Six Rivers National Forest
Klamath National Forest – Ukonom District

WATERSHED AND FISHERIES RESTORATION PROGRAM

2015-2030

BIOLOGICAL ASSESSMENT

Threatened, Endangered, Proposed Anadromous Species

AND

Forest Service Sensitive Anadromous Salmonids

Final – July 2015
(January 2016 Updates)

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Changes to the Document since July 2015

On December 14, 2015 the Forest received a biological opinion based on the original July 2015 Watershed and Fisheries Restoration Program BA along with additional edits/corrections found during preparation of the biological opinion. With these additional minor errors and corrections as well as the release of the Public Draft Multi-Species Recovery Plan (October 2015), the decision was made to update the July 2015 BA to reflect those changes and to fix typos, table numbering and formatting. All edits were discussed with NMFS through the Level 1 process between Leslie Wolff (NMFS) and Karen Kenfield (SRNF). A complete list of all changes can be found in the files and are available on request.

None of the edits change the proposed activities or effects analysis.

Watershed and Fisheries Restoration Program BA

Formal Consultation Summary:

Six Rivers National Forest (SRNF) submitted the draft Watershed and Fisheries Restoration Program Biological Assessment (Draft WFR BA) to initiate Formal Consultation with National Marine Fisheries Service (NMFS) on April 22, 2015. NMFS responded on May 8, 2015 that the Draft WFR BA had sufficient information to initiate consultation.

Since that date, NMFS and SRNF staff worked together to clarify and refine the Draft WFR BA – see Consultation to Date section on page 17 for more information on the changes from draft to final. This document represents the final SRNF Watershed and Fisheries Restoration Biological Assessment (July 2015).

Proposed Action Summary:

The Watershed and Fisheries Restoration Program (WFR Program) goals are to follow the Aquatic Conservation Strategy (ACS) and implement restoration activities identified in state and federal recovery plans (NMFS 2014, CDFG 2004) to reduce stressors and threats to salmonid populations and their habitat over the long term and to provide for short term improvements in habitat quality for salmonids. This programmatic approach provides SRNF and NMFS with a consistent methodology to design, implement, monitor, and document watershed and fisheries restoration activities in support of the ACS and listed salmonid recovery plans (see page 19).

Program Effects Summary:

Based on the Matrix of Pathways and Indicators (see summary table on page 97), activities implemented under the Watershed and Fisheries Restoration Program (WFR Program) would have beneficial or neutral effects to the majority of the indicators. The indicators Turbidity and Substrate/Sediment have the potential to be negatively impacted in the short term by those activities that have the potential to cause sediment into the stream network. The relative significance of the effect would be based on the proximity of the individual activity to occupied habitat, magnitude of the amount of turbidity/sediment released, and the probability that the intensity and duration of any turbidity/sediment disturbance. All activities under the WFR Program would result in long term improvements to the watershed condition.

The **primary cause of project related sediment will be heavy machinery use** in floodplains, along or within the stream channels or by decommissioning roads with large fill volumes. During project implementation, the use of heavy equipment would disturb channel and streambank substrates and promote suspension of fine sediments in the water column, creating a short-term (hours) turbidity plumes. Decommissioning roads with significant fill volume could result in adjustments over a 0-2 year window with the potential input of sediment from work would be a much smaller amount than would have been released under conditions leading to road failure. Implementation of best management practices would reduce the amount of project related sediment entering the channel such that habitat components (indicators) would be insignificantly affected.

Project activities that occur without heavy equipment—moving large wood into channels -- may result in soil disturbance and potential for sediment being introduced into the channel,

however, amount would be localized and in small quantities. Site specific erosion control measures would be implemented to reduce input to a level that would be insignificant.

Harm or harassment of ESA-listed fish could occur through three potential pathways:

1. Fish may be incidentally injured or killed by all WFR Program activities involving heavy equipment in occupied habitat; however fish typically would exhibit avoidance behavior, thereby limiting this type of impact.
2. Individual projects that occur in occupied habitat may involve isolation, capture, handling, transport, and relocation of TEP salmonids. This would occur only when moving them would be less of an overall affect than operating within occupied habitat. Fish handling has the potential to result in fish injury or death.
3. Individual or grouped project may result in sufficient sediment entering occupied habitat such that individuals' behavior is significantly altered and harm occurs.

Determination Summary

Species	**Status**	**Overall WFR Program Determination**	
		Individuals	**Critical Habitat**
Southern Oregon/Northern California Coasts Coho ESU	Threatened	LAA – potential for project specific harm	NLAA
Northern California Steelhead DPS	Threatened	LAA– potential for project specific harm	NLAA
California Coastal Chinook ESU	Threatened	NLAA – Beneficial - improvement to watershed conditions	NE
Eulachon	Threatened	NE – No proximity	NE – No proximity
Green Sturgeon – Southern DPS	Threatened	N/A – no overlap w/SRNF	N/A – no overlap
Green Sturgeon – Northern DPS	Species of Concern	NLAA	N/A
Klamath Mountain Province Steelhead DPS	FS Sensitive	May affect individuals, would not trend towards Federal listing	N/A
Southern Oregon/California Coastal Chinook ESU	FS Sensitive	May affect individuals, would not trend towards Federal listing	N/A
Upper Klamath/Trinity River Chinook ESU	FS Sensitive	May affect individuals, would not trend towards Federal listing	N/A

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I. INTRODUCTION

The Watershed and Fisheries Restoration Program (WFR Program) goals are to implement the Aquatic Conservation Strategy (ACS) which was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems on federal lands (FEMAT 1993). In meeting the objectives of the ACS, the WFR Program implements restoration activities identified in state and federal recovery plans (NMFS 2014, CDFG 2004) to reduce stressors and threats to salmonid populations and their habitat over the long term, and to provide for short term improvements in habitat quality for salmonids.

All proposed activity categories comply with the Record of Decision and Standards and Guidelines of the Northwest Forest Plan (USDA and USDI 1994) as incorporated into the Six Rivers and Klamath National Forest land and resource management plans (LRMPs). All proposed activity categories are also identified in the Southern Oregon/Northern California Coast (SONCC) Coho Salmon Recovery Plan (NMFS 2014).

The Watershed and Fisheries Restoration Program Biological Assessment (WFRBA) is primarily intended to include those aquatic restoration activities that are implemented on lands under the jurisdiction of the FS. This consultation may also cover actions that occur on non-Federal lands when that action is located immediately adjacent to Six Rivers National Forest and the project helps achieve FS aquatic restoration goals as covered under Wyden Amendment authority (16 U.S.C. 1011(a), as amended by Section 136 of PL 105-277).

The WFRBA actions can occur on a routine basis or sporadically, starting in 2015 based on staffing and funding levels and appropriate NEPA completion. This programmatic approach provides SRNF with a consistent methodology to design, implement, monitor, and document watershed and fisheries restoration activities in support of the ACS and listed salmonid recovery plans. The WFRBA facilitates Endangered Species Act (ESA) Section 7 and Magnuson/Stevens Act (MSA) consultation with the National Marine Fisheries Service (NMFS). The WFRBA also provides information in sufficient detail and quality to support NMFS analysis for consultation.

The activities are predictable as to their effects to ESA- and MSA- listed species and consistent with broad-scale aquatic conservation strategies and the best available science. Further, new activities not covered in this WFRBA can be added by amendment as long as the effects and outcomes of such actions are consistent with those described in WFRBA. Projects that are inconsistent with the Aquatic Conservation Strategy objectives, goals, outcomes and/or effects described in this WFRBA are not eligible for inclusion by amendment and may require a separate consultation with NMFS.

Background

Though relatively productive, streams on Six Rivers National Forest are still impaired by the legacy effects of floods, fire and land use. In 1964, a major flood changed the riparian areas with the removal of large stream side conifers. Concerned over fish passage and landslide aggravation, biologists at the time removed resulting log jams. On the mainstem Klamath and Trinity Rivers, the dams, development and highways have altered most of the mainstem channel,

changed the rise and fall of the river and disconnected side-channel habitat from the river. Historically, these side-channels were part of a web of small tributaries, wet meadows, oxbows, beaver ponds and these off-channel habitats along the river provided important summer rearing and winter refuge for resident and anadromous fish.

Stream surveys in the 1970s indicated streams responded to the 1964 flood with simplified instream habitat and riparian areas dominated by young alders. In the 1980 and early 1990s, Six Rivers National Forest, partnering with California Department of Fish and Wildlife [Game] and the other river restoration programs, focused on increasing the complexity of instream habitat through various grants programs. Mid 1990s and the publication of FEMAT encouraged managers to look to the hillsides to restore natural processes of sediment and vegetation. Since the signing of the Six Rivers LRMP and Klamath LRMP in 1995 (which incorporated the Northwest Forest Plan in its entirety), the Forests have decommissioned roads, planted landslides and upgraded necessary road systems to both reduce known sediment sources and the risk of future impacts (see Appendix A for maps showing history of restoration). The Six Rivers National Forest web page documents recent watershed restoration activities.

During this time, three fish species and their critical habitat have been listed as threatened under the federal ESA, and others have been identified as "at risk" covering all six river systems found on the Forest. Current status reviews by NMFS have indicated a continuing decline in populations[1]. Other threats such as invasive species, areas of potential catastrophic fires and climate change are increasing the stresses on these populations.

Summary of Existing Condition: The Forest has streams and rivers that currently provide habitat for Chinook salmon, coho salmon, steelhead trout, cutthroat trout, pacific lamprey, and resident rainbow trout and other aquatic species (mussels, snails, and crayfish). This habitat is on a continuum of recovery since the 1964 flood which, in combination with past management activities, simplified the riparian areas and stream habitat. On SRNF little streamside logging took place near fish bearing streams, however, land management activities that did take place were compounded following the 1964 flood. Over this same time period, a road network was developed to serve ongoing timber management priorities, including harvesting, reforestation, and stand management. With the signing of the LRMPs in 1995, focus on the Aquatic Conservation Strategy has led to improved management of riparian reserves that has reduced the risk of negative impacts to stream habitats due to management actions. The Forest has had an aggressive road decommissioning and upgrading program (see Appendix A) that has reduced the risk of flood-driven excessive sedimentation.

SONCC Coho Salmon Recovery Plan: Released in September 2014, the SONCC coho salmon recovery plan was developed to provide a roadmap to recovery of this species which conservation partners can follow together. Specifically, the Recovery Plan was designed to guide implementation of prioritized actions needed to conserve and recover the species by providing an informed, strategic, and voluntary approach to recovery that is based on the best available science. Actions carried out under the WFR Program implement portions of this recovery plan as described below. The SONCC coho salmon recovery plan also identifies threats and stresses to

[1] Most current status reviews are located at the National Marine Fisheries Service West Coast Region website. http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead.html

coho that are not addressed here. Actions to reduce the risk of high severity fires, while important for long term recovery of SONCC coho salmon, are not addressed in this WFRBA.

Multispecies Recovery Plan: NMFS is in the process of developing a multispecies recovery plan for three additional listed salmonids. Two of these species, Northern California (NC) steelhead and California Coastal (CC) Chinook salmon are found within or downstream of SRNF in the Redwood Creek, Mad River and Eel River watersheds. Upon release of the Public Draft and Final versions, this WFRBA may be updated to reflect new information.

Direction

While developing individual NEPA projects, the Forest shall meet and implement direction from both the Forest Service and partnering regulatory agencies. The following is a list of the primary law, policy and regulations that define actions on National Forest administered lands. For a complete list of direction that must be followed, see Appendix B.

1) *Six Rivers/Klamath National Forests Forest Plans* (SRNF/KNF LRMPs, 1995)

   Both LRMP's discuss the distribution of the land base to management areas and the management direction that determines their goals, implementation direction, and standards and guidelines. Standards and guidelines describe the management practices that will be applied to specific management areas and how Forest-wide direction will be implemented. Riparian Reserves are a land allocation under the Aquatic Conservation Strategy that:

   - maintain and restore riparian structures and functions of intermittent streams,
   - confer benefits to riparian-dependent and associated species other than fish,
   - enhance habitat conservation for organisms that are dependent of the transition zone between upslope and riparian areas,
   - improve travel and dispersal corridors for many terrestrial animals and plants, and
   - provide for greater connectivity of the watershed.

   Aquatic Conservation Strategy - The Aquatic Conservation strategy outlines specific objectives regarding the Forest goals in the management of aquatic and riparian resources. It strives to maintain and restore ecosystem health at the watershed and landscape scales to protect habitat for fish and other riparian-dependent species and to restore currently degraded habitats. Watershed Analysis documents have been completed for the majority of the watersheds on SRNF and Ukonom RD of the KNF. Watershed Analysis is an important step in supporting ecosystem planning and are updated through large scale planning efforts (see Appendix A-2 for a list of all relevant analysis documents). Watershed restoration will be an integral part of this program to aid recovery of fish habitat riparian habitat and water quality. The most important components of a watershed restoration program on the SRNF are control and prevention of road-related runoff and sediment production, restoration of the condition of riparian vegetation, and restoration of instream habitat complexity.

2) *Federal and State recovery plans* for declining populations of anadromous salmonids.

   Recovery plans delineate such reasonable actions as may be necessary, based upon the best scientific and commercial data available, for the conservation (survival and recovery) of

listed species. The 2014 Southern Oregon/Northern California Coasts coho salmon Recovery Plan (NMFS 2014) and California coho recovery strategy (CDFG 2004) identify actions that may be taken to stop the downward trend of the species and return the species to a viable, naturally self-sustaining condition. These documents establish criteria for delisting SONCC coho salmon and present recovery actions necessary to reduce stresses and threats for species recovery.

Currently underway is the development of the Multispecies Recovery Plan for three additional listed anadromous species, including NC steelhead and CC Chinook salmon. In watersheds with overlapping listed populations, recovery actions for one species would likely benefit all.

Actions proposed in this Watershed and Fisheries Restoration Program BA are designed to aid in recovery of listed coho salmon, steelhead and Chinook salmon (and other aquatic species) by addressing those existing stresses and threats identified in the recovery plans (final SONCC and draft multispecies) the Forest Service has influence on through its management (See Appendix C for list of recovery actions by watershed).

3) *Threatened, Endangered and Sensitive Plants and Animals* (FSM 2670, September 2005)

The objective for TE species under this FSM is to manage National Forest System habitats and activities for threatened and endangered species to achieve recovery objectives so that special protection measures provided under the ESA are no longer necessary.

For sensitive species, the objectives are to develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions and to maintain viable populations of all native and desired non-native wildlife, fish and plant species in habitats distributed throughout their geographic range on National Forest System Lands.

4) *Clean Water Act/Water Quality Management Objectives* (FSH 2509.22, December 2011)

Forest Service handbook direction includes water quality management objectives that are intended to 1) ensure that the quality and beneficial uses of water are maintained where they are in good condition, consistent with the Federal and State anti-degradation/non-degradation policies, and the principles of conservation biology, 2) protect the quality and beneficial uses of water from further degradation in water bodies that are trending toward impairment, as defined by Clean Water Act Section 303 (d) and 3) make substantial progress toward eventual delisting of water body segments listed pursuant to Clean Water Act Section 303(d). With the exception of the Smith River, all other river basins have TMDLs identified.

The California Regional Water Quality Control Board, North Coast Region, in collaboration with the United States National Forest (Pacific Southwest Region) is renewing the Categorical Waiver of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Federal Land Management Activities on National Forest System Land (Waiver). This Waiver addresses activities associated with National Forest Service management that may generate sediment, affect shade canopy, or influence other water quality parameters of waters of the state. The Waiver conditions provide reasonable assurance that sediment, temperature, dissolved oxygen, and nutrient impairments caused by activities on NFS lands will be restored by requiring: 1) protection, maintenance, and enhancement of riparian conditions and shade, 2) inventories and remediation of legacy sediment sites, 3) the application of BMPs and on-the-ground prescriptions

activities on NFS land to avoid excess sediment discharges and to improve shade, and 4) periodic review, monitoring and reassessment.

As part of this direction, Water Quality Best Management Practices (BMP) are included in every project to meet these objectives. The programmatic BMPS listed in Appendix B-2 are action-initiating practices that result in the development of site-specific detailed prescriptions that are designed at the project scale during the IDT process (FSM 2509.22 section 11.2). Currently both Regional and National BMPs are to be implemented. Additional implementation and effectiveness monitoring is also required to document the efficacy of the Waiver in protecting water quality and associated beneficial uses such as anadromous fisheries.

5) *Watershed Condition Framework* (USDA 2011)

The Watershed Condition Framework (WCF) established a new consistent, comparable, and credible process for improving the health of watersheds on national forests and grasslands. Watershed condition classification was completed on National Forest System lands in May of 2011. During the summer and fall of 2011, priority watersheds were identified and work began on Watershed Restoration Action Plans. Watershed Restoration Action Plans describes existing resource conditions and identifies possible management actions that could be taken to move the Agency towards a desired future condition. Information used to develop the WCF classification for each 6th field watershed is being used to support prioritizing and planning for recovery actions (see Appendix C).

Watershed and Fisheries Restoration Program Goals

To achieve LRMP goals and objectives of the Aquatic Conservation Strategy, SRNF proposes to accomplish actions to conserve TEP salmon and steelhead species as per Section 7a(1) of the ESA; meet the SONCC Recovery Plan and meet Clean Water Act requirements by the following:

- Improve instream conditions for salmonids,
- Improve impaired water quality and reduce the risk of road and trail related sediment from entering the stream system, especially during high precipitation events,
- Improve upstream and downstream passage conditions for all life stages of salmonids and restore or improve continuous paths for wood, nutrients, sediments, and other vegetative material essential for quality fish habitat
- Improve riparian conditions to maintain or increase shade, increase large woody debris recruitment, increase input of nutrients and macroinvertebrates,
- Reduce impacts from other land management activities such as historic mining activities, recreation, and livestock grazing currently impacting water quality, and
- Reduce impacts from identified illegal marijuana grows when aquatic resources are at risk.

Programmatic Consultation vs Traditional Consultation

Consultation on ESA listed species can occur under traditional project or batched consultation on a single or a suite of projects. Consultation can also occur at the programmatic level. The purpose of this Programmatic Consultation is to determine if SRNF watershed and fisheries restoration complies with the requirements of section 7(a)(2). Programmatic consultation focuses on the decision-making process that results in actions implemented on the ground. The key to successful implementation of the WFRBA is to clearly describe the decision making process and

provide evidence on SRNF pattern of practice or track record in successfully implementing projects within the Program framework. Appendix D includes a diagram of the decision making process all actions would follow, including the internal and external screening processes (public review and comment, NEPA compliance, and other agencies requirements). Also included in Appendix D includes monitoring and compliance documentation including the Best Management Practices Evaluation Program conducted by the SRNF. The following table from NMFS Section 7 Training material displays the differences between the two consultation styles.

Table 1. Traditional vs Programmatic Consultation

	Traditional	**Programmatic**
Focus	Single action (or batch)	Decision-making process that results in actions
Spatial Scale of focus	Usually Local	Usually Global
Temporal scale of focus	Usually Local	Usually Global
Evidence	Public and grey literature relevant to specific action	Public and grey literature on agency pattern of practice
Remedies	Modify action	Modify program

Scope of Activities under Programmatic Consultation

While the Forest is interested in partnering with state, private and tribal landowners on recovery actions for listed salmon and steelhead, this consultation covers those actions carried out on Forest Service administered lands. This consultation may also covers actions that occur on non-Federal lands when that action is located immediately adjacent to Six Rivers National Forest and the project helps achieve FS aquatic restoration goals as covered under Wyden Amendment authority (16 U.S.C. 1011(a), as amended by Section 136 of PL 105-277).

Projects that include any of the following elements would be outside the scope of this consultation:

- Building new system roads –Temporary access for heavy equipment may be constructed (see section starting on page 25), however would be rehabilitated post-activity, thereby restoring hydrologic function, riparian vegetation and long term soil productivity.
- Use of gabion baskets or chemically-treated timbers for any instream structures would not fall under this consultation. This program focuses on restoring natural process and structure.
- Activity that substantially disrupts the movement of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through an action area.
- Activities such as stabilizing stream banks solely as a mitigation for non-aquatic restoration actions.

Limits on Area of Disturbance for Individual Projects

In order to avoid cumulative impacts due to multiple projects being implemented at once, limits on the amount of disturbance per year in a single watershed are described on page 49. These limits were developed based on staffing and funding levels.

The number of sediment-producing projects (i.e., instream habitat improvement, instream barrier removal, stream bank stabilization, fish passage improvement, creation of off-channel/side channel habitat, and upslope road work) will be limited by the watershed size (Table 4 on page 49).

List of Activities Covered

This WFRBA covers 17 aquatic restoration activities that will maintain, enhance and/or restore watershed processes that affect aquatic species and water quality. This WFRBA is intended to include those aquatic restoration activities that are predictable as to their effects to ESA- and MSA-listed species, and are consistent with broad scale aquatic conservation strategies and the best available science. For project descriptions, administration requirements, conservation measures, and project design criteria, refer to Section II A (Program Administration on page 19) and Section III (Project Activities and Design Criteria on page 25). Page number for specific design criteria are indicated for each activity.

Those activity types identified with an * typically have no known locations on SRNF, however are being included due to the potential for partnership projects under the Wyden Agreement or for special use permits issued by SRNF. These activities would need to follow the process described (including design features) to be covered under this WFRBA as well as having signed NEPA decisions.

Fish Access to Habitat/Habitat Connectivity

1. Fish Passage Restoration – all life stages (instream/flow related, weir modification, culvert replacement) and reconnecting downstream movement of habitat components through road related actions (see page 32)

Instream Habitat Enhancement

2. Large Wood and Boulder Projects (adding wood and boulders, engineered log jams, boulder weirs) (see page 33)
3. Gravel Augmentation (see page 36)
4. Legacy/Historic Structure Improvements or Removal (instream enhancements, water flow controls/diversions, etc) (see page 37)
5. Beaver Habitat Restoration (see page 38)

Side-Channel/Off Channel

6. Off- and Side-Channel Habitat Restoration (see page 39

Streambank Restoration

7. Streambank Restoration (including toe of landslide treatments - see page 40)
8. Reduction/Relocation of Recreation Impacts (see page 41)
9. Livestock Fencing, Stream Crossings, and Off-Channel Livestock Watering (see page 42)

Riparian Restoration

10. Riparian Restoration/Enhancement (planting, alder girdling for conifer growth – see page 43)
11. Non-native Invasive Plant Control (see page 44)

Road Related Actions

12. Road and Trail Erosion Control (road/trail maintenance, and stormproofing, – see page 46)
13. Decommissioning Roads (including unauthorized non-system routes - see page 46)

Other

14. Reduction of Impacts related to Illegal Marijuana Grow Clean up (see page 48)
15. Mine Reclamation (see page 48)
16. In-channel Nutrient Enhancement (see page 48)

The Watershed and Fisheries Program also has responsibilities to native resident fish and other aquatic species and, for desired warm water game fish and their habitats. Most resident coldwater species are found either co-located with anadromous fish, or are found higher in the watersheds above anadromous salmonid barriers. Actions to improve conditions for TES salmonids would also benefit resident aquatic species. Actions under the Program to specifically address non TES anadromous species are located in the following section:

17. Resident Aquatic Species Stream and Lake Enhancement (see page 49)

Table 2 demonstrates the way WFR activities address watershed-scale processes that control delivery of sediment, water, organic matter, nutrient and chemicals, light and heat, and biota from the surrounding environment into floodplains and stream channels (Beechie 2010).

Beechie (2012) did a review of restoration literature, and found that restoring floodplain connectivity, restoring stream flow regimes, and re-aggrading incised channels are most likely to ameliorate stream flow and temperature changes and increase habitat diversity and population resilience. By contrast, most restoration actions focused on in-stream rehabilitation are unlikely to ameliorate climate change effects; however these actions could have short term positive effects to rearing salmonids.

Table 2. Connection of WFR Activities to Process-based Restoration

Ecosystem Features (Beechie et al. 2010)	Natural Driving Process	Aquatic Conservation Strategy Objectives	WFRBA Activities
Watershed Scale			
Sediment	Sediment delivered to river systems through land sliding, surface erosion and soil creep	Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	2 – 9, 12, 13, 14, 15
Hydrology	Runoff delivered to streams through surface and subsurface flow paths	Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	4-7, 10, 12, 13, 14
Organic Matter	Tee fall and leaf litter fall	Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation	2, 5, 7, 10, 11
Light and Heat	Solar insolation and advective heat transfer to water column	Maintain and restore species composition and structural diversity of riparian plant communities to provide summer and winter thermal regulation.	2, 5, 7, 10, 11
Nutrients	Delivery of nutrients via groundwater flow	Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.	2, 4-10, 12, 13, 15
Biota	Migration of aquatic organisms, seed transport	Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian species.	1, 2,4, 5, 6, 7, 9, 10, 12, 13, 14

Ecosystem Features (Beechie et al. 2010)	**Natural Driving Process**	**Aquatic Conservation Strategy Objectives**	**WFRBA Activities**
Reach Scale			
Channel morphology and habitat structure	Channel migration, bank erosion, bar formation, and floodplain sediment deposition create a dynamic mosaic of main-channel, secondary-channel, and floodplain environments. Wood recruitment results in part from bank erosion and channel migration, and wood accumulations reduce bank erosion rates or enhance island formation. Sediment and wood transport and storage processes drive channel cross-section shape, formation of pools, and locations of sediment accumulation. Bank reinforcement by roots reduces bank erosion rates and may force narrowing and deepening of channels. Animals such as beaver physically modify the environment and create new habitats.	Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations. Maintain and restore species composition and structural diversity of riparian plant communities to provide for channel migration and amounts and distributions of woody debris to sustain physical complexity and stability.	1-11
Thermal regime	Local stream shading and exchange of water between surface and hyporheic flows regulates stream temperature at the scale of habitat units and reaches.	Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation	2, 5, 7, 10, 11
Water chemistry	Delivery of dissolved nutrients through groundwater and hyporheic exchange; uptake of nutrients by aquatic and riparian plants. Delivery of pesticides and other pollutants at point sources damage health and survival of biota.	Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of nutrient, routing.	2, 4, 5, 6, 7, 8, 10, 12, 13, 15
Riparian species assemblages	Seedling establishment, tree growth, succession drive reach-scale riparian plant assemblages.	Maintain and restore species composition and structural diversity of riparian plant communities to provide summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of woody debris to sustain physical complexity and stability.	2, 5, 7, 10, 11
Aquatic Species Assemblages	Photosynthesis drives primary production of algae and aquatic plants. Leaf-litter inputs drive detritus based food web strands. Habitat selection, predation, feeding, growth, and competition drive species composition of invertebrate, amphibian, and fish assemblages.	Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	2, 5, 7, 10, 11

Geographic Scope

This WFRBA covers those portions of California wherever SRNF administrative units are found. Projects that occur on non-federal lands are included under this consultation when a project directly assists SRNF in achieving their aquatic restoration goals and the FS contributes resources (funds, materials, planning, etc.) to the project. The FS are permitted to fund such projects under Wyden Amendment authority (16 U.S.C. 1011(a), as amended by Section 136 of PL 105-277). To be included, non-federal land projects must follow all elements of the WFRBA. SRNF will ensure that projects covered under this programmatic on non-federal land undergo the same review, design, implementation and post-project processes as projects occurring on SRNF administered lands.

The Action Area is defined (for ESA purposes) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved action" (50 CFR 402). Figure 1 identifies the general Action Area for some of the activities carried out under this program. The maps in Appendix A display the following location information:

- Instream/Riparian Activities – maps identify where past instream restoration activities have occurred and the locations of where activities are likely to occur under future NEPA decisions.
- Upslope Treatments – maps identify the National Forest Transportation System where road actions may occur. The maps also identify roads that have been decommissioned under previous NEPA decisions.

No Effect Site Specific Geographic areas that can be eliminated from analysis due to lack of proximity, and thus lack of effects, to listed salmonids:

- Lakes and Reservoirs - The Watershed and Fisheries Program also has responsibilities to native resident fish and other aquatic species and, for desired warm water game fish and their habitats. Activities identified in lakes and in Ruth Reservoir are disconnected from anadromous habitat and would have no effect.
- Watersheds are above Matthews Dam. Matthews Dam is a complete barrier to anadromous salmonids. Activities occurring within these watersheds would be considered a "no effect" to TES anadromous salmonids although beneficial to other aquatic species inhabiting this area.

The Recovery Plan, in conjunction with the Watershed Condition Framework and local knowledge, will be used to prioritize projects implemented under this WFRBA. Projects would be implemented based on completed NEPA decisions and available funding.

Appendix A-4 has a complete list of 6th field watersheds with key stresses and threats identified from the SONCC Recovery Plan and data from the Watershed Condition Framework to identify opportunities for restoration actions. Specific project locations and descriptions would be identified during the individual NEPA process by the SRNF. See page 19 for a description of the WFR Program and process for implementing projects under this consultation.

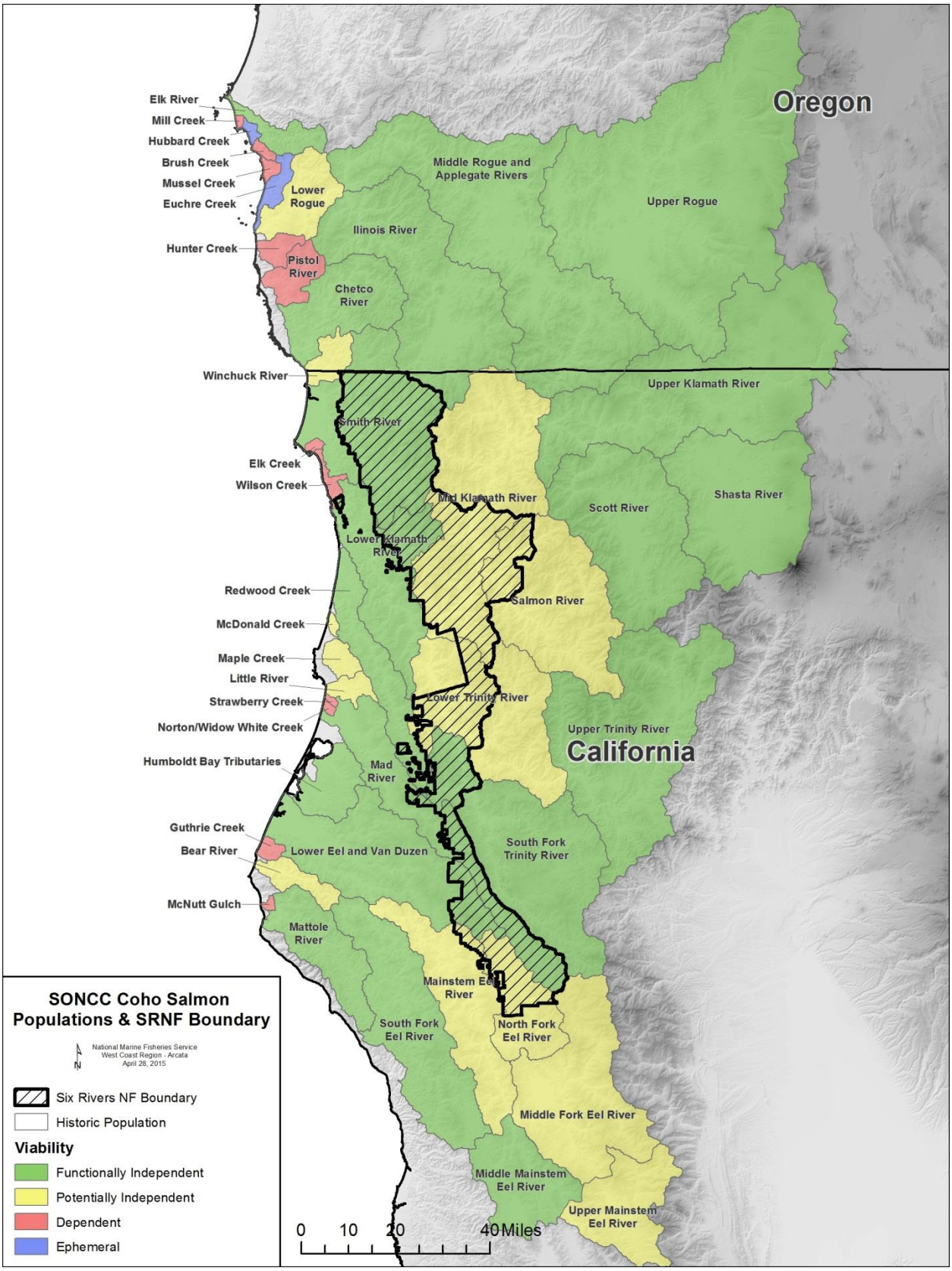

Figure 1. Action Area for the Watershed and Fisheries Program

Species Considered

This BA covers all threatened, endangered and proposed (TEP) anadromous fisheries species that may be affected by actions identified. This document also considers anadromous species that are not currently listed under the ESA, but have been designated by the Regional Forester as "Forest Service Sensitive Species (FSS)". NMFS has completed status reviews of many of these species. In the event any of these species are proposed for listing, this document would form the basis of re-initiation of consultation on those species or their habitat. Table 3 is a current list of TEP and FSS anadromous species for Six Rivers National Forest.

