranging from approximately 22 to 95 percent. No anadromous stream habitat occurs in these planning watersheds. SPL&T lands contain approximately 320 road miles, none of which occurs within 300 feet of anadromous stream habitat. SPL&T ownership contains approximately 111 miles of perennial stream above anadromy and 152 miles of seasonally flowing streams. There are 675 road crossings in the Big Chico Creek watershed, though none occur in anadromous stream habitat.

SPL&T lands in the watershed are managed for long-term timber production and, therefore, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the Plumas National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI.

Big Chico Creek historically supported low numbers of spring-run Chinook salmon that used the creek opportunistically (Reynolds et al. 1993), but a viable population is no longer believed to exist (CH2MHill 1998; Williams et al. 2016). Spring-run Chinook salmon have been observed spawning and rearing in the 9-mile stretch below Iron Canyon in the foothill reach of Big Chico Creek, but passage through Iron Canyon fish ladder has been impeded in low flow years (Chappell 2009).

Central Valley steelhead spawn in the foothill reach of Big Chico Creek; however, specific steelhead distribution data are limited due to the lack of species-specific monitoring (Chappell 2009). In Big Chico Creek, the main hydrological limiting factors to salmonid habitat use are physical passage impediments and flow-based barriers associated with dams (Chappell 2009; NMFS 2014a). The Five-Mile Dam on Big Chico Creek diverts water into the Lindo Channel, historically known as Sandy Gulch, 16 miles below the HCP Action Area (Big Chico Creek Watershed Alliance 2017). Above the Five-Mile Dam, base flows in Big Chico Creek in the summer typically range from 20 to 25 cfs. The upper reaches of Big Chico Creek have been cut through metamorphic rock to create a narrow canyon and are relatively pristine due to their rugged nature and inaccessibility (CH2M Hill 1998).

All SPL&T lands in the Big Chico Creek watershed occur in the upper watershed upstream from the limits of anadromy. Big Chico Creek was designated as a Core 2 watershed for spring-run Chinook salmon and Central Valley DPS steelhead by NMFS in the Central Valley Recovery Plan (NMFS 2014a).

4.1.10.11. Butte Creek

Butte Creek originates in the Jonesville Basin and drains approximately 800 square miles (512,000 acres) of northeastern Butte County (NMFS 2014a). The stream is considered one of the most important Sacramento Valley streams for fish, particularly for spring-run Chinook salmon. SPL&T lands in the HCP Action Area within the Butte Creek watershed encompass approximately 59.18 square miles (37,876 acres), or 40 percent of the total watershed area.

Baseline condition for selected metrics in the Butte Creek watershed is summarized in Table 19. SPI manages lands in seven planning watersheds with ownership ranging from less than 1 to approximately 96 percent. No anadromous stream habitat occurs in these planning watersheds. SPL&T lands contain approximately 278 road miles, none of which occurs within 300 feet of anadromous stream habitat. SPL&T ownership contains approximately 126 miles of perennial stream above anadromy and 101 miles of seasonally flowing streams. There are 574 road crossings in the watershed and none occur in anadromous stream habitat.

Table 19. Baseline Conditions for SPL&T Lands in the Butte Creek Watershed.											
Planning Watershed Name	Miles of Anadromous Stream Habitat	Miles of Perennial Stream	Miles of Seasonal Stream	Road Length (miles)	Road Length in Anadromous Stream and 300-foot Corridor (miles)	Number of Stream Crossings	Number of Stream Crossings in Anadromous Stream Habitat	Current Percent of Road Length Delivering to Streams	Percent Planning Watershed Burned by Wildfire (2007-2018)	Percent Planning Watershed in SPL&T Ownership	Distance to Anadromy (miles)
Bolt Creek	0.00	1.28	2.07	4.44	0.00	3	0	NA	0.00	52.46	18.61
Willow Creek	0.00	18.13	10.27	45.51	0.00	70	0	NA	0.00	0.01	25.82
Timbered Crater	0.00	0.00	0.00	0.06	0.00	0	0	NA	0.08	95.88	7.27
Carpenter Ridge	0.00	46.68	36.65	75.70	0.00	189	0	NA	0.68	98.99	5.15
Forks of Butte	0.00	33.65	31.17	98.78	0.00	181	0	NA	0.24	51.50	4.31
Mosquito Creek	0.00	17.45	11.74	25.19	0.00	63	0	NA	0.00	40.72	7.49
Bull Creek	0.00	8.95	8.64	28.57	0.00	68	0	NA	0.00	83.81	11.46

All SPL&T lands in the watershed are managed for long-term timber production. As a result, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the Lassen National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI.

Butte Creek supports the largest population of Central Valley spring-run Chinook salmon. Williams et al. (2016) estimated the recent 3-year total spawning population at over 20,000 fish. A wild Central Valley DPS steelhead population also occurs in Butte Creek; however, the status of that population is unknown (NMFS 2014a).

Butte Creek historically supported a self-sustaining spring-run Chinook salmon population despite occurring at somewhat low elevations and having relatively warm summer water temperatures. Currently, Butte Creek water temperatures are augmented by the PG&E DeSabla-Centerville hydroelectric project, as inflows from diversions to the upper West Branch Feather River enter Butte Creek. These flows deliver cold water that help support the Central Valley spring-run Chinook salmon population by providing water temperatures suitable for summer holding and successful spawning (NMFS 2014a). Water temperature issues continue to pose threats to holding adult spring-run Chinook salmon and may limit habitat availability for steelhead (NMFS 2014a).

All SPL&T lands in the Butte Creek watershed occur in the upper watershed upstream from the limits of anadromy. Butte Creek was designated as a Core 1 watershed for spring-run Chinook salmon and a Core 2 watershed for Central Valley DPS steelhead by NMFS in the Central Valley Recovery Plan (NMFS 2014a).

4.2. Trinity Basin HCP Action Area

This section provides general baseline information for the Trinity River basin and summarizes covered species and watershed information in the Trinity Basin portion of the HCP Action Area. The NMFS SONCC Coho Salmon Recovery Plan (NMFS 2014b) classifications are used to summarize SPL&T lands relative to recovery plan classifications and describe common environmental conditions in the basin.

4.2.1. Topography/Geology

The Trinity River is the largest tributary to the Klamath River and drains approximately 3,000 square miles (1.92 million acres). The terrain in the Trinity River system is predominantly mountainous and forested, with elevations ranging from 9,000 feet in the Trinity Alps and the Trinity Mountains to 190 feet at the Klamath River confluence.

The topography within the Trinity River region is generally steep. Streams and rivers in the region are confined within deep canyons due primarily to the persistent and significant geologic uplift. Landslides are common on the steep valley walls, particularly within streamside inner gorges (USDA 2003). The abundance of mass wasting in the areas is a result of the steep topography, high rainfall amounts, and poorly lithified substrate, which has resulted in the delivery of large amounts of fine sediment in stream channels (USDA 2003).

The geology in the Trinity River region is complex and underlain by two major geologic provinces: the Klamath and Coast mountain ranges. The two ranges differ significantly based on age, lithology, structure, and metamorphism. The Klamath Mountains make up over 98 percent of the Lower and Middle Trinity River watersheds. The South Fork Trinity River watershed straddles the boundary between the Klamath Mountains and the Coast Range.

The Klamath Mountains province is a complex geologic region formed by the accretion of crustal material along the western edge of the North American continent during ancient subduction (California Geological Survey 2010). The region is characterized by elongate, fault-bounded belts of rock representing individual accretion events (USDA 2003). The belts are aligned in a concentric, northwest-trending fashion, and increase in age from southwest to northeast. Rocks in the province include greywacke sandstones, mudstones, greenstones, radiolarian chert, and relatively minor limestone, as well as metamorphic equivalents of those rock types and abundant granitic and intrusive ultramafic rocks (Snoke and Barnes 2006). The arrangement of those materials and their varying permeability often give rise to unstable landscapes capable of producing a large range of sediment from boulders to sand, silt, and clay. The Coast Range is underlain by the Franciscan Assemblage, a highly deformed, faulted, and sheared complex of partly metamorphosed marine sedimentary and volcanic rocks that actively decompose as they are exposed to the atmosphere and generate large volumes of sediment (CalWater 1980).

The Lower Trinity River landscape has historically been sensitive to human disturbance. Many slope failures are attributable to land use activities such as timber harvest, road construction, and hydraulic mining (USDA 2003). Similarly, the South Fork Trinity River watershed is characterized by unstable geology along with erosion-producing land use practices that lead to streamside landslides (NMFS 2014b). The Middle Trinity River includes the Weaverville Formation, a large slice of Oligocene continental material consisting of weakly consolidated mudstone and sandstone conglomerate with an impervious clay matrix. The Weaverville Formation tends to be unstable, particularly along over-steepened road cuts and steep banks (Trinity Resource Conservation and Development Council 2004) and can produce large quantities of fine-grained sediment.

SPI conducted a GIS-based land stability analysis for planning watersheds in the Trinity River Basin HCP Plan Area and SHA Plan area to aid conservation strategy and mitigation planning efforts. The analysis used data compiled by Wills et al. (2011) which incorporates landslide inventory, geology, rock strength, and slope to analyze statewide landslide susceptibility. The data creates classes of landslide susceptibility from zero to ten, low to high. SPI overlaid the GIS dataset onto the Trinity River Basin HCP and SHA planning watershed boundaries and summarized landslide risk categories for all HCP Plan Area and SHA Plan Area lands. This summary provides criteria for prioritizing mitigation strategies by planning watersheds and enables SPI to select planning watersheds most prone to slope failure in conjunction with READI model results for road improvement treatments. This allows SPI the ability to reduce the greatest risk and most likely potential sediment sources during the permit period. The land stability analysis summaries by HCP Plan Area and SHA Plan Area planning watersheds are presented in Appendix E, Tables E-3 and E-4.

4.2.2. Watershed Conditions

Recent assessments of watershed conditions describe several key threats to ESA listed fish in the Trinity River basin (NMFS 2014b) including dams and diversions, hatcheries, and roads; and key stressors that include altered hydrologic function, impaired water quality, and adverse hatchery related effects.

Appendix E, Table E-1 provides information within the HCP summarizing the number of miles of road, stream crossings and past harvest within planning watersheds encompassing SPL&T lands. Additionally, where planning watershed data has been collected, additional columns showing the number of connected sites and percentage of the road miles that are disconnected have been populated.

Appendix E, Table E-2 shows the planning watersheds and streams included in Table E-1 and provides road mile and stream crossing summary information relative to the amount of streams subject to anadromy. These summaries show the limited amount of planning watersheds subject to anadromy, the limited amount of anadromous stream reaches on SPL&T lands in these planning watersheds, and that relatively few road miles and a limited number of stream crossings occur in these anadromous stream reaches. Additionally, of the 29 stream crossings occurring in known or presumed anadromous stream reaches, 23 (79 percent) consist of bridges or culverts.

Within the Trinity River basin, mean annual precipitation can reach 70 to 80 inches over the coastal ridges, diminishing with lower elevations to averages of 40 to 60 inches in the foothills. Approximately 90 percent of the precipitation falls between October and April. Snow usually remains at highest elevations through May or June (USDA 2003).

The combination of land use, fire suppression actions, and climate change has contributed to the increase in frequency and severity of wildfires in the western United States (Miller et al. 2012). In the Klamath Mountains, fire frequency, size, and total area burned have greatly increased over the last 20 years (Miller et al. 2012). A recent study in the Klamath Mountains showed fire severity increases in relation to the amount of time since the previous fire, but is also correlated with other variables such as recent weather patterns and topography (Estes et al. 2017). Mechanical treatments for treating fuels and reducing fire hazards are impractical in many areas of the Klamath Mountains due to the steepness of the landscape (Estes et al. 2017). In 2017, the Trinity River basin experienced 12 wildfires that burned 55 square miles (35,200 acres) (CAL FIRE 2017). Of the 12 wildfires, only two wildfires accounted for over 99 percent of the area burned (CAL FIRE 2017).

Timber harvest within the Trinity River basin has required construction of hundreds of miles of unpaved timber roads (USDOI 1981). Road networks in the Trinity River basin and many areas of the Pacific Northwest are considered the most significant source of anthropogenic sediment input to anadromous fish habitats (USFS 2003). Roads have led to decreased hydrologic function and increased fine sediment input, which have reduced biological productivity of the Trinity River (NMFS 2014b).

The climate in the Lower Trinity River area experiences summer temperatures above 100°F and winter temperatures below freezing. Snow frequently accumulates above elevation 4,000 feet, with elevations between 3,000 and 4,000 feet frequently subjected to rain-on-snow events. The maximum elevation in the watershed is nearly 5,300 feet at the summit of East Fork Willow Creek. The lower Trinity River has 43 water withdrawal permits and 25 other non-permitted water systems, including the domestic water supply to residential areas within the Hoopa Valley from a surface withdrawal in Campbell Creek (USDA 2003). The reduction in surface and subsurface flow in tributaries reduces the amount of cool water refugia (USDA 2003).

Fire is also a large source of habitat disturbance, and several high severity fires have burned through the Lower Trinity River area since fire suppression activities began in the mid-1900s. For example, in 1999, two fires burned 302 square miles (205,000 acres), approximately 53 percent of the New River watershed (NMFS 2014b). Both fires impacted the riparian communities and accelerated the delivery of fine sediment to several streams in the Lower Trinity River basin. Since 2007, 0.38 square miles (243 acres) of HCP Action Area in the Lower Trinity River have been burned by wildfire.

Within the Middle Trinity River watershed, the main stem of the Trinity River leaves Trinity Reservoir and Lewiston Reservoir and flows west through the HCP Action Area. Since 2000, SPI has upgraded or maintained 400 miles of roads in the basin (100 miles were upgraded prior to 2000, and 100 miles need additional maintenance) and has upgraded over 800 water crossings (either through rock armoring, replacing, abandoning, or placing critical dips). The managed hydrology in the main stem has important effects on the presence of anadromous salmonids in the HCP Action Area. However, the effects of SPI management primarily occur within three watersheds, rather than in the main stem. Within Browns Creek, Little Browns Creek, and Weaver Creek, several total and partial physical and thermal barriers exist in the lower reaches, hindering access to headwaters (NMFS 2014b).

Fires have swept through the Middle and Upper Trinity River watersheds in the recent past (NMFS 2014b). The altered vegetation characteristics, consisting of stands composed of smaller trees and shrubs, present a higher threat for future high severity fires (Miller et al. 2012), which could alter sedimentation processes and riparian vegetation characteristics. Since 2007, 0.04 square miles (25 acres) of HCP Action Area in the Middle Trinity River have been burned by wildfire.

In the South Fork Trinity River watershed, streamflow characteristics vary somewhat throughout the system. For example, the Upper Hayfork watershed experiences variable streamflow due to differences in soil and geologic composition (USDA 1998). As throughout the Trinity River system, impacts of historical mining activities remain apparent within riparian areas on valley floors, especially along Hayfork Creek. Piles of mining tailings line the channel, constricting flow in places, producing fine sediment sources, and reducing the proper functioning condition of the stream and associated riparian zone (USDA 1998). Most of the tailings are at least 10 miles downstream from the HCP Action Area.

Within the South Fork Trinity River watershed, fire is a significant disturbance factor. Prior to the early 1900s, the basin experienced 5- to 30-year intervals of low intensity surface fires (USFS 2008). The suppression of fire, along with unnatural fuel loading, led to an era characterized by more frequent, high severity fires (USFS 2008). Since 2007, 4.35 square miles (2,784 acres) of the HCP Action Area in the South Fork Trinity River region have been burned by wildfire. The construction of 19.5 miles of roads within the HCP Action Area, along with wildfires and timber harvest, have contributed significant input of fine sediment in the South Fork Trinity River (US EPA 1998, 2001).

4.2.3. Water Quality

The tributaries within the Trinity River basin have been modified to various degrees by timber harvest, mining, and road building (US EPA 2001). Water quality ranges from excellent in the Trinity Alps Wilderness and northern main stem tributaries, to various degrees of human-caused impairment in the Middle and South Fork Trinity River watersheds (US EPA 2001). Potential sources of water quality impacts in stream reaches downstream from the HCP Action Area include increased suspended sediment concentration and turbidity, which are discussed in the following subsections.

4.2.3.1. Temperature

Prior to construction of Lewiston and Trinity Dams, juvenile salmonids and adult spring-run Chinook salmon are thought to have spent much of their time in tributary streams located in the upper watershed reaches. Many of these areas are now inaccessible due to these dams and the lower river reaches that are historically shallow and warm in the summer, are now expected to sustain these species and life stages throughout this period. Lewiston Dam releases are now sustained through the summer to provide adequate flow of cool water and meet these temperature needs (TRRP 2017).

Water quality in the Upper Trinity River is primarily impacted on a localized basis by fine sediments and water temperature (NMFS 2014b). Coho salmon distribution in the mainstem Trinity River can be at least partially explained by water temperature. While mainstem water temperatures during the summer months in the Upper Trinity River are usually cool downstream to the vicinity of Douglas City, temperatures can be problematic during drought years when storage in Trinity Reservoir is low, tributary flows are low, and air temperatures are typically high for long durations. Downstream of Douglas City, daily average mainstem water temperatures during the summer months are higher than the published range for juvenile coho salmon rearing, and some smaller tributary streams may be subject to water temperatures increasing to levels stressful for rearing coho salmon during this period (NMFS 2014b).

4.2.3.2. Suspended Sediment

The wet, uplifted marine sedimentary geology of the Trinity River basin is like other areas that have been shown to produce more frequent sediment when logged (Bunn and Montgomery 2004). The South Fork Trinity River watershed experienced extensive timber harvesting in the past that has caused erosion and sedimentation of streams and the river, especially following the flood of 1964. The area is also susceptible to naturally occurring landslides and other mass-wasting events because of steep terrain, loosely consolidated soils (decomposed granite), and heavy precipitation. Mass wasting events also contribute a significant source of sediment to tributary streams and may explain the high sediment loading of Trinity River basin streams, particularly in the South Fork Trinity River watershed. Both the main stem Trinity River and South Fork Trinity River are listed as impaired due to fine sediment impacts under Clean Water Act Section 303(d). The US EPA has established TMDLs for both streams (US EPA 1998, 2001). While noting that conditions were improving in some areas, the TMDLs set sediment load allocations that specify the amount of fine sediment reduction needed to meet the water quality objectives.

The Trinity River basin HCP Plan Area has 964 identified features that meet the CFPR definition of unstable areas. Those features amount to 1.9 square miles (1,218 acres) where timber operations are modified to minimize instability and may be reviewed by a licensed geologist. Mass wasting and road failures within the Trinity River watershed generally occur during episodic events with either high duration, high intensity rainfall or warm atmospheric river events causing rain on snow melting. During the winter of 1997, Trinity County experienced a large storm event resulting from a warm tropical storm that brought large quantities of moisture and hastened the snowmelt below 7,000 feet. This storm closed state Highways 3 and 299 due to eroded fills and mass wasting. The impacts from this storm event and the wet winter of 1998 have resulted in some stream bank destabilization, aggradation of pools, and gravel siltation. Conversely, these pulses of water have deepened pools, scoured channels, and recruited LWD into the stream channel. An extremely heavy winter rainfall also occurred in 2006. Numerous shallow debris slides were triggered during the 1998 storms, within the Lowden fire near Lewiston. This material moved into watercourses and some sediment eventually reached the Trinity River, where most of the material was flushed downstream during the resultant BOR managed high water flows of spring 2006 (T. Waltz, former SPI Weaverville District Manager, pers. comm.). This ebb and flow of episodic sediment material is typical of all the planning watersheds in the HCP; however, the Trinity River basin has the highest propensity for mass wasting due to topography, parent material, and soil types.

Mass wasting risk as experienced in 1997 generally originates from inner gorge stream side destabilization due to over-steepened slopes adjacent to watercourses or concave headwall swales located in the steepest, highest reaches of a watershed. Inner gorges and headwall swales are characterized in the CFPRs as areas where additional expertise from a professional geologist may be required if harvest or road building activities are proposed. The CFPRs require identification, disclosure, and review by geologist professionals and protection measure implementation when operations are proposed on unstable areas, inner gorges or headwall swales.

The Middle Trinity River watershed is relatively flat and, therefore, has high levels of sediment deposition. Logging operations and road building and use have caused erosion, sedimentation, and elevated turbidity of tributary streams and the river. Several analyses have been conducted in tributaries in this area. De la Fuente et al. (2000) considered Weaver and Rush Creeks to be impaired, based on the stream conditions. The water quality conditions were rated as functioning, and the watershed hazard condition is high.

In USFS research prior to the US EPA's TMDL, De la Fuente et al. (2000) determined that Browns Creek was in moderate condition, with a high number of road-stream intersects and road miles on steep slopes. As described above, De la Fuente et al. (2000) stated that the high numbers of road/stream intersects and steep roads contributed to the sediment loading in Rush Creek and Weaver Creek. The US EPA (2001) reported turbidity values in Indian, Reading, and Browns

Creeks during storm events exceeding 500 NTU, much higher than in high quality reference streams. These streams are located outside the HCP Plan Area in the Middle Trinity HA.

The Lower Trinity River watershed was not subject to as much historical timber harvesting as the Middle Trinity watershed. It also has much greater topographic relief and extensive areas of barren rock than the Middle Trinity watershed. In most locations, sediment loads are lower as a result (NCRWQCB 2005). The small area of SPL&T lands in the Lower Trinity River watershed is not expected to be the source of suspended sediment.

4.2.3.3. Turbidity

Turbidity is typically low in the Upper Trinity River during summer conditions and is a natural occurrence in during storms or other runoff events (TRRP 2017). High turbidity levels have been measured historically in the Upper Trinity River watershed during high flow events, including the Grass Valley, Indian Creek, and Browns Creek sub-watersheds (California Department of Water Resources 1980). Based on their sampling results and noting approximately 50 percent of these watersheds had been logged during the previous 25 years, the California Department of Water Resources (1980) suggested soils and bedrock in these areas are sensitive to human disturbance. Turbidity effects have also been noted as part of impaired water quality issues in the South Fork Trinity River Watershed (NMFS 2014b).

4.2.4. Aquatic Habitat

Most streams within the Trinity River system begin in the Trinity Alps Wilderness area and the upper portions of these watersheds are in very good condition. These areas are outside the HCP and SHA Plan and Action Areas. Outside these areas, the quality of riparian areas and instream habitat decline due to habitat degradation from hydraulic mining, water diversions, and timber harvest and road construction (see Section 4.2.3, *Water Quality*).

The HCP Action Area is primarily in the upper reaches and headwaters, which typically provide high quality aquatic habitat. SPI does not have data on the aquatic habitat condition of these watersheds. General information on the lower reaches that may impact accessibility to the HCP Action Area are summarized below.

Impoundment of the Trinity River by Trinity and Lewiston Dams during the early 1960s blocked 109 miles of spawning and rearing habitat from access by migrating salmon and steelhead (NMFS 2014b). The dams and the associated diversion also led to substantially different conditions in the river below the dams, especially in the Middle Trinity River watershed, allowing intruding riparian vegetation, simplified instream habitat, embedded substrates, and unnatural seasonal stream flows (USDOI 2000). Reduced flows led to accumulations of fine sediment, particularly from logged areas in the Grass Valley Creek watershed. More recently, the Trinity River Restoration Program (TRRP) has conducted many projects involving mechanical channel modifications and streamflow management (Buffington et al. 2014). In addition, BLM has acquired and is restoring 26.6 square miles (17,000 acres) of former private timber lands, primarily in the Grass Valley Creek watershed, and extensive erosion control programs are being implemented by the Trinity County Resource Conservation District and the Natural Resources Conservation Service (US EPA 2001).

Aquatic habitat in Browns Creek has also been affected by low flows. Although the Browns Creek watershed historically supported spawning Chinook salmon, stream flows are regularly too low to support spawning. In addition, access was reportedly not available until later in the season when increasing precipitation raised flows (LaFaunce 1965). In the 1940s, impoundments and dam removal were considered to increase salmon spawning capacity by providing adequate flows earlier in the season, but such changes were never implemented (USDOI 1995).

Mining and road construction have altered stream channel configuration in the Upper Hayfork Creek drainage (including East Hayfork Creek). Along Hayfork Creek, the removal of riparian forests for mining and roads, fire suppression, and the practice of removing large wood from active channels to prevent flooding have altered the amount and rate of recruitment of large wood into streams (USDA 1998). Such activities have negatively affected the function of stream ecosystems and their dependent fish populations (USDA 1998).

Spawning and rearing habitat in Trinity River tributaries has been affected by grazing, timber harvest, roads, and local diversions, especially in lower reaches with the lower gradients preferred by coho salmon. Past assessments (De la Fuente et al. 2000; US EPA 2001) found Weaver and Rush Creeks to be impaired and at risk, and Browns Creek to be in moderate condition. The TRRP, Trinity County Resource Conservation District, and other cooperators have conducted numerous restoration actions in the tributary watersheds, especially the Grass Valley Creek watershed (e.g., 5C Program 2017; TRRP 2017; Tri County Resource Conservation District 2017).

4.2.5. Riparian Function

Riparian conditions are measured using metrics on canopy cover (canopy closures average 70 percent), average diameter of overstory trees (exceeding 24 inches), core area harvest restrictions (no cut core areas of 30 feet on each side of fish-bearing streams), and harvest restrictions near unstable soils (an inner zone of 70 feet within minimal harvest occurring and soil stabilization required when greater than 100 square feet of exposed soil occurs as part of CEQA approved projects). Although SPI does not have data on these metrics within the HCP Plan Area, riparian corridors within SPL&T lands are consistent with CFPRs. Compliance with the CFPRs reduce activities within near proximity to streams to protect riparian corridors that increase hardwood canopy retention and forage material for salmonids, maintain cold-water inputs from springs and smaller streams, and provide a source of LWD for improving habitat complexity.

4.2.6. Land Use

Approximately 70 percent of land within the Trinity River basin is managed by USFS or BLM or is included in the Hoopa Tribal Reservation. The Six Rivers and Shasta-Trinity National Forests, and the Redding District BLM account for most public land management. Nearly half of the public lands are within federally designated wilderness areas or inventoried roadless areas (USDA 1998). Private lands account for the remaining 30 percent of land within the basin, approximately half of which is owned by logging companies. In addition to being used for timber harvest, land within the Trinity River basin, particularly the Upper Hayfork Creek watershed, has been used for mining (USDA 1998). USDA (1998) reported that there were several hundred miles of roads within the watershed, ranging from state highways to rudimentary jeep roads and trails, which provided access for timber harvest and mining, as well as recreation. While road improvements and decommissioning have occurred in recent years, SPI has not found summary documentation of the extent.

Much of the Lower Trinity River watershed is designated as a federal wild and scenic river; however, the area experienced hydrologic mining in the past. Current mining practices consist of small placer sluicing and hard rock milling operations (NCRWQCB 2005). The Helena watershed is mostly designated as wilderness and, therefore, little timber harvesting occurs in that subarea. Some mining still takes place in the lower part of the watershed.

The South Fork Trinity River watershed is primarily mountainous, forested land, with two broad agricultural valleys occupied by the towns of Hayfork and Hyampom. The area has a mix of private land and public land administered by USFS. Extensive timber harvesting in the past has caused erosion and sedimentation of streams and the Trinity River (NCRWQCB 2005).

The Middle Trinity River watershed has the highest population of the three watersheds in the unit. Douglas City and Weaverville are the population centers (NCRWQCB 2005). The only large-scale agriculture use is cattle grazing. Timber harvest continues, but at a reduced level than in the past on federal lands (NCRWQCB 2005).

4.2.7. SONCC Coho Salmon Diversity Strata and Populations

The NMFS (2014b) recovery plan classification includes the Interior Trinity Diversity Stratum, which consists of the Upper, South Fork, and Lower Trinity River populations. The Lower Trinity River population is outside the HCP/SHA Plan and Action Areas. The Upper and South Fork Trinity River populations correspond to the Lower Trinity and South Fork Trinity CalWater Hydrologic Areas, respectively, as shown in Appendix E, Tables E-1 and E-1.

The HCP Action Area within the Trinity River basin occurs within one NMFS (2014b) diversity strata: The Interior Trinity (Appendix E). The Interior Trinity diversity strata includes the Lower Trinity, South Fork Trinity and Upper Trinity SONCC coho salmon populations.

The Lower Trinity River CalWater Hydrologic Area includes all watersheds occurring in the main stem Trinity River extending from the North Fork Trinity River confluence downstream to the Klamath River confluence. SPL&T does not own lands in this SONCC coho salmon population portion of the Interior Trinity diversity strata.

The South Fork Trinity River includes watersheds occurring in the South Fork Trinity River extending from the South Fork Trinity River confluence upstream to the South Fork Trinity River headwaters. The 932-square-mile South Fork Trinity River originates in the northern Yolla Bolly Mountains, about 50 miles southwest of Redding, and runs northwest for approximately 90 miles before reaching its confluence with the Trinity River near Salyer. The South Fork Trinity River, which is the largest undammed river remaining in California (US EPA 1998), flows mostly through Trinity County before forming the boundary between Trinity and Humboldt Counties in its lower 12 miles. SPL&T lands comprise about 3 percent of the South Fork Trinity River watershed overall, including small portions of the Barker Creek (6.2 percent of 10.3 square miles), Eltapom Creek (2.3 percent of 9.1 square miles), Hayfork Creek (35.3 percent of 20.9 square miles), and Salt Creek (3.2 percent of 14.15 square miles) watersheds.

The South Fork Trinity River SONCC coho salmon population of the Interior Trinity Diversity Strata is considered Functionally Independent and at a High extinction risk (NMFS 2014b).

The Upper Trinity River includes all watersheds occurring in the main stem Trinity River extending from the North Fork Trinity River confluence upstream to Lewiston Dam, including the Trinity River watersheds above Lewiston and Trinity Lakes. SPL&T lands in the watersheds below these reservoirs are included in the HCP Action Area. These watersheds include Canyon Creek (39.4 square miles), Dutch Creek (78.4 square miles), and Soldier Creek (16.5 square miles). The HCP Action Area comprises approximately 1.7 percent, 14.1 percent, and 11.5 percent of these watersheds, respectively. The Upper Trinity River also includes the Grass Valley (45.4 square miles), Indian (49.3 square miles), Reading (16.2 square miles), Browns (198.9), Rush (22.5 square miles), East Weaver (12.9 square miles), West Weaver (10.2 square miles), and Weaver Creeks (14.1 square miles). Combined, approximately 32 percent of these watersheds are in SPL&T ownership, making it an important portion of this HCP.

The Upper Trinity River SONCC coho salmon population of the Interior Trinity Diversity Strata is considered Functionally Independent and at a Moderate extinction risk (NMFS 2014b).

4.2.8. Upper Klamath River/Trinity River ESU Chinook Salmon and Klamath Mountains Province Steelhead DPS

For the purposes of this HCP, the geographic extent of Upper Klamath River/Trinity River ESU Chinook salmon and Klamath Mountains Province steelhead DPS is assumed to include all Class I streams as defined in the CFPRs in all planning watersheds within the HCP Action Area. This area includes all streams considered currently accessible and otherwise restorable for these covered species. Using the Class I stream designation represents a conservative estimate of anadromy in the HCP Plan Area, as this designation is based on fish presence, regardless of anadromous or resident status. These stream designations in the HCP Plan Area are all included in the ASP rules.

4.2.9. Baseline Conditions of Trinity River Basin SPL&T Lands by SONCC Coho Salmon Diversity Strata and Populations

The baseline conditions for the Upper, South Fork, and Middle Trinity River Hydrologic Areas are described in the following subsections.

4.2.9.1. Upper Trinity River

The Interior Trinity diversity strata includes the Lower Trinity, South Fork Trinity and Upper Trinity SONCC coho salmon populations. The Upper Trinity population includes the Lower Trinity River CalWater Hydrologic Area.

SPL&T lands in the HCP Plan Area occur in six planning watersheds included in the Lower Trinity Hydrologic Area. These planning watersheds encompass approximately 67 square miles (43,120 acres). SPL&T ownership includes approximately 18 percent (7,907 acres) of these watersheds.

Baseline conditions for selected metrics in the Upper Trinity River are summarized in Table 20. SPI manages lands in six planning watersheds with ownership ranging from approximately 3 to 74 percent. Approximately 4 miles of anadromous stream habitat (Class I streams) occurs in these watersheds. SPL&T lands contain approximately 83 road miles, 1 of which occurs within 30 feet of anadromous stream habitat. SPL&T ownership contains approximately 26 miles of perennial stream above anadromy and 30 miles of seasonally flowing streams. There are 171 road crossings in the Upper Trinity River watershed, and one crossing occurs in anadromous stream habitat.

SPL&T lands in the watershed are managed for long-term timber production and therefore, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the Shasta-Trinity National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI.

Table 20. Baseline Conditions for SPL&T Lands in the Lower Trinity Hydrologic Area (Upper Trinity Southern Oregon/Northern California Coast Coho Salmon Population).											
Planning Watershed Name	**Miles of Anadromous Stream Habitat**	**Miles of Perennial Stream**	**Miles of Seasonal Stream**	**Road Length (miles)**	**Road Length in Anadromous Stream and 300-foot Corridor (miles)**	**Number of Stream Crossings**	**Number of Stream Crossings in Anadromous Stream Habitat**	**Current Percent of Road Length Delivering to Streams**	**Percent Planning Watershed Burned by Wildfire (2007-2018)**	**Percent Planning Watershed in SPL&T Ownership**	**Distance to SONCC Coho Salmon Anadromy (miles)**
Mill Creek	0.00	0.69	0.51	14.46	0.00	2	0	31.95	58.16	2.60	2.49
Oregon Gulch	0.00	3.33	4.13	1.92	0.00	15	0	7.55	1.07	25.10	2.37
Clear Creek	0.00	0.14	0.09	21.86	0.00	0	0	0	0.00	2.89	3.34
Dutch Creek	2.02	6.41	10.51	32.61	0.89	33	1	8.5	0.00	34.4	0.00
Maxwell Creek	1.60	12.92	11.43	11.34	0.08	101	0	18.26	0.00	74.2	0.12
Soldier Creek	0.76	3.07	3.54	1.40	0.05	20	0	9.71	0.00	11.5	3.34

4.2.9.2. South Fork Trinity River

The Interior Trinity diversity strata includes the Lower Trinity, South Fork Trinity and Upper Trinity SONCC coho salmon populations. The South Fork Trinity population includes the South Fork Trinity River CalWater Hydrologic Area. SPL&T lands in the HCP Plan Area occur in 18 planning watersheds included in the South Fork Trinity Hydrologic Area. These planning watersheds encompass approximately 208 square miles (132,776 acres). SPL&T ownership includes approximately 13 percent (17,162 acres) of these watersheds. Baseline conditions for selected metrics within the South Fork Trinity River are summarized in Table 21. SPI manages lands in 18 planning watersheds with ownership ranging from less than 1 to 61 percent. Approximately 7 miles of anadromous stream habitat (Class I streams) occurs in these watersheds. SPL&T lands contain approximately 288 road miles, of which 4 road miles are located within 300 feet of anadromous stream habitat. SPL&T ownership contains approximately 52 miles of perennial stream above anadromy and 82 miles of seasonally flowing streams. There are 424 stream crossings in the South Fork Trinity River watershed, and five crossings occur in anadromous stream habitat.

SPL&T lands in the watershed are managed for long-term timber production and, therefore, the planning watersheds have high levels of road use and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the Shasta-Trinity National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI.

Table 21. Baseline Conditions for SPL&T Lands in the South Fork Trinity Hydrologic Area.

Planning Watershed Name	Miles of Anadromous Stream Habitat	Miles of Perennial Stream	Miles of Seasonal Stream	Road Length (miles)	Road Length in Anadromous Stream and 300-foot Corridor (miles)	Number of Stream Crossings	Number of Stream Crossings in Anadromous Stream Habitat	Current Percent of Road Length Delivering to Streams	Percent Planning Watershed Burned by Wildfire (2007-2018)	Percent Planning Watershed in SPL&T Ownership	Distance to SONCC Coho Salmon Anadromy (miles)
Middle Eltapom Creek	0.00	0.57	1.31	7.35	0.00	4	0	NA	93.45	2.33	7.31
Bierce Creek	1.37	3.35	4.82	0.56	0.68	13	1	15.16	0.00	7.18	39.45
Swift Creek	0.00	0	0	5.26	0.00	0	0	0	102.25	0.90	21.44
Cave Creek	0.00	0	0.52	4.92	0.00	3	0	2.2	100.74	3.99	21.50
Jims Creek	0.00	0	0	1.81	0.00	0	0	NA	84.83	0.11	15.65
Naufus Creek	0.00	0	1.94	11.48	0.00	3	0	10.34	82.98	6.67	14.80
Upper Indian Valley Creek	0.00	0	0.17	13.8	0.00	0	0	0	57.20	2.19	9.34
Hall City Creek	0.74	2.07	5.06	47.96	0.57	32	1	21.13	0.00	6.66	22.22
Potato Creek	0.00	3.31	4.07	2.96	0.00	20	0	10.27	0.00	13.10	16.13
North Fork Hayfork Creek	3.16	17.05	16.15	13.28	1.68	128	1	12.26	0.00	51.15	17.25
Wilson Creek	0.86	1.57	1.07	28.41	0.44	4	1	39.3	19.21	1.88	20.00
Devils Gulch	0.00	3.97	5.81	15.09	0.00	40	0	16.41	0.00	54.52	11.28
Upper Carr Creek	0.62	9.52	19.35	12.41	0.41	84	1	17.05	9.06	61.18	9.49
Duncan Creek	0.56	4.35	3.32	4.56	0.00	20	0	4.6	0.00	31.28	9.36
Lower Carr Creek	0.10	3.68	10.9	20.56	0.23	40	0	14.24	24.67	16.92	7.96
Barker Creek	0.00	0.86	1.58	1.49	0.00	4	0	8.5	12.69	6.20	7.40
Shock Creek	0.00	6.75	5.75	35.18	0.00	29	0	2.87	0.00	55.51	11.89
Brock Gulch	0.00	1.52	0	61.09	0.00	0	0	NA	99.55	3.15	0.83

4.2.9.3. Middle Trinity River

The Interior Trinity diversity strata includes the Lower Trinity, South Fork Trinity and Upper Trinity SONCC coho salmon populations. The Upper Trinity population includes the Middle Trinity River CalWater Hydrologic Area.

SPL&T lands in the HCP Plan Area occur in 23 planning watersheds included in the Middle Trinity Hydrologic Area. These planning watersheds encompass approximately 296 square miles (189,121 acres). SPL&T ownership includes approximately 40 percent (116.8 square miles) of these watersheds.

Within the Middle Trinity River watershed, the main stem of the Trinity River leaves Trinity Reservoir and Lewiston Reservoir and flows west through the HCP Action Area. Since 2000, SPI has upgraded or maintained 400 miles of roads in the basin (100 miles were upgraded prior to 2000, and 100 miles need additional maintenance) and has upgraded over 800 water crossings (either through rock armoring, replacing, abandoning, or placing critical dips). The managed hydrology in the main stem has important effects on the presence of anadromous salmonids in the HCP Action Area. However, the effects of SPI management primarily occur within three watersheds, rather than in the main stem. Within Browns Creek, Little Browns Creek, and Weaver Creek, several total and partial physical and thermal barriers exist in the lower reaches, hindering access to headwaters (NMFS 2014b).

Baseline conditions for selected metrics within the Middle Trinity River watershed are described in Table 22. SPI manages lands in 23 planning watersheds with ownership ranging from approximately 1 to 95 percent. Approximately 49 miles of anadromous stream habitat (Class I streams) occurs in these watersheds. SPL&T lands contain approximately 561 road miles, and 24 road miles are located within 300 feet of anadromous stream habitat. SPL&T ownership contains approximately 208 miles of perennial stream above anadromy and 334 miles of seasonally flowing streams. There are 1,622 road crossings in the Middle Fork Trinity River watershed, and 23 crossings occur in anadromous stream habitat.

All SPL&T lands in the watershed are managed for long-term timber production. As a result, the planning watersheds have high levels of roading and historic timber harvest. Most non-SPL&T land in the forested portion of the watershed is public land managed by the Shasta-Trinity National Forest. Timber harvest on public lands has been reduced in the past several decades, and consists primarily of thinning, and limited salvage following wildfire. As a result, the amount of timber harvest (and roads) in planning watersheds is directly correlated with the portion of the watershed managed by SPI.

Table 22. Baseline Conditions for SPL&T lands in the Middle Trinity Hydrologic Area.											
Planning Watershed Name	**Miles of Anadromous Stream Habitat**	**Miles of Perennial Stream**	**Miles of Seasonal Stream**	**Road Length (miles)**	**Road Length in Anadromous Stream and 300-foot Corridor (miles)**	**Number of Stream Crossings**	**Number of Stream Crossings in Anadromous Stream Habitat**	**Current Percent of Road Length Delivering to Streams**	**Percent Planning Watershed Burned by Wildfire (2007-2018)**	**Percent Planning Watershed in SPL&T Ownership**	**Distance to SONCC Coho Salmon Anadromy (miles)**
Johnson Gulch	0.78	11.37	12.13	55.79	0.00	51	0	8.01	20.12	44.12	0.27
East Fork Browns Creek	8.02	25.40	26.53	31.69	4.93	157	5	12.51	1.06	76.57	0.31
Middleton Gulch	4.44	21.80	19.89	2.98	1.88	101	4	13.55	0.00	95.27	0.00
Hazel Gulch	1.14	8.38	20.39	0.20	0.32	53	0	8.31	0.00	68.99	0.00
Chanchelulla Creek	1.66	6.78	3.35	16.14	0.41	27	2	16.15	12.15	15.11	6.26
Dutton Creek	2.83	11.15	8.23	38.00	1.77	52	0	11.98	0.91	35.30	0.00
Little Creek	3.88	27.01	18.47	39.41	3.32	95	1	13.09	0.00	90.68	0.45
Lower Reading Creek	3.45	17.59	26.45	39.81	1.02	100	0	14.29	0.57	54.55	0.00
Upper Reading	3.19	16.68	14.16	35.38	0.46	92	1	6.07	0.00	43.96	4.19
Middle Indian Creek	3.46	12.91	12.09	22.84	1.92	44	1	8.16	0.00	58.20	0.05
Lower Indian Creek	2.26	10.92	15.78	36.99	0.49	71	1	13.66	0.00	45.78	0.00
Tom Lang Gulch	0.31	14.05	14.01	43.52	0.06	80	0	14.64	0.00	49.46	0.00
Upper Indian Creek	3.15	12.94	9.40	14.76	0.39	58	2	12.68	0.29	42.13	2.49
Little Grass Valley Creek	2.35	0.09	1.13	0.25	0.00	0	0	0.00	98.39	1.32	4.71
Upper Grass Valley Creek	0.13	5.44	8.22	16.65	0.00	55	0	13.53	11.90	14.79	0.31
Deadwood Creek	2.79	9.35	17.46	23.34	2.30	68	1	18.57	63.64	30.13	0.00
Upper Rush Creek	0.59	1.52	6.49	2.82	0.02	5	0	32.65	0.00	9.63	0.00

Table 22 (continued). Baseline Conditions for SPL&T lands in the Middle Trinity Hydrologic Area.											
Planning Watershed Name	**Miles of Anadromous Stream Habitat**	**Miles of Perennial Stream**	**Miles of Seasonal Stream**	**Road Length (miles)**	**Road Length in Andromous Stream and 300-foot Corridor (miles)**	**Number of Stream Crossings**	**Number of Stream Crossings in Anadromous Stream Habitat**	**Current Percent of Road Length Delivering to Streams**	**Percent Planning Watershed Burned by Wildfire (2007-2018)**	**Percent Planning Watershed in SPL&T Ownership**	**Distance to Anadromy (miles)**
Lower Rush Creek	1.08	19.50	36.19	53.68	2.16	240	3	22.40	0.00	63.33	0.00
Lower Grass Valley Creek	2.16	10.32	25.80	31.08	0.28	112	0	20.75	12.32	34.45	0.00
West Weaver Creek	0.27	3.52	6.90	14.96	0.25	28	0	7.46	1.92	14.26	0.46
Little Browns Creek	0.83	5.22	14.13	15.40	1.17	57	2	24.24	0.32	58.84	0.00
Lower Weaver Creek	0.78	3.21	8.31	16.06	0.15	38	0	14.02	0.42	23.40	0.00
East Weaver Creek	8.02	2.05	8.72	9.17	0.43	38	0	11.35	0.00	9.73	0.40

4.3. Baseline Conditions in SHA Action Areas

This section provides baseline information for covered species and watersheds in the SHA Action Area and includes the priority watershed classifications for reintroduction in the Sacramento Basin per the NMFS Recovery Plan (NMFS 2014a) and Trinity Basin for the SONCC coho salmon recovery plan (NMFS 2014b). The NMFS recovery plans identified potential reintroduction areas based on the historical range of the listed species and that current habitat conditions in these areas are capable of supporting listed salmonid populations. The SHA Action Areas are within five CalWater (2018) Hydrologic Units (HUs), and several CalWater Hydrologic Areas (HAs) and Hydrologic Sub-Areas (HSAs). The five HUs include: McCloud River, Upper Sacramento River, Shasta Dam, Yuba River, and Trinity River.

The elevated baseline in the SHA Plan Area will support NMFS' listed salmonid species reintroduction efforts. SPI will use the READI model to identify locations of road and drainage improvement projects. Once implemented, these improvements become permanent features in the SHA Plan Area, regardless of current NMFS reintroduction efforts, resulting in improved, or elevated, baseline habitat conditions.

Currently, NMFS plans to reintroduce listed salmonids in the following locations in the SHA Plan Area:

- The Sacramento River above the Shasta Dam (also referred to as the Little Sacramento River or the Upper Sacramento River) from Box Canyon Dam downstream to Lake Shasta.
- The McCloud River, extending downstream of Lower McCloud Falls through Lake McCloud to Lake Shasta.
- In the Battle Creek watershed, extending downstream from Whispering Falls on North Fork Battle Creek and downstream from Angel Falls on South Fork Battle Creek to the Coleman National Fish Hatchery.
- In the North Yuba River, above New Bullards Bar Dam, and in the South and Middle Yuba River, upstream of Englebright Dam on the Yuba River.
- In Stuart's Fork of the Upper Trinity River, the East Fork of the Trinity River, and the main stem of the Trinity River upstream of Trinity Lake as influenced by Trinity Dam.

The SHA Plan Area includes the SPL&T property within watersheds upstream of currently impassable barriers where NMFS intends to reintroduce listed salmonids. The SHA Action Area includes SPL&T lands that will be accessible to reintroduced salmonids, and other SPL&T lands that are upstream of the estimated upper limit of anadromy because of potential downstream impacts on water quality.

4.3.1. General Description

The SHA Plan Area includes portions of the Upper Sacramento River, McCloud River, Shasta Dam, Yuba River, and Trinity River HUs. General descriptions of these HUs are provided below.

4.3.1.1. Upper Sacramento River

The 423-square-mile Upper Sacramento[1] HU originates from water draining from Mount Shasta to the north and from the Klamath Mountains to the west. The basin spreads south for approximately 40 miles and empties into Lake Shasta, above Shasta Dam. SPL&T ownership includes approximately 14.4 percent of the land in the Upper Sacramento River basin; however, much of the surface drainage from Mount Shasta typically only connects to the river above Box Canyon Dam, outside the SHA Action Area. SPL&T lands included in the SHA Plan Area encompass approximately 60 square miles (38,420 acres), or about 9 percent of the 109-square-

[1] The Upper Sacramento River referred to here is the same stream referred to as the Little Sacramento River in NMFS (2014a).

mile Dunsmuir HSA below Box Canyon Dam. Importantly for the SHA, SPL&T owns 29.7 percent of the 169-square-mile Lamoine HA in the lower portion of the Upper Sacramento River Canyon.

The Upper Sacramento River is classified as a Candidate stream for winter-run Chinook salmon, spring-run Chinook salmon, and steelhead by NMFS (2014a). Candidate streams are areas for reintroduction that are characterized as currently unoccupied habitats requiring further study of their potential for successful reintroduction efforts.

4.3.1.2. McCloud River

The McCloud River HU drains an approximately 684 square mile (437,760 acres) area and is located near the southern end of the Cascade Range. The headwaters are located in Colby Meadows, approximately 85 miles northeast of Redding. The McCloud River flows southwesterly for approximately 50 miles to Lake Shasta, entering the Shasta Dam HU. Overall, SPL&T owns 14.6 percent of the McCloud River HU, which is divided among the Wyntoon and Squaw Creek HAs. Overall, about 60 percent of the Wyntoon HA lies in the McCloud River HU above McCloud Dam and Reservoir, and about two-thirds of SPL&T ownership in the Wyntoon HA is also above the dam and impoundment. These areas of the McCloud River HU are excluded from the SHA.

Below McCloud Dam, the Lower McCloud River and its major tributary, Squaw Valley Creek, run south through steep forested canyons toward Lake Shasta, which is 15 air miles downstream. Below McCloud Dam, SPL&T lands included in the SHA Plan Area encompass approximately 27.2 square miles (17,400 acres), or about 26.3 percent and 7.7 percent of land in the Lower McCloud River and Squaw Valley (Creek) HSA's, respectively — representing the most important portion of the McCloud River area for purposes of the SHA.

The McCloud River is classified as a Primary stream for winter-run Chinook salmon, spring-run Chinook salmon, and steelhead reintroduction by NMFS (2014a). Primary streams are areas for reintroductions where there is a known high likelihood of success based on species-specific life history needs, and available habitat quality and quantity.

4.3.1.3. Shasta Dam Basin

The 373-square-mile Shasta Dam HU comprises the Lake Shasta HA. The HU includes numerous small streams entering the reservoir, but it does not include the lake's four major tributaries (Upper Sacramento River, McCloud River, Squaw Creek, and Pit River). SPL&T owns 11 percent of the land within the Shasta Dam HU, but most of SPL&T land within the unit drains into Lake Shasta rather than into the tributaries included in the SHA.

The Shasta Dam basin is not included in the NMFS (2014a) reintroduction priority classifications.

4.3.1.4. Yuba River

The 1,495-square-mile Yuba River HU drains from the west slope of the Sierra Nevada at Donner Pass to the Feather River near Yuba City. Most of the flow in the Yuba River comes from its three supporting HAs: North, Middle, and South Yuba Rivers. The North Yuba River HA is blocked by New Bullards Bar Dam and Bullards Bar Reservoir. SPL&T owns about 38.7 square miles (24,760 acres), or 8 percent, of the 349-square-mile (223,359 acres) North Yuba River HA; 55.3 square miles (35,432 acres), or 27 percent of the 211-square-mile (135,039 acres) Middle Yuba River HA; and approximately 32.4 square miles (20,754 acres), or 9.2 percent, of the 353-square-mile (225,920-acre) South Yuba River HA. Below New Bullards Bar Dam, the three forks join to form the main stem Yuba River, which is then impounded by Englebright Reservoir and Englebright Dam. Englebright Reservoir is over 20 miles downstream from any SPL&T property, except for one parcel of 0.17 square miles (108 acres) located just below New Bullards Bar Dam in the Ure Mountain HA. The HAs of the three Yuba River forks comprise the SHA Action Area in the Yuba River HU.

The North and Middle Yuba Rivers are classified as Primary streams for spring-run Chinook salmon and steelhead reintroduction by NMFS (2014a); while the South Yuba River is classified as a primary stream for steelhead and a Candidate stream for spring-run Chinook salmon (NMFS 2014a).

4.3.1.5. Trinity River

The Trinity River HU encompasses 29,710 square miles. This unit includes the Upper Trinity River HA, which encompasses 1,183 square miles (757,120 acres), and represents the portion of the Trinity River HU upstream of Trinity Lake. Historically, the Upper Trinity River functioned as a dynamic river reach, with quality spawning and rearing habitat for anadromous fish. The 1958 construction of the Trinity River Diversion and the 1963 construction of the Lewiston Dam effectively blocked upstream access and limited production of salmonids downstream of the dam. The SHA Action Area includes three watersheds in the Upper Trinity River HU; Stuart's Fork Trinity River, (upper) main stem Trinity River, and the East Fork Trinity River. SPL&T lands in these watersheds encompass approximately 6.6 square miles, 29.1 square miles, and 27.0 square miles (4,204 acres, 18,634 acres, and 17,294 acres), respectively.

The Upper Trinity River HU occurs within the Upper Trinity River population of the Interior Trinity Diversity Strata for SONCC coho salmon population (NMFS 2014b). While this HU is currently above the current anadromous limits, the SONCC population encompassing this area is considered Functionally Independent and at a Moderate extinction risk (NMFS 2014b).

4.3.2. Topography/Geology

The Upper Sacramento River HU is in the southeastern portion of the Klamath Mountains. At the highest elevations, the geology is predominantly competent, plutonic granite. On the eastern half of the unit and in its lower reaches, the geology is more diverse and accretionary, typical of the other Klamath Mountain areas. The streams are deeply incised and steep, but generally stable, at least compared to units farther west.

The McCloud River HU headwaters are located in the high-elevation volcanic terrain southeast of Mount Shasta. Those predominantly spring-fed watercourses do not possess the hydrologic variability necessary to increase fine sediment loading, though the relatively young age of the landscape means that extreme events can produce fine sediment on rare occasions. However, the downstream (lower elevation) portions of the McCloud River HU run through the more geologically diverse and complex accreted terrain associated with the Klamath Mountains, and have formed deep canyons that can produce landslides and sediment.

The Shasta Dam HU is exclusively within the southeastern Klamath Mountains and contains many deep valleys drowned by the reservoir in the diverse, accreted terrain. Sediment inputs can be locally significant due the diverse geology, steep terrain, and (artificial) lake level fluctuations. The size and depth of Lake Shasta prevent any coarse sediment from passing further downstream of Shasta Dam.

The Yuba River HU is geographically and geologically distinct from the other basins included in the SHA Action Area. Originating on the crest of the northern Sierra Nevada, headwater streams in the unit consist primarily of plutonic (hard rock) granite, intermixed with ancient, relatively well-lithified volcanic rocks. The streams flow through steep, deeply incised canyons, but are relatively stable. The unit has several large faults oriented perpendicular to the direction of flow (westward).

The Trinity River HU is in the Klamath Mountains in a region characterized by greywacke sandstones, mudstones, greenstones, radiolarian chert, and relatively minor limestone. The substrate arrangement and the substrate permeability often produce unstable landscapes that produce a wide range of sediment including boulders, sand, silt, and clay.

4.3.3. Watershed Conditions

Recent assessments of watershed conditions in the SHA Plan Area that would present potential threats to reintroduced ESA-listed fish include; road density and stream crossings; current and past timber harvest; and wildfires (Table 23).

Higher temperatures, reduced snowpack, and earlier spring snowmelt all contribute to the increased frequency, intensity, and extent of fires in the SHA Action Area (NMFS 2014b). Fire risks will continue to increase as conditions become drier and hotter as a result of climate change. Areas prone to fire risk are spread throughout the Trinity and Sacramento River basins. Since 2007, 46.8 square miles (29,952 acres) of the SHA Plan Area has been burned by wildfires.

In the Upper Sacramento River HU, springs from the volcanic geology of Mount Shasta and the numerous tributary streams driven by precipitation and snowmelt provide a consistent year-round flow of cold water to the Upper Sacramento River. Located in the upper watershed near the city of Mount Shasta, the 26,100-acre-foot Box Canyon Dam/Siskiyou Reservoir is operated

Table 23. Conditions of Historically Anadromous Watersheds in the SHA Plan Area.

CalWater Hydrologic Unit	Hydrologic Unit Area (square miles)	Area Within SHA Action Area (square miles)	Miles of Perennial Stream	Miles of Seasonal Stream	Number of Stream Crossings	Road Density (road miles per square mile)	Area Harvested 2007–2016 (square miles)	Area Burned by Wildfire 2007–2016 (square miles)
Upper Sacramento	423	60	138	147	943	6.1	9.8	0.8
McCloud River	684	47	119	123	650	5.7	13.6	18.0
Shasta Dam	373	35	87	127	656	4.9	2.9	NA
Yuba River	1,495	126	238	443	2,067	5.7	46.1	0.8
Trinity	2,970	63	209	190	1,669	6.3	12.5	NA

by Siskiyou County for hydropower generation and recreation (Heiman and Knecht 2010). Box Canyon Dam maintains a minimum flow that is rapidly augmented by springs and tributaries in the 40–mile reach down to Lake Shasta. Surface flow in the river has been monitored by USGS at a location near Lake Shasta since 1945. Average daily flow is approximately 1,000 cfs, with a peak daily flow of 70,000 cfs (1974) and extreme low of 117 cfs (1977) (Heiman and Knecht 2010). Within the Upper Sacramento River HU, there are approximately 342.87 miles of active roads used for timber operation and forest management.

In the McCloud River HU, most streams flowing south from the southern slopes of Mount Shasta do not reach the upper McCloud River; they sink into the volcanic soils except during periods of glacial melt, when Mud Creek flows to the river upstream of Lake McCloud. The most prominent exception is Squaw Valley Creek, which originates above the town of McCloud and joins the river about 9 miles below McCloud Dam. A few small creeks enter the upper river from the south, but nearly all flow in the upper McCloud River enters the river system via springs, most notably Big Springs, which contributes a flow of more than 600 cfs (Heiman and Knecht 2010) a few miles above Lake McCloud.

Approximately 9 miles southeast of the town of McCloud, the McCloud River is impounded by McCloud Dam, creating McCloud Reservoir. Approximately 80 percent of the flow entering McCloud Reservoir is diverted at McCloud Dam through a tunnel to PG&E’s McCloud-Pit hydroelectric project. However, that water diversion does not significantly influence the larger peak flow events in the lower watershed, where the river flows approximately 23 river miles from McCloud Reservoir into Lake Shasta. Heiman and Knecht (2010) stated that tributaries below Lake McCloud supply more than three times the runoff to the McCloud River than is supplied by the entire Upper McCloud River watershed, but the US Bureau of Reclamation (USBR) reported higher stream flows above McCloud Reservoir than at Lake Shasta. Hawkins, Squaw Valley, Claiborne, and Chatterdown Creeks are major tributaries to the McCloud River below McCloud Reservoir (USDOI 2014). In most years, McCloud River flow into Lake Shasta varies seasonally between 200 and 10,000 cfs, with a mean daily flow of 270 cfs (USDOI 2014). Within the McCloud River HU are approximately 286.2 miles of active roads used for timber operation and forest management.

The Shasta Dam HU is composed of the Lake Shasta HA. The unit includes numerous small streams entering the reservoir, but it does not include the lake's four major tributaries (Upper Sacramento River, McCloud River, Squaw Creek, and Pit River). Shasta Dam, constructed in the early 1940s a few miles north of Redding on the Sacramento River below the four major tributaries, stores up to 4.5 million acre-feet of water (USFWS 1995) in Lake Shasta (California's largest reservoir) and controls the Sacramento River water flow into the Sacramento Valley below the dam. The Shasta Dam HU includes approximately 169.8 miles of active roads used for timber operation and forest management.

The Yuba River HU contains four HAs: Ure Mountain, South Yuba, Middle, Yuba, and North Yuba. Flows in the Yuba River HU are typical of Sacramento Valley tributaries with headwaters in the Sierra Nevada; flows are highest in the winter and spring from rain-on-snow events and decrease quickly in late spring. More than 100 jurisdictional dams or diversions exist within the Yuba River basin, and a large amount of water is diverted from the South Yuba watershed at Lake Spaulding for irrigation and power generation (Heiman and Knecht 2010). The South Yuba watershed alone supports 20 small reservoirs and 20 hydroelectric dams (Heiman and Knecht 2010). Englebright Dam, in the Ure Mountain HA, has a storage capacity of 45,000 acre-feet and provides electricity and recreational opportunities (Heiman and Knecht 2010). The Yuba River HU includes approximately 724.7 miles of active roads used for timber operation and forest management.

The mean annual precipitation in the Trinity River HU can reach 70 to 80 inches. Approximately 90 percent of the precipitation falls between October and April, with snow remaining through May or June at the highest elevations (USDA 2003). Approximately half of the main stem Trinity River is diverted to the Sacramento Valley, and remaining flows are regulated by Lewiston Dam. Flows above the dam are impounded, creating Trinity Lake. The Trinity River HU includes approximately 397.5 miles of active roads used for timber operation and forest management.

4.3.4. Water Quality

The SHA Action Area is in upper watershed reaches, which are relatively undeveloped. Generally, water quality (suspended sediment concentration and turbidity) in upper reaches and watershed headwaters is very good. The cumulative impacts of natural hillslope erosion, roads, timber management, and water storage/diversion exert the largest influence on water quality parameters. Changes in most water quality parameters occur in response to winter precipitation.

4.3.4.1. Temperature

Observations of July water temperatures in the Upper Sacramento River during 2003 through 2012 varied from 50°F below Box Canyon Dam to 69°F just above Lake Shasta (USDOI 2014). In the McCloud River, USDOI (2014) reported stream temperatures for summer months varying from 55°F below McCloud Dam to 65°F above Lake Shasta. Water temperature in the McCloud River below Lake McCloud has increased because of PG&E hydropower operations. Before construction of the dam, water temperatures in the river largely were regulated by Big Springs, which provided a constant flow of 45°F water to the river and never exceeded 60°F. Following completion of the reservoir, stream temperatures as high as 75°F have been recorded in the lower river by the CDFW (Heiman and Knecht 2010).

Temperature is a significant water quality concern in the Yuba River HU. Warming water temperatures can be attributed to dams, water diversions, inadequate shading due to reduced riparian cover, and low instream flows. However, none of the 270 samples exceeded US EPA temperature guidelines for the South Yuba River watershed (California Environmental Protection Agency 2017). The Middle Yuba River watershed did not meet the required 26 sample size and is, therefore, not listed on the CWA 303(d) list. In the North Yuba River basin, 1 of 361 samples exceeded the US EPA temperature guidelines (California Environmental Protection Agency 2017).

4.3.4.2. Suspended Sediment

The McCloud River and Yuba River HUs, and the Upper Trinity River HA all experience elevated fine sediment levels (Heiman and Knecht 2010). A watershed assessment for the Upper Sacramento (North State Resources 2010) reported few data were available to describe sediment conditions. Modeling identified relative hazard areas for sediment delivery, with reaches in the middle and lower portions of the watershed demonstrating higher erosion potential. Suspended and settleable sediment levels were below the level of harm for aquatic life, but localized erosion and fine sediment problems still need to be addressed (Heiman and Knecht 2010).

Within the McCloud River HU, high flows during winter rains increase suspended sediment and turbidity, which quickly drop to pre-storm levels following peak flow events. Mud Creek, in the upper watershed, carries glacial silt into McCloud Reservoir that can become resuspended and move downstream through the McCloud River (Heiman and Knecht 2010). Water clarity in the McCloud River fluctuates from excellent during most of the year to highly turbid for short periods (Heiman and Knecht 2010).

Sediment loads in the Yuba River basin can be attributed to historical mining and human activities, such as road construction associated with rural housing development, logging, and recreation (Heiman and Knecht 2010).

4.3.5. Aquatic Habitat

The headwaters of the McCloud River and Upper Sacramento River watersheds above the Shasta Dam historically provided clean, loose gravel; cold, well-oxygenated water; and optimal stream flow in riffle habitats for spawning and incubation. They also provided the cold, productive waters necessary for egg and fry development and survival, and juvenile rearing over the summer. Nearly 300 miles of tributary spawning habitat is now inaccessible to winter-run Chinook salmon and other anadromous species due to Shasta Dam (NMFS 2014a). In general, waterbodies above the dam provide good quality, aquatic habitat. Following dam construction, stream channel width decreased, and channel sinuosity, hillslope, topographic aspect, and vegetation cover increased (USDOI 2014). The quality of physical spawning and rearing habitat attributes generally improve progressing downstream from Dunsmuir to Lake Shasta (USDOI 2014).