Table 3. Anadromous species considered in this document.

Species	ESU/DPS	Rivers	Status	Critical Habitat
Coho Salmon *Oncorhynchus kisutch*	Southern Oregon/Northern California ESU Naturally spawned populations between Cape Blanco Oregon and Punta Gorda California.	Coho found on FS lands in these rivers Smith, Klamath, Salmon Trinity Coho found downstream of FS lands in these rivers Mad Van Duzen Eel	**Threatened** 70 FR 37160, June 28, 2005 (originally listed 62 FR 24588 May 6, 1997 – Effective: June 5, 1997) Recovery Plan, September 2014	**Designated** 64 FR 24049 May 5, 1999 Critical habitat is designated to include all river reaches accessible to listed coho salmon. Critical habitat consists of the water, substrate, and adjacent riparian zone of estuarine and riverine reaches (including off-channel habitats)
Steelhead *Oncorhynchus mykiss*	Northern California DPS Naturally spawned anadromous *O mykiss* originating below natural and manmade impassable barriers in California coastal river basins from Redwood Creek to and including the Gualala River	NC Steelhead found on FS lands in these rivers Mad Van Duzen Eel NC steelhead found downstream of FS lands: Redwood Creek	**Threatened** FR 71 834, Jan 5, 2006 (Originally listed 65 FR 36074 Jun 7, 1999) Effective Aug 7, 2000 Multispecies Recovery Plan Public Draft Oct 2015	**Designated** 65 FR 7764 Feb 16, 2000 All river reaches accessible to NC steelhead. Excluded are areas above specific dams or above longstanding, naturally impassable barriers. NF Eel was excluded from CH designation.
	Klamath Province DPS	KMP steelhead found on FS lands in these rivers: Smith, Klamath, Salmon Trinity	**Not Warranted** 66 FR 17845 Apr 4, 2001 (originally proposed for listing 61 FR 41541 Aug 9, 1996) Forest Service Sensitive Species	N/A
Chinook Salmon *Oncorhynchus tshawytscha*	California Coastal ESU Naturally spawned populations from rivers	CC Chinook found downstream of FS	**Threatened** 70 FR 37160, June 28, 2005	**Designated** 65 FR 7764 Feb 16, 2000

Species	ESU/DPS	Rivers	Status	Critical Habitat
	and streams south of the Klamath River to and including the Russian River	lands in these rivers Redwood Creek, Mad Van Duzen Eel	Originally listed 64 FR 50394 Sept 16, 1999 Effective: Nov 15, 1999 Multispecies Recovery Plan Public Draft Oct 2015	All river reaches accessible to Chinook salmon. Excluded are areas above specific dams or above longstanding, naturally impassable barriers.
	Upper Klamath/Trinity ESU	UKT Chinook found on FS lands in these rivers Klamath, Salmon Trinity	**Not Warranted -** Forest Service Sensitive Species Status Review: Williams et al 2011	N/A
	Southern Oregon/California Coast ESU	SOCC Chinook found on FS lands in these rivers: Smith, Lower Klamath	**Not Warranted -** Forest Service Sensitive Species Status Review: Williams et al 2011	N/A
Green Sturgeon *Acipenser medirostris*	Southern DPS Coastal and central valley populations south of the Eel River.	N/A – Southern DPS does not overlap with SRNF watersheds	**Threatened** 67 FR 17757 Apr 7, 2006 Effective: June 6, 2006	**Designated** 74 FR 52300 Oct 9, 2009 Marine waters Monterey to US Canada Border Bays and Estuaries – Humboldt Bay Estuaries of the Eel, Mad, Klamath and Smith were not designated.
	Northern DPS Coastal watersheds northward of and including the Eel River. Species of Concern is a species or population for which there is concern or great uncertainty about its status. They are not listed or protected under the Endangered Species Act.	Klamath Mad Eel	**Not Warranted** 70 FR 17386 Apr 6, 2005 NMFS Species of Concern (2003)	N/A
Eulachon *Thaleichthys pacificus*	Southern DPS	Smith Klamath	**Threatened** 75 FR 13012 Mar 18, 2010 Status Review Gustafson et al. 2010	**Designated** 76 FR 65324 Oct 20, 2011
Listing dates as per 79 FR 20802 April 14, 2014: Final Rule to Revise the Code of Federal Regulations for Species Under the Jurisdiction of the National Marine Fisheries Service.				

Distribution

Distribution and critical habitat information (displayed in the maps in Appendix A) upon which the effects analysis was based on:

- Current known SONCC coho and NC steelhead distribution based on historic and current surveys (SRNF surveys, CalFish database, NMFS etc).
- Critical habitat for NC steelhead and CC Chinook where specifically identified in federal resister notices. Critical Habitat for SONCC coho was not spatially identified but rather described in the Federal Register as all river reaches accessible to coho salmon.
- Known upstream migration barriers for anadromous salmonids such as Matthews Dam
    - For NC steelhead: Resident trout population distribution was considered where new information indicates the occasional anadromous steelhead may be surpassing historic barriers.

Threatened and Endangered Anadromous Fish Species Not Carried Forward

The list of TEP anadromous salmonids was reviewed by NMFS thought the Level 1 process. In addition to the list of species carried forward for analysis, the following anadromous species are located in or downstream of the Forest boundary: southern DPS green sturgeon, and southern DPS eulachon. These two species (and their critical habitat) will not be carried forward in this BA for the following reasons:

- The Southern DPS Green Sturgeon or its critical habitat does not overlap SRNF lands nor is it found downstream of SRNF administered lands where project is proposed, however, Critical Habitat for this species is located along the Pacific Coast. It includes some estuaries and bays north of the southern DPS natal streams; however, none of the estuaries at the mouths of rivers draining SRNF administered lands were designated. This species will not be carried forward for analysis.

- Eulachon and its designated critical habitat are located in the lower reaches of the Klamath River (to Omogar Creek), Mad River (to the North Fork Mad River) and Redwood Creek (to McDonald Creek). Species are not in proximity to SRNF lands (greater than 20 miles downstream of the forest boundary). This species (and designated critical habitat) will not be carried forward for further analysis as actions proposed would have no effect to downstream populations.

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act is the federal law that governs US marine fisheries management. In 1996 Congress added new habitat conservation provisions to that act in recognition of the importance of fish habitat. The act mandated identification of essential fish habitat (EFH) for managed species and to conserve and enhance the habitat needed by fish to carry out their life cycles. EFH is defined as “those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity”.

Pacific Salmon EFH includes all those water bodies occupied or historically accessible in Washington, Oregon, Idaho and California in hydrologic units identified in Table 1 of 73 FR 60987 (October 15, 2008). EFH is considered for both Coho and Chinook salmon, with consultation occurring under 305 (b) (4) (A) of the Magnuson-Stevens Fishery Conservation and

Management Act. The definition of Coho/Chinook EFH components and extent is described by Amendment 14 (Appendix A, pages 12-35 [adopted year 2000]) of the 1978 Pacific Fisheries Management Council Salmon Fisheries Management Plan. The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 required NMFS to develop a recovery plan for Klamath River coho salmon (NMFS 2007). Actions within this WFRBA are consistent with actions proposed in this document.

Consultation to Date

Consultations from 1997 to 2014

With the first proposed listing of anadromous salmonids in northern California, the Forest Service entered into consultation with the National Marine Fisheries Service on the 1995 Land and Resource Management Plan as well as all ongoing actions that may have affected the Southern Oregon/Northern California Coasts coho salmon.

Previous consultations on watershed and fisheries restoration have occurred on the Six Rivers National Forest and throughout the range of coho salmon in the Pacific Northwest. These previous consultations include batch, programmatic, and plan level BAs and Biological Opinions (BOs) that have addressed instream restoration, road maintenance, road decommissioning, culvert removal, and related road repair activities (documents available upon request).

- Consultation on LRMP (SRNF and KNF) 1997 including all ongoing actions at time of listing
    - The Forests prepared biological assessments on routine and non-routine road maintenance and watershed/instream restoration activities. In 1997, NMFS issued a programmatic BO to the USFS and Bureau of Land Management (BLM) in northern California for routine and non-routine road maintenance and flood response actions and instream enhancement projects addressing effects to coho salmon (Northern California/Southern Oregon and Central California. In this BO, NMFS determined that routine and non-routine road maintenance, with the exception of culvert replacement in riparian reserves and decommissioning, would result in a not likely to adversely affect determination for listed and proposed salmonids. NMFS anticipated that some actions may still have a more than negligible likelihood of taking listed salmonids, including actions considered to be beneficial. Adverse effects of management actions such as these are largely unquantifiable but may include impacts to substrate quality, turbidity and suspended sediment levels all of which may directly affect life history stages.
- Travel Management – Designation of minimum road and trail network as per the 2005 Travel Management Rule (36 CFR Part 212). This rule established policies and procedures to ensure that the use of motorized vehicles on public lands would be controlled to protect resources, promote safety and minimize conflicts among various uses of those lands. Appendix A-3 lists the status of all SRNF inventories, analyses and NEPA documents completed to date. Consultations have included decommissioning, upgrading, storm proofing, OHV trail designation and road/trail maintenance.

- Orleans Transportation Road and Restoration BA 2007– This consultation covered the entire Orleans Ranger District and established the minimum road and trail network through a roads analysis and public involvement process. The SRNF received a LOC from NMFS concurring with the determination of "not likely to adversely affect." Activities and design features in this BA are consistent with the Road Actions described on page 44. See Appendix E (Status of Past Consultations) for remaining work activities.
- Smith River Roads BA 2007 – The BA covered the entire Smith River NRA. The SRNF received a LOC from NMFS concurring with the determination of "not likely to adversely affect." However; implementation was delayed due to appeals and litigation. A Draft EIS was released September 2014. Activities and design features in the BA and DEIS are consistent with the Road Actions (including OHV trails) described on page 44.See Appendix G-2 for the revised proposed action.
- Lower Trinity/Mad River Travel Management BA 2010 – This consultation included designating roads and trails for motor vehicle use. The consultation did not include decommissioning or road upgrades however, maintenance activities and design features in the BA are consistent with the Road Actions (including OHV trails) described on page 44. The SRNF received a LOC from NMFS concurring with the BA determination.

This consultation document supplements or replaces all previous watershed and fisheries restoration programmatic and batched consultations so that all future restoration actions will tier to the process outlined in this document.

WFRBA consultation

Summary of Level 1 meetings related to this programmatic consultation effort:

- January 16, 2014 – Discussions between SRNF and NMFS on programmatic consultations in general. Watershed and Fisheries Restoration Program level consultation was identified as a priority for the SRNF.
- Components of the Watershed and Fisheries Restoration BA (WFRBA) were discussed on the following dates in 2014 (October 10, Nov 7) and in 2015 (January 9 and 30, February 10, and February 26) – Leslie Wolff (NMFS) and Karen Kenfield (SRNF) (WFRBA Team) met to go over the WFRBA components including proposed action, design criteria/minimization measures, environmental baselines, and effects analysis. Similar consultations completed recently in other regions and other agencies were reviewed for current design features:
  - 2010 Army Corps of Engineers/NMFS Restoration Center Biological Opinion
  - 2014 California Department of Transportation Biological Opinion
  - 2013 Aquatic Restoration BA and BO for USFS, BLM and BIA in Oregon and Washington

- A final Draft BA was submitted on April 22, 2015 with the request for formal consultation and the Forest received a reply from NMFS on May 8, 2015 acknowledging receipt of the BA and the initiation of Formal Consultation timeframes.
- The BA was finalized through a series of weekly meetings (May 27, June 11, June 19, and June 25) to finalize the details of the proposed action, map contents and information necessary to complete the effects section.
    - Changes included adding design features, clarifying proposed activities, referencing recent literature, and grammatical/formatting changes.
    - A complete list of changes between the April 22, 2015 Draft BA and the July 2015 Final BA is available in the files.

II. WATERSHED/FISHERIES RESTORATION PROGRAM

The SRNF proposes to implement watershed and fisheries restoration activities as described under this WFRBA over a 15 year period. The key to successful implementation of the WFRBA is to clearly describe the decision making process and provide evidence on SRNF pattern of practice or track record in successfully implementing projects within the Program decision framework. This section, along with Appendix F, describes the process that projects are implemented under this program consultation and how they would be tracked.

As part of the WFR Program, the following large scale NEPA projects are currently under development and would implement many of the actions described under this WFR Program consultation. These projects have been developed concurrently with this WFRBA and follow the process described below. Additional information, including Project maps, is included in Appendix G both as examples, and because based on where they are in the NEPA process, they are ripe for consultation. Additional projects, including road decommissioning, are being developed through the process described below (including NEPA).

Six Rivers National Forest Aquatic Restoration EA – 2015 to 2030

This project would implement riparian and instream restoration activities designed to meet ESA listed species recovery objectives. This project is currently in the scoping period and, based on a final NEPA decision, would be implemented across the Forest as indicated in Appendix G-1. Activities included in this project are:

- Fish Access to Habitat
- Instream Habitat Enhancement (Large wood, gravel augmentation, beaver habitat restoration)
- Sid-Channel/Off-channel Restoration
- Streambank Restoration
- Riparian Restoration

- Other (reduction of impacts from marijuana grows, mine reclamation, nutrient enhancement)

Smith River National Recreation Area Restoration and Motorized Travel Management DEIS – 2015 to 2030

This project implements the 2005 Travel Management Rule to provide access and recreation opportunities while reducing the risk to ecological resources in the Smith River watershed. This project proposes to reduce existing resource impacts to water quality by restoring drainage patterns, decommissioning roads and storm-proofing remaining road network. This project is due to release the final EIS in late summer 2015 and would be implemented following a final NEPA decision. See description and map in Appendix G-2 for potential actions. Activities included in this project include:

- Reduction/Relocation of Recreation Impacts
- Road and Trail Erosion Control
- Decommissioning Roads

Six Rivers Forest Wide Road Maintenance Proposed CE – 2015 – 2022

This project would authorize maintaining roads across the Forest to provide for safe travels and to reduce the risk of water quality impacts. This project implements a consistent annual review process for ensuring water quality objectives are met during maintaining the road network. This project is awaiting completion of consultation under this programmatic and with USFWS prior to a decision being signed. See the project descriptions in Appendix G-3 for more information.

All maps in this document show the existing road network that would be maintained under current Travel Management decisions. Future Travel Management Decisions (i.e., Smith River National Recreation Area Restoration and Motorized Travel Management FEIS) would reference/incorporate this road maintenance CE and update the road network needing to be maintained.

- Road and Trail Erosion Control
- Reducing the risk of road failure during storm events

Program Description/Project Process

Annual Level 1 Coordination/Tracking

Program administration of WFRBA will be guided by the Local Operating Guidelines – National Marine Fisheries Service (Arcata Office) and Six Rivers National Forest under the 2013 Streamlining MOU (see Appendix F-1). The Local Operating Guidelines were updated March 2015 to include this program level consultation.

The Level 1 team and Watershed and Fisheries Program Manager will meet annually, once at a minimum, or the more typical, once per calendar quarter to review and discuss watershed and aquatic restoration projects planned for implementation during an upcoming work season (Project Notification). The number of times the team meets would be based on the number and complexity of the projects proposed. Not all projects are required to come forward to the Annual

Coordination meeting (see below). This team will also review previous year's work that was undertaken (Project Compliance Tracking) in order to identify any actions that would improve conservation under this Programmatic Consultation or provide additional efficiency and accountability.

Integration of WFRBA components into Project development

Key to the WFR Program is successful implementation of the design criteria. To that end, General Aquatic Conservation Measures and Project Design Criteria (PDC) listed in this WFRBA would be incorporated into the NEPA, contract language, and agreements or force-account implementation plans. All applicable USFS Pacific Southwest Region Best Management Practices will be implemented for land disturbing activities or projects that may impact water quality (LRMP S&G IV-71). Project biologists and hydrologist ensure this by reviewing NEPA decisions, draft contracts and agreements prior to awarding.

Relationship between the WFRBA and NEPA and the Notification Process

During the NEPA analysis, the site specific effects of individual actions would be documented for tracking purposes – both for recovery and any potential "take". This would occur for individual projects under the large scale NEPA above and for the individual NEPA projects that would come under this consultation.

Project activities would be run through the following criteria (from the Analytic Process, NMFS 2004)[2] to determine where impacts had a probability of occurring. Using these criteria (or similar), each individual activity under this WFRBA can be demonstrated to have a range of activities from "no effect" to "may affect likely to adversely affect" depending on the following:

- **Proximity** ~ the geographic relationship between the project element or action and the species and their habitat. Activities under this WFBA range from being within TES anadromous salmonid habitat (instream enhancement) to upslope actions designed to reduce impacts or lower risk of impacts occurring (road decommissioning/road maintenance).
- **Probability** ~ the likelihood that the species or habitat will be exposed to the biotic or abiotic effects of the project elements. Actions that have a higher probability of delivering sediment into the stream system (hydrological connectivity) would have a higher probability of causing an effect. Once that sediment enters the stream channel, the distance to anadromous habitat (as indicated on map) can be determined. Other considerations in determining if an effect could occur are the number of individuals present and the condition of the watershed (environmental baseline).
- **Magnitude, Duration and Timing** ~ the severity and intensity of the effect (level of response to a stressor), how long the activity may impact (press/pulse effect) and the life stage at which the impact may be felt.

[2] The process described here is an example of the analysis necessary to make a determination of effects on listed species. Other analysis (matrix of pathways and indicators, stress-response, FSM 2670) can be used in the site specific analyses that tier to this WFRBA as long as it meets the requirements of law, policy and regulation.

If the activity is proximal to TE fish habitat and the outcome of the Probability step is not entirely discountable or insignificant, determine the severity and intensity of the effect to habitat components and TE fish. Consider the limits established for each activity and watershed to reduce the likelihood multiple activities would result in cumulative impacts occurring.

Project Notification Guidance

The following is guidance on when projects should be brought forward to the Annual Coordination Meeting for pre-implementation review and when projects, especially recovery actions, would be shared.

Notification Not Required

Projects that have either no effect or an extremely low anticipated effect to listed species and their habitat would not need to be brought forward during the annual Level 1 meeting; however, consistency with this BA would be documented via the NEPA decision or, in the case of the multi-year NEPA decisions above, the tracking/compliance process identified within (see "Multi-year Program NEPA" section below).

- Projects that are determined to be a no effect to listed salmonid species or their habitat (NE).
- Projects that have an extremely low anticipated effect based on type of project and distance to habitat (proximity). These projects may be brought forward to the Annual Level 1 coordination meeting at the request of Level 1 team.
- These types of projects are typically not claimed as watershed or fisheries accomplishments for TEP salmonids, although other benefits may be present.

Notification Not Required Prior to Implementation

Projects that may have some insignificant or discountable level of effect, positive or negative, and do not result in take of a listed species or adverse effects to critical habitat. Projects may be located within or near listed species habitat. These projects do not require notification prior to construction but would require tracking by watershed and would be shared at the annual Level 1 meeting for tracking recovery activities.

- Projects that are entirely beneficial (NLAA).
- Projects that may result in some level of effect from short term minor sediment delivery, species disturbance, however, the changes to habitat or disturbance to species were determined to be insignificant or discountable (NLAA) and project results in a long term benefit to aquatic ecosystems.
- Typically these are projects that are claimed as a watershed or fisheries accomplishment for water quality or TE fish habitat improvements.

Notification Required Prior to Implementation

Projects that have the potential (based on proximity, probability and magnitude analysis or stressor/response analysis) to result in a "may affect, likely to adversely affect" determination

to listed species or designated habitat would require notification prior to construction (typically at the Annual Coordination Meeting) and completion of post-project reporting.

- Any project that involves listed fish handling or potential for harm (e.g., displacement, etc.) to occur due to type of action and/or actions occurring near or within occupied habitat.
- Projects that may result in a short term minor sediment delivery or turbidity, temporary change in flow conditions, species disturbance, where the changes to habitat or disturbance to species cannot be discounted and project results in a long term benefit to aquatic ecosystems.
- Projects that may involve temporary change in flow conditions, or, in the case of improving water diversion locations, involve setting minimum flows that could affect fish movement or cool water Refugia.
- Any project that involves full spanning structures or engineered projects in listed fish habitat.

Projects that result in a solely negative effect could not tier to this WFRBA and would require separate consultation.

Project Notification Information

The following information should be provided prior to the Annual Level 1 Coordination meeting. The need for post project compliance monitoring would be identified based on the information provided during project notification. An example Project Notification Form is provided in Appendix F-2, however as long as the following information is provided, the form is not required:

a. Project Name – Use the same project name from notification to completion (i.e., Jones Creek 2015 Culvert replacement).
b. NEPA Document Name and Date
c. Location – watershed/stream name, and latitude and longitude (decimal degrees) or map
d. Forest Service Contact – Agency and project lead name
e. Timing – Project start and end dates, potential need for Outside NOS notification to NMFS
f. Activity Type – As listed in this WFRBA
g. Project Description – Brief narrative of the project and objectives
h. Extent – Number of stream miles or acres to be treated and miles of habitat benefited
i. Fish Information
    i. Species Affected
    ii. Distance to occupied habitat?
    iii. Fish handling required? (seining/block net/electrofishing/dewatering)
j. Verification –Verification that all appropriate General Aquatic Conservation Measures, Project Design Criteria for WFR activities have been thoroughly reviewed and will be incorporated into project design, implementation, and monitoring as appropriate based on

project specifics. The Level 1 team may request additional verification dependent on the scope and scale of the project.

k. Variances (see page 23):
   i. cite the restoration activity and the design feature that needs variance
   ii. define the requested variance
   iii. explain why the variance is necessary
   iv. provide rationale why variance will either provide an equal conservation benefit or, at a minimum, not cause additional adverse effects that are not described in this BA or associated BO.
l. Effects Determination of project (See Appendix F-3)
m. Project lead fish biologist's signature

Multi-year Program NEPA

For the multiple year NEPA projects implementing any of the suite of restoration activities, the Annual Coordination meeting would serve as a checkpoint for continued compliance with the design criteria and salmonid minimization measures. If changes to the project need to occur or the specific project results in impacts different than those analyzed in this assessment this annual process would identify the need to re-initiate. Appendix G contains the three multi-year NEPA projects along with a description of how they will follow this consultation process.

Minor Variance Process

Because of the wide range of proposed activities and the natural variability within and between stream systems, some projects may require minor variations from project design criteria specified herein. Criteria that are also identified as LRMP Standards and Guidelines cannot be changed or modified without a plan amendment, and therefore cannot occur as part of this consultation. Best Management Practices would always be implemented to meet obligations under the Waiver and Clean Water Act. SRNF proposes the following variance process when the variance provides equal or greater conservation benefit, and does not result in effects that were not analyzed during consultation. Minor variance requests must be documented (i. e., Project Notification Form) and include the following information:

1. cite the restoration activity and the design feature that needs variance
2. define the requested variance
3. explain why the variance is necessary
4. provide a rationale why the variance will either provide a conservation benefit or, at a minimum, not cause additional adverse effects

Variances that do not result in an effect to listed salmonids (i.e., following or not following a minimization measure would have no effect positive or negative) would be documented as such in the project record (Appendix F-2).

Project Implementation

All projects that fall under this WFR Program BA would not be implemented until the NEPA process has been completed and a decision signed by the appropriate line officer, or as indicated

in the multi-year NEPA proposed action description. The signature indicates the line officer has determined that the project has been thoroughly vetted through the IDT process, public input sought and considered, tribal consultation completed and partnering agencies concurrence sought based on level of impacts. Any ground disturbing project with the potential to generate sediment would not be implemented on the ground until a letter from the North Coast Water Quality Board has been received stating the project was compliant with the Waiver and therefore, meets the CWA. Implementation of the project would be accomplished through a myriad of means depending on the scope and scale of the project including partnerships, contracting or Forest Service personnel.

All contracts and agreements would have the project appropriate general aquatic conservation measures and project design features included. Projects require oversight by Forest Service biologists or hydrologists to insure actions are carried out as planned, and to coordinate efforts in the event of unexpected situations. However, the level of oversight in any one project is commensurate with the potential or increased risk of negative effects occurring to listed salmonids and water quality.

NEPA Requirements for Consideration of New Information Post Decision

Supplemental Information Reports (FSH 1909.15 Chapter 10. section 18) are completed for signed NEPA documents when new information or changed circumstances relating to the environmental impacts of a proposed action come to the attention of the responsible official after a decision has been made and prior to completion of the approved program or project. IDT review by hydrologists and biologists would provide another feedback loop for ensuring consistency with this WFRBA.

Project/Program Monitoring and Reporting

The Forest will monitor projects implemented under the WFR Program as part of existing requirements to report on Forest accomplishments and monitoring efforts. In order to monitor the effects, both positive and negative, to the protected ESUs, DPSs and critical habitats over the life of the Program, and to track incidental take of listed species, the Forest would share existing monitoring report/accomplishment tracking processes with NMFS at the Annual Coordination meeting and through official correspondence (see Appendix D) for additional information on monitoring). These reports include:

- **Annual Level 1 Coordination Meeting –** as described in the Local Operating Guidelines and above, the annual Level 1 meeting would review projects accomplished the previous year and those proposed in the upcoming year.
- **Quality Assurance Protection Plan and Annual Reports –** required by (North Coast Water Quality Control Board) and include BMPEP monitoring as well as other water quality monitoring results. 2012-2014 Report provided in Appendix D.)
- **Watershed Improvement Tracking –** Annual geo-referenced accomplishment reporting system of stream miles improved, roads decommissioned, or any other actions done to benefit watershed and aquatic ecosystems.
- **Northwest Forest Plan Aquatic and Riparian Monitoring Program Reports –** this monitoring program is at the scale of the Northwest Forest Plan/Range of the

Northern Spotted Owl and is designed to track changes due to implementation of the Aquatic Conservation Strategy Objectives.

Project Activities and Design Criteria

Watershed and Aquatic Restoration projects are designed to reduce existing threats and stresses while avoiding or minimizing any potential long or short-term negative impacts.

This section identifies the **General Aquatic Conservation Measures (ACM**) that are intended to minimize effects to the aquatic environment followed by the activity specific **Project Design Criteria (PDC)** that are specific to the identified watershed and aquatic restoration activities. The ACM and PDC were developed to minimize adverse effects to the aquatic environment and ESA-listed fish and their designated Critical Habitat as well as MSA habitats. These Design Criteria may be supplemented by the most recent version of California Department of Fish and Wildlife's Fisheries Restoration Grant Program minimization measures.

General Aquatic Conservation Measures

Technical Skill and Planning Requirements

1. Ensure that an experienced fisheries biologist or hydrologist is involved in the design of all projects covered by this WFRBA. The experience should be commensurate with technical requirements of a project.
2. Planning and design includes field evaluations and site-specific surveys, which may include reference reach evaluations that describe the appropriate geomorphic context in which to design and implement the project. Planning and design involves appropriate expertise from staff or experienced technicians (e.g., fisheries biologist, hydrologist, geomorphologist, wildlife biologist, botanist, engineer, silviculturist.)
3. Review current restoration manuals (e.g.,CDFW restoration manual available on line: www.dfg.ca.gov/fish/resources/habitatmanual.asp) and literature for best available information and monitoring results on restoration techniques.
4. Best Management Practices will be implemented on a site-specific basis during project-level NEPA. The appropriate BMPs necessary to protect or improve water quality and the methods and techniques of implementing the BMPs are identified at the time of this on-site, project-specific assessment. BMPs will be incorporated into implementation documents (LRMP IV-71, App M-1)
5. The project fisheries biologist/hydrologist will ensure that project design criteria are incorporated into implementation contracts. If a biologist or hydrologist is not the Contracting Officers Representative (COR), then the biologist or hydrologist must regularly coordinate with the project COR to ensure the project design criteria and conservation measures are being followed.

Resource Surveys

Fisheries, Hydrology, Geomorphology, Wildlife, Botany, and Cultural surveys are those in support of Aquatic Restoration and include assessments and monitoring projects that could or are associated with planning, implementation, and monitoring of aquatic restoration projects covered by this WFRBA. Such support projects may include surveys to document the following aquatic and riparian attributes: fish habitat, hydrology, channel geomorphology, water quality, fish spawning, fish presence, macro invertebrates, riparian vegetation, wildlife, and cultural resources. This also includes effectiveness monitoring associated with projects implemented under this consultation.

1. Train resource personnel in survey methods to prevent or minimize disturbance of fish when survey protocols occur adjacent to occupied habitat.
2. Avoid impacts to fish redds.
3. Coordinate with other local agencies to prevent redundant surveys.

Climate Change

Climate change has been identified as a threat to recovery of listed salmonids in the 2014 SONCC Recovery Plan. Climate Change is expected to detrimentally affect SONCC coho salmon in freshwater habitats. Climate change will likely alter water runoff patterns (Kiparsky and Gleick 2003) lower summer flows (Barr et al. 2010), and more intense storms that will increase peak flows. Furniss et al. (2013) describe the most effective response to the changing climate is a renewed commitment to watershed restoration. Habitat restoration can play an important role in offsetting the effects of climate change, although our results suggest that most expected climate impacts cannot be mitigated entirely (Battin et. al 2008, Beechie et al. 2010). Consider climate change information, such as predictive hydrographs for a given watershed or region, when designing projects under the WFR Program.

Lamprey

To the extent possible, incorporate lamprey BMPs found in Best Management Practices to Minimize Adverse Effects to Pacific Lamprey, *Entosphenus tridentatus* (USFWS 2010). Implementing salmonid restoration activities should not result in a reduction of lamprey habitat quantity and quality in a watershed.

Work Periods/Timing

Sediment: Individual projects with the potential to generate sediment under the WFRBA will typically be implemented annually during the Normal Operating Season (between June 15 and November 1[3]) or first significant rainfall, whichever comes first. Actual project start and end dates are based on weather predictions and rainfall predictions. The work window can be extended to November 15 contingent on appropriate dry weather conditions and stream flows. Extensions will be initiated on an as needed basis and as agreed upon by NMFS as documented on the Notification Form.

[3] FRGP instream work period

SRNF will monitor weather and stream flows during fall months, using all appropriate tools, such as the fall, low flow season emails and phone calls with National Weather Service. Projects will end early if needed.

Flows: Instream projects in occupied habitat should consider flow levels and life history stage when implementing projects with heavy equipment. Instream projects will occur during times of low stream flow, which typically occurs during summer and early fall months.

Other: Limited Operating Periods for wildlife species would be implemented according to the NEPA process.

Site Assessment for Contaminants

In developed or previously developed sites, such as areas with past dredge mines, or illegal marijuana cleanup locations, a site assessment for contaminants will be conducted on projects that involve excavation of > 20 cubic yards of material where in proximity to TEP salmonid habitat. SRNF will complete a site assessment to identify the type, quantity, and extent of any potential contamination.

Site Preparation

1. Flagging Sensitive Areas – Prior to construction, flag critical riparian vegetation areas, wetlands, and other sensitive sites to minimize ground disturbance.
2. Staging Area– Establish staging areas for storage of vehicles, equipment, and fuels to minimize erosion into or contamination of streams and floodplains.
    a. No Topographical Restrictions – place staging area outside riparian reserves where topography does not restrict such a distance.
    b. Topographical Restrictions –place staging area away from any natural water body or wetland to the greatest extent possible in areas with high topographical restriction, such as constricted valley types.
3. Temporary Erosion Controls – Place sediment barriers prior to construction around sites where significant levels of erosion may enter the stream directly or through road ditches. Temporary erosion controls will be in place before any significant alteration of the action site and will be removed once the site has been stabilized following construction activities.
4. Stockpile Materials – Minimize clearing and grubbing activities when preparing staging, project, and or stockpile areas. Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration. Materials used for implementation of aquatic restoration categories (e.g., large wood, boulders, fencing material etc.) may be staged within the 100-year floodplain.
5. Hazard Trees –The Six Rivers National Forest has adopted the April 2012 Region 5 document (report #RO-12-01), titled *Hazard Tree Guidelines for Forest Service Facilities and Roads in the Pacific Southwest Region* for all projects containing hazards tree abatement components. Where appropriate, include hazard tree removal (amount and type) in project design. Fell hazard trees within riparian areas when they pose a safety

risk. If possible, fell trees towards a stream. Keep felled trees on site when needed to meet coarse woody debris objectives (LRMP IV-46).

Heavy Equipment Use

Heavy equipment will be commensurate with the project and operated in a manner that minimizes adverse effects to the environment (e.g., minimally-sized, low pressure tires, minimal hard turn paths for tracked vehicles, temporary mats or plates within wet areas or sensitive soils). These GACM for using heavy equipment include design features for working in stream, fueling locations, road – related activities including water drafting, and considerations for noise (pile driving).

1. **Work from Top of Bank** – To the extent feasible, heavy equipment will work from the top of the bank, unless work from another location (instream) would result in less habitat disturbance, less floodplain disturbance, and/or better meet WFRBA design criteria. In another way, operate heavy equipment in streams only when project specialists believe that such actions are the only reasonable alternative for implementation, or would result in less sediment in the stream channel or damage (short- or long-term) to the overall aquatic and riparian ecosystem relative to other alternatives.
    a. Use of heavy equipment in the wetted channel will be minimized and only occur after all salmonid species have emerged from the gravels and have sufficient flee response (post June 30 for steelhead).
2. **Fueling and Cleaning and Inspection for Petroleum Products and Invasive Weeds**
    a. All equipment used for instream work will be cleaned for petroleum accumulations, dirt, plant material (to prevent the spread of noxious weeds), and leaks repaired prior to entering the project area. Such equipment includes large machinery, stationary power equipment (e.g., generators, canes, etc.), and gas-powered equipment with tanks larger than five gallons.
    b. Store and fuel equipment in staging areas after daily use.
    c. Inspect daily for fluid leaks before leaving the vehicle staging area for operation.
    d. Thoroughly clean equipment before operation below ordinary high water or within 50 feet of any natural water body or areas that drain directly to streams or wetlands and as often as necessary during operation to remain grease free.
    e. List and describe any hazardous material that would be used at the project site, including specific clean-up and disposal instructions for different products available on the site; proposed methods for disposal of spilled material; and employee training for spill containment.
3. **Temporary Access Roads** – Existing roadways or travel paths will be used whenever possible. Minimize the number of temporary access roads to lessen soil disturbance and compaction and impacts to vegetation.
    a. Temporary access roads will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure.

   b. Temporary access roads will be obliterated and/or revegetated.
   c. Temporary roads in wet or flooded areas will be restored by the end of the applicable in-water work period.
   d. Construction of new permanent roads is not permitted.
4. **Stream Crossings** – Minimize number and length of stream crossings. Such crossings will be at right angles and avoid potential spawning areas to the greatest extent possible. Stream crossings shall not increase the risk of channel re-routing at low and high water conditions. After project completion, temporary stream crossings will be abandoned and the stream channel and banks restored.
5. **Water Drafting -** Water drafting will occur at existing water drafting sites (locations are shown on maps in Appendix A). The design features below will be implemented to minimize effects of water drafting on sediment and aquatic species including the following:
   a. Draft water only at designated water drafting sites, with preference given to non-fish-bearing tributaries and no modification/ improvement of drafting sites in TEP habitat would occur;
   b. Coordinate with SRNF fisheries biologists so effects to thermal Refugia, fish holding areas, or spawning habitat are avoided;
   c. Water drafting by more than one truck shall not occur simultaneously;
   d. Rock and gravel will be applied to drafting sites if it is needed to prevent stream sedimentation, including rocking the approach to prevent sedimentation. Water drafting sites located in non-fish-bearing waters only may include minor instream modification;
   e. When drafting from waters designated as critical habitat, implement NMFS Fisheries Water Drafting Specifications (2001) and implement Forest Service BMPs outside of CH.
      i. Intakes will be screened with 3/32" mesh for rounded or square openings, or 1/16" mesh for slotted openings. When in habitat potentially occupied by steelhead trout, intakes will be screened with 1/8" mesh size. Wetted surface area of the screen or fish-exclusion device shall be proportional to the pump rate to ensure that water velocity at the screen surface does not exceed 0.33 feet/second.
      ii. Fish screen will be placed parallel to flow.
      iii. Pumping rate will not exceed 350 gallons-per-minute or 10% of the flow of the anadromous stream drafted from.
      iv. Pumping will be terminated when tank is full.
   f. To prevent petroleum products from entering stream channel, vehicles would be inspected for leaks and use of absorbent pads may be required.
6. **Timely Completion** – Minimize time in which heavy equipment is in stream channels, riparian areas, and wetlands. Complete earthwork (including drilling, excavation,

dredging, filling and compacting) as quickly as possible. During excavation, stockpile native streambed materials above the bankfull elevation, where it cannot reenter the stream, for later use.

Ensuring Fish Passage during Restoration Activities

Fish passage will be provided for any adult or juvenile fish likely to be present in the action area during instream construction, unless passage did not exist before construction, stream isolation and dewatering is required during project implementation (below), or where the stream reach is naturally impassible at the time of construction. After construction, adult and juvenile passage that meets NMFS's fish passage criteria (NMFS 2011a) will be provided for the life of the action. See Activity-specific design features below.

Fish Handling - Work Area Isolation & Fish Capture and Release

When activities occur in occupied habitat and it is determined that removing of listed salmonids would result in less of an effect, isolate the construction area and remove fish from a project site for projects that include concentrated and major excavation at a single location within the stream channel. The need for work isolation and fish handling would be identified at the annual coordination meeting and would typically include fish passage and activities that would impact the entire channel width (such as Legacy Structure Removal; and any log or boulder full spanning weir construction).

Few projects of this scale are anticipated under this WFRBA and outside funding would be required. These funding sources (NOAA, CDFW) typically have their own requirements for fish capture and release, including electrofishing guidelines. This WFRBA identifies one fish handling effort for three populations of SONCC coho salmon: Smith, Middle Klamath, and Lower Trinity as these are the places where the likelihood of fish handling is the greatest.

Dewatering Construction Site – Fish bearing locations

When dewatering is necessary to protect species and/or critical habitat, divert flow around the construction site with a coffer dam (built with non-erosive materials) and an associated pump, a by-pass culvert, or a water-proof lined diversion ditch. Diversion sandbags can be filled with material mined from the floodplain as long as such material is replaced at end of project. Small amounts of instream material can be moved to help seal and secure diversion structures. Dissipate flow energy at the bypass outflow to prevent damage to riparian vegetation or stream channel. If diversion allows for downstream fish passage, place diversion outlet in a location to promote safe reentry of fish into the stream channel, preferably into pool habitat with cover. When necessary, pump seepage water from the de-watered work area to a temporary storage and treatment site or into upland areas and allow water to filter through vegetation prior to reentering the stream channel.

1. For the dewatering of a work site a fish screen must be used on the pump intake to avoid juvenile fish entrainment that meets criteria specified by NMFS (2011, or most recent version).
2. Stream Re-watering – Upon project completion, slowly re-water the construction site to prevent loss of surface water downstream as the construction site streambed absorbs

water and to prevent a sudden increase in stream turbidity. Monitor downstream during re-watering to prevent stranding of aquatic organisms below the construction site.

Site Restoration

Upon project completion, rehabilitate all disturbed areas in a manner that results in similar or better than pre-work conditions through removal of project related waste, spreading of stockpiled materials (soil, large wood, trees, etc.) seeding, and/or planting with local native seed mixes or plants.

1. Short-term Stabilization – Measures may include the use of non-native sterile seed mix (when native seeds are not available), weed-free certified straw, jute matting, and other similar techniques. Short-term stabilization measures will be maintained until permanent erosion control measures are effective. Stabilization measures will be instigated within three days of construction completion.
2. Revegetation – Replant each area requiring vegetation prior to or at the beginning of the first growing season following construction. Achieve re-establishment of vegetation in disturbed areas to at least 70% of pre-project levels within three years. Use an appropriate mix of species that will achieve establishment and erosion control objectives, preferably forb, grass, shrub, or tree species native to the project area or region and appropriate to the site. All riparian plantings shall use native plants as approved by Forest Botanist. Barriers will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
3. Decompact Soils – When necessary, loosen compacted areas, such as access roads and paths, stream crossings, staging, and stockpile areas.

Monitoring

Project specific monitoring would be outlined during project NEPA or during Annual Coordination Level 1 meeting. Projects identified could include the following follows:

1. Implementation - General
   a. Visually monitor during project implementation to ensure effects are not greater (amount, extent) than anticipated and to contact Level 1 representatives if problems arise.
   b. Fix any problems that arise during project implementation.
   c. Regular biologist/hydrologist coordination with COR if biologist/hydrologist is not always on site to ensure contractor is following all stipulations.
   d. Water Quality Checklists for Category B type projects under the Waiver
   e. **Fish Mortality during Project Implementation -** If a sick, injured, or dead specimen of a threatened or endangered species is found in the project area, the finder must notify NMFS through the contact person identified in the transmittal letter for this opinion and follow any instructions. If the proposed action may worsen the fish's condition before NMFS can be contacted, the finder should attempt to move the fish

to a suitable location near the capture site while keeping the fish in the water and reducing its stress as much as possible. Do not disturb the fish after it has been moved. If the fish is dead, or dies while being captured or moved, report the following information: (a) NMFS consultation number; (b) the date, time, and location of discovery; (c) a brief description of circumstances and any information that may show the cause of death; and (d) photographs of the fish and where it was found. The NMFS also suggests that the finder coordinate with local biologists to recover any tags or other relevant research information. If the specimen is not needed by local biologists for tag recovery or by NMFS for analysis, the specimen should be returned to the water in which it was found, or otherwise discarded.

2. Post Project – For those projects identified during the Annual Coordination Meeting, a post-project review shall be conducted after winter and spring high flows as identified on the Project Tracking Form.
   a. For each project, conduct a walk through/visual observation to determine if there are post-project effects that were not considered during consultation.
   b. In cases where remedial action is required, such actions are permitted without additional consultation if they use relevant PDCs and ACMs and the effects of BO programmatic actions are not exceeded.

Activity Specific Project Design Criteria

Fish Access to Habitat/ Habitat Connectivity

Road Related Fish Passage: Based on the location of the Forest road system, there are no known road crossings that are preventing salmonid migration upstream, however, barriers may exist on private land that could be addressed under the Wyden Agreement. Potential actions includes the following: total removal of culverts or bridges, or replacing culverts or bridges with properly sized culverts and bridges, replacing a damaged culvert or bridge, and resetting an existing culvert that was improperly installed or damaged; stabilizing and providing passage over headcuts; removing, constructing (including relocations), repairing, or maintaining fish ladders; and replacing, relocating, or constructing fish screens and diversions.

- gradient control weirs upstream or downstream of barriers to control water velocity, water surface elevation, or provide sufficient pool habitat to facilitate jumps, or
- interior baffles or weirs to mediate velocity and the increased water depth.

Other Passage Activities: Natural barriers (i.e. boulder barriers that move during high flows) exist that in the past have allowed for salmon and steelhead passage would be considered for improvement. This proposed action would consider non-salmonid fish passage issues for other aquatic species including Pacific lamprey and salamanders. Modifying partial barriers formed by previously constructed instream structures are described below under "*Existing or Legacy Structure Improvements or Removal.*" Barrier modification projects are intended to improve passage by:

- providing or improving access to refugia during summer months,

- increasing the duration of accessibility (both within and between years).
- improving low flow barriers and log jam modifications to facilitate juvenile and adult fish passage, including at existing/historic instream restoration sites.

Habitat Connectivity: In addition to barriers to fish migration up and down stream, restoration activities reconnect stream corridors and allow the downstream movement of wood, macro invertebrates and other necessary components of a healthy stream system. This activity is primarily accomplished through culvert removal during decommissioning and to some extent, upgrading during road maintenance.

Implementing these types of projects may require the use of heavy equipment (*e.g.*, self-propelled logging yarders, mechanical excavators, backhoes); however, hand labor will be used when possible.

Design Features:

- See NMFS Fish Passage guidance (Appendix B-4)
- Fish Xing software is consulted

Instream habitat enhancement

Increasing instream cover and complexity for juvenile survival and spawning success are intended to provide predator escape and resting cover, increase spawning and rearing habitat, improve migration corridors, improve pool to riffle ratios, and add habitat complexity and diversity. Specific techniques for instream habitat improvement include:

- Placing large woody debris (LW) in the stream channel to enhance pool formation and increase stream channel complexity. Projects will include both anchored (engineered log jams) and unanchored logs, depending on site conditions and wood availability. LW placed in streams without cabling would allow for natural distribution of wood in the channel. LW sources are described below.
- Placing new boulders in stream channel to provide cover and scour opportunities (boulder clusters, deflectors)
- Maintaining and improving historic instream enhancement sites through reconstruction or addition of LW. This could include:
  - Addressing low flow barriers in old weirs by adding low flow notches or reconfiguring boulders or logs.
- Placement of imported spawning gravel.
- Restoration of habitat to support beaver populations

These projects will occur in stream channels and adjacent floodplains to increase channel stability, rearing habitat, pool formation, spawning gravel deposition, channel complexity, hiding cover, low velocity areas, and floodplain function. Equipment such as helicopters, excavators, dump trucks, front-end loaders, full-suspension yarders, and similar equipment may be used to implement projects.

Large Wood and Boulder Projects

Sources of Trees for Instream Work

Large wood could come from existing riparian wood sources - spanner logs dropped into channel, moving downed LW from adjacent riparian areas, cutting and falling individual trees into channel:

- Live conifers and other trees can be felled or pulled/pushed over in the riparian area and upland areas for in-channel large wood placement only when conifers and trees are fully stocked and fall within Wildlife consultation documents.
    a. Tree felling shall not create excessive stream bank erosion or increase the likelihood of channel avulsion during high flows.
    b. Canopy cover would not be reduced based individual tree selection from riparian areas therefore no change to stream temperatures would be anticipated.

Large wood could also come from off-site sources and be brought in via trucks or helicopters.

- Danger trees and trees killed through fire, insects, disease, blow-down and other means can be felled and used for in-channel placement regardless of live-tree stocking levels.
- Trees from other management activities may be stock piled for future instream restoration projects. The removal and stockpiling of these trees would be analyzed under a separate project.
- Downed trees from clearings made for illegal marijuana grows.

Design Features

1. Place LW and boulders in areas where they would naturally occur and in a manner that closely mimic natural accumulations for that particular stream type. For example, boulder placement may not be appropriate in low-gradient meadow streams.
2. Structure types shall simulate disturbance events to the greatest degree possible and include, but are not limited to, log jams (see engineered log jams below), debris flows, wind-throw, and tree breakage.
3. No limits are to be placed on the size or shape of structures as long as such structures are within the range of natural variability of a given location and do not block fish passage.
4. The partial burial of LW and boulders is permitted and may constitute the dominant means of placement. This applies to all stream systems but more so for larger stream systems where use of adjacent riparian trees or channel features is not feasible or does not provide the full stability desired.
5. LW includes whole conifer and hardwood trees, logs, and rootwads. LW size (diameter and length) should account for bankfull width and stream discharge rates. When available, trees with rootwads should be a minimum of 1.5x bankfull channel width, while logs without rootwads should be a minimum of 2.0 x bankfull width.
6. Structures may partially or completely span stream channels or be positioned along stream banks. See engineered log jams and boulder weirs for additional design features)
7. Stabilizing or key pieces of LW must be intact, hard, with little decay, and if possible have root wads (untrimmed) to provide functional refugia habitat for fish. Consider

orienting key pieces such that the hydraulic forces upon the large wood increases stability.

8. Anchoring Large Wood – Anchoring alternatives may be used in preferential order:
    a. use of adequate sized wood sufficient for stability
    b. orient and place wood in such a way that movement is limited
    c. ballast (gravel and/or rock) to increase the mass of the structure to resist movement
    d. use of large boulders as anchor points for the LW
    e. Pin LW with rebar to large rock to increase its weight. For streams that are entrenched or for other streams with very low width to depth ratios (<12) an additional 60% ballast weight may be necessary due to greater flow depths and higher velocities.

Engineered Log jam (ELJs)

These are structures designed to redirect flow and change scour and deposition patterns. To the extent practical, they are patterned after stable natural log jams and can be either unanchored or anchored in place using rebar, rock, or piles. These log jams create a hydraulic shadow, a low-velocity zone downstream that allows sediment to settle out. Scour holes develop adjacent to the log jam. While providing valuable fish and wildlife habitat they also redirect flow and can provide stability to a streambank or downstream gravel bar. Designing these projects will require an interdisciplinary team of biologists, hydrologists, geologists and engineers.

1. ELJs will be patterned, to the greatest degree possible, after stable natural log jams.
2. Grade control ELJs are designed to arrest channel downcutting or incision by providing a grade control that retains sediment, lowers stream energy, and increases water elevations to reconnect floodplain habitat and diffuse downstream flood peaks.
3. Stabilizing or key pieces of LW that will be relied on to provide streambank stability or redirect flows must be intact, solid (little decay). If possible, acquire LW with untrimmed rootwads to provide functional refugia habitat for fish.
4. When available, trees with rootwads attached should be a minimum length of 1.5 times the bankfull channel width, while logs without rootwads should be a minimum of 2.0 times the bankfull width.
5. The partial burial of LW and boulders may constitute the dominant means of placement, and key boulders (footings) or LW can be buried into the stream bank or channel
6. Angle and Offset – The LW portions of engineered log jam structures should be oriented such that the forces upon the large wood increases stability. If a rootwad is left exposed to the flow, the bole placed into the streambank should be oriented downstream parallel to the flow direction so the pressure on the rootwad pushes the bole into the streambank and bed. Wood members that are oriented parallel to flow are more stable than members oriented at 45 or 90 degrees to the flow.
7. If LW anchoring is required, a variety of methods may be used. These include buttressing the wood between riparian trees, the use of manila, sisal or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, such as

rebar pinning or bolted connections, may be used. Rock may be used for ballast but is limited to that needed to anchor the LW.

Boulder Weirs

1. Full channel spanning boulder weirs are to be installed only in highly uniform, incised, bedrock-dominated channels to enhance or provide fish habitat in stream reaches where log placements are not practicable due to channel conditions (not feasible to place logs of sufficient length, bedrock dominated channels, deeply incised channels, artificially constrained reaches, etc.), where damage to infrastructure on public or private lands is of concern, or where private landowners will not allow log placements due to concerns about damage to their streambanks or property.
2. Install boulder weirs low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).
3. Boulder weirs are to be placed diagonally across the channel or in more traditional upstream pointing "V" or "U" configurations with the apex oriented upstream.
4. Boulder weirs are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream. Plunges shall be kept less than 6" in height.
5. The use of gabions, cable, or other means to prevent the movement of individual boulders in a boulder weir is not allowed.
6. Rock for boulder weirs shall be durable and of suitable quality to assure long-term stability in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.
7. The project designer or an inspector experienced in these structures should be present during installation.
8. Full spanning boulder weir placement should be coupled with measures to improve habitat complexity and protection of riparian areas to provide long-term inputs of LW.

Gravel Augmentation

Design Features

1. Gravel can be placed directly into the stream channel, at tributary junctions, or other areas in a manner that mimics natural debris flows and erosion.
2. Augmentation will only occur in areas where the natural supply has been eliminated, significantly reduced through anthropogenic disruptions, or used to initiate gravel accumulations in conjunction with other projects, such as simulated log jams and debris flows.
3. Gravel to be placed in streams shall be a properly sized gradation for that stream, clean, and non-angular. When possible use gravel of the same lithology as found in the watershed. Reference the Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings to determine gravel sizes appropriate for the stream. This manual can be found at the following location: http://stream.fs.fed.us/fishxing/aop_pdfs.html
4. Gravel can be mined from the floodplain at elevations above bankfull. Crushed rock is not permitted.
5. After gravel placement in areas accessible to higher stream flow, allow the stream to naturally sort and distribute the material.

6. Do not place gravel directly on bars and riffles that are known spawning areas, which may cause fish to spawn on the unsorted and unstable gravel, thus potentially resulting in redd destruction.
7. Imported gravel must be free of invasive species and non-native seeds. If necessary, wash gravel prior to placement.

Existing or Legacy Structure Improvements or Removal

Projects will be implemented to reconnect stream corridors, floodplains, and estuaries, reestablish wetlands, improve aquatic organism passage, and restore more natural channel and flow conditions. This includes removal or modifying channel-spanning weirs and existing habitat structures as needed to restore fish passage and improve instream conditions. Projects involving earthen embankments, subsurface drainage features, outfalls, pipes, instream flow redirection structures (e.g., drop structure, gabion, groin), or similar devices used to control, discharge, or maintain water levels would be improved. These existing water diversions are operated through special use permits. Equipment such as excavators, bull dozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Improvement of Legacy Structures Design Features

This action includes modification of past projects and includes adding components to exiting locations and modifying those legacy structures that are no longer functioning properly (i.e. log weirs that have undercut and may be a low flow barrier to juvenile salmonids). Design criteria for instream structure work as described above would apply to modification.

Existing Water Diversion improvements: Water diversions on the forest typically are a result of a Special Use Permit for the infrastructure crossing FS lands. Improvements to these historic diversion sites could result in decreased impacts to water quality and potentially water quantity. No new diversions would be approved under this consultation.

1. Diversion structures—associated with points of diversion and future fish screens—must pass all life stages of T&E aquatic species that historically used the affected aquatic habitat.
2. Diversions that involve setting minimum flows that could affect fish movement or cool water refugia may be outside the scope of this consultation as determined during project notification at the Annual Coordination Meeting.
3. Water diversion intake and return points must be designed (to the greatest degree possible) to prevent all native fish life stages from swimming or being entrained into the diversion. NMFS fish screen criteria (Appendix B-4) would apply in TE and FSS salmonid habitat.
4. Abandoned ditches and other similar structures will be plugged or backfilled, as appropriate, to prevent fish from swimming or being entrained into them.
5. When making improvements to pressurized diversions, install a totalizing flow meter capable of measuring rate and duty of water use. For non-pressurized systems, install a staff gage or other measuring device capable of measuring instantaneous rate of water flow.
6. Multiple existing diversions may be consolidated into one diversion as long as there is new instream construction or structures and if the consolidated diversion is located at the most downstream existing barrier.

7. Conversion of instream diversions to groundwater wells will only be used in circumstances where there is an agreement to ensure that any surface water made available for instream flows is protected from surface withdrawal by another water-user.

Removal of Legacy Structures Design Features

This action includes the removal of past projects, such as large wood, boulder, rock gabions, and other in-channel and floodplain structures.

1. If the structure being removed contains material (i.e., large wood, boulders, etc.) not typically found within the stream or floodplain at that site, remove material from the 100-year floodplain.
2. If the structure being removed contains material (i.e., large wood, boulders, etc.) that is typically found within the stream or floodplain at that site, the material can be reused to implement habitat improvements described under Large Wood, Boulder, and Gravel Placement activity category in this WFRBA.
3. If the structure being removed is keyed into the bank, fill in "key" holes with native materials to restore contours of stream bank and floodplain. Compact the fill material adequately to prevent washing out of the soil during over-bank flooding. Do not mine material from the stream channel to fill in "key" holes.
4. When removal of buried log structures may result in significant disruption to riparian vegetation and/or the floodplain, consider using a chainsaw to extract the portion of log within the channel and leaving the buried sections within the streambank.
5. If the legacy structures (log, rock, or gabion weirs) were placed to provide grade control, evaluate the site for potential headcutting and incision due to structure removal. If headcutting and channel incision are likely to occur due to structure removal, additional measures must be taken to reduce these impacts.

Beaver Habitat Restoration

This includes installation of in-channel structures to encourage beavers to build dams in incised channels and across potential floodplain surfaces. The dams are expected to entrain substrate, aggrade the bottom, and reconnect the stream to the floodplain. Like natural beaver dams, these beaver dam analogs (aka beaver dam support [BDS] structures or post assisted woody structures (PAWS)) are temporary features on the landscape. These structures are intended to aid in the development of beaver dams where beavers are present. And like streams with beavers colonies, multiple placements of these analogs are important to increase the overall system resilience and not count on any one resulting dam (Pollock et al. 2015). Most work would be accomplished by hand; however use of equipment such as excavators, bull dozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Design Features

1. Determine suitability of site for beaver habitat restoration through coordination with CDFW and review of site selection criteria (biological, political, social) such as developed in the 2015 Beaver Restoration Guidebook (Pollock et.al, 2015) or the "Beaver Tool Box" located here: www.martinezbeavers.org.

2. In-channel structures
    a. Placement of posts in channel to aid in the creation of beaver dams. Posts may be driven into the stream channel using heavy equipment or through the use of a hydrologic post hole digger.
    b. Consist of porous channel-spanning structures comprised of biodegradable vertical posts (beaver dam support [BDS] structures or post assisted woody structures (PAWS)) approximately 0.5 to 1 meter apart and at a height intended to act as the crest elevation of an active beaver dam. Variation of this restoration treatment may include post lines only, post lines with wicker weaves, construction of starter dams, reinforcement of existing active beaver dams, and reinforcement of abandoned beaver dams (Pollock et al. 2015).
    c. Consider fish passage, both adult and juvenile life stages in managing beaver instream habitat with structures by
        i. Placing structures in a low gradient area so that during higher flows when adult salmonids are moving there are side channels and over topping flows that provide channels for passage
        ii. During long periods of low flows during the winter when fish are moving, there needs to be diligent monitoring and ability to break out a section of the willow to allow passage.
    d. Place BDS structures in areas conducive to dam construction as determined by stream gradient and/or historical beaver use.
    e. Place in areas with sufficient deciduous shrub and trees to promote sustained beaver occupancy.
3. Habitat Restoration
    a. Drainages historically occupied by beaver, but which may be currently unsuitable for relocations, may require management for improvement and recovery. Restoration activities may include planting riparian hardwoods (species such as willow, red osier dogwood, and alder) and building exclosures (such as temporary fences) to protect and enhance existing or planted riparian hardwoods until they are established
    b. Maintain or develop grazing plans that will ensure the success of beaver habitat restoration objectives.

Side Channel/Off Channel Rearing Habitat

Projects will be implemented to reconnect historic side-channels with floodplains by removing off-channel fill and plugs. Furthermore, new side-channels and alcoves can be constructed in geomorphic settings that will accommodate such features. This activity category typically applies to areas where side channels, alcoves, and other backwater habitats have been filled or blocked from the main channel, disconnecting them from most if not all flow events. These project types will increase habitat diversity and complexity, improve flow heterogeneity, provide long-term nutrient storage and substrate for aquatic macroinvertebrates, moderate flow disturbances, increase retention of leaf litter, and provide refuge for fish during high flows. Creating side channels or off channel rearing habitat has been identified as a critical need for recovering SONCC coho salmon. Types of side channel or off-channel restoration projects include:

- connecting of abandoned side channel, pond habitats or remnant oxbows to restore fish access,

- creating of side channel or off-channel habitat with self-sustaining channels, and
- improving hydrologic connection between floodplains and main channels.

Restoration projects in this category may include: channel and pond excavation, creating temporary access roads, constructing wood or rock tailwater control structures, removal or breaching of levees and dikes, and construction of LWD habitat features.

Implementation of these types of projects may require the use of heavy equipment (e.g., self-propelled logging yarders, mechanical excavators, backhoes).

Design Features

1. Allowable Excavation – Off- and side-channel improvements can include minor excavation (< 10% of volume) of naturally accumulated sediment within historical channels. There is no limit as to the amount of excavation of anthropogenic fill within historic side channels as long as such channels can be clearly identified through field and/or aerial photographs. Excavation depth will not exceed the maximum thalweg depth in the main channel.
2. Excavated material removed from off- or side-channels shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity.

Streambank Restoration and Enhancement

Improve streambank condition by stabilizing stream banks with appropriate site-specific techniques. Reduction of streambank sediment input will improve fish habitat and fish survival by increasing fish embryo and alevin survival in spawning gravels, and minimizing the loss of, or reduction in size of, pools from excess sediment deposition. The proposed activities will reduce stream sedimentation from bank erosion by streambank projects include:

- stabilizing stream banks by use of structures
- reducing recreation impacts associate with stream access points.
- constructing livestock barriers and improving water sources to limit livestock access to stream banks.

Implementation of these types of projects could require the use of heavy equipment (*e.g.* mechanical excavators, backhoes) with hand tools (including chainsaws) used when possible.

Stabilizing stream banks

Stream banks that are currently eroding fine sediments into the channel could be protected through the use of boulders, logs and native plant material to deflect flows away from raw banks until revegetation would occur. Projects will be implemented through bank shaping and installation of coir logs or other soil reinforcements as necessary to support riparian vegetation; planting or installing large wood, trees, shrubs, and herbaceous cover as necessary to restore ecological function in riparian and floodplain habitats; or a combination of the above methods. Such actions are intended to restore banks that have been altered through road construction, improper grazing, invasive plants, and more. Benefits include increased amounts of riparian vegetation and associated shading, bank stability, and reduced sedimentation into stream

channels and spawning gravels. Equipment such as excavators, bull dozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Streambank Restoration Design Features

1. Without changing the location of the bank toe, restore damaged streambanks to a natural slope and profile suitable for establishment of riparian vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose or the use of benches in consolidated, cohesive soils.
2. Complete all soil reinforcement earthwork and excavation in the dry season. When necessary, use soil layers or lifts that are strengthened with biodegradable fabrics and penetrable by plant roots.
3. Include large wood to the extent it would naturally occur. If possible, large wood should have untrimmed root wads to provide functional refugia habitat for fish. Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.
4. Use a diverse assemblage of vegetation species native to the action area or region, including trees, shrubs, and herbaceous species. Vegetation, such as willow, sedge and rush mats, may be gathered from abandoned floodplains, stream channels, etc.
5. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
6. Conduct post-construction monitoring and treatment or removal of invasive plants until native plant species are well established.

Reduction/Relocation of Recreation Impacts

These projects are intended to close, better control, or relocate recreation infrastructure and use along streams and within riparian areas. This includes removal, improvement, or relocation of infrastructure associated with designated campgrounds, dispersed camp sites, day-use sites, foot trails, and off-road vehicle (ORV) roads/trails in riparian areas. The primary purpose is to eliminate or reduce recreational impacts to restore riparian areas and vegetation, improve bank stability, and reduce sedimentation into adjacent streams. Equipment such as excavators, bull dozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Design Features

1. For existing recreation facilities within Riparian Reserves, evaluate and mitigate impact to ensure that these do not prevent, and to the extent practicable contribute to, attainment of ACS objectives (LRMP IV-48).
2. Adjust dispersed and developed recreation practices that retard or prevent attainment of ACS objectives. Where adjustment measures such as education, use limitations, traffic control devices, increased maintenance, relocation of facilities, and/or specific site closures are not effective, eliminate the practice or occupancy (LRMP IV-48)..
3. Design remedial actions to restore floodplain characteristics—elevation, width, gradient, length, and roughness—in a manner that closely mimics, to the extent possible, those that would naturally occur at that stream and valley type.
4. To the extent possible, non-native fill material shall be removed from the floodplain to an upland site.

5. Overburden or fill comprised of native materials, which originated from the project area, can be used to reshape the floodplain, placed in small mounds on the floodplain, used to fill anthropogenic holes, buried on site, and/or disposed into upland areas.
6. For recreation relocation projects—such as campgrounds, dispersed sites, ORV trails—move current facilities out of the riparian area or as far away from the stream as possible.
7. Consider de-compaction of soils and vegetation planting once overburden material is removed.
8. Place barriers—boulders, fences, gates, etc.—outside of the bankfull width and across traffic routes to prevent ORV access into and across streams.
9. For work conducted on ORV roads and trails, follow relevant PDC in the Road and Trail Erosion Control and Decommissioning category

Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering Facilities

These projects will be implemented by constructing fences to exclude riparian grazing, providing controlled access for walkways that livestock use to transit across streams and through riparian areas, and reducing livestock use in riparian areas and stream channels by providing upslope water facilities. Such projects promote a balanced approach to livestock use in riparian areas, reducing livestock impacts to riparian soils and vegetation, streambanks, channel substrates, and water quality. Equipment such as excavators, bull dozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Design Features

1. Livestock Fencing
    a. Fence placement should allow for lateral movement of a stream and to allow establishment of riparian plant species. To the extent possible, fences will be placed outside the channel migration zone.
    b. Minimize vegetation removal, especially potential large wood recruitment sources, when constructing fence lines.
    c. Where appropriate, construct fences at water gaps in a manner that allows passage of large wood and other debris.
2. Off-channel livestock watering facilities
    a. Water withdrawals must not dewater habitats or cause low stream flow conditions that could affect ESA-listed fish. Withdrawals may not exceed 10% of the available flow.
    b. Surface water intakes must be screened to meet the most recent version of NMFS fish screen criteria (see Appendix B-4) be self-cleaning, or regularly maintained by removing debris buildup. A responsible party will be designated to conduct regular inspection and as-needed maintenance to ensure pumps and screens are properly functioning.
    c. Place troughs far enough from a stream or surround with a protective surface to prevent mud and sediment delivery to the stream. Avoid steep slopes and areas

where compaction or damage could occur to sensitive soils, slopes, or vegetation due to congregating livestock.

d. Ensure that each livestock water development has a float valve or similar device, a return flow system, a fenced overflow area, or similar means to minimize water withdrawal and potential runoff and erosion.
e. Minimize removal of vegetation around springs, wet areas.
f. When necessary, construct a fence around the spring development to prevent livestock damage.