The steady supply and volume of cold, clean water in the Upper Sacramento River basin supports high quality aquatic habitat conditions. Anadromous salmon and steelhead populations that historically were abundant in the basin ended with the 1943 completion of Shasta Dam (Heiman and Knecht 2010).

USDOI (2014) rated salmonid spawning habitat in the Upper Sacramento River watershed as fair to good throughout. In general, habitat quality for spawning and rearing increases with distance from Box Canyon Dam. Spawning and rearing habitat in the McCloud River watershed was rated fair to good, with some limitation of deep pools, with rearing habitat improving with downstream distance. Regarding potential reintroduction of winter-run Chinook salmon, NMFS (2014a) indicated that the McCloud River is more favorable, because of stream temperature limitation in reaches of the Upper Sacramento River watershed that otherwise contain good spawning habitat.

4.3.6. Riparian Function

The riparian conditions and function in the SHA Plan Area are similar to the HCP Plan Area and have been subject to the standard CFPRs water course protection measures since the early 1970s. The buffer zones are 50 to 100 feet and the minimum required canopy retention is 50 percent. The LWD recruitment trees are retained based on proximity to the watercourse and propensity to lean towards the watercourse. Stream crossings are designed to provide passage for all life stages of fish, including salmonids.

The CFPR ASP rules do not apply to the SHA Plan Area, as these areas are outside the range of anadromy and upstream from any (direct) hydrologic connection due to dams and reservoirs. While lower canopy retention requirements are allowed in non-ASP watersheds under the CFPRs, streamside habitats in the SHA Plan Area are in good condition and provide fully functional riparian functions including shade and LWD recruitment, particularly considering the previously described differences between vertical canopy cover and ecological shade.

4.3.7. Land Use

Timber management is still a common land use on private lands in the Upper Sacramento River basin. Within the McCloud River watershed, land ownership is approximately 50 percent public (USFS and BLM), and land use is dominated by timber management, hydroelectric energy production, grazing, and agriculture. Land use is primarily open space on designated National Forest System Lands, which are managed by the Shasta-Trinity National Forest under their Forest Plan and other applicable laws, policies, and guidelines. Shasta-Trinity National Forest management includes Riparian Reserves and Late Successional Reserves. The Riparian Reserves within the watershed are located along rivers, streams, lakes, and wetlands. They were established to provide natural corridors. The late successional reserves are large blocks of land reserved for northern spotted owl (*Strix occidentalis caurina*) and other species that are dependent on late successional old-growth forest. Late successional reserves are scattered throughout the watershed (USDA and USDOI 1994). Over 95 percent of the Shasta Dam HU is federally owned, and the remaining 5 percent of lands are held in private ownership (USDOI 2011).

In the Yuba River watershed, timber management is still a prominent land use, but many businesses and communities in the watershed have been shifting from logging to other enterprises that capitalize on the recreational and scenic qualities of the watershed (Heiman and Knecht 2010). Although population is sparse, the South Yuba and Middle Yuba River watersheds have been extensively developed for hydroelectric power generation and consumptive uses. The South Yuba River watershed contains South Yuba River State Park. Additionally, historical reminders of Native Americans and the gold rush era are woven throughout the landscape. Evidence of prehistoric uses in the area, such as camps, along with activities such as pioneer trails, ridges, mining features, and logging camps are scattered throughout the basin (Heiman and Knecht 2010).

4.4. Existing Monitoring Data

SPI has been collecting water quality data at several sites in the HCP Action Area and SHA Action Area since 2000. Monitoring data indicate that overall water quality in streams on SPL&T lands is generally in good condition, as stream temperature and turbidity levels maintain levels meeting regulatory standards. CAL FIRE has also conducted several sediment and erosion monitoring studies. Results of those studies indicate the rate of compliance with CFPRs designed to protect water quality is high, and the CFPRs, when properly implemented, are effective in preventing erosion, sedimentation, and sediment transport to channels.

4.4.1. SPI Monitoring

SPI established its Research and Monitoring Department in 2000 to study and reduce potential impacts of timber harvest operations Road erosion and delivery to stream networks. SPI has developed a quality assurance project plan (QAPP) detailing project activities, and how data are collected, analyzed, validated, and reported (Appendix G). The Research and Monitoring Department maintains several projects designed to monitor the water quality in specific stream catchments-three of which are in the Action Area (Table 24; Appendix G). The monitoring projects assesses potential impacts from forest management operations, fires, ground-treatments, logging and road construction, site preparation, and annual climatic fluctuations on water quality. SPI collects data on stream turbidity, temperature, flow, suspended sediment concentrations, and particulate organic matter. Tables summarizing select water quality monitoring results from stations in the Action Area are presented in Appendix F.

Table 24. Water Quality Monitoring Projects, Station ID, and Fire Exposure.

Project	Station ID	Install Date	Fire Date	Water Sampling?
Southern Exposure	514	12/8/2000	Not applicable	Yes
Upper San Antonio Creek	509	10/26/2000	Not applicable	Yes
Hazel Creek (Upper Sacramento)	531	2/25/2003	Not applicable	Yes

Each project has one to five continuous water quality stations installations at specific stream waypoints where time series data are collected and used in subsequent analysis and assessment. Installations consist of YSI multiparameter sondes that record continuous measurements of water temperature, turbidity, stage, and other aquatic parameters. Flow measurement with periodic transects are collected at 1-foot intervals and stream depth and water velocity are recorded. Water sampling points are collected periodically (usually during storm events) every 2 hours over a 2-day interval (Appendix G).

Water quality in monitored streams within the HCP Action Area and SHA Action Area is generally good, with turbidity of 10 NTU or less.

SPI maintains a network of more than 75 automated weather stations that operate 24 hours a day, 7 days a week. Data from those stations are downloaded daily by automated radio connections to a central computer in SPI Research Office. Each water quality monitoring project is assigned one to three nearby weather stations from which hourly precipitation in the form of rain or snowfall is available.

4.4.2. California State Board of Forestry and Fire Protection Monitoring Data

CAL FIRE has conducted several sediment and erosion monitoring studies relevant to SPL&T lands and practices. The Hillslope Monitoring Program evaluated the implementation and effectiveness of the CFPRs analyzed through field inspections of 295 Timber Harvest Plans (THPs) between 1996 and 2001 (Cafferata and Munn 2002). Study sites were on the Eldorado National Forest and SPL&T land in the central Sierra Nevada. The Modified Completion Report monitoring program investigated the adequacy of both implementation and effectiveness of the CFPRs in protecting water quality and riparian and aquatic habitat (Brandow et al. 2006). The

CFPR Implementation and Effectiveness Monitoring (FORPRIEM) study analyzed a random sample of 126 THPs between 2003 and 2008 to understand the rate at which water quality-related CFPRs are being properly implemented and, when properly implemented, how effectively those CFPRs protect water quality and the beneficial uses of water (Brandow and Cafferata 2014). Approximately 50 percent of the THPs were from CAL FIRE's Coast Region and the remaining from the Cascade and Sierra Regions, but the report did not specify land ownership where the THPs were located.

Overall, the study results indicated that implementation rates of the CFPRs related to hillslope sediment production and delivery, canopy cover and water quality are high (greater than 90 percent) and that properly implemented practices required by the CFPRs were effective in preventing erosion, sedimentation, and fine sediment transport to channels. Mean total canopy exceeded CFPR standards. WLPZs retained high levels of post-harvest canopy (average total canopy of 82 percent, with a median of 84 percent) and surface cover and prevented harvest-related erosion. Road-related CFPRs had high rates of proper implementation and were also found to be highly effective in preventing erosion, but poor waterbreak spacing, as well as the improper size, number, or location could lead to poorly functioning drainage structures. Numerous problems were also noted at watercourse crossings, which present a higher risk of sediment discharge to streams than roads. Common deficiencies at crossings were diversion potential, road cut-off drainage structure function, fill slope erosion, culvert plugging, and scour at the outlet. Despite the listed deficiencies and issues, the FORPRIEM study concluded that in general and at most sites the rules were very effective.

In 2011, THP Review Team agencies formed the interagency Battle Creek Task Force (Task Force) to determine if SPI clearcut harvesting in Battle Creek resulted in observable erosion and sediment delivery to waters of the state (CAL FIRE et al. 2011). The Task Force evaluated 135 sites for their potential for water quality impacts: 55 clear cuts, 29 watercourse road crossings, 24 watercourse-adjacent road segments, six watercourse-adjacent landings, five tractor crossings of watercourses, and three sites associated with other sources of erosion. Only one clearcut site was directly associated with low-magnitude (less than one cubic yard) sediment delivery, and delivery resulted from a violation of the CFPRs (encroachment of a tractor adjacent to a watercourse) rather than erosion associated with the clearcut (CAL FIRE et al. 2011).

The Task Force found that roads (particularly County roads), not clearcuts, had the highest risk of sediment delivery to water bodies. Approaches draining to watercourse crossings on county-managed roads were almost twice as long on the average as those on SPI-managed roads (370 feet versus 190 feet). Because of the longer hydrologically-connected approaches, the magnitude of sediment delivery to crossings on county-managed roads was disproportionately larger than it was for gated SPI roads (CAL FIRE et al. 2011).

Road crossings delivered sediment 69 percent of the time, and watercourse-adjacent road segments delivered sediment 67 percent of the time. The magnitude of sediment delivery was low, particularly if BMPs were properly implemented. Crossings with rocked surfaces generally had a lower likelihood and lower amount of sediment delivery (CAL FIRE et al. 2011). The lower sediment loads from rocked roads is consistent with literature suggesting rock surfacing can reduce erosion from roads by up to an order of magnitude (Burroughs and King 1989; Coe 2006). Roads associated with poorly implemented BMPs had the highest magnitudes of sediment delivery (CAL FIRE et al. 2011).

4.5. Climate Change

A factor potentially affecting the condition of watersheds in the Sacramento River and Trinity River basins, and aquatic habitat at large, is climate change. Climate experts predict physical changes to river and stream environments along the West Coast that include rising air temperatures, increased precipitation from rain rather than snow, and diminished snow pack—all of which will result in altered stream flow volume and timing, increased winter flooding, lower late summer flows, and a continued rise in stream temperatures (Williams et al. 2016). The increase in air temperatures and decrease in precipitation associated with warmer climate change scenarios also may increase the frequency and severity of wildfires (Sankey et al. 2017). The long-term changes may change salmon and steelhead distribution, behavior, growth, and survival, and are important to consider when evaluating existing conditions and potential future conditions relevant to habitat conservation, and potential effects of covered activities included in the HCP/SHA. The main impacts of climate change relevant to the covered actions include changes in temperature, hydrology, wildfire and associated fine sediment input, and vegetation.

Warmer temperatures associated with climate change may reduce snowpack and alter the seasonality and volume of seasonal hydrograph patterns (Cohen et al. 2000). California has recently experienced record high air temperatures (2013 and 2015; NOAA 2017). Central and north coast California have shown trends toward warmer winters since the 1940s (Dettinger and Cayan 1995). An altered seasonality results in runoff events occurring earlier in the year due to a shift in precipitation falling as rain rather than snow (Roos 1991; Dettinger 2005a). Water temperatures may rise, especially during the summer months when lower streamflow and warmer air temperatures will contribute to warming regional waters. Such changes may not be spatially homogenous. Areas with elevations high enough to maintain temperatures 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 may be more affected.

In recent years, California has experienced well below average precipitation (2012, 2013, 2014, and 2015; NOAA 2017), record high air temperatures (2014 and 2015; NOAA 2017), and record low snowpack (2015; Seghesio and Wilson 2016). North coast and central California have shown trends toward an increase in the ratio of rain to snow, shortened and delayed snowfall season, and accelerated rates of spring snowmelt (Kiparsky and Gleick 2003). The altered seasonality results in runoff events occurring earlier in the year due to a shift in precipitation falling as rain rather than snow (Roos 1991; Dettinger et al. 2004). Studies suggest that the spring streamflow maximum could occur about 1 month earlier by 2050 (Barnett et al. 2005).

The magnitude of snowpack reductions is subject to annual variability in precipitation and air temperature, particularly in the Cottonwood Creek watershed. Factors modeled by VanRheenen et al. (2004) show that melt season shifts to earlier in the year, leading to a large percent reduction of spring snowmelt (up to 100 percent in shallow snowpack areas). Additionally, an air temperature increase of 3.8°F is expected to result in a loss of about half of the average April snowpack storage (VanRheenen et al. 2004). The decrease in spring snowmelt would be greatest in the region of the Sacramento River watershed and the Trinity River watershed, where snowpack is shallower than in the San Joaquin River watershed located south of the HCP/SHA Plan Areas.

Climate change effects contributing to warming and reduced snowpack, an increase in the number of fire ignitions, and historical land management practices including timber harvest and fire suppression activities likely have led to an increase in the number of large wildfires (greater than 1 square mile) and the total area burned annually across the western United States (Barr et al. 2010). Along the west coast, 88 percent of the watersheds are projected to have a 10 percent increase in sediment yield between 2001 and 2050 due to increases in burning and post-fire hillslope erosion (Sankey et al. 2017). The increase in sediment yield will likely be caused by climate-change-induced increases in frequency and severity of wildfires through 2050 (Hawbaker and Zhu 2012). Other climate change effects may include issues associated with increases to sediment yield resulting from episodic sediment input due to changes in the magnitude and frequency of large storms. These events may cause increased runoff or slope failure on landscape features impacted by roads and timber management.

Central Valley spring- and winter-run Chinook salmon, SONCC coho salmon, and Central Valley steelhead are particularly vulnerable to climate change because they spend summers as pre-spawn adults and/or rearing juveniles in freshwater streams (Williams et al. 2016). Based on existing climate models, the most plausible projection for warming over northern California is 4.5°F by 2050 and 9°F by 2100 (Dettinger 2005b). Because most existing salmonid runs are restricted to low elevations by impassable dams, if the climate warms by 9°F, it has been questioned whether any Central Valley or Trinity River salmonid populations can persist (Williams 2006; South Fork Trinity River Spring Chinook Subgroup 2013). Tributaries without cold water refugia (usually input from springs) will be more susceptible to impacts of climate change. Even in tributaries with cool water springs, in years of extended drought and warming water temperatures, unsuitable conditions may occur. Additionally, juvenile salmon often rear in the natal stream for one or two summers prior to emigrating and would be susceptible to warming water temperatures.

5. POTENTIAL BIOLOGICAL IMPACTS AND TAKE ASSESSMENT

An HCP must contain an analysis of the impacts of take that may occur on covered species. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct (16 USC § 1532(19)). "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 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). This section describes the covered activities and associated environmental effects that have potential to cause take of covered species, as well as potential impacts of taking on the covered species.

SPI has designed a conservation strategy to avoid or minimize take; mitigate the impacts of SPI forestland management activities on covered species; and contribute to conservation efforts for the covered species. Conservation measures are listed in Section 6.4 of this HCP. Certain forest management activities and their effects have the potential to take covered species. Of the covered activities, SPI timber harvest operations, including maintenance and use of forest roads, landings, culverts, and crossings associated with timber harvest, water drafting, and grazing have the greatest potential to cause environmental effects that could result in take of covered species. Additionally, potential take due to grazing is minimized by the SPI grazing permit conditions and monitoring, overall limited allotments, and limited allotments occurring within anadromous streams.

5.1. Direct and Indirect Effects

This section describes the environmental and other effects of the HCP's covered activities on covered species and their habitat. Descriptions of direct and indirect effects to covered species and habitat by the covered activities are described in the context of SPI's compliance with the CFPRs. The potential effects of HCP covered activities include direct effects resulting from in-channel road watercourse crossing construction/reconstruction and entrainment. Potential indirect effects may occur due to modification of habitat elements resulting from covered activities. Because the potential indirect impacts of covered activities involve the modification of habitat for covered species, the occurrence of take is monitored using habitat surrogates (Section 5.6).

5.1.1. Background

The decline and extinction of Pacific salmon populations has been linked to habitat loss and degradation in their spawning and rearing streams (Nehlsen et al. 1991). Beechie et al. (1994) identified three principal causes for these habitat losses, in order of importance, as hydromodification (e.g., dams and diversions), migration-blocking culverts, and forest practices. Because the proposed HCP activities have the potential to adversely affect aquatic habitat, this effects assessment on covered species and habitat is primarily habitat-based.

Available information indicates that populations of threatened and endangered Pacific salmon are limited by the existing condition of aquatic habitat, and these populations were depleted, at least partially, due to past forestry practices (Tschaplinsky and Hartman 1983; Lichatowich 1989; McMahon and Holtby 1992; Reeves et al. 1993; Beechie et al. 1994; Gregory and Bisson 1997). As described in Section 4 of this HCP, habitat conditions in the HCP/SHA Action Area were degraded by past activities, including (depending on location) hydraulic mining, water diversions, timber harvesting, and road building. As indicated in Sections 2 and 4, continued development of the CFPRs have resulted in improved habitat conditions relative to historic practices as past impacts are gradually ameliorated.

The effects assessment on habitat and covered species is organized using the five watershed products (water, woody debris, sediment, heat, and nutrients) described by Lisle (1999). These products are responsible for providing and maintaining salmonid habitat. This effects assessment evaluates how the covered actions, particularly timber harvest and road management, affect processes and functions in the HCP Action Area watersheds, and then translate how changes affect watershed products and impact habitat and salmonids; including individuals and populations. In addition to the five watershed products, SPI included consideration of three additional factors; habitat connectivity, covered activities that occur directly in habitat, and fish entrainment during water drafting. Finally, this section analyzes the cumulative effects of the previously described factors and additional actions on State, tribal, local, or private lands that are reasonably certain to occur in the HCP/SHA Action Area during the permit period. This additional analysis provides information considering both the effects of the proposed action and the cumulative effects of other activities to determine whether the action is likely to jeopardize the continued existence of covered species or their habitat. The additional actions considered include timberland management, wildfire suppression on non-federal lands, roads, mining, habitat restoration projects, agricultural activities, residential development and infrastructure, recreation, water withdrawals, and chemical use.

5.1.2. Analytical Approach

The effects analysis includes the following components:

- The assumptions used in the analysis.

- An overview of covered activities and related activities that may impact watershed products, habitat, and fish.
- Evaluation of the impact of covered activities on watershed functions, processes, and products.
- Evaluation of the impacts to habitat and covered species.

Potential effects are considered at the site scale and described primarily at the watershed scale. The exception to watershed scale evaluations are impacts from covered activities upon which analysis determined effects of covered activities could be discounted. These activities include road maintenance, mastication of roadside rights-of-way, fuel break construction and maintenance, harvest of minor forest products, transportation of materials and heavy equipment, and conversion of brush fields to timber plantations. These activities are described in Section 5.2.

5.1.3. Assumptions

The effects analysis includes the following overall assumptions:

- Compliance with CFPRs, including winter period operation plans and ASP watershed rules in all applicable planning watersheds currently subject to anadromy.
- READI model implementation and road and crossing reconstruction and improvement work will be conducted using the following priority considerations;
    - Complete READI model field work and analyses in the HCP Plan Area within three years upon permit issuance.
    - Complete READI model field work and analyses in the SHA Plan Area upon notification from NMFS that proposed listed salmonid relocation activities will occur.
    - Plan and implement road construction and maintenance improvements based on the READI model results in the Sacramento River basin by giving highest priority to Core and reintroduction classifications; beginning with Core 1 and Core 2 watersheds, followed by Primary and Candidate classifications, that would provide the greatest conservation benefit. In the Trinity River basin, SPI will give highest priority to watersheds with unstable lands based on the landslide risk assessment results and known or potential distribution of covered species.
- The amount of skid trails and landings will increase slightly over the course of the permit period with more area subject to harvest as treatments move from clearcutting to selection and thinning prescriptions.

5.1.4. Potential Impacts of Covered Activities

Tables 25 and 26 display the primary potential impacts of covered activities on watershed products, and the impacts of these changes on elements of fish habitat. Impacts of entrainment and direct disturbance of habitat are also included. The impacts shown here are those considered and discussed in the effects analysis. The potential impacts to fish resulting from these effects are summarized in Table 27.

Potential effects to covered species and habitat from covered activities are described in this HCP/SHA. These effects can be assessed at smaller scales (e.g., hydrologic area, planning watershed). An example application of the proposed Conservation Measures described in this HCP/SHA and their potential impacts applied to the planning watershed scale is included as Appendix K.

The impacts of forestry activities on covered species vary depending on the type of activity and the species and life stage considered. Activities covered under this HCP may generate stressors potentially affecting listed species and critical habitat by potentially degrading salmonid habitat and cause fish to avoid the immediate area, reduce foraging efficiency and ability to avoid predators, and could injure or kill fish. Fish may be displaced from areas with poor water quality and may experience delayed foraging and increased predation. Loss of aquatic and riparian habitat can reduce habitat complexity and prey availability, thereby increasing predation risk and lowering fitness of individual fish.

Table 25. Impacts of Timber Harvest and Road Management Covered Activities on Watershed Products and Habitat Elements.

Activity	Related Activity(s)	Activity Effect	Changes of Concern (Environmental Stressors): Watershed Product	Changes of Concern (Environmental Stressors): Habitat Element(s)
Timber harvest (includes salvage harvest, fuel break construction)	Skidding/yarding	Loss of ground cover/ compaction	Sediment	Turbidity
				Substrate
	Loading/landing			Substrate
	Site preparation			Spawning substrate
				Pools
	Skidding/yarding	Compaction (increased runoff)	Water	Channel morphology
	Loading/landing			Bed scour
	Felling bucking	Removal of stream shade	Heat, nutrients	Water temperature
		Removal of potential LWD recruits	Wood	LWD
		Changes in stand structure		Large wood recruitment
		Removal of vegetation	Water	Flow regime
		Increased soil moisture	Sediment	Sediment
	Mastication	Compaction (increased runoff)	Water	Peak flows
	Maintenance, fueling, and fuel storage	Fuel spills		Water contamination
Road construction	Drafting	Entrainment disturbance of habitat, sediment delivery	NA	Entrainment
	Watercourse crossing facility placement and maintenance		Sediment	Sediment, channel morphology
	Maintenance, fueling, and fuel storage	Fuel spills		Water contamination
	Construction	Disturbance of unstable lands		Sediment
		Loss of ground cover/ compaction		
Road use/ maintenance/ reconstruction	Drafting	Disturbance of habitat, sediment delivery	NA	Direct impact on fish
	Watercourse crossing facility placement and maintenance		Sediment	Sediment, channel morphology
		Equipment in channels	NA	Direct impact on fish
	Maintenance, fueling, and fuel storage	Fuel spills		Water contamination
	Mechanical mastication of vegetation along roads	Compaction (increased runoff)	Water	Peak flows
	Crossing infrastructure	Barriers to movement	NA	Fish passage
		Crossing failure	Sediment	Sediment, turbidity
		Concentrated surface flow		Substrate
	Road surfaces	Compaction (increased runoff)	Water	Sediment, peak flows

Table 26. Impacts of Non-Timber Harvest and Road Management Covered Activities on Watershed Products and Habitat Elements.

Activity	Related Activity(s)	Activity Effect	Changes of Concern (Environmental Stressors)	
			Watershed Product	Habitat Element(s)
Prescribed fire		Loss of ground cover	Sediment	Sediment, turbidity
		Loss of vegetation	Water	Flow regime
		Hydrophobic soils		Peak flows
Site preparation		Loss of ground cover/compaction	Sediment	Turbidity
Mastication		Compaction (increased runoff)	Water	Peak flows
Rock pit development and rock processing	Access roads and hauling	Loss of ground cover	Sediment	Sediment, turbidity
		Compaction areas, areas with low infiltration	Water	
Range management	Cattle trampling	Channel bank disturbance	Sediment	Channel morphology, sediment, turbidity
		Disturbance to redds	NA	Direct impact on fish
	Utilization of riparian vegetation	Reduce shade	Heat, nutrients	Water temperature
		Changes in stand structure	Wood	Large wood recruitment
	Forage utilization	Loss of ground cover/compaction	Sediment	Sediment, turbidity
Chipping		Increase in ground cover	NA	NA
Harvest of minor forest products		NA		
Conversion of brush fields to timberland		Loss of groundcover	Sediment	Sediment, turbidity
		Compaction	Sediment, water	
Fire suppression	Dozer line construction	Loss of groundcover	Sediment	
		Compaction	Sediment, water	
	Water drafting	Entrainment	NA	Direct impact on fish
	Water dipping			

Table 27. Examples of Watershed Products Relationships to Habitats and Individuals.	
Watershed Product	**Examples of Impact to Habitat and Individuals**
Turbidity	Changes to feeding, growth and behavior.
Sediment	Changes to egg and alevin survival, reduced pool depth; changes to substrate for benthic invertebrates, habitat simplification.
Peak flows	Change to timing, frequency and amount of flows, impacts to low gradient channels and bedload mobility.
Reduction in shade	Changes to water temperature, feeding, growth and behavior, mortality.
Flow regime	Changes to volume and timing of flow. Influences on amount of habitat, water temperature (decreases with flow increase).
Fish passage	Reduced habitat connectivity, loss of access to habitat, loss of genetic diversity.
Entrainment	Harm or mortality.
Activity in channel	Increased sediment delivery, damage to banks and substrate, physical harm or mortality.
Large wood	Changes to channel morphology, loss of pools, changes to bedload movement and storage, loss of cover.
Large wood recruitment	Change to timing, type and volume of wood delivered to habitat.
Water contamination	Mortality, harm.

5.1.5. Water Quantity

Potential impacts to water quantity (peak flows and water yield) are described in the subsections below:

5.1.5.1. Peak Flows

Soil compaction caused by heavy equipment and yarding can decrease infiltration capabilities, increasing surface runoff. As a result, runoff from roads and other connected compacted surfaces can increase peak flows during rainstorms (Ziemer 1998). Grant et al. (2008) reviewed studies of forestry impacts on peak flows and determined watersheds in the transient snow zone were more susceptible to increase than those in rain dominated systems. Grant et al. (2008) concluded that changes to peak flows were predictable but affected only fairly frequent (2- to 6-year floods) rather than the largest floods. As with LWD recruitment, past influence of timber harvest and road management on hydrologic processes will gradually lessen as riparian buffers mature.

Removal of vegetation reduces evapotranspiration for several years following harvest, which increases the amount of water that infiltrates the soil and ultimately reaches the stream. Streams draining recently logged areas can see increased summer base flows (Keppeler 1998; Lewis et al. 2001). Research in coastal forests (Lovett et al. 1982) found that timber harvest impacted fog drip and reduced water yields; that climatic condition does not occur in the HCP Action Area, as the nearest portion of this area is 30+ miles inland from coast.

Comparing current baseline disturbance acreage to projected acreage within the permit term along with implementation of projects based on the READI model results to reduce road-stream convergent points and road surface connected to stream channels will reduce potential impacts from peak flow fluctuations. The road improvements will result in slightly greater rates of recovery of hydrologic processes, given the greater emphasis on improving fish passage and passage of stormwater and wood through water-crossing structures, repair of existing road failures, and design improvements for new roads. While reduced at the planning watershed scale, localized impacts (e.g., enlargement of receiving channels and increased sediment delivery) associated with peak flows could occur at the site scale. The distribution of stand ages across the HCP and SHA Plan Areas greatly diminishes the likelihood of concentrated peak flows resulting from timber harvest.

5.1.5.2. Water Yield

Water yield, also known as water crop or runout, generally refers to water runoff from a particular drainage basin, including ground-water outflow (USGS 2019). Research on timber harvest and water yield (Keppeler 1998; Lewis et al. 2001; Troendle, 2007) supports the assertion that water yield, and possibly summer low flows have been increased at the site of timber harvest and in some HCP and SHA Plan Area watersheds due to reduced vegetation and associated water uptake. This results from the amount of regeneration cutting and site preparation to reduce competing species in conifer plantations over the past two decades. While increased water yield may have impacts on individual fish or populations due to flow velocity, increases in summer flows could have positive effects on habitat conditions in the form of lower stream temperatures and increased habitat area. Water yields are greatest in areas where harvest is concentrated over a relatively short time period. Responses are dependent on numerous factors including amount of precipitation and if the precipitation is dominated by rain or snow. Based on the work of Keppeler (1998) the expectation is that water yield increases would gradually diminish over a 12-year period.

Current increases in water yield in Plan Area's watersheds will diminish over the course of the permit period. Silvicultural treatments will transition from predominantly regeneration harvest to thinning and selections. These treatments retain more canopy cover and basal area than regeneration cutting and do not reduce evapotranspiration to the levels of clear cutting. Troendle (2007) estimates that measurable increases in water yield are likely when 20 percent or more of the basal area is removed from a given area. Given the assumed 12-year recovery period, it is unlikely that water yield increases would be detectable from Plan Area watersheds after the first decade of the permit period. Following that period, yield would likely remain constant at the planning watershed scale due to the combination of clearcut, regeneration, and selection harvests.

5.1.6. Woody Debris

Several authors have found positive relationships between LWD in streams and salmonid populations (Tschaplinsky and Hartman 1983; Reeves et al. 1993; McMahon and Holtby 1992), as

LWD provides habitat complexity, cover, and food sources for juvenile and adult salmonids. Harvest of trees in streamside areas may reduce the recruitment of large wood. The LWD can be affected in the long-term by harvesting trees that could eventually be delivered to channels by windthrow or stream channel bank undercutting.

5.1.7. Sediment

Timber operations and forest management have the potential to increase fine sediment inputs to nearby streams primarily through the construction and operation of forest roads, landings, and skid trails. Clean water is one of the most important ecological requirements for Chinook salmon, coho salmon, and steelhead (NMFS 2014a, 2014b). Increased sediment delivery (especially fine sediment) impacts covered fish and their habitat in multiple ways. Siltation of streambeds can reduce the diversity and densities of aquatic macroinvertebrates used as a food source by covered fish species. Sediment deposited on the streambed reduces the amount of interstitial cover available to juveniles. Siltation of spawning gravels leads to increased egg and alevin mortality, reduced juvenile emergence success, suffocation of fry, and entombment.

Adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991) and adapt their feeding in response to turbidity (Harvey and White 2010). However, research indicates that chronic exposure can cause adverse impacts. Fish typically avoid waters with high suspended sediment levels, potentially displacing themselves from preferred habitat (Bash and Berman 2001). Fish unable to avoid elevated suspended sediment can experience adverse effects, such as increased energy expenditure, elevated blood sugars and cough rates (Servizi and Martens 1987), and reduced growth rates (Bash and Berman 2001). In both juvenile and adult fishes, elevated suspended sediment levels can abrade or clog gill membranes (Cederholm and Reid 1987; Bilby and Ward 1991) and even lead to death. However, concentrations causing fatalities are far higher than what is normally produced by erosion of road surfaces and stream banks (Bilby and Ward 1991).

The potential for sediment delivery from timber-harvest activities strongly depends on the interaction between the location of the activity relative to a waterbody and the erosion potential of the activity (Croke and Hairsine 2006). The location of the activity is important because eroded sediment from a disturbed site can rapidly settle as it discharges onto undisturbed forest floor, and the further an activity is from a watercourse the more likely it will be that eroded material will deposit before it reaches the water and causes a water-quality impact. The ability of the undisturbed forest floor to filter sediment is a fundamental concept used in forestry-related BMPs, and the CFPRs rely heavily on riparian buffer strips to prevent sediment delivery from timber-harvest activities. Hence, the likelihood of sediment delivery generally decreases as distance from the watercourse increases.

The erosion potential of an activity is an important consideration as the ability of the sediment to reach a waterbody is dependent upon the magnitude of erosion from the disturbed area (Megahan and Ketcheson 1996). Sites with high rates of erosion have a higher likelihood of delivering to water bodies than sites with low rates of erosion. While erosion is strongly dependent on factors such as geology, soils, slope steepness, climate, and vegetation, the various components of timber harvesting (e.g., roads, forest harvest) each have a characteristic erosion potential. Erosion potential from these various activities is generally related to the degree of disturbance.

Although the CFPRs and other timber harvest BMPs are designed to reduce the amount of erosion and delivery to watercourses (see Section 6.4.1), BMPs cannot prevent all erosion from forest roads (Keppeler et al. 2008). Turbidity is the optical determination of water clarity caused primarily by fine particulate (sediment or organic matter) suspended in the water column. Elevated turbidity reduces the penetration of light, limiting periphyton and algae growth, the food source for some macroinvertebrates, which are salmonid prey (MacDonald et al. 1991). Elevated turbidity can reduce fishes' ability to detect prey, as well as their ability to avoid predators (Ligon et al. 1999, Bash and Berman 2001). Turbidity also affects fish physiology by reducing growth rates (Sigler et al. 1984; Ligon et al. 1999; Bash and Berman 2001). A study by Sigler et al. (1984) demonstrated a reduction in salmonid growth rates after chronic exposure to elevated turbidity as low as 25 NTU over 14 days, though these fish could survive in turbidity levels up to 77 NTU.

SPI generated road runoff hydrographs using storm intensities and durations to estimate flow and the delivery of sediment directly to streams at road-stream intersections or infiltration into the forest floor. The READI model was applied in seven watersheds in northern California using a 1 year, 1-hour design storm, and found that existing mitigation measures (drains and surfacing) reduced road-stream connectivity by an average of 60 percent across all study watersheds. Furthermore, estimated total sediment reduction delivered to streams ranged from 82 to 92 percent.

5.1.7.1. Chronic and Episodic Sediment Delivery

This effects evaluation discusses two sources of sediment delivery to channels; chronic and episodic. Chronic delivery is that which occurs frequently, as a result of precipitation events that produce runoff, or snowmelt. Episodic sediment delivery occurs infrequently, as the result of large storm events. These events can trigger mass wasting events and produce floods large enough to cause failures of channel crossings. SPI considers runoff following wildfire episodic.

The evaluation of episodic delivery includes assessment of both road crossing failures, and mass wasting, as applicable.

5.1.8. Increased Water Temperature

Water temperature affects metabolism, behavior, and survival of both adults and juvenile fish as well as other aquatic organisms that may be food sources. Carter (2005) compiled a literature review of the effects of temperature on steelhead, coho salmon and Chinook salmon supporting TMDL establishment for water temperature in the Klamath River Basin. The introduction to

Carter's (2005) review is excerpted here: "Temperature is one of the most important environmental influences on salmonid biology. Most aquatic organisms, including salmon and steelhead, are poikilotherms, meaning their temperature and metabolism is determined by the ambient temperature of water. Temperature therefore influences growth and feeding rates, metabolism, development of embryos and alevins, timing of life history events such as upstream migration, spawning, freshwater rearing, and seaward migration, and the availability of food." Temperature changes can also cause stress and lethality (Ligon et al. 1999). Temperatures at sub-lethal levels can effectively block migration, lead to reduced growth, stress fish, affect reproduction, inhibit smoltification, create disease problems, and alter competitive dominance (US EPA 1999). Further, the stressful impacts of water temperatures on salmonids are cumulative and positively correlated to the duration and severity of exposure. The longer the salmonid is exposed to thermal stress, the less chance it has for long-term survival (Ligon et al. 1999).

Removing trees in riparian areas reduces the amount of shade which leads to increases in thermal loading to the stream (Moore and Wondzell 2005). Substantial effects on shade in clearcut systems have been observed with no-cut buffers ranging from 20 to 30 meters (66 to 99 feet) (Brosofske et al. 1997; Kiffney et al. 2003; Groom et al. 2011b), and small effects were observed in studies that examined no-cut buffers 46 meters (151 feet) wide (Science Team Review 2008; Groom et al. 2011a). For no-cut buffer widths of 46 to 69 meters (151-227 feet), the effects of tree removal on shade and temperature were either not detected or were minimal (Anderson et al. 2007; Science Team Review 2008; Groom et al. 2011a, 2011b).

For evaluation of timber management associated with BLM's Resource Management Plan for Western Oregon, NMFS (2016b) utilized modeling results provided by the US EPA which considered before-after-control-impact studies of 33 streams exposed to riparian harvest. The results showed an increase in stream temperature for streams that had a shade loss of greater than 6 percent. Based on these findings, the EPA developed a defensible shade loss Assimilative Capacity that used a maximum of 3 percent shade loss of streams to add a margin of safety.

The relationship of shade with the width of no-cut riparian zones is variable. Factors influencing the relationship include stream characteristics of aspect, size and discharge, and site factors such as topography, forest structure and species composition (Caissie 2006). The relationship is also influenced by groundwater seepage from streambanks and surface flows from tributaries which can reduce water temperatures in the summer (Wondzell 2012). The density of vegetation in riparian areas affects shade and thermal loading to a stream due to the penetration of solar radiation through gaps in the canopy and among the branches and stems (DeWalle 2010).

Yarding corridors within the no-cut buffers on perennial streams can decrease stream shade and increase stream temperatures; however, on a much smaller magnitude than timber harvest. This is because yarding corridors are relatively narrow (12 feet wide) when compared to the size of a typical timber harvest unit. The effects will continue for decades until the vegetation recovers.

5.1.9. Nutrients

Allochthonous inputs (nutrients derived from outside the aquatic system typically through leaf and needle [i.e., detrital] inputs) are important sources of nutrients in streams in the Action Areas. Leaves and needles, along with other biological material falling into streams from riparian vegetation, supply nutrients and food for aquatic organisms (Gregory et al. 1991; Richardson 1992). Alder (*Alnus* sp.) fixes atmospheric nitrogen and is one of the most important sources of detrital inputs to lower order streams. The organisms in the base of the food chain that rely on those inputs are ultimately the food base that juvenile salmonids consume when rearing and migrating to the ocean.

Studies indicate that nutrients in streams from a variety of sources increase in the first few years following logging (Hicks et al. 1991), elevating nutrient levels and increasing food production. Where additional light is provided to the stream, increases in primary and secondary productivity may occur and provide greater food availability for fish, enabling increases in individual juvenile salmonid growth, but effects on overall salmonid production have not been detected related to these increases (Hicks et al. 1991). Past management activities in the Action Area probably provided conditions favorable for hardwood growth, as hardwoods or brush stands replaced conifers in the riparian zone following harvest and provided additional nutrients, detritus, and food to stream habitats.

5.1.10. Fish Passage

Road stream crossings are accomplished by constructing a variety of structures. Typically, these structures are culverts, followed in frequency by fords and bridges. Bridges usually do not alter stream morphology and no not obstruct passage of aquatic organisms. Fords typically impact short lengths of the stream bottom and therefore also do not obstruct passage. Many culverted crossings are barriers to different life stages of salmonids. Passage problems are associated with confined flow area that accelerate velocity, and the length and slope of culverts, which exceed the sustained and burst swimming capabilities of fish, especially young fish. Culverts may also have inlets not placed at stream grade that present jump distances exceeding capabilities of fish.

5.1.11. Entrainment

Water drafting involves the drafting of stream flow into a water truck which is then applied to road surfaces for dust abatement and to maintain road surfaces. During water drafting small salmon and steelhead may be entrained in the hose or impinged against the surface of the pump screen. Entrainment or impingement could result in injury or mortality. Most drafting occurs in summer and early-fall.

Water drafting may also reduce available habitat if the amount of water withdrawn is excessive. The amount of habitat decrease from water withdrawals would depend on the amount of stream flow, how much water is withdrawn, and the duration of water drafting. When withdrawn water is a large portion of stream flow, shallower riffles and pools are likely to result from water withdrawal, leading to the temporary loss of margin habitat and instream cover. These adverse effects persist only during the periods when equipment is pumping water.

5.1.12. Physical Disturbance of Habitat

Physical disturbance from covered activities include road reconstruction and new road construction associated with THPs. No new road construction will occur in Critical Habitat, so no Critical Habitat impacts will occur from these activities. However, activities to improve or maintain existing crossing infrastructure could occur in Critical Habitat. In most cases, these actions are conducted to upgrade the crossing structure where the crossing may fail and need replacement, while in other cases they may need replacement because they have aged and are subject to failure. Activities include the use of heavy equipment to remove existing fill and to construct or place new structures.

5.2. Effects on Habitat and Populations

To assess differences between existing condition and conditions that will occur as a result of the covered actions, SPI selected and considered indicators for each watershed product. The indicators are closely tied to both the covered action and impacts to watershed products and ultimately, habitat condition. The watershed scale evaluations and considerations rely on these metrics to assess the magnitude of impact. The existing condition of relevant metrics are described in the environmental baseline. Comparison and consideration of the baseline and projected metrics provides the direction and magnitude of anticipated change. These indicators are summarized in Table 28.

Table 28. Impacts to Watershed Products and Processes and Effects Indicators.			
Watershed Product	**Process/Element**	**Concern**	**Indicator(s)**
Water	Water yield	Connected to compacted areas	Connected road surfaces
			Acres harvested
	Peak flows		Connected road surfaces
			Acres harvested
Sediment	Chronic	Road surface erosion	Connected road surfaces
			Number of crossings
			Road construction
		Landing, yarding erosion	Acres harvested
		Site preparation	Acres treated
		Prescribed fire	
		Quarries	Number and size of quarries
	Episodic	Mass wasting	Harvest on unstable soils
			Road construction, unstable lands
		Crossing failure	Number of crossings
			Number of crossings with diversion potential
			Number of crossings at risk
Large wood	In-channel wood	LWD recruitment	Length of habitat subject to harvest (critical habitat)
			Length of habitat subject to harvest (perennial stream)
Heat	Water temperatures	Shade	Length of habitat subject to harvest (critical habitat)
			Length of habitat subject to harvest (perennial stream)
Nutrients	Entrainment	Water drafting	Number of drafting sites in critical habitat
			Frequency of drafting
		Physical damage to habitat	Constructed crossings in critical habitat
			Reconstructed crossings in critical habitat
			Constructed crossings in perennial streams
			Reconstructed crossings in perennial streams
	Fish passage	Barriers	Crossings that are barriers

Numerous factors influence the potential for covered activities to impact watershed products, habitat, and covered species. Key factors include the presence of habitat on the HCP Plan Area, the distance to occupied habitat (in planning watersheds where critical habitat is absent), and the proportion of the planning watershed managed by SPI. Effects evaluations are grouped by Sacramento River and Trinity River basins. Watersheds supporting covered species and with SPL&T ownership are summarized in Tables 29 and 30.

Table 29. Summary of Sacramento River Basin Listed Species Populations and Watershed Characteristics in the SPL&T HCP Plan Area.

Watershed/ Population	NMFS Recovery Plan Designation: Spring-run Chinook Salmon ESU	NMFS Recovery Plan Designation: Central Valley Steelhead DPS	Percent Total Ownership	Planning Watersheds with SPL&T Ownership	Range Percent Total SPL&T Lands in Planning Watersheds	Miles of Anadromous Stream Habitat	Miles of Perennial Stream Habitat	Miles of Seasonal Stream Habitat
Cow Creek	NA	Core 2	7.9	17	1-48	5.6	61.9	84.8
Big Chico Creek	Core 3	Core 2	23	7	22-95	0	110.9	152.3
Deer Creek	Core 1	Core 1	13.2	8	1-75	0.8	42.5	64.8
Mill Creek	Core 1	Core 1	6.5	2	8-32	3.1	11.9	19.5
Antelope Creek	Core 2	Core 1	38.9	7	21-99	5.4	80.4	99.2
Cottonwood Creek	Core 2	Core 2	3.4	12	4-55	0.43	92.0	120.4
Upper Butte Creek	Core 1	Core 2	40	7	1-96	0	126	101
Clear Creek	Core 1	Core 1	<1	1	16.7	0	6.6	6.2

Table 30. Summary of Trinity River Basin Listed Species Populations and Watershed Characteristics in the SPL&T HCP Plan Area.							
Watershed/ Population	**Percent Total SPL&T Ownership**	**Planning Watershed with SPL&T Ownership**	**Range Percent Total SPL&T Lands in Planning Watershed**	**Miles of Potential Southern Oregon/Northern California Coast Coho Salmon Habitat**	**Miles of Class I Stream Habitat (All Potential Anadromy)**	**Miles of Perennial Stream Habitat**	**Miles of Seasonal Stream Habitat**
Upper Trinity	12	9	3-74	0.22	4	23	32
South Fork Trinity	13	18	1-61	0	7	52	82
Middle Trinity	40	23	1-95	12.9	49	208	42.5

5.2.1. Activities with Minor Impacts

Several covered activities are not subject to THP approval or other CEQA review; including routine road maintenance, mastication of vegetation within road rights-of-way, timber cruising, timber harvest preparation, pre-commercial thinning, construction and operation of communication sites, scientific research, fire suppression, harvest of minor forest products, and grazing. These activities do not require the THP process or other CEQA review because the Board of Forestry determined they are minor and potential impacts from these activities are negligible. These activities are included in the HCP/SHA and discussed below for disclosure purposes to show they were considered, and because they occasionally occur in the HCP and SHA Plan Areas.

5.2.1.1. Road Maintenance

Road maintenance is required under the CFPRs, both within active THPs and on other lands. Within THP areas, road maintenance is covered by the THP. Outside of THPs, the CFPRs do not require specific permits or analysis because potential impacts are minimal. Streambed Alteration Agreements with CDFW are required for all crossing repair projects outside of THPs for Class I and II streams. General maintenance includes ensuring the integrity of the road prism, road drainage, and associated watercourse crossing facilities, and does not require substantial changes to the road prism. Except for mastication for fuel breaks described below, road maintenance does not require substantial vegetation removal. SPI applies standard BMPs during road maintenance including WLPZs buffers and standards for watercourse crossings, and equipment management. Potential impacts to covered species and habitat associated with road maintenance activities are negligible.

5.2.1.2. Mastication of Roadway Rights-of Way

Mechanical mastication of vegetation along roads helps roads function more effectively as fuel breaks. Mastication of roadway rights-of-way targets brush, trees up to 6 inches dbh, and limbs of larger trees within 25 to 30 feet of the roadway. A THP is required if timber is removed for commercial use. SPI applies standard BMPs during roadway mastication including WLPZs buffers and standards for watercourse crossings, and equipment management. Mastication does not occur in WLPZs. Potential impacts to covered species and habitat associated with mastication of roadway rights-of-way activities are negligible.

5.2.1.3. Fuel Break Construction and Maintenance

Fuel breaks occurring in forested stands are covered by THPs and the CFPRs. Construction and maintenance of fuel breaks in low stocked or brush fields (i.e., non-forested areas) does not require THPs. Most of the current and proposed fuel breaks have been or will be constructed under the THP process and apply appropriate mitigation methods such as WLPZs buffers, standards for watercourse crossings, road and landing construction, and equipment management. Potential impacts to covered species and habitat associated with (non-THP) fuel break construction and maintenance activities are negligible.

5.2.1.4. Harvest of Minor Forest Products

Permits issued by SPI for harvest of minor forest products are conditioned to ensure that harvesting methods protect sensitive habitats and avoids and minimizes potential incidental take of covered species. Harvesting is allowed only in predesignated areas and generally subject to constraints such as watercourse protection zones, slope limitation, weather conditions, and access road designation. Firewood collection is primarily limited to firewood generated in otherwise authorized commercial harvests, which have met all required retention standards for wildlife and snags. SPI does not allow firewood collection in WLPZs. Potential impacts to covered species and habitat associated with minor forest products harvest activities are negligible.

5.2.1.5. Transportation of Materials and Heavy Equipment

Transportation of materials and equipment generally entails transportation of rock pit aggregate and heavy equipment used during road maintenance activities including water trucks, end-dump trucks, low beds, and belly dump trucks. Due to the alignments and grades of the roads typically used for such activities, hauling operations generally occur at speeds less than 25 miles per hour and occur on existing road networks. Potential impacts to covered species and habitat associated with transportation of materials and heavy equipment activities are negligible.

5.2.1.6. Conversion of Brush Fields to Timber Plantations

SPI may occasionally convert brush fields to timber plantations. In such cases, brush is destroyed, and the ground is prepared for planting with combined mechanical methods and prescribed fire. The CFPRs do not regulate these activities; however, SPI will apply appropriate standard THP methods, including WLPZs, watercourse crossing standards, road and landing construction standards, and equipment management. Potential impacts to covered species and habitat associated with conversion of brush fields to timber plantations are negligible.

5.2.2. Sacramento River Basin

The following sections describe impacts to watershed products, covered species, and habitat in the Sacramento River basin.

5.2.2.1. Water Yield

As discussed in Section 5.2.1, the trend on SPL&T lands in all planning watersheds is decreases in water yield following peaks when planning watersheds had the greatest level of clearcutting (the decade ending in 2016). Increases in water yield would have been highest in planning watersheds with the greatest amount of SPL&T ownership, and the expected water yield declines will follow a similar pattern across all planning watersheds as clearcut harvesting decreases and thinning increases.

Spring-run Chinook salmon and Central Valley DPS steelhead would be affected by changes in flow. Over the permit period, slightly lower flows, approaching those that existed prior to historic timber harvest, would be delivered from planning area watersheds. Potential contributions from climate change over the permit period aside, the result would be slightly less instream habitat area. Flow changes would also affect water temperatures (likely slight increase) and probably have no impact to low flow temperatures. Covered species would adapt to the slight change by redistributing to remaining potential habitat. Given the relatively low number of fish present in the Sacramento River basin HCP Plan Area streams, overall potential impacts from water yield are low; however, potential effects to the fitness of individual covered species may occur.

Potential effects to covered species and habitat resulting from water yield changes would occur throughout the Sacramento River basin HCP Plan Area; however, the greatest effects would occur in stream reaches occupied by these species. These streams occur in 11 planning watersheds in the Sacramento River basin (Table 29, Table D-2).

5.2.2.2. Peak Flows

Peak flow response is strongly correlated with sediment delivery, as discussed below for sediment (see Section 5.3.2.4). Based on this assessment, the risk changes to peak flows would be slightly reduced from current condition over the permit term due to reductions in the length of connected road surfaces. The amount of change is closely correlated to chronic sediment delivery; the magnitude of which is discussed below. Similar to water yield, potential effects to covered species and habitat resulting from peak flow changes would occur throughout the Sacramento River basin HCP Plan Area; however, the potential greatest effects would occur in stream reaches occupied by these species. These streams occur in 11 planning watersheds in the Sacramento River basin (Table 29, Table D-2).

5.2.2.3. Woody Debris

Riparian habitats on SPL&T lands and SPI management activities provide the conditions and process for WLPZ tree retention and LWD recruitment. SPI assumes an improving trend in LWD recruitment and delivery throughout the permit term. CFPR tree retention standards in WLPZs, existing forest conditions, and continued tree growth in streamside areas throughout the HCP Plan Area, provide for increasing tree numbers and size classes available for potential LWD recruitment.

Aquatic habitat improvements resulting from LWD recruitment would likely be most prevalent in ASP watersheds, which consist of all lands in the HCP Plan Area. Most direct benefits to covered species from these improvements would occur in stream reaches within the HCP Plan Area potentially occupied by these species. These streams occur in 11 planning watersheds in the Sacramento River basin (Table 29, Table D-2).

5.2.2.4. Sediment

5.2.2.4.1. Chronic

Sediment delivered from crossings and road surfaces and areas burned by high severity wildfire are the primary source of potential chronic sediment in the Sacramento River basin HCP Plan Area watersheds. Road density on SPL&T ownership in these planning watersheds is relatively high (see Appendix D). SPI has conducted READI surveys of SPL&T roads in 50 of the 78 Sacramento River basin planning watersheds and these surveys indicate that the percentage of connected road varies from 0 to 40 percent. This amount of connected surface and road crossings can be expected to contribute at least moderate amounts of sediment to stream channels.

Impacts of temperature and microclimate associated with clearcut logging in Judd Creek were studied by SPI monitoring initiated during 1999 (James 2003), and later for sediment and turbidity. This additional monitoring (MacDonald and James 2012 reported extensive road work was conducted during 2007 as part of a THP, and in 2009, 16 percent of the watershed was clearcut. Preliminary data analysis using available annual suspended sediment yields for water years 2001 through 2012 indicated there was no signal from the roading work completed in 2007 or timber harvesting undertaken in 2009; with sediment yields responding primarily to variations in precipitation (Brandow and Cafferata 2014). This result was attributed to both erosion control measures and the volcanic soils of treated area that have high infiltration capacity.

Application of these results at a given watershed scale would lower the expectation of the amount of sediment delivered to channels from a road system. It could be expected that older roads might present higher risk of sediment delivery than recent road construction due to advances in understanding of road related sediment. Based on CFPRs trends, current design standards and considerations will continue to advance and apply to future road reconstruction actions, and road sites delivering the most sediment would be treated first. As a result, additional road lengths would be disconnected, and the efficiency and durability of road crossings also improved so that their risk of failure is reduced. These changes to the road system would result in less sediment delivery (and flow) from road surfaces, and less sediment delivery from road crossings.

SPI assumes the amount of skid trails and landings would increase slightly in the HCP Plan Area over the course of the permit period, with more acreage subject to harvest with the reduction in clearcutting and increase in selection and thinning prescriptions. Assuming that sediment delivery from skid trails and landings is correlated to the amount of area harvested, SPI projects a slight increase in sediment from this source. These increases would be mitigated to insignificant levels by implementing the CFPRs. SPI also expects decreases in sediment from road sources, collectively resulting in a moderate decrease in chronic sediment delivery over the permit term. SPI projects that over the permit term, reductions would be greatest during the first two decades, as the sites delivering the most sediment would be treated. Beyond that time, declines would continue but diminish as sites delivering less sediment are improved.

Sediment from chronic sources is delivered during all storms with intensity great enough to initiate surface flow. Input of sediment can be expected throughout the rainy season, and from occasional summer thundershowers. This includes delivery of sediment to habitat when steelhead and salmon eggs and alevins are in stream gravels and deposition of sediment leads to increased mortality. Because the trend and projections are less sediment delivery, the potential impact to eggs and alevins would be positive, with less potential suffocation of eggs and alevins, and less obstruction to emergence for young fish. The same trend applies to potential impacts on juveniles and adults, as potential impacts to behavior and feeding are reduced. Improvement to Central Valley DPS steelhead habitat would be slightly greater than spring-run Chinook salmon habitat, due to the proximity of roads and harvest activities in the HCP area to their respective habitats. The duration of the change would be for the length of the permit, with no improvement until the first entry following permit issuance. Sediment delivery from roads would be reduced most during the first entries, as sites with the most delivery become treated. Once treated and regularly maintained, a trend to less sediment delivery will continue over the permit term.

Given the location, permit conditions, and monitoring of cattle grazing on Sacramento River basin lands in the HCP Plan Area, no detectable change in sediment delivery is expected from these activities.

Potential impacts to covered species resulting from chronic sediment would most likely occur on lands within the HCP Action Area in stream reaches potentially occupied by these species. These streams occur in 11 planning watersheds in the Sacramento River basin (Table 29, Table D-2).

5.2.2.4.2. Episodic

Because Sacramento River basin planning watersheds in the HCP Plan Area are not prone to mass wasting, road crossing failures represent the primary risk of episodic sediment delivery. SPI analyzed THP and other records for Sacramento River basin HCP Plan Area lands to evaluate and characterize historic forest road conditions and failures, and to estimate potential future road failures and sediment delivery trends. Trends were based on the past 21 years and used the 100-year flood event of 1997 as a benchmark. The analysis suggests a trend of fewer watercourse crossing and road drainage failures, and nearly no events resulting in watercourse diversion. Watercourse and drainage failures occurring during this period were all within areas burned by wildfire and then subject to rain-on-snow events. Collectively, these trends suggest some failure events will continue, including large events on rare occasion; and those large events most likely occurring in situations where landscapes are burned in wildfire and then subject to rain-on-snow weather conditions. During the permit period, SPI expects similar or slightly reduced instances of road damage due to hill side debris torrents during normal conditions as on-going maintenance and improvements continue. SPI also expects an average of 2.5 slope failure events per decade creating larger debris torrents caused by flood events following wildfire; these events may occur exclusive of the road system. All road failures will be repaired following all CFPR design and monitoring standards.

The amount of sediment delivered by these crossing failures is difficult to predict, due to the variation in the size of crossing fills and the extent of the failure. SPI has constructed critical dips at all crossings with diversion potential. During flood flows that cause crossing failure, critical dips prevent flow from draining down the road and reduces erosion from gullying of road surfaces and fills. As a result, material delivered to channels during crossing failures should be limited to sediment in the fill. The SPI efforts during the past 20 years to strengthen crossings with larger culverts includes rock armoring the inlet and outlet to reduce the risk of losing fill if a culvert plugs or overtops. Generally, culverts over 30 inches in diameter have rock armoring to stabilize the fill and minimize the risk of failure. The overall trend on SPL&T lands for watercourse crossings is greater numbers of repairs and associated upgrades, and fewer crossing failures.

With large culvert placement as a benchmark, for analysis purposes SPI made an assumption for existing culverts either 18 or 24 inches in diameter that may not be armored, and regarding the amount of fill covering those crossings. Assuming an average crossing length for installing a 24-inch-diameter culvert of 10 feet with a 14-foot roadway, plus 3-foot fill base in each side (20-foot total width) and a height of 2 feet, (generally the height of fill over the culvert is similar to the height of the culvert) a crossing would have a fill volume of about 6 cubic yards. Assuming 50 percent of fill volume were delivered during failure, about 3 cubic yards of material would be delivered from each crossing with an 18- or 24-inch culvert installation that failed but did not divert the watercourse channel. With this minimal sediment contribution to streams if crossing failures occur, the expectation that few failures will occur, and the trend of even fewer potentially failing crossings present in the HCP Plan Area due to upgrades, the potential effects and risk to covered species and habitats is low.

Research into causes of crossing failures (Furniss et al. 1998) indicates failures are typically caused by woody debris obstructing culvert inlets, coupled with flood flows. Failures are less often caused by exceedance of flow capacity. As crossings are improved, design features such as larger pipes, tapered or winged inlets, or replacement of culverts with low water crossings are incorporated into reconstruction. As a result, the number of crossings at risk to failure will decline over time. Since these improvements will be built to higher standards due to the current CFPRs and HCP mitigation measures, the risk (and number) of failures will decline over the course of the permit period, even with increasing flood events as predicted in most climate change models. This is the same trend as for chronic sediment (no change at onset, most change in first two decades, continuing positive trend over permit term).

The impact of crossing failures on habitat and fish depends on the timing of the flows causing the event. The worst-case situation is road crossing failure to occur when eggs or alevins are in redds (typically December-April for Central Valley DPS steelhead; September-February for spring-run Chinook salmon). Sediment deposition at this time may result in mortality. The additional amount of sediment from crossing failures during storm events that trigger them would be low, as sediment delivery from both natural and other human caused sources is high during storm events large enough to cause crossing failures. The duration of the increased sediment would also be low, but most likely longer than the storm event, as newly formed rills or gullies on the failed fill slopes would continue to deliver sediment. Given all factors, sediment from crossing failures could be expected to result in minor increases and stress and mortality to steelhead eggs and alevins. Due to timing of spawning and incubation, impacts to spring-run Chinook salmon and Central Valley DPS steelhead would be essentially the same. Additional stress to juveniles and adults during these flooding events resulting from crossing failures would be minor due to relatively high levels of background sediment.

Similar to chronic sediment, potential impacts to covered species resulting from episodic sediment would most likely occur on lands within the HCP Action Area in stream reaches occupied by these species. These streams occur in 11 planning watersheds in the Sacramento River basin (Table 29, Table D-2).

5.2.2.4.3. Heat

SPL&T's Sacramento River basin land base includes approximately 15 miles of riparian habitat bordering anadromous streams, and 619 miles of additional perennial stream habitat. SPI assumes that all riparian habitat adjacent to these streams will be included in THPs during the permit term. In most situations, stream shade is mainly provided by vegetation in the WLPZ Core. Stream shade from Inner Zone vegetation could occur when stream channel geomorphology, floodplain, and valley form, is such that shade is provided by vegetation other than vegetation present in the WLPZ Core (i.e., where no timber harvest would occur). In such cases, some stream shade canopy could be removed by covered activities. CFPRs guidelines for the Inner Zone require retention of 70 percent canopy and the 7 to 13 largest trees per acre. The combination of these controls further limits the amount of vegetation providing stream shade that may be removed. NMFS (2016b) estimated that shade reduction of 6 percent was necessary to increase water temperatures in streams in western Oregon. Given the natural factors controlling stream shade and CFPR regulations, SPI assumes that any shade removal from timber harvest causing impacts to stream temperatures would be minor, very rare; and stream shade reduction levels greater than 6 percent would be even more rare. In such cases, duration of the effect would be short term, due to vegetation growth in the Inner Zone. SPI assumes that shade removal impacts from covered activities are minor and would have no adverse impacts on habitat or covered species.

Removal of streamside vegetation resulting from cable logging corridors passing through the WLPZ may have minor impacts to stream shading. Yarder corridors generally do not drag logs through a WLPZ. Most yarder corridors are limited to only having a cable hanging through the WLPZ and logs being removed are pulled away from the watercourse zone. The cable extending through the stream zone is used to gain deflection in order to lift logs from the ground and aerially suspend them while being pulled to the adjoining road or landing. While lifting the cable through the stream zone some individual trees may interfere with the cable and require cutting, but this is a limited occurrence and a cut corridor is generally less than 10 feet wide.

Due to the location, permit conditions, and monitoring of cattle grazing on Sacramento River basin lands in the HCP Plan Area, SPI expects no detectable change in stream shade to occur due to grazing activities.

Potential effects to covered species and habitat resulting from changes in heat would occur throughout the Sacramento River basin HCP Plan Area; however, the greatest effects would occur in stream reaches occupied by these species. These streams occur in 11 planning watersheds in the Sacramento River basin (Table 29, Table D-2).

5.2.2.4.4. Nutrients

Past harvest activities in the HCP Action Area likely provided conditions favorable for hardwood growth following harvest, with hardwoods at least partially replacing harvested conifers in the riparian zone. As the CFPRs have required increasing conservation of streamside vegetation during operations, detrital inputs are likely trending toward pre-harvest conditions.

Detrital input will continue to trend toward pre-timber harvest conditions due to retention of detrital sources in the no-harvest WLPZ Core Zones. Compared to baseline conditions, the amount of leaf and needle delivery is expected to closely mimic pre-harvest conditions, as riparian stands grow to older mixed hardwood and conifer stands. The covered activities should cause no detectable changes in salmonid production resulting from changed nutrient loads.

Similar to heat, potential effects to covered species and habitat resulting from changes in nutrients would occur throughout the Sacramento River basin HCP Plan Area; however, the greatest effects would occur in stream reaches occupied by these species. These streams occur in 11 planning watersheds in the Sacramento River basin (Table 29, Table D-2).

5.2.2.4.5. Passage

There are no impassible crossings in anadromous stream habitat on streams in the Sacramento River basin HCP Plan Area. Four stream crossings occur in anadromous stream reaches in the Sacramento River basin HCP Plan Area; one bridge, one culvert, and two fords located in the Deadhorse Creek and Taylor Gulch planning watersheds (Table D-2). These streams occur in the Antelope Creek and Cottonwood Creek watersheds, respectively. There will be no change to habitat connectivity during the permit period.

5.2.2.4.6. Entrainment

SPI assumes stream crossings of anadromous habitat will be occasionally used as water drafting sites during harvest activities each decade throughout the permit period. Juvenile Central Valley DPS steelhead are the species and life stage most likely to be affected by this activity.

Potential effects to covered species resulting from entrainment would occur in stream reaches potentially occupied by these species. These streams occur in 11 planning watersheds in the Sacramento River basin (Table 29, Table D-2). Given four crossings occur in the HCP Plan Area in anadromous stream habitats in only two planning watersheds, and the standard CFPR fish protective measures required and employed during drafting, the likelihood of potential impacts to covered species, including juveniles, will be very low.

During water drafting SPI will implement several avoidance and minimization measures to avoid the likelihood of effects to covered species. Pumps are screened to prevent fish and other aquatic life from entering the pump intake, and the drafting rate is capped at 350 gallons per minute to reduce the risk of fish being impinged against the screen. Minimization measures described in the THP and CDFW 1600 Agreement are implemented by the licensed timber operator. The CFPRs and 1600 Agreement standard in ASP watersheds include implementing NMFS water drafting standards.