Riparian Restoration and Enhancement

Improve Riparian Condition by increasing future recruitment of LW to stream. Riparian habitat restoration projects will aid in the restoration of riparian habitat by increasing the number of plants and plant groupings: Riparian projects include:

- Planting native species,
- girding alders in dense stands to allow natural alder mortality leading to increased sunlight for conifer recruitment
- removing invasive riparian species, including blackberry, etc

Implementation of these types of projects would likely be accomplished with hand tools.

Riparian Vegetation Planting

This includes the planting of native riparian species that would occur under natural disturbance regimes. Activities may include the following: planting conifers, deciduous trees and shrubs; placement of sedge and or rush mats; gathering and planting willow cuttings. The resulting benefits to the aquatic system can include desired levels of stream shade, bank stability, stream nutrients, large wood inputs, increased grasses, forbs, and shrubs, and reduced soil erosion. Equipment may include excavators, backhoes, dump trucks, power augers, chainsaws, and manual tools.

1. Experienced silviculturists, botanists, ecologists, or associated technicians shall be involved in designing vegetation treatments.
2. Species to be planted will be of the same species that naturally occur in the project area. Acquire native seed and/or plant sources as close to the watershed as possible.
3. Tree and shrub species, willow cuttings, as well as sedge and rush mats to be used as transplant material shall come from outside the bankfull width,typically in terraces (abandoned flood plains), or where such plants are abundant.
4. Sedge and rush mats should be sized to prevent their movement during high flow events.
5. Concentrate plantings above the bankfull elevation.
6. Removal of native and non-native vegetation that will compete with plantings is permitted.
7. Exclosure fencing to prevent utilization of plantings by deer, elk, and livestock is permitted.

Riparian Vegetation Restoration

This includes actions to accelerate conifer growth in areas where areas were historically conifer dominate. Girdling is a technique used to suppress and then stop the growth of a living tree without felling it among other healthy plants. Using a saw (often a chainsaw), the tree is cut about an inch or so to cut off the flow of water and food up and down the tree. Girdling forces the tree to become less competitive for sunlight, and gradually the leaves fail to capture sunlight and the plants die in place – standing. Over time, the tree will die and either fall over or degrade in place all the while providing parts of the forest system with something of value (habitat, protection, etc.).

1. Experienced silviculturists, botanists or ecologists shall be involved in designing vegetation treatments.
2. Minimize number of alders to be girdled while still creating openings to accelerate conifer growth.
3. Consider staggering treatments along stream channels.

Non-native Invasive Plant Control

This includes manual methods to remove invasive non-native plants within Riparian Reserves, or equivalent and adjacent uplands. This activity is intended to improve the composition, structure, and abundance of native riparian plant communities important for bank stability, stream shading, large wood and other organic inputs into streams, all of which are important elements to fish habitat and water quality. Manual and hand-held equipment will be used to remove plants.

1. Manual treatments are those done with hand tools or hand held motorized equipment. These treatments typically involve a small group of people in a localized area. Vegetation disturbance varies from cutting or mowing to temporarily reduce the size and vigor of plants to removal of entire plants. Soil disturbance is minimized by managing group size and targeting individual plants.
2. Impacts could be lessened by minimizing the use of heavy equipment in riparian areas, avoiding treatments that create bare soil in large or extensive areas, reseeding and mulching following treatments, and avoiding work when soils are wet and subject to compaction.

Road Actions

Reduce delivery of sediment to stream network through upslope watershed restoration projects. Road and trail related actions fall into two main categories:

- First: maintaining and upgrading the identified minimum road (and trail) transportation system as determined through travel management plans (see Appendix A-3) and implemented through past and future decisions across the Forest to prevent existing road network from degrading such water quality impacts occur, and programmatic/public notice road closures. This includes:
    - Upgrading undersized or worn out pipes,
    - Storm-proofing by adding rolling dips to prevent diversions at stream crossings,
    - Changing Maintenance Level of road (either increase or decrease to meet management objective)

  - Closing roads - make the road unavailable for vehicle use, make hydrologically maintenance free and could include:
    - installation of gates (for Level 1 roads and or seasonally for POC concerns)
    - placement of boulders or earth berm/vehicle trap to prevent traffic
  - Maintaining and improving OHV and non-motorized trails to reduce sedimentation and could include:
    - Sediment reduction work on routes not added to trail system as identified during travel management NEPA.
    - Relocation of recreation sites/reducing impacts.
  - Improving access for aquatic organism passage at culverts or low water crossings

- Second: Implementing decisions to decommission system roads, trails and unauthorized routes to restore drainage patterns (i.e, removing culvert, re-establish vegetation, re-contour).

Implementation of these types of projects would require the use of heavy equipment (*e.g.* mechanical excavators, backhoes) with hand labor used when possible.

Road Analysis Process

Since 1996, SRNF has been implementing travel management planning to identify the properly sized road system on a watershed or district basis. The ultimate goal is management and sustainability of a road system that minimizes adverse environmental impacts by assuring roads are in locations where they are necessary to meet access needs, and can be maintained within budget constraints. This WFRBA also would update existing consultation documents done in 2007 for the Smith River NRA and the OTRRP Travel Management efforts (See Consultation to Date section). See Appendix A-3 for the current status of road analysis.

Culvert and Bridge Projects – Repair and replacement

All road-stream crossing structures shall simulate stream channel conditions per Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings ("Fish Xing"), located at: http://stream.fs.fed.us/fishxing/aop_pdfs.html in conjunction with NMFS fish passage guidelines

Culvert Criteria – Within the considerations of stream simulation, the structure shall, at a minimum, accommodate a bankfull wide channel plus constructed banks to provide for passage of all life stages of native fish species.

1. Crossings shall be designed using an interdisciplinary design team consisting of an experienced Engineer, Fisheries Biologist, and Hydrologist/Geomorphologist and reviewed by the USDA Forest Service AOP Design Assistance Team when necessary.
2. Bankfull width shall be based on the upper end of the distribution of bankfull width measurements as measured in the reference reach to account for channel variability and dynamics.

Bridge Design/Replacement

1. Bridges with vertical abutments—including concrete box culverts, which are constructed as bridges—shall have their stream channels, including width, designed according to culvert guidelines.
2. Structure material must be concrete or metal. Concrete must be sufficiently cured or dried before coming into contact with stream flow. The use of treated wood for bridge construction or replacement is not allowed under this WFRBA.
3. Riprap must not be placed within the bankfull width of the stream. Riprap may only be placed below bankfull height when necessary for protection of abutments and pilings. However, the amount and placement of riprap should not constrict the bankfull flow.
4. Site containment during demolition so concrete wash water or other concrete does not enter stream. When concrete is poured to construct bridge footings or other infrastructure in the vicinity of flowing water, work must be conducted to prevent contact of wet concrete with water (*e.g.*, within a cofferdam). Concrete or concrete slurry will not come into direct contact with flowing water.
5. Falsework will be installed to keep bridge debris and construction, maintenance, and repair materials from falling into streams during demolition, construction, and substantial maintenance and repair activities.

Road and Trail Erosion Control

The following definitions describe activities that would occur within the proposed action. All activities incorporate Standards and Guidelines (S&Gs) Best Management Practice (BMPs) as standard practice. Where applicable, the activities described below include pertinent BMPs.

Road and Trail Maintenance

1. Road maintenance - This includes brushing, culvert cleaning, slide removal etc. See Appendix G for a complete description of road maintenance descriptions and design features as included in the 2015-2022 Road Maintenance CE. Some overlap exists with storm proofing category. Culvert replacement/upgrading in stream channels would follow the below design criteria.
2. Trail maintenance – Actions are similar to maintenance necessary for road maintenance, however, equipment used is based on the allowable use of the trail.

Road Maintenance - Risk Reduction ("Stormproofing")

1. Upgrade culverts for 100 year flood (See Culvert and Bridge Project)
2. Drainage features used for stormproofing and treatment projects should be spaced as to hydrologically disconnect road surface runoff from stream channels. If grading and resurfacing is required, use gravel, bark, or other permeable materials for resurfacing.
3. Minimize disturbance of existing vegetation in ditches and at stream crossings.

Downgrading to OML 1 (Closing of roads)

This work is required when a road is managed as, or downgraded to, an OML1 and may be accomplished through gating, obliterating take-off, recontouring the take-off, or barring at the road entrance. If earthen barriers are created, they will be treated to avoid erosion into waterways, such as seeding and mulching, as site conditions require. Downgrading is primarily

aimed at the reduction of maintenance costs on low-use roads. Downgrading to OML 1 would close the road for vehicle use but would maintain the option of future use.

1. Road must be left in hydrological maintenance free state, which typically includes removal of drainage structures.

Road Decommissioning

Road decommissioning is the appropriate action when the risks to water quality and TE salmonids outweigh the need for the road for long term management and public use, or when unauthorized user created routes need to be restored and use prevented. This decision occurs during the Travel Management process. Travel analysis has occurred on portions of SRNF and identified roads have been decommissioned (Appendix A-3). Surveys have or will be completed on remaining portions of SRNF to determine road condition and risk to water quality. Transportation Analysis Plans would be completed

Road decommissioning typically includes the following: 1) Outsloping roads at 10% to 30% where necessary to restore natural surface drainage, 2) Ripping the roadbed surface to restore infiltration and promote revegetation, 3) Seeding, mulching and fertilizing restored areas as needed to control short-term surface erosion and invasive weeds, 4) Installing barricades at road take-offs, 5) Crushing and/or removal of cross-drain culverts, 6) Stabilizing road prism landslides, and 7) Removal of stream crossing culverts and associated fill material at a depth to original channel gradient; width to original "canyon" walls or, where not practical, 1.5:1 or flatter side slopes.

Decommissioning roads places them in a maintenance-free condition (culverts and other drainage structures are removed, reestablishing natural drainage patterns), are not drivable by motor vehicle, and are not on the Forest Transportation System. In areas along roads that show signs of road failure due to slope instability, road prisms would be outsloped (sloped towards downhill side of roadway) to improve surface drainage and to reduce the risk of slumps and landslides. In most cases, the road bed will remain intact and provide non-motorized access. Depending on the slope location, type of stream crossings, and diversion potential of an unneeded road, decommissioning may require as little as a simple barricade or as much as the use of heavy equipment

1. For road decommissioning and hydrologic closure projects within riparian areas, recontour the affected area to mimic natural floodplain contours and gradient to the extent possible.
2. When obliterating or removing segments adjacent to a stream, use sediment control barriers between the project and stream if applicable for the site and as guided by appropriate BMPs.
3. Dispose of slide and waste material in stable sites out of the flood-prone area. Native material may be used to restore natural or near-natural contours.
4. Conduct activities during dry-field conditions (generally June 15 to October 15) when the soil is more resistant to compaction and soil moisture is low. See general ACM for Work Period (page 26) and Wet Weather Operations in Appendix B-3 for process for determining soil moisture.
5. When removing a culvert from a first or second order, non-fishing bearing stream, project specialists shall determine if culvert removal should include stream isolation and

rerouting in project design. Culvert removal on fish bearing streams shall adhere to the measures described in the Fish Access activity (page 32).

6. For culvert removal projects, restore natural drainage patterns and channel morphology. Evaluate channel incision risk and construct in-channel grade control structures when necessary.

Other Activities

Illegal Marijuana Grow Clean Ups

This includes the cleanup of illegal marijuana grows that have been cleared by law enforcement and pose some risk to aquatic ecosystems. Actions included in this activity are:

- Re-establishing stream channels, removing illegal dams from headwater streams
- Restoring access roads – see roads section.
- Remove waste products like pipe, tarps, garbage, chemicals products
- Revegetate with native plants
- Consider stockpiling trees illegally cut down during clearing for use on stream enhancement projects. Test for chemical contamination prior to use instream.

Implementation of these types of projects could require the use of heavy equipment (e.g. mechanical excavators, backhoes) with hand tools (including chainsaws) used when possible. Helicopters could be used to remove waste and transport trees that were illegally cut down.

Mine Tailing Removal/Mine Restoration

The restoration of mines locations include the excavation and removal of mine waste from stream channels, banks, terraces and lower hill slopes; stabilization and re-vegetation of mines and associated waste areas, transportation of waste materials to safe impoundment areas and, capping of impoundments with soil and vegetation.

1. See Streambank and Riparian restoration activities.

In-channel Nutrient Enhancement

This includes the placement of salmon carcasses, carcass analogs (processed fish cakes), or inorganic fertilizers in stream channels to help return stream nutrient levels back to historic levels. This action helps restore marine-derived nutrients to aquatic systems, thereby adding an element to the food chain that is important for growth of macroinvertebrates, juvenile salmonids, and riparian vegetation.

1. Coordinate with California Department of Fish and Wildlife early on.
2. Ensure that the relevant streams have the capacity to capture and store placed carcasses.
3. Carcasses should be of species native to the watershed and placed during the normal migration and spawning times that would naturally occur in the watershed.
4. Do not supplement nutrients in eutrophic or naturally oligotrophic systems.

Application and distribution of nutrients throughout a stream corridor can occur from bridges, stream banks, or helicopter.

Resident Aquatic Species Lake and Stream Restoration

Activities described here include the improvement of the recreational fisheries in Ruth Reservoir and in natural lakes where fishing is allowed. Additionally, restoration or enhancement of other water bodies with native non-salmonid aquatic fish and wildlife species would occur. Lakes where activities are likely to occur are found on the Aquatic Restoration EA maps in Appendix G. Activities include:

- Maintenance of Bass Structures at Ruth Reservoir
- Manual Invasive Weed Removal in natural lakes and ponds
- Installation of Western Pond turtle basking platforms
- Bullfrog/Nonnative aquatic species eradication through non chemical treatments (seining, draining) of natural and artificial (livestock) ponds.

Pond levels may be lowered to aid in removal of nonnative species. Implementation of these types of projects could typically involve use of hand tools (including chainsaws) and hand labor.

Upper Limits on Actions

Table 4 displays the project activities along with the estimation of the number of projects and the type (miles/acres) of area affected per 5th field watershed. This estimation is set per 5th field watershed, however, typically only two or three types of activities would occur in a watershed in any given year based on current staffing levels and an optimistic vision of obtaining funding. Table 5 identifies the anticipated activities that could occur in each watershed based on:

- Opportunity for activity (i.e. access)
- Need for activity (i.e., livestock fencing would only occur in watersheds with grazing allotments)
- Identified Recovery Actions

Only 11 of the 22 5th field HUCs would have heavy equipment potentially operating in occupied habitat (See maps associated with Proposed Aquatic Restoration actions in Appendix G for locations of potential heavy equipment sites).

Annual Project Limit: Although a limit per 5th field watershed was set in order to prevent a cumulative impact of multiple sediment projects from occurring, it is highly unlikely that more than two to three types of restoration activities would occur in any one year. The Annual Level 1 Coordination meeting would serve as another checkpoint for ensuring no cumulative impact would occur.

Watersheds with TMDLs for sediment or turbidity have to prevent cumulative impacts related to sediment from occurring because the SRNF cannot exceed the waste allocation for TMDLs.

Table 4. Upper Limits of Activities

Restoration Activity	Annual Project Limit in a single 5th Watershed
Fish Passage Restoration *No anadromous fish passage projects on Forest Service roads*	1 w/Heavy Equipment 5 w/Hand Crews Total 30 miles

Restoration Activity	**Annual Project Limit in a single 5th Watershed**
Fish passage projects would involve modification of legacy structures or modifying creek mouths for access to cool water refugia	
Instream habitat enhancement Large Wood and Boulder placement	2 w/Heavy Equipment 5 w/Hand Crews Total 50 miles
Gravel Augmentation	1 w/Heavy Equipment
Legacy/Historic Structure Modification or Removal 1 Penstock Dike located in Madden Creek that is proposed for removal.	2 w/Heavy Equipment 5 w/Hand Crews Total 20 miles
Beaver Habitat Enhancement	2 – Reaches – no more than 1,000 feet. combination heavy equipment and hand crews
Off- and Side-Channel Habitat Restoration Potential reaches for these identified on the maps and primarily occur in the Klamath/Trinity. Other sites may be identified	2 combination heavy equipment and hand crews
Streambank Restoration	3 combination heavy equipment and hand crews
Reduction/Relocation of Recreation Impacts	2 w/Heavy Equipment 5 w/Hand Crews Each site typically less than ¼ acre
Livestock Fencing, Stream Crossings, and Off-Channel Livestock Watering	Less than 5 across Mad River and Lower Trinity Ranger Districts
Riparian Restoration & Enhancement • Planting includes landslides • Alder Girdling - Individual locations would be small patches (0.5 acres) separated by untouched areas.	100 sites – all handcrews
Non-native Invasive Plant Control A site would typically range from ¼ acre up to 2 acres with patchy ground disturbance	25 sites – all hand crews heavy equipment on existing access roads
Road and Trail Decommissioning	20 miles road decommissioning – validated by hydrologists annually based on TMDL compliance.

Restoration Activity	**Annual Project Limit in a single 5th Watershed**
Road and Trail Maintenance and Upgraded (storm proofing) Mileage based on the historic amount of road maintenance completed on each District	60 miles per district of ground disturbing activities See Appendix G-3 activity descriptions for historic range of implementation for those that could produce sediment.
Illegal Marijuana Grow Clean up Ability to implement this activity is based on Law Enforcement approval of accessing sites.	5 sites per year
Mine Reclamation Most of the larger sites are addressed through the CERCLA process through EPA and would not be addressed under this consultation.	2 per year
In-channel Nutrient Enhancement Project locations would be identified in partnership with CDFW/NOAA	5 across the Forest
Fish Handling – By ESU/DPS: (See page:30) SONCC coho salmon NC steelhead CC Chinook salmon	By Population: 1 event per year Smith, Mid Klamath, Lower Trinity NF Eel, Mad River, Van Duzen N/A – no occupied habitat on SRNF

The following table identifies for each 5th field watershed, the potential for any of the above listed activities to occur within the watershed, and, whether or not the activity would occur within occupied habitat.

Table 5. Potential Activities by Watershed

5th Field Watersheds YO – Activity could occur within occupied habitat YOR – Activity could occur adjacent to occupied habitat - Riparian YA – Activity above[5] occupied habitat – instream/Riparian P – Potential- Surveys Required to Determine Need N/A - Activity unlikely to occur in watershed *(NMFS populations in parenthesis)*	SONCC Coho on FS land	NC Steelhead on FS land[4] (FSS indicates presence of FSS)	Fish Access to Habitat	Large wood and Boulder Projects – Heavy Equip.	Large wood Projects – Hand Treatment	Gravel Augmentation	Legacy/Historic Structure mod (incl. water diversion upgrades)	Beaver Habitat Restoration	Off-Side Channel Habitat Rest	Streambank Restoration	Reduction of Recreation Impacts	Livestock Fencing	Riparian Vegetation - planting	Riparian Vegetation - girdling	Non-native invasive plants	Road and Trail Erosion Control and maintenance	Road Decommissioning	Reduction of Impacts - IMG	Mine Reclamation	In channel Nutrient Enhancement	Lake and Pond Restoration
North Fork Smith (*Smith River*)	Yes	FSS	YO	YO	YO	N/A	N/A	N/A	P	YO	YO	N/A	YOR	YOR	YOR	YOR	YOR	P	YO	YO	N/A
Middle Fork Smith (*Smith River*)	Yes	FSS	YO	YO	YO	YO	YO	N/A	P	YO	YO	N/A	YOR	YOR	YOR	YOR	YOR	P	YO	YO	YA
South Fork Smith (*Smith River*)	Yes	FSS	YO	YO	N/A	YO	YO	N/A	P	YO	YO	N/A	YOR	YOR	YOR	YOR	YOR	P	YO	YO	YA
Lower Smith River (*Smith River*)	Yes	FSS	YO	YO	N/A	N/A	N/A	YO	N/A	YO	YO	N/A	YOR	YOR	YOR	YOR	YOR	P	N/A	N/A	N/A
Oak Flat-Ukonom (*Mid Klamath*)	Yes	FSS	YO	N/A	YO	N/A	N/A	P	N/A	YO	YO	N/A	YOR	YOR	YOR	YOR	YA	P	N/A	N/A	YA
Rock-Ti (*Mid Klamath*)	Yes	FSS	YO	YO	YO	P	YO	P	YO	YO	YO	N/A	YOR	YOR	YOR	YOR	YA	P	YO	YO	YA
Lower Mid Klamath (*Mid Klamath*)	Yes	FSS	YO	YO	YO	P	YO	YO	YO	YO	YO	N/A	YOR	YOR	YOR	YOR	YOR	P	YO	YO	YA
Dillon Creek (*Mid Klamath*)	Yes	FSS	YO	N/A	YO	N/A	N/A	P	N/A	YO	YO	N/A	YOR	YOR	YOR	YOR	YA	P	YA	N/A	YA
Blue Creek (*Lower Klamath*)	Yes[6]	FSS	P	N/A	P	N/A	N/A	N/A	N/A	YA	YA	N/A	YA	YA	YA	YA	N/A	P	N/A	N/A	YA
Wooley Creek (*Salmon River*)	Yes	FSS	YA	N/A	YA	N/A	N/A	N/A	N/A	YA	YA	N/A	YA	YA	YA	YA	N/A	P	N/A	N/A	YA
Main Salmon (*Salmon River*)	Yes	FSS	YO	YO	YO	P	N/A	P	YO	YO	YO	N/A	YOR	YOR	YOR	YOR	YA	P	YO	YO	YA
Main Trinity River (*Lower Trinity*)	Yes	FSS	YO	YO	YO	YO	YO	YO	YO	YO	YO	YA	YOR	YOR	YOR	YOR	YA	P	YO	YO	YA
Lower Trinity River (*Lower Trinity*)	Yes	FSS	YO	YO	YO	YO	YO	YO	YO	YO	YO	YA	YOR	YOR	YOR	YOR	YA	P	YO	YO	YA
Lower SF Trinity River (*SF Trinity*)	Yes	FSS	YO	YO	YO	YO	YO	YO	YO	YO	YO	YA	YOR	YOR	YOR	YOR	YA	P	YO	YO	YA
Redwood Creek (*Redwood Ck*)	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	YA	N/A	N/A	N/A	YA	N/A	P	N/A	N/A	N/A
Upper Mad River (*Mad River*)	No	No	N/A	YA	YA	N/A	N/A	N/A	N/A	YA	YA	YA	YA	N/A	YA	YA	YA	P	N/A	N/A	YA
Middle Mad River (*Mad River*)	No	Yes	N/A	N/A	YO	N/A	YO	N/A	N/A	YO	YO	YA	YOR	YOR	YOR	YA	YA	P	N/A	N/A	N/A
North Fork Eel River (*NF Eel River*)	No	Yes	P	N/A	YO	N/A	YO	N/A	N/A	YO	YO	YOR	YOR	P	P	YOR	YOR	P	N/A	N/A	YA
Bell Springs (*Mainstem Eel*)	No	No	N/A	N/A	P	N/A	N/A	N/A	N/A	P	N/A	YA	P	N/A	N/A	YA	P	P	N/A	N/A	N/A
Dobbyn Creek (*Mainstem Eel*)	No	Yes	N/A	N/A	P	N/A	N/A	N/A	N/A	P	N/A	YOR	P	N/A	N/A	YA	P	P	N/A	N/A	N/A
Upper Van Duzen (*Lower Eel/VD*)	No	Yes	P	YO	YO	N/A	N/A	P	P	YO	YO	P	YOR	P	P	P	P	P	N/A	N/A	N/A
Lower Van Duzen (*Lower Eel/VD*)	No	Yes	P	N/A	P	N/A	N/A	N/A	N/A	P	P	N/A	P	N/A	N/A	P	P	P	N/A	N/A	N/A

[4] CC chinook not found on SRNF; FSS anadromous species include: SOCC Chinook, UKTR Chinook, KMP Steelhead
[5] Above – at a minimum, greater than 1500' upstream
[6] No known coho presence, however, CalFish distribution layer indicates potential occupancy on USFS administered lands.

III. AFFECTED SPECIES

The following species descriptions summarize biological requirements and may include other elements, such as historical numbers and distribution, which offer insights into the life histories of affected ESA-listed fish. With the exception of information pertaining to Six Rivers National Forest, all information came from NMFS listing and recent status review documents, including associated literature citations.

SONCC Coho Salmon

SONCC coho salmon evolutionarily significant unit (ESU), which includes populations spawning from the Elk River (Oregon) in the north to the Mattole River (California) in the south, as a threatened species in 1997 (62 FR 24588; May 6, 1997). Reliable current time series of naturally produced adult migrants or spawners are limited for SONCC coho salmon ESU rivers (Williams et al. 2011, Good et al. 2005).

In 2005, NMFS reaffirmed its status as a threatened species and also listed three hatchery stocks as part of the ESU (70 FR 37160; June 28, 2005). In 2006, Williams et al. described the historical population structure of coho salmon in the SONCC coho salmon ESU based on the location and amount of potential coho salmon habitat, with an assumption that the relative abundance of different populations mirrored the amount of intrinsic habitat potential in each watershed. Williams et al. (2006) found that, in general, the SONCC coho salmon ESU was characterized by small-to-moderate-sized coastal basins in which habitat was concentrated in the lower portions of the basins (such as Redwood Creek), and by three large basins in which some habitat was located in the lower portions of the basins, relatively little habitat was available in the middle portions of the basins, and the greatest amount of habitat was located in the upper sub-basins (such as the Klamath River Basin). In 2008, Williams et al. then described the SONCC coho salmon historical population structure as containing19 functionally independent populations, 12 potentially independent populations, and 17 small dependent populations, and two ephemeral populations. Williams et al. (2008) also organized the independent and dependent populations of coho salmon in the SONCC ESU into diversity strata largely based on the geographical arrangement of these populations and basin-scale environmental and ecological characteristics.

Analysis of recent genetic data from coho salmon in this and adjacent ESUs (Oregon Coast ESU to the north and Central California Coast ESU to the south) supports the existing boundaries of the SONCC coho salmon ESU boundary (Stout et al. 2010, Williams et al. 2011). NMFS recently completed a status review of the SONCC coho salmon ESU (Williams et al. 2011) and determined that the ESU, although trending in declining abundance, should remain listed as threatened. The primary factors affecting diversity of SONCC coho salmon appear to be low population abundance, ocean survival conditions, and drought effects (Williams et al. 2011).

The following life history and status information is from this source and the 2014 SONCC coho salmon recovery plan:
http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/coho/coho_salmon.html

Life History and Diversity

Life History

Typically, adult coho salmon reach sexual maturity at 3 years and die after spawning. Precocious 2 year olds, especially males, also make up a small percentage of the spawning population. Coho salmon adults migrate and spawn in small streams that flow directly into the ocean, or tributaries and headwater creeks of larger rivers (Sandercock 1991, Moyle 2002). Adults migrate upstream to spawning grounds from September through late December, peaking in October and November. Spawning occurs mainly in November and December, with fry emerging from the gravel in the spring, approximately 3 to 4 months after spawning. Juvenile rearing usually occurs in tributary streams with a gradient of 3 percent or less, although they may move up to streams of 4 or 5 percent gradient. Juveniles occupy streams as small as 1 to 2 meters wide. They may spend 1 to 2 years rearing in freshwater (Bell and Duffy 2007), or emigrate to lower river and estuary habitat as age 0+ juveniles (Tschaplinski 1988, Koski 2009). Emigration of age 0+ coho salmon is not as common as emigration at age 1 or 2, but represents an important nomadic life history diversity strategy that adds resilience to populations (Koski 2009). Coho salmon juveniles are also known to redistribute into non-natal rearing streams, lakes, or ponds, often following rainstorms, where they continue to rear (Peterson 1982). As small as 38 to 45 mm long, fry may migrate upstream a considerable distance to reach lakes or other rearing areas (Sandercock 1991, Nickelson et al. 1992). Emigration from streams to the estuary and ocean generally takes place from March through May. Peak outmigration timing generally occurs in May, with some runs earlier or later, and with most smolts measuring 90-115 mm fork length.

Survival and distribution of juvenile coho salmon have been associated with available winter habitat (Bustard and Narver 1975, Peterson 1982, Tschaplinski and Hartman 1983, Nickelson et al. 1992, Quinn and Peterson 1996). Both instream cover and off-channel habitats that provide slow water are essential to juvenile coho salmon for protection against displacement by high flows and as for cover from predation (Bustard and Narver 1975, Mason 1976, Solazzi et al. 2000). Juvenile coho appear to prefer deep (greater than 1.5 feet), slow water (less than 1 fps) habitats within or near cover of roots, large wood, or flooded brush (Bustard and Narver 1975), especially during freshets (Tschaplinski and Hartman 1983, Swales et al. 1986, McMahon and Hartman 1989).

Diversity

Williams et al. (2006) classified populations as dependent or independent based on their historic population size. Independent populations are populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years and are rated as functionally independent (FI) and potentially independent (PI). Core population types are independent populations judged most likely to become viable most quickly. Non-core 1 population types are independent populations judged to have lesser potential for rapid recovery than the core populations. Non-Core 2 populations were identified in response to the requirement that “most” (not all) independent populations should be at moderate risk of extinction, which allows that some independent populations do not need to be either at moderate risk or low risk. For some independent populations, there is little to no documentation of coho salmon presence in the last century, and prospects are low for the population to recover to numbers at least four

spawners per IP-km. These populations are categorized as Non-Core 2 populations (NMFS 2014). Dependent populations are populations that historically would not have had a high likelihood of persisting in isolation for 100 years. These populations relied upon periodic immigration from other populations to maintain their abundance. Two ephemeral populations are defined as populations both small enough and isolated enough that they are only intermittently present (McElhany et al. 2000; Williams et al. 2006; NMFS 2014). The following table lists the SONCC coho salmon populations that overlap with Six Rivers National Forest.

Table 6. SONCC coho salmon populations in California on or downstream of SRNF

Stratum	Population	Population Type	Risk of Extinction
Central Coast Basin	Smith River	Core	High
	Lower Klamath River	Core	Moderate
	Redwood Creek	Core	High
	Mad River	Core	High
Interior Klamath River	Middle Klamath River	Non-core 1	High
	Salmon River	Non-core 1	High
Interior Trinity River	Lower Trinity River	Core	High
	South Fork Trinity River	Non-core 1	High
Southern Coastal Basin	Lower Eel/Van Duzen River	Non-core 1	High
Interior Eel River	Mainstem Eel River	Core	High
	North Fork Eel River	Non-Core 2	High

Given the recent trends in abundance across the ESU, the genetic and life history diversity of populations is likely very low and is inadequate to contribute to a viable ESU. The most recent status review (Williams et al. 2011) indicated that the biological status of the SONCC coho salmon ESU has worsened since 2005, and the primary factors currently affecting diversity of SONCC coho salmon appear to be low population abundance, ocean survival conditions, and drought.

Distribution

The historical population structure by Williams et al. (2006), coho salmon status reviews (CDFG 2002, Good et al. 2005, Williams et al. 2011), and the presence and absence update for the northern California portion of the SONCC coho salmon ESU (Brownell et al. 1999) summarize historical and current distributions of SONCC coho salmon in northern California.

The distribution of SONCC coho salmon within the ESU is reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which they are now absent (NMFS 2001, Good et al. 2005, Williams et al. 2011). Scientists at the NMFS Southwest Fisheries Science Center compiled a presence-absence database for the SONCC coho salmon ESU using information for coho salmon streams listed in Brown and Moyle (1991), as well as other streams where NMFS found historical or recent evidence of coho salmon presence. Brown and Moyle (1991) identified 396 streams within the ESU as historic coho streams.

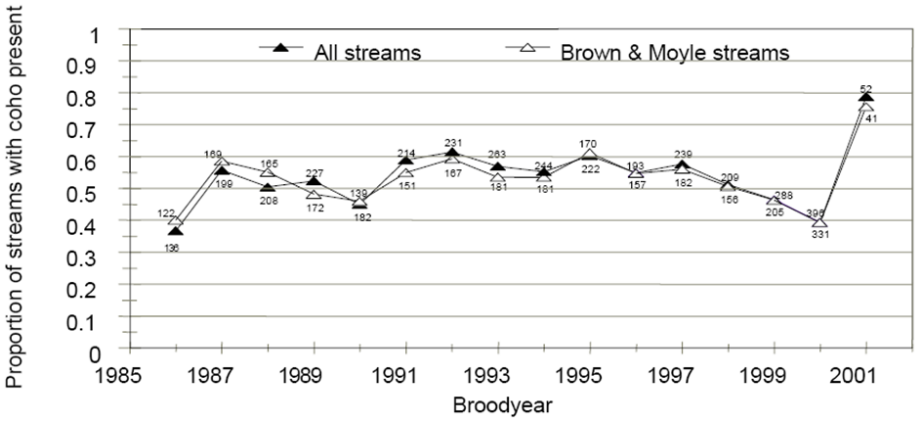

Figure 4. Number of streams with coho present (number of streams surveyed reported next to data point)

Using the NMFS database, Good et al. (2005) compiled information on the presence of coho salmon in streams throughout the SONCC ESU (Figure 4), which closely matched the results of Brown and Moyle (1991). Garwood (2012) compiled coho data through 2004 to generate a historical coho salmon stream list for the California watersheds of the SONCC ESU. Garwood (2012) verified the presence of juvenile coho in 325 of the streams from the Brown and Moyle (1991) study, and identified 217 additional streams. From 2001 to 2003, CDFG conducted 628 surveys in 301 streams across the California portion of the SONCC ESU. Coho salmon were detected in 153 of 245 sampled historic coho salmon streams (Garwood 2012).