5.2.2.4.7. Physical Alteration of Streams and Anadromous Habitat

Reconstruction of stream crossings will result in short term sediment delivery to stream channels. Reconstruction activities will occur during low flow periods and will adhere to CFPRs limiting the extent of activity. The CFPRs require that reconstruction activities conducted in flowing water must have a de-watering plan in place prior to beginning activities. Typically, a plastic pipe is used to collect water above the proposed construction site and to re-route the water around the site into the same channel below the construction site. During culvert replacement this technique confines all disturbed soil to the construction site and eliminates delivery downstream and potential effects to fishes. The overall result is impacts are limited in magnitude and duration; on the order of less than 1 cubic yard of sediment added to channels over the period of a few days.

Activities may occur when eggs or alevins are in stream gravel. Increases in turbidity resulting from the activities could cause stress to adult and juvenile spring-run Chinook salmon and Central Valley DPS steelhead, causing them to move to avoid turbid water or adjust feeding behavior. Juvenile steelhead are the species and life stage most likely to be affected by this activity; however, CFPRs providing protective measures for operations in streams will be required and used. As a result, the work presents a low risk of causing harm or mortality to individual fishes.

Potential impacts to covered species resulting from physical alteration would occur in stream reaches within the HCP Plan Area occupied by these species where these streams intersect with road crossings. These streams include four crossing locations occurring in the Sacramento River basin HCP Plan Area in the Deadhorse Creek and Taylor Gulch planning watersheds. These streams occur in the Antelope Creek and Cottonwood Creek watersheds, respectively. Reconstruction activities at these locations will be infrequent during the permit period and only necessary following storm events causing extensive damage to these structures.

5.2.2.5. Summary of Effects on Habitat

Changes to both peak flows and water yield are expected to generally reflect increases in planning watersheds following timber harvest, followed by gradual decreases as harvested stands regenerate. The overall pattern of peak flow and water yield increases and decreases will diminish over the permit term, as the amount of clearcut harvesting decreases and thinning increases. An upward trend in LWD recruitment is expected due to continued tree growth in WLPZs during the permit period. No changes to water temperature or nutrient delivery are expected to result from covered activities during the permit period. Levels of chronic sediment delivery is anticipated to potentially remain above natural levels due to the high density of both roads and road crossings but is expected to diminish over the permit term as road improvements continue. Levels of episodic sediment delivery is also anticipated to remain above natural levels following rare natural events due to the high density of both roads and road crossings, but is also expected to diminish over the permit term as the number of potential locations at which these events could cause sediment delivery are reduced during continuous upgrades over time.

The likelihood of potential effects to watershed products in the Sacramento River basin HCP Plan Area include water yield and peak flows, woody debris, chronic and episodic sediment, heat, and nutrients. While the probability of potential effects to watershed products is low, SPI recognizes that potential impacts to individuals of the covered species may occur due to covered activities and take may occur. Potential take is minimized and mitigated to the maximum extent practicable by the conservation measures included in this HCP.

5.2.2.6. Summary of Effects on Covered Species

Potential direct and indirect effects to covered species may occur due to covered activities. Direct effects include potential impacts causing harm to individual covered species, most likely occurring during water drafting and instream construction or construction activities at stream crossings in covered species habitat. These impacts would most likely effect individual juveniles of Sacramento River basin covered species. These impacts are expected to be minimal due to CFPR practices designed to limit impacts to fishes, including implementing NMFS water drafting standards, and compliance with project specific CDFW 1600 Agreements for any instream construction activities.

Indirect effects include potential impacts from sediment due to physical disturbance of anadromous fish habitat and input from road systems. Effects of chronic sediment on eggs and alevins are the most likely impact from covered activities. This impact would occur at current levels but diminish over time as road improvements are implemented. Following those improvements, reductions in sediment delivery is expected, with corresponding reduction of potential impacts to fish. Given the proximity of potential habitat to roads and harvest activities, and the low amount of potential habitat in the HCP Plan Area, potential impacts from chronic sediment are more likely to affect Central Valley DPS steelhead than spring-run Chinook salmon. Minimal impacts to eggs and alevins are anticipated from episodic sediment sources.

Collectively, potential direct and indirect effects to covered species are expected to most likely occur in the 11 planning watersheds in the Sacramento River basin HCP Plan Area known or potentially occupied by these species. These effects are most likely in watersheds with covered species habitat and high numbers of roads and crossings. Potential effects are more likely in watersheds proximal to covered species habitat with high numbers of crossings, and least likely in watersheds with low proportions of SPL&T lands.

Potential effects to covered species and habitats in the Sacramento River basin HCP Plan Area from blocked or compromised fish passage, entrainment, and physical disturbance of streams and anadromous fish habitat are minor. By following all applicable CFPRs, and the mitigation measures described in the HCP, the probability of potential effects and risk to these resources is low. While the probability of potential effects is low and the overall effects negligible, SPI recognizes that individuals of the covered species may be impacted by covered activities and take may occur. Potential take is minimized and mitigated to the maximum extent practicable by the conservation measures included in this HCP.

5.2.3. Trinity River Basin

The following sections describe impacts to watershed products, covered species, and habitat in the Trinity River basin.

5.2.3.1. Water Yield

As discussed in Section 5.2.1, the trend in all SPL&T lands in all planning watersheds in the HCP is decreases in water yield following peaks when planning watersheds had the greatest level of clearcutting (the decade ending in 2016). Increases were greatest in planning watersheds with the greatest amount of SPL&T ownership and declines will follow a similar pattern across all planning watersheds.

Potential impacts from water yield changes to Upper Klamath/Trinity River ESU Chinook salmon, SONCC coho salmon, and Klamath Mountains Province DPS steelhead are similar as described for the Sacramento River basin HCP Plan Area. Potential effects to covered species and habitat resulting from water yield changes would occur throughout the Trinity River basin HCP Plan Area; however, the greatest effects would occur in stream reaches occupied by these species. These streams occur in 31 planning watersheds in the Trinity River basin (Table 30, Table E-2).

5.2.3.2. Peak Flows

Potential impacts to covered species and habitat in the Trinity River basin HCP Plan Area resulting from changes in peak flows are similar as described for the Sacramento River basin HCP Plan Area; that the risk of peak flows would be slightly reduced from current condition over the permit term due to reduction in the length of connected road surfaces. These potential impacts would occur throughout the Trinity River basin HCP Plan Area; however, the greatest effects would occur in stream reaches occupied by these species. These streams occur in 31 planning watersheds in the Trinity River basin (Table 30, Table E-2).

5.2.3.3. Woody Debris

Similar to the Sacramento River basin HCP Plan Area, SPI management provides the conditions and process for WLPZ tree retention and LWD recruitment and assumes an improving trend in LWD recruitment and delivery throughout the permit term in the Trinity River basin HCP Area due to CFPR tree retention standards in WLPZs, existing forest conditions, and continued tree growth in streamside areas. Aquatic habitat improvements resulting from LWD recruitment would likely be most prevalent in ASP watersheds, which consist of all lands in the HCP Plan Area. Most direct benefits to covered species from these improvements would occur in stream reaches within the HCP Plan Area potentially occupied by these species. These streams occur in 31 planning watersheds in the Trinity River basin (Table 30, Table E-2).

5.2.3.4. Sediment

5.2.3.4.1. Chronic

Similar to the Sacramento River basin HCP Plan Area, sediment delivered from crossings and road surfaces and areas burned by high severity wildfire are the primary source of potential chronic sediment in the Trinity River basin HCP Plan Area watersheds. Road density on SPL&T ownership in these planning watersheds is relatively high (see Appendix E). SPI has conducted READI surveys of SPL&T roads in 26 of the 31 Trinity River basin planning watersheds and these surveys indicate that the percentage of connected road varies from 0 to 44 percent. This amount of connected surface and road crossings can be expected to contribute at least moderate amounts of sediment to stream channels. Additionally, as described in Section 4.2, the Trinity

River basin HCP Action Area lies within less stable geologic landforms than the Sacramento River basin. Greater chronic sediment levels can be expected in the HCP planning watersheds with greater landslide risk.

Continued application of the CFPRs and SPI's READI model lower the expected amount of sediment delivered to channels from the road system. It could be expected that older roads might present higher risk of sediment delivery; however, current CFPR design considerations would continue for future road reconstruction actions, and road sites delivering the most sediment would be treated first, while prioritizing geologically unstable watersheds. Improvement to Klamath Mountains Province DPS steelhead and steelhead habitat would be slightly greater than SONCC coho salmon habitat improvement, due to the proximity of roads, harvest activities relative to their respective habitats, and the amount of known or potential habitat in the HCP Plan Area.

Given the location, permit conditions, and monitoring of cattle grazing on Trinity River basin lands in the HCP Plan Area, no detectable change in sediment delivery is expected from these activities.

Potential impacts to covered species resulting from chronic sediment would most likely occur on lands within the HCP Action Area in stream reaches potentially occupied by these species. These streams occur in 31 planning watersheds in the Trinity River basin (Table 30, Table E-2). Within these planning watersheds 12 are considered high or moderate-high risk for landslides (Table E-3) and would have the highest likelihood to produce sources of chronic sediment. Three of those 12 planning watersheds are within the known or suspected SONCC coho salmon geographic range.

5.2.3.4.2. Episodic

Because Trinity River basin planning watersheds in the HCP Plan Area are generally more prone to mass wasting than Sacramento River basin watersheds, wasting events and road crossing failures represent the primary risks of episodic sediment delivery. SPI analyzed THP and other records for Trinity River basin HCP Plan Area lands to evaluate and characterize historic forest road conditions and failures and estimate potential future road failures and sediment delivery trends. Trends were based on the past 21 years and used the 100-year flood event of 1997 as a benchmark. Similar to the Sacramento River basin HCP Plan Area, the analysis suggests a trend of fewer watercourse crossing and road drainage failures, and nearly no events resulting in watercourse diversion. Watercourse and drainage failures occurring during this period were all within areas burned by wildfire and then subject to rain-on-snow events. The analysis suggests large events will continue, including large events on rare occasion; and those large events most likely occurring in situations where landscapes are burned in wildfire and then subject to rain-on-snow weather conditions. Additionally, events causing greater episodic sediment can be expected in the HCP planning watersheds with greater landslide risk (Table E-3). During the permit period SPI expects similar or slightly reduced instances of events causing episodic sediment due to road damage or hill side debris torrents during normal conditions as on-going maintenance and improvements continue. Based on the trend information, SPI also expects an average of one event per decade creating larger debris torrents caused by flood events following wildfire; these events may occur exclusive of the road system. All failures will be repaired and following all CFPR design, agency review, and monitoring standards.

The impact of crossing failures on habitat and fish depends on the timing of the flows causing the event. The worst-case situation is road crossing failure to occur when eggs or alevins are in redds (typically October-December for Upper Klamath/Trinity River ESU Chinook salmon, October-January for SONCC coho salmon, and November-May for Klamath Mountains Province DPS steelhead). Due to timing of spawning and incubation, impacts to SONCC coho salmon and Klamath Mountains Province DPS steelhead would be essentially the same. Sediment deposition at this time may result in egg or juvenile mortality. Potential impacts to covered species resulting from episodic sediment would most likely occur on lands within the HCP Action Area in stream reaches potentially occupied by these species. These streams occur in 31 planning watersheds in the Trinity River basin (Table 30, Table E-2). Within these planning watersheds three are considered high risk for landslides and 14 considered moderate-high (Table E-3) and would have the highest likelihood to produce sources of episodic sediment. One of the three high risk (Upper Rush Creek) and two of the 14 moderate-high risk (Maxwell Creek and Little Browns Creek) planning watersheds are within the known or suspected SONCC coho salmon geographic range.

5.2.3.5. Heat

SPL&T's Trinity River basin HCP Plan Area lands include approximately 61 miles of riparian habitat bordering anadromous or Class I streams, and 283 miles of additional perennial stream habitat. SPI assumes that all riparian habitat adjacent to these streams will be included in THPs during the permit term. Similar general conditions and expected heat trends as described for the Sacramento River basin HCP Plan Area occur in the Trinity River basin HCP Plan Area.

Potential effects to covered species and habitat resulting from changes in heat would occur throughout the Trinity River basin HCP Plan Area; however, the greatest effects would occur in stream reaches occupied by these species. These streams occur in 31 planning watersheds in the Trinity River basin (Table 30, Table E-2).

Due to the location, permit conditions, and monitoring of cattle grazing on Trinity River basin lands in the HCP Plan Area, SPI expects no detectable change in stream shade to occur due to grazing activities.

5.2.3.6. Nutrients

Similar general conditions and expected trends as described for the Sacramento River basin HCP Plan Area occur in the Trinity River basin HCP Plan Area. Potential effects to covered species and habitat resulting from changes in nutrients would occur throughout the Trinity River basin HCP Plan Area; however, the greatest effects would occur in stream reaches occupied by these species. These streams occur in 31 planning watersheds in the Trinity River basin (Table 30, Table E-2).

5.2.3.7. Passage

There are no impassible crossings in anadromous stream habitat on streams in the Trinity River basin HCP Plan Area. Twenty-nine stream crossings occur in anadromous stream reaches in the Trinity River basin HCP Plan Area; 14 bridges, nine culverts, and six fords located in 17 planning watersheds (Table E-2). These streams occur in the Lower, South Fork, and Middle Trinity River Hydrologic Areas. There will be no change to habitat connectivity during the permit period.

5.2.3.8. Entrainment

Similar to the Sacramento River basin HCP Plan Area, SPI assumes stream crossings of anadromous habitat will be occasionally used as water drafting sites during harvest activities each decade throughout the permit period in the Trinity River basin HCP Plan Area. Juvenile Klamath Mountains Province DPS steelhead are the species and life stage most likely to be affected by this activity.

During water drafting SPI will implement several avoidance and minimization measures to reduce the likelihood of effects to covered species. Pumps are screened to prevent fish and other aquatic life from entering the pump intake, and the drafting rate is capped at 350 gallons per minute to reduce the risk of fish being impinged against the screen. Minimization measures described in the THP and 1600 Agreement are implemented by the licensed timber operator. The CFPRs and 1600 Agreement standards for ASP watersheds including implementing NMFS water drafting standards.

Potential effects to covered species resulting from entrainment would occur in stream reaches potentially occupied by these species. These streams occur in 31 planning watersheds in the Trinity River basin (Table 30, Table E-2). Twenty-nine crossings occur in the HCP Plan Area in anadromous or Class I stream habitats in 17 planning watersheds. Two of the 29 crossings occur in a planning watershed potentially occupied by SONCC coho salmon (Little Browns Creek); both of which are bridges.

5.2.3.9. Physical Alteration of Streams and Anadromous Habitat

As described for the Sacramento River basin HCP Plan Area, reconstruction of stream crossings may occur in the Trinity River basin HCP Plan area resulting in short term sediment delivery to stream channels when eggs or alevins are in stream gravel. Increases in turbidity resulting from the activities could cause stress to adult and juvenile Upper Klamath/Trinity River ESU Chinook salmon, SONCC coho salmon, and Klamath Mountains Province DPS steelhead, causing them to move to avoid turbid water or adjust feeding behavior. Juvenile steelhead are the species and life stage most likely to be affected by this activity.

Potential impacts to these covered species resulting from physical alteration would occur in stream reaches within the HCP Plan Area occupied by these species where these streams intersect with road crossings. These streams include 29 crossing locations occurring in the Trinity River basin HCP Plan Area in 17 planning watersheds in the Lower, South Fork, and Middle Trinity River Hydrologic Areas (Table 30, Table E-2). Reconstruction activities at these locations will be infrequent during the permit period and only necessary following storm events causing extensive damage to these structures. Two of the 29 crossings occur in a planning watershed potentially occupied by SONCC coho salmon (Little Browns Creek); both of which are bridges.

5.2.3.10. Summary of Effects on Habitat

SPI expects the same general habitat effects in the Trinity River basin HCP Plan Area as the Sacramento River basin HCP Plan Area. Changes to both peak flows and water yield are expected to gradually decrease as harvested stands regenerate, clearcutting decreases, and thinning increases. An upward trend in LWD recruitment is expected due to continued tree growth in WLPZs, and no changes to overall water temperature or nutrient delivery are expected to occur. Chronic and episodic sediment delivery are anticipated to remain above natural levels due to the high density of both roads and road crossings, particularly in areas characterized by high landslide risk due to unstable geology. Reduced sediment delivery levels are expected over the permit term as road improvements continue, particularly during the first two decades when most sites would be treated following READI model completion and analysis. Potential effects to watershed products in the Trinity River basin HCP Plan Area including water yield and peak flows, woody debris, chronic and episodic sediment, heat, and nutrients are minor. While the probability of potential effects to watershed products is low and the overall effects negligible, SPI recognizes that potential impacts to individuals of the covered species may occur due to covered activities and take may occur. Potential take is minimized and mitigated to the maximum extent practicable by the conservation measures included in this HCP.

5.2.3.11. Summary of Effects on Covered Species

Potential direct and indirect effects to covered species may occur due to covered activities. Direct effects include potential impacts causing harm to individual covered species, most likely consisting of impingement, crushing, and displacement occurring during water drafting and instream construction or construction activities at stream crossings in covered species habitat. These impacts would most likely effect individual juveniles of Trinity River basin covered species. These impacts are expected to be minimal due to CFPR practices designed to limit impacts to fishes, including implementing NMFS water drafting standards, and compliance with project specific CDFW 1600 Agreements for any instream construction activities.

Indirect effects include potential impacts from sediment due to physical disturbance of anadromous fish habitat and input from road systems. Effects of chronic sediment on eggs and alevins are the most likely impact from covered activities. This impact would occur at current levels and gradually diminish during the first two decades as the READI model analysis is completed and improvements to roads are implemented. Following those improvements, reductions in sediment delivery is expected, with corresponding reduction on impacts to fish. Given the timing of spawning, potential impacts could occur to Upper Klamath/Trinity River ESU Chinook salmon, SONCC coho salmon, and Klamath Mountains Province DPS steelhead. Potential indirect effects to eggs and alevins are anticipated from episodic sediment sources to individual juveniles of all of these species.

Collectively, potential impacts to covered species are expected to most likely occur in the 29 planning watersheds in the Trinity River basin HCP Plan Area known or potentially occupied by these species. These effects are most likely in watersheds with covered species habitat, high numbers of roads and crossings, and greater proportions of unstable lands. Seventeen planning watersheds are characterized by unstable geology (Appendix E, Tables E-3 and E-4), and potential impacts to SONCC coho salmon are most likely to occur in three of those watersheds. Potential effects are less likely in watersheds proximal to covered species habitat with high numbers of crossings, and least likely in watersheds with low proportions of SPL&T lands.

Potential effects to covered species and habitats in the Trinity River basin HCP Plan Area from fish passage, entrainment, and physical disturbance of streams and anadromous habitat are minor. By following all applicable CFPRs, and the mitigation measures described in the HCP, the probability of potential effects and risk to these resources is low. While the probability of potential effects is low and the overall effects minor, SPI recognizes that individuals of the covered species may be impacted by covered activities and take may occur. Potential take is minimized and mitigated to the maximum extent practicable by the conservation measures included in this HCP

5.2.4. 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 HCP/SHA Action Area. The cumulative effects analysis conducted for this HCP/SHA considers SPI's previously described management context, land ownership patterns in the HCP Action Area, including lands excluded by the definition of cumulative effects (i.e., federal lands), and that all SPI covered activities are regulated by the CFPRs program, as described below.

SPL&T lands comprise approximately 24 percent of the Sacramento River basin HCP Action Area, while other private landowners encompass approximately 51 percent of those lands. Federal lands account for approximately 22 percent, most of which is managed by the USFS. State lands occupy approximately 3 percent of the HCP Action Area.

Approximately 26 percent of lands in the Trinity River basin HCP Action Area are owned by SPL&T, while other private landowners collectively own approximately 19 percent. Federal lands account for approximately 55 percent, most of which is managed by the USFS. State lands occupy less that 1 percent of the HCP Action Area.

Timber Harvest and associated activities are regulated under a functional equivalent program that was approved by the California Secretary of Resources in 1976. Under the CEQA process this means that a formal Environmental Impact Report and related analysis is replaced by the entirety of the functional equivalent program. The approved functional equivalent program includes the California Forest Practice Act, CFPRs, the BOF rule making process, THP documents, a multi-disciplinary Review Team (Review Team), a pre-harvest inspection by the Review Team, the public comment period, and if necessary, the CalFire Official Response to issues raised. The BOF rule making process includes public participation and comment periods, and the Board also conducts a CEQA analysis for each rule making effort.

Each Review Team has standing members of CalFire, CDFW, and the California Regional Water Quality Control Board; additionally, as local circumstances dictate, the Review Team can also include the California Geologic Survey, U.S. Forest Service, National Park Service, California State Parks, and local Counties. All review team members can raise issues. The land owner and CalFire as lead agency must address all issues deemed potentially significant adverse impacts. This functional equivalent program represents over 42 years of continual advancement in the process by all participating parties and entities.

SPI conducts all forestland management activities in full compliance with the CFPRs, which set prescriptive standards for natural resource protection minimization measures for all privately- and state-owned timberland management activities in California. The CFPRs set even higher standards for activities in ASP watersheds; SPI lands in the ITP permit area presently are considered ASP watersheds. Each THP prepared under the CFPRs includes multi-agency, multi-disciplinary administrative and field review, and public participation. Resource agency approvals include post-project assessment to assure compliance with all appropriate CFPRs protection measures. In particular, the process has required that each THP must include a complete cumulative impacts analysis, which is available for public review and comment. As a result of this functional equivalent program, CalFire cannot approve a project that causes a significant environmental impact.

The cumulative effects of additional actions on State, tribal, local, or private lands that are reasonably certain to occur in the HCP Action Area during the permit period are summarized below.

5.2.4.1.1. Timberland Management

Approximately 104,074 acres, or 19 percent, of the other (i.e., non-SPL&T) private lands in the Sacramento River basin HCP Action Area consist of commercial timberlands. In the Trinity River basin HCP Action Area, approximately 70,960 acres, or 8 percent, of the other private lands in the Trinity River basin HCP Action Area consist of commercial timberlands.

SPI assumes timberland management activities on those lands including timber harvest, yarding, loading, hauling, site preparation, planting, and vegetation management will continue during the permit period. These activities may potentially impact covered species and their habitat. However, activities on these lands are subject to the CFPRs, including the ASP rules where applicable, and all potential project effects, including cumulative effects, are addressed and mitigated to insignificant levels by each proposed THP and other programmatic agreements.

5.2.4.1.2. Wildfire suppression on non-federal lands

Wildfire is likely to occur in the HCP Action Area watersheds over the permit term. Depending on size, severity, and location, fires could have effects ranging from beneficial (increase water yield, improved riparian condition, reduced fuel loadings) to negative (increased sediment loading, increased water temperatures). Wildfire suppression may include the removal or modification of vegetation due to firebreak construction or setting backfires as fire control measures. An undetermined amount of potential covered species habitat may be removed or modified by this activity. Post-fire rehabilitation is performed by the state or federal incident lead agency per their guidelines. This HCP/SHA includes mitigation measures to minimize potential impacts post-fire including road crossing upgrades and other relevant BMPs.

5.2.4.1.3. Roads

Numerous private, county, and state roads occur in the HCP Action Area. The amount of existing road maintenance and new road construction cannot be determined; however, SPI assumes maintenance and new construction will continue similar to current levels. Standard and project-specific aquatic resource protection measures are expected to continue and maintain trends for higher road construction, reconstruction, and maintenance standards compared to historical standards. Continued improvement of environmental conditions on private and state lands related to roads throughout the HCP Action Area is expected during the permit period.

Increased sediment from timber harvest and related road management is addressed in the evaluation of the covered activities, as SPI is responsible for most timber harvest in the HCP Plan Area watersheds. Potential impacts from roads on other private timberlands are subject to the CFPRs, including the ASP rules where applicable, and all potential project effects, including cumulative effects, are addressed and mitigated to insignificant levels. Potential road impacts from federal lands can be expected to remain at about current levels during the permit period. Road conditions on SPL&T lands are expected to continue improving during the permit period by implementing the READI model and implementing road and drainage improvements.

5.2.4.1.4. Mining

Limited gravel and hard rock mining and quarrying, and associated gravel processing, occurs in the HCP Action Area. SPI assumes these activities will continue during the permit period. The potential effects of mining on aquatic resources in the HCP Action Area depend on the type, size, location, and distance from aquatic habitats. Instream gravel mining can impact sedimentation, erosion, streambank and streambed stability, and substrate. Surface mining may cause soil compaction and loss of vegetative cover. Mining activities may also impact riparian vegetation. Because potential effects of quarries and rock mines depend numerous variables, the effects of mining within the HCP Action Area to covered species and their habitats are unknown. All mining activities, however, are regulated by the State of California under SMARA and additional local and county regulations. This regulatory framework mandates that the impacts from these activities be mitigated to insignificant levels.

5.2.4.1.5. Habitat Restoration Projects

Several salmonid restoration projects occur in the HCP Action Area, such as the TRRP in the Trinity River basin and active Sacramento river basin programs in the Clear Creek and Battle Creek watersheds. It is reasonable to assume these will continue, and additional projects will occur during the permit period. These restoration projects are subject to CEQA and NEPA analyses and all supporting consultations, permitting, and mitigation planning. SPI assumes this regulatory framework will continue to address potential impacts to covered species and habitat on a project-specific basis. Implementation of this HCP/SHA will augment many of these restoration efforts over time, particularly NMFS planned salmonid reintroduction efforts in the SHA Plan Area.

5.2.4.1.6. Agricultural Activities

Agricultural activities, predominately grazing, occurs on many of the private lands in the Sacramento River basin HCP Action Area. Upward trends in values of dairy-related agricultural products (e.g., milk, cows and calves, pasture, and hay) in the Sierra Nevada and Cascade Range foothills is expected to continue as populations continue to increase. SPI expects the agricultural industry in the HCP Action Area to continue throughout the permit period. Potential impacts on water quality are expected to be regulated under applicable laws. Additional potential impacts to covered species and habitat, including riparian vegetation, decreased bank stability, loss of overstory shade, increased sediment inputs, and elevated bacteria levels are expected to continue.

Activities in the Trinity River basin HCP Action Area includes similar agricultural practices, but at smaller scales. These lands also include significant landowner participation in California’s legal cannabis program. Potential impacts to covered species and their habitat include effects to water quality, stream flow, diversions, riparian vegetation, and sedimentation. These farming operations are regulated by several state and local agencies including the Bureau of Cannabis control, California Department of Food and Agriculture, California Department of Public Health, CDFW, CRWQCB, and Trinity County. SPI expects these activities to continue during the permit period and anticipates the proportion of illegal cannabis to continue decreasing as legal growing and the regulatory framework become more established.

5.2.4.1.7. Residential Development and Infrastructure

The Sacramento River basin HCP Action Area is characterized by rural residential and small community developments. SPI expects this type of development pattern will remain during the permit period; however, it’s reasonable to assume continued development and development pressure will persist as growth in the greater populated regions located primarily downslope (westerly) of the Sacramento River basin HCP Action Area continues. The Trinity River basin HCP Action Area is much less populated and remote than the Sacramento River basin. Development in this region includes several small primary communities and scattered rural residential development. SPI also expects this development pattern to also continue, with more growth likely centered near small communities.

Potential impacts to covered species and habitats from development and associated utility and road infrastructure include riparian habitat loss, changes to stream channel morphology, altered watershed hydrology (increased storm runoff), increased sediment loading, pollutants, and water temperature. Potential impacts on covered species and their habitats, including water quality, will be regulated by State and local CEQA requirements. The anticipated impacts to covered species and their habitats from continued residential development are expected to be sustained and locally intense, but are not expected to increase substantially over current levels due to the existing regulatory framework and associated conservation, minimization, and mitigation measures.

5.2.4.1.8. Recreation

Recreation in the HCP Action Area consists of mainly dispersed activities such as hunting, fishing, and camping. SPI allows dispersed, non-motorized recreation, with seasonal closures for high fire risk and adverse weather conditions. Potential impacts to covered species and their habitats from these activities include localized effects on turbidity, water quality, streambanks, riparian vegetation, and spawning redds wherever human use is concentrated and these resources occur.

All hunting and fishing in the HCP Action Area is regulated by CDFW rules. Currently, all the watersheds in the HCP Action Area in the Sacramento River basin are closed to salmon and steelhead fishing. Many tributary streams in the Trinity River basin are subject to similar restrictions. Other fishing in the HCP Action Area is subject to various closures and seasonal restrictions per the CDFW regulations. Potential impacts levels to covered species within the HCP Action Area are unknown, but given limited legal public access, are likely very low and expected to remain at current levels.

5.2.4.1.9. Water Withdrawals

Flows in most HCP Action Area Sacramento River basin watersheds are impacted by diversions downstream of SPL&T ownership. An unknown number of permanent and temporary water withdrawal facilities exist within the action area, most of which are associated with agricultural lands. Due to the anticipated development and continued agricultural use in the Sacramento River basin HCP Action Area, the number of diversions and amount of water diverted is expected to increase. Potential impacts to covered species and their habitat include entrapment and impingement of younger life stages, localized dewatering of stream reaches, elevated stream temperature, and depleted flows.

Watersheds in the Trinity River basin HCP Action Area above and below SPL&T ownership are also likely impacted by diversions, primarily for agricultural purposes. SPI expects the number of diversions to increase during the permit period, though at a smaller individual scale. All water diversions are expected to be conducted under applicable laws, including the State Water Rights, CDFW regulations, CRWQCB regulations, and other local or county regulations. Current and future salmonid restoration activities to restore flows, especially during critical fish passage periods could result in improved conditions.

5.2.4.1.10. Chemical Use

Herbicides are primarily used by SPI to temporarily delay the growth of brush and weeds that compete with conifers for nutrients and sunlight while conifers are young. The application of forest chemicals is not a covered activity in the HCP/SHA; however, some herbicide use is a reasonably foreseeable outcome of even-aged timber harvesting and SPI considers this an interrelated and interdependent activity. Both direct effects from exposure and indirect effects from habitat alteration or changes in primary and secondary production may occur within the HCP Action Area. Therefore, potential effects of herbicide applications are reasonably foreseeable during the permit period.

SPI forest chemical application is regulated by several federal, state, and local agencies and their use is conducted under applicable laws. Each chemical used by SPI has been tested and researched by the Department of Pesticide Regulations (DPR). The DPR regulatory process serves as a CEQA equivalent program and includes use of the U.S. EPA label and additional label restrictions if necessary. Herbicide use requires a formal recommendation by a licensed Pest Control Advisor and application by a licensed Pest Control Operator. The County Agricultural Commissioner also participates in the DPR CEQA functional equivalent program. The CFPRs and chemical labels provide regulations regarding buffers for aquatic habitats and other conditions during application.

By following all chemical label and other regulations regarding the application methods, transport, and fate of the various herbicides, the chance of these chemicals entering a fish-bearing watercourse and impacts to covered species or their habitat is low.

5.2.4.1.11. Summary of Cumulative Effects

The covered activities conducted by SPI on SPL&T lands in the HCP Plan Area are mitigated to less than significant levels due the CFPRs process. Because these activities are mitigated to insignificance they do not contribute to cumulative effects, even if activities on adjacent lands caused potential effects. However, this does not preclude potential small-scale or individual impacts that may result in take of covered species.

This HCP/SHA includes a monitoring and adaptive management program providing assurances that potential effects to covered species and their habitat are minimized. SPI anticipates the conservation strategy and mitigation measures provide significant net conservation benefits to the covered species and their habitats over the permit term, including contributing to listed species recovery efforts.

5.3. RETURN TO BASELINE (SHA)

In exchange for actions contributing to the recovery of covered species on non-federal lands, SPL&T will receive assurances from NMFS in the form of an ESP including the SHA. If SPL&T fulfills the conditions of the SHA, NMFS will not require any additional or different management activities by SPI on SHA covered lands during the permit term without SPI's consent. In addition, at the end of the agreement period, SPI may return the SHA Plan Area to the elevated baseline conditions described in Sections 4.3 of this SHA.

SPI has described the elevated baseline habitat conditions, which includes areas above impassable barriers where covered species do not presently occur.