The number of streams and rivers currently supporting coho salmon in this ESU has been greatly reduced from historical levels, and watershed-specific extirpations of coho salmon have been documented (Brown et al.1994, CDFG 2004, Good et al. 2005, Moyle et al. 2008, Yoshiyama and Moyle 2010). In summary, information on the SONCC ESU of coho salmon indicates that their distribution within the ESU has been reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which they are now absent (Williams et al. 2011). However, extant populations can still be found in all major river basins within the ESU (70 FR 37160; June 28, 2005).

Given that all diversity strata are occupied (Williams et al. 2011), the spatial structure of the SONCC coho salmon ESU is broadly distributed throughout its range. However, extirpations, loss of brood years, and sharp declines in abundance (in some cases to zero) of SONCC coho salmon in several streams throughout the ESU indicate that the SONCC coho salmon's spatial structure is more fragmented at the population-level than at the ESU scale.

During the fall and spring, juvenile coho salmon often make seasonal or temporary shifts to off-channel areas that provide key winter habitat features when temperatures drop and base flows rise (Scarlett and Cederholm 1984, Bell et al. 2001). These off-channel habitats provide low velocity rearing areas, often with ample foraging opportunities (Bell et al. 2001). Overwintering coho salmon are often found in slower velocity habitats such as floodplains, sloughs, alcoves, backwaters, beaver ponds, and complex or deep in-channel habitats associated with large wood (County and Stillwater Sciences 2011). Off-channel ponds are important winter rearing areas for juvenile coho salmon, and growth rates of juveniles in off-channel habitats were greater than those in the mainstem river (Morley et al. 2005, Swales and Levings 1989, Brown and Hartman 1988).

Abundance

Quantitative population-level estimates of adult spawner abundance spanning more than 9 years are scarce for SONCC ESU coho salmon. New data since publication of the previous status review (Good et al. 2005) consists of continuation of a few time series of adult abundance, expansion of efforts in coastal basins of Oregon to include SONCC ESU coho salmon populations, and continuation and addition of several population scale monitoring efforts in California. Other than the Shasta River and Scott River adult counts, reliable current time series of naturally produced adult spawners are not available for the California portion of the SONCC ESU at the population scale.

Although long-term data on coho salmon abundance are scarce, the available evidence from short-term research and monitoring efforts indicate that spawner abundance has declined since the last status review for populations in this ESU (Williams et al. 2011). In fact, most of the 30 independent populations in the ESU are at high risk of extinction because they are below or likely below their depensation threshold, which can be thought of as the minimum number of adults needed for survival of a population.

Populations that are under depensation have increased likelihood of being extirpated. To summarize conditions across the ESU, extirpations have already occurred in the Eel River basin and are likely in the interior Klamath River basin for one or all year classes (e.g., Shasta and Scott rivers), Bear River, and Mattole River. Coho salmon spawners in the Eel River watershed, which historically supported significant spawners (e.g., 50,000 to 100,000 per year; Yoshiyama and Moyle 2010), have declined. Yoshiyama and Moyle (2010) concluded that coho salmon populations in the Eel River basin appear to be headed for extirpation by 2025. One population contains critically low numbers (i.e., Upper Mainstem Eel River; with only a total of 7 coho salmon adults counted at the Van Arsdale Fish Station in over six decades; Jahn 2010Although long term spawner data are not available, both NMFS and CDFG believe the Lower Eel/Van Duzen River, Middle Mainstem Eel and Mainstem Eel River populations are likely below the depensation threshold, and thus are at a high risk of extinction.

Six Rivers National Forest Distribution/Abundance

Smith River: The lower 6 miles of the Smith River watershed has the highest intrinsic potential for coho salmon. Distribution of coho salmon in the Smith River is extensive, however, forty percent of the watershed is known to be sloped over 50% gradient (Barston 1997), and does not support coho salmon. Coho salmon occurrence in the Smith River National Recreation Area has been low over the past 30 years, as indicated by annual spawning and juvenile fish surveys since 1976. Adult and juvenile coho are not observed in survey reaches on the NRA every year, but rather sporadically. Spawning and juvenile coho have been observed sporadically in the low gradient and gravel-rich reaches of large 6th order tributaries of the North, South and Middle Forks Smith River, including Hurdygurdy, Patrick, and upper North Fork Smith (2007 Smith River Travel Management BA)

Klamath River: Coho occur in the mainstem Klamath River year round, and also inhabit a number of Klamath tributaries (Yurok Tribe 2001, CDFG 2002). Juvenile coho surveys have been conducted by the USFS, in cooperation with the CDF&G, USFWS and local Tribes, within the Klamath River mainstem and selected tributaries since 2002. Within the OTRRP, coho salmon populations are known to occur in Blue Creek, and between the Trinity and Salmon

Rivers, in Camp Creek, Slate Creek, Bluff Creek, Aikens Creek, Red Cap Creek, and Boise Creek (L.Cyr, pers. obs.). These annual surveys provide an indication of the low number of young coho salmon within many of these mid-Klamath tributaries within the action area. Many of the smaller tributaries provide a small (less than 0.2 miles) of habitat directly above the mainstem Klamath.

Trinity River: Information regarding coho distribution on SRNF in the Trinity River has been collected incidental to surveys for Chinook salmon. Several tributary streams to the mainstem Trinity River provide spawning habitat (Willow Cr., Horse Linto Cr., Cedar Ck. Sharber/ Peckham Cr. Populations in the lower portion of Mill and Horse Linto creeks are extremely low.

Mad River: Limited data exists about the coho salmon population in the Mad River. Potential coho salmon habitat is primarily distributed in the downstream 40 percent of the basin. The area downstream of Matthews Dam, including Pilot Creek, is typically not accessible to coho salmon due to a series of boulder bedrock falls beginning at river mile 43.

Eel River (North Fork, Mainstem Tributaries): Differing opinions exist as to whether or not coho salmon were ever present in the North Fork Eel River above Split Rock. Low quality habitat exists if passage became possible. SRNF manages the headwaters of Dobbyn Creek and a very small portion of Kekawaka Creek. Coho are currently present in the mainstem Eel River, however surveys have not found coho to be present in either of these tributaries.

Van Duzen River: According to the SONCC coho recovery plan, coho salmon have been observed intermittently over the past few decades in the lower Van Duzen River with the upper limit being identified at Grizzly Creek (NMFS 2014). SRNF lands are located over 20 miles upstream of this upper distribution.

NC Steelhead Trout

The NC steelhead DPS includes all naturally spawning populations of steelhead in California coastal river basins from Redwood Creek in Humboldt County, to just south of Gualala River in Mendocino County (Spence et al. 2008). This distribution includes the Eel River, the third largest watershed in California, with its four forks (North, Middle, South, and Van Duzen) and their extensive tributaries. Spence et al. (2008) identified 42 historically independent populations in the DPS based on habitat availability and gene flow among watersheds. An additional 33 small populations are likely dependent upon immigration from the more permanent populations (Bjorkstedt et al. 2005, NMFS 2011b).

The following life history and status information is from this source:

http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/steelhead/steelhead.html

Life History and Diversity

Life History

There are two basic steelhead life history patterns, winter-run and summer-run (Quinn 2005, Moyle 2002). Winter-run steelhead enter rivers and streams from December to March in a sexually mature state and spawn in tributaries of mainstem rivers, often ascending long distances (Moyle 2002). Summer steelhead, also known as spring-run steelhead, enter rivers in a sexually

immature state during receding flows in the spring and migrate to headwater reaches of tributary streams where they hold in deep pools until spawning the following winter or spring (Moyle 2002). Spawning for all runs generally takes place in the late winter or early spring. Eggs hatch in 3 to 4 weeks and fry emerge from the gravel 2 to 3 weeks later (Moyle 2002). Juveniles spend 1 to 4 years in freshwater before migrating to estuaries and the ocean where they spend 1 to 3 years before returning to freshwater to spawn. Steelhead smolts are usually 15-20 cm total length and migrate to the ocean in the spring (Meehan and Bjornn 1991). Another life history diversity of steelhead is the "half pounder". "Half pounder" steelhead are sexually immature steelhead that spend about 3 months in estuaries or the ocean before returning to lower river reaches on a feeding run (Moyle 2002). Half pounders then return to the ocean where they spend 1 to 3 years before returning to freshwater to spawn. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (Busby et al. 1996). Some steelhead "residualize," becoming resident trout and never adopting the anadromous life history.

Upon emerging from the gravel, steelhead fry rear in edgewater habitats and move gradually into pools and riffles as they grow larger; older juveniles establish and defend territories (County and Stillwater Sciences 2011). Cover is an important habitat component for juvenile steelhead, both as velocity refuge and as a means of avoiding predation (Shirvell 1990, Meehan and Bjornn 1991). Summer rearing steelhead tend to use riffles and other habitats not strongly associated with cover more than other salmonids (County and Stillwater Sciences 2011), but winter rearing juvenile steelhead become inactive and hide in any available cover, including large substrate or woody debris (County and Stillwater Sciences 2011).

Diversity

Millions of steelhead from outside the DPS have been stocked in rivers in the NC steelhead DPS since the 1970s. Bjorkstedt et al. (2005) documented 39 separate releases of steelhead, many of which occurred over multiple years. Of particular concern is the practice of rearing Eel River-derived steelhead in a hatchery on the Mad River before restocking in the Eel River (Bjorkstedt et al. 2005). Over ten years, more than one-half million yearlings were reared and released in this way, and this practice may have reduced the effectiveness of adult homing to the Eel River (Bjorkstedt et al. 2005). In addition, abundance of summer-run steelhead was considered "very low" in 1996 (Good et al. 2005), indicating that an important component of life history diversity in this DPS may be at risk. NMFS determined in the most recent status review that the potential risks of stochastic processes associated with small population size have increased in the past five years since the previous review (Good et al. 2005), likely placing populations of NC steelhead at a higher risk of extinction (Williams et al.2011).

Williams et al. (2006) classified populations as dependent or independent based on their historic population size. Independent populations are populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years and are rated as functionally independent (FI) and potentially independent (PI). Core population types are independent populations judged most likely to become viable most quickly. Non-core 1 population types are independent populations judged to have lesser potential for rapid recovery than the core populations. Dependent populations (D) are populations that historically would not have had a high likelihood of persisting in isolation for 100 years. These populations relied upon

periodic immigration from other populations to maintain their abundance. Two ephemeral populations (E) are defined as populations both small enough and isolated enough that they are only intermittently present (McElhany et al. 2000; Williams et al. 2006). The following table lists the NC steelhead trout populations that overlap with Six Rivers National Forest and their role in recovery(NMFS 2015).

Table 7. NC steelhead populations in California on or downstream of SRNF

Stratum	Population	Role in Recovery
Northern Coastal/Northern Mountain Interior	Redwood Creek Lower	Essential
	Mad River – Lower	Essential
North Mountain Interior	Redwood Creek - Upper	Essential
	Van Duzen River	Essential
	Dobbyn Creek	Supporting
	North Fork Eel River	Essential
	Mad River - Upper	Essential

Given the recent trends in abundance across the ESU, the genetic and life history diversity of populations is likely very low and is inadequate to contribute to a viable ESU. The most recent status review (see website listed above) indicated that the biological status of the NC steelhead trout DPS has worsened since 2005.

Distribution

With few exceptions, NC steelhead are present wherever streams are accessible to anadromous fish and have sufficient flows. Experts consulted during the 2005 status review gave this DPS a mean risk score of 2.2 (out of 5) for the spatial structure and connectivity VSP category (Good et al. 2005), indicating it is unlikely that this factor contributes significantly to risk of extinction by itself, but there is some concern that it may, in combination with other factors. In response to observations of "large trout" above Eaton Falls (an assumed total passage barrier) on the Van Duzen, juvenile *o. mykiss* were sampled to determine if anadromous fish were spawning above this falls. Based on preliminary data, at least one juvenile located approximately 5 miles above the falls had markers indicating anadromous parentage (B. Harvey, PSW Fisheries Biologist, email/personal communication 2014)

As the 'default' historic spatial processes described by McElhany et al. (2000) have likely not been preserved, NMFS (Williams et al. 2011) concluded in the most recent status review that winter steelhead continue to inhabit most of the watersheds in which they historically occurred, thus all diversity strata within the DPS appeared to be represented by extant populations. However, given this information, there is still little information available for assessing whether conditions have improved or worsened over the past 5 years (Williams et al. 2011).

Although large wood features such as debris jams may provide winter refuge for steelhead, cover consisting of interstitial spaces in cobble or boulder substrate is considered the key attribute defining winter habitat suitability for juvenile steelhead (Hartman 1965, Chapman and Bjornn 1969, Meyer and Griffith 1997). Hartman (1965) and Bustard and Narver (1975) found that during high winter flows, juvenile steelhead seek refuge in interstitial spaces in cobble and

boulder substrates that range in size from 10 to 40+ cm (4 to 16+ in). Initial observations from experiments conducted by Redwood Sciences Laboratory and Stillwater Sciences (unpublished data; cited in County and Stillwater Sciences 2011) in artificial stream channels, indicate that juvenile steelhead respond to high flows by seeking cover deep within cobble and boulder substrate, suggesting that steelhead will seek refuge at least 1 to 2 times the depth of the median particle size (d50) in unembedded cobble/boulder substrate.

Abundance

Steelhead abundance has been monitored at three dams in the NC steelhead ESU since the 1930s: Sweasey Dam on the Mad River (annual adult average 3,800 in the 1940s), Cape Horn Dam on the upper Eel River (4,400 annual average in the 1930s), and Benbow Dam on the South Fork Eel River (18,784 annual average in the 1940s; Murphy and Shapovalov 1951, Shapovalov and Taft 1954, Busby et al. 1996). These data can be compared to the annual average of 2,000 at Sweasey Dam in the 1960s, annual average at 1,000 at Cape Horn Dam in the 1980s, and annual average of 3,355 at Benbow Dam in the 1970s (McEwan and Jackson 1996, Busby et al. 1996). In the mid-1960s, California Department of Fish and Game (CDFG) estimated steelhead spawning in many rivers in this ESU to total about 198,000 (McEwan and Jackson 1996). Currently, the most abundant run is in the Middle Fork Eel River, with about 2,000 fish in 1996 (McEwan and Jackson 1996). Substantial declines from historic levels at major dams indicate a probable decline from historic levels at the DPS scale.

Busby et al. (1996) and Good et al. (2005) summarized current abundance estimates, and stated that: (1) population abundances are low compared to historical estimates, (2) recent trends are downward (except for a few small summer-run populations), and (3) summer-run steelhead abundance was "very low" (Good et al. 2005). The most recent status reviews (Williams et al. 2011) cited lack of data on population level abundances, particularly time series data within the DPS, as a major source of uncertainty, hindering the assessment of NC steelhead status. Population level abundance estimates were only available for 4 of the 42 independent winter-run steelhead populations and for 1 of 10 summer-run populations in the DPS. Trends for all five independent populations are negative, three of which are significant (Williams et al. 2011). Of the six winter-run and three summer-run partial population estimates, trends were not calculated by NMFS because the data sets were too short (Williams et al. 2011). Of the six remaining that had sufficient data, two partial populations are exhibiting significant negative trends. Only one partial population is exhibiting a significant positive trend ($p>0.05$).

Summer dive surveys are conducted on Redwood Creek, the Mad River and in the Eel River basin to count summer-run fish.

Only the Middle Fork Eel River summer-run steelhead populations approached low-risk thresholds established by the Technical Review Team (TRT) (Williams et al. 2011). The TRT also found that the summer-run population in Redwood Creek showed chronically low numbers during all surveys, suggesting that this population continues to be at a high risk of extinction (Williams et al. 2011).

Busby et al. (1996) and Good et al. (2005) concluded that the NC steelhead DPS was not in danger of extinction, but was likely to become endangered in the foreseeable future. In the most recent status review update, Williams et al. (2011) found that historical and current information indicates that NC steelhead populations are depressed in basins where they are being monitored.

Williams et al. (2011) concluded, albeit with limited data, that: (1) population abundances are low, compared to historical estimates; (2) recent trends are downward, although not significantly, (3) summer-run steelhead abundance remains low, (4) in the Mad River, the high number of hatchery fish in the basin, coupled with the uncertainty about the relative abundance of hatchery and wild spawners is of concern, and (5) the status of NC steelhead was unchanged from that determined by Good et al. (2005).

Six Rivers National Forest Distribution/Abundance

Mad River: Steelhead are distributed up to Matthews Dam, although uncertainty exists as to how many steelhead surpass the boulder/bedrock falls (Bug Creek falls). Tributary use for spawning is probable; however, most tributaries dry up leaving only pockets of water for rearing. Pilot Creek is the largest tributary upstream of these falls. Basin wide summer steelhead surveys were performed in 2013 and 2014 (Mad River Alliance 2013, 2014). One summer steelhead was found on USFS lands in the reaches below Matthews Dam during both surveys (personal observation), although none were found in 2015.

Eel River (North Fork, Mainstem Tributaries): Steelhead are present in the North Fork Eel River above Split Rock, although summer steelhead are believed to be extirpated (Moyle 2002). Resident rainbow trout are found co-located with the anadromous steelhead. Juvenile young-of-year steelhead/RBT are found in intermittent pools in the summer months. Many tributaries dry up leaving isolated pools. The NFE was not designated as Critical Habitat. SRNF manages the headwaters of Dobbyn Creek and a very small portion of Kekawaka Creek. Steelhead are present in the mainstem Eel River, with NC steelhead critical habitat reaching up on to SRNF lands in Dobbyn Creek.

Van Duzen River: Steelhead were believed to be unable to surpass Eaton Roughs to reach SRNF lands. The 2014 genetic sampling showssteelhead may be able to migrate upstream of Eaton Roughs, however it is likely to occur in extremely rare circumstances given the conditions at Eaton Roughs. Steelhead to migrate up the Little Van Duzen to Forest Service lands, but the numbers spawning are unknown.

CC Chinook Salmon

The CC Chinook salmon ESU extends from Redwood Creek in Humboldt County, south to, and including, the Russian River. The CC Chinook salmon ESU was historically comprised of approximately 38 Chinook salmon populations (Spence et al. 2008). Many of these populations (about 21) were independent, or potentially independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts. The remaining populations were likely more dependent upon immigration from nearby independent populations than dependent populations of other salmonids (Spence et al. 2008). The most recent estimate of ESU-wide CC Chinook salmon abundance is 73,000 fish, predominantly in the Eel River (55,500) with smaller populations in Redwood Creek, Mad River, Mattole River (5,000 each), Russian River (500), and several small streams in Del Norte and Humboldt Counties (NMFS website).

The following life history and status information is from this source:

http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/chinook/chinook_salmon.html

Life History and Diversity

Adult Chinook salmon reach sexual maturity at 3 to 5 years and die soon after spawning. Precocious 2 year olds, make up a relatively small percentage of the spawning population. Healey (1991) described two basic life history strategies for Chinook salmon, stream-type and ocean-type, which provide variation within the species. Like most salmonids, Chinook salmon have evolved with variation in juvenile and adult behavioral patterns, which can help decrease the risk of catastrophically high mortality in a particular year or habitat (Healey 1991). Only fall-run Chinook salmon currently occur in the CC Chinook salmon ESU. However, historical information indicates that spring-run Chinook salmon existed in the Mad River and the North Fork and Middle Fork of the Eel River (Keter 1995, Myers et al. 1998, Moyle 2002).Juveniles emerge from the gravel in the early spring and typically spend one year in freshwater before migrating downstream to estuaries and then the ocean (Moyle 2002).

Fall-run Chinook salmon are unambiguously ocean-type (Moyle 2002) and specifically adapted for spawning in lowland reaches of big rivers and their tributaries (Moyle 2002, Quinn 2005). Adults move into rivers and streams from the ocean in the fall or early winter in a sexually mature state and spawn within a few weeks or days upon arrival on the spawning grounds (Moyle 2002). Juveniles emerge from the gravel in late winter or early spring and within a few months migrate downstream to the estuary and the ocean (Moyle 2002, Quinn 2005). This life history strategy allows fall-run Chinook salmon to utilize quality spawning and rearing areas in the valley reaches of rivers, which are often too warm to support juvenile salmonid rearing in the summer (Moyle 2002). The CC Chinook salmon ESU historically consisted of fifteen independent populations of fall-run Chinook salmon, as many as six spring-run populations, and an unknown number of dependent populations that have been grouped into four strata diversity, which are subdivided by fall-run and spring-run life history types (Spence et al. 2008). Spence et al. (2008) expressed concern over the loss of spring-run populations in this ESU, as all six putative spring-run independent populations of Chinook salmon within the ESU are believed extinct.

NMFS recently completed a 5-year status review of the CC Chinook salmon ESU, including consideration of hatchery fish in the risk analysis (NMFS 2011c). The status assessment involved viability attributes of abundance, productivity, spatial structure, and diversity, and concluded that this ESU remains at risk of becoming endangered in the foreseeable future (NMFS 2011c). The TRT was especially concerned with the loss of the spring-run Chinook life history type and the diminished connectivity between populations in the northern and southern halves of the ESU, and concluded that additional information available since Good et al. (2005) does not suggest any significant improvement in the status of this ESU that would change the extinction risk (Williams et al. 2011). Spence et al. (2008) concluded that the lack of demonstrably viable populations in any of the CC Chinook salmon diversity strata, the apparent loss of populations from all watersheds between the Mattole and Russian rivers, and the loss of important life-history diversity (i.e. spring-run populations) all indicate that this ESU fails to meet the representation, redundancy, and connectivity criteria developed by Spence et al. (2008) to assess species viability.

Williams et al. (2006) classified populations as dependent or independent based on their historic population size. Independent populations are populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years and are rated as

functionally independent (FI) and potentially independent (PI). Core population types are independent populations judged most likely to become viable most quickly. Non-core 1 population types are independent populations judged to have lesser potential for rapid recovery than the core populations. Dependent populations (D) are populations that historically would not have had a high likelihood of persisting in isolation for 100 years. These populations relied upon periodic immigration from other populations to maintain their abundance. Two ephemeral populations (E) are defined as populations both small enough and isolated enough that they are only intermittently present (McElhany et al. 2000; Williams et al. 2006).

Distribution

The geographic distribution of CC Chinook salmon in the ESU extends from Redwood Creek in Humboldt County, south to, and including, the Russian River.

NMFS identified four regions of this portion of the California coast with similar basin-scale environmental and ecological characteristics (Bjorkstedt et al. 2005). Sixteen watersheds were identified in these four regions that have a minimum amount of habitat available to support independently viable populations. In the North Mountain-Interior Region, the Upper Eel and Middle Fork Eel Rivers contain functionally independent CC Chinook populations, while the Lower Eel and Van Duzen Rivers have the potential to be independent. In the North Coastal Region, Redwood Creek and the Mad, Lower Eel, South Fork Eel, Bear and Mattole rivers all contain sufficient habitat for functionally independent CC Chinook salmon populations. The most recent status review (NMFS 2011c) found that until more exhaustive and spatially representative surveys of the available habitat are done on a consistent basis, the status of Chinook salmon in these watersheds will remain highly uncertain.

Good et al. (2005) stated that the current spatial structure of CC Chinook salmon contributed significantly to long-term risk of extinction but did not in itself constitute a danger of extinction in the near future. However, Good et al. (2005) found that a reduction in geographic distribution continued to present substantial risk, particularly for spring-run Chinook salmon and for basins in the southern portion of the ESU. Based on consideration of information available since the previous status review in 2005, and as the ‘default’ historic spatial processes described by McElhany et al. (2000) have likely not been preserved due to the reduction in geographic distribution, NMFS concluded that this ESU is not viable in regards to the spatial structure VSP parameter (NMFS 2011c).

Abundance

Myers et al. (1998) summarized information on historical abundance of CC Chinook salmon, including an escapement estimate for the ESU of 73,000 adults, predominantly in the Eel River (55,500) with smaller populations in Redwood Creek, Mad River, Mattole River (5,000 each), Russian River (500), and several small streams in Del Norte and Humboldt Counties.

Widespread declines in abundance and the present distribution of small populations with sometimes sporadic occurrences contribute to the risks faced in this ESU. Good et al. (2005) found that historical and current information indicates that CC Chinook salmon populations are depressed in basins where they are monitored.

Six Rivers National Forest Distribution/Abundance

Chinook do not currently migrate upstream to SRNF lands in the Mad River, North Fork Eel River, or the Van Duzen River. Based on interviews done with longtime residents of the North Fork Eel, Keter (1995) determined that Chinook salmon historically were found in the North Fork Eel. Chinook are present in the mainstem Eel River, including Dobbyn Creek, and like steelhead, chinook critical habitat reaches up on to SRNF lands in the North Fork Dobbyn Creek.

Critical Habitat

Section 7 of the Endangered Species Act requires that Federal agencies must ensure that any activities they authorize, fund or carry out are not likely to destroy or adversely modify the designated critical habitat of a listed species. Critical habitat is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

NMFS designates critical habitat by determining the conservation value of particular areas and balancing the benefits of designation against its impacts (e.g., economic, national security). The proposed designation then goes through a period of public comment before the final rule is published and critical habitat is designated.

Information and GIS layers for SONCC coho salmon, NC steelhead and CC Chinook salmon is located at the following NMFS website:

http://www.westcoast.fisheries.noaa.gov/habitat/critical_habitat/critical_habitat_on_the_wc.html

SONCC Coho Salmon Critical Habitat

Description

Designated CH (CH) for Coho salmon encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California and the Elk River in Oregon, inclusive (May 5, 1999, 64 FR 24049). Excluded are: (1) areas above specific dams identified in the Federal Register notice; (2) areas above longstanding natural impassible barriers (i.e., natural waterfalls); and (3) tribal lands. The area described in the final rule represented the current freshwater and estuarine range of Coho salmon. Land ownership patterns within the Coho salmon ESU analyzed in this document and spanning southern Oregon and northern California are 53% private lands; 36% Federal lands; 10% State and local lands; and 1% Tribal lands.

SONCC coho salmon ESU critical habitat is separated into five essential habitat types of the species' life cycle. The five essential habitat types include: (1) juvenile summer and winter rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; (4) adult migration corridors; and (5) spawning areas. Essential habitats 1 and 5 are often located in small headwater streams and side channels, while essential habitats 2 and 4 include these tributaries as well as mainstem reaches and estuarine zones. Growth and development to adulthood (essential habitat 3) occurs primarily in near-and offshore marine waters, although final maturation takes place in freshwater tributaries when the adults return to

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

Current Condition

The condition of SONCC coho salmon critical habitat at the ESU scale, specifically its ability to provide for the species' conservation, has been degraded from conditions known to support viable salmonid populations that contribute to survival and recovery of the species. NMFS determined that present depressed population conditions are, in part, the result of human-induced factors affecting critical habitat, including: intensive timber harvesting, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals for irrigation. All of these factors were identified when SONCC coho salmon were listed as threatened under the ESA, and they continue to affect this ESU (NMFS 2014). However, efforts to improve coho salmon critical habitat have been widespread and are expected to benefit the ESU over time (NMFS 2014).

SONCC coho salmon are dependent upon complex, low gradient habitats for winter rearing, and will express diversity by overwintering in low-gradient, off-channel and estuarine habitats when they are available. The lack of complex aquatic habitat, and much decreased access to floodplains and low gradient tributaries are common features of current critical habitat conditions within the SONCC coho salmon ESU (NMFS 2014). The Recovery Plan also describes that land use activities (e.g., timber harvest, road building, etc.) that occur upstream of low gradient streams, still affect the habitat within low gradient streams by reducing the amount of large wood and shade available and by increasing the amount of sediment that routes through the valley bottom habitats.

Mapping

Since the Federal Register did not provide a map of coho CH, conclusions regarding CH (and coho Essential Fish Habitat (EFH) occurrence are based on field review of habitat suitability as defined by the Intrinsic Potential model[7] (NMFS 2006), professional judgment, District fish survey records, and California Department of Fish and Wildlife (CDFW) information. Watersheds without historical records of coho presence are not considered as containing coho CH even if IP habitat is identified. Where information on coho is lacking (e.g., no/few surveys have been completed), else it is the professional judgment of the Fish Biologist that neither SRNF nor Calfish.org range maps fully capture CH/EFH extent, the SRNF steelhead trout distribution (GIS) layer may be used as a proxy for maximum range of anadromous fishes. This dataset is recognized as a conservative approach for assessment of effects to anadromous fish habitat because coho (and Chinook for EFH) may not occupy the same waters as steelhead due to

[7] Since information concerning the historical distribution of SONCC coho was lacking through a large portion of the their ranges and biological data necessary to assess carrying capacity directly was also lacking, the technical recovery teams made use of habitat-based proxies for historical use and environmental capacity as a measure of a population's carrying capacity. To develop such proxies, they implemented a GIS model that predicts the distribution of species-specific "intrinsic potential" (IP) for habitat suitable for spawning or juvenile rearing (Williams et al. 2006)

differences in jumping abilities. The maximum jumping height (under ideal conditions) for coho is 2.2 meters; Chinook salmon is 2.4 meters; and steelhead is 3.4 meters (Meehan 1991). Therefore, steelhead trout can access more habitat than Coho or Chinook salmon (i.e., steelhead trout can make a 3-meter jump to migrate up a stream, but Coho and Chinook salmon cannot.). Additionally, differences in spawn timing may also affect actual distribution. In all cases, field review and site-specific surveys may refine the location of CH or EFH.

NC Steelhead and CC Chinook Critical Habitat

Description

NMFS designated critical habitat for seven of the ESUs/DPSs of Pacific salmon and steelhead, including CC Chinook salmon and NC steelhead in September 2005 (70 FR 52488, September 2, 2005). Specific PCEs, that are essential for the conservation of each species, were identified as: freshwater spawning sites; freshwater rearing sites; freshwater migration corridors; estuarine areas; nearshore marine areas; and offshore marine areas. Within the PCEs, essential elements of CC Chinook salmon and NC steelhead critical habitats include adequate (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, (10) safe passage conditions, and (11) salinity conditions (70 FR 52488, September 2, 2005).

Habitat areas within the geographic range of the ESU/DPSs having these attributes and occupied by the species were considered for designation. Steelhead critical habitat was designated throughout the watersheds occupied by the ESU/DPSs. In general, the extent of critical habitat conforms to the known distribution of NC steelhead in streams, rivers, lagoons and estuaries (NMFS 2005). In some cases, streams containing steelhead were not designated because the economic benefit of exclusion outweighed the benefits of designation. This occurred in the North Fork Eel River for NC steelhead. Critical Habitat for Chinook was designated up to Rock Creek (tributary to NFE). Native American lands and U.S. Department of Defense lands were also excluded. Essential Fish Habitat for Chinook is discussed above.

Current Condition

For CC Chinook salmon, NMFS identified 45 occupied HSAs within the freshwater and estuarine range of the ESU. Eight HSAs were rated low in conservation value, 14 were rated medium, and 27 were rated high in conservation value (NMFS 2005). Within the ESU, NMFS' ratings and economic benefits analysis resulted in the designation of critical habitat with essential features for spawning, rearing and migration in approximately 1,634 miles of occupied habitat.

Similar to the current condition of SONCC coho salmon critical habitat, the current condition of NC steelhead and CC Chinook salmon critical habitat is degraded throughout most of the range of these species. NMFS believes the status of CC Chinook salmon critical habitat in the 45 HSAs has not changed substantially since the 2005 assessment (NMFS 2011c). Estuaries and lower river habitats are greatly reduced, in both area and condition, as the valley bottoms near the mouths of rivers are where most of the agricultural and urban development is concentrated. Levees constrain most estuaries and lower rivers in this DPS and ESU and prevent access to important off-channel rearing habitat. Upstream land uses increase the amount of sediment and

warm water that enters low gradient streams and decreases the availability of large wood in these habitats.

Mapping

Upper limits for chinook and steelhead CH were determined during designation of critical habitat and maps are available at NMFS website for downloading.