5.4. ANTICIPATED EFFECTS TO CRITICAL HABITAT

Designated critical habitat for Central Valley spring-run Chinook salmon (Figure 11), Sacramento River winter-run Chinook salmon (Figure 12), California Valley steelhead (Figure 13), and SONCC coho salmon (Figure 15) occurs within the HCP Action Area. Increased temperature, suspended sediment and turbidity from timber harvest and road runoff have the potential to degrade critical habitat for those species, as described below. Because the PBFs for each species are identical, impacts on critical habitat are described collectively and not separated by species. The PBFs and related impacts include:

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

While following slight increases during the first decade of the permit term, peak flows and water yield are expected to gradually decrease for the remainder of the permit term and overall water quantity will not be significantly affected by covered activities. Water withdrawals for drafting will be too infrequent and minor to affect stream flows at large scales, though minor, temporary affects may occur at the site scale.

Elevated temperatures can influence the rate of egg development. SPI's management objective includes maintaining stream temperatures below 16°C and minimizing exceedances beyond that level caused by covered activities by following CFPR requirements to maintain a riparian buffer and no-harvest zone. This includes maintaining 70 percent canopy cover within the riparian buffer, maintaining an average diameter of 24 inches for overstory trees, and maintaining a core area of 30 feet on each side of a fish bearing stream.

Increased sediment input caused by timber operations and forest management activities, particularly the effect of runoff from roads, can increase embeddedness of spawning gravel, smother redds, and reduce egg and alevin survival rates. SPI has developed a model of unpaved roads and sediment delivery to streams (READI model) that will identify locations for new drains and road surfacing to optimize disconnecting roads from streams and reducing sediment delivery (see Section 6.5.1). Implementing the READI model and related improvements will result in between 85-90 percent hydrologic disconnection of SPL&T roads. This conservation measure will reduce fine sediment inputs to streams and improve water quality.

2. *Freshwater rearing sites with:*

   a. *Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility.*

   b. *Water quality and forage supporting juvenile development.*

   c. *Natural cover, such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.*

   Covered activities may have temporary and localized effects on water quality by increasing suspended sediment and turbidity downstream of logging roads from sediment in road runoff. The SPI READI model will identify and prioritize road improvement locations to reduce sediment delivery to receiving waterbodies, and increase hydrologic disconnection of road surfaces at the planning watershed scale; thereby improving water quality in the permit area. Long-term effects of increased temperature include changes to rearing success, salmonid behavior, disease virulence, and species competition; and cause mass mortalities when temperatures exceed the upper thermal tolerances for salmonids. Long-term effects related to temperature exceedances will be minimized by following CFPR requirements to maintain a riparian buffer and no-harvest zone.

3. *Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover, such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks, supporting juvenile and adult mobility and survival.*

   Covered activities will not obstruct migration corridors. There may be some occasions, such as during storm events in burn areas, when turbidity levels will be high enough to cause fish to avoid the area, essentially forming a migration barrier. Such events will be temporary, and water quality will return to acceptable levels shortly after the storm. SPI will reforest burned areas as soon as possible following fire to limit the period of bare soil exposure. Other fish migration barriers, such as road crossings, do not occur on SPL&T lands in the HCP Plan Area. The HCP Plan Area includes 33 road crossings on anadromous streams for covered species; 15 bridges, 10 culverts, and 8 fords. None of these crossings represent barriers to upstream or downstream movement to any life stage of covered species. Approximately 76 miles of streams occurring on SPL&T lands in the HCP Plan Area are within the limits of anadromy for the covered species.

5.5. TAKE ASSESSMENT

The ESA and its regulations require that HCPs specify the impact that will likely result from the taking [ESA Section 10(a)(2)(A)(i), 50 CFR 222.307(b)(5)(i)]. While take happens to individuals, the impact of taking occurs at the population and species level.

Incidental take of covered species is reasonably certain to occur. Listed species (Central Valley spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, SONCC coho salmon, and California Valley steelhead) will, or may be present in the HCP Action Area and may be harmed by covered activities, particularly sediment input from road runoff. Excess sediment can reduce available spawning habitat, smother redds, and eliminate high quality pool and backwater habitat, particularly in the absence of LWD. Exposure to excess turbidity caused by fine sediment and organic material can interfere with juvenile feeding and predator avoidance, reduce growth rates, cause gill abrasion, and delay adult and juvenile migration.

Potential impacts to covered species resulting from direct effects include causing harm to individual covered species occurring during water drafting and instream construction or construction activities at stream crossings in covered species habitat. These potential impacts will most likely effect juvenile life stages of covered species. Potential impacts are expected to be minimal due to CFPR practices designed to limit impacts to fishes, including implementing NMFS water drafting standards and compliance with project specific CDFW 1600 Agreements for any instream construction activities.

Sediment loads will be highest in the immediate location of harvest and roads, especially in burned areas, but fine sediments can travel downstream for miles, degrading water quality downstream of the site. Most sediment is generated during storm events, which are concentrated between November and April (Appendix F).

Although available information indicates that individuals of covered species may occur and become exposed to elevated suspended sediment and turbidity, the numbers of each species in occupied habitats within the HCP Plan Area specific locations is unknown, particularly at the time any potential take would occur. Additionally, as the timing and specific location of events causing potential impacts are unknown, there is no practicable way to observe or count the number of fishes affected. Therefore, SPI cannot quantify the number of fishes that will be exposed to the potential impacts of covered activities.

SPI will use habitat-based surrogates (Section 5.6) and monitor selected watershed products (stream temperature, turbidity) to represent the amount and extent of take resulting from stream temperature, sediment, and turbidity. These habitat-based surrogates are causally-linked to take and include stream water temperatures and turbidity levels (Table 31). SPI will monitor these surrogates and any exceedances annually at designated stations in the HCP and SHA Plan Areas to determine if authorized incidental take occurred and the amount of any surrogate level exceedance associated with these watershed products.

If authorized incidental take thresholds are exceeded for a consecutive three-year period, SPI and NMFS will conduct an investigation to determine if covered activities are responsible for the condition. If the covered activities are determined responsible, exceedance of the take threshold would occur. If take threshold exceedance occurs, SPI will develop an adaptive management strategy to implement corrective actions addressing the authorized incidental take exceedance (Section 6.7).

Table 31. Surrogate Indicator Monitoring Measures.

Monitoring Measures	Watershed Processes	Habitat Elements	Range of Surrogate Indicators for Authorized Take[a]	Time Period Covering All Life Stages						
				Central Valley Fall/Late Fall-Run ESU Chinook Salmon	Central Valley Spring-Run ESU Chinook Salmon	Sacramento River Winter-Run ESU Chinook Salmon	Upper Klamath/Trinity River ESU Chinook Salmon	SONCC Coho Salmon	California Central Valley DPS Steelhead	Klamath Mountains Province DPS Steelhead
Temperature Monitoring	Stream temperature at designated monitoring locations.	Water Quality	Increases in MWMT from 16.5°C[b] to 20.5°C (21.5°C in low water years). (MWMT levels above 20.5°C [21.5°C in low water years] represent take exceedance). Green level response threshold = 16.5⁰C-18.5⁰C (19.5°C in low water years). Red level response threshold = 18.5⁰C-20.5⁰C (21.5°C in low water years).	June - March	Mid-August through January	Mid-April through November	June - March	November - April	December - June	December - June
Turbidity Monitoring	Light refraction and penetration at designated monitoring locations.	Water Quality	Increases in turbidity at designated monitoring stations from 25 to 77 NTU[c] for a continuous 14-day period. (Turbidity levels greater than 77 NTU for a continuous 14-day period represent take exceedance). Green level response threshold = 25 NTU-51 NTU. Red level response threshold = 51 NTU-77 NTU.	Year-round	Year-round	Year-round	Year-round	Year-round	Year-round	Year-round

[a] Indicators and temporal periods correspond to the geographic range for each covered species.

[b] Water temperatures at or below 16.5°C is considered fully protective for salmon and steelhead (Dunsmoor and Huntington 2006).

[c] Sigler et al. (1984).

°C = degrees Celsius.

DPS = Distinct Population Segment.

ESU = Evolutionarily Significant Unit.

mg/L = milligrams per liter.

MWMT = mean weekly minimum water temperature.

SONCC =Southern Oregon/Northern California Coast.

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5.6. Habitat-Based Surrogate Monitoring

SPI seeks coverage for incidental take of covered species potentially occurring from continued land management activities during the permit term. Aside from the general habitat and distribution information presented in this HCP/SHA, the number of fishes affected by covered activities cannot be directly quantified because of the uncertainty regarding specifically how many or where fish might be impacted by potential effects from covered activities in the HCP Action Area and SHA Plan Area. As an alternative, SPI will monitor habitat-based surrogates (i.e., water temperature, and turbidity) at defined monitoring locations to demonstrate that authorized take levels are not exceeded. This monitoring effort is in addition to standard water quality monitoring efforts routinely conducted to comply with CFPRs and Regional Water Quality Control Board regulations for post timber harvest activities. These standard efforts include monitoring and performing maintenance (if required) to minimize sediment movement into watercourses at watercourse crossings, diversions, roads, and other significant existing or potential erosion sites for a period of 1 to 3 years following timber harvest and reporting results to the RWQCB.

As described in Section 5 of this HCP, covered activities may affect water quality within and downstream of the HCP Action and SHA Plan Areas by potentially influencing local temperatures, sediment, and turbidity concentrations. Water temperature, and turbidity levels serve as reasonable surrogates because they represent important water quality components that individually, or in combination with other water quality parameters, potentially influence salmonid habitat quality. Monitoring these parameters will provide indications of the overall habitat quality and a mechanism for demonstrating compliance with authorized take levels from temperature, sediment, and turbidity. As described below, significant negative changes in the water temperature and turbidity parameters during the permit term may indicate an increase in the potential for take potentially requiring adaptive management by SPI.

SPI has developed a surrogate monitoring strategy to evaluate water temperature and turbidity levels, as summarized in Table 31 and described below. The surrogate monitoring strategy includes two management response levels based on the values established for each of the surrogate indicators. A “green level” response threshold will be used when average surrogate indicator values are within the lower 50 percent of the surrogate indicator range (as described below and in Table 31). The green level represents surrogate values within the exceedance threshold, but otherwise requiring no immediate management actions. A “red level” response threshold will be used when average surrogate values are within the upper 50 percent of the surrogate indicator range for a consecutive 3-year period. The red level threshold would result in an internal review by SPI to determine if covered activities are responsible for the condition and a review with NMFS to discuss the review findings. If the covered activities are determined responsible, SPI will implement adaptive management actions to address the condition as practicable.

Red level management response investigations will include all review of all practicable information potentially influencing surrogate monitoring levels. This information includes, but is not limited to air/water temperature correlations, planning watershed size and hydrologic regime, water year, SPI covered activities, disturbance events in applicable planning watersheds, and activities on other lands potentially influencing surrogate levels.

5.6.1. Water Temperature

The water temperature surrogate for indicating whether SPI exceeds authorized levels of incidental take is based on mean weekly maximum water temperatures (MWMT). An MWMT of 16.5°C is the level at which water temperature is considered fully protective for Chinook and coho salmon and steelhead (Dunsmoor and Huntington 2006). Elevated MWMT levels above 16.5°C greater than 4°C in medium to high water years, or 5°C in low water years, represent authorized incidental take levels. If MWMT levels occur above 20.5°C (21.5°C in low water years) during the temporal periods described in Table 31 as a result of covered activities, then authorized incidental take is exceeded. This potential increase would be determined from exceedances beyond these levels in MWMT as measured at one of the five monitoring stations (Upper San Antonio Creek, Judd Creek, Hazel Creek, and the two new stations to be located in the Trinity River basin).

Once established and SPI has 5 years of monitoring data, these thresholds will be further refined in consultation with NMFS for the Trinity Basin portion of the HCP/SHA.

The procedures for the monitoring of the water temperature surrogate would include:

1. Hourly monitoring of water temperature at defined monitoring locations defined in the monitoring plan. High, medium, and low water years will be determined from the 10 years of SPI’s 20 permanent weather station rainfall data.

2. Data assessment relative to the surrogate level.

3. The monitoring data will establish the appropriate management response threshold level as described below:

    a. A green level response threshold occurs when MWMT levels are between 16.5°C and 18.5°C (19.5°C in low water years); no immediate management actions are required.

    b. The red level response threshold occurs when MWMT levels are between 18.5^{0}C and 20.5°C (21.5°C in low water years) for a continuous 3-year period. If this occurs, SPI will investigate the issue and confer with NMFS to determine if covered activities are responsible for the exceedance. In the event of such a determination, SPI will implement adaptive management actions to address the condition as practicable.

4. Development of an annual report summarizing monitoring results during this time period, including discussion of each monitoring procedure, as applicable.

5.6.2. Turbidity

The turbidity level surrogate indicating whether the authorized level of incidental take is exceeded is based on the NTU level described by Sigler et al. (1984), who describe levels as little as 25 NTUs cause growth reductions in steelhead and coho salmon, and that these fish could survive turbidity levels up to 77 NTU. Therefore, SPI considers this the range for determining potential effects and authorized take. If turbidity levels exceed a range of 25 to 77 NTUs for a continuous 14-day period during the temporal periods described in Table 31 as a result of covered activities, then authorized incidental take will be exceeded.

The monitoring procedures for the sediment concentration surrogate would include:

1. Monitoring turbidity levels at locations defined in the monitoring plan.
2. Data assessment relative to the surrogate level.
3. The monitoring data will establish the appropriate management response threshold level as described below:
    a. A green level response threshold occurs when NTU levels are between 25 and 64; no immediate management actions are required.
    b. The red level response threshold occurs if NTU levels are between 64 and 77 for a continuous 3-year period. If this occurs, SPI will investigate the issue and confer with NMFS to determine if covered activities are responsible for the exceedance. In the event of such a determination, SPI will implement adaptive management actions to address the condition as practicable.
4. Development of an annual report summarizing monitoring results during this time period, including discussion of each monitoring procedure, as applicable.

6. CONSERVATION STRATEGY

This section describes SPL&T's Goals and Objectives under this HCP and provides the overall conservation strategy. This section also includes descriptions of SPI's HCP monitoring program and the process for adjusting HCP implementation through adaptive management and changed circumstances, if necessary.

The National Marine Fisheries Service (2014a, 2014b) and U.S. Bureau of Reclamation (U.S. Bureau of Reclamation 2014, 2016) identified aquatic habitats in the Trinity and Sacramento River basins located upstream of existing man-made barriers to anadromy as high quality habitat for proposed listed salmonid species reintroduction efforts. These aquatic habitats include lands managed by SPI. The proposed reintroduction areas were selected for these efforts because they are within the historic species' range and contain high quality habitats capable of supporting these efforts. SPI's Conservation Strategy Goals and Objectives reflect this understanding and are designed to maintain and improve this high-quality habitat.

SPL&T's role and overall objective in the HCP/SHA process for these covered species is continued maintenance of streams and other wetlands providing cold, clean water to lands in the HCP/SHA Plan Areas and downstream habitats supporting anadromous salmonids.

This section lists the HCP goals and objectives and how they align with other conservation and recovery strategies. This section also details standard conservation and minimization measures and monitoring activities currently performed to minimize potential impacts on covered species. SPI will monitor the potential impacts of covered activities to gauge the effectiveness of the conservation and minimization measures, document compliance with the conservation strategy, and will utilize an adaptive management plan to address uncertainties in HCP implementation. SPI will report results to NMFS annually. The conservation strategy has been designed to fully offset incidental take, and provide a net conservation benefit to covered species.

6.1. GOALS

The HCP goals are descriptive, open-ended statements of desired future conditions used to guide the conservation strategy. SPL&T's goal is to improve watershed conditions to provide high quality habitat and delivery of flow, sediment, wood, heat, and nutrients at levels that maintain high quality habitat downstream. The HCP goals include:

1. Improve habitat for covered species on SPL&T lands.

2. Provide cold, clean water to downstream watersheds supporting anadromous species.

3. Improve riparian habitat structure.

4. Reduce sediment delivery at the planning watershed scale to promote high quality aquatic habitat.
5. Monitor overall management and aquatic habitat quality performance at five continuous water quality monitoring stations.
6. Enhance watershed resiliency by identifying and implementing projects designed to reduce wildfire behavior, intensity, and magnitude.
7. Improve stream crossings at existing or new roads during post-fire salvage and reforestation.
8. Reduce delivery of flow and sediment from the existing SPI road system.
9. Provide an elevated habitat baseline in the SHA Plan Area supporting NMFS listed salmonid species reintroduction efforts.

6.2. Objectives

Objectives are the incremental steps taken to achieve a goal. They provide a foundation for determining conservation measures, monitoring, and evaluating the effectiveness of the conservation strategy. SPI's objectives include measures for maintaining standard procedures established by the CFPRs to provide conservation and minimization measures for covered activities and proactive improvements outside the CFPRs framework. The HCP objectives include:

1. Improve habitat for covered species on SPL&T lands by maintaining or improving fish passage and stream flows, reducing potential sediment sources; and maintaining or improving conditions providing wood, heat, and nutrients at levels supporting high quality habitats on SPL&T lands and habitats and further downstream.
2. Provide cold, clean water to downstream watersheds supporting anadromous species by maintaining stream shade, limiting potential diversions caused by road systems, and maintaining stream temperatures.
3. Improve riparian structure and function by assuring natural recruitment processes of riparian vegetation, including hardwoods and conifers, will continue.
4. Identify and reduce sources of suspended sediment stemming from covered activities by:
    a. Minimizing stream channel network extension by maintaining existing SPL&T roads in proper function, increasing hydrologic disconnection, constructing new roads meeting CFPRs design and function, upgrading stream crossings, and decommissioning roads no longer required for forest management activities.

b. Implementing road improvement projects at those locations where new drains and surfacing will have the greatest effect in reducing sediment production and delivery to streams. Use SPI's READI model to identify sediment sources from road runoff.

5. Provide for reduced watershed impacts from fire by implementing safe practices and creating fuel break networks and participating in multi-stakeholder fuel reduction strategies; such as SPI's Memorandum of Understanding (MOU) with the USFS, the National Fish and Wildlife Foundation, and CAL FIRE to coordinate protection of spotted owl habitat to reduce potential impacts on owl habitat from large-scale, high-severity wildfire, and to coordinate fire suppression planning and response efforts on federal, state, and SPL&T lands with an emphasis on preserving habitat.

6. Establish (SPL&T) road systems in each HCP Plan Area watershed that are between 85 to 90 percent hydrologically disconnected by completing the READI model field work, analysis, and specific site improvements. In the Trinity River basin HCP/SHA Plan Areas, SPI will prioritize road improvements on unstable lands based on the landslide risk assessment results and known or potential distribution of covered species. Sacramento River basin HCP/SHA Plan Area lands will be prioritized using the NMFS Core and reintroduction classifications, beginning with Core 1 and Core 2 watersheds, followed by Primary and Candidate classifications.

7. Provide an elevated habitat baseline in the SHA Plan Area supporting NMFS listed salmonid species reintroduction efforts. SPI will use the READI model to identify locations of road and drainage improvement projects. Once implemented, these improvements become permanent features in the SHA Plan Area, regardless of current NMFS reintroduction efforts, resulting in improved, or elevated, habitat conditions.

6.3. Relationship with Other Conservation and Recovery Strategies

The HCP conservation strategy is framed within the context of larger aquatic conservation efforts. This section demonstrates consistency of the HCP goals and objectives with other major conservation and recovery plans. Several federal, state, tribal, and non-profit groups have collaborated on species recovery plans and river restoration plans. Major efforts are described below.

6.3.1. NMFS Central California Valley Chinook Salmon and Steelhead Recovery Plan

NMFS finalized the recovery plan for Sacramento River winter-run and Central Valley spring-run Chinook salmon, and California Central Valley steelhead, in 2014 (NMFS 2014a). The recovery plan's strategy is to secure all extant populations and reintroduce populations to historical habitat. The primary means of securing existing populations is to reduce or eliminate limiting factors and threats to those populations and their habitats. Those limiting factors and threats include historical spawning habitat loss, degradation of remaining habitat, and threats to genetic integrity (NMFS 2014a). Recovery actions proposed by NMFS (2014a) include measures associated with fish passage, instream flow, erosion, water quality monitoring, CFPRs implementation, riparian habitat restoration and protection, grazing, and illegal activities such as marijuana cultivation and poaching. The McCloud River, Battle Creek, and the Yuba River were all identified as primary reintroduction areas. The HCP/SHA will contribute towards achieving recovery goals and proposed recovery actions described in the recovery plan by implementing BMPs prescribed in the CPFRs that reduce habitat degradation, identifying sources of sediment from road runoff and implementing road improvements, achieving between 85-90 percent hydrologic disconnection of SPL&T forest roads from streams, potentially reducing watershed impacts from wildfire, improving stream crossings following wildfire, and supporting Chinook salmon and steelhead reintroduction.

6.3.2. NMFS Southern Oregon and Northern California Coast Coho Recovery Plan

The strategy of the Southern Oregon and Northern California Coast Recovery Plan (NMFS 2014b) is to carry out recovery actions to restore habitat and reduce stresses and threats to SONCC coho salmon. Key limiting stresses and threats in the Trinity River basin are lack of floodplain and channel structure, insufficient water in streams and rivers, dams and diversions, water quality, and roads. The HCP/SHA will contribute towards achieving recovery goals and proposed recovery actions described in the recovery plan by implementing BMPs prescribed in the CPFRs that reduce habitat degradation, identifying sources of sediment from road runoff and implementing road improvements, achieving between 85-90 percent hydrologic disconnection of SPL&T forest roads from streams, potentially reducing watershed impacts from wildfire, improving stream crossings following wildfire, and supporting Coho salmon reintroduction.

6.3.3. CDFG Coho Recovery Strategy

The California Department of Fish and Game Coho Recovery Strategy (CDFG 2004) identified numerous threats to coho salmon, including those related to forestry activities. The Strategy (CDFG 2004) states "The Department's conclusion is that historical forestry practices impacted and continue to impact watersheds inhabited by northern California coho salmon, and that current activities (e.g., road construction, use, and maintenance; activity near streams and on unstable slopes; removal of sources of future LWD), depending on how they are managed, can still affect important habitat elements essential to coho salmon" (pg. 3.9). The Strategy also acknowledged that "current forestry activities, including forest nonpoint source control programs, have made strides in improving pollution and sediment discharge into streams over historical forestry practices" (pg. 3.8), but stated that too little time had elapsed to evaluate potential positive effects for coho salmon. The Strategy estimated that at least 21 years would be required to evaluate the status and trend of coho salmon in California.

The Strategy established the Trinity River and the South Fork Trinity River as Recovery Units that were expected to be consistent with recovery units being developed by NMFS. Enhancement and restoration of habitat within the coho salmon range was included as a primary Recovery Goal. The Strategy also noted that "voluntary cooperation between private and public sectors is a critical aspect of coho salmon recovery" (pg. 5.6), and that "cooperative efforts to maintain and restore coho salmon habitat on private land are usually more effective in watersheds where there are large contiguous parcels of forest and agricultural lands, in comparison to watersheds with multiple small ownerships and a relatively high human population density" (pg. 5.6). SPL&T's HCP is intended to provide these types of benefits by implementing BMPs prescribed in the CPFRs that reduce habitat degradation, identifying sources of sediment from road runoff and implementing road improvements, achieving between 85-90 percent hydrologic disconnection of SPL&T forest roads from streams, potentially reducing watershed impacts from wildfire, improving stream crossings following wildfire, and supporting Coho salmon reintroduction.

6.3.4. Trinity River Restoration Program

The Trinity River Restoration Program is a multi-agency program consisting of various federal, state, tribal, local, and non-profit groups. The TRRP was created by a 2000 record of decision for the Trinity River main stem Fishery Restoration Final Environmental Impact Statement (USDOI 2000), which outlined the restoration plan for the Trinity River and its fish and wildlife populations. The restoration strategy consists of: flow management through releases from Lewiston Dam; construction of channel rehabilitation sites; sediment management through augmentation of spawning gravels below Lewiston Dam and control of fine sediments; watershed restoration to reduce fine sediment inputs; infrastructure improvements; adaptive assessment and monitoring; and environmental compliance and mitigation. SPI READI model will help reduce fine sediments that degrade fish habitat by identifying sediment sources and prioritizing locations where drains or resurfacing will be most effective at reducing delivery of water and fine sediment to the stream system.

6.3.5. Central Valley Project and State Water Project

In 2009 NMFS issued a biological opinion to the USBR for the long-term operations of the Central Valley Project and State Water Project. In that opinion, NMFS determined the operations of the Central Valley Project State Water Project were likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. NMFS identified a reasonable and prudent alternative (RPA) to the proposed action to avoid the likelihood of jeopardy to the species and adverse modification of designated and proposed critical habitat. The RPA stipulated, among other things, that the USBR develop a fish passage program that includes implementation of a pilot reintroduction program. The USBR completed the Shasta Dam Fish Passage Evaluation Draft Pilot Implementation Plan (Pilot Plan) in December 2016 (USBR 2016). As mitigation for potential take resulting from covered activities, SPL&T will support reintroduction of listed salmonids in the McCloud River upstream of Shasta Dam (see Section 6.5.2), directly supporting the purpose and need of the Pilot Plan.

6.3.6. Battle Creek Salmon and Steelhead Restoration Project

The Battle Creek Salmon and Steelhead Restoration Project (BCRP) was formally established by an interagency group led by the USBR. According to the Record of Decision (USDOI 2008), "The purpose of the Restoration Project is to restore approximately 42 miles of habitat in Battle Creek and an additional 6 miles of habitat in its tributaries while minimizing the loss of clean and renewable energy produced by the Battle Creek Hydroelectric Project owned and operated by the Pacific Gas & Electric Company (PG&E)." The project will remove five diversion dams and modify another, along with modifying numerous associated hydroelectric and fish management facilities (USBR 2018). As of March 2018, removal and reconstruction of various facilities was underway (USBR 2018).

The BCRP is intended to benefit all four Central Valley anadromous salmonids covered by this HCP/SHA. In anticipation of the restoration of anadromous salmonids to the Battle Creek watershed, the CFPRs extended the ASP rules to the area. More recently, CDFW prepared a plan for reintroduction of winter-run Chinook salmon into the North Fork of Battle Creek, assuming successful implementation of the BCRP (ICF International 2016).

SPL&T lands in the watershed are all above manmade or natural barriers that will remain in place at the completion of the Restoration Project, so anadromous salmonids will not access streams within SPL&T lands. However, quality of water flowing from SPL&T lands will influence water quality in areas occupied by anadromous salmonids. Therefore, SPL&T lands in the Battle Creek watershed are included in the SHA.

6.4. Take Avoidance and Minimization Measures

Section 10(a)(2)(A) of the ESA requires that an HCP specify the measures that the permittee will take to minimize and mitigate to the maximum extent practicable the impacts of the taking of any federally listed animal species as a result of activities covered by the HCP. SPI fully complies with the CFPRs, which set prescriptive standards for natural resource protection minimization measures for all activities. The CFPRs set even higher standards for activities in ASP watersheds. The subsections below summarize the standards contained in the CFPRs particularly relevant to salmonid and aquatic habitat protection, and numerous other conservation measures implemented by SPI designed to protect riparian resources and water quality. The conservation measures are summarized below; detailed lists and descriptions of the conservation measures for the Northern Forest District are included in the CFPRs and available at: <http://calfire.ca.gov/resource_mgt/resource_mgt_forestpractice>.

The CFPRs are updated annually by the State Board of Forestry. Under this HCP/SHA, SPI will follow the Z'Berg-Nejedly Forest Practice Act and relevant Public Resource Codes, and all CFPRs current for each year of the permit period. As described in Section 2.2, for the purposes of this HCP/SHA, if SPI proposes an exception, exemption, alternative practice, in-lieu practice, or other deviation from standard rules relating to WLPZ or road erosion issues covered under Water Course and Lake Protection, and Logging Roads, Landings, and Logging Road Watercourse Crossings (CFPR Articles 6 and 11 [Northern]), SPI will notify NMFS 10 business days in advance of filing the THP and provide an opportunity to participate in the review process. Once notified, NMFS may elect to engage or oppose the deviation. Absent any comment or opposition from NMFS, the in-lieu practice will proceed according to the THP approval process.

6.4.1. Erosion Control

Relevant erosion control measures (CFPR Article 4) include tractor operations (934.2); waterbreaks (934.6), timber operations in the winter period (934.7); and tractor road watercourse crossing (934.8).

6.4.1.1. Tractor Operations

Tractors and other heavy equipment are restricted from operations that cause erosion, such as operating on skid roads or slopes when equipped with a blade, and operating in unstable areas, slopes greater than 65 percent, or slopes with high hazard rating. Slash and debris are not placed in locations where they could be discharged into nearby waterbodies.

6.4.1.2. Waterbreaks

Waterbreaks, also known as waterbars, are a ditch, dike, or dip, or a combination thereof, constructed diagonally across logging roads, tractor roads, and firebreaks designed to effectively divert waterflow from these features. Waterbreak installations are seasonally restricted. They are constructed concurrently with the construction of firebreaks and are used on tractor roads, roads, layouts, and landings that do not have permanent and adequate drainage. Waterbreaks are installed at all watercourses on tractor roads and firebreaks, except where permanent drainage facilities are provided. Discharge from waterbreaks flow through some form of vegetative cover, duff, slash, rocks, or less erodible material. Waterbreaks are maintained during timber operations so they minimize erosion and slope instability and prevent water quality degradation.

6.4.1.3. Timber Operations, Winter Period

During the winter period (November 15 – April 1), mechanical site preparation and timber harvest are restricted unless a winter period operating plan is incorporated in the timber harvesting plan. The winter period operating plan will include specific measures taken during the winter operating period to avoid or minimize erosion, soil movement into watercourses, and soil compaction from timber operations. In lieu of a winter period operating plan, the RPF can specify erosion control measures in the THP. Winter operations are a minor component of SPI management activities. Approximately 15 percent of SPI's annual harvest in the HCP/SHA Plan Areas occur during the winter period.

6.4.1.4. Tractor Road Watercourse Crossings

Road crossings are kept to a minimum, and existing crossing locations are used when possible; SPI prefers using existing crossings. If a new watercourse crossing is required, it will be prepared using a structure such as a bridge, culvert, or temporary log culvert. Crossing facilities on watercourses supporting fish shall allow unrestricted passage for all life stages that may be present. All tractor road watercourse crossing facilities are removed and stabilized before winter unless described in the winter operating plan and approved by the CAL FIRE Director.

6.4.2. Site Preparation

Site preparation is planned and conducted in manner to encourage maximum timber productivity, minimize fire hazards, prevent substantial adverse effects on soil resources and fish and wildlife habitat, and prevent degradation of water quality (Article 5). Heavy equipment will not be used for site preparation under saturated soil conditions that may produce sediment discharge. Watercourse crossings for heavy equipment are planned, constructed, maintained, and removed in accordance with requirements for tractor roads. Undisturbed areas or energy dissipaters are used to control and disperse concentrated runoff from roads, landings, tractor roads, firebreaks and erosion control facilities where it flows into site preparation areas.

6.4.3. Watercourse and Lake Protection

Conservation measures under watercourse and lake protection ensure that timber operations do not cause significant adverse site-specific and cumulative impacts on the beneficial uses of water and native aquatic and riparian-associated species, and the beneficial functions of riparian zones (Article 6). Protective measures include general limitations near watercourses, lakes, marshes, meadows, and other wet areas (936.3); watercourse and lake protection (936.4); reduction of soil loss (936.7); protection and restoration of the beneficial functions of the riparian zone in watersheds with listed anadromous salmonids (936.9); and Class I watercourses with confined channels in watersheds in the coastal anadromy zone (936.9[f][2]).