NMFS Species of Concern

Northern DPS Green Sturgeon – Species of Concern

http://www.westcoast.fisheries.noaa.gov/publications/SOC/greensturgeon_detailed.pdf

A status review was completed in 2002 (Adams et al. 2002) for green sturgeon (*Acipenser medirostris).* Two green sturgeon DPSs were identified based on the fact that sturgeon generally show fidelity to their spawning site so they have a general pattern of multiple DPSs, and on the preliminary genetic evidence that indicates differences at least between the Klamath River and San Pablo Bay samples. The northern DPS would include all green sturgeon populations starting with the Eel River and extending northward. The southern DPS would include all green sturgeon populations south of the Eel River with the only known population being in the Sacramento River. As discussed above, this southern DPS and its critical habitat is not located on or downstream of SRNF. The Northern DPS has been considered a species of concern with NMFS since 2003.

Green sturgeon have a complex anadromous life history. They spend more time in the ocean than any other sturgeon. The majority of green sturgeon are thought to spawn in the Klamath River, but spawning also occurs in the Sacramento and Rogue rivers. First spawning occurs at 15 years for males and 17 years for females. Female green sturgeon are thought to spawn only every 5 years. Adults migrate into rivers to spawn from April to July with a May to June peak. Eggs are spawned among rocky bottom substrates and juveniles spend 1 to 4 years in freshwater. After green sturgeon enter the ocean, they appear to make northern migrations indicated from very limited tag information. Green sturgeon concentrate in coastal estuaries, particularly the Columbia River estuary and coastal Washington estuaries during the late summer and early fall. Neither feeding nor spawning occurs in association with these concentrations, and there is no information about how much of the population is in these concentrations each year or whether this varies.

Forest Service Sensitive Anadromous Species

Three additional anadromous species will benefit from implementing the WFR Program as they are co-located with SONCC coho salmon or NC steelhead trout. Species were considered for listing and status reviews were completed. Determinations were made that the two ESUs and two DPS did not warrant listing under the ESA, however, concerns exist such that all three were placed on the Regional Foresters Sensitive species list (July 2013) after internal reviews were completed (on file).

Chinook

Southern Oregon/California Coastal Chinook salmon ESU

Upper Trinity/Klamath River Chinook salmon ESU

Status Summary: On March 9, 1998 (63 FR 11481) NMFS reviewed west coast Chinook salmon populations for listing under the ESA. NMFS described the ESUs then proposed that some of the populations may be proposed for listing and others would not. The Southern Oregon and California Coastal (SOCC) ESU Chinook salmon was proposed for listing as threatened. At that time, this ESU contains Chinook from the Elk River, Oregon south to the northern cape forming San Francisco Bay.

On determined that proposed listing was not warranted for the Upper Klamath and Trinity Rivers ESU. The ESU includes all naturally spawned populations of Chinook salmon in the Klamath and Trinity River Basins upstream of the confluence of the Klamath and Trinity Rivers. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 6,429 square miles in California. The following counties lie partially or wholly within these basins: Del Norte, Humboldt, Siskiyou, and Trinity.

On September 16, 1999, NMFS determined that listing was not warranted for this ESU. The ESU includes all naturally spawned populations of chinook salmon from rivers and streams between Cape Blanco, Oregon (excluding the Elk River), and the lower Klamath River, California, excluding populations in the Klamath River Basin upstream from the confluence of the Klamath and Trinity Rivers. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 6,528 square miles in California and Oregon.

Klamath Mountain Province Steelhead DPS

NMFS determined that listing was not warranted for this DPS on March 19, 1998. The ESU includes steelhead from the Elk River in Oregon to the Klamath and Trinity Rivers in California, inclusive. Major river basins containing spawning and rearing habitat for this DPS comprise approximately 13,011 square miles in California and Oregon.

The Klamath Mountain Province DPS includes summer (stream maturing) and winter (ocean maturing) steelhead as well as the unusual "half-pounder" life history (characterized by immature steelhead that return to fresh water after only two to four months in salt water, over winter in rivers without spawning, then return to salt water the following spring). Summer-run steelhead enter fresh water between May and October and begin their spawning migration in a sexually immature state. After several months in fresh water, summer steelhead mature and spawn. Winter-run steelhead enter fresh water between November and April with well-developed gonads. In drainages with populations of both summer- and winter-run steelhead, there may or may not be temporal separation of spawning (Roelofs 1984, Barnhart 1986, Busby et. al. 1996). For a complete life history description and status review see Busby et al (1996) "Status Review of West Coast Steelhead from Washington, Idaho, Oregon and California".

Populations of KMP steelhead are located in the Smith, Klamath and Trinity rivers. Summer runs are also known to occur in the Smith River, Klamath River (Bluff Creek, Red Cap Creek, Camp Creek, Wooley and Dillon), and Trinity River mainstem. Annual adult snorkel surveys are performed on all the above drainages. Juvenile population information has been collected in

various years via downstream migrant trapping (Horse Linto, Willow Creek, Camp Creek, and Red Cap creeks) as well as snorkel surveys on various tributaries.

IV. ENVIRONMENTAL BASELINE

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

As previously described, the action area includes Six Rivers National Forest lands that overlap the following watersheds/populations: Smith River, Redwood Creek, Mad River, North Fork Eel River, Mainstem Eel River, Lower Eel River/Van Duzen River, Middle Klamath River, Lower Klamath River, Salmon River, Lower Trinity River, and South Fork Trinity River.

Urban development is found primarily on the estuaries of the larger streams downstream of SRNF lands. Small towns and rural residences throughout the area. Forestry is the dominant land-use throughout the area, although there is some agriculture.

Native vegetation in the action area includes Douglas-fir (*Pseudotsuga menziesii*) intermixed with hardwoods, to ponderosa pine (*Pinus ponderosa*) and Jeffery pine (*Pinus jefferyi*) stands along the upper elevations. Grasslands are located along the main ridge tops and south-facing slopes of the watersheds.

The overall action area has a Mediterranean climate characterized by cool, wet winters with typically high runoff; and dry, warm summers characterized by greatly reduced instream flows. While fog is a dominant climatic feature along the coast, the higher elevations and inland areas where SRNF lands are found tend to be relatively fog free. Most precipitation falls during the winter and early spring as rain, with occasional snow above 1,600 feet. The action area receives one of the highest annual amounts of rainfall in California, with a few sections averaging over 85 inches a year. Mean rainfall amounts ranges from 9 to 125 inches. Extreme rain events do occur, with over 240 inches recorded over parts of the action area during 1982/83. Along the coast, average air temperatures range from 46 °F to 56 °F. Farther inland and in the southern part of the action area, annual air temperatures are much more varied, ranging from below freezing in winter to over 100 °F during the summer months.

High seasonal rainfall on bedrock and other geologic units with relatively low permeability, erodible soils, and steep slopes contribute to the flashy nature (stream flows rise and fall quickly) of the watersheds within the action area. In addition, these high natural runoff rates have been increased by extensive road systems and other land uses. High seasonal rainfall combined with rapid runoff rates on unstable soils delivers large amounts of sediment to river systems. As a result, many river systems within the action area contain a relatively large sediment load, typically deposited throughout the lower gradient reaches of these systems.

Matrix of Pathways and Indicators/Watershed Condition Framework

The Matrix of Pathways and Indicators (NMFS 1996) is a tool for characterizing environmental baselines for anadromous fish habitat and can be used to predict the effect of human activities on these conditions. The Matrix of Pathways and Indicators provides generalized ranges of functional values for aquatic, riparian and watershed elements that collectively describe properly functioning condition for aquatic habitat essential to the long-term survival of anadromous fish. Properly functioning values for these indicators generally correspond with the Aquatic Conservation Strategy objectives that are important to pacific salmonids.

The 2011 **Watershed Condition Framework** (WCF) is a comprehensive approach for proactively implementing integrated restoration on priority watersheds on national forests and grasslands (Figure 3). The WCF was implemented across all National Forests to improve the Forest Service approach to watershed restoration by establishing a consistent methodology for condition assessment, and targeting the implementation of integrated collections of enhancement activities on those watersheds identified as priorities for restoration (USDA 2011).

Six-Steps of the Watershed Condition Framework (WCF) process.

Prior to the WCF each national forest classified watershed condition (typically at the watershed, or HU5, scale) using local methods that were not consistent between forests. The WCF provides a framework for consistent assessments at the subwatershed, or HU6 scale, and for prioritizing watersheds for restoration.

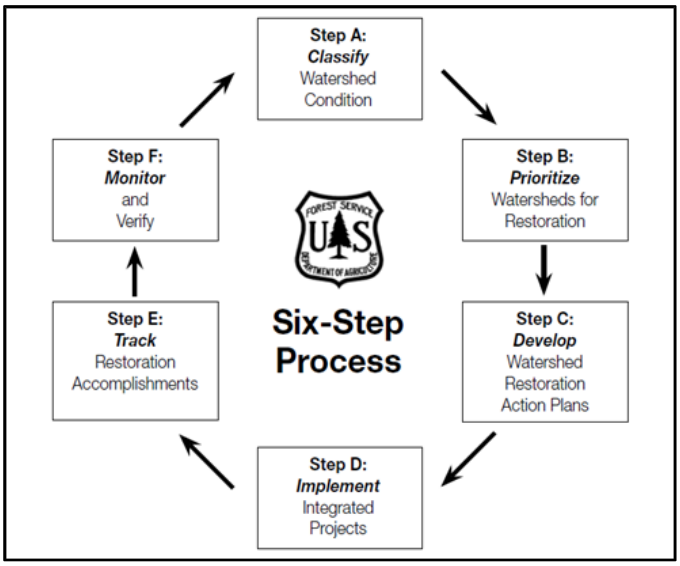

Figure 5. Six-steps of the Watershed Condition Framework Process.

Watershed condition classification is the process of describing watershed condition in terms of discrete categories (or classes) that reflect the level of watershed health or integrity. The WCF classifies watershed condition using a comprehensive set of 12 indicators that are surrogate variables representing the underlying ecological, hydrological, and geomorphic functions and

processes that affect watershed condition. Information from the Matrix of Pathways and Indicators, in addition to recent GIS information was used to develop values for these WCF indicators.

The indicators are grouped according to four major process categories: (1) aquatic physical, (2) aquatic biological, (3) terrestrial physical, and (4) terrestrial biological. These categories represent terrestrial, riparian, and aquatic ecosystem processes or mechanisms by which management actions can affect the condition of watersheds and associated resources. The four "process categories" are then weighted to reflect their relative contribution toward watershed condition from a national perspective. The aquatic physical and aquatic biological categories are weighted at 30% each because of their direct impact to aquatic systems (endpoint indicators). The terrestrial physical category was weighted at 30% because roads are one of the greatest sources of impact to watershed condition. The terrestrial biological category is weighted at 10% because these indicators have less direct impact on watershed condition.

Primary emphasis is placed on aquatic and terrestrial processes and conditions that Forest Service management activities can influence. The approach is designed to promote integrated watershed assessments; target programs of work in watersheds that have been identified for restoration; enhance communication and coordination with external agencies and partners; and improve reporting and monitoring of program accomplishments.

On the SRNF, there were 71 subwatersheds (6th field HUC) included in the assessment. National forest ownership within subwatersheds ranged from 5-100 percent (watersheds with less than 5 percent national forest lands were not rated). Assessment data came from the national forests so ratings apply only to the national forest lands in the watershed (See Appendix A-4). The following table summarizes these two efforts in order to identify watersheds that may have a higher sensitivity to impacts, or a higher need for restoration actions.

Table 8. Overall Watershed Condition Ratings by HU4 Subbasin - Number of HU6 Subwatersheds by Condition Class

Rating	Smith River	Klamath River	Salmon River	Redwood/ Mad River	Trinity River	Van Duzen River	Eel River	Totals
Functioning Properly	14	9	6	1	2	0	2	34
Functioning at Risk	1	6	0	2	5	3	8	25
Impaired Function	2	2	0	4	3	1	0	12
Totals	17	17	6	7	10	4	10	71

While not an exact cross walk, the following table summarizes the NMFS Matrix of Pathways and Indicators for these same watersheds.

Table 9. Crosswalk of NMFS Matrix and Watershed Condition Framework

Pathways and indicators	Smith River	Klamath River	Salmon River	Trinity River	South Fork Trinity River	Mad River	Van Duzen River	North Fork Eel River
Water Quality								
Temperature	PF	AR	AR	AR	AR	AR	AR	AR
Turbidity	PF	AR	AR	AR	AR	AR	NPF	AR
Chemical Concentration/Nutrients	AR	AR	AR	AR	AR	AR	AR	AR
Habitat Access								
Physical Barriers	PF – No known road fish migration barriers	PF – No known road fish migration barriers	PF – No known road fish migration barriers	PF – No known road fish migration barriers	PF – No known road fish migration barriers	PF – No known road fish migration barriers	AR – if anadromy above Eaton Falls	PF – No known road fish migration barriers
Habitat Element								
Substrate/Sediment	Currently PF	AR	AR	AR	AR	AR	AR	AR
Large Wood	AR	AR	AR	AR	AR	AR	AR	AR
Pool Frequency and Quality	PF	AR	AR	AR	AR	AR	NPF	AR
Off-Channel Habitat	PF	AR	AR	AR	AR	AR	NPF	PF
Refugia	PF	AR	AR	AR	AR	AR	NPF	AR
Channel Condition and Dynamics								
Width/Depth Ratio	PF	PF	PF	PF	PF	PF	AR	AR
Streambank Condition	PF	PF	PF	AR	AR	AR	AR	AR
Floodplain Connectivity	PF	AR	AR	AR	AR	AR	AR	PF
Flow/Hydrology								
Changes in Peak/Base Flows	PF	NPF	NPF	NPF	NPF	NPF	AR	PF
Increase in Drainage Network	AR	AR	AR	AR	AR	AR	NPF	PF
Watershed Condition								
Road Density and Location	AR	AR	AR	AR	AR	AR	AR	PF
Riparian Reserves	AR	AR	AR	AR	AR	AR	AR	AR
Distribution History	PF	AR	AR	AR	AR	AR	AR	PF

PF = Properly Functioning; AR = At Risk; NPF = Not Properly Functioning

Redwood Creek and Mainstem Eel River (Dobbyn and Kekawaka creeks) are not included in the above tables due to the minor amount of activities that would occur in these watersheds.

Smith River

There is a paucity of information with regard to salmon and steelhead populations in the Smith River and trend information is very limited. CDFG (1965) estimated escapement of Chinook salmon for Smith River drainage at approximately 15,000 fish annually. The best information regarding coho salmon abundance and trends was collected during Chinook salmon spawning surveys on an index reach of the West Branch of Mill Creek by Jim Waldvogel, Sea Grant Advisor for Del Norte County (NOAA Fisheries 2003b). The number of adult coho salmon trapped ranged from 2 (1981, 1990) to 28 (1985) fish annually, with a 23 year average of 11 adult coho salmon per year. No negative or positive trends are apparent from these data. Despite the lack of data, NMFS suspects anadromous salmonid populations within the Smith River drainage have likely experienced declines similar to other northern California and southern Oregon coastal watersheds.

Current estimates of the abundance and distribution of the Smith River coho population are based on studies that have been conducted over the past several decades. These include a long-term data set describing salmon abundance in the West Branch and East Fork Mill Creek (McLeod and Howard 2010) since 1994. Within West Branch of Mill Creek, adult coho salmon spawner counts have ranged from a high of 175 to a low of 3 between 1994 and 2009 with decreases in numbers seen in more recent years (McLeod and Howard 2010).

Habitat conditions in the Smith River basin have been degraded by high timber harvest activities, mostly from redwood harvest on private lands in the coastal sections. Timber harvest in riparian areas has reduced the recruitment potential for LWD for decades or centuries (USDA SRNF 1995). Early logging, prior to more recent forest practice rules, removed much of the streamside vegetation, particularly along larger, more accessible channels. In many cases, regeneration within these areas is now dominated by hardwoods. Hardwood dominance has the dual effect of not providing adequately-sized wood to adjacent channels while suppressing conifer regeneration. The lack of conifer-derived woody debris is likely to persist and perhaps worsen as existing instream wood decays or is transported downstream and the adjacent stands are not capable of providing adequate replacements.

A legacy of mining roads and open pits and shafts that were used and operated in the 1850s to 1950s still exist in the North Fork Smith subbasin and in the Hardscrabble, Myrtle, Patrick, and Shelly watersheds. Many of these mining features are chronic sources of sediment since revegetation, and restoration is difficult due to the inherent harsh soil conditions of these areas. Hydraulic mining was intensive in low-gradient reaches of several tributaries, significantly altering stream channel characteristics and impacting fish habitat. Currently, the lower river is mined for aggregate material and is the primary aggregate source in Del Norte County.

A widespread and aging road network continues to present a sediment hazard to channels in the Smith River basin. SRNF has released a draft environmental impact statement analyzing a range of alternatives for developing a road and trail network that reduces the impacts from roads by upgrading or decommissioning (USDA 2014). Additionally, hillslope landslides from timber harvest and other activities in the watershed (*e.g.*, mining) provide additional sediment. While some information suggests that the upper portions of the Smith River may be able to transport much of the sediment, lower gradient reaches may be vulnerable to the accumulation of this

sediment. The Smith River basin is not currently listed as water quality impaired under section 303(d) of the CWA.

Analysis of watershed and road conditions (and effects) on the Smith River NRA is based on road assessments done to date (see Appendix A-3). These analyses address current and potential sediment sources, road density and location, drainage network increases, and effects from road drainage features.

Klamath and Trinity Rivers

The Klamath River once supported diverse, abundant anadromous fish runs thought to number in the millions. Now, all of the anadromous fish species inhabiting the Klamath River are in a state of serious decline (Higgins et al. 1992), especially those species or stocks that depend on summer freshwater aquatic habitat, such as coho salmon, steelhead, or spring Chinook salmon.

In the Klamath River, poor water quality during the summer season is considered a major contributing factor to the decline of anadromous fish runs (Bartholow 1995). The main causative factors behind the poor water quality in the mainstem Klamath River are the large-scale water impoundment and diversion projects above Iron Gate Dam (Klamath River) and Lewiston Dam (Trinity River). Average annual runoff below Iron Gate Dam has declined by more than 370,000 acre-feet since inception of the Bureau of Reclamation's Klamath Project, while up to 90 percent of the Trinity River flow has been annually diverted into the Sacramento River. The large volume of water diverted from each of these basins significantly affects downstream flow levels and aquatic habitat. After analyzing both pre- and post-Klamath Project hydrologic records, Hecht and Kamman (1996) concluded that variability and timing of mean, minimum, and maximum flows changed significantly after construction of the project. Project operations tend to increase flows in October and November, and decrease flows in the late spring and summer as measured throughout the Klamath mainstem. Low summer flows within the Klamath River can increase daily maximum water temperatures by slowing flow transit rates and increasing thermal loading relative to higher flows (Deas and Orlob 1999). Moreover, further heating the already-warm, nutrient-rich water released from Iron Gate Dam typically results in poor water quality (*e.g.*, low dissolved oxygen, increased algal blooms) in the Klamath River between the dam and Seiad Valley.

Lower summer flows emanating from the Klamath Project (*i.e.*, released at Iron Gate Dam) are exacerbated by diminished inflow from many of the major tributaries to the middle Klamath River. The Klamath and Trinity rivers both contain numerous instream barriers upstream of SRNF lands that preclude salmon and steelhead migration into much of their historic range.

Much of the middle reach of the Klamath River basin (*i.e.*, between the confluence of the Trinity River and Iron Gate Dam) and Trinity River basin is under Federal ownership and not managed for intensive timber harvest. Both the Klamath River (nutrients, organic enrichment/low dissolved oxygen, and temperature) and Trinity River (sedimentation/siltation) are listed under section 303(d) of the CWA as water quality limited (CSWRCB 2003).

Mad River

The Mad River watershed has endured a long legacy of watershed disturbance. Streamside vegetation removal, channel modifications, and instream gravel extraction dating back many

decades, combined with intensive upslope activities such as timber harvest and road construction, have had a significant influence on the condition of both watersheds. Furthermore, Mad River watersheds is section 303(d) listed for turbidity and sedimentation due to timber harvest, resource extraction, and nonpoint sources (CSWRCB 2003). A principal contributor of fine sediment is hydrologically connected road segments.

Population growth rates for salmonids in the Mad River have not been quantified. The closest researchers have come to this goal is when Spence et al. (2007) described diver surveys which demonstrated the number of adult summer-run steelhead in three reaches of the Mad River declined at an average rate of 23 percent per year over two generations (from 1994 to 2002). The apparent decrease in population sizes of Mad River coho salmon, Chinook salmon, and steelhead indicates the populations are not replacing themselves.

The steelhead population in the Mad River watershed is at risk from adverse hatchery effects. NMFS specifically identified the past practices of the Mad River Hatchery as potentially damaging to NC steelhead. CDFG out-planted non-indigenous Mad River Hatchery brood stock to other streams within the DPS, and attempted to cultivate a run of non-indigenous summer-run steelhead within the Mad River. CDFG ended these practices in 1996. The current operation of the Mad River Hatchery has been identified as having potentially harmful effects to wild salmon populations as well.

Williams et al. (2008) determined at least 153 coho salmon spawners are needed each year in the Mad River population to avoid depensatory effects of extremely low population sizes. The most recent information indicates that adult coho salmon returns have declined to an average of 38 adults trapped and 16 females spawned at the Mad River hatchery between 1991 and 1999 (NMFS 2005). Only a fraction of all fish ascending the Mad River enter the Mad River fish ladder and fish hatchery, therefore counts there do not capture all spawners. However, the number of adult coho returns has been so low that the overall number of spawners is almost certainly a small fraction of the number required for viability. It is therefore likely that the Mad River coho salmon population is at high risk of detrimental population effects resulting from low population size.

Habitat surveys within the Mad River watershed detail the low amount and small size of existing LWD (primarily 1- to 2-foot diameter pieces). Further, due to past logging practices and development along streams, many riparian zones tend to be dominated by alder, willow, and younger conifers. Given the current vegetation age structure and past logging history along streams, recruitment of adequately-sized woody debris to many Mad River tributaries is not likely to occur for several decades.

Redwood Creek

The Redwood Creek watershed has endured a long legacy of watershed disturbance. Streamside vegetation removal, channel modifications, and instream gravel extraction dating back many decades, combined with intensive upslope activities such as timber harvest and road construction, have had a significant influence on the condition of both watersheds. Furthermore, Redwood Creek watershed is section 303(d) listed for turbidity and sedimentation due to timber harvest, resource extraction, and nonpoint sources (CSWRCB 2003). A principal contributor of fine sediment is hydrologically connected road segments.

Logging, road building, and the construction and maintenance of flood control levees are the land uses that have had the most pronounced effect on coho salmon habitat in the Redwood Creek basin. The lower portion of the watershed was historically logged prior to the creation of the Redwood National Park. Much of the upper and middle portions of the basin are owned by private timber companies and are used for timber production. In addition, livestock grazing occurs on some private lands, both in the middle and upper portions of the basin and in the valley bottom near Orick, where the grazing land is protected by flood control levees. Six Rivers National Forest manages approximately 1% of the headwaters of Redwood Creek

Eel River – North Fork Eel and Van Duzen

Historic land and water management, specifically large-scale timber extraction and water diversion projects, contributed to a loss of habitat diversity within the mainstem Eel River and many of its tributaries. The Eel River is listed under section 303(d) of the CWA as water quality limited due to excessive sediment and high water temperatures (CSWRCB 2003). Essential habitat feature limitations include high water temperatures, low instream cover levels, high sediment levels, and low LWD abundance.

Water diversion within the Eel River basin has occurred since the early 1900s at the Potter Valley facilities. Annually, about 160,000 acre-feet (219 cfs average) are diverted at Cape Horn Dam, through a screened diversion, to the Russian River basin. Flow releases from the Potter Valley facilities have both reduced the quantity of water in the mainstem Eel River, particularly during summer and fall low-flow periods, as well as dampened the within-year and between-year flow variability that is representative of unimpaired watersheds. These conditions have restricted juvenile salmonid rearing habitat, impeded migration of adult fish and late emigrating smolts, and provided ideal low-flow, warm water conditions for predatory Sacramento pikeminnow (*Ptychocheilus grandis*; NOAA Fisheries 2002).

Intensive timber extraction within the lower Eel and Van Duzen watersheds has caused chronic erosion in certain areas due to the highly erodible soils common throughout the two watersheds. An extensive study of sediment discharge within the Eel River watershed (Brown and Ritter 1971) determined that the suspended sediment discharge increases downstream, unlike most rivers. The average annual suspended sediment load is 10,000 tons per square mile (Brown and Ritter 1971), which is one of the highest measured sediment yields in the world. As discussed previously, high levels of suspended sediment can negatively affect salmonid populations by degrading essential freshwater habitat as well as reducing fitness of individual fish and modifying behavior.

The **North Fork Eel River** watershed is a very rugged and remote watershed characterized by gentle upland terrain that has been dissected by steep, inner gorge canyons. The bulk of sediment generated by landslides is of natural, non-management related origin. The mainstem North Fork Eel River is primarily low-gradient interspersed with higher-gradient boulder and bedrock stretches. The channel is defined by large amounts of course sediment (e.g. gravel, cobble, boulder) especially in the mainstem and major tributaries.

Little historical information is available for instream habitat conditions in the drainages covered by this report. The earliest surveys were done in the 1970's and were simple qualitative surveys with no flow data or other physical parameters collected. For the North Fork Eel River and its tributaries, Tom Keter, SRNF archaeologist, (Keter 1995), states that long-time residents of the

area interviewed agreed that 40 to 60 years ago the streams within that basin used to run at higher water levels in the summer than they do today. If true, it may be sufficient reason there were a greater number and diversity of anadromous fish (summer steelhead and Chinook). Water quality within the North Fork Eel River is listed as sediment and temperature impaired under Section 303(d) of the Clean Water Act and was assessed through the Total Maximum Daily Load process (TMDL).

The **Van Duzen River** watershed reflects a long legacy of upstream and upslope impacts coupled with the effects of continued instream disturbances. The Van Duzen River is listed under section 303(d) of the CWA as water quality limited due to excessive sediment (CSWRCB 2003). Much of the available salmonid habitat within the Van Duzen watershed is currently degraded by high levels of sediment, low pool density, high water temperatures, and low instream cover levels. The upper Van Duzen has higher quality habitat, cleaner gravels and more boulder areas to provide cover. A recent genetics study indicates steelhead occasionally reach the upper watershed (personal communication, Bret Harvey).

VI. EFFECTS ANALYSIS

This WFRBA includes a program of work where activities are designed to improve watershed conditions in general and to enhance TES anadromous salmonid habitat in the short and long term. This WFRBA analysis combines two effects methodology to capture the effects of restoration activities: Matrix of Pathways and Indicators (MPI) (1999) and the Analytic Process (2005) developed by NMFS in conjunction with USFS.

Definitions

WFRBA activities have varying degrees of direct and indirect effects to aquatic ESA-listed species and their Critical Habitat (CH) based on site specificity. **Direct effects** cause an immediate impact to listed fish at the time of the activity. **Indirect effects** are those that occur later in time either to individual fish or habitat components upon which they rely.

Activities under this WFRBA range from “no effect” to “not likely to adversely affect” to “likely to adversely affect” listed salmonids.

> “**No Effect**” determination is the appropriate conclusion when there is no effect whatsoever including small effects, effects that are unlikely to occur, and beneficial effects (all of which are recognized as “may affect” determinations). A no effect determination is only appropriate if the proposed action will literally have no effect whatsoever on the species and/or critical habitat, not a small effect, an effect that is unlikely to occur, or a beneficial effect.
>
> “**Not Likely to Adversely Affect**” determination is the appropriate conclusion when effects are expected to be discountable, or insignificant, or completely beneficial.
>
> “**Likely to Adversely Affect**” determination is appropriate if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial (see definition of "is not likely to adversely affect").

- In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action "is likely to adversely affect" the listed species.
- If incidental take[8] is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made. An "is likely to adversely affect" determination requires the initiation of formal section 7 consultation.

Scale of Analysis

The potential effects of WFR Programmatic actions are analyzed at two scales: Program level and site specific level.

- **The program activity scale analysis**: Project activities (starting on page 25) are analyzed to determine the potential effects that could happen to TES species. Potential effects are based on current scientific literature. Actions involving heavy equipment operating in occupied TES habitat would always have the potential to cause adverse impacts to individual fish or their habitat whereas actions occurring on roads would range from having no effects (road maintenance on a ridgetop road) to an adverse impact from culvert replacements near occupied habitat).
    - The final determination of the WFR Program is made on the greatest effect determination - the WFR Program as a whole is intended to improve watershed conditions for anadromous species.
- **The site activity scale analysis:** activities may or may not have adverse impacts based on the proximity of the activity to TE fish/CH, whether or not there is a causal mechanism for an impact to occur, and the environmental baseline of the habitat to absorb or withstand an impact.

  This analysis is documented during the NEPA process. Projects are reviewed at the Annual Coordination Meeting (see Program Description/Project Process on page 20) to ensure the site specific activity effects are tracked and that impacts stay within the bounds of the Program Analysis. Site specific determinations of the activity would be documented in the NEPA decision and on the Project Notification Form. See Appendix F for the site specific process

Effects of most concern under this programmatic consultation are those resulting from short-term effects to habitat quantity and/or quality, or impacts that cause changes to listed species' growth,

[8] Incidental take - take of listed fish or wildlife species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by a Federal agency or applicant. [50 CFR §402.02]

Take - to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct. [ESA §3(19)] Harm is further defined by FWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by FWS as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. [50 CFR §17.3]

reproduction, and survival. The aquatic conservation measures and project design criteria listed above are intended to minimize potential adverse direct and indirect project effects to ESA/MSA listed species, CH, and EFH.

Effects of the Programmatic Actions

Aquatic restoration activities proposed in this WFRBA are intended to have an overall beneficial impact on ESA listed fish and the watersheds in which they are found. These restoration activities have been identified in the SONCC Recovery Plan (NMFS 2014). In implementing these restoration activities, the possibility exists that adverse impacts could occur; however, the majority of the restoration activities would result in minimal impacts.

Activities that are determined to result in a conclusion of "Likely Adversely Affect" (LAA) ESA listed fish species and designated CH are those that:

> a) will be completed outside occupied habitat (upstream, within riparian areas) such that the intensity and duration of any disturbance caused is likely to impair the function of aquatic habitats or essential fish behavior (effect is not discountable or insignificant);
>
> b) will be completed with heavy equipment within occupied habitat such that harm to ESA-listed fish is possible; or
>
> c) include pursuit or capture of ESA-listed fish when removing fish is thought to be less of an impact.

Effects of WFRBA Activities on Pathways and Indictors

Each of the aquatic restoration activities listed within the proposed action may have varying degrees of direct and indirect effects to aquatic ESA-listed species and their Critical Habitat (CH) and Essential Fish Habitat (EFH) as well as to Forest sensitive species. Effects of most concern under this programmatic consultation are those resulting from short-term habitat removal or degradation or impacts that cause changes to species' growth, reproduction, and survival. The aquatic conservation measures and project design criteria are intended to minimize potential adverse direct and indirect project effects to ESA/MSA listed species, CH, and EFH, sensitive species.

The following discussion presents the effects of programmatic activities on individual indicators. The WFRBA Activities are intended to "Enhance" conditions at the site scale and move a 5th field watershed baseline towards a "Restore" rating over the long-term. These programmatic actions may result in some degree of short-term adverse effects to fish or their habitat given the results of the proximity, magnitude and probability analysis. This information is summarized in Table 10 on page 98

a. Indicator Description: How the indicator affects ESA list salmonids – including current science of stressor/response relationship.

b. Long term Benefits of WFR Program on Indicators (+, - / +) – Description of how the restoration activities result in immediate benefits to habitat or fish, as well as benefits to indictors after potential negative impacts. The underlying assumption is that appropriate design features and best management practices would be implemented.

c. Discountable Effects (*) – effects to indicators that are minor and of short duration, have been mitigated through best management practices, timing of activity and other design criteria such that impacts are unmeasurable.

d. Short Term Negative Effects (-*, - / +) – Description of potential short term negative effects to the indicators. Restoration activities could result in a short term negative effects to an indicator while in pursuit of recovery actions. For some pathways, no short term negative effects would occur due to the activities proposed.

Water Quality Pathway

a. Indicator Description

The description of the following three pathway indicators provides the ways in which they serve as essential ecological functions necessary for the overall viability of fish stocks:

Indicator	**Description**
Water Temperature See "Cool Water Refugia" below for additional information on temperature	Water temperatures affect the survival and production of fish throughout all life stages: salmon survival from fertilization to hatching (Garling and Masterson 1985); increased temperatures resulting in disease of juvenile salmonids; changes in growth (Armour 1990) accompanied by decreased feeding, increased stress, and warm water diseases. Finally, at a certain point, temperatures become lethal for all fish. McCullough (1999), citing numerous studies, stated that temperatures above 21˚C equal or exceed incipient lethal temperatures for Columbia River Chinook stocks and steelhead stocks migrating during the summer season.
Sediment/Turbidity,	Increased levels of sedimentation often have adverse effects on fish habitats and riparian ecosystems. Fine sediment deposited in spawning gravels can reduce egg survival and developing alevins (Everest et al. 1987; Hicks et al. 1991) by reducing the availability of dissolved oxygen in the gravel. Primary production, benthic invertebrate abundance, and thus, food availability for fish may be reduced as sediment levels increase (Cordone and Kelley 1961; Loyd et al. 1987) due to reductions in photosynthesis within murky waters. Social (Berg and Northcoate 1985) and feeding behavior (Noggle 1978) can be disrupted by increased levels of suspended sediment. Robichaud et al. (2010) documented that sediment influxes into streams, which create turbidity, were lower in natural (undisturbed) forests relative to disturbed sites created by land management activities.
Chemical Contamination/ Nutrients	Aquatic ecosystem perturbations related to chemical contamination include thermal pollution, toxicity due to organic compounds and heavy metals, organic wastes and resulting changes in dissolved oxygen, acidification, and

	increased eutrophication. ESU wide, sources of these chemical inputs commonly result from industry, urban development and agriculture. However, on SRNF, little of these inputs influence streams. Sources on contamination include chemicals from heavy equipment and illegal marijuana grows. Nutrient input from livestock and dispersed recreation sites adjacent to coho habitat may cause localized impacts.
Salmon derived nutrients (not part of the MPI)	It is clear from the growing body of literature that salmon may influence the food webs, trophic structure, nutrient budgets, and possibly the productivity of freshwater and terrestrial systems, although the effect varies widely between systems and is contingent upon timing, scale, retention mechanisms, alternative nutrient sources, and baseline limiting factors (Gende et al. 2002). Reduced inputs of salmon-derived organic matter and nutrients (SDN) may limit freshwater production and thus establish a negative feedback loop affecting future generations of fish.

b. Long-term Benefits of WFRBA Activities to the Water Quality Pathway

In general, the WFRBA aquatic restoration categories listed in Table 10 will improve or restore one or more of the following: stream structure/complexity, stream sinuosity and length, bank stability, floodplain connectivity, and riparian vegetation structure and diversity. Such results will promote conditions that maintain or decrease stream temperature (via increased shading and hyporheic flow), reduce turbidity (via stable banks, improved sediment retention through increased channel structure, riparian areas, and floodplains), and improved nutrient input (via increased riparian allocthonous sources and nutrient supplementation) and retention (via increased channel structure, sinuosity, and floodplain areas).

Salmon derived nutrients: Restoration efforts use the rationale of declining SDN to justify artificial nutrient additions, with the goal of reversing salmon decline. Biological responses to this method have also been documented (Roni et al. 2002). Elevated primary production and density of invertebrates have been associated with carcass additions (Wipfli et al. 1999). Kohler et al. (2012) documented that invertebrate productivity and fish growth increased after a carcass analog treatments in several Columbia River Basin streams. While evidence suggests that fish and wildlife may benefit from increases in food availability as a result of carcass additions, stream ecosystems vary in their ability to use nutrients to benefit salmon. Moreover, the practice may introduce excess nutrients, disease, and toxic substances to streams that may already exceed proposed water quality standards (Compton 2006).

c. Discountable Effects

Temperature: The WFRBA concluded that these activities are unlikely to have negative impacts to stream temperatures because only minimal amounts of vegetation will be removed. Selecting individual tree selection out of riparian areas for instream placement would not change the canopy cover. Riparian treatments designed to improve riparian conditions in the long term (alder girdling and planting), may result in a site change to canopy as alders die. This local

increase in solar radiation to the stream channel could result in site specific increase in primary production which could provide additional food resources (Wilzbach et. al. 2006). Based on the localized nature of treatments no change in stream temperature would result at the reach level.

Chemical Contamination/nutrients: Road related activities requiring heavy equipment occur outside of fish habitat. Other activities such as instream restoration actions may use heavy equipment powered by diesel fuel and lubricated by other petroleum products that are hazardous to salmonids. The potential for hazardous fluid spills or leaks exists on dry gravel bars and within the wetted channel. However, given that: 1) all equipment will be fueled outside of the riparian reserves (with some exceptions due to topography), 2) equipment will be checked for leaks before operations and daily during operations and 3) spill response kits are to be included with all equipment, only small amounts of hazardous fluids have the potential to leak, or be delivered to the wetted channel. Due to the proposed protection measures that reduce the risk of petroleum product entry to the wetted channel and the potential size of a leak, and proposed measures that allow for a quick response to a potential leak, any effects to juvenile or adult salmonids or their habitat from equipment fueling or chemical fluid leaks are expected to be insignificant.

The use of heavy equipment within RRs represents a risk to water quality because fuel or hydraulic fluid spills could occur. BMPs 2.8 and 2.11 of the Region 5 Forest Service BMP Handbook will be implemented to minimize the risk of spills. BMPs include requirements that equipment be properly maintained and cleaned, including daily inspections; fueling and servicing of equipment in designated areas outside of RR, with the exception of hydrologically disconnected project landings; having a spill plan in place prior to implementation; removal and disposal of leaks/spills; and requirement to have a spill kit on site. Based on implementation of minimization measures, fuel spills are not expected and effects on the Water Quality habitat indicator group and anadromous salmonid habitat will be insignificant.

d. Short-term Negative Impacts of WFRBA Activities to Water Quality

WFRBA activity categories are expected to benefit the Water Quality Pathway. In acquiring these benefits, short-term negative impacts are expected. Such effects will be minimized by incorporating Best Management Practices, Aquatic Conservation Measures (ACM) and Project Design Features (PDF).

Turbidity: There are three potential sources for turbidity/suspended solids that enter the water column. Fine sediments from the stream bed that have been disturbed by work performed in channel; fine sediment introduced from the stream banks during restoration activities; and fine sediment that enters the stream network from upstream, typically from road/stream crossings interactions (road maintenance, culvert upgrades and decommissioning).

Suspended sediment and turbidity caused by heavy equipment entry into the wetted channel will cause a short-term (i.e., a few hours) and small (i.e., about one-half a channel width wide, extending for approximately 1500 feet downstream) plume of turbidity during the summer or early fall months when the water in the action area would otherwise be clear. When this occurs above occupied habitat, the turbidity would have little to no effect until winter flows flushed the settled sediment out. During winter flows, the amount of sediment is unlikely to be distinguishable from background.

Increased sediment loads would result from the use of large equipment within or near a stream channel or movement of large wood through the riparian area causing soil disturbance and transport within the stream system. In-stream equipment operations within the wetted channel are likely to cause small and short-term increases in turbidity at and downstream of locations where activities are occurring. Short-term inputs of sediment could result from instream structure placement, opening of side channels, road treatments, and other projects that occur inside the bankfull channel. The sediment plume will be most concentrated in the immediate project vicinity and should dissipate within a few hours. The amount, extent, and duration of fine sediment inputs and turbidity are related to the following: type and duration of heavy machinery used in or near a bankfull channel; soil type; the amount of soil disturbance; the sensitivity of the channel banks to erosion and other disturbances; the amount of time it takes for disturbed areas to re-vegetate and stabilize; and the probability of precipitation events before disturbed areas are re-vegetated or stabilized. Aquatic Conservation Measures and Best Management Practices would minimize the amount of fine sediment delivery and associated turbidity.

WFR Program activities such road decommissioning and upgrading are typically upstream and upslope of occupied coho salmon or steelhead habitat, such as erosion control of roads and trails, and road decommissioning. For these types of projects, sediment is typically not transported until the first few storm events following road treatment.

Summer Effects - Within or Upstream (1,500 ft) of Occupied Habitat

Even with minimization measures, in-stream equipment use may result in short-term turbidity and suspended sediment increases up to 1,500 feet downstream of the activity's location, based on observations of similar construction activities in other rivers (NMFS - Free *pers. comm.* 2009). Background levels of turbidity are low during the summer and early fall months, as is river flow that is required to transport fine sediment downstream and out of the action area. During instream activities, it is expected that small and short-term increases in turbidity will result in a decrease in the salmonid prey base up to 1,500 feet downstream of the source of input due to settling of fine sediment on substrates (NMFS 2010). Increased sediment input during summer low flow will also result in sediments depositing into downstream surface gravels after suspension (due to low flow and not enough stream power to keep sediments in suspension and flushed out of the river) and may reduce the interstitial spaces of channel substrate, decreasing the habitable area for aquatic invertebrates, an important food source for juvenile salmonids (Bjornn and Reiser 1991, Spence et al. 1996).

Increased turbidity during the summer and early fall may result in short-term behavioral changes of juvenile salmonids (Newcombe and Jensen 1996). Behavioral changes include changes in feeding, predator detection, and avoidance of sediment plumes up to 1,500 feet downstream of the disturbance, such that juvenile salmonids will temporarily be displaced into different habitat. Increases in turbidity and sedimentation from in-stream equipment use will be temporally and spatially staggered throughout the season and action area.

First Winter Storm Effects

The fall and winter storms of the water year (water year defined as October 1 to September 31 of each calendar year) will expose adult and juvenile steelhead, and adult and juvenile coho salmon, to increases in SSC from both background and WFR Program activities. The first storms of the year typically have the highest relative SSC because natural erosional and human related processes produce fresh material for transport during the drier summer and early fall months.

The magnitude of the SSC increases from WFR Program activities are a function of the number of channel crossings removed each year and the location of those channel crossings in relation to occupied habitat and designated critical habitat. Background levels of SSC are already high in most waterways within the action area during fall and winter storms, and although we do not have an estimate of how much sediment will be released from channel crossing removal. Local monitoring of suspended sediment concentrations (SSC) in Lost Man Creek (tributary to Redwood Creek) shows that removal of upslope channel crossings (upslope and upstream of listed salmonid distribution) caused temporary increases in SSC downstream of project sites within occupied habitat during the first winter following road decommissioning (from channel erosion adjustment at culvert removal sites). However, levels of turbidity typically returned to pre-project concentrations after the first winter following project implementation (Klein 2007). The increases in SSC downstream of channel crossing removal sites was an order of magnitude greater than background, but that the increased SSC quickly went down to background after the first few storms of the winter. The duration of the SSC increases are also a function of the early storms' duration; storm duration may vary, but typically last from a few days to about a week.

Roads – Decommissioning and Culvert Upgrades

While the majority of activities have some potential to introduce sediment into the channel, road decommissioning and culvert replacements have the greatest potential for introducing sediment and fines into the stream channel. SRNF examined 117 km (73 miles) of decommissioned roads, including 262 stream crossings, on the Six Rivers National Forest, northwestern California, to quantify erosion and identify failure mechanisms and potential areas for improvement. Although most crossings had experienced some adjustment, erosion was generally minor. The average amount of erosion for stream crossings was 21 m^3 (28 yd^3), which represents 4.5% of the amount of fill excavated. Of this volume, 40% of the erosion was due to channel adjustment and 60% was due to bank failures. Erosion from the roadbed between crossings was very small and was observed only in areas of highly unstable geology. The amount of erosion appears well correlated with the timing and intensity of storm events. Large storm events occurring the first winter after decommissioning produced elevated erosion levels. After several dry winters, erosion was very minor, even from large storm events (Cook & Dresser 2007). Keppeler et al. (2007) identified the 0-2 year period as the most significant period for sediment movement in streams after human disturbance.

Conclusion – Water Quality Pathway

WFR Program activities could result in minor discountable and insignificant impacts to Temperature and Chemical Concentrations indicators with the potential for beneficial impacts in those watersheds where nutrient enhancement is implemented. Activities are intended to maintain or improve this Pathway with an emphasis on reducing the amount of fine sediments entering the stream network.

Short-term periods of elevated turbidity are possible from the majority of the activities listed. The distance for sedimentation effects to dissipate to background levels is dependent on site specific environmental factors, such as channel gradient, sediment size and lithology (Lawrence et al., 2014).

Habitat Access Pathway

a. Indicator Description

Human constructed physical barriers within the stream channel, such as culverts and dams can impair sediment and debris transport, migration routes, life history patterns, and population viability. Historic instream structures can also adjust such that they form low flow barriers to movement of juvenile fish. First and second order streams, which generally include permanently flowing non-fish bearing streams and seasonally flowing or intermittent streams, often comprise over 70 percent of the cumulative channel length in mountain watersheds in the Pacific Northwest (Benda et al. 1992). These streams are the sources of water, nutrients, wood, and other vegetative material for streams inhabited by fish and other aquatic organisms (Swanson et al. 1982; Benda and Zhanag 1990). Decoupling the stream network (through physical barriers) can result in the disruption and loss of functions and processes necessary for creating and maintaining fish habitat. Further, physical barriers prevent the movement of fish in their fulfillment of life history functions. Culverts, for instance, prevent juvenile fish from reaching rearing habitats (Furniss et al. 1991) and have blocked significant amounts of historical anadromous salmonid habitat (Roni et al. 2002). Even more, barriers restrict the expression of various life history forms within a species.

On SRNF, no Forest Service roads are known to block movement of adult or juvenile fish species. Bridges are located at all road stream crossings where anadromous fish are found. County and state roads may still form barriers. With the potential of NC steelhead to surpass historic barriers (Eaton Falls) Forest Road/stream crossings would need to be reevaluated on the upper Van Duzen.

In addition to man-made barriers, low flow conditions at the mouths of tributaries (influenced by illegal and legal water diversions) may prevent juvenile fish from reaching cool water refugia.

b. Long-term Benefits of WFRBA Activities to the Habitat Access Pathway

The Legacy Structure/maintenance or removal category contains two subcategories that will target fish passage restoration in old structures that may be preventing movement of individuals at low flows. Removing or fixing these historic structures would allow for uninhibited stream access for migrating and rearing fish. Culvert upgrades, while not causing fish passage concerns, would result in restored or improved continuous paths for wood, nutrients, sediments, and other vegetative material essential for quality fish habitat.

c. Short-term Negative Impacts of WFRBA Activities to the Habitat Access Pathway

As described above, WFRBA activity categories are expected to benefit Habitat Access. None of the activities identified would cause a negative impact to this indicator.

Conclusion – Habitat Access

The majority of the WFR Program activities would have no effect on this indicator (See Table 10). Beneficial activities that would benefit this indicator include: improving access to cool water refugia (Fish Access to Habitat), modification of historic structures to allow passage of all life

stages and increased flows from improved water diversions and reduction of impacts from marijuana grows).

Habitat Elements Pathway

a. Indicator Description –

Descriptions of the following five indicators provide the ways in which each indicator serves as an essential ecological function necessary for the overall viability of fish stocks:

Indicator	**Description**
Substrate/Sediment,	(excerpts from Rieman and McIntyre 1993) – This indicator is similar to "Sediment" in that it addresses fines and their effects on fish habitat. The NMFS (1996) notes that rearing capacity of salmon habitat decreases as cobble embeddedness levels increase, resulting from increased sedimentation. Furthermore, over wintering rearing habitat within substrate may be a limiting factor to fish production and survival, and the loss of this over wintering habitat may result in increased levels of mortality during rearing life stages.
Large Wood	Large wood in streams is an important roughness element influencing channel morphology, sediment distribution, and water routing (Swanson and Lienkaemper 1978; Bisson et al. 1987). Large wood influences channel gradient by creating step pools and dissipating energy (Heede 1985), lengthens streams by increasing sinuosity (Swanston 1991), and serves as an important agent in pool formation (Montgomery et al.1995; Reeves et al. 2011). In low order streams, in particular, LW collects sediment and larger substrates during high flow events (Keller et al. 1985) and can account for 50% of the sediment/substrate storage sites (Megahan 1982). Further, LW is instrumental in nutrient retention by capturing and storing salmon carcasses (Cederholm and Peterson 1985; Strobel et al. 2009) and allochthonous materials, a primary energy source for smaller rivers and streams (Gregory et al. 1991). The resulting effect of LW on fish habitat is significant. Crispin et al. (1993) noted increased salmon spawning activity in an area where gravels accumulated behind LW. Bjornn and Reiser (1991) cited several studies that documented an increase in fish densities with higher levels of LW, and Fausch and Northcote (1992) documented that coho salmon and cutthroat trout production was greater in LW-dominated streams, where pools, sinuosity, and overhead cover were greatest. The role of LW decreases as streams become larger, because greater currents will carry LW out of the active channel and onto the banks (Murphy and Meehan 1991).
Pool Frequency and Quality	Pools are considered to be one of the most important habitat elements and are the preferred habitat type by most fish (Bestcha

	and Platts 1986), offering low velocity refuges, cooler stream temperatures during summer months, and overwintering habitat (Reeves et al. 1991). Salmonid density is positively correlated to pool volume and frequency; pool loss reduces the production capability of salmonid habitat (Everest et al. 1987; MacDonald et al. 1991; Nickelson et al. 1992; Fausch and Northcote 1992; Reeves et al. 2011). Availability of pools during summer low flow periods can be a limiting factor in survival and production of salmonids (Reeves et al., 1990). In reference to spawning, pool tailouts, where gravel is deposited, are important areas for redd construction, and the pool bodies provide rearing habitat for juveniles and holding habitat for adults (Bjornn and Reiser 1991). Further, Sedell et al. (1990) describes pools as being important refuges from drought, fire, winter icing, and other disturbances.
Off-Channel Habitat	Off-Channel habitat-comprised of alcoves, side channels, freshwater sloughs, wetlands or other seasonally or permanently flooded areas—are important rearing sites for juvenile fish (Roni et al. 2002). Roni et al. (2002) noted that most off channel habitat research focused on coho salmon, noting that juveniles are much more reliant on this habitat type for over-winter rearing and growth than other salmonids, such as cutthroat trout and Chinook salmon. In an Oregon coastal stream, Reeves et al. (2011) noted that side channels comprised 5% of the total habitat but contained 20-60% of the coho fry in the study area.
Refugia	Refugia, or areas providing high quality habitat, either currently or in the future, are a cornerstone of most species conservation strategies. Naiman et al. (1992) and Sheldon (1998) noted that past attempts to recover fish populations were unsuccessful because the problem was not approached from a watershed perspective. Noss et al. (1997) provides additional information, listing several principals that should be considered when evaluating reserves (refugia). First, refugia should be well distributed across a landscape, the idea being that widely distributed subpopulations will not experience catastrophic or adverse impacts across its entire range. Second, large reserves are better than small ones, because there is a greater opportunity for habitat diversity and larger population size. Thirdly, refugia that are closer together are better than those farther apart. A short distance between refugia promotes dispersion and genetic interchange. If enough interchange occurs between refugia, fish are functionally united into a larger population that can better avoid extinction.
Cool Water Refugia (Not part of the MPI)	Elevated water temperatures in river systems and the associated thermal stress on their biota is an increasingly serious and

	widespread problem. Use of thermal refuges by adult salmonids has been demonstrated during upriver migration (Nielsen et al. 1994) and upon arrival to prespawn holding areas in rivers and heated streams (Berman and Quinn 1991; Torgersen et al. 1999). Thermal refuges can increase the carrying capacity of juveniles in thermally compromised streams (Ebersole et al. 2006) and can allow the presence of salmonids in otherwise inhospitable habitats (Biro 1998; Torgersen et al. 1999; Sutton et al. 2007). In a thorough literature review, McCullough (1999) found that thermal refuge use generally did not occur until water temperatures reached or exceeded 20ºC for juvenile and adult Chinook salmon, although questions remain about temperature thresholds that distinguish between facultative and obligatory thermal refuge use. Besides directly causing physiological stress, elevated water temperatures in the Klamath River are correlated with prevalence of diseases including *Ceratomyxa shasta* that cause mortality in Klamath River coho salmon (Ray et al 2012).

b. Long-term Benefits of WFRBA Activities to the Habitat Elements Pathway

Large wood and boulder placement will enhance habitat elements described in the Large Wood indicator. A literature review by Roni et al. (2014) reported that the vast majority of studies on wood placement have reported improvements in physical habitat (e.g. increased pool frequency, cover, habitat diversity) with most evaluations of fish response showing a positive response from salmonids. Developing side channels will increase adult and juvenile rearing habitat as described in the Off-channel Habitat indicator above. Streambank restoration and road treatment projects will decrease direct sediment inputs into the stream channel, thereby enhancing conditions for juvenile rearing within channel substrate. Fish Passage restoration projects will provide access to Refugia while all restoration actions within the proposed action will enhance the quality of such Refugia.

c. Discountable Effects

When activities occur upstream of occupied habitat the increased stream turbidity may deposit fine coats of sediment on channel substrate a short distance downstream When this “short distance” falls above occupied habitat, then the short term negative impacts to salmonids described under Turbidity would not occur. Best Management Practices are designed to site specifically reduce the amount of sediment entering a channel. The sediment may eventually work its way downstream during the first winter’s storm. In cases of fall-spawning fish, the fine layer of sediment deposited on channel substrate will be cleared away as the fish construct their redds. It is anticipated that all project related sediment will be flushed out during the first fall/winter/spring high flows after project completion, and site restoration conservation measures are expected to prevent future project related sediment inputs into the stream.

d. Short-term Negative Impacts of WFRBA Activities

In acquiring benefits of the restoration activities, short-term negative impacts are expected in some locations. Such impacts will be minimized by incorporating ACMs and PDCs into project design, implementation, and monitoring.

The WFRBA Team determined that negative impacts would be likely to occur to Substrate/Sediment indicator when in close proximity to occupied habitat and the amount of sediment coming into the channel was above background levels. Further, the Team determined that these increased sediment loads would result from those activities that used large equipment within or adjacent to a stream channel, causing soil disturbance and transport within the stream system. The WFRBA Team also concluded that these activities are unlikely to have negative impacts to the remaining indicators of this pathway as WFRBA projects are intended to enhance such indicators. Therefore the following analysis will focus on activity affects to the Substrate/Sediment indicator.

Short-term inputs of sediment could result from instream structure placement, opening of side channels, road treatments, and other projects that occur inside or near the bankfull channel. The amount, extent, and duration of sediment inputs are related to the following: the type and duration of heavy machinery used within or near a bankfull channel; soil type; the amount of soil disturbance; whether restoration is in or out of the wetted channel; the sensitivity of the channel banks to erosion and other disturbances; the amount of time it takes for disturbed areas to re-vegetate and stabilize; and the probability of precipitation events before disturbed areas are re-vegetated or stabilized. Best Management Practices are designed to site specifically reduce the amount of sediment entering a channel. Because the work will be conducted during the in-water work periods (a time when spawning is not expected and after emergence of fry), the project should not interfere with spawning, egg development, and the sac fry life stage. The effects to individual fish and their habitat is based in large part on proximity to designated critical habitat or occupied habitat.

Conclusion for Habitat Elements

The majority of the WFR Program activities are intended to improve habitat elements such as addition of large wood, improved pool quantity and quality, off-channel habitat and overall quality of the individual watersheds as Refugia. Program activities such as road decommissioning and road upgrading (to disconnect road run off from stream systems) are intended to reduce the risk of catastrophic failure of roads along with associated fills.

In implementing these activities, increases in sediment input to stream networks are likely. Like turbidity, this increase would be short-term.

Channel Conditions and Dynamics Pathway

a. Indicator Description

Descriptions of the following three indicators provide the ways in which each indicator serves as an essential ecological function necessary for the overall viability of fish stocks

Indicator	Description
Width to Depth Ratio	The width to depth ratio is an index value that helps describe

	the shape of a stream channel, and is the ratio of bankfull width to mean bankfull depth (Rosgen 1996). Relatively small width/ depth values are indicative of stream stability, and Rosgen (1996) suggests that width to depth ratios can be used as a surrogate to stream stability. Finally, Bestcha and Platts (1986) state that as width to depth ratios increase, the stream becomes shallower and may result in a loss of pools.
Streambank Condition	Streambank condition is related to its ability to dissipate stream power. For many stream channels, riparian vegetation with woody root masses, along with instream debris, serve as physical barriers to erosive and downcutting forces of stream power (Bestcha and Platts 1986). Further, the stems of herbaceous and woody plants, residing on the stream bank, provide additional roughness to dissipate stream power and capture suspended sediments (Elmore and Bestcha 1987). When these roughness elements are removed, however, a streambanks ability to withstand stream power is decreased, resulting in bank erosion, relatively higher width to depth ratios, and possible channel incision. Even if streambanks are in good condition, increased peak flows can damage banks and cause channel incision. Finally, streambanks that are in good condition can provide quality fish habitat through undercut banks and overhanging vegetation (Bestcha and Platts 1986).
Floodplain Connectivity	Leopold (1994) defines a floodplain as a level area near a river channel, constructed by the river in the present climate and overland flow during moderate flow events. When a stream can readily access its floodplain during high flow events, the stream will overflow its banks and spread across the floodplain, dissipating stream energy, depositing sediments, accessing side channels. Bestcha and Platts (1986) suggest that for a floodplain to be effective in sorting and capturing flood-born sediment it must have roughness elements, such as trees and other debris. Floodplains or riparian areas adjacent to stream channels serve as water storage sites—water collected from flooding and precipitation—which can increase subsurface flow to the stream channel (Elmore and Bestcha 1987), especially important to augmentation of low stream flows during summer months. Likewise, Tonina and Buffington (2009) note that floodplains that are connected to stream channels result in hyporheic exchange of water, resulting in increased nutrient distribution and increased inundation of floodplain habitats, such as side channels, a habitat type offering refuge to juvenile salmonids during high flow events (Roni et al. 2002).

b. Long-term Benefits of WFRBA Activities

All projects will enhance one or more of the indicators under the Channel Condition and Dynamics Pathway. Each of these projects will occur within the bankfull channel and/or immediate floodplain area and are intended to restore channel, bank, and floodplain areas to more natural conditions. As a result, WFRBA projects are expected to decrease width/depth ratios, improve streambank condition, and/or increase floodplain connectivity. Removing forest road stream crossings is an effective restoration tool for reducing sedimentation for aquatic systems. While restoration has the potential to deliver fine sediment to the stream network as discussed under Water Quality Pathway, the amount is quite small relative to the potential pulse deliver from crossing failure and chronic erosion of crossing fill (Maurin and Stubblefield, 2011)

c. Discountable Effects/ Short-term Negative Impacts of WFRBA Activities

As described above, WFRBA activity categories are expected to benefit Channel Conditions and Dynamics. The activity categories will not result in negative impacts to any of the three pathway indicators as no projects will increase width/depth ratios, decrease streambank condition, or disconnect floodplains.

Conclusions for Channel Conditions and Dynamics

None of the WFR Program activities would directly cause negative impacts to any of the indicators. While increased sediment could indirectly impact channel conditions, the amount of sediment likely to come into the stream network from Program activities would be limited to small, pulses that would be stored in the stream channels or transported downstream and would not be at the level where channel conditions would be affected.

Flow Hydrology Pathway

a. Indicator Descriptions

The descriptions of the following two pathway indicators provide the ways in which each indicator serves as an essential ecological function necessary for the overall viability of fish stocks:

Indicator	**Description**
Changes in Peak/Base Flows (Altered Hydrologic Function)	Water is the most essential component of fish habitat. Alteration of hydrology can create both environmental and physical changes. Environmental changes include altered timing and magnitude of high and low flows, alteration of temperature and dissolved oxygen levels, and changed cues for seasonal migration. Physical changes include aggradation or incision of the stream channel, scouring of the stream bed, disconnection of channel and floodplains and damage to riparian vegetation from flooding events. A variety of human activities reduce infiltration and groundwater recharge, resulting in increase storm flow and reduced base flow (NMFS 2014). Roads can divert surface flow, expand channel networks, convert subsurface flow to surface flow, and reduce infiltration.

	A channel network can be expanded by road ditches and road-related erosional features (e.g. gullies and rills), which intercept and concentrate runoff from their natural flow path. These factors may affect the overall hydrology in a watershed, particularly the quantity and timing of flow.
Increase in Drainage Network	Wemple et al. (1996) documented that 57% of a road system within a watershed, located in the western Cascades of Oregon, was hydrologically connected to the stream network by roadside ditches draining directly into streams and roadside ditches draining into relief culverts with gullies below their outlets. Thus, an increase in road densities led to an associated increase in drainage density by up to 50%. High-density road systems have been linked to changes in the hydrograph or magnitude and timing of flow events. For instance, in an Oregon Coast Range watershed, Harr et al. (1975) showed that peak flows increased significantly after road building converted at least 12% of the area to road prisms. The causal effects were attributed to increased surface compaction, which reduces water infiltration, resulting in excess water being carried down the road, drainage ditches, and relief culverts into the stream network. Jones and Grant (1996) documented that peak flows increased by 50% in a watershed within a five year period following road construction and logging. The longevity of the hydrologic changes are as permanent as the roads, and until a road is removed and natural drainage patterns are restored, the road will continue to affect the routing of water through a watershed.

b. Long-term Benefits of WFRBA Activities

Each of these projects will enhance floodplain connectivity, thereby addressing wetland functions described under Peak/base Flows above. Road and Trail Erosion Control and Decommissioning will provide additional benefits in that they will reduce the drainage network, thus addressing issues discussed in the Drainage Network category above.

Restoring instream flows from water diverted from streams and springs to grow illegal marijuana on Forest Service lands would be beneficial to the flow hydrology pathway. Improving legal diversion sites in partnership with landowners and other agencies would have slight benefits.

c. Discountable Effects/ Short-term Negative Impacts of WFRBA Activities

WFRBA activity categories are expected to benefit Peak/base Flows and Drainage Network categories. The WFRBA activity categories will not result in negative impacts to any of the two pathway indicators as projects will not disrupt natural peak/base flow patterns or increase the drainage network.

Conclusions for Flow/Hydrology Pathway

None of the WFR Program activities would directly cause negative impacts to any of the indicators. Benefits associated with disconnecting the road stream network could result in improved conditions.

Watershed Condition Pathway

a. Indicator Description

The descriptions of the following three MPI Indicators provide the ways in which each indicator serves as an essential ecological function necessary for the overall viability of fish stocks:

Indicator	**Description**
Road Density and Location	Available information consistently indicates that roads are one of the greatest sources of habitat degradation in managed watersheds, especially when they are within riparian zones (Geppert et al., 1984; Furniss et al., 1991). Roads significantly elevate on-site erosion and sediment delivery for the life of the road (Geppert et al. 1984). Studies consistently indicate that roads increase the frequency of mass failures in mountainous terrain (Dunne and Leopold, 1978; Geppert et al., 1984; Furniss et al. 1991). Mass failure volumes from roads are orders of magnitude greater than from undisturbed areas on a per unit area basis (Dunne and Leopold, 1978; Geppert et al., 1984; Furniss et al., 1991). Road crossings cause extreme increases in sediment delivery (Fowler et al., 1987). Roads also disrupt subsurface flows (Megahan 1982). Roads increase peakflows (King and Tennyson 1984). Roads within riparian zones reduce shading and disrupt LWD sources for the life of the road.
Riparian Reserves	The following discussion was adapted from FEMAT (1993). Riparian areas are those portions of watersheds that are directly coupled to streams and rivers, the portions of watersheds required for maintaining hydrologic, geomorphic, and ecological processes that directly affect streams, stream processes, and fish habitats. The network of Riparian Reserves—comprised of all stream orders both intermittent and perennial—allow for connectivity of the aquatic ecosystem within a watershed. Riparian zones and wetland/aquatic vegetation serve important functions in stream ecosystems such as providing shade (Poole and Berman 2001), sediment storage and filtering (Cooper et al. 1987), nutrient inputs (Murphy and Meehan 1991), water quality improvements channel and stream bank stability (Platts 1991), source of woody debris that creates fish habitat diversity (Bryant 1983, Lisle 1986, Shirvell 1990), and both cover and shelter for fish (Bustard and Narver 1975, Murphy

	and Meehan 1991). Riparian areas are shaped by disturbances characteristic of upland ecosystems, such as fire and windthrow, as well as disturbance processes unique to stream systems, such as lateral channel erosion, peakflows, deposition by floods and debris flows. The near-stream riparian areas—floodplains—may contain an increased diversity of plant species and extensive hydrologic nutrient cycling interactions between groundwater and riparian vegetation. This vegetation, ranging from conifers to deciduous hardwoods, provides allochthonous (organic debris) to stream channels and associated aquatic invertebrate communities.
Disturbance History	Information for this section was acquired from Reeves et al. (1995). Riverine-riparian ecosystems used by anadromous salmonids naturally experience periodic catastrophic disturbances, which then moved through a series of recovery states over a period of decades to centuries, resulting in a landscape that varies in suitability for salmonids. Disturbance can be categorized as being pulse or press disturbances. A pulse disturbance is one that allows an ecosystem to recover to pre-disturbance conditions, and a press disturbance is one that prohibits an ecosystem from rebounding to pre-disturbance conditions. The dominant pulse disturbances in which the salmonids are adapted to include natural fire regimes, landslides, floods and drought, all working in concert in a manner that produce habitat patches, varying in quality and quantity. Streams in SRNF are still recovery from the 1964 flood. Risk of high severity fires is considered a threat for most of SRNF.

b. Long-term Benefits of WFRBA Activities

WFRBA activity categories may not provide immediate benefits but will provide long-term benefits: Non-native Invasive Plant Control; Riparian Restoration/Enhancement; Riparian Vegetative Planting; Beaver Habitat Restoration.

All of these activities will promote growth of riparian vegetation, thus improving riparian conditions as described under the Riparian Area category. Road treatment projects will reduce the potential for negative impacts as described in the Road Density and Location category as well as restoring processes that would occur under a more natural disturbance regime. Road and Trail Erosion Control and Decommissioning projects will help transform disturbance regimes from a press to a pulse regime.

c. Discountable Effects/Short-term Negative Impacts of WFRBA Activities

Besides targeted activities such as alder girlding and individual tree selection for instream LW, all Site-Specific Projects could include removal of hazard trees as a result of implementing these activities when it meets the SRNF Hazard Tree definition or when identified as part of site

preparation. Typically, the area of vegetation removed in association with the proposed activities is relatively small.

WFRBA activity categories are expected to benefit Watershed Condition indicators as no adverse effects are expected to occur to road density, increase press disturbance regime processes, or degrade riparian conditions.

Summary of Direct and Indirect Effects to Habitat Components

Table 10 below summarizes the potential positive, negative, neutral effect of WFR Program activities on the Matrix of Pathways and indicators.

All projects will result in positive or neutral impacts to Matrix Indicators with the exception of the Turbidity and Substrate/Sediment Indicators. Increased sediment can result in impacts to habitat that can indirectly impact salmonids. The way in which sediment impacts the habitat and the biotic components of the stream system depends upon whether this material is deposited or immediately carried downstream after entry into the channel (Bilby et al 1989).

Effects of Sediment/Turbidity on Habitat

The potential for Project-related sediment mobilization to affect aquatic resources downstream is based on site conditions (including unit-specific slope stability, soil types, disturbance potential, and effects minimization measures that are to be implemented).Increases in suspended sediment and turbidity from most of the project types is expected to be minor and temporary due to the small work footprint of most projects, the work season window, (dry season, low flow conditions), and that many of the projects covered by this Program will occur either upstream or upslope of listed salmonid distribution (e.g., road decommissioning). In-stream projects with equipment operations or other forms of soil disturbance within the wetted channel, and/or adjacent streambank are likely to cause small and short-term increases in turbidity at, and downstream of, instream project implementation sites. Suspended sediment and turbidity caused by disturbance in the channel will cause a short-term (i.e., a few hours or less) and small (i.e., less than one-half a channel width wide, extending for approximately a few hundred feet downstream) plume of turbidity during the summer or early fall months when the water in the action area would otherwise be clear.

Limits are imposed due to meeting TMDL requirements that limit the potential for cumulative effects. Limits on number of projects per watershed were also identified. Furthermore, SRNF will minimize impacts related to increases in suspended sediment and turbidity by implementing multiple erosion control, water quality protection, and sediment containment minimization measures and BMPs described above.

Project design features and BMPs aimed to minimize the amount of fine sediment disturbance and associated turbidity, as previously described in the Activity Specific Design Features, will be included, but even with minimization measures, in-stream disturbance may result in short-term turbidity and suspended sediment increases based on observations of similar construction activities in other rivers (Free *pers. comm.* 2009).

Conclusions

Long-term impacts to turbidity and substrate/sediment, including spawning gravels are not expected within individual project areas, and within the action area as a whole. The limits on

numbers of activity types per watershed per year, and the upslope location of erosional sources will moderate the effects of sediment input associated with the WFR Program.

Furthermore, many of the activities outlined for inclusion under this Program are, for the most part, intended to reduce sedimentation from eroding banks and road related infrastructure such as culverts that are presently, and will likely continue, degrading critical habitat or fish passage conditions, and reduce the remaining infrastructure more resilient to natural stochastic events such as floods. The amount, duration and frequency of sediment input is unlikely to negatively affect habitat components. All WFR Program activities would be implemented with Best Management Practices and activity specific design criteria intended to improve habitat conditions while having minimal negative effects to habitat.

Summary Table of WFR Program Activities on MPI

The following table summarizes the potential general effects of the activities on the matrix of pathways and indicators. Road decommissioning, for instance may have a neutral effect on turbidity and substrate composition when there is no hydrologic connectivity to the stream channel. Overall the projects are intended to have long term positive effects to fisheries habitat as a whole.

0 equals a neutral effect – activity has no beneficial or negative effect to that indicator

+ equals a beneficial short or long term effect to the indicator (restore)

- /+ equals a short term negative effect to that indicator, but results in a long term beneficial trend for that indicator (restore)

-* denotes the negative effect is likely to be insignificant and discountable, typically used to describe those effects that have some negligible impact on the indicator, but does not result in a change to the quality of the habitat nor cause a significant change in behavior to individual fish.

Y equals “Yes” potential for direct effects - Take of ESA listed fish could occur

N equals “No” potential for direct effects – Take of ESA listed fish is not expected

Table 10. Summary of Potential Effects to Pathways and Indicators from WFRBA Activities[9]

Potential Effects to Pathways and Indicators 0 equals neutral effect + equals positive effect - /+ equals short neg /long term pos - equals short term negative * equals insignificant/ discountable Y equals Yes take could occur N equals no potential for direct effects	Fish Access to Habitat	Large wood and Boulder Projects – Heavy Equip.	Large wood Projects – Hand Treatment	Gravel Augmentation	Legacy/Historic Structure modification	Beaver Habitat Restoration	Off-Side Channel Habitat Rest	Streambank Restoration	Reduction of Recreation Impacts	Livestock Fencing	Riparian Vegetation - planting	Riparian Vegetation - girdling	Non-native invasive plants	Road and Trail Erosion Control (Mtnce)	Road Decommissioning	Reduction of Impacts - IMG	Mine Reclamation	In channel Nutrient Enhancement
Water Quality																		
Temperature	0	0	0	0	0	+	0	+*	0	0	+	+	0	0	0	+	0	0
Turbidity	-*	-*	-*	-*	-*	-*	-*	- / +	- / +	+	+	0	0	-*/+	- / +	+	-*/+	0
Chemical Concentration/Nutrients	0	-*	0	-*	-*	-*	0	0	0	+	0	0	0	0	-*	+	+	+
Habitat Access																		
Physical Barriers	+	0	0	0	+	0	0	0	0	0	0	0	0	0	0	+/0	0	0
Habitat Element																		
Substrate/Sediment	0	-*/+	-*/+	+	-*/+	-/+	-*	- / +	-*	+	+	0	0	-*/+	- / +	+	+	0
Large Wood	0	+	+	0	+	+	0	0	0	0	+	+	0	0	0	0	0	0
Pool Frequency and Quality	0	+	+	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0
Off-Channel Habitat	0	0	0	0	0	+	+	0	0	0	0	0	0	0	0	0	0	0
Refugia	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Channel Condition and Dynamics																		
Width/Depth Ratio	0	+	+	0	0	+	+	+	+	+	0	0	0	0	0	0	0	0
Streambank Condition	0	+	+	0	0	0	+	+	+	+	+	0	0	0	0	0	+	0
Floodplain Connectivity	0	+	+	0	0	+	+	0	0	0	+	0	0	0	0	0	+	0
Flow/Hydrology																		
Changes in Peak/Base Flows	0	0	0	0	0	+	0	0	0	0	+	+	0	+	+	+	0	0
Increase in Drainage Network	0	0	0	0	0	0	0	0	0	0	0	0	0	+	+	0	0	0
Watershed Condition																		
Road Density and Location	0	0	0	0	0	0	0	0	+	0	0	0	0	+	+	0	0	0
Riparian Reserves	0	-*/0	-*/0	0	+	+	+	+	+	+	+	+	+	+	+	+	+	0
Disturbance History	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Potential For Take (when activity occurs in occupied habitat)	**Y**	**Y**	**N**	**Y**	**Y**	**Y**	**Y**	**N**	**N**	**N**	**N**	**N**	**N**	**N***	**N***	**N**	**N**	**Y**

[9] Site specific circumstances may result in different effects than indicated above. Activities with an * may involve water drafting from ESA occupied habitat.

Effects to Anadromous Fish

Direct effects could occur through three potential pathways:

1. Fish may be incidentally injured or killed by all WFRBA activities involving heavy equipment. Use of helicopters to transport wood or salmon carcass (Nutrient Enhancement) or pile driving posts for beaver restoration in occupied habitat could also directly harass fish.
2. Projects that occur in occupied habitat may involve isolation, capture, handling, transport, and relocation of TEP salmonids (including water withdrawal). Fish handling has the potential to result in fish injury or death.
3. Project results in sediment entering occupied habitat such that individuals behavior is significantly altered, or harm occurs.

Projects that could result in direct effects to ESA listed salmonids would document the impacts through the use of Appendix F-3.

Direct Effects from Use of Heavy Equipment:

Incidental injury or mortality to fish may occur through the use of heavy equipment that operates within occupied habitat. Noise, motion, and vibration produced by heavy equipment operation are also expected at most instream restoration sites. However, the use of equipment, which will occur primarily outside the active channel, and the infrequent, short-term use of heavy equipment in the wetted channel is expected to result in insignificant adverse effects to listed fishes. Most of the proposed restoration project types include the potential for placement of structures in the stream channel. These structural placements can vary in their size and extent, depending on their restoration objective. Most structural placements are discrete where only a localized area will be affected. Where structural placements are small and discrete, salmonids are expected to avoid the active construction area and thus will not be crushed. When structural placements are large or cover a large area, such as gravel augmentation or full channel construction, some juvenile salmonids may be injured or killed. Listed salmonids will be able to avoid interaction with instream machinery by temporarily relocating either upstream or downstream into suitable habitat adjacent to the worksite. Use of helicopters to transport wood or salmon carcass will likely harass fish though the degree of harassment will depend on the proximity of the helicopter to the water and amount of LW or carcasses being dropped. In addition, the minimum distance between instream project sites and the maximum number of instream projects under the proposed Program would further reduce the potential aggregated effects of heavy equipment disturbance on listed salmonids

Water drafting activities may occur under the WFR Program, primarily in association with road maintenance activities. Water drafting sites may be located within occupied TE habitat. Drafting operations can disturb holding or spawning adult fish, as well as impinge or entrain juveniles (Sicking 2003). Additionally, water drafting operations can mobilize suspended sediment to nearby downstream aquatic habitat. Suspended sediment increases turbidity, exposing juvenile fish to gill damage and reduced oxygen uptake, and/or reduced vision and compromised feeding effectiveness. While screening intakes can reduce effects to fingerlings and fry, minimization of impingement requires the use of specific mesh sizes, pumping rates, and

sufficiently large screen areas, as outlined in the 2001 NMFS Water Drafting Specifications (Appendix B-4). There is a very low probability of impingement given that fish have been routinely observed to temporarily move away from a drafting pump site when a truck or hose is detected. Based on observations, it is anticipated that fish temporarily avoiding water drafting activities are not likely to experience reduced feeding success, nor be exposed to a significantly higher probability of exposure to prey.

Water drafting can result in minor, short-term and localized decreases in flow, especially in smaller streams, affecting water quality. This is particularly true during drought conditions, which may occur during project implementation. However, NMFS 2001 specifications don't allow drafting volumes to exceed 10% of stream flow within fish-bearing streams, to allow for adequate downstream flow to support fish, aquatic insects, amphibians, and other biota. Project BMPs don't allow drafting volumes to exceed 50% of stream flow outside of CH. Additionally, SRNF fish biologists will be consulted prior to water drafting operations so that they can ensure that sites with rearing TEP salmon and steelhead are avoided and sites that are not suitable for fish (primarily due to high stream temperatures) are prioritized for use. Due to PDFs that have been designed to minimize drops in stream flow and associated changes to water quality (PDF 18), the requirement to adhere to NMFS 2001 water drafting specifications and SRNF BMPs, the proposed action will have insignificant effects on water quality and anadromous salmonid habitat, and minor effects on TEP salmon and steelhead.

Pile Driving in association with Beaver Habitat Restoration activities could occur within occupied habitat, leading to the potential for noise/vibration impacts to occur. Wooden spikes would be driven into the gravel bed using the bucket of a backhoe or through use of a hydraulic posthole driver, both which could generate noise. The number of posts placed would be dependent on the stream width and the number of rows placed. Halverson et al (2012) examined the risk of pile driving and seismic exploration on chinook salmon exposure to the impulsive sound. Impulsive sounds are those that last for a short period of time and include frequencies over a large portion of the acoustic spectrum, such as a hammer blow or hand clap. Based on a review of literature by Hastings and Popper (2005) the degree of damage is not related directly to the distance of the fish from the pile, but to the received level and duration of the sound exposure. Laboratory data for a variety of sound sources have been used to estimate the thresholds of effects of pile driving on fish. However, there have been few experiments that evaluate pile driving sound propagation and attendant physical effects of pile driving sound on fish in natural environments, particularly in riverine systems.

CalTrans used caged fish deployments within the Mad River (California) to expose juvenile steelhead (*Onchorhynchus mykiss*) to a variety of peak sound pressures levels (SPLs) and cumulative sound exposure levels (SELs) from 2.2-meter-diameter (7.2-foot-diameter) cast-insteel-shell (CISS) piles driven immediately adjacent to the Mad River (CalTrans 2010). In this one study, On-site necropsies of all exposed and control fish conducted following each trial, as well as histopathology of the fish from the cages closest to the pile driving and control fish, showed no physical trauma that could be related to exposure to underwater noise from pile driving, and no statistically significant differences between experimental and control animals were detected. Similarly, hematocrit and plasma cortisol levels were not significantly related to exposure to noise generated by pile driving. In summary, there were no immediate significant physical effects of exposure to peak SPLs or cumulative SELs of ≤194 dB from pile driving at the project site.

Coho juveniles would be able to disperse away from the areas with pile driving occurring. In addition, since the posts being used in beaver habitat restoration would be out of wood, the noise and vibration level would be significantly less (NOAA September 24 2014 LOC on Chevron Terminal Dock Repairs Humboldt Bay). Physical or behavioral responses from juvenile coho due to the pile driving would be insignificant.

Direct Effects of Fish Handling

Fish handling has the potential to result in fish injury or death. No fish movement would occur in NC steelhead habitat, therefore the potential for direct effects due to fish handling would only occur for projects in SONCC coho salmon occupied habitat that involve isolation, capture, handling, transport, and relocation of coho salmon. Mortality may be immediate or delayed. Handling of fish increases their stress levels and can cause a variety of injurious conditions, including reduced disease resistance, osmoregulatory problems, decreased growth, decreased reproductive capacity, and increased mortality. There is a potential for a small number (up to five percent) of juvenile fish that are present in the dewatered section to avoid being captured and relocated, and thus die because they remain undetected in stream margins under vegetation, rocks, or gravels. All projects potentially involving fish handling would be consistent with NMFS Guidelines (Appendix B-3) and reviewed with NMFS during project development to minimize injury or death to fish.

Projects that could involve fish handling include:

- Instream structures involving full spanning weirs
- Partnership project on private land involving fish passage in occupied habitat

The number of fish injured or killed during relocation, dewatering or construction is not expected to have a detectable effect on the overall individual stream populations of salmonids. This is because only a small portion of an ESU/DPS's entire juvenile population will be exposed to electrofishing over the Program's 15 year period and only a very small portion of those salmonids electrofished will be injured or killed (*i.e.*, no more than three percent). An even smaller portion of an ESU/DPS's juvenile population will be injured or killed during dewatering and construction activities *(i.e.,* one percent).

NC steelhead DPS would not be impacted because no activities are proposed that would require fish handling. CC Chinook ESU would not be effected as CC Chinook are found downstream of the Forest boundary.

Indirect Effects of Sediment/Turbidity to TE individuals

Increased turbidity during the summer and early fall may result in short-term behavioral changes of juvenile coho salmon and steelhead (Newcombe and Jensen 1996). Behavioral changes include changes in feeding, predator detection, and avoidance of sediment plumes up to a few hundred feet downstream of the disturbance, such that juvenile coho salmon and steelhead may temporarily be displaced into different habitat. However, the timing of each sediment plume will vary throughout the season, so that increases in turbidity and sedimentation from in-stream projects will be temporally and spatially staggered throughout the season, years of WFR Program implementation, and action area. The small area of in-stream disturbance, and the measures for limiting fine sediment delivery, will also limit exposure of habitat and individuals. However, even small pulses of turbid water will cause salmonids to disperse from established territories

(Waters 1995), which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of individual survival.

Ivanovich and Hamid (2014) reviewed information about aquatic ecosystem quality over a wide range of sediment concentrations, durations of exposure, species, life stage and severity of ill effect for fish. Using a decision tree methodology, they determined that exposure duration is the most important parameter for significant severity of ill effect predictions. Most exposed individuals will be able to relocate to nearby areas of suitable habitat for feeding and cover, but that this relocation of individuals may temporarily increase competition for resources. Given that there will only be a few instream projects per watershed, per year, and that exposure and displacement will be minimal, the fitness of only a few individual coho salmon or steelhead would decrease due to increased turbidity, displacement and increased competition/predation. A slight reduction in feeding opportunities and predator detection, and an increase in competition is expected, and that the PCEs of food and substrate will be slightly reduced in a few isolated places each year across the SRNF.

The response of individuals will be limited by little exposure, that there is suitable habitat nearby to be displaced into, and that the small magnitude of increased turbidity from instream and streambank disturbance will be of short duration. Projects that result in a continual flux of turbidity would have a greater likelihood of causing a higher severity of effects.

Because the work will be conducted during the in-water work periods (a time when spawning is not expected and after emergence of fry), the projects should not interfere with spawning, egg development, and the sac fry life stage. In cases of fall-spawning fish, the fine layer of sediment deposited on channel substrate will be cleared away as the fish construct redds.

Therefore, long-term impacts to turbidity and substrate/sediment, including spawning gravels are not expected nor would it affect the survival, reproduction, or distribution of listed salmonids, within individual project areas, and within the action area as a whole.

Effects to Critical Habitat

A thorough MPI analysis for project effects to aquatic species yields an adequate and effective analysis of project effects to the features and functions of Primary Constituent Elements (PCEs) for CH and EFH. Based on the crosswalk analysis (Table 11) between pertinent MPI indicators and PCEs, effects to PCEs from each of the 16 programmatic activity types are fully consistent with those effects identified for ESA listed fish species.

Table 11. Crosswalk between Critical Habitat PCEs and MPI for ESA-listed salmon species

Primary Constituent Elements (PCEs)	MPI Pathways, Indicators that crosswalk with PCEs	Summary of effects to MPI Indicators
Spawning Habitat as defined by water quality, water quantity and substrate	**Pathway:** Water Quality **Indicators:** Temperature, Suspended Sediment, Substrate **Pathway:** Flow/Hydrology **Indicator:** Change in Peak/Base flows **Pathway:** Habitat Elements **Indicator:** Substrate/Embeddedness	**Temperature** was determined to have a minor long term beneficial effect based on the lack of disturbance to riparian areas and increased conifer component. Changes to **peak/base flow** would be minor and, likely beneficial as diversions from

Primary Constituent Elements (PCEs)	**MPI Pathways, Indicators that crosswalk with PCEs**	**Summary of effects to MPI Indicators**
		illegal grows would be restored, and there would be a greater disconnect between roads and stream systems. Minor short term **sediment** input would cause increased turbidity from fine sediment, however, the amount of larger sizes of sediment would not fill in pools, or cause impacts to spawning gravels.
Rearing as defined by adequate water quantity and floodplain connectivity	**Pathway:** Channel Conditions and Dynamics **Indicators:** Floodplain connectivity **Pathway:** Flow/Hydrology **Indicator:** Change in Peak/Base flows **Pathway:** Habitat Elements **Indicator:** Substrate/Embeddedness	Overall activities improve conditions for connectivity and flows by addressing diversions and re-establishing off-channel habitat.
Rearing as defined by adequate water quality and forage	**Pathway:** Water Quality **Indicators:** Temperature, Substrate **Pathway:** Habitat Elements **Indicator:** Large wood, Pool Frequency and Quality, Off-channel habitat **Non Pathway:** Forage – macroinvertebrates **Non Pathway**: cool water refugia	Minor short term **sediment** input would cause increased turbidity from fine sediment; however, the amount of larger sizes of sediment would not fill in pools, or cause impacts to spawning gravels.
Rearing as defined by adequate natural cover	**Pathway:** Habitat Elements **Indicator:** Large wood, Pool Frequency and Quality, Large Pools, Off-channel habitat	Overall activities improve conditions for large wood, pool quality and off channel habitats.
Migration as defined by habitat free of artificial obstructions, and adequate water quality, water quantity, and natural cover	**Pathway:** Habitat Access **Indicators:** Physical Barriers **Pathway:** Water Quality **Indicators:** Temperature **Pathway:** Flow/Hydrology **Indicator:** Change in Peak/Base flows **Pathway:** Habitat Elements **Indicator:** Large wood, Pool Frequency and Quality, Large Pools	Migration would be improved by improving passage for adult and juvenile salmonids. Increased cover in pools would provide higher quality and more diverse holding areas. Peak/base flows would be minimally improved.
Estuarine Areas	**N/A –** SRNF does not manage estuarine habitat	

Cumulative Effects

"Cumulative effects" are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action

are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

State, tribal, local, or private actions that may affect listed species within the action area include timber management, suppression of wildfires, water development, and river restoration. Those actions were driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of social groups dedicated to the river restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

The most common private activity likely to occur in the action areas addressed by this consultation is unmanaged recreation and illegal marijuana grows. Recreational activities are managed to some degree (*i.e.,* campgrounds, trailheads, off-road-vehicle trails), a considerable amount of dispersed unmanaged recreation occurs. Expected impacts to salmon and steelhead from this type of recreation include minor releases of suspended sediment, impacts to water quality, short-term barriers to fish movement, and minor changes to habitat structures. Streambanks, riparian vegetation, and spawning redds can be disturbed wherever human use is concentrated.

Climate Change and Drought: Global climate change presents an additional potential threat to coastal salmonid ESUs/DPSs and their critical habitats. Modeling of projected climate change impacts in California suggests that average summer air temperatures are expected to increase (Lindley et al. 2007). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe et al. 2004). Total precipitation in California may decline; critically dry years may increase (Lindley et al. 2007). Wildfires are expected to increase in frequency and magnitude, by as much as 55 percent under the medium emissions scenarios modeled (Luers et al. 2006). Vegetative cover may also change, with decreases in evergreen conifer forests and increases in grasslands and mixed evergreen forests. The likely change in amount of rainfall in Northern and Central Coastal streams under various warming scenarios is less certain, although as noted above, total rainfall across the state is expected to decline. For the California North Coast, some models show large increases (75 to 200 percent) in rainfall amounts while other models show decreases of 15 to 30 percent (Hayhoe et al. 2004). Many of these changes are likely to further degrade habitat of these listed species by, for example, reducing stream flows during the summer and raising summer water temperatures. The projections described above are for the mid to late 21st Century. In shorter time frames, climate conditions not caused by the human addition of carbon dioxide to the atmosphere are more likely to predominate (Cox and Stephenson 2007).

A. Timber/Grazing Management

The economic and environmental significance of natural resource-based economy is currently declining in absolute terms and relative to a newer economy based on mixed manufacturing and marketing with an emphasis on high technology. Nonetheless, resource-based industries are likely to continue to have an influence on environmental conditions within the program-action area for the indefinite future. However, over time those industries have adopted management practices that avoid or reduce many of their most harmful impacts, as is evidenced by the extensive conservation measures included with the proposed action, but which were unknown or in uncommon use until even a few years ago.

Timber management and grazing on private lands is prevalent downstream of the action area. Future timber harvest levels in the action area cannot be predicted; however, it is assumed that, for the foreseeable future, levels will be within the approximate range of those occurring since the listing of the northern spotted owl in 1992. Between 1992 and 2011 for the counties within the action area, the average annual harvest volume was 894 million board feet (MMBF), with most of the harvest occurring in Humboldt, Mendocino, and Siskiyou Counties. It is assumed similar trends in harvest will continue. Grazing is likely to continue at similar levels as well.

B. Suppression and Control of Wildfires

The California Department of Forestry and Fire Protection in conjunction with other state and federal agencies will likely be involved in the suppression or control of wildfires in the action area during the term of the proposed action. Future levels of suppression or control of wildfires in the action area cannot be predicted; however, it is assumed that, for the foreseeable future, levels will be steady or increasing. Federally controlled suppression activities would be consulted on through emergency consultation.

C. Industrial Activities

Currently, quarrying, gravel mining, and associated processing operations are located within the action area, and will likely continue to be operated by non-federal parties. Current operations fall under the jurisdiction of the California Coastal Commission (for those activities conducted within the state's coastal zone), the Corps, and any local governments, and will likely continue to do so in the future. Future demand cannot be estimated, but it may increase as private timber and agricultural landowners look for ways to increase revenue generated from their lands. Because the effects of quarries and rock mines depend on several variables, the extent of effects of the operations on covered species within the action area are unknown.

D. Population Growth

The U.S. Census Bureau estimates California's population at approximately 38 million in 2012, up from 37.25 million in 2010. The state population is projected to increase to about 40.1 million by 2015. Between 1990 (29.76 million) and 2000 (33.87 million), the state experienced a 13.82 percent growth in population. California had the 18th-highest population growth by percentage among all states in that time period. Future growth patterns are expected to continue to follow historical patterns. Primary effects of land development include direct habitat loss, decreased water quality, contamination of natural resources (e.g., groundwater, surface waters, and land), changes to runoff patterns, habitat fragmentation, isolation of wildlife populations, and decreased habitat diversity. As development increases, the general quantity and quality of habitat suitable for threatened and endangered species will most likely decrease.

VII. DETERMINATIONS

WFR Program/Project Impacts to Baseline Conditions for Matrix Indicators: All activities are intended to improve Matrix Indicators. All projects (except for In-channel Nutrient Enhancement, Riparian enhancement and Livestock Fencing) will result in short term negative impacts to the Turbidity and Substrate/Sediment Indicators in pursuit of improving watershed

conditions and enhancing instream habitat for SONCC coho salmon and NC steelhead. CC Chinook are found considerable downstream of any project activity such that as sediment is moved downstream overtime, it would be discountable. Since actions are intended to improve watershed conditions (and reduce risk of road-generated sediment) as a whole, the WFR Program would be beneficial to downstream habitat and populations. Implementation of Best Management Practices, Aquatic Conservation Measures and Activity Design Features will minimize the amount of sediment from project activities such that the short term effects (based on site specific proximity, probability and magnitude analysis, would not degrade habitat quality. Long-term impacts to turbidity and substrate/sediment, including spawning gravels, are not expected.

WFRBA Project Effects to Critical Habitat: The analysis of effects to habitat indicators corresponding to water quality and substrate components of PCEs for anadromous salmonids support an NLAA determination for critical habitat for SONCC coho and for NC steelhead as the amount generated would result in short term ephemeral impacts to primary constituent elements.

WFRBA Project Effects to Essential Fish Habitat: Analysis of habitat indicators corresponding to "waters" and "substrate" in the definition for EFH would be similar to effects to critical habitat, therefore, WFR Program would result in a "not likely adversely affect" EFH determination.

WFRBA Project Effects to Individual ESA-listed Fish: Project Activities that generate sediment in proximity to listed fish species and within occupied habitat may cause turbidity plumes that will cause fish to move downstream and alter behavior patterns for a short time. Heavy equipment used within occupied habitat may incidentally harm, harass, or kill individual SONCC coho salmon or NC steelhead. CC Chinook are not found on SRNF therefore no direct effect would occur. Because the work will be conducted during the in-water work periods (a time when spawning is not expected and after emergence of fry), the projects should not interfere with spawning, egg development, and the sac fry life stage. In cases of fall-spawning fish, the fine layer of sediment deposited on channel substrate will be cleared away as the fish construct redds.

WFRBA Project Effects to Forest Service Sensitive Fish Species: FS Sensitive Fish species occupy the same habitat as ESA listed species therefore the effects would be the same. Project Activities that generate sediment in proximity to FSS species may cause turbidity plumes that will cause fish to move downstream and alter behavior patterns for a short time. Heavy equipment used within occupied habitat may incidentally harm, harass, or kill individual FSS species. Because the work will be conducted during the in-water work periods (a time when spawning is not expected and after emergence of fry), the projects should not interfere with spawning, egg development, and the sac fry life stage. In cases of fall-spawning fish, the fine layer of sediment deposited on channel substrate will be cleared away as the fish construct redds.

In conclusion, while the majority of projects implemented under this WFRBA are intended to implement recovery actions habitat supporting SONCC coho salmon and NC steelhead, individual projects (based on proximity, probability and magnitude analysis) are also likely to cause adverse effects to individual fish. If incidental take is anticipated to occur as a result of the proposed action, the "is likely to adversely affect" determination is appropriate and formal section 7 consultation is required.The WFR Program may implement projects and activities that "may affect likely to adversely affect SONCC coho and NC steelhead due to:

Individual Projects in occupied habitat involving use of heavy equipment may result in SONCC coho and NC steelhead being incidentally injured or killed.

- Individual Projects that result in moving SONCC coho and NC steelhead may involve isolation, capture, transport, handling and relocation all of which have the potential to result in fish injury or death.
- Individual Projects could result in sediment entering occupied habitat such that individuals behavior is significantly altered.

Therefore, the overall determination for the Watershed and Fisheries Restoration Program is indicated in Table 12.

Table 12. Determinations of the WFR Program

Species	**Status**	**Overall WFR Program Determination**	
		Individuals	**Critical Habitat**
Southern Oregon/Northern California Coasts Coho ESU	Threatened	LAA – potential for project specific harm	NLAA
Northern California Steelhead DPS	Threatened	LAA– potential for project specific harm	NLAA
California Coastal Chinook ESU	Threatened	NLAA – Beneficial - improvement to watershed conditions	NE
Eulachon	Threatened	NE – No proximity	NE – No proximity
Green Sturgeon – Southern DPS	Threatened	N/A – no overlap w/SRNF	N/A – no overlap
Green Sturgeon – Northern DPS	Species of Concern	NLAA	N/A
Klamath Mountain Province Steelhead DPS	FS Sensitive	May affect individuals, would not trend towards Federal listing	N/A
Southern Oregon/California Coastal Chinook ESU	FS Sensitive	May affect individuals, would not trend towards Federal listing	N/A
Upper Klamath/Trinity River Chinook ESU	FS Sensitive	May affect individuals, would not trend towards Federal listing	N/A

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APPENDICES

Appendices A through G are located in a separate document with maps being provided in hardcopy and electronic formats.

Appendix A – Maps and Baseline Information

A geodatabase with all relevant information was provided to NMFS on 4/9/2015 and again with updates on 7/9/2015. This was supplemented with the TE Salmonid Distribution layer (6/11/2015) and Aquatic Restoration locations (6/22/2015)

- A-1 Maps
    - Action Area Maps - Figure 1 of BA
    - Proposed Action Maps (by District) with the following information:
        - ESA listed fish distribution
        - Potential locations for Instream Activities with the potential for the use of Heavy Equipment (Additional information on the Forest wide Aquatic Restoration proposed suite of projects in Appendix G-1)
        - Current National Forest Transportation System roads identified by operation maintenance level.
- A-2 Watershed Analysis Documents and Information Sources
- A-3 Transportation Planning Status
- A-4 Population and Watershed Spreadsheets (.xls spreadsheet file)

Appendix B – Direction and Guidance

- B-1 Land and Resource Management Plans
    - Table 1: Law, Policy and Regulation;
    - Table 2: LRMP S&Gs that guide decision making
- B-2 Best Management Practices
- B-3 Forest Service Policies/Guidance Documents
    - Wet Weather Specifications
    - Hazard Tree Guidelines
- B-4 National Marine Fisheries Service Guidance Documents

Appendix C – Stresses and Threats – Recovery Plans

- Table 1: Threats identified for SONCC populations on SRNF
- Table 2: Stresses identified for SONCC populations on SRNF

Appendix D – WFRP Decision Process and Monitoring

- D-1 Decision Framework for Restoration Projects
- D-2 Regional Best Management Program Evaluation Program Reports
- D-3 SRNF Water Quality Reports

Appendix E – Status of Past Consultations

Appendix F – Project Compliance with the WFRBA

- F-1 – Streamlining Local Operational Guidance
- F-2 –Process for Tiering to WFRBA
- F-3 – Determination of Effects Documentation

Appendix G – Projects with Upcoming NEPA Decisions

- G-1 – Forest-wide Aquatic Restoration Proposed Action
- G-2 - Smith River National Recreation Area Travel Management
- G-3 - Forest Road Maintenance