6.4.3.1. General Limitations Near Watercourses, Lakes, Marshes, Meadows, and Other Wet Areas

Several general minimization measures apply to all watercourses and lakes. Trees are felled to lean away from watercourses and lakes. Equipment is serviced in locations to prevent grease, oil, or fuel from entering lakes or watercourses. Pesticides are not used, and snags and green wildlife trees are retained. Accidental depositions of soil or other debris in lakes or watercourses is removed immediately. Tractor roads are not constructed or used in watercourses and other wet areas, except at prepared tractor road crossings, crossings over dry watercourses, and at new and existing tractor road crossings as part of the Fish and Game Code process (F&GC § 1600 et seq.). Non-commercial vegetation bordering and covering meadows and wet areas are retained and protected during timber operations unless explained and justified in the THP and approved by the CAL FIRE Director. Where less than 50 percent canopy cover exists before timber operations, only sanitation salvage will be used to protect stream features, which include water temperature, streambed and flow modification by LWD, filtration of organic and inorganic material, upslope stability, bank and channel stability, spawning and rearing habitat for salmonids, and vegetation structure diversity for fish and wildlife habitat. LWD recruitment for instream habitat is provided by retaining core, inner and outer tree zone and canopy requirements as described in CFPR 936.9 for the HCP Plan Area and maintaining at least two live conifers (at least 16-inch dbh and 50 feet tall) within 50 feet of Class I and II watercourses in SHA Plan Area.

6.4.3.2. Watercourse and Lake Protection

All lakes and watercourses will be examined and mapped. This includes areas with the potential to directly affect watercourses and lakes for sensitive conditions, including, but not limited to, existing and proposed roads, skid trails and landings, unstable and erodible watercourse banks, unstable upslope areas, debris jam potential, inadequate flow capacity, migrating channels, overflow channels, flood-prone areas, and riparian zones wherein the functions listed above are impaired. The THP also identifies conditions that interact with proposed timber operations that individually or cumulatively adversely affect water quality and describes measures to protect and restore water quality. The location of spawning and rearing habitat for anadromous salmonids, and the condition of the habitat will be evaluated using habitat typing that identifies the pool, flatwater, and riffle percentages.

Within the WLPZ, at least 75 percent surface cover and undisturbed area will be retained for wildlife habitat and to provide ground cover and act as a filter strip to dissipate raindrop energy and reduce potential surface erosion. Soil deposited during timber operations will be removed, and debris deposited during timber operations will be removed or stabilized before the conclusion of timber operations. Temporary crossings will be removed before the winter period unless explained and justified in the winter operating plan and approved by the Director of CAL FIRE. Heavy equipment will not be used in timber falling, yarding, or site preparation within the WLPZ unless explained and justified.

6.4.3.3. Reduction of Soil Loss

The WLPZ areas where mineral soil exceeds 800 continuous square feet in size in the SHA Plan Area and 100 continuous square feet in size in the HCP Plan Area, exposed by timber operations, are treated for reduced soil loss. Treatment is completed by October 15, and bare areas created after October 15 will be treated within 10 days. Stabilization measures are selected to prevent significant movement of soil into watercourses. Where mineral soil is exposed by timber operations on approaches to watercourse crossings, the disturbed area will be stabilized to prevent the discharge of soil into watercourses or lakes in amounts deleterious to the quality of water. Where necessary to protect water from timber operations, protection measures, such as seeding, mulching, or replanting, are specified to retain and improve the natural ability of the ground cover within the standard width of the WLPZ to filter sediment, minimize soil erosion, and stabilize banks of watercourses and lakes.

6.4.3.4. Protection and Restoration of the Beneficial Functions of the Riparian Zone in Watersheds with Listed Anadromous Salmonids

Watersheds with listed anadromous salmonids, as well as watersheds immediately upstream of and contiguous to any watershed with listed anadromous salmonids, require additional planning and protection measures during timber operations. Every timber operation is planned and conducted to protect, maintain, and contribute to restoration of properly functioning salmonid habitat and listed salmonid species. To achieve that goal, every timber operation will be planned and conducted to comply with the terms of a TMDL, prevent significant sediment load increase to a watercourse system or lake, prevent instability of a watercourse channel, prevent significant blockage of aquatic migratory routes, prevent significant adverse effects to streamflow, protect and restore riparian vegetation, and restrict timber operations within the channel zone.

6.4.3.5. Class I Watercourses with Confined Channels in Watersheds in the Coastal Anadromy Zone

The Coastal Anadromy Zone refers to any planning watershed where listed or candidate salmonid species occur or could occur following restoration activities. The WLPZ delineation and timber operations in coastal anadromy Class I WLPZs in watersheds have several requirements designing minimum buffer widths of four separate zones along watercourses incorporating overstory canopy retention, large tree retention, and silvicultural and operational requirements.

6.4.4. Road Construction and Maintenance

SPI’s overall management and planning considerations include limiting the number and length of roads within planning watersheds to the extent feasible, which reduces the number of potential water crossings. Constructed and reconstructed logging roads are designed in accordance with their proposed use, maintenance requirements, and approved THP. Minimization measures for the design and location of all forest roads and landings include avoiding unstable areas, outsloping logging roads and landings, draining with waterbreaks, and hydrologically disconnecting logging roads and landings from watercourses and lakes.

SPI will not build any new roads in the currently identified WLPZ on anadromous stream reaches during the permit term. Also, all existing crossings in anadromous stream reaches are passable to every life stage of all covered species and SPI will maintain that passage status for the permit term.

6.4.5. Water Drafting

Water drafting sites are selected to minimize disturbance to riparian systems. Where possible, existing drafting sites, storage tanks, and off-channel sources are used. Drafting sites are chosen in streams and pools where water is deep and flowing, as opposed to streams with low flow and small isolated pools. Pumping is terminated when the tank is full. In all watersheds, all intakes will be screened to prevent impingement of juvenile fish against the screen. The following requirements apply to screens and water drafting in Class I waters:

1. Openings in perforated plate or woven wire mesh screens shall not exceed 3/32 inch (2.38 millimeters). Slot openings in wedge wire screens shall not exceed 1/16 inch (1.75 millimeters).
2. The total (unobstructed) surface area of the screen shall be at least 2.5 square feet.
3. The drafting operator shall regularly inspect, clean, and maintain screens to ensure proper operation whenever water is drafted.
4. The approach velocity (water moving through the screen) shall not exceed 0.3 foot/second.
5. The diversion rate shall not exceed 350 gallons per minute.

6.4.6. Grazing

Grazing allotments on SPL&T lands in the HCP Plan Area are part of larger grazing leases including federal lands administered and monitored by the USFS. Grazing permits issued by SPI require licensees to abide by all state and federal laws and prohibit licensees from overgrazing the property. The number of cattle that can graze a permit area is described in the grazing lease. Salt licks will be located a minimum of 150 feet from WLPZs. Licensees must maintain proper distribution of livestock by frequent herding via horseback or vehicles. Licensees must agree to use the property in accordance with the best approved practices of range management.

SPI cattle grazing permits include approximately 98 square miles (62,492 acres) in the HCP Plan Area: 74.5 square miles (47,652 acres) in the Sacramento River basin and 23.2 square miles (14,840 acres) in the Trinity River basin. The Sacramento Basin grazing allotments occur in the Old Cow Creek, Antelope Creek, and Deer Creek watersheds. SPL&T's Sacramento Basin allotment includes up to 125 head for approximately 6 months annually, typically late-spring through early-fall. The Trinity River basin allotment occurs in the Browns Creek and Hayfork Creek watersheds and include 35 head for approximately 6 months annually. This allotment is also active between late-spring through early-fall.

6.4.7. Fuels Reduction

Although SPL&T is not requesting take for impacts to covered species resulting from fires, SPI will work to reduce the potential for catastrophic fires. Altering fire behavior and reducing fire intensity will be accomplished through the continued use of even-age management and the ongoing establishment of a system of fuel breaks and fuels reduction strategies across the landscape. Harvesting in an even-aged system dramatically reduces ladder fuels and, over time, creates stands that reduce the tendency for ground fires to become large crown fires. As more of the landscape is placed in an adjacency-driven pattern of even-aged land class, the resulting fuel structure conditions will create a landscape that becomes increasingly resistant to crown-propagated wildfire.

SPI's system of fuel breaks will assist keeping fires confined to a smaller size and aid fire suppression efforts. Fuel breaks provide some reduction in spread of low-intensity fire, but often are not effective in reducing spread of high intensity wind-blown fire. Their primary objective is to limit the advance of wildfires by providing a functional space and safety zone for conducting fire suppression operations, including an already-prepared area from which to conduct backfires. Fuel breaks can be effective because they strategically address sources of ignition (lightning and human-caused) and focus on locations with access by suppression forces.

SPI recognizes that large scale high severity fires pose a risk to species on SPL&T lands. In August 2017, SPI entered into a Memorandum of Understanding (MOU) with CAL FIRE, the National Fish and Wildlife Foundation (NFWF), and the USFS to establish a framework to help restore and protect areas where sensitive species are threatened by habitat degradation from extensive and severe adverse effects from fires. Under the MOU, SPI will:

1. Provide CAL FIRE, NFWF, and USFS with:

    a. Information concerning the forest fuels management plans, fuels work planned or completed by USFS and CAL FIRE.

    b. Information that may contribute to the conservation of California spotted owl and other sensitive species; and

    c. Other data and information requested by CAL FIRE, NFWF, and the USFS.

2. Meet and coordinate regularly with CAL FIRE and the USFS regarding forest fuels management on the parties' respective lands.

SPI has estimated that a completed network of fuel breaks will overlap approximately 2.5 percent of the Plan Area. Fuel breaks will be built under THPs as stand-alone projects or as a separate part of THPs which include other Option A harvesting. Like all other harvesting the volume produced will be reported under the sustained yield limits and follow the CFPRs. Generally, these protective measures are located on top of ridges (far from salmonid habitat) and include roads for firefighting access.

6.5. MEASURES TO MITIGATE UNAVOIDABLE TAKE

SPI will mitigate for unavoidable take by implementing activities relating to:

1. Using the READI model to identify sources of sediment from road runoff and apply road crossing BMPs (such as new drains and road surfacing) to reduce sediment delivery to the extent practicable.

2. Support reintroduction of listed salmonids on SPL&T lands above impassable barriers.

6.5.1. Road Design and Future BMP Evaluation

SPI will continue using the READI model to identify sources of sediment from SPL&T road runoff and apply road crossing BMPs (Weaver et al. 2015) to further reduce potential sediment delivery. READI is designed to: (1) evaluate hydrologic connectivity using a simple hydrologic model that can be calibrated using data on runoff and sediment delivery characteristics; (2) predict effects of changing conditions on runoff and sediment delivery, such as after wildfire when soil infiltration is reduced, or after changing surfacing or traffic levels; (3) model scenarios, including predicting where additional road drains can be strategically placed to optimize reductions in road disconnections and sediment delivery, and where road surfacing upgrades can optimize reductions in sediment production; (4) make predictions capable of being tested, including runoff sediment plume lengths below roads; (5) use a dimensionless index of road sediment production and delivery where local controls on erosion potential are unknown or where sediment yield predictions are not required or reliable; (6) link sediment delivery storm intensity and duration to provide a physical basis for calculating road to stream hydrologic connectivity and disconnections; and (7) utilize geo-referenced locations of topographic drainage sites and engineered drainage structures to increase spatial precision. The READI model can be applied over a range of spatial scales, such as individual THPs, small watersheds, entire road networks, larger watersheds, and entire land jurisdictions. Detailed and extensive field inspections of all road and drainage structures are required to populate the READI model data set.

To evaluate the effectiveness of existing road engineering, READI assesses each individual road segment in a road system by using road field survey data to assess each road segment, stream crossing, and their potential to deliver sediment to a watercourse. The values calculated for a single segment have much uncertainty because of the many factors that influence sediment production and transport. READI can serve as a screening tool to characterize road networks in terms of relative rates of sediment and water delivery to streams and to identify areas for improvement, but field observations are required to determine actual road conditions.

For designing mitigation, the READI model evaluates road slope, area, surface erodibility, and runoff generation on unpaved roads. The READI model provides an approximation of on-the-ground conditions; however, it often over-predicts annual erosion rates and sediment yields (Surfleet et al. 2011). Field validation of model predictions and flexibility are used to determine which best road management practices to apply at each site. Not all on-the-ground site conditions are represented in READI because of its reliance on remote sensing and numerical models.

By examining this background information, SPI derives an implementation strategy designed to bring watershed conditions into similar, 80 percent or greater, percent disconnection ranges. Using percentage of road length disconnection as an implementation goal would be to bring each planning watershed into 80 percent or greater hydrologic disconnection to match the percentage disconnection within the SPI monitoring study watersheds. Once that implementation measure is achieved, then road improvement measures to achieve between 85 to 90 percent hydrologic disconnection of SPL&T forest roads would be implemented during the life of the Plan, with the overall goal of establishing a road system between 85 to 90 percent hydrologically disconnected in each planning watershed.

SPI will complete the READI model field work and data analysis within the HCP Plan Area during the first 3 years of the permit period. This schedule provides immediate benefits to covered species, as the analysis would be completed during the minimum life cycle period for salmon species. Road improvements will continue throughout the permit period until reaching the 85-90 percent disconnection goal for SPL&T roads.

READI model field work and data analysis within the HCP Plan Area in planning watersheds that have not been surveyed is currently in progress. SPI will provide updated results in annual monitoring reports as described in Section 6.8 upon permit issuance.

SPI will plan and implement road construction and maintenance based on the READI model results by giving highest priority to locations that would provide the greatest conservation benefit based on the following criteria. In the Trinity River basin HCP/SHA Plan Areas, SPI will give highest priority to implementing road improvements on unstable lands based on the landslide risk assessment results and watersheds occupied by covered species. Improvements in the Sacramento River basin HCP/SHA Plan Areas will be prioritized using the NMFS Recovery Plan guidelines (NMFS 2014a). Core and reintroduction classifications, beginning with Core 1 and Core 2 watersheds, followed by Primary and Candidate classifications.

SPI will initiate READI model field work, data analysis, and project implementation in the SHA Plan Area following permit issuance and upon notification from NMFS that reintroduction efforts will occur. SPI understands that NMFS will notify SPI once NMFS determines specifically when and where reintroduction tasks will begin. Upon notification, SPI will initiate planning efforts to perform READI in the appropriate HUs, HAs, or HSAs selected for reintroduction efforts. SPI will complete the READI model field work and data analysis within these areas during the first 3 years of the permit period. The READI model results in the SHA Plan Area will be included in annual monitoring reports as described in Section 6.8.

6.5.2. Salmonid Reintroduction

As part of the mitigation for the covered activities included in the HCP, SPL&T supports Chinook and coho salmon and steelhead reintroduction to the SHA Plan Area per the NMFS species recovery plans (NMFS 2014a, 2014b).

Central Valley Chinook salmon and steelhead are proposed to be reintroduced to the Sacramento River above the Shasta Dam; the McCloud River; Battle Creek, downstream from Whispering falls and Angel Falls; and the Yuba River. SONCC coho salmon are proposed to be reintroduced to Stuart's Fork, (upper) Trinity River, and East Fork Trinity River, above the Trinity Dam and reservoir.

SPI will support these reintroduction efforts by maintaining or improving aquatic habitats in the reintroduction areas by reducing potential sediment delivery using the READI model and road improvement projects to establish (SPL&T) road systems that are between 85 to 90 percent hydrologically disconnected at the planning watershed scale (as described in section 6.5.1); enhance watershed resiliency by identifying and implementing projects designed to reduce wildfire behavior, intensity, potential and magnitude; and improve stream crossings at existing or new roads during post-fire salvage and reforestation. These improvements will provide an elevated habitat baseline and remain in the SHA Plan Area upon completion, regardless of NMFS continued reintroduction efforts in the future. Additionally, SPI will support NMFS' reintroduction efforts by providing physical access to SHA Plan Area lands and related items such as specific access information, maps, gate key/combo information, physical escort, relevant existing data, etc.

6.5.3. Net Conservation Benefit

SPL&T will provide a net conservation benefit within the SHA Plan Area and the HCP Action Area by maintaining or improving aquatic habitats within and downstream of the Plan Areas and supporting reintroduction efforts. All proposed recovery actions described in the species recovery plans are collectively linked and include efforts below and above currently impassible barriers to anadromous fish. The conservation measures included in the HCP Plan Area and SHA Plan Area contribute to recovery efforts above and below these barriers. Salmonid reintroductions are designed to restore Central Valley Chinook salmon and steelhead, and SONCC coho salmon, to historical habitat in the Sacramento River and the Trinity River watersheds. These reintroductions will contribute to recovery efforts addressing several limiting factors identified in salmonid recovery plans, including:

- Keswick and Shasta dams blocking access to habitat historically used by listed salmonids in the upper Sacramento River watershed
- Passage impediments and flow fluctuations resulting from hydropower operations on the North and South Forks of Battle Creek

- Englebright Dam blocking access to habitat historically used by Yuba River listed salmonids

- Lewiston and Trinity Dams blocking access to habitat historically used by Upper Trinity River listed salmonids

These reintroductions also assist recovery plan objectives for Central Valley Chinook salmon and steelhead by contributing towards the following Diversity Group characteristics which are necessary for these ESU's/DPS to achieve recovery:

- Winter-run Chinook salmon ESU
    - Three populations in the Basalt and Porous Lava Diversity Group at low risk of extinction
- Spring-run Chinook salmon ESU
    - One population in the Northwestern California Diversity Group at low risk of extinction
    - Two populations in the Basalt and Porous Lava Diversity Group at low risk of extinction
    - Four populations in the Northern Sierra Diversity Group at low risk of extinction
    - Maintain multiple populations at moderate risk of extinction
- California Central Valley steelhead DPS
    - One population in the Northwestern California Diversity Group at low risk of extinction
    - Two populations in the Basalt and Porous Lava Flow Diversity Group at low risk of extinction
    - Four populations in the Northern Sierra Diversity Group at low risk of extinction
    - Maintain multiple populations at moderate risk of extinction

6.5.3.1. Enhancement of Survival Permit Regulatory Criteria

This HCP/SHA meets the ESP criteria by describing the SHA Plan Area, baseline habitat conditions in the SHA Plan Area, management actions accomplishing the net conservation benefits; and the likelihood of potential incidental take including agency notifications, monitoring, and other ESA Section 10 requirements.

The SHA Plan Area includes all SPL&T lands in planning watersheds outside the current limits of anadromy in which salmonid reintroductions are proposed. These watersheds are within historically occupied anadromous salmonid habitat and above currently impassable barriers to anadromy. Approximately 211,824 acres of SPL&T lands occur in the SHA Plan Area, including lands that will be accessible to reintroduced salmonids and lands upstream of the estimated upper limits to anadromy to reduce potential downstream water quality impacts associated with covered activities.

SHA Plan Area lands include watersheds in the Sacramento River and Trinity River basins and occur in the Upper Sacramento River, McCloud River, Battle Creek, North, Middle, and South Yuba Rivers, and Stuart's Fork, (mainstem) Trinity River above Trinity Reservoir, and East Fork Trinity River. Species planned for reintroduction by NMFS include spring- and winter-run ESUs of Chinook salmon in the Sacramento River basin, and the SONCC ESU of coho salmon in the Trinity River basin. Other introduced species may include the Upper Klamath/Trinity River ESU of Chinook salmon and the Klamath Mountains Province DPS of steelhead in the Trinity River basin, and the California Central Valley DPS of steelhead in the Sacramento River basin.

River and stream habitats in the SHA Plan Areas have been identified by NMFS as high quality and suitable for reintroduction efforts. Baseline conditions in these areas for covered species populations is zero, as the SHA Plan Areas occur in historical anadromous salmonid habitat currently inaccessible due to man-made barriers. Potential high quality anadromous salmonid habitat conditions will persist in the SHA Plan Area, as SPI will continue to manage these lands following the CFPRs. Additionally, conditions in the SHA Plan Area watersheds will improve as SPI implements the READI model to further reduce potential sediment delivery to streams and post-wildfire road crossing upgrades. These improvements will provide an elevated habitat baseline, as these improved habitat conditions will remain in the SHA Plan Area upon completion, regardless of NMFS' continued reintroduction efforts in the future.

SPI is committed to implementing management actions and conservation measures described in this HCP/SHA immediately upon permit approval, and will continue these activities throughout the permit term.

The anticipated results of management actions described in this HCP/SHA will improve watershed conditions to delivery of flow, sediment, wood, heat, and nutrients at levels that maintain high quality habitat to covered and downstream lands. These actions will improve habitat for covered species on SPL&T lands, provide cold, clean water to downstream watersheds supporting anadromous species, improve riparian habitat structure, reduce sediment delivery at the planning watershed scale to promote high quality habitat, and provide for reduced watershed impacts from fire. Potential incidental take or other effects associated with the management actions and covered activities are expected to be low risk and minor, as SPI's forest management activities strictly follow the CFPRs. While overall low risk, the potential for some minor level of take does occur, and the conservation measures described in this HCP will minimize and mitigate those effects to the maximum extent practicable.

The SPL&T HCP/SHA includes notification requirements to provide NMFS or CDFW with a reasonable opportunity to rescue individual specimens of a covered species before any authorized incidental take occurs, where appropriate and feasible.

SPI anticipates the expected incidental take upon termination of the SHA to be zero, as no covered species currently occur in the SHA Plan Area. SPI also anticipates an elevated baseline of aquatic and riparian habitat and watershed conditions upon termination of the SHA due to the improvements as described in this HCP/SHA that would occur during the permit term.

SPL&T's HCP/SHA identifies a multi-disciplinary team responsible for monitoring maintenance of baseline conditions, implementation of terms and conditions of the SHA, and any incidental take authorized in the ITP. The monitoring will include continued watershed effectiveness monitoring using continuous water quality stations and compliance monitoring for the terms of the ITP. These monitoring activities will be implemented to demonstrate compliance with this HCP/SHA and to demonstrate maintenance or improvement of habitat in the HCP Plan Area and SHA Plan Area. SPI's monitoring activities also include standard collaboration with CAL FIRE inspectors to ensure compliance with THP conditions, and annual third-party audits through the SFI certification.

6.6. Monitoring

Monitoring is required for all HCPs and provides the information necessary to evaluate compliance, assess impacts, and verify progress towards the biological goals and objectives. Monitoring also provides feedback for the adaptive management strategy (see Section 6.7). This HCP/SHA includes three monitoring components: effectiveness monitoring, which evaluates the effects of covered activities; implementation monitoring, which summarizes READI model application and documents other road crossing improvements; and compliance monitoring to verify SPI is implementing the terms of the HCP and ITP.

6.6.1. Effectiveness Monitoring

Effectiveness monitoring and programs measure the success of operating within the CFPR guidelines in relation to meeting the conservation strategy biological goals and objectives. Effectiveness monitoring tracks trends in water quality in relation to timber operation and forest management activities and provides information to better inform the READI model for designing roads and road crossings to minimize sediment input to nearby watercourses (see Appendix H).

SPI already monitors several habitat indicators in ASP watersheds, so all effectiveness monitoring will be a continuation of ongoing monitoring efforts. Existing monitoring projects assess the impacts of fires, ground treatment after fires, logging and road construction, and annual climatic fluctuations on water temperature, stream flows, suspended sediment, and turbidity (see Section 4.4).

Since 2001, SPI has installed 18 continuous water quality stations throughout its forestlands within the HCP and SHA Plan and Action Areas. These stations collect 15-minute data for a suite of parameters, including conductivity, dissolved oxygen (percent and mg/L), dissolved oxygen charge, flow, pH, specific conductance, temperature, and turbidity. Flow is collected manually along established transects at all monitoring locations and ISCO pump samplers are programmed to collect water samples during storm events. Four locations within a single watershed in northern California have Parshall flumes installed to measure flow. These monitoring stations represent and monitor the output of all covered activities upstream from their geographic location. The stations provide data demonstrating representative conditions and provide 10 years of data summarizing the baseline conditions and effectiveness of the CFPRs. The covered activities are the same inside or outside of the HCP/SHA Plan Areas; therefore, monitoring stations in the SHA Plan Area or outside both plan areas can represent and monitor covered activities anywhere with similar forest types and soils/parent material.

For the purposed of this HCP/SHA, SPI selected three of the existing water quality stations to represent the Sacramento River basin; Judd Creek, Upper San Antonio Creek, and Hazel Creek (Figure 17). These are SPI's longest-tenured stations and will serve to monitor overall management practices and the habitat surrogates selected to determine take of covered species. Upper San Antonio Creek represents southern Sierra Nevada granitic landscapes, Judd Creek represents spring-fed systems in the volcanic Cascade Range, and Hazel Creek represents metavolcanic/metasedimentary lands in the southeastern Klamath Ranges. Upper San Antonio and Judd creeks are within typical moderate mountainous topography, while Hazel Creek represents very steep mountainous topography. SPL&T owns approximately 4,500 acres (71 percent) of the Judd Creek planning watershed, approximately 4,450 acres (43 percent) of the Upper San Antonio Creek planning watershed, and approximately 6,175 acres (73 percent) of the Hazel Creek planning watershed.

In addition to the existing monitoring stations, SPI will install two water quality monitoring stations in the Trinity River basin HCP Plan Area or SHA Plan Area within 6 months from permit issuance. The final monitoring locations will be selected in consultation with NMFS. Following installation of the two new stations in the Trinity River basin, SPI expects that these stations will then require five years of data collection to allow development of comparable standards.

The effectiveness monitoring for this HCP includes two additional components for THPs occurring adjacent to anadromous fish habitat. These efforts are designed to complement the surrogate monitoring by focusing on potential site-specific effects and include monitoring WLPZ canopy cover effectiveness on steam temperatures, and spawning gravel suitability for covered species.

SPI will conduct stream temperature monitoring directly relating to THPs occurring in planning watersheds occupied by state- or federally-listed covered species. When a THP is proposed in a planning watershed with stream habitat occupied by covered species that are also state- or federally-listed, and THP activities will occur in WLPZs, SPI will monitor air and stream temperature the year prior to harvest, the harvest year, and one year following harvest.

This monitoring effort complements the stream and air temperature surrogate indicator monitoring by focusing on potential site-specific effects to stream temperatures. SPI will conduct the THP monitoring for the initial decade of the permit period. Monitoring will be conducted using appropriate air and water temperature logging devices at locations immediately upstream and downstream of the stream reach included in the THP. The monitoring will occur during the summer, as this is the time period potential effects would be most evident and have the highest likelihood of affecting fish. The summer time period is defined as June 1 through August 31. Monitoring data will be analyzed for the subject aquatic/riparian habitats and included in annual monitoring reports.

SPI will also assess and monitor potential spawning gravel characteristics directly relating to THPs occurring in planning watersheds occupied by covered species. When a THP is proposed in a planning watershed with stream habitat occupied by covered species, and THP activities will occur in WLPZs, SPI will conduct a spawning gravel assessment and monitor potential spawning gravel substrate the year prior to harvest, the harvest year, and one year following harvest.

The spawning gravel monitoring is designed to complement the turbidity surrogate indicator monitoring by focusing on potential site-specific effects to potential spawning redd locations. SPI will conduct the THP monitoring for the initial decade of the permit period. SPI will conduct the monitoring by performing a habitat assessment of the subject stream reach to determine if potential spawning habitat for covered species occurs. If potential spawning habitat occurs, SPI will conduct substrate monitoring in coordination with NMFS using current, standard protocols to measure substrate embeddedness and composition at potential spawning gravel locations immediately upstream and downstream of the stream reach included in the THP.

The monitoring will occur during the summer or fall time periods when stream conditions allow for instream survey work. The summer and fall time periods are defined as June 1 through August 31, and September 1 to November 30, respectively. SPI will analyze the monitoring data to describe spawning gravel characteristics in the subject stream reaches and include results in the annual monitoring reports.

6.6.2. Implementation Monitoring

Implementation monitoring includes providing information relating to READI model application, and documenting other road watercourse crossing improvements.

The SPI READI model serves as a tool for implementing mitigation measures designed to achieve between 85-90 percent hydrologic disconnection goal for SPL&T roads in the HCP and SHA Plan Areas. As READI model application proceeds during the first 3 years of the HCP, SPI will compile output data at the planning watershed scale. These summaries will be provided in the annual monitoring reports to demonstrate the amount of planning watersheds completed and summarize percent hydrologic disconnection. As SPI implements projects based on READI model results, additional documentation will be provided describing the improvement projects and the changes to percent disconnection values.

Implementation monitoring also includes providing summaries of all other road crossing improvements not directly related to READI model application, such as stream crossing upgrades during THPs or crossing improvements made during post-wildfire rehabilitation. These summaries apply to the HCP and SHA Plan Areas and include geographic location, planning watershed, stream name, and improvements made.

6.6.3. Compliance Monitoring

Compliance monitoring of technical matters will be conducted by a team within SPI, including but not limited to internal forestry, fisheries, and wildlife staff. Monitoring will also include the SPI on-going patrol program, which is coordinated with local law enforcement agencies and includes controlling trespassing, vehicle and off-highway vehicle use, and illegal marijuana grows. Collectively, these efforts will ensure compliance with the conservation strategy goals and objectives. The monitoring plan will be implemented or continued as necessary to demonstrate compliance with this HCP, and to demonstrate that habitat quality does not fall below the baseline established in the SHA.

SPI works with CAL FIRE to ensure compliance with conditions in the THP. Following the approval of a THP, CAL FIRE Unit Forest Practice Inspectors periodically inspect logging operations. When a THP operation has been completed, SPI submits a completion report to CAL FIRE, which then inspects the area to certify that all rules were followed. SPI is also subject to annual third-party audits through SFI certification, which annually reviews SPI forest management practices and confirms compliance with the SFI program goals and requirements.

6.7. Adaptive Management

Adaptive management is a method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned. Adaptive management addresses uncertainty in natural resources management and is an integral part of the conservation strategy. Adaptive management has two key features: (1) a direct feedback loop between science and management, and (2) the use of management strategies as a scientific experiment (Walters 1986; Halbert 1993). The SPI monitoring and adaptive management program incorporates both of these features with the goals of increasing the understanding of watershed processes and the effects of management activities on the habitats and populations of the covered species over the life of the plan and adapting this HCP's conservation measures in response to new information.

Effectiveness and compliance monitoring will be used to evaluate how well the HCP goals and objectives are being met. If the monitoring results indicate the goals and objectives are not being met, SPI will adjust the appropriate management strategies. If habitat surrogate take threshold exceedances occur at any of the five water quality monitoring stations, SPI will investigate the cause of the exceedance. If SPI management activities are determined responsible for the exceedance, SPI will modify those activities across all lands in the HCP and SHA Plan Areas with similar characteristics and management issues to reduce the potential for these exceedances to occur throughout all covered lands. All exceedances, investigations, and resulting actions will be summarized and included in the annual monitoring reports submitted to NMFS.

The conservation strategy is designed to minimize and mitigate all identified impacts of taking the covered species to the maximum extent practicable, based on current knowledge. However, specific conservation measures may change over time as the result of the adaptive management provisions.

6.8. Reporting/Notification Requirements

SPI will provide an annual report to NMFS for the duration of the HCP to verify that the conservation measures are being implemented and to ensure that the level of authorized take is not exceeded. The report will be prepared by SPI and delivered to NMFS by June 30 of each year covering the previous calendar year the HCP and SHA are in effect. The water quality-related monitoring and reporting will include data and analysis for the previous water year (October 1 through September 30). The monitoring report will contain summaries of all effectiveness, implementation, and compliance monitoring including:

- A summary of project implementation
- Monitoring methods and results
- Efforts supporting salmonid reintroduction
- Information on the project status and impacts
- Take tracking
- Avoidance and minimization measures
- A summary of habitat surrogate monitoring results
- Relevant information on mitigation, changed circumstances and funding
- Summary of CAL FIRE violation notices pertaining to HCP covered activities, if such notices occur.

Additionally, SPI will provide NMFS or CDFW with a reasonable opportunity to rescue individual specimens of a covered species before any authorized incidental take occurs, where appropriate and feasible.

7. CHANGED AND UNFORESEEN CIRCUMSTANCES

SPL&T requests the benefits of the "No Surprises" Rule, 63 FR 8859 (February 23, 1998) (codified at 50 CFR 222.307(g)). The federal No Surprises Rule ensures ESA Section 10 permit holders that, as long as the permittee is properly implementing the HCP and the ITP, no additional commitment of land, water, or financial compensation will be required with respect to covered species, and no restrictions on the use of land, water, or other natural resources will be imposed beyond those specified in the HCP without the consent of the permittee (USFWS and NOAA Fisheries 2016). The No Surprises rule has two major components: changed circumstances and unforeseen circumstances.

7.1. Changed Circumstances

"Changed circumstances" are defined in 50 CFR 222.102 as changes in circumstances affecting a species or geographic area covered by an HCP that can reasonably be anticipated by HCP developers and NMFS, and for which contingency plans can be prepared (e.g., the new listing of species, a fire, or other natural catastrophic event in areas prone to such event). If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances, and such measures were not provided for in the HCP, NMFS will not require those additional measures, provided that the commitments and provisions of the HCP have been or are fully implemented. SPL&T may elect to implement additional voluntary conservation measures. SPI has identified five types of changed circumstances:

1. Effects due to climate change.
2. Fire covering more than 3.9 square miles (2,500 acres) within the HCP Action Area, or more than 1.5 square mile (1,000 acres) within a single watershed in the HCP Action Area but covering less than 23.5 square miles (15,000 acres) of the HCP Plan Area or SHA Plan Area (which is defined as an unforeseen circumstance). If these events occur in any of the five watersheds containing water quality monitoring stations, SPI will meet with NMFS and evaluate the need to select another station location, as the fire event could substantially affect monitoring results.
3. Blowdown of previously standing timber extending between 150 and 900 feet along the length of a stream within a WPLZ.
4. Landslides that deliver between 20,000 and 100,000 cubic yards of sediment to a channel.

5. Listing, or change in listing status of covered or non-covered species or designation or revision of critical habitat for a covered or non-covered species that may be affected by a covered activity.

6. Management change due to scientific advances.

The above circumstances, as well as SPI proposed response to each, are detailed in the following sections.

7.1.1. Effects Due to Climate Change

The gradual increase of potential effects related to climate change may warrant consideration in this HCP/SHA. As a potential driver of increased wildfire intensity and size, fire season length, and as a cause of the additional stressors of drought or storm intensity, climate effects may impact covered species and their habitat. When changes in climate becomes an identifiable changed circumstance in this HCP/SHA they will likely be expressed in other changed circumstances. Therefore, we will address the impacts as the potential results of the specific changed circumstances described below, while recognizing that each of these effects may also occur independent of climate change.

7.1.2. Fire

As described in Section 2 of this HCP, SPI actively works to prevent and contain fires on its property. SPI uses prescribed burns to reduce fuels and thins and prunes stands to prevent ground fires from becoming crown fires. SPI hires contractors to control wildfires on an emergency basis to limit burning and to prevent the spread of fire across the landscape. Despite those measures, some fires may get out of control and have unpredictable impacts on covered species. Soils exposed after fire, particularly soils on steep slopes, have the potential to deliver large amounts of sediment to salmonid-bearing streams. If a fire covers more than 3.9 square miles (2,500 acres) within the HCP Action Area and SHA Plan Area, or more than 1.5 square mile (1,000 acres) within a single watershed in the HCP Action Area and SHA Plan Area, SPI will notify NMFS within 30 days. Once the fire is extinguished, SPI will conduct the following prescriptive measures in burned areas:

1. Trees damaged by fire will be considered for salvage. Tree salvage will follow all the conservation measures in the CFPRs.

2. Salvage within WLPZs will be carried out to limit soil erosion to the extent possible, retain structural features that contribute to bank or slope stability, and retain standing dead trees that contribute to the recruitment of LWD to watercourses within the area affected by fire.

3. Burned landscapes, including WLPZs within the area affected by fire will be reforested as soon as possible.

Although large fires have occurred during recent years, fires covering more than 23.5 square miles (15,000 acres) in the HCP Plan Area and SHA Plan Area are still uncommon and will be considered an unforeseen circumstance.

7.1.3. Windthrow

Windthrow refers to trees uprooted or broken by wind. Small-scale windthrow is a frequent event and not likely to adversely affect aquatic habitat. If a single windthrow event extends more than 150 feet, measured along the length of the stream within the WLPZ, implement the following measures:

1. SPI will operate under the emergency notice procedures for Substantially Damaged Timberlands. SPI would retain any down tree keyed into the ground and in the stream channel.

2. WLPZs within the area affected by windthrow will be reforested as soon as possible.

Windthrow extending more than 900 feet along the length of a stream within a WLPZ is not reasonably foreseeable and would be considered an unforeseen circumstance.

7.1.4. Landslides

Landslide rates and processes differ in the different geologic settings in the HCP Plan Area. Conservation measures in the HCP were developed to limit delivery of fine sediment to aquatic ecosystems. Based on historical evidence, landslides delivering between 20,000 and 100,000 cubic yards of sediment to stream channels are uncommon, but may occur. If a landslide of such magnitude occurs within the HCP Plan Area, SPI will:

1. Notify NMFS within 30 days that the event has occurred.

2. Coordinate with NMFS to determine if management activities on or adjacent to the landslide could have contributed to the event. If NMFS or SPI determines that management activities contributed to the event, SPI will retain a qualified geotechnical expert to analyze the slide and develop a written report. The report will contain, at a minimum:

    a. An assessment of the factors likely to have caused the slide; and

    b. Any changes to management activities, which, had they been implemented on or adjacent to the area of the slide, would have likely prevented the slide from occurring.

3. Implement recommendations in the geotechnical report as appropriate.

7.1.5. New Species Listings

The listing of a new species as endangered or threatened could constitute a changed circumstance. SPI has included non-federally listed species in this HCP to prevent the need to revise the HCP should non-listed salmonids in the Action Area become listed in the near future. However, other species not included in this HCP could become listed before the ITP expires. If a new species is listed during the term of the ITP, SPL&T may seek to include such newly listed species as covered species in the ITP prior to, or after, issuance of the final ITP.

7.1.6. Management Change Due to Scientific Advances

Scientific advances may occur or new information may become available during the permit period warranting revised management considerations. For example, the CFPRs (Article 6, 916.1, 936.1, 956.1) allow proposals for in lieu practices of WLPZ management if justifications suggest these practices are warranted. Recent concerns and increasing amounts of scientific information (e.g.., Newton and Ice [2012]) suggest current WLPZ standards are not providing functional riparian habitats due to overshading and limiting disturbance. As the amount of scientific information regarding this issue increases in the near future, conditions may suggest alternative WLPZ management strategies providing additional disturbance in riparian areas could be appropriate. SPI may choose to propose such activities in the HCP/SHA Plan Areas during the permit term. All such proposals would be submitted to NMFS and follow all applicable CFPR requirements.

7.2. Unforeseen Circumstances

“Unforeseen circumstances” are defined in 50 CFR 222.103 as changes in circumstances affecting a species or geographic area covered by an HCP that could not reasonably be anticipated by HCP developers and NMFS at the time of the negotiation and development of the HCP, and that result in a substantial and adverse change in the status of the covered species.

The purpose of the No Surprises Rule is to provide assurances to non-federal landowners participating in habitat conservation planning under the ESA that no additional land restrictions or financial compensation will be required without their consent for species adequately covered by a properly implemented HCP. If unforeseen circumstances require additional conservation and mitigation measures, those measures will be negotiated between SPL&T and NMFS on a case-by-case basis.

8. PLAN IMPLEMENTATION

This HCP/SHA is designed to be self-implementing, providing the requirements for implementation of Covered Activities are followed, and all required avoidance, minimization and mitigation measures are implemented. The following subsections are intended to provide further guidance on the implementation of the HCP/SHA over the permit term. SPL&T enters the HCP/SHA and ITP based on the understandings outlined below.

8.1. No Surprises Assurances

SPL&T requests the benefits of the Federal ESA "No Surprises" assurances (codified at 50 C.F.R. § 222.307(g). As further detailed in the rule and Federal Register notice adopting the rule, if SPI is properly implementing the HCP/SHA and the ITP, then no additional commitment of land, water, or financial compensation will be required with respect to covered species, and no additional restrictions on the use of land, water, or other natural resources will be imposed beyond those specified in the HCP/SHA without the consent of SPL&T. With respect to unforeseen circumstances, NMFS bears the burden of demonstrating that they exist using the best available scientific and commercial data available while considering certain factors as specified in 50 C.F.R. § 222.307(g).

Notwithstanding these assurances, nothing in the No Surprises Rule will be construed to limit or constrain NMFS, any federal agency, or a private entity, from taking additional actions, at its own expense, to protect or conserve a species included in a conservation plan.

8.2. Unforeseen Circumstances

Unforeseen circumstances are defined as changes in circumstances affecting a species or geographic area covered by this conservation plan that could not reasonably have been anticipated by plan developers and NMFS at the time of the negotiation and development of the plan and that result in a substantial and adverse change in the status of the covered species (50 CFR § 222.102).

NMFS bears the burden of demonstrating that unforeseen circumstances exist using the best available scientific and commercial data available. In deciding whether unforeseen circumstances exist, NMFS will consider, but not be limited to, the following factors (50 C.F.R. § 222.307(g)(3)(iii)):

1. The size of the current range of the affected species;

2. The percentage of the range adversely affected by the conservation plan;

3. The percentage of the range that has been conserved by the conservation plan;

4. The ecological significance of that portion of the range affected by the conservation plan;

5. The level of knowledge about the affected species and the degree of specificity of the conservation program for that species under the conservation plan; and

6. Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

In negotiating unforeseen circumstances, NMFS will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the HCP/SHA without the consent of the permittee (50 CFR §§ 222.307(g)(3)). If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, NMFS may require additional measures of the permittee where the HCP/SHA is being properly implemented only if such measures are limited to modifications within conserved habitat areas, if any, or to the HCP/SHA's operating conservation program for the affected species, while maintaining the original terms of the plan to the maximum extent possible (50 CFR § 222.307(g)(3)). Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of SPL&T.

8.3. Permit Amendments

The HCP/SHA ITP and/or ESP may be modified in accordance with the ESA, NMFS's implementing regulations and this section. HCP/SHA and permit modifications are not anticipated on a regular basis; however, modifications to the HCP/SHA and/or ITP may be requested by either SPL&T or NMFS. NMFS also may amend the ITP at any time for just cause, and upon a written finding of necessity, during the permit term in accordance with 50 CFR § 222.306. The categories of modifications are administrative changes, minor amendments, and major amendments.

The HCP Handbook (USFWS and NOAA Fisheries 2016) indicates that an ITP should be amended when the permittee significantly modifies the covered activities, the Project, or the conservation plan as described in the original HCP. Such modifications may include changes in the Project area, changes in funding, addition of species to the ITP that were not addressed in the original HCP, or adjustments to the HCP due to changes in strategies developed to address changed or unforeseen circumstances.

8.3.1. Administrative Changes

Administrative changes are internal changes or corrections to the HCP/SHA that may be made by SPL&T, at its own initiative, or approved by SPL&T in response to a written request submitted by NMFS. Requests from NMFS will include an explanation of the reason for the change, as well as any supporting documentation. SPL&T will notify NMFS in writing of any proposed administrative changes to the HCP/SHA and confirm receipt by the appropriate NMFS personnel implementing the HCP/SHA. Thereafter, NMFS shall have 30 business days to respond in writing to the proposed change. In the event NMFS does not respond within this period, the change shall be deemed approved.

Administrative changes are those that will not: (a) result in effects on a covered species that are new or different than those analyzed in the HCP/SHA, NEPA document, or the NMFS BO; (b) result in take beyond that authorized by the ITP; (c) negatively alter the effectiveness of the HCP/SHA; or (d) have consequences to elements of the human environment that have not been evaluated. SPL&T will document each administrative change in writing and provide NMFS with a summary of all changes, as part of its annual report, along with any replacement pages, maps, and other relevant documents for insertion in the revised document.

Administrative changes include, but are not limited to, the following:

- Corrections of typographical, grammatical, and similar editing errors that do not change intended meanings; and
- Corrections of any maps or exhibits to correct minor errors in mapping.

8.3.2. Minor Modifications

Minor modifications are changes to the HCP/SHA the effects of which on covered species, the conservation strategy, and SPI's ability to achieve the biological goals and objectives of the HCP/SHA are either beneficial or not significantly different than those described in this HCP/SHA. Such modifications will not increase impacts to species, their habitats, and the environment beyond those analyzed in the HCP/SHA, NEPA document, and BO or increase the levels of take beyond that authorized by the ITP.

Minor modifications to the HCP/SHA may also require changes to the ITP. A proposed minor modification must be approved in writing by both NMFS and SPL&T before it may be implemented.

SPL&T or NMFS may propose minor modifications by providing written notice to the other party. The party responding to the proposed minor modification should respond within 30 days of receiving notice of such a proposed modification. Such notice shall satisfy the provisions of 50 CFR § 222.306, as well as include a description of the proposed minor modification; the reasons for the proposed modification; an analysis of the environmental effects, if any, from the proposed modification, including the effects on and an assessment of the amount of take of the covered species; an explanation of the reason(s) the effects of the proposed modification conform to and are not significantly different from those described in this HCP/SHA; and any other information required by law. When SPL&T proposes a minor modification to the HCP/SHA, NMFS may approve or disapprove such modification, or recommend that the modification be processed as a major amendment as provided below. NMFS will provide SPL&T with a written explanation for its decision. When NMFS proposes a minor modification to the HCP/SHA, SPL&T may agree to adopt such modification or choose not to adopt the modification. SPL&T will provide NMFS with a written explanation for its decision. NMFS retains its authority to amend the ITP, however, consistent with 50 CFR § 222.306(c).

Provided a proposed modification is consistent in all respects with the criteria above, minor modifications include, but are not limited to, the following:

- Updates to the land cover map or to covered species occurrence data;
- Increasing or Decreasing the scope of the Plan Area in the HCP/SHA;
- Minor changes to the HCP goals or objectives;
- Modification of monitoring protocols for HCP/SHA effectiveness not in response to changes in standardized monitoring protocols from NMFS;
- Modification of existing, or adoption of new, incidental take avoidance or minimization measures;
- Modification of existing, or adoption of new, impact minimization and mitigation measures which improve the likelihood of achieving HCP/SHA goals and objectives;
- Discontinuance of implementation of conservation measures if they prove ineffective;
- Modification of existing or adoption of new performance indicators or standards to replace existing indicators if results of monitoring and research, or new information developed by others, indicate that the initial performance indicators or standards are inferior or inefficient measures of success of the applicable conservation measures;
- Modification of existing or the adoption of additional habitat objectives for the covered species, where such changes are consistent with achieving HCP/SHA goals and objectives;
- Minor changes to survey or monitoring protocols that do not materially reduce the quality of the data gathered from those surveys;
- Day-to-day Project implementation decisions, such as maintenance of erosion and sediment control devices;

- Conducting monitoring surveys in addition to those required by the HCP/SHA and ITP/ESP;
- Modifying HCP/SHA monitoring protocols to align with any future modifications to the protocols by NMFS;
- Adopting new monitoring protocols that may be promulgated by NMFS in the future;
- Minor changes to the reporting protocol; and,
- Management changes due to scientific advances or new information.

8.3.3. Major Amendments

A major amendment is any proposed change or modification that does not satisfy the criteria for an administrative change or minor amendment. Major amendments to the HCP/SHA and ITP are required if SPL&T desires, among other things, to modify the Projects and Covered Activities described in the HCP/SHA such that they may affect the impact and take analyses or conservation strategy of the HCP/SHA, affect other environmental resources or other elements of the human environment in a manner not already analyzed, or result in a change for which public review is required. Major amendments must comply with applicable permitting requirements, including ESA Section 7.

In addition to the provisions of 50 CFR § 222.306(c), which authorize NMFS to amend an ITP at any time for just cause and upon a finding of necessity during the permit term, the HCP/SHA and ITP may be modified by a major amendment upon SPL&T's submission of a formal permit amendment application and the required application fee to NMFS, which will be processed in the same manner as the original permit application. Such application generally will require submittal of a revised HCP/SHA, and preparation of an environmental review document in accordance with NEPA. The specific document requirements for the application may vary, however, based on the substance of the amendment. For instance, if the amendment involves an action that was not addressed in the original HCP/SHA, or NEPA analysis, the documents may need revision or new versions prepared addressing the proposed amendment. If circumstances necessitating the amendment were adequately addressed in the original documents, simply amending the ITP and/or ESP may be sufficient.

Upon submission of a complete application package, NMFS will publish a notice of the receipt of the application in the Federal Register, initiating the NEPA and HCP/SHA Amendment public comment process. After the close of the public comment period, NMFS may approve or deny the proposed amendment application. SPL&T may, in its sole discretion, reject any major amendment proposed by NMFS.

Changes that would require a major amendment to the HCP/SHA or ITP include, but are not limited to:

- Revisions to the Plan Area or covered activities that do not qualify as a minor amendment;
- Addition of a new covered species that is not analyzed in the HCP/SHA or NEPA document and is likely to be taken by the covered activities; or
- A renewal or extension of the permit term beyond the original term of the ITP, where the criteria for a major amendment are otherwise met, and where such request for renewal is in accordance with 50 CFR § 222.304.

8.3.4. Changes Due to Adaptive Management or Changed Circumstances

Unless explicitly provided in Section 6, *Conservation Strategy*, and Section 7, *Changed and Unforeseen Circumstances*, of this HCP/SHA, the need for and type of amendment to deal with Adaptive Management or Changed Circumstances will be determined by NMFS, in coordination with SPL&T, at the time such responses are triggered. In general, most changes in the HCP/SHA or ITP in response to Adaptive Management or Changed Circumstances are expected to qualify as minor modifications to the HCP/SHA or ITP, however, there may be changes that do not qualify as minor modifications and would require an amendment to the HCP/SHA or ITP.

8.4. Permit Renewal

SPL&T requests that the ITP associated with this HCP/SHA be renewable pursuant to 50 CFR § 222.304. If SPL&T seeks to renew the ITP, then SPL&T will file in writing a renewal request at least 30 days prior to the permit expiration of the ITP in accordance with the requirements of 50 CFR § 222.304.

8.5. Financial Assurances

8.5.1. Expenditure of Funds

SPL&T warrants that it has, and shall expend, such funds as may be necessary to fulfill its obligations under the ITP and the HCP/SHA. SPL&T's demonstrated capability and commitment to fund the Projects and studies during development of the HCP/SHA provides assurances that commitments under the HCP/SHA will be completed when needed. SPL&T shall promptly notify NMFS of any material change in SPL&T's financial ability to fulfill its obligations under the HCP/SHA and the ITP.

8.5.2. Financial Assurances

The ESA implementing regulations provide that an applicant for an ITP must establish that sufficient funding will be available to implement the HCP/SHA, including the requirements to monitor, minimize, and mitigate the impacts from the taking.

Measures requiring funding in an HCP/SHA typically include onsite measures during project implementation or construction (e.g., monitoring, surveys, research), as well as onsite measures required after completion of covered activities. For relatively small to medium-sized projects involving only one or two applicants, the funding source is usually the permittee and funding is provided immediately before project activities commence, immediately after, or in stages.

SPL&T ensures full performance of the conservation measures and monitoring obligations contained in Sections 5 and 6 of this HCP/SHA, and the financial assurance obligations contained in Section 8.5 of this HCP/SHA. SPL&T will submit a written re-assurance by June 1 of each year of the ITP that it will carry out all its obligations under this HCP/SHA. In that submission, SPL&T will provide a summary of expenditures made in the prior year of the ITP, and a scope of work and budget for all monitoring actions and any other HCP/SHA implementation actions SPL&T will undertake in the following year. The estimated annual budget and budget for the term of the ITP are identified in Table 32. A responsible corporate official with authority to commit SPL&T's financial resources shall certify that funds to implement this HCP/SHA has been budgeted and will be committed for use in the following year, as well as any material changes in cost estimates provided below based upon actual work performed.

Note: All costs are in 2018 dollars, not adjusted for inflation. All reports will include the following certification by a responsible company official who supervised or directed preparation of the report:

> *Under penalty of law, I certify that, to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of this report, the information submitted is true, accurate, and complete.*

SPL&T, and any successor in interest, will notify NMFS if the permittee's funding resources have materially changed, including a discussion of the nature of the change.

Task	Estimated Cost Per Year	Total	Cost Basis and Assumptions
Review of hydrologically disconnected road progress	$6,000	$300,000	Producing the report for updates, to document progress made to improving hydrologic disconnection of SPL&T forest roads.
Adaptive management monitoring	$6,000	$300,000	During season triggered, based on changed circumstances or adaptive management.
Annual permanent monitoring and field verification,	$200,000	$10,000,000	Install and maintain permanent habitat surrogate monitoring stations. Collate data to submit an annual report verifying adequacy of surrogates for habitat conditions.
Annual meetings	$6,000	$300,000	Conducted by SPI annually with NMFS.
Administrative costs	$60,000	$3,000,000	Consultant expenses; contracting.
Changed circumstance costs (average $2,000/year)	$20,000	$100,000	Consultant expenses; studies; contracting; up to five events.
Totals	$280,000	$14,000,000	

Table 32. Estimated Costs for Implementing this HCP/SHA.

8.6. PROPERTY RIGHTS RETAINED

SPL&T and NMFS agree that SPL&T has entered the HCP/SHA on a voluntary basis. Except as otherwise specifically provided herein, nothing in the HCP/SHA or ITP shall be deemed to restrict the rights of SPL&T to manage its lands. Covered activities may provide multiple benefits beyond conservation of covered species, including, but not limited to, renewable benefits, pollution benefits, tax benefits, environmental benefits, carbon benefits, clean water benefits, and open space benefits ("Additional Benefits"). Nothing in the HCP/SHA or ITP is intended to limit SPL&T's rights to participate in any program or enter into any agreement to recognize the full financial value of these Additional Benefits if SPL&T complies with the ITP.

The terms hereof are not intended to run with the land and will not bind the existing owners of Plan Area or subsequent purchasers of the Projects or Permit Area unless such parties agree in writing to become bound by the HCP/SHA and the ITP. Such parties that are not bound the ITP shall not benefit from NMFS's authorization of incidental take coverage or assurances.

8.7. REMEDIES AND LIABILITY

Except as set forth below, each Party shall have all remedies otherwise available (including specific performance and injunctive relief) to enforce the terms of the ITP and the HCP/SHA. Nothing contained in the ITP is intended to limit the authority of the United States government to seek civil or criminal penalties or otherwise fulfill its enforcement responsibilities under the ESA or other applicable law.

No Party shall be liable in damages to any other Party for any breach of the HCP/SHA or ITP, any performance or failure to perform a mandatory or discretionary obligation imposed by the HCP/SHA or ITP, or any other cause of action arising from the HCP/SHA or ITP.

8.8. Dispute Resolution

The Parties recognize that good faith disputes concerning implementation of, or compliance with, or suspension, revocation or termination of the HCP/SHA or the ITP may arise from time to time. The Parties agree to work together in good faith to resolve such disputes, using the dispute resolution procedures set forth in this Paragraph or such other procedures upon which the Parties may later agree. However, if at any time any Party determines that circumstances so warrant, it may seek any available remedy without waiting to complete dispute resolution.

If NMFS has reason to believe that SPL&T may have violated the ITP with respect to any covered species, it will notify SPL&T in writing of the specific provisions that may have been violated, the reasons NMFS believes SPL&T may have violated them, and the remedy NMFS proposes to impose to correct or compensate for the alleged violation. SPL&T will then have sixty (60) days, or such longer time as may be mutually acceptable, to respond. If any issues cannot be resolved within thirty (30) days, or such longer time as may be mutually acceptable, after SPL&T's response is due, the Parties will consider non-binding mediation and other alternative dispute resolution processes.

The Parties reserve the right, at any time without completing informal dispute resolution, to use whatever enforcement powers and remedies are available by law or regulation, including but not limited to, in the case of NMFS, suspension or revocation of the ITP and civil or criminal penalties.

8.9. References to Regulations

Any reference in the HCP/SHA or the ITP to any regulation or rule of NMFS shall be deemed to be a reference to such regulation or rule in existence at the time an action is taken, except that SPL&T may reference federal regulations in effect at the time the ITP became effective to protect its rights under the HCP/SHA and the ITP.

8.10. Assignments and Transfers

Assignments or other transfers (in whole or in part) of the ITP and/or ESP shall be governed by the federal regulations located at 50 CFR 222.305. In accordance with 50 CFR § 222.305(a)(3), the Parties agree that the ITP and/or ESP may be transferred in whole or in part to a new party through a joint submission by SPL&T and the new party to the NMFS field office responsible for administering the ITP and/or ESP describing: (1) each party's role and responsibility in implementing the HCP/SHA, (2) each party's role in funding the implementation of the

HCP/SHA, and (3) any proposed changes to the HCP/SHA reasonably necessary to effectuate the transfer and implement the ITP and/or ESP.

NMFS may approve a proposed transfer of the ITP and/or ESP in whole or in part to a new party in accordance with the regulations, provided that NMFS determines that: (1) the proposed transferee meets all of the qualifications to hold an ITP under Parts 222, 223, or 224 (as applicable); (2) the proposed transferee provides adequate written assurances that it will provide sufficient funding for the HCP/SHA, and that the proposed transferee will implement the terms and conditions of the ITP, including any outstanding minimization or mitigation requirements; and (3) the proposed transferee has provided such other information that NMFS determines is relevant to the processing of the transfer.

8.11. Reporting and Inspections

8.11.1. Reporting and Annual Meeting

SPL&T will provide NMFS with the reports described in Section 6.8 of this HCP/SHA at the notice address then in effect for NMFS and will provide any available information reasonably requested by NMFS to verify the information contained in such reports. SPL&T will provide NMFS, within 30 calendar days, any additional information requested to determine whether SPL&T is in compliance with the ITP, ESP, and HCP/SHA.

SPL&T and NMFS shall conduct semiannual meetings during the months of April and September commencing the first April after the first year the ITP is issued to discuss the results of HCP/SHA implementation and monitoring, and selection of mitigation projects under the HCP/SHA. Nothing in the ITP, ESP, or HCP/SHA shall prevent the parties from meeting more frequently.

8.11.2. Inspections

SPL&T agrees that NMFS may inspect the Permit Area in accordance with its applicable regulations and law. Except where NMFS has reason to believe that SPL&T may be acting in violation of applicable laws or regulations or in breach of the ITP, NMFS will provide reasonable advance notice (24 hours) of its inspection, and in such cases will adhere to SPI's safety procedures, which require representatives of the Company to escort NMFS's representatives making such inspection.

NMFS shall ensure that any individual conducting an inspection regarding implementation of this HCP/SHA on its behalf performs such inspection in compliance with all regulations and statutes applicable to NMFS, and the requirement of this section for advance notice, where applicable. Any representative of NMFS conducting such inspections shall use reasonable efforts to promptly brief SPL&T on the information learned during any such inspection.

For the purpose of this paragraph, NMFS is intended to mean agency employees and contractors. NMFS law enforcement agents acting in their official capacity are not subject to these noticing or information requirements.

8.12. NOTICES UNDER THE HCP/SHA OR ITP

8.12.1. Required Notices by SPL&T

SPL&T shall notify NMFS in writing within 10 days of the occurrence of any of the following: (1) any change in the registered name of SPL&T; (2) the dissolution of SPL&T; (3) the sale or conveyance of SPL&T or any of the Projects; (4) bankruptcy proceedings by SPL&T as well as whether SPL&T is in receivership; (5) when SPI will no longer perform the covered activities in the Permit Area; (6) the revocation or suspension of SPL&T's corporate authorization to do business in the state or states in which it is registered to do business and, (7) SPL&T is disqualified from performing covered activities under the ITP for either of the disqualifying factors listed in 50 CFR § 222.303(e)(1), as may be amended, or under any future NMFS regulation.

SPL&T notices must be sent to NMFS at:

NMFS California Central Valley Salmon
National Marine Fisheries Service
650 Capitol Mall, Suite 8-300
Sacramento, CA 95819

8.12.2. Required Notices by NMFS

NMFS will notify SPL&T within a reasonable timeframe if: (1) for any reason (court ruling or lack of appropriated funds), NMFS is unable to fulfill any obligation associated with the HCP/SHA or ITP; (2) any lawsuits are filed against NMFS related to this HCP/SHA or ITP and/or ESP; (3) requests for disclosures of documents are received by NMFS under the Freedom of Information Act pertaining to this HCP/SHA or ITP and/or ESP; or (4) written notices or letters are received by NMFS expressing an intent to file suit against NMFS challenging the issuance of, or SPL&T's compliance with, the ITP and/or ESP. NMFS will provide notice to SPL&T of any such events by telephone, email or other appropriate means to a party designated in writing to NMFS by SPL&T.

8.13. Permit Revocation, Suspension, or Relinquishment

8.13.1. Permit Revocation and Suspension

The ITP may be revoked by NMFS as to one or both covered species in accordance with 50 CFR §222.306(e) for any violations of 50 CFR Parts 222, 223, or 224, or of the ESA, or of a term or condition of the ITP or ESP. Subpart D to 15 CFR 904 provides permit sanctions for violation or noncompliance.

When NMFS believes there are valid grounds for revoking the ITP, it will notify SPL&T in writing of the proposed revocation by certified or registered mail. The notice, which may be amended by NMFS at any time, will identify the ITP, whether the revocation is as to part or all of the ITP, the covered activities and covered species as to which the revocation applies, the reason(s) for the revocation, and the proposed disposition of the wildlife, if any. The notice also shall inform SPL&T of its right to object to the proposed revocation. Upon receipt of the proposed notice, SPL&T may file a written objection to the proposed action within 45 calendar days of the date of the notice providing its reasons for objecting to the proposed revocation as well as any supporting documentation.

NMFS will issue a written decision on the revocation within 45 days after the end of the objection period. The written decision will include NMFS's decision and its reasons for such as well as information concerning SPL&T's right to request reconsideration of the decision. Upon notification that the ITP has been revoked and after all appeal procedures have been exhausted, SPL&T must surrender the ITP and/or ESP to NMFS.

NMFS may suspend the ITP, in whole or in part, in accordance with its regulations located at 50 CFR §222.306.

8.13.2. Permit Relinquishment

SPL&T reserves the right to relinquish the ITP as to each covered species prior to expiration by providing thirty (30) days advance written notice to NMFS as provided by 50 CFR § 222.306. Prior to NMFS' cancelation of the permit, SPL&T will ensure that the mitigation required under the HCP for all the incidental take that has occurred is carried out, including any ongoing conservation funding and implementation assurances. The permit will not be canceled until NMFS determines that all outstanding minimization and mitigation measures for past take have been implemented.

8.14. Post-Termination Obligations

SPL&T and NMFS acknowledge that SPL&T's compliance with the HCP/SHA and ITP and or ESP will result in SPL&T having fully mitigated for any incidental take of any covered species if SPL&T has fully funded the Plan in accordance with the HCP/SHA and implemented the HCP/SHA in accordance with the ITP and ESP.

If SPL&T is in compliance with the terms of the HCP/SHA and ITP and/or ESP upon the date of termination, relinquishment, or revocation of the ITP or ESP, then SPL&T shall have no further obligations pursuant to the ITP with regard to covered species or Permit Area, and no further post-termination mitigation shall be owed by SPL&T if the ITP and/or ESP is terminated, relinquished, or revoked prior to the end of the permit term. NMFS will determine if SPL&T is in compliance with the terms of the HCP/SHA and ITP and/or ESP in accordance with applicable regulations consistent with the HCP/SHA and ITP and/or ESP prior to any relinquishment or termination.

8.15. Land Transactions

If SPL&T acquires any additional Projects, SPL&T may elect to include such Projects in the HCP/SHA and ITP in accordance with the Amendment Process. Upon such election, SPL&T shall provide notice to NMFS of its desire to include additional lands, along with a specific description of the location, legal description, and conditions of such additional property.

SPL&T may not sell or dispose of any Projects included in Plan Area, or exchange any portion thereof, to any new party during the term of the HCP/SHA unless: (a) the HCP/SHA or ITP is modified to delete such lands in accordance with Section 8.13.2, *Permit Relinquishment*; or (b) the lands are transferred to a third party who has agreed to be bound by the terms of the HCP/SHA, in accordance with Section 8.10, *Assignments and Transfers*.

8.16. No Recording

The HCP/SHA, the ITP, the ESP, or any obligations thereunder, will not be recorded on Plan Area, and will not run with Plan Area.

